(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
4 May 2017 (04.05.2017)

WIPO | PCT

(10) International Publication Number
WO 2017/072099 A1

(51) International Patent Classification:
C07D 405/14 (2006.01) *A61P 25/28* (2006.01)
A61K 31/4025 (2006.01)

(21) International Application Number:
PCT/EP2016/075632

(22) International Filing Date:
25 October 2016 (25.10.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
1518950.9 27 October 2015 (27.10.2015) GB

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

(54) Title: D-PROLINE DERIVATIVES AS SAP DEPLETING AGENT

(57) Abstract: The present invention relates to the compound ((2R,2'R)-bis(((tetrahydro-2H-pyran-4- carbonyl)oxy)methyl) 1,1'-adipoylbis(pyrrolidine-2-carboxylate), pharmaceutical compositions comprising the same and the use of the same for treatment of diseases or disorders wherein depletion of serum amyloid P component (SAP) would be beneficial, including amyloidosis, Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

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D-PROLINE DERIVATIVES AS SAP DEPLETING AGENT

FIELD OF THE INVENTION

The present invention relates to the compound (2R,2'R)-bis(((tetrahydro-2H-pyran-4-carbonyl)oxy)methyl) 1,1'-adipoylbis(pyrrolidine-2-carboxylate), pharmaceutical compositions comprising the same and the use of the same for treatment of diseases or disorders wherein depletion of serum amyloid P component (SAP) would be beneficial.

BACKGROUND TO THE INVENTION

Serum amyloid P component (SAP) is a normal, structurally invariant, soluble, non-fibrillar, constitutive plasma glycoprotein, mass 127,310 Da, produced exclusively by the liver. It is composed of 5 identical 25,462 Da protomers non-covalently associated with cyclic pentameric symmetry in a disc like configuration. Each subunit, composed of a flattened -jellyroll, with tightly tethered loops joining the -strands, contains a single calcium dependent ligand binding site on the planar B (binding) face of the intact pentamer. SAP binds to all types of amyloid fibrils with the high avidity conferred by multivalent interactions. This strictly calcium dependent interaction is responsible for the universal presence of human SAP in all human amyloid deposits of all types, and hence the name of the protein, where P stands for plasma, the source of this component of amyloid. In addition to its capacity for specific calcium dependent binding to particular ligands, a key property of human SAP is that the protein itself is intrinsically resistant to proteolysis. Its avid binding to amyloid fibrils is mutually stabilising, strongly protecting the fibrils against proteolysis and phagocytic degradation *in vitro*[1] and significantly contributing to persistence of amyloid *in vivo*[2]. These observations underlie the validation of SAP as a therapeutic target in amyloidosis (MB Pepys & TL Blundell, US Patent 6126918, 3 October 2000). Furthermore, binding of SAP to nascent amyloid fibrils strongly promotes amyloid fibrillogenesis[3-5]. European patent application EP 0915088 discloses compounds which are competitive inhibitors of binding of SAP to amyloid fibrils, as well as methods for their manufacture. One of the compounds disclosed therein is (R)-1-[6-[(R)-2-carboxy-pyrrolidin-1-yl]-6-oxo-hexanoyl]pyrrolidine-2-carboxylic acid (CPHPC).

Administration of these palindromic bivalent ligands for SAP causes the rapid and almost complete depletion of SAP from the circulation for as long as the compounds are administered[6,7], as described in WO2003/013508, US Patent No. 7,045,499; US Patent No. 7,691,897; and US Patent No. 8,173,694. This treatment also reduces the amount of SAP associated with the amyloid deposits but does not remove all the SAP[7].

Amyloid is an abnormal, insoluble, extracellular deposit, composed predominantly of characteristic protein fibrils[8] together with abundant proteoglycans and glycosaminoglycans. About 25 different, unrelated, natively soluble, globular proteins form the amyloid fibrils which cause the different types of systemic amyloidosis but all amyloid fibrils have very similar morphology and the same cross- core structure. This structure binds the ordered arrays of Congo red dye molecules which create pathognomonic red-green birefringence in strong cross polarised light: the gold standard diagnostic criterion for amyloid. Certain soluble, non-fibrillar plasma proteins may also be present in amyloid deposits but only one, serum amyloid P component (SAP), is universal in all human amyloid deposits, due to its avid, specific, calcium dependent binding to all types of amyloid fibrils.

Amyloid deposits disrupt the structure and function of affected tissues and organs, causing the serious disease, amyloidosis. Systemic amyloidosis is a rare, fatal condition caused by amyloid deposits which may be present in connective tissue and blood vessel walls throughout the body, as well as the parenchyma of the major organs, but never in brain substance itself. In local amyloidosis, the amyloid deposits are confined to a single anatomical site or a single organ/tissue system.

Cerebral amyloid angiopathy, with amyloid deposition confined to the walls of cerebral blood vessels, is the most common and important form of local amyloidosis. It is responsible for a substantial proportion of intracerebral haemorrhages in both demented Alzheimer s disease patients and non-demented individuals, and is thus an important cause of dementia in its own right.

Treatment of systemic amyloidosis patients with CPHPC produced almost complete depletion of circulating SAP for as long as the drug was administered but did not remove all the SAP bound to the amyloid deposits.[7] The patients remained clinically stable while being treated, with no new amyloid accumulation, and their organ function was maintained but there was no regression of amyloid, probably due to the failure of complete removal of amyloid bound SAP. Since the amyloid deposits in the tissues are the direct cause of disease, it is highly desirable that they should be eliminated. This important unmet medical need led to the invention of a new approach to treatment of amyloidosis in which SAP bound to amyloid deposits is used as a target for anti-human SAP antibodies. Such antibodies could not be safely or effectively administered to patients with normal circulating concentrations of SAP since the antibodies would bind to the SAP in the plasma, forming tissue damaging immune complexes, and the antibodies would be consumed in this process making them unavailable for binding to SAP in amyloid. However prior administration of CPHPC depletes SAP from the circulation, so that anti-SAP antibodies can be safely infused and remain available to bind to residual SAP left in the amyloid deposits. Binding of the antibodies to the amyloid-associated SAP activates the complement system and engages macrophages to phagocytose and destroy the amyloid deposits leading to clinical benefit.

International patent application WO2009/000926 discloses the use of compounds which deplete SAP from the circulation co-administered with an antibody specific for SAP for potential treatment of amyloidosis.

International patent application WO2009/155962 discloses mouse monoclonal antibody Abp1 and provides binding and efficacy data for various mouse monoclonal antibodies which may be co-administered with compounds which deplete SAP from the circulation for potential use in the treatment of amyloidosis.

International patent application WO2011/107480 discloses antigen binding proteins, in particular humanised antibodies, specific for SAP and their potential use in the treatment of diseases associated with amyloid deposition.

In addition to the rare clinical condition of amyloidosis, which is unequivocally directly caused by extracellular amyloid deposition disrupting tissue structure and function, amyloid deposits are also present in two very common and important diseases: Alzheimer s disease and type 2 diabetes. In these latter diseases, the amyloid deposits are microscopic, are confined to the brain and islets of Langerhans respectively, and it is not known whether or how they may contribute to pathogenesis of neurodegeneration and diabetes respectively. Alzheimer s disease and type 2 diabetes thus cannot be classified as forms of amyloidosis but rather should be considered as amyloid associated diseases. Nevertheless, amyloid deposits are always present in them and the deposits also always contain SAP[15-19]. The brain in Alzheimer s disease also contains another type of abnormal insoluble fibrillar protein aggregate, known as neurofibrillary tangles, and SAP binds avidly to these, as it does to amyloid.[15-19] Neurofibrillary tangles bearing SAP, but not amyloid, are present in the brain in other types of dementia, including the frontotemporal dementias

In addition to, and quite independent of, its role in amyloidosis, human SAP binds to and enters cerebral neurones and causes neuronal apoptosis *in vitro* and *in vivo*[9-13]. It has been shown that unique, pharmaceutical grade pure human SAP[14] disrupts synaptic transmission, causing abnormal paired pulse ratio and long term potentiation in organotypic rodent brain slices *in vitro*.

The cerebral neurotoxicity of human SAP is therefore likely to contribute to neurodegeneration in humans[9-12, 20]. The fact that most of the common risk factors for dementia increase brain exposure to SAP is consistent with this concept. Thus age, a key risk factor, is associated with prolonged exposure of the ageing brain to normal SAP concentrations, whilst the major risk factors of non-penetrating head trauma and cerebral haemorrhage cause blood to enter the brain, sharply increasing cerebral SAP content. In Alzheimer s disease, brain content of SAP is abnormally high due to its binding to amyloid deposits and neurofibrillary tangles[15-19]. This is also likely to be the case in other dementias with neurofibrillary tangles but not amyloid deposits. Importantly, higher brain SAP content is reported in demented Alzheimer s disease patients than in elderly subjects who were cognitively intact at death, either with or without co-existing plaques and tangles at autopsy[20]. The significant positive correlation between cerebral SAP content and dementia[20] is consistent with a causative role for SAP.

The quantities of SAP in cerebrospinal fluid and bound to cerebral amyloid deposits and neurofibrillary tangles are dramatically lower than in systemic extracellular fluid and on systemic amyloid deposits respectively. Depletion of plasma SAP by CPHPC, from the normal 20-50 mg/L to <0.1 mg/L, reduces the CSF SAP concentration from 2-30 µg/L to <0.1 µg/L in patients with Alzheimer s disease[21]. Human SAP is produced only by the liver and reaches the brain via the blood[22]. CPHPC treatment thus removes virtually all SAP from the cerebrospinal fluid and, since SAP binding is fully reversible, will also remove it from the cerebral amyloid deposits and neurofibrillary tangles. Furthermore in Alzheimer s disease patients, CPHPC enters the cerebrospinal fluid[21] where it can also block binding of any free SAP to amyloid fibrils, to neurofibrillary tangles and cerebral neurones. All amyloid fibril types can be degraded by proteases and phagocytic cells *in vitro*[1], and systemic amyloid deposits spontaneously regress slowly *in vivo* when the abundance of their respective fibril precursor proteins is sufficiently reduced[8]. Mechanisms for amyloid clearance thus do operate *in vivo*. Confirmation that human SAP is itself neurocytotoxic[9-13], independent of its binding to amyloid, demonstrates the potential, additional, direct benefit of SAP depletion.

All plasma proteins enter diseased or damaged joints *in vivo* but in patients with various different arthropathies, uptake of radiolabelled SAP into some joints that did not have clinically detectable effusions was observed. Furthermore the concentration of SAP in synovial effusion fluids was substantially below that predicted from the molecular size of SAP, demonstrating that the SAP visualised scintigraphically was not free in solution but was actually bound to solid structures within the joint. Synovium, articular cartilage and/or joint capsules of elderly individuals often contain microscopic amyloid deposits, associated with age rather than extent or severity of osteoarthritis, and these deposits could explain the localisation of SAP. SAP also binds avidly, *in vivo* as well as *in vitro*, to exposed DNA and chromatin, and to apoptotic cells. Increased cell death in osteoarthritic joints may thus provide ligands for SAP deposition. WO2004/108131 discloses the treatment of patients with osteoarthritis by injection of CPHPC ((R)-1-[6-[(R)-2-carboxy-pyrrolidin-1-yl]-6-oxo-hexanoyl]pyrrolidine-2-carboxylic acid) resulting in the alleviation of osteoarthritis symptoms.

