

(19)



(11)

EP 4 826 158 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
21.10.2026 Bulletin 2026/43

(21) Application number: **25305552.9**

(22) Date of filing: **15.04.2025**

(51) International Patent Classification (IPC):
D21H 17/02 ^(2006.01) **A24D 1/02** ^(2006.01)
D21H 17/14 ^(2006.01) **D21H 17/00** ^(2006.01)
D21H 27/00 ^(2006.01)

(52) Cooperative Patent Classification (CPC):
D21H 17/02; A24D 1/02; D21H 17/14; D21H 17/72;
D21H 27/00

(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 ME MK MT NL
NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
GE KH LA MA MD TN

(71) Applicant: **SWM Holdco Luxembourg**
5326 Contern (LU)

(72) Inventors:
• **DUROT, Nathalie**
L-5326 Contern (LU)
• **BRENNER, Oliver**
L-5326 Contern (LU)
• **DEJOIE, Stéphane**
L-5326 Contern (LU)

(74) Representative: **Plasseraud IP**
104 Rue de Richelieu
CS92104
75080 Paris Cedex 02 (FR)

(54) **PAPER SHEET WITH STABILIZED NICOTINE AND NON-VOLATILE ORGANIC ACID**

(57) The present invention relates to a paper sheet comprising a plant extract comprising a non-volatile or-

ganic acid, and nicotine stabilized thanks to the pH of the paper sheet.

EP 4 826 158 A1

Description**Technical Field**

[0001] The present disclosure belongs to the field of heat not burn product and concerns non tobacco nicotine aerosol generating substrate with plant extract comprising a non volatile organic acid.

Background Art

[0002] In recent years a large number of systems have been developed to provide nicotine to a user while avoiding the formation of harmful constituents generated by tobacco combustion. Such systems are, for example, e-cigarette and systems for heating tobacco substrate without burning it.

[0003] E-cigarettes generate a nicotine-containing aerosol by heating a solution of nicotine/nicotine salt and aerosol-generating agent contained in a cartridge of said e-cigarette. The solution may also comprise flavors. E-cigarettes offer a wide range of strengths and tastes by modulating the nicotine salt concentration and varying the nature and quantity of flavors. However, it can be not easy to fill out the cartridge with the solution and the cartridge can leak during use. Nonetheless the user can get his/her hands dirty but it is also known that nicotine passes the skin barrier quickly and easily, posing a safety problem. In addition, children can accidentally ingest e-liquid and suffer oral nicotine poisoning.

[0004] Systems for heating tobacco without burning it are an alternative to the E-cigarette. WO 2016/026810 and WO 2016/207407 describe such heating systems. Tobacco sticks are placed into these heating devices, the tobacco is then heated by the heating device without being burnt, which leads to the formation of an aerosol when the user sucks in air through the device. The generated aerosol has advantageous organoleptic properties when it is inhaled by the user.

[0005] It may be advantageous to offer the user of these heating devices aromas that are different from those of tobacco or a neutral aroma. That is the reason why reconstituted plant sheets, such as the ones described in WO 2019/043119, have been developed. The aerosols generated from these reconstituted plant sheets have generally satisfactory organoleptic properties. However, these reconstituted plant sheets are free of nicotine. Therefore, the aerosols generated from these reconstituted plant sheets do not provide a fully satisfactory experience for users of heating devices since they do not provide nicotine. Moreover, some reconstituted plant sheets may be difficult to produce since the plant fibers may be difficult to process.

[0006] To solve this technical problem, the inventors tried to add nicotine in neutral form and plant extract to paper sheets. However, nicotine in its neutral form can be volatile, leading to some conservation issues as nicotine can be lost over time, for example during the storage of the paper sheets and of the consumables for heating system comprising these paper sheets. To reduce its volatility, nicotine can be stabilized by maintaining it at an pH where nicotine is mainly under monoprotonated or diprotonated forms. One method can involve adding an organic acid, while another method also uses plant extracts to acidify the nicotine. The more acid the paper sheet is, the less nicotine is lost. However, the aerosol generated from a paper sheet having a pH below 4.9 can have an unpleasant, harsh and pungent taste and may even have deleterious physiological effects in certain cases due to the increase of the amount of specific organic acid in said paper sheet.

