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(54) Title: SALTS OF PHENYL PYRROLE AMINO GUANIDINE AND POLYMORPHS OF PHENYL PYRROLE AMINO GUANIDINIUM SALTS

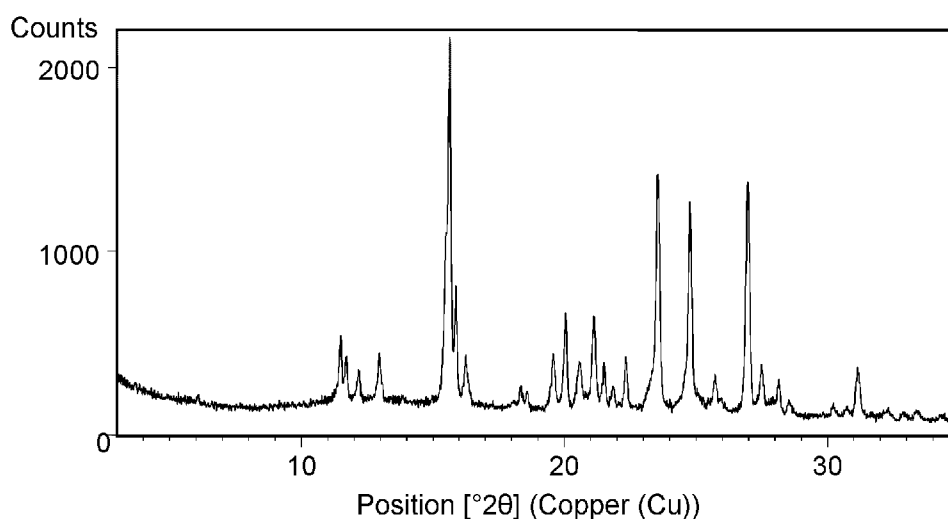


FIG 1

(57) Abstract: The present disclosure relates to crystalline forms of *N*-{3-[1-(2-nitrophenyl)-1H-pyrrol-2-yl]-allylidene}-aminoguanidinium salts having high solubility. The disclosure also relates to use of said crystalline forms in medicine.

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SALTS OF PHENYL PYRROLE AMINO GUANIDINE AND POLYMORPHS OF PHENYL PYRROLE AMINO GUANIDINIUM SALTS

Technical field

The present invention relates to salts of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine having a high solubility at low pH.

Background

The melanocortin system is a set of neuropeptidergic and immuneendocrine signalling pathways that play an integral role in the homeostatic control of a diverse array of physiological functions, including melanogenesis, stress response, inflammation, immunomodulation and adrenocortical steroidogenesis. It consists of multiple components, including the five G protein-couple melanocortin receptors: melanocortin receptor 1 (MC1R) to MC5R; peptide ligands; α , β , γ -melanocyte stimulating hormone (α , β , γ -MSH); adrenocorticotrophic hormone (ACTH) secreted by the anterior pituitary; and endogenous antagonists. The biological functions of the melanocortin system are mediated by the five melanocortin receptors (MCRs), which have distinct tissue distribution, convey different signalling and exert varying biological activities in different organ systems.

Phenyl pyrrole aminoguanidine derivatives with activity on the melanocortin receptors have previously been disclosed. One example of such compound is the anti-inflammatory AP1189 (*N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine) which was first shown to bind the MC1R and later was identified as a biased dual agonist at receptors MC1R and MC3R that does not provoke canonical cAMP generation (and hence no MC1R-induced melanogenesis) but instead appear to induce alternative pathways including ERK1/2-phosphorylation and Ca^{2+} mobilisation.

Summary

The present inventors have discovered salts of AP1189 with particularly favourable solubility profiles for gastric delivery. The inventors found that certain polymorphs of AP1189 salts have very high solubilities, especially at low pH.

Thus, one aspect of the present disclosure provides for a crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate exhibiting at least

X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 11.5 $\pm$ 0.2, 23.5 $\pm$ 0.2, and 27.0 $\pm$ 0.2.

Another aspect of the present disclosure provides for a crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 9.7 $\pm$ 0.2, 22.8 $\pm$ 0.2, and 26.7 $\pm$ 0.2.

The present disclosure also provides methods of producing such crystalline forms.

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One aspect of the present disclosure provides a method for producing the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A as disclosed herein, said method comprising:

- i. mixing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine and acetic acid in a solvent to form a mixture; and
- ii. isolating the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A from said mixture.

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One aspect of the present disclosure provides a method for producing the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A as disclosed herein, said method comprising:

- i. mixing a *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt and acetic acid in a solvent to form a mixture; and
- ii. isolating the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A from the mixture.

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One aspect of the present disclosure provides a method for producing the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A as disclosed herein, said method comprising:

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- i. mixing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate in a solvent to form a composition; and
- ii. isolating the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A from said composition.

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One aspect of the present disclosure provides a method for producing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate of crystalline Form B as disclosed herein, said method comprising:

- i. mixing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine and succinic acid in a solvent to form a mixture; and
- ii. isolating the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate of crystalline Form B from the mixture.

One aspect of the present disclosure provides a method for producing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate of crystalline Form B as disclosed herein, said method comprising:

- i. mixing a *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt and succinic acid in a solvent to form a mixture, and
- ii. isolating the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate of crystalline Form B from the mixture.

One aspect of the present disclosure provides a crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate produced by a method as disclosed herein.

One aspect of the present disclosure provides a crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate produced by a method as disclosed herein.

One aspect of the present disclosure provides a pharmaceutical composition comprising the crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate as disclosed herein and a pharmaceutically acceptable excipient.

One aspect of the present disclosure provides a pharmaceutical composition comprising the crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate as disclosed herein and a pharmaceutically acceptable excipient.

One aspect of the present disclosure provides a method of preparing a pharmaceutical composition comprising mixing the crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate as disclosed herein and a pharmaceutically acceptable excipient.

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One aspect of the present disclosure provides a method of preparing a pharmaceutical composition, said method comprising mixing the crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate as disclosed herein with a pharmaceutically acceptable excipient.

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One aspect of the present disclosure provides a method of treating a disease or disorder in a subject in need thereof, said method comprising administering crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate as disclosed herein, the crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate as disclosed herein, or the pharmaceutical composition as disclosed herein to a subject in need thereof.

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One aspect of the disclosure provides for a use of the crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate as disclosed herein or the crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate as disclosed herein, or the pharmaceutical composition as disclosed herein, for the manufacture of a medicament for treatment of a disease or disorder.

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One aspect of the present disclosure is to provide for crystalline forms of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salts having high solubility at low pH, e.g. at pH 1.2. Thus, one aspect provides for a crystalline Form of an *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt selected from the group consisting of:

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- 30 i. a crystalline Form XIV of AP1189 besylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 13.0 $\pm$ 0.2, 15.1 $\pm$ 0.2, and 19.9 $\pm$ 0.2,
- ii. a crystalline Form XIX of AP1189 oxoglutarate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured
- 35 using Cu K α radiation at 16.8 $\pm$ 0.2, 23.4 $\pm$ 0.2, and 23.6 $\pm$ 0.2,

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- iii. a crystalline Form XX of AP1189 DL-mandelic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 14.8 $\pm$ 0.2, 24.2 $\pm$ 0.2, and 25.5 $\pm$ 0.2,
 - iv. a crystalline Form XXII of AP1189 hippuric exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 20.1 $\pm$ 0.2, 24.1 $\pm$ 0.2, and 24.5 $\pm$ 0.2,
 - v. a crystalline Form XXIII of AP1189 formate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 13.3 $\pm$ 0.2, 15.1 $\pm$ 0.2, and 25.6 $\pm$ 0.2,
 - vi. a crystalline Form XXIV of AP1189 L-lactic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 3.8 $\pm$ 0.2, 9.9 $\pm$ 0.2, and 11.9 $\pm$ 0.2,
 - vii. a crystalline Form XXV of AP1189 DL-lactic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 9.8 $\pm$ 0.2, 11.9 $\pm$ 0.2, and 27.6 $\pm$ 0.2,
 - viii. a crystalline Form XXVI of AP1189 glutaric acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 8.3 $\pm$ 0.2, 15.9 $\pm$ 0.2, and 21.9 $\pm$ 0.2, and
 - ix. a crystalline Form XXIX of AP1189 adipic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 13.4 $\pm$ 0.2, 14.5 $\pm$ 0.2, and 25.5 $\pm$ 0.2.

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One aspect of the present disclosure is to provide crystalline forms of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salts that can be converted into useful crystalline forms of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salts. Thus, one aspect of the present disclosure provides for a crystalline Form of an *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt selected from the group consisting of:

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- i. a crystalline Form III of AP1189 napadisylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 13.4 $\pm$ 0.2, 22.2 $\pm$ 0.2, and 26.8 $\pm$ 0.2,
 - ii. a crystalline Form IV of AP1189 napadisylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 5.4 $\pm$ 0.2, 15.6 $\pm$ 0.2, and 23.4 $\pm$ 0.2,

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- iii. a crystalline Form V of AP1189 esylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 14.5 ± 0.2 , 16.5 ± 0.2 , and 18.6 ± 0.2 ,
 - iv. a crystalline Form VI of AP1189 edisylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 4.8 ± 0.2 , 12.8 ± 0.2 , and 16.5 ± 0.2 ,
 - v. a crystalline Form VII of AP1189 edisylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 6.1 ± 0.2 , 15.7 ± 0.2 , and 23.6 ± 0.2 ,
 - vi. a crystalline Form VIII of AP1189 edisylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 15.5 ± 0.2 , 20.7 ± 0.2 , and 21.7 ± 0.2 ,
 - vii. a crystalline Form IX of AP1189 edisylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 4.5 ± 0.2 , 16.7 ± 0.2 , and 24.7 ± 0.2 ,
 - viii. a crystalline Form X of AP1189 nitrate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 15.3 ± 0.2 , 21.4 ± 0.2 , and 25.1 ± 0.2 ,
 - ix. a crystalline Form XI of AP1189 cyclamate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 7.0 ± 0.2 , 13.8 ± 0.2 , and 15.7 ± 0.2 ,
 - x. a crystalline Form XII of AP1189 cyclamate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 7.3 ± 0.2 , 15.3 ± 0.2 , and 17.9 ± 0.2 ,
 - xi. a crystalline Form XIII of AP1189 cyclamate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 15.3 ± 0.2 , 18.5 ± 0.2 , and 18.7 ± 0.2 ,
 - xii. a crystalline Form XV of AP1189 oxalate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 19.5 ± 0.2 , 23.3 ± 0.2 , and 25.8 ± 0.2 ,
 - xiii. a crystalline Form XVI of AP1189 oxalate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 17.1 ± 0.2 , 17.9 ± 0.2 , and 19.6 ± 0.2 ,

- xiv. a crystalline Form XVII of AP1189 oxalate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_{α} radiation at 6.3 ± 0.2 , 10.6 ± 0.2 , and 19.8 ± 0.2 ,
- xv. a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_{α} radiation at 6.5 ± 0.2 , 11.5 ± 0.2 , and 14.8 ± 0.2 ,
- xvi. a crystalline Form XXI of AP1189 DL-mandelic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_{α} radiation at 5.4 ± 0.2 , 10.0 ± 0.2 , and 24.6 ± 0.2 ,
- xvii. a crystalline Form XXVII of AP1189 glutaric acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_{α} radiation selected from the group consisting of 16.9 ± 0.2 , 25.6 ± 0.2 , 27.1 ± 0.2 , 28.2 ± 0.2 , and 28.7 ± 0.2 , and
- xviii. a crystalline Form XXVIII of AP1189 glutaric acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_{α} radiation at 14.2 ± 0.2 , 16.9 ± 0.2 , and 24.5 ± 0.2 .

One aspect of the present disclosure is to provide for *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salts that can be converted into useful crystalline Forms of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salts. Thus, one aspect of the disclosure provides for a compound selected from the group consisting of:

- i. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate,
- ii. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium tosylate,
- iii. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium fumarate,
- iv. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium napadisylate,
- v. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium esylate,
- vi. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium edisylate,

- vii. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium nitrate,
- viii. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium cyclamate,
- 5 ix. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium besylate,
- x. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium oxalate,
- 10 xi. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine (+)-camphor-10-sulfonic acid salt,
- xii. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium oxoglutarate,
- xiii. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine DL-mandelic acid salt,
- 15 xiv. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine hippuric acid salt,
- xv. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium formate,
- xvi. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine L-lactic acid salt,
- 20 xvii. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine DL-lactic acid salt,
- xviii. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine glutaric acid salt, and
- 25 xix. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine adipic acid salt.

One aspect of the disclosure provides for a composition, a pharmaceutical composition, a liquid composition, a unit dosage form, or an oral formulation comprising the crystalline forms of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt disclosed herein.

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One aspect of the disclosure provides for use of such crystalline form of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt, composition,

pharmaceutical composition, liquid composition, unit dosage form, or oral formulation in medicine.

One aspect of the disclosure provides for use of such crystalline form of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt, composition,
pharmaceutical composition, liquid composition, unit dosage form, or oral formulation in the treatment of a kidney disease, an arthritic disease, a cardiovascular disease, atherosclerosis, a viral disease or disorder, or a systemic inflammatory disorder.

10 Description of Drawings

FIG 1: XRPD diffractogram for AP1189 acetate salt Pattern 1 crystallised from acetonitrile.

FIG 2: XRPD diffractogram for AP1189 acetate salt Pattern 1 and 2 crystallised from ethyl acetate.

15 FIG 3: XRPD diffractogram for AP1189 acetate salt Pattern 3 crystallised from THF.

FIG 4: XRPD diffractogram for AP1189 tosylate salt Pattern 1 crystallised from methanol.

FIG 5: XRPD diffractogram for AP1189 fumarate salt Pattern 1 crystallised from isopropylalcohol:water 90:10 v/v.

20 FIG 6: XRPD diffractogram for AP1189 succinate salt Pattern 1 crystallised from isopropylalcohol:water 90:10 v/v.

FIG 7: TGA/DSC thermogram of AP1189 acetate Pattern 1 from 1,4-dioxane. Peak temperature: 183.75 °C; onset: 164.62 °C; enthalpy (normalised): 629.95 J/g. Weight loss: 0.001 mg; weight percent loss: 0.057 %.

25 FIG 8: DSC thermogram of AP1189 acetate Pattern 1 from acetonitrile. Peak temperature 197.86 °C; onset: 192.19 °C; enthalpy (normalised): 147.26 J/g.

FIG 9: TGA/DSC thermogram of AP1189 acetate Pattern 1 & 2 from 2-methyl THF. Peak temperature: 194.18 °C; onset: 171.54 °C; enthalpy (normalised): 475.77 J/g. Weight loss: 0.021 mg; weight percent loss: 0.478 %.

30 FIG 10: TGA/DSC thermogram of AP1189 acetate Pattern 3 from THF. Peak temperature: 118.76 °C; onset: 100.62 °C; enthalpy (normalised): 138.49 J/g. First weight loss segment: weight loss: 0.002 mg; weight percent loss: 0.067 %. Second weight loss segment: weight loss: 0.672 mg; weight percent loss: 18.610 %.

FIG 11: TGA/DSC thermogram of AP1189 tosylate Pattern 1 from IPA:water 90:10 v/v after storage at 40°C. Peak temperature: 239.24 °C; onset: 233.75 °C; enthalpy (normalised): 99.785 J/g. Weight loss: 0.006 mg; weight percent loss: 0.330 %.

5 FIG 12: TGA/DSC thermogram of AP1189 fumarate Pattern 1 from 2-propanol:water 90:10. Peak temperature: 218.27 °C; onset: 214.61 °C; enthalpy (normalised): 68.467 J/g. WE0.012 mg; weight percent loss: 0.319 %.

FIG 13: DSC thermogram of AP1189 succinate Pattern 1 from IPA:water 90:10 v/v. Peak temperature: 196.27 °C; onset: 195.18 °C; enthalpy (normalised): 196.27 J/g.

FIG 14: XRPD Diffractogram of AP1189 Napadisylate Pattern 1.

10 FIG 15: XRPD Diffractogram of AP1189 Napadisylate Pattern 2.

FIG 16: XRPD Diffractogram of AP1189 Esylate Pattern 1.

FIG 17: XRPD Diffractogram of AP1189 Edisylate Pattern 1.

FIG 18: XRPD Diffractogram of AP1189 Edisylate Pattern 2.

FIG 19: XRPD Diffractogram of AP1189 Edisylate Pattern 4.

15 FIG 20: XRPD Diffractogram of AP1189 Edisylate Pattern 5.

FIG 21: XRPD Diffractogram of AP1189 Nitrate Pattern 1.

FIG 22: XRPD Diffractogram of AP1189 Cyclamate Pattern 2.

FIG 23: XRPD Diffractogram of AP1189 Cyclamate Pattern 4.

FIG 24: XRPD Diffractogram of AP1189 Cyclamate Pattern 5.

20 FIG 25: XRPD Diffractogram of AP1189 Besylate Pattern 1.

FIG 26: XRPD Diffractogram of AP1189 Oxalate Pattern 1.

FIG 27: XRPD Diffractogram of AP1189 Oxalate Pattern 2.

FIG 28: XRPD Diffractogram of AP1189 Oxalate Pattern 4.

FIG 29: XRPD Diffractogram of AP1189 (+)-Camphor-10-sulfonic acid Pattern 1.

25 FIG 30: XRPD Diffractogram of AP1189 Oxoglutarate Pattern 1.

FIG 31: XRPD Diffractogram of AP1189 DL-mandelic acid Pattern 2.

FIG 32: XRPD Diffractogram of AP1189 DL-mandelic acid Pattern 3.

FIG 33: XRPD Diffractogram of AP1189 Hippuric acid Pattern 1.

FIG 34: XRPD Diffractogram of AP1189 Formic acid Pattern 1.

30 FIG 35: XRPD Diffractogram of AP1189 L-Lactic acid Pattern 1.

FIG 36: XRPD Diffractogram of AP1189 DL-Lactic acid Pattern 1.

FIG 37: XRPD Diffractogram of AP1189 Glutaric acid Pattern 1.

FIG 38: XRPD Diffractogram of AP1189 Glutaric acid Pattern 1.

FIG 39: XRPD Diffractogram of AP1189 Adipic acid Pattern 1.

FIG 40: TG/DSC thermogram of AP1189 Napadisylate Pattern 1. Weight loss: 0.1356 mg. Weight Percent Loss: 3.974 %. Enthalpy (normalised): 29.422 J/g; Onset x: 87.38 °C; peak temperature: 104.76 °C. Enthalpy (normalised): 1.8937 J/g; Peak temperature: 187.47 °C.

5 FIG 41: TG/DSC thermogram of AP1189 Esylate Pattern 1. Weight Loss: 0.032 mg. Weight Percent Loss: 0.911 %. Enthalpy (normalised): 42.119 J/g; Onset x: 201.95 °C; Peak temperature: 207.06 °C.

FIG 42: TG/DSC thermogram of AP1189 Edisylate Pattern 2. Weight Loss: 0.061 mg. Weight Percent Loss: 1.175 %. Weight Loss: 0.158 mg. Weight Percent Loss: 3.040 %.
10 Enthalpy (normalised): 3.1886 J/g; Onset x: 220.71 °C; Peak temperature: 224.57 °C.

FIG 43: TG/DSC thermogram of AP1189 Edisylate Pattern 4. Weight Loss: 1.463 mg. Weight Percent Loss: 6.372 %. Enthalpy (normalised): 100.17 J/g. Onset x: 208.40 °C; Peak temperature: 217.37 °C.

FIG 44: TG/DSC thermogram of AP1189 Edisylate Pattern 5. Weight Loss: 0.120 mg.
15 Weight Percent Loss: 4.701 %. Enthalpy (normalised): 54.800 J/g; Onset x: 58.52 °C; Peak temperature: 78.51 °C. Enthalpy (normalised): 0.93567 J/g; Onset x: Not found; Peak temperature: 151.11 °C.

FIG 45: TG/DSC thermogram of AP1189 Nitrate Pattern 1. Weight Loss: 0.095 mg. Weight Percent Loss: 2.139 %. Enthalpy (normalised): 0.4851 J/g; Onset x: 178.54 °C;
20 Peak temperature: 182.88 °C.

FIG 46: TG/DSC thermogram of AP1189 Cyclamate Pattern 2. Weight Loss: 0.033 mg. Weight Percent Loss: 0.459 %. Enthalpy (normalised): 6.4491 J/g; Onset x: 129.90 °C; Peak temperature: 137.27 °C.

FIG 47: TG/DSC thermogram of AP1189 Cyclamate Pattern 4. Weight Loss: 0.041 mg.
25 Weight Percent Loss: 1.080 %. Weight Loss: 0.088 mg. Weight Percent Loss: 2.337 %. Enthalpy (normalised): 0.0143 J/g; Onset x: 133.07 °C; Peak temperature: 138.20 °C.

FIG 48: TG/DSC thermogram of AP1189 Besylate Pattern 1. Weight Loss: 0.014 mg. Weight Percent Loss: 2.369 %. Enthalpy (normalised): 48.524 J/g; Onset x: 216.45 °C; Peak temperature: 220.49 °C.

30 FIG 49: TG/DSC thermogram of AP1189 Oxalate Pattern 1. Weight Loss: 0.023 mg. Weight Percent Loss: 1.665 %. Enthalpy (normalised): 0.32686 J/g; Peak temperature: 210.52 °C.

FIG 50: TG/DSC thermogram of AP1189 Oxalate Pattern 2. Weight Loss: 0.035 mg. Weight Percent Loss: 2.156 %. Enthalpy (normalised): 40.935 J/g; Onset x: 207.42 °C;
35 Peak temperature: 211.50 °C.

FIG 51: TG/DSC thermogram of AP1189 Oxalate Pattern 4. Weight Loss: 0.016 mg. Weight Percent Loss: 2.164 %.

FIG 52: TG/DSC thermogram of AP1189 (+)-Camphor-10-sulfonic acid Pattern 1. Weight Loss: 0.017 mg. Weight Percent Loss: 1.843 %. Enthalpy (normalised): 107.65 J/g; Onset x: 205.38 °C; Peak temperature: 209.93 °C.

FIG 53: TG/DSC thermogram of AP1189 Oxoglutarate Pattern 1. Weight Loss: 0.167 mg. Weight Percent Loss: 2.379 %. Weight Loss: 0.462 mg. Weight Percent Loss: 6.588 %. Enthalpy (normalised): 68.335 J/g. Onset x: 81.31 °C. Peak temperature: 87.92 °C.

FIG 54: TG/DSC thermogram of AP1189 DL-mandelic acid Pattern 2. Weight Loss: 0.424 mg. Weight Percent Loss: 8.372 %. Enthalpy (normalised): 43.266 J/g; Onset x: 104.13 °C; Peak temperature: 110.06 °C.

FIG 55: TG/DSC thermogram of AP1189 DL-mandelic acid Pattern 3. Weight Loss: 0.066 mg. Weight Percent Loss: 3.021 %. Weight Loss: 0.081 mg. Weight Percent Loss: 3.698 %.

FIG 56: TG/DSC thermogram of AP1189 Hippuric acid Pattern 1. Weight Loss: 0.022 mg. Weight Percent Loss: 1.294 %. Weight Loss: 0.026 mg. Weight Percent Loss: 1.495 %. Enthalpy (normalised): 4.7263 J/g; Onset x: 138.92 °C; Peak temperature: 149.72 °C.

FIG 57: FT-IR Spectrum of AP1189 Napadisylate Pattern 1.

FIG 58: FT-IR Spectrum of AP1189 Napadisylate Pattern 2.

FIG 59: FT-IR Spectrum of AP1189 Esylate Pattern 1.

FIG 60: FT-IR Spectrum of AP1189 Edisylate Pattern 2.

FIG 61: FT-IR Spectrum of AP1189 Edisylate Pattern 4.

FIG 62: FT-IR Spectrum of AP1189 Edisylate Pattern 5.

FIG 63: FT-IR Spectrum of AP1189 Nitrate Pattern 1.

FIG 64: FT-IR Spectrum of AP1189 Cyclamate Pattern 2.

FIG 65: FT-IR Spectrum of AP1189 Cyclamate Pattern 4.

FIG 66: FT-IR Spectrum of AP1189 Cyclamate Pattern 5.

FIG 67: FT-IR Spectrum of AP1189 Besylate Pattern 1.

FIG 68: FT-IR Spectrum of AP1189 Oxalate Pattern 1.

FIG 69: FT-IR Spectrum of AP1189 Oxalate Pattern 2.

FIG 70: FT-IR Spectrum of AP1189 Oxalate Pattern 4.

FIG 71: FT-IR Spectrum of AP1189 (+)-Camphor-10-sulfonic acid Pattern 1.

FIG 72: FT-IR Spectrum of AP1189 Oxoglutarate Pattern 1.

FIG 73: FT-IR Spectrum of AP1189 DL-mandelic acid Pattern 2.

FIG 74: FT-IR Spectrum of AP1189 DL-mandelic acid Pattern 3.

FIG 75: FT-IR Spectrum of AP1189 Hippuric acid Pattern 1.

FIG 76: FT-IR Spectrum of AP1189 Formic acid Pattern 1.

5 FIG 77: FT-IR Spectrum of AP1189 L-Lactic acid Pattern 1.

FIG 78: FT-IR Spectrum of AP1189 DL-Lactic acid Pattern 1.

FIG 79: FT-IR Spectrum of AP1189 Glutaric acid Pattern 1.

FIG 80: FT-IR Spectrum of AP1189 Glutaric acid Pattern 2.

10 FIG 81: TG/DSC thermogram of AP1189 Napadisylate Pattern 2. Weight Loss: 0.157 mg. Weight Percent Loss: 7.940 %.

FIG 82: TG/DSC thermogram of AP1189 Edisylate Pattern 1. Weight Loss: 0.082 mg. Weight Percent Loss: 4.634 %. Enthalpy (normalised): 3.2707 J/g; Onset x: 69.98 °C; Peak temperature: 78.37 °C. Enthalpy (normalised): 0.83635 J/g; Peak temperature: 151.31 °C.

15 FIG 83: TG/DSC thermogram of AP1189 Cyclamate Pattern 5. Weight Loss: 0.070 mg. Weight Percent Loss: 1.696 %. Enthalpy (normalised): 0.68855 J/g; Onset x: 140.91 °C; Peak temperature: 146.39 °C.

20 FIG 84: TG/DSC thermogram of AP1189 Formic acid Pattern 1. Weight Loss: 0.008 mg. Weight Percent Loss: 3.049 %. Enthalpy (normalised): 7.5282 J/g; Onset x: 169.12 °C; Peak temperature: 171.97 °C.

FIG 85: TG/DSC thermogram of AP1189 L-Lactic acid Pattern 1. Weight Loss: 0.026 mg. Weight Percent Loss: 0.859 %. Enthalpy (normalised): 31.499 J/g. Onset x: 189.47 °C. Peak temperature: 192.80 °C.

25 FIG 86: TG/DSC thermogram of AP1189 DL-Lactic acid Pattern 1. Weight Loss: 0.034 mg. Weight Percent Loss: 1.476 %. Enthalpy (normalised): 2.2523 J/g; Onset x: 198.48 °C; Peak temperature: 200.63 °C.

30 FIG 87: TG/DSC thermogram of AP1189 Glutaric acid Pattern 1. Weight Loss: 0.27 mg. Weight Percent Loss: 1.256 %. Enthalpy (normalised): 0.0964 J/g; Onset x: 109.24 °C; Peak temperature: 115.31 °C. Enthalpy (normalised): 16.647 J/g; Onset x: 159.93 °C; Peak temperature: 164.02 °C.

FIG 88: TG/DSC thermogram of AP1189 Glutaric acid Pattern 2. Weight Loss: 0.019 mg. Weight Percent Loss: 1.001 %. Enthalpy (normalised): 48.550 J/g; Onset x: 162.77 °C; Peak temperature: 165.94 °C.

35 FIG 89: TG/DSC thermogram of AP1189 Glutaric acid Pattern 4. Weight Loss: 0.010 mg. Weight Percent Loss: 1.764 %. Enthalpy (normalised): 18.475 J/g; Onset x: 114.55

°C; Peak temperature: 148.15 °C. Enthalpy (normalised): 10.102 J/g; Onset x: 160.45 °C; Peak temperature: 163.28 °C.

FIG 90: TG/DSC thermogram of AP1189 Adipic acid Pattern 1. Weight Loss: 0.015 mg. Weight Percent Loss: 6.117 %. Enthalpy (normalised): 12.428 J/g. Onset x: 183.34 °C; Peak temperature: 187.98 °C.

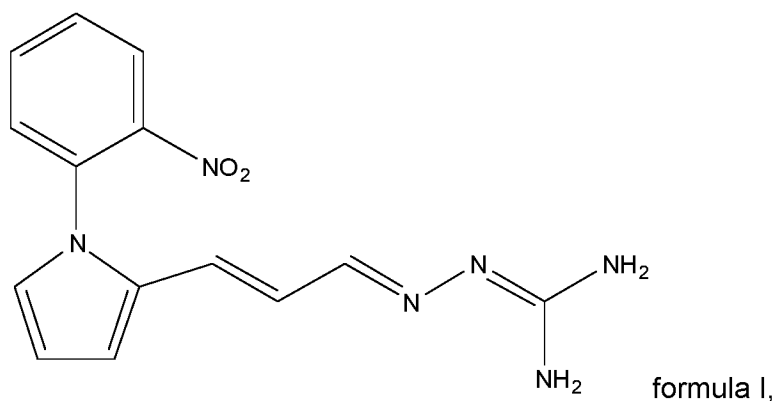
FIG 91: XRPD Diffractogram of AP1189 Glutaric acid Pattern 4.

FIG 92: IR spectrum of AP1189 acetate Pattern 1.

Detailed description

Definitions

By a “compound of formula I”, “compound I”, and “AP1189” is meant the compound *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine, which has the chemical structure of formula I:



as well as tautomers and stereoisomers thereof. Another name for the compound is *N'*-[(*E*)-[(2*E*)-3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]prop-2-en-1-ylidene]amino]guanidine.

In some instances the term “AP1189” may refer to either the free base structure of Formula I or it may refer to the acetate salt of AP1189. Preferable, the term “AP1189 free base” refers to the structure of Formula I. Preferably, the term “AP1189 acetate” refers to the acetate salt of the structure of Formula I.

As used herein, the term “SP1189” refers to the succinate salt of the structure of Formula I. The terms “SP1189” and “AP1189 succinate” are synonymous as used herein.

Regarding the naming of salts, it is to be construed that terms such as "*N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine acetate" and "*N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate" are synonymous, i.e. when an anion is written immediately after "*N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine", then the protonated form of "*N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine" is meant, i.e. "*N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium". Similarly, when an acid is written as part of the name of a protonated compound, e.g. "*N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetic acid", then the non-protonated form is meant of that compound, e.g. "*N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine acetic acid" is meant. These considerations also apply to other salts of the disclosed compound.

In one embodiment, the compound of the disclosure *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine, including tautomers and stereoisomers thereof.

In one embodiment, the compound of the disclosure is *N*-{(1*E*)-3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine, including tautomers and stereoisomers thereof.

In one embodiment, the compound of the disclosure is *N*'-[(*E*)-[3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]prop-2-en-1-ylidene]amino]guanidine, including tautomers and stereoisomers thereof.

In one embodiment, the compound of the disclosure is *N*-{(2*E*)-3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine, including tautomers and stereoisomers thereof.

In one embodiment, the compound of the disclosure is *N*'-[(2*E*)-3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]prop-2-en-1-ylidene]amino]guanidine, including tautomers and stereoisomers thereof.

In one embodiment, the compound of the disclosure is *N*-{(1*E*,2*E*)-3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine (also termed (*E*)-*N-trans*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine herein)), including tautomers thereof. In one embodiment, the compound of the disclosure is *N*'-[(*E*)-[(2*E*)-3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]prop-2-en-1-ylidene]amino]guanidine, including tautomers thereof. These compounds may also appear as the salts and corresponding crystalline forms disclosed herein. In one embodiment, the compound of the disclosure is selected from the group consisting of *N*-{(1*Z*)-3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-

aminoguanidine, N-{(2Z)-3-[1-(2-nitrophenyl)-1H-pyrrol-2-yl]-allylidene}-
aminoguanidine, N-{(1Z,2Z)-3-[1-(2-nitrophenyl)-1H-pyrrol-2-yl]-allylidene}-
aminoguanidine, N-{(1Z,2E)-3-[1-(2-nitrophenyl)-1H-pyrrol-2-yl]-allylidene}-
aminoguanidine, and N-{(1E,2Z)-3-[1-(2-nitrophenyl)-1H-pyrrol-2-yl]-allylidene}-
5 aminoguanidine.

In one embodiment, the compound of the disclosure is selected from the group
consisting of *N'*-[(Z)-[3-[1-(2-nitrophenyl)-1H-pyrrol-2-yl]prop-2-en-1-
ylidene]amino]guanidine, *N'*-[(2Z)-3-[1-(2-nitrophenyl)-1H-pyrrol-2-yl]prop-2-en-1-
10 ylidene]amino]guanidine, *N'*-[(Z)-[(2Z)-3-[1-(2-nitrophenyl)-1H-pyrrol-2-yl]prop-2-en-1-
ylidene]amino]guanidine, *N'*-[(Z)-[(2E)-3-[1-(2-nitrophenyl)-1H-pyrrol-2-yl]prop-2-en-1-
ylidene]amino]guanidine, and *N'*-[(E)-[(2Z)-3-[1-(2-nitrophenyl)-1H-pyrrol-2-yl]prop-2-
en-1-ylidene]amino]guanidine.

15 In a preferred embodiment, the alkene moiety of the compound is in the E
configuration, and the imine moiety is in the Z or the E configuration. In one
embodiment, the compound is a mixture of *N'*-[(E)-[(2E)-3-[1-(2-nitrophenyl)-1H-pyrrol-
2-yl]prop-2-en-1-ylidene]amino]guanidine and *N'*-[(Z)-[(2E)-3-[1-(2-nitrophenyl)-1H-
pyrrol-2-yl]prop-2-en-1-ylidene]amino]guanidine.

20

The compound of the disclosure may additionally be any tautomer of the above
structures. As used herein, "tautomer" means other structural isomers that exist in
equilibrium resulting from the migration of a hydrogen atom.

In reporting results of a measurement, such as the measurement of a 2-theta value,
25 e.g. the reading of a 2-theta value from an XRPD diffractogram, the skilled person will
understand that the method of measuring the value inherently comprises some degree
of uncertainty. For example, measurements of 2-theta values may have an uncertainty
of 0.2°.

30 By a crystalline "Form A" of AP1189 acetate is meant the crystalline form of AP1189
acetate that exhibits the X-ray lines (2-theta values) in a powder diffraction pattern
when measured using Cu K α radiation corresponding to AP1189 acetate Pattern 1 as
disclosed herein.

By a crystalline "Form B" of AP1189 succinate is meant the crystalline form of AP1189
35 succinate that exhibits the X-ray lines (2-theta values) in a powder diffraction pattern

when measured using Cu K α radiation corresponding to AP1189 succinate Pattern 1 as disclosed herein.

Unless otherwise specified, the unit of 2-theta values is degrees ($^{\circ}$).

5

By "onset temperature" is meant the designed intersection point of the extrapolated baseline and the inflectional tangent at the beginning of the melting.

10

As used herein, "seeding" refers to the technique of adding a "seed" crystal to the crystallization solution to promote the formation of crystals. Preferably, the composition of the seed crystal is the same as the composition of the crystals being formed.

Compounds

15

In one embodiment, the present disclosure provides the compound AP1189, specifically a salt thereof. One embodiment provides for the compound AP1189, including tautomeric forms thereof and/or isomeric forms thereof, such as enantiomeric forms and/or diastereomeric forms thereof. In one embodiment, the diastereomeric forms comprise *cis* and *trans* forms of the compound, specifically with respect to the alkene moiety. The compound may also exist as either the *E* or *Z* form with respect to the C=N double bond of the structure of Formula I. The person of skill in the art understands that in certain instances, *E* configuration is synonymous to *trans* configuration, and that in certain instances, *Z* configuration is synonymous to *cis* configuration. For example, in the specific case where both of the atoms forming part of a double bond are each bound to exactly 1 further moiety that is not a hydrogen moiety or a lone pair. One embodiment of the present disclosure provides for the acetate salt of AP1189. Another embodiment of the present disclosure provides for the succinate salt of AP1189. In one embodiment the term "compound of the disclosure" means the crystalline Form A of AP1189 acetate. In one embodiment the term "compound of the disclosure" means the crystalline Form B of AP1189 succinate.

25

30

In some embodiments, the pharmaceutically acceptable salt of AP1189 is selected from the group consisting of:

(E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidinium acetate, including tautomeric and stereoisomeric forms thereof;

- (E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidinium succinate, including tautomeric and stereoisomeric forms thereof;
- (E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidine DL-mandelic acid salt, including tautomeric and stereoisomeric forms thereof;
- 5 (E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidine hippuric acid salt, including tautomeric and stereoisomeric forms thereof;
- (E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidine L-lactic acid salt, including tautomeric and stereoisomeric forms thereof;
- >50 mM
- 10 (E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidinium besylate, including tautomeric and stereoisomeric forms thereof;
- (E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidinium oxoglutarate, including tautomeric and stereoisomeric forms thereof;
- (E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidine formic acid salt, including tautomeric and stereoisomeric forms thereof;
- 15 (E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidine DL-lactic acid salt, including tautomeric and stereoisomeric forms thereof;
- (E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidine glutaric acid salt, including tautomeric and stereoisomeric forms thereof;
- 20 (E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidine adipic acid salt, including tautomeric and stereoisomeric forms thereof; and
- (E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidinium nitrate salt, including tautomeric and stereoisomeric forms thereof.
- 25 In one embodiment, a pharmaceutically acceptable salt of AP1189 is selected from the group consisting of the acetate salt of AP1189, the succinate salt of AP1189, the DL-mandelic acid salt of AP1189, the hippuric acid salt of AP1189, the L-lactic acid salt of AP1189, the besylate salt of AP1189, the oxoglutarate salt of AP1189, the formic acid salt of AP1189, the DL-lactic acid salt of AP1189, the glutaric acid salt of AP1189, the adipic acid salt of AP1189 and the nitrate salt of AP1189.
- 30

One embodiment provides for a salt of AP1189 selected from the group consisting of:
(E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidinium napadisylate, including tautomeric and stereoisomeric forms thereof;

(E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidinium esylate,
including tautomeric and stereoisomeric forms thereof;

(E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidinium edisylate,
including tautomeric and stereoisomeric forms thereof;

5 (E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidinium cyclamate,
including tautomeric and stereoisomeric forms thereof;

(E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidinium oxalate,
including tautomeric and stereoisomeric forms thereof; and

10 (E)-N-[1-(2-nitrophenyl)-1-H-pyrrole-2-yl-allylideneamino]-guanidine (+)-Camphor-10-
sulfonic acid salt, including tautomeric and stereoisomeric forms thereof.

The terms "treatment" and "treating" as used herein refer to the management and care
of a subject for the purpose of combating a condition, disease or disorder. The term is
intended to include the full spectrum of treatments for a given condition from which the
15 subject is suffering. The subject to be treated is preferably a mammal, in particular a
human being. Treatment of animals, such as mice, rats, dogs, cats, horses, cows,
sheep and pigs, is, however, also within the scope of the present context. The subjects
to be treated can be of various ages.

20 It is an aspect of the present disclosure to provide an oral formulation as disclosed
herein comprising a crystalline form of an AP1189 salt disclosed herein, for use in the
treatment of a disease or disorder in a subject, wherein the subject to be treated is a
mammal. In some embodiment the mammal is a human being. In some embodiments
the mammal is a domestic animal. In some embodiments the mammal is selected from
25 the group consisting of mice, rats, dogs, cats, horses, cows, sheep and pigs.

Crystalline forms

The present disclosure relates to crystalline forms of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-
2-yl]-allylidene}-aminoguanidinium salts. It is an object of the disclosure to provide
30 crystalline forms of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium
salts having high solubility in aqueous medium, particularly at low pH. It is likewise an
object of the disclosure to provide crystalline forms of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-
2-yl]-allylidene}-aminoguanidinium salts having high dissolution rate in aqueous
medium, particularly at low pH.

35

Crystalline forms of AP1189 and salts thereof may be characterised by X-Ray Powder Diffraction (XRPD) analysis. Such analysis may be carried out using a suitable X-ray powder diffractometer such as a PANalytical X'pert pro with PIXcel detector (128 channels). Scanning of samples may be performed between 3 and 35° 2 θ . Samples may be gently ground prior to measurement to release any agglomerates. Samples may be loaded onto a multi-well plate with Kapton or Mylar polymer film to support the sample. Measurements may be carried out by placing the multi-well plate in the diffractometer followed by analysis using Cu K radiation ($\alpha_1 \lambda = 1.54060 \text{ \AA}$; $\alpha_2 = 1.54443 \text{ \AA}$; $\beta = 1.39225 \text{ \AA}$; $\alpha_1:\alpha_2$ ratio = 0.5) running in transmission mode (step size 0.0130° 2 θ , step time 18.87s) using 40 kV / 40 mA generator settings.

Table 1 shows an overview of the polymorphs disclosed herein

Table 1: overview of polymorphs

Salt and polymorph form of AP1189	XRPD pattern	Figures			Counterion trivial and/or systematic name
		XRPD	TGA/DSC	FT-IR	
Acetate Form A	1	1	7,8		Acetic acid
Acetate Form I	1+2	2	9		Acetic acid
Succinate Form B	1	6	13		Succinic acid
Tosylate Form C	1	4	11		Toluenesulfonic acid
Fumarate Form D	1	5	12		(2E)-But-2-enedioic acid
Acetate Form II	3	3	10		Acetic acid
Napadisylate Form III	1	14	40	57	Naphthalene-1,5-disulfonic acid
Napadisylate Form IV	2	15	81	58	Naphthalene-1,5-disulfonic acid
Esylate Form V	1	16	41	59	Ethanesulfonic acid
Edisylate Form VI	1	17	82		Ethane-1,2-disulfonic acid
Edisylate Form VII	2	18	42	60	Ethane-1,2-disulfonic acid
Edisylate Form VIII	4	19	43	61	Ethane-1,2-disulfonic acid
Edisylate Form IX	5	20	44	62	Ethane-1,2-disulfonic acid
Nitrate Form X	1	21	45	63	Nitric acid
Cyclamate Form XI	2	22	46	64	Cyclohexylsulfamic acid
Cyclamate Form XII	4	23	47	65	Cyclohexylsulfamic acid

Cyclamate Form XIII	5	24	83	66	Cyclohexylsulfamic acid
Besylate Form XIV	1	25	48	67	Benzenesulfonic acid
Oxalate Form XV	1	26	49	68	Oxalic acid
Oxalate Form XVI	2	27	50	69	Oxalic acid
Oxalate Form XVII	4	28	51	70	Oxalic acid
(+)-Camphor-10-sulfonic acid Form XVIII	1	29	52	71	(+)-Camphor-10-sulfonic acid
Oxoglutarate Form XIX	1	30	53	72	2-oxoglutaric acid, ketoglutaric acid, 2-oxopentanedioic acid α -ketoglutaric acid alpha-ketoglutaric acid
DL-Mandelic acid Form XX	2	31	54	73	Hydroxy(phenyl)acetic acid
DL-Mandelic acid Form XXI	3	32	55	74	Hydroxy(phenyl)acetic acid
Hippuric acid Form XXII	1	33	56	75	N-Benzoylglycine
Formic acid Form XXIII	1	34	84	76	Formic acid
L-Lactic acid Form XXIV	1	35	85	77	2-Hydroxypropanoic acid
DL-Lactic acid Form XXV	1	36	86	78	2-Hydroxypropanoic acid
Glutaric acid Form XXVI	1	37	87	79	Pentanedioic acid
Glutaric acid Form XXVII	2	38	88	80	Pentanedioic acid
Glutaric acid Form XXVIII	4	91	89		Pentanedioic acid
Adipic acid Form XXIX	1	39	90		Hexanedioic acid

AP1189 acetate Form A

The present disclosure provides for a crystalline Form A of AP1189 acetate. Crystalline Form A of AP1189 acetate exhibits an XRPD diffractogram as shown in Figure 1. One

acetate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 11.5 $\pm$ 0.2, 23.5 $\pm$ 0.2, and 27.0 $\pm$ 0.2. One embodiment provides for a crystalline Form A of AP1189 acetate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 11.7 $\pm$ 0.2, 13.0 $\pm$ 0.2, 15.5 $\pm$ 0.2, 15.6 $\pm$ 0.2, 16.2 $\pm$ 0.2, 19.6 $\pm$ 0.2, 20.0 $\pm$ 0.2, 21.1 $\pm$ 0.2, and 24.8 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form A of AP1189 acetate exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 1.

One embodiment of the disclosure provides for a crystalline Form A of AP1189 acetate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.1, 11.5, 11.7, 12.2, 13.0, 15.5, 15.6, 15.9, 16.2, 18.3, 18.6, 19.6, 20.0, 20.6, 21.1, 21.5, 21.8, 22.3, 23.5, 24.8, 25.7, 27.0, 27.5, 28.2, 28.5, 30.2, 30.7, 31.2, 32.3, 32.9, 33.4, and 34.3. One embodiment of the disclosure provides for a crystalline Form A of AP1189 acetate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.1 $\pm$ 0.2, 11.5 $\pm$ 0.2, 11.7 $\pm$ 0.2, 12.2 $\pm$ 0.2, 13.0 $\pm$ 0.2, 15.5 $\pm$ 0.2, 15.6 $\pm$ 0.2, 15.9 $\pm$ 0.2, 16.2 $\pm$ 0.2, 18.3 $\pm$ 0.2, 18.6 $\pm$ 0.2, 19.6 $\pm$ 0.2, 20.0 $\pm$ 0.2, 20.6 $\pm$ 0.2, 21.1 $\pm$ 0.2, 21.5 $\pm$ 0.2, 21.8 $\pm$ 0.2, 22.3 $\pm$ 0.2, 23.5 $\pm$ 0.2, 24.8 $\pm$ 0.2, 25.7 $\pm$ 0.2, 27.0 $\pm$ 0.2, 27.5 $\pm$ 0.2, 28.2 $\pm$ 0.2, 28.5 $\pm$ 0.2, 30.2 $\pm$ 0.2, 30.7 $\pm$ 0.2, 31.2 $\pm$ 0.2, 32.3 $\pm$ 0.2, 32.9 $\pm$ 0.2, 33.4 $\pm$ 0.2, and 34.3 $\pm$ 0.2. It may be advantageous to identify the crystalline Form A of AP1189 acetate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form A of AP1189 acetate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 11.5, 11.7, 13.0, 15.5, 15.6, 16.2, 19.6, 20.0, 21.1, 23.5, 24.8, and 27.0. One embodiment of the present disclosure provides for a crystalline Form A of AP1189 acetate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 11.5 $\pm$ 0.2, 11.7 $\pm$ 0.2, 13.0 $\pm$ 0.2, 15.5 $\pm$ 0.2, 15.6 $\pm$ 0.2, 16.2 $\pm$ 0.2, 19.6 $\pm$ 0.2, 20.0 $\pm$ 0.2, 21.1 $\pm$ 0.2, 23.5 $\pm$ 0.2, 24.8 $\pm$ 0.2, and 27.0 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form A of AP1189 acetate exhibiting one or more X-ray lines

(2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 2.

AP1189 acetate Form I

5 Another crystalline form of AP1189 acetate has been identified herein which exhibits a mixture of a XRPD Pattern 1 and XRPD Pattern 2. In a preferred embodiment, the crystalline Form A of AP1189 acetate is substantially free of the polymorph of AP1189 acetate, which gives rise to XRPD Pattern 2. In one embodiment, "substantially free" means that the crystalline Form A of AP1189 acetate comprises less than 90 % of the
10 polymorph of AP1189 acetate which gives rise to XRPD Pattern 2, such as less than 80 %, such as less than 70 %, such as less than 60 %, such as less than 50 %, such as less than 40 %, such as less than 30 %, such as less than 20 %, such as less than 15 %, such as less than 10 %, such as less than 5 % of the polymorph of AP1189 acetate, which gives rise to XRPD Pattern 2. The content of the polymorph of AP1189
15 acetate, which gives rise to XRPD Pattern 2, may be assessed by the intensity of X-ray lines of Pattern 2 relative to the intensity of the X-ray lines of Pattern 1 of AP1189 acetate. For example, Pattern 2 exhibits X-ray lines at (2-theta values) 14.9, 18.0, and 24.2 which do not overlap with X-ray lines originating from Pattern 1 of AP1189. Thus, one embodiment of the present disclosure provides for a crystalline Form A of AP1189
20 acetate substantially free of a second crystalline form of AP1189 acetate, the second crystalline form of AP1189 acetate exhibits X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 14.9 ± 0.2 , 18.0 ± 0.2 , and/or 24.2 ± 0.2 . One embodiment of the present disclosure provides for a crystalline Form A of AP1189 acetate substantially free of a second crystalline form of AP1189 acetate,
25 the second crystalline form of AP1189 acetate exhibits X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 14.9, 18.0, and/or 24.2. In one embodiment of the present disclosure, the crystalline Form A of AP1189 acetate exhibits no X-ray lines at 14.9 ± 0.2 , 18.0 ± 0.2 , and/or 24.2 ± 0.2 in an powder diffraction pattern, or the crystalline Form A of AP1189 acetate exhibits lines at
30 14.9 ± 0.2 , 18.0 ± 0.2 , and/or 24.2 ± 0.2 that have a relative intensity less than 30 %, such as less than 25 %, such as less than 20 %, such as less than 15 %, such as less than 10 %, such as less than 5 %.

AP1189 succinate Form B

The present disclosure provides for a crystalline Form B of AP1189 succinate.

Crystalline Form B of AP1189 succinate exhibits an XRPD diffractogram as shown in Figure 6. One embodiment of the present disclosure provides for a crystalline Form B

5 of AP1189 succinate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 9.7 $\pm$ 0.2, 22.8 $\pm$ 0.2, and 26.7 $\pm$ 0.2. One embodiment provides for a crystalline Form B of AP1189 succinate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of
10 5.4 $\pm$ 0.2, 13.4 $\pm$ 0.2, 16.3 $\pm$ 0.2, and 19.5 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form B of AP1189 succinate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 12.2 $\pm$ 0.2, 15.8 $\pm$ 0.2, 21.8 $\pm$ 0.2, and 28.5 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form B of
15 AP1189 succinate exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 6.

One embodiment of the disclosure provides for a crystalline Form B of AP1189 succinate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction
20 pattern when measured using Cu K α radiation selected from the group consisting of 5.4, 9.7, 12.2, 12.7, 13.4, 13.6, 15.8, 16.3, 18.1, 18.6, 18.9, 19.5, 19.9, 21.1, 21.8, 21.8, 22.0, 22.2, 22.4, 22.8, 23.4, 23.7, 24.6, 25.0, 25.3, 26.1, 26.3, 26.7, 27.5, 28.5, 29.1, 29.4, 30.0, 31.5, 32.3, 32.7, 33.6, and 34.1. One embodiment of the disclosure provides for a crystalline Form B of AP1189 succinate exhibiting one or more X-ray
25 lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.4 $\pm$ 0.2, 9.7 $\pm$ 0.2, 12.2 $\pm$ 0.2, 12.7 $\pm$ 0.2, 13.4 $\pm$ 0.2, 13.6 $\pm$ 0.2, 15.8 $\pm$ 0.2, 16.3 $\pm$ 0.2, 18.1 $\pm$ 0.2, 18.6 $\pm$ 0.2, 18.9 $\pm$ 0.2, 19.5 $\pm$ 0.2, 19.9 $\pm$ 0.2, 21.1 $\pm$ 0.2, 21.8 $\pm$ 0.2, 21.8 $\pm$ 0.2, 22.0 $\pm$ 0.2, 22.2 $\pm$ 0.2, 22.4 $\pm$ 0.2, 22.8 $\pm$ 0.2, 23.4 $\pm$ 0.2, 23.7 $\pm$ 0.2, 24.6 $\pm$ 0.2, 25.0 $\pm$ 0.2, 25.3 $\pm$ 0.2, 26.1 $\pm$ 0.2, 26.3 $\pm$ 0.2, 26.7 $\pm$ 0.2,
30 27.5 $\pm$ 0.2, 28.5 $\pm$ 0.2, 29.1 $\pm$ 0.2, 29.4 $\pm$ 0.2, 30.0 $\pm$ 0.2, 31.5 $\pm$ 0.2, 32.3 $\pm$ 0.2, 32.7 $\pm$ 0.2, 33.6 $\pm$ 0.2, and 34.1 $\pm$ 0.2. It may be advantageous to identify the crystalline Form B of AP1189 succinate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form B of AP1189 succinate exhibiting one or more X-ray
35 lines (2-theta values) in a powder diffraction pattern when measured using Cu K α

radiation selected from the group consisting of 5.4, 9.7, 12.2, 13.4, 15.8, 16.3, 19.5, 21.8, 22.8, 26.7, and 28.5. One embodiment of the present disclosure provides for a crystalline Form B of AP1189 succinate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.4 $\pm$ 0.2, 9.7 $\pm$ 0.2, 12.2 $\pm$ 0.2, 13.4 $\pm$ 0.2, 15.8 $\pm$ 0.2, 16.3 $\pm$ 0.2, 19.5 $\pm$ 0.2, 21.8 $\pm$ 0.2, 22.8 $\pm$ 0.2, 26.7 $\pm$ 0.2, and 28.5 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form B of AP1189 succinate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 7.

AP1189 acetate Form II

One embodiment provides for crystalline forms of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate, which may be converted to AP1189 acetate of crystalline Form A. One embodiment provides for a crystalline Form I of AP1189 acetate corresponding to XRPD Pattern 1 and 2. A specific embodiment provides for a crystalline Form I of AP1189 acetate exhibiting X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at one or more of 11.5 $\pm$ 0.2, 11.7 $\pm$ 0.2, 12.9 $\pm$ 0.2, 14.9 $\pm$ 0.2, 15.4 $\pm$ 0.2, 15.6 $\pm$ 0.2, 18.0 $\pm$ 0.2, 19.9 $\pm$ 0.2, 20.0 $\pm$ 0.2, 21.1 $\pm$ 0.2, 21.5 $\pm$ 0.2, 21.8 $\pm$ 0.2, 22.4 $\pm$ 0.2, 23.5 $\pm$ 0.2, 24.2 $\pm$ 0.2, 24.7 $\pm$ 0.2, and 26.9 $\pm$ 0.2. One embodiment provides for a crystalline Form I of AP1189 acetate exhibiting X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation as shown in Figure 2. One embodiment of the present disclosure provides for a crystalline Form II of AP1189 acetate corresponding to XRPD Pattern 3. A specific embodiment provides for a crystalline Form II of AP1189 acetate exhibiting X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at one or more of 7.5 $\pm$ 0.2, 9.4 $\pm$ 0.2, 12.8 $\pm$ 0.2, 13.3 $\pm$ 0.2, 14.2 $\pm$ 0.2, 15.3 $\pm$ 0.2, 16.0 $\pm$ 0.2, 17.0 $\pm$ 0.2, 18.8 $\pm$ 0.2, 19.7 $\pm$ 0.2, 20.3 $\pm$ 0.2, 21.1 $\pm$ 0.2, 21.4 $\pm$ 0.2, 21.9 $\pm$ 0.2, 22.0 $\pm$ 0.2, 22.7 $\pm$ 0.2, and 23.1 $\pm$ 0.2. One embodiment provides for a crystalline Form II of AP1189 acetate exhibiting X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation as shown in Figure 3.

AP1189 solid and/or amorphous forms

One embodiment of the present disclosure provides for a solid form of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate. One embodiment

of the present disclosure provides for a solid, amorphous form of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate.

AP1189 tosylate Form C

- 5 The disclosure also provides for a crystalline Form C of AP1189 tosylate. Crystalline Form C of AP1189 tosylate exhibits an XRPD diffractogram as shown in Figure 4. One embodiment of the present disclosure provides for a crystalline Form C of AP1189 tosylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 14.5 $\pm$ 0.2, 21.0 $\pm$ 0.2, and 25.2 $\pm$ 0.2. In one
- 10 embodiment of the present disclosure, the crystalline Form C of AP1189 tosylate further exhibits one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 13.4 $\pm$ 0.2 and 16.0 $\pm$ 0.2. In one embodiment of the present disclosure, the crystalline Form C of AP1189 tosylate further exhibits one or more X-ray lines (2-theta values) in a powder
- 15 diffraction pattern when measured using Cu K α radiation selected from the group consisting of 8.0 $\pm$ 0.2, 9.4 $\pm$ 0.2, 10.0 $\pm$ 0.2, 15.3 $\pm$ 0.2, 16.7 $\pm$ 0.2, 17.6 $\pm$ 0.2, 19.2 $\pm$ 0.2, 19.8 $\pm$ 0.2, 21.3 $\pm$ 0.2, and 25.4 $\pm$ 0.2. In one embodiment, the crystalline Form C of AP1189 tosylate exhibits an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 4.
- 20 One embodiment of the disclosure provides for a crystalline Form C of AP1189 tosylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 8.0, 9.4, 10.0, 10.8, 12.1, 12.3, 13.4, 14.1, 14.5, 15.3, 15.7, 16.0, 16.7, 17.6, 19.2, 19.8, 20.0, 20.7,
- 25 21.0, 21.3, 22.0, 22.4, 22.7, 22.8, 23.1, 23.6, 24.1, 24.3, 25.2, 25.4, 25.7, 26.1, 26.7, 27.1, 27.7, 28.1, 29.0, 29.2, 29.9, 30.3, 30.7, 31.4, 32.7, 33.2, 33.5, and 34.1.
- 34.6. One embodiment of the disclosure provides for a crystalline Form C of AP1189 tosylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of
- 30 8.0 $\pm$ 0.2, 9.4 $\pm$ 0.2, 10.0 $\pm$ 0.2, 10.8 $\pm$ 0.2, 12.1 $\pm$ 0.2, 12.3 $\pm$ 0.2, 13.4 $\pm$ 0.2, 14.1 $\pm$ 0.2, 14.5 $\pm$ 0.2, 15.3 $\pm$ 0.2, 15.7 $\pm$ 0.2, 16.0 $\pm$ 0.2, 16.7 $\pm$ 0.2, 17.6 $\pm$ 0.2, 19.2 $\pm$ 0.2, 19.8 $\pm$ 0.2, 20.0 $\pm$ 0.2, 20.7 $\pm$ 0.2, 21.0 $\pm$ 0.2, 21.3 $\pm$ 0.2, 22.0 $\pm$ 0.2, 22.4 $\pm$ 0.2, 22.7 $\pm$ 0.2, 22.8 $\pm$ 0.2, 23.1 $\pm$ 0.2, 23.6 $\pm$ 0.2, 24.1 $\pm$ 0.2, 24.3 $\pm$ 0.2, 25.2 $\pm$ 0.2, 25.4 $\pm$ 0.2, 25.7 $\pm$ 0.2, 26.1 $\pm$ 0.2, 26.7 $\pm$ 0.2, 27.1 $\pm$ 0.2, 27.7 $\pm$ 0.2, 28.1 $\pm$ 0.2, 29.0 $\pm$ 0.2, 29.2 $\pm$ 0.2, 29.9 $\pm$ 0.2, 30.3 $\pm$ 0.2, 30.7 $\pm$ 0.2,
- 35 31.4 $\pm$ 0.2, 32.7 $\pm$ 0.2, 33.2 $\pm$ 0.2, 33.5 $\pm$ 0.2, and 34.1 $\pm$ 0.2. It may be advantageous to

identify the crystalline Form C of AP1189 tosylate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form C of AP1189 tosylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 8.0, 9.4, 10.0, 13.4, 14.5, 15.3, 16.0, 16.7, 17.6, 19.2, 19.8, 21.0, 21.3, 25.2, and 25.4. One embodiment of the present disclosure provides for a crystalline Form C of AP1189 tosylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 8.0 $\pm$ 0.2, 9.4 $\pm$ 0.2, 10.0 $\pm$ 0.2, 13.4 $\pm$ 0.2, 14.5 $\pm$ 0.2, 15.3 $\pm$ 0.2, 16.0 $\pm$ 0.2, 16.7 $\pm$ 0.2, 17.6 $\pm$ 0.2, 19.2 $\pm$ 0.2, 19.8 $\pm$ 0.2, 21.0 $\pm$ 0.2, 21.3 $\pm$ 0.2, 25.2 $\pm$ 0.2, and 25.4 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form C of AP1189 tosylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 5.

AP1189 fumarate Form D

The disclosure also provides for a crystalline Form D of AP1189 fumarate. Crystalline Form D of AP1189 fumarate exhibits an XRPD diffractogram as shown in Figure 5. One embodiment of the present disclosure provides for a crystalline Form D of AP1189 fumarate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 17.6 $\pm$ 0.2, 21.2 $\pm$ 0.2, and 26.3 $\pm$ 0.2. In one embodiment of the present disclosure, the crystalline Form D of AP1189 fumarate further exhibits one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 11.5 $\pm$ 0.2, 21.9 $\pm$ 0.2, and 23.9 $\pm$ 0.2. In one embodiment of the present disclosure, the crystalline Form D of AP1189 fumarate further exhibits one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 9.2 $\pm$ 0.2, 10.5 $\pm$ 0.2, 10.9 $\pm$ 0.2, 11.9 $\pm$ 0.2, 15.8 $\pm$ 0.2, 18.7 $\pm$ 0.2, 19.4 $\pm$ 0.2, 23.4 $\pm$ 0.2, and 24.5 $\pm$ 0.2. In one embodiment, the crystalline Form D of AP1189 fumarate exhibits an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 5.

One embodiment of the disclosure provides for a crystalline Form D of AP1189 fumarate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of

- 8.6, 9.2, 10.2, 10.5, 10.9, 11.5, 11.9, 13.4, 15.8, 16.0, 16.4, 16.6, 17.3, 17.6, 18.2, 18.5, 18.7, 19.4, 19.6, 19.8, 20.6, 21.2, 21.4, 21.9, 22.7, 23.1, 23.4, 23.9, 24.5, 24.8, 25.0, 26.1, 26.3, 27.0, 27.6, 28.0, 28.5, 28.8, 29.1, 29.5, 29.9, 30.3, 31.0, 31.0, 31.5, 32.0, 32.4, 33.1, 33.5, 34.2, and 34.7. One embodiment of the disclosure provides for a
- 5 crystalline Form D of AP1189 fumarate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 8.6 $\pm$ 0.2, 9.2 $\pm$ 0.2, 10.2 $\pm$ 0.2, 10.5 $\pm$ 0.2, 10.9 $\pm$ 0.2, 11.5 $\pm$ 0.2, 11.9 $\pm$ 0.2, 13.4 $\pm$ 0.2, 15.8 $\pm$ 0.2, 16.0 $\pm$ 0.2, 16.4 $\pm$ 0.2, 16.6 $\pm$ 0.2, 17.3 $\pm$ 0.2, 17.6 $\pm$ 0.2, 18.2 $\pm$ 0.2, 18.5 $\pm$ 0.2, 18.7 $\pm$ 0.2, 19.4 $\pm$ 0.2, 19.6 $\pm$ 0.2, 19.8 $\pm$ 0.2, 20.6 $\pm$ 0.2, 21.2 $\pm$ 0.2,
- 10 21.4 $\pm$ 0.2, 21.9 $\pm$ 0.2, 22.7 $\pm$ 0.2, 23.1 $\pm$ 0.2, 23.4 $\pm$ 0.2, 23.9 $\pm$ 0.2, 24.5 $\pm$ 0.2, 24.8 $\pm$ 0.2, 25.0 $\pm$ 0.2, 26.1 $\pm$ 0.2, 26.3 $\pm$ 0.2, 27.0 $\pm$ 0.2, 27.6 $\pm$ 0.2, 28.0 $\pm$ 0.2, 28.5 $\pm$ 0.2, 28.8 $\pm$ 0.2, 29.1 $\pm$ 0.2, 29.5 $\pm$ 0.2, 29.9 $\pm$ 0.2, 30.3 $\pm$ 0.2, 31.0 $\pm$ 0.2, 31.0 $\pm$ 0.2, 31.5 $\pm$ 0.2, 32.0 $\pm$ 0.2, 32.4 $\pm$ 0.2, 33.1 $\pm$ 0.2, 33.5 $\pm$ 0.2, 34.2 $\pm$ 0.2, and 34.7 $\pm$ 0.2. It may be advantageous to identify the crystalline Form D of AP1189 fumarate by X-ray lines (2-theta values)
- 15 having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form D of AP1189 fumarate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 9.2, 10.5, 10.9, 11.5, 11.9, 15.8, 17.6, 18.7, 19.4, 21.2, 21.9, 23.4, 23.9, 24.5, 26.3.
- 20 One embodiment of the present disclosure provides for a crystalline Form D of AP1189 fumarate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 9.2 $\pm$ 0.2, 10.5 $\pm$ 0.2, 10.9 $\pm$ 0.2, 11.5 $\pm$ 0.2, 11.9 $\pm$ 0.2, 15.8 $\pm$ 0.2, 17.6 $\pm$ 0.2, 18.7 $\pm$ 0.2, 19.4 $\pm$ 0.2, 21.2 $\pm$ 0.2, 21.9 $\pm$ 0.2, 23.4 $\pm$ 0.2, 23.9 $\pm$ 0.2, 24.5 $\pm$ 0.2, 26.3 $\pm$ 0.2. One
- 25 embodiment of the present disclosure provides for a crystalline Form D of AP1189 fumarate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 6.
- 30 AP1189 napadisylate Form III
- The present disclosure provides for a crystalline Form III of AP1189 napadisylate. Crystalline Form III of AP1189 napadisylate exhibits an XRPD diffractogram as shown in Figure 14. One embodiment of the present disclosure provides for a crystalline Form III of AP1189 napadisylate exhibiting at least X-ray lines (2-theta values) in a powder
- 35 diffraction pattern when measured using Cu K α radiation at 13.4 $\pm$ 0.2, 22.2 $\pm$ 0.2, and

26.8±0.2. One embodiment provides for a crystalline Form III of AP1189 napadisylate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 15.1±0.2, 15.5±0.2, 23.5±0.2, and 28.0±0.2. One embodiment of the present disclosure provides for a crystalline Form III of AP1189 napadisylate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 7.6±0.2, 10.7±0.2, 12.4±0.2, and 22.8±0.2. One embodiment of the disclosure provides for a crystalline Form III of AP1189 napadisylate exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K_α radiation according to FIG 14.

One embodiment of the disclosure provides for a crystalline Form III of AP1189 napadisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 7.5, 10.7, 12.4, 13.4, 14.0, 15.1, 15.5, 17.2, 18.3, 18.8, 19.3, 20.3, 21.4, 21.8, 22.2, 22.8, 23.5, 24.3, 24.9, 25.3, 26.8, 27.1, 27.6, 28.0, 28.5, 28.9, 29.5, 29.9, 30.5, 31.4, 31.9, 32.6, and 33.5. embodiment of the disclosure provides for a crystalline Form III of AP1189 napadisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 7.5±0.2, 10.7±0.2, 12.4±0.2, 13.4±0.2, 14.0±0.2, 15.1±0.2, 15.5±0.2, 17.2±0.2, 18.3±0.2, 18.8±0.2, 19.3±0.2, 20.3±0.2, 21.4±0.2, 21.8±0.2, 22.2±0.2, 22.8±0.2, 23.5±0.2, 24.3±0.2, 24.9±0.2, 25.3±0.2, 26.8±0.2, 27.1±0.2, 27.6±0.2, 28.0±0.2, 28.5±0.2, 28.9±0.2, 29.5±0.2, 29.9±0.2, 30.5±0.2, 31.4±0.2, 31.9±0.2, 32.6±0.2, and 33.5±0.2. It may be advantageous to identify the crystalline Form III of AP1189 napadisylate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form III of AP1189 napadisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 7.6, 10.7, 12.4, 13.4, 15.1, 15.5, 22.2, 22.8, 23.5, 26.8, and 28.0. One embodiment of the present disclosure provides for a crystalline Form III of AP1189 napadisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 7.6±0.2, 10.7±0.2, 12.4±0.2, 13.4±0.2, 15.1±0.2, 15.5±0.2, 22.2±0.2, 22.8±0.2, 23.5±0.2, 26.8±0.2, and 28.0±0.2. One embodiment of the present disclosure provides for a crystalline Form III of AP1189 napadisylate exhibiting one or

more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 9.

5 AP1189 napadisylate Form IV

The present disclosure provides for a crystalline Form IV of AP1189 napadisylate. Crystalline Form IV of AP1189 napadisylate exhibits an XRPD diffractogram as shown in Figure 15. One embodiment of the present disclosure provides for a crystalline Form IV of AP1189 napadisylate exhibiting at least X-ray lines (2-theta values) in a powder
10 diffraction pattern when measured using Cu K α radiation at 5.4 $\pm$ 0.2, 15.6 $\pm$ 0.2, and 23.4 $\pm$ 0.2. One embodiment provides for a crystalline Form IV of AP1189 napadisylate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 18.4 $\pm$ 0.2, 22.0 $\pm$ 0.2, 24.2 $\pm$ 0.2, and 25.8 $\pm$ 0.2. One embodiment of the present disclosure
15 provides for a crystalline Form IV of AP1189 napadisylate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 8.5 $\pm$ 0.2, 10.8 $\pm$ 0.2, 12.6 $\pm$ 0.2, 13.1 $\pm$ 0.2, 19.5 $\pm$ 0.2, 19.9 $\pm$ 0.2, 21.1 $\pm$ 0.2, 22.7 $\pm$ 0.2, and 25.2 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form IV of AP1189 napadisylate exhibiting an
20 X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 15.

One embodiment of the disclosure provides for a crystalline Form IV of AP1189 napadisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction
25 pattern when measured using Cu K α radiation selected from the group consisting of 5.4, 6.5, 7.4, 8.5, 10.1, 10.8, 11.3, 12.1, 12.6, 13.1, 15.6, 16.3, 16.6, 18.4, 19.0, 19.5, 19.9, 20.3, 21.1, 22.0, 22.7, 23.4, 24.2, 25.2, 25.8, 26.9, and 30.5. One embodiment of the disclosure provides for a crystalline Form IV of AP1189 napadisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured
30 using Cu K α radiation selected from the group consisting of 5.4 $\pm$ 0.2, 6.5 $\pm$ 0.2, 7.4 $\pm$ 0.2, 8.5 $\pm$ 0.2, 10.1 $\pm$ 0.2, 10.8 $\pm$ 0.2, 11.3 $\pm$ 0.2, 12.1 $\pm$ 0.2, 12.6 $\pm$ 0.2, 13.1 $\pm$ 0.2, 15.6 $\pm$ 0.2, 16.3 $\pm$ 0.2, 16.6 $\pm$ 0.2, 18.4 $\pm$ 0.2, 19.0 $\pm$ 0.2, 19.5 $\pm$ 0.2, 19.9 $\pm$ 0.2, 20.3 $\pm$ 0.2, 21.1 $\pm$ 0.2, 22.0 $\pm$ 0.2, 22.7 $\pm$ 0.2, 23.4 $\pm$ 0.2, 24.2 $\pm$ 0.2, 25.2 $\pm$ 0.2, 25.8 $\pm$ 0.2, 26.9 $\pm$ 0.2, and 30.5 $\pm$ 0.2. It may be advantageous to identify the crystalline Form IV of AP1189 napadisylate by X-
35 ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray

lines. Thus, one embodiment of the present disclosure provides for a crystalline Form IV of AP1189 napadisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.4, 8.5, 10.8, 12.6, 13.1, 15.6, 18.4, 19.5, 19.9, 21.1, 22.0, 22.7, 23.4, 24.2, 25.2, and 25.8. One embodiment of the present disclosure provides for a crystalline Form IV of AP1189 napadisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.4 $\pm$ 0.2, 8.5 $\pm$ 0.2, 10.8 $\pm$ 0.2, 12.6 $\pm$ 0.2, 13.1 $\pm$ 0.2, 15.6 $\pm$ 0.2, 18.4 $\pm$ 0.2, 19.5 $\pm$ 0.2, 19.9 $\pm$ 0.2, 21.1 $\pm$ 0.2, 22.0 $\pm$ 0.2, 22.7 $\pm$ 0.2, 23.4 $\pm$ 0.2, 24.2 $\pm$ 0.2, 25.2 $\pm$ 0.2, and 25.8 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form IV of AP1189 napadisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 10.

15 AP1189 esylate Form V

The present disclosure provides for a crystalline Form V of AP1189 esylate. Crystalline Form V of AP1189 esylate exhibits an XRPD diffractogram as shown in Figure 16. One embodiment of the present disclosure provides for a crystalline Form V of AP1189 esylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 14.5 $\pm$ 0.2, 16.5 $\pm$ 0.2, and 18.6 $\pm$ 0.2. One embodiment provides for a crystalline Form V of AP1189 esylate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 9.8 $\pm$ 0.2, 19.7 $\pm$ 0.2, 20.1 $\pm$ 0.2, and 26.8 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form V of AP1189 esylate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 8.5 $\pm$ 0.2, 10.4 $\pm$ 0.2, 15.3 $\pm$ 0.2, 21.9 $\pm$ 0.2, 22.5 $\pm$ 0.2, and 26.1 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form V of AP1189 esylate exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 16.

One embodiment of the disclosure provides for a crystalline Form V of AP1189 esylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 8.5, 9.8, 10.4, 11.3, 11.5, 13.0, 14.3, 14.5, 15.3, 16.5, 18.6, 19.7, 20.1, 21.0, 21.1, 21.9, 22.4, 23.9,

25.5, 26.1, 26.4, 26.8, 27.5, 29.7, 31.4, 32.2, and 33.5. One embodiment of the disclosure provides for a crystalline Form V of AP1189 esylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 8.5 $\pm$ 0.2, 9.8 $\pm$ 0.2, 10.4 $\pm$ 0.2, 11.3 $\pm$ 0.2, 11.5 $\pm$ 0.2, 13.0 $\pm$ 0.2, 14.3 $\pm$ 0.2, 14.5 $\pm$ 0.2, 15.3 $\pm$ 0.2, 16.5 $\pm$ 0.2, 18.6 $\pm$ 0.2, 19.7 $\pm$ 0.2, 20.1 $\pm$ 0.2, 21.0 $\pm$ 0.2, 21.1 $\pm$ 0.2, 21.9 $\pm$ 0.2, 22.4 $\pm$ 0.2, 23.9 $\pm$ 0.2, 25.5 $\pm$ 0.2, 26.1 $\pm$ 0.2, 26.4 $\pm$ 0.2, 26.8 $\pm$ 0.2, 27.5 $\pm$ 0.2, 29.7 $\pm$ 0.2, 31.4 $\pm$ 0.2, 32.2 $\pm$ 0.2, and 33.5 $\pm$ 0.2. It may be advantageous to identify the crystalline Form V of AP1189 esylate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form V of AP1189 esylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 8.5, 9.8, 10.4, 14.5, 15.3, 16.5, 18.6, 19.7, 20.1, 21.9, 22.5, 26.1, and 26.8. One embodiment of the present disclosure provides for a crystalline Form V of AP1189 esylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 8.5 $\pm$ 0.2, 9.8 $\pm$ 0.2, 10.4 $\pm$ 0.2, 14.5 $\pm$ 0.2, 15.3 $\pm$ 0.2, 16.5 $\pm$ 0.2, 18.6 $\pm$ 0.2, 19.7 $\pm$ 0.2, 20.1 $\pm$ 0.2, 21.9 $\pm$ 0.2, 22.5 $\pm$ 0.2, 26.1 $\pm$ 0.2, and 26.8 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form V of AP1189 esylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 11.

AP1189 edisylate Form VI

The present disclosure provides for a crystalline Form VI of AP1189 edisylate. Crystalline Form VI of AP1189 edisylate exhibits an XRPD diffractogram as shown in Figure 17. One embodiment of the present disclosure provides for a crystalline Form VI of AP1189 edisylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 4.8 $\pm$ 0.2, 12.8 $\pm$ 0.2, and 16.5 $\pm$ 0.2. One embodiment provides for a crystalline Form VI of AP1189 edisylate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 17.9 $\pm$ 0.2, 21.4 $\pm$ 0.2, 23.4 $\pm$ 0.2, and 27.1 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form VI of AP1189 edisylate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 9.5 $\pm$ 0.2, 10.9 $\pm$ 0.2, 14.3 $\pm$ 0.2, 15.2 $\pm$ 0.2,

18.6±0.2, and 24.5±0.2. One embodiment of the disclosure provides for a crystalline Form VI of AP1189 edisylate exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 17.

- 5 One embodiment of the disclosure provides for a crystalline Form VI of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 4.8, 9.5, 10.9, 11.6, 12.8, 14.3, 15.2, 16.5, 17.0, 17.9, 18.6, 19.2, 20.3, 21.4, 22.5, 23.4, 24.5, 25.3, 25.5, 26.5, 27.2, 28.0, 29.5, 29.7, 30.2, 31.0, 32.6, 33.3, and 34.3. One
- 10 embodiment of the disclosure provides for a crystalline Form VI of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 4.8±0.2, 9.5±0.2, 10.9±0.2, 11.6±0.2, 12.8±0.2, 14.3±0.2, 15.2±0.2, 16.5±0.2, 17.0±0.2, 17.9±0.2, 18.6±0.2, 19.2±0.2, 20.3±0.2, 21.4±0.2, 22.5±0.2, 23.4±0.2, 24.5±0.2, 25.3±0.2,
- 15 25.5±0.2, 26.5±0.2, 27.2±0.2, 28.0±0.2, 29.5±0.2, 29.7±0.2, 30.2±0.2, 31.0±0.2, 32.6±0.2, 33.3±0.2, and 34.3±0.2. It may be advantageous to identify the crystalline Form VI of AP1189 edisylate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form VI of AP1189 edisylate exhibiting one or
- 20 more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 4.8, 9.5, 10.9, 12.8, 14.3, 15.2, 16.5, 17.9, 18.6, 21.4, 23.4, 24.5, and 27.1. One embodiment of the present disclosure provides for a crystalline Form VI of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α
- 25 radiation selected from the group consisting of 4.8±0.2, 9.5±0.2, 10.9±0.2, 12.8±0.2, 14.3±0.2, 15.2±0.2, 16.5±0.2, 17.9±0.2, 18.6±0.2, 21.4±0.2, 23.4±0.2, 24.5±0.2, and 27.1±0.2. One embodiment of the present disclosure provides for a crystalline Form VI of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group
- 30 consisting of the 2-theta values in listed in Table 12.

AP1189 edisylate Form VII

The present disclosure provides for a crystalline Form VII of AP1189 edisylate.

- Crystalline Form VII of AP1189 edisylate exhibits an XRPD diffractogram as shown in
- 35 Figure 18. One embodiment of the present disclosure provides for a crystalline Form

VII of AP1189 edisylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 6.1 $\pm$ 0.2, 15.7 $\pm$ 0.2, and 23.6 $\pm$ 0.2. One embodiment provides for a crystalline Form VII of AP1189 edisylate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 12.1, 20.1 $\pm$ 0.2, and 21.8 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form VII of AP1189 edisylate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 11.7 $\pm$ 0.2, 12.7 $\pm$ 0.2, and 19.3 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form VII of AP1189 edisylate exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 18.

One embodiment of the disclosure provides for a crystalline Form VII of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.1, 10.0, 11.7, 12.1, 12.7, 14.1, 15.7, 16.3, 17.6, 17.9, 18.3, 19.3, 20.1, 20.9, 21.8, 22.4, 22.7, 23.6, 24.3, 24.8, 25.1, 25.8, 26.5, 27.0, 27.5, 28.2, 28.6, 29.7, 30.6, 31.2, 31.9, 32.4, 32.9, 33.5, and 34.1. One embodiment of the disclosure provides for a crystalline Form VII of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.1 $\pm$ 0.2, 10.0 $\pm$ 0.2, 11.7 $\pm$ 0.2, 12.1 $\pm$ 0.2, 12.7 $\pm$ 0.2, 14.1 $\pm$ 0.2, 15.7 $\pm$ 0.2, 16.3 $\pm$ 0.2, 17.6 $\pm$ 0.2, 17.9 $\pm$ 0.2, 18.3 $\pm$ 0.2, 19.3 $\pm$ 0.2, 20.1 $\pm$ 0.2, 20.9 $\pm$ 0.2, 21.8 $\pm$ 0.2, 22.4 $\pm$ 0.2, 22.7 $\pm$ 0.2, 23.6 $\pm$ 0.2, 24.3 $\pm$ 0.2, 24.8 $\pm$ 0.2, 25.1 $\pm$ 0.2, 25.8 $\pm$ 0.2, 26.5 $\pm$ 0.2, 27.0 $\pm$ 0.2, 27.5 $\pm$ 0.2, 28.2 $\pm$ 0.2, 28.6 $\pm$ 0.2, 29.7 $\pm$ 0.2, 30.6 $\pm$ 0.2, 31.2 $\pm$ 0.2, 31.9 $\pm$ 0.2, 32.4 $\pm$ 0.2, 32.9 $\pm$ 0.2, 33.5 $\pm$ 0.2, and 34.1 $\pm$ 0.2. It may be advantageous to identify the crystalline Form VII of AP1189 edisylate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form VII of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.1, 11.7, 12.1, 12.7, 15.7, 19.3, 20.1, 21.8, and 23.6. One embodiment of the present disclosure provides for a crystalline Form VII of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.1 $\pm$ 0.2, 11.7 $\pm$ 0.2, 12.1 $\pm$ 0.2,

12.7±0.2, 15.7±0.2, 19.3±0.2, 20.1±0.2, 21.8±0.2, and 23.6±0.2. One embodiment of the present disclosure provides for a crystalline Form VII of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 13.

AP1189 edisylate Form VIII

The present disclosure provides for a crystalline Form VIII of AP1189 edisylate.

Crystalline Form VIII of AP1189 edisylate exhibits an XRPD diffractogram as shown in Figure 19. One embodiment of the present disclosure provides for a crystalline Form VIII of AP1189 edisylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 15.5±0.2, 20.7±0.2, and 21.7±0.2. One embodiment provides for a crystalline Form VIII of AP1189 edisylate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 12.1±0.2, 13.0±0.2, and 24.1±0.2. One embodiment of the present disclosure provides for a crystalline Form VIII of AP1189 edisylate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.4±0.2 and 25.2±0.2. One embodiment of the disclosure provides for a crystalline Form VIII of AP1189 edisylate exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 19.

One embodiment of the disclosure provides for a crystalline Form VIII of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.4, 9.9, 12.1, 12.5, 13.0, 14.0, 15.5, 17.8, 18.3, 18.7, 19.5, 20.0, 20.7, 21.7, 22.2, 23.1, 24.1, 25.2, 25.7, 27.1, 27.9, 30.7, 31.1, 31.6, and 34.5. One embodiment of the disclosure provides for a crystalline Form VIII of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.4±0.2, 9.9±0.2, 12.1±0.2, 12.5±0.2, 13.0±0.2, 14.0±0.2, 15.5±0.2, 17.8±0.2, 18.3±0.2, 18.7±0.2, 19.5±0.2, 20.0±0.2, 20.7±0.2, 21.7±0.2, 22.2±0.2, 23.1±0.2, 24.1±0.2, 25.2±0.2, 25.7±0.2, 27.1±0.2, 27.9±0.2, 30.7±0.2, 31.1±0.2, 31.6±0.2, and 34.5±0.2. It may be advantageous to identify the crystalline Form VIII of AP1189 edisylate by X-ray lines (2-

theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form VIII of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.4, 12.1, 13.0, 15.5, 20.7, 21.7, 24.1, and 25.2. One embodiment of the present disclosure provides for a crystalline Form VIII of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.4 $\pm$ 0.2, 12.1 $\pm$ 0.2, 13.0 $\pm$ 0.2, 15.5 $\pm$ 0.2, 20.7 $\pm$ 0.2, 21.7 $\pm$ 0.2, 24.1 $\pm$ 0.2, and 25.2 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form VIII of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 14.