Human SAP binds avidly to all forms of free DNA and also to chromatin, both *in vitro* and *in vivo*. Indeed SAP is the only normal human plasma protein which binds specifically in a calcium dependent interaction with DNA[23,24]. In contrast, SAP from some other species, including mouse and horse, binds weakly if at all to DNA, and dogs and rabbits do not even have the SAP gene and thus produce no SAP. DNA vaccination, in which immunisation is achieved by injection of DNA coding for the immunogen rather by injection of the immunogen itself, has been extensively investigated as a highly desirable approach to induction of protective immunity against infections and as a potential immunotherapeutic intervention in cancer. However, although DNA vaccination is effective in mice. dogs, rabbits and horses, it has consistently failed in humans and also in cows, which like humans

have SAP which binds avidly to DNA. In the species in which DNA vaccination works, SAP either does not bind to DNA or is absent. Furthermore, experiments in mice with transgenic expression of human SAP and using CPHPC to deplete it, confirm that the presence of human SAP blocks efficacy of DNA vaccination.[25,26]

SAP binds to some bacterial species but not to others. For those pathogenic bacteria to which SAP binds, the SAP has a powerful anti-opsonic effect *in vitro* and *in vivo*, reducing phagocytosis and killing of the organisms and thus protecting them from the host s innate immune system[27]. This effect, which promotes infectivity and virulence, is abrogated by administration of CPHPC to inhibit binding of SAP to the bacteria[27]. SAP is also present bound to the surface of the fungal cells in the tissues of patients suffering from invasive candidiasis[28]. This binding reflects the presence of amyloid fibrils, formed from fungal proteins, on the surface of the pathogenic organism.[28]

CPHPC is pharmacologically effective but it has very low and variable oral bioavailability of ~3-5% and therefore only parenteral administration by intravenous infusion or subcutaneous injection is optimal to achieve the desired SAP depletion. However most of the existing and potential indications for therapeutic SAP depletion require long term administration. Long term intravenous administration is not practical. Although long term subcutaneous administration is feasible, the injections may cause stinging discomfort and this is not tolerated by some patients.[7]

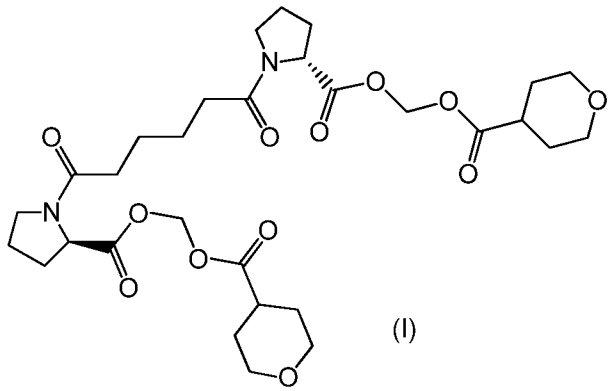
WO2003/051836 discloses D-prolines pro-drugs useful for the treatment of diseases where SAP depletion has a beneficial effect. The 25 Examples disclosed therein were predominantly obtained as oils; only 5 of them were solid. In proceedings at the European Patent Office, a divisional application to the European equivalent of WO2003/051836 was filed with claims directed to (R)-1-(6-{(R)-2-[1-(2,2-dimethyl-propionyloxy)-ethoxycarbonyl]-pyrrolidin-1-yl}-6-oxo-hexanoyl)-pyrrolidine-2-carboxylic acid 1-(2,2-dimethyl-propionyloxy)-ethyl ester. At the time of filing of the present application, the GlaxoSmithKline group of companies (Glaxo Group Limited) has a Licence and Research Collaboration Agreement with Pentraxin Therapeutics Limited including a licence to EP 0915088 and WO2003/051836, and corresponding applications thereof.

There is a need for a compound which is capable of generating CPHPC in quantities capable of depleting SAP efficiently following oral administration, whilst possessing physicochemical properties suitable for pharmaceutical development.

SUMMARY OF THE INVENTION

It has surprisingly been found that the compound (2R,2'R)-bis(((tetrahydro-2H-pyran-4-carbonyl)oxy)methyl) 1,1'-adipoylbis(pyrrolidine-2-carboxylate) according to Formula (I) possesses physicochemical properties suitable for pharmaceutical development and is capable of generating CPHPC in quantities capable of depleting SAP efficiently following oral administration.

Accordingly, in a first aspect, the present invention provides a compound (2R,2'R)-bis(((tetrahydro-2H-pyran-4-carbonyl)oxy)methyl) 1,1'-adipoylbis(pyrrolidine-2-carboxylate) according to Formula (I):



(I)

The compound of Formula (I) is also referred to hereinafter as the compound of the invention .

The compound of the invention exhibits good physiochemical properties and is capable of generating CPHPC in quantities capable of depleting SAP efficiently following oral administration.

The compound of Formula (I) has good pH solution stability and intestinal microsome stability, and low liver microsome stability, readily generating CPHPC, suggesting the compound of Formula (I) will readily generate circulating levels of CPHPC on oral dosing in humans. Also, it does not show any interaction with cytochrome p450, suggesting the compound of Formula (I) will not show CYP450 mediated drug-drug interactions (DDIs). Additionally, the compound of Formula (I) is highly crystalline, which is advantageous with respect to formulation of the active substance and manufacture of the pharmaceutical product.

The use of a compound with this profile may result in advantages in the treatment of diseases or disorders wherein depletion of SAP (serum amyloid P component) would be beneficial, for example in amyloidosis (including systemic amyloidosis and local amyloidosis), Alzheimer s disease, type II diabetes, osteoarthritis, bacterial infection, invasive candiasis and other fungal infections, and in conjunction with administration of DNA vaccines.

In a further aspect the invention provides a pharmaceutical composition, which comprises a therapeutically effective amount of the compound of Formula (I) and one or more pharmaceutically acceptable carriers.

In a further aspect there is provided the compound of Formula (I) or a pharmaceutical composition herein described for the depletion of circulating SAP in a subject.

In a further aspect there is provided the compound of Formula (I) or a pharmaceutical composition herein described, for use in the treatment of diseases or disorders wherein SAP depletion would be beneficial.

In a further aspect there is provided a method of treatment of a disease or disorder wherein SAP depletion would be beneficial.

In a further aspect there is provided the use of the compound of Formula (I) or a pharmaceutical composition herein described, in the manufacture of a medicament for use in the treatment of diseases or disorders wherein SAP depletion would be beneficial.

In a further aspect there is provided a kit of parts comprising one or more dosage forms of an anti-SAP antibody (in particular an antibody as disclosed in WO2011/107480) and one or more dosage forms of the compound of Formula (I).

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1: XRPD spectrum for Form I of compound of Formula (I)

Figure 2: In vitro physical hydrolysis of compound of Formula (I) in phosphate buffered saline at pH6, 7, 7.5 and 8

Figure 3: In vitro Intestinal Microsomal Stability of Compound of Formula (I) in human microsomes. 0/3/6/12/30 min refers to the time (in minutes) that the sample was taken from the mixture for analysis.

Figure 4: In vitro Blood stability of compound of Formula (I) in human blood. 0/5/10/30/60 min refers to the time (in minutes) that the sample was taken from the mixture for analysis.

Figure 5: In vitro Liver microsomal stability of compound of Formula (I) in human liver microsomes. 0/3/6/12/30 min refers to the time (in minutes) that the sample was taken from the mixture for analysis.

DETAILED DESCRIPTION OF THE INVENTION

Definitions

The following terms are intended to have the meanings presented herewith below and are useful in understanding the description and the scope of the present invention.

Pharmaceutically acceptable means approved or approvable by a regulatory agency of the Federal government of the United States of America or the corresponding agency in countries other than the United States of America (such as the EMA, the European Medicines Agency), or that is listed in the United States Pharmacopeia or European Pharmacopoeia (Ph. Eur.).

Therapeutically effective amount means the amount of a compound that, when administered to a subject for treating a disease or disorder, is sufficient to effect such treatment for the disease.

The term "antibody" is used in the broadest sense to refer to molecules with an immunoglobulin-like domain and includes monoclonal, recombinant, polyclonal, chimeric, humanised, human, bispecific and heteroconjugate antibodies; and antigen binding fragments. An antibody according to the present invention activates the human complement system and/or results in regression of amyloid deposits.

It will be appreciated that reference to treatment includes acute treatment or prophylaxis as well as the alleviation of established symptoms and/or retardation of progression of the disease or disorder, and may include the suppression of symptom recurrence in an asymptomatic patient.

The term anti-SAP in relation to an antibody , i.e. an anti-SAP antibody , means an antibody that binds to human SAP with no or insignificant binding to any other proteins, including closely related molecules such as C-reactive protein (CRP).

The term CDR means complementarity determining region. A CDR of an antibody as used herein means a CDR as determined using any of the well known CDR numbering methods, including Kabat, Chothia, AbM and contact methods.

By circulating SAP is meant SAP that is present in free form in the plasma *in vivo* and *in vitro* and is not associated with amyloid deposits in the tissues.

Pharmaceutical Compositions, Routes of Administration and Dosages

In order to use the compound of Formula (I) in therapy, it will normally be formulated into a pharmaceutical composition in accordance with standard pharmaceutical practice.

The invention therefore provides a pharmaceutical composition, which comprises a therapeutically effective amount of the compound of Formula (I) and one or more pharmaceutically acceptable carriers.

The present invention also provides a process for preparing a pharmaceutical composition, the process comprising admixing a therapeutically effective amount of the compound of Formula (I) and one or more pharmaceutically acceptable carriers.

The present invention also provides a dosage form comprising the pharmaceutical composition of the invention.

A pharmaceutical composition of the invention, which may be prepared by admixture, suitably at ambient temperature and atmospheric pressure, is usually adapted for oral administration and, as such, may be in the form of tablets, capsules, oral liquid preparations, powders, granules, or lozenges.

In one embodiment, there is provided the pharmaceutical composition of the invention for oral administration.

Tablets and capsules for oral administration may be in unit dose form, and may contain conventional carriers, such as binding agents (e.g. pregelatinised maize starch, polyvinylpyrrolidone or hydroxypropyl methylcellulose); fillers (e.g. lactose, microcrystalline cellulose or calcium hydrogen phosphate); tabletting lubricants (e.g. magnesium stearate, talc or silica); disintegrants (e.g. potato starch or sodium starch glycollate); and acceptable wetting agents (e.g. sodium lauryl sulphate). The tablets may be coated according to methods well known in normal pharmaceutical practice.

Oral liquid preparations may be in the form of, for example, oily suspension, non-aqueous solutions, emulsions, syrups or elixirs, or may be in the form of a dry product for reconstitution with suitable aqueous or non-aqueous vehicle immediately prior to administration. Such liquid preparations may contain conventional additives such as suspending agents (e.g. sorbitol syrup, cellulose derivatives or hydrogenated edible fats), emulsifying agents (e.g. lecithin or acacia), non-aqueous vehicles (which may include edible oils e.g. almond oil, oily esters, ethyl alcohol or fractionated vegetable oils), preservatives (e.g. methyl or propyl-p-hydroxybenzoates or sorbic acid), and, if desired, conventional flavourings or colorants, buffer salts and sweetening agents as appropriate. Preparations for oral administration may be suitably formulated to give controlled release of the active compound.

