(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 902 416 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
08.02.2023 Bulletin 2023/06

(21) Application number: **19829151.0**

(22) Date of filing: **18.12.2019**

(51) International Patent Classification (IPC):
A24B 15/167 *(2020.01)* ***A24B 15/16*** *(1980.01)*
A24F 40/20 *(2020.01)* ***A24F 40/10*** *(2020.01)*

(52) Cooperative Patent Classification (CPC):
A24B 15/165; A24B 15/167; A24F 40/48;
A24F 40/10; A24F 40/20

(86) International application number:
PCT/EP2019/086110

(87) International publication number:
WO 2020/136062 (02.07.2020 Gazette 2020/27)

(54) **NICOTINE FORMULATION COMPRISING METAL SALT**

NIKOTINFORMULIERUNG MIT METALLSALZ

FORMULATION DE NICOTINE COMPRENANT UN SEL DE MÉTAL

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **28.12.2018 EP 18248224**

(43) Date of publication of application:
03.11.2021 Bulletin 2021/44

(73) Proprietor: **Philip Morris Products S.A.**
2000 Neuchâtel (CH)

(72) Inventor: **TAURINO, Irene**
2000 Neuchâtel (CH)

(74) Representative: **Whitfield, Ian**
Reddie & Grose LLP
The White Chapel Building
10 Whitechapel High Street
London E1 8QS (GB)

(56) References cited:
US-A- 5 105 836
US-A- 5 484 604
US-A1- 2007 023 056
US-A1- 2009 221 489
US-A1- 2010 108 059
US-A1- 2015 096 572
US-A1- 2018 199 617

EP 3 902 416 B1

Description

[0001] The invention relates to a nicotine formulation for use in an aerosol-generating system. The invention also relates to an aerosol-generating article comprising the nicotine formulation for use in an aerosol-generating system and an aerosol-generating system comprising the nicotine formulation and an atomiser.

[0002] Aerosol-generating systems for delivering nicotine to a user that comprise an atomiser configured to generate an inhalable aerosol from a nicotine formulation are known. Some known aerosol-generating systems comprise a thermal atomiser such as an electric heater that is configured to heat and vaporise the nicotine formulation to generate an aerosol. Other known aerosol-generating systems comprise a non-thermal atomiser that is configured to generate an aerosol from the nicotine formulation using, for example, impinging jet, ultrasonic or vibrating mesh technologies. Typical nicotine formulations for use in aerosol-generating systems are liquid nicotine formulations comprise glycerine, propylene glycol and water as solvents.

[0003] US2018/199617A1 describes A tobacco-free absorbent dry gel that delivers flavored smoke and/or nicotine when heated or burned. The dry gel formulation includes a binder compound to which flavors and/or nicotine can be added. The dry gel is suitable for use in a hookah smoking apparatus. Example 2 of US2018/199617A1 describes a composition having a polyhydric alcohol content of 38.9% by weight. US2018/199617A1 also described that the composition may have a preservative content of 0.5 to 2% by weight. The preservative may be sodium benzoate.

[0004] It would be desirable to provide a nicotine formulation that exhibits more efficient vaporization of nicotine and increased nicotine delivery to a user compared to typical liquid nicotine formulations when used in an aerosol-generating system.

[0005] It would also be desirable to provide a nicotine formulation that exhibits reduced risk of leakage compared to typical nicotine formulations when used in an aerosol-generating system.

[0006] According to the invention there is also provided a nicotine formulation for use in an aerosol-generating system, the nicotine formulation comprising: one or more water-miscible polyhydric alcohols; and one or more metal salts, and one or more organic acids, wherein the nicotine formulation has a metal salt content of greater than or equal to about 0.5 percent by weight, wherein the one or more metal salts are selected from the group consisting of metal benzoates, metal cinnamates, metal cycloheptanecarboxylates, metal levulinates, metal propanoates, metal stearates and metal undecanoates, and wherein the nicotine formulation has an organic acid content of between about 0.5 percent and about 4 percent by weight.

[0007] According to the invention there is also provided an aerosol-generating article for use in an aerosol-generating system, the aerosol-generating article containing a nicotine formulation comprising: one or more water-miscible polyhydric alcohols; and one or more metal salts, and one or more organic acids, wherein the nicotine formulation has a metal salt content of greater than or equal to about 0.5 percent by weight, and wherein the one or more metal salts are selected from the group consisting of metal benzoates, metal cinnamates, metal cycloheptanecarboxylates, metal levulinates, metal propanoates, metal stearates and metal undecanoates, and wherein the nicotine formulation has an organic acid content of between about 0.5 percent and about 4 percent by weight.

[0008] According to the invention there is further provided an aerosol-generating system comprising: a nicotine formulation comprising: one or more water-miscible polyhydric alcohols; and one or more metal salts, and one or more organic acids, wherein the nicotine formulation has a metal salt content of greater than or equal to about 0.5 percent by weight; and an atomiser configured to generate an aerosol from the nicotine formulation, and wherein the one or more metal salts are selected from the group consisting of metal benzoates, metal cinnamates, metal cycloheptanecarboxylates, metal levulinates, metal propanoates, metal stearates and metal undecanoates, and wherein the nicotine formulation has an organic acid content of between about 0.5 percent and about 4 percent by weight.

[0009] As used herein with reference to the invention, the term "nicotine" describes nicotine, nicotine base or a nicotine salt. In embodiments in which the nicotine formulation comprises a nicotine base or a nicotine salt, the amounts of nicotine recited herein are the amount of free base nicotine or amount of protonated nicotine, respectively.

[0010] As used herein with reference to the invention, the term "water-miscible polyhydric alcohol" describes a polyhydric alcohol that is liquid at 20°C and mixes with water in all proportions to form a homogenous solution.

[0011] Unless stated otherwise, percentages by weight of components of the nicotine formulation recited herein are based on the total weight of the nicotine formulation.

[0012] Bonding between the one or more metal salts and the one or more polyhydric alcohols in the nicotine formulation may elevate the boiling point of the one or more polyhydric alcohols. This may advantageously enhance vaporization of nicotine from the nicotine formulation when used in an aerosol-generating system as compared to a typical liquid nicotine formulation that does not include one or more metal salts.

[0013] Without wishing to be bound by theory, the interactions between the one or more metal salts and the molecules of the one or more polyhydric alcohols in the nicotine formulation may be stronger than the interactions between the molecules of the one or more polyhydric alcohols. This may result in more energy being required to vaporize the one or more polyhydric alcohols. In use, the inclusion of one or more metal salts in the nicotine formulation may thereby

advantageously increase the percentage of nicotine in an aerosol generated from the nicotine formulation by up to one order of magnitude compared to a typical liquid nicotine formulation that does not include one or more metal salts.

[0014] Bonding between the one or more metal salts and the one or more polyhydric alcohols in the nicotine formulation may increase the viscosity of the nicotine formulation compared to a typical liquid nicotine formulation that does not include one or more metal salts. This may advantageously reduce the risk of leakage of the nicotine formulation when used in an aerosol-generating system compared to a typical liquid nicotine formulation that does not include one or more metal salts.

[0015] Advantageously, including propylene glycol in the nicotine formulation has also been shown to improve vaporisation of the nicotine formulation, which leads to the production of more aerosol for a given heating cycle.