AP1189 edisylate Form IX

The present disclosure provides for a crystalline Form IX of AP1189 edisylate. Crystalline Form IX of AP1189 edisylate exhibits an XRPD diffractogram as shown in Figure 20. One embodiment of the present disclosure provides for a crystalline Form IX of AP1189 edisylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 4.5 $\pm$ 0.2, 16.7 $\pm$ 0.2, and 24.7 $\pm$ 0.2. One embodiment provides for a crystalline Form IX of AP1189 edisylate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 12.2 $\pm$ 0.2 and 15.5 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form IX of AP1189 edisylate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 9.0 $\pm$ 0.2 and 18.0. One embodiment of the disclosure provides for a crystalline Form IX of AP1189 edisylate exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 20.

One embodiment of the disclosure provides for a crystalline Form IX of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 4.5, 9.0, 11.7, 12.2, 12.4, 13.1, 15.5, 16.7, 17.3, 18.0, 19.9, 20.4, 21.1, 22.0, 22.9, 24.7,

26.8, and 28.3. One embodiment of the disclosure provides for a crystalline Form IX of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 4.5 $\pm$ 0.2, 9.0 $\pm$ 0.2, 11.7 $\pm$ 0.2, 12.2 $\pm$ 0.2, 12.4 $\pm$ 0.2, 13.1 $\pm$ 0.2, 15.5 $\pm$ 0.2, 16.7 $\pm$ 0.2, 17.3 $\pm$ 0.2, 18.0 $\pm$ 0.2, 19.9 $\pm$ 0.2, 20.4 $\pm$ 0.2, 21.1 $\pm$ 0.2, 22.0 $\pm$ 0.2, 22.9 $\pm$ 0.2, 24.7 $\pm$ 0.2, 26.8 $\pm$ 0.2, and 28.3 $\pm$ 0.2. It may be advantageous to identify the crystalline Form IX of AP1189 edisylate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form IX of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 4.5, 9.0, 12.2, 15.5, 16.7, 18.0, and 24.7. One embodiment of the present disclosure provides for a crystalline Form IX of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 4.5 $\pm$ 0.2, 9.0 $\pm$ 0.2, 12.2 $\pm$ 0.2, 15.5 $\pm$ 0.2, 16.7 $\pm$ 0.2, 18.0 $\pm$ 0.2, and 24.7 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form IX of AP1189 edisylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 15.

AP1189 nitrate Form X

The present disclosure provides for a crystalline Form X of AP1189 nitrate. Crystalline Form X of AP1189 nitrate exhibits an XRPD diffractogram as shown in Figure 21. One embodiment of the present disclosure provides for a crystalline Form X of AP1189 nitrate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 15.3 $\pm$ 0.2, 21.4 $\pm$ 0.2, and 25.1 $\pm$ 0.2. One embodiment provides for a crystalline Form X of AP1189 nitrate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 11.9 $\pm$ 0.2, 12.5 $\pm$ 0.2, and 27.7 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form X of AP1189 nitrate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.7 $\pm$ 0.2, 7.5 $\pm$ 0.2, 14.7 $\pm$ 0.2, 17.7 $\pm$ 0.2, and 18.1 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form X of AP1189 nitrate

exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 21.

One embodiment of the disclosure provides for a crystalline Form X of AP1189 nitrate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.7, 7.5, 11.9, 12.5, 13.1, 14.7, 15.3, 16.9, 17.7, 18.1, 18.7, 19.6, 21.4, 23.0, 24.1, 25.1, 26.6, 27.7, 29.5, and 31.7. One embodiment of the disclosure provides for a crystalline Form X of AP1189 nitrate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.7 $\pm$ 0.2, 7.5 $\pm$ 0.2, 11.9 $\pm$ 0.2, 12.5 $\pm$ 0.2, 13.1 $\pm$ 0.2, 14.7 $\pm$ 0.2, 15.3 $\pm$ 0.2, 16.9 $\pm$ 0.2, 17.7 $\pm$ 0.2, 18.1 $\pm$ 0.2, 18.7 $\pm$ 0.2, 19.6 $\pm$ 0.2, 21.4 $\pm$ 0.2, 23.0 $\pm$ 0.2, 24.1 $\pm$ 0.2, 25.1 $\pm$ 0.2, 26.6 $\pm$ 0.2, 27.7 $\pm$ 0.2, 29.5 $\pm$ 0.2, and 31.7 $\pm$ 0.2. It may be advantageous to identify the crystalline Form X of AP1189 nitrate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form X of AP1189 nitrate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.7, 7.5, 11.9, 12.5, 14.7, 15.3, 17.7, 18.1, 21.4, 25.1, and 27.7. One embodiment of the present disclosure provides for a crystalline Form X of AP1189 nitrate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.7 $\pm$ 0.2, 7.5 $\pm$ 0.2, 11.9 $\pm$ 0.2, 12.5 $\pm$ 0.2, 14.7 $\pm$ 0.2, 15.3 $\pm$ 0.2, 17.7 $\pm$ 0.2, 18.1 $\pm$ 0.2, 21.4 $\pm$ 0.2, 25.1 $\pm$ 0.2, and 27.7 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form X of AP1189 nitrate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 16.

AP1189 cyclamate Form XI

The present disclosure provides for a crystalline Form XI of AP1189 cyclamate. Crystalline Form XI of AP1189 cyclamate exhibits an XRPD diffractogram as shown in Figure 22. One embodiment of the present disclosure provides for a crystalline Form XI of AP1189 cyclamate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 7.0 $\pm$ 0.2, 13.8 $\pm$ 0.2, and 15.7 $\pm$ 0.2. One embodiment provides for a crystalline Form XI of AP1189 cyclamate

further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 15.3 $\pm$ 0.2, 20.7 $\pm$ 0.2, and 21.5 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XI of AP1189 cyclamate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.2 $\pm$ 0.2, 11.3 $\pm$ 0.2, and 21.8 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form XI of AP1189 cyclamate exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 22.

One embodiment of the disclosure provides for a crystalline Form XI of AP1189 cyclamate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.2, 5.2, 7.0, 10.4, 11.3, 11.9, 13.8, 14.2, 15.3, 15.7, 16.3, 17.6, 18.5, 19.2, 20.1, 20.7, 21.5, 21.8, 22.1, 22.7, 23.4, 25.2, 26.0, and 27.8. One embodiment of the disclosure provides for a crystalline Form XI of AP1189 cyclamate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.2 $\pm$ 0.2, 5.2 $\pm$ 0.2, 7.0 $\pm$ 0.2, 10.4 $\pm$ 0.2, 11.3 $\pm$ 0.2, 11.9 $\pm$ 0.2, 13.8 $\pm$ 0.2, 14.2 $\pm$ 0.2, 15.3 $\pm$ 0.2, 15.7 $\pm$ 0.2, 16.3 $\pm$ 0.2, 17.6 $\pm$ 0.2, 18.5 $\pm$ 0.2, 19.2 $\pm$ 0.2, 20.1 $\pm$ 0.2, 20.7 $\pm$ 0.2, 21.5 $\pm$ 0.2, 21.8 $\pm$ 0.2, 22.1 $\pm$ 0.2, 22.7 $\pm$ 0.2, 23.4 $\pm$ 0.2, 25.2 $\pm$ 0.2, 26.0 $\pm$ 0.2, and 27.8 $\pm$ 0.2. It may be advantageous to identify the crystalline Form XI of AP1189 cyclamate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XI of AP1189 cyclamate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.2, 7.0, 11.3, 13.8, 15.3, 15.7, 20.7, 21.5, and 21.8. One embodiment of the present disclosure provides for a crystalline Form XI of AP1189 cyclamate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.2 $\pm$ 0.2, 7.0 $\pm$ 0.2, 11.3 $\pm$ 0.2, 13.8 $\pm$ 0.2, 15.3 $\pm$ 0.2, 15.7 $\pm$ 0.2, 20.7 $\pm$ 0.2, 21.5 $\pm$ 0.2, and 21.8 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XI of AP1189 cyclamate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 17.

AP1189 cyclamate Form XII

The present disclosure provides for a crystalline Form XII of AP1189 cyclamate.

Crystalline Form XII of AP1189 cyclamate exhibits an XRPD diffractogram as shown in Figure 23. One embodiment of the present disclosure provides for a crystalline Form

5 XII of AP1189 cyclamate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 7.3 $\pm$ 0.2, 15.3 $\pm$ 0.2, and 17.9 $\pm$ 0.2. One embodiment provides for a crystalline Form XII of AP1189 cyclamate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of
10 16.3 $\pm$ 0.2, 19.1 $\pm$ 0.2, 22.0 $\pm$ 0.2, and 22.7 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XII of AP1189 cyclamate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 11.3 $\pm$ 0.2, 13.1 $\pm$ 0.2, and 16.9 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form XII of AP1189 cyclamate
15 exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 23.

One embodiment of the disclosure provides for a crystalline Form XII of AP1189 cyclamate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction
20 pattern when measured using Cu K α radiation selected from the group consisting of 6.3, 7.3, 9.3, 11.3, 12.7, 13.1, 14.8, 15.3, 16.3, 16.9, 17.9, 19.1, 19.3, 20.1, 22.0, 22.7, 24.1, 24.8, 25.8, 27.1, 28.0, and 29.0. One embodiment of the disclosure provides for a crystalline Form XII of AP1189 cyclamate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected
25 from the group consisting of 6.3 $\pm$ 0.2, 7.3 $\pm$ 0.2, 9.3 $\pm$ 0.2, 11.3 $\pm$ 0.2, 12.7 $\pm$ 0.2, 13.1 $\pm$ 0.2, 14.8 $\pm$ 0.2, 15.3 $\pm$ 0.2, 16.3 $\pm$ 0.2, 16.9 $\pm$ 0.2, 17.9 $\pm$ 0.2, 19.1 $\pm$ 0.2, 19.3 $\pm$ 0.2, 20.1 $\pm$ 0.2, 22.0 $\pm$ 0.2, 22.7 $\pm$ 0.2, 24.1 $\pm$ 0.2, 24.8 $\pm$ 0.2, 25.8 $\pm$ 0.2, 27.1 $\pm$ 0.2, 28.0 $\pm$ 0.2, and 29.0 $\pm$ 0.2. It may be advantageous to identify the crystalline Form XII of AP1189 cyclamate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray
30 lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XII of AP1189 cyclamate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 7.3, 11.3, 13.1, 14.3, 16.3, 16.9, 17.9, 19.1, 22.0, and 22.7. One embodiment of the present disclosure provides for a crystalline Form XII of AP1189
35 cyclamate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction

pattern when measured using Cu K α radiation selected from the group consisting of 7.3 $\pm$ 0.2, 11.3 $\pm$ 0.2, 13.1 $\pm$ 0.2, 14.3 $\pm$ 0.2, 16.3 $\pm$ 0.2, 16.9 $\pm$ 0.2, 17.9 $\pm$ 0.2, 19.1 $\pm$ 0.2, 22.0 $\pm$ 0.2, and 22.7 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XII of AP1189 cyclamate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 18.

AP1189 cyclamate Form XIII

The present disclosure provides for a crystalline Form XIII of AP1189 cyclamate.

Crystalline Form XIII of AP1189 cyclamate exhibits an XRPD diffractogram as shown in Figure 24. One embodiment of the present disclosure provides for a crystalline Form XIII of AP1189 cyclamate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 15.3 $\pm$ 0.2, 18.5 $\pm$ 0.2, and 18.7 $\pm$ 0.2. One embodiment provides for a crystalline Form XIII of AP1189 cyclamate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.4 $\pm$ 0.2, 14.6 $\pm$ 0.2, 16.7 $\pm$ 0.2, and 19.8 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XIII of AP1189 cyclamate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.6 $\pm$ 0.2, 7.1 $\pm$ 0.2, 8.5 $\pm$ 0.2, 10.5 $\pm$ 0.2, 13.1 $\pm$ 0.2, and 16.2 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form XIII of AP1189 cyclamate exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 24.

One embodiment of the disclosure provides for a crystalline Form XIII of AP1189 cyclamate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.3, 5.6, 6.4, 7.1, 7.6, 8.5, 9.4, 9.9, 10.2, 10.5, 10.9, 11.6, 11.9, 12.3, 13.1, 13.3, 13.7, 14.1, 14.6, 15.3, 16.2, 16.7, 17.5, 18.5, 18.7, 19.8, 20.2, 20.6, 21.1, 21.1, 21.3, 21.7, 22.1, 22.6, 22.8, 23.7, 24.1, 24.9, 25.1, 25.7, 26.2, 27.0, 27.7, 28.7, 29.4, 30.0, 30.8, 31.6, 32.4, and 33.6. One embodiment of the disclosure provides for a crystalline Form XIII of AP1189 cyclamate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.3 $\pm$ 0.2, 5.6 $\pm$ 0.2, 6.4 $\pm$ 0.2, 7.1 $\pm$ 0.2, 7.6 $\pm$ 0.2, 8.5 $\pm$ 0.2, 9.4 $\pm$ 0.2, 9.9 $\pm$ 0.2, 10.2 $\pm$ 0.2, 10.5 $\pm$ 0.2, 10.9 $\pm$ 0.2, 11.6 $\pm$ 0.2, 11.9 $\pm$ 0.2, 12.3 $\pm$ 0.2, 13.1 $\pm$ 0.2,

13.3±0.2, 13.7±0.2, 14.1±0.2, 14.6±0.2, 15.3±0.2, 16.2±0.2, 16.7±0.2, 17.5±0.2, 18.5±0.2, 18.7±0.2, 19.8±0.2, 20.2±0.2, 20.6±0.2, 21.1±0.2, 21.1±0.2, 21.3±0.2, 21.7±0.2, 22.1±0.2, 22.6±0.2, 22.8±0.2, 23.7±0.2, 24.1±0.2, 24.9±0.2, 25.1±0.2, 25.7±0.2, 26.2±0.2, 27.0±0.2, 27.7±0.2, 28.7±0.2, 29.4±0.2, 30.0±0.2, 30.8±0.2,

5 31.6±0.2, 32.4±0.2, and 33.6±0.2. It may be advantageous to identify the crystalline Form XIII of AP1189 cyclamate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XIII of AP1189 cyclamate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using
10 Cu K_α radiation selected from the group consisting of 5.6, 6.4, 7.1, 8.5, 10.5, 13.1, 14.6, 15.3, 16.2, 16.7, 18.5, 18.7, 19.8, 26.2, and 27.0. One embodiment of the present disclosure provides for a crystalline Form XIII of AP1189 cyclamate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using
15 Cu K_α radiation selected from the group consisting of 5.6±0.2, 6.4±0.2, 7.1±0.2, 8.5±0.2, 10.5±0.2, 13.1±0.2, 14.6±0.2, 15.3±0.2, 16.2±0.2, 16.7±0.2, 18.5±0.2, 18.7±0.2, 19.8±0.2, 26.2±0.2, and 27.0±0.2. One embodiment of the present disclosure provides for a crystalline Form XIII of AP1189 cyclamate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of the 2-theta values in listed in Table 19.

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AP1189 besylate Form XIV

The present disclosure provides for a crystalline Form XIV of AP1189 besylate.

Crystalline Form XIV of AP1189 besylate exhibits an XRPD diffractogram as shown in Figure 25. One embodiment of the present disclosure provides for a crystalline Form

25 XIV of AP1189 besylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation at 13.0±0.2, 15.1±0.2, and 19.9±0.2. One embodiment provides for a crystalline Form XIV of AP1189 besylate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of
30 11.2±0.2 and 18.3±0.2. One embodiment of the present disclosure provides for a crystalline Form XIV of AP1189 besylate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 8.3±0.2, 9.0±0.2, 16.4±0.2, and 18.7±0.2. One embodiment of the disclosure provides for a crystalline Form XIV of AP1189 besylate

exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 25.

One embodiment of the disclosure provides for a crystalline Form XIV of AP1189 besylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.2, 8.3, 9.0, 9.9, 10.8, 11.2, 13.0, 13.1, 15.1, 16.0, 16.4, 16.7, 17.3, 18.1, 18.3, 18.7, 19.0, 19.4, 19.9, 20.3, 20.9, 21.3, 21.7, 22.0, 22.8, 23.1, 23.6, 24.8, 25.1, 25.4, 26.3, 26.5, 27.1, 28.1, 28.5, 29.8, 30.4, 31.1, 32.0, 33.2, and 34.1. One embodiment of the disclosure provides for a crystalline Form XIV of AP1189 besylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.2 $\pm$ 0.2, 8.3 $\pm$ 0.2, 9.0 $\pm$ 0.2, 9.9 $\pm$ 0.2, 10.8 $\pm$ 0.2, 11.2 $\pm$ 0.2, 13.0 $\pm$ 0.2, 13.1 $\pm$ 0.2, 15.1 $\pm$ 0.2, 16.0 $\pm$ 0.2, 16.4 $\pm$ 0.2, 16.7 $\pm$ 0.2, 17.3 $\pm$ 0.2, 18.1 $\pm$ 0.2, 18.3 $\pm$ 0.2, 18.7 $\pm$ 0.2, 19.0 $\pm$ 0.2, 19.4 $\pm$ 0.2, 19.9 $\pm$ 0.2, 20.3 $\pm$ 0.2, 20.9 $\pm$ 0.2, 21.3 $\pm$ 0.2, 21.7 $\pm$ 0.2, 22.0 $\pm$ 0.2, 22.8 $\pm$ 0.2, 23.1 $\pm$ 0.2, 23.6 $\pm$ 0.2, 24.8 $\pm$ 0.2, 25.1 $\pm$ 0.2, 25.4 $\pm$ 0.2, 26.3 $\pm$ 0.2, 26.5 $\pm$ 0.2, 27.1 $\pm$ 0.2, 28.1 $\pm$ 0.2, 28.5 $\pm$ 0.2, 29.8 $\pm$ 0.2, 30.4 $\pm$ 0.2, 31.1 $\pm$ 0.2, 32.0 $\pm$ 0.2, 33.2 $\pm$ 0.2, and 34.1 $\pm$ 0.2. It may be advantageous to identify the crystalline Form XIV of AP1189 besylate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XIV of AP1189 besylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 8.3, 9.0, 11.2, 13.0, 15.1, 16.4, 18.3, 18.7, and 19.9. One embodiment of the present disclosure provides for a crystalline Form XIV of AP1189 besylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 8.3 $\pm$ 0.2, 9.0 $\pm$ 0.2, 11.2 $\pm$ 0.2, 13.0 $\pm$ 0.2, 15.1 $\pm$ 0.2, 16.4 $\pm$ 0.2, 18.3 $\pm$ 0.2, 18.7 $\pm$ 0.2, and 19.9 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XIV of AP1189 besylate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 20.

AP1189 oxalate Form XV

The present disclosure provides for a crystalline Form XV of AP1189 oxalate.

Crystalline Form XV of AP1189 oxalate exhibits an XRPD diffractogram as shown in

- Figure 26. One embodiment of the present disclosure provides for a crystalline Form XV of AP1189 oxalate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 19.5 $\pm$ 0.2, 23.3 $\pm$ 0.2, and 25.8 $\pm$ 0.2. One embodiment provides for a crystalline Form XV of AP1189 oxalate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 13.9 $\pm$ 0.2, 15.6 $\pm$ 0.2, and 23.8 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XV of AP1189 oxalate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 7.2 $\pm$ 0.2, 10.8 $\pm$ 0.2, and 21.7 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form XV of AP1189 oxalate exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 26.
- One embodiment of the disclosure provides for a crystalline Form XV of AP1189 oxalate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 7.2, 10.8, 12.1, 13.9, 14.5, 15.0, 15.6, 16.5, 16.8, 17.3, 18.2, 18.5, 19.5, 20.1, 21.7, 22.9, 23.3, 23.8, 24.3, 24.8, 25.8, 27.0, 27.9, 28.6, 29.3, 29.7, 30.2, 32.2, and 32.9.
- One embodiment of the disclosure provides for a crystalline Form XV of AP1189 oxalate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 7.2 $\pm$ 0.2, 10.8 $\pm$ 0.2, 12.1 $\pm$ 0.2, 13.9 $\pm$ 0.2, 14.5 $\pm$ 0.2, 15.0 $\pm$ 0.2, 15.6 $\pm$ 0.2, 16.5 $\pm$ 0.2, 16.8 $\pm$ 0.2, 17.3 $\pm$ 0.2, 18.2 $\pm$ 0.2, 18.5 $\pm$ 0.2, 19.5 $\pm$ 0.2, 20.1 $\pm$ 0.2, 21.7 $\pm$ 0.2, 22.9 $\pm$ 0.2, 23.3 $\pm$ 0.2, 23.8 $\pm$ 0.2, 24.3 $\pm$ 0.2, 24.8 $\pm$ 0.2, 25.8 $\pm$ 0.2, 27.0 $\pm$ 0.2, 27.9 $\pm$ 0.2, 28.6 $\pm$ 0.2, 29.3 $\pm$ 0.2, 29.7 $\pm$ 0.2, 30.2 $\pm$ 0.2, 32.2 $\pm$ 0.2, and 32.9 $\pm$ 0.2. It may be advantageous to identify the crystalline Form XV of AP1189 oxalate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XV of AP1189 oxalate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 7.2, 10.8, 13.9, 15.6, 19.5, 21.7, 23.3, 23.8, and 25.8. One embodiment of the present disclosure provides for a crystalline Form XV of AP1189 oxalate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 7.2 $\pm$ 0.2, 10.8 $\pm$ 0.2, 13.9 $\pm$ 0.2, 15.6 $\pm$ 0.2,

19.5±0.2, 21.7±0.2, 23.3±0.2, 23.8±0.2, and 25.8±0.2. One embodiment of the present disclosure provides for a crystalline Form XV of AP1189 oxalate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of the 2-theta values in listed in Table 21.

5

AP1189 oxalate Form XVI

The present disclosure provides for a crystalline Form XVI of AP1189 oxalate.

Crystalline Form XVI of AP1189 oxalate exhibits an XRPD diffractogram as shown in Figure 27. One embodiment of the present disclosure provides for a crystalline Form

10 XVI of AP1189 oxalate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation at 17.1±0.2, 17.9±0.2, and 19.6±0.2. One embodiment provides for a crystalline Form XVI of AP1189 oxalate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of
15 15.9±0.2, 24.2±0.2, 24.4±0.2, and 27.3±0.2. One embodiment of the present disclosure provides for a crystalline Form XVI of AP1189 oxalate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 9.5±0.2, 11.3±0.2, 21.2±0.2, and 25.4±0.2. One embodiment of the disclosure provides for a crystalline Form XVI of
20 AP1189 oxalate exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K_α radiation according to FIG 27.

One embodiment of the disclosure provides for a crystalline Form XVI of AP1189 oxalate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction
25 pattern when measured using Cu K_α radiation selected from the group consisting of 9.5, 11.3, 12.1, 13.1, 14.0, 15.3, 15.9, 16.4, 17.1, 17.9, 18.9, 19.6, 20.0, 21.2, 22.0, 22.7, 23.0, 23.4, 24.2, 24.4, 24.8, 25.4, 25.7, 26.3, 27.3, 28.4, 29.9, 30.4, 31.3, 32.2, 33.3, 33.9, 34.3, and 34.9. One embodiment of the disclosure provides for a crystalline Form XVI of AP1189 oxalate exhibiting one or more X-ray lines (2-theta values) in a
30 powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 9.5±0.2, 11.3±0.2, 12.1±0.2, 13.1±0.2, 14.0±0.2, 15.3±0.2, 15.9±0.2, 16.4±0.2, 17.1±0.2, 17.9±0.2, 18.9±0.2, 19.6±0.2, 20.0±0.2, 21.2±0.2, 22.0±0.2, 22.7±0.2, 23.0±0.2, 23.4±0.2, 24.2±0.2, 24.4±0.2, 24.8±0.2, 25.4±0.2, 25.7±0.2, 26.3±0.2, 27.3±0.2, 28.4±0.2, 29.9±0.2, 30.4±0.2, 31.3±0.2, 32.2±0.2,
35 33.3±0.2, 33.9±0.2, 34.3±0.2, and 34.9±0.2. It may be advantageous to identify the

crystalline Form XVI of AP1189 oxalate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XVI of AP1189 oxalate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 9.5, 11.3, 15.9, 17.1, 17.9, 19.6, 21.2, 24.2, 24.4, 25.4, and 27.3. One embodiment of the present disclosure provides for a crystalline Form XVI of AP1189 oxalate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 9.5 $\pm$ 0.2, 11.3 $\pm$ 0.2, 15.9 $\pm$ 0.2, 17.1 $\pm$ 0.2, 17.9 $\pm$ 0.2, 19.6 $\pm$ 0.2, 21.2 $\pm$ 0.2, 24.2 $\pm$ 0.2, 24.4 $\pm$ 0.2, 25.4 $\pm$ 0.2, and 27.3 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XVI of AP1189 oxalate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 22.

AP1189 oxalate Form XVII

The present disclosure provides for a crystalline Form XVII of AP1189 oxalate.

Crystalline Form XVII of AP1189 oxalate exhibits an XRPD diffractogram as shown in Figure 28. One embodiment of the present disclosure provides for a crystalline Form

XVII of AP1189 oxalate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 6.3 $\pm$ 0.2, 10.6 $\pm$ 0.2, and 19.8 $\pm$ 0.2. One embodiment provides for a crystalline Form XVII of AP1189 oxalate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 11.7 $\pm$ 0.2, 12.3 $\pm$ 0.2, 18.4 $\pm$ 0.2, and 23.8 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XVII of AP1189 oxalate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 14.1 $\pm$ 0.2, 23.5 $\pm$ 0.2, and 30.0 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form XVII of AP1189 oxalate exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 28.

One embodiment of the disclosure provides for a crystalline Form XVII of AP1189 oxalate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of

6.3, 8.2, 10.6, 11.7, 12.3, 12.6, 12.9, 13.2, 14.1, 14.2, 15.8, 16.1, 17.1, 17.8, 18.4, 19.0, 19.2, 19.8, 20.3, 20.7, 21.0, 21.4, 21.8, 22.0, 22.3, 22.6, 23.2, 23.5, 23.8, 24.4, 24.8, 25.4, 25.9, 26.1, 26.6, 27.1, 27.5, 27.8, 28.3, 28.7, 29.0, 30.0, 31.1, 33.0, 33.7, and 34.3. One embodiment of the disclosure provides for a crystalline Form XVII of AP1189 oxalate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.3 $\pm$ 0.2, 8.2 $\pm$ 0.2, 10.6 $\pm$ 0.2, 11.7 $\pm$ 0.2, 12.3 $\pm$ 0.2, 12.6 $\pm$ 0.2, 12.9 $\pm$ 0.2, 13.2 $\pm$ 0.2, 14.1 $\pm$ 0.2, 14.2 $\pm$ 0.2, 15.8 $\pm$ 0.2, 16.1 $\pm$ 0.2, 17.1 $\pm$ 0.2, 17.8 $\pm$ 0.2, 18.4 $\pm$ 0.2, 19.0 $\pm$ 0.2, 19.2 $\pm$ 0.2, 19.8 $\pm$ 0.2, 20.3 $\pm$ 0.2, 20.7 $\pm$ 0.2, 21.0 $\pm$ 0.2, 21.4 $\pm$ 0.2, 21.8 $\pm$ 0.2, 22.0 $\pm$ 0.2, 22.3 $\pm$ 0.2, 22.6 $\pm$ 0.2, 23.2 $\pm$ 0.2, 23.5 $\pm$ 0.2, 23.8 $\pm$ 0.2, 24.4 $\pm$ 0.2, 24.8 $\pm$ 0.2, 25.4 $\pm$ 0.2, 25.9 $\pm$ 0.2, 26.1 $\pm$ 0.2, 26.6 $\pm$ 0.2, 27.1 $\pm$ 0.2, 27.5 $\pm$ 0.2, 27.8 $\pm$ 0.2, 28.3 $\pm$ 0.2, 28.7 $\pm$ 0.2, 29.0 $\pm$ 0.2, 30.0 $\pm$ 0.2, 31.1 $\pm$ 0.2, 33.0 $\pm$ 0.2, 33.7 $\pm$ 0.2, and 34.3 $\pm$ 0.2. It may be advantageous to identify the crystalline Form XVII of AP1189 oxalate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XVII of AP1189 oxalate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.3, 10.6, 11.7, 12.3, 14.1, 18.4, 19.8, 23.5, 23.8, and 30.0. One embodiment of the present disclosure provides for a crystalline Form XVII of AP1189 oxalate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.3 $\pm$ 0.2, 10.6 $\pm$ 0.2, 11.7 $\pm$ 0.2, 12.3 $\pm$ 0.2, 14.1 $\pm$ 0.2, 18.4 $\pm$ 0.2, 19.8 $\pm$ 0.2, 23.5 $\pm$ 0.2, 23.8 $\pm$ 0.2, and 30.0 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XVII of AP1189 oxalate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 23.

AP1189 (+)-Camphor-10-sulfonic acid Form XVIII

The present disclosure provides for a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid. Crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid exhibits an XRPD diffractogram as shown in Figure 29. One embodiment of the present disclosure provides for a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 6.5 $\pm$ 0.2, 11.5 $\pm$ 0.2, and 14.8 $\pm$ 0.2. One embodiment provides for a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid further

exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 13.0 $\pm$ 0.2, 13.7 $\pm$ 0.2, 16.1 $\pm$ 0.2, and 21.1 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 15.9 $\pm$ 0.2, 18.8 $\pm$ 0.2, and 19.8 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 29.

One embodiment of the disclosure provides for a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.1, 6.5, 7.7, 9.4, 9.9, 10.4, 11.0, 11.5, 12.2, 13.0, 13.7, 14.0, 14.3, 14.8, 15.6, 15.9, 16.1, 17.2, 18.1, 18.4, 18.8, 19.8, 21.1, 21.5, 22.2, 22.7, 23.2, 23.8, 25.1, 25.7, 26.1, 27.2, 28.7, 30.1, and 31.5. One embodiment of the disclosure provides for a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.1 $\pm$ 0.2, 6.5 $\pm$ 0.2, 7.7 $\pm$ 0.2, 9.4 $\pm$ 0.2, 9.9 $\pm$ 0.2, 10.4 $\pm$ 0.2, 11.0 $\pm$ 0.2, 11.5 $\pm$ 0.2, 12.2 $\pm$ 0.2, 13.0 $\pm$ 0.2, 13.7 $\pm$ 0.2, 14.0 $\pm$ 0.2, 14.3 $\pm$ 0.2, 14.8 $\pm$ 0.2, 15.6 $\pm$ 0.2, 15.9 $\pm$ 0.2, 16.1 $\pm$ 0.2, 17.2 $\pm$ 0.2, 18.1 $\pm$ 0.2, 18.4 $\pm$ 0.2, 18.8 $\pm$ 0.2, 19.8 $\pm$ 0.2, 21.1 $\pm$ 0.2, 21.5 $\pm$ 0.2, 22.2 $\pm$ 0.2, 22.7 $\pm$ 0.2, 23.2 $\pm$ 0.2, 23.8 $\pm$ 0.2, 25.1 $\pm$ 0.2, 25.7 $\pm$ 0.2, 26.1 $\pm$ 0.2, 27.2 $\pm$ 0.2, 28.7 $\pm$ 0.2, 30.1 $\pm$ 0.2, and 31.5 $\pm$ 0.2. It may be advantageous to identify the crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.5, 11.5, 13.0, 13.7, 14.8, 15.9, 16.1, 18.8, 19.8, and 21.1. One embodiment of the present disclosure provides for a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.5 $\pm$ 0.2, 11.5 $\pm$ 0.2, 13.0 $\pm$ 0.2, 13.7 $\pm$ 0.2, 14.8 $\pm$ 0.2, 15.9 $\pm$ 0.2, 16.1 $\pm$ 0.2, 18.8 $\pm$ 0.2, 19.8 $\pm$ 0.2, and 21.1 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XVIII of AP1189 (+)-camphor-10-

sulfonic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 24.

5 AP1189 oxoglutarate Form XIX

The present disclosure provides for a crystalline Form XIX of AP1189 oxoglutarate. Crystalline Form XIX of AP1189 oxoglutarate exhibits an XRPD diffractogram as shown in Figure 30. One embodiment of the present disclosure provides for a crystalline Form XIX of AP1189 oxoglutarate exhibiting at least X-ray lines (2-theta values) in a powder
10 diffraction pattern when measured using Cu K α radiation at 16.8 $\pm$ 0.2, 23.4 $\pm$ 0.2, and 23.6 $\pm$ 0.2. One embodiment provides for a crystalline Form XIX of AP1189 oxoglutarate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 13.4 $\pm$ 0.2, 16.4 $\pm$ 0.2, 21.6 $\pm$ 0.2, and 26.5 $\pm$ 0.2. One embodiment of the present disclosure
15 provides for a crystalline Form XIX of AP1189 oxoglutarate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 9.1 $\pm$ 0.2, 10.7 $\pm$ 0.2, 12.8 $\pm$ 0.2, 13.2 $\pm$ 0.2, 20.8 $\pm$ 0.2, 24.1 $\pm$ 0.2, and 24.2 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form XIX of AP1189 oxoglutarate exhibiting an X-ray pattern
20 (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 30.

One embodiment of the disclosure provides for a crystalline Form XIX of AP1189 oxoglutarate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction
25 pattern when measured using Cu K α radiation selected from the group consisting of 9.1, 10.7, 11.8, 12.0, 12.8, 13.2, 13.4, 13.8, 14.0, 15.9, 16.4, 16.8, 17.1, 17.9, 18.3, 19.5, 20.1, 20.8, 21.6, 22.0, 22.9, 23.4, 23.6, 24.1, 24.2, 25.8, 26.5, 26.9, 27.4, 27.9, 28.9, 29.9, 30.3, 30.9, 32.3, 32.6, 33.1, 33.8, and 34.7. One embodiment of the disclosure provides for a crystalline Form XIX of AP1189 oxoglutarate exhibiting one or
30 more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 9.1 $\pm$ 0.2, 10.7 $\pm$ 0.2, 11.8 $\pm$ 0.2, 12.0 $\pm$ 0.2, 12.8 $\pm$ 0.2, 13.2 $\pm$ 0.2, 13.4 $\pm$ 0.2, 13.8 $\pm$ 0.2, 14.0 $\pm$ 0.2, 15.9 $\pm$ 0.2, 16.4 $\pm$ 0.2, 16.8 $\pm$ 0.2, 17.1 $\pm$ 0.2, 17.9 $\pm$ 0.2, 18.3 $\pm$ 0.2, 19.5 $\pm$ 0.2, 20.1 $\pm$ 0.2, 20.8 $\pm$ 0.2, 21.6 $\pm$ 0.2, 22.0 $\pm$ 0.2, 22.9 $\pm$ 0.2, 23.4 $\pm$ 0.2, 23.6 $\pm$ 0.2, 24.1 $\pm$ 0.2, 24.2 $\pm$ 0.2, 25.8 $\pm$ 0.2, 26.5 $\pm$ 0.2,
35 26.9 $\pm$ 0.2, 27.4 $\pm$ 0.2, 27.9 $\pm$ 0.2, 28.9 $\pm$ 0.2, 29.9 $\pm$ 0.2, 30.3 $\pm$ 0.2, 30.9 $\pm$ 0.2, 32.3 $\pm$ 0.2,

32.6±0.2, 33.1±0.2, 33.8±0.2, and 34.7±0.2. It may be advantageous to identify the crystalline Form XIX of AP1189 oxoglutarate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XIX of AP1189 oxoglutarate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 9.1, 10.7, 12.8, 13.2, 13.4, 16.4, 16.8, 20.8, 21.6, 23.4, 23.6, 24.1, 24.2, 26.5, and 26.9. One embodiment of the present disclosure provides for a crystalline Form XIX of AP1189 oxoglutarate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 9.1±0.2, 10.7±0.2, 12.8±0.2, 13.2±0.2, 13.4±0.2, 16.4±0.2, 16.8±0.2, 20.8±0.2, 21.6±0.2, 23.4±0.2, 23.6±0.2, 24.1±0.2, 24.2±0.2, 26.5±0.2, and 26.9±0.2. One embodiment of the present disclosure provides for a crystalline Form XIX of AP1189 oxoglutarate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of the 2-theta values in listed in Table 25.

AP1189 DL-mandelic acid Form XX

The present disclosure provides for a crystalline Form XX of AP1189 DL-mandelic acid. Crystalline Form XX of AP1189 DL-mandelic acid exhibits an XRPD diffractogram as shown in Figure 31. One embodiment of the present disclosure provides for a crystalline Form XX of AP1189 DL-mandelic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation at 14.8±0.2, 24.2±0.2, and 25.5±0.2. One embodiment provides for a crystalline Form XX of AP1189 DL-mandelic acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 9.6±0.2, 10.0±0.2, 19.1±0.2, and 21.5±0.2. One embodiment of the present disclosure provides for a crystalline Form XX of AP1189 DL-mandelic acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 5.3±0.2, 12.4±0.2, 13.3±0.2, 16.0±0.2, 16.8±0.2, 17.9±0.2, 21.2±0.2, and 24.8±0.2. One embodiment of the disclosure provides for a crystalline Form XX of AP1189 DL-mandelic acid exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K_α radiation according to FIG 31.

One embodiment of the disclosure provides for a crystalline Form XX of AP1189 DL-mandelic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.3, 9.6, 10.0, 10.7, 10.9, 11.7, 12.0, 12.4, 13.3, 13.9, 14.8, 15.3, 16.0, 16.8, 17.0, 17.3, 17.6, 17.9, 18.5, 19.1, 19.8, 20.2, 20.7, 21.2, 21.5, 21.8, 22.9, 24.2, 24.5, 24.8, 25.5, 26.4, 26.9, 27.1, 27.5, 28.1, 28.4, 29.7, 30.3, 31.2, 32.4, 32.8, 33.1, 33.5, 34.4, and 34.7. One embodiment of the disclosure provides for a crystalline Form XX of AP1189 DL-mandelic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.3 $\pm$ 0.2, 9.6 $\pm$ 0.2, 10.0 $\pm$ 0.2, 10.7 $\pm$ 0.2, 10.9 $\pm$ 0.2, 11.7 $\pm$ 0.2, 12.0 $\pm$ 0.2, 12.4 $\pm$ 0.2, 13.3 $\pm$ 0.2, 13.9 $\pm$ 0.2, 14.8 $\pm$ 0.2, 15.3 $\pm$ 0.2, 16.0 $\pm$ 0.2, 16.8 $\pm$ 0.2, 17.0 $\pm$ 0.2, 17.3 $\pm$ 0.2, 17.6 $\pm$ 0.2, 17.9 $\pm$ 0.2, 18.5 $\pm$ 0.2, 19.1 $\pm$ 0.2, 19.8 $\pm$ 0.2, 20.2 $\pm$ 0.2, 20.7 $\pm$ 0.2, 21.2 $\pm$ 0.2, 21.5 $\pm$ 0.2, 21.8 $\pm$ 0.2, 22.9 $\pm$ 0.2, 24.2 $\pm$ 0.2, 24.5 $\pm$ 0.2, 24.8 $\pm$ 0.2, 25.5 $\pm$ 0.2, 26.4 $\pm$ 0.2, 26.9 $\pm$ 0.2, 27.1 $\pm$ 0.2, 27.5 $\pm$ 0.2, 28.1 $\pm$ 0.2, 28.4 $\pm$ 0.2, 29.7 $\pm$ 0.2, 30.3 $\pm$ 0.2, 31.2 $\pm$ 0.2, 32.4 $\pm$ 0.2, 32.8 $\pm$ 0.2, 33.1 $\pm$ 0.2, 33.5 $\pm$ 0.2, 34.4 $\pm$ 0.2, and 34.7 $\pm$ 0.2. It may be advantageous to identify the crystalline Form XX of AP1189 DL-mandelic acid by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XX of AP1189 DL-mandelic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.3, 9.6, 10.0, 12.4, 13.3, 14.8, 16.0, 16.8, 17.9, 19.1, 21.2, 21.5, 24.2, 24.8, and 25.5. One embodiment of the present disclosure provides for a crystalline Form XX of AP1189 DL-mandelic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.3 $\pm$ 0.2, 9.6 $\pm$ 0.2, 10.0 $\pm$ 0.2, 12.4 $\pm$ 0.2, 13.3 $\pm$ 0.2, 14.8 $\pm$ 0.2, 16.0 $\pm$ 0.2, 16.8 $\pm$ 0.2, 17.9 $\pm$ 0.2, 19.1 $\pm$ 0.2, 21.2 $\pm$ 0.2, 21.5 $\pm$ 0.2, 24.2 $\pm$ 0.2, 24.8 $\pm$ 0.2, and 25.5 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XX of AP1189 DL-mandelic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 26.

AP1189 DL-mandelic acid Form XXI

The present disclosure provides for a crystalline Form XXI of AP1189 DL-mandelic acid. Crystalline Form XXI of AP1189 DL-mandelic acid exhibits an XRPD diffractogram as shown in Figure 32. One embodiment of the present disclosure

provides for a crystalline Form XXI of AP1189 DL-mandelic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 5.4 $\pm$ 0.2, 10.0 $\pm$ 0.2, and 24.6 $\pm$ 0.2. One embodiment provides for a crystalline Form XXI of AP1189 further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 9.8 $\pm$ 0.2, 16.6 $\pm$ 0.2, 18.1 $\pm$ 0.2, and 21.1 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XXI of AP1189 DL-mandelic acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 12.7 $\pm$ 0.2, 13.5 $\pm$ 0.2, 21.7 $\pm$ 0.2, and 25.4 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form XXI of AP1189 DL-mandelic acid exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 32.

One embodiment of the disclosure provides for a crystalline Form XXI of AP1189 DL-mandelic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.4, 9.8, 10.0, 11.2, 11.5, 11.8, 12.7, 13.5, 14.4, 15.0, 15.5, 15.7, 15.8, 16.6, 17.2, 18.1, 19.6, 20.2, 20.7, 21.1, 21.7, 22.6, 23.3, 23.6, 24.6, 25.4, 26.1, 27.0, 27.3, 28.7, 29.0, 29.8, 30.4, 30.7, 31.2, 32.8, 33.5, 34.0, and 34.5. One embodiment of the disclosure provides for a crystalline Form XXI of AP1189 DL-mandelic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.4 $\pm$ 0.2, 9.8 $\pm$ 0.2, 10.0 $\pm$ 0.2, 11.2 $\pm$ 0.2, 11.5 $\pm$ 0.2, 11.8 $\pm$ 0.2, 12.7 $\pm$ 0.2, 13.5 $\pm$ 0.2, 14.4 $\pm$ 0.2, 15.0 $\pm$ 0.2, 15.5 $\pm$ 0.2, 15.7 $\pm$ 0.2, 15.8 $\pm$ 0.2, 16.6 $\pm$ 0.2, 17.2 $\pm$ 0.2, 18.1 $\pm$ 0.2, 19.6 $\pm$ 0.2, 20.2 $\pm$ 0.2, 20.7 $\pm$ 0.2, 21.1 $\pm$ 0.2, 21.7 $\pm$ 0.2, 22.6 $\pm$ 0.2, 23.3 $\pm$ 0.2, 23.6 $\pm$ 0.2, 24.6 $\pm$ 0.2, 25.4 $\pm$ 0.2, 26.1 $\pm$ 0.2, 27.0 $\pm$ 0.2, 27.3 $\pm$ 0.2, 28.7 $\pm$ 0.2, 29.0 $\pm$ 0.2, 29.8 $\pm$ 0.2, 30.4 $\pm$ 0.2, 30.7 $\pm$ 0.2, 31.2 $\pm$ 0.2, 32.8 $\pm$ 0.2, 33.5 $\pm$ 0.2, 34.0 $\pm$ 0.2, and 34.5 $\pm$ 0.2. It may be advantageous to identify the crystalline Form XXI of AP1189 DL-mandelic acid by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XXI of AP1189 DL-mandelic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.4, 9.8, 10.0, 12.7, 13.5, 16.6, 18.1, 21.1, 21.7, 24.6, and 25.4. One embodiment of the present disclosure provides for a crystalline Form XXI of AP1189 DL-mandelic acid exhibiting

one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.4 $\pm$ 0.2, 9.8 $\pm$ 0.2, 10.0 $\pm$ 0.2, 12.7 $\pm$ 0.2, 13.5 $\pm$ 0.2, 16.6 $\pm$ 0.2, 18.1 $\pm$ 0.2, 21.1 $\pm$ 0.2, 21.7 $\pm$ 0.2, 24.6 $\pm$ 0.2, and 25.4 $\pm$ 0.2.

One embodiment of the present disclosure provides for a crystalline Form XXI of AP1189 DL-mandelic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 27.

AP1189 hippuric acid Form XXII

The present disclosure provides for a crystalline Form XXII of AP1189 hippuric acid. Crystalline Form XXII of AP1189 hippuric acid exhibits an XRPD diffractogram as shown in Figure 33. One embodiment of the present disclosure provides for a crystalline Form XXII of AP1189 hippuric acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 20.1 $\pm$ 0.2, 24.1 $\pm$ 0.2, and 24.5 $\pm$ 0.2. One embodiment provides for a crystalline Form XXII of AP1189 hippuric acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 10.9 $\pm$ 0.2, 11.5 $\pm$ 0.2, 14.4 $\pm$ 0.2, 14.9 $\pm$ 0.2, and 18.1 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XXII of AP1189 hippuric acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 9.6 $\pm$ 0.2, 14.1 $\pm$ 0.2, and 15.5 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form XXII of AP1189 hippuric acid exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 33.

One embodiment of the disclosure provides for a crystalline Form XXII of AP1189 hippuric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 8.6, 9.6, 9.8, 10.9, 11.5, 11.8, 12.7, 13.3, 13.8, 14.1, 14.4, 14.9, 15.5, 16.4, 17.5, 18.1, 19.5, 20.1, 20.7, 21.0, 22.0, 22.4, 22.8, 23.1, 24.1, 24.5, 25.3, 25.8, 27.1, 28.1, and 29.1. One embodiment of the disclosure provides for a crystalline Form XXII of AP1189 hippuric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 8.6 $\pm$ 0.2, 9.6 $\pm$ 0.2, 9.8 $\pm$ 0.2, 10.9 $\pm$ 0.2, 11.5 $\pm$ 0.2, 11.8 $\pm$ 0.2, 12.7 $\pm$ 0.2, 13.3 $\pm$ 0.2, 13.8 $\pm$ 0.2,

14.1±0.2, 14.4±0.2, 14.9±0.2, 15.5±0.2, 16.4±0.2, 17.5±0.2, 18.1±0.2, 19.5±0.2, 20.1±0.2, 20.7±0.2, 21.0±0.2, 22.0±0.2, 22.4±0.2, 22.8±0.2, 23.1±0.2, 24.1±0.2, 24.5±0.2, 25.3±0.2, 25.8±0.2, 27.1±0.2, 28.1±0.2, and 29.1±0.2. It may be

advantageous to identify the crystalline Form XXII of AP1189 hippuric acid by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XXII of AP1189 hippuric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 9.6, 10.9, 11.5, 14.1, 14.4, 14.9, 15.5, 18.1, 20.1, 24.1, and 24.5.

One embodiment of the present disclosure provides for a crystalline Form XXII of AP1189 hippuric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 9.6±0.2, 10.9±0.2, 11.5±0.2, 14.1±0.2, 14.4±0.2, 14.9±0.2, 15.5±0.2, 18.1±0.2, 20.1±0.2, 24.1±0.2, and 24.5±0.2. One embodiment of the present disclosure provides for a crystalline Form XXII of AP1189 hippuric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of the 2-theta values in listed in Table 28.

AP1189 formic acid Form XXIII

The present disclosure provides for a crystalline Form XXIII of AP1189 formate. Crystalline Form XXIII of AP1189 formate exhibits an XRPD diffractogram as shown in Figure 34. One embodiment of the present disclosure provides for a crystalline Form XXIII of AP1189 formate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation at 13.3±0.2, 15.1±0.2, and 25.6±0.2. One embodiment provides for a crystalline Form XXIII of AP1189 formate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 17.3±0.2, 18.9±0.2, 21.8±0.2, and 23.6±0.2. One embodiment of the present disclosure provides for a crystalline Form XXIII of AP1189 formate further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 12.2±0.2, 20.6±0.2, 22.8±0.2, 28.9±0.2, and 29.2±0.2. One embodiment of the disclosure provides for a crystalline Form XXIII of AP1189 formate exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K_α radiation according to FIG 34.

One embodiment of the disclosure provides for a crystalline Form XXIII of AP1189 formate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 7.4, 10.4, 10.6, 12.2, 13.3, 14.1, 15.1, 15.2, 16.8, 17.3, 18.0, 18.5, 18.8, 18.9, 19.1, 20.6, 20.9, 21.4, 21.8, 22.3, 22.6, 22.8, 23.1, 23.6, 24.0, 24.5, 24.9, 25.6, 26.8, 27.1, 27.6, 28.1, 28.6, 28.9, 29.2, 30.5, 30.9, 31.7, 32.2, 32.7, 33.1, and 34.0. One embodiment of the disclosure provides for a crystalline Form XXIII of AP1189 formate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 7.4 $\pm$ 0.2, 10.4 $\pm$ 0.2, 10.6 $\pm$ 0.2, 12.2 $\pm$ 0.2, 13.3 $\pm$ 0.2, 14.1 $\pm$ 0.2, 15.1 $\pm$ 0.2, 15.2 $\pm$ 0.2, 16.8 $\pm$ 0.2, 17.3 $\pm$ 0.2, 18.0 $\pm$ 0.2, 18.5 $\pm$ 0.2, 18.8 $\pm$ 0.2, 18.9 $\pm$ 0.2, 19.1 $\pm$ 0.2, 20.6 $\pm$ 0.2, 20.9 $\pm$ 0.2, 21.4 $\pm$ 0.2, 21.8 $\pm$ 0.2, 22.3 $\pm$ 0.2, 22.6 $\pm$ 0.2, 22.8 $\pm$ 0.2, 23.1 $\pm$ 0.2, 23.6 $\pm$ 0.2, 24.0 $\pm$ 0.2, 24.5 $\pm$ 0.2, 24.9 $\pm$ 0.2, 25.6 $\pm$ 0.2, 26.8 $\pm$ 0.2, 27.1 $\pm$ 0.2, 27.6 $\pm$ 0.2, 28.1 $\pm$ 0.2, 28.6 $\pm$ 0.2, 28.9 $\pm$ 0.2, 29.2 $\pm$ 0.2, 30.5 $\pm$ 0.2, 30.9 $\pm$ 0.2, 31.7 $\pm$ 0.2, 32.2 $\pm$ 0.2, 32.7 $\pm$ 0.2, 33.1 $\pm$ 0.2, and 34.0 $\pm$ 0.2. It may be advantageous to identify the crystalline Form XXIII of AP1189 formate by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XXIII of AP1189 formate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 12.2, 13.3, 15.1, 17.3, 18.9, 20.6, 21.8, 22.8, 23.6, 25.6, 28.9, and 29.2. One embodiment of the present disclosure provides for a crystalline Form XXIII of AP1189 formate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 12.2 $\pm$ 0.2, 13.3 $\pm$ 0.2, 15.1 $\pm$ 0.2, 17.3 $\pm$ 0.2, 18.9 $\pm$ 0.2, 20.6 $\pm$ 0.2, 21.8 $\pm$ 0.2, 22.8 $\pm$ 0.2, 23.6 $\pm$ 0.2, 25.6 $\pm$ 0.2, 28.9 $\pm$ 0.2, and 29.2 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XXIII of AP1189 formate exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 29.

AP1189 L-lactic acid Form XXIV

The present disclosure provides for a crystalline Form XXIV of AP1189 L-lactic acid. Crystalline Form XXIV of AP1189 L-lactic acid exhibits an XRPD diffractogram as shown in Figure 35. One embodiment of the present disclosure provides for a crystalline Form XXIV of AP1189 L-lactic acid exhibiting at least X-ray lines (2-theta

values) in a powder diffraction pattern when measured using Cu K α radiation at 3.8 $\pm$ 0.2, 9.9 $\pm$ 0.2, and 11.9 $\pm$ 0.2. One embodiment provides for a crystalline Form XXIV of AP1189 L-lactic acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 7.7 $\pm$ 0.2, 23.0 $\pm$ 0.2, and 27.5 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XXIV of AP1189 L-lactic acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 15.4 $\pm$ 0.2, 23.9 $\pm$ 0.2, and 25.3 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form XXIV of AP1189 L-lactic acid exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 35.

One embodiment of the disclosure provides for a crystalline Form XXIV of AP1189 L-lactic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.8, 7.7, 9.9, 11.9, 13.6, 14.0, 14.2, 14.7, 15.4, 15.8, 18.0, 18.3, 18.7, 19.3, 19.8, 20.2, 20.4, 20.7, 20.9, 21.4, 21.6, 22.4, 22.6, 23.0, 23.3, 23.7, 23.9, 25.3, 25.9, 27.5, 27.8, 28.5, 28.7, 29.6, 30.0, 30.4, 31.4, 31.8, 33.1, and 33.6. One embodiment of the disclosure provides for a crystalline Form XXIV of AP1189 L-lactic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.8 $\pm$ 0.2, 7.7 $\pm$ 0.2, 9.9 $\pm$ 0.2, 11.9 $\pm$ 0.2, 13.6 $\pm$ 0.2, 14.0 $\pm$ 0.2, 14.2 $\pm$ 0.2, 14.7 $\pm$ 0.2, 15.4 $\pm$ 0.2, 15.8 $\pm$ 0.2, 18.0 $\pm$ 0.2, 18.3 $\pm$ 0.2, 18.7 $\pm$ 0.2, 19.3 $\pm$ 0.2, 19.8 $\pm$ 0.2, 20.2 $\pm$ 0.2, 20.4 $\pm$ 0.2, 20.7 $\pm$ 0.2, 20.9 $\pm$ 0.2, 21.4 $\pm$ 0.2, 21.6 $\pm$ 0.2, 22.4 $\pm$ 0.2, 22.6 $\pm$ 0.2, 23.0 $\pm$ 0.2, 23.3 $\pm$ 0.2, 23.7 $\pm$ 0.2, 23.9 $\pm$ 0.2, 25.3 $\pm$ 0.2, 25.9 $\pm$ 0.2, 27.5 $\pm$ 0.2, 27.8 $\pm$ 0.2, 28.5 $\pm$ 0.2, 28.7 $\pm$ 0.2, 29.6 $\pm$ 0.2, 30.0 $\pm$ 0.2, 30.4 $\pm$ 0.2, 31.4 $\pm$ 0.2, 31.8 $\pm$ 0.2, 33.1 $\pm$ 0.2, and 33.6 $\pm$ 0.2. It may be advantageous to identify the crystalline Form XXIV of AP1189 L-lactic acid by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XXIV of AP1189 L-lactic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.8, 7.7, 9.9, 11.9, 15.4, 23.0, 23.9, 25.3, and 27.5. One embodiment of the present disclosure provides for a crystalline Form XXIV of AP1189 L-lactic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.8 $\pm$ 0.2, 7.7 $\pm$ 0.2, 9.9 $\pm$ 0.2, 11.9 $\pm$ 0.2,

15.4±0.2, 23.0±0.2, 23.9±0.2, 25.3±0.2, and 27.5±0.2. One embodiment of the present disclosure provides for a crystalline Form XXIV of AP1189 L-lactic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 30.

AP1189 DL-lactic acid Form XXV

The present disclosure provides for a crystalline Form XXV of AP1189 DL-lactic acid. Crystalline Form XXV of AP1189 DL-lactic acid exhibits an XRPD diffractogram as shown in Figure 36. One embodiment of the present disclosure provides for a crystalline Form XXV of AP1189 DL-lactic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 9.8±0.2, 11.9±0.2, and 27.6±0.2. One embodiment provides for a crystalline Form XXV of AP1189 DL-lactic acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.8±0.2, 23.3±0.2, and 23.9±0.2. One embodiment of the present disclosure provides for a crystalline Form XXV of AP1189 DL-lactic acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 7.6±0.2, 15.3±0.2, and 25.6±0.2. One embodiment of the disclosure provides for a crystalline Form XXV of AP1189 DL-lactic acid exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 36.

One embodiment of the disclosure provides for a crystalline Form XXV of AP1189 DL-lactic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.8, 7.6, 9.8, 11.9, 13.7, 14.1, 14.3, 15.3, 15.8, 18.2, 18.6, 19.2, 19.8, 20.5, 21.0, 21.3, 21.5, 22.5, 22.7, 22.9, 23.3, 23.6, 23.9, 25.0, 25.6, 26.1, 27.6, 28.7, 29.4, 29.6, 29.8, 30.2, 30.6, 31.6, 32.0, and 34.1. One embodiment of the disclosure provides for a crystalline Form XXV of AP1189 DL-lactic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.8±0.2, 7.6±0.2, 9.8±0.2, 11.9±0.2, 13.7±0.2, 14.1±0.2, 14.3±0.2, 15.3±0.2, 15.8±0.2, 18.2±0.2, 18.6±0.2, 19.2±0.2, 19.8±0.2, 20.5±0.2, 21.0±0.2, 21.3±0.2, 21.5±0.2, 22.5±0.2, 22.7±0.2, 22.9±0.2, 23.3±0.2, 23.6±0.2, 23.9±0.2, 25.0±0.2, 25.6±0.2, 26.1±0.2, 27.6±0.2, 28.7±0.2, 29.4±0.2,

29.6±0.2, 29.8±0.2, 30.2±0.2, 30.6±0.2, 31.6±0.2, 32.0±0.2, and 34.1±0.2. It may be advantageous to identify the crystalline Form XXV of AP1189 DL-lactic acid by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XXV of AP1189 DL-lactic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.8, 7.6, 9.8, 11.9, 15.3, 23.3, 23.9, 25.6, and 27.6. One embodiment of the present disclosure provides for a crystalline Form XXV of AP1189 DL-lactic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.8±0.2, 7.6±0.2, 9.8±0.2, 11.9±0.2, 15.3±0.2, 23.3±0.2, 23.9±0.2, 25.6±0.2, and 27.6±0.2. One embodiment of the present disclosure provides for a crystalline Form XXV of AP1189 DL-lactic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 31.

AP1189 glutaric acid Form XXVI

The present disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid. Crystalline Form XXVI of AP1189 glutaric acid exhibits an XRPD diffractogram as shown in Figure 37. One embodiment of the present disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 8.3±0.2, 15.9±0.2, and 21.9±0.2. One embodiment provides for a crystalline Form XXVI of AP1189 glutaric acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 12.8±0.2, 15.1±0.2, and 27.1±0.2. One embodiment of the present disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.2±0.2, 8.7±0.2, 14.4±0.2, 16.2±0.2, 19.0±0.2, 19.8±0.2, 28.8±0.2, and 29.5±0.2. One embodiment of the disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 37.

One embodiment of the disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.2, 6.3, 8.3, 8.7, 9.8, 10.1, 10.5, 12.8, 13.6, 14.4, 15.1, 15.9, 16.2, 17.1, 17.5, 18.0, 18.3, 19.0, 19.8, 20.2, 20.5, 21.0, 21.4, 21.7, 21.9, 23.0, 23.6, 24.1, 24.5, 25.0, 26.0, 26.5, 27.1, 27.6, 28.2, 28.8, 29.5, 30.6, 31.4, 32.3, and 33.8. One embodiment of the disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.2 $\pm$ 0.2, 6.3 $\pm$ 0.2, 8.3 $\pm$ 0.2, 8.7 $\pm$ 0.2, 9.8 $\pm$ 0.2, 10.1 $\pm$ 0.2, 10.5 $\pm$ 0.2, 12.8 $\pm$ 0.2, 13.6 $\pm$ 0.2, 14.4 $\pm$ 0.2, 15.1 $\pm$ 0.2, 15.9 $\pm$ 0.2, 16.2 $\pm$ 0.2, 17.1 $\pm$ 0.2, 17.5 $\pm$ 0.2, 18.0 $\pm$ 0.2, 18.3 $\pm$ 0.2, 19.0 $\pm$ 0.2, 19.8 $\pm$ 0.2, 20.2 $\pm$ 0.2, 20.5 $\pm$ 0.2, 21.0 $\pm$ 0.2, 21.4 $\pm$ 0.2, 21.7 $\pm$ 0.2, 21.9 $\pm$ 0.2, 23.0 $\pm$ 0.2, 23.6 $\pm$ 0.2, 24.1 $\pm$ 0.2, 24.5 $\pm$ 0.2, 25.0 $\pm$ 0.2, 26.0 $\pm$ 0.2, 26.5 $\pm$ 0.2, 27.1 $\pm$ 0.2, 27.6 $\pm$ 0.2, 28.2 $\pm$ 0.2, 28.8 $\pm$ 0.2, 29.5 $\pm$ 0.2, 30.6 $\pm$ 0.2, 31.4 $\pm$ 0.2, 32.3 $\pm$ 0.2, and 33.8 $\pm$ 0.2. It may be advantageous to identify the crystalline Form XXVI of AP1189 glutaric acid by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.2, 8.3, 8.7, 12.8, 14.4, 15.1, 15.9, 16.2, 19.0, 19.8, 21.9, 27.1, 28.8, and 29.5. One embodiment of the present disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 3.2 $\pm$ 0.2, 8.3 $\pm$ 0.2, 8.7 $\pm$ 0.2, 12.8 $\pm$ 0.2, 14.4 $\pm$ 0.2, 15.1 $\pm$ 0.2, 15.9 $\pm$ 0.2, 16.2 $\pm$ 0.2, 19.0 $\pm$ 0.2, 19.8 $\pm$ 0.2, 21.9 $\pm$ 0.2, 27.1 $\pm$ 0.2, 28.8 $\pm$ 0.2, and 29.5 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 32.

AP1189 glutaric acid Form XXVII

The present disclosure provides for a crystalline Form XXVII of AP1189 glutaric acid. Crystalline Form XXVII of AP1189 glutaric acid exhibits an XRPD diffractogram as shown in Figure 38. One embodiment of the present disclosure provides for a crystalline Form XXVII of AP1189 glutaric acid exhibiting at least X-ray lines (2-theta

values) in a powder diffraction pattern when measured using Cu K α radiation at 14.1 $\pm$ 0.2, 21.7 $\pm$ 0.2, and 25.0 $\pm$ 0.2. One embodiment provides for a crystalline Form XXVII of AP1189 glutaric acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 16.9 $\pm$ 0.2, 25.6 $\pm$ 0.2, 27.1 $\pm$ 0.2, 28.2 $\pm$ 0.2, and 28.7 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XXVII of AP1189 glutaric acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.3 $\pm$ 0.2, 10.1 $\pm$ 0.2, 14.3 $\pm$ 0.2, 14.7 $\pm$ 0.2, 15.1 $\pm$ 0.2, 17.4 $\pm$ 0.2, 21.1 $\pm$ 0.2, 22.6 $\pm$ 0.2, and 26.5 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form XXVII of AP1189 glutaric acid exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 38.

One embodiment of the disclosure provides for a crystalline Form XXVII of AP1189 glutaric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.3, 10.1, 10.8, 12.6, 12.7, 13.5, 14.1, 14.3, 14.7, 15.1, 15.3, 15.7, 16.5, 16.7, 16.9, 17.4, 18.0, 18.3, 18.7, 18.9, 19.3, 19.6, 20.1, 20.2, 20.5, 20.9, 21.3, 21.7, 22.1, 22.6, 23.2, 24.0, 24.4, 25.0, 25.6, 26.0, 26.5, 26.8, 27.1, 27.6, 28.2, 28.7, 29.0, 29.4, 29.7, 30.5, 31.3, 32.0, 33.0, and 34.1. One embodiment of the disclosure provides for a crystalline Form XXVII of AP1189 glutaric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.3 $\pm$ 0.2, 10.1 $\pm$ 0.2, 10.8 $\pm$ 0.2, 12.6 $\pm$ 0.2, 12.7 $\pm$ 0.2, 13.5 $\pm$ 0.2, 14.1 $\pm$ 0.2, 14.3 $\pm$ 0.2, 14.7 $\pm$ 0.2, 15.1 $\pm$ 0.2, 15.3 $\pm$ 0.2, 15.7 $\pm$ 0.2, 16.5 $\pm$ 0.2, 16.7 $\pm$ 0.2, 16.9 $\pm$ 0.2, 17.4 $\pm$ 0.2, 18.0 $\pm$ 0.2, 18.3 $\pm$ 0.2, 18.7 $\pm$ 0.2, 18.9 $\pm$ 0.2, 19.3 $\pm$ 0.2, 19.6 $\pm$ 0.2, 20.1 $\pm$ 0.2, 20.2 $\pm$ 0.2, 20.5 $\pm$ 0.2, 20.9 $\pm$ 0.2, 21.3 $\pm$ 0.2, 21.7 $\pm$ 0.2, 22.1 $\pm$ 0.2, 22.6 $\pm$ 0.2, 23.2 $\pm$ 0.2, 24.0 $\pm$ 0.2, 24.4 $\pm$ 0.2, 25.0 $\pm$ 0.2, 25.6 $\pm$ 0.2, 26.0 $\pm$ 0.2, 26.5 $\pm$ 0.2, 26.8 $\pm$ 0.2, 27.1 $\pm$ 0.2, 27.6 $\pm$ 0.2, 28.2 $\pm$ 0.2, 28.7 $\pm$ 0.2, 29.0 $\pm$ 0.2, 29.4 $\pm$ 0.2, 29.7 $\pm$ 0.2, 30.5 $\pm$ 0.2, 31.3 $\pm$ 0.2, 32.0 $\pm$ 0.2, 33.0 $\pm$ 0.2, and 34.1 $\pm$ 0.2. It may be advantageous to identify the crystalline Form XXVII of AP1189 glutaric acid by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XXVII of AP1189 glutaric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of

6.3, 10.1, 14.1, 14.3, 14.7, 15.1, 16.9, 17.4, 21.7, 22.1, 22.6, 25.0, 25.6, 26.5, 27.1, 28.2, and 28.7. One embodiment of the present disclosure provides for a crystalline Form XXVII of AP1189 glutaric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.3 $\pm$ 0.2, 10.1 $\pm$ 0.2, 14.1 $\pm$ 0.2, 14.3 $\pm$ 0.2, 14.7 $\pm$ 0.2, 15.1 $\pm$ 0.2, 16.9 $\pm$ 0.2, 17.4 $\pm$ 0.2, 21.7 $\pm$ 0.2, 22.1 $\pm$ 0.2, 22.6 $\pm$ 0.2, 25.0 $\pm$ 0.2, 25.6 $\pm$ 0.2, 26.5 $\pm$ 0.2, 27.1 $\pm$ 0.2, 28.2 $\pm$ 0.2, and 28.7 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XXVII of AP1189 glutaric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 33.

AP1189 glutaric acid Form XXVIII

The present disclosure provides for a crystalline Form XXVIII of AP1189 glutaric acid. Crystalline Form XXVIII of AP1189 glutaric acid exhibits an XRPD diffractogram as shown in Figure 91. One embodiment of the present disclosure provides for a crystalline Form XXVIII of AP1189 glutaric acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 14.2 $\pm$ 0.2, 16.9 $\pm$ 0.2, and 24.5 $\pm$ 0.2. One embodiment provides for a crystalline Form XXVIII of AP1189 glutaric acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.3 $\pm$ 0.2, 15.2 $\pm$ 0.2, 20.9 $\pm$ 0.2, and 21.9 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XXVIII of AP1189 glutaric acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 8.9 $\pm$ 0.2, 10.1 $\pm$ 0.2, 12.6 $\pm$ 0.2, 17.4 $\pm$ 0.2, 19.1 $\pm$ 0.2, 20.6 $\pm$ 0.2, and 28.4 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form XXVIII of AP1189 glutaric acid exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 91.

One embodiment of the disclosure provides for a crystalline Form XXVIII of AP1189 glutaric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.3, 8.9, 10.1, 10.4, 10.7, 12.6, 13.4, 13.8, 14.2, 15.2, 15.6, 16.5, 16.9, 17.4, 18.2, 19.1, 19.8, 20.2, 20.6, 20.9, 21.7, 21.9, 22.5, 23.0, 23.6, 23.8, 24.5, 24.9, 25.3, 26.1, 27.2, 27.8, 28.4, 29.3, 29.6, 30.5, 31.0, 31.4, 32.4, 33.6, and 34.3. One embodiment of the

disclosure provides for a crystalline Form XXVIII of AP1189 glutaric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.3 $\pm$ 0.2, 8.9 $\pm$ 0.2, 10.1 $\pm$ 0.2, 10.4 $\pm$ 0.2, 10.7 $\pm$ 0.2, 12.6 $\pm$ 0.2, 13.4 $\pm$ 0.2, 13.8 $\pm$ 0.2, 14.2 $\pm$ 0.2, 15.2 $\pm$ 0.2, 15.6 $\pm$ 0.2, 16.5 $\pm$ 0.2, 16.9 $\pm$ 0.2, 17.4 $\pm$ 0.2, 18.2 $\pm$ 0.2, 19.1 $\pm$ 0.2, 19.8 $\pm$ 0.2, 20.2 $\pm$ 0.2, 20.6 $\pm$ 0.2, 20.9 $\pm$ 0.2, 21.7 $\pm$ 0.2, 21.9 $\pm$ 0.2, 22.5 $\pm$ 0.2, 23.0 $\pm$ 0.2, 23.6 $\pm$ 0.2, 23.8 $\pm$ 0.2, 24.5 $\pm$ 0.2, 24.9 $\pm$ 0.2, 25.3 $\pm$ 0.2, 26.1 $\pm$ 0.2, 27.2 $\pm$ 0.2, 27.8 $\pm$ 0.2, 28.4 $\pm$ 0.2, 29.3 $\pm$ 0.2, 29.6 $\pm$ 0.2, 30.5 $\pm$ 0.2, 31.0 $\pm$ 0.2, 31.4 $\pm$ 0.2, 32.4 $\pm$ 0.2, 33.6 $\pm$ 0.2, and 34.3 $\pm$ 0.2. It may be advantageous to identify the crystalline Form XXVIII of AP1189 glutaric acid by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XXVIII of AP1189 glutaric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.3, 8.9, 10.1, 12.6, 14.2, 15.2, 16.9, 17.4, 19.1, 20.6, 20.9, 21.9, 24.5, and 28.4. One embodiment of the present disclosure provides for a crystalline Form XXVIII of AP1189 glutaric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 6.3 $\pm$ 0.2, 8.9 $\pm$ 0.2, 10.1 $\pm$ 0.2, 12.6 $\pm$ 0.2, 14.2 $\pm$ 0.2, 15.2 $\pm$ 0.2, 16.9 $\pm$ 0.2, 17.4 $\pm$ 0.2, 19.1 $\pm$ 0.2, 20.6 $\pm$ 0.2, 20.9 $\pm$ 0.2, 21.9 $\pm$ 0.2, 24.5 $\pm$ 0.2, and 28.4 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XXVIII of AP1189 glutaric acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 34.

25 AP1189 adipic acid Form XXIX

The present disclosure provides for a crystalline Form XXIX of AP1189 adipic acid. Crystalline Form XXIX of AP1189 adipic acid exhibits an XRPD diffractogram as shown in Figure 39. One embodiment of the present disclosure provides for a crystalline Form XXIX of AP1189 adipic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 13.4 $\pm$ 0.2, 14.5 $\pm$ 0.2, and 25.5 $\pm$ 0.2. One embodiment provides for a crystalline Form XXIX of AP1189 adipic acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 17.6 $\pm$ 0.2, 23.5 $\pm$ 0.2, 25.4 $\pm$ 0.2, and 27.1 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XXIX of AP1189 adipic acid further exhibiting one or more X-ray

lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.2 $\pm$ 0.2, 19.2 $\pm$ 0.2, and 21.4 $\pm$ 0.2. One embodiment of the disclosure provides for a crystalline Form XXIX of AP1189 adipic acid exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 39.

One embodiment of the disclosure provides for a crystalline Form XXIX of AP1189 adipic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.2, 10.5, 11.2, 12.7, 13.4, 14.5, 15.3, 15.8, 17.1, 17.6, 18.0, 18.8, 19.2, 20.5, 21.0, 21.4, 22.4, 22.8, 23.0, 23.5, 23.9, 24.4, 24.8, 25.4, 25.5, 26.1, 26.3, 27.1, 27.5, 28.1, 28.9, 29.5, 30.6, 32.2, 33.9, and 34.5. One embodiment of the disclosure provides for a crystalline Form XXIX of AP1189 adipic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.2 $\pm$ 0.2, 10.5 $\pm$ 0.2, 11.2 $\pm$ 0.2, 12.7 $\pm$ 0.2, 13.4 $\pm$ 0.2, 14.5 $\pm$ 0.2, 15.3 $\pm$ 0.2, 15.8 $\pm$ 0.2, 17.1 $\pm$ 0.2, 17.6 $\pm$ 0.2, 18.0 $\pm$ 0.2, 18.8 $\pm$ 0.2, 19.2 $\pm$ 0.2, 20.5 $\pm$ 0.2, 21.0 $\pm$ 0.2, 21.4 $\pm$ 0.2, 22.4 $\pm$ 0.2, 22.8 $\pm$ 0.2, 23.0 $\pm$ 0.2, 23.5 $\pm$ 0.2, 23.9 $\pm$ 0.2, 24.4 $\pm$ 0.2, 24.8, 25.4, 25.5, 26.1, 26.3, 27.1, 27.5, 28.1, 28.9, 29.5, 30.6, 32.2, 33.9, and 34.5 $\pm$ 0.2. It may be advantageous to identify the crystalline Form XXIX of AP1189 adipic acid by X-ray lines (2-theta values) having a high relative intensity, and/or by characteristic X-ray lines. Thus, one embodiment of the present disclosure provides for a crystalline Form XXIX of AP1189 adipic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.2, 13.4, 14.5, 17.6, 19.2, 21.4, 23.5, 25.4, 25.5, and 27.1. One embodiment of the present disclosure provides for a crystalline Form XXIX of AP1189 adipic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 5.2 $\pm$ 0.2, 13.4 $\pm$ 0.2, 14.5 $\pm$ 0.2, 17.6 $\pm$ 0.2, 19.2 $\pm$ 0.2, 21.4 $\pm$ 0.2, 23.5 $\pm$ 0.2, 25.4 $\pm$ 0.2, 25.5 $\pm$ 0.2, and 27.1 $\pm$ 0.2. One embodiment of the present disclosure provides for a crystalline Form XXIX of AP1189 adipic acid exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of the 2-theta values in listed in Table 35.

Further characterisation of crystalline forms

The salts of AP1189 provided herein may be further characterised by the onset temperatures they exhibit as assessed by differential scanning calorimetry.

- 5 One embodiment of the present disclosure provides for a crystalline Form A of AP1189 acetate exhibiting in differential scanning calorimetry an onset temperature between 185 and 199 °C. One specific embodiment of the present disclosure provides a crystalline Form A of AP1189 acetate exhibiting in differential scanning calorimetry an onset temperature of substantially 192 °C. In a further embodiment, the onset
- 10 temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form A of AP1189 acetate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 8. One embodiment of the present disclosure provides a crystalline Form A of AP1189 acetate
- 15 exhibiting a differential scanning calorimetry thermogram according to Figure 8. One embodiment of the present disclosure provides for a crystalline Form A of AP1189 acetate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 192 ± 7 °C, such as 192 ± 6 °C, such as 192 ± 5 °C, such as 192 ± 4 °C, such as 192 ± 3 °C, such as 192 ± 2 °C, such as 192 ± 1 °C.
- 20
- One embodiment of the present disclosure provides for a crystalline Form B of AP1189 succinate exhibiting in differential scanning calorimetry an onset temperature between 187 and 201 °C. One specific embodiment of the present disclosure provides a crystalline Form B of AP1189 succinate exhibiting in differential scanning calorimetry
- 25 an onset temperature of substantially 194 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form B of AP1189 succinate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 13. One
- 30 embodiment of the present disclosure provides a crystalline Form B of AP1189 succinate exhibiting a differential scanning calorimetry thermogram according to Figure 13. One embodiment of the present disclosure provides for a crystalline Form B of AP1189 succinate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 195 ± 7 °C, such as 195 ± 6 °C, such as 195 ± 5 °C, such as
- 35 195 ± 4 °C, such as 195 ± 3 °C, such as 195 ± 2 °C, such as 195 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form C of AP1189 tosylate exhibiting in differential scanning calorimetry an onset temperature between 227 and 241 °C. One specific embodiment of the present disclosure provides a crystalline Form C of AP1189 tosylate exhibiting in differential scanning calorimetry an onset temperature of substantially 234 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form C of AP1189 tosylate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 11. One embodiment of the present disclosure provides a crystalline Form C of AP1189 tosylate exhibiting a differential scanning calorimetry thermogram according to Figure 11. One embodiment of the present disclosure provides for a crystalline Form C of AP1189 tosylate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 234 ± 7 °C, such as 234 ± 6 °C, such as 234 ± 5 °C, such as 234 ± 4 °C, such as 234 ± 3 °C, such as 234 ± 2 °C, such as 234 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form D of AP1189 fumarate exhibiting in differential scanning calorimetry an onset temperature between 208 and 222 °C. One specific embodiment of the present disclosure provides a crystalline Form D of AP1189 fumarate exhibiting in differential scanning calorimetry an onset temperature of substantially 215 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form D of AP1189 fumarate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 12. One embodiment of the present disclosure provides a crystalline Form D of AP1189 fumarate exhibiting a differential scanning calorimetry thermogram according to Figure 12. One embodiment of the present disclosure provides for a crystalline Form D of AP1189 fumarate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 215 ± 7 °C, such as 215 ± 6 °C, such as 215 ± 5 °C, such as 215 ± 4 °C, such as 215 ± 3 °C, such as 215 ± 2 °C, such as 215 ± 1 °C.

Certain salts disclosed herein exhibit more than one onset temperature, e.g. two onset temperatures. The salts may be characterised by either of their onset temperatures in isolation, or as a combination of onset temperatures.

- 5 One embodiment of the present disclosure provides for a crystalline Form III of AP1189 napadisylate exhibiting in differential scanning calorimetry an onset temperature between 80 and 94 °C. One specific embodiment of the present disclosure provides a crystalline Form III of AP1189 napadisylate exhibiting in differential scanning calorimetry an onset temperature of substantially 87 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form III of AP1189 napadisylate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 40. One embodiment of the present disclosure provides a crystalline Form III of AP1189 napadisylate exhibiting a differential scanning calorimetry thermogram according to Figure 40. One embodiment of the present disclosure provides for a crystalline Form III of AP1189 napadisylate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 87 ± 7 °C, such as 87 ± 6 °C, such as 87 ± 5 °C, such as 87 ± 4 °C, such as 87 ± 3 °C, such as 87 ± 2 °C, such as 87 ± 1 °C.
- 20 One embodiment of the present disclosure provides for a crystalline Form III of AP1189 napadisylate exhibiting in differential scanning calorimetry an onset temperature between 180 and 194 °C. One specific embodiment of the present disclosure provides a crystalline Form III of AP1189 napadisylate exhibiting in differential scanning calorimetry an onset temperature of substantially 187 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form III of AP1189 napadisylate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 40. One embodiment of the present disclosure provides a crystalline Form III of AP1189 napadisylate exhibiting a differential scanning calorimetry thermogram according to Figure 40. One embodiment of the present disclosure provides for a crystalline Form III of AP1189 napadisylate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 187 ± 7 °C, such as 187 ± 6 °C, such as 187 ± 5 °C, such as 187 ± 4 °C, such as 187 ± 3 °C, such as 187 ± 2 °C, such as 187 ± 1 °C.
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One embodiment of the disclosure provides for a crystalline Form IV of AP1189 napadisylate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 81. One embodiment of the present disclosure provides a crystalline Form IV of AP1189 napadisylate exhibiting a differential scanning calorimetry thermogram according to Figure 81.

One embodiment of the present disclosure provides for a crystalline Form V of AP1189 esylate exhibiting in differential scanning calorimetry an onset temperature between 200 and 214 °C. One specific embodiment of the present disclosure provides a crystalline Form V of AP1189 esylate exhibiting in differential scanning calorimetry an onset temperature of substantially 207 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form V of AP1189 esylate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 41. One embodiment of the present disclosure provides a crystalline Form V of AP1189 esylate exhibiting a differential scanning calorimetry thermogram according to Figure 41. One embodiment of the present disclosure provides for a crystalline Form V of AP1189 esylate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 207 ± 7 °C, such as 207 ± 6 °C, such as 207 ± 5 °C, such as 207 ± 4 °C, such as 207 ± 3 °C, such as 207 ± 2 °C, such as 207 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form VI of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature between 71 and 85 °C. One specific embodiment of the present disclosure provides a crystalline Form VI of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature of substantially 78 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form VI of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 82. One embodiment of the present disclosure provides a crystalline Form VI of AP1189 edisylate exhibiting a differential scanning calorimetry thermogram according to Figure

82. One embodiment of the present disclosure provides for a crystalline Form VI of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 78 ± 7 °C, such as 78 ± 6 °C, such as 78 ± 5 °C, such as 78 ± 4 °C, such as 78 ± 3 °C, such as 78 ± 2 °C, such as 78 ± 1 °C.

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One embodiment of the present disclosure provides for a crystalline Form VI of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature between 144 and 158 °C. One specific embodiment of the present disclosure provides a crystalline Form VI of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature of substantially 151 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form VI of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 82. One embodiment of the present disclosure provides a crystalline Form VI of AP1189 edisylate exhibiting a differential scanning calorimetry thermogram according to Figure 82. One embodiment of the present disclosure provides for a crystalline Form VI of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 151 ± 7 °C, such as 151 ± 6 °C, such as 151 ± 5 °C, such as 151 ± 4 °C, such as 151 ± 3 °C, such as 151 ± 2 °C, such as 151 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form VII of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature between 218 and 232 °C. One specific embodiment of the present disclosure provides a crystalline Form VII of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature of substantially 225 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form VII of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 42. One embodiment of the present disclosure provides a crystalline Form VII of AP1189 edisylate exhibiting a differential scanning calorimetry thermogram according to Figure 42. One embodiment of the present disclosure provides for a crystalline Form VII of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature

falling within the interval 225 ± 7 °C, such as 225 ± 6 °C, such as 225 ± 5 °C, such as 225 ± 4 °C, such as 225 ± 3 °C, such as 225 ± 2 °C, such as 225 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form VIII of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature between 201 and 215 °C. One specific embodiment of the present disclosure provides a crystalline Form VIII of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature of substantially 208 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form VIII of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 43. One embodiment of the present disclosure provides a crystalline Form VIII of AP1189 edisylate exhibiting a differential scanning calorimetry thermogram according to Figure 43. One embodiment of the present disclosure provides for a crystalline Form VIII of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 208 ± 7 °C, such as 208 ± 6 °C, such as 208 ± 5 °C, such as 208 ± 4 °C, such as 208 ± 3 °C, such as 208 ± 2 °C, such as 208 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form IX of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature between 52 and 66 °C. One specific embodiment of the present disclosure provides a crystalline Form IX of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature of substantially 59 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form IX of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 44. One embodiment of the present disclosure provides a crystalline Form IX of AP1189 edisylate exhibiting a differential scanning calorimetry thermogram according to Figure 44. One embodiment of the present disclosure provides for a crystalline Form IX of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 59 ± 7 °C, such as 59 ± 6 °C, such as 59 ± 5 °C, such as 59 ± 4 °C, such as 59 ± 3 °C, such as 59 ± 2 °C, such as 59 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form XI of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature between 144 and 158 °C. One specific embodiment of the present disclosure provides a crystalline Form IX of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature of substantially 151 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form IX of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 44. One embodiment of the present disclosure provides a crystalline Form IX of AP1189 edisylate exhibiting a differential scanning calorimetry thermogram according to Figure 44. One embodiment of the present disclosure provides for a crystalline Form IX of AP1189 edisylate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 151±7 °C, such as 151±6 °C, such as 151±5 °C, such as 151±4 °C, such as 151±3 °C, such as 151±2 °C, such as 151±1 °C.