In another embodiment, the dosage form is a tablet or a capsule.

The composition may contain from 0.1% to 99% by weight, preferably from 10 to 60% by weight, of the active material, depending on the method of administration. The dose of the

compound used in the treatment of the aforementioned disorders will vary in the usual way with the seriousness of the disorders, the weight of the sufferer, and other similar factors. However, as a general guide suitable unit doses may be 0.05 to 5000 mg, 1.0 to 1000 mg, or 100 to 600 mg, for example 100, 200 or 300 mg, and such unit doses may be administered more than once a day, for example two or three times a day. Such therapy may extend for a number of days, weeks, months or years.

The invention further provides the compound of Formula (I) or a pharmaceutical composition as herein described, for use in therapy.

The compound of Formula (I) is therefore of use in the treatment of diseases wherein SAP depletion would be beneficial.

The invention further provides the compound of Formula (I) or a pharmaceutical composition as herein described, for use in depletion of SAP.

The invention further provides the compound of Formula (I) or a pharmaceutical composition as herein described, for use in the treatment of diseases or disorders wherein SAP depletion would be beneficial.

In a further aspect there is provided a method of treatment of a disease or disorder in a subject wherein SAP depletion would be beneficial, which method comprises administration of a therapeutically effective amount of the compound of Formula (I).

In a further aspect there is provided a method of treatment of a disease or disorder in a subject wherein SAP depletion would be beneficial, which method comprises administration of a therapeutically effective amount of a pharmaceutical composition as herein described.

The invention further provides a method of depletion of SAP in a subject, which method comprises administering to the subject a therapeutically effective amount of the compound of Formula (I).

The invention further provides a method of depletion of SAP in a subject, which method comprises administering to the subject a therapeutically effective amount of a pharmaceutical composition as herein described.

Many forms of transmissible spongiform encephalopathy (prion diseases) are associated with amyloid deposits in the brain, and the present invention therefore relates to all these diseases or disorders, including variant Creutzfeldt-Jakob disease in humans, Creutzfeldt-Jakob disease itself, kuru and the various other forms of human prion disease, and also bovine spongiform encephalopathy, chronic wasting disease of mule-deer and elk, and transmissible encephalopathy of mink.

The invention further provides a method of treatment of a disease or disorder in a subject, wherein the disease or disorder is selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus, osteoarthritis, bacterial infections, invasive candiasis, transmissible spongiform encephalopathy, variant Creutzfeld-Jakob disease in humans, Creutzfeld-Jakob disease, kuru, other human prion diseases, bovine spongiform encephalopathy, chronic wasting disease of mule-deer and elk, and transmissible encephalopathy of mink, which method comprises administering to the subject a therapeutically effective amount of the compound of Formula (I).

The invention further provides a method of treatment of a disease or disorder in a subject, wherein the disease or disorder is selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus, osteoarthritis, bacterial infections, invasive candiasis, transmissible

spongiform encephalopathy, variant Creutzfeld-Jakob disease in humans, Creutzfeld-Jakob disease, kuru, other human prion diseases, bovine spongiform encephalopathy, chronic wasting disease of mule-deer and elk, and transmissible encephalopathy of mink, which method comprises administering to the subject a therapeutically effective amount of a pharmaceutical composition as herein described.

The invention further provides a method of treatment of a disease or disorder in a subject, wherein the disease or disorder is selected from the group consisting of transmissible spongiform encephalopathy, variant Creutzfeldt-Jakob disease in humans, Creutzfeldt-Jakob disease, kuru, bovine spongiform encephalopathy, chronic wasting disease of mule-deer and elk, and transmissible encephalopathy of mink, which method comprises administering to the subject a therapeutically effective amount of the compound of Formula (I).

The invention further provides a method of treatment of a disease or disorder in a subject, wherein the disease or disorder is selected from the group consisting transmissible spongiform encephalopathy, variant Creutzfeldt-Jakob disease in humans, Creutzfeldt-Jakob disease, kuru , bovine spongiform encephalopathy, chronic wasting disease of mule-deer and elk, and transmissible encephalopathy of mink, which method comprises administering to the subject a therapeutically effective amount of a pharmaceutical composition as herein described.

The invention further provides a method of treatment of a disease or disorder in a subject, wherein the disease or disorder is selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis, which method comprises administering to the subject a therapeutically effective amount of the compound of Formula (I).

The invention further provides a method of treatment of a disease or disorder in a subject, wherein the disease or disorder is selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis, which method comprises administering to the subject a therapeutically effective amount of a pharmaceutical composition as herein described.

The invention further provides a method of treatment of a disease or disorder in a subject, wherein the disease or disorder is selected from the group consisting of Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis, which method comprises administering to the subject a therapeutically effective amount of the compound of Formula (I).

The invention further provides a method of treatment of a disease or disorder in a subject, wherein the disease or disorder is selected from the group consisting of Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis, which method comprises administering to the subject a therapeutically effective amount of a pharmaceutical composition as herein described.

The invention further provides a method of treatment of a disease or disorder in a subject, wherein the disease or disorder is amyloidosis, which method comprises administering to the subject a therapeutically effective amount of the compound of Formula (I).

The invention further provides a method of treatment of a disease or disorder in a subject, wherein the disease or disorder is amyloidosis, which method comprises administering to the subject a therapeutically effective amount of a pharmaceutical composition as herein described.

The invention further provides a method of improvement of efficacy of human DNA vaccines, which method comprises administering to the subject a therapeutically effective amount of the compound of Formula (I).

The invention further provides a method of improvement of efficacy of human DNA vaccines, which method comprises administering to the subject a therapeutically effective amount of a pharmaceutical composition as herein described.

The invention further provides the use of the compound of formula (I) in combination with a DNA vaccine.

The invention further provides the use of a pharmaceutical composition as herein described in combination with a DNA vaccine.

The invention further provides for the compound of Formula (I) for use in the improvement of the efficacy of human DNA vaccines.

The invention further provides for a pharmaceutical composition as herein described for use in the improvement of the efficacy of human DNA vaccines.

The invention further provides for the use of the compound of Formula (I) in the improvement of the efficacy of human DNA vaccines.

The invention further provides for the use of a pharmaceutical composition as herein described in the improvement of the efficacy of human DNA vaccines.

The invention further provides the use of the compound of Formula (I) in the manufacture of a medicament for use in the improvement of the efficacy of human DNA vaccines.

By improvement in efficacy of human DNA vaccines is meant enabling the DNA vaccine to induce immunoprotective immune responses against the immunogens encoded by the human DNA vaccine.

The subject may be a mammal. The subject is typically a human.

The term amyloidosis encompasses both systemic amyloidosis (including, but not limited to, AL-type amyloidosis, AA-type amyloidosis, dialysis amyloidosis, ATTR (transthyretin) amyloidosis, hereditary systemic amyloidosis) and local amyloidosis (including, but not limited to cerebral amyloid angiopathy).

In another aspect, the invention provides for the compound of Formula (I) or a pharmaceutical composition as herein described for use in the treatment of a disease or disorder wherein SAP depletion would be beneficial.

In another aspect, the invention provides for the compound of Formula (I) or a pharmaceutical composition as herein described for use in the depletion of SAP.

In one embodiment, the invention provides for the compound of Formula (I) or a pharmaceutical composition as herein described for use in the depletion of SAP *in vivo*.

In another aspect, the invention provides for the compound of Formula (I) for use in the treatment of a disease or disorder selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

In another aspect, the invention provides for a pharmaceutical composition as herein described for use in the treatment of a disease or disorder selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

In one embodiment, the invention provides for the compound of Formula (I) for use in the treatment of a disease or disorder selected from the group consisting of Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

In one embodiment, the invention provides for the compound of Formula (I) for use in the treatment of amyloidosis.

In another aspect, the invention provides for a pharmaceutical composition as herein described for use in the treatment of a disease or disorder selected from the group consisting of Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

In another aspect, the invention provides for a pharmaceutical composition as herein described for use in the treatment of amyloidosis.

In another aspect, the invention provides for the use of the compound of Formula (I) or a pharmaceutical composition herein described in the treatment of a disease or disorder wherein SAP depletion would be beneficial.

In another aspect, the invention provides for the use of the compound of Formula (I) or a pharmaceutical composition herein described in the depletion of SAP.

In another aspect, the invention provides for the use of the compound of Formula (I) in the treatment of a disease or disorder selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

In another aspect, the invention provides for the use of a pharmaceutical composition herein described in the treatment of a disease or disorder selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

In another aspect, the invention provides for the use of the compound of Formula (I) in the treatment of a disease or disorder selected from the group consisting of Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

In another aspect, the invention provides for the use of the compound of Formula (I) in the treatment of amyloidosis.

In another aspect, the invention provides for the use of a pharmaceutical composition herein described in the treatment of a disease or disorder selected from the group consisting of Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

In another aspect, the invention provides for the use of a pharmaceutical composition herein described in the treatment of amyloidosis.

In another aspect, the invention provides for the use of the compound of Formula (I) in the manufacture of a medicament for use in the treatment of a disease or disorder wherein SAP depletion would be beneficial.

In another aspect, the invention provides for the use of the compound of Formula (I) in the manufacture of a medicament for use in the depletion of SAP.

In another aspect, the invention provides for the use of the compound of Formula (I) in the manufacture of a medicament for use in the treatment of a disease or disorder selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

In another aspect, the invention provides for the use of the compound of Formula (I) in the manufacture of a medicament for use in the treatment of a disease or disorder selected from the group consisting of Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

In another aspect, the invention provides for the use of the compound of Formula (I) in the manufacture of a medicament for use in the treatment of amyloidosis.

When used for the treatment of amyloidosis, the compounds of Formula (I) may be administered with an anti-SAP antibody.

In an embodiment, the anti-SAP antibody binds to the A face of human SAP. In an embodiment, the anti-SAP antibody comprises the heavy chain complementarity determining regions (CDRs) present within SEQ ID NO:28 and the light chain CDRs present within SEQ ID NO:35 in WO 11/107480.

In an embodiment the anti-SAP antibody comprises a heavy chain variable region of SEQ ID NO:28 and a light chain variable region of SEQ ID NO:35 in WO 11/107480.

In an embodiment, the anti-SAP antibody comprises a human IgGl or IgG3 human constant domain.

In an embodiment the anti-SAP antibody comprises a heavy chain of SEQ ID NO:62 and a light chain of SEQ ID NO:64 in WO 11/107480.

In an embodiment, the anti-SAP antibody comprises the heavy and light chain CDRs described within WO 11/107480 as SEQ ID NO:1, SEQ ID NO:2 and SEQ ID NO:3, SEQ ID NO:4, SEQ ID NO:5 and SEQ ID NO:6.

Therefore, in a further aspect, the invention provides for a method of treatment of amyloidosis which method comprises administering to a subject a therapeutically effective amount of the compound of Formula (I) or a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody.

In one embodiment, the administration of the compound of Formula (I) in co-administration with an anti-SAP antibody is sequential.

Such sequential administration may be close in time (eg. simultaneously) or remote in time. Furthermore, it does not matter if the compounds are administered in the same dosage form, e.g. one compound may be administered intravenously and the other compound may be administered orally.