[0016] By including propylene glycol in the nicotine formulation, there may also be an improvement in the nicotine content of the aerosol due to vaporisation of the nicotine. It is believed that this may be due to propylene glycol having a lower boiling point (188°C) compared to glycerine (290°C). However, if there is high amount of propylene glycol in the nicotine formulation then the nicotine content of the aerosol has been found to decrease. Therefore, it may be advantageous to have a limited amount of propylene glycol in the nicotine formulation.

[0017] The nicotine formulation may be a liquid nicotine formulation.

[0018] As used herein with reference to the invention, the term "liquid nicotine formulation" describes a liquid formulation comprising nicotine or a gel formulation comprising nicotine.

[0019] As used herein with reference to the invention, the term "gel" describes a substantially dilute cross-linked system, which exhibits no flow when in the steady-state.

[0020] The nicotine formulation may have a viscosity at 25°C of greater than or equal to about 5 Pa s.

[0021] Preferably, the nicotine formulation has a viscosity at 25°C of greater than or equal to about 10 Pa s. For example, the nicotine formulation may have a viscosity at 25°C of greater than or equal to about 25 Pa s, greater than or equal to about 50 Pa·s or greater than or equal to about 75 Pa s.

[0022] More preferably, the nicotine formulation has a viscosity at 25°C of greater than or equal to about 100 Pa s. For example, the nicotine formulation may have a viscosity at 25°C of greater than or equal to about 250 Pa s, greater than or equal to about 500 Pa·s or greater than or equal to about 750 Pa s.

[0023] Most preferably, the nicotine formulation has a viscosity at 25°C of greater than or equal to about 1000 Pa·s. For example, the nicotine formulation may have a viscosity at 25°C of greater than or equal to about 2500 Pa s, greater than or equal to about 5000 Pa s, greater than or equal to about 7500 Pa·s or greater than or equal to about 10,000 Pa s.

[0024] Unless stated otherwise, viscosity values recited herein are the viscosity of a 1 cubic centimetre (cm^3) sample volume of nicotine formulation measured using a Thermo Scientific HAAKE RheoStress 6000 rheometer using a parallel plate P20 probe with a MP60 (60 mm diameter) measuring plate at 25°C at a speed of 6 revolutions per minute (rpm).

[0025] The nicotine formulation may be a solid nicotine formulation.

[0026] As used herein with reference to the invention, the term "solid nicotine formulation" describes a solid formulation comprising nicotine.

[0027] Advantageously, including propylene glycol in the nicotine formulation results in a solid formulation that is less rigid, less brittle, and is easier to form into plugs. These properties improve subsequent processing and handling of the nicotine formulation during the manufacturing process. Nicotine formulations according to the invention may advantageously be used as aerosol-forming substrates in aerosol-generating systems that comprise an automatic or manual mechanism to move or advance the aerosol-forming substrate toward the atomiser as illustrated in FIGS. 1-3. The aerosol-forming substrate thus maintains contact with the atomiser even as the aerosol-forming substrate is consumed during use. In such aerosol-generating systems, the advancement mechanism may form a portion of an aerosol-generating article comprising the nicotine formulation or a portion of an aerosol-generating device that receives an aerosol-generating article comprising the nicotine formulation.

[0028] The nicotine formulation may comprise natural nicotine or synthetic nicotine.

[0029] The nicotine formulation may have a nicotine content of greater than or equal to about 0.5 percent by weight.

[0030] Preferably, the nicotine formulation has a nicotine content of greater than or equal to about 1 percent by weight. More preferably, the nicotine formulation has a nicotine content of greater than or equal to about 1.5 percent by weight.

[0031] The nicotine formulation may have a nicotine content of less than or equal to about 10 percent by weight or less than or equal to about 8 percent by weight.

[0032] Preferably, the nicotine formulation has a nicotine content of less than or equal to about 5 percent by weight. More preferably, the nicotine formulation has a nicotine content of less than or equal to about 3 percent by weight.

[0033] The nicotine formulation may have a nicotine content of between about 0.5 percent by weight and about 10 percent by weight. For example, the nicotine formulation may have a nicotine content of between about 0.5 percent by weight and about 8 percent by weight, between about 0.5 percent by weight and about 5 percent by weight or between about 0.5 percent by weight and about 3 percent by weight.

[0034] Preferably, the nicotine formulation has a nicotine content of between about 1 percent by weight and about 10 percent by weight. For example, the nicotine formulation may have a nicotine content of between about 1 percent by

weight and about 8 percent by weight, between about 1 percent by weight and about 5 percent by weight or between about 1 percent by weight and about 3 percent by weight.

[0035] More preferably, the nicotine formulation has a nicotine content of between about 1.5 percent by weight and about 10 percent by weight. For example, the nicotine formulation may have a nicotine content of between about 1.5 percent by weight and about 8 percent by weight, between about 1.5 percent by weight and about 5 percent by weight or between about 1.5 percent by weight and about 3 percent by weight.

[0036] The nicotine formulation may have a water-miscible polyhydric alcohol content of greater than or equal to about 5 percent by weight. The nicotine formulation may have a water-miscible polyhydric alcohol content of greater than or equal to about 10 percent by weight, greater than or equal to about 20 percent by weight or greater than or equal to about 30 percent by weight.

[0037] Preferably, the nicotine formulation has a water-miscible polyhydric alcohol content of greater than or equal to about 40 percent by weight. More preferably, the nicotine formulation has a water-miscible polyhydric alcohol content of greater than or equal to about 50 percent by weight. Most preferably, the nicotine formulation has a water-miscible polyhydric alcohol content of greater than or equal to about 60 percent by weight. For example, the nicotine formulation may have a water-miscible polyhydric alcohol content of greater than or equal to about 70 percent by weight, greater than or equal to about 80 percent by weight or greater than or equal to about 90 percent by weight.

[0038] Preferably, the nicotine formulation has a water-miscible polyhydric alcohol content of less than or equal to about 95 percent by weight.

[0039] The nicotine formulation may have a water-miscible polyhydric alcohol content of between about 5 percent by weight and about 95 percent by weight. For example, the nicotine formulation may have a water-miscible polyhydric alcohol content of between about 10 percent by weight and about 95 percent by weight, between about 20 percent by weight and about 95 percent by weight or between about 30 percent by weight and about 95 percent by weight.

[0040] Preferably, the nicotine formulation has a water-miscible polyhydric alcohol content of between about 40 percent by weight and about 95 percent by weight. More preferably, the nicotine formulation has a water-miscible polyhydric alcohol content of between about 50 percent by weight and about 95 percent by weight. Most preferably, the nicotine formulation has a water-miscible polyhydric alcohol content of between about 60 percent by weight and about 95 percent by weight. For example, the nicotine formulation may have a water-miscible polyhydric alcohol content of between about 70 percent by weight and about 95 percent by weight, between about 80 percent by weight and about 95 percent by weight or between about 90 percent by weight and about 95 percent by weight.

[0041] Preferably, the nicotine formulation comprises one or more water-miscible polyhydric alcohols selected from the group consisting of 1,3-butanediol, glycerine, propylene glycol, and triethylene glycol.

[0042] More preferably, the nicotine formulation comprises glycerine.

[0043] Most preferably, the nicotine formulation comprises vegetable glycerine.

[0044] Preferably, the nicotine formulation has a glycerine content of greater than or equal to about 5 percent by weight.

[0045] According to a preferred embodiment of the invention there is provided a nicotine formulation for use in an aerosol-generating system, the nicotine formulation comprising: glycerine; and one or more metal salts, wherein the nicotine formulation has a metal salt content of greater than or equal to about 0.5 percent by weight.