Summary

[0007] This disclosure improves the situation.

[0008] It is proposed a paper sheet comprising:

- a fibrous support comprising cellulose-based fibers,
- an aerosol-generating agent,
- nicotine, a salt of nicotine or mixtures thereof,
- a plant extract,

characterized in that:

- the plant extract comprises a non-volatile organic acid,
- the paper sheet has a pH from 3.5 to 4.9, in particular from 4 to 4.9, more particularly from 4.4 to 4.9, and
- the total content by weight of solids of volatile organic acids in the paper sheet is less than 1%, in particular less than 0.5%, more particularly less than 0.1%.

[0009] Advantageously, the use of a plant extract from an acid plant or plant parts containing non-volatile endogen-

ous organic acids such as shikimic acid stabilizes the nicotine of the paper sheet by maintaining an acidic environment. This stabilization reduces nicotine volatility and loss during storage, ensuring consistent nicotine delivery over time. In addition, the inventors have discovered that a paper sheet, as described in the present disclosure, even with a pH ranging from 3.5 to 4.9, does not produce a sour or pungent taste for the consumer when used in a heat-not-burn system.

[0010] This finding is unexpected, as it was previously believed that maintaining a higher pH was necessary to avoid unpleasant sensory properties. The formulation of the paper sheet with non-volatile organic acid of the present disclosure can thus balance nicotine stability with desirable sensory characteristics in a range of pH from 3.5 to 4.9.

[0011] In another aspect, it is proposed a process for producing a paper sheet as defined above, comprising the following steps:

a) forming a solution comprising:

- the aerosol-generating agent,
- the nicotine, the salt of nicotine or mixtures thereof, and
- the plant extract,

b) bringing the solution into contact with a base web produced from a fibrous support to obtain a wet paper sheet, and

c) drying the wet paper sheet to produce the paper sheet.

Detailed description

[0012] It is proposed a paper sheet comprising:

- a fibrous support comprising cellulose-based fibers,
- an aerosol-generating agent,
- nicotine, a salt of nicotine or mixtures thereof,
- a plant extract,

characterized in that:

- the plant extract comprises a non-volatile organic acid,
- the paper sheet has a pH from 3.5 to 4.9, in particular from 4 to 4.9, more particularly from 4.4 to 4.9, and
- the total content by weight of solids of volatile organic acids in the paper sheet is less than 1%, in particular less than 0.5%, more particularly less than 0.1%.

[0013] The pH of the paper sheet of the present invention is measured as follows:

- grinding the paper sheet to obtain particles below 1 mm,
- weighing 5.0 +/- 0.1 g of grounded paper sheet and mixing with 100.0 +/- 0.1 g of deionized water, the resistivity of the deionized water being below 18.2 Megohm/cm,
- stirring magnetically the sample in water during 15 min at a temperature of 20°C,
- measuring the pH.

[0014] For the purposes of the present application, the term "plant extract" denotes all of the solvent-soluble compounds of the plant.

[0015] Typically, the solvent may be an apolar solvent, an aprotic polar solvent, a protic polar solvent, or mixtures thereof, in particular the solvent may be methanol, dichloromethane, ethanol, acetone, butanol, supercritical CO₂, water or mixtures thereof, more particularly the solvent is ethanol, acetone, water or mixtures thereof, more particularly, the solvent is water.

[0016] The paper sheet of the invention comprises a plant extract wherein said plant extract comprises a non-volatile organic acid.

[0017] The non-volatile organic acid is preferably shikimic acid.