In a further embodiment, the compound of Formula (I) is administered first. In a further embodiment, the anti-SAP antibody is administered when the level of circulating SAP in the subject has been reduced to a level of less than 2 mg/L. In one embodiment, the level of circulating SAP has been reduced to a level of 1 mg/L or less. In a further embodiment the level of circulating SAP has been reduced to a level of 0.5 mg/L or less.

The level of circulating SAP can be measured using a commercially available ELISA (enzyme-linked immunosorbent assay) kit (e.g. HK331 Human SAP ELISA Kit from Hycult Biotech).

In a further embodiment, the compound of Formula (I) is administered for 5-8 days or until the level of the SAP circulating in the subject has been reduced to a level of less than 2 mg/L whichever is longer. In one embodiment, the level of the SAP circulating in the subject has been reduced to 1 mg/L or less. In a further embodiment, the level of SAP circulating in the subject has been reduced to 0.5 mg/L or less. In a further embodiment administration of the compound of

Formula (I) is continued while a single dose of 200-2000 mg (preferably 250-1000 mg, more preferably 250-600 mg) of anti-SAP antibody is administered, and for 4-6 days thereafter. This constitutes a therapeutic course patients may require several courses to achieve the desired therapeutic effect. They may also require intermittent repeat treatment. In one embodiment, the therapeutic course is repeated at least once at 3-6 week intervals as required. In a further embodiment, the therapeutic course is repeated at least once at 3-6 week intervals followed by at least one therapeutic course at 6-12 month intervals as required.

In a further aspect there is provided a method of treatment of a disease or disorder in a subject wherein SAP depletion would be beneficial, which method comprises administration of a therapeutically effective amount of the compound of Formula (I) in co-administration with an anti-SAP antibody.

In a further aspect there is provided a method of treatment of a disease or disorder in a subject wherein SAP depletion would be beneficial, which method comprises administration of a therapeutically effective amount of a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody.

In a further aspect there is provided a method of depletion of SAP, which method comprises administration of a therapeutically effective amount of the compound of Formula (I) in co-administration with an anti-SAP antibody.

In a further aspect there is provided a method of depletion of SAP, which method comprises administration of a therapeutically effective amount of a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody.

The invention further provides a method of treatment of a disease or disorder in a subject, wherein the disease or disorder is selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis, which method comprises administering to the subject a therapeutically effective amount of the compound of Formula (I) in co-administration with an anti-SAP antibody.

The invention further provides a method of treatment of a disease or disorder in a subject, wherein the disease or disorder is selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis, which method comprises administering to the subject a therapeutically effective amount of a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody.

In another aspect, the invention provides for the compound of Formula (I) or a pharmaceutical composition herein described in co-administration with an anti-SAP antibody for use in the treatment of a disease or disorder wherein SAP depletion would be beneficial.

In another aspect, the invention provides for the compound of Formula (I) or a pharmaceutical composition herein described in co-administration with an anti-SAP antibody for use in the depletion of SAP.

In another aspect, the invention provides for the compound of Formula (I) in co-administration with an anti-SAP antibody for use in the treatment of a disease or disorder selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

In another aspect, the invention provides for the compound of Formula (I) in co-administration with an anti-SAP antibody for use in the treatment of amyloidosis.

In one embodiment, the invention provides for the compound of Formula (I) in co-administration with an anti-SAP antibody for use in the treatment of systemic amyloidosis.

In one embodiment, the invention provides for the compound of Formula (I) in co-administration with an anti-SAP antibody for use in the treatment of AL-type amyloidosis.

In one embodiment, the invention provides for the compound of Formula (I) in co-administration with an anti-SAP antibody for use in the treatment of AA-type amyloidosis.

In one embodiment, the invention provides for the compound of Formula (I) in co-administration with an anti-SAP antibody for use in the treatment of dialysis amyloidosis.

In one embodiment, the invention provides for the compound of Formula (I) in co-administration with an anti-SAP antibody for use in the treatment of ATTR (transthyretin) amyloidosis.

In one embodiment, the invention provides for the compound of Formula (I) in co-administration with an anti-SAP antibody for use in the treatment of hereditary systemic amyloidosis.

In one embodiment, the invention provides for the compound of Formula (I) in co-administration with an anti-SAP antibody for use in the treatment of local amyloidosis.

In one embodiment, the invention provides for the compound of Formula (I) in co-administration with an anti-SAP antibody for use in the treatment of cerebral amyloid angiopathy.

In another aspect, the invention provides for a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody for use in the treatment of a disease or disorder selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

In another aspect, the invention provides for a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody for use in the treatment of amyloidosis.

In one embodiment, the invention provides for a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody for use in the treatment of systemic amyloidosis.

In one embodiment, the invention provides for a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody for use in the treatment of AL-type amyloidosis.

In one embodiment, the invention provides for a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody for use in the treatment of AA-type amyloidosis.

In one embodiment, the invention provides for a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody for use in the treatment of dialysis amyloidosis.

In one embodiment, the invention provides for a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody for use in the treatment of ATTR (transthyretin) amyloidosis.

In one embodiment, the invention provides for a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody for use in the treatment of hereditary systemic amyloidosis.

In one embodiment, the invention provides for a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody for use in the treatment of local amyloidosis.

In one embodiment, the invention provides for a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody for use in the treatment of cerebral amyloid angiopathy.

In another aspect, the invention provides for the use of the compound of Formula (I) or a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody in the treatment of a disease or disorder wherein SAP depletion would be beneficial.

In another aspect, the invention provides for the use of the compound of Formula (I) or a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody for use in the depletion of SAP.

In another aspect, the invention provides for the use of the compound of Formula (I) in co-administration with an anti-SAP antibody in the treatment of a disease or disorder selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

In another aspect, the invention provides for the use of the compound of Formula (I) in co-administration with an anti-SAP antibody in the treatment of amyloidosis.

In one embodiment, the invention provides for the use of the compound of Formula (I) in co-administration with an anti-SAP antibody in the treatment of systemic amyloidosis.

In one embodiment, the invention provides for the use of the compound of Formula (I) in co-administration with an anti-SAP antibody in the treatment of AL-type amyloidosis.

In one embodiment, the invention provides for the use of the compound of Formula (I) in co-administration with an anti-SAP antibody in the treatment of AA-type amyloidosis.

In one embodiment, the invention provides for the use of the compound of Formula (I) in co-administration with an anti-SAP antibody in the treatment of dialysis amyloidosis.

In one embodiment, the invention provides for the use of the compound of Formula (I) in co-administration with an anti-SAP antibody in the treatment of ATTR (transthyretin) amyloidosis.

In one embodiment, the invention provides for the use of the compound of Formula (I) in co-administration with an anti-SAP antibody in the treatment of hereditary systemic amyloidosis.

In one embodiment, the invention provides for the use of the compound of Formula (I) in co-administration with an anti-SAP antibody in the treatment of local amyloidosis.

In one embodiment, the invention provides for the use of the compound of Formula (I) in co-administration with an anti-SAP antibody in the treatment of cerebral amyloid angiopathy.

In another aspect, the invention provides for the use of a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody in the treatment of a disease or disorder selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

In another aspect, the invention provides for the use of a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody in the treatment of amyloidosis.

In one embodiment, the invention provides for the use of a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody in the treatment of systemic amyloidosis.

In one embodiment, the invention provides for the use of a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody in the treatment of AL-type amyloidosis.

In one embodiment, the invention provides for the use of a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody in the treatment of AA-type amyloidosis.

In one embodiment, the invention provides for the use of a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody in the treatment of dialysis amyloidosis.

In one embodiment, the invention provides for the use of a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody in the treatment of ATTR (transthyretin) amyloidosis.

In one embodiment, the invention provides for the use of a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody in the treatment of hereditary systemic amyloidosis.

In one embodiment, the invention provides for the use of a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody in the treatment of local amyloidosis.

In one embodiment, the invention provides for the use of a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody in the treatment of cerebral amyloid angiopathy.

The skilled person will understand that co-administration of the compound of Formula (I) or a pharmaceutical composition as herein described with an anti-SAP antibody should only take place when circulating SAP levels have been lowered to a suitable level.

In another aspect, the invention provides for the use of the compound of Formula (I) and an anti-SAP antibody in the manufacture of a medicament for use in the treatment of a disease or disorder wherein SAP depletion would be beneficial.

In another aspect, the invention provides for the use of the compound of Formula (I) and an anti-SAP antibody in the manufacture of a medicament for use in the depletion of SAP.

In another aspect, the invention provides for the use of the compound of Formula (I) and an anti-SAP antibody in the manufacture of a medicament for use in the treatment of a disease or disorder selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

In another aspect, the invention provides for the use of the compound of Formula (I) and an anti-SAP antibody in the manufacture of a medicament for use in the treatment of amyloidosis.

In one embodiment, the invention provides for the use of the compound of Formula (I) and an anti-SAP antibody in the manufacture of a medicament for use in the treatment of systemic amyloidosis.

In one embodiment, the invention provides for the use of the compound of Formula (I) and an anti-SAP antibody in the manufacture of a medicament for use in the treatment of AL-type amyloidosis.

In one embodiment, the invention provides for the use of the compound of Formula (I) and an anti-SAP antibody in the manufacture of a medicament for use in the treatment of AA-type amyloidosis.

In one embodiment, the invention provides for the use of the compound of Formula (I) and an anti-SAP antibody in the manufacture of a medicament for use in the treatment of dialysis amyloidosis.

In one embodiment, the invention provides for the use of the compound of Formula (I) and an anti-SAP antibody in the manufacture of a medicament for use in the treatment of ATTR (transthyretin) amyloidosis.

In one embodiment, the invention provides for the use of the compound of Formula (I) and an anti-SAP antibody in the manufacture of a medicament for use in the treatment of hereditary systemic amyloidosis.

In one embodiment, the invention provides for the use of the compound of Formula (I) and an anti-SAP antibody in the manufacture of a medicament for use in the treatment of local amyloidosis.

In one embodiment, the invention provides for the use of the compound of Formula (I) and an anti-SAP antibody in the manufacture of a medicament for use in the treatment of cerebral amyloid angiopathy.

In one embodiment the disease or disorder is amyloidosis.

In a further embodiment the disease or disorder is systemic amyloidosis.

In a further embodiment the disease or disorder is AL-type amyloidosis.

In a further embodiment the disease or disorder is AA-type amyloidosis.

In a further embodiment the disease or disorder is dialysis amyloidosis.

In a further embodiment the disease or disorder is ATTR (transthyretin) amyloidosis.

In a further embodiment the disease or disorder is hereditary systemic amyloidosis.

In another embodiment the disease or disorder is local amyloidosis.

In a further embodiment the disease or disorder is cerebral amyloid angiopathy.

In one embodiment the disease or disorder is Alzheimer s disease.

In one embodiment the disease or disorder is type 2 diabetes mellitus.

In one embodiment the disease or disorder is osteoarthritis.

In another embodiment of the invention, an article of manufacture, or kit of parts , containing one or more unit doses of an anti-SAP antibody and one or more unit doses of the compound of Formula (I), useful for the treatment of amyloidosis, is provided.

In one embodiment the kit of parts comprises a unit dose of an anti-SAP antibody and one or more unit doses of the compound of Formula (I).

Suitably the kit of parts is formulated for the separate or sequential administration of the one or more unit doses of compound of Formula (I) and the unit dose of the anti-SAP antibody.