[0046] According to a preferred embodiment of the invention there is also provided an aerosol-generating article for use in an aerosol-generating system, the aerosol-generating article containing a nicotine formulation comprising: glycerine; and one or more metal salts, wherein the nicotine formulation has a metal salt content of greater than or equal to about 0.5 percent by weight.

[0047] According to a preferred embodiment of the invention there is further provided an aerosol-generating system comprising: a nicotine formulation comprising: glycerine; and one or more metal salts, wherein the nicotine formulation has a metal salt content of greater than or equal to about 0.5 percent by weight; and an atomiser configured to generate an aerosol from the nicotine formulation.

[0048] The nicotine formulation may have a glycerine content of greater than or equal to about 10 percent by weight, greater than or equal to about 20 percent by weight or greater than or equal to about 30 percent by weight.

[0049] Preferably, the nicotine formulation has a glycerine content of greater than or equal to about 40 percent by weight. More preferably, the nicotine formulation has a glycerine content of greater than or equal to about 50 percent by weight. Most preferably, the nicotine formulation has a glycerine content of greater than or equal to about 60 percent by weight. For example, the nicotine formulation may have a glycerine content of greater than or equal to about 70 percent by weight, greater than or equal to about 80 percent by weight or greater than or equal to about 90 percent by weight.

[0050] Preferably, the nicotine formulation has a glycerine content of less than or equal to about 95 percent by weight.

[0051] The nicotine formulation may have a glycerine content of between about 5 percent by weight and about 95 percent by weight. For example, the nicotine formulation may have a glycerine content of between about 10 percent by weight and about 95 percent by weight, between about 20 percent by weight and about 95 percent by weight or between about 30 percent by weight and about 95 percent by weight.

[0052] Preferably, the nicotine formulation has a glycerine content of between about 40 percent by weight and about 95 percent by weight. More preferably, the nicotine formulation has a glycerine content of between about 50 percent by weight and about 95 percent by weight. Most preferably, the nicotine formulation has a glycerine content of between about 60 percent by weight and about 95 percent by weight. For example, the nicotine formulation may have a glycerine content of between about 70 percent by weight and about 95 percent by weight, between about 80 percent by weight and about 95 percent by weight or between about 90 percent by weight and about 95 percent by weight.

[0053] The nicotine formulation may comprise glycerine and propylene glycol.

[0054] In embodiments in which the nicotine formulation comprises glycerine and propylene glycol, preferably the ratio of the weight percent glycerine content to the weight percent propylene glycol content of the nicotine formulation is greater than or equal to about 1. More preferably, the ratio of the weight percent glycerine content to the weight percent propylene glycol content of the nicotine formulation is greater than or equal to about 1.5. For example, the ratio of the weight percent glycerine content to the weight percent propylene glycol content of the nicotine formulation may be greater than or equal to about 2, greater than or equal to about 2.5 or greater than or equal to about 3.

[0055] The nicotine formulation may have a metal salt content of greater than or equal to about 0.75 percent by weight or greater than or equal to about 1 percent by weight.

[0056] Preferably, the nicotine formulation has a metal salt content of less than or equal to about 15 percent by weight. More preferably, the nicotine formulation has a metal salt content of less than or equal to about 12 percent by weight. For example, the nicotine formulation may have a metal salt content of less than or equal to about 10 percent by weight.

[0057] Preferably, the nicotine formulation has a metal salt content of between about 0.5 percent by weight and about 15 percent by weight. For example, the nicotine formulation may have a metal salt content of between about 0.5 percent by weight and about 12 percent by weight or between about 0.5 percent by weight and about 10 percent by weight.

[0058] The nicotine formulation may have a metal salt content of between about 0.75 percent by weight and about 15 percent by weight. For example, the nicotine formulation may have a metal salt content of between about 0.75 percent by weight and about 12 percent by weight or between about 0.75 percent by weight and about 10 percent by weight.

[0059] The nicotine formulation may have a metal salt content of between about 1 percent by weight and about 15 percent by weight. For example, the nicotine formulation may have a metal salt content of between about 1 percent by weight and about 12 percent by weight or between about 1 percent by weight and about 10 percent by weight.

[0060] The one or more metal salts may have a molar mass of less than or equal to about 500 g/mol or less than or equal to about 400 g/mol.

[0061] Preferably, the one or more metal salts are selected from the group consisting of metal cinnamates, metal cycloheptanecarboxylates, metal levulinates, metal propanoates, metal stearates and metal undecanoates.

[0062] Preferably the one or more metal salts are selected from the group consisting of metal cinnamates, metal cycloheptanecarboxylates, metal stearates and metal undecanoates.

[0063] According to a preferred embodiment of the invention there is also provided an aerosol-generating article for use in an aerosol-generating system, the aerosol-generating article containing a nicotine formulation comprising: one or more water-miscible polyhydric alcohols; and one or more metal salts selected from the group consisting of metal benzoates metal cinnamates, metal cycloheptanecarboxylates, metal levulinates, metal propanoates, metal stearates and metal undecanoates, wherein the nicotine formulation has a metal salt content of greater than or equal to about 0.5 percent by weight.

[0064] According to a preferred embodiment of the invention there is further provided an aerosol-generating system comprising: a nicotine formulation comprising: one or more water-miscible polyhydric alcohols; and one or more metal salts selected from the group consisting of metal benzoates, metal cinnamates, metal cycloheptanecarboxylates, metal levulinates, metal propanoates, metal stearates and metal undecanoates, wherein the nicotine formulation has a metal salt content of greater than or equal to about 0.5 percent by weight; and an atomiser configured to generate an aerosol from the nicotine formulation.

[0065] More preferably, the one or more metal salts are selected from the group consisting of metal stearates.

[0066] According to a preferred embodiment of the invention there is provided a nicotine formulation for use in an aerosol-generating system, the nicotine formulation comprising: one or more water-miscible polyhydric alcohols; and one or more metal salts selected from the group consisting of metal stearates, wherein the nicotine formulation has a metal salt content of greater than or equal to about 0.5 percent by weight.

[0067] According to a preferred embodiment of the invention there is also provided an aerosol-generating article for use in an aerosol-generating system, the aerosol-generating article containing a nicotine formulation comprising: one or more water-miscible polyhydric alcohols; and one or more metal salts selected from the group consisting of metal stearates, wherein the nicotine formulation has a metal salt content of greater than or equal to about 0.5 percent by weight.

[0068] According to a preferred embodiment of the invention there is further provided an aerosol-generating system comprising: a nicotine formulation comprising: one or more water-miscible polyhydric alcohols; and one or more metal salts selected from the group consisting of metal stearates, wherein the nicotine formulation has a metal salt content of greater than or equal to about 0.5 percent by weight; and an atomiser configured to generate an aerosol from the nicotine

formulation.

[0069] Particularly preferably, the nicotine formulation comprises one or more metal stearates.

[0070] Advantageously, covalent bonding between the one or more metal stearates and the one or more water-miscible polyhydric alcohols in the nicotine formulation may further elevate the boiling point of the one or more water-miscible polyhydric alcohols. When the formulation includes nicotine, this may advantageously enhance the efficiency of vaporization of nicotine from the nicotine formulation when used in an aerosol-generating system as compared to a typical liquid nicotine formulation that does not include one or more metal stearates.