[0018] "Shikimic acid" refers to an organic acid, in particular a bicyclic α -hydroxy acid with the molecular formula C₇H₁₀O₅, named (3R,4S,5R)-3,4,5-trihydroxycyclohex-1-ene-1-carboxylic acid. It consists of a cyclohexene ring bearing three hydroxyl groups at positions 3, 4, and 5, and a carboxylic acid moiety at position 1. Shikimic acid is characterized by its high solubility in polar solvents, particularly water and lower alcohols, attributed to the presence

of multiple hydroxyl groups and a carboxyl moiety. The acidic properties of shikimic acid stem from its carboxyl functional group, which exhibits a pKa of approximately 4.1, classifying it as a weak acid under physiological conditions.

[0019] Typically, the plant of the plant extract is selected from the group consisting of *Illicium verum*, *Ginkgo biloba*, *Triticum aestivum*, *Tanacetum parthenium*, *Illicium henryi*, *Illicium pachyphyllum*, *Terminalia arjuna*, *Pistacia lentiscus*, *Ribes aureum*, *Alangium salvifolium*, *Terminalia pallida*, *Illicium diffengri*, *Hypericum frondosum*, *Triadenum walteri*, *Dipsacus pilosus*, *Dipsacus laciniatus*, *Agastache urticifolia*, *Inula helenium*, *Hypericum dolabriforme*, *Commelina bengalensis*, *Gymnema sylvestris*, *Terminalia chebula*, *Hemidesmus indicus*, *Cistus incanus*, *Sida acuta*, *Celastrus paniculatus*, *Glycosmis muricata* and mixtures thereof, in particular *Illicium verum*, *Ginkgo biloba*, *Triticum aestivum*, *Tanacetum parthenium* and mixtures thereof.

[0020] *Illicium verum* is also commonly known by its generic name star anise.

[0021] The skilled person knows how to select the part of the plant which is the main source of shikimic acid in said plant.

[0022] Typically, the main source of shikimic acid is the leaf for *Triticum aestivum*, the fruit for *Illicium verum*, the inner bark and leaves for *Ginkgo biloba*, and the leaf and blossom for *Tanacetum parthenium*.

[0023] Typically, the main source of shikimic acid may be the fruit, for example for *Illicium henryi*, *Illicium pachyphyllum*, *Terminalia arjuna*, *Illicium diffengri*, *Terminalia chebula*, *Terminalia pallida*, *Dipsacus pilosus*, *Dipsacus laciniatus*, *Inula helenium*, *Gymnema sylvestris*, *Celastrus paniculatus*, *Alangium salvifolium*, *Hemidesmus indicus* and *Glycosmis muricata*; the whole plant, for example for *Pistacia lentiscus*, *Ribes aureum*, *Hypericum frondosum*, *Triadenum walteri*, *Agastache urticifolia*, *Hypericum dolabriforme*, *Cistus incanus* and *Sida acuta*; the root for example for *Alangium salvifolium*, *Hemidesmus indicus* and *Glycosmis muricata*; or the stem for example for *Commelina bengalensis*.

[0024] The plant extract may be obtained from a plant mixture. For example, the plant extract may be obtained from a plant mixture of *Illicium verum* and Green Tea.

[0025] Let S_p be the total content by weight of solids of the plant extract included in the paper sheet of the present invention. S_p may be from 1% to 60%, in particular from 5% to 50%, more particularly from 10% to 35%.

[0026] Advantageously, an S_p within these ranges of values makes it possible to generate, at a comfortable draw resistance, an aerosol having satisfactory organoleptic properties, *i.e.* having constant and high taste intensity and constant and higher volume.

[0027] Advantageously, the pH of the paper sheet from 3.5 to 4.9, in particular from 4 to 4.9, more particularly from 4.5 to 4.9 may be obtained thanks to the non-volatile organic acid.

[0028] Typically, the total content by weight of solids of non-volatile organic acid comprised by the paper sheet may be from 1% to 18%, in particular from 3% to 16%, more particularly from 4% to 9%.

[0029] Typically, the total content by weight of solids of non-volatile organic acid can be measured by any suitable methods known by the person skilled in the art, such as High-Performance Liquid Chromatography with Ultraviolet detection (HPLC-UV).