One embodiment of the present disclosure provides for a crystalline Form X of AP1189 nitrate exhibiting in differential scanning calorimetry an onset temperature between 172 and 186 °C. One specific embodiment of the present disclosure provides a crystalline Form X of AP1189 nitrate exhibiting in differential scanning calorimetry an onset temperature of substantially 179 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form X of AP1189 nitrate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 45. One embodiment of the present disclosure provides a crystalline Form X of AP1189 nitrate exhibiting a differential scanning calorimetry thermogram according to Figure 45. One embodiment of the present disclosure provides for a crystalline Form X of AP1189 nitrate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 179±7 °C, such as 179±6 °C, such as 179±5 °C, such as 179±4 °C, such as 179±3 °C, such as 179±2 °C, such as 179±1 °C.

One embodiment of the present disclosure provides for a crystalline Form XI of AP1189 cyclamate exhibiting in differential scanning calorimetry an onset temperature between 123 and 137 °C. One specific embodiment of the present disclosure provides

a crystalline Form XI of AP1189 cyclamate exhibiting in differential scanning calorimetry an onset temperature of substantially 130 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XI of AP1189 cyclamate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 46. One embodiment of the present disclosure provides a crystalline Form XI of AP1189 cyclamate exhibiting a differential scanning calorimetry thermogram according to Figure 46. One embodiment of the present disclosure provides for a crystalline Form XI of AP1189 cyclamate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 130 ± 7 °C, such as 130 ± 6 °C, such as 130 ± 5 °C, such as 130 ± 4 °C, such as 130 ± 3 °C, such as 130 ± 2 °C, such as 130 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form XII of AP1189 cyclamate exhibiting in differential scanning calorimetry an onset temperature between 131 and 145 °C. One specific embodiment of the present disclosure provides a crystalline Form XII of AP1189 cyclamate exhibiting in differential scanning calorimetry an onset temperature of substantially 138 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XII of AP1189 cyclamate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 47. One embodiment of the present disclosure provides a crystalline Form XII of AP1189 cyclamate exhibiting a differential scanning calorimetry thermogram according to Figure 47. One embodiment of the present disclosure provides for a crystalline Form XII of AP1189 cyclamate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 138 ± 7 °C, such as 138 ± 6 °C, such as 138 ± 5 °C, such as 138 ± 4 °C, such as 138 ± 3 °C, such as 138 ± 2 °C, such as 138 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form XIII of AP1189 cyclamate exhibiting in differential scanning calorimetry an onset temperature between 134 and 148 °C. One specific embodiment of the present disclosure provides a crystalline Form XIII of AP1189 cyclamate exhibiting in differential scanning calorimetry an onset temperature of substantially 141 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of

the disclosure provides for a crystalline Form XIII of AP1189 cyclamate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 83. One embodiment of the present disclosure provides a crystalline Form XIII of AP1189 cyclamate exhibiting a differential scanning calorimetry thermogram according to Figure 83. One embodiment of the present disclosure provides for a crystalline Form XIII of AP1189 cyclamate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 141 ± 7 °C, such as 141 ± 6 °C, such as 141 ± 5 °C, such as 141 ± 4 °C, such as 141 ± 3 °C, such as 141 ± 2 °C, such as 141 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form XIV of AP1189 besylate exhibiting in differential scanning calorimetry an onset temperature between 219 and 223 °C. One specific embodiment of the present disclosure provides a crystalline Form XIV of AP1189 besylate exhibiting in differential scanning calorimetry an onset temperature of substantially 216 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XIV of AP1189 besylate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 48. One embodiment of the present disclosure provides a crystalline Form XIV of AP1189 besylate exhibiting a differential scanning calorimetry thermogram according to Figure 48. One embodiment of the present disclosure provides for a crystalline Form XIV of AP1189 besylate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 216 ± 7 °C, such as 216 ± 6 °C, such as 216 ± 5 °C, such as 216 ± 4 °C, such as 216 ± 3 °C, such as 216 ± 2 °C, such as 216 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form XV of AP1189 oxalate exhibiting in differential scanning calorimetry a peak temperature between 204 and 218 °C. One specific embodiment of the present disclosure provides a crystalline Form XV of AP1189 oxalate exhibiting in differential scanning calorimetry a peak temperature of substantially 211 °C. In a further embodiment, the peak temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XV of AP1189 oxalate exhibiting in differential scanning calorimetry a peak temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 49. One

embodiment of the present disclosure provides a crystalline Form XV of AP1189 oxalate exhibiting a differential scanning calorimetry thermogram according to Figure 49. One embodiment of the present disclosure provides for a crystalline Form XV of AP1189 oxalate exhibiting in differential scanning calorimetry a peak temperature
5 falling within the interval 211 ± 7 °C, such as 211 ± 6 °C, such as 211 ± 5 °C, such as 211 ± 4 °C, such as 211 ± 3 °C, such as 211 ± 2 °C, such as 211 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form XVI of AP1189 oxalate exhibiting in differential scanning calorimetry an onset temperature
10 between 200 and 214 °C. One specific embodiment of the present disclosure provides a crystalline Form XVI of AP1189 oxalate exhibiting in differential scanning calorimetry an onset temperature of substantially 207 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XVI of AP1189 oxalate exhibiting in
15 differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 50. One embodiment of the present disclosure provides a crystalline Form XVI of AP1189 oxalate exhibiting a differential scanning calorimetry thermogram according to Figure 50. One embodiment of the present disclosure provides for a crystalline Form XVI of
20 AP1189 oxalate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 207 ± 7 °C, such as 207 ± 6 °C, such as 207 ± 5 °C, such as 207 ± 4 °C, such as 207 ± 3 °C, such as 207 ± 2 °C, such as 207 ± 1 °C.

One embodiment of the disclosure provides for a crystalline Form XVII of AP1189
25 oxalate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 51. One embodiment of the present disclosure provides a crystalline Form XVII of AP1189 oxalate exhibiting a differential scanning calorimetry thermogram according to Figure 51.

30 One embodiment of the present disclosure provides for a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid exhibiting in differential scanning calorimetry an onset temperature between 198 and 212 °C. One specific embodiment of the present disclosure provides a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid
35 exhibiting in differential scanning calorimetry an onset temperature of substantially 205

°C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 52. One embodiment of the present disclosure provides a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid exhibiting a differential scanning calorimetry thermogram according to Figure 52. One embodiment of the present disclosure provides for a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid exhibiting in differential scanning calorimetry an onset temperature falling within the interval 205 ± 7 °C, such as 205 ± 6 °C, such as 205 ± 5 °C, such as 205 ± 4 °C, such as 205 ± 3 °C, such as 205 ± 2 °C, such as 205 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form XIX of AP1189 oxoglutarate exhibiting in differential scanning calorimetry an onset temperature between 74 and 88 °C. One specific embodiment of the present disclosure provides a crystalline Form XIX of AP1189 oxoglutarate exhibiting in differential scanning calorimetry an onset temperature of substantially 81 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XIX of AP1189 oxoglutarate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 53. One embodiment of the present disclosure provides a crystalline Form XIX of AP1189 oxoglutarate exhibiting a differential scanning calorimetry thermogram according to Figure 53. One embodiment of the present disclosure provides for a crystalline Form XIX of AP1189 oxoglutarate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 81 ± 7 °C, such as 81 ± 6 °C, such as 81 ± 5 °C, such as 81 ± 4 °C, such as 81 ± 3 °C, such as 81 ± 2 °C, such as 81 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form XX of AP1189 DL-mandelic acid exhibiting in differential scanning calorimetry an onset temperature between 103 and 117 °C. One specific embodiment of the present disclosure provides a crystalline Form XX of AP1189 DL-mandelic acid exhibiting in differential scanning calorimetry an onset temperature of substantially 110 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10

°C/min. One embodiment of the disclosure provides for a crystalline Form XX of AP1189 DL-mandelic acid exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 54. One embodiment of the present disclosure provides a crystalline Form XX of AP1189 DL-mandelic acid exhibiting a differential scanning calorimetry thermogram according to Figure 54. One embodiment of the present disclosure provides for a crystalline Form XX of AP1189 DL-mandelic acid exhibiting in differential scanning calorimetry an onset temperature falling within the interval 110 ± 7 °C, such as 110 ± 6 °C, such as 110 ± 5 °C, such as 110 ± 4 °C, such as 110 ± 3 °C, such as 110 ± 2 °C, such as 110 ± 1 °C.

One embodiment of the disclosure provides for a crystalline Form XXI of AP1189 mandelic acid exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 55. One embodiment of the present disclosure provides a crystalline Form XXI of AP1189 mandelic acid exhibiting a differential scanning calorimetry thermogram according to Figure 55.

One embodiment of the present disclosure provides for a crystalline Form XXII of AP1189 hippuric acid exhibiting in differential scanning calorimetry an onset temperature between 132 and 146 °C. One specific embodiment of the present disclosure provides a crystalline Form XXII of AP1189 hippuric acid exhibiting in differential scanning calorimetry an onset temperature of substantially 139 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XXII of AP1189 hippuric acid exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 56. One embodiment of the present disclosure provides a crystalline Form XXII of AP1189 hippuric acid exhibiting a differential scanning calorimetry thermogram according to Figure 56. One embodiment of the present disclosure provides for a crystalline Form XXII of AP1189 hippuric acid exhibiting in differential scanning calorimetry an onset temperature falling within the interval 139 ± 7 °C, such as 139 ± 6 °C, such as 139 ± 5 °C, such as 139 ± 4 °C, such as 139 ± 3 °C, such as 139 ± 2 °C, such as 139 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form XXIII of AP1189 formate exhibiting in differential scanning calorimetry an onset temperature between 162 and 176 °C. One specific embodiment of the present disclosure provides a crystalline Form XIII of AP1189 formate exhibiting in differential scanning calorimetry an onset temperature of substantially 169 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XXIII of AP1189 formate exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 84. One embodiment of the present disclosure provides a crystalline Form XXIII of AP1189 formate exhibiting a differential scanning calorimetry thermogram according to Figure 84. One embodiment of the present disclosure provides for a crystalline Form XXIII of AP1189 formate exhibiting in differential scanning calorimetry an onset temperature falling within the interval 169±7 °C, such as 169±6 °C, such as 169±5 °C, such as 169±4 °C, such as 169±3 °C, such as 169±2 °C, such as 169±1 °C.

One embodiment of the present disclosure provides for a crystalline Form XXIV of AP1189 L-lactic acid exhibiting in differential scanning calorimetry an onset temperature between 182 and 196 °C. One specific embodiment of the present disclosure provides a crystalline Form XXIV of AP1189 L-lactic acid exhibiting in differential scanning calorimetry an onset temperature of substantially 189 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XXIV of AP1189 L-lactic acid exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 85. One embodiment of the present disclosure provides a crystalline Form XXIV of AP1189 L-lactic acid exhibiting a differential scanning calorimetry thermogram according to Figure 85. One embodiment of the present disclosure provides for a crystalline Form XXIV of AP1189 L-lactic acid exhibiting in differential scanning calorimetry an onset temperature falling within the interval 189±7 °C, such as 189±6 °C, such as 189±5 °C, such as 189±4 °C, such as 189±3 °C, such as 189±2 °C, such as 189±1 °C.

One embodiment of the present disclosure provides for a crystalline Form XXV of AP1189 DL-lactic acid exhibiting in differential scanning calorimetry an onset

temperature between 191 and 205 °C. One specific embodiment of the present disclosure provides a crystalline Form XXV of AP1189 DL-lactic acid exhibiting in differential scanning calorimetry an onset temperature of substantially 198 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XXV of AP1189 DL-lactic acid exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 86. One embodiment of the present disclosure provides a crystalline Form XXV of AP1189 DL-lactic acid exhibiting a differential scanning calorimetry thermogram according to Figure 86. One embodiment of the present disclosure provides for a crystalline Form XXV of AP1189 DL-lactic acid exhibiting in differential scanning calorimetry an onset temperature falling within the interval 198 ± 7 °C, such as 198 ± 6 °C, such as 198 ± 5 °C, such as 198 ± 4 °C, such as 198 ± 3 °C, such as 198 ± 2 °C, such as 198 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature between 102 and 116 °C. One specific embodiment of the present disclosure provides a crystalline Form XXVI of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature of substantially 109 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 87. One embodiment of the present disclosure provides a crystalline Form XXVI of AP1189 glutaric acid exhibiting a differential scanning calorimetry thermogram according to Figure 87. One embodiment of the present disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature falling within the interval 109 ± 7 °C, such as 109 ± 6 °C, such as 109 ± 5 °C, such as 109 ± 4 °C, such as 109 ± 3 °C, such as 109 ± 2 °C, such as 109 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature between 153 and 167 °C. One specific embodiment of the present

disclosure provides a crystalline Form XXVI of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature of substantially 160 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 87. One embodiment of the present disclosure provides a crystalline Form XXVI of AP1189 glutaric acid exhibiting a differential scanning calorimetry thermogram according to Figure 87. One embodiment of the present disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature falling within the interval 160 ± 7 °C, such as 160 ± 6 °C, such as 160 ± 5 °C, such as 160 ± 4 °C, such as 160 ± 3 °C, such as 160 ± 2 °C, such as 160 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form XXVII of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature between 156 and 170 °C. One specific embodiment of the present disclosure provides a crystalline Form XXVII of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature of substantially 163 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XXVII of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 88. One embodiment of the present disclosure provides a crystalline Form XXVII of AP1189 glutaric acid exhibiting a differential scanning calorimetry thermogram according to Figure 88. One embodiment of the present disclosure provides for a crystalline Form XXVII of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature falling within the interval 163 ± 7 °C, such as 163 ± 6 °C, such as 163 ± 5 °C, such as 163 ± 4 °C, such as 163 ± 3 °C, such as 163 ± 2 °C, such as 163 ± 1 °C.

One embodiment of the present disclosure provides for a crystalline Form XXVIII of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature between 138 and 152 °C. One specific embodiment of the present disclosure provides a crystalline Form XXVIII of AP1189 glutaric acid exhibiting in

differential scanning calorimetry an onset temperature of substantially 145 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XXVIII of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 89. One embodiment of the present disclosure provides a crystalline Form XXVIII of AP1189 glutaric acid exhibiting a differential scanning calorimetry thermogram according to Figure 89. One embodiment of the present disclosure provides for a crystalline Form XXVIII of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature falling within the interval 145±7 °C, such as 145±6 °C, such as 145±5 °C, such as 145±4 °C, such as 145±3 °C, such as 145±2 °C, such as 145±1 °C.

One embodiment of the present disclosure provides for a crystalline Form XXVIII of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature between 153 and 167 °C. One specific embodiment of the present disclosure provides a crystalline Form XXVIII of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature of substantially 160 °C. In a further embodiment, the onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XXVIII of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 89. One embodiment of the present disclosure provides a crystalline Form XXVIII of AP1189 glutaric acid exhibiting a differential scanning calorimetry thermogram according to Figure 89. One embodiment of the present disclosure provides for a crystalline Form XXVIII of AP1189 glutaric acid exhibiting in differential scanning calorimetry an onset temperature falling within the interval 160±7 °C, such as 160±6 °C, such as 160±5 °C, such as 160±4 °C, such as 160±3 °C, such as 160±2 °C, such as 160±1 °C.

One embodiment of the present disclosure provides for a crystalline Form XXIX of AP1189 adipic acid exhibiting in differential scanning calorimetry an onset temperature between 176 and 190 °C. One specific embodiment of the present disclosure provides a crystalline Form XXIX of AP1189 adipic acid exhibiting in differential scanning calorimetry an onset temperature of substantially 183 °C. In a further embodiment, the

onset temperature is assessed using a heating rate of 10 °C/min. One embodiment of the disclosure provides for a crystalline Form XXIX of AP1189 adipic acid exhibiting in differential scanning calorimetry an onset temperature as shown in the examples herein, specifically example 4, and/or in the figures herein, specifically Figure 90. One
5 embodiment of the present disclosure provides a crystalline Form XXIX of AP1189 adipic acid exhibiting a differential scanning calorimetry thermogram according to Figure 90. One embodiment of the present disclosure provides for a crystalline Form XXIX of AP1189 adipic acid exhibiting in differential scanning calorimetry an onset temperature falling within the interval 183 ± 7 °C, such as 183 ± 6 °C, such as 183 ± 5 °C,
10 such as 183 ± 4 °C, such as 183 ± 3 °C, such as 183 ± 2 °C, such as 183 ± 1 °C.

The salts of AP1189 disclosed herein may be further identified by their FT-IR spectra. FT-IR spectra may be obtained as outlined in Example 13. FT-IR are reported in peaks corresponding to specific wavenumbers given in cm^{-1} . While the peaks are given herein
15 with some degree of certainty, it is to be construed that the accuracy of an FT-IR measurement is typically ± 1 , ± 2 , or ± 3 cm^{-1} . Accordingly, any peak reported herein is to be interpreted as having an accuracy of ± 1 , ± 2 , or ± 3 cm^{-1} .

One embodiment of the present disclosure provides for a crystalline Form III of AP1189 napadisylate having an FT-IR as shown in Figure 57. One embodiment of the present
20 disclosure provides for a crystalline Form III of AP1189 napadisylate having in an FT-IR spectrum peaks as shown in Table 45.

One embodiment of the present disclosure provides for a crystalline Form IV of
25 AP1189 napadisylate having an FT-IR as shown in Figure 58. One embodiment of the present disclosure provides for a crystalline Form IV of AP1189 napadisylate having in an FT-IR spectrum peaks as shown in Table 46.

One embodiment of the present disclosure provides for a crystalline Form V of AP1189
30 esylate having an FT-IR as shown in Figure 59. One embodiment of the present disclosure provides for a crystalline Form V of AP1189 esylate having in an FT-IR spectrum peaks as shown in Table 47.

One embodiment of the present disclosure provides for a crystalline Form VII of
35 AP1189 edisylate having an FT-IR as shown in Figure 60. One embodiment of the

present disclosure provides for a crystalline Form VII of AP1189 edisylate having in an FT-IR spectrum peaks as shown in Table 48.

5 One embodiment of the present disclosure provides for a crystalline Form VIII of AP1189 edisylate having an FT-IR as shown in Figure 61. One embodiment of the present disclosure provides for a crystalline Form VIII of AP1189 edisylate having in an FT-IR spectrum peaks as shown in Table 49.

10 One embodiment of the present disclosure provides for a crystalline Form IX of AP1189 edisylate having an FT-IR as shown in Figure 62. One embodiment of the present disclosure provides for a crystalline Form IX of AP1189 edisylate having in an FT-IR spectrum peaks as shown in Table 50.

15 One embodiment of the present disclosure provides for a crystalline Form X of AP1189 nitrate having an FT-IR as shown in Figure 63. One embodiment of the present disclosure provides for a crystalline Form X of AP1189 nitrate having in an FT-IR spectrum peaks as shown in Table 51.

20 One embodiment of the present disclosure provides for a crystalline Form XI of AP1189 cyclamate having an FT-IR as shown in Figure 64. One embodiment of the present disclosure provides for a crystalline Form XI of AP1189 cyclamate having in an FT-IR spectrum peaks as shown in Table 52.

25 One embodiment of the present disclosure provides for a crystalline Form XII of AP1189 cyclamate having an FT-IR as shown in Figure 65. One embodiment of the present disclosure provides for a crystalline Form XII of AP1189 cyclamate having in an FT-IR spectrum peaks as shown in Table 53.

30 One embodiment of the present disclosure provides for a crystalline Form XIII of AP1189 cyclamate having an FT-IR as shown in Figure 66. One embodiment of the present disclosure provides for a crystalline Form XIII of AP1189 cyclamate having in an FT-IR spectrum peaks as shown in Table 54.

35 One embodiment of the present disclosure provides for a crystalline Form XIV of AP1189 besylate having an FT-IR as shown in Figure 67. One embodiment of the

present disclosure provides for a crystalline Form XIV of AP1189 besylate having in an FT-IR spectrum peaks as shown in Table 55.

5 One embodiment of the present disclosure provides for a crystalline Form XV of AP1189 oxalate having an FT-IR as shown in Figure 68. One embodiment of the present disclosure provides for a crystalline Form XV of AP1189 oxalate having in an FT-IR spectrum peaks as shown in Table 56.

10 One embodiment of the present disclosure provides for a crystalline Form XVI of AP1189 oxalate having an FT-IR as shown in Figure 69. One embodiment of the present disclosure provides for a crystalline Form XVI of AP1189 oxalate having in an FT-IR spectrum peaks as shown in Table 57.

15 One embodiment of the present disclosure provides for a crystalline Form XVII of AP1189 oxalate having an FT-IR as shown in Figure 70. One embodiment of the present disclosure provides for a crystalline Form XVII of AP1189 oxalate having in an FT-IR spectrum peaks as shown in Table 58.

20 One embodiment of the present disclosure provides for a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid having an FT-IR as shown in Figure 71. One embodiment of the present disclosure provides for a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid having in an FT-IR spectrum peaks as shown in Table 59.

25 One embodiment of the present disclosure provides for a crystalline Form XIX of AP1189 oxoglutarate having an FT-IR as shown in Figure 72. One embodiment of the present disclosure provides for a crystalline Form XIX of AP1189 oxoglutarate having in an FT-IR spectrum peaks as shown in Table 60.

30 One embodiment of the present disclosure provides for a crystalline Form XX of AP1189 DL-mandelic acid having an FT-IR as shown in Figure 73. One embodiment of the present disclosure provides for a crystalline Form XX of AP1189 DL-mandelic acid having in an FT-IR spectrum peaks as shown in Table 61.

35 One embodiment of the present disclosure provides for a crystalline Form XXI of AP1189 DL-mandelic acid having an FT-IR as shown in Figure 74. One embodiment of

the present disclosure provides for a crystalline Form XXI of AP1189 DL-mandelic acid having in an FT-IR spectrum peaks as shown in Table 62.

5 One embodiment of the present disclosure provides for a crystalline Form XXII of AP1189 hippuric acid having an FT-IR as shown in Figure 75. One embodiment of the present disclosure provides for a crystalline Form XXII of AP1189 hippuric acid having in an FT-IR spectrum peaks as shown in Table 63.

10 One embodiment of the present disclosure provides for a crystalline Form XXIII of AP1189 formate having an FT-IR as shown in Figure 76. One embodiment of the present disclosure provides for a crystalline Form XXIII of AP1189 formate having in an FT-IR spectrum peaks as shown in Table 64.

15 One embodiment of the present disclosure provides for a crystalline Form XXIV of AP1189 L-lactic acid having an FT-IR as shown in Figure 77. One embodiment of the present disclosure provides for a crystalline Form XXIV of AP1189 L-lactic acid having in an FT-IR spectrum peaks as shown in Table 65.

20 One embodiment of the present disclosure provides for a crystalline Form XXV of AP1189 DL-lactic acid having an FT-IR as shown in Figure 78. One embodiment of the present disclosure provides for a crystalline Form XXV of AP1189 DL-lactic acid having in an FT-IR spectrum peaks as shown in Table 66.

25 One embodiment of the present disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid having an FT-IR as shown in Figure 79. One embodiment of the present disclosure provides for a crystalline Form XXVI of AP1189 glutaric acid having in an FT-IR spectrum peaks as shown in Table 67.

30 One embodiment of the present disclosure provides for a crystalline Form XXVII of AP1189 glutaric acid having an FT-IR as shown in Figure 80. One embodiment of the present disclosure provides for a crystalline Form XXVII of AP1189 glutaric acid having in an FT-IR spectrum peaks as shown in Table 68.

35 One embodiment of the present disclosure provides for a crystalline Form A of AP1189 acetic acid having an IR spectrum as shown in Figure 92.

Properties of crystalline forms

The present disclosure provides salts of AP1189 having higher solubility. It is to be construed that when solubility is discussed in the context of the present disclosure, solubility in aqueous solution is preferably meant. In one embodiment of the disclosure, solubility is in aqueous medium. Specifically, as shown in the examples herein, the crystalline Form A of AP1189 acetate was found to have a high solubility at pH 1.2. Likewise, crystalline Form B of AP1189 succinate was found to have a higher solubility at pH 1.2-1.3. It is an object of the present disclosure to provide salts of AP1189 having a high solubility at low pH, as this improves *in vivo* uptake of AP1189 after administration to a subject, such as oral administration to a subject.

High solubility of AP1189 salts is not a given, as is shown in the examples herein. For example, both AP1189 tosylate and AP1189 fumarate were found to have low solubility at low pH, e.g. pH 1.2-1.3.

One embodiment of the present disclosure provides for a salt of AP1189 having a solubility at pH 1.2 of at least 10 mM, such as at least 15 mM, such as at least 20 mM, such as at least 25 mM, such as at least 30 mM, such as at least 35 mM.

One embodiment of the present disclosure provides for a crystalline Form A of AP1189 acetate having a solubility at pH 1.2 of at least 100 mM, such as at least 110 mM, such as at least 120 mM.

One embodiment of the present disclosure provides for a crystalline Form B of AP1189 succinate having a solubility at pH 1.2 of at least 20 mM, such as at least 25 mM, such as at least 30 mM, such as at least 35 mM.

The solubility of a compound may be assessed by adding a surplus of the compound to a volume of solvent such that some of the compound is not dissolved, then isolating the non-dissolved compound and measuring the amount. The solubility of a compound may alternatively be assessed by adding a surplus of the compound to a volume of solvent such that some of the compound is not dissolved, and then measure the amount of compound in solution. Measuring the amount of compound in solution may be done using any suitable method, such as HPLC, titration, or spectrometry.

Methods for preparing AP1189 salts

Salts of AP1189 may be prepared as disclosed herein.

5 One embodiment of the present disclosure provides for a method of producing AP1189 acetate of crystalline Form A, said method comprising:

- i. mixing AP1189 and acetic acid in a solvent to form a mixture; and
- ii. isolating the AP1189 acetate of crystalline Form A from said mixture.

10 As used herein, "mixture" can mean a solution or a slurry of one or more solids in a solvent or mixture of solvents. In one embodiment of the disclosure, the mixture is a solution, where the solute or solutes are substantially fully dissolved. In one embodiment, the mixture is a slurry, wherein one or more solutes are only partly dissolved, and the remaining part or parts of the solute or solutes are not dissolved.

15

One embodiment of the present disclosure provides for a method for producing AP1189 acetate of crystalline Form A, said method comprising:

- i. mixing AP1189 and acetate salt in a solvent to form a mixture; and
- ii. isolating the AP1189 acetate of crystalline Form A from said mixture.

20

In one embodiment, the acetate salt is ammonium acetate or a metal acetate salt such as sodium acetate, lithium acetate, magnesium acetate, potassium acetate, or calcium acetate.

25 In one embodiment, the method further comprises adding an acid in step i, such as an organic acid or a mineral acid.

One embodiment of the disclosure provides for a method for producing AP1189 acetate of crystalline Form A, said method comprising:

- 30
- i. mixing AP1189 acetate in a solvent to form a composition; and
 - ii. isolating the AP1189 acetate of crystalline Form A from said composition.

In one embodiment, such method is effective in converting AP1189 acetate not of crystalline Form A to AP1189 acetate of crystalline Form A.

35

As used herein, "composition" can mean a solution or a slurry of one solid in a solvent or mixture of solvents. In one embodiment of the disclosure, the composition is a solution, where the solute is substantially fully dissolved. In one embodiment, the composition is a slurry, wherein the solute is only partly dissolved, and the remaining part of the solute is not dissolved. The composition may further comprise one or more other agents or reagents which may be dissolved or may be only partly dissolved. Such other agents includes, but are not limited to, surfactants, detergents, acids, bases, sugars, salts, biomolecules, bioactive agents, and other excipients such as pharmaceutical excipients.

This present disclosure also relates to non-solid compositions, e.g. liquid compositions, gel compositions, pastes, creams, or ointments prepared from the crystalline forms disclosed herein. One embodiment provides for a liquid composition, gel composition, paste, cream, or ointment prepared from a crystalline form disclosed herein. One specific embodiment provides for a liquid composition prepared from a crystalline form disclosed herein and a solvent. In a specific embodiment, the solvent is aqueous. In one embodiment, the present disclosure provides for a method of preparing a liquid composition, a gel composition, a paste, a cream, or an ointment, said method comprising mixing a crystalline form disclosed herein and one or more additional agents. One specific embodiment provides for a method of preparing a liquid composition, said method comprising mixing a crystalline form disclosed herein and a solvent. In a further embodiment, the solvent is aqueous.

One embodiment of the disclosure provides for a method for producing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A, said method comprising:

- i. mixing 3-[1-(2-nitrophenyl)-1-*H*-pyrrole-2-yl]-propanal, amino guanidine or a salt thereof, and acetic acid or a salt thereof in a solvent, and
- ii. isolating the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A from said composition.

Any one of the above agents of step i may be generated from a precursor *in situ*.

One embodiment of the present disclosure provides for a method for producing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A, said method comprising:

- 5 i. providing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine or an *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt,
- ii. introducing acetate as a counter ion using ion exchange, and
- iii. isolating *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A.

10

One embodiment of the present disclosure provides for a method of producing AP1189 succinate of crystalline Form B, said method comprising:

- i. mixing AP1189 and succinic acid in a solvent to form a mixture; and
- ii. isolating the AP1189 succinate of crystalline Form B from the mixture.

15

One embodiment of the present disclosure provides for a method of producing AP1189 succinate of crystalline Form B, said method comprising:

- i. mixing a AP1189 salt and succinic acid in a solvent to form a mixture, and
- 20 ii. isolating the AP1189 succinate of crystalline Form B from the mixture.

20

One embodiment of the present disclosure provides for a method for producing the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate of crystalline Form B, said method comprising:

- 25 i. mixing 3-[1-(2-nitrophenyl)-1-*H*-pyrrole-2-yl]-propanal, amino guanidine or a salt thereof, and succinic acid or a salt thereof in a solvent, and
- ii. isolating the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate of crystalline Form B from said composition.

30

Any one of the above agents of step i may be generated from a precursor *in situ*.

One embodiment of the present disclosure provides for a method for producing the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate of crystalline Form B, said method comprising:

- i. providing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine or an *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt,
- ii. introducing succinate as a counter ion using ion exchange, and
- 5 iii. isolating *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate of crystalline Form B.

10 In one embodiment of the present disclosure, the solvent is a protic or a polar aprotic solvent. In one embodiment, the solvent is selected from the group consisting of 1,4-dioxane, methanol, ethanol, 1-propanol, 2-propanol, acetone, acetonitrile, anisole, isopropyl acetate, methylethyl ketone, water, and ethyl acetate.

15 In one embodiment of the present disclosure, the mixture or the composition is heated at least once before the isolating step. In one embodiment, the mixture or the composition is heated and cooled in cycles before the isolation step. In one embodiment, the mixture or the composition is heated and cooled in cycles for up to 72 hours before the isolating step. In one embodiment the mixture or the composition is heated and cooled in cycles for 15 min to 72 hours before the isolating step. In one embodiment, one cycle comprises heating the mixture or the composition to at least a first threshold temperature, maintaining the temperature above said first threshold temperature for a first duration, then cooling the mixture or the composition to below a second threshold temperature and maintaining the temperature below said second threshold temperature for a second duration. In one embodiment of the present disclosure, the cycle is carried out 1 to 200 times. In one embodiment of the present disclosure, the first threshold temperature is 30 °C, such as 35 °C, such as 40 °C, such as 45 °C, such as 50 °C, such as 55 °C, such as 60 °C, such as 65 °C, such as 70 °C, such as 75 °C, such as 80 °C. In one embodiment of the present disclosure, the second threshold temperature is 30 °C, such as 25 °C, such as 20 °C, such as 15 °C, such as 10 °C, such as 7 °C, such as 5 °C. In one embodiment of the present disclosure, the first and/or the second duration is 1 to 2 min, such as 2 to 5 min, such as 5 to 10 min, such as 10 to 20 min, such as 20 to 30 min, such as 30 to 40 min, such as 40 to 50 min, such as 50 to 60 min, such as 1 hour to 1.5 hours, such as 1.5 to 2 hours, such as 2 to 3 hours, such as 3 to 4 hours, such as 4 to 5 hours, such as 5 to 6 hours, such as 6 to 7 hours, such as 7 to 8 hours. In one embodiment, the first and the second durations are the same. In one embodiment, the first and the second durations

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are different. In one embodiment, the first duration is different or the same for each cycle. In one embodiment, the second duration is different or the same for each cycle.

In one embodiment, heating is to about 40 °C.

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In one embodiment, cooling is to about 20 °C.

In one embodiment, the method further comprises a step of adding an anti-solvent to the mixture or the composition before the isolation step. In one embodiment, the anti-solvent is a non-polar aprotic solvent. In one embodiment, the anti-solvent is selected from the group consisting of *tert*-butyl methyl ether, THF, and acetone, and mixtures comprising *tert*-butyl methyl ether, THF, or acetone. In one embodiment of the present disclosure, the anti-solvent is water.

Isolation of crystals may be carried out using an appropriate means. In one embodiment of the disclosure, the isolation is carried out using filtration, centrifugation, and/or evaporation of the solvent or solvents. In one embodiment, a slow evaporation method is utilised. In one embodiment, a fast evaporation method is utilised. In one embodiment, the evaporation is carried out using spray drying. In one embodiment, the evaporation is carried out using fluid bed drying, freeze drying, vacuum drying, tumble drying, rotary evaporation, and/or thin-film evaporation. In one embodiment, the drying is carried out using a conductive (contact) dryer, including tray dryers, rotary cone dryers, tumble dryers, and paddle dryers. In one further embodiment, the drying is carried out using a carrier gas.

25

In one embodiment of the present disclosure, one or more pKa values, such as at least one pKa, of the corresponding acid to the counter ion of the AP1189 salt is about equal to or lower than the pKa value of succinic acid and/or acetic acid. By way of example, “the corresponding acid to the counter ion of the AP1189 fumarate” is fumaric acid. The pKa value of acetic acid is 4.756. The pKa value corresponding to the first acid dissociation of succinic acid is 4.2. The pKa value corresponding to the second acid dissociation of succinic acid is 5.6. Accordingly, in one embodiment, the pKa value of the corresponding acid to the counter ion of the AP1189 salt is about equal to or lower than 4.756. In another embodiment, the pKa value of the corresponding acid to the counter ion of the AP1189 salt is about equal to or lower than 4.2 and/or 5.6.

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One embodiment of the present disclosure provides for a crystalline Form A of AP1189 acetate produced by the method as disclosed herein.

- 5 One embodiment of the present disclosure provides for a crystalline Form B of AP1189 succinate produced by the method as disclosed herein.

One embodiment of the present disclosure provides for a method of producing crystalline Form A of AP1189 acetate as disclosed herein, wherein the method further
10 comprises adding a seed crystal of crystalline Form A of AP1189 acetate before the isolation step. One embodiment of the present disclosure provides for a method of producing crystalline Form B of AP1189 succinate as disclosed herein, wherein the method further comprises adding a seed crystal of crystalline Form B of AP1189 succinate before the isolation step.

15

Pharmaceutical compositions

One embodiment of the disclosure provides for a pharmaceutical composition comprising the crystalline Form A of AP1189 acetate as disclosed herein and a pharmaceutically acceptable excipient.

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One embodiment of the disclosure provides for a pharmaceutical composition comprising the crystalline Form B of AP1189 succinate as disclosed herein and a pharmaceutically acceptable excipient.

- 25 In some embodiments there is provided an oral formulation, a pharmaceutical composition, or unit dosage form comprising the crystalline Form A of AP1189 acetate as disclosed herein or the crystalline Form B of AP1189 succinate as disclosed herein.

One embodiment provides for a pharmaceutical composition as disclosed herein,
30 wherein the pharmaceutical composition is formulated for oral administration. Such composition may be in the form of a tablet or a capsule.

One embodiment of the disclosure provides for a method of preparing a pharmaceutical composition comprising mixing the crystalline Form A of AP1189
35 acetate with a pharmaceutically acceptable excipient.

One embodiment of the disclosure provides for a method of preparing a pharmaceutical composition comprising mixing the crystalline Form B of AP1189 succinate with a pharmaceutically acceptable excipient.

5

One embodiment of the disclosure provides for the crystalline Form A of AP1189 acetate, the crystalline Form B of AP1189 succinate, or the pharmaceutical composition as disclosed herein for use in medicine. One embodiment of the present disclosure provides for the crystalline Form A of AP1189 acetate, the crystalline Form B of AP1189 succinate, or the pharmaceutical composition as disclosed herein, for use in the treatment of a kidney disease such as proteinuria, a cardiovascular disease, an arthritic disease, or a viral infection.

10

One embodiment of the present disclosure provides for a method of treating a disease or disorder in a subject in need thereof, said method comprising administering crystalline Form A of AP1189 acetate, crystalline Form B of AP1189 succinate, or the pharmaceutical composition as disclosed herein, to a subject in need thereof. In one further embodiment, the disease or disorder is selected from the list consisting of a kidney disease such as proteinuria, a cardiovascular disease, an arthritic disease, or a viral infection.

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One embodiment of the present disclosure provides for a use of the crystalline Form A of AP1189 acetate or the crystalline Form B of AP1189 succinate, or the pharmaceutical composition as disclosed herein for the manufacture of a medicament for treatment of a disease or disorder.

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Medical use

It is an aspect of the present disclosure to provide a pharmaceutical formulation, such as an oral formulation, comprising the crystalline Form A of AP1189 acetate as disclosed herein or the crystalline Form B of AP1189 succinate as disclosed herein, for use in the treatment of a disease or disorder.

30

In some embodiments, the disease or disorder is selected from the group consisting of a kidney disease, an arthritic disease, a viral disease or disorder, and a cardiovascular disease and/or atherosclerosis.

35

Kidney disease

It is an aspect of the present disclosure to provide a pharmaceutical formulation such as an oral formulation, a pharmaceutical composition, or unit dosage form according to the present disclosure for use in treating or preventing a kidney disease.

Also disclosed is a method of treating or preventing a kidney disease in a subject in need thereof, wherein the subject is administered a therapeutically effect amount of the oral formulation, pharmaceutical composition, or unit dosage form of the present disclosure.

Also disclosed is the use of an oral formulation, pharmaceutical composition, or unit dosage form according to the present disclosure for use in the manufacture of a medicament for the treatment or prevention of a kidney disease.

In some embodiments of the present disclosure there is provided an oral formulation, such as a solid oral formulation, comprising the crystalline form A of AP1189 acetate or the crystalline Form B of AP1189 succinate, and at least one pharmaceutically acceptable excipient, as disclosed herein, for use in treating or preventing a kidney disease.

In some embodiments said kidney disease present with proteinuria. In some embodiments said kidney disease is a proteinuric kidney disease.

In some embodiments said kidney disease is a glomerular disease

In some embodiments said kidney disease is nephrotic syndrome (glomerulonephrosis).

In some embodiments said kidney disease is primary nephrotic syndrome (primary glomerulonephrosis).

In some embodiments said primary nephrotic syndrome is membranous glomerulonephritis (MGN) (or membranous nephropathy (MN)).

In some embodiments said primary nephrotic syndrome is focal segmental glomerulosclerosis (FSGS).

5 In some embodiments said primary nephrotic syndrome is membranoproliferative glomerulonephritis (MPGN) (mesangiocapillary glomerulonephritis).

In some embodiments said membranoproliferative glomerulonephritis (MPGN) is selected from Type 1 MPGN and Type 2 MPGN.

10 In some embodiments said primary nephrotic syndrome is rapidly progressive glomerulonephritis (RPGN) (crescentic GN).

In some embodiments said primary nephrotic syndrome is minimal change disease (MCD).

15 In some embodiments said kidney disease is secondary nephrotic syndrome (secondary glomerulonephrosis).

20 In some embodiments said secondary nephrotic syndrome is caused by an underlying autoimmune disease, an underlying cancer disease, an underlying genetic disorder, or by an underlying disease selected from the group consisting of: Systemic lupus erythematosus (SLE), Diabetic nephropathy, Sarcoidosis, Sjögren's syndrome, Amyloidosis, Multiple myeloma, Vasculitis, Cancer and Genetic disorders (such as congenital nephrotic syndrome).

25 In some embodiments said secondary nephrotic syndrome is caused by Diabetic nephropathy, by an infection, such as a urinary tract infection, such as an infection selected from the group consisting of HIV, syphilis, hepatitis such as hepatitis A, B and C, post-streptococcal infection, urinary schistosomiasis and Ebola. In some
30 embodiments said secondary nephrotic syndrome is drug-induced.

In some embodiments said kidney disease is an inflammatory kidney disease.

35 In some embodiments said kidney disease is glomerulonephritis (GN). In some embodiments said glomerulonephritis is selected from the group consisting of IgA

nephropathy (Berger's disease), IgM nephropathy, Post-infectious glomerulonephritis and Thin basement membrane disease.

5 In some embodiment said kidney disease is idiopathic membranous nephropathy (iMN).

10 In some embodiments there is provided an oral formulation, a pharmaceutical composition, or unit dosage form according to the present disclosure for use in treating or preventing idiopathic membranous nephropathy (iMN).

Arthritic disease

15 It is as aspect of the present disclosure to provide an oral formulation, a pharmaceutical composition, or unit dosage form according to the present disclosure for use in treating or preventing an arthritic disease.

20 Also disclosed is a method of treating or preventing an arthritic disease in a subject in need thereof, wherein the subject is administered a therapeutically effect amount of the oral formulation, pharmaceutical composition, or unit dosage form of the present disclosure.

Also disclosed is the use of an oral formulation, pharmaceutical composition, or unit dosage form according to the present disclosure for use in the manufacture of a medicament for the treatment or prevention of an arthritic disease.

25 In some embodiments of the present disclosure there is provided an oral formulation, such as a solid oral formulation, comprising the crystalline Form A of AP1189 acetate or crystalline Form B of AP1189 succinate, and at least one pharmaceutically acceptable excipient, as disclosed herein, for use in treating or preventing an arthritic disease.

30 In one embodiment the arthritic disease is an auto-immune disease and/or an inflammatory disease that presents with joint inflammation.

In one embodiment, the arthritic disease is selected from the group consisting of inflammatory arthritis, degenerative arthritis, metabolic arthritis, reactive arthritis and infectious arthritis.

- 5 In one embodiment, the arthritic disease is inflammatory arthritis.

In one embodiment, the inflammatory arthritis is selected from the group consisting of Rheumatoid Arthritis (RA), Psoriatic Arthritis, and Ankylosing Spondylitis.

- 10 In one embodiment, the inflammatory arthritis is Rheumatoid Arthritis (RA).

In one embodiment, the rheumatoid arthritis is severe active RA (CDAI > 22). In one embodiment, the rheumatoid arthritis is RA with a CDAI > 22.

- 15 In one embodiment, the rheumatoid arthritis is RA with a DAS28 score of above 5.1.

In one embodiment, the rheumatoid arthritis is juvenile rheumatoid arthritis (JRA).

In one embodiment, the degenerative arthritis is osteoarthritis.

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In one embodiment, the metabolic arthritis is gouty arthritis.

In one embodiment, the reactive and/or infectious arthritis is arthritis associated with infection with one or more of Hepatitis C, Chlamydia, gonorrhoea, salmonella or shigella.

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In one embodiment the arthritic disease is arthritis as part of a systemic inflammatory disease.

- 30 In one embodiment, the arthritis as part of a systemic inflammatory disease, such as an inflammatory disease selected from the group consisting of systemic lupus erythematosus, mixed connective tissue disease, Still's disease, and Polymyalgia Rheumatica.

In some embodiments there is provided an oral formulation, a pharmaceutical composition, or unit dosage form according to the present disclosure for use in treating or preventing rheumatoid arthritis.

- 5 In some embodiments there is provided an oral formulation, a pharmaceutical composition, or unit dosage form according to the present disclosure in combination with MTX (methotrexate) for use in treating or preventing rheumatoid arthritis.

- 10 In some embodiments there is provided an oral formulation, a pharmaceutical composition, or unit dosage form according to the present disclosure, alone or in combination with MTX (methotrexate), for use in treating or preventing rheumatoid arthritis in patients with an inappropriate response to MTX (such as patients with a reduced response to MTX treatment, such as an MTX non-responder).

15 Viral disease or disorder

It is an aspect of the present disclosure to provide an oral formulation, a pharmaceutical composition, or unit dosage form according to the present disclosure for use in treating or preventing a viral disease or disorder.

- 20 Also disclosed is a method of treating or preventing a viral disease or disorder in a subject in need thereof, wherein the subject is administered a therapeutically effective amount of the oral formulation, pharmaceutical composition, or unit dosage form of the present disclosure.

- 25 Also disclosed is the use of an oral formulation, pharmaceutical composition, or unit dosage form according to the present disclosure for use in the manufacture of a medicament for the treatment or prevention of a viral disease or disorder.

- 30 In some embodiments of the present disclosure there is provided an oral formulation, such as a solid oral formulation, comprising a pharmaceutically acceptable salt of AP1189, such as AP1189 acetate or AP1189 succinate, and at least one pharmaceutically acceptable excipient, as disclosed herein, for use in treating or preventing a viral disease or disorder.

In some embodiments said viral disease or disorder is a symptomatic viral disease or disorder.

5 In some embodiments said viral disease or disorder is a symptomatic viral disease or disorder with inflammation, such as hyperinflammation.

In some embodiments said viral disease or disorder is a symptomatic viral disease or disorder with inflammation, such as hyperinflammation, in one or more organs.

Inflammation in one or more organs may also be referred to as local inflammation.

10

In some embodiments said one or more organs are selected from the group consisting of lungs, the respiratory tract, kidney, liver, pancreas, spleen, exocrine glands, endocrine glands, lymph nodes, brain, heart, muscles, bone marrow, skin, skeleton, bladder, reproduction organs including the phallopian tubes, eye, ear, vascular system, the gastrointestinal tract including small intestines, colon, rectum, canalis analis and the prostate gland.

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In some embodiments said viral disease or disorder is inflammatory viral diseases or disorders.

20

In some embodiments said viral disease or disorder is a viral respiratory infection, such as a viral lower respiratory infection.

In some embodiments said viral disease or disorder is viral respiratory diseases or disorders.

25

In some embodiments said viral disease or disorder is viral diseases or disorders of the lung.

30

In some embodiments said viral disease or disorder is viral diseases or disorders with inflammation in the respiratory system, such as in the lungs and/or respiratory tract.

In some embodiments said viral disease or disorder is viral diseases or disorders with one or more respiratory symptoms. In one embodiment said one or more respiratory symptoms are selected from the group consisting of cough, dry cough, dyspnea,

35

impaired oxygenation, respiratory illness, respiratory dysfunction, respiratory failure, respiratory syndrome and acute respiratory disease (ARD).

5 In some embodiments said viral disease or disorder is severe disease. Severe disease present with dyspnoea, increased respiratory frequency, reduced blood oxygen saturation and/or lung infiltrates.

10 In some embodiments said viral disease or disorder is critical disease. Critical disease present with respiratory failure, septic shock, and/or multiple organ dysfunction (MOD) or multiple organ failure (MOF).

In some embodiments said viral disease or disorder is viral pneumonia.

15 In some embodiments said viral disease or disorder is viral bronchiolitis.

In some embodiments said viral disease or disorder is viral diseases or disorders with respiratory failure.

20 In some embodiments said viral disease or disorder is acute respiratory distress syndrome (ARDS).

In some embodiments said viral disease or disorder is viral acute respiratory distress syndrome (ARDS).

25 In some embodiments said viral disease or disorder is symptomatic COVID-19 with acute respiratory distress syndrome (ARDS).

30 In some embodiments there is provided an oral formulation, a pharmaceutical composition, or unit dosage form according to the present disclosure for use in treating or preventing ARDS, such as viral ARDS.

In some embodiments said viral disease or disorder is viral diseases and disorders with systemic inflammatory distress syndrome (SIDS) and/or sepsis.

In some embodiments said viral disease or disorder is viral diseases and disorders with pulmonary insufficiency.

5 In some embodiments said viral disease or disorder is viral diseases or disorders with cytokine release syndrome (CRS) and/or a cytokine storm (hypercytokinemia).

10 In some embodiments said viral disease or disorder is caused by a viral infection selected from the group consisting of Severe Acute Respiratory Syndrome CoronaVirus 2 (SARS-CoV-2), often referred to as the COVID-19 virus; SARS-CoV, MERS-CoV, the dengue virus and influenza virus (including Type A, Type B and Type C).

Cardiovascular disease and/or atherosclerosis

15 It is as aspect of the present disclosure to provide an oral formulation, a pharmaceutical composition, or unit dosage form according to the present disclosure for use in treating or preventing a cardiovascular disease and/or atherosclerosis.

20 Also disclosed is a method of treating or preventing a cardiovascular disease and/or atherosclerosis in a subject in need thereof, wherein the subject is administered a therapeutically effect amount of the oral formulation, pharmaceutical composition, or unit dosage form of the present disclosure.

25 Also disclosed is the use of an oral formulation, pharmaceutical composition, or unit dosage form according to the present disclosure for use in the manufacture of a medicament for the treatment or prevention of a cardiovascular disease and/or atherosclerosis.

30 In some embodiments of the present disclosure there is provided an oral formulation, such as a solid oral formulation, comprising the crystalline Form A of AP1189 acetate as disclosed herein or the crystalline Form B of AP1189 succinate as disclosed herein, and at least one pharmaceutically acceptable excipient, as disclosed herein, for use in treating or preventing a cardiovascular disease and/or atherosclerosis.

35 In some embodiments said cardiovascular disease is selected from the group consisting of coronary artery diseases (CAD) such as angina and myocardial infarction

(commonly known as a heart attack); stroke, heart failure, hypertensive heart disease, rheumatic heart disease, cardiomyopathy, abnormal heart rhythms, congenital heart disease, valvular heart disease, carditis, aortic aneurysms, peripheral artery disease, vascular disease, thromboembolic disease, and venous thrombosis.

5

In some embodiments said cardiovascular disease is atherosclerotic cardiovascular disease.

10 In some embodiments said atherosclerotic cardiovascular disease is selected from the group consisting of coronary artery disease, stroke (cerebrovascular disease), and peripheral artery disease.

In some embodiments said cardiovascular disease is vascular inflammation.

15 Systemic inflammatory disorders

It is an aspect of the present disclosure to provide an oral formulation, a pharmaceutical composition, or unit dosage form according to the present disclosure for use in treating or preventing a systemic inflammatory disorder.

20 Also disclosed is a method of treating or preventing a systemic inflammatory disorder in a subject in need thereof, wherein the subject is administered a therapeutically effective amount of the oral formulation, pharmaceutical composition, or unit dosage form of the present disclosure.

25 Also disclosed is the use of an oral formulation, pharmaceutical composition, or unit dosage form according to the present disclosure for use in the manufacture of a medicament for the treatment or prevention of a systemic inflammatory disorder.

30 In some embodiments of the present disclosure there is provided an oral formulation, such as a solid oral formulation, comprising the crystalline Form A of AP1189 acetate as disclosed herein or the crystalline Form B of AP1189 succinate, and at least one pharmaceutically acceptable excipient, as disclosed herein, for use in treating or preventing a systemic inflammatory disorder.

Systemic disorders with possible involvement of the nervous system include a variety of diseases with presumed inflammatory and autoimmune pathomechanisms, among them Behçet disease, sarcoidosis, systemic lupus erythematosus, juvenile idiopathic arthritis, scleroderma, and Sjögren syndrome. This disease group encompasses
5 systemic inflammatory disorders with a genetically defined dysregulation of the innate immune system as well as systemic autoimmune disorders characterized by alterations of the adaptive immunity such as autoantibodies and autoreactive T cells.

In some embodiments said systemic inflammatory disorder is an autoimmune disorder.

10 In some embodiments said systemic inflammatory disorder is selected from the group consisting of Behçet disease, sarcoidosis, systemic lupus erythematosus, juvenile idiopathic arthritis, scleroderma, Sjögren syndrome, myositis including dermatomyositis and polymyositis, vasculitis, giant cell arteritis, ankylosing spondylitis, polymyalgia
15 rheumatic and psoriatic arthritis.

Examples

Example 1: Formation of salts

From the reaction yielding *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-
20 aminoguanidine

An acid is added as a slurry or solution in a protic or polar aprotic solvent to a heated slurry or solution of 3-[1-(2-nitrophenyl)-1-*H*-pyrrole-2-yl]-propanal and aminoguanidine or a salt thereof in a protic or polar aprotic solvent. The resulting mixture is heated and stirred, preferably until completion of the reaction, before cooled and optionally an anti-
25 solvent, such as a non-polar aprotic solvent, is added. The resulting salt is isolated by conventional methods, such as filtration, centrifugation, evaporation of the solvents, including spray drying.

From free base

30 An acid is added (such as an excess of said acid) as a slurry or solution in a protic or polar aprotic solvent to a slurry of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine in a protic or polar aprotic solvent. The resulting mixture is heated and cooled in cycles between 15 min and 72 hours, before cooled and optionally an anti-solvent, such as a non-polar aprotic solvent, is added. The resulting salt is isolated by

conventional methods, such as filtration, centrifugation, evaporation of the solvents, including spray drying.

From another salt

- 5 This method is feasible if the corresponding acid to the counterion is stronger in the salt formed. An excess of an acid is added as a slurry or solution in a protic or polar aprotic solvent to a slurry of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt in a protic or polar aprotic solvent. The resulting mixture is heated and cooled in cycles between 15 min and 72 hours, before cooled and
- 10 optionally an anti-solvent, such as a non-polar aprotic solvent, is added. The resulting salt is isolated by conventional methods, such as filtration, centrifugation, or evaporation of the solvents, including spray drying.

Exemplary procedure for formation of acetate salt

- 15 0.9 equivalent of acetic acid was slowly whilst stirring added to 3-[1-(2-nitrophenyl)-1-*H*-pyrrole-2-yl]-propanal and aminoguanidine hydrogen carbonate in ethanol. Heated at 50-55 °C for 1 hour before additional 0.11 equivalent acetic acid was added and the mixture was heated to reflux for at least 2 hours. The suspension was cooled to 60 °C before tert-butyl methyl ether was added. Cooled and kept at 2-5 °C for 10-16 hours.
- 20 Filtered and washed with tert-butyl methyl ether, before recrystallized from ethanol.

The procedure produces a polymorph of AP1189 acetate salt corresponding to XRPD pattern 1.

25 Exemplary procedure for formation of succinate salt of AP1189

- 2-propanol:water 90:10 v/v was added to AP1189 acetate to prepare a slurry. 2-propanol:water 90:10 v/v was added to 1.1 equivalents of succinic acid. The counterion slurry was added to the acetate salt slurry. Temperature cycling was carried out between ambient and 40 °C for ca. 18 h with 4 hour hold periods at ambient
- 30 temperature and 4 hour hold periods at 40 °C. The entire slurry was then isolated by Büchner filtration and washed with deionised water. The solids were dried under vacuum at ambient.

- The procedure produced a polymorph of AP1189 succinate salt corresponding to
- 35 XRPD pattern 1.

Salt break of freebase AP1189

Ethyl acetate and 1 M sodium bicarbonate was added to AP1190 acetate to create a biphasic mixture. The mixture was transferred to a separating funnel and the aqueous phase was removed. The organic phase was washed with water. The organic phase was dried with sodium sulphate. The solvent of the organic phase was removed by rotary evaporation.

The procedure produced AP1189 freebase as a solid.

Example 2: Polymorphism assessment for AP1189 acetate salt

Methods

A polymorphism assessment was carried out in order to identify alternate polymorphs of AP1189 acetate: AP1189 acetate was dissolved in 1,4-dioxane-water and lyophilized to obtain an amorphous solid. Aliquots were suspended in the specific solvents and heated in temperature cycles between ambient and 40 °C for 3 days, before being isolated by filtration.

Results

Table 2 outlines the results of the polymorphism study. Acetate Pattern 1 was obtained from 8 solvent systems. A mixture of Pattern 1 and 2 was obtained from 8 solvent systems. Pattern 3 was obtained from THF. Extended temperature cycling for a further 3 days for the acetate Pattern 1 and 2 mixture from ethyl acetate resulted in conversion to acetate Pattern 1.

Table 2: Results from polymorphism study. *: Extended temperature cycling for a further 3 days for the acetate Pattern 1 and 2 mixture from ethyl acetate resulted in conversion to acetate Pattern 1.

Solvent or solvent system	XRPD analysis
1,4-Dioxane	Pattern 1
1-Butanol	Gum
1-Propanol	Gum
2-Methyl THF	Pattern 1 and 2
2-Propanol	Pattern 1
90 % 2-Propanol : 10 % Water (% v/v)	Gum

Acetone	Pattern 1
Acetonitrile	Pattern 1
Anisole	Pattern 1
Dichloromethane	Pattern 1 and 2
Di-isopropyl ether	Gum
3% Dimethylsulfoxide: 97% THF (% v/v)	Solution
Ethanol	Gum
Ethyl Acetate	Pattern 1 and 2*
Heptane	Pattern 1 and 2
Isopropyl Acetate	Pattern 1
11% Methanol: 89% t-BME (% v/v)	Gum
Methylethyl Ketone	Pattern 1
Methylisobutyl Ketone	Pattern 1 and 2
14% N,N'-Dimethylacetamide: 86% t-BME (% v/v)	Pattern 1 and 2
<i>tert</i> -Butylmethyl ether	Pattern 1 and 2
Tetrahydrofuran	Pattern 3
Toluene	Pattern 1 and 2
Water	Pattern 1

Conclusion

The polymorphism study for AP1189 acetate revealed three different polymorphs, corresponding to XRPD Pattern 1, Pattern 1 and 2 (i.e. Pattern 2 as a mixture with Pattern 1), and Pattern 3.

Example 3: X-ray Powder Diffraction

Methods

XRPD analysis was carried out on a PANalytical X'pert pro with PIXcel detector (128 channels), scanning the samples between 3 and 35° 2θ. The material was gently ground (where required) to release any agglomerates and loaded onto a multi-well plate with Kapton or Mylar polymer film to support the sample. The multi-well plate was then placed into the diffractometer and analysed using Cu K radiation ($\alpha_1 \lambda = 1.54060 \text{ \AA}$; $\alpha_2 = 1.54443 \text{ \AA}$; $\beta = 1.39225 \text{ \AA}$; $\alpha_1:\alpha_2$ ratio = 0.5) running in transmission mode (step size 0.0130° 2θ, step time 18.87s) using 40 kV / 40 mA generator settings.

Results

AP1189 acetate Form A

The XRPD diffractogram for AP1189 acetate salt Pattern 1 crystallised from acetonitrile is shown in Figure 1. The corresponding XRPD diffractogram peak list for acetate

5 Pattern 1 is shown in Table 3.

Table 3: XRPD diffractogram peak list for acetate Pattern 1 from acetonitrile.

Characteristic peaks are indicated in bold. Indexed unit cell data: a [Å] 7.8; b [Å] 15.1; c [Å] 20.7; alpha [°] 73.6; beta [°] 80.5; gamma [°] 86.5; volume [Å³] 2311.8.

Pos. [°2θ]	Height [cts]	FWHM Left [°2θ]	d-spacing [Å]	Rel. Int. [%]
6.0782	61.99	0.0768	14.54111	3.01
11.4999	376.76	0.0768	7.69497	18.27
11.7129	266.97	0.0895	7.55551	12.94
12.1877	173.70	0.0895	7.26219	8.42
12.9668	297.55	0.0512	6.82756	14.43
15.4892	966.17	0.0512	5.72091	46.85
15.6424	2062.40	0.0768	5.66523	100.00
15.8752	681.44	0.0768	5.58267	33.04
16.2455	289.74	0.0640	5.45625	14.05
18.3417	132.31	0.0640	4.83712	6.42
18.5685	91.14	0.0768	4.77856	4.42
19.5716	316.98	0.0895	4.53584	15.37
20.0451	546.76	0.1023	4.42976	26.51
20.5722	265.47	0.1151	4.31743	12.87
21.1229	532.99	0.1151	4.20611	25.84
21.5003	272.41	0.0895	4.13312	13.21
21.8494	142.83	0.0895	4.06787	6.93
22.3320	305.94	0.0895	3.98103	14.83
23.5498	1324.22	0.1279	3.77786	64.21
24.7752	1187.85	0.1151	3.59371	57.60
25.7239	208.72	0.1279	3.46328	10.12
26.9625	1300.30	0.1151	3.30693	63.05
27.4977	285.23	0.0768	3.24378	13.83

28.1563	198.27	0.0895	3.16939	9.61
28.5405	90.88	0.1279	3.12758	4.41
30.2113	66.51	0.1023	2.95832	3.22
30.7262	58.06	0.1279	2.90991	2.82
31.2143	198.84	0.0768	2.86551	9.64
32.2538	40.40	0.2047	2.77549	1.96
32.8859	29.42	0.1535	2.72357	1.43
33.4037	43.22	0.2047	2.68254	2.10
34.3356	17.97	0.2047	2.61183	0.87

AP1189 acetate Form I

The XRPD diffractogram for AP1189 acetate salt Pattern 1 and 2 crystallised from ethyl acetate is shown in Figure 2. The corresponding XRPD diffractogram peak list for acetate salt Pattern 1 and 2 is shown in Table 4.

5

Table 4: XRPD diffractogram peak list for acetate Pattern 1 and 2 from ethyl acetate. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	Height [cts]	FWHM Left [°2 θ]	d-spacing [Å]	Rel. Int. [%]
3.2635	158.25	0.6140	27.07331	6.65
5.7636	129.03	0.0512	15.33407	5.42
11.5242	491.32	0.1023	7.67882	20.64
11.7039	436.17	0.0640	7.56130	18.32
12.1439	260.95	0.1023	7.28832	10.96
12.9022	494.37	0.0895	6.86160	20.76
14.7250	397.68	0.0768	6.01607	16.70
14.9424	1114.74	0.1279	5.92902	46.82
15.3955	2380.95	0.0768	5.75554	100.00
15.6099	1481.01	0.0640	5.67694	62.20
15.8562	467.40	0.0895	5.58931	19.63
16.2700	306.75	0.1279	5.44809	12.88
16.4491	241.34	0.0768	5.38917	10.14
16.7354	143.36	0.1023	5.29761	6.02
18.0224	665.00	0.0895	4.92210	27.93

18.3450	141.43	0.0768	4.83626	5.94
18.5587	133.47	0.0768	4.78105	5.61
18.9146	118.41	0.0895	4.69189	4.97
19.5667	272.77	0.1279	4.53697	11.46
19.9482	633.37	0.0624	4.44737	26.60
19.9955	663.36	0.0384	4.44065	27.86
20.1366	348.13	0.0640	4.40985	14.62
20.4922	248.29	0.1535	4.33412	10.43
21.0979	338.62	0.1279	4.21103	14.22
21.4992	410.08	0.1023	4.13333	17.22
21.7757	380.77	0.1279	4.08146	15.99
22.4413	550.91	0.0768	3.96190	23.14
22.7456	183.39	0.1023	3.90958	7.70
23.2063	330.75	0.1279	3.83300	13.89
23.5430	2355.44	0.1279	3.77893	98.93
24.2404	2157.44	0.1151	3.67177	90.61
24.7492	788.30	0.1023	3.59742	33.11
25.3486	189.70	0.0768	3.51371	7.97
25.7030	227.22	0.1023	3.46606	9.54
26.5363	135.18	0.0768	3.35907	5.68
26.9149	1479.12	0.1407	3.31268	62.12
27.5238	407.92	0.1023	3.24076	17.13
28.1364	363.05	0.0512	3.17158	15.25
28.6315	98.86	0.1535	3.11786	4.15
28.9219	125.28	0.1023	3.08720	5.26
30.1919	39.10	0.1535	2.96018	1.64
30.6694	51.02	0.2558	2.91516	2.14
31.1058	142.84	0.1279	2.87525	6.00
32.3303	18.51	0.2047	2.76910	0.78
33.2416	39.67	0.3070	2.69524	1.67
33.8884	21.89	0.2047	2.64527	0.92

AP1189 acetate Form II

The XRPD diffractogram for AP1189 acetate salt Pattern 3 crystallised from THF is shown in Figure 3. The corresponding XRPD diffractogram peak list for acetate salt Pattern 3 is shown in Table 5.

5

Table 5: XRPD diffractogram peak list for acetate Pattern 3 from THF. Characteristic peaks are indicated in bold. Indexed unit cell data: a [Å] 12.5; b [Å] 12.7; c [Å] 20.9; alpha [°] 76.0; beta [°] 73.1; gamma [°] 86.6; volume [Å³] 3074.1.

Pos. [°2θ]	Height [cts]	FWHM Left [°2θ]	d-spacing [Å]	Rel. Int. [%]
7.4087	420.49	0.1023	11.93253	11.02
7.5476	521.50	0.0640	11.71324	13.67
9.3630	615.90	0.0895	9.44578	16.15
10.2795	148.14	0.0768	8.60560	3.88
10.3817	145.57	0.0640	8.52114	3.82
12.7834	3086.55	0.0768	6.92512	80.93
12.8920	1547.27	0.0384	6.86699	40.57
13.2514	3226.07	0.0895	6.68157	84.58
13.5704	569.08	0.0512	6.52520	14.92
14.1812	647.30	0.0768	6.24549	16.97
14.8366	334.40	0.1279	5.97104	8.77
15.1355	499.98	0.0384	5.85381	13.11
15.3087	614.19	0.1023	5.78798	16.10
15.5117	478.34	0.0895	5.71268	12.54
16.0316	1497.51	0.0895	5.52858	39.26
16.3925	709.43	0.1023	5.40763	18.60
17.0466	862.25	0.1023	5.20159	22.61
17.2943	190.95	0.0768	5.12765	5.01
17.6910	274.54	0.0895	5.01355	7.20
18.2222	208.88	0.0895	4.86857	5.48
18.4583	387.60	0.0640	4.80685	10.16
18.8043	1265.02	0.1407	4.71917	33.17
19.5046	902.38	0.0895	4.55128	23.66
19.6774	1113.67	0.0640	4.51170	29.20

19.7852	1009.94	0.0512	4.48735	26.48
20.2727	758.58	0.1023	4.38054	19.89
21.1079	3814.09	0.1023	4.20907	100.00
21.4406	1810.10	0.1023	4.14449	47.46
21.8531	1509.72	0.1151	4.06719	39.58
22.0123	1816.88	0.0895	4.03813	47.64
22.3192	771.07	0.1535	3.98330	20.22
22.7104	1217.98	0.0895	3.91555	31.93
23.0558	2438.93	0.1151	3.85768	63.95
23.3224	694.42	0.0768	3.81417	18.21
23.6146	902.32	0.1279	3.76763	23.66
23.9023	235.45	0.1023	3.72293	6.17
24.5581	544.77	0.0768	3.62499	14.28
25.0512	717.52	0.0768	3.55474	18.81
25.4354	261.30	0.2047	3.50191	6.85
26.0711	205.72	0.1023	3.41795	5.39
26.6312	908.25	0.0780	3.34455	23.81
26.6726	949.13	0.0512	3.34222	24.88
26.9412	646.78	0.1279	3.30951	16.96
27.2272	315.93	0.0895	3.27539	8.28
27.6284	279.23	0.1535	3.22872	7.32
27.8687	183.38	0.1023	3.20144	4.81
28.3712	268.31	0.1791	3.14586	7.03
28.6345	398.22	0.1023	3.11753	10.44
29.3348	503.54	0.0640	3.04468	13.20
29.7178	312.61	0.1023	3.00631	8.20
30.2079	657.53	0.1535	2.95865	17.24
30.5905	188.33	0.0768	2.92251	4.94
30.9427	286.22	0.1791	2.89004	7.50
31.9648	186.60	0.1279	2.79992	4.89
33.1436	281.81	0.1535	2.70299	7.39
33.6247	136.29	0.1535	2.66540	3.57
34.5747	173.57	0.128	2.59431	4.55

AP1189 tosylate Form C

The XRPD diffractogram for AP1189 tosylate salt Pattern 1 crystallised from methanol is shown in Figure 4. The corresponding XRPD diffractogram peak list for tosylate salt Pattern 1 is shown in Table 6.

5

Table 6: XRPD diffractogram peak list for tosylate Pattern 1 from methanol.

Characteristic peaks are indicated in bold.

Pos. [°2 θ]	Height [cts]	FWHM Left [°2 θ]	d-spacing [Å]	Rel. Int. [%]
7.95280	565.46	0.0768	11.11733	13.44
9.42330	1279.54	0.0895	9.38555	30.41
9.96040	1509.46	0.0895	8.88062	35.88
10.76630	133.52	0.0768	8.21756	3.17
12.07190	246.37	0.0640	7.33164	5.86
12.31920	203.44	0.0640	7.18500	4.84
13.44230	2110.32	0.0895	6.58708	50.16
14.09060	1043.18	0.0768	6.28546	24.80
14.49790	4207.16	0.1023	6.10978	100.00
15.28210	833.29	0.1023	5.79797	19.81
15.70980	713.17	0.0895	5.64106	16.95
15.98490	2747.52	0.1023	5.54462	65.31
16.74560	1838.99	0.1023	5.29441	43.71
17.55870	1963.25	0.1535	5.05103	46.66
19.15130	708.39	0.1151	4.63442	16.84
19.79500	1554.81	0.1023	4.48515	36.96
20.01010	1455.65	0.1151	4.43743	34.60
20.74200	698.27	0.1023	4.28247	16.60
20.98000	3263.54	0.1279	4.23443	77.57
21.34790	1658.88	0.1279	4.16229	39.43
22.02470	407.91	0.1151	4.03589	9.70
22.38540	763.27	0.0640	3.97167	18.14
22.65840	400.17	0.0384	3.92442	9.51
22.83650	258.14	0.0768	3.89421	6.14
23.14460	310.98	0.1279	3.84307	7.39

23.55690	160.13	0.1279	3.77674	3.81
24.05140	646.06	0.1023	3.70020	15.36
24.29100	327.31	0.1023	3.66424	7.78
25.15830	4097.87	0.1151	3.53984	97.40
25.43100	1927.26	0.1151	3.50250	45.81
25.70240	416.16	0.1023	3.46613	9.89
26.05180	374.86	0.1023	3.42043	8.91
26.65210	421.78	0.1791	3.34474	10.03
27.13070	158.43	0.1535	3.28682	3.77
27.66440	258.67	0.0895	3.22461	6.15
28.07950	526.46	0.0895	3.17788	12.51
29.04430	391.90	0.1023	3.07448	9.32
29.24250	336.72	0.0384	3.05409	8.00
29.88270	587.69	0.1023	2.99009	13.97
30.28370	319.89	0.2303	2.95141	7.60
30.67120	509.33	0.1535	2.91500	12.11
31.39270	66.82	0.2047	2.84963	1.59
32.74010	194.37	0.1279	2.73537	4.62
33.15360	274.41	0.1791	2.70220	6.52
33.52400	157.80	0.1791	2.67318	3.75
34.06450	185.09	0.1279	2.63200	4.40
34.63470	112.70	0.1535	2.58996	2.68

AP1189 fumarate Form D

The XRPD diffractogram for AP1189 fumarate salt Pattern 1 crystallised from isopropylalcohol:water 90:10 v/v is shown in Figure 5. The corresponding XRPD diffractogram peak list for fumarate salt Pattern 1 from isopropylalcohol:water 90:10 v/v is shown in Table 7.

Table 7: XRPD diffractogram peak list for fumarate Pattern 1 from isopropylalcohol:water 90:10 v/v. Characteristic peaks are indicated in bold.

Pos. [°2θ]	Height [cts]	FWHM Left [°2θ]	d-spacing [Å]	Rel. Int. [%]
8.6209	310.50	0.0640	10.25719	6.33

9.2296	1873.51	0.0895	9.58209	38.22
10.2345	347.27	0.0640	8.64332	7.08
10.5354	852.43	0.0640	8.39713	17.39
10.9191	1388.14	0.0768	8.10292	28.32
11.4728	2930.97	0.0895	7.71311	59.80
11.8926	2170.42	0.0895	7.44176	44.28
13.3718	346.23	0.0512	6.62169	7.06
15.7963	1426.98	0.1023	5.61039	29.11
16.0311	849.53	0.0895	5.52872	17.33
16.3575	561.06	0.1023	5.41913	11.45
16.5708	474.42	0.0768	5.34985	9.68
17.2941	531.10	0.0640	5.12771	10.84
17.5600	3319.60	0.1023	5.05067	67.73
18.1912	548.58	0.0895	4.87682	11.19
18.5329	529.75	0.0512	4.78765	10.81
18.6734	794.04	0.0895	4.75195	16.20
19.4122	1637.66	0.1023	4.57272	33.41
19.5565	1187.94	0.0512	4.53932	24.24
19.7714	359.40	0.0640	4.49046	7.33
20.5917	692.05	0.0512	4.31338	14.12
21.1710	4901.56	0.1279	4.19667	100.00
21.3706	1056.31	0.0768	4.15791	21.55
21.9494	2839.37	0.1407	4.04957	57.93
22.6944	230.40	0.1023	3.91828	4.70
23.0753	363.82	0.0895	3.85446	7.42
23.4284	1295.19	0.1407	3.79716	26.42
23.8881	2543.55	0.1535	3.72511	51.89
24.5122	1525.50	0.1535	3.63167	31.12
24.7719	401.96	0.0768	3.59418	8.20
25.0387	542.09	0.1151	3.55649	11.06
26.0822	1360.04	0.1279	3.41652	27.75
26.3417	4606.74	0.1407	3.38345	93.99
26.9772	178.54	0.0900	3.30243	3.64
27.5829	462.97	0.1023	3.23395	9.45

27.9868	874.09	0.1023	3.18819	17.83
28.5342	442.65	0.1151	3.12826	9.03
28.7849	321.79	0.1023	3.10159	6.57
29.1336	199.54	0.1279	3.06525	4.07
29.5204	318.82	0.0640	3.02597	6.50
29.9470	467.63	0.0895	2.98382	9.54
30.2812	204.98	0.1535	2.95165	4.18
30.9714	1155.91	0.1404	2.88504	23.58
31.0214	1083.09	0.0624	2.88766	22.10
31.5455	443.03	0.2808	2.83383	9.04
31.9500	514.93	0.0780	2.79887	10.51
32.4106	193.90	0.1872	2.76014	3.96
33.0815	204.69	0.1248	2.70568	4.18
33.5275	415.89	0.0936	2.67070	8.48
34.2307	89.28	0.1872	2.61743	1.82
34.7358	407.34	0.0468	2.58051	8.31

AP1189 succinate Form B

The XRPD diffractogram for AP1189 succinate salt Pattern 1 crystallised from isopropanol:water 90:10 v/v is shown in Figure 6. The corresponding XRPD diffractogram peak list for succinate salt Pattern 1 is shown in Table 8.

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Table 8: XRPD diffractogram peak list for succinate Pattern 1 from isopropanol:water 90:10 v/v. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	Height [cts]	FWHM Left [°2 θ]	d-spacing [Å]	Rel. Int. [%]
5.4069	986.93	0.0640	16.34500	48.23
9.7178	2046.18	0.0768	9.10169	100.00
12.2493	579.97	0.0895	7.22581	28.34
12.6625	194.49	0.0768	6.99096	9.50
13.3815	1060.24	0.0895	6.61688	51.82
13.6088	85.82	0.0768	6.50687	4.19
15.7849	670.53	0.1023	5.61442	32.77

16.2820	940.26	0.1023	5.44410	45.95
18.0910	90.94	0.1023	4.90360	4.44
18.6109	131.29	0.1023	4.76776	6.42
18.9143	81.96	0.0895	4.69198	4.01
19.5146	976.30	0.1023	4.54897	47.71
19.8650	251.71	0.0895	4.46952	12.30
21.1182	76.58	0.1279	4.20703	3.74
21.7806	623.87	0.0624	4.07718	30.49
21.8237	575.40	0.0468	4.07934	28.12
21.9659	346.03	0.0624	4.04321	16.91
22.1773	283.42	0.1092	4.00514	13.85
22.3520	227.12	0.0936	3.97423	11.10
22.7669	1214.56	0.1404	3.90274	59.36
23.4039	80.68	0.1560	3.79793	3.94
23.7400	51.39	0.0936	3.74492	2.51
24.6205	235.25	0.1092	3.61295	11.50
24.9667	183.96	0.0624	3.56363	8.99
25.2780	236.68	0.1404	3.52044	11.57
26.0672	79.01	0.1872	3.41562	3.86
26.2812	115.48	0.0936	3.38830	5.64
26.7189	1090.24	0.1404	3.33377	53.28
27.4666	226.04	0.0936	3.24470	11.05
28.5058	649.21	0.1560	3.12872	31.73
29.0947	167.43	0.1560	3.06673	8.18
29.4393	71.92	0.1560	3.03161	3.51
30.0230	19.05	0.3744	2.97398	0.93
31.5076	74.16	0.1560	2.83715	3.62
32.3204	158.75	0.2496	2.76763	7.76
32.7195	60.07	0.1248	2.73478	2.94
33.5540	65.22	0.1872	2.66865	3.19
34.1457	52.21	0.5616	2.62374	2.55

AP1189 napadisylate Form III

The XRPD diffractogram for AP1189 napadisylate salt Pattern 1 crystallised from 2-propanol:water 90:10 %v/v is shown in Figure 14. The corresponding XRPD diffractogram peak list for napadisylate salt Pattern 1 is shown in Table 9.

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Table 9: XRPD diffractogram peak list for napadisylate Pattern 1 from 2-propanol:water 90:10 %v/v. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
7.5504	11.70884	689.5	18.85
10.7197	8.2532	944.25	25.82
12.3794	7.1502	1041.08	28.46
13.4473	6.58465	1775.32	48.54
13.9776	6.33602	516.26	14.11
15.0881	5.87208	1507.82	41.22
15.5452	5.70043	1428.49	39.06
17.1935	5.15749	578.34	15.81
18.2562	4.8596	147.08	4.02
18.7653	4.72888	105.22	2.88
19.2562	4.60944	116.02	3.17
20.3308	4.36815	344.81	9.43
21.3564	4.16064	180.29	4.93
21.7571	4.08153	255.62	6.99
22.1571	4.01206	3657.63	100
22.8309	3.89516	1110.18	30.35
23.4703	3.79047	1179.36	32.24
24.3345	3.65778	425.24	11.63
24.904	3.57542	341.67	9.34
25.3384	3.5151	356.8	9.76
26.817	3.32455	2133.99	58.34
27.1283	3.28439	217.11	5.94
27.6015	3.22914	261.56	7.15
27.9744	3.18957	1458.18	39.87
28.5214	3.12964	329.01	9.00
28.9049	3.08898	129.88	3.55

29.4676	3.03126	159.64	4.36
29.9117	2.98727	132.26	3.62
30.4558	2.93512	173.56	4.75
31.3597	2.85019	60.18	1.65
31.8567	2.80918	261.91	7.16
32.5624	2.74989	58.95	1.61
33.4807	2.67654	56.16	1.54

AP1189 napadisylate Form IV

The XRPD diffractogram for AP1189 napadisylate salt Pattern 2 crystallised from THF is shown in Figure 15. The corresponding XRPD diffractogram peak list for napadisylate salt Pattern 2 is shown in Table 10.

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Table 10: XRPD diffractogram peak list for napadisylate Pattern 2 from THF.
Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
5.4286	16.27965	346.5	79.53
6.5128	13.56063	14.65	3.36
7.4311	11.89657	47.58	10.92
8.5219	10.37613	163.19	37.46
10.0575	8.7878	35.75	8.21
10.8271	8.17155	104.41	23.97
11.3074	7.81909	58.98	13.54
12.0655	7.32943	70.52	16.19
12.5500	7.05339	242.28	55.61
13.1311	6.7425	159.5	36.61
15.5722	5.6906	435.67	100
16.2658	5.44496	141.14	32.4
16.6142	5.33158	109.83	25.21
18.3509	4.83472	301.22	69.14
19.0496	4.65509	92.9	21.32
19.4848	4.55586	195.31	44.83
19.8774	4.46675	193.35	44.38
20.2585	4.37995	158.03	36.27

21.0620	4.21813	219.31	50.34
22.0067	4.03915	314.65	72.22
22.7195	3.91401	259.61	59.59
23.3676	3.8069	367.37	84.32
24.1961	3.67839	303.55	69.67
25.1931	3.53212	169.22	38.84
25.8383	3.44821	292.44	67.13
26.8947	3.31512	155.27	35.64
30.4999	2.92856	25.88	5.94

AP1189 esylate Form V

5 The XRPD diffractogram for AP1189 esylate salt Pattern 1 crystallised from methylethyl ketone is shown in Figure 16. The corresponding XRPD diffractogram peak list for esylate salt Pattern 1 is shown in Table 11.

Table 11: XRPD diffractogram peak list for esylate Pattern 1 from methylethyl ketone. Characteristic peaks are indicated in bold.

Pos. [°2θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
8.4696	10.44008	96.34	47.64
9.813	9.01365	125.06	61.84
10.4203	8.48969	99.32	49.11
11.331	7.80283	29.09	14.39
11.5369	7.66404	26.98	13.34
12.9606	6.82518	30.38	15.02
14.3275	6.17693	62.18	30.75
14.5301	6.09631	200.81	99.29
15.3453	5.77425	76.71	37.93
16.5381	5.36036	202.23	100
18.639	4.76065	175.44	86.75
19.7148	4.50323	125.45	62.03
20.1181	4.41384	174.51	86.29
20.9895	4.22902	74.36	36.77
21.1237	4.20595	83.32	41.2

21.9184	4.05521	76.71	37.93
22.4735	3.9563	80.84	39.97
23.9411	3.71699	58.21	28.78
25.514	3.48841	36.26	17.93
26.0564	3.41702	74.49	36.83
26.4224	3.3705	46.97	23.23
26.7682	3.3305	111.98	55.37
27.5072	3.24	35.01	17.31
29.7173	3.00387	10.74	5.31
31.4122	2.84555	22.93	11.34
32.1715	2.7801	16.17	8.00
33.501	2.67275	24.35	12.04

AP1189 edisylate Form VI

The XRPD diffractogram for AP1189 edisylate salt Pattern 1 crystallised from 2-Propanol:water (80:20 %v/v) is shown in Figure 17. The corresponding XRPD diffractogram peak list for edisylate salt Pattern 1 is shown in Table 12.

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Table 12: XRPD diffractogram peak list for edisylate Pattern 1 from 2-Propanol:water (80:20 %v/v). Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
4.7606	18.56231	1152.22	94.52
9.5373	9.27355	445.57	36.55
10.8586	8.14796	233.5	19.16
11.603	7.62679	126.33	10.36
12.7876	6.92285	908.15	74.5
14.2703	6.2067	250.78	20.57
15.2286	5.81822	339.82	27.88
16.4938	5.37466	1218.96	100
16.976	5.21876	97.95	8.04
17.8605	4.96636	561.86	46.09
18.5957	4.77162	419.86	34.44
19.1831	4.62683	215.67	17.69
20.2602	4.38322	273.24	22.42

21.4287	4.14676	516.36	42.36
22.4944	3.95267	481.25	39.48
23.4349	3.79612	624.9	51.27
24.4775	3.63674	376.83	30.91
25.2503	3.52716	478.62	39.26
25.4765	3.49346	234.8	19.26
26.4673	3.36767	160.37	13.16
27.167	3.28251	506.76	41.57
28.0417	3.17944	76.44	6.27
29.4833	3.02968	120.53	9.89
29.7204	3.00357	71.2	5.84
30.1891	2.96045	157.41	12.91
30.9905	2.88569	105.44	8.65
32.5886	2.74774	59.41	4.87
33.3411	2.68743	98.37	8.07
34.2969	2.61252	25.44	2.09

AP1189 edisylate Form VII

The XRPD diffractogram for AP1189 edisylate salt Pattern 2 crystallised from methylethyl ketone is shown in Figure 18. The corresponding XRPD diffractogram peak list for edisylate salt Pattern 2 is shown in Table 13.