[0071] Preferably, the nicotine formulation comprises glycerine and one or more metal salts selected from the group consisting of metal stearates

[0072] Particularly preferably, the nicotine formulation comprises glycerine and one or more metal stearates.

[0073] Covalent bonding between the one or more metal stearates and the glycerine in the nicotine formulation may elevate the boiling point of the glycerine. This may advantageously enhance vaporization of nicotine from the nicotine formulation when used in an aerosol-generating system.

[0074] Covalent bonding between the one or more metal stearates and the glycerine in the nicotine formulation may increase the viscosity of the nicotine formulation. This may advantageously reduce the risk of leakage of the nicotine formulation when used in an aerosol-generating system.

[0075] The nicotine formulation may comprise one or more salts of any suitable metal.

[0076] Preferably, the one or more metal salts are one or more alkali metal salts.

[0077] More preferably, the one or more metal salts are one or more sodium salts.

[0078] More preferably, the one or more metal salts are one or more sodium salts selected from the group consisting of sodium benzoate, sodium cinnamate, sodium cycloheptanecarboxylate, sodium levulinate, sodium propanoate, sodium stearate and sodium undecanoate.

[0079] According to a preferred embodiment of the invention there is provided a nicotine formulation for use in an aerosol-generating system, the nicotine formulation comprising: one or more water-miscible polyhydric alcohols; and sodium stearate, wherein the nicotine formulation has a sodium salt content of greater than or equal to about 0.5 percent by weight.

[0080] According to a preferred embodiment of the invention there is also provided an aerosol-generating article for use in an aerosol-generating system, the aerosol-generating article containing a nicotine formulation comprising: one or more water-miscible polyhydric alcohols; and sodium stearate, wherein the nicotine formulation has a sodium salt content of greater than or equal to about 0.5 percent by weight.

[0081] According to a preferred embodiment of the invention there is further provided an aerosol-generating system comprising: a nicotine formulation comprising: one or more water-miscible polyhydric alcohols; sodium stearate, wherein the nicotine formulation has a sodium salt content of greater than or equal to about 0.5 percent by weight; and an atomiser configured to generate an aerosol from the nicotine formulation.

[0082] Particularly preferably, the nicotine formulation comprises sodium stearate.

[0083] A metal salt with a high weighted average molecular weight may improve the above mentioned advantages related to efficiency of vaporization of nicotine. However, if the weighted average molecular weight of a metal salt is too high then properties such as solubility begin to be negatively affected. Advantageously, including sodium stearate in the formulation may provide an optimal trade-off in improved efficiency of vaporization of nicotine, whilst maintaining solubility.

[0084] In embodiments in which the nicotine formulation comprises sodium stearate, preferably the nicotine formulation has a sodium stearate content of greater than or equal to about 0.25 percent by weight. More preferably, the nicotine formulation has a sodium stearate content of greater than or equal to about 0.5 percent by weight.

[0085] According to a preferred embodiment of the invention there is provided a nicotine formulation for use in an aerosol-generating system, the nicotine formulation comprising: one or more water-miscible polyhydric alcohols; and sodium stearate, wherein the nicotine formulation has a sodium stearate content of greater than or equal to about 0.5 percent by weight.

[0086] According to a preferred embodiment of the invention there is also provided an aerosol-generating article for use in an aerosol-generating system, the aerosol-generating article containing a nicotine formulation comprising: one or more water-miscible polyhydric alcohols; and sodium stearate, wherein the nicotine formulation has a sodium stearate content of greater than or equal to about 0.5 percent by weight.

[0087] According to a preferred embodiment of the invention there is further provided an aerosol-generating system comprising: a nicotine formulation comprising: one or more water-miscible polyhydric alcohols; and sodium stearate, wherein the nicotine formulation has a sodium stearate content of greater than or equal to about 0.5 percent by weight; and an atomiser configured to generate an aerosol from the nicotine formulation.

[0088] For example, the nicotine formulation may have a sodium stearate content of greater than or equal to about 0.75 percent by weight or greater than or equal to about 1 percent by weight.

[0089] Preferably, the nicotine formulation has a sodium stearate content of less than or equal to about 15 percent by weight. More preferably, the nicotine formulation has a sodium stearate content of less than or equal to about 12 percent

by weight. For example, the nicotine formulation may have a sodium stearate content of less than or equal to about 10 percent by weight.

[0090] Preferably, the nicotine formulation has a sodium stearate content of between about 0.25 percent by weight and about 15 percent by weight. For example, the nicotine formulation may have a sodium stearate content of between about 0.25 percent by weight and about 12 percent by weight or between about 0.25 percent by weight and about 10 percent by weight.

[0091] More preferably, the nicotine formulation has a sodium stearate content of between about 0.5 percent by weight and about 15 percent by weight. For example, the nicotine formulation may have a sodium stearate content of between about 0.5 percent by weight and about 12 percent by weight or between about 0.5 percent by weight and about 10 percent by weight.

[0092] The nicotine formulation may have a sodium stearate content of between about 0.75 percent by weight and about 15 percent by weight. For example, the nicotine formulation may have a sodium stearate content of between about 0.75 percent by weight and about 12 percent by weight or between about 0.75 percent by weight and about 10 percent by weight.

[0093] The nicotine formulation may have a sodium stearate content of between about 1 percent by weight and about 15 percent by weight. For example, the nicotine formulation may have a sodium stearate content of between about 1 percent by weight and about 12 percent by weight or between about 1 percent by weight and about 10 percent by weight.

[0094] Particularly preferably, the nicotine formulation comprises glycerine and sodium stearate.

[0095] Covalent bonding between the sodium stearate and the glycerine in the nicotine formulation may elevate the boiling point of the glycerine. This may advantageously enhance vaporization of nicotine from the nicotine formulation when used in an aerosol-generating system.

[0096] Covalent bonding between the sodium stearate and the glycerine in the nicotine formulation may increase the viscosity of the nicotine formulation. This may advantageously reduce the risk of leakage of the nicotine formulation when used in an aerosol-generating system.

[0097] According to a particularly preferred embodiment of the invention there is provided a nicotine formulation for use in an aerosol-generating system, the nicotine formulation comprising: glycerine; and sodium stearate, wherein the nicotine formulation has a sodium stearate content of greater than or equal to about 0.5 percent by weight.

[0098] According to a particularly preferred embodiment of the invention there is also provided an aerosol-generating article for use in an aerosol-generating system, the aerosol-generating article containing a nicotine formulation comprising: glycerine; and sodium stearate, wherein the nicotine formulation has a sodium stearate content of greater than or equal to about 0.5 percent by weight.

[0099] According to a preferred embodiment of the invention there is further provided an aerosol-generating system comprising: a nicotine formulation comprising: glycerine; and sodium stearate, wherein the nicotine formulation has a sodium stearate content of greater than or equal to about 0.5 percent by weight; and an atomiser configured to generate an aerosol from the nicotine formulation.

[0100] The nicotine formulation may comprise water.

[0101] The nicotine formulation may have a water content of less than or equal to about 20 percent by weight or less than or equal to about 15 percent by weight.

[0102] Preferably, the nicotine formulation has a water content of less than or equal to about 10 percent by weight. For example, the nicotine formulation may a water content of less than or equal to about 8 percent by weight or less than or equal to about 6 percent by weight.