[0030] Typically, the plant sheet of the invention may comprise other organic acids. For example, the plant extract may comprise other organic acids. Furthermore, other organic acids may be added during the process of producing the paper sheet of the invention, for instance in order to lower the pH of the paper sheet of the invention. Organic acids include volatile organic acids, or non-volatile organic acids such as shikimic acid or salicylic acid. The total content of volatile organic acids in the paper sheet is less than 1%, in particular less than 0.5%, more particularly less than 0.1% by weight of solids. Indeed, a total content volatile organic acids in the paper sheet higher than 1% by weight of solids can cause a sour or pungent taste for the consumer when the paper sheet is used in a heat-not-burn system.

[0031] Typically, the total content of volatile organic acids by weight of solids of the paper sheet can be measured by any suitable methods known by the person skilled in the art, such as High-Performance Liquid Chromatography with Ultraviolet detection (HPLC-UV).

[0032] A volatile organic acid is an organic compound that vaporizes or decomposes at or below 300 °C under atmospheric pressure.

[0033] A non-volatile organic acid is an organic compound that does not vaporize and does not decompose at or below 300°C under atmospheric pressure.

[0034] For the purposes of the present application, the term "fibrous support" denotes a base web made of cellulose-based fibers, in particular refined cellulose-based fibers. The base web is typically obtained by a papermaking process.

[0035] For the purposes of the present application, the term "cellulose-based fibers" denotes fibers obtained by means of a chemical or mechanical or thermomechanical pulping process, such as wood fibers, hemp fibers, or flax fibers for example, in particular wood fibers. A mixture of these cellulose-based fibers may also be used.

[0036] The fibrous support may not comprise plant fibers. The fibers of the fibrous support may consist of cellulose-based fibers. Typically, in this case, the total content by weight of solids of the cellulose-based fibers included in the

paper sheet of the invention is at least 10%, preferably at least 20%, in particular from 35% to 85%, more particularly from 40% to 73%.

[0037] Alternatively, the fibrous support may further comprise plant fibers. The plant fibers may be for example of one same plant or of several plants.

[0038] Typically, the plant fibers and the plant extract may be of one same plant. For example, the plant fibers and the plant extract may be of *Illicium verum* or *Ginkgo Biloba*, in particular of *Illicium verum*. Alternatively, the plant fibers and the plant extract may be of several different plants. Typically, the plant of the plant fibers is chosen from food plants, aromatic plants, fragrant plants, medicinal plants, plants of the family *Cannabaceae*, and mixtures thereof. For example, the plant fibers may be black tea fibers or green tea fibers.

[0039] Typically, the total content by weight of solids of the plant fibers included in the paper sheet may be less than 71%, in particular from 3% to 60%, more particularly from 5% to 55%, the remaining fibers of the paper sheet being the cellulose-based fibers. Typically, in this case the total content by weight of solids of the cellulose-based fibers included in the paper sheet of the invention is at least 10%, in particular at least 12%, more particularly at least 15%.

[0040] The cellulose-based fibers confer the mechanical strength properties to the paper sheet.

[0041] Wood fibers may be hardwood pulp, bleached hardwood pulp, softwood pulp, bleached softwood pulp, softwood fluff pulp, lyocell fibers (cellulose fibers which are ground and dissolved in N-methylmorpholine N-oxide monohydrate for the purpose of obtaining fibers with a cross section of variable shape (round, oval, cross-shaped, circular, lamellar cross section) with calibrated length and mass per unit length, which the person skilled in the art can choose depending on their needs), viscose fibers (fibers obtained by dissolving cellulose by means of modification of its hydroxyl groups by carbon disulfide (CS_2) and then precipitating it in the presence of sulfuric acid (H_2SO_4) for the purpose of obtaining fibers with a cross section of variable shape (round, oval, cross-shaped, circular, lamellar cross section) with calibrated length and mass per unit length, which the person skilled in the art can choose depending on their needs) or mixtures thereof, in particular bleached softwood pulp, softwood pulp, softwood fluff pulp, lyocell fibers, viscose fibers or mixtures thereof, more particularly softwood pulp, bleached softwood pulp, or mixtures thereof.