In one embodiment, the kit of parts comprises a container comprising one or more unit doses of the compound of Formula (I) or a pharmaceutical composition as herein described and the unit dose of the anti-SAP antibody.

In another embodiment, the kit of parts comprises a first container comprising one or more unit doses of the compound of Formula (I) or a pharmaceutical composition as herein described and a second container comprising the unit dose of the anti-SAP antibody.

The kit of parts may further comprise directions for the administration of the one or more unit doses of compound of Formula (I) and the unit dose of the anti-SAP antibody for treating or preventing amyloidosis.

In an alternative embodiment of the invention, an article of manufacture, or kit of parts , containing one or more unit doses of the compound of Formula (I) or a pharmaceutical composition as herein described and one or more unit doses of a DNA vaccine is provided.

Suitable containers include, for example, bottles, vials, syringes and blister packs, etc.

WO2011/139917 discloses anti-transthyretin (anti-TTR) antisense oligonucleotides potentially useful in the modulation of expression of transthyretin and in treating, preventing, delaying or ameliorating transthyretin amyloidosis.

In another aspect, the invention provides for a method of treatment of ATTR (transthyretin) amyloidosis, which method comprises i) administering to a subject a therapeutically effective amount of the compound of formula (I) or a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody, and ii) administering to a subject a therapeutically effective amount of an anti-TTR antisense oligonucleotide.

In one embodiment of the invention, the anti-TTR antisense oligonucleotide is ISIS 420915.

In one embodiment, steps i) and ii) are carried out sequentially.

In one embodiment, step ii) is carried out after step i).

WO2009/040405 discloses agents for stabilising the tetrameric form of transthyretin useful in the treatment or prevention of transthyretin amyloidosis.

Therefore, in another aspect, the invention provides for a method of treatment of ATTR (transthyretin) amyloidosis, which method comprises i) administering to a subject a therapeutically effective amount of the compound of formula (I) or a pharmaceutical composition as herein described in co-administration with an anti-SAP antibody, and ii) administering to a subject a therapeutically effective amount of an agent as described in WO2009/040405.

In one embodiment, steps i) and ii) are carried out sequentially.

In one embodiment, step ii) is carried out after step i).

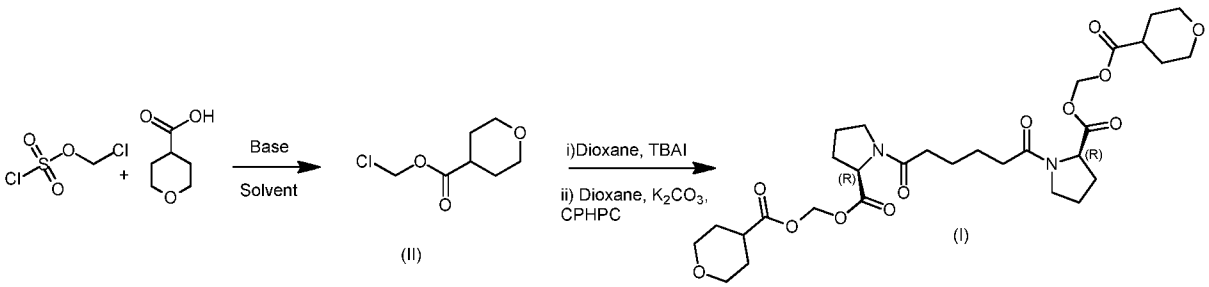
General Synthetic Routes

The compound of Formula (I) may be synthesised substantially according to Reaction Scheme 1.

The compound of Formula (I) can be prepared by reaction of the chloromethyl carboxylate of Formula (II) with CPHPC in the presence of a solvent (e.g. 1,4-dioxane), a base (e.g. potassium carbonate) and catalytic amounts of TBAI (tetrabutylammonium iodide).

The chloromethyl carboxylate of Formula (II) can be prepared by reaction of chloromethyl sulfochloridate with tetrahydro-2H-pyran-4-carboxylic acid in the presence of a solvent (e.g. water, diethyl ether or dichloromethane) and a base (e.g. tetrabutylammonium bromide, sodium carbonate, pyridine or dimethylaminopyridine).

Chloromethyl sulfochloridate (also known as chloromethyl chlorosulphate) and tetrahydro-2H-pyran-4-carboxylic acid are commercially available (for example, from Sigma Aldrich or Fisher Scientific).



Reaction Scheme 1

CPHPC can be synthesised according to the experimental procedure disclosed in EP0915088.

EXAMPLES

The following Example illustrates the invention. This Example is not intended to limit the scope of the present invention, but rather to provide guidance to the skilled artisan to prepare and use the compound, compositions, and methods of the present invention. While particular embodiments of the present invention are described, the skilled artisan will appreciate that various changes and modifications can be made without departing from the spirit and scope of the invention.

All publications, including but not limited to patents and patent applications, cited in this specification are herein incorporated by reference as if each individual publication were specifically and individually indicated to be incorporated by reference herein as though fully set forth.

The following Intermediates and Examples illustrate the preparation of the compound of the invention.

Abbreviations

aq. aqueous

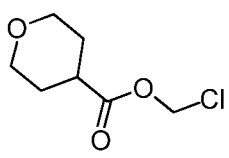
DCM	dichloromethane/methylene chloride
EtOAc	ethyl acetate
h	hour
HCl	hydrochloric acid
HPLC	high performance liquid chromatography
iPr_2O	isopropyl ether
min	minute
MS	mass spectrometry
Na_2SO_4	sodium sulphate
NMR	nuclear magnetic resonance
RT	room temperature
TBAI	tetrabutylammonium iodide
TOF	time of flight

^{1}H and ^{13}C NMR spectra were recorded on a Bruker 300 or 400 MHz NMR spectrometer. Chemical shifts are reported in parts per million (ppm, units). High-resolution mass spectra were recorded on a Micromass LCT (TOF) spectrometer coupled to analytical high performance liquid chromatography (HPLC). HPLC was conducted on a Waters X-Terra MS C18 column (3.5 µm 30 x 4.6 mm id) eluting with 0.01M ammonium acetate in water (solvent A) and 100% acetonitrile (solvent B), using the following elution gradient 0-0.5 minutes 5% B, 0.5-3.75 minutes 5% to 100% B, 3.75-4.5 100% B, 4.5-5 100% to 5% B, 5-5.5 5% B at a flow rate of 1.3 mL/minute at 40 °C. The mass spectra (MS) were recorded on a Waters LCT mass spectrometer using electrospray positive ionisation [ES^+ve to give MH^+ molecular ions] or electrospray negative ionisation [ES-ve to give $(M-H)^-$ molecular ions] modes.

Analytical HPLC was conducted on a XSelect XP C18 column (2.5 µm 30 x 4.6 mm id) eluting with 0.1% formic acid in water (solvent A) and 0.1% formic acid in acetonitrile (solvent B), using the following elution gradient 0-3.2 minutes: 5% to 100% B, 3.2-4.0 minutes 100% B, at a flow rate of 1.8 mL/minute at 40 °C. The mass spectra (MS) were recorded on a Waters ZQ mass spectrometer using electrospray positive ionisation [ES^+ to give MH^+ molecular ions] or electrospray negative ionisation [ES^- to give $(M-H)^-$ molecular ions] modes.

EXPERIMENTAL

Chloromethyl tetrahydro-2H-pyran-4-carboxylate



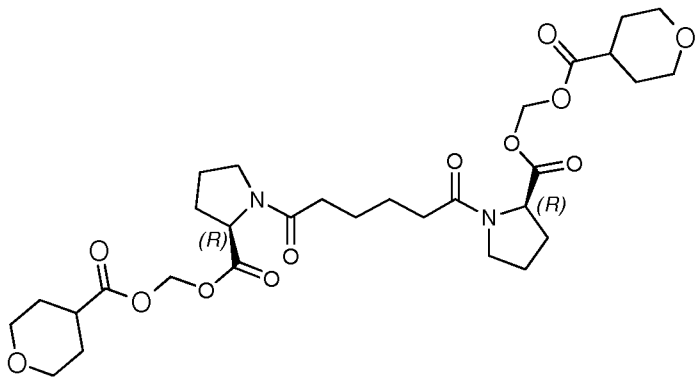
A 3L flask equipped with a mechanical stirrer was charged with a suspension of tetrahydro-2H-pyran-4-carboxylic acid (50 g, 384 mmol) in water (50 mL) then a solution of Na_2CO_3 (163 g, 1537 mmol) in water (600 mL) was slowly added. The colourless aqueous solution was cooled down to 0 °C and tetrabutylammonium bromide (12.39 g, 38.4 mmol) was added. A solution of chloromethyl sulfochloridate (127 g, 768 mmol) in DCM (250 mL) was added drop wise over 1 h at 0 °C with vigourous stirring. The reaction mixture was stirred at 0 °C for 1 h then allowed to rise to RT and stirred overnight at that temperature. The precipitate formed during the reaction was filtered off and the filtrate was extracted with DCM (2 x 300 mL). The organic phases were gathered, dried over anhydrous Na_2SO_4 and concentrated under reduced pressure.

The yellow oily residue was dissolved in DCM (100 mL), loaded onto a silica pad (500 g) and eluted with 10% EtOAc in cyclohexane (1 L) then DCM (250 mL) to afford the title compound as a pale yellow oil *(*24 g, 35%).

^{1}H NMR (400 MHz, $CDCl_3$) ppm 5.74 (s, 2 H), 3.97 (m, 2 H), 3.45 (m, 2 H), 2.64 (m, 1 H), 1.86 (m, 4 H).

Minor peaks were observed due to the presence of side product.

(2R,2'R)-bis(((tetrahydro-2H-pyran-4-carbonyl)oxy)methyl) 1,1'-adipoylbis(pyrrolidine-2-carboxylate



A 3 L flask equipped with a mechanical stirrer was charged with a suspension of (2R,2'R)-1,1'-adipoylbis(pyrrolidine-2-carboxylic acid) (30 g, 88 mmol) in 1,4-dioxane (200 mL). K_2CO_3 (30.5 g, 220 mmol) was added to stirred suspension at RT and the reaction mixture was stirred at RT for 10 min then heated to 80 °C. Tetrabutylammonium iodide (6.51 g, 17.63 mmol) was added to a solution of chloromethyl tetrahydro-2H-pyran-4-carboxylate (36.2 g, 203 mmol) dissolved in 1,4-dioxane (100 mL). After 10 min stirring at RT, the precipitate was filtered and the orange filtrate was added drop wise over 30 min in the reaction mixture prepared above. After 8 h at 80 °C, the reaction mixture was filtered and the filtrate was concentrated under reduced pressure. The residue was taken up in EtOAc (300 mL) and washed with $NaHCO_3$ aq. solution (1 x 100 mL), sodium sulfite aq. solution (1 x 100 mL), 0.5 N HCl (1 x 50 mL), water (1 x 100 mL) and brine. The organic layer was dried over anhydrous Na_2SO_4, filtered then stirred 15 min with vegetal charcoal, filtered over celite bed and concentrated *in vacuo* to afford the title compound as a pale yellow gum which crystallized. The amorphous solid was taken up in iPr_2O and filtered to afford the title compound as off-white powder (28 g, 50.9 %).