[0103] In embodiments in which the nicotine formulation comprises water, the nicotine formulation may have a water content of greater than or equal to about 1 percent by weight. For example, the nicotine formulation may have a water content of greater than or equal to about 2 percent by weight or greater than or equal to about 3 percent by weight.

[0104] The nicotine formulation may have a water content of between about 1 percent by weight and about 20 percent by weight. For example, the nicotine formulation may have a water content of between about 2 percent by weight and about 20 percent by weight or between about 3 percent by weight and about 20 percent by weight.

[0105] The nicotine formulation may have a water content of between about 1 percent by weight and about 15 percent by weight. For example, the nicotine formulation may have a water content of between about 2 percent by weight and about 15 percent by weight or between about 3 percent by weight and about 15 percent by weight.

[0106] In embodiments in which the nicotine formulation comprises water, preferably the nicotine formulation has a water content of between about 1 percent by weight and about 10 percent by weight. For example, the nicotine formulation may have a water content of between about 2 percent by weight and about 10 percent by weight or between about 3 percent by weight and about 10 percent by weight.

[0107] The nicotine formulation may have a water content of between about 1 percent by weight and about 8 percent by weight. For example, the nicotine formulation may have a water content of between about 2 percent by weight and about 8 percent by weight or between about 3 percent by weight and about 8 percent by weight.

[0108] The nicotine formulation may have a water content of between about 1 percent by weight and about 6 percent

by weight. For example, the nicotine formulation may have a water content of between about 2 percent by weight and about 6 percent by weight or between about 3 percent by weight and about 6 percent by weight.

[0109] In some embodiments the one or more organic acids may be water-soluble organic acids. As used herein with reference to the invention, the term "water-soluble organic acid" describes an organic acid having a water solubility at 20°C of greater than or equal to about 100 mg/ml, preferably greater than or equal to about 500 mg/ml, more preferably greater than or equal to about 750mg/ml most preferably greater than or equal to about 1000mg/ml.

[0110] Unless stated otherwise, water solubility values recited herein are the water solubility measured based on the preliminary test of OECD (1995), *Test No. 105: Water Solubility,* OECD Guidelines for the Testing of Chemicals, Section 1, OECD Publishing, Paris, https://doi.org/10.1787/9789264069589-en. In a stepwise procedure, increasing volumes of distilled water are added at 20°C to 0.1 g of the sample (solid substances must be pulverized) in a 10 ml glass-stoppered measuring cylinder. However, when the substance is an acid, the sample is added to the distilled water in the first step. After each addition of an amount of water, the mixture is shaken for 10 minutes and is visually checked for any undissolved parts of the sample. If, after addition of 10 ml of water, the sample or parts of it remain undissolved, the experiment is continued in a 100 ml measuring cylinder. The approximate solubility is given in Table 1 below under that volume of water in which complete dissolution of the sample occurs.

[0111] When the solubility is low, a long time may be required to dissolve a substance and at least 24 hours should be allowed. If, after 24 hours, the substance is still not dissolved, the measuring cylinder is placed for at 40°C in an ultrasound bath for 15 minutes and another 24 hours allowed (up to a maximum of 96 hours). If the substance is still not dissolved, the solubility is considered to be below the limit value or not soluble.

Table 1

ml of water in which 0.1 g of sample is soluble	0.1	0.5	1	2	10	100	>100
Approximate solubility (mg/ml)	>1000	1000 to 200	200 to 100	100 to 50	50 to 10	10 to 1	<1

[0112] According to the invention, the nicotine formulation comprises one or more organic acids, in a content of between about 0.5 percent and about 4 percent by weight. The nicotine formulation may comprise one or more carboxylic acids

[0113] Suitable carboxylic acids include, but are not limited to, acetic acid, citric acid, lactic acid, malic acid, malonic acid and pyruvic acid.

[0114] In embodiments in which the nicotine formulation comprises one or more organic acids, the nicotine formulation may have an organic acid content of greater than or equal to about 0.5 percent by weight or greater than or equal to about 1 percent by weight.

[0115] For example, the nicotine formulation may an organic acid content of less than or equal to about 2 percent by weight.

[0116] For example, the nicotine formulation may have an organic acid content of between about 1 percent by weight and about 4 percent by weight or between about 1 percent by weight and about 2 percent by weight.

[0117] The nicotine formulation may comprise one or more flavourants. Suitable flavourants include, but are not limited to, menthol.

[0118] Preferably, the nicotine formulation has a flavourant content of less than or equal to about 4 percent by weight. More preferably, the nicotine formulation has a flavourant content of less than or equal to about 3 percent by weight.

[0119] According to the invention there is also provided an aerosol-generating article for use in an aerosol-generating system, the aerosol-generating article containing a nicotine formulation according to the invention.

[0120] The aerosol-generating article may comprise an atomiser configured to generate an aerosol from the nicotine formulation.

[0121] The aerosol-generating article may be a cartridge.

[0122] A cartridge containing the nicotine formulation and an atomiser may be referred to as a "cartomiser".

[0123] The atomiser may be a thermal atomiser.

[0124] As used herein with reference to the invention, the term "thermal atomiser" describes an atomiser that is configured to heat the nicotine formulation to generate an aerosol.

[0125] The aerosol-generating article may comprise any suitable type of thermal atomiser.

[0126] The thermal atomiser may comprise an electric heater. For example, the thermal atomiser may comprise an electric heater comprising a resistive heating element or an inductive heating element.

[0127] The heating element may be a grid or mesh element or layer. In such embodiments, the nicotine formulation may flow into the interstitial spaces forming the grid or mesh element.

[0128] The atomiser may be a non-thermal atomiser.

[0129] As used herein with reference to the invention, the term "non-thermal atomiser" describes an atomiser that is

configured to generate an aerosol from the nicotine formulation by means other than heating.

[0130] The aerosol-generating article may comprise any suitable type of non-thermal atomiser.

[0131] For example, the non-thermal atomiser may be an impinging jet atomiser, an ultrasonic atomiser or a vibrating mesh atomiser.

[0132] According to the invention there is further provided an aerosol-generating system comprising a nicotine formulation according to the invention and an atomiser configured to generate an aerosol from the nicotine formulation.

[0133] The atomiser may be a thermal atomiser.

[0134] The aerosol-generating system may comprise any suitable type of thermal atomiser.

[0135] The thermal atomiser may comprise an electric heater. For example, the thermal atomiser may comprise an electric heater comprising a resistive heating element or an inductive heating element.

[0136] The heating element may be a grid or mesh element or layer. In such embodiments, the nicotine formulation may flow into the interstitial spaces forming the grid or mesh element.

[0137] The atomiser may be a non-thermal atomiser.

[0138] The aerosol-generating system may comprise any suitable type of non-thermal atomiser.

[0139] For example, the non-thermal atomiser may be an impinging jet atomiser, an ultrasonic atomiser or a vibrating mesh atomiser.

[0140] The aerosol-generating system may comprise an aerosol-generating article according to the invention containing the nicotine formulation and an aerosol-generating device comprising a housing defining a device cavity configured to receive at least a portion of the aerosol-generating article.

[0141] The aerosol-generating system may comprise a consumable aerosol-generating article according to the invention containing the nicotine formulation and a reusable aerosol-generating device comprising a housing defining a device cavity configured to receive at least a portion of the aerosol-generating article.

[0142] The aerosol-generating device may comprise a battery and control electronics.

[0143] The aerosol-generating system may comprise: an aerosol-generating article according to the invention containing the nicotine formulation and the atomiser; and an aerosol-generating device comprising a housing defining a device cavity configured to receive at least a portion of the aerosol-generating article.