Table 13: XRPD diffractogram peak list for edisylate Pattern 2 from methylethyl ketone. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
6.0662	14.56989	1499.14	71.99
10.0241	8.82426	358.32	17.21
11.7435	7.53586	730.04	35.06
12.0936	7.31848	994.92	47.78
12.7392	6.94906	586	28.14
14.1325	6.26692	281.25	13.51
15.7281	5.63457	2082.36	100
16.2886	5.43741	73.51	3.53
17.6463	5.02614	139.37	6.69

17.9369	4.94129	119.4	5.73
18.3429	4.83683	256.13	12.3
19.2641	4.60756	739.74	35.52
20.1215	4.41311	922.85	44.32
20.893	4.25186	304.45	14.62
21.7546	4.08539	1293.59	62.12
22.3549	3.97702	230.14	11.05
22.7399	3.91055	531.54	25.53
23.6495	3.76216	1405.44	67.49
24.2528	3.66992	299.01	14.36
24.825	3.58662	279.37	13.42
25.1151	3.54584	413	19.83
25.7826	3.45553	230.5	11.07
26.5375	3.35893	317.73	15.26
27.0339	3.29837	200.04	9.61
27.4795	3.2432	119.71	5.75
28.2254	3.16178	267.76	12.86
28.6125	3.11988	326.38	15.67
29.6505	3.01298	123.96	5.95
30.5784	2.92363	141.58	6.8
31.2303	2.86408	184.2	8.85
31.8981	2.80331	50.64	2.43
32.4213	2.76154	98.58	4.73
32.8959	2.72277	69.53	3.34
33.53	2.6705	24.94	1.2
34.1437	2.6239	13.62	0.65

AP1189 edisylate Form VIII

The XRPD diffractogram for AP1189 edisylate salt Pattern 4 crystallised from THF is shown in Figure 19. The corresponding XRPD diffractogram peak list for edisylate salt Pattern 4 is shown in Table 14.

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Table 14: XRPD diffractogram peak list for edisylate Pattern 4 from THF. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
6.4465	13.71127	191.95	14.27
9.9098	8.92585	71.5	5.32
12.145	7.28767	583.39	43.38
12.4961	7.07778	129.05	9.6
12.9954	6.81261	368.87	27.43
14.0381	6.30364	112.5	8.37
15.4892	5.72092	1344.79	100
17.7793	4.98886	229.27	17.05
18.2552	4.85583	85.69	6.37
18.6687	4.75313	171.63	12.76
19.5432	4.53863	215.92	16.06
20.0215	4.43494	373.31	27.76
20.6977	4.29155	760.34	56.54
21.672	4.10076	591.86	44.01
22.2098	3.99935	256.17	19.05
23.123	3.84661	356.78	26.53
24.1173	3.69023	405.74	30.17
25.23	3.52996	365.37	27.17
25.6746	3.46695	126.18	9.38
27.0992	3.29057	76.34	5.68
27.9198	3.19305	16.88	1.26
30.6998	2.91235	54.54	4.06
31.0943	2.87391	70.76	5.26
31.6385	2.82571	50.08	3.72
34.4866	2.59859	31.14	2.32

AP1189 edisylate Form IX

The XRPD diffractogram for AP1189 edisylate salt Pattern 5 crystallised from 2-Propanol:water (80:20 %v/v) is shown in Figure 20. The corresponding XRPD diffractogram peak list for edisylate salt Pattern 5 is shown in Table 15.

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Table 15: XRPD diffractogram peak list for edisylate Pattern 5 from 2-Propanol:water (80:20 %v/v). Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
4.4981	19.645	792.29	100
8.987	9.84018	198.33	25.03
11.701	7.55689	88.54	11.17
12.1573	7.28032	254.63	32.14
12.3685	7.15054	124.48	15.71
13.098	6.75385	29.04	3.67
15.4882	5.7213	274.49	34.64
16.703	5.30781	484.11	61.1
17.3062	5.11992	85.77	10.83
18.0377	4.91797	183.23	23.13
19.9018	4.46133	148.72	18.77
20.3543	4.36316	157.85	19.92
21.0548	4.21606	86.99	10.98
21.9589	4.04782	136.42	17.22
22.8828	3.88644	218	27.51
24.6983	3.60472	418.6	52.83
26.7569	3.33188	87.66	11.06
28.3461	3.14859	42.09	5.31

AP1189 nitrate Form X

The XRPD diffractogram for AP1189 nitrate salt Pattern 1 crystallised from THF is shown in Figure 21. The corresponding XRPD diffractogram peak list for nitrate salt Pattern 1 is shown in Table 16.

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Table 16: XRPD diffractogram peak list for nitrate Pattern 1 from THF. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
3.726	23.71408	179.91	19.17
7.5467	11.71468	136.08	14.5
11.8592	7.46261	408.46	43.52
12.4917	7.08616	368.75	39.29
13.0853	6.76599	242.4	25.83
14.712	6.02134	295.86	31.53

15.2583	5.80697	522.07	55.63
16.9052	5.24478	238.58	25.42
17.7422	4.99921	322.64	34.38
18.1478	4.88837	288.49	30.74
18.7034	4.74047	109.88	11.71
19.6432	4.51949	198.86	21.19
21.3874	4.15468	938.45	100
22.9764	3.87083	226.32	24.12
24.1196	3.68989	348.22	37.11
25.1008	3.54782	430.13	45.83
26.6187	3.34886	432.7	46.11
27.7139	3.21896	372.36	39.68
29.5135	3.02665	108.41	11.55
31.6588	2.82629	101.37	10.8

AP1189 cyclamate Form XI

The XRPD diffractogram for AP1189 cyclamate salt Pattern 2 crystallised from THF is shown in Figure 22. The corresponding XRPD diffractogram peak list for cyclamate salt Pattern 2 is shown in Table 17.

5

Table 17: XRPD diffractogram peak list for cyclamate Pattern 2 from THF.

Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
3.1621	27.94165	179.59	22.76
5.2127	16.95363	87.48	11.09
7.0019	12.62477	789.01	100
10.3525	8.5451	123.07	15.6
11.2896	7.83785	208.18	26.39
11.8811	7.44278	58.65	7.43
13.7568	6.4372	370.07	46.9
14.1759	6.24266	73.01	9.25
15.2643	5.8047	355.29	45.03
15.6888	5.64858	426.88	54.1
16.2658	5.44496	134.02	16.99

17.5752	5.04633	231.81	29.38
18.5197	4.78707	90.13	11.42
19.1685	4.6303	187.78	23.8
20.0509	4.4285	273.46	34.66
20.7048	4.29009	321.46	40.74
21.4639	4.14005	317.94	40.3
21.7871	4.07598	242.18	30.69
22.0945	4.01997	146.05	18.51
22.7092	3.91253	125.64	15.92
23.4403	3.79526	148.21	18.78
25.2406	3.52849	143	18.12
26.0048	3.42651	115.43	14.63
27.7815	3.21128	54.76	6.94

AP1189 cyclamate Form XII

The XRPD diffractogram for AP1189 cyclamate salt Pattern 4 crystallised from acetone is shown in Figure 23. The corresponding XRPD diffractogram peak list for cyclamate salt Pattern 4 is shown in Table 18.

5

Table 18: XRPD diffractogram peak list for cyclamate Pattern 4 from acetone.
Characteristic peaks are indicated in bold.

Pos. [°2θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
6.2906	14.05077	102.71	26.16
7.3357	12.05109	335.85	85.54
9.3353	9.4659	8.68	2.21
11.3095	7.82408	86.03	21.91
12.7131	6.95747	47.33	12.05
13.1319	6.74211	97.06	24.72
14.7863	5.98632	106.38	27.09
15.3435	5.77491	392.64	100
16.2948	5.43987	164.44	41.88
16.8716	5.25516	128.27	32.67
17.8941	4.95711	338.3	86.16
19.0531	4.65811	184.82	47.07

19.3468	4.58425	98.78	25.16
20.1366	4.40984	126.64	32.25
21.9846	4.04315	195.66	49.83
22.655	3.92501	157.07	40
24.0828	3.69238	90.63	23.08
24.7776	3.59337	97.12	24.74
25.779	3.45315	28.08	7.15
27.1015	3.28757	6.68	1.7
27.9415	3.19062	19.87	5.06
29.0272	3.07624	38.61	9.83

AP1189 cyclamate Form XIII

The XRPD diffractogram for AP1189 cyclamate salt Pattern 5 crystallised from THF is shown in Figure 24. The corresponding XRPD diffractogram peak list for cyclamate salt Pattern 5 is shown in Table 19.

Table 19: XRPD diffractogram peak list for cyclamate Pattern 5 from THF.

Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
3.3077	26.69018	8.98	0.58
5.5967	15.7911	187.14	12.03
6.4474	13.70936	956.81	61.52
7.1491	12.36521	828.98	53.3
7.588	11.65099	39.91	2.57
8.517	10.38213	485.85	31.24
9.4338	9.36732	140.49	9.03
9.8762	8.95612	582.21	37.44
10.2304	8.64685	266.94	17.16
10.4969	8.42791	570.75	36.7
10.9495	8.08048	182.36	11.73
11.6202	7.61559	281.21	18.08
11.8805	7.4431	57.72	3.71
12.3095	7.19065	168.44	10.83
13.0658	6.77606	629.6	40.48

13.3285	6.64308	706.95	45.46
13.7029	6.46239	245.66	15.8
14.1105	6.27663	180.03	11.58
14.6296	6.05509	1139.54	73.27
15.2647	5.80454	1555.19	100
16.2222	5.46402	565.52	36.36
16.6625	5.32062	949.92	61.08
17.4798	5.06945	169.19	10.88
18.4631	4.80561	1460.84	93.93
18.7365	4.73609	1201.35	77.25
19.8483	4.47324	1059.17	68.11
20.2298	4.38973	770.27	49.53
20.5681	4.3183	571.09	36.72
21.0659	4.21388	-403.55	-25.95
21.1423	4.20229	606.37	38.99
21.346	4.1592	442.84	28.47
21.6546	4.10402	389.75	25.06
22.0577	4.02991	385.89	24.81
22.5829	3.93737	598.47	38.48
22.8215	3.89352	314.13	20.2
23.6665	3.75949	387.36	24.91
24.1076	3.69169	372.97	23.98
24.8773	3.5792	301.43	19.38
25.1001	3.54498	361.41	23.24
25.7105	3.46506	300.34	19.31
26.2315	3.39741	512.24	32.94
26.9513	3.30828	549.96	35.36
27.7471	3.21519	196.84	12.66
28.6818	3.10992	34.66	2.23
29.4102	3.03453	16.29	1.05
29.9519	2.98088	42.78	2.75
30.844	2.89907	51.86	3.33
31.6221	2.82948	75.34	4.84
32.3706	2.76575	66.76	4.29

33.6225	2.66558	27.56	1.77
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AP1189 besylate Form XIV

The XRPD diffractogram for AP1189 besylate salt Pattern 1 crystallised from 2-Propanol:water 80:20 %v/v is shown in Figure 25. The corresponding XRPD

5 diffractogram peak list for besylate salt Pattern 1 is shown in Table 20.

Table 20: XRPD diffractogram peak list for besylate Pattern 1 from 2-Propanol:water 80:20 %v/v. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
3.2175	27.46024	62.4	1.8
8.3275	10.61794	225.23	6.49
9.0111	9.81393	198.54	5.72
9.9442	8.89498	282.36	8.14
10.7688	8.21566	502.34	14.48
11.2282	7.88052	765.63	22.07
12.9603	6.83095	1879.15	54.16
13.1459	6.73493	2421.9	69.8
15.0755	5.87695	3469.81	100
15.9809	5.54599	542.33	15.63
16.4072	5.40284	568.66	16.39
16.6812	5.31472	255.6	7.37
17.2775	5.13261	246.45	7.1
18.0701	4.90514	144.29	4.16
18.3074	4.84612	830.57	23.94
18.6991	4.74549	548.41	15.81
18.9774	4.67651	338.15	9.75
19.4439	4.56536	154.45	4.45
19.9239	4.45643	1750.81	50.46
20.252	4.38496	383.72	11.06
20.8939	4.24817	111.11	3.2
21.2688	4.17759	274.85	7.92
21.6759	4.10004	975.93	28.13
22.0414	4.02953	110.44	3.18

22.7796	3.90382	519.42	14.97
23.1205	3.84703	470.89	13.57
23.5722	3.77431	700.52	20.19
24.8029	3.58976	481.62	13.88
25.0701	3.54917	168.35	4.85
25.4203	3.50395	642.92	18.53
26.268	3.39277	2290.5	66.01
26.4692	3.36743	1015.25	29.26
27.1415	3.28553	372.17	10.73
28.1081	3.17471	152.82	4.4
28.5473	3.12686	199.35	5.75
29.8458	2.99371	178.8	5.15
30.4198	2.93852	180.23	5.19
31.1212	2.87387	102.11	2.94
32.0148	2.79567	64.16	1.85
33.1565	2.70197	130.3	3.76
34.1106	2.62636	20.78	0.6

AP1189 oxalate Form XV

The XRPD diffractogram for AP1189 oxalate salt Pattern 1 crystallised from 2-Propanol:water 80:20 %v/v is shown in Figure 26. The corresponding XRPD diffractogram peak list for oxalate salt Pattern 1 is shown in Table 21.

5

Table 21: XRPD diffractogram peak list for oxalate Pattern 1 from 2-Propanol:water 80:20 %v/v. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
7.2467	12.19886	450.79	12.92
10.7644	8.21907	1408.52	40.37
12.1117	7.30758	459.79	13.18
13.8551	6.39177	2142.95	61.42
14.5121	6.10385	746.59	21.4
15.0495	5.88706	2731.17	78.28
15.6303	5.66959	1938.29	55.55
16.4777	5.37988	392.84	11.26

16.813	5.27334	908.28	26.03
17.3104	5.12291	635.74	18.22
18.2079	4.87238	433.56	12.43
18.4636	4.80547	727.13	20.84
19.46	4.56161	3187.27	91.35
20.0756	4.42311	1393.22	39.93
21.6762	4.09998	1576.06	45.17
22.9254	3.87931	1254.01	35.94
23.2534	3.82534	3284.1	94.13
23.789	3.74041	2446.77	70.13
24.2503	3.67029	918.98	26.34
24.7678	3.59477	612.09	17.54
25.8167	3.45105	3489.04	100
27.0213	3.29987	560.44	16.06
27.9092	3.19688	158.4	4.54
28.5985	3.12137	374.56	10.74
29.2965	3.04605	218.5	6.26
29.7343	3.00468	369.86	10.6
30.1941	2.95996	331	9.49
32.2394	2.7744	121.27	3.48
32.8731	2.72461	547.75	15.7

AP1189 oxalate Form XVI

The XRPD diffractogram for AP1189 oxalate salt Pattern 2 crystallised from acetone is shown in Figure 27. The corresponding XRPD diffractogram peak list for oxalate salt Pattern 2 is shown in Table 22.

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Table 22: XRPD diffractogram peak list for oxalate Pattern 2 from acetone.

Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
9.4812	9.32829	213.07	10.76
11.2719	7.85012	650.76	32.86
12.1183	7.30367	220.43	11.13
13.0908	6.75757	112.09	5.66

13.9612	6.34341	478.29	24.15
15.2544	5.80845	324.46	16.39
15.898	5.57471	1338.77	67.61
16.4116	5.4014	416.06	21.01
17.1359	5.1747	1606.29	81.12
17.9059	4.95387	1980.2	100
18.9149	4.69182	528.99	26.71
19.5773	4.53453	1768.33	89.3
20.0364	4.43166	1097.18	55.41
21.2196	4.18715	1066.83	53.87
22.0167	4.03734	440.36	22.24
22.6679	3.9228	1185.33	59.86
23.0104	3.86518	733.85	37.06
23.3684	3.80677	872.51	44.06
24.1748	3.68159	1377.48	69.56
24.3941	3.64898	1473.07	74.39
24.7636	3.59536	607.76	30.69
25.3618	3.51191	1006.2	50.81
25.7384	3.45851	366.83	18.52
26.3029	3.38835	461.15	23.29
27.3315	3.26312	1359.3	68.64
28.43	3.13949	406.26	20.52
29.8952	2.98887	274.54	13.86
30.4479	2.93586	457.22	23.09
31.2648	2.861	142.51	7.2
32.1862	2.78117	104.33	5.27
33.3237	2.68879	132.12	6.67
33.8688	2.64675	154.16	7.79
34.2555	2.61776	191.52	9.67
34.8614	2.5715	107.77	5.44

AP1189 oxalate Form XVII

The XRPD diffractogram for AP1189 oxalate salt Pattern 4 crystallised from THF is shown in Figure 28. The corresponding XRPD diffractogram peak list for oxalate salt Pattern 4 is shown in Table 23.

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Table 23: XRPD diffractogram peak list for oxalate Pattern 4 from THF. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
6.3181	13.98948	2384.52	98.7
8.1738	10.81722	70.4	2.91
10.5526	8.38352	2415.83	100
11.7369	7.54012	942.41	39.01
12.3228	7.18288	950.21	39.33
12.5733	7.04032	282.57	11.7
12.875	6.87604	519.84	21.52
13.2362	6.68366	89.53	3.71
14.0559	6.3009	588.24	24.35
14.2029	6.23602	569.99	23.59
15.8039	5.6077	284.16	11.76
16.0669	5.51651	324.39	13.43
17.0726	5.19374	809.18	33.5
17.7878	4.98649	345.64	14.31
18.4337	4.81321	1051.56	43.53
19.0388	4.65772	111.88	4.63
19.2304	4.61554	251.01	10.39
19.7672	4.4914	1361.5	56.36
20.2529	4.38479	312.67	12.94
20.6597	4.29935	413.55	17.12
20.9554	4.23934	722.78	29.92
21.3823	4.15566	252.83	10.47
21.7977	4.07739	397.86	16.47
21.9785	4.04091	211.05	8.74
22.2699	3.992	329.34	13.63
22.6213	3.93077	878.11	36.35

23.2335	3.82856	349.11	14.45
23.517	3.78305	702.57	29.08
23.7795	3.74188	1071.63	44.36
24.4105	3.64656	424.2	17.56
24.7951	3.58791	104.42	4.32
25.4426	3.50094	211.14	8.74
25.8594	3.44545	657.65	27.22
26.0571	3.41975	541.52	22.42
26.5554	3.35393	72.07	2.98
27.1137	3.28884	147.15	6.09
27.5269	3.24041	139.31	5.77
27.8473	3.20119	46.04	1.91
28.3054	3.15302	258.71	10.71
28.6747	3.11068	101.9	4.22
29.0198	3.07701	115.18	4.77
30.0442	2.97439	642.27	26.59
31.1015	2.87565	58.92	2.44
33.0328	2.7118	49.68	2.06
33.6771	2.66138	64.96	2.69
34.2549	2.61563	22.71	0.94

AP1189 (+)-Camphor-10-sulfonic acid Form XVIII

- The XRPD diffractogram for AP1189 (+)-camphor-10-sulfonic acid salt Pattern 1 crystallised from 2-Propanol:water 80:20 %v/v is shown in Figure 29. The
- 5 corresponding XRPD diffractogram peak list for (+)-camphor-10-sulfonic acid salt Pattern 1 is shown in Table 24.

Table 24: XRPD diffractogram peak list for (+)-Camphor-10-sulfonic acid Pattern 1 from 2-Propanol:water 80:20 %v/v. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
5.1412	17.18901	74.2	4.85
6.54	13.51547	654.67	42.8
7.6658	11.53287	63.53	4.15
9.3718	9.43695	250.57	16.38

9.8668	8.96463	153.81	10.06
10.402	8.50455	214.98	14.05
10.9801	8.05138	117.55	7.69
11.5235	7.67925	673.45	44.03
12.2098	7.2431	124.1	8.11
12.9822	6.81949	581.07	37.99
13.6946	6.46629	561.07	36.68
13.9583	6.34474	251.61	16.45
14.345	6.16946	118.72	7.76
14.788	5.99059	1529.62	100
15.5959	5.67733	160.54	10.5
15.8762	5.5777	338.29	22.12
16.1184	5.49898	574.21	37.54
17.2105	5.15243	315.7	20.64
18.131	4.89288	262.31	17.15
18.3504	4.83086	148.91	9.73
18.8333	4.71198	392.27	25.64
19.7635	4.49224	398.89	26.08
21.0597	4.21859	535.54	35.01
21.5101	4.13126	268.38	17.55
22.2216	3.99725	162.99	10.66
22.7338	3.91158	214.89	14.05
23.1598	3.8374	165.06	10.79
23.8376	3.7329	280.8	18.36
25.0641	3.55295	203.63	13.31
25.6703	3.47039	163.36	10.68
26.0558	3.41992	103.35	6.76
27.1796	3.28102	169.26	11.07
28.7362	3.10673	78.1	5.11
30.0563	2.97322	53.81	3.52
31.5327	2.8373	32.12	2.1

AP1189 oxoglutarate Form XIX

The XRPD diffractogram for AP1189 oxoglutarate salt Pattern 1 crystallised from acetone is shown in Figure 30. The corresponding XRPD diffractogram peak list for oxoglutarate salt Pattern 1 is shown in Table 25.

5

Table 25: XRPD diffractogram peak list for oxoglutarate Pattern 1 from acetone.
Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
9.1083	9.70943	477.95	11.66
10.7459	8.23315	495.72	12.1
11.7595	7.51943	326.29	7.96
11.9888	7.38223	1205.72	29.42
12.8261	6.90214	1716.69	41.89
13.2196	6.69755	1567	38.24
13.3525	6.63121	2125.73	51.88
13.8276	6.39912	275.65	6.73
14.0138	6.31972	404.29	9.87
15.9327	5.56267	304.57	7.43
16.4363	5.39333	2897.8	70.72
16.8348	5.26657	4097.71	100
17.0851	5.18996	2766.55	67.51
17.9377	4.94515	772.63	18.86
18.2986	4.84842	340.41	8.31
19.4963	4.5532	718.78	17.54
20.0696	4.42442	924.41	22.56
20.8084	4.26896	1505.3	36.74
21.6016	4.11397	3079.97	75.16
21.9908	4.04204	800.41	19.53
22.9225	3.87981	615.58	15.02
23.4067	3.80062	3422.59	83.52
23.6024	3.76956	3716.86	90.71
24.0809	3.69267	1988.14	48.52
24.1593	3.69001	1705.36	41.62
25.7946	3.4511	992.25	24.21

26.5255	3.35764	3336.34	81.42
26.9122	3.31026	3545.15	86.52
27.4146	3.25073	816.47	19.93
27.8612	3.19962	818.49	19.97
28.8582	3.09132	551.01	13.45
29.9137	2.9846	238.13	5.81
30.337	2.94391	890.96	21.74
30.8796	2.8934	536.6	13.1
32.2965	2.76963	570.06	13.91
32.6262	2.74239	457.46	11.16
33.1486	2.70036	572.75	13.98
33.8402	2.64673	328.06	8.01
34.6933	2.58358	456.51	11.14

AP1189 DL-mandelic acid Form XX

The XRPD diffractogram for AP1189 DL-mandelic acid salt Pattern 2 crystallised from methylethyl ketone is shown in Figure 31. The corresponding XRPD diffractogram peak list for DL-mandelic acid salt Pattern 2 is shown in Table 26.

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Table 26: XRPD diffractogram peak list for DL-mandelic acid Pattern 2 from methylethyl ketone. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
5.3278	16.58759	1845	55.02
9.5789	9.23344	2024.97	60.39
9.968	8.87386	2381.68	71.02
10.6699	8.28474	231.21	6.89
10.8512	8.15348	328.99	9.81
11.7447	7.53513	368.64	10.99
12.0395	7.35127	603.48	18.00
12.3648	7.15856	1003.51	29.92
13.3371	6.63884	1307.90	39.00
13.9345	6.35027	169.90	5.07
14.7843	5.99208	2603.01	77.62
15.304	5.78972	241.37	7.2

16.0411	5.52532	758.96	22.63
16.8321	5.26741	1019.62	30.41
17.0395	5.19944	178.31	5.32
17.3113	5.12267	830.26	24.76
17.6081	5.03696	738.87	22.03
17.9246	4.94873	1940.47	57.87
18.5095	4.79366	874.43	26.08
19.1041	4.64578	2097.59	62.55
19.7677	4.49129	625.71	18.66
20.2411	4.3873	503.03	15.00
20.6976	4.29157	616.33	18.38
21.2349	4.18417	1247.47	37.20
21.4535	4.14203	2057.15	61.34
21.8113	4.07152	163.21	4.87
22.8944	3.88451	381.11	11.36
24.1665	3.68283	2677.35	79.84
24.5371	3.62805	739.38	22.05
24.7981	3.59044	1227.19	36.60
25.4748	3.49658	3353.42	100
26.3652	3.38048	266.48	7.95
26.885	3.31630	824.52	24.59
27.1313	3.28675	532.22	15.87
27.5018	3.24331	648.76	19.35
28.0542	3.18068	402.6	12.01
28.3699	3.14600	228.01	6.80
29.6695	3.01110	302.57	9.02
30.3377	2.94628	551.12	16.43
31.2069	2.86617	280.40	8.36
32.3828	2.76473	130.17	3.88
32.7924	2.73113	272.61	8.13
33.0937	2.70695	199.35	5.94
33.4812	2.67650	153.52	4.58
34.3739	2.60901	154.65	4.61
34.6967	2.58333	89.00	2.65

AP1189 DL-mandelic acid Form XXI

The XRPD diffractogram for AP1189 DL-mandelic acid salt Pattern 3 crystallised from acetone is shown in Figure 32. The corresponding XRPD diffractogram peak list for DL-mandelic acid salt Pattern 3 is shown in Table 27.

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Table 27: XRPD diffractogram peak list for DL-mandelic acid Pattern 3 from acetone. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
5.3893	16.39843	4912.28	88.86
9.7591	9.06332	3991.44	72.2
10.0419	8.80866	5528.14	100
11.2198	7.88644	781.77	14.14
11.5373	7.66373	229.46	4.15
11.7936	7.504	1004.79	18.18
12.6722	6.98565	1846.06	33.39
13.5326	6.54335	2579.7	46.66
14.3544	6.17052	699.64	12.66
15.0397	5.89088	1043.83	18.88
15.4731	5.72682	1523.04	27.55
15.6775	5.65264	1495.79	27.06
15.8208	5.59712	378.04	6.84
16.5687	5.35053	3283.44	59.39
17.1736	5.16342	1270.64	22.98
18.1157	4.89697	3148.28	56.95
19.5677	4.53675	762.3	13.79
20.2232	4.39116	892.62	16.15
20.6533	4.30067	1765.5	31.94
21.1402	4.20269	2967.73	53.68
21.7114	4.09342	2549.07	46.11
22.5571	3.94182	860.51	15.57
23.255	3.82508	1053.7	19.06
23.5888	3.77171	2097.93	37.95
24.5508	3.62604	5283.58	95.58

25.3869	3.50849	2895.23	52.37
26.0622	3.41909	1624.06	29.38
27.0317	3.29589	972.29	17.59
27.2552	3.27209	1730.57	31.3
28.664	3.11439	405.06	7.33
28.9743	3.08174	371.42	6.72
29.8399	2.99429	436.53	7.9
30.4007	2.94032	770.85	13.94
30.6937	2.91051	239.34	4.33
31.1806	2.86854	293.27	5.31
32.8239	2.72858	186.18	3.37
33.4914	2.67571	336.08	6.08
33.9645	2.63951	205.17	3.71
34.5199	2.59831	222.06	4.02

AP1189 hippuric acid Form XXII

The XRPD diffractogram for AP1189 hippuric acid salt Pattern 1 crystallised from methylethyl ketone is shown in Figure 33. The corresponding XRPD diffractogram peak list for hippuric acid salt Pattern 1 is shown in Table 28.

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Table 28: XRPD diffractogram peak list for hippuric acid Pattern 1 from methylethyl ketone. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
8.6143	10.25659	113.08	8.83
9.598	9.21503	527.96	41.23
9.8144	9.00493	260.1	20.31
10.8895	8.12492	928.65	72.51
11.4793	7.70874	893.63	69.78
11.7567	7.52125	410.35	32.04
12.6953	6.97294	640.66	50.03
13.255	6.67974	664.76	51.91
13.8253	6.40018	374.81	29.27
14.1095	6.27188	395.92	30.92
14.4273	6.13954	822.58	64.23

14.8688	5.95818	960.42	74.99
15.5334	5.70474	717.01	55.99
16.3714	5.4101	289.13	22.58
17.4516	5.08178	564.67	44.09
18.0621	4.91136	797.05	62.24
19.4664	4.55635	312.87	24.43
20.0768	4.42284	1099.31	85.84
20.686	4.29394	945.98	73.87
20.9823	4.23046	638.13	49.83
21.989	4.04236	1034.88	80.81
22.3837	3.97197	1097	85.66
22.781	3.90358	958.14	74.82
23.1141	3.84489	610.08	47.64
24.0708	3.69726	1280.66	100
24.489	3.63506	1255.08	98.00
25.2989	3.5205	684.15	53.42
25.7814	3.45569	537.56	41.98
27.1059	3.28976	557.88	43.56
28.072	3.17871	304.59	23.78
29.1378	3.06482	381.24	29.77

AP1189 formic acid Form XXIII

The XRPD diffractogram for AP1189 formate salt Pattern 1 crystallised from acetone is shown in Figure 34. The corresponding XRPD diffractogram peak list for formate salt Pattern 1 is shown in Table 29.

5

Table 29: XRPD diffractogram peak list for formate Pattern 1 from acetone.

Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
7.3974	11.95078	545.69	3.73
10.3677	8.53261	1240.38	8.47
10.6166	8.33313	1104.27	7.54
12.1932	7.25896	1192.4	8.14
13.2943	6.66011	12637.58	86.28

14.1263	6.26963	1121.3	7.66
15.0608	5.88266	14646.45	100
15.2423	5.81303	2665.72	18.2
16.7797	5.28372	2633.7	17.98
17.3341	5.11595	8220.13	56.12
17.9963	4.92918	2302.64	15.72
18.4846	4.80007	7429.09	50.72
18.7509	4.73248	7824.4	53.42
18.9261	4.68908	7877.5	53.78
19.1184	4.64235	4567.83	31.19
20.5992	4.31184	5415.68	36.98
20.8504	4.26047	1014.98	6.93
21.3519	4.1615	596.99	4.08
21.845	4.06867	8642.95	59.01
22.3365	3.98024	835.56	5.7
22.5988	3.93464	2569.5	17.54
22.7594	3.90723	4206.51	28.72
23.1395	3.84391	843.2	5.76
23.6272	3.76566	8913.09	60.85
24.0258	3.70408	3919.64	26.76
24.5257	3.6297	1772.27	12.1
24.8627	3.58126	2985.77	20.39
25.5562	3.48562	11808.59	80.62
26.7988	3.32676	1871.33	12.78
27.1478	3.28479	5298.04	36.17
27.555	3.23716	1232.48	8.41
28.1048	3.17508	688.88	4.7
28.5576	3.12575	1537.8	10.5
28.8538	3.09433	3072.99	20.98
29.2239	3.05598	2924.78	19.97
30.4606	2.93468	795.57	5.43
30.8589	2.8977	822.88	5.62
31.6975	2.82292	355.5	2.43
32.2437	2.77634	361.16	2.47

32.676	2.74059	1050.97	7.18
33.0782	2.70818	1100.1	7.51
34.0175	2.63552	712.7	4.87

AP1189 L-lactic acid Form XXIV

The XRPD diffractogram for AP1189 L-lactic acid salt Pattern 1 crystallised from acetone is shown in Figure 35. The corresponding XRPD diffractogram peak list for L-lactic acid salt Pattern 1 is shown in Table 30.

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Table 30: XRPD diffractogram peak list for L-lactic acid Pattern 1 from acetone. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
3.8307	23.06604	3178.24	47.86
7.6777	11.51498	1767.12	26.61
9.8772	8.95518	6641.34	100
11.9193	7.42511	4378.1	65.92
13.5622	6.52914	518.09	7.8
14.0188	6.31748	708.8	10.67
14.2103	6.2328	605.57	9.12
14.6766	6.03078	123.41	1.86
15.409	5.75051	1357.73	20.44
15.7676	5.62053	469.6	7.07
18.0461	4.91568	554.63	8.35
18.2556	4.85976	852	12.83
18.6623	4.75475	897.72	13.52
19.2881	4.60186	483.92	7.29
19.8255	4.47833	386.24	5.82
20.1676	4.40313	1223.74	18.43
20.4033	4.3528	919.15	13.84
20.6573	4.29984	1559.52	23.48
20.8905	4.25237	990.19	14.91
21.3526	4.16138	1157.33	17.43
21.646	4.10562	908.23	13.68
22.3961	3.96979	855.37	12.88

22.6249	3.93017	939.37	14.14
22.971	3.87172	2321.73	34.96
23.2857	3.82011	441.69	6.65
23.7043	3.75359	592.41	8.92
23.9203	3.72017	1448.41	21.81
25.3489	3.51366	1592.32	23.98
25.8516	3.44647	814.66	12.27
27.4586	3.24831	2881.16	43.38
27.8125	3.20777	443.85	6.68
28.5067	3.13122	1135.06	17.09
28.663	3.1145	927.83	13.97
29.5915	3.01635	53.45	0.8
29.9951	2.97668	37.42	0.56
30.429	2.93765	222.79	3.35
31.4341	2.84598	106.84	1.61
31.8482	2.8099	177.22	2.67
33.0644	2.70928	164.9	2.48
33.6444	2.66389	179.49	2.7

AP1189 DL-lactic acid Form XXV

The XRPD diffractogram for AP1189 DL-lactic acid salt Pattern 1 crystallised from 2-propanol:water 80:20 %v/v is shown in Figure 36. The corresponding XRPD

5 diffractogram peak list for DL-lactic acid salt Pattern 1 is shown in Table 31.

Table 31: XRPD diffractogram peak list for DL-lactic acid Pattern 1 from 2-propanol:water 80:20 %v/v. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
3.8162	23.15347	1804.22	34.05
7.6494	11.55762	1162.58	21.94
9.8321	8.9962	5298.36	100
11.8679	7.45715	3991.73	75.34
13.6586	6.48328	804.02	15.17
14.1081	6.27769	790.27	14.92
14.2862	6.19986	766.33	14.46

15.3333	5.77875	955.8	18.04
15.8231	5.60095	461.73	8.71
18.161	4.88484	815.96	15.4
18.5718	4.77771	802.78	15.15
19.2085	4.62076	490.09	9.25
19.7509	4.49507	401.86	7.58
20.5233	4.32761	965.62	18.22
20.9608	4.23826	1332.56	25.15
21.282	4.17503	639.09	12.06
21.5473	4.12421	839.68	15.85
22.4898	3.95019	262.35	4.95
22.6827	3.92028	577.78	10.9
22.8882	3.88554	782.98	14.78
23.2724	3.82226	1405.85	26.53
23.5751	3.77386	564.88	10.66
23.8954	3.72399	1240.54	23.41
25.0342	3.55417	184.12	3.48
25.5625	3.48479	1065.01	20.1
26.0731	3.41769	771.57	14.56
27.6295	3.2286	1820.33	34.36
28.6694	3.11382	923.63	17.43
29.3516	3.04046	87.68	1.65
29.6094	3.01458	79.61	1.5
29.8349	2.9923	57.71	1.09
30.216	2.95542	62.38	1.18
30.6416	2.91775	94.23	1.78
31.5599	2.83492	87.33	1.65
31.9945	2.79739	92.91	1.75
34.1244	2.62751	173.05	3.27

AP1189 glutaric acid Form XXVI

The XRPD diffractogram for AP1189 glutaric acid salt Pattern 1 crystallised from acetone is shown in Figure 37. The corresponding XRPD diffractogram peak list for glutaric acid salt Pattern 1 is shown in Table 32.

5

Table 32: XRPD diffractogram peak list for glutaric acid Pattern 1 from acetone.
Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
3.2187	27.45066	1273.8	44.98
6.2662	14.10535	91.37	3.23
8.2746	10.68563	2609.46	92.15
8.6516	10.22081	1050.19	37.08
9.8059	9.02016	1139.11	40.22
10.0791	8.76902	223.29	7.89
10.4696	8.44977	349.34	12.34
12.8461	6.89144	1821.76	64.33
13.6255	6.49895	355.14	12.54
14.3832	6.15823	1410.65	49.81
15.0994	5.86773	1435.45	50.69
15.8515	5.59098	2831.89	100
16.2437	5.45684	1350.34	47.68
17.0593	5.19775	800.86	28.28
17.4716	5.07602	467.92	16.52
17.9619	4.93854	515.41	18.2
18.3427	4.83288	132.32	4.67
19.0191	4.66636	1161.13	41
19.7618	4.49262	942.09	33.27
20.1675	4.40316	327.58	11.57
20.5267	4.32691	479.36	16.93
21.0323	4.22402	514.69	18.17
21.4391	4.14478	927.37	32.75
21.7032	4.09494	1737.14	61.34
21.9433	4.05068	2661.11	93.97
23.0149	3.86444	761.72	26.9

23.6232	3.76629	871.91	30.79
24.1144	3.69067	335.65	11.85
24.5213	3.62734	178.61	6.31
24.9925	3.56296	523.88	18.5
26.0019	3.42689	608.37	21.48
26.47	3.36733	449.64	15.88
27.108	3.28951	1957.29	69.12
27.6238	3.22926	659.12	23.28
28.1734	3.1675	497.17	17.56
28.8455	3.09521	1331.98	47.04
29.4794	3.03008	690.69	24.39
30.5566	2.92567	279.74	9.88
31.4382	2.84561	247.41	8.74
32.3422	2.76811	174.16	6.15
33.8394	2.64898	126.9	4.48

AP1189 glutaric acid Form XXVII

The XRPD diffractogram for AP1189 glutaric acid salt Pattern 2 crystallised from methylethyl ketone is shown in Figure 38. The corresponding XRPD diffractogram peak list for glutaric acid salt Pattern 2 is shown in Table 33.

Table 33: XRPD diffractogram peak list for glutaric acid Pattern 2 from methylethyl ketone. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
6.2713	14.09393	1348.45	21.68
10.0606	8.79234	2465.26	39.64
10.7964	8.19475	1055.44	16.97
12.5578	7.04898	1369.87	22.03
12.7174	6.96091	816.87	13.14
13.4536	6.5816	976.38	15.7
14.0559	6.30088	4576.13	73.58
14.3305	6.18077	2421.41	38.94
14.7434	6.00859	2331.2	37.48
15.1147	5.86181	3300.67	53.07

15.3445	5.77454	1725.44	27.74
15.6849	5.64529	297.83	4.79
16.5052	5.37099	3574.38	57.47
16.7069	5.30659	2329.22	37.45
16.9302	5.23709	3892.59	62.59
17.4284	5.08848	3107.29	49.96
18.0004	4.92807	1304.54	20.98
18.3123	4.84484	3268.21	52.55
18.6803	4.7502	1268.95	20.4
18.9049	4.6904	348.68	5.61
19.2764	4.60083	230.03	3.7
19.6067	4.52407	213.08	3.43
20.1361	4.4063	1951.43	31.38
20.2103	4.4012	1852.93	29.79
20.4529	4.33876	1029.79	16.56
20.9143	4.24407	525.31	8.45
21.2592	4.17598	1295.43	20.83
21.6882	4.09434	6219.02	100
22.1229	4.01487	3700.13	59.5
22.5809	3.93447	3263.88	52.48
23.1992	3.83097	666.23	10.71
23.9542	3.71192	738.95	11.88
24.3918	3.64631	1342.56	21.59
24.9548	3.56529	4913.53	79.01
25.5599	3.48226	4269.78	68.66
25.9989	3.42444	1726.37	27.76
26.5216	3.35813	3601.16	57.91
26.8383	3.3192	1448.36	23.29
27.1448	3.28242	3733.35	60.03
27.6013	3.22916	1037	16.67
28.1593	3.16643	3739.98	60.14
28.7121	3.10671	4338.65	69.76
28.9792	3.07869	1514.53	24.35
29.3573	3.03989	1131.3	18.19

29.7049	3.0051	1374.88	22.11
30.5161	2.92703	742.83	11.94
31.3096	2.85464	2126.37	34.19
32.0253	2.79246	1658.17	26.66
32.9797	2.71379	391.9	6.3
34.0663	2.62968	459.08	7.38

AP1189 glutaric acid Form XXVIII

The XRPD diffractogram for AP1189 glutaric acid salt Pattern 4 crystallised from acetone is shown in Figure 91. The corresponding XRPD diffractogram peak list for glutaric acid salt Pattern 4 is shown in Table 34.

5

Table 34: XRPD diffractogram peak list for glutaric acid Pattern 4 from acetone. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
6.2649	14.10824	2317.26	45.92
8.856	9.98546	1016.84	20.15
10.0581	8.79456	1068.48	21.17
10.3774	8.52465	827.42	16.4
10.7078	8.25549	282.03	5.59
12.5708	7.04173	1531.07	30.34
13.4458	6.58542	495.2	9.81
13.8282	6.39883	372.75	7.39
14.2416	6.21914	2854.8	56.57
15.238	5.81468	2052.8	40.68
15.5797	5.6879	878.27	17.4
16.4839	5.37788	1494.63	29.62
16.8787	5.25296	5046.34	100
17.4128	5.09303	1366.17	27.07
18.1957	4.87561	1005.32	19.92
19.1108	4.64417	1212.63	24.03
19.7816	4.48446	372.75	7.39
20.1893	4.39845	1158.28	22.95
20.6392	4.30358	1641.43	32.53

20.9102	4.24841	1980.44	39.25
21.6891	4.09756	1391.84	27.58
21.9308	4.05295	1854.79	36.76
22.5489	3.94324	675.52	13.39
23.0328	3.86147	1238.92	24.55
23.5993	3.77005	740.75	14.68
23.8463	3.72846	584.45	11.58
24.536	3.6282	3003.71	59.52
24.949	3.56907	820.3	16.26
25.2746	3.52382	778.83	15.43
26.0869	3.41591	1010.15	20.02
27.1988	3.27874	738.77	14.64
27.8279	3.20604	827.7	16.4
28.372	3.14577	1720.94	34.1
29.2659	3.04917	634.85	12.58
29.631	3.01492	674.74	13.37
30.5003	2.93095	356.34	7.06
30.9655	2.88797	448.36	8.88
31.4367	2.84574	415.64	8.24
32.4495	2.7592	328.32	6.51
33.6052	2.66691	196.33	3.89
34.3331	2.61202	366.12	7.26

AP1189 adipic acid Form XXIX

The XRPD diffractogram for AP1189 adipic acid salt Pattern 1 crystallised from 2-Propanol:water 80:20 %v/v is shown in Figure 39. The corresponding XRPD diffractogram peak list for adipic acid salt Pattern 1 is shown in Table 35.

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Table 35: XRPD diffractogram peak list for adipic acid Pattern 2 from 2-Propanol:water 80:20 %v/v. Characteristic peaks are indicated in bold.

Pos. [°2 θ]	d-spacing [Å]	Height [cts]	Rel. Int. [%]
5.2288	16.9012	374.38	14.26
10.4544	8.46204	332.6	12.67
11.1721	7.92002	402.89	15.35

12.7447	6.94605	331.3	12.62
13.3934	6.61103	2624.96	100
14.5087	6.10526	2071.88	78.93
15.3038	5.78982	468.09	17.83
15.7578	5.62399	302.36	11.52
17.0607	5.19734	820.45	31.26
17.6454	5.0264	1305.13	49.72
18.0415	4.91694	783.53	29.85
18.794	4.72173	270.99	10.32
19.157	4.63306	977.8	37.25
20.5149	4.32579	76.13	2.9
21.0048	4.22949	277.16	10.56
21.389	4.15438	746.25	28.43
22.3725	3.97063	121.59	4.63
22.751	3.90866	583.38	22.22
22.996	3.86757	720.73	27.46
23.5265	3.78155	1287.83	49.06
23.9413	3.71696	408.65	15.57
24.4366	3.63972	198.1	7.55
24.8265	3.58641	586.6	22.35
25.3953	3.50735	1334.01	50.82
25.5279	3.48943	1466.02	55.85
26.0524	3.42035	225.22	8.58
26.2942	3.38664	103.24	3.93
27.0894	3.29173	1235.27	47.06
27.4729	3.24665	840.7	32.03
28.0693	3.17637	83.67	3.19
28.9363	3.08315	67.85	2.58
29.4981	3.0282	169.21	6.45
30.5878	2.92275	295.43	11.25
32.1777	2.78189	215.64	8.21
33.9424	2.64118	87.52	3.33
34.5436	2.59658	170.22	6.48

Conclusion

X-ray powder diffraction data was collected for a selection of different AP1189 salts.

Example 4: Thermogravimetric analysis/differential scanning calorimetry and

5 *Differential scanning calorimetry*

Methods

For the TGA/DSC assessment, approximately, 5-10 mg of material was added into a pre-tared open aluminium pan, loaded into a TA Instruments Discovery SDT 650 Auto - Simultaneous DSC and held at room temperature. The sample was then heated at a rate of 10°C/min from 30°C to 400°C during which time the change in sample weight was recorded along with the heat flow response (DSC). Nitrogen was used as the sample purge gas, at a flow rate of 200 cm³/min.

For the DSC assessment, approximately, 1-5 mg of material was weighed into an aluminium DSC pan and sealed non-hermetically with an aluminium lid. The sample pan was then loaded into a TA Instruments Discovery DSC 2500 differential scanning calorimeter equipped with a RC90 cooler. The sample and reference were heated to 230°C or 240°C at a scan rate of 10°C/min and the resulting heat flow response monitored. The sample was re-cooled to 20°C and then reheated again to 230°C or 240°C all at 10°C/min. Nitrogen was used as the purge gas, at a flow rate of 50 cm³/min.

Results

Results from the TGA/DSC and DSC assessments are shown in Table 36.

25

Table 36: TGA/DSC (*) and DSC (**) data for AP1189 salts.

Counter ion	Solvent	TGA/DSC or DSC results
Acetic Acid	Acetonitrile, Pattern 1	Endothermic onset 192°C. (**)
Acetic Acid	Ethyl acetate, Pattern 1 + 2	Endothermic onset 172°C. (*) Note: Thermal data generated on 2-MeTHF sample.
Acetic Acid	THF, Pattern 3	Endothermic onset 101°C. (*)

<i>p</i> -Toluenesulfonic acid	2-propanol:water 90:10 v/v / methanol, Pattern 1	Endothermic onset 234°C. (*)
Fumaric acid	2-propanol:water 90:10 v/v, Pattern 1	Endothermic onset 215°C (*)
Succinic acid	2-propanol:water 90:10 v/v	Endothermic onset 195°C. (*)
Napadisylate pattern 1	2-propanol:water 90:10 %v/v	1 st onset 87 °C (*) 2 nd onset 187 °C (*)
Esylate pattern 1	methylethyl ketone	Onset 207 °C (*)
Edisylate pattern 1	2-Propanol:water (80:20 %v/v)	1 st onset 78 °C (*) 2 nd onset 151 °C (*)
Edisylate pattern 2	methylethyl ketone	Onset 225 °C (*)
Edisylate pattern 4	THF	Onset 208 ° (*)
Edisylate pattern 5	2-Propanol:water (80:20 %v/v)	1 st onset 59 °C (*) 2 nd onset 151 °C (*)
Nitrate pattern 1	THF	Onset 179 °C (*)
Cyclamate pattern 2	THF	Onset 130 °C (*)
Cyclamate pattern 4	acetone	Onset 138 °C (*)
Cyclamate pattern 5	THF	Onset 141 °C (*)
Besylate pattern 1	2-Propanol:water 80:20 %v/v	Onset 216 °C (*)
Oxalate pattern 1	2-Propanol:water 80:20 %v/v	Peak 211 °C (*)
Oxalate pattern 2	acetone	Onset 207 °C (*)
(+)-Camphor-10-sulfonic acid pattern 1	2-Propanol:water 80:20 %v/v	Onset 205 °C (*)
Oxoglutarate pattern 1	acetone	Onset 81 °C (*)
DL-mandelic acid pattern 2	methylethyl ketone	Onset 110 °C (*)
Hippuric acid pattern 1	methylethyl ketone	Onset 139 °C (*)
Formic acid pattern 1	acetone	Onset 169 °C (*)
L-Lactic acid pattern 1	acetone	Onset 189 °C (*)

DL-Lactic acid pattern 1	2-propanol:water 80:20 %v/v	Onset 198 °C (*)
Glutaric acid pattern 1	acetone	1 st onset 109 °C (*) 2 nd onset 160 °C (*)
Glutaric acid pattern 2	methylethyl ketone	Onset 163 °C (*)
Glutaric acid pattern 4	acetone	1 st onset 145 °C (*) 2 nd onset 160 °C (*)
Adipic acid pattern 1	2-Propanol:water 80:20 %v/v	Onset 183 °C (*)

Example 5: Nuclear magnetic resonance

Methods

- 5 NMR experiments were performed on a Bruker AVIIIHD spectrometer equipped with a DCH or PRODIGY cryoprobe operating at 500.12 or 500.23 MHz for protons. Experiments were performed in deuterated DMSO and each sample was prepared to ca. 10 mM concentration.

Results

- 10 Chemical shifts and integration of ¹H-NMR signals from AP1189 salts are given in Table 37.

Table 37: Chemical shifts and integration of ¹H-NMR signals from AP1189 salts. In DMSO-d₆.

AP1189 Salt	¹ H-NMR data	
Acetic Acid	Chemical shift (ppm)	Integration
	8.16	1.00
	7.89	1.04
	7.78	1.05
	7.63	2.04
	6.99	1.00
	6.65	1.07
	6.48	1.20
	6.30	1.72

	6.21	2.31
	4.04	0.28
	3.64	0.40
	3.57	1.32
	1.98	0.30
	1.84	2.98
	1.26	0.54
	1.17	0.18
	0.87	0.09
<i>p</i> -Toluenesulfonic acid	Chemical shift (ppm)	Integration
	11.07	0.97
	8.16	1.00
	7.92	1.08
	7.82	1.08
	7.74	1.09
	7.66	1.11
	7.49	2.32
	7.37	3.26
	7.15	3.29
	6.80	1.05
	6.59	1.11
	6.34	2.04
	2.28	3.18
	2.04	0.16
	1.87	0.05
	1.27	0.77
	0.85	0.11
Fumaric acid	Chemical shift (ppm)	Integration
	13.34	1.42
	8.17	1.00
	7.90	1.37
	7.80	1.18
	7.73	1.14
	7.65	1.23

	7.08	0.92
	6.76	0.90
	6.52	0.91
	6.46	1.73
	6.41	0.94
	6.33	0.92
	2.09	0.17
	1.90	0.01
	1.24	0.16
Succinic acid	Chemical shift (ppm)	Integration
	13.80	1.02
	8.17	1.00
	7.90	1.05
	7.79	1.08
	7.67	2.06
	7.05	1.47
	6.93	3.12
	6.71	1.06
	6.50	2.11
	6.29	0.98
	3.77	0.14
	2.33	4.10
	1.88	0.06
	1.23	0.32
	1.04	0.29
	0.84	0.06

Chemical shifts and integration of ^1H -NMR signals from further AP1189 salts are given below reported as “relative integral (chemical shift in ppm)”.

- 5 AP1189 napadisylate pattern 1: 0.9004 (11.0566); 1 (8.8646); 0.8869 (8.1785); 1.0576 (7.9423); 0.908 (7.9008); 0.9585 (7.801); 0.9148 (7.7435); 0.9532 (7.6544); 3.6717 (7.4436); 1.8894 (7.4081); 0.9671 (7.1002); 0.929 (6.7843); 0.9571 (6.5594); 1.8182 (6.364).

AP1189 napadisylate pattern 2: 0.7543 (11.0629); 2.557 (8.8634); 1 (8.1806); 2.6217 (7.941); 0.974 (7.9028); 1.0037 (7.7975); 0.8754 (7.739); 1.0347 (7.656); 3.5752 (7.4103); 0.8399 (7.096); 0.7845 (6.7841); 0.7859 (6.5499); 1.5389 (6.3551); 2.0976 (1.764).

5

AP1189 esylate pattern 1: 1 (11.2407); 1.0302 (8.1724); 1.0864 (7.9088); 1.1096 (7.7985); 1.0938 (7.7285); 1.1564 (7.6532); 3.1799 (7.5066); 1.0215 (7.0896); 1.0396 (6.7843); 1.0711 (6.5428); 2.0916 (6.3686); 2.2641 (2.4374); 3.2592 (1.0734).

10

AP1189 edisylate pattern 1: 0.9389 (11.1051); 1 (8.1816); 1.1764 (7.915); 1.2168 (7.8057); 1.0864 (7.7419); 1.1486 (7.66119); 4.2764 (7.4823); 1.1528 (7.1064); 1.0797 (6.7887); 1.1652 (6.5561); 1.941 (6.3703); 3.1838 (2.6499).

15

AP1189 edisylate pattern 2: 1 (8.1754); 1.0457 (7.9043); 1.055 (7.7933); 1.0496 (7.7126); 1.0385 (7.6399); 3.6468 (7.2657); 1.0648 (7.074); 1.0135 (6.758); 1.0489 (6.5107); 2.0588 (6.3692); 1.8314 (2.6762); 0.4358 (1.8961).

20

AP1189 edisylate pattern 4: 0.9704 (11.1726); 0.3728 (8.6189); 1 (8.1889); 1.0879 (7.9082); 1.1163 (7.8048); 1.1018 (7.7262); 1.2479 (7.649); 3.9613 (7.4808); 1.239 (7.081); 1.0035 (6.7776); 0.9982 (6.5529); 1.9363 (6.364); 5.8322 (2.7036); 0.3181 (1.9026); 2.3234 (1.7578).

25

AP1189 edisylate pattern 5: 1 (11.1488); 1.0198 (8.1751); 1.0482 (7.9077); 1.0504 (7.7991); 1.0194 (7.7345); 1.0616 (7.6536); 3.4068 (7.4789); 0.9855 (7.0894); 1.0035 (6.7829); 1.0279 (6.5554); 2.0024 (6.3682); 2.1727 (2.6737).

30

AP1189 nitrate pattern 1: 0.855 (11.0579); 1 (8.1758); 1.1992 (7.9089); 1.1124 (7.8009); 1.1028 (7.7426); 1.1063 (7.6607); 3.1664 (7.4236); 0.9762 (7.0947); 0.9159 (6.7819); 0.9574 (6.5523); 1.984 (6.3525); 0.3361 (2.0666); 0.2449 (1.909); 0.3598 (0.9061).

AP1189 cyclamate pattern 2: 0.8634 (11.3476); 1 (8.1712); 1.0915 (7.9119); 1.0957 (7.7968); 1.0703 (7.7201); 1.1419 (7.6556); 3.5247 (7.5221); 1.0013 (7.0879); 1.0173 (6.7856); 1.0326 (6.5094); 2.0216 (6.3759); 1.0084 (2.8695); 0.0439 (2.0639); 2.0563

(1.889); 2.0597 (1.599); 1.0453 (1.4747); 2.129 (1.157); 3.1001 (1.0312); 0.0716 (0.9069).

5 AP1189 cyclamate pattern 4: 0.9437 (11.3653); 1 (8.1707); 1.0501 (7.9029); 1.0542 (7.7958); 1.0598 (7.7205); 1.0888 (7.6517); 3.4746 (7.4706); 0.9954 (7.0905); 1.0072 (6.7896); 1.0321 (6.5128); 1.994 (6.3726); 1.0213 (2.877); 0.7166 (1.909); 1.9717 (1.8707); 2.0065 (1.5967); 0.9909 (1.4832); 2.0949 (1.1546); 3.0111 (1.037).

10 AP1189 besylate pattern 1: 0.8981 (11.0474); 1 (8.1732); 1.0646 (7.9073); 1.077 (7.8033); 1.0818 (7.7354); 1.0947 (7.6588); 2.0107 (7.5938); 3.1874 (7.4508); 3.2895 (7.3107); 1.0376 (7.0824); 1.0335 (6.7775); 1.0395 (6.5391); 2.042 (6.3614); 0.081 (1.9071); 0.1755 (1.0388).

15 AP1189 oxalate pattern 1: 1 (8.1532); 1.0304 (7.8871); 1.0453 (7.7725); 1.0065 (7.681); 1.0478 (7.6319); 2.9399 (7.1515); 1.1976 (7.0314); 1.0234 (6.7175); 2.04 (6.4104); 1.014 (6.3244); 0.105 (1.0377).

20 AP1189 oxalate pattern 2: 1 (8.1689); 1.0959 (7.902); 1.0853 (7.7878); 1.2373 (7.7194); 1.4553 (7.6482); 2.6457 (7.5415); 0.988 (7.0686); 1.0003 (6.7689); 2.0665 (6.4477); 0.9929 (6.3465); 0.063 (2.0968).

25 AP1189 oxalate pattern 4: 1 (8.1515); 1.0445 (7.8892); 1.0462 (7.7742); 1.0282 (7.6758); 1.0219 (7.6301); 2.6642 (7.1097); 1.2483 (7.024); 1.0034 (6.7159); 2.0859 (6.3975); 0.997 (6.3192); 0.1217 (1.7624).

30 AP1189 (+)-camphor-10-sulfonic acid pattern 1: 0.8814 (11.1521); 1 (8.1744); 1.0627 (7.9089); 1.0996 (7.8055); 1.0638 (7.7356); 1.114 (7.6573); 3.3236 (7.4351); 1.012 (7.0913); 1.0191 (6.7741); 1.0391 (6.5267); 2.0264 (6.3743); 1.0414 (2.8818); 1.35 (2.661); 1.381 (2.3787); 1.0478 (2.2319); 1.0068 (1.9412); 0.0876 (1.9105); 0.9801 (1.8546); 1.1612 (1.7889); 2.1252 (1.276); 3.0996 (1.0314); 3.0831 (0.7379).

35 AP1189 oxoglutarate pattern 1: 1 (8.1669); 1.8014 (7.8993); 1.5121 (7.7883); 1.1804 (7.7205); 1.0352 (7.6395); 0.9369 (7.0709); 0.9511 (6.7756); 0.9802 (6.5257); 1.8945 (6.3703); 2.0183 (2.7771); 2.0935 (2.3762); 3.775 (2.0831); 0.2799 (1.9065).

AP1189 DL-mandelic acid pattern 2: 1 (8.1765); 1.1357 (7.9075); 1.1573 (7.8014); 2.282 (7.658); 2.4615 (7.373); 2.4095 (7.2395); 1.2411 (7.1718); 1.0362 (7.0527); 0.9926 (6.7419); 2.2546 (6.4249); 0.9906 (6.3355); 1.1242 (4.6566); 1.9165 (2.4309); 2.6899 (2.0752); 2.7184 (0.9137).

5

AP1189 DL-mandelic acid pattern 3: 1 (8.1719); 1.0907 (7.8985); 1.1332 (7.7964); 2.0988 (7.6516); 3.1244 (7.3791); 1.5978 (7.3108); 2.5396 (7.2455); 1.2963 (7.173); 1.0635 (7.0434); 0.9514 (6.7353); 2.2616 (6.418); 0.9986 (6.3312); 1.0491 (4.6436); 1.5842 (2.0853); 0.9834 (1.8978); 0.3683 (0.9089).

10

AP1189 hippuric acid pattern 1: 0.7548 (13.5715); 1.1969 (8.3963); 1 (8.16); 1.0703 (7.8863); 2.3929 (7.8433); 1.087 (7.7812); 1.0158 (7.6668); 1.0966 (7.633); 1.3863 (7.5276); 2.6135 (7.4589); 1.2686 (7.0294); 1.028 (6.7102); 1.0111 (6.4352); 0.9644 (6.3695); 1.0492 (6.3181); 2.4392 (3.7385); 0.3539 (2.0654); 0.4149 (1.8873); 0.3571 (0.9132).

15

AP1189 formic acid pattern 1: 1.0292 (8.2978); 1 (8.1572); 1.11 (7.8919); 1.1402 (7.7789); 2.0493 (7.6393); 1.4368 (7.0232); 1.0484 (6.6976); 1.0843 (6.4271); 0.8414 (6.3563); 1.3615 (6.315).

20

AP189 L-lactic acid pattern 1: 1 (8.1477); 1.0199 (7.8914); 1.0281 (7.7688); 1.016 (7.6355); 0.912 (7.5871); 0.8946 (6.9724); 0.9739 (6.6292); 0.9826 (6.4603); 1.1694 (6.2913); 2.0197 (6.1996); 3.1739 (1.8746).

25

AP1189 DL-lactic acid pattern 1: 1 (8.162); 1.0734 (7.8983); 1.089 (7.7857); 1.1388 (7.6686); 0.8544 (7.6311); 3.8862 (7.0181); 1.0121 (6.703); 1.8676 (6.4245); 1.4225 (6.3346); 1.1312 (3.8217); 3.4204 (1.1735).

30

AP1189 glutaric acid pattern 1: 1 (8.1619); 1.2231 (7.8898); 1.2238 (7.7746); 2.2688 (7.6176); 1.1544 (6.9851); 1.1233 (6.6576); 2.5919 (6.4392); 2.628 (6.2658); 5.0598 (2.1953); 0.155 (2.0861); 2.5366 (1.6883).

35

AP1189 glutaric acid pattern 2: 1 (8.1501); 1.0837 (7.8878); 1.0944 (7.7738); 2.0793 (7.6257); 1.07 (6.9923); 1.5227 (6.6621); 1.5132 (6.44); 2.1718 (6.286); 4.2751 (2.1788); 0.1721 (1.8732); 2.132 (1.677); 0.0775 (0.9072).

AP1189 glutaric acid pattern 4: 1 (8.1477); 1.0427 (7.889); 1.0498 (7.7725); 2.067 (7.6188); 1.0236 (6.9887); 1.0425 (6.6531); 4.4525 (6.4277); 2.3299 (6.2728); 4.2147 (2.1823); 2.0993 (1.6841).

5

AP1189 adipic acid pattern 1: 1 (8.1534); 1.0731 (7.889); 1.1078 (7.7765); 2.1422 (7.6374); 1.3346 (7.0193); 1.1785 (6.6987); 1.078 (6.4364); 2.1349 (6.3344); 0.3194 (3.7674); 6.2668 (2.1336); 1.1285 (1.8523); 6.2972 (1.4746); 1.5977 (1.0395).

10 Conclusion

Chemical shift values and integration of peaks corresponds to the expected salts.

Example 6: Solubility of AP1189 and its salts

Methods

15 The solubility of AP1189 acetate (XRPD pattern 1), fumarate (XRPD pattern1), and succinate (XRDP pattern 1) salts were assessed in 0.5 M buffer solutions having pH of 1.2 and 4.5.

Results

20 The results of the study are shown in tables 38a and 38b for 0.5 M and 0.2 M buffers, respectively. Table 38c shows the solubility of further AP1189 salts.

For the 0.5 M buffers, the highest solubility was observed for acetate Pattern 1. Higher solubility was observed for succinate Pattern 1 compared with fumarate Pattern 1.

25 XRPD analysis showed acetate Pattern 1 remained at pH 4.5. At pH 1.2 for the acetate, a likely HCl salt (assigned as HCl Pattern 1) was formed. Succinic acid was obtained from the succinate Pattern 1 experiment at pH 1.2. The free succinic acid in the residual solids may indicate that the system was not saturated with respect to the API and the solubility may be higher than that reported.

30

Table 38a: Thermodynamic solubility results using 0.5 M buffers

Test compound	Buffer	Initial pH	24 h pH	Solubility (mM freebase)
Acetate Salt	pH 1.2	4.06 → 1.16	3.73 → 1.24	243.85

Pattern 1 (Form A)	pH 4.5	4.60	4.60	1.05
Fumarate Salt Pattern 1 (Form D)	pH 1.2	1.46 → 1.19	1.23	7.84
	pH 4.5	4.55	4.50	1.64
Succinate Salt Pattern 1 (Form B)	pH 1.2	2.06 → 1.30	2.23 → 1.26	98.20
	pH 4.5	4.58	4.54	1.71

Table 38b: *Thermodynamic solubility results using 0.2 M buffers*

Test compound	Buffer	Initial pH	24 h pH	Salt or freebase input concentration (mM)	Solubility at 24 h (mM freebase)
Acetate salt	pH 1.2	3.74 → 1.24	3.44 → 1.23	210*	134.10
	pH 4.5	4.52	4.54	74	2.23
	pH 6.8	6.85	6.81	69	1.18
Tosylate Salt	pH 1.2	1.22	1.26	31	0.31
	pH 4.5	4.91 → 4.45	4.47	34	0.17
	pH 6.8	6.77	6.87	30	- ‡
Fumarate Salt	pH 1.2	1.35 → 1.18	1.29	38	10.90
	pH 4.5	4.47	4.48	39	2.73
	pH 6.8	6.61 → 11.24 → 6.84	6.65 → 6.74	39	0.86
Succinate Salt	pH 1.2	1.62 → 1.21	1.36 → 1.26	89 *	>36.26**
	pH 4.5	4.48	4.56	36	4.26
	pH 6.8	6.61 → 6.80	6.42 → 7.03 → 6.82	41	0.78

→: pH adjusted using hydrochloric acid or sodium hydroxide

5

*: Estimated input concentration

**: Fully soluble, input material was not sufficient to maintain a slurry

‡: Not detected

For pH 1.2 succinate experiments there was insufficient available material at the time of experiment to maintain a suspension.

Table 38c: Solubility of additional AP1189 salts

AP1189 salt form	Solubility HCl/KCl Buffer 0.5 M pH 1.2	Salt form crystallised from
Napadisylate (Form III, IV)	<15 mM	2-propanol:water 90:10 %v/v (Form III) or THF (Form IV)
Esylate (Form V)	<15 mM	methylethyl ketone
Edisylate (Form VII)	<15 mM	methylethyl ketone
Nitrate (Form X)	-	THF
Cyclamate (Form XI, XII)	<15 mM	THF (Form XI) or acetone (Form XII)
Besylate (Form XIV)	≥ 15 to < 50 mM	2-Propanol:water 80:20 %v/v
Oxalate (Form XV, XVI, XVII)	<15 mM	2-Propanol:water 80:20 %v/v (Form XV) or acetone (Form XVI) or THF (Form XVII)
(+)-Camphor-10-sulfonic acid (Form XVIII)	<15 mM	2-Propanol:water 80:20 %v/v
Oxoglutarate (Form XIX)	≥ 15 to < 50 mM	acetone
DL-Mandelic acid (Form XX)	≥ 50 mM	methylethyl ketone
Hippuric acid (Form XXII)	≥ 50 mM	methylethyl ketone
Formic acid (Form XXIII)	≥ 15 to < 50 mM	acetone
L-Lactic acid (Form XXIV)	≥ 50 mM	acetone
DL-Lactic acid (Form XXV)	≥ 15 to < 50 mM	2-propanol:water 80:20 %v/v
Glutaric acid (Form XXVI)	≥ 15 to < 50 mM	acetone
Adipic acid (Form XXIX)	≥ 15 to < 50 mM	2-Propanol:water 80:20 %v/v

Conclusion

The test compounds exhibited remarkably different solubilities, especially at low pH. Specifically, the acetate and succinate salts showed high solubility at pH 1.2, indicating the potential for using these compounds in applications where a high solubility at low pH is desirable.

Example 7: Polymorph study of AP1189 succinate

Materials and methods

Approximately 300 mg of the received succinate salt was added to 14 mL vials. The required volume of the appropriate solvent system was added to each vial, and the experiments were stirred at 70 - 73°C until complete dissolution was achieved. The experiments were then cooled to 68 °C, and seeded with AP1189 succinate. 5 to 15 % seed load was used. The experiments were stirred at 68 °C for another 1 h to allow for equilibration. The experiments were then cooled to 5 °C at 0.1 °C/min, and stirred at 5°C until isolation. The experiments (slurries) were vacuum filtered, and the cakes were each washed with 3 mL of the respective input solvent system (precooled at 5 °C). The solids were analysed by XRPD to check the polymorphic form. The remainder of the solids were dried under vacuum at ambient for ca. 3 days. The dried solids were characterised. The concentrations of the recovered mother liquors and was were determined by HPLC.

Results

Both damp and dried crystallised solids were consistent with Pattern 1 of the succinate salt. Table 39 summarises the findings of the study.

Table 39: results from polymorph study for AP1189 succinate. Succ. Patt. 1 is succinate Pattern 1.

Solvent system	Yield (%)		Purity (%area)		XRPD	
	Isolated	HPLC	Solid	ML	Damp	Dried
1-Propanol:water 50:50 v/v%	67.7	82.9	96.52	80.94	Succ. Patt. 1	Succ. Patt. 1
2-Propanol:water 50:50 v/v%	71.3	84.7	96.21	83.59	Succ. Patt. 1	Succ. Patt. 1
Ethanol:water 75:25 v/v%	65.9	74.3	96.22	88.75	Succ. Patt. 1	Succ. Patt. 1

Ethanol:water 50:50 v/v%	76.3	86.5	96.17	83.98	Succ. Patt. 1	Succ. Patt. 1
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Conclusion

AP1189 succinate exhibiting the crystal form of Pattern 1 was obtained using various crystallisation conditions.

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Example 8: Polymorph study of AP1189 succinate

Materials and methods

Approximately 300 mg of AP1189 was added to 20 mL vials. The required volume of the appropriate solvent system was added to each vial, and the experiments were stirred at 65 - 69 °C. The experiments were then cooled to 55 °C, and seeded with AP1189 succinate. 2 % seed load was used. The experiments were stirred at 55 °C for another 1 h to allow for equilibration. The experiments were then cooled to 5 °C at 0.1 °C/min, and stirred at 5 °C. After ca. 18 h of stirring at 5 °C, 200 µL aliquot of each slurry was extracted and centrifuged using 0.2 µm nylon tubes. The isolated solids were dried under vacuum at ambient and analysed by HPLC (purity). The concentration and purity of the mother liquors were also determined by HPLC. To the remainder of the experiments, anti-solvent addition was carried out at 5 °C, to reach the target final ratio. Afterwards, stirring continued at 5 °C for another ca. 4 h. The experiments (slurries) were vacuum filtered and the cakes each washed with 0.9 mL of the respective organic solvent (pre-cooled at 5 °C). The solids were dried under vacuum at ambient for ca. 48 h. The dried solids were characterised. The mother liquors were subsampled and analysed by HPLC for concentration and solution purity determination. The rest of the mother liquors were left open in an oven, to allow the solvents to evaporate under vacuum, at ambient. After 3 days, the residual solids were analysed by XRPD and HPLC (purity).

Results

All isolated solids were consistent with Pattern 1 of the succinate salt. Table 40 summarises the findings of the study.

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Table 40: results from polymorph study for AP1189 succinate. Succ. Patt. 1 is succinate Pattern 1. PC is poorly crystalline.

	Sample	Yield (%)	Purity (%area)	
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Solvent system		Isolated	ML Conc. (mg/mL)	HPLC	Solid	ML	XRPD (Dried)
1-propanol:water 50:50 v/v%	After cooling-only	-	10.91	88.0	95.64	83.03	-
	After isolation	77.1	8.14	88.8	95.83	83.35	Succ. Patt. 1
	ML Evaporation	-	-	-	88.82	-	Succ Patt. 1, PC
Ethanol:water 50:50 v/v%	After cooling-only	-	6.15	90.3	95.69	82.42	-
	After isolation	57.5	6.14	87.0	95.67	79.73	Succ. Patt. 1
	ML evaporation	-	-	-	91.20	-	Succ. Patt. 1, PC

Conclusion

AP1189 succinate exhibiting the crystal form of Pattern 1 was obtained using various crystallisation conditions. Isolated yield obtained was between 65 and 80 %. Addition of water as anti-solvent improved the theoretical yield by 2 to 6 % %w/w.

Example 9: Polymorph study of AP1189 succinate

Materials and methods

Approximately 5 g of AP1189 succinate was added to temperature controlled reactor in an EasyMax 102 (100 mL vessel). 55.6 mL (11.1 vol.) of 1-propanol/water (50:50 v/v%) was added to the reactor, and the experiment was stirred at 70 °C. Target concentration was 90 mg/mL. Stirring speed was 200 rpm. When complete dissolution was observed, the experiment was cooled to 55 °C, and seeded with AP1189 succinate. 2 % seed load was used, and it persisted with evidence of slurry formation. Post-seeding, stirring continued at 55 °C for 2 hours to allow experiment to equilibrate. The experiment was cooled to 5 °C at 0.1 °C/min, and allowed to stir at 5 °C for 1 h. Stirring speed was increased to 300 rpm during the cooling step. At 5 °C, water (pH 7.22) was added to the experiment as an anti-solvent at 1 vol./hr, to reach a target ratio

of 40:60 %v/v. 14 mL (2.8 vol.) of water was added. Post-addition, stirring continued at 5 °C for ca. 6 hours. A subsample of the slurry was extracted into a 0.2 µm nylon tube and centrifuged. The concentration and solution purity of the isolated mother liquor were determined by HPLC. The isolated solid was dried under vacuum at ambient for ca. 4 days, and analysed by HPLC for purity analysis. At 5 °C, more water was added as anti-solvent at 1 vol./hr, to reach a target ratio of 30:70 %v/v. 23.4 mL (4.6 vol.) of water was added. Stirring speed was increased further to 350 rpm during the addition. Post-addition, stirring continued at 5 °C for another 90 min. At 5 °C, the slurry was vacuum-filtered using Buchner funnel. The filter cake was washed with 10 mL (2 vol.) of water (precooled to 5 °C) and dried under vacuum at ambient for ca. 4 days. XRPD analysis was carried out on both the damp and dried solid sample. The dried solid was characterised. 10 mL aliquot of the mother liquor was left open in an oven to allow the solvent to evaporate under vacuum at ambient. The residual solid was analysed by XRPD and HPLC (purity). The concentration and solution purity of the rest of the mother liquor and the wash were determined by HPLC.

Results

All samples were consistent with AP1189 succinate salt having XRPD Pattern 1. The results are shown in Table 41.

Table 41: results from polymorph study for AP1189 succinate. Succ. Patt. 1 is succinate Pattern 1. PC is poorly crystalline. Starting solvent system: 1-propanol:water (50:50 %v/v).

Sample	Yield (%)			Purity (%area)		XRPD	
	Isolated	ML conc. (mg/mL)	HPLC	Solid	ML	Wet	Dry
After ASA 1 (40:60 v/v)	-	6.21	88.3	97.06	84.36	-	Succ. Patt 1.
Final sample	80.9	3.37	92.4	96.56	84.86	Succ. Patt 1.	Succ. Patt 1.

Crust	6.4	-	-	95.78	-	-	Succ. Patt 1.
ML-Evap	-	-	-	84.32	-	-	Succ. Patt 1.

Conclusion

AP1189 succinate exhibiting the crystal form of Pattern 1 was obtained.

5 *Example 10: Polymorph study of AP1189 succinate*

Materials and methods

Approximately 10 g of the AP1189 succinate was added to temperature-controlled reactor in an EasyMax 402 (400 mL vessel). 100 mL (10 vol.) of 1-propanol:water (50:50 v/v%) was added to the reactor, and the experiment was stirred at 68 °C.

- 10 Concentration was 100 mg/mL. Stirring speed was 200 rpm. When complete dissolution was observed, the experiment was polish-filtered at 70 °C to remove any insoluble impurities, and the filtrate was added back into the reactor. 5 mL (0.5 vol.) of 1-propanol:water (50:50 v/v%) was used to wash the reactor and passed through the filter. 7 mL (0.7 vol.) of 1.propanol:water (50:50 v/v%) was used to filter into the reactor.
- 15 Concentration was 90 mg/mL. The experiment was allowed to equilibrate at 65 °C, and then cooled to 55 °C. At 55 °C, the experiment was seeded with 1 % seed load, using AP1189 succinate. Post-seeding, the experiment was allowed to equilibrate at 55 °C for ca. 1 hour. At 5 °C, water was added to the experiment as an anti-solvent at 1 vol./hr, to reach a target ratio of 30:70 %v/v. 74.7 mL (7.4 vol.) of water was added.
- 20 Stirring speed was increased stepwise to 250 rpm during the addition. Post-addition, stirring continued at 5 °C for ca. 2.5 hours. At 5 °C, the slurry was vacuum filtered using Buchner funnel. The cake was washed with 10 mL (1 vol.) of water (pre-cooled to 5 °C), and dried under vacuum at ambient for 4 days. XRPD analysis was carried out on both the damp and dried solid sample. The dried solid was characterised. 10 mL
- 25 aliquot of the mother liquor was left open in an oven to allow the solvent to evaporate under vacuum at ambient. The residual solid was analysed by XRPD and HPLC (purity). The concentration and solution purity of the rest of the mother liquor and the wash were determined by HPLC.

Results

All samples were consistent with AP1189 succinate salt having XRPD Pattern 1. The results are shown in Table 42.

- 5 Table 42: results from polymorph study for AP1189 succinate. Succ. Patt. 1 is succinate Pattern 1. PC is poorly crystalline. Starting solvent system: 1-propanol:water (50:50 %v/v).

Sample	Yield (%)			Purity (%area)		XRPD	
	Isolated	ML conc. (mg/mL)	HPLC	Solid	ML	Wet	Dry
Final sample	67.4	3.19	93.3	96.51	82.39	Succ. Patt. 1	Succ. Patt. 1
Crust	20.1	-	-	95.46	-	-	Succ. Patt. 1
ML-Evap	-	-	-	81.57	-	-	Succ. Patt. 1

10 Conclusion

AP1189 succinate exhibiting the crystal form of Pattern 1 was obtained.

Example 11: Further solubility study of AP1189 acetate and AP1189 succinate

Materials and methods

- 15 3.4 g of AP1189 succinate and 2.9 g of AP1189 acetate were added to separate vials containing 10.0 mL of buffer solution pH 1.2 (one determination per salt). For the AP1189 acetate and AP1189 succinate solutions, the pH was measured to 3.9 and 2.2, respectively. As a result, the pH was adjusted to 1.2 with concentrated hydrochloric acid in both solutions. Both sample preparations were diluted 500 times with the sample diluent (acetonitrile:water 1:1 v/v).
- 20

The diluted samples preparations were analysed by HPLC within 5 hours from preparation and the content of AP1189 was determined from the area under the curve by comparing to standard solutions of AP1189 acetate and AP1189 succinate respectively.

25

Equilibrium solubilities were also assessed at pH 4.5 and pH 6.8 following the procedure as described in WHO Technical Report Series 1019, 2019 annex 4: Protocol to conduct equilibrium solubility experiments for the purpose of Biopharmaceutics Classification System-based classification of active pharmaceutical ingredients for biowaiver.

Results

The sample materials in both vials were fully dissolved prior to dilution.

The solubilities of the test compounds at pH 1.2 are shown in Table 43. The solubilities of the test compounds at pH 4.5 and pH 6.8 are shown in Table 44, where all purities were found to be within 92 % and 95 %.

Table 43: Determined concentration of AP1189 acetate and AP1189 succinate in pH 1.2 samples. The HPLC purities are also included in the table. The first purity results are obtained from the CoAs for the lots and the second purity results were measured in the solubility experiment.

Sample	pH 1.2 (time)	HPLC purity
AP1189 acetate	> 617 mM (5 h) > 223 mg/mL	99.3 % → 92.5 %
AP1189 succinate	> 593 mM (0.5 h) > 245 mg/mL	99.4 % → 91.9 %

Table 44: Summarized equilibrium solubilities (including standard deviations) for AP1189 acetate and AP1189 succinate at 37 °C in buffer pH solutions 4.5 and 6.8. The HPLC purities are also included in the table. The first purity results are obtained from the CoAs for the lots and the second purity results were measured in the solubility experiment.

Sample	pH 4.5 (time)	pH 6.8 (time)
AP1189 acetate	3.2 mM ± 0.0 mM (22 h) 284 mg ± 3 mg/250 mL 99.3 % → 91.9 %	2.4 mM ± 0.0 mM (22 h) 216 mg ± 2 mg/250 mL 99.3 % → 94.5 %
AP1189 succinate	3.6 mM ± 0.0 mM (22 h) 370 mg ± 3 mg/250 mL	2.5 mM ± 0.1 mM (22 h) 261 mg ± 13 mg/250 mL

	99.4 % → 92.2 %	99.4 % → 93.7 %
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Example 12: Preparation of further polymorphs of AP1189 salts

Tosylate pattern 1

The tosylate salt of AP1189 having XRPD pattern 1 was prepared by crystallisation from methanol.

Fumarate pattern 1

The fumarate salt of AP1189 having XRPD pattern 1 was prepared by crystallisation from isopropylalcohol:water 90:10 v/v.

Naphthalene-1,5-Disulfonic Acid Pattern 1

Naphthalene-1,5-Disulfonic Acid having XRPD Pattern 1 was prepared as follows: 50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 μ L 2-Propanol:water 90:10 %v/v. A further 500 μ L 2-Propanol:water 90:10 %v/v was added to Naphthalene-1,5-disulfonic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Naphthalene-1,5-Disulfonic Acid Pattern 2

Naphthalene-1,5-Disulfonic Acid having XRPD Pattern 2 was prepared as follows: 50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 μ L THF. A further 500 μ L of THF was added to Naphthalene-1,5-disulfonic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Ethanesulfonic Acid Pattern 1

Ethanesulfonic Acid having XRPD Pattern 1 was prepared as follows: 50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 1 mL of methylethyl ketone. Ethanesulfonic acid (1.1 molar equivalents) was transferred by

pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

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Ethane-1,2-disulfonic Acid Pattern 1

Ethane-1,2-disulfonic Acid having XRPD Pattern 1 was prepared as follows:

50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 µL 2-Propanol:water (80:20 %v/v). A further 500 µL of 2-Propanol:water (80:20 %v/v) was added to Ethane-1,2-disulfonic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD giving Pattern 1. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD giving Pattern 5. After storage at 40°C/75%RH for 24 hours the diffractogram was consistent with pattern 1 by XRPD.

15

Ethane-1,2-disulfonic Acid Pattern 2

Ethane-1,2-disulfonic having XRPD Acid Pattern 2 was prepared as follows:

50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 µL methylethyl ketone. A further 500 µL of methylethyl ketone was added to Ethane-1,2-disulfonic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

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Ethane-1,2-disulfonic Acid Pattern 4

Ethane-1,2-disulfonic Acid having XRPD Pattern 4 was prepared as follows:

50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 µL THF. A further 500 µL of THF was added to Ethane-1,2-disulfonic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration

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and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Ethane-1,2-disulfonic Acid Pattern 5

- 5 Ethane-1,2-disulfonic Acid having XRPD Pattern 5 was prepared as follows:
50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 μ L 2-Propanol:water (80:20 %v/v). A further 500 μ L of 2-Propanol:water (80:20 %v/v) was added to Ethane-1,2-disulfonic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3
10 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Nitric Acid Pattern 1

- 15 Nitric Acid having XRPD Pattern 1 was prepared as follows:
50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 1 mL of THF. Nitric acid (1.1 molar equivalents) was transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by
20 centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Cyclamic Acid Pattern 2

- Cyclamic Acid having XRPD Pattern 2 was prepared as follows:
25 50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 μ L THF. A further 500 μ L of THF was added to Cyclamic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed
30 wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Cyclamic Acid Pattern 4

Cyclamic Acid having XRPD Pattern 4 was prepared as follows:

50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 μ L Acetone. A further 500 μ L of Acetone was added to Cyclamic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Cyclamic Acid Pattern 5

10 Cyclamic Acid having XRPD Pattern 5 was prepared as follows:

50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 μ L THF. A further 500 μ L of THF was added to Ethane-1,2-disulfonic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD. After storage at 40°C/75%RH for 24 hours the diffractogram was consistent with pattern 5 by XRPD.