Crystallisation

Final purification

Several batches of (2R,2'R)-Bis(((tetrahydro-2H-pyran-4-carbonyl)oxy)methyl) 1,1'-adipoylbis(pyrrolidine-2-carboxylate) (106 g, 170 mmol) were gathered and diluted in ethyl acetate (200 mL) and heated to reflux in a 2 L flask with magnetic stirrer. After 20 min the solid was dissolved and the flask was taken off the heating system, filtered and allowed to cool down naturally to RT. When the temperature fell to 50 °C some crystals began to appear. The product was left to stand overnight at RT without stirring to complete the crystallisation process. The mixture was filtered, washed successively with iPr_2O (1 x 150 mL) and pentane (2 x 100 mL). The product was dried at 35 °C and 5 mbars for 5 h to afford the product as a white powder (82.5 g, 80 %).

LC/MS : m/z 625 $[M+H]^+$, Rt 2.68 min.

^1H NMR (400 MHz, $CDCl_3$) ppm 5.84 (d, J = 5.5 Hz, 2 H), 5.74 (d, J = 5.5 Hz, 2 H), 4.46 (m, 2 H), 4.01-3.91 (m, 4 H), 3.70-3.59 (m, 2 H), 3.58-3.38 (m, 6 H), 2.67-2.55 (m, 2H), 2.43 - 1.54 (m, 24 H).

Some minor peaks were observed due to the presence of rotamers.

^{13}C NMR (100 MHz, $CDCl_3$) 173.20, 171.41, 171.21, 79.55, 66.33, 58.53, 46.95, 33.68, 29.11, 28.53, 24.88 , 24.20 , 22.52.

HRMS : m/z calculated for $C_{30}H_{45}N_2O_{12}$ $[M+H]^+$ 625.2972, found 625.3010.

XRPD data were acquired on a PANalytical X Pert Pro powder diffractometer, model PW3040/60 using an X Celerator detector. The acquisition conditions were: radiation: Cu K , generator tension: 40 kV, generator current: 45 mA, start angle: 2.0° 2 , end angle: 40.0° 2 , step size: 0.0167° 2 , time per step: 31.75 seconds. The sample was prepared by mounting a few milligrams of sample (compound of Formula (I)) on a silicon wafer (zero background plate), resulting in a thin layer of powder.

The XRPD spectrum of the crystalline solid compound of Formula (I) is shown in Figure 1.

Characteristic XRPD angles and d-spacings for Form I of the compound of Formula (I) are recorded in Table 1. The margin of error is approximately ± 0.1° 2 for each of the peak assignments. Peak intensities may vary from sample to sample due to preferred orientation.

Peak positions were measured using Highscore software.

Compound of formula (I)	
2• / °	d-spacings / Å

3.6	24.4
7.2	12.3
10.8	8.2
14.4	6.2
16.3	5.4
17.0	5.2
18.0	4.9
18.6	4.8
21.0	4.2
22.8	3.9

Table 1: XRPD diffraction angles and d-spacings for Form I of compound of Formula (I)

In a further aspect, the invention provides for the compound of Formula (I) in crystalline form.

In a further aspect, the invention provides for the compound of Formula (I) as a crystalline solid characterised by an XRPD spectrum that is substantially as shown in Figure 1.

In a further aspect, the invention provides for the compound of Formula (I) as a crystalline solid characterised by an XRPD spectrum comprising at least nine diffraction angles, when measured using Cu K radiation, selected from the peaks of Table 1. In a further aspect, the invention provides for the compound of Formula (I) as a crystalline solid characterised by an XRPD spectrum comprising at least eight diffraction angles or at least seven diffraction angles or at least six diffraction angles or at least five diffraction angles or at least four diffraction angles, when measured using Cu K radiation, selected from the peaks of Table 1. In a further aspect, the invention provides for the compound of Formula (I) as a crystalline solid characterised by an XRPD spectrum comprising at least three diffraction angles, when measured using Cu K radiation, selected from the peaks of Table 1.

Comparator Compounds

The data hereinafter reported compares the compound of Formula (I) with (2R,2'R)-bis(1-(pivaloyloxy)ethyl) 1,1'-adipoylbis(pyrrolidine-2-carboxylate) (Comparator Compound).

(2R,2'R)-Bis(1-(pivaloyloxy)ethyl) 1,1'-adipoylbis(pyrrolidine-2-carboxylate) (also known as (R)-1-(6-{(R)-2-[1-(2,2-dimethyl-propionyloxy)-ethoxycarbonyl]-pyrrolidin-1-yl}-6-oxo-hexanoyl)-pyrrolidine-2-carboxylic acid 1-(2,2-dimethyl-propionyloxy)-ethyl ester) can be synthesised according to the experimental protocol disclosed in WO2003/051836.

Physicochemical Properties

Physical form

The compound of Formula (I) is obtainable as a crystalline solid. By contrast, Comparator Compound is obtained as an oil (see WO2003/051836).

Solubility

Protocol for determining solubility

A known quantity of the compound of Formula (I) was weighed into a suitable vessel (e.g. a screw capped clear glass vial) and a known volume of the required media added (e.g. Simulated Gastric Fluid pH 1.6 [SGF], Simulated Fed State Intestinal Fluid pH 6.5 [FeSSIF], Simulated Fasted State Intestinal Fluid pH 6.5 [FaSSIF], Water [Purified Water], or Britton-Robinson buffer). The compound was wetted with the media by vortex mixing for 30 seconds to 1 minute. The sample was then visually observed to ensure that undissolved solid remained present. The sample was transferred to a gentle mixer (such as a roller mixer) and allowed to agitate until the desired time point was reached. At appropriate times the sample was reassessed visually. If all the solid had dissolved the solubility was recorded as >x mg/mL where x is the known weight used divided by the volume added. If undissolved solid remained a portion of the sample was taken and centrifuged to remove the solid leaving a clear supernatant. The supernatant was diluted volumetrically with a suitable diluent to provide an analytical sample of suitable concentration for analysis. This diluted sample was then analysed by a suitable method such as HPLC against a standard(s) of known concentration. The solubility of the compound can then be calculated using a knowledge of the concentration of the standard, the relative response (e.g. peak areas) of the standard and the analytical sample described, and the dilution of the analytical sample.

The solubility of the compound of Formula (I) in various aqueous media are shown below in Table 2.

Media Tested	**Solubility (mg/mL) at 4 hour timepoint**
SGF	0.577
FaSSIF	1.036
FeSSIF	0.599
Water	0.574

Table 2: Solubility of compound of Formula (I) in water, FeSSIF, FaSSIF and SGF at 4 hour timepoint

Therefore the compound of Formula (I) is highly soluble in biologically relevant media.

Cytochrome p450 and drug-drug interactions

The compound of Formula (I) and Comparator Compound were assessed in the cytochrome p450 (CYP 450) assay below. The results are shown below in Table 3.

The assay was designed to evaluate inhibition on cytochrome P450 (CYP) 3A4, 2C9, 2C19, 1A2 and 2D6 enzymes from bactosomes source using fluorogenic substrates. Compound (compound of Formula (I) or Comparator Compound) was dissolved in methanol at 1.65 mM. Daughter solutions were prepared in methanol at 660, 264, 106, 42, 17, 6.8, 2.7, 1.1 and 0.43 µM. NADPH cofactor was prepared with Glucose-6-phosphate (7.8 mg), Glucose -6-phosphate dehydrogenase (6 units), NADP (1.7 mg) per 1 mL in $NaHCO_3$ 2%.

Substrate preparation was as follows:

- 7-Methoxy-4-triFluoromethyl Coumarin-3-Acetic acid ethyl ester (FCA): 12.5 mM in acetonitrile
- EthoxyResorufin (ER): 0.05 mM in acetonitrile
- 4-MethylaminoMethyl-7-Methoxy Coumarin (MMC): 2.5 mM in methanol
- 3-Butyryl-7Methoxy Coumarin (BMC): 2.5 mM in DMSO
- 7-BenzyloxyQuinoline (7BQ): 2.5 mM in acetonitrile
- DiEthoxyFluorescein (DEF): 0.1 mM in acetonitrile

Bactosomes (Cypex source) at the concentration of 10mg of protein per mL were diluted in phosphate buffer 50mM pH7.4:

- 0.33 mL of bactosomes CYP2C9 with 23.8 mL of buffer and 0.11 mL of FCA
- 0.33 mL of bactosomes CYP1A2 with 23.6 mL of buffer and 0.275 mL of ER
- 0.33 mL of bactosomes CYP2D6 with 23.8 mL of buffer and 0.11 mL of MMC
- 0.33 mL of bactosomes CYP2C19 with 23.8 mL of buffer and 0.11 mL of BMC
- 0.33 mL of bactosomes CYP3A4H with 23.6 mL of buffer and 0.275 mL of 7BQ
- 0.33 mL of bactosomes CYP3A4L with 23.6 mL of buffer and 0.275 mL of DEF

Pre-Incubation consisted in mixing 5 µL of compound solution with 220 µL diluted bactosomes and warming it at 37 °C for 10min. Incubation was started with the addition of 25 µL of NADPH. Then fluorescence of substrate metabolite was read in a SAFIRE instrument (from Tecan) for 5 min:

- FCA (2C9): Excitation at 410 nm and Emission at 510 nm
- ER (1A2): Excitation at 530 nm and Emission at 590 nm
- MMC (2D6): Excitation at 410 nm and Emission at 485 nm
- BMC (2C19): Excitation at 410 nm and Emission at 465 nm
- 7BQ (3A4H): Excitation at 410 nm and Emission at 530 nm
- DEF (3A4L): Excitation at 485 nm and Emission at 530 nm

Plotting of inhibition of substrate production against compound concentration allowed the determination of IC_{50} values.

	Compound of Formula (I)	**Comparator Compound**
CYP450 enzyme	IC_{50} (µM)	IC_{50} (µM)
CYP1A2	>33	>33

CYP2C19	>33	>33
CYP2C9	>33	26
CYP2D6	>33	>33
CYP3A4 (7BQ)	>33	5.5
CYP3A4 (DEF)	>33	1.1

Table 3: Inhibition of cytochrome p450 enzymes by compound of Formula (I) (Example 1) and Comparator Compound.

In fluorescence based screening assays using recombinant human CYP 450, the compound of Formula (I) and its mono-ester derivative did not demonstrate significant inhibition of the major human liver cytochrome P450s (Cypex): CYP3A4-DEF and 3A4-7BQ with IC_{50} >33 µM. The other isoforms were also not significantly inhibited by both compounds with IC_{50} >33 µM). By contrast, Comparator Compound demonstrated significant inhibition of CYP3A4-DEF and CYP3A4-7BQ.

For a compound where the systemic concentration is going to be low, only CYP3A4 inhibition is relevant as only intestinal inhibition will be relevant (CYP3A is present in enterocytes and is responsible for enterocyte first pass).

Physical Stability

Protocol for determining physical stability :

The assay was designed for determining physical stability of compound in buffer at various pHs. Compound of Formula (I) was dissolved in DMSO at 1mg/mL. Phosphate buffer (PBS) was prepared by mixing K_2HPO_4 50 mM and KH_2PO_4 50 mM solutions to obtain 4 buffers at pH 6.0, 7.0, 7.5, 8.0.

Stability studies were conducted at room temperature, and were started by the addition of 8 µL of DMSO solution to 792 µL of PBS 50 mM at pH 6.0, 7.0, 7.5 or 8.0 (1% DMSO). 75 µl of mixture was taken at 0, 1, 2, 4 and 24 h and 225 µL acetonitrile containing internal standard was added.