[0144] The aerosol-generating system may comprise: an aerosol-generating article according to the invention containing the nicotine formulation; and an aerosol-generating device comprising a housing defining a device cavity configured to receive at least a portion of the aerosol-generating article and the atomiser.

[0145] For the avoidance of doubt, features described above in relation to one aspect of the invention may also be applicable to other aspects of the invention. In particular, features described above in relation to the nicotine formulation of the invention may also relate, where appropriate, to the aerosol-generating article of the invention and the aerosol-generating system. Similarly, features described above in relation to the aerosol-generating article of the invention may also relate, where appropriate, to the aerosol-generating system of the invention, and *vice versa.*

[0146] Embodiments of the invention will now be described, by way of example only, with reference to the following examples and accompanying drawings, in which:

FIG. 1 is a schematic cross-sectional side view of an aerosol-generating system comprising an aerosol-generating device and an aerosol-generating article comprising a nicotine formulation according to the invention;

FIG. 2 is a schematic sectional view of a spring-loaded aerosol-generating article comprising a nicotine formulation according to the invention; and

FIG. 3 is a schematic sectional view of a "lip-stick" advance mechanism aerosol-generating article comprising a nicotine formulation according to the invention.

FIG. 1 shows an aerosol-generating system 400 comprising an aerosol-generating device 600 and an aerosol-generating article 500.

[0147] The aerosol-generating device 600 shown in FIG. 1 is configured for receiving the aerosol-generating article 500. The aerosol-generating device 600 comprises a housing 601 and a receptacle 610 formed in the housing 601. The receptacle 610 is constructed for receiving the aerosol-generating article 500. The receptacle 610 may be sized and shaped so that when the aerosol-generating article 500 is inserted in the receptacle 610, at least a portion of the aerosol-generating article 500 remains outside of the receptacle 610.

[0148] The aerosol-generating device 600 comprises a heating element 622 at the closed end of the receptacle 610. The heating element 622 comprises a mesh layer.

[0149] The aerosol-generating device 600 may include a power supply 651 operably connected to a controller 653 and optional graphical user interface 652. The power supply 651 operably connected to a controller 653 may be disposed within the housing 601. The graphical user interface 652 may be disposed on the housing 601.

[0150] The aerosol-generating article 500 includes a body 512 defining a cavity 512 having a cavity opening 515. An aerosol-forming substrate 511 is disposed in the cavity 510. The body 512 includes a closed end portion 551 that may

be a ring or rotation portion or a fixed support.

[0151] Alternatively, the aerosol-generating article 500 may include an advancement mechanism may be arranged in the proximal end of the aerosol-generating article 500. The advancement mechanism may be configured as a piston-type element. The advancement mechanism may be configured as a screw-type element. The advancement mechanism may translate rotational movement into lateral movement.

[0152] The cavity opening of the aerosol-generating article 500 abuts the heating element 622 when the aerosol-generating article 500 is received into the receptacle 610 of the aerosol-generating device 600. The heating element 622 is disposed proximate to the cavity opening 515. The aerosol-forming substrate 511 of the aerosol-generating article 500 is a nicotine formulation according to the invention that may flow into and through the mesh layer of the heating element 622.

[0153] Air may flow into the receptacle 610 aerosol-generating device 600 and entrain the volatized aerosol components from the heated aerosol-forming substrate 511 and through the aerosol-generating device 600 via an air channel 650 and to the consumer.

[0154] FIG. 2 is a schematic sectional view of a spring-loaded aerosol-generating article 500. The aerosol-generating article 500 includes a body 512 defining a cavity 510 having a cavity opening 515. The aerosol-forming substrate 511 is disposed in the cavity 512. The heating element 622 is disposed proximate to the cavity opening 515. The body 512 includes a closed end portion 551 that may be a fixed support. A spring element 517 biases a movable rigid base 513 to the spring support 551 fixed to the body 512. The aerosol-forming substrate 511 is a nicotine formulation according to the invention.

[0155] FIG. 3 is a schematic sectional view of a "lip-stick" advance mechanism aerosol-generating article 500. The aerosol-generating article 500 includes a body 512 defining a cavity 510 having a cavity opening 515. The aerosol-forming substrate 511 is disposed in the cavity 512. The heating element 622 is disposed proximate to the cavity opening 515. The body 512 includes a ring or rotation element 551 that is coupled to the movable rigid base 513 and translates rotational movement into lateral movement via a spiral or helical groove 514. Pins (not shown) couple the rigid base 513 to the spiral or helical groove 514 to provide the lateral movement of the aerosol-forming substrate 511. The aerosol-forming substrate 511 is a nicotine formulation according to the invention.

[0156] In alternative embodiments (not shown), the aerosol-generating system may comprise an automatic mechanism to move or advance the aerosol-forming substrate 511 toward the heating element 622. In such alternative embodiments, the controller 653 of the aerosol-generating device 600 may activate an actuator or advancement mechanism on either the aerosol-generating article 500 or the aerosol- generating device 600 to advance the aerosol-forming substrate 511 and rigid base 513 toward the heating element 622 upon detecting that the heating element 622 is not in contact the aerosol-forming substrate 511.

Examples

[0157] Three liquid nicotine formulations, not according to the invention (Examples A, B and C) were prepared having the compositions and viscosities shown in Table 2.

Table 2

Example		A	B	C
Nicotine (% by weight)		2	2	2
Water (% by weight)		6	6	6
Vegetable Glycerine (% by weight)	polyhydric alcohol	91	68	91.5
Propylene Glycol (% by weight)	polyhydric alcohol	0	23	0
Sodium Stearate (% by weight)	metal salt	1	1	0.5
Viscosity (Pa s)		3366	225	185

[0158] Three solid nicotine formulations (Examples D, E and F) were prepared having the compositions shown in Table 3. Example D is according to the invention.

Table 3

Example		D	E	F
Nicotine (% by weight)		2	2	2

(continued)

Example		D	E	F
Water (% by weight)		4	5	0
Vegetable Glycerine (% by weight)	polyhydric alcohol	85	68	88
Propylene Glycol (% by weight)	polyhydric alcohol	0	15	0
Sodium Stearate (% by weight)	metal salt	8	10	5
Sodium Alginate (% by weight)	metal salt	0	0	5
Lactic Acid	organic acid	1	0	0

[0159] Each of the nicotine compositions was prepared by:

(1) heating the one or more polyhydric alcohols to a temperature of between about 100°C and about 120°C using a hotplate stirrer;
(2) adding a fine powder of the one or more metal salts to the one or more polyhydric alcohols, while stirring constantly, and then continuing to heat the mixture to a temperature of between about 85°C and about 95°C until the mixture was clear;
(3) adding water to the clear mixture;
(4) decreasing the heating temperature of the mixture to about 50°C and adding nicotine to the mixture, while stirring constantly; and
(5) pouring the heated mixture into a mold and then allowing the mixture to cool and congeal to form the nicotine composition.

[0160] As shown in Table 2, inclusion of less than or equal to about 1 percent by weight of metal salt (sodium stearate) results in liquid nicotine formulations having a viscosity at 25°C of greater than or equal to about 185 Pa s.
[0161] As shown in Table 3, inclusion of greater than or equal to about 8 percent by weight of metal salt (sodium stearate and sodium alginate) results in solid nicotine formulations.