Benzenesulfonic Acid Pattern 1

Benzenesulfonic Acid having XRPD Pattern 1 was prepared as follows:

50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 1 mL of 2-Propanol:water 80:20 %v/v. Benzenesulfonic acid (1.1 molar equivalents) was transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Oxalic Acid Pattern 1

30 Oxalic Acid having XRPD Pattern 1 was prepared as follows:

50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 μ L 2-Propanol:water 80:20 %v/v. A further 500 μ L of 2-Propanol:water 80:20 %v/v was added to Oxalic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were

isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Oxalic Acid Pattern 2

- 5 Oxalic Acid having XRPD Pattern 2 was prepared as follows:
50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 µL Acetone. A further 500 µL of Acetone was added to Oxalic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Oxalic Acid Pattern 4

- 15 Oxalic Acid having XRPD Pattern 4 was prepared as follows:
50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 µL THF. A further 500 µL of THF was added to Oxalic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

(+)-Camphor-10-Sulfonic Acid Pattern 1

- 25 (+)-Camphor-10-Sulfonic Acid having XRPD Pattern 1 was prepared as follows:
50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 1 mL of 2-Propanol:water 80:20 %v/v. (+)-camphor-10-sulfonic acid (1.1 molar equivalents) was transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Ketoglutaric Acid Pattern 1

Ketoglutaric Acid having XRPD Pattern 1 was prepared as follows:

50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 1 mL of Acetone. Ketoglutaric acid (1.1 molar equivalents) was transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

DL-Mandelic Acid Pattern 2

DL-Mandelic Acid having XRPD Pattern 2 was prepared as follows:

50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 µL methylethyl ketone. A further 500 µL of methylethyl ketone was added to DL-Mandelic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

DL-Mandelic Acid Pattern 3

DL-Mandelic Acid having XRPD Pattern 3 was prepared as follows:

50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 µL Acetone. A further 500 µL of Acetone was added to DL-Mandelic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Hippuric Acid Pattern 1

Hippuric Acid having XRPD Pattern 1 was prepared as follows:

50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 µL methylethyl ketone. A further 500 µL of methylethyl ketone was added to Hippuric acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by

centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Formic Acid Pattern 1

- 5 Formic Acid having XRPD Pattern 1 was prepared as follows:
50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 1 mL of Acetone. Formic acid (1.1 molar equivalents) was transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated
10 by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

L-Lactic Acid Pattern 1

- L-Lactic Acid having XRPD Pattern 1 was prepared as follows:
15 50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 µL Acetone. A further 500 µL of Acetone was added to L-Lactic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration
20 and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

DL-Lactic Acid Pattern 1

- DL-Lactic Acid having XRPD Pattern 1 was prepared as follows:
25 50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 µL 2-propanol:water 80:20 %v/v. A further 500 µL of 2-propanol:water 80:20 %v/v was added to DL-Lactic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids
30 were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Glutaric Acid Pattern 1

Glutaric Acid having XRPD Pattern 1 was prepared as follows:

50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 μ L Acetone. A further 500 μ L of Acetone was added to Glutaric acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Glutaric Acid Pattern 2

10 Glutaric Acid having XRPD Pattern 2 was prepared as follows:
50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 μ L methylethyl ketone. A further 500 μ L of methylethyl ketone was added to Glutaric acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Glutaric Acid Pattern 4

20 50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 μ L Acetone. A further 500 μ L of Acetone was added to Glutaric acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD giving Pattern 1. Storage of Pattern 1 at 40°C/75%RH for 24 hours resulted in a new pattern by XRPD (Pattern 4)

Adipic Acid Pattern 1

30 Adipic Acid having XRPD Pattern 1 was prepared as follows:
50 mg of AP1189 Acetate was weighed into a 1.5 mL HPLC vial and dissolved in 500 μ L 2-Propanol:water 80:20 %v/v. A further 500 μ L of 2-Propanol:water 80:20 %v/v was added to Adipic acid (1.1 molar equivalents), which was then transferred by pipette into the API. The resulting mixture was thermally cycled for 3 days between 40°C and 5°C (Ramp rate: 0.1 °C/min with isothermal holds of 1 hour at 40°C and 5°C). Solids were

isolated by centrifuge filtration and analysed wet by XRPD. Sample was dried at 40°C under vacuum for 24 hours then reanalysed by XRPD.

Example 13: FT-IR measurements

5 Materials and methods

Infrared spectroscopy was carried out on a Bruker ALPHA P spectrometer. Sufficient material was placed onto the centre of the plate of the spectrometer and the spectra were obtained using the following parameters: Resolution: 4 cm⁻¹; Background Scan Time: 16 scans; Sample Scan Time: 16 scans; Data Collection: 4000 to 400 cm⁻¹,
10 Result Spectrum: Transmittance; Software: OPUS version 6.

Results

Tables 45-68 show the FT-IR peak lists for various AP1189 salt polymorphs.

15 FIG 92 shows the IR spectrum of AP1189 acetate Pattern 1.

Table 45: FT-IR peak list for AP1189 napadisylate Pattern 1.

Wavenumber	Absolute Intensity	Relative Intensity
3466.6868	0.886	0.028
3348.6067	0.877	0.078
3191.3211	0.895	0.005
3151.5669	0.898	0.001
3118.6795	0.9	0.002
3043.0897	0.901	0.006
2968.754	0.91	0.007
2872.5429	0.92	0.003
1675.6159	0.787	0.084
1632.1472	0.684	0.245
1531.9778	0.681	0.269
1494.9203	0.83	0.074
1440.297	0.795	0.138
1347.2845	0.725	0.209
1295.435	0.881	0.05

1237.4246	0.815	0.084
1217.2817	0.79	0.064
1193.3462	0.747	0.08
1166.4915	0.664	0.26
1081.1736	0.832	0.063
1025.0437	0.574	0.373
1025.0437	0.574	0.373
968.7163	0.7	0.182
890.1769	0.892	0.035
870.6032	0.916	0.008
855.9669	0.849	0.085
839.5018	0.918	0.012
793.4597	0.734	0.182
776.4759	0.797	0.047
758.5855	0.743	0.113
721.6015	0.622	0.243
661.4094	0.796	0.022
644.2371	0.781	0.024
644.2371	0.781	0.024
599.9555	0.586	0.086
558.3191	0.596	0.048
518.543	0.562	0.118
518.543	0.562	0.182
463.4629	0.572	0.096
463.4629	0.572	0.115
441.8127	0.655	0.02

Table 46: FT-IR peak list for AP1189 napadisylate Pattern 2.

Wavenumber	Absolute Intensity	Relative Intensity
3457.0059	0.915	0.001
3330.9717	0.895	0.001
3121.7024	0.877	0.003
1676.3847	0.833	0.053

1624.8494	0.789	0.109
1606.2505	0.811	0.009
1579.1694	0.836	0.017
1527.463	0.779	0.142
1493.3067	0.835	0.034
1444.2738	0.846	0.036
1414.9494	0.881	0.005
1395.9339	0.875	0.018
1348.1145	0.836	0.062
1297.3292	0.888	0.01
1237.2278	0.839	0.019
1189.0537	0.713	0.019
1155.8105	0.703	0.143
1029.7055	0.641	0.249
969.3187	0.744	0.036
888.0521	0.823	0.022
850.9679	0.824	0.037
790.0213	0.729	0.102
765.1716	0.725	0.122
720.6873	0.77	0.013
700.4846	0.759	0.033
662.5114	0.753	0.034
601.4669	0.575	0.152
601.4669	0.575	0.152
564.0144	0.639	0.029
525.7536	0.621	0.051
491.9536	0.652	0.005
462.2125	0.621	0.049

Table 47: FT-IR peak list for AP1189 esylate Pattern 1.

Wavenumber	Absolute Intensity	Relative Intensity
3349.7247	0.955	0.001
3277.377	0.957	0.005

3187.823	0.947	0.001
3141.9143	0.934	0.06
3017.314	0.958	0.007
2935.0847	0.962	0.009
2879.2134	0.971	0.001
1684.2122	0.907	0.046
1656.4218	0.942	0.006
1627.0362	0.864	0.117
1612.4111	0.888	0.016
1526.9552	0.886	0.091
1494.7631	0.919	0.04
1459.0201	0.908	0.057
1446.057	0.924	0.017
1416.6283	0.964	0.007
1360.4768	0.918	0.055
1335.6655	0.926	0.033
1297.1634	0.948	0.021
1240.7436	0.939	0.027
1189.9984	0.855	0.112
1150.3317	0.869	0.044
1134.1169	0.873	0.009
1103.8023	0.909	0.016
1036.5662	0.826	0.155
1010.6467	0.936	0.008
982.056	0.898	0.059
982.056	0.898	0.059
982.056	0.898	0.059
982.056	0.898	0.059
887.7475	0.939	0.039
849.2158	0.95	0.028
783.8148	0.924	0.032
745.9402	0.869	0.104
745.9402	0.869	0.104
699.2813	0.877	0.066

651.1217	0.883	0.017
629.68	0.884	0.013
604.5022	0.88	0.036
577.5411	0.88	0.028
530.9237	0.871	0.084
490.6684	0.926	0.008
471.9556	0.888	0.055
471.9556	0.888	0.055
455.469	0.913	0.016
406.1926	0.94	0.007

Table 48: FT-IR peak list for AP1189 edisylate Pattern 2.

Wavenumber	Absolute Intensity	Relative Intensity
3462.9446	0.995	0.001
3257.0805	0.991	0.002
3150.1577	0.99	0.012
2884.3168	0.998	0
2866.5313	0.997	0
2866.5313	0.997	0
2826.2672	0.995	0.005
2242.0076	0.994	0.006
2159.6369	0.994	0.007
2135.3353	0.994	0.008
2035.2014	0.993	0.011
1985.1016	0.995	0.009
1926.5194	0.996	0.001
1901.158	0.996	0.002
1841.97	0.997	0.002
1816.3004	0.998	0.001
1808.22	0.998	0
1777.6607	0.997	0.002
1734.3136	0.997	0.002
1684.9728	0.984	0.009

1655.6732	0.989	0.003
1625.4399	0.974	0.026
1625.4399	0.974	0.026
1615.0231	0.98	0.001
1527.2346	0.982	0.014
1496.9895	0.991	0.004
1442.4714	0.989	0.008
1356.9431	0.989	0.008
1297.8821	0.995	0.002
1229.6559	0.981	0.008
1207.4986	0.981	0.007
1176.4347	0.981	0.016
1139.4076	0.988	0.003
1106.709	0.992	0.001
1065.3893	0.995	0.001
1027.718	0.973	0.026
1027.718	0.973	0.026
983.2416	0.986	0.009
983.2416	0.986	0.009
958.9998	0.994	0.002
958.9998	0.994	0.002
916.0674	0.996	0.001
898.6396	0.997	0
864.6502	0.996	0.001
850.6436	0.994	0.004
813.3872	0.995	0.001
790.6623	0.991	0.004
766.2961	0.988	0.007
731.909	0.983	0.013
702.5531	0.992	0.003

Table 49: FT-IR peak list for AP1189 edisylate Pattern 4.

Wavenumber	Absolute Intensity	Relative Intensity
2952.4532	0.953	0.003
2923.0149	0.912	0.087
2923.0149	0.912	0.087
2853.1668	0.945	0.024
2177.7444	0.991	0.003
2177.7444	0.991	0.003
2134.4653	0.989	0.009
1953.93	0.991	0.007
1742.2199	0.992	0.003
1684.2966	0.988	0.008
1601.1227	0.988	0
1523.9903	0.988	0.004
1494.8295	0.987	0.002
1457.1297	0.974	0.026
1376.8764	0.983	0.007
1362.1338	0.985	0.002
1338.7981	0.987	0.001
1315.6263	0.989	0.001
1228.4413	0.986	0.002
1191.3421	0.983	0.002
1163.1826	0.982	0.008
1081.7777	0.984	0.003
1026.5845	0.982	0.009
965.9176	0.983	0.005
949.699	0.985	0.001
848.3372	0.986	0.003
768.2207	0.983	0.008
734.2275	0.986	0.001
710.1008	0.985	0.001
686.0188	0.987	0.002
665.3046	0.985	0.003

616.5624	0.985	0.001
546.6271	0.98	0.009
526.3169	0.982	0.004
487.214	0.979	0.018
472.8975	0.983	0.001
438.7736	0.982	0.006
407.2507	0.984	0.003

Table 50: FT-IR peak list for AP1189 edisylate Pattern 5.

Wavenumber	Absolute Intensity	Relative Intensity
3474.8306	0.986	0.001
3411.0414	0.984	0
3359.3266	0.981	0.003
3174.2727	0.98	0.016
2472.9486	0.99	0.003
2428.6704	0.99	0.004
2346.2568	0.991	0.003
2304.5187	0.99	0.003
2256.8486	0.99	0.005
2237.9225	0.994	0
2199.0413	0.987	0.008
2153.65	0.987	0.009
1979.1896	0.992	0.004
1674.6247	0.964	0.02
1635.7648	0.96	0.036
1562.1009	0.986	0.002
1524.5681	0.964	0.025
1495.236	0.976	0.01
1445.9543	0.979	0.011
1427.2528	0.987	0.002
1412.9172	0.987	0.004
1353.4254	0.976	0.015
1297.1385	0.987	0.005

1241.464	0.972	0.015
1191.238	0.967	0.023
1134.2407	0.975	0.005
1080.2047	0.979	0.005
1025.609	0.95	0.043
1025.609	0.95	0.043
1008.4288	0.979	0.002
972.1472	0.976	0.011
888.5929	0.988	0.005
851.0858	0.984	0.008
775.0492	0.968	0.021
734.6082	0.969	0.013
734.6082	0.969	0.013
701.1599	0.979	0.006
701.1599	0.979	0.006
680.0768	0.985	0.001
608.8946	0.97	0.007
577.0193	0.97	0.004
555.0791	0.962	0.022
500.426	0.969	0.004
490.8807	0.969	0.013
459.2056	0.973	0.005
459.2056	0.973	0.005
449.358	0.973	0.004
408.8247	0.976	0.008

Table 51: FT-IR peak list for AP1189 nitrate Pattern 1.

Wavenumber	Absolute Intensity	Relative Intensity
3406.5302	0.962	0.013
3366.0481	0.967	0.003
3323.5268	0.967	0.001
3212.388	0.961	0.001
3163.9009	0.957	0.038

3127.5574	0.962	0.003
3005.5918	0.971	0
2913.8193	0.974	0.005
2871.3217	0.978	0.001
1680.7274	0.91	0.054
1680.7274	0.91	0.054
1624.0671	0.899	0.095
1528.6756	0.915	0.059
1528.6756	0.915	0.059
1497.3045	0.932	0.034
1497.3045	0.932	0.034
1466.4331	0.957	0.005
1447.1912	0.939	0.03
1447.1912	0.939	0.03
1384.114	0.9	0.078
1384.114	0.9	0.078
1359.8347	0.909	0.015
1331.1636	0.907	0.023
1242.2081	0.953	0.006
1186.1164	0.922	0.045
1186.1164	0.922	0.045
1154.2162	0.942	0.009
1132.4738	0.937	0.02
1081.0367	0.947	0.011
1048.6406	0.959	0.007
1038.6568	0.956	0.014
1003.3579	0.963	0.007
975.7122	0.916	0.059
936.6737	0.961	0.009
889.5881	0.962	0.017
851.0713	0.957	0.023
851.0713	0.957	0.023
820.317	0.952	0.025
820.317	0.952	0.025

781.2615	0.943	0.03
781.2615	0.943	0.03
753.3192	0.951	0.013
728.8132	0.927	0.02
684.2259	0.922	0.029
641.2375	0.935	0.005
607.5582	0.915	0.014
574.157	0.923	0.002
554.4784	0.915	0.004
523.0893	0.91	0.019
473.9605	0.901	0.045

Table 52: FT-IR peak list for AP1189 cyclamate Pattern 2.

Wavenumber	Absolute Intensity	Relative Intensity
3327.5952	0.894	0.015
3256.7062	0.896	0.005
3133.7961	0.861	0.101
3051.8543	0.9	0.003
2926.2906	0.873	0.049
2852.1869	0.897	0.02
1681.758	0.816	0.086
1623.3821	0.737	0.216
1623.3821	0.737	0.216
1623.3821	0.737	0.216
1623.3821	0.737	0.216
1529.9469	0.745	0.192
1494.8375	0.836	0.08
1445.9552	0.819	0.104
1415.3786	0.903	0.016
1353.8559	0.845	0.091
1336.4044	0.856	0.021
1296.3806	0.894	0.034
1264.8937	0.922	0.005

1242.4293	0.895	0.017
1184.9897	0.742	0.018
1156.8898	0.727	0.193
1134.2283	0.744	0.018
1083.0619	0.84	0.023
1029.6039	0.583	0.357
1029.6039	0.583	0.357
974.7489	0.79	0.1
903.7209	0.922	0.007
889.7243	0.878	0.046
864.5368	0.866	0.069
850.5855	0.867	0.033
836.2203	0.908	0.013
784.6589	0.827	0.065
751.7587	0.818	0.029
700.9984	0.722	0.055
630.931	0.735	0.005
605.618	0.677	0.216
559.4107	0.76	0.011
530.7647	0.749	0.052
471.4197	0.74	0.113
455.4746	0.767	0.028
410.2427	0.837	0.024

Table 53: FT-IR peak list for AP1189 cyclamate Pattern 4.

Wavenumber	Absolute Intensity	Relative Intensity
3604.5853	0.935	0.007
3343.728	0.852	0.036
3257.5858	0.868	0.007
3129.6006	0.825	0.127
3042.9076	0.871	0.01
2921.4146	0.831	0.067
2850.5435	0.857	0.036

2133.8407	0.95	0.003
2005.1942	0.955	0.012
1714.6479	0.927	0.006
1680.2622	0.728	0.136
1623.7709	0.65	0.268
1607.6163	0.658	0.066
1529.9951	0.653	0.254
1496.3013	0.77	0.113
1446.2453	0.746	0.151
1358.0905	0.779	0.122
1336.0631	0.812	0.053
1295.8377	0.862	0.033
1264.2435	0.872	0.012
1243.4692	0.829	0.032
1187.9086	0.642	0.24
1165.1333	0.65	0.04
1132.1103	0.701	0.023
1080.3651	0.783	0.051
1031.1931	0.507	0.409
1031.1931	0.507	0.409
1031.1931	0.507	0.409
972.5047	0.727	0.116
908.6013	0.876	0.017
889.2883	0.812	0.068
889.2883	0.812	0.068
869.394	0.809	0.088
851.4427	0.817	0.045
851.4427	0.817	0.045
837.7939	0.865	0.021
800.6091	0.822	0.041
783.2208	0.754	0.103
752.268	0.756	0.054
701.8152	0.639	0.113
672.5668	0.657	0.014

640.3004	0.647	0.024
610.5714	0.586	0.268
555.1012	0.691	0.017
529.8224	0.691	0.043
472.8574	0.66	0.135
413.9675	0.796	0.009

Table 54: FT-IR peak list for AP1189 cyclamate Pattern 5.

Wavenumber	Absolute Intensity	Relative Intensity
3330.1338	0.845	0.025
3257.8603	0.847	0.007
3128.0082	0.787	0.091
3050.923	0.842	0.005
3015.2804	0.845	0.006
2923.7029	0.729	0.224
2852.3392	0.775	0.056
1683.2005	0.746	0.119
1621.6978	0.651	0.015
1607.4517	0.642	0.252
1528.9946	0.631	0.287
1494.4844	0.763	0.107
1445.2176	0.727	0.157
1415.5026	0.85	0.028
1353.5039	0.768	0.132
1336.1138	0.79	0.026
1296.8249	0.839	0.052
1265.711	0.882	0.008
1242.2991	0.848	0.022
1183.5642	0.656	0.026
1155.3181	0.64	0.02
1131.4271	0.625	0.169
1083.7773	0.716	0.014
1029.0064	0.472	0.439

1029.0064	0.472	0.439
971.4767	0.68	0.102
904.6085	0.874	0.013
889.124	0.8	0.074
865.1575	0.789	0.105
865.1575	0.789	0.105
865.1575	0.789	0.105
837.8596	0.851	0.014
784.4749	0.75	0.119
784.4749	0.75	0.119
752.6207	0.748	0.055
700.5195	0.634	0.033
659.5072	0.623	0.027
606.4863	0.549	0.302
555.7751	0.651	0.027
530.6326	0.663	0.043
469.1368	0.639	0.154
453.1841	0.681	0.033
408.2296	0.747	0.04

Table 55: FT-IR peak list for AP1189 besylate Pattern 1.

Wavenumber	Absolute Intensity	Relative Intensity
3381.0336	0.893	0.053
3335.7129	0.912	0.006
3262.156	0.906	0.017
3166.2704	0.87	0.011
3128.0067	0.867	0.111
3053.0452	0.911	0.007
3017.5919	0.916	0.005
2770.6051	0.953	0.003
1727.6199	0.956	0.014
1683.2305	0.825	0.09
1661.1658	0.877	0.017

1625.152	0.753	0.206
1614.6217	0.758	0.024
1526.8978	0.724	0.238
1495.0095	0.848	0.073
1456.8814	0.854	0.043
1443.6263	0.818	0.125
1350.1157	0.835	0.116
1334.7203	0.876	0.022
1334.7203	0.876	0.022
1299.5393	0.909	0.03
1266.1667	0.933	0.009
1243.167	0.924	0.011
1203.5849	0.787	0.014
1187.6114	0.745	0.036
1162.458	0.745	0.083
1123.4106	0.658	0.309
1123.4106	0.658	0.309
1098.2649	0.81	0.021
1033.8037	0.727	0.183
1015.9959	0.715	0.214
996.3734	0.782	0.115
966.4141	0.772	0.137
921.5827	0.933	0.008
891.0203	0.886	0.07
850.9437	0.898	0.058
784.81	0.828	0.11
751.3821	0.765	0.113
730.5034	0.703	0.172
688.9137	0.717	0.031
670.5872	0.697	0.034
648.9273	0.689	0.056
628.6312	0.702	0.024
608.8258	0.647	0.259
608.8258	0.647	0.259

568.5532	0.663	0.127
552.345	0.674	0.023
485.2531	0.788	0.053
469.715	0.724	0.151
453.4275	0.809	0.024

Table 56: FT-IR peak list for AP1189 oxalate Pattern 1.

Wavenumber	Absolute Intensity	Relative Intensity
3425.6525	0.99	0.007
2950.9765	0.989	0
2263.6431	0.993	0.007
2224.0341	0.993	0.007
2189.4208	0.992	0.002
2094.4029	0.992	0.007
2051.0775	0.992	0.011
2033.9801	0.997	0.003
1999.5002	0.994	0.003
1999.5002	0.994	0.003
1985.8891	0.996	0
1678.8294	0.974	0.013
1629.9945	0.954	0.041
1531.0679	0.96	0.025
1495.3869	0.967	0.014
1448.2014	0.976	0.008
1365.3126	0.973	0.014
1334.8102	0.978	0.006
1299.4122	0.967	0.022
1271.9425	0.982	0.001
1245.3147	0.982	0.004
1193.0299	0.964	0.025
1142.4289	0.98	0.006
1107.9208	0.969	0.018
1082.1335	0.972	0.006

1041.1368	0.978	0.009
1002.3102	0.985	0.003
972.8647	0.96	0.029
972.8647	0.96	0.029
972.8647	0.96	0.029
936.0322	0.985	0.003
913.8475	0.988	0.001
891.0902	0.976	0.011
853.3722	0.974	0.006
797.5541	0.953	0.002
775.2629	0.941	0.033
775.2629	0.941	0.033
775.2629	0.941	0.033
717.0275	0.919	0.041
698.1751	0.937	0.011
662.3845	0.949	0.004
639.5379	0.936	0.015
610.0509	0.916	0.045
560.327	0.922	0.022
478.1393	0.878	0.084
478.1393	0.878	0.084
448.8653	0.935	0.015
412.7337	0.95	0.011

Table 57: FT-IR peak list for AP1189 oxalate Pattern 2.

Wavenumber	Absolute Intensity	Relative Intensity
3469.2855	0.966	0.015
3388.4016	0.972	0.007
3208.2501	0.969	0
3178.2688	0.964	0.005
3081.3694	0.964	0.025
1717.1041	0.972	0.002
1676.3502	0.94	0.013

1638.0497	0.892	0.096
1638.0497	0.892	0.096
1606.9259	0.92	0.006
1584.1888	0.929	0.006
1526.4462	0.9	0.05
1526.4462	0.9	0.05
1496.0078	0.93	0.024
1496.0078	0.93	0.024
1446.6016	0.945	0.019
1411.6974	0.962	0.005
1350.7637	0.935	0.037
1297.892	0.961	0.01
1268.8868	0.972	0.002
1219.9916	0.933	0.006
1195.0947	0.922	0.055
1133.3026	0.946	0.01
1109.5923	0.949	0.002
1078.7344	0.948	0.01
1040.2025	0.959	0.005
1009.5453	0.967	0.002
970.6392	0.937	0.036
889.7046	0.97	0.012
849.9818	0.963	0.019
838.3275	0.976	0.002
783.9531	0.944	0.025
750.869	0.946	0.019
711.2381	0.894	0.084
711.2381	0.894	0.085
632.4438	0.95	0.01
607.1294	0.947	0.006
532.9389	0.93	0.011
476.4709	0.913	0.053

Table 58: FT-IR peak list for AP1189 oxalate Pattern 4.

Wavenumber	Absolute Intensity	Relative Intensity
3461.2741	0.94	0.007
3433.1516	0.94	0.005
3401.1149	0.939	0.003
3401.1149	0.939	0.003
3118.5203	0.916	0.057
1714.3801	0.927	0.005
1675.5708	0.87	0.023
1621.3503	0.822	0.071
1605.3663	0.825	0.008
1525.658	0.811	0.105
1525.658	0.811	0.105
1494.204	0.842	0.039
1444.5779	0.848	0.049
1414.708	0.885	0.01
1351.0291	0.854	0.055
1335.9272	0.863	0.007
1297.156	0.872	0.025
1188.4546	0.829	0.081
1162.4208	0.854	0.004
1127.9079	0.843	0.022
1080.6836	0.856	0.014
1039.6416	0.865	0.015
1001.676	0.883	0.002
970.2682	0.837	0.053
888.3688	0.874	0.028
849.9282	0.864	0.039
783.2574	0.841	0.052
749.7977	0.853	0.024
699.2885	0.788	0.052
631.9542	0.823	0.01
608.1246	0.812	0.017

570.4806	0.815	0.002
543.3487	0.794	0.01
513.8479	0.793	0.009
466.0991	0.747	0.05
444.8321	0.76	0.007

Table 59: FT-IR peak list for AP1189 (+)-camphor-10-sulfonic acid Pattern 1.

Wavenumber	Absolute Intensity	Relative Intensity
3340.5146	0.896	0.022
3269.6418	0.901	0.011
3133.0809	0.857	0.119
3047.6991	0.92	0.003
3013.6744	0.916	0.006
2958.3394	0.905	0.025
2919.5524	0.919	0.002
2889.1522	0.93	0.002
2828.226	0.951	0.001
2774.1878	0.954	0.001
1746.602	0.779	0.179
1683.0383	0.754	0.139
1625.0654	0.666	0.278
1529.6827	0.652	0.299
1495.1053	0.813	0.095
1455.3026	0.802	0.122
1455.3026	0.802	0.122
1445.0707	0.81	0.023
1416.4506	0.891	0.041
1391.8206	0.914	0.017
1352.9555	0.781	0.152
1336.8328	0.849	0.025
1296.9587	0.879	0.043
1282.3231	0.886	0.011
1226.9819	0.862	0.021

1190.9074	0.666	0.256
1167.1669	0.683	0.06
1152.9806	0.69	0.018
1134.1984	0.724	0.016
1134.1984	0.724	0.016
1134.1984	0.724	0.016
1134.1984	0.724	0.016
1134.1984	0.724	0.016
1134.1984	0.724	0.016
1134.1984	0.724	0.016
1040.839	0.529	0.434
1040.839	0.529	0.434
1040.839	0.529	0.434
1006.9516	0.883	0.021
975.42	0.79	0.135
936.6847	0.937	0.008
889.5805	0.89	0.068
850.4344	0.873	0.081
786.0655	0.752	0.15
753.8361	0.794	0.058
729.8806	0.758	0.083
701.7408	0.676	0.208
651.2693	0.72	0.012
634.9463	0.709	0.022
608.3725	0.684	0.097

Table 60: FT-IR peak list for AP1189 oxoglutarate Pattern 1.

Wavenumber	Absolute Intensity	Relative Intensity
3434.1072	0.973	0.008
3316.28	0.973	0.005
3079.0769	0.965	0.024
2748.1019	0.974	0.001
1974.6528	0.979	0.015

1744.1048	0.973	0.004
1725.7973	0.965	0.004
1711.8043	0.955	0.012
1682.1477	0.936	0.043
1622.6454	0.937	0.012
1599.5051	0.936	0.033
1529.649	0.935	0.056
1529.649	0.935	0.053
1498.9929	0.954	0.018
1447.8637	0.963	0.012
1393.3645	0.956	0.017
1393.3645	0.956	0.017
1360.1431	0.95	0.026
1336.6705	0.957	0.005
1336.6705	0.957	0.005
1298.4765	0.973	0.001
1229.0516	0.968	0.008
1190.0286	0.944	0.034
1159.4946	0.953	0.018
1132.3278	0.964	0.007
1080.9647	0.955	0.021
1027.079	0.973	0.007
1000.7884	0.978	0.002
969.5172	0.958	0.023
969.5172	0.958	0.023
930.5613	0.977	0.004
890.4947	0.972	0.009
828.1089	0.96	0.017
828.1089	0.96	0.017
813.6562	0.973	0.001
779.5765	0.95	0.031
779.5765	0.95	0.032
754.0045	0.961	0.009
711.9895	0.951	0.022

642.9228	0.964	0.004
624.4739	0.967	0.002
606.95	0.964	0.006
589.2528	0.969	0.001
560.2316	0.97	0.006
532.2474	0.967	0.01
467.9573	0.967	0.012
412.8724	0.971	0.012

Table 61: FT-IR peak list for AP1189 DL mandelic acid Pattern 2.

Wavenumber	Absolute Intensity	Relative Intensity
3324.9282	0.82	0.119
3152.8917	0.841	0.014
3069.0933	0.823	0.057
3040.9086	0.824	0.002
3015.6015	0.825	0.001
2979.4458	0.827	0.003
2933.1051	0.84	0.015
2874.4871	0.865	0.009
2786.4381	0.871	0.001
2748.2612	0.871	0.001
2646.4095	0.878	0.001
2609.8399	0.878	0.003
2588.4994	0.879	0.003
1699.5562	0.748	0.037
1674.6619	0.463	0.397
1674.6619	0.463	0.397
1643.6605	0.579	0.06
1606.2055	0.687	0.059
1579.8052	0.734	0.056
1524.8976	0.448	0.485
1524.8976	0.448	0.485
1494.5467	0.631	0.18

1494.5467	0.631	0.18
1454.4981	0.687	0.141
1404.3973	0.733	0.093
1360.7749	0.542	0.069
1346.1451	0.493	0.354
1346.1451	0.493	0.354
1294.554	0.771	0.044
1270.4268	0.83	0.014
1270.4268	0.83	0.014
1246.9404	0.824	0.043
1193.6969	0.575	0.305
1135.9058	0.771	0.055
1114.6922	0.741	0.091
1080.9246	0.714	0.146
1042.4307	0.661	0.211
1002.6618	0.825	0.045
974.7184	0.599	0.284
974.7184	0.599	0.284
929.9534	0.733	0.157
889.4518	0.74	0.135
850.1391	0.662	0.219
783.2	0.518	0.346
755.5291	0.618	0.208
734.8637	0.524	0.292
704.2896	0.44	0.398
646.4857	0.51	0.047
635.2889	0.51	0.206
561.6984	0.661	0.041

Table 62: FT-IR peak list for AP1189 DL-mandelic acid Pattern 3.

Wavenumber	Absolute Intensity	Relative Intensity
3438.9914	0.945	0.004
3414.2546	0.945	0.002

3305.8784	0.934	0.001
3029.7727	0.921	0.05
2736.8009	0.936	0.001
1676.8694	0.871	0.044
1676.8694	0.871	0.044
1624.7713	0.862	0.068
1605.7456	0.87	0.006
1579.8096	0.885	0.007
1525.2321	0.839	0.122
1525.2321	0.839	0.122
1493.2721	0.87	0.036
1453.0437	0.887	0.028
1406.6532	0.895	0.016
1348.6562	0.854	0.065
1335.9744	0.858	0.002
1294.6387	0.896	0.01
1237.9816	0.91	0.005
1191.3174	0.868	0.053
1191.3174	0.868	0.053
1191.3174	0.868	0.053
1132.5099	0.895	0.009
1132.5099	0.895	0.009
1114.6238	0.896	0.004
1080.2331	0.888	0.02
1056.0946	0.896	0.006
1028.7992	0.897	0.003
1001.0851	0.913	0.005
971.5213	0.879	0.04
930.8348	0.902	0.022
888.9418	0.905	0.02
888.9418	0.905	0.02
849.8642	0.89	0.036
781.182	0.866	0.047
750.3994	0.877	0.016

733.4775	0.864	0.013
699.6274	0.834	0.063
699.6274	0.834	0.063
634.7914	0.853	0.009
606.2778	0.849	0.018
568.7299	0.858	0.002
532.1813	0.858	0.003
510.4669	0.856	0.008
469.0286	0.836	0.038
469.0286	0.836	0.038
451.8363	0.844	0.009
407.8772	0.862	0.01

Table 63: FT-IR peak list for AP1189 hippuric acid Pattern 1.

Wavenumber	Absolute Intensity	Relative Intensity
3478.5092	0.986	0.004
3462.8585	0.987	0.002
3391.5891	0.98	0.014
3351.9339	0.983	0.003
2019.2428	0.988	0.01
1692.0022	0.965	0.016
1625.0168	0.953	0.026
1625.0168	0.953	0.026
1573.5216	0.97	0.005
1560.279	0.972	0.001
1523.7117	0.952	0.042
1483.5359	0.963	0.015
1453.7204	0.974	0.004
1445.2105	0.973	0.011
1395.626	0.953	0.034
1395.626	0.953	0.034
1348.9271	0.971	0.012
1320.0629	0.98	0.003

1296.3458	0.98	0.002
1272.1234	0.985	0.002
1243.1359	0.983	0.003
1199.7151	0.973	0.015
1165.661	0.983	0.003
1136.9015	0.98	0.008
1114.0689	0.984	0.002
1082.649	0.982	0.006
1042.5752	0.987	0.004
982.3329	0.98	0.011
938.7359	0.985	0.005
888.4103	0.982	0.007
850.5125	0.981	0.009
783.0247	0.979	0.011
751.2867	0.975	0.007
729.0162	0.977	0.005
708.0583	0.967	0.003
696.2757	0.966	0.024
656.1822	0.973	0.009
637.5248	0.975	0.004
599.4983	0.976	0.005
576.4886	0.975	0.003
552.808	0.973	0.009
552.808	0.973	0.009
517.638	0.978	0.003
489.6767	0.973	0.005
467.5258	0.967	0.021
434.7231	0.975	0.007

Table 64: FT-IR peak list for AP1189 formic acid Pattern 1.

Wavenumber	Absolute Intensity	Relative Intensity
3432.3814	0.874	0.059
2981.6644	0.826	0.129

2812.6797	0.836	0.033
2723.0736	0.852	0.015
2631.8709	0.857	0.013
1676.7328	0.763	0.047
1627.8235	0.584	0.226
1605.8813	0.663	0.018
1581.7727	0.741	0.007
1531.3788	0.582	0.318
1531.3788	0.582	0.318
1493.4246	0.626	0.148
1493.4246	0.626	0.148
1447.5484	0.711	0.078
1351.0058	0.58	0.348
1351.0058	0.58	0.348
1296.5694	0.798	0.03
1271.9368	0.835	0.018
1242.541	0.824	0.042
1199.1381	0.669	0.205
1138.5633	0.799	0.019
1120.1193	0.727	0.114
1081.2687	0.762	0.077
1043.2571	0.789	0.064
999.926	0.847	0.024
973.6776	0.682	0.209
935.6882	0.864	0.019
890.7174	0.801	0.094
851.1643	0.801	0.021
807.8253	0.725	0.059
767.7829	0.633	0.201
712.4497	0.582	0.284
712.4497	0.582	0.238
698.69	0.6	0.029
640.9999	0.697	0.057
610.1032	0.674	0.105

610.1032	0.674	0.105
594.6837	0.736	0.009
545.17	0.683	0.078
486.8537	0.731	0.033
472.0881	0.681	0.103
448.1613	0.733	0.05
403.3132	0.771	0.003

Table 65: FT-IR peak list for AP1189 L-lactic acid Pattern 1.

Wavenumber	Absolute Intensity	Relative Intensity
3443.026	0.899	0.022
3301.6603	0.841	0.122
3104.1943	0.855	0.006
3077.6911	0.848	0.037
2980.2002	0.87	0.015
2964.0623	0.876	0.005
2930.9886	0.889	0.006
2865.3491	0.891	0.001
2846.9568	0.888	0.013
2790.497	0.892	0.002
2748.4106	0.891	0.001
2685.0933	0.894	0.004
1703.147	0.711	0.162
1678.0314	0.715	0.101
1625.7241	0.631	0.188
1607.9149	0.703	0.037
1527.4719	0.564	0.388
1527.4719	0.564	0.388
1495.0557	0.684	0.108
1458.6145	0.693	0.143
1445.9522	0.703	0.069
1403.0228	0.741	0.091
1359.487	0.668	0.184

1359.487	0.668	0.184
1336.7196	0.752	0.051
1291.4634	0.749	0.115
1270.3898	0.832	0.01
1237.741	0.848	0.025
1200.7797	0.734	0.143
1165.9727	0.845	0.022
1119.7668	0.659	0.225
1089.3157	0.769	0.042
1043.8629	0.783	0.106
1031.9237	0.838	0.013
975.0628	0.711	0.189
956.7339	0.794	0.066
956.7339	0.794	0.066
888.356	0.826	0.077
876.9653	0.874	0.008
848.4237	0.721	0.15
796.0445	0.819	0.013
775.3283	0.708	0.161
750.9077	0.712	0.14
717.6257	0.618	0.193
700.7775	0.675	0.041
656.2251	0.745	0.024
633.1683	0.701	0.045
611.8089	0.658	0.118
586.2594	0.669	0.05
532.3279	0.701	0.019

Table 66: FT-IR peak list for AP1189 DL-lactic acid Pattern 1.

Wavenumber	Absolute Intensity	Relative Intensity
3282.8423	0.848	0.114
3137.2294	0.891	0.002
3106.7371	0.878	0.007

3078.3359	0.874	0.026
3054.1371	0.876	0.003
2980.1703	0.887	0.016
2959.8998	0.886	0.019
2928.186	0.906	0.006
2863.9284	0.907	0.01
2830.9054	0.914	0.001
2767.7562	0.911	0.002
1706.6962	0.769	0.13
1677.4684	0.777	0.089
1628.5031	0.704	0.167
1606.954	0.769	0.032
1527.8575	0.642	0.325
1527.8575	0.642	0.325
1494.7078	0.744	0.096
1494.7078	0.744	0.096
1456.7346	0.751	0.124
1446.5759	0.758	0.027
1409.4495	0.755	0.114
1409.4495	0.755	0.114
1359.0736	0.728	0.16
1336.0661	0.8	0.04
1299.0075	0.825	0.075
1284.0812	0.848	0.01
1269.9398	0.876	0.009
1237.0916	0.883	0.024
1202.4033	0.78	0.132
1168.1212	0.879	0.02
1118.8217	0.697	0.219
1088.5536	0.819	0.048
1046.0438	0.799	0.12
1046.0438	0.799	0.12
1046.0438	0.799	0.12
1032.0492	0.873	0.012

1000.5308	0.911	0.007
975.3702	0.747	0.182
975.3702	0.747	0.182
957.32	0.837	0.064
887.9494	0.86	0.071
877.4801	0.897	0.011
848.442	0.755	0.17
827.5387	0.842	0.018
797.1482	0.851	0.026
775.3905	0.776	0.109
750.5948	0.757	0.132
718.7205	0.669	0.174
718.7205	0.669	0.174

Table 67: FT-IR peak list for AP1189 glutaric acid Pattern 1.

Wavenumber	Absolute Intensity	Relative Intensity
3451.4823	0.909	0.051
3273.8599	0.904	0.035
3247.2814	0.908	0.001
3213.4294	0.908	0.005
2950.2826	0.884	0.09
2772.9078	0.908	0.002
1983.7185	0.959	0.001
1945.1815	0.956	0.01
1912.7557	0.958	0.004
1681.2131	0.733	0.119
1632.9309	0.694	0.203
1608.0157	0.79	0.018
1555.0838	0.833	0.029
1525.973	0.679	0.273
1525.973	0.679	0.273
1493.208	0.753	0.082
1493.208	0.753	0.082

1453.6917	0.765	0.12
1453.6917	0.765	0.12
1411.5581	0.797	0.084
1411.5581	0.797	0.084
1347.2594	0.773	0.016
1340.1909	0.771	0.137
1306.3792	0.834	0.038
1265.4491	0.856	0.047
1223.6023	0.766	0.045
1192.895	0.728	0.137
1148.2185	0.704	0.212
1148.2185	0.704	0.212
1081.9008	0.812	0.043
1041.9241	0.824	0.044
1024.5139	0.83	0.019
997.3686	0.859	0.017
969.7962	0.784	0.105
926.2335	0.868	0.048
889.0404	0.889	0.037
889.0404	0.889	0.037
852.9313	0.827	0.092
804.882	0.811	0.037
785.2951	0.749	0.136
785.2951	0.749	0.136
785.2951	0.749	0.136
751.9143	0.744	0.132
751.9143	0.744	0.132
727.2603	0.746	0.125
682.267	0.746	0.07
640.5213	0.77	0.055
640.5213	0.77	0.055
610.3421	0.801	0.039
520.4538	0.75	0.051

Table 68: FT-IR peak list for AP1189 glutaric acid Pattern 2.

Wavenumber	Absolute Intensity	Relative Intensity
3430.3134	0.879	0.076
3288.1782	0.887	0.052
3209.4296	0.905	0.008
3132.4855	0.911	0.008
3113.8608	0.911	0.004
3016.0295	0.878	0.093
2941.5484	0.884	0.025
2922.1175	0.889	0.012
2872.472	0.906	0.005
2769.5575	0.902	0.014
1678.217	0.671	0.146
1630.5087	0.636	0.248
1552.6043	0.798	0.045
1527.0178	0.612	0.325
1493.0553	0.67	0.138
1452.4984	0.712	0.136
1409.1509	0.762	0.093
1352.9723	0.691	0.205
1352.9723	0.691	0.205
1318.4605	0.804	0.028
1318.4605	0.804	0.028
1298.4179	0.83	0.029
1267.3811	0.835	0.049
1229.3818	0.752	0.043
1194.241	0.642	0.213
1131.5232	0.615	0.284
1131.5232	0.615	0.284
1131.5232	0.615	0.284
1081.7286	0.706	0.058
1047.651	0.772	0.024
1047.651	0.772	0.024

1047.651	0.772	0.024
1026.3725	0.78	0.04
1011.9658	0.808	0.013
967.7876	0.745	0.114
926.12	0.802	0.096
889.4235	0.836	0.066
852.4417	0.747	0.149
802.3239	0.762	0.059
802.3239	0.762	0.059
782.8912	0.642	0.227
782.8912	0.642	0.227
752.8624	0.706	0.134
724.9698	0.638	0.213
702.3892	0.718	0.076
665.9727	0.695	0.02
641.3229	0.66	0.148
609.8383	0.756	0.033
550.6147	0.558	0.342
550.6147	0.558	0.342

Claims

1. A crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 11.5 $\pm$ 0.2, 23.5 $\pm$ 0.2, and 27.0 $\pm$ 0.2.
2. The crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate according to claim 1 further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 11.7 $\pm$ 0.2, 15.6 $\pm$ 0.2, and 24.8 $\pm$ 0.2.
3. The crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate according to any one of the preceding claims further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 13.0 $\pm$ 0.2, 15.5 $\pm$ 0.2, 16.2 $\pm$ 0.2, 19.6 $\pm$ 0.2, 20.0 $\pm$ 0.2, and 21.1 $\pm$ 0.2.
4. The crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate according to any one of the preceding claims exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 1.
5. The crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate according to any one of the preceding claims substantially free of a second crystalline form of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate, wherein the second form exhibits X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 14.9 $\pm$ 0.2, 18.0 $\pm$ 0.2, and/or 24.2 $\pm$ 0.2.
6. The crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate according to any one of the preceding claims exhibiting in differential scanning calorimetry an onset temperature between 185 and 199 °C using a heating rate of 10 °C per minute.

- 5 7. The crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate according to any one of the preceding claims exhibiting in differential scanning calorimetry an onset temperature of substantially 192 °C using a heating rate of 10 °C per minute.
- 10 8. A crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation at 9.7±0.2, 22.8±0.2, and 26.7±0.2.
- 15 9. The crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate according to claim 8 further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 5.4±0.2, 13.4±0.2, 16.3±0.2, and 19.5±0.2.
- 20 10. The crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate according to any one of claims 8 and 9 further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 12.2±0.2, 15.8±0.2, 21.8±0.2, and 28.5±0.2.
- 25 11. The crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate according to any one of claim 8 to 10 the preceding claims exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K_α radiation according to FIG 6.
- 30 12. The crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate according to any one of claims 8 to 11 exhibiting in differential scanning calorimetry an onset temperature between 187 and 201 °C using a heating rate of 10 °C per minute.
- 35 13. The crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate according to any one of claims 8 to 12 exhibiting in

differential scanning calorimetry an onset temperature of substantially 195 °C using a heating rate of 10 °C per minute.

- 5 14. A method for producing the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A according to any one of claims 1 to 7 comprising:
- i. mixing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine and acetic acid in a solvent to form a mixture; and
 - 10 ii. isolating the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A from said mixture.
- 15 15. A method for producing the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A according to any one of claims 1 to 7 comprising:
- i. mixing a *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt and acetic acid in a solvent to form a mixture; and
 - 20 ii. isolating the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A from the mixture.
- 25 16. A method for producing the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A according to any one of claims 1 to 7 comprising:
- i. mixing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate in a solvent to form a composition; and
 - 30 ii. isolating the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A from said composition.
- 35 17. A method for producing the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A according to any one of claims 1 to 7 comprising:
- i. mixing 3-[1-(2-nitrophenyl)-1-*H*-pyrrole-2-yl]-propanal, amino guanidine or a salt thereof, and acetic acid or a salt thereof in a solvent, and
 - 35 ii. isolating the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A from said composition.

18. A method for producing the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A according to any one of claims 1 to 7 comprising:
- 5 i. providing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine or an *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt,
 - ii. introducing acetate as a counter ion using ion exchange, and
 - iii. isolating *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate of crystalline Form A.
- 10
19. A method for producing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate of crystalline Form B according to any one of claims 8 to 13 comprising:
- 15 i. mixing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine and succinic acid in a solvent to form a mixture; and
 - ii. isolating the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate of crystalline Form B from the mixture.
- 20
20. A method for producing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate of crystalline Form B according to any one of claims 8 to 13 comprising:
- i. mixing a *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt and succinic acid in a solvent to form a mixture,
 - 25 and
 - ii. isolating the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate of crystalline Form B from the mixture.
21. A method for producing the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate of crystalline Form B according to any one of claims 8 to 13 comprising:
- 30 i. mixing 3-[1-(2-nitrophenyl)-1-*H*-pyrrole-2-yl]-propanal, amino guanidine or a salt thereof, and succinic acid or a salt thereof in a solvent, and

- ii. isolating the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate of crystalline Form B from said composition.

5 22. A method for producing the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate of crystalline Form B according to any one of claims 8 to 13 comprising:

- 10 i. providing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine or an *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt,
- ii. introducing succinate as a counter ion using ion exchange, and
- 15 iii. isolating *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate of crystalline Form B.

15 23. The method according to any one of claims 14 to 22, wherein the solvent is a protic or a polar aprotic solvent.

20 24. The method according to any one of claims 14 to 23, wherein the solvent is selected from the group consisting of 1,4-dioxane, methanol, ethanol, 1-propanol, 2-propanol, acetone, acetonitrile, anisole, isopropyl acetate, methylethyl ketone, water, and ethyl acetate.

25 25. The method according to any one of claims 14 to 24, wherein the mixture or the composition is heated at least once before the isolating step.

26. The method according to any one of claims 14 to 25, wherein the mixture or the composition is heated and cooled in cycles for 15 min to 72 hours before the isolating step.

30 27. The method according to claim 26, wherein the heating is to about 40 °C, to about 60 °C, or to about 80 °C.

28. The method according to claim 26, wherein the cooling is to about 20 °C.

29. The method according to any one of claims 14 to 28, further comprising a step of adding an anti-solvent to the mixture or the composition before the isolation step.
- 5 30. The method according to claim 29, wherein the anti-solvent is a non-polar aprotic solvent.
31. The method according to claim 29, wherein the anti-solvent is water.
- 10 32. The method according to any one of claims 29 and 30, wherein the anti-solvent is selected from the group consisting of *tert*-butyl methyl ether, THF, and acetone, and mixtures comprising *tert*-butyl methyl ether, THF, or acetone.
- 15 33. The method according to any one of claims 14 to 32, wherein the isolation is carried out using filtration, centrifugation, and/or evaporation of the solvent or solvents.
- 20 34. The method according to claim 33, wherein the evaporation is carried out using spray drying, fluid bed drying, freeze drying, vacuum drying, tumble drying, rotary evaporation, and/or thin-film drying.
- 25 35. The method according to any one of claims 14 to 34, wherein the pK_a value of the corresponding acid to the counter ion of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt is about equal to or lower than the pK_a value of succinic acid and/or acetic acid.
- 30 36. The method according to claim 35 wherein the pK_a value of the corresponding acid to the counter ion of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt is lower than the pK_a value of succinic acid and/or acetic acid.
37. The method according to any one of claims 14 to 36, further comprising the step of adding a seed crystal of crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate or a seed crystal of crystalline

Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate.

5 38. A crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate produced by the method of any one of claims 14 to 18 and 23 to 37.

10 39. A crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate produced by the method of any one of claims 19 to 37.

15 40. A pharmaceutical composition comprising the crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate according to any one of claims 1 to 7 and 38, and a pharmaceutically acceptable excipient.

20 41. A pharmaceutical composition comprising the crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate according to any one of claims 8 to 13 and 39, and a pharmaceutically acceptable excipient.

25 42. A pharmaceutical composition prepared by mixing the crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate and/or the crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate in a pharmaceutically acceptable solvent.

43. The pharmaceutical composition according to any one of claims 40 to 42, wherein the pharmaceutical composition is for oral administration.

30 44. A method of preparing a pharmaceutical composition, said method comprising mixing the crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate according to any one of claims 1 to 7 and 38 and a pharmaceutically acceptable excipient.

45. A method of preparing a pharmaceutical composition, said method comprising mixing the crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate according to any one of claims 8 to 13 and 39, and a pharmaceutically acceptable excipient.
- 5
46. The crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate according to any one of claims 1 to 7 and 38, the crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate according to any one of claims 8 to 13 and 39, or
- 10 the pharmaceutical composition according to any one of claims 40 to 43 for use in medicine.
47. The crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate according to any one of claims 1 to 7 and 38, the
- 15 crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate according to any one of claims 8 to 13 and 39, or the pharmaceutical composition according to any one of claims 40 to 43 for use in the treatment of a kidney disease, an arthritic disease, a cardiovascular disease, atherosclerosis, a viral disease or disorder, or a systemic inflammatory
- 20 disorder.
48. The use according to claim 47, wherein the kidney disease is selected from the group consisting of:
- 25
- i. kidney disease presenting with proteinuria,
 - ii. proteinuric kidney disease,
 - iii. glomerular disease,
 - iv. nephrotic syndrome (glomerulonephrosis),
 - v. primary nephrotic syndrome (primary glomerulonephrosis),
 - vi. secondary nephrotic syndrome (secondary glomerulonephrosis),
 - 30 vii. an inflammatory kidney disease,
 - viii. glomerulonephritis (GN), and
 - ix. idiopathic membranous nephropathy (iMN).
49. The use according to claim 48, wherein said primary nephrotic syndrome is
- 35 membranous glomerulonephritis (MGN) (or membranous nephropathy (MN)),

focal segmental glomerulosclerosis (FSGS), membranoproliferative glomerulonephritis (MPGN) (mesangiocapillary glomerulonephritis), rapidly progressive glomerulonephritis (RPGN) (crescentic GN), or minimal change disease (MCD).

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50. The use according to claim 49, wherein said membranoproliferative glomerulonephritis (MPGN) is selected from Type 1 MPGN and Type 2 MPGN.

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51. The use according to claim 48, wherein said secondary nephrotic syndrome is caused by an underlying autoimmune disease, an underlying cancer disease, an underlying genetic disorder, or by an underlying disease selected from the group consisting of: Systemic lupus erythematosus (SLE), Diabetic nephropathy, Sarcoidosis, Sjögren's syndrome, Amyloidosis, Multiple myeloma, Vasculitis, Cancer and Genetic disorders (such as congenital nephrotic syndrome).

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52. The use according to claim 48, where said secondary nephrotic syndrome is caused by Diabetic nephropathy, by an infection, such as a urinary tract infection, such as an infection selected from the group consisting of HIV, syphilis, hepatitis such as hepatitis A, B and C, post-streptococcal infection, urinary schistosomiasis and Ebola. In some embodiments said secondary nephrotic syndrome is drug-induced.

25

53. The use according to claim 48, wherein said glomerulonephritis is selected from the group consisting of IgA nephropathy (Berger's disease), IgM nephropathy, Post-infectious glomerulonephritis and thin basement membrane disease.

30

54. The use according to claim 47, wherein the arthritic disease is selected from the group consisting of:

- i. an auto-immune disease and/or an inflammatory disease that presents with joint inflammation,
- ii. inflammatory arthritis,
- iii. degenerative arthritis,
- iv. metabolic arthritis,
- v. reactive arthritis,

35

- vi. infectious arthritis, and
- vii. arthritis as part of a systemic inflammatory disease.

5 55. The use according to claim 54, wherein the inflammatory arthritis is selected from the group consisting of Rheumatoid Arthritis (RA), Psoriatic Arthritis, and Ankylosing Spondylitis.

10 56. The use according to claim 55, wherein the rheumatoid arthritis is severe active RA (CDAI > 22).

57. The use according to claim 55, wherein the rheumatoid arthritis is RA with a DAS28 score of above 5.1.

15 58. The use according to claim 55, wherein the rheumatoid arthritis is juvenile rheumatoid arthritis (JRA).

59. The use according to claim 54, wherein the degenerative arthritis is osteoarthritis.

20 60. The use according to claim 54, wherein the metabolic arthritis is gouty arthritis.

61. The use according to claim 54, wherein the reactive and/or infectious arthritis is arthritis associated with infection with one or more of Hepatitis C, Chlamydia, gonorrhoea, salmonella or shigella.

25 62. The use according to claim 54, wherein the inflammatory disease is selected from the group consisting of systemic lupus erythematosus, mixed connective tissue disease, Still's disease, and Polymyalgia Rheumatica.

30 63. The use according to claim 47, wherein the viral disease or disorder is selected from the group consisting of:

- i. a symptomatic viral disease or disorder,
- ii. a symptomatic viral disease or disorder with inflammation,
- iii. an inflammatory viral disease or disorder,
- 35 iv. a viral respiratory infection,

- 5 v. a viral respiratory disease or disorder,
 vi. a viral disease or disorder of the lung,
 vii. a viral disease or disorder with inflammation in the respiratory system,
 viii. a viral disease or disorder with one or more respiratory symptoms,
 ix. severe disease,
 x. critical disease,
 xi. viral pneumonia,
 xii. viral bronchiolitis,
 xiii. viral diseases or disorders with respiratory failure,
10 xiv. acute respiratory distress syndrome (ARDS),
 xv. viral acute respiratory distress syndrome (ARDS),
 xvi. symptomatic COVID-19 with acute respiratory distress syndrome
 (ARDS),
 xvii. a viral disease or disorder with systemic inflammatory distress syndrome
15 (SIDS) and/or sepsis,
 xviii. a viral disease or disorder with pulmonary insufficiency,
 xix. a viral disease or disorder with cytokine release syndrome (CRS) and/or
 a cytokine storm (hypercytokinemia),
 xx. a viral disease or disorder caused by a viral infection selected from the
20 group consisting of Severe Acute Respiratory Syndrome CoronaVirus 2
 (SARS-CoV-2); SARS-CoV, MERS-CoV, the dengue virus and influenza
 virus (including Type A, Type B and Type C).
- 25 64. The use according to claim 63, wherein the inflammation is hyperinflammation,
 such as hyperinflammation in one or more organs.
- 30 65. The use according to claim 64, wherein the one or more organs is selected from
 the group consisting of lungs, the respiratory tract, kidney, liver, pancreas,
 spleen, exocrine glands, endocrine glands, lymph nodes, brain, heart, muscles,
 bone marrow, skin, skeleton, bladder, reproduction organs including the
 fallopian tubes, eye, ear, vascular system, the gastrointestinal tract including
 small intestines, colon, rectum, canalis analis and the prostate gland.
- 35 66. The use according to claim 63, wherein the viral respiratory infection is viral
 lower respiratory infection.

- 5 67. The use according to claim 63, wherein the viral disease or disorder with inflammation in the respiratory system is a viral disease or disorder with inflammation in the respiratory system in the lungs and/or respiratory tract.
68. The use according to claim 63, wherein said one or more respiratory symptoms are selected from the group consisting of cough, dry cough, dyspnea, impaired oxygenation, respiratory illness, respiratory dysfunction, respiratory failure, respiratory syndrome and acute respiratory disease (ARD).
- 10 69. The use according to claim 63, wherein said severe disease present with dyspnoea, increased respiratory frequency, reduced blood oxygen saturation and/or lung infiltrates.
- 15 70. The use according to claim 63, wherein said critical disease present with respiratory failure, septic shock, and/or multiple organ dysfunction (MOD) or multiple organ failure (MOF).
- 20 71. The use according to claim 47, wherein the cardiovascular disease is selected from the group consisting of:
- i. coronary artery diseases (CAD),
 - ii. stroke,
 - iii. heart failure,
 - iv. hypertensive heart disease,
 - 25 v. rheumatic heart disease,
 - vi. cardiomyopathy,
 - vii. abnormal heart rhythms,
 - viii. congenital heart disease,
 - ix. valvular heart disease,
 - 30 x. carditis,
 - xi. aortic aneurysms,
 - xii. peripheral artery disease,
 - xiii. vascular disease,
 - xiv. thromboembolic disease,
 - 35 xv. venous thrombosis,

- xvi. vascular inflammation, and
- xvii. atherosclerotic cardiovascular disease.

5 72. The use according to claim 71, wherein the coronary artery diseases (CAD) is selected from the group consisting of angina and myocardial infarction.

73. The use according to claim 71, wherein the atherosclerotic cardiovascular disease is selected from the group consisting of coronary artery disease, stroke (cerebrovascular disease), and peripheral artery disease.

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74. The use according to claim 47, wherein the systemic inflammatory disorder is an autoimmune disorder.

15 75. The use according to claim 47, wherein the systemic inflammatory disorder is selected from the group consisting of Behçet disease, sarcoidosis, systemic lupus erythematosus, juvenile idiopathic arthritis, scleroderma, Sjögren syndrome, myositis including dermatomyositis and polymyositis, vasculitis, giant cell arteritis, ankylosing spondylitis, polymyalgia rheumatic and psoriatic arthritis.

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76. A method of treating a disease or disorder in a subject in need thereof, said method comprising administering crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate according to any one of claims 1 to 7 and 38, crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate according to any one of claims 8 to 13 and 39, or the pharmaceutical composition according to any one of claims 40 to 43 to a subject in need thereof.

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30 77. The method according to claim 74 wherein the disease or disorder is selected from the list consisting of a kidney disease, an arthritic disease, a cardiovascular disease, atherosclerosis, a viral disease or disorder, or a systemic inflammatory disorder.

35 78. Use of the crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate according to any one of claims 1 to 7 and

38, the crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate according to any one of claims 8 to 13 and 39, or the pharmaceutical composition according to any one of claims 40 to 43 for the manufacture of a medicament for treatment of a disease or disorder.

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79. A crystalline form of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate, wherein the crystalline form is selected from the group consisting of:

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- i. crystalline Form I exhibiting X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation at one or more of 11.5±0.2, 11.7±0.2, 12.9±0.2, 14.9±0.2, 15.4±0.2, 15.6±0.2, 18.0±0.2, 19.9±0.2, 20.0±0.2, 21.1±0.2, 21.5±0.2, 21.8±0.2, 22.4±0.2, 23.5±0.2, 24.2±0.2, 24.7±0.2, and 26.9±0.2, and

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- ii. crystalline Form II exhibiting X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation at one or more of 7.5±0.2, 9.4±0.2, 12.8±0.2, 13.3±0.2, 14.2±0.2, 15.3±0.2, 16.0±0.2, 17.0±0.2, 18.8±0.2, 19.7±0.2, 20.3±0.2, 21.1±0.2, 21.4±0.2, 21.9±0.2, 22.0±0.2, 22.7±0.2, and 23.1±0.2.

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80. A compound *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate.

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81. A compound *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium tosylate.

82. A compound *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium fumarate.

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83. The compound *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate according to claim 80, wherein the compound is on solid form.

84. The compound *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate according to claim 83, wherein the compound is on amorphous solid form.
- 5 85. A crystalline Form C of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium tosylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 14.5 ± 0.2 , 21.0 ± 0.2 , and 25.2 ± 0.2 .
- 10 86. The crystalline Form C of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium tosylate according to claim 85, further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group consisting of 13.4 ± 0.2 and 16.0 ± 0.2 .
- 15 87. The crystalline Form C of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium tosylate according to any one of claims 85 and 86, further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation selected from the group
- 20 consisting of 8.0 ± 0.2 , 9.4 ± 0.2 , 10.0 ± 0.2 , 15.3 ± 0.2 , 16.7 ± 0.2 , 17.6 ± 0.2 , 19.2 ± 0.2 , 19.8 ± 0.2 , 21.3 ± 0.2 , and 25.4 ± 0.2 .
- 25 88. The crystalline Form C of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium tosylate according to any one of claims 85 to 87 exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K α radiation according to FIG 4.
- 30 89. The crystalline Form C of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium tosylate according to any one of claims 85 to 88 exhibiting in differential scanning calorimetry an onset temperature between 227 and 241 °C using a heating rate of 10 °C per minute.
90. The crystalline Form C of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium tosylate according to any one of claims 85 to 89, exhibiting in

differential scanning calorimetry an onset temperature of substantially 234 °C using a heating rate of 10 °C per minute.

- 5 91. A crystalline Form D of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium fumarate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation at 17.6±0.2, 21.2±0.2, and 26.3±0.2.
- 10 92. The crystalline Form D of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium fumarate according to claim 91, further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 11.5±0.2, 21.9±0.2, and 23.9±0.2.
- 15 93. The crystalline Form D of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium fumarate according to any one of claims 91 and 92, further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation selected from the group consisting of 9.2±0.2, 10.5±0.2, 10.9±0.2, 11.9±0.2, 15.8±0.2, 18.7±0.2, 20 19.4±0.2, 23.4±0.2, and 24.5±0.2.
- 25 94. The crystalline Form D of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium fumarate according to any one of claims 91-93 exhibiting an X-ray pattern (2-theta values) in a powder diffraction when measured using Cu K_α radiation according to FIG 5.
- 30 95. The crystalline Form D of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium fumarate according to any one of claims 91 to 94 exhibiting in differential scanning calorimetry an onset temperature between 208 and 222 °C using a heating rate of 10 °C per minute.
- 35 96. The crystalline Form D of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium fumarate according to any one of claims 91 to 95, exhibiting in differential scanning calorimetry an onset temperature of substantially 215 °C using a heating rate of 10 °C per minute.

- 5 97. A liquid formulation prepared from mixing the crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate according to any one of claims 1 to 7 and 38 or the crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate according to any one of claims 8 to 13 and 39 and a solvent.
- 10 98. A method of preparing a liquid formulation, said method comprising mixing the crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate according to any one of claims 1 to 7 and 38 or the crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate according to any one of claims 8 to 13 and 39 and a solvent.
- 15 99. A method of preparing an amorphous form of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate, said method comprising converting the crystalline Form A of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate according to any one of claims 1 to 7 and 38 to the amorphous form of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium acetate.
- 20 100. A method of preparing an amorphous form of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate, said method comprising converting the crystalline Form B of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate according to any one of claims 8 to 13 and 39 to the amorphous form of *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium succinate.
- 25 101. A crystalline Form of an *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt selected from the group consisting of:
- 30 i. a crystalline Form XIV of AP1189 besylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_α radiation at 13.0±0.2, 15.1±0.2, and 19.9±0.2,

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- ii. a crystalline Form XIX of AP1189 oxoglutarate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 16.8 ± 0.2 , 23.4 ± 0.2 , and 23.6 ± 0.2 ,
 - iii. a crystalline Form XX of AP1189 DL-mandelic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 14.8 ± 0.2 , 24.2 ± 0.2 , and 25.5 ± 0.2 ,
 - iv. a crystalline Form XXII of AP1189 hippuric exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 20.1 ± 0.2 , 24.1 ± 0.2 , and 24.5 ± 0.2 ,
 - v. a crystalline Form XXIII of AP1189 formate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 13.3 ± 0.2 , 15.1 ± 0.2 , and 25.6 ± 0.2 ,
 - vi. a crystalline Form XXIV of AP1189 L-lactic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 3.8 ± 0.2 , 9.9 ± 0.2 , and 11.9 ± 0.2 ,
 - vii. a crystalline Form XXV of AP1189 DL-lactic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 9.8 ± 0.2 , 11.9 ± 0.2 , and 27.6 ± 0.2 ,
 - viii. a crystalline Form XXVI of AP1189 glutaric acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 8.3 ± 0.2 , 15.9 ± 0.2 , and 21.9 ± 0.2 , and
 - ix. a crystalline Form XXIX of AP1189 adipic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 13.4 ± 0.2 , 14.5 ± 0.2 , and 25.5 ± 0.2 .
102. A crystalline Form of an *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt selected from the group consisting of:
- i. a crystalline Form III of AP1189 napadisylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 13.4 ± 0.2 , 22.2 ± 0.2 , and 26.8 ± 0.2 ,
 - ii. a crystalline Form IV of AP1189 napadisylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 5.4 ± 0.2 , 15.6 ± 0.2 , and 23.4 ± 0.2 ,

- iii. a crystalline Form V of AP1189 esylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 14.5 ± 0.2 , 16.5 ± 0.2 , and 18.6 ± 0.2 ,
- 5 iv. a crystalline Form VI of AP1189 edisylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 4.8 ± 0.2 , 12.8 ± 0.2 , and 16.5 ± 0.2 ,
- v. a crystalline Form VII of AP1189 edisylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 6.1 ± 0.2 , 15.7 ± 0.2 , and 23.6 ± 0.2 ,
- 10 vi. a crystalline Form VIII of AP1189 edisylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 15.5 ± 0.2 , 20.7 ± 0.2 , and 21.7 ± 0.2 ,
- vii. a crystalline Form IX of AP1189 edisylate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 4.5 ± 0.2 , 16.7 ± 0.2 , and 24.7 ± 0.2 ,
- 15 viii. a crystalline Form X of AP1189 nitrate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 15.3 ± 0.2 , 21.4 ± 0.2 , and 25.1 ± 0.2 ,
- ix. a crystalline Form XI of AP1189 cyclamate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 7.0 ± 0.2 , 13.8 ± 0.2 , and 15.7 ± 0.2 ,
- 20 x. a crystalline Form XII of AP1189 cyclamate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 7.3 ± 0.2 , 15.3 ± 0.2 , and 17.9 ± 0.2 ,
- 25 xi. a crystalline Form XIII of AP1189 cyclamate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 15.3 ± 0.2 , 18.5 ± 0.2 , and 18.7 ± 0.2 ,
- xii. a crystalline Form XV of AP1189 oxalate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 19.5 ± 0.2 , 23.3 ± 0.2 , and 25.8 ± 0.2 ,
- 30 xiii. a crystalline Form XVI of AP1189 oxalate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K α radiation at 17.1 ± 0.2 , 17.9 ± 0.2 , and 19.6 ± 0.2 ,

- xiv. a crystalline Form XVII of AP1189 oxalate exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_{α} radiation at 6.3 ± 0.2 , 10.6 ± 0.2 , and 19.8 ± 0.2 ,
- 5 xv. a crystalline Form XVIII of AP1189 (+)-camphor-10-sulfonic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_{α} radiation at 6.5 ± 0.2 , 11.5 ± 0.2 , and 14.8 ± 0.2 ,
- 10 xvi. a crystalline Form XXI of AP1189 DL-mandelic acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_{α} radiation at 5.4 ± 0.2 , 10.0 ± 0.2 , and 24.6 ± 0.2 ,
- xvii. a crystalline Form XXVII of AP1189 glutaric acid further exhibiting one or more X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_{α} radiation selected from the group consisting of 16.9 ± 0.2 , 25.6 ± 0.2 , 27.1 ± 0.2 , 28.2 ± 0.2 , and 28.7 ± 0.2 , and
- 15 xviii. a crystalline Form XXVIII of AP1189 glutaric acid exhibiting at least X-ray lines (2-theta values) in a powder diffraction pattern when measured using Cu K_{α} radiation at 14.2 ± 0.2 , 16.9 ± 0.2 , and 24.5 ± 0.2 .
103. A composition comprising the crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt according to any one of claims 101 and 102.
- 20 104. A pharmaceutical composition comprising the crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt according to any one of claims 101 and 102.
- 25 105. The composition according to claim 103 or the pharmaceutical composition according to claim 104, wherein the composition or the pharmaceutical composition is a liquid composition.
- 30 106. The composition or pharmaceutical composition according to claim 105, wherein the liquid composition is a slurry or a solution.
- 35 107. A unit dosage form comprising the pharmaceutical composition according to claim 105 and a pharmaceutically acceptable carrier or excipient.

108. An oral formulation comprising the crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt according to any one of claims 101 and 102.
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109. The crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt according to any one of claims 101 and 102, the composition according to claim 103, the pharmaceutical composition according to claim 105, the unit dosage form according to claim 107, or the oral
- 10 formulation according to claim 108, for use in medicine.
110. The crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt according to any one of claims 101 and 102, the composition according to claim 103, the pharmaceutical composition
- 15 according to claim 105, the unit dosage form according to claim 107, or the oral formulation according to claim 108, for use in the treatment of a kidney disease, an arthritic disease, a cardiovascular disease, atherosclerosis, a viral disease or disorder, or a systemic inflammatory disorder.
- 20 111. The crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt for use according to claim 110, wherein the arthritic disease is rheumatoid arthritis.
- 25 112. The crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt for use according to claim 110, wherein the treatment is of treatment of rheumatoid arthritis in a subject with an inappropriate response to MTX.
- 30 113. The crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt for use according to claim 112, wherein the inappropriate response to MTX is reduced response to MTX treatment, such as an MTX non-responder.
114. A compound selected from the group consisting of:

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- i. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium napadisylate,
 - ii. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium esylate,
 - iii. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium edisylate,
 - iv. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium nitrate,
 - v. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium cyclamate,
 - vi. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium besylate,
 - vii. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium oxalate,
 - viii. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine (+)-camphor-10-sulfonic acid salt,
 - ix. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium oxoglutarate,
 - x. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine DL-mandelic acid salt,
 - xi. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine hippuric acid salt,
 - xii. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium formate,
 - xiii. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine L-lactic acid salt,
 - xiv. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine DL-lactic acid salt,
 - xv. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine glutaric acid salt, and
 - xvi. *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine adipic acid salt.

115. A method for producing the crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt according to any one of claims 101 and 102, comprising:
- i. mixing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine and an acid in a solvent to form a mixture; and
 - ii. isolating the crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt from said mixture.
116. A method for producing the crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt according to any one of claims 101 and 102 comprising:
- i. mixing a second *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt and an acid in a solvent to form a mixture; and
 - ii. isolating the crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt from the mixture.
117. A method for producing the crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt according to any one of claims 101 and 102 comprising:
- i. mixing an amorphous form or a second crystalline form *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt in a solvent to form a composition; and
 - ii. isolating the crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt from said composition.
118. A method for producing the crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt according to any one of claims 101 and 102 comprising:
- i. mixing 3-[1-(2-nitrophenyl)-1-*H*-pyrrole-2-yl]-propanal, amino guanidine or a salt thereof, and an acid or a salt thereof in a solvent, and
 - ii. isolating the crystalline form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt from said composition.

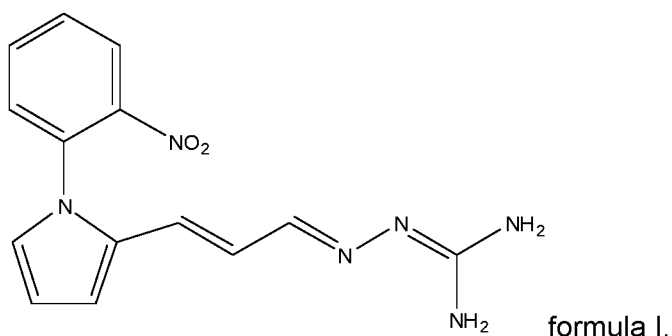
119. A method for producing the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt according to any one of claims 101 and 102 comprising:

- i. providing *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine or a second *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt,
- ii. introducing a counter ion of an acid ion using ion exchange, and
- iii. isolating the crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt.

120. The method according to any one of the preceding claims, wherein the acid is selected from the group consisting of: acetic acid, succinic acid, fumaric acid, toluene sulfonic acid, naphthalene-1,5-disulfonic acid, ethanesulfonic acid, ethane-1,2-disulfonic acid, nitric acid, cyclohexylsulfamic acid, benzenesulfonic acid, oxalic acid, (+)-camphor-10-sulfonic acid, 2-oxoglutaric acid, hydroxy(phenyl)acetic acid such as DL-hydroxy(phenyl)acetic acid, *N*-benzoylglycine, formic acid, 2-hydroxypropanoic acid such as L-2-hydroxypropanoic acid or DL-2-hydroxypropanoic acid, pentanedioic acid, and Hexanedioic acid.

121. The crystalline Form of the *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidinium salt according to any one of claims 101 and 102 produced by the method of any one of claims 19 to 37.