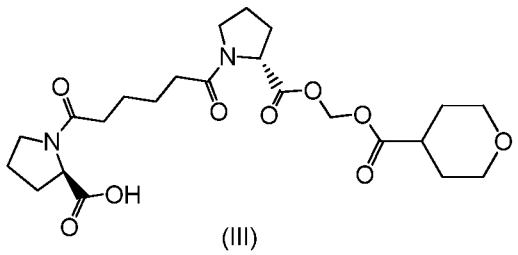
2 µL of samples were injected into the liquid chromatography system and eluted with a Ascentis C18 column (50 × 2.1 mm id, 2.7 µm) and with 0.1% formic acid in water (A) and 0.1% formic acid in acetonitrile (B), using the following elution 2min gradient: 5 to 95% B over 1.2 min, 95% B over 0.6 min and 0.1 min for re-equilibrate column, at 0.5 mL/min at 50 °C.

Samples were analysed by Mass Spectrometry with an electrospray source and in positive mode and with following mass transitions:

- Compound of Formula (I): 625 to 368
- Monoester of CPHPC: 483 to 226

- CPHPC: 341 to 226

By monoester of CPHPC is meant the compound (R)-1-(6-oxo-6-((R)-2-((((tetrahydro-2H-pyran-4-carbonyl)oxy)methoxy)carbonyl)pyrrolidin-1-yl)hexanoyl)pyrrolidine-2-carboxylic acid of Formula (III).



(III)

The hydrolysis of the compound of Formula (I) was evaluated at different pH (from pH6 to pH8) and the results are shown in Figure 2. The compound of Formula (I) seemed to be less sensitive to hydrolysis for a pH below 7.5. Less than 20% of the compound of Formula (I) was hydrolysed after 24 h in an acidic environment (pH less than 7.0).

Intestinal and Liver microsomal hydrolysis

Intestine and Liver Microsomal Assay protocol

The assay was designed for determining stability of compound in microsomal matrix. Compound (Compound of Formula (I)) was dissolved in DMSO at 1 mg/mL. Daughter solution was prepared in methanol/water (50/50) at 30.3 ng/mL. Microsomes (from Xenotech) were diluted at 0.625 mg proteins per mL in phosphate buffer 50 mM pH 7.4.

Pre-Incubation consisted of warming microsomal solution 395 µL with 100 µL $NaHCO_3$ (2%) at 37 °C for 7 min. Incubation was started with the addition of 5 µL of daughter solution. 50 µL aliquots of mixture were taken at 0, 3, 6, 12 and 30 min and quenched with 150 µL acetonitrile containing internal standard.

After 10 min centrifugation at 4000 rpm, 2 µL of samples were injected into the liquid chromatography system and eluted on a Ascentis C18 column (50 × 2.1 mm id, 2.7 µm) with 0.1% formic acid in water (A) and 0.1% formic acid in acetonitrile (B), using the following 2 minute elution gradient: 5 to 95% B over 1.2 min, 95% B over 0.6 min and 0.1 min for re-equilibrate column, at 0.5 mL/min at 50 °C.

Samples were analysed by Mass Spectrometry with an electrospray source, in positive mode and with following mass transitions:

- Compound of Formula (I): 625 to 368
- Monoester of CPHPC: 483 to 226
- CPHPC: 341 to 226

Controls were made to calculate percentage of disappearance of parent but also appearance of suspected metabolite, i.e. monoester and diacidic form.

As can be seen from Figure 3, the compound of Formula (I) exhibited a low rate of hydrolysis in human intestinal microsomes, even after 30 minutes, suggesting that the compound of Formula (I) will not be unduly unstable in the gut and so be available for absorption.

From the intestine, the compound of Formula (I) is transported through the intestinal wall and is transported to the bloodstream and liver, both sites of circulating SAP.

Protocol for determining blood hydrolysis

The assay was designed for determining stability of compound in fresh blood. Compound (compound of Formula (I)) was dissolved in DMSO at 1 mg/mL. Daughter solution was prepared in DMSO at 100 µg/mL. Fresh blood was diluted ½ in isotonic buffer pH 7.4.

Pre-Incubation consisted of warming 792 µL of blood at 37 °C for 7 min. Incubations were started with the addition of 5 µL of daughter solution. 50 µL of mixture were taken at 0, 5, 15, 30 and 60 min. 50 µL of water was add to sample and then quenched with 300 µL acetonitrile containing internal standard.

After 10 min centrifugation at 4000 rpm, 2 µL of samples were injected into the liquid chromatography system and eluted with a Ascentis C18 column (50 × 2.1 mm id, 2.7 µm) and with 0.1% formic acid in water (A) and 0.1% formic acid in acetonitrile (B), using the following elution gradient over 2 minutes: 5 to 95% B over 1.2 min, 95% B over 0.6 min and 0.1 min for re-equilibrate column, at 0.5 mL/min at 50 °C.

Samples were analysed by Mass Spectrometry with an electrospray source and in positive mode and with following mass transitions:

- Compound of Formula (I): 625 to 368
- Monoester of CPHPC: 483 to 226
- CPHPC: 341 to 226

Controls were made to calculate percentage of disappearance of parent but also appearance of suspected metabolite, i.e. monoester and diacidic form.

In human blood, a high rate of hydrolysis of compound of Formula (I) to CPHPC was observed (approximately 75% conversion to CPHPC was achieved within 60 minutes), suggesting that compound of Formula (I) is capable of being cleaved to active CPHPC once absorbed.

In vitro liver microsomal activity of was assessed using the protocol detailed above (Intestine and Liver Microsomal Assay protocol).

In human liver microsomes, a high rate of hydrolysis of compound of Formula (I) to CPHPC was observed (approximately 70% conversion to CPHPC was achieved within 30 minutes), suggesting that compound of Formula (I) is capable of being cleaved to active CPHPC once absorbed.

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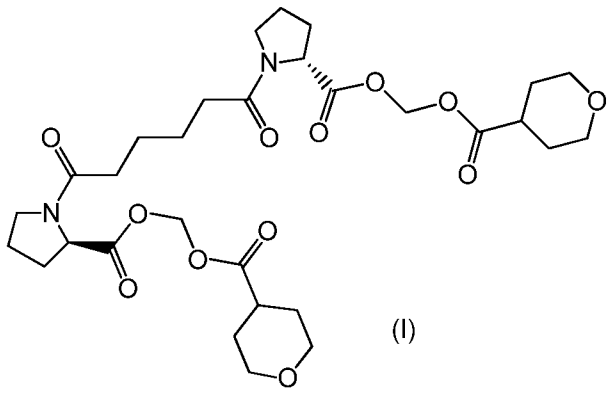
CLAIMS

1. A compound which is:



(I)

.

2. A compound according to claim 1 in crystalline form.

3. A pharmaceutical composition comprising a therapeutically effective amount of a compound according to claim 1 or claim 2 and a pharmaceutically acceptable excipient.

4. A pharmaceutical composition according to claim 3 for oral administration.

5. A kit of parts comprising one or more dosage forms of an anti-SAP antibody and one or more dosage forms of a compound or pharmaceutical composition according to any of claims 1 to 4.

6. A compound or pharmaceutical composition according to any of claims 1 to 4 for use in therapy.

7. A compound or pharmaceutical composition according to any of claims 1 to 4 for use in the depletion of SAP.

8. A compound or pharmaceutical composition according to any of claims 1-4 for use in the treatment of diseases or disorders wherein SAP depletion would be beneficial.

9. Use of a compound or pharmaceutical composition according to any of claims 1 to 4 in the depletion of SAP.

10. Use of a compound or pharmaceutical composition according to any of claims 1 to 4 in the treatment of diseases or disorders wherein SAP depletion would be beneficial.

11. A compound or pharmaceutical composition according to any of claims 1 to 4 and an anti-SAP antibody for use in the treatment of amyloidosis

12. A method of treatment of a disease or disorder in a subject wherein SAP depletion would be beneficial, which method comprises administration of a therapeutically effective amount of a compound or pharmaceutical composition according to any of claims 1 to 4.

13. The method according to claim 12 wherein the disease or disorder is selected from the group consisting of amyloidosis, Alzheimer s disease, type 2 diabetes mellitus and osteoarthritis.

14. The method according to claim 12 or claim 13 wherein the disease or disorder is amyloidosis.

15. The method according to any one of claims 12 to 14 wherein the disease or disorder is systemic amyloidosis.

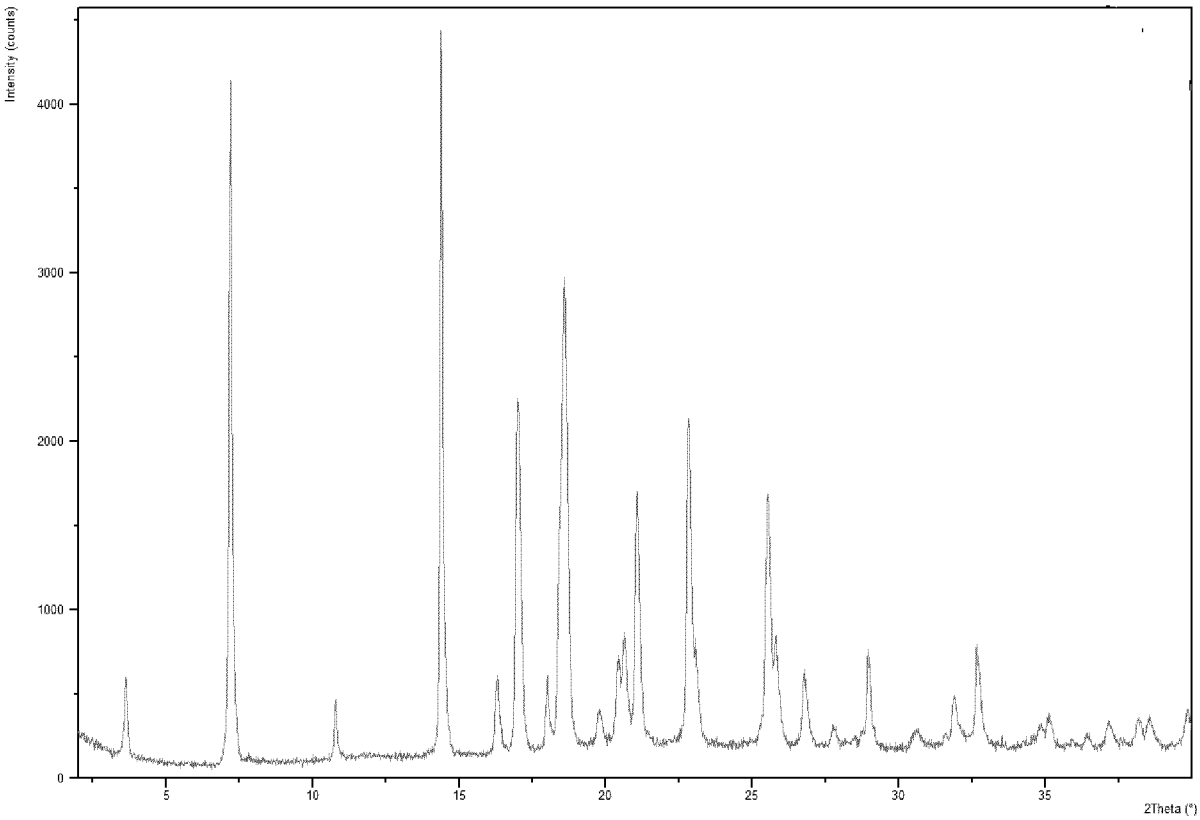


Figure 1: XRPD spectrum for Form I of compound of Formula (I)