Claims

1. A nicotine formulation for use in an aerosol-generating system, the nicotine formulation comprising:

one or more water-miscible polyhydric alcohols;
one or more metal salts, and
one or more organic acids,
wherein the nicotine formulation has a metal salt content of greater than or equal to about 0.5 percent by weight, and
wherein the one or more metal salts are selected from the group consisting of metal benzoates, metal cinnamates, metal cycloheptanecarboxylates, metal levulinates, metal propanoates, metal stearates and metal undecanoates,
wherein the nicotine formulation has an organic acid content of between about 0.5 percent and about 4 percent by weight.

2. A nicotine formulation according to claim 1 having a metal salt content of less than or equal to about 15 percent by weight.

3. A nicotine formulation according to claim 1 or 2 wherein the one or more metal salts are selected from the group consisting of metal cinnamates, metal cycloheptanecarboxylates, metal levulinates, metal propanoates, metal stearates and metal undecanoates, preferably wherein the one or more metal salts are selected from the group consisting of metal cinnamates, metal cycloheptanecarboxylates, metal stearates and metal undecanoates.

4. A nicotine formulation according to any one of claims 1 to 3 wherein the one or more metal salts comprise sodium stearate.

5. A nicotine formulation according to any one of claims 1 to 4 comprising sodium stearate, wherein the nicotine formulation has a sodium stearate content of greater than or equal to about 0.25 percent by weight.

6. A nicotine formulation according to any one of claims 1 to 5 having a water-miscible polyhydric alcohol content of at least about 40 percent by weight.

7. A nicotine formulation according to any one of claims 1 to 6 wherein the one or more water-miscible polyhydric alcohols comprise glycerine.

8. A nicotine formulation according to claim 7 wherein the one or more water-miscible polyhydric alcohols comprise glycerine and propylene glycol.

9. A nicotine formulation according to claim 8 wherein the ratio of the weight percent glycerine content to the weight percent propylene glycol content of the nicotine formulation is greater than or equal to about 1.

10. A nicotine formulation according to any one of claims 1 to 9 comprising water.

11. A nicotine formulation according to claim 10 having a water content of less than or equal to about 10 percent by weight.

12. A nicotine formulation according to any one of claims 1 to 11, wherein the nicotine formulation has a viscosity at 25°C of greater than or equal to about 10 Pa·s.

13. An aerosol-generating article for use in an aerosol-generating system, the aerosol-generating article containing a nicotine formulation according to any one of claims 1-12.

14. An aerosol-generating system comprising:

a nicotine formulation according to any one of claims 1 to 12; and
an atomiser configured to generate an aerosol from the nicotine formulation.

Patentansprüche

1. Nikotinformulierung zum Gebrauch in einem Aerosolerzeugungssystem, wobei die Nikotinformulierung umfasst:

einen oder mehrere mit Wasser mischbare mehrwertige Alkohole;
ein oder mehrere Metallsalze, und
eine oder mehrere organische Säuren,
wobei die Nikotinformulierung einen Metallsalzgehalt von mehr als oder gleich etwa 0,5 Gewichtsprozent aufweist, und
wobei das eine oder die mehreren Metallsalze ausgewählt sind aus der Gruppe bestehend aus Metallbenzoaten, Metallcinnamaten, Metallcycloheptancarboxylaten, Metalllevulinaten, Metallpropanoaten, Metallstearaten und Metallundecanoaten,
wobei die Nikotinformulierung einen Gehalt an organischer Säure von etwa 0,5 Gewichtsprozent bis etwa 4 Gewichtsprozent aufweist.

2. Nikotinformulierung nach Anspruch 1, aufweisend einen Metallsalzgehalt von weniger als oder gleich etwa 15 Gewichtsprozent.

3. Nikotinformulierung nach Anspruch 1 oder 2, wobei das eine oder die mehreren Metallsalze ausgewählt sind aus der Gruppe bestehend aus Metallcinnamaten, Metallcycloheptancarboxylaten, Metalllevulinaten, Metallpropanoaten, Metallstearaten und Metallundecanoaten, bevorzugt wobei das eine oder die mehreren Metallsalze ausgewählt sind aus der Gruppe bestehend aus Metallcinnamaten, Metallcycloheptancarboxylaten, Metallstearaten und Metallundecanoaten.

4. Nikotinformulierung nach einem der Ansprüche 1 bis 3, wobei das eine oder die mehreren Metallsalze Natriumstearat aufweisen.

5. Nikotinformulierung nach einem der Ansprüche 1 bis 4, umfassend Natriumstearat, wobei die Nikotinformulierung einen Natriumstearatgehalt von mehr als oder gleich etwa 0,25 Gewichtsprozent aufweist.

6. Nikotinformulierung nach einem der Ansprüche 1 bis 5, aufweisend einen Gehalt an mit Wasser mischbarem mehrwertigem Alkohol von wenigstens etwa 40 Gewichtsprozent.

7. Nikotinformulierung nach einem der Ansprüche 1 bis 6, wobei der eine oder die mehreren mit Wasser mischbaren mehrwertigen Alkohole Glycerin aufweisen.

8. Nikotinformulierung nach Anspruch 7, wobei der eine oder die mehreren mit Wasser mischbaren mehrwertigen Alkohole Glycerin und Propylenglykol aufweisen.

9. Nikotinformulierung nach Anspruch 8, wobei das Verhältnis des gewichtsprozentualen Glyceringehalts zum gewichtsprozentualen Propylenglykolgehalt der Nikotinformulierung größer als oder gleich etwa 1 ist.

10. Nikotinformulierung nach einem der Ansprüche 1 bis 9, umfassend Wasser.

11. Nikotinformulierung nach Anspruch 10, aufweisend einen Wassergehalt von weniger als oder gleich etwa 10 Gewichtsprozent.

12. Nikotinformulierung nach einem der Ansprüche 1 bis 11, wobei die Nikotinformulierung bei 25 °C eine Viskosität von mehr als oder gleich etwa 10 Pa s aufweist.

13. Aerosolerzeugender Artikel zum Gebrauch in einem Aerosolerzeugungssystem, wobei der aerosolerzeugende Artikel eine Nikotinformulierung nach einem der Ansprüche 1 bis 12 enthält.

14. Aerosolerzeugungssystem, umfassend:

    Nikotinformulierung nach einem der Ansprüche 1 bis 12; und
    einen Zerstäuber, der für die Erzeugung eines Aerosols aus der Nikotinformulierung ausgelegt ist.

Revendications

1. Formulation de nicotine destinée à être utilisée dans un système de génération d'aérosol, la formulation de nicotine comprenant :

    un ou plusieurs alcools polyhydriques miscibles à l'eau ;
    un ou plusieurs sels métalliques, et
    un ou plusieurs acides organiques,
    dans laquelle la formulation de nicotine a une teneur en sel métallique supérieure ou égale à environ 0,5 pour cent en poids, et
    dans laquelle les un ou plusieurs sels métalliques sont choisis dans le groupe constitué par les benzoates métalliques, les cinnamates métalliques, les cycloheptanecarboxylates métalliques, les lévulinates métalliques, les propanoates métalliques, les stéarates métalliques et les undécanoates métalliques,
    dans laquelle la formulation de nicotine a une teneur en acide organique comprise entre environ 0,5 pour cent et environ 4 pour cent en poids.

2. Formulation de nicotine selon la revendication 1, ayant une teneur en sel métallique inférieure ou égale à environ 15 pour cent en poids.