[0042] For the purposes of the present application, the term "refined cellulose-based fibers" denotes cellulose-based fibers which have undergone a refining step enabling fibrillation and/or cutting of the cellulose-based fibers. The refining step is conventionally carried out in a papermaking process, such as the papermaking process producing reconstituted papermaking tobacco.

[0043] For the purposes of the present application, the term "aerosol-generating agent" denotes a compound which allows the formation of an aerosol when it is heated.

[0044] The aerosol-generating agent may be a polyol, a non-polyol or mixtures thereof. Typically, an aerosol generating agent that is a polyol may be glycerol, propylene glycol, sorbitol, triethylene glycol or mixtures thereof. An aerosol generating agent that is a non-polyol may be glyceryl diacetate, glyceryl triacetate, triethyl citrate, isopropyl myristate or mixtures thereof.

[0045] The aerosol-generating agent may preferably be glycerol, propylene glycol, or a mixture of glycerol and propylene glycol, glycerol being preferred.

[0046] Let S_{AG} be the total content by weight of solids of the aerosol-generating agent included in the paper sheet of the present invention. S_{AG} may be from 6% to 67%, in particular from 10% to 62%, more particularly from 15% to 39%.

[0047] The volume of the aerosol generated from a paper sheet having an S_{AG} lower than the ranges mentioned above is too low to be pleasant. This aerosol is also not tasteful.

[0048] For the purposes of the present application, "salt of nicotine" denotes a form of nicotine characterized by the interaction between nicotine in monoprotonated form or diprotonated form and non-volatile organic acid in carboxylate form.

[0049] In the paper sheet of the present invention, the salt of nicotine may be formed *in-situ* or *ex-situ* by the reaction between the nicotine and the non-volatile organic acid. The skilled person knows that this reaction is an equilibrium. Therefore, nicotine and non-volatile organic acid may be present with the salt of nicotine formed *in-situ* or *ex-situ*.

[0050] Alternatively, the salt of nicotine may be purchased as such and added to the paper sheet of the present invention.

[0051] The total content by weight of solids of nicotine in the paper sheet may be from 0.1% to 8%, in particular from 0.5% to 4%, more particularly from 0.75% to 3%.

[0052] Advantageously, the paper sheet comprising the nicotine in such ranges generates an aerosol which enables the user to get a nicotine experience similar to the experience provided by the aerosol generated by a classical tobacco heating device and by a smoke generated by a combusted tobacco product.

[0053] Typically, the paper sheet may have a basis weight of lower than 300 g/m², in particular from 15 g/m² to 200 g/m², more particularly from 30 g/m² to 150 g/m².

[0054] To determine the basis weight of the paper sheet, the following method may be used:

a sample of 0.25 m² is cut out with a template (dimensions: 57.5 x 43.5 cm) at approximately 15 cm from the edge of the paper sheet to be analyzed. The sample is then folded in four and placed on a hotplate so as to be dried thereon in

order to remove the water without removing the aerosol-generating agent.
The dried sample is then weighed to determine the basis weight of the paper sheet.

[0055] According to a particular embodiment, the paper sheet may comprise:

- 5 - a fibrous support comprising cellulose-based fibers,
 - an aerosol-generating agent,
 - nicotine, a salt of nicotine or mixtures thereof,
 - a plant extract,

10 characterized in that:

- the plant extract comprises a non-volatile organic acid,
 - the paper sheet has a pH from 4.4 to 4.9, and
 - the total content by weight of solids of volatile organic acids in the paper sheet is less than 1%,

15 wherein the non-volatile organic acid is shikimic acid,
 wherein the plant of the plant extract is *Illicium verum*,
 wherein the total content by weight of solids of the cellulose-based fibers included in the paper sheet of the
 invention is from 40% to 73%.