122. The crystalline Form according to any one of the preceding claims, wherein *N*-{3-[1-(2-nitrophenyl)-1*H*-pyrrol-2-yl]-allylidene}-aminoguanidine has the structure of Formula I:



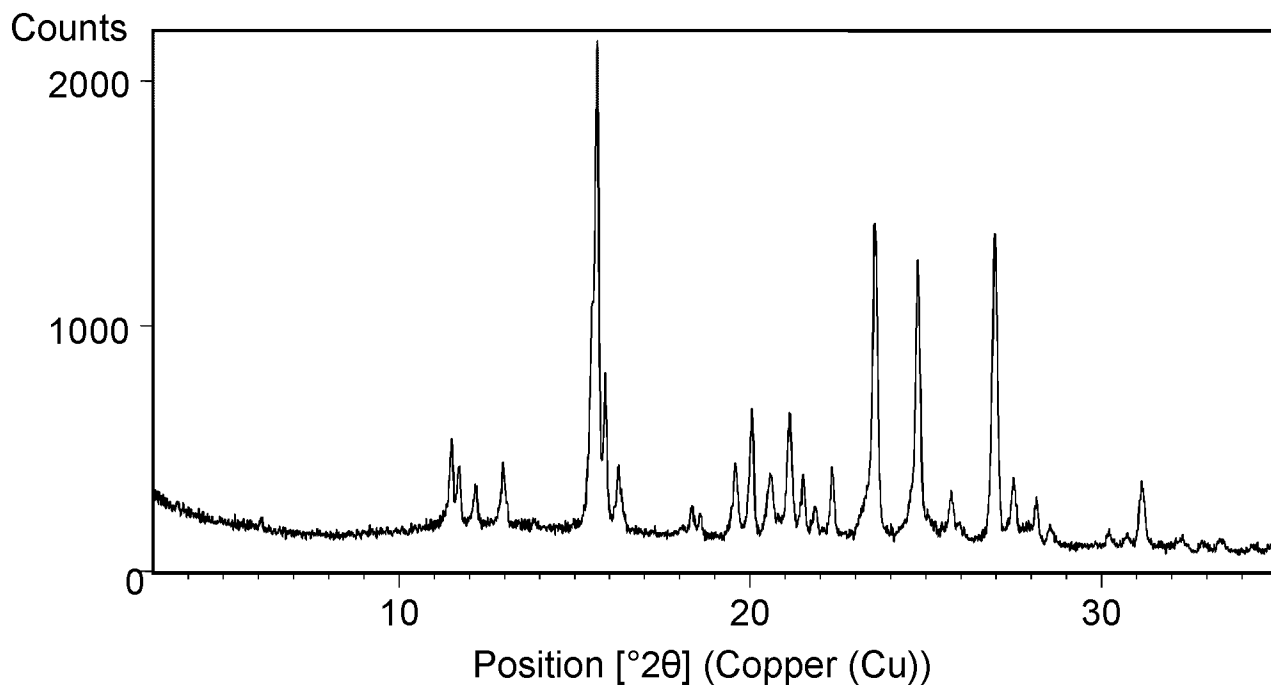


FIG 1

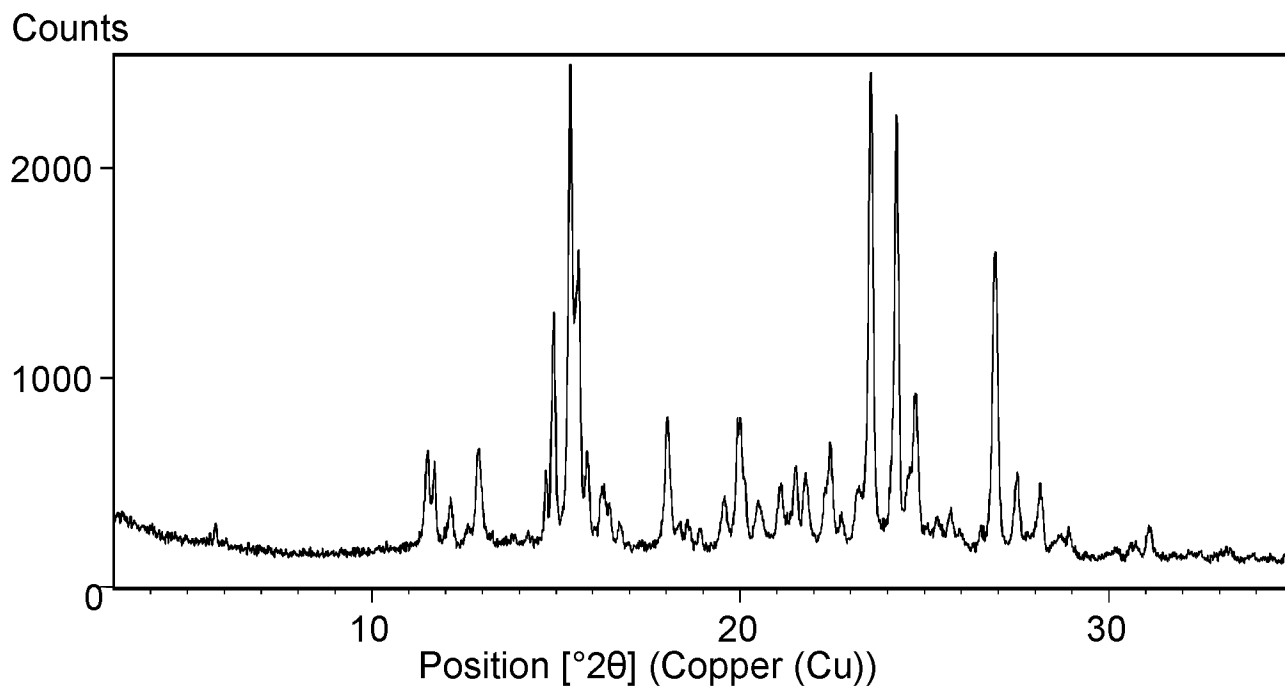


FIG 2

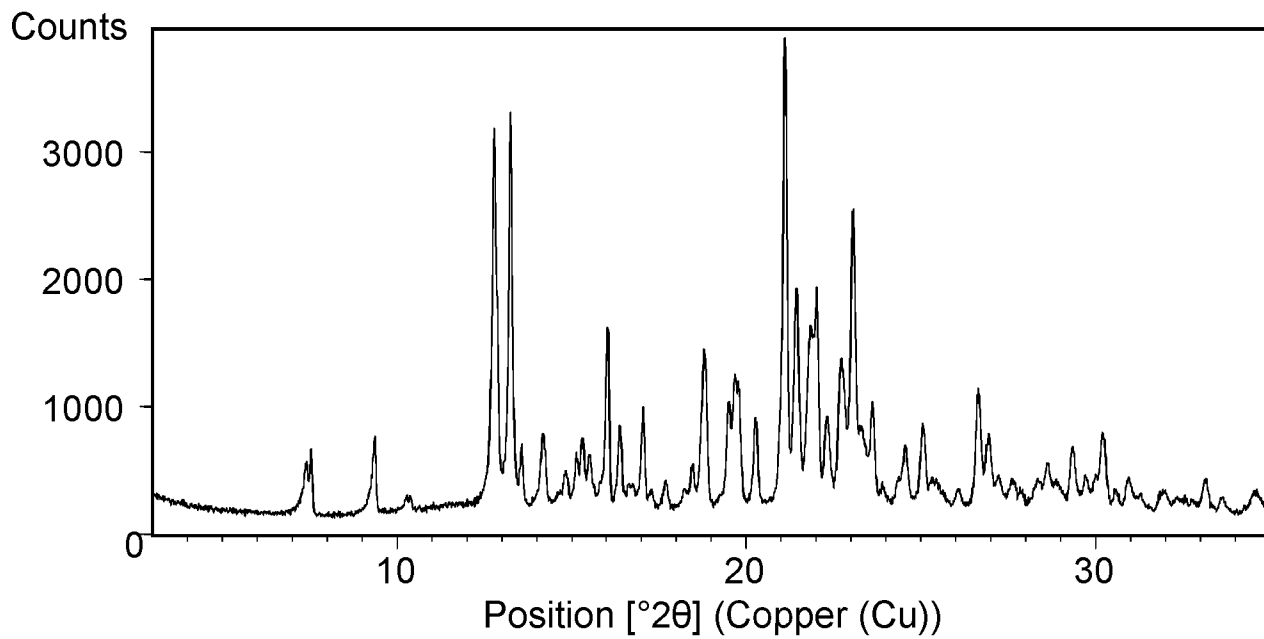


FIG 3

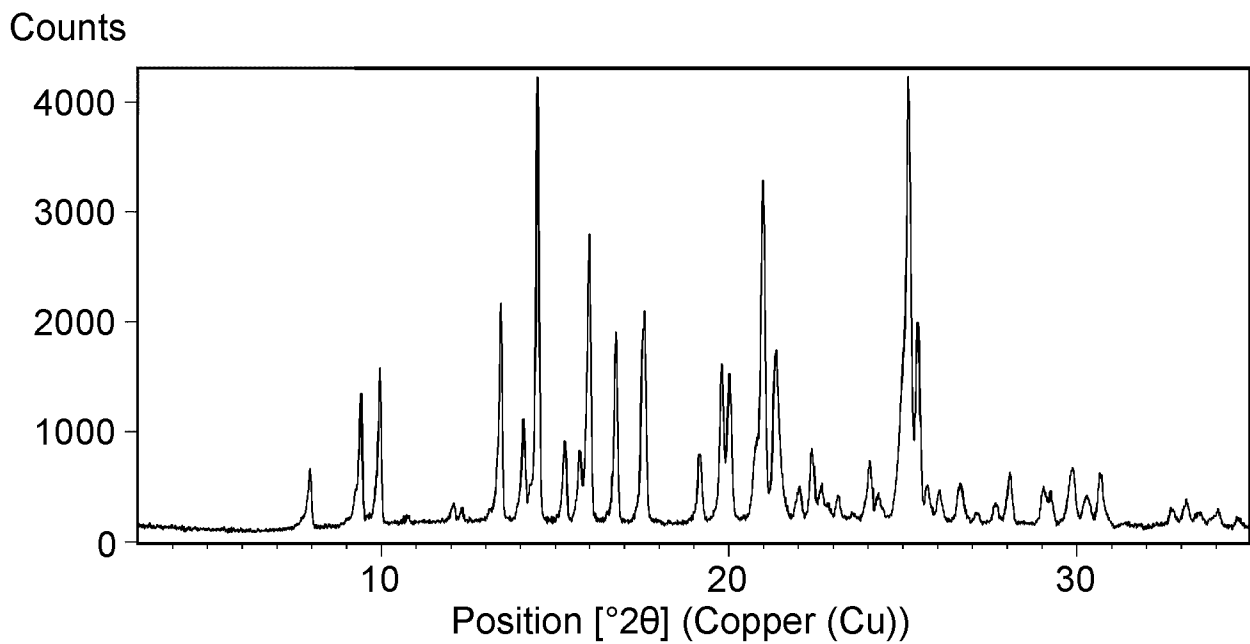


FIG 4

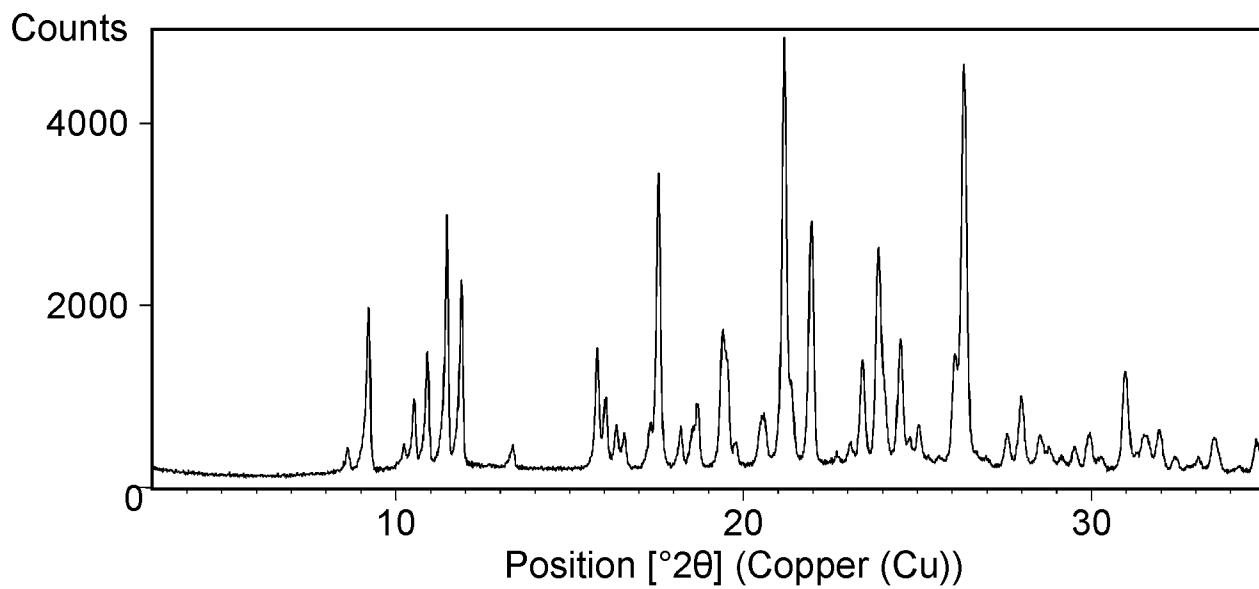


FIG 5

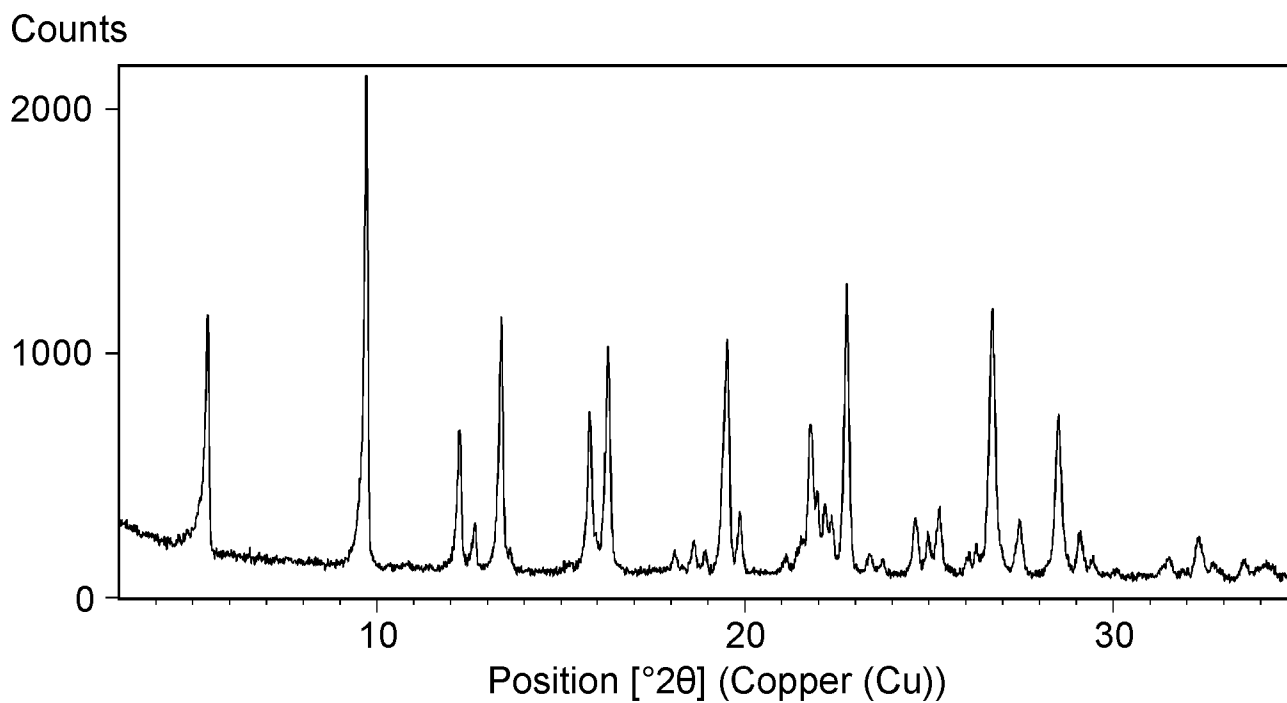


FIG 6

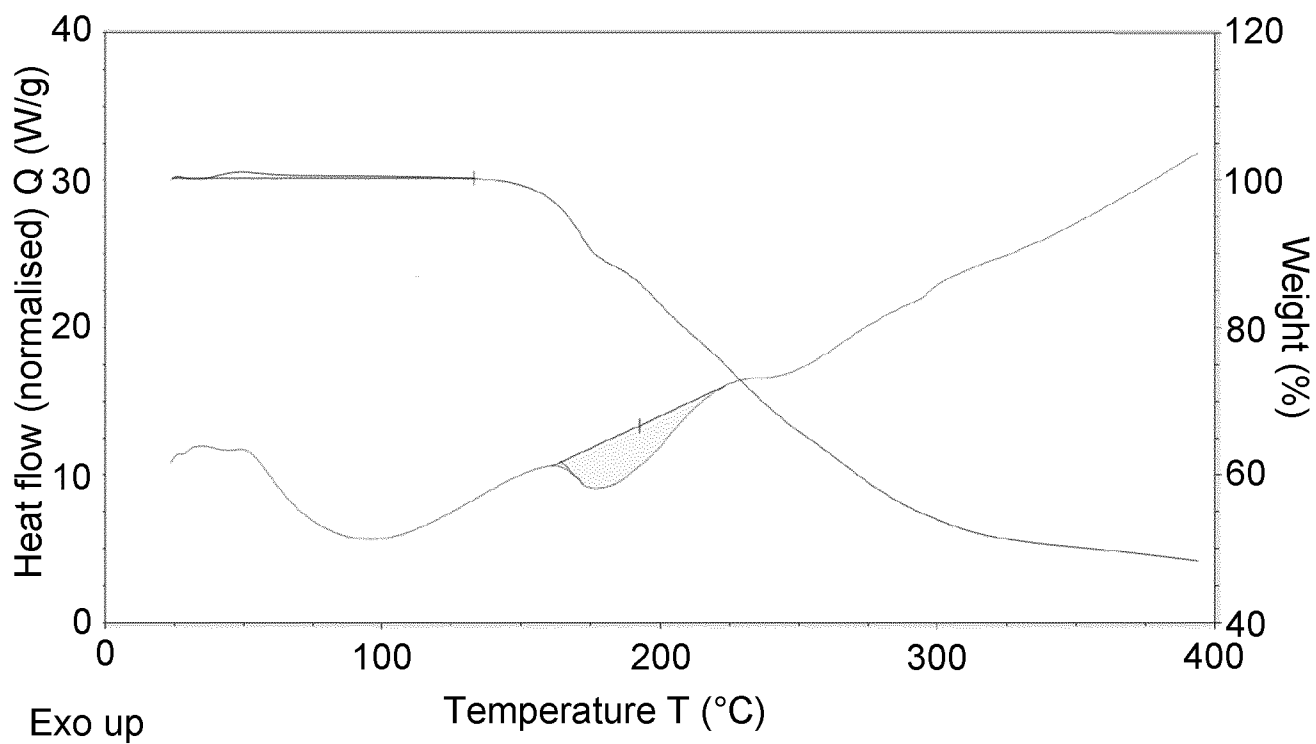


FIG 7

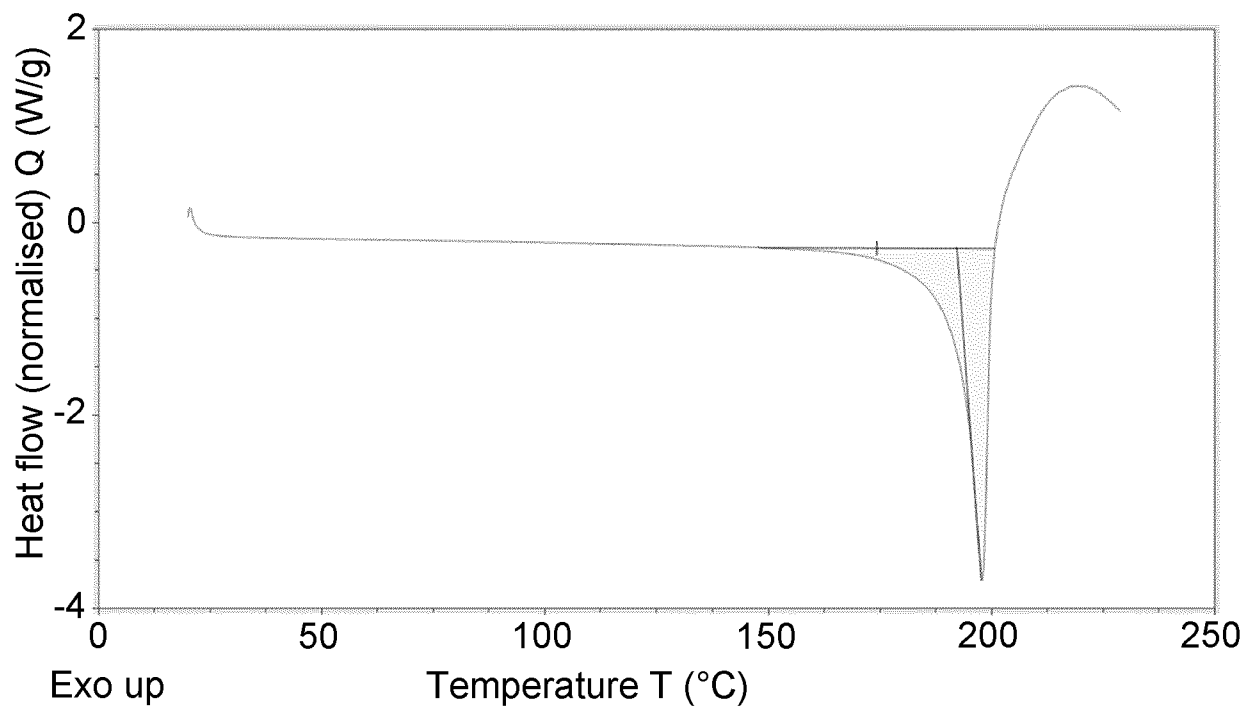


FIG 8

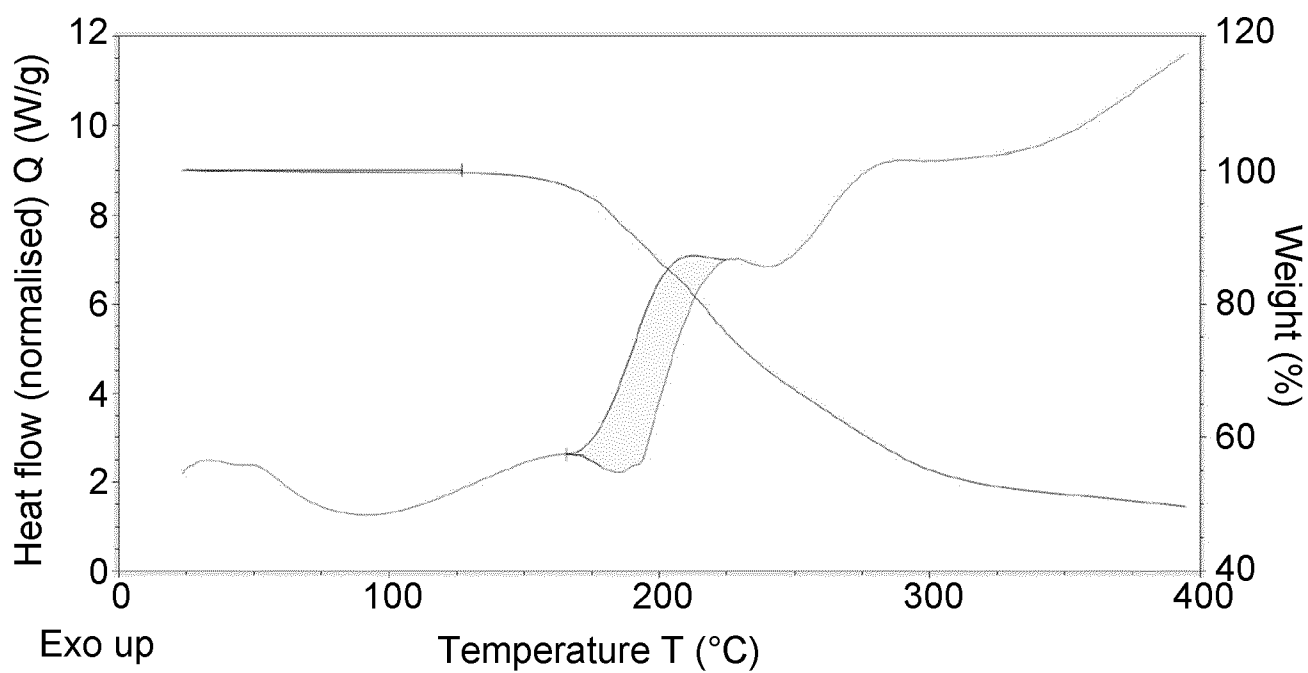


FIG 9

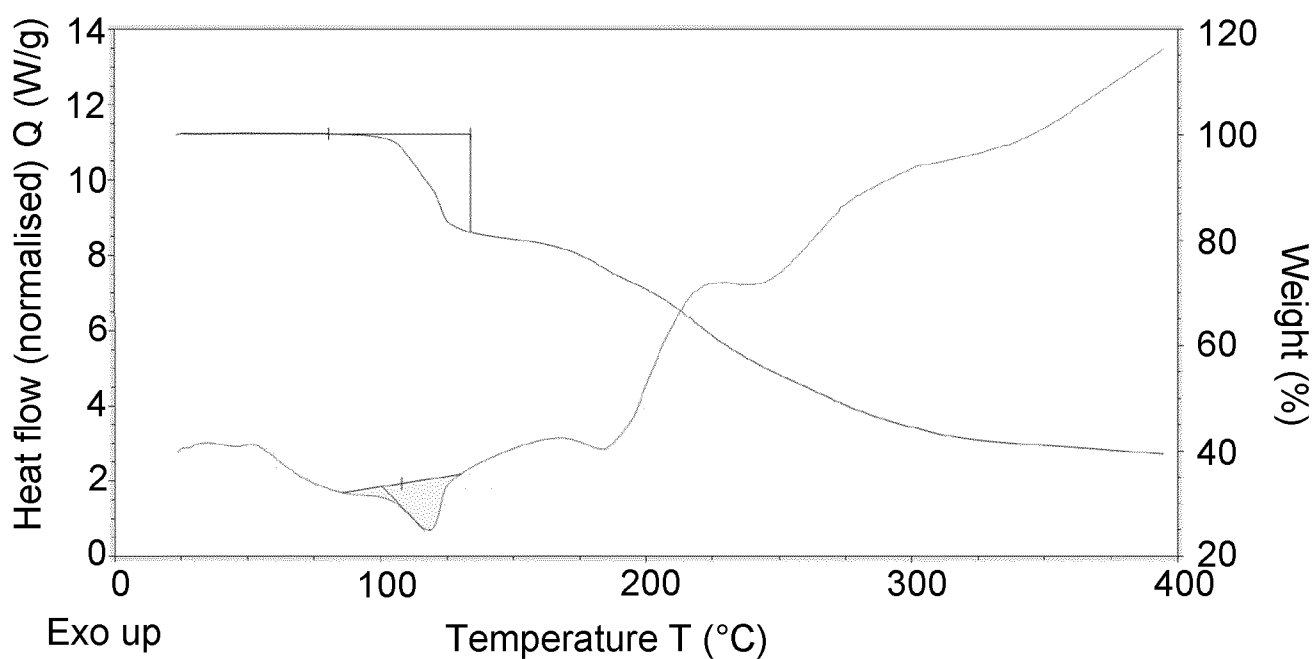


FIG 10

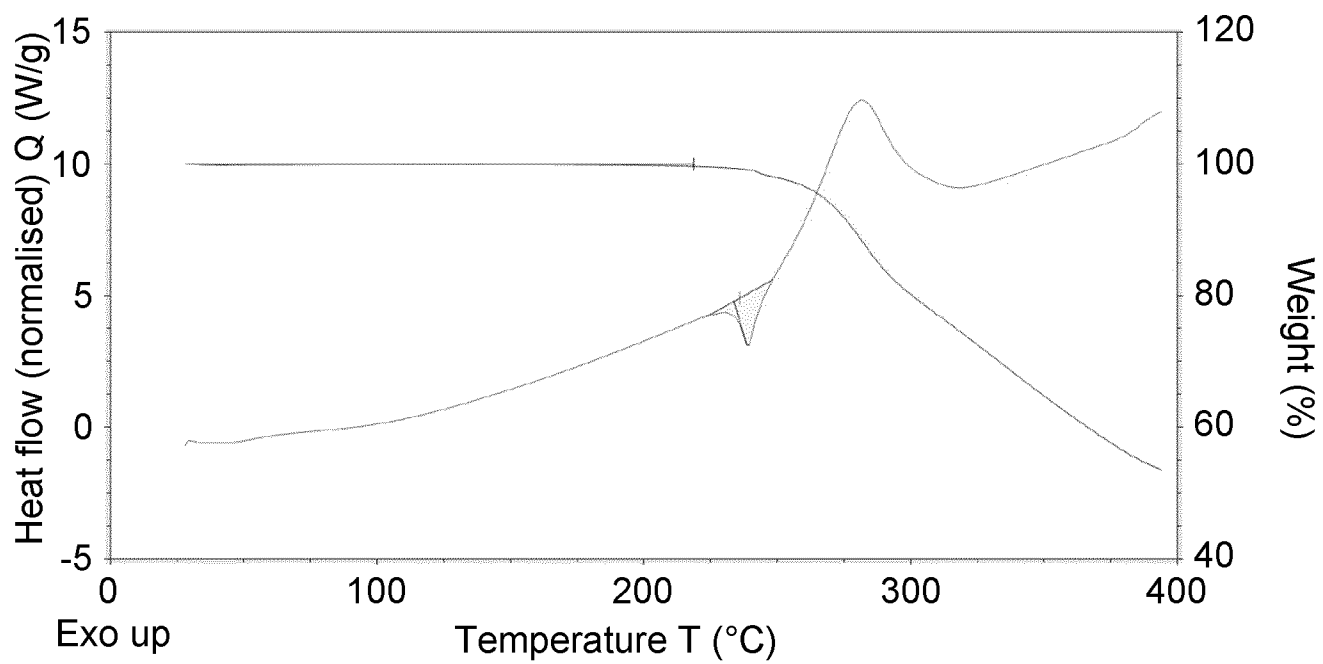


FIG 11

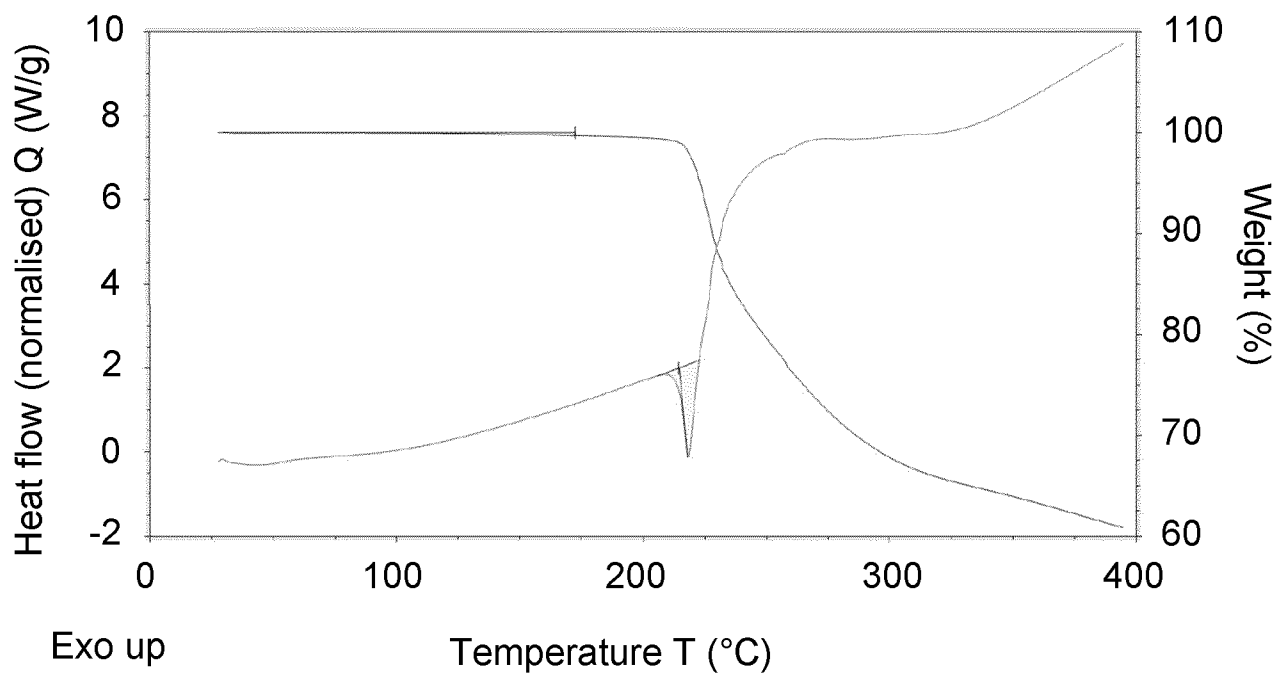


FIG 12

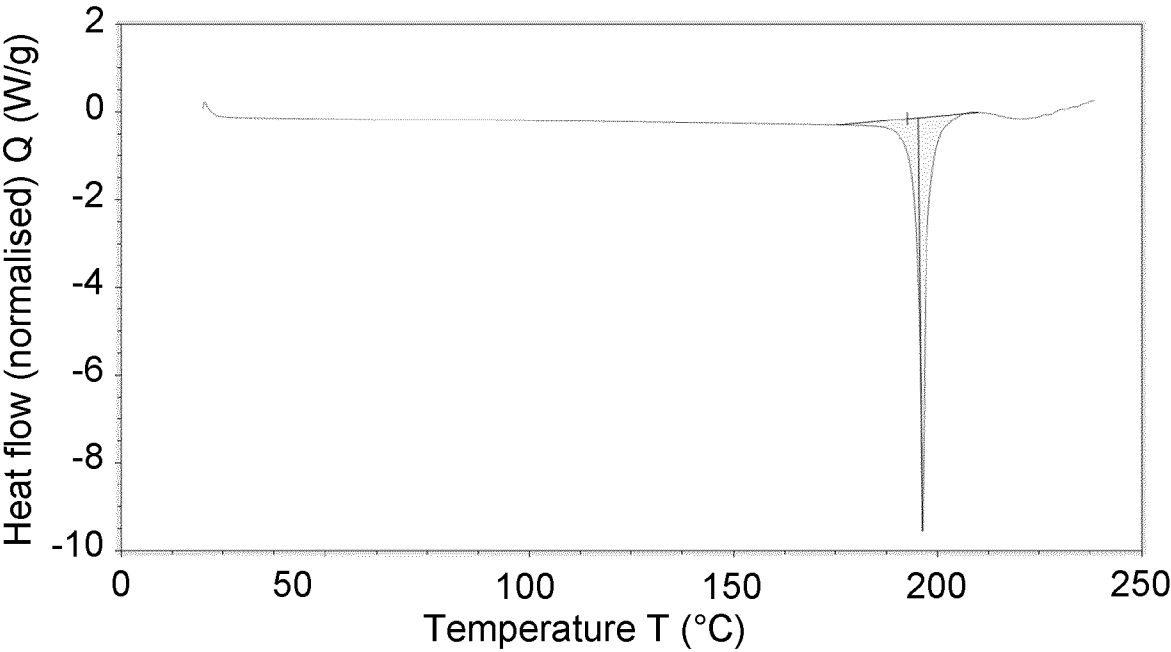


FIG 13

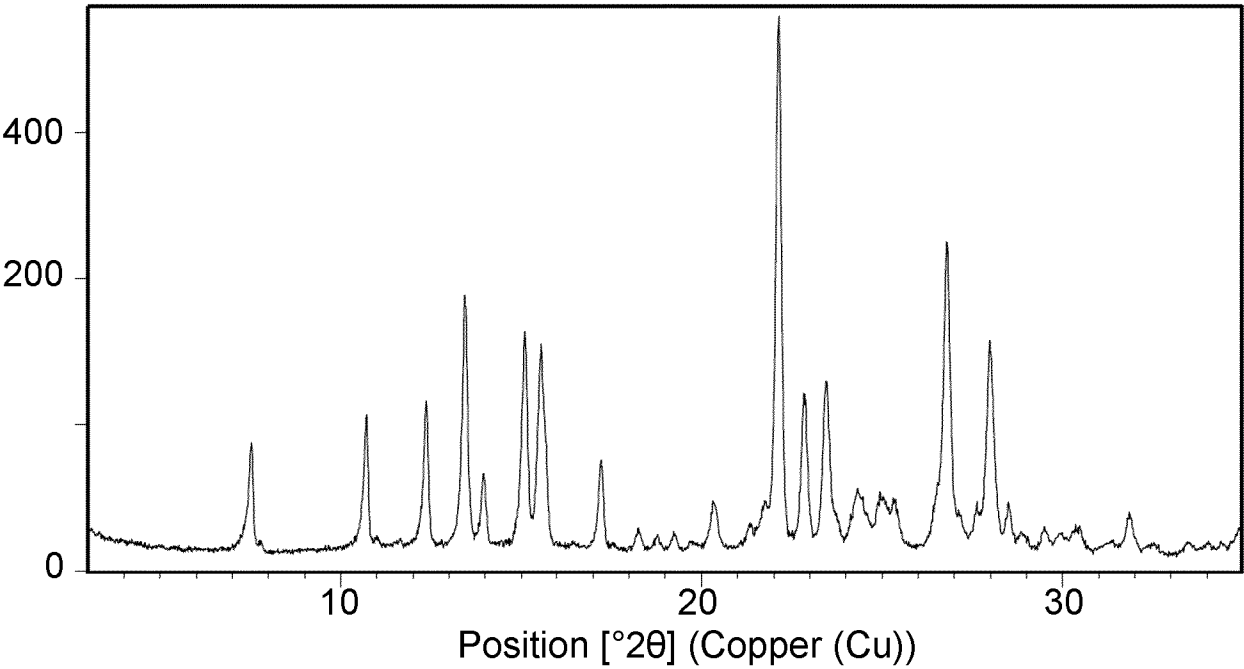


FIG 14

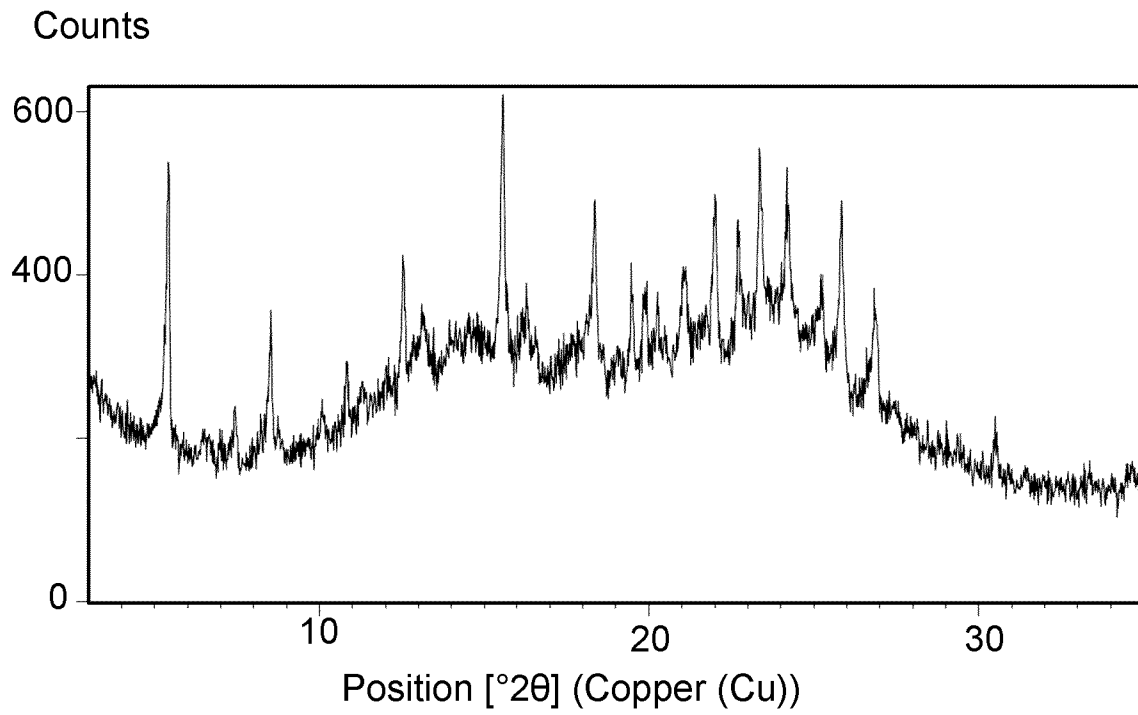


FIG 15

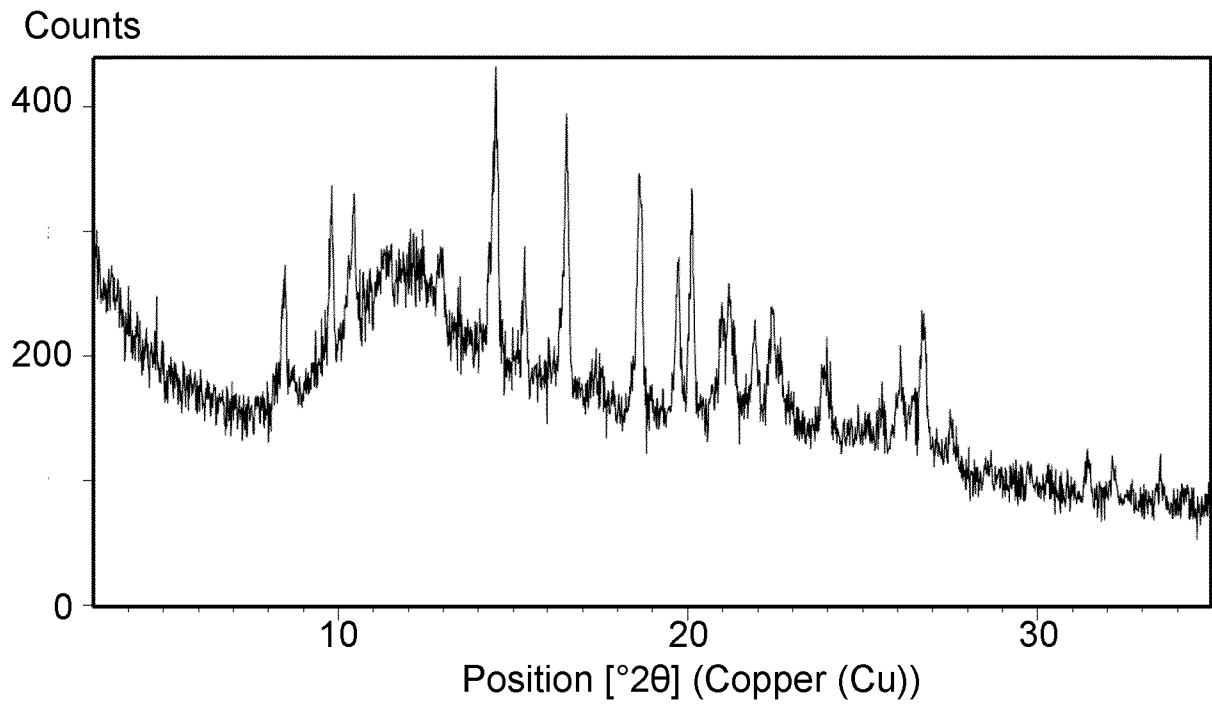


FIG 16

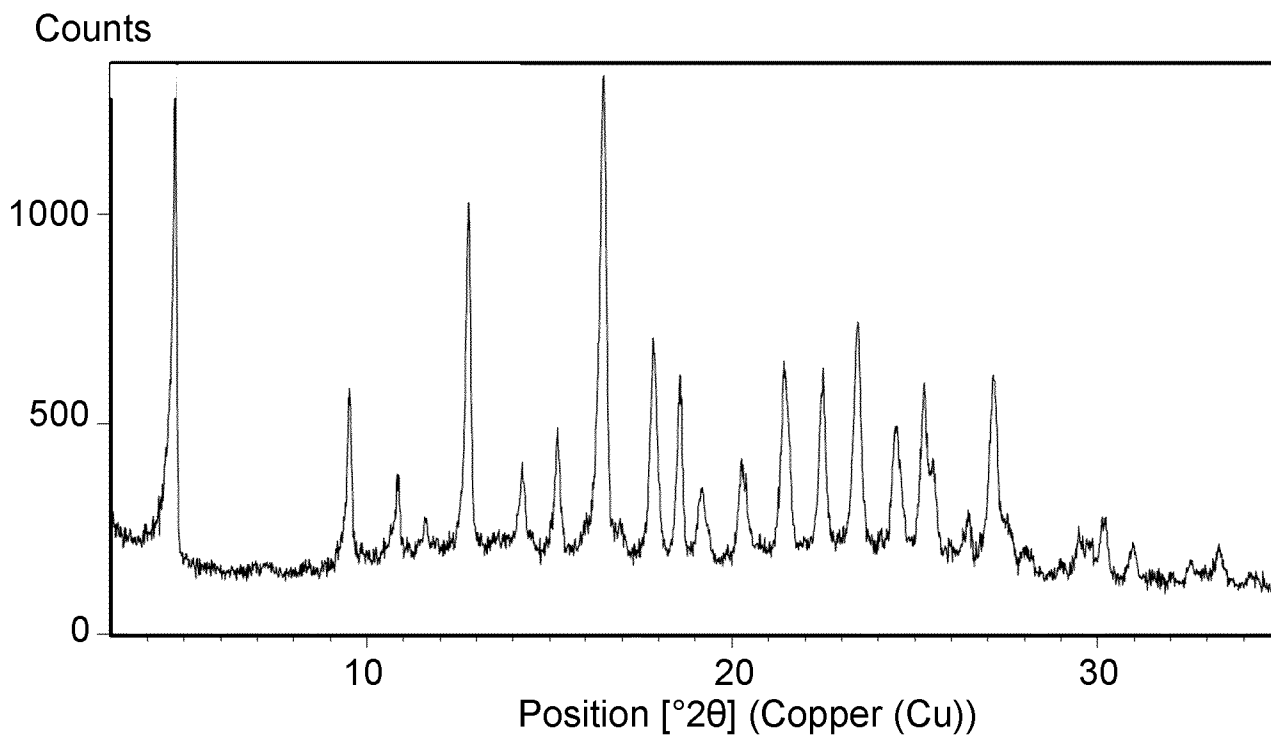


FIG 17

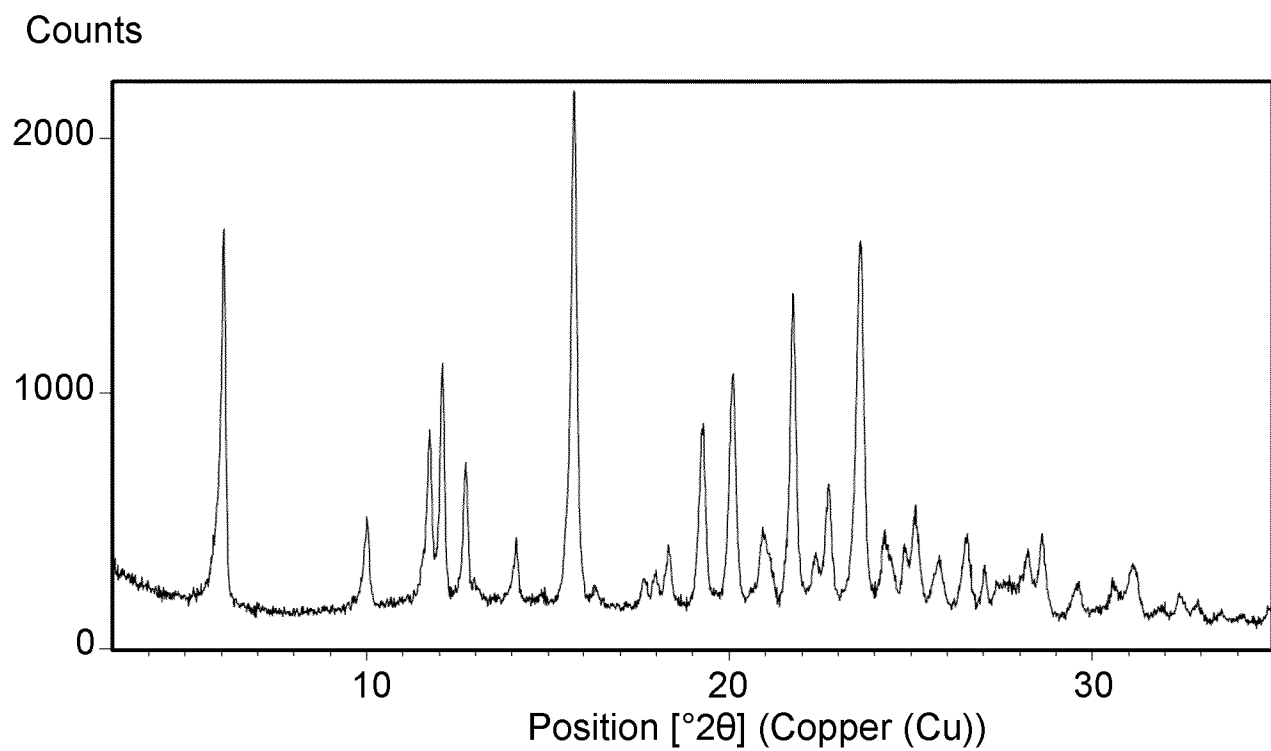


FIG 18

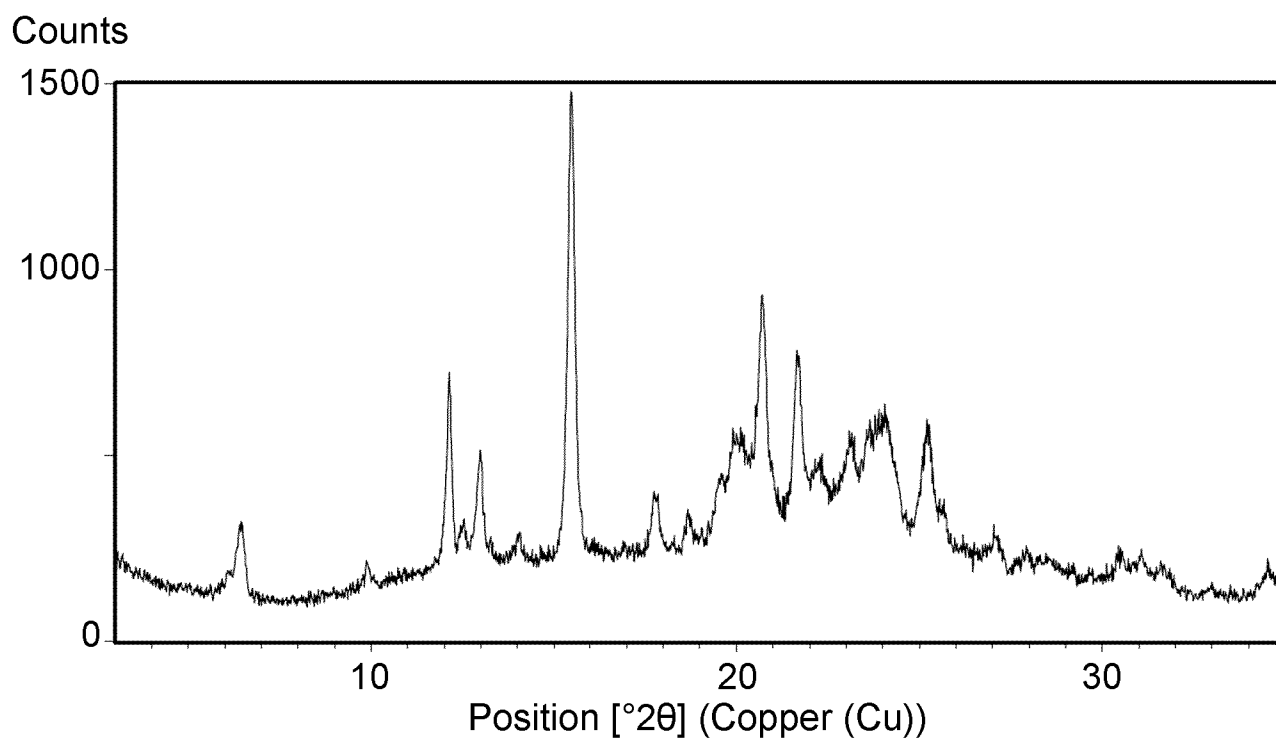


FIG 19

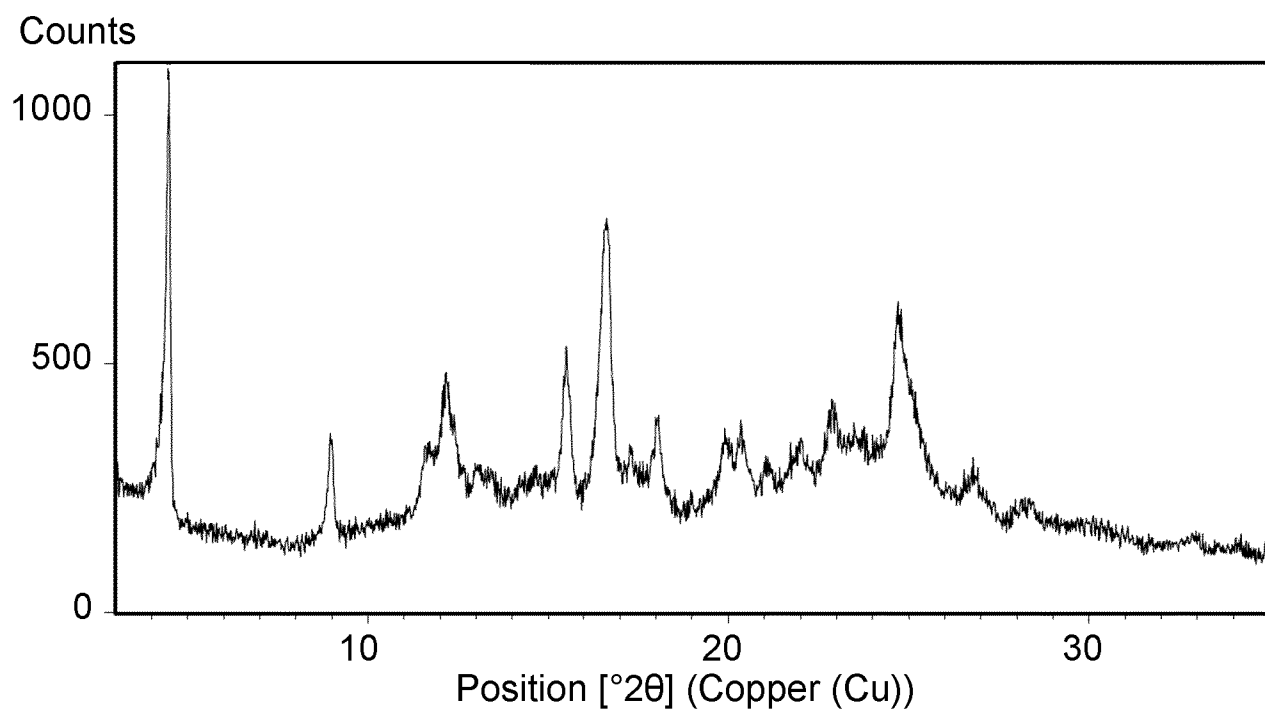


FIG 20

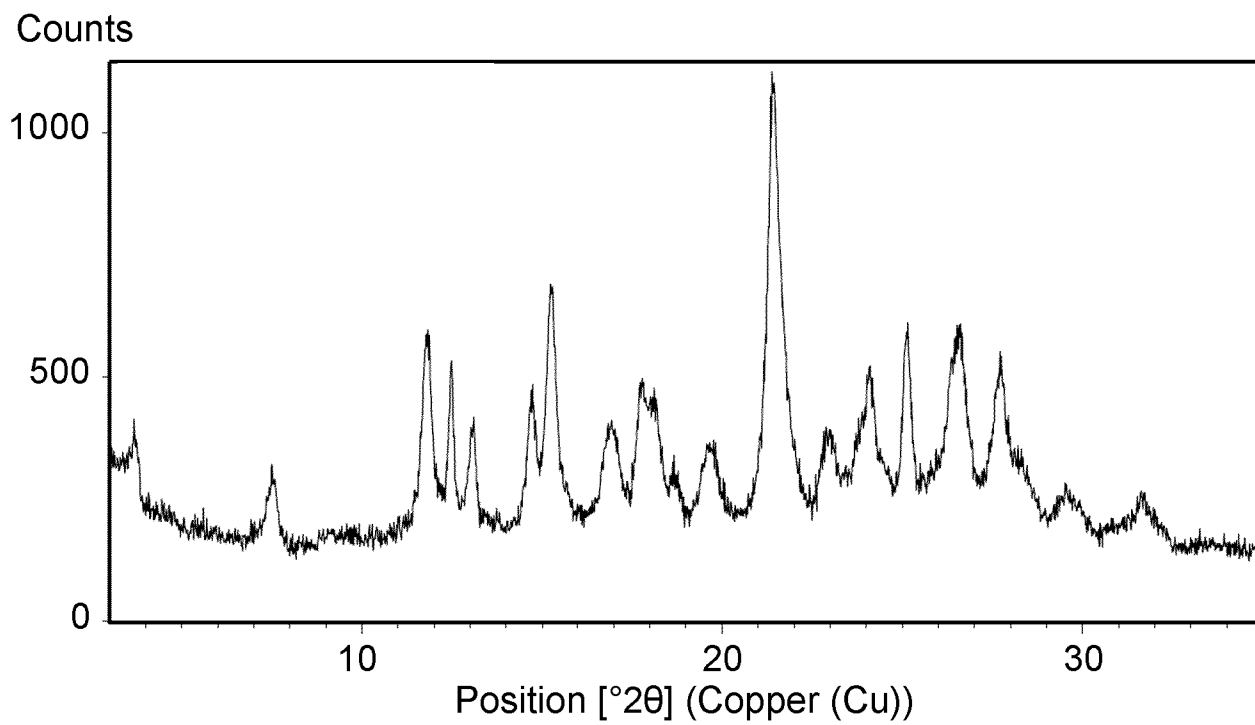


FIG 21

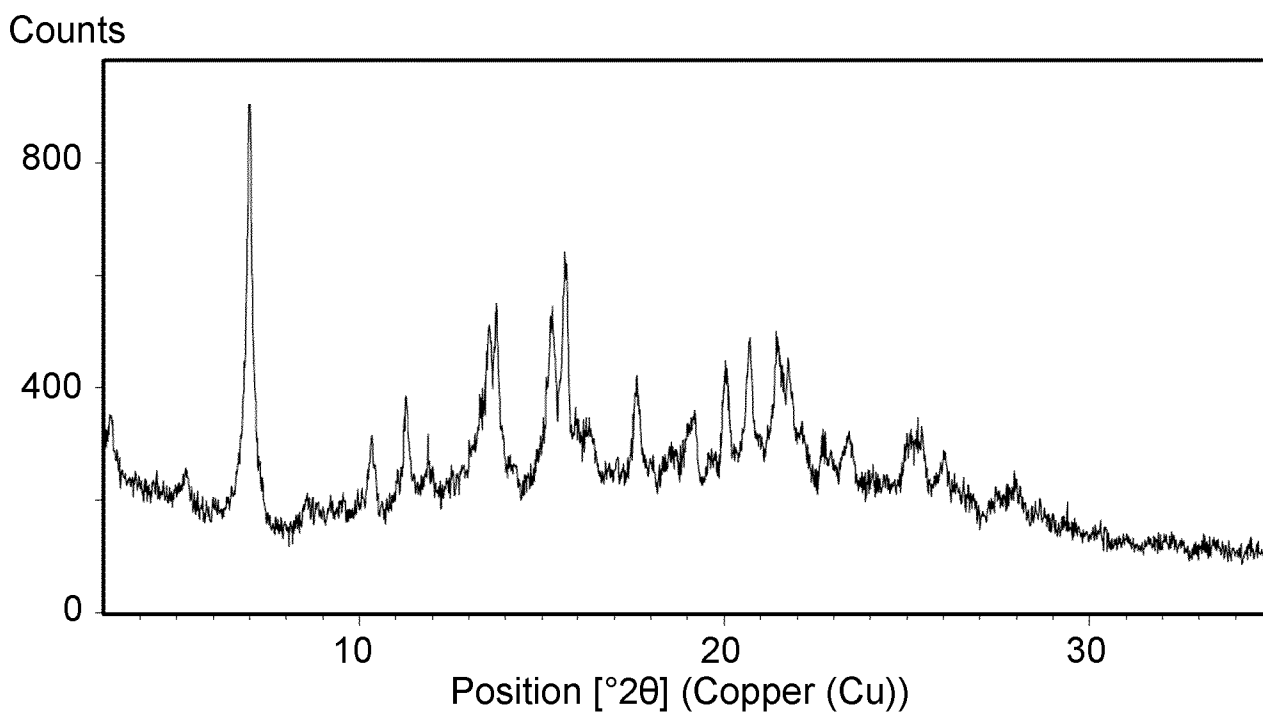


FIG 22

Counts

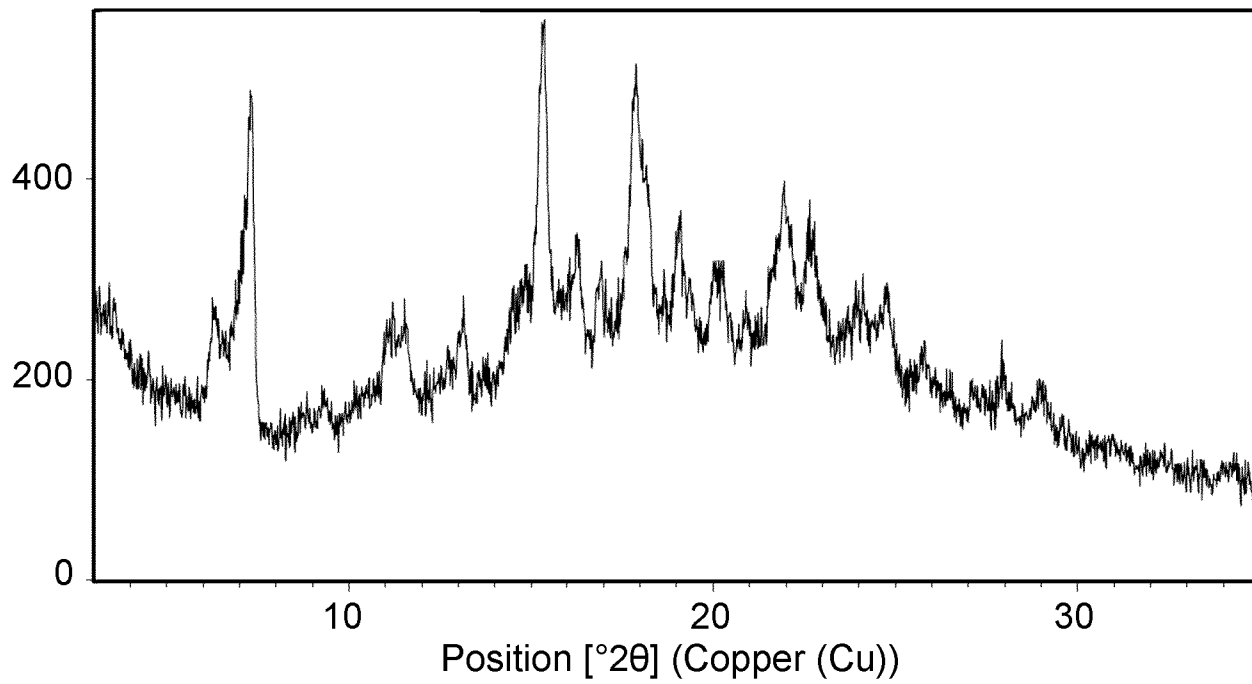


FIG 23

Counts

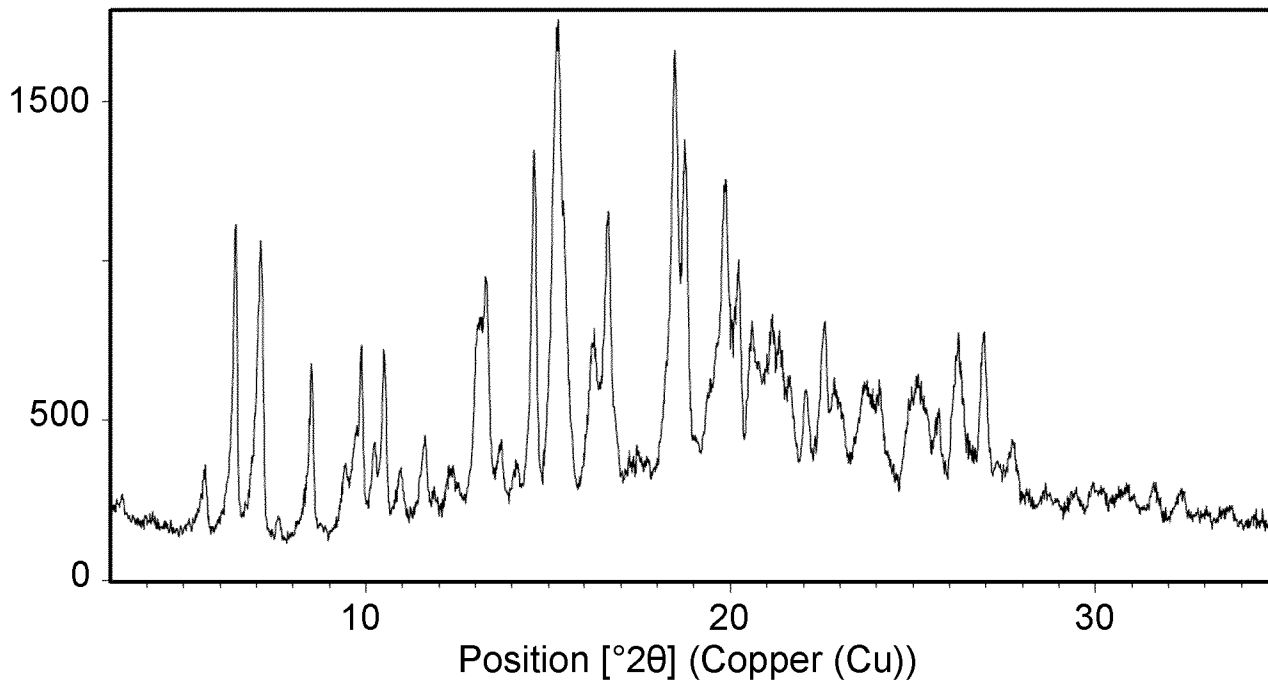


FIG 24

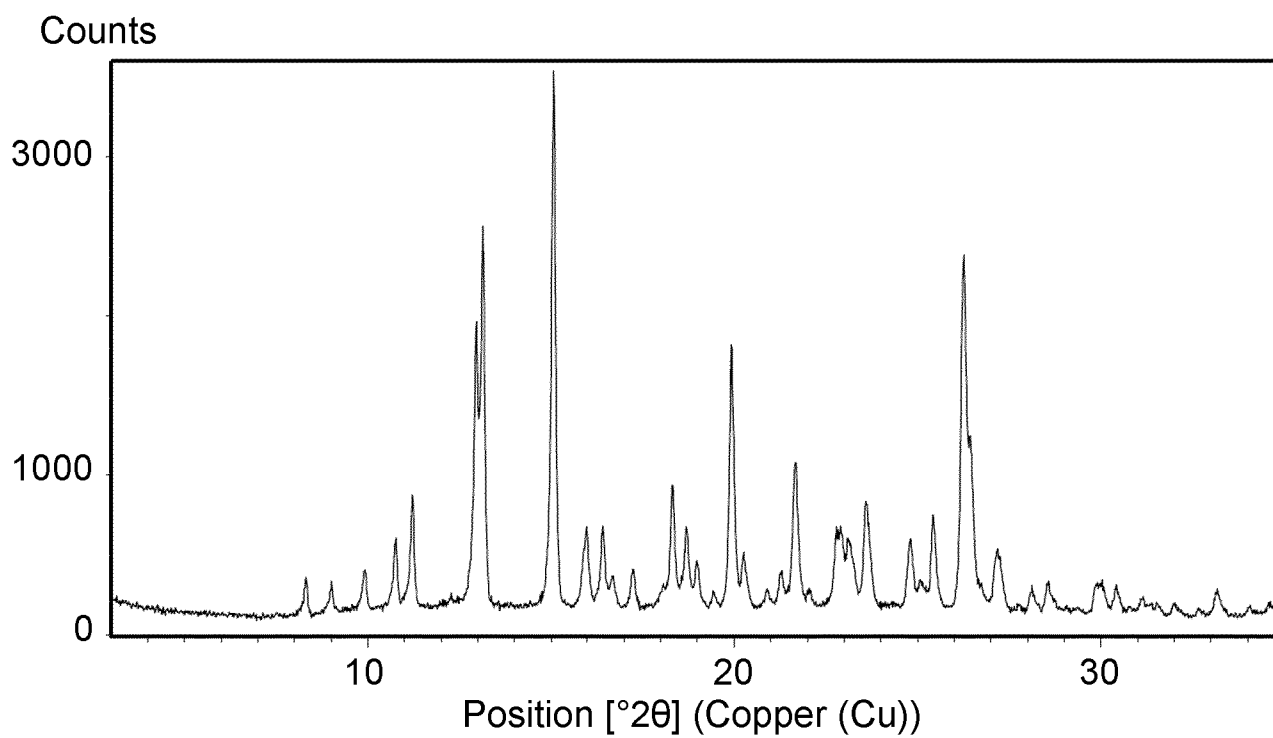


FIG 25

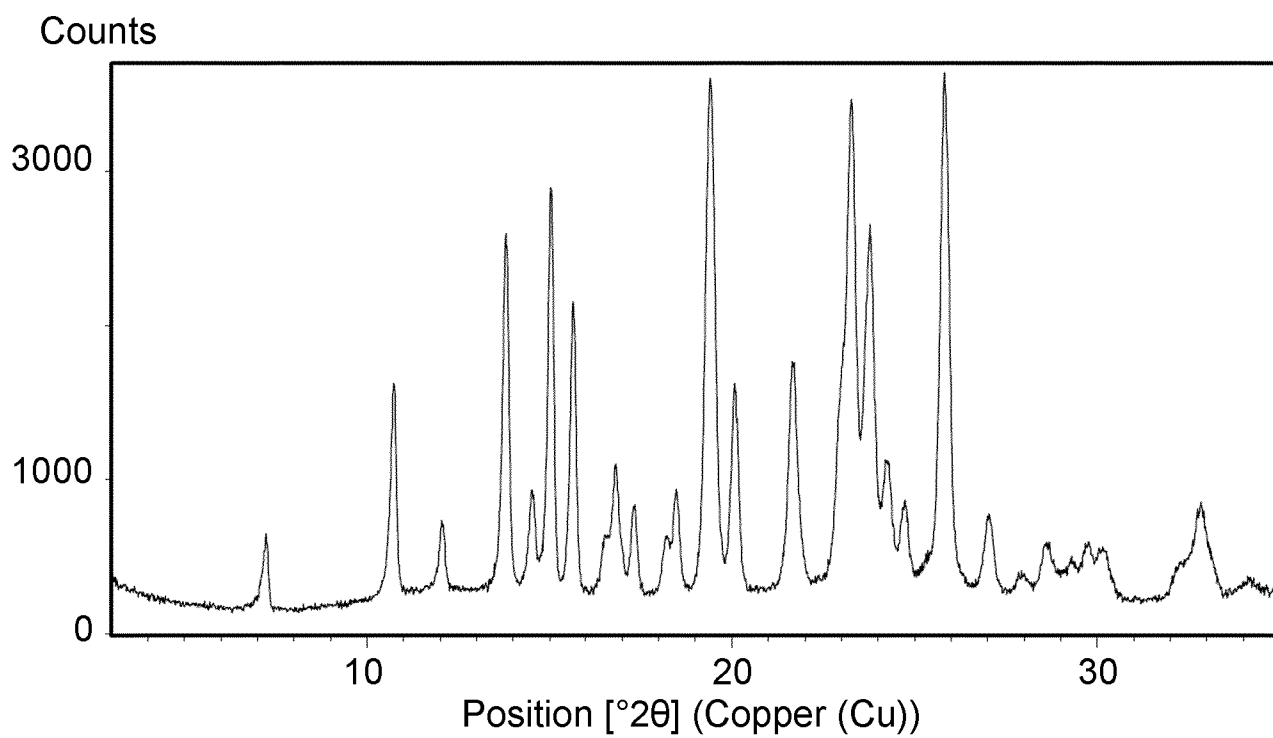


FIG 26

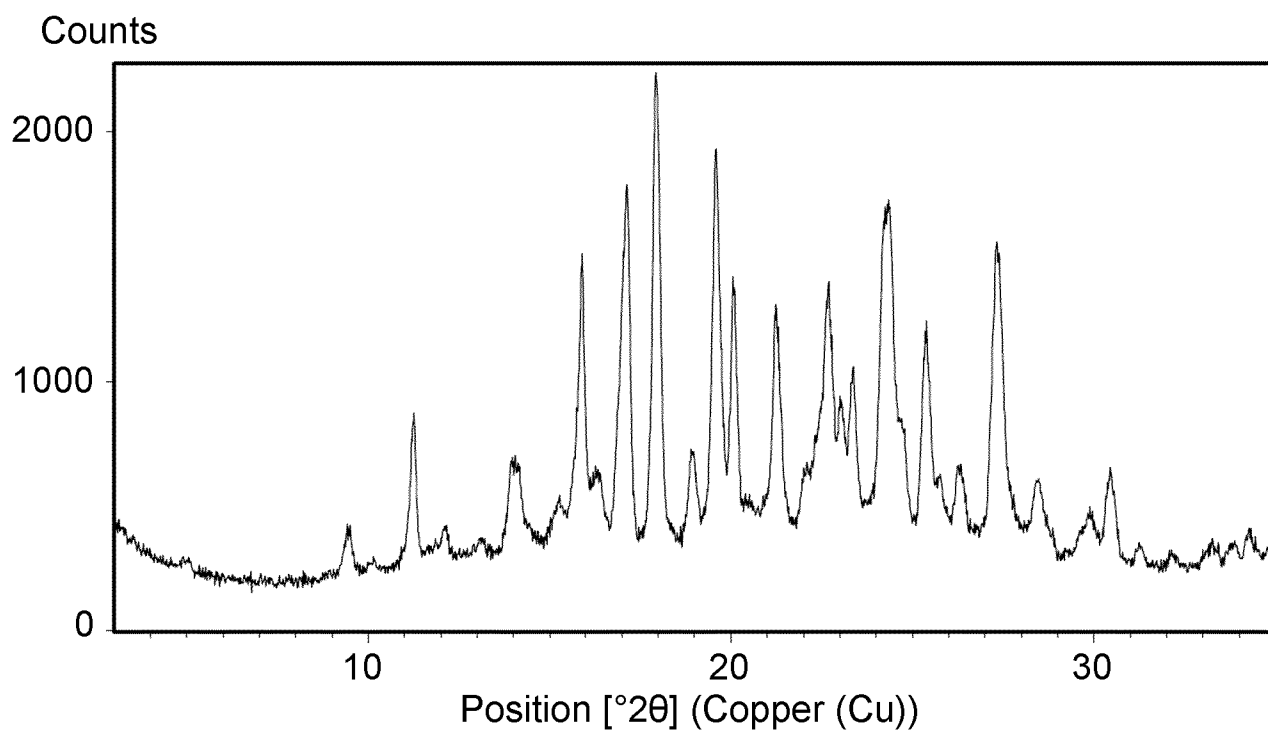


FIG 27

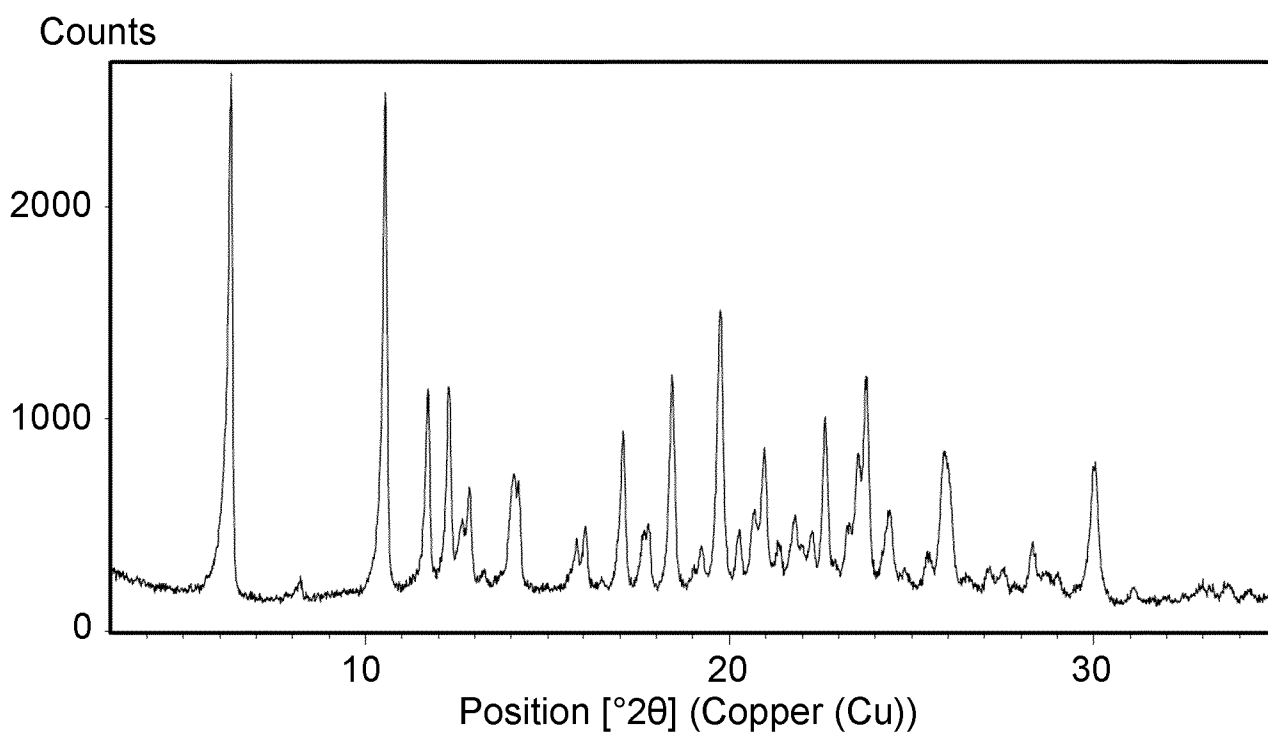


FIG 28

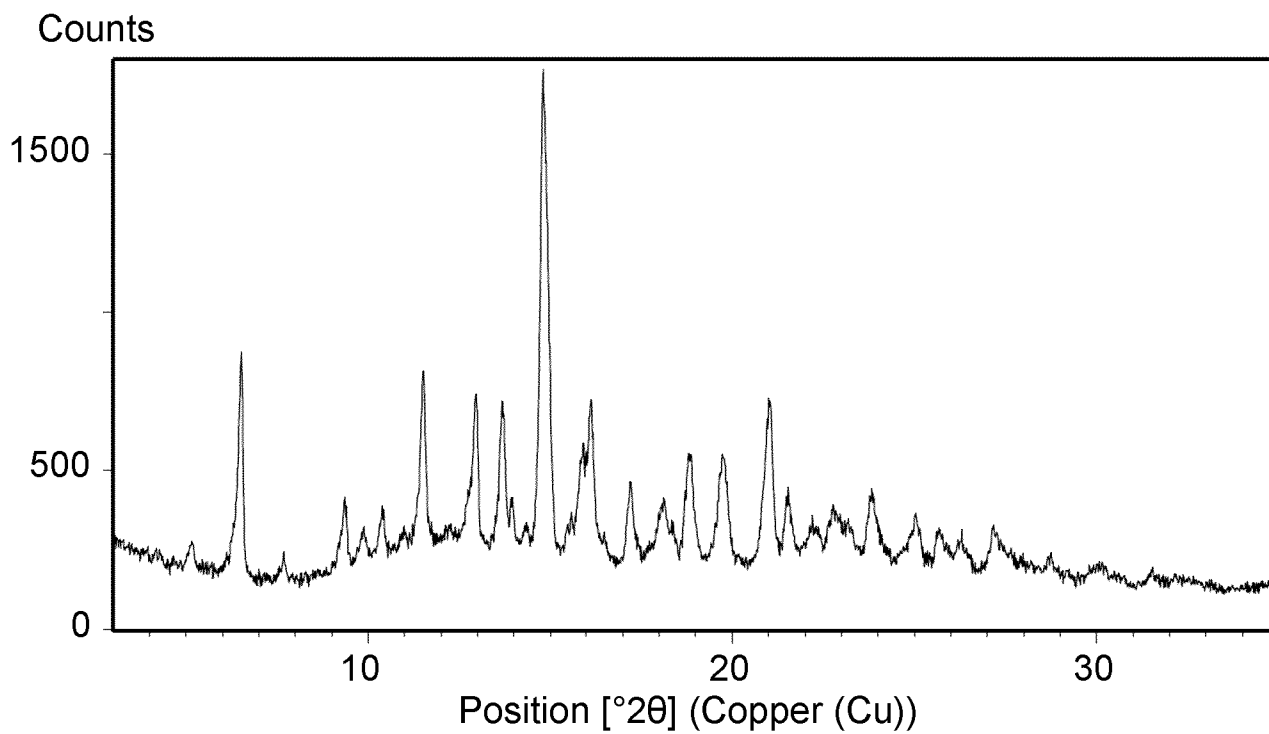


FIG 29

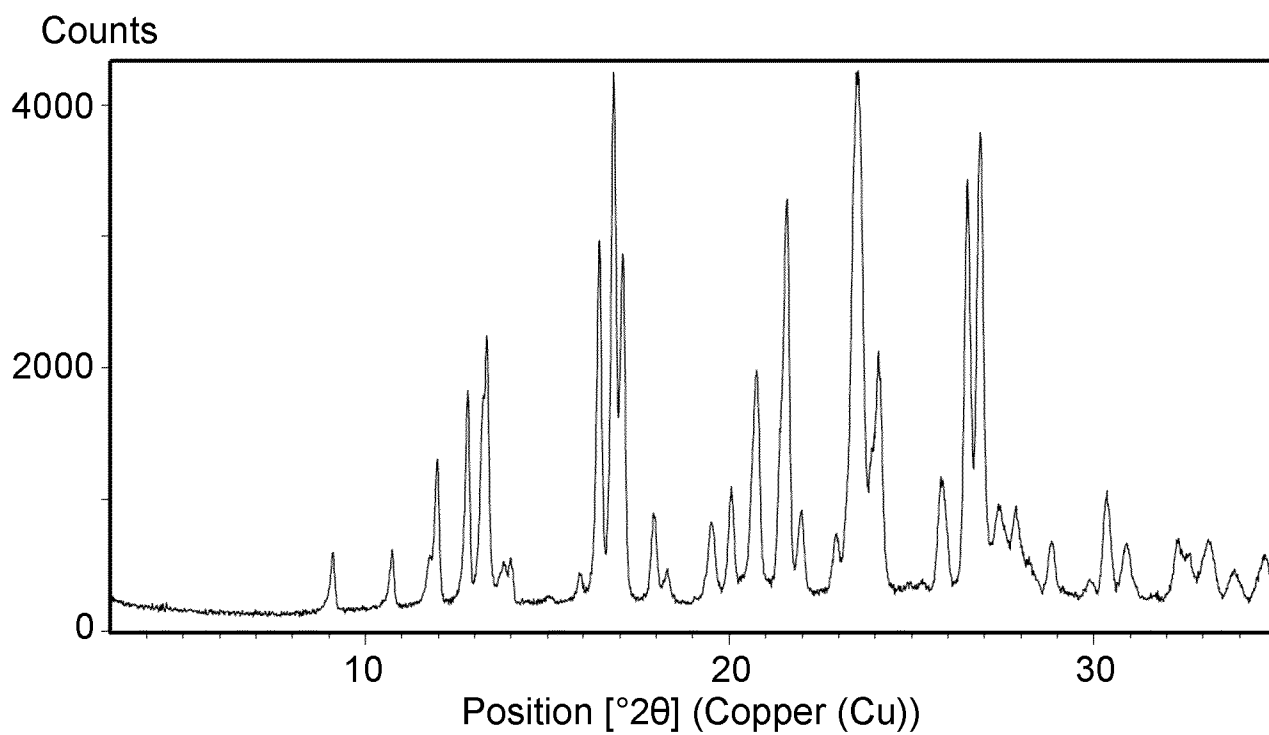


FIG 30

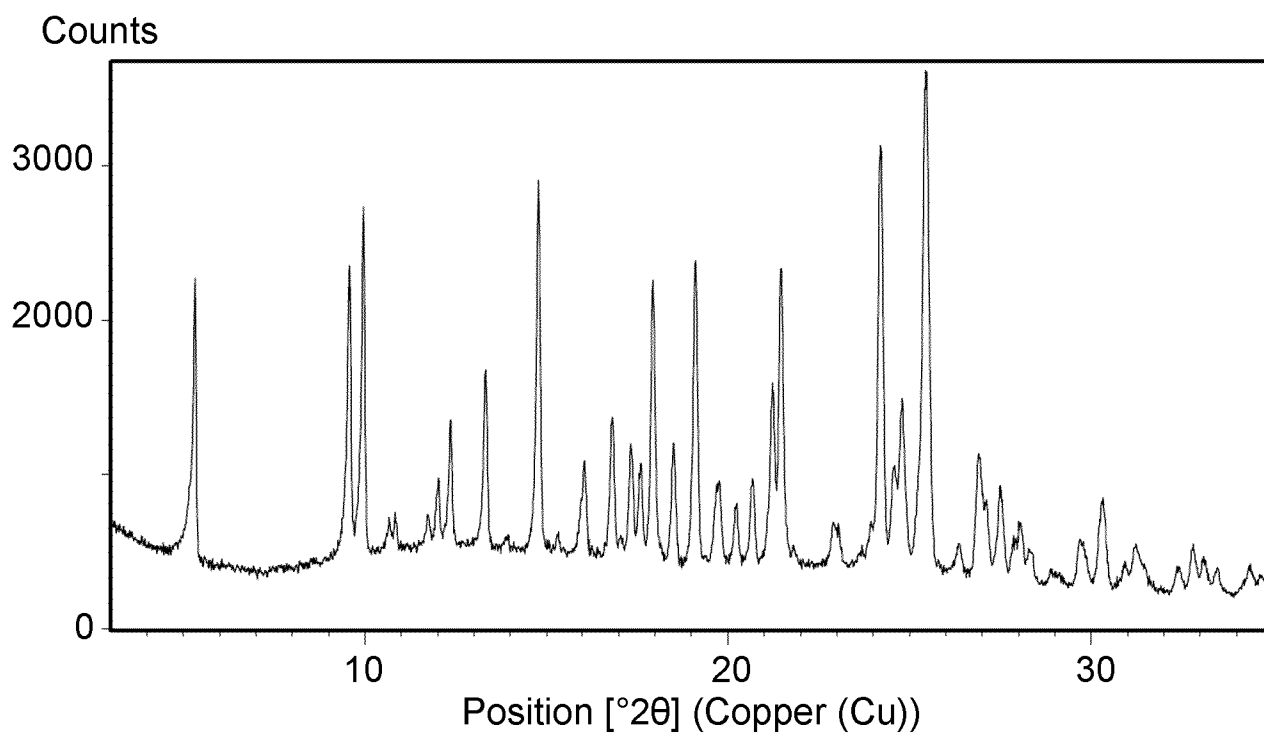


FIG 31

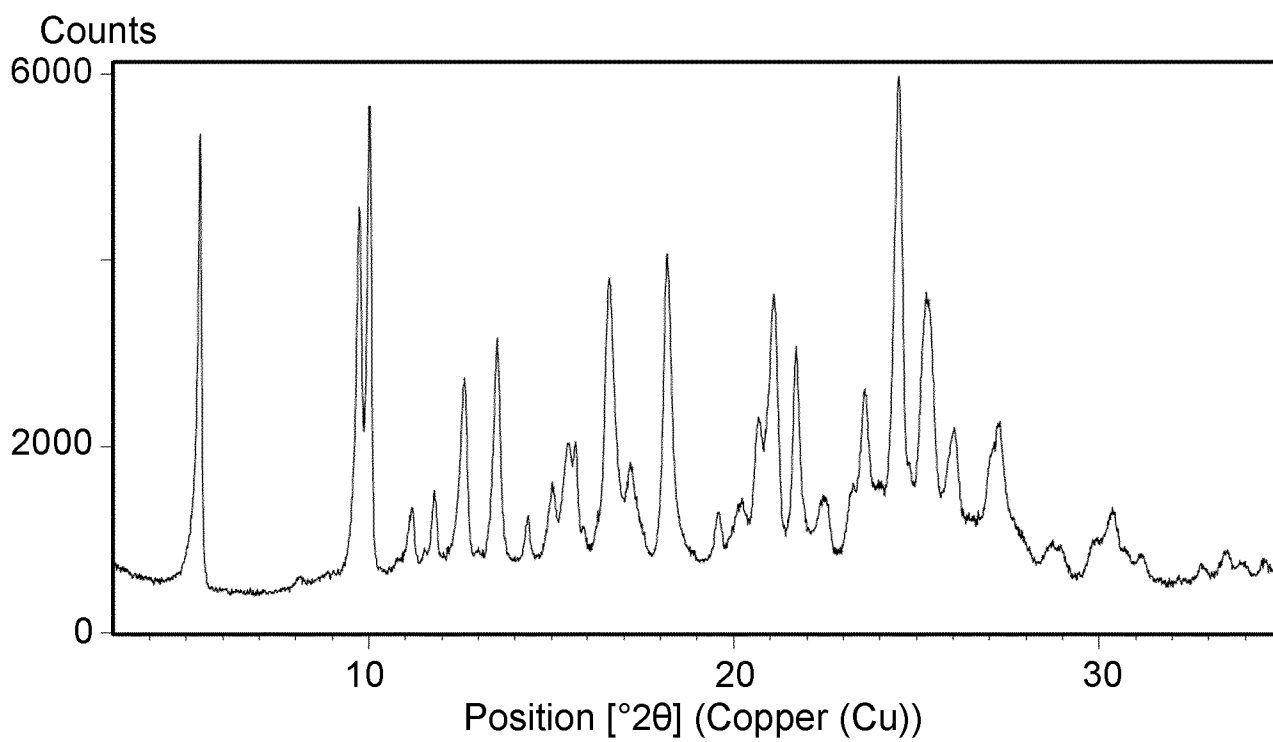


FIG 32

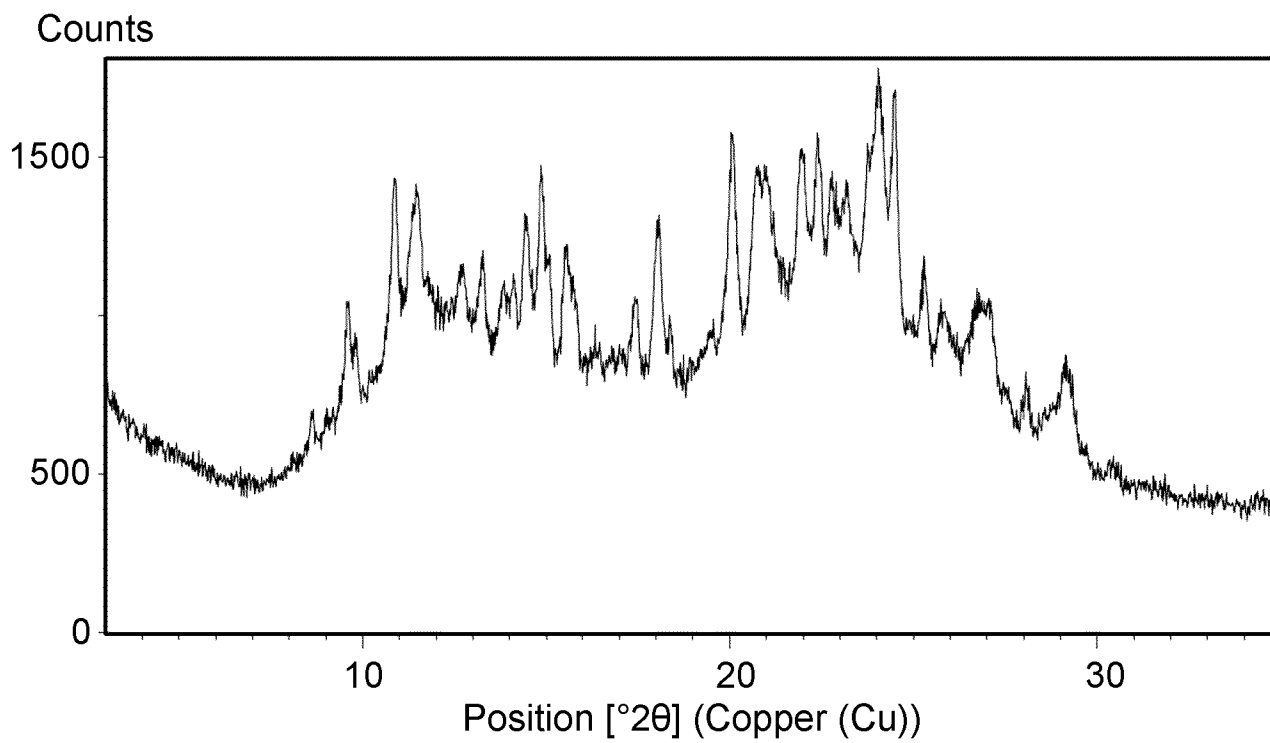


FIG 33

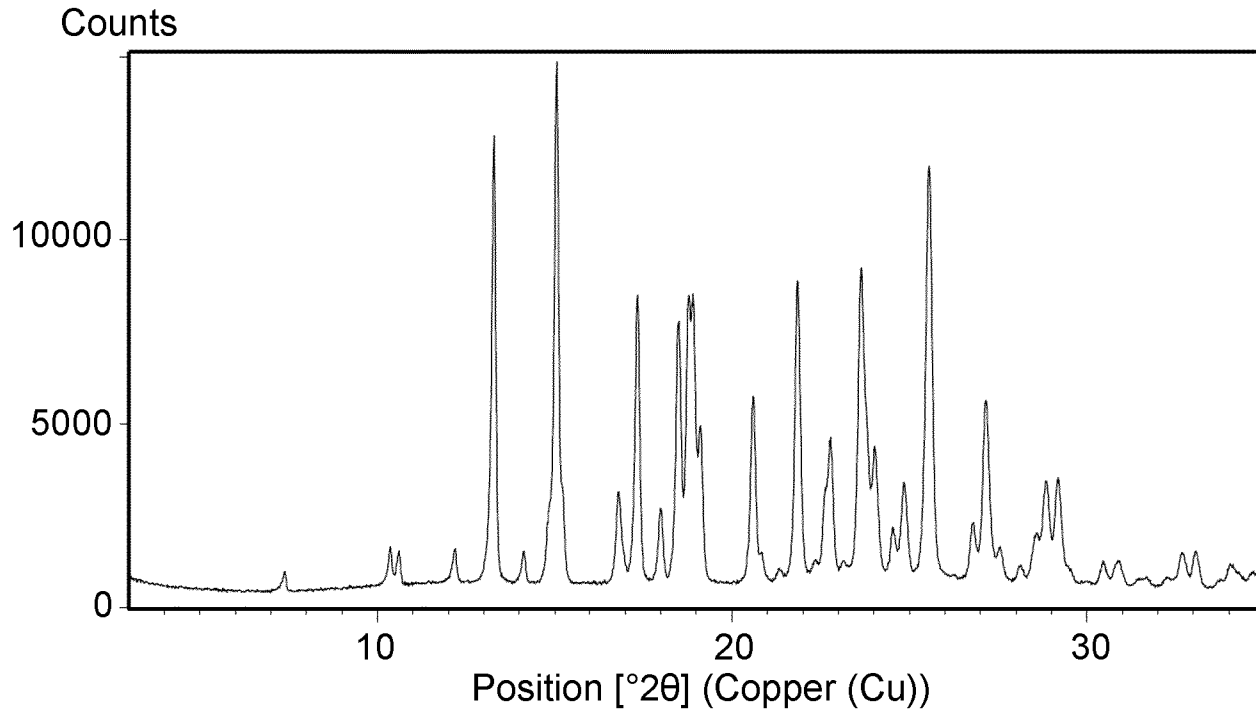


FIG 34

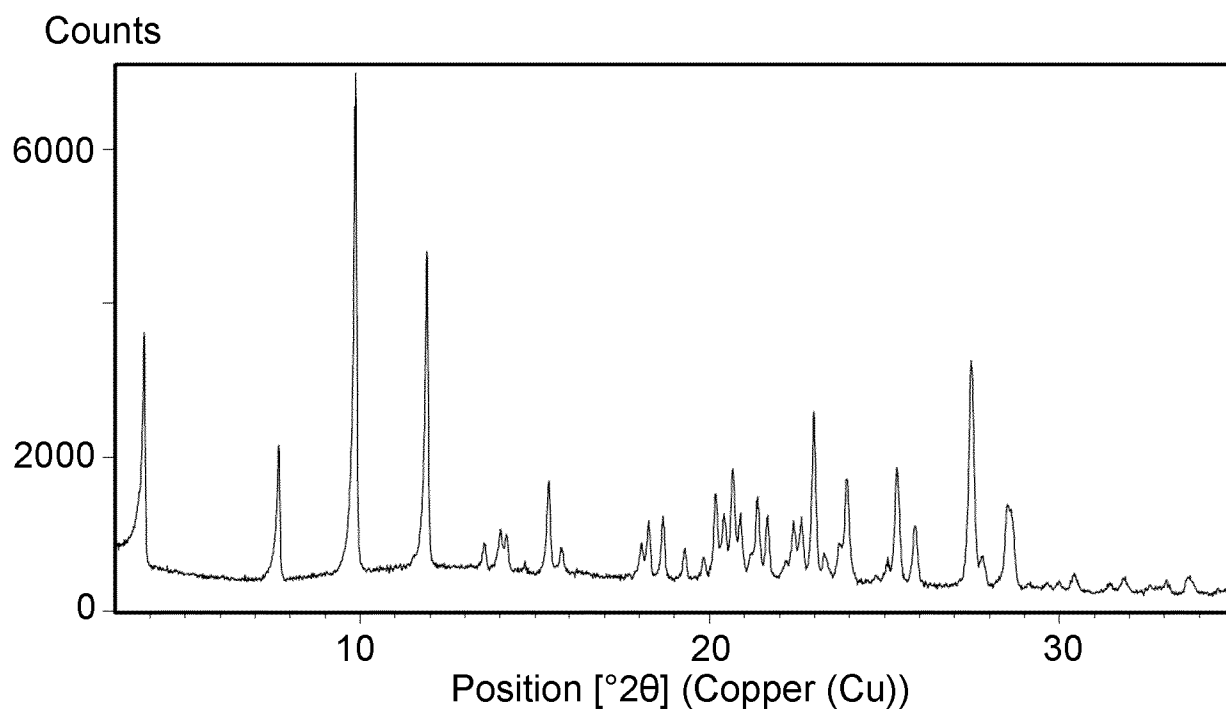


FIG 35

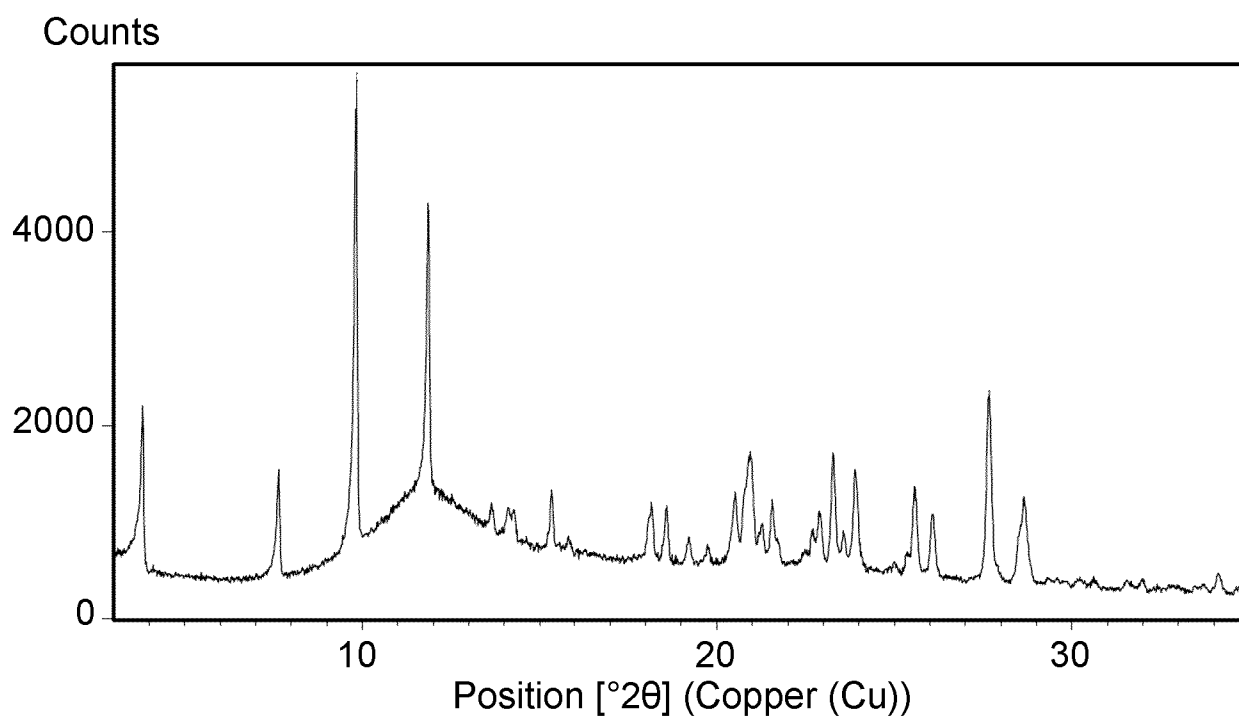


FIG 36

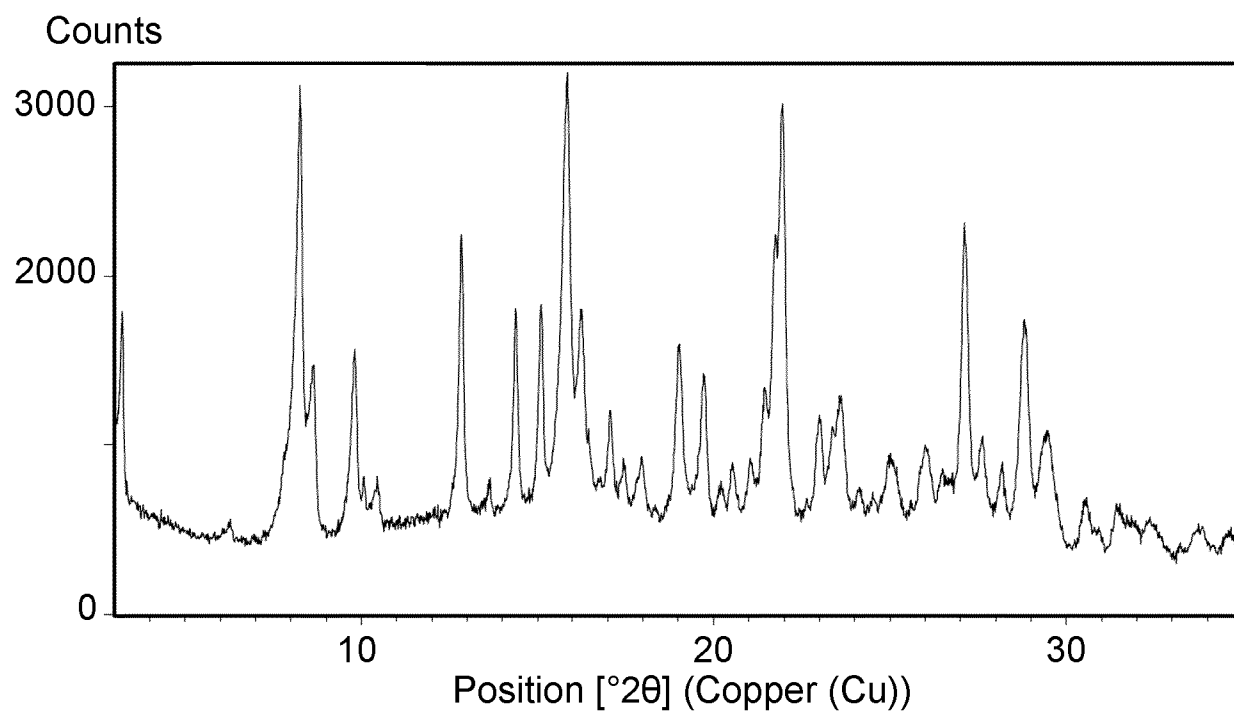


FIG 37

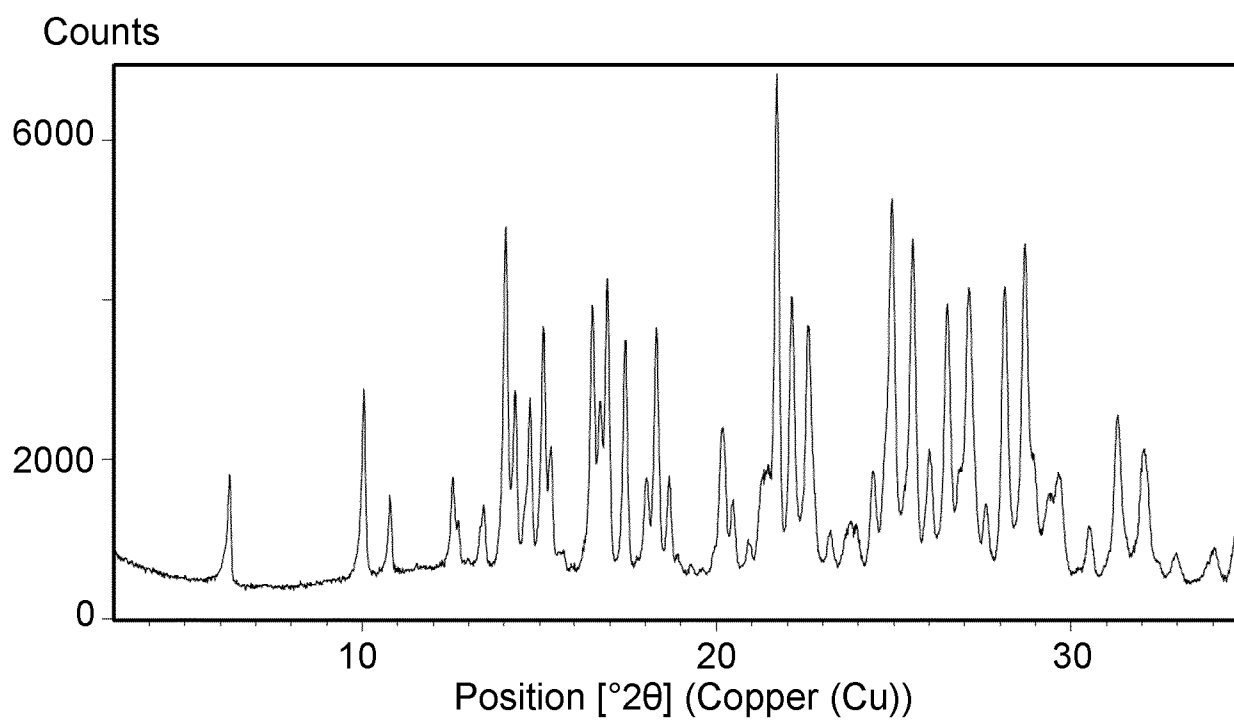


FIG 38

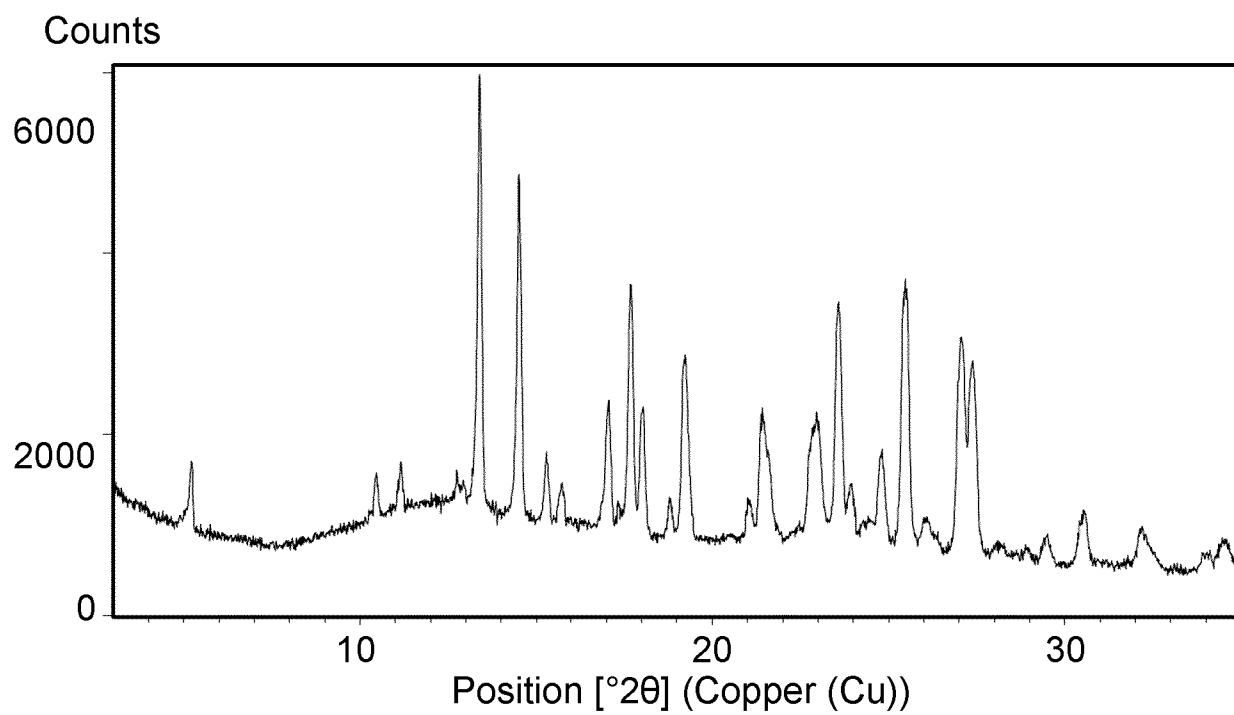


FIG 39

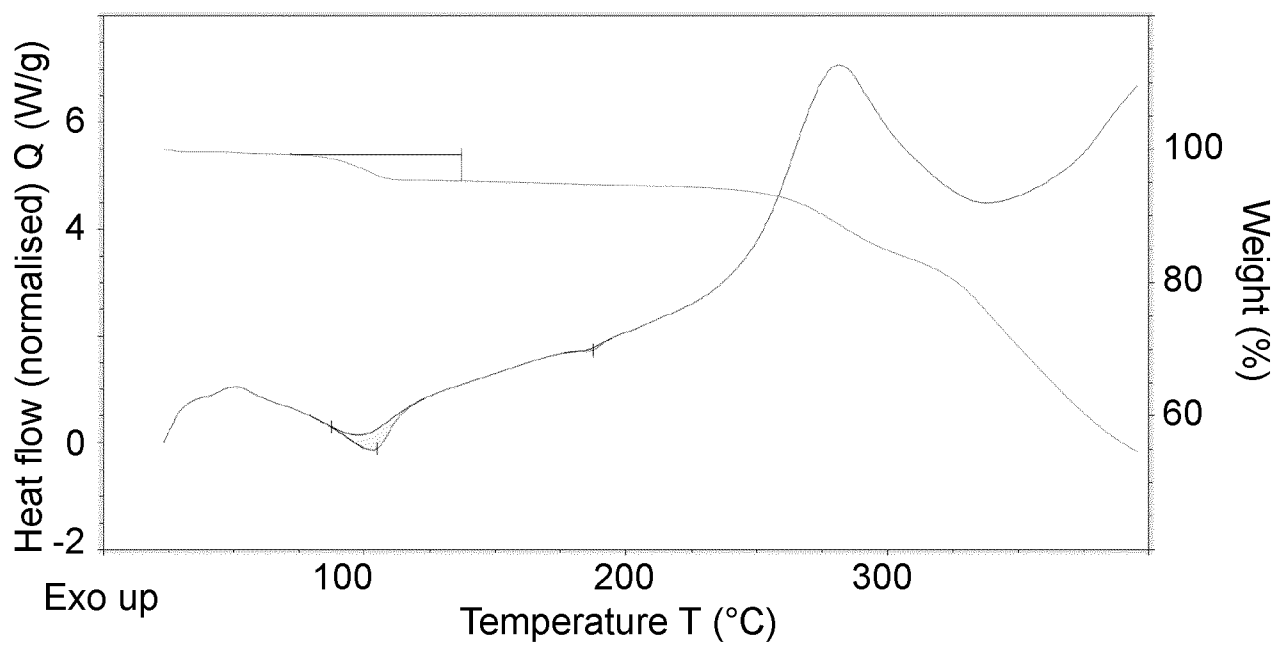


FIG 40

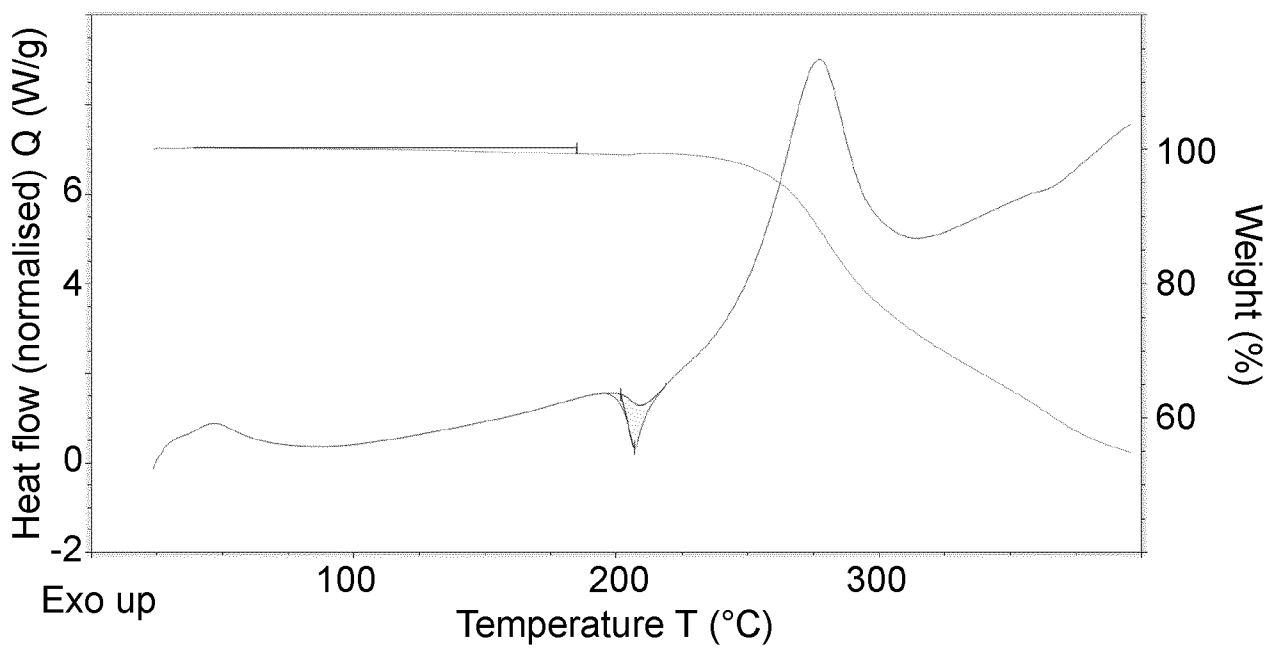


FIG 41

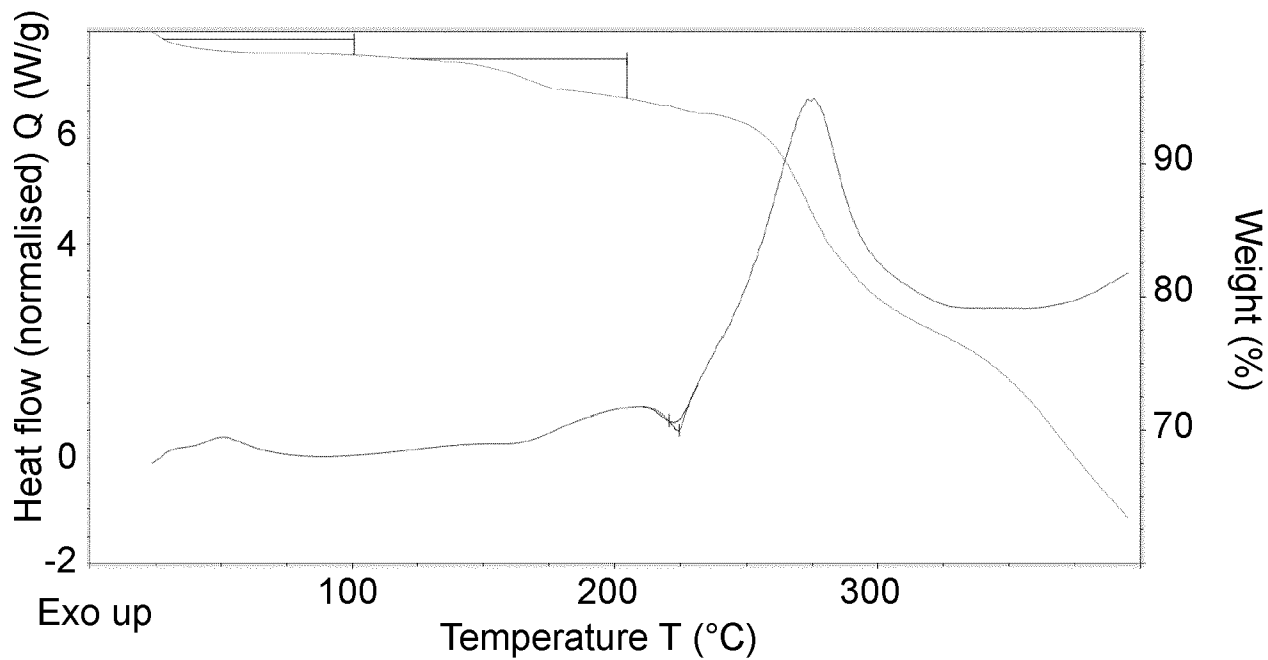


FIG 42

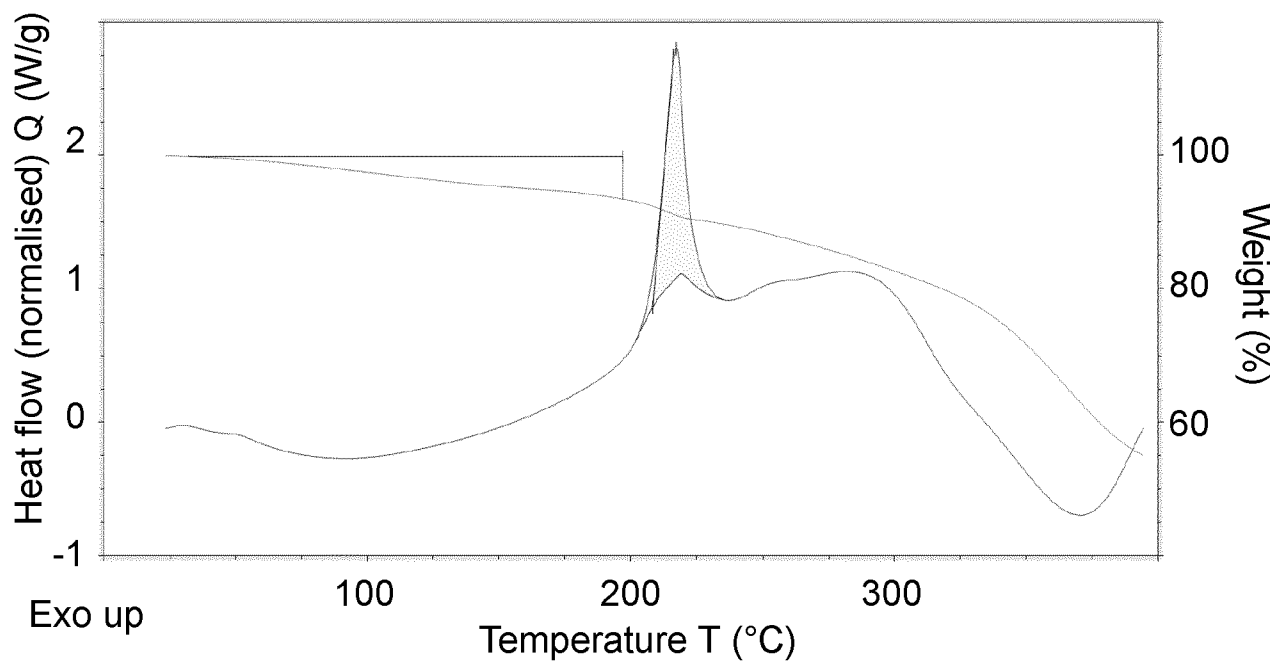


FIG 43

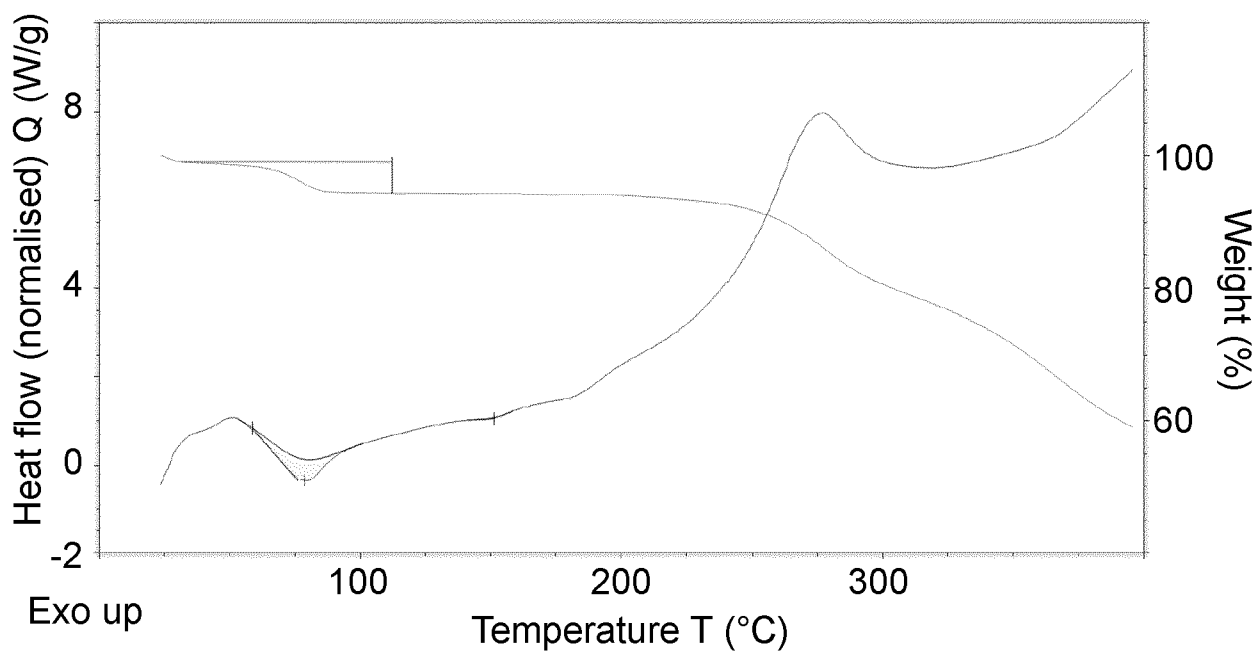


FIG 44

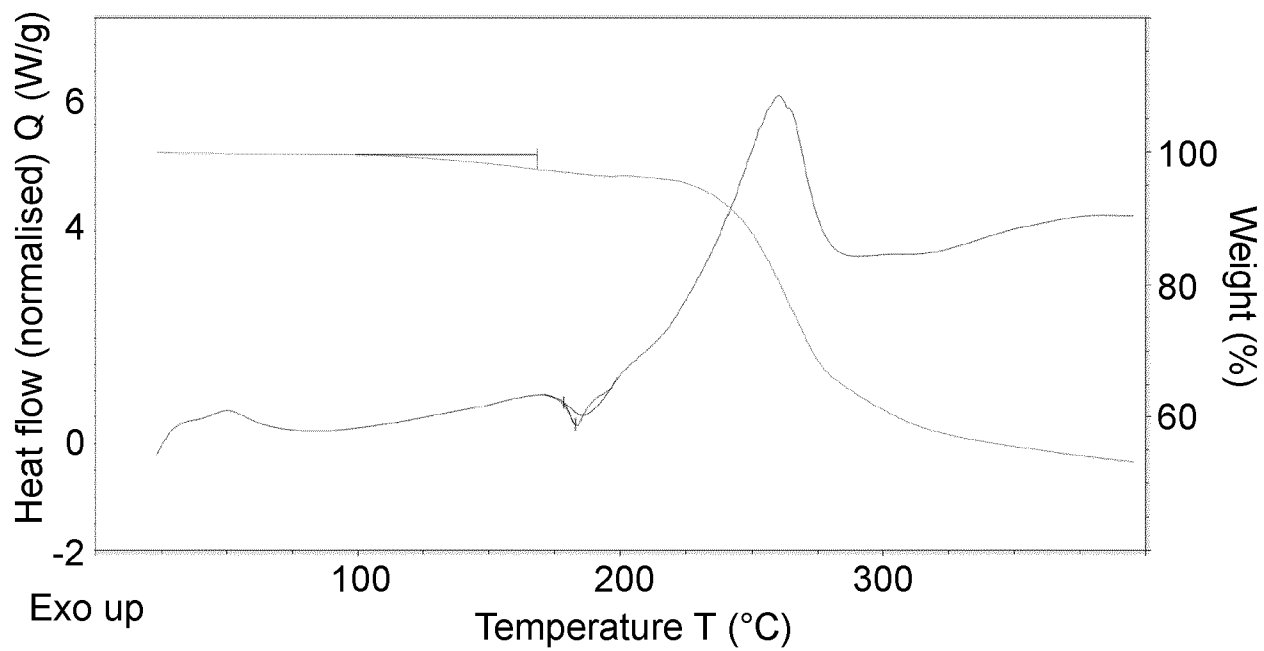


FIG 45

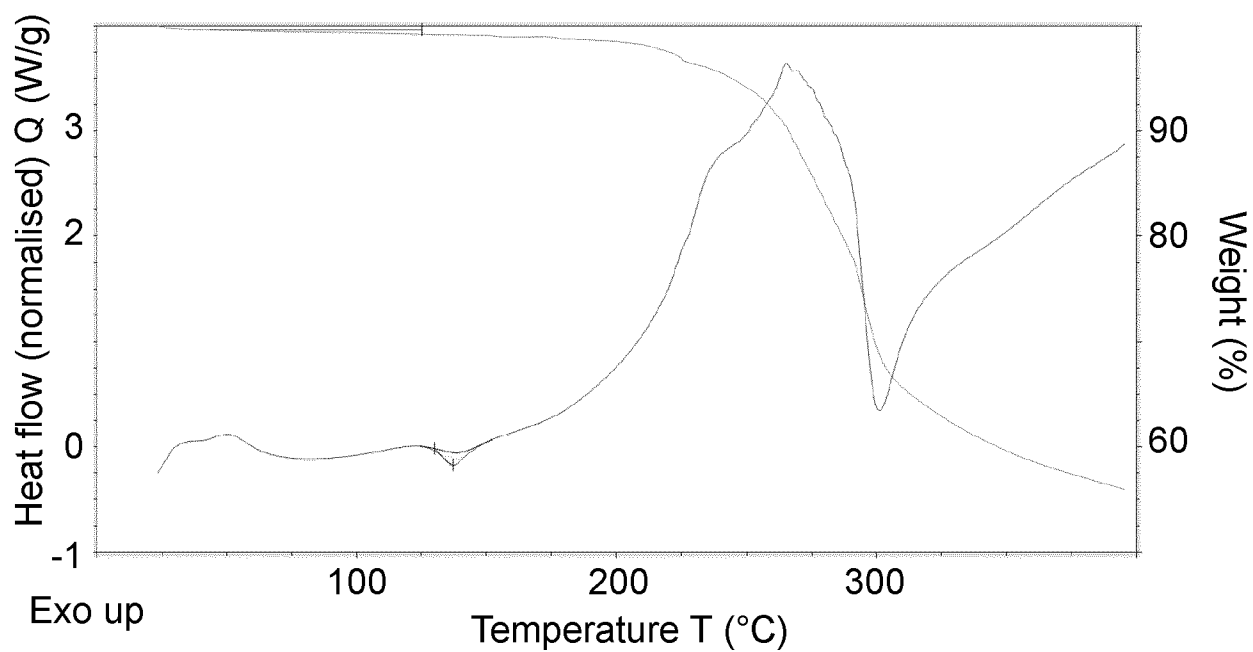


FIG 46

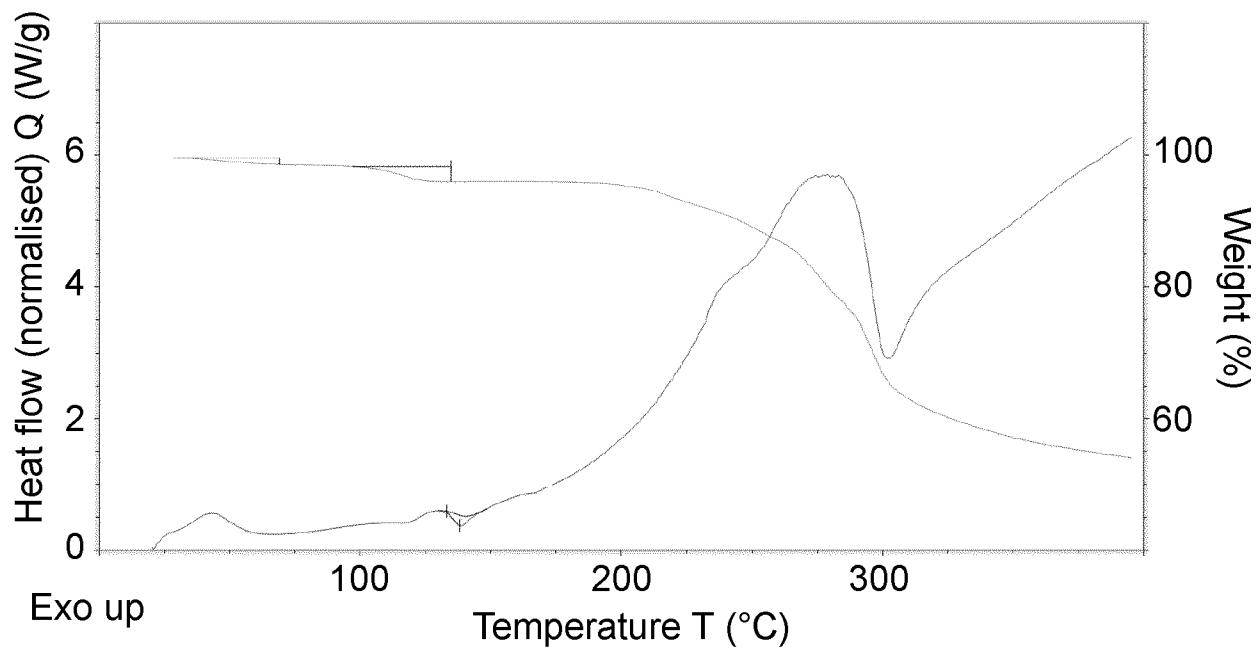


FIG 47

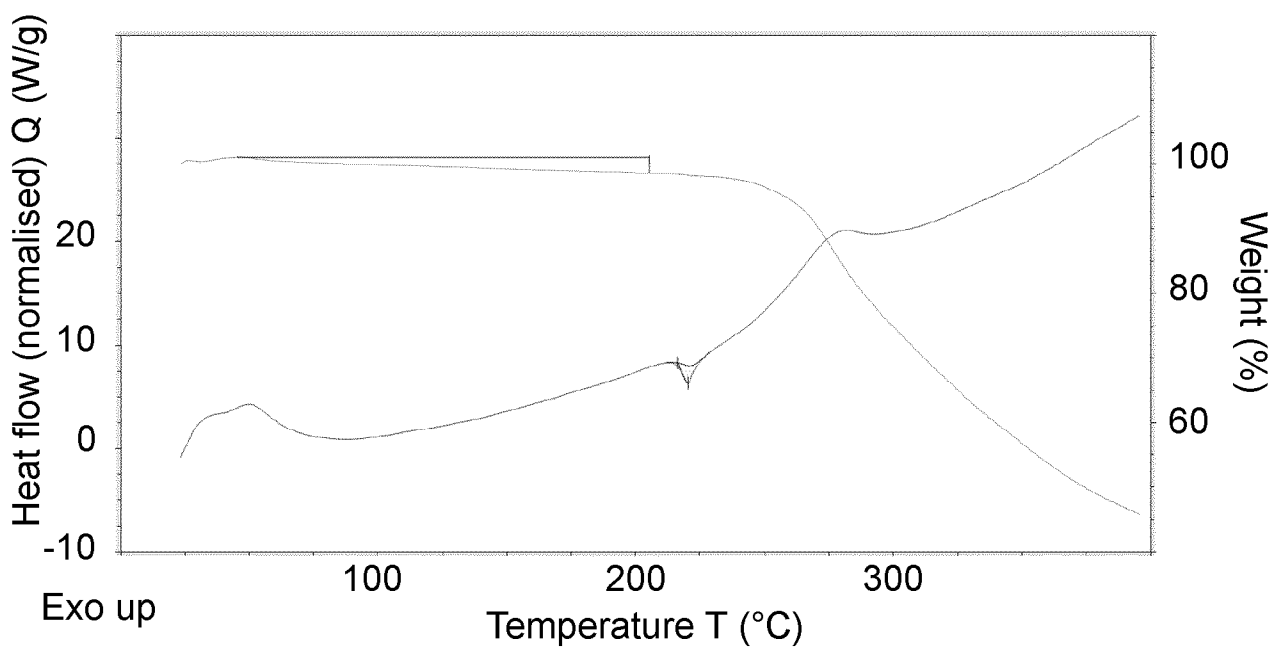


FIG 48

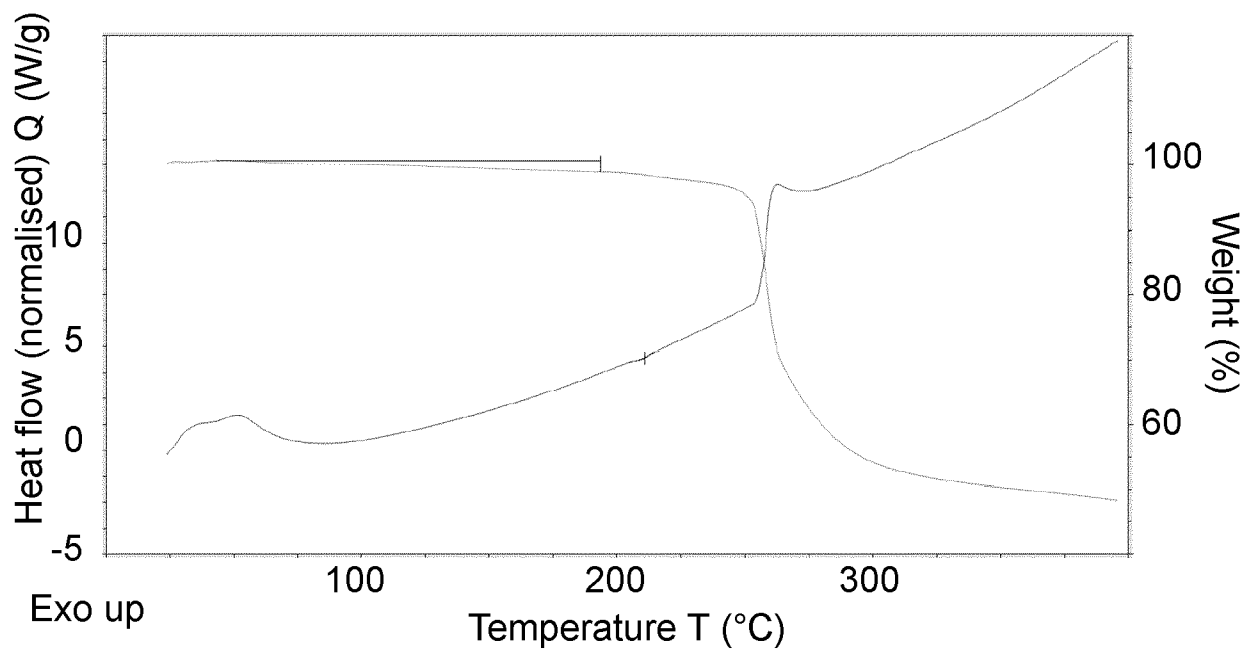


FIG 49

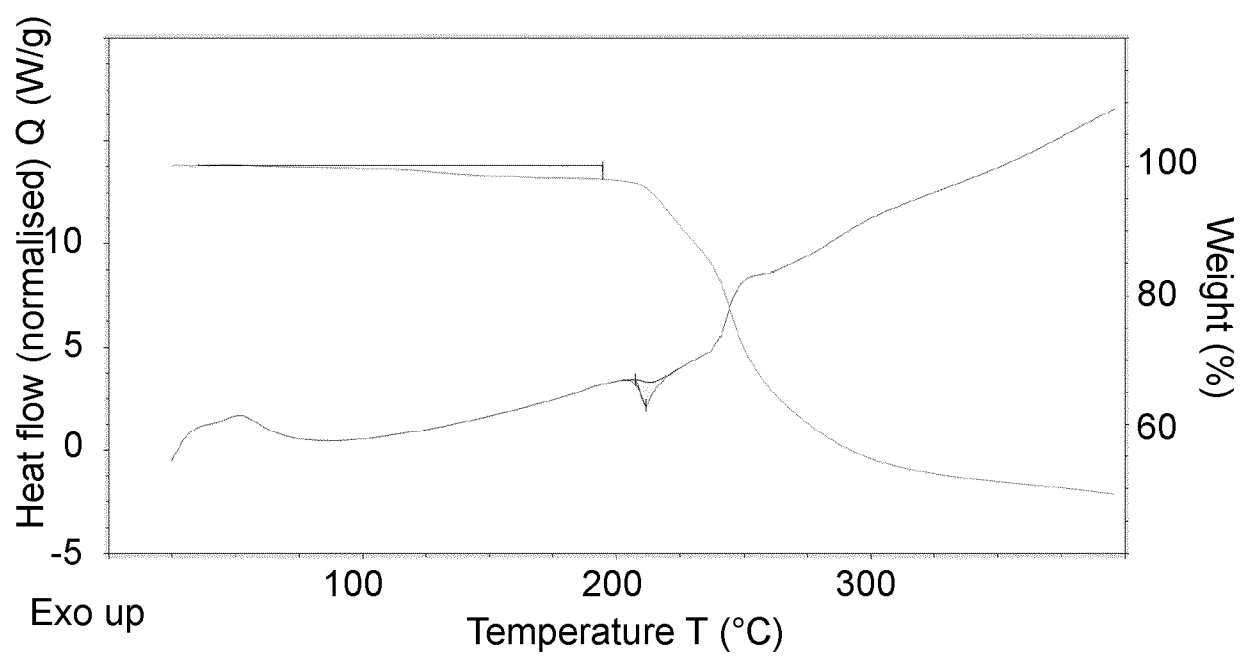