3. Formulation de nicotine selon la revendication 1 ou 2, dans laquelle les un ou plusieurs sels métalliques sont choisis dans le groupe constitué par les cinnamates métalliques, des cycloheptanecarboxylates métalliques, des lévulinates métalliques, des propanoates métalliques, des stéarates métalliques et des undécanoates métalliques, de préférence dans laquelle les un ou plusieurs sels métalliques sont choisis dans le groupe constitué par des cinnamates métalliques, des cycloheptanecarboxylates métalliques, des stéarates métalliques et des undécanoates métalliques.

4. Formulation de nicotine selon l'une quelconque des revendications 1 à 3, dans laquelle les un ou plusieurs sels

métalliques comprennent du stéarate de sodium.

5. Formulation de nicotine selon l'une quelconque des revendications 1 à 4, comprenant du stéarate de sodium, dans laquelle la formulation de nicotine a une teneur en stéarate de sodium supérieure ou égale à environ 0,25 pour cent en poids.

6. Formulation de nicotine selon l'une quelconque des revendications 1 à 5, ayant une teneur en alcool polyhydrique miscible à l'eau d'au moins environ 40pour cent en poids.

7. Formulation de nicotine selon l'une quelconque des revendications 1 à 6, dans laquelle les un ou plusieurs alcools polyhydriques miscibles à l'eau comprennent la glycérine.

8. Formulation de nicotine selon la revendication 7, dans laquelle les un ou plusieurs alcools polyhydriques miscibles à l'eau comprennent la glycérine et le propylèneglycol.

9. Formulation de nicotine selon la revendication 8, dans laquelle le rapport du pourcentage en poids de la teneur en glycérine sur le pourcentage en poids de la teneur en propylèneglycol de la formulation de nicotine est supérieur ou égal à environ 1.

10. Formulation de nicotine selon l'une quelconque des revendications 1 à 9, comprenant de l'eau.

11. Formulation de nicotine selon la revendication 10, ayant une teneur en eau inférieure ou égale à environ 10 pour cent en poids.

12. Formulation de nicotine selon l'une quelconque des revendications 1 à 11, dans laquelle la formulation de nicotine a une viscosité à 25 °C supérieure ou égale à environ 10 Pa.s.

13. Article de génération d'aérosol destiné à être utilisé dans un système de génération d'aérosol, l'article de génération d'aérosol contenant une formulation de nicotine selon l'une quelconque des revendications 1 à 12.

14. Système de génération d'aérosol comprenant :

une formulation de nicotine selon l'une quelconque des revendications 1 à 12 ; et
un atomiseur configuré pour générer un aérosol à partir de la formulation de nicotine.

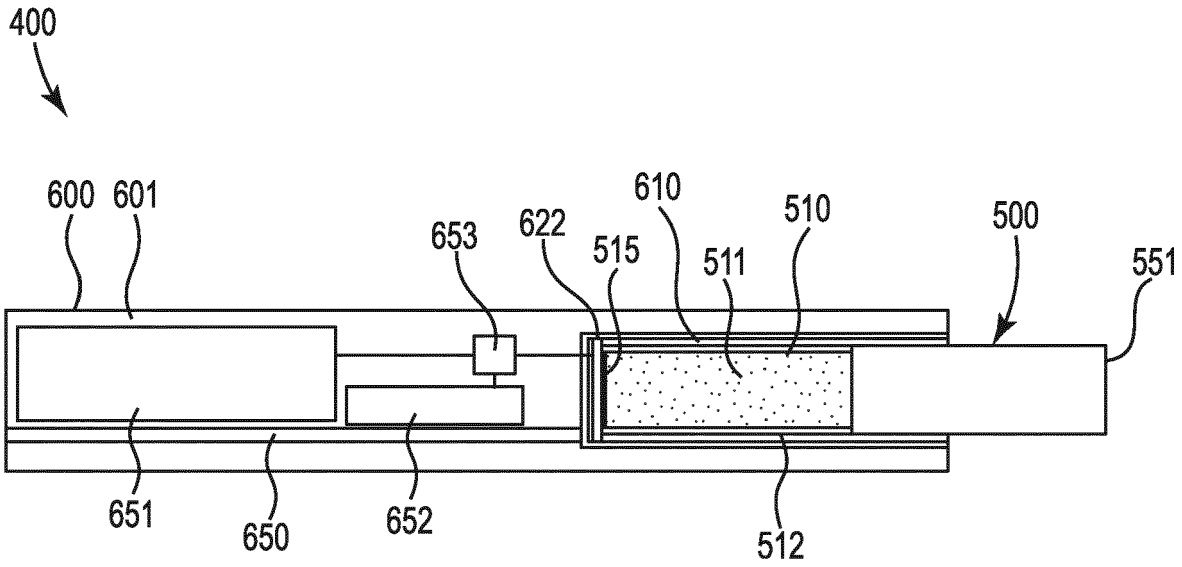

Fig. 1

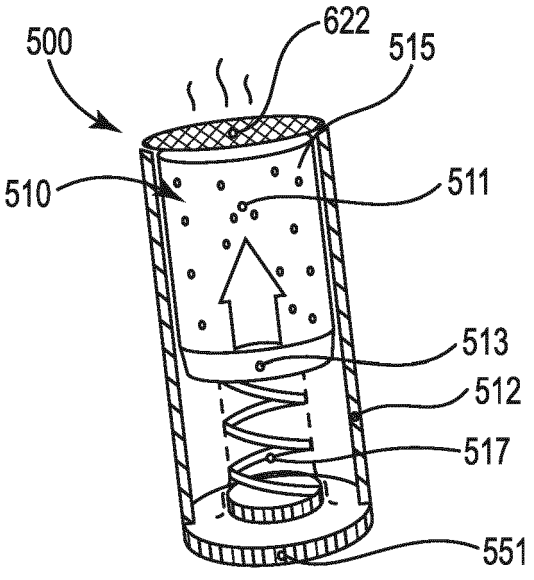

Fig. 2

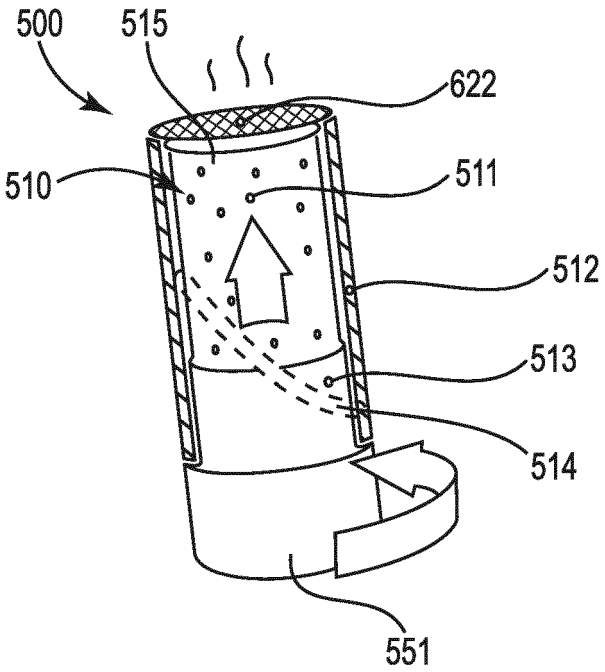

Fig. 3

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 2018199617 A1 **[0003]**