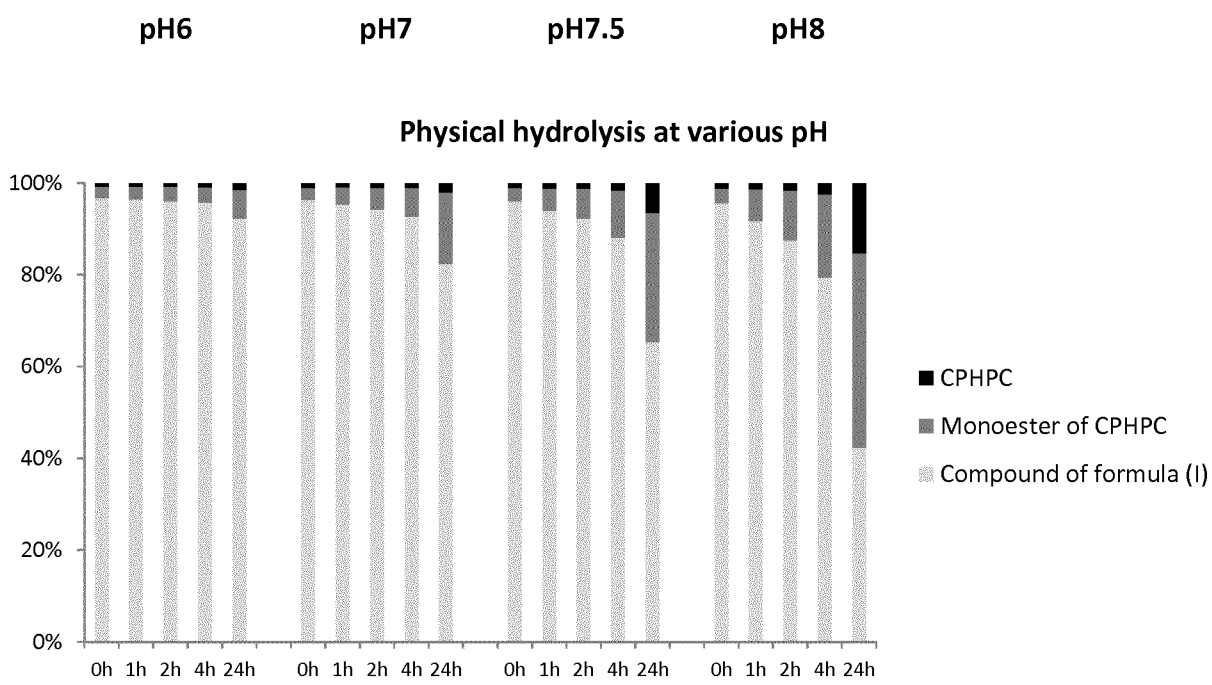


Figure 2: In vitro physical hydrolysis of compound of Formula (I) in phosphate buffered saline at pH6, 7, 7.5 and 8

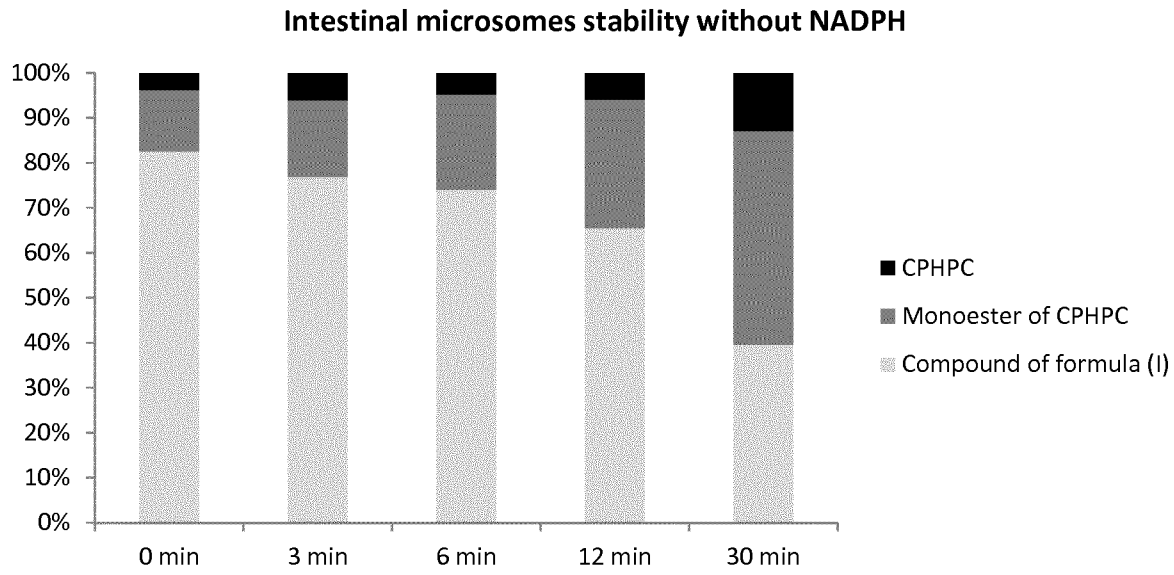


Figure 3: In vitro Intestinal Microsomal Stability of Compound of Formula (I) in human microsomes. 0/3/6/12/30 min refers to the time (in minutes) that the sample was taken from the mixture for analysis.

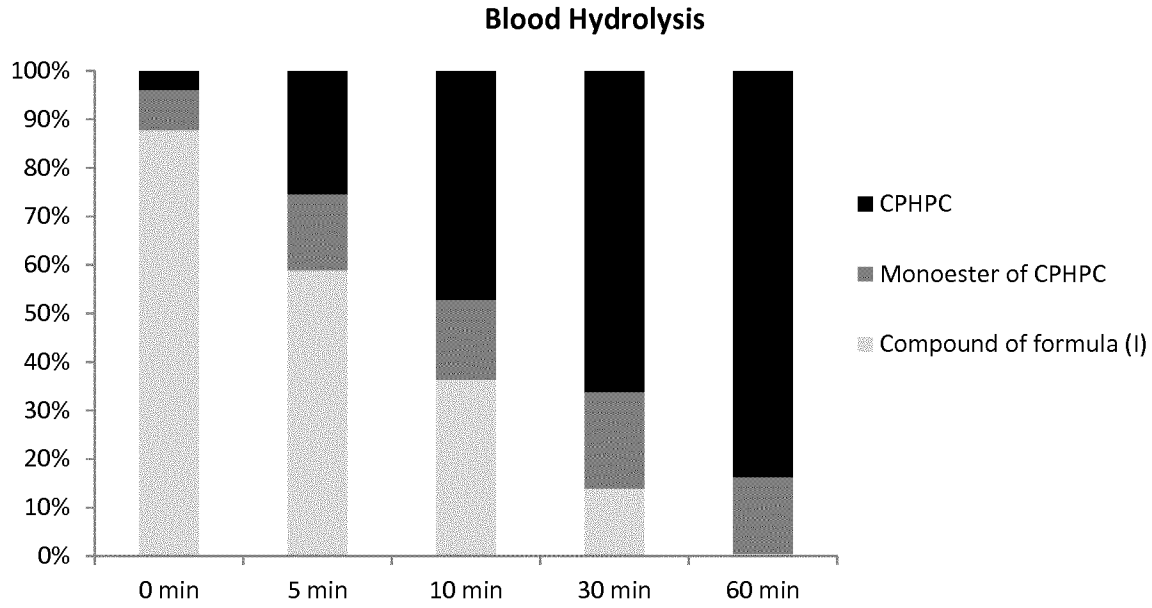


Figure 4: In vitro Blood stability of compound of Formula (I) in human blood. 0/5/10/30/60 min refers to the time (in minutes) that the sample was taken from the mixture for analysis.

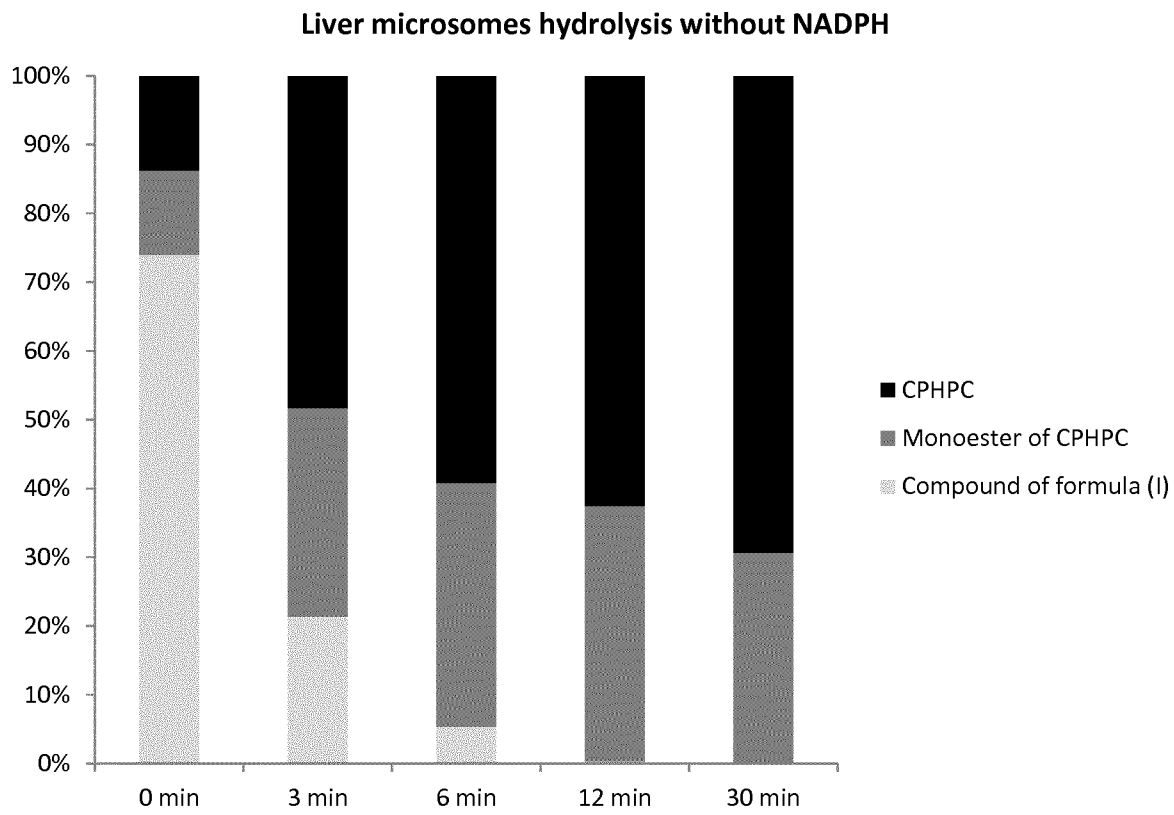


Figure 5: In vitro Liver microsomal stability of compound of Formula (I) in human liver microsomes. 0/3/6/12/30 min refers to the time (in minutes) that the sample was taken from the mixture for analysis.