FIG 50

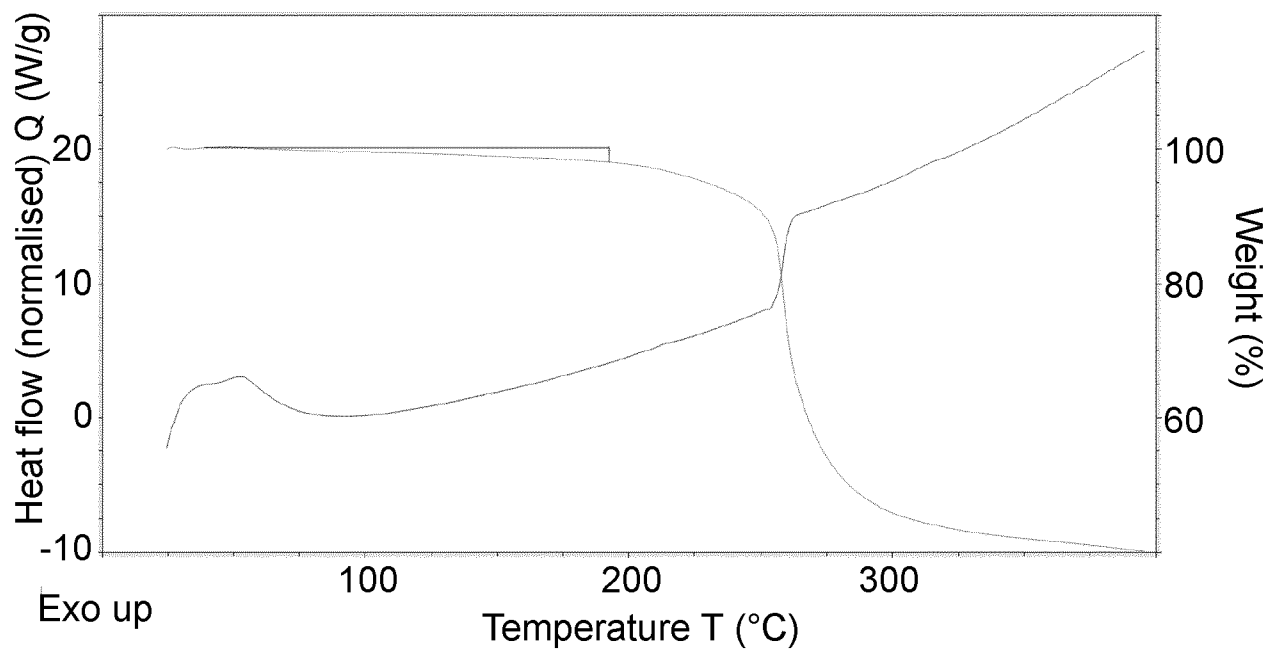


FIG 51

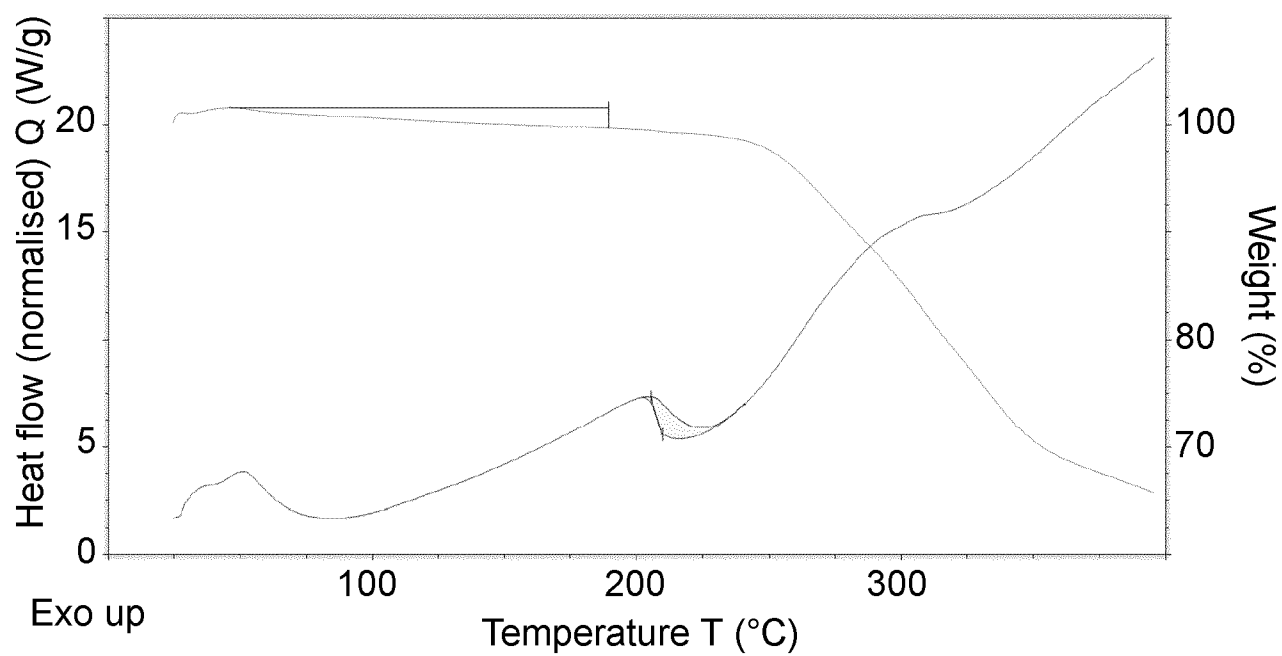


FIG 52

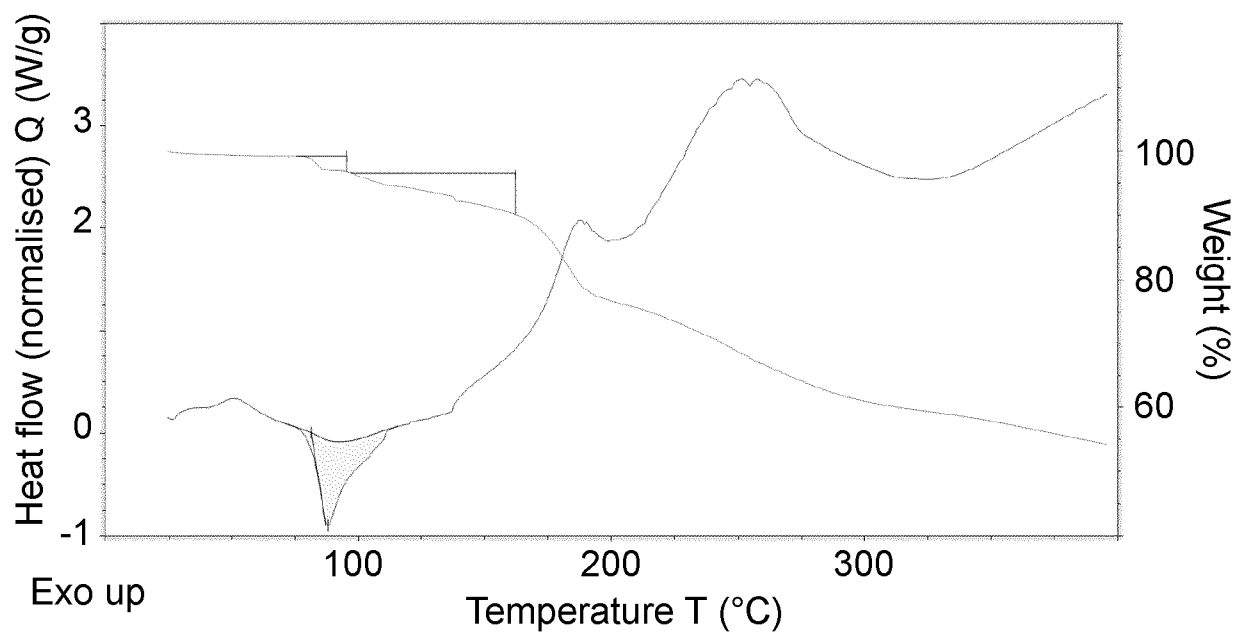


FIG 53

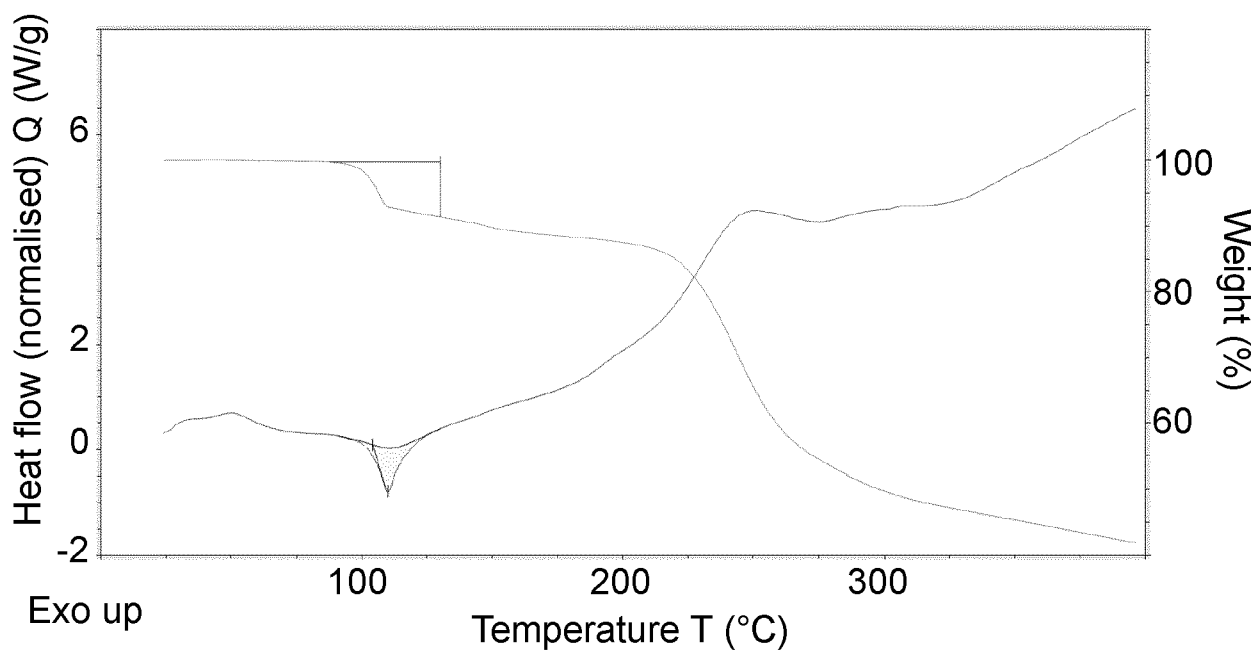


FIG 54

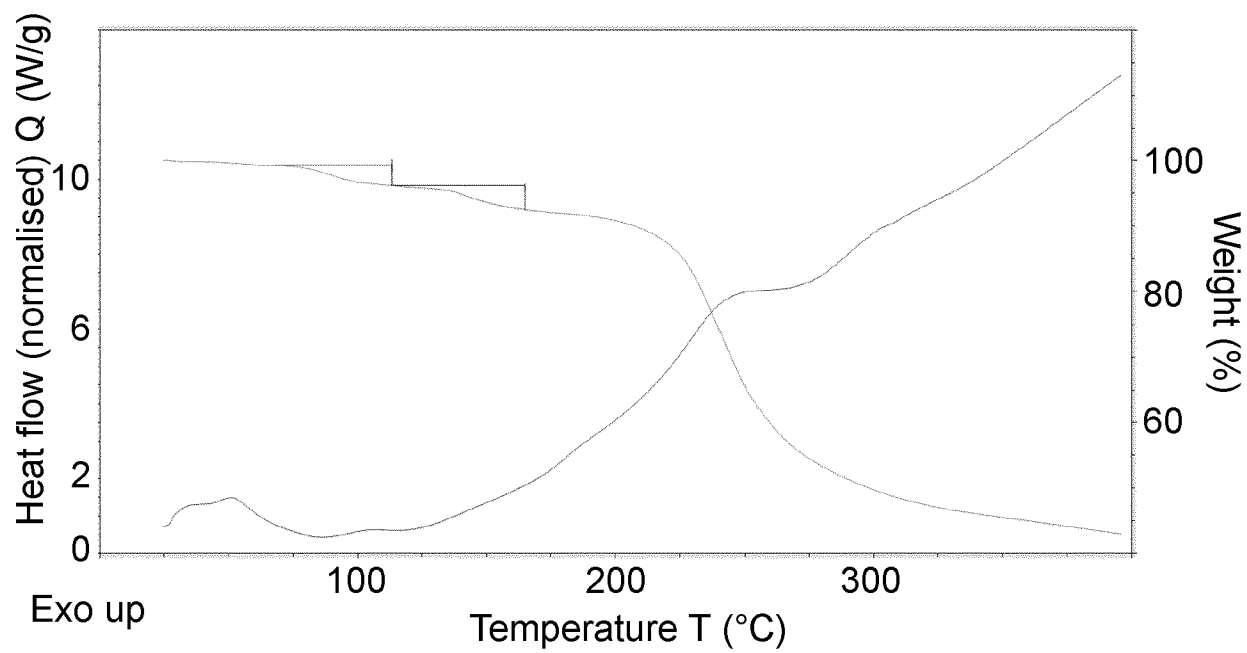


FIG 55

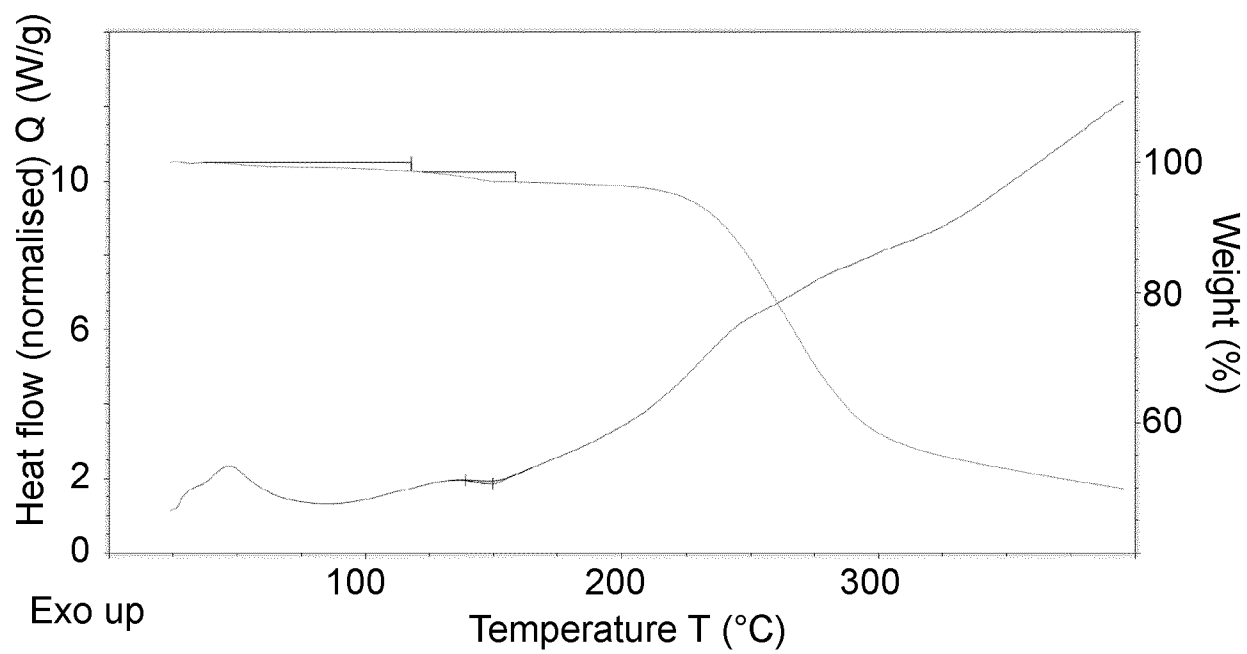


FIG 56

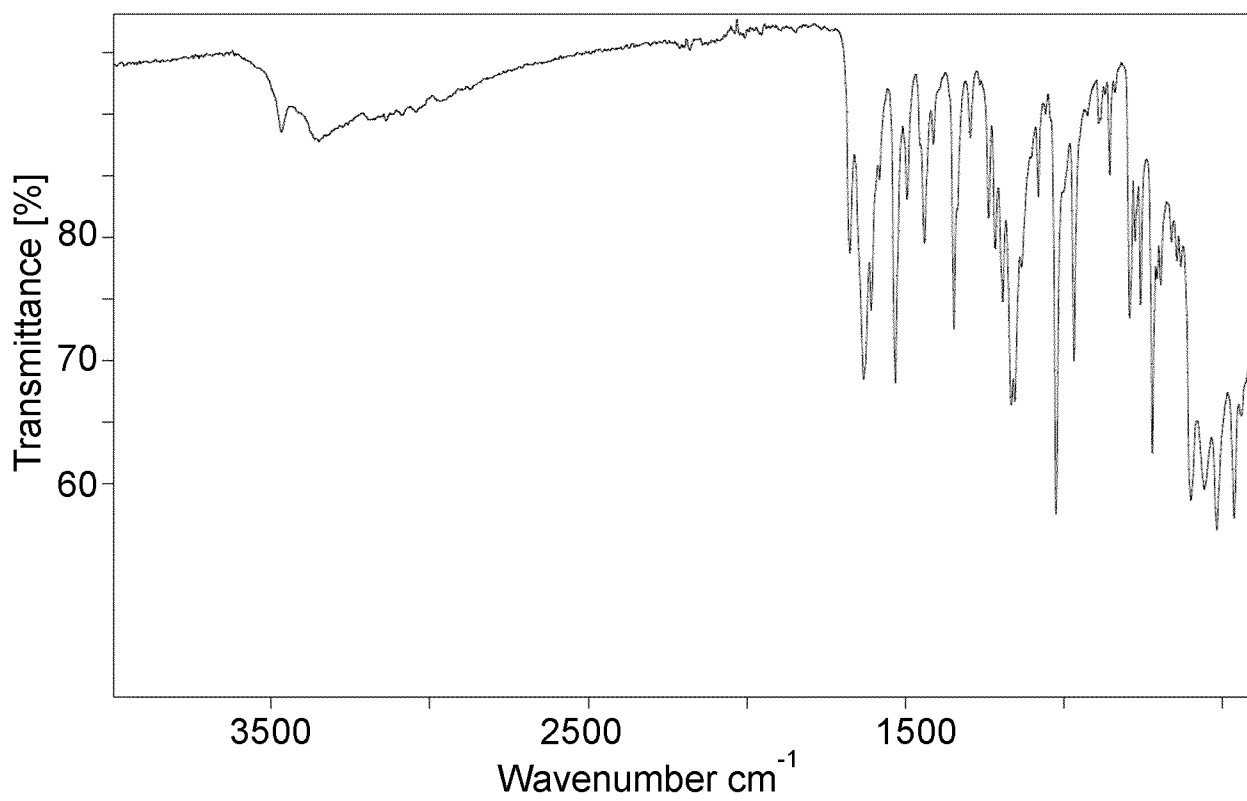


FIG 57

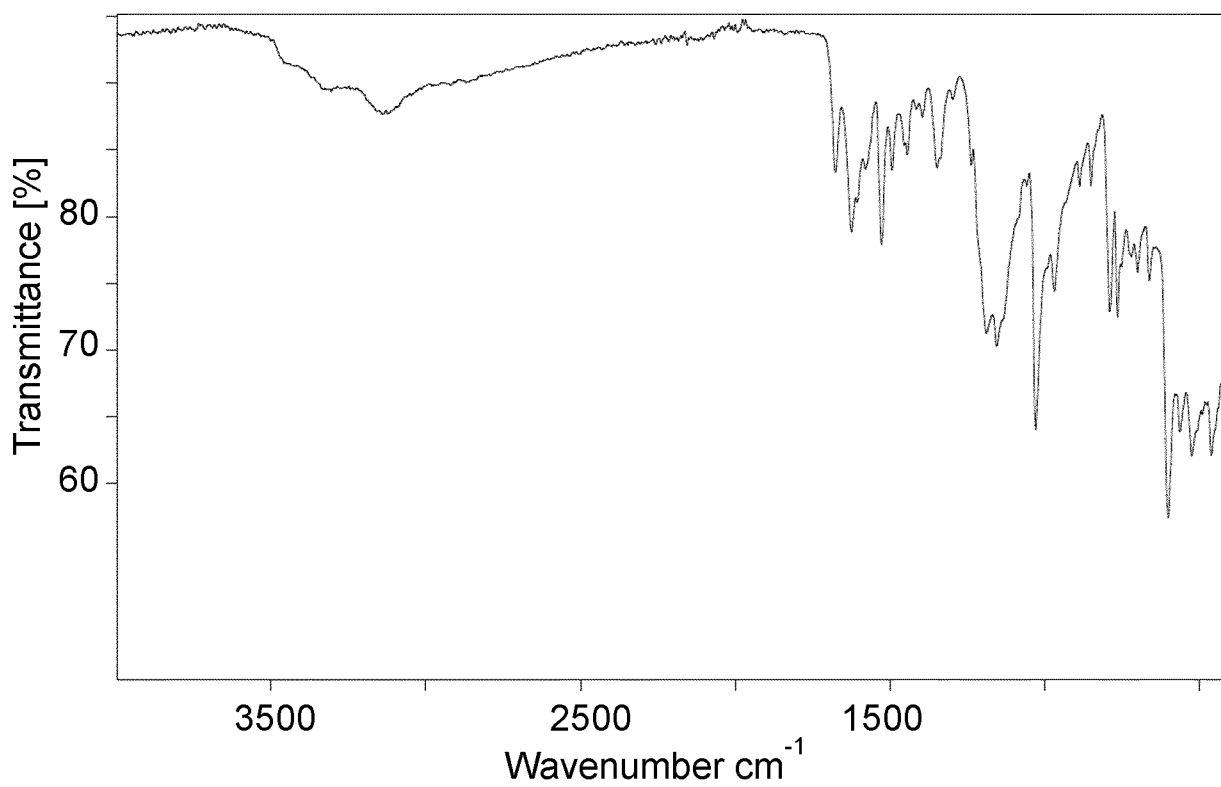


FIG 58

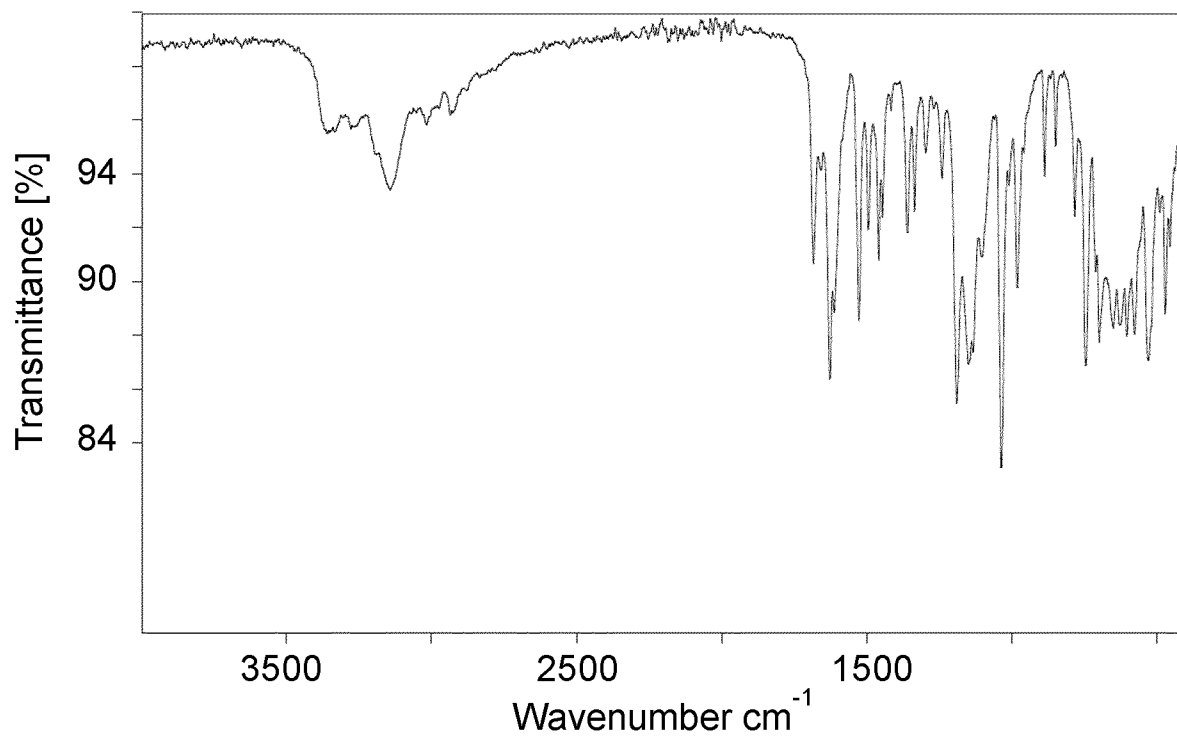


FIG 59

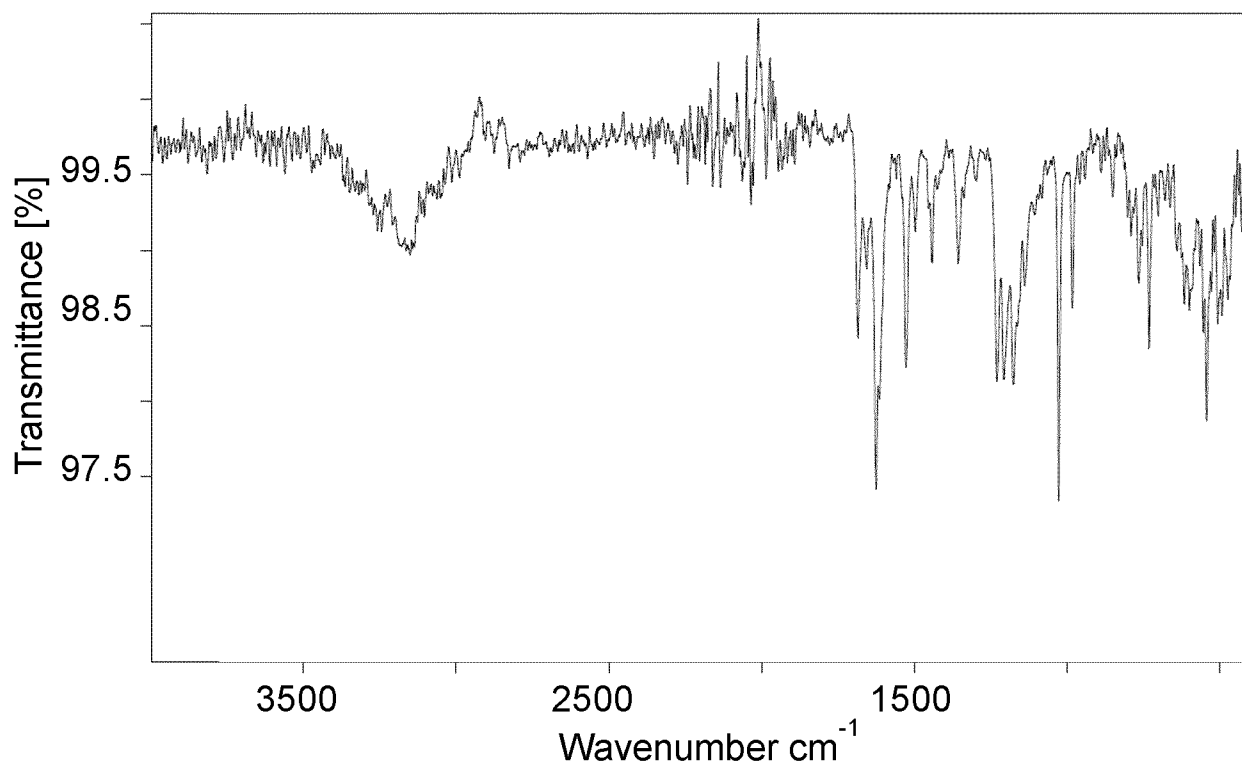


FIG 60

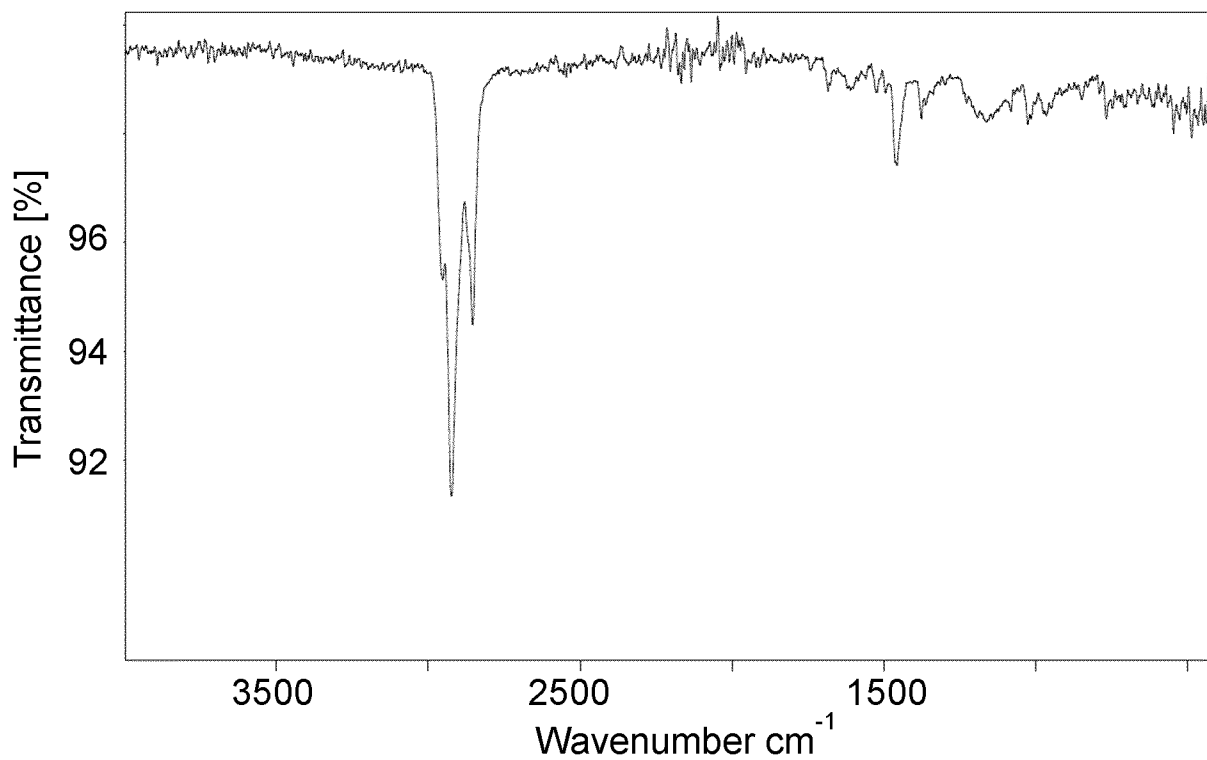


FIG 61

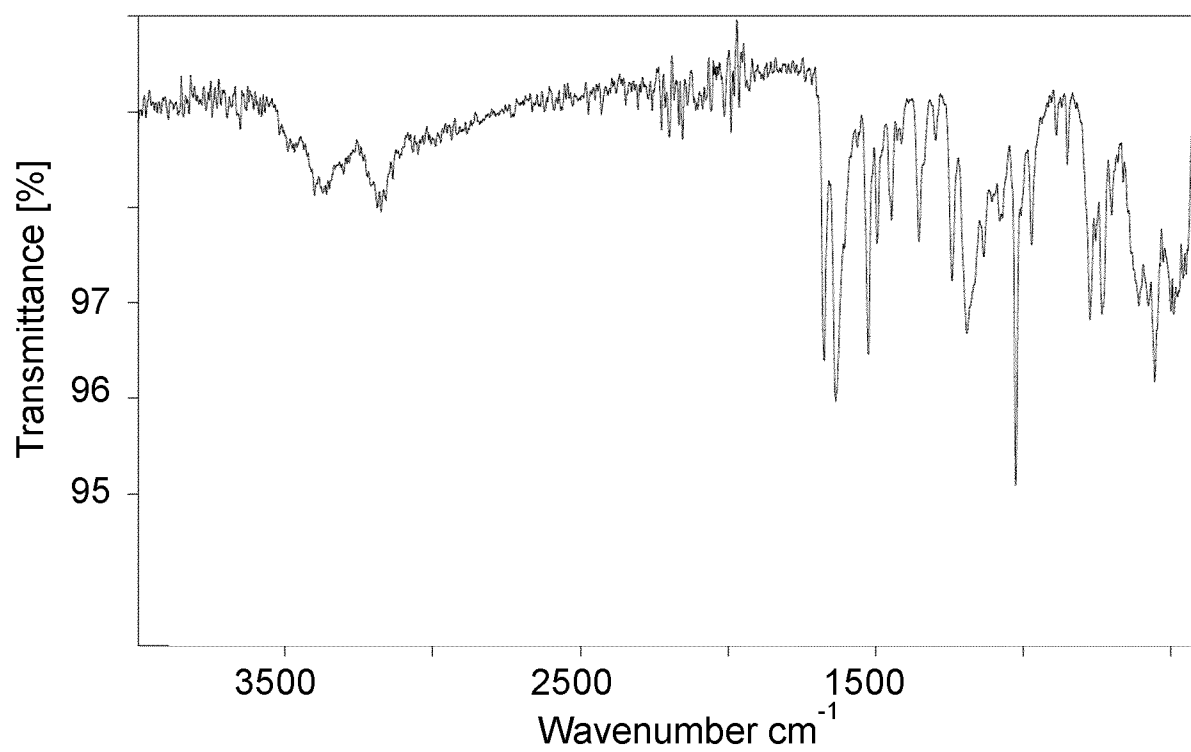


FIG 62

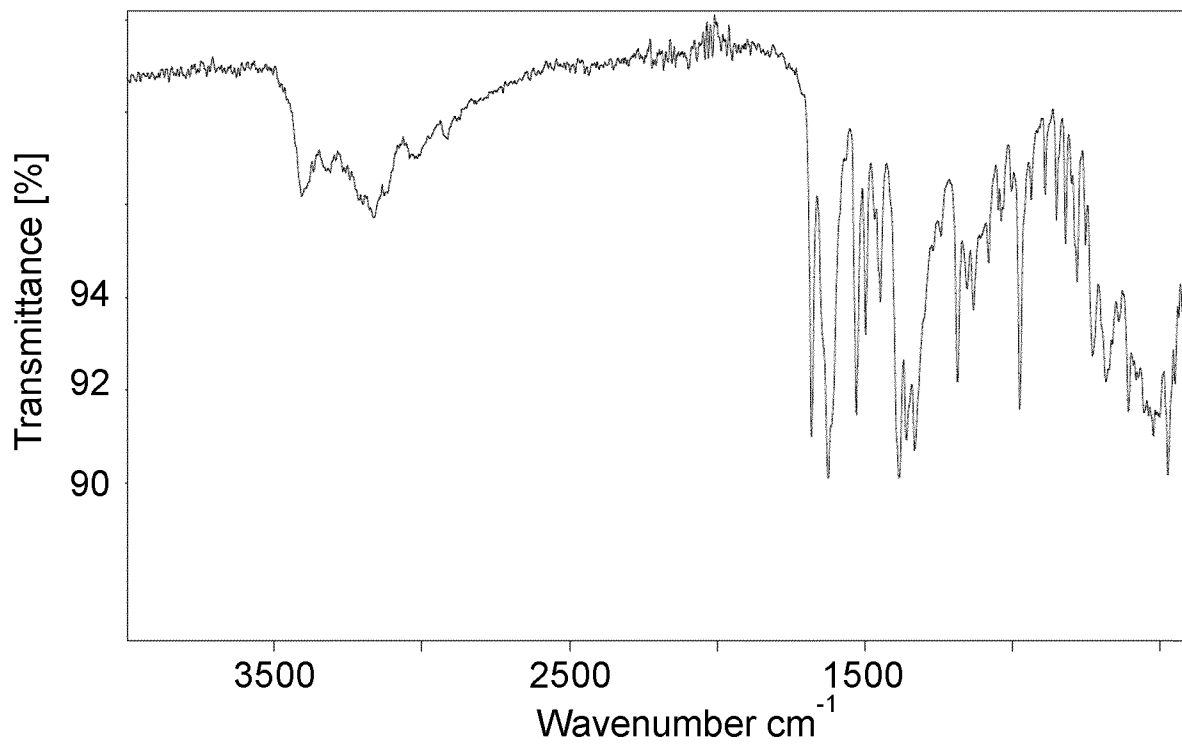


FIG 63

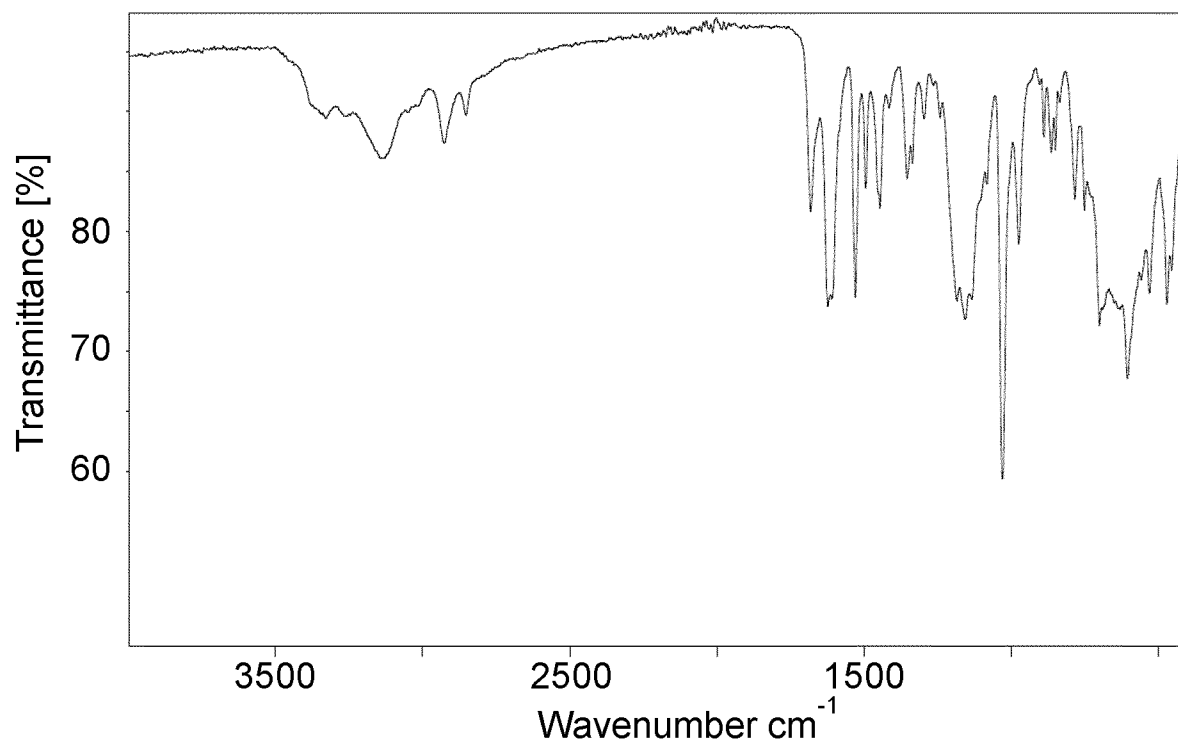


FIG 64

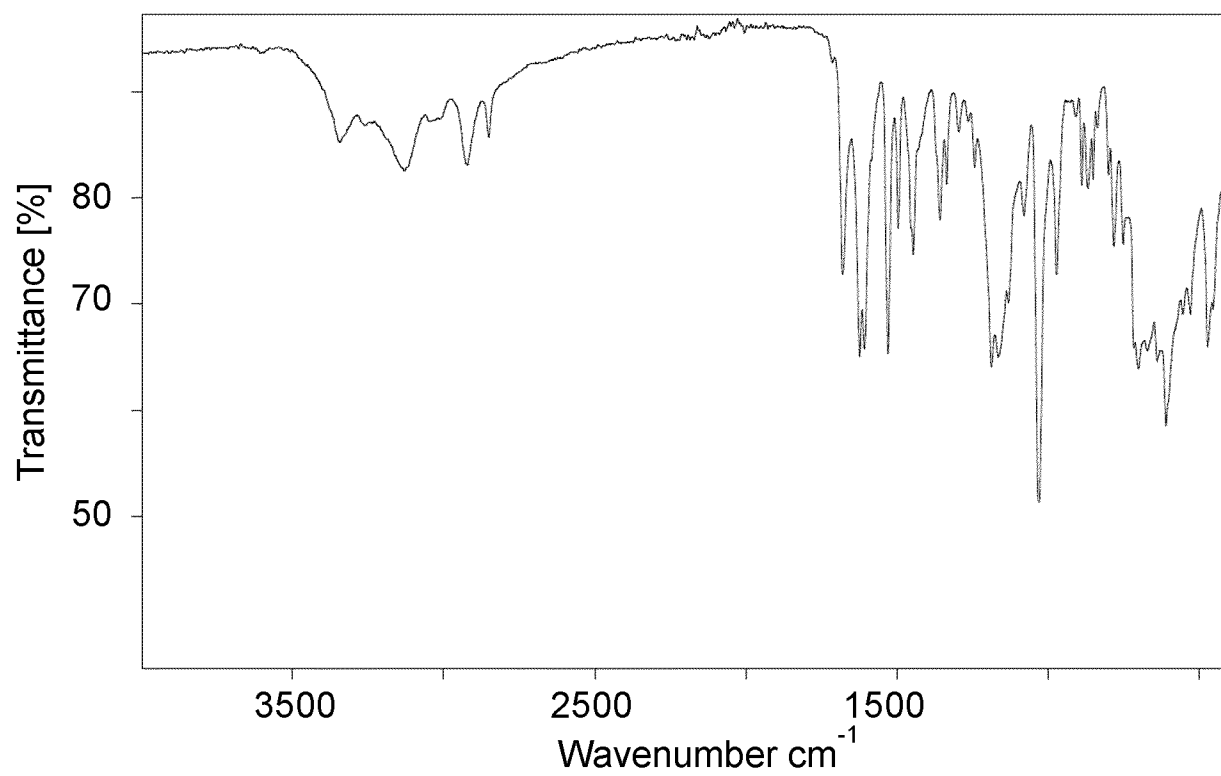


FIG 65

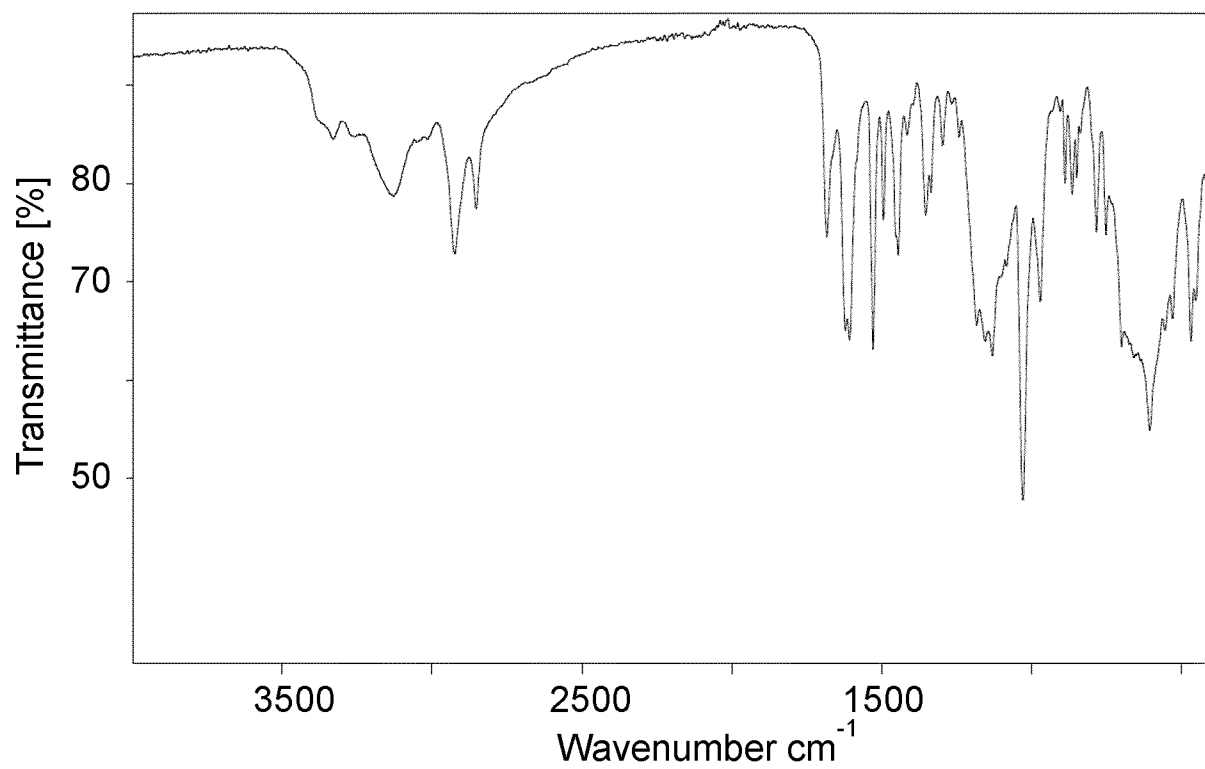


FIG 66

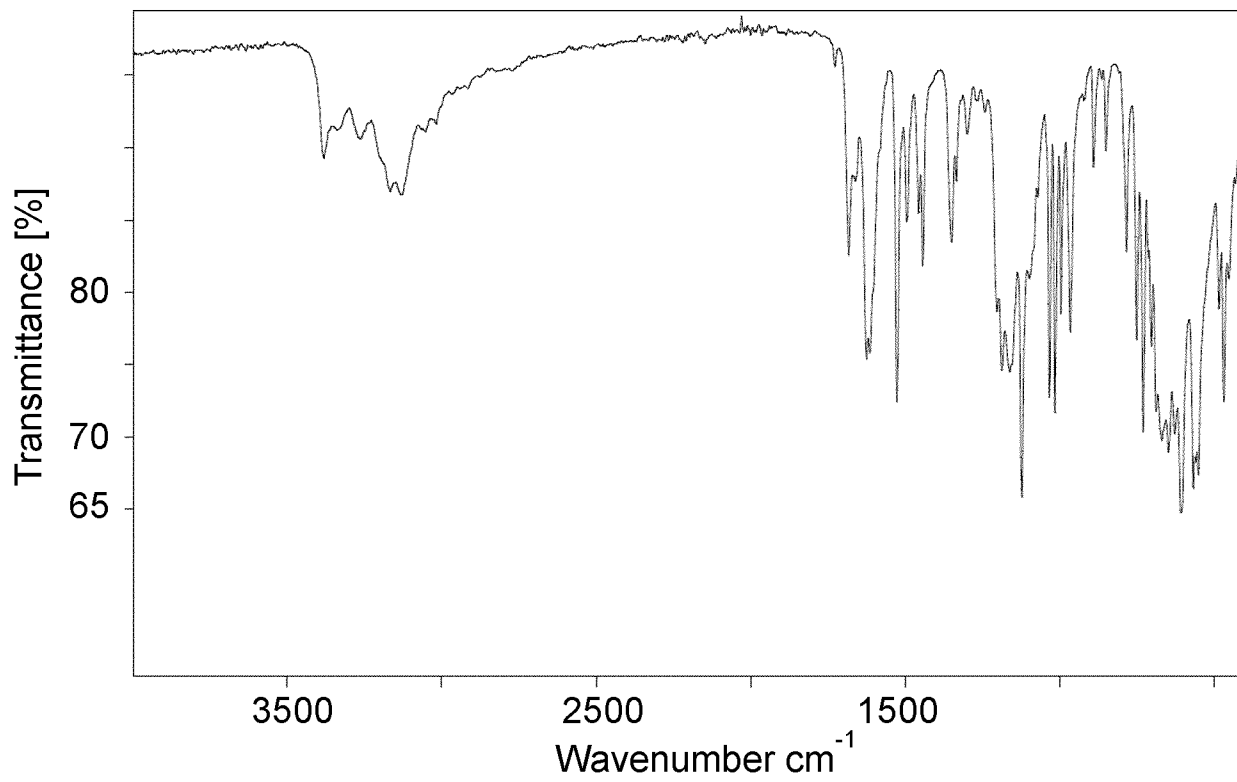


FIG 67

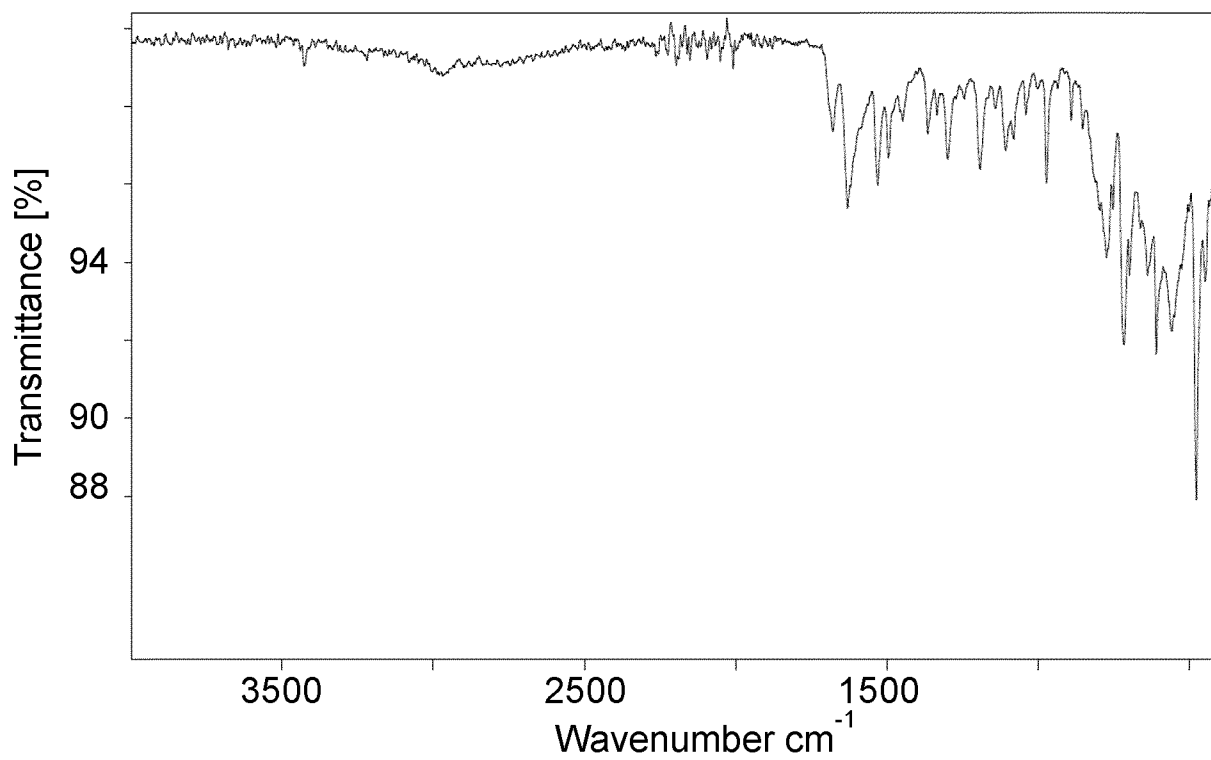


FIG 68

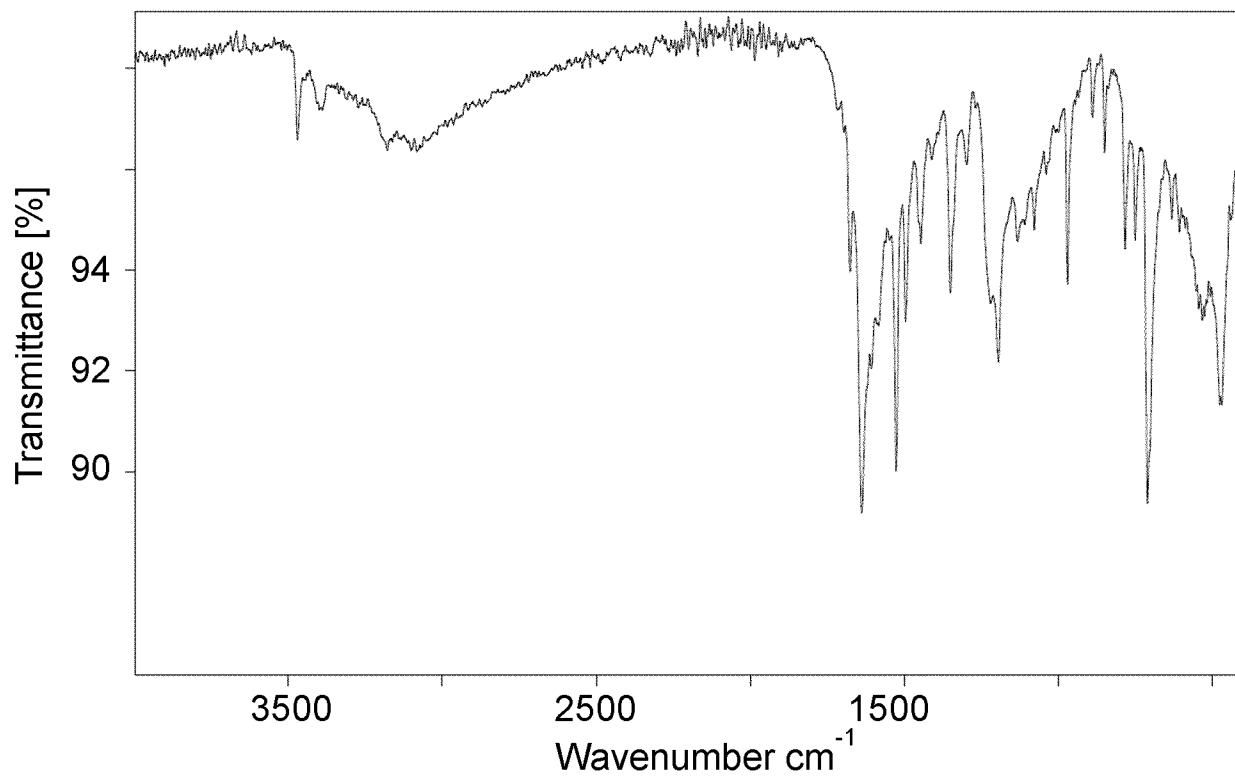


FIG 69

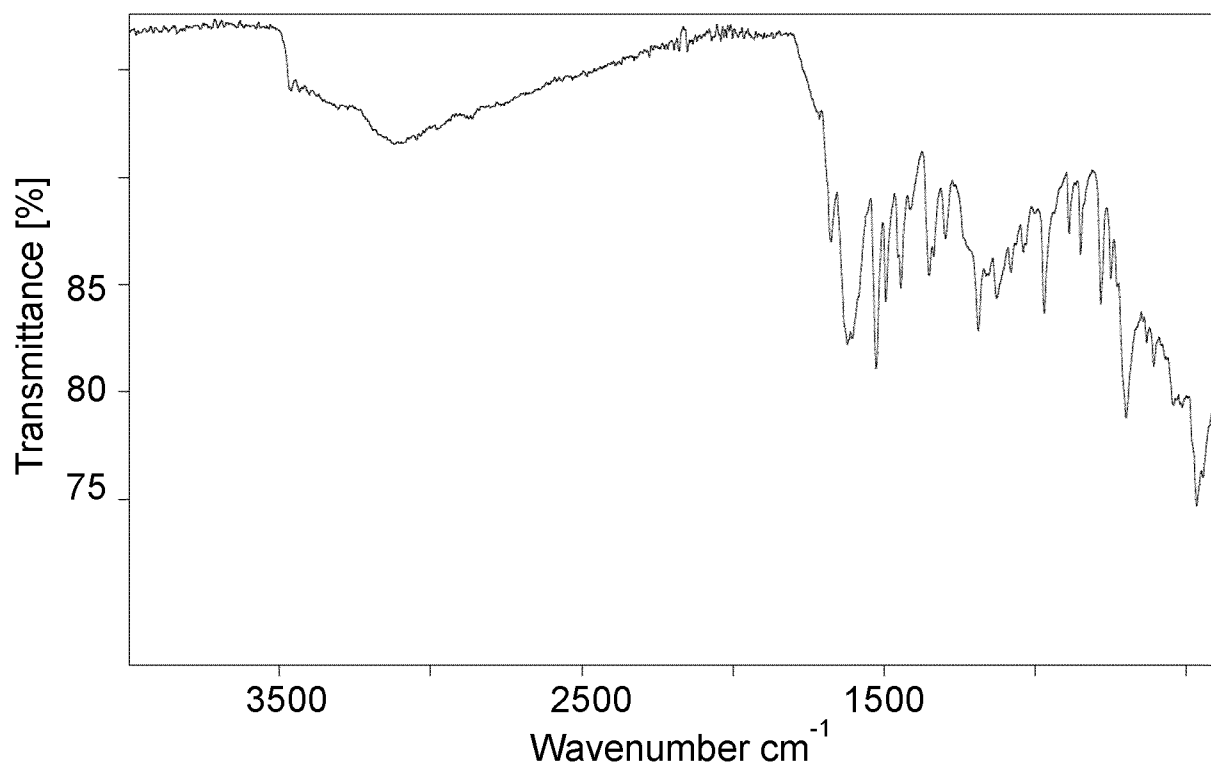


FIG 70

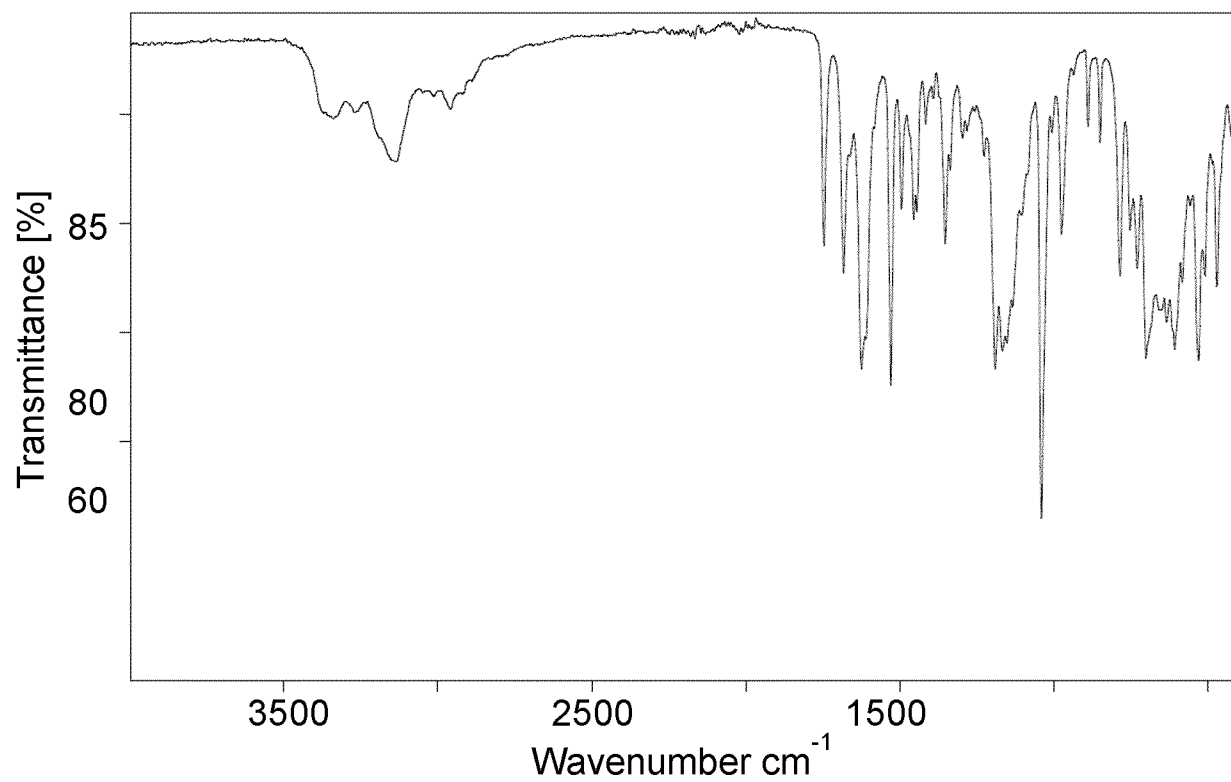


FIG 71

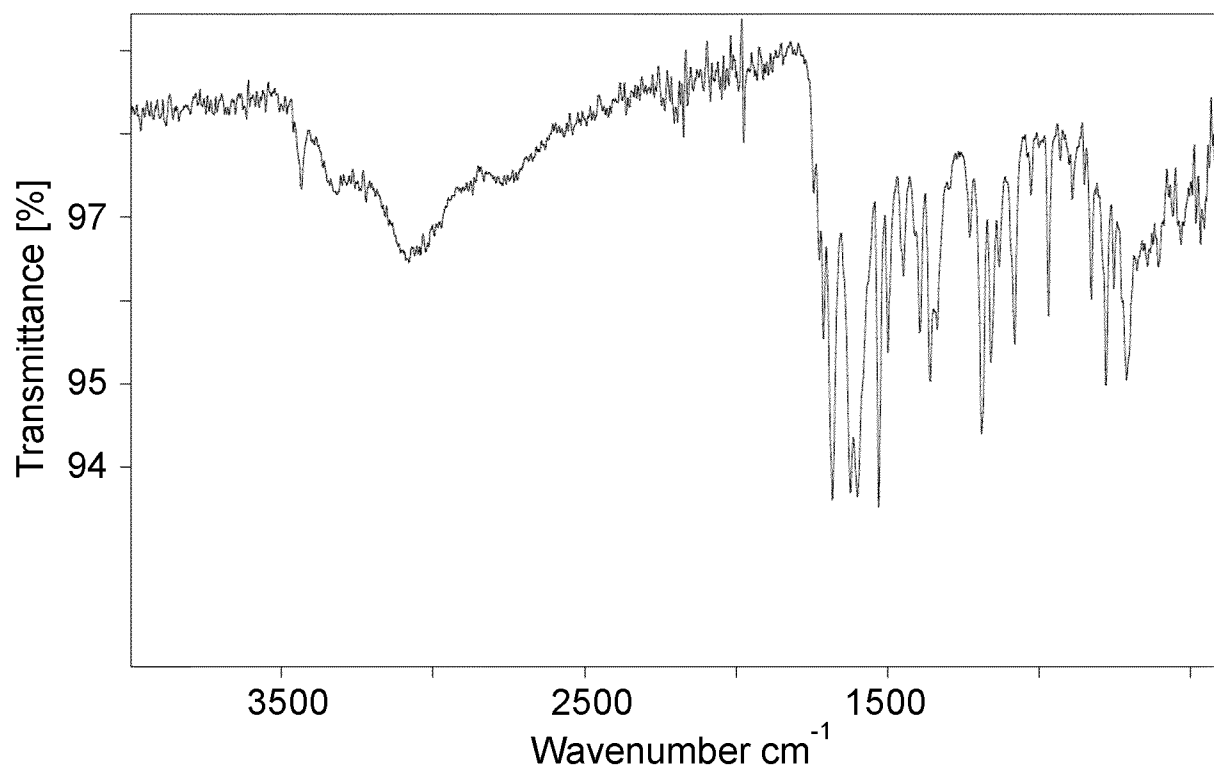


FIG 72

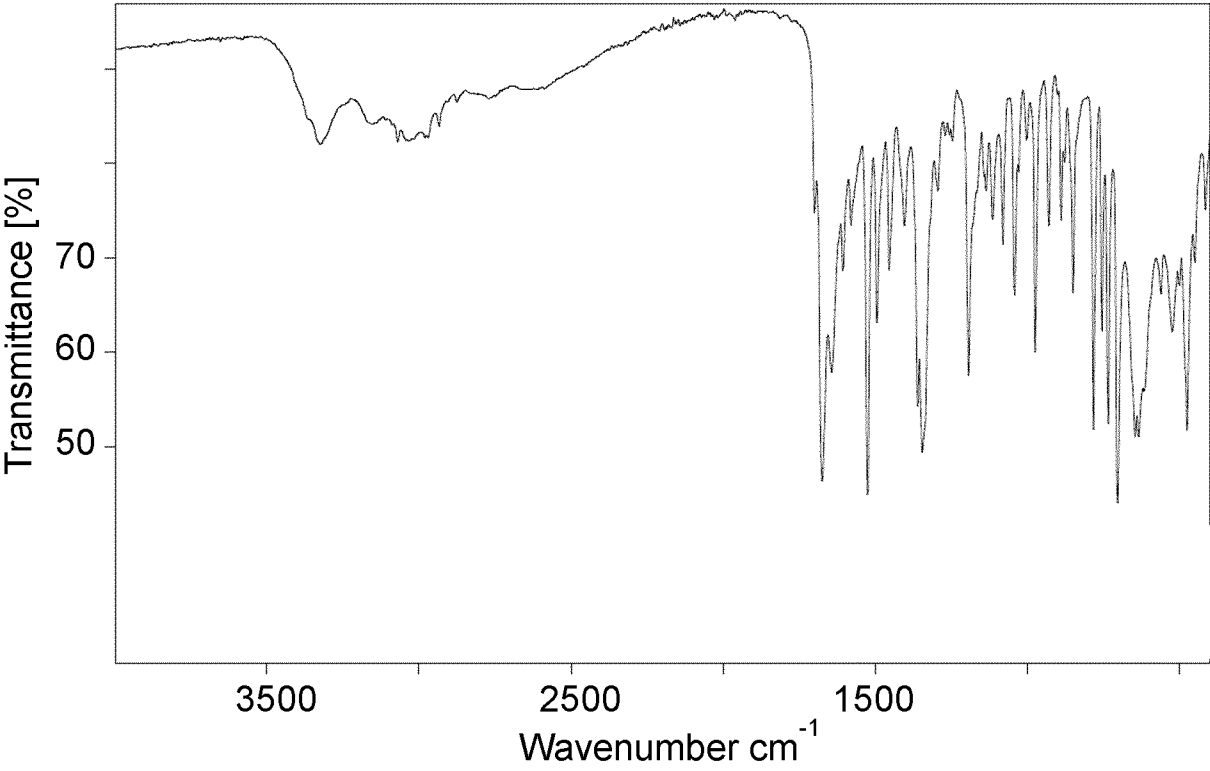


FIG 73

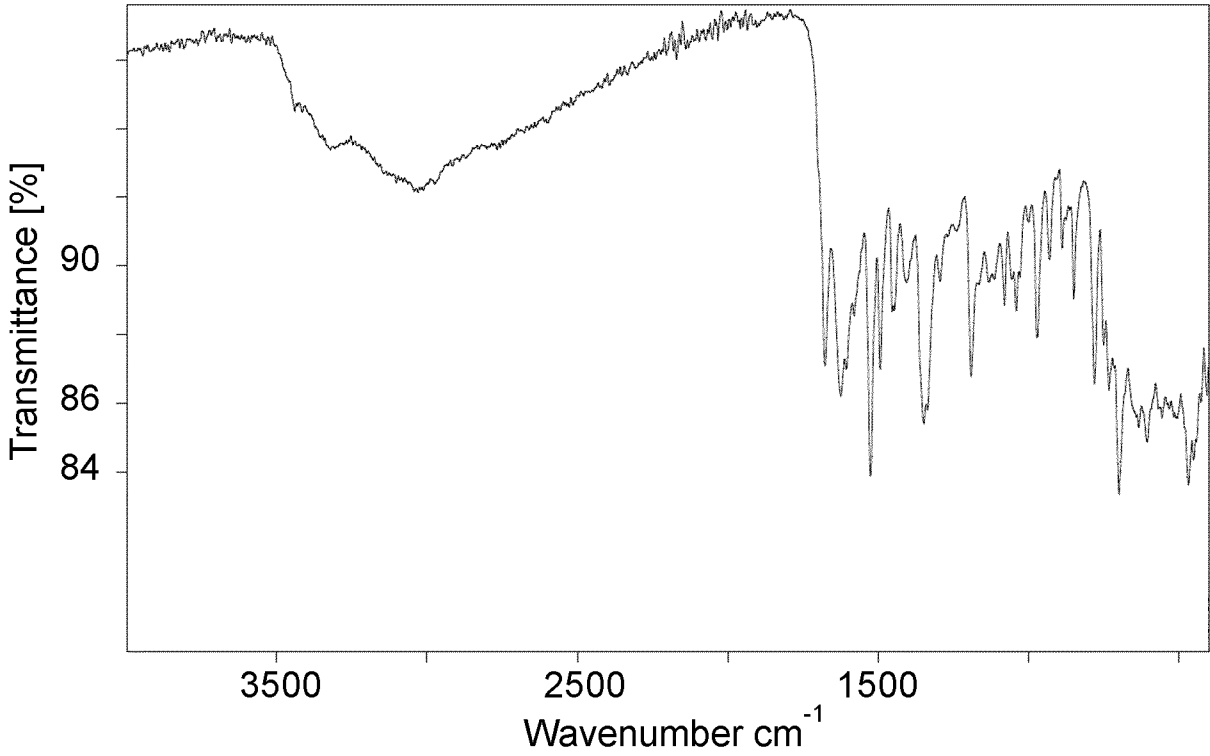


FIG 74

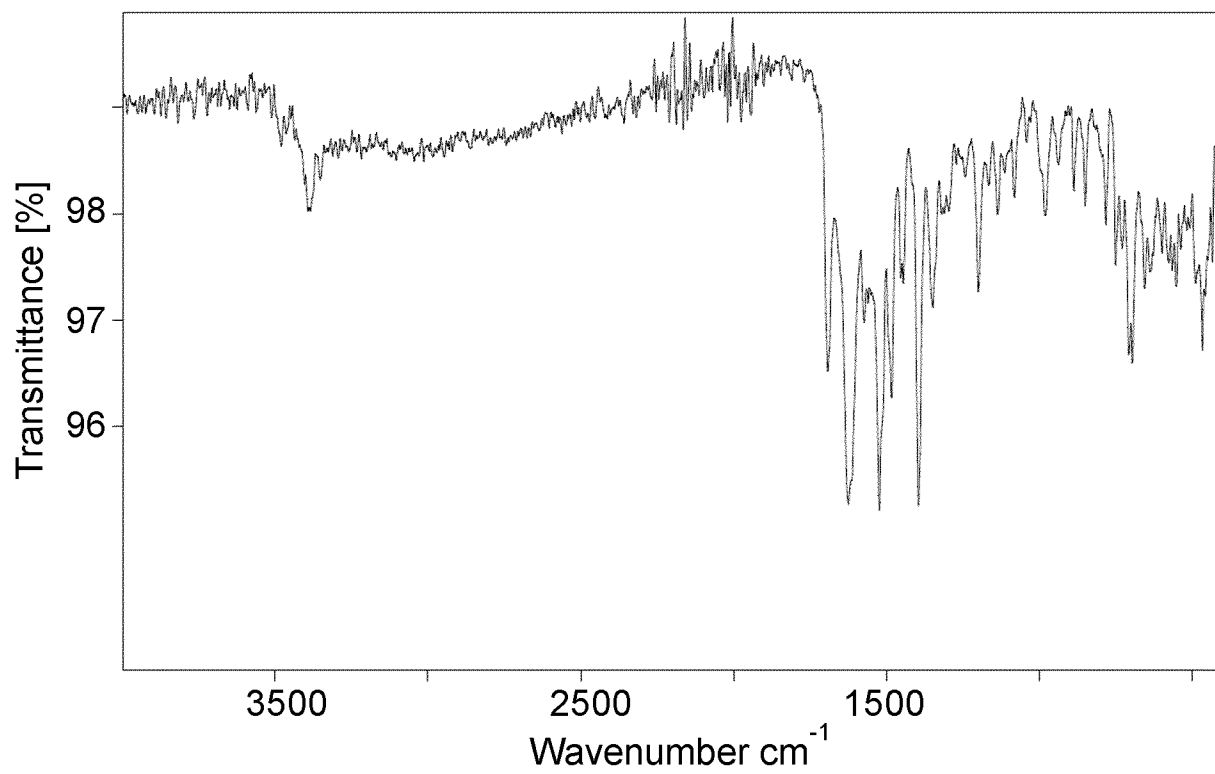


FIG 75

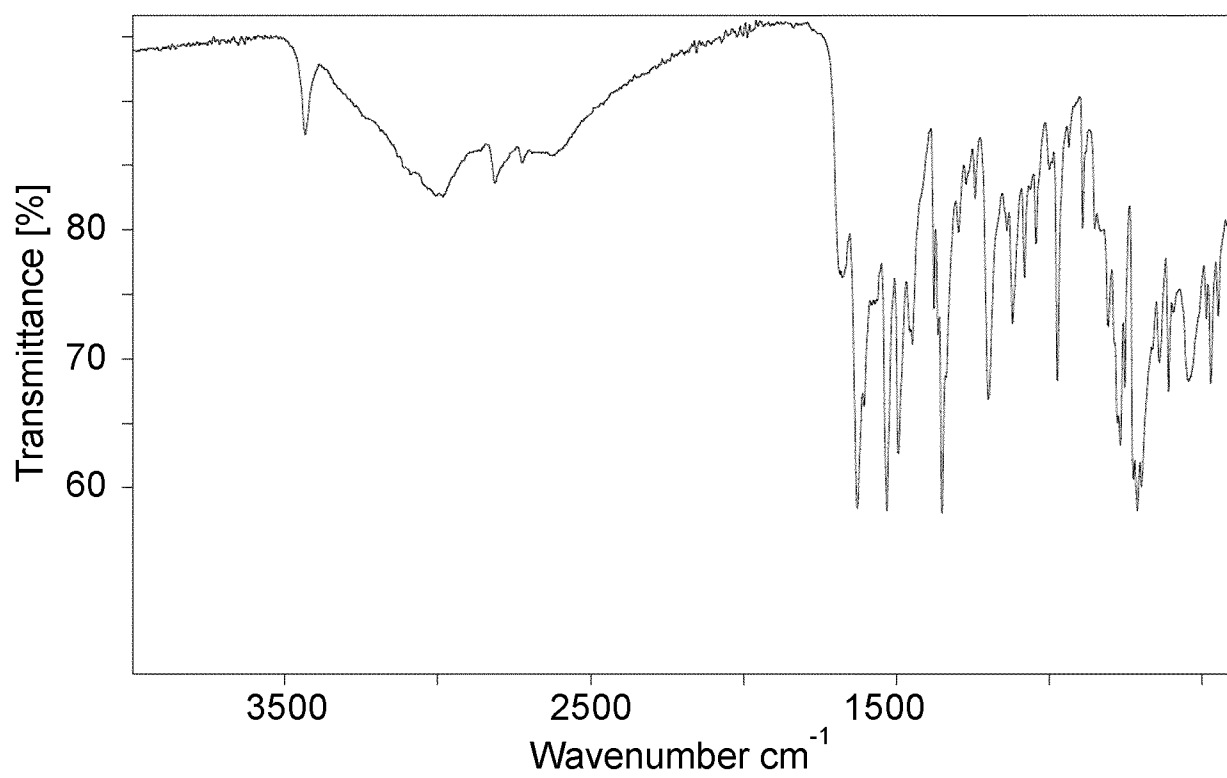


FIG 76

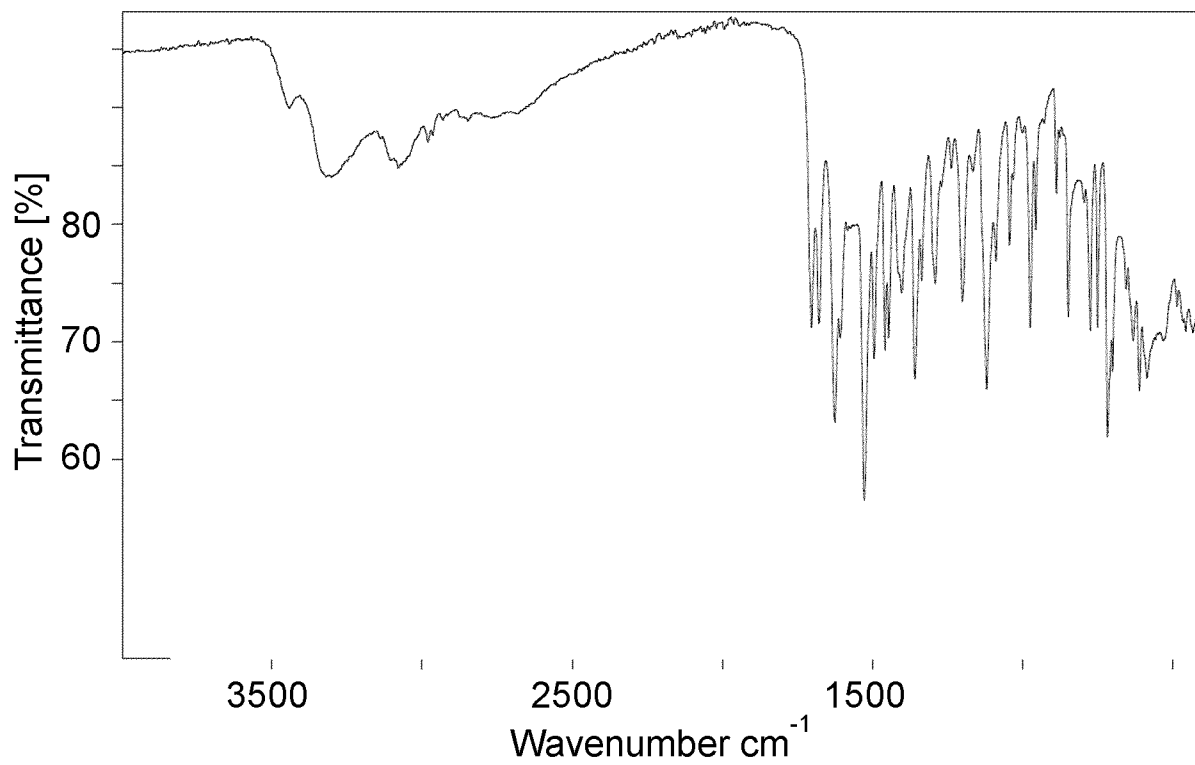


FIG 77

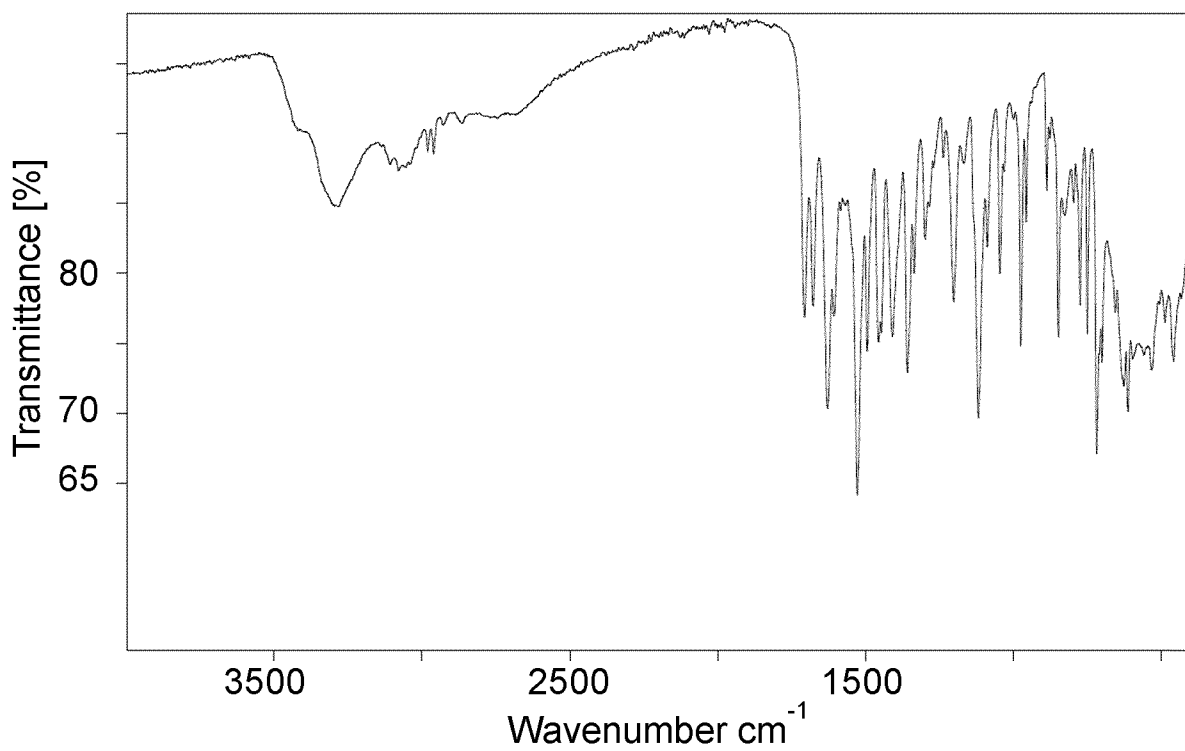


FIG 78

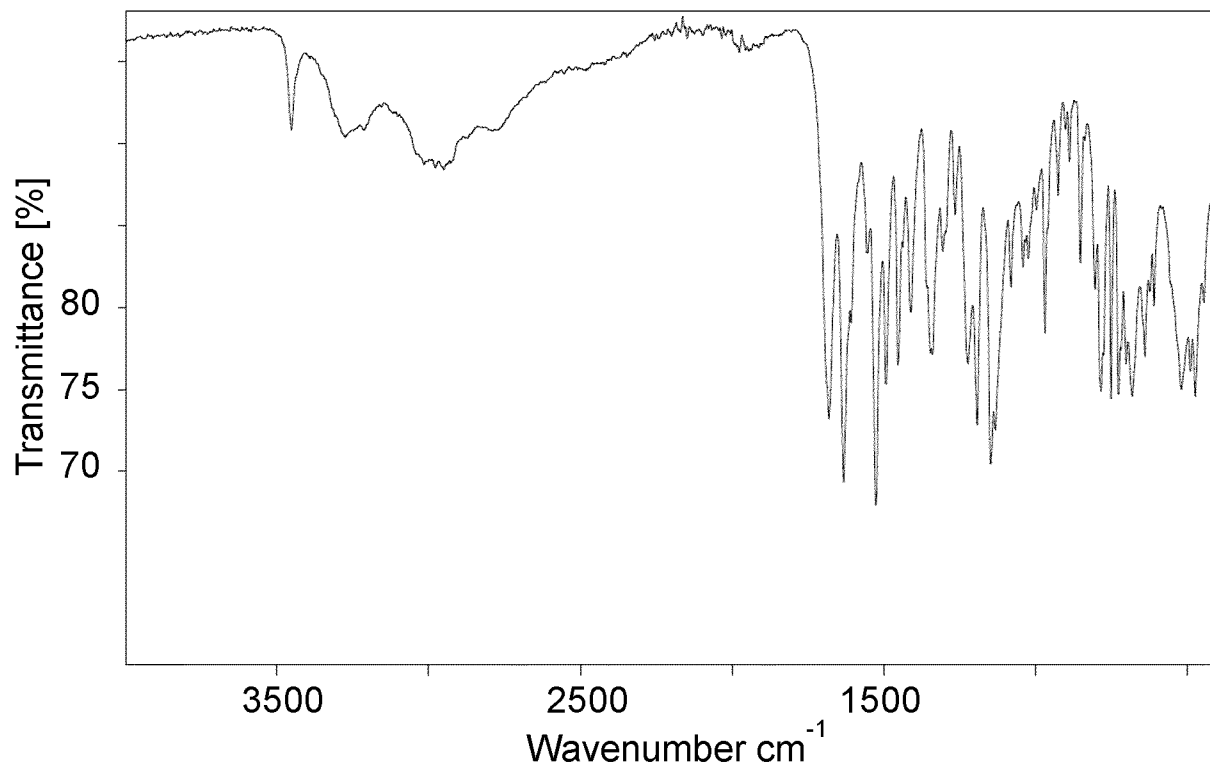


FIG 79

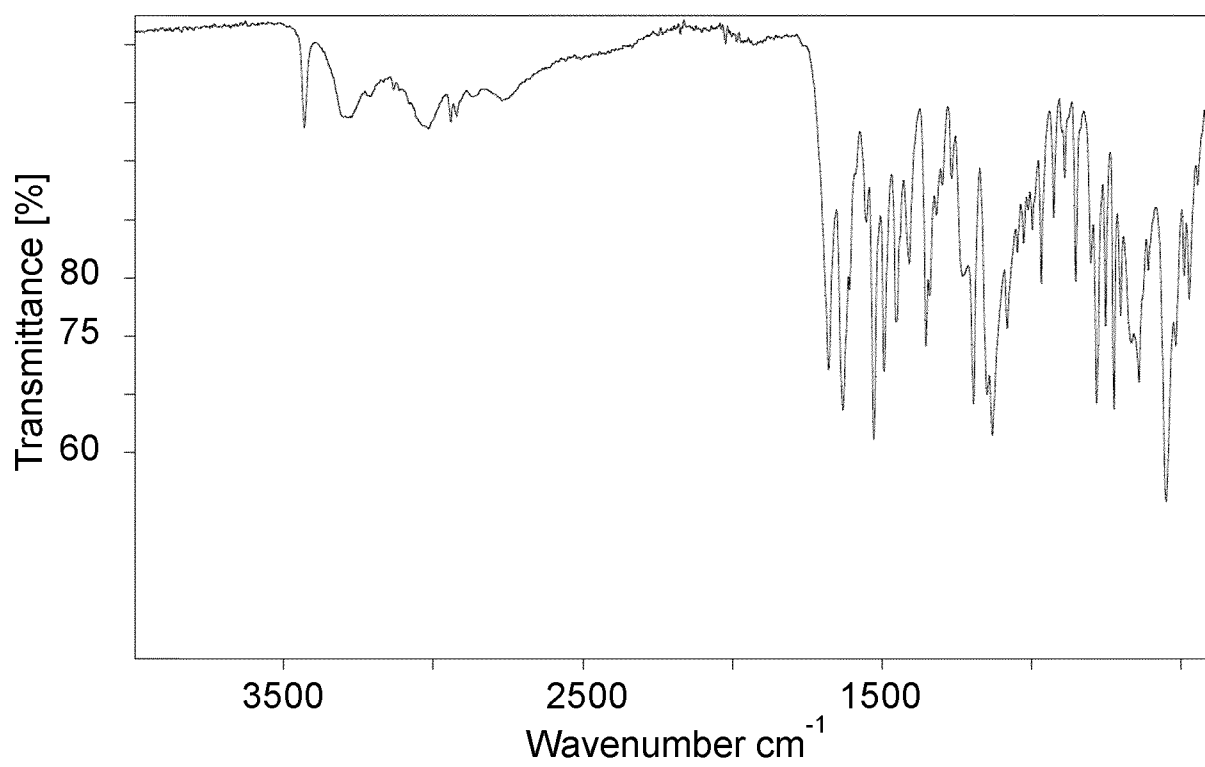


FIG 80

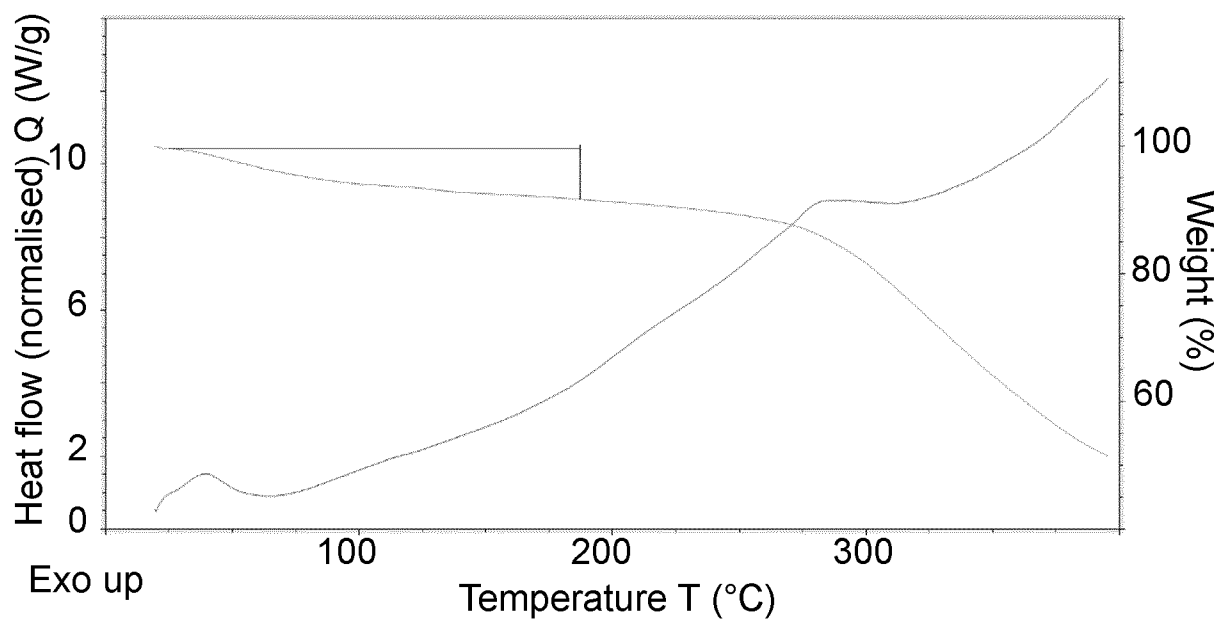


FIG 81

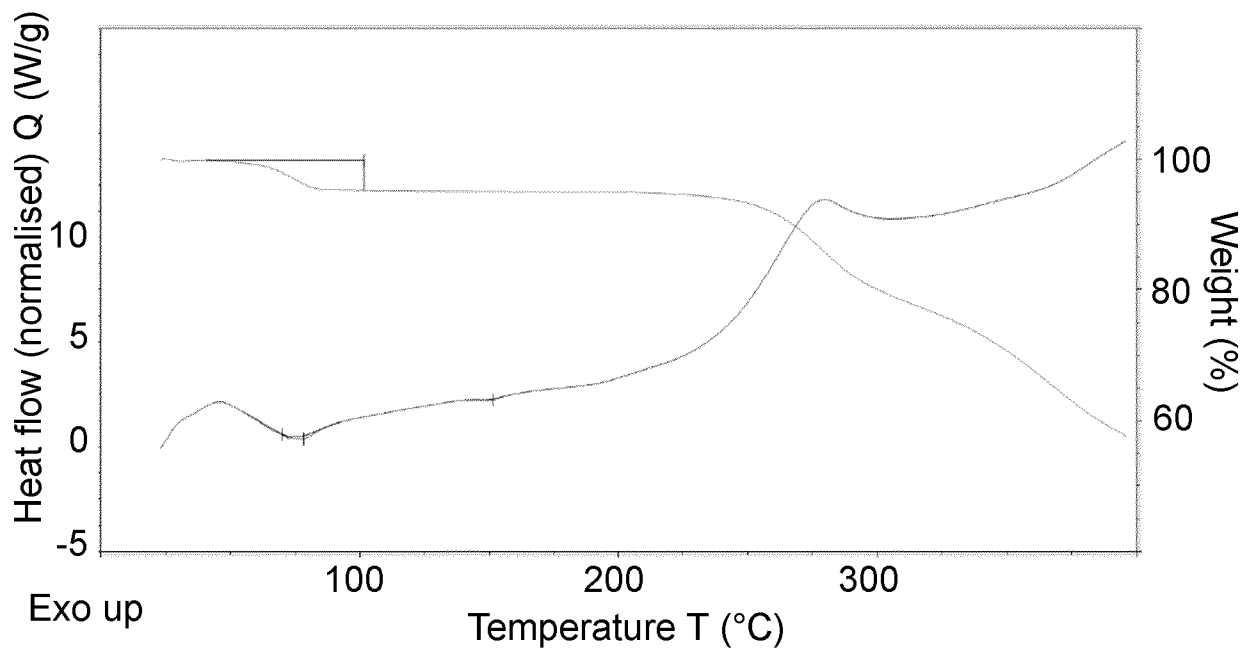


FIG 82

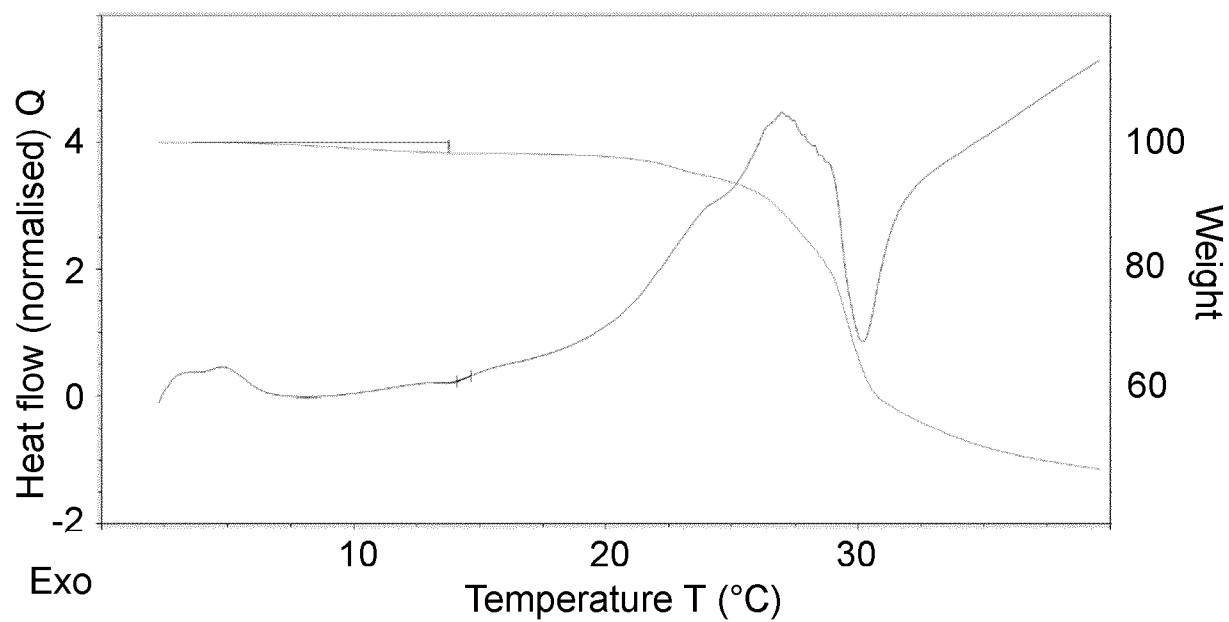


FIG 83

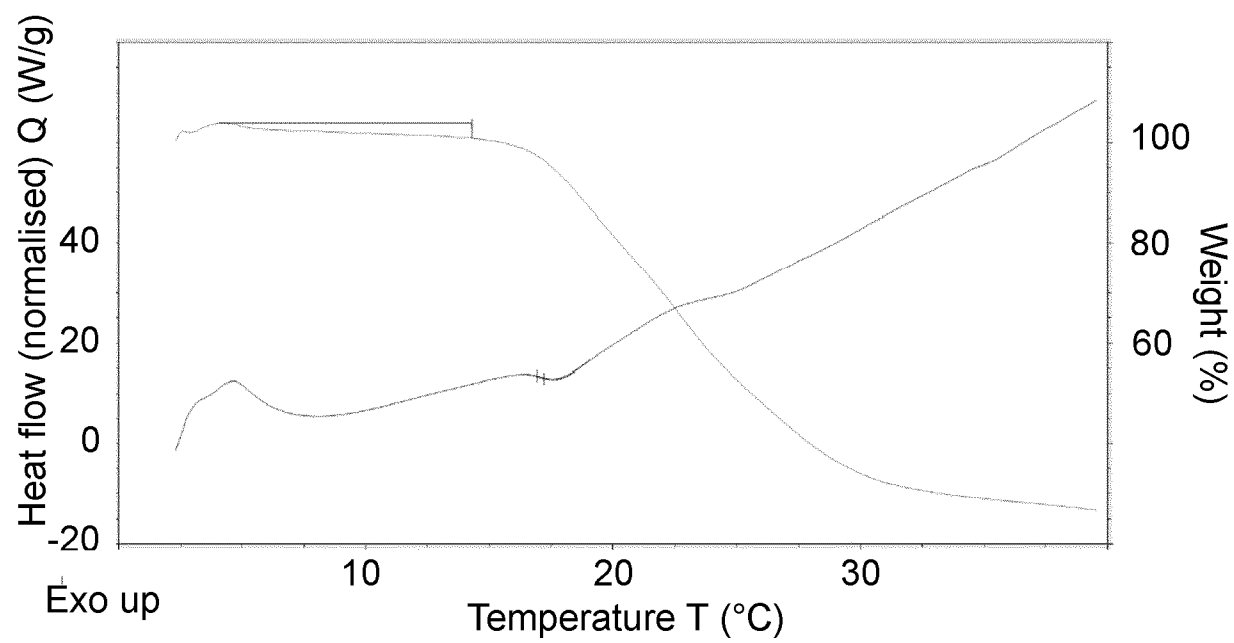


FIG 84

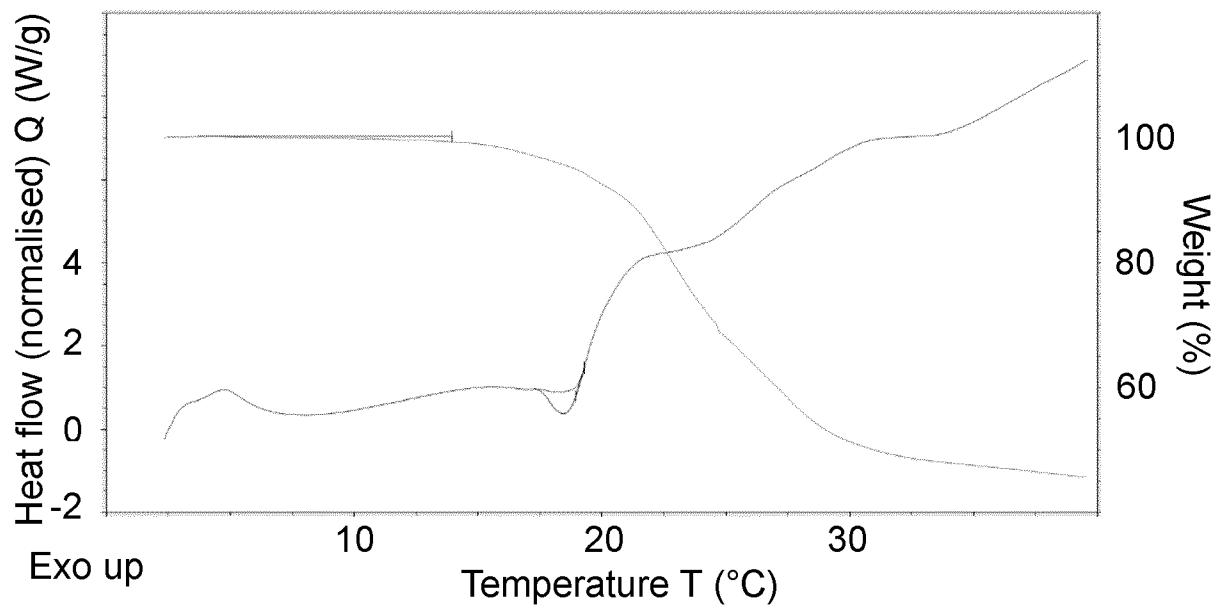


FIG 85

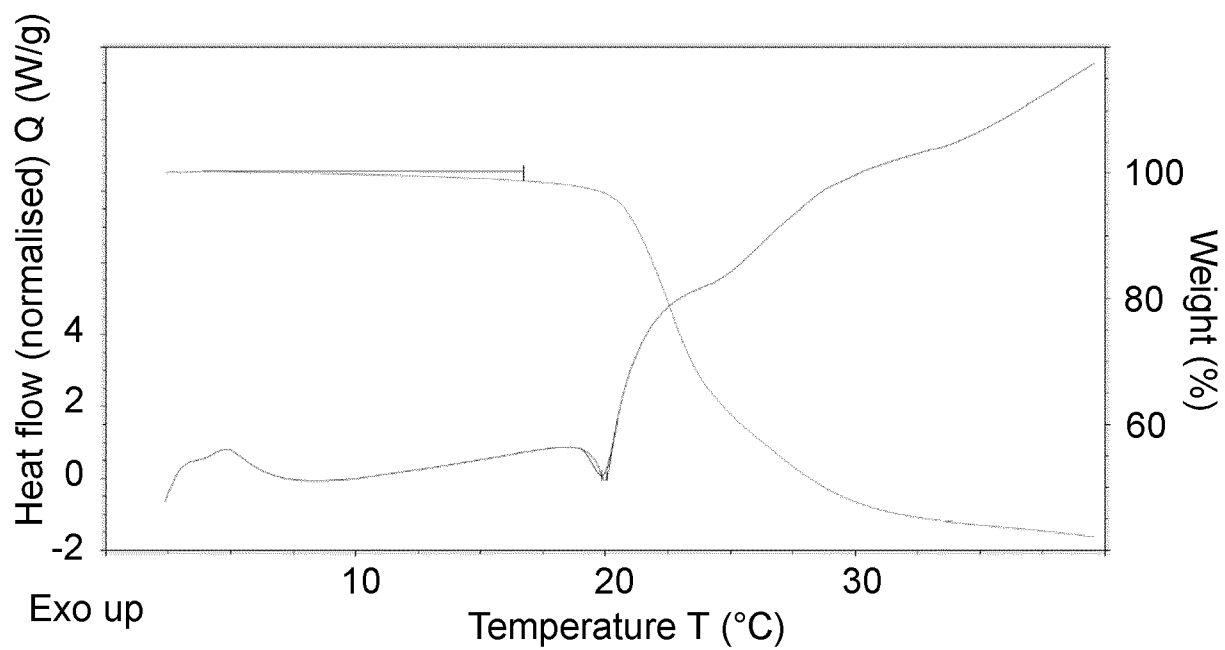


FIG 86

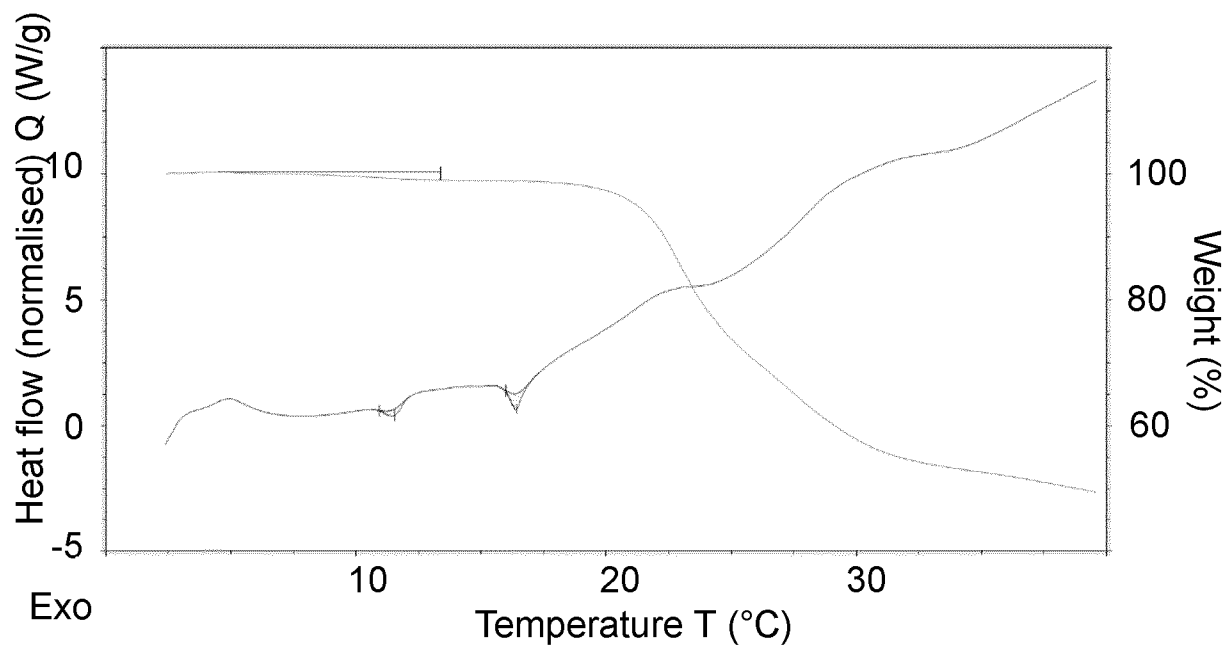


FIG 87

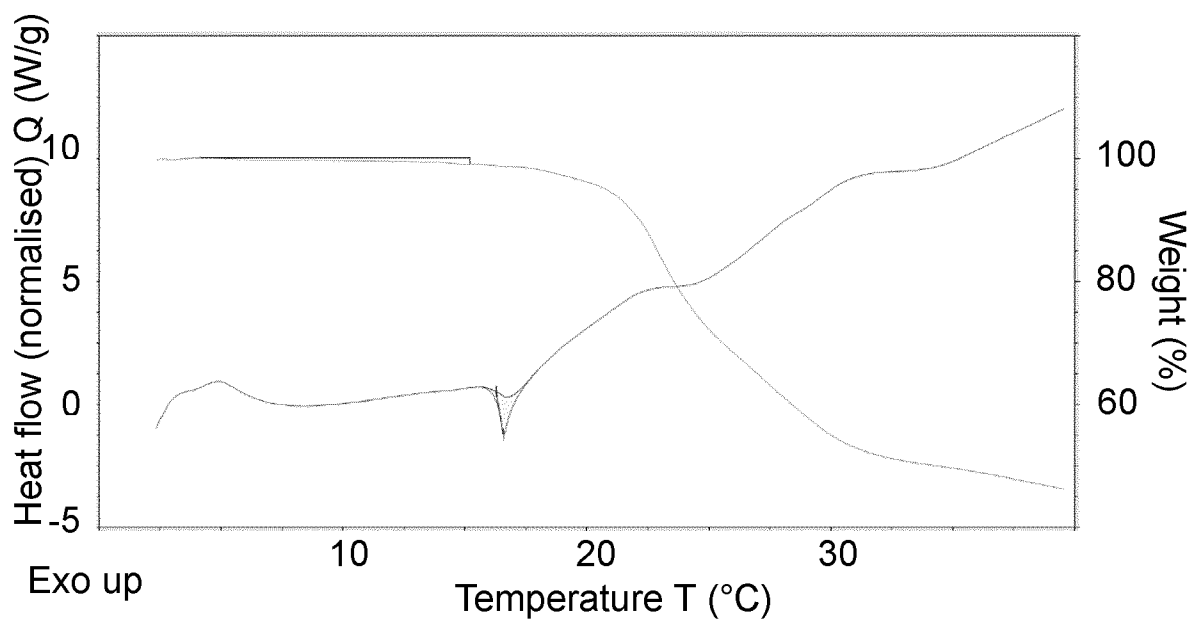


FIG 88

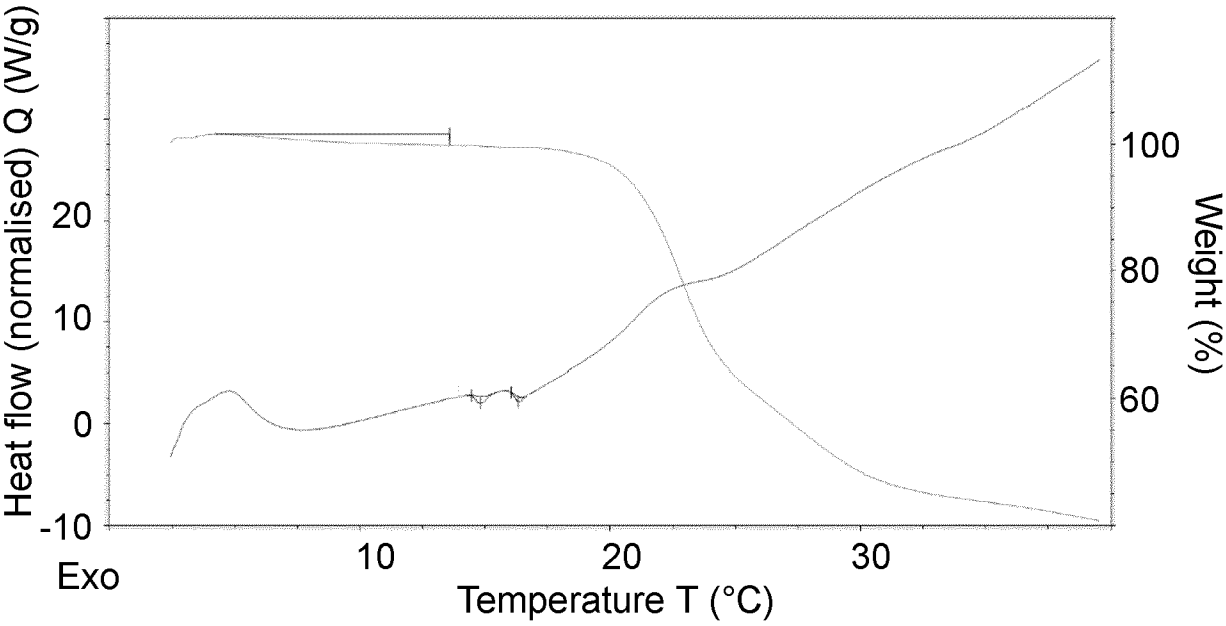


FIG 89

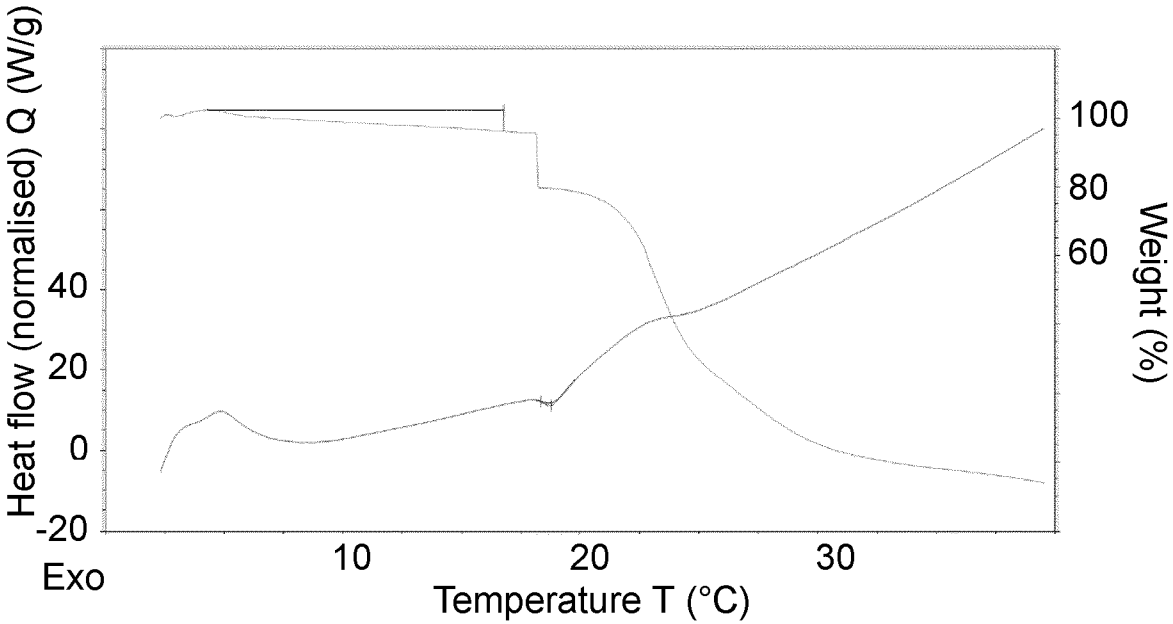


FIG 90

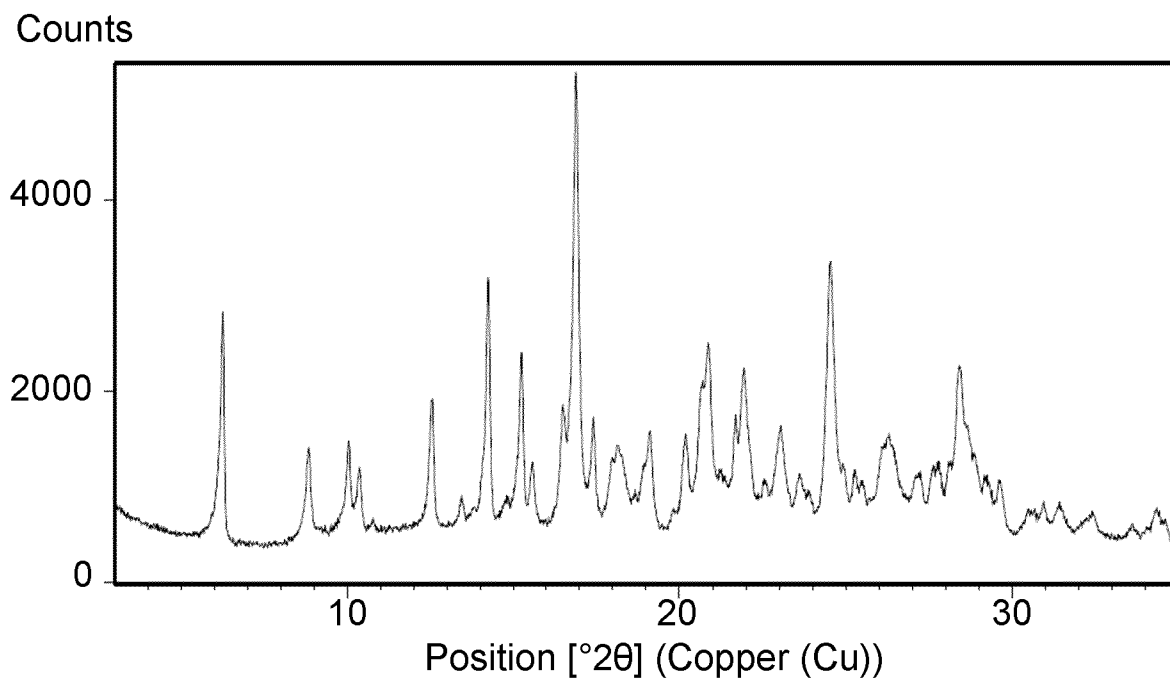


FIG 91

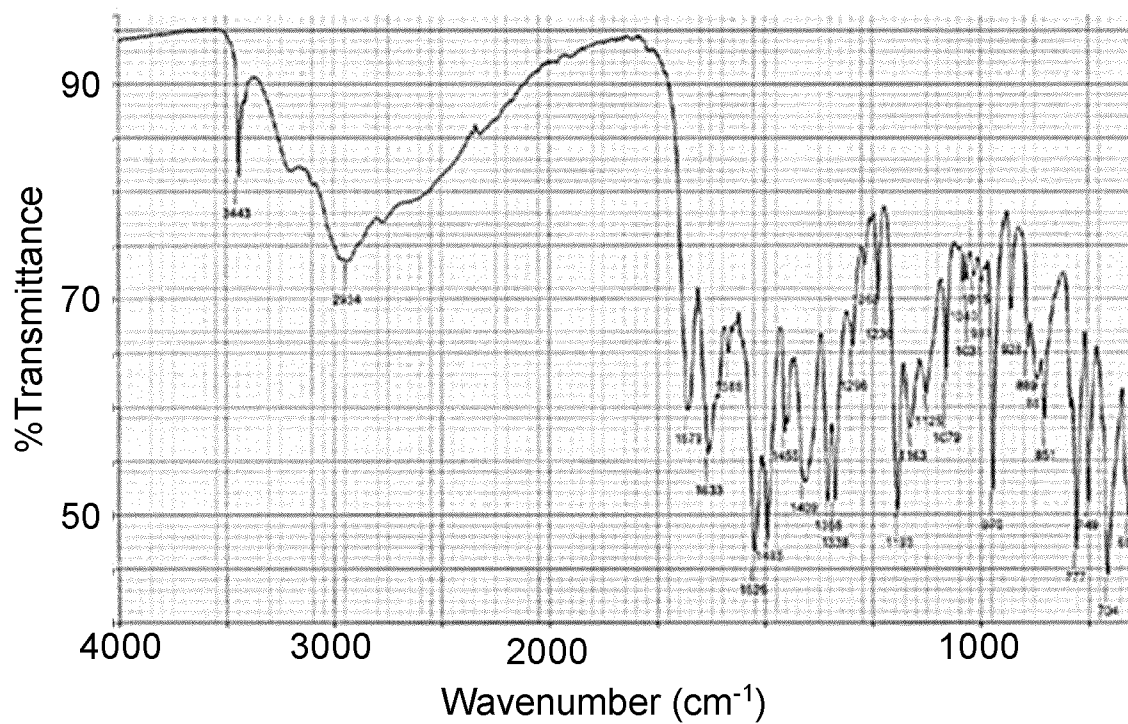


FIG 92

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2022/066884

A. CLASSIFICATION OF SUBJECT MATTER

INV. C07D207/335 A61K31/402 A61P9/00 A61P13/00 A61P29/00
A61P31/00

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

C07D A61P A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, EMBASE, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2020/229297 A1 (SYNACT PHARMA APS [DK]) 19 November 2020 (2020-11-19) page 53, line 7 - line 14; compound AP1189 -----	1-79, 85-113, 115-122
X	WO 2007/141343 A1 (ACTION PHARMA AS [DK]; BOMAN ARNE [SE] ET AL.) 13 December 2007 (2007-12-13) page 26, line 34; page 40, lines 20-21; claim 1; example 1; compound 2 -----	1-79, 85-113, 115-122
A	WO 2019/243625 A1 (SYNACT PHARMA APS [DK]) 26 December 2019 (2019-12-26) page 35, line 2 - line 3 -----	1-79, 85-113, 115-122



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

26 July 2022

Date of mailing of the international search report

27/09/2022

Name and mailing address of the ISA/

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Authorized officer

Moriggi, J

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2022/066884

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims;; it is covered by claims Nos.:
1-79, 85-113, 115-122

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-79, 85-113, 115-122

crystalline forms of
N-{3-[1-(2-nitrophenyl)-1H-pyrrol-2-yl]-allylidene}-aminoguanidinium salts, their methods of preparation, compositions containing them as well as their synthetic and medical uses

2. claims: 80-84, 114

non-crystalline or otherwise unspecified forms of
N-{3-[1-(2-nitrophenyl)-1H-pyrrol-2-yl]-allylidene}-aminoguanidinium salts

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2022/066884

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 2020229297 A1	19-11-2020	AU 2020273479 A1	23-12-2021	
		CA 3139000 A1	19-11-2020	
		CN 113795250 A	14-12-2021	
		EP 3773558 A1	17-02-2021	
		IL 287904 A	01-01-2022	
		JP 2022531906 A	12-07-2022	
		KR 20220006551 A	17-01-2022	
		LT 3773558 T	12-09-2022	
		SG 11202111821S A	29-11-2021	
		US 2022211666 A1	07-07-2022	
		WO 2020229297 A1	19-11-2020	

WO 2007141343 A1	13-12-2007	AT 508111 T	15-05-2011	
		AU 2007255366 A1	13-12-2007	
		CA 2688485 A1	13-12-2007	
		CN 101466669 A	24-06-2009	
		CY 1117851 T1	17-05-2017	
		DK 2348016 T3	30-05-2016	
		EP 2035373 A1	18-03-2009	
		EP 2348016 A1	27-07-2011	
		ES 2571253 T3	24-05-2016	
		HK 1160136 A1	10-08-2012	
		HU E029016 T2	28-02-2017	
		JP 5444523 B2	19-03-2014	
		JP 2009539809 A	19-11-2009	
		NZ 573457 A	30-06-2011	
		PL 2348016 T3	30-09-2016	
		US 2011082183 A1	07-04-2011	
		WO 2007141343 A1	13-12-2007	
		ZA 200810347 B	26-05-2010	

WO 2019243625 A1	26-12-2019	AU 2019289563 A1	04-02-2021	
		BR 112020024284 A2	23-02-2021	
		CA 3102466 A1	26-12-2019	
		CN 112292125 A	29-01-2021	
		DK 3743064 T3	08-11-2021	
		EP 3743064 A1	02-12-2020	
		EP 3970717 A1	23-03-2022	
		ES 2899200 T3	10-03-2022	
		HU E056300 T2	28-02-2022	
		IL 279497 A	31-01-2021	
		JP 7124130 B2	23-08-2022	
		JP 2021528395 A	21-10-2021	
		KR 20210023829 A	04-03-2021	
		LT 3743064 T	25-11-2021	
		PL 3743064 T3	10-01-2022	
		PT 3743064 T	09-11-2021	
		SG 11202011614W A	28-01-2021	
		SI 3743064 T1	31-12-2021	
		US 2021121418 A1	29-04-2021	
		WO 2019243625 A1	26-12-2019	
		ZA 202006987 B	30-03-2022	