20 **[0056]** According to a particular embodiment, the paper sheet may comprise:

- a fibrous support comprising cellulose-based fibers,
 - an aerosol-generating agent,
25 - nicotine, a salt of nicotine or mixtures thereof,
 - a plant extract,

characterized in that:

- 30 - the plant extract comprises a non-volatile organic acid,
 - the paper sheet has a pH from 4.4 to 4.9, and
 - the total content by weight of solids of volatile organic acids in the paper sheet is less than 1%,

35 wherein the non-volatile organic acid is shikimic acid,
 wherein the plant of the plant extract is *Illicium verum*,
 wherein the fibrous support further comprises plant fibers,
 wherein the plant of the plant fibers is *Illicium verum*,
 wherein the total content by weight of solids of the plant fibers included in the paper sheet is from 5% to 55%.

40 **[0057]** It is also proposed a process for producing a paper sheet as defined above, comprising the following steps:

a) forming a solution comprising:

- 45 - the aerosol-generating agent,
 - the nicotine, the salt of nicotine or mixtures thereof, and
 - the plant extract,

50 b) bringing the solution into contact with a base web produced from a fibrous support to obtain a wet paper sheet,
 and

c) drying the wet paper sheet to produce the paper sheet.

55 **[0058]** The cellulose-based fibers, the aerosol-generating agent, the plant extract, the nicotine and the salt of nicotine are as defined above in relation with the paper sheet of the present invention.

[0059] The base web may be produced by passing the cellulose-based fibers through a papermaking machine. Therefore, the paper sheet of the invention may be a paper sheet obtainable by a papermaking process.

[0060] An organic acid, such as salicylic acid, may be added to the solution formed during step a) and involved in step b).

[0061] The pH of the solution formed during step a) and involved in step b) may be acidic, in particular from 3.5 to 4.8, more particularly from 4.0. to 4.8.

5 Advantageously, a solution having a pH in these ranges may enable the production of the paper sheet of the present invention.

[0062] The pH of the solution mainly depends on the amount of non-volatile organic acid, nicotine and/or salt of nicotine in said solution. The skilled person knows how to adjust the amount of non-volatile organic acid, nicotine and/or salt of nicotine in the solution so that said solution has a pH in the above range.

10 **[0063]** The pH of the solution is determined using a pH electrode. The pH of the base web is determined by the method described above determining the pH of the paper sheet of the present invention.

[0064] The paper sheet produced by the process of the present invention, and thus the base web of step b), may further comprise plant fibers. The plant fibers are as defined above in relation with the paper sheet of the present invention.

15 Accordingly, a mixture of cellulose-based fibers and plant fibers may be passed through a papermaking machine to produce the base web involved in step b).

[0065] The plant fibers and the plant extract may be obtained in accordance with the following steps:

d) mixing one or more plant parts with a solvent in order to extract the plant extract from the plant fibers, and

20 e) separating the plant extract from the plant fibers.

[0066] The plant extract and the plant fibers are therefore typically obtained by means of a dissociation process. During step d), one or more plant parts are mixed with a solvent, for example in a digester, in order to extract the plant extract from the plant fibers. During step e), the plant extract is separated from the plant fibers, for example by passing through a screw press, in order to isolate and obtain, on the one hand, the plant fibers and, on the other hand, the plant extract.

[0067] The skilled person knows how to adapt the temperature of the solvent during step d) to the plant, to the plant part and to the plant parts to be treated. Typically, the temperature of the solvent during the treatment of a root or of a bark will be higher than the temperature of the solvent during the treatment of a leaf or a petal.

30 **[0068]** Typically, the temperature of the solvent during step d) may be from 10°C to 100°C, in particular from 30°C to 90°C, more particularly from 40°C to 80°C.

[0069] Typically, the plant fibers may be refined in a refiner to produce the base web.

[0070] Typically, the plant fibers may originate from various plants.

[0071] The fibers of each plant can be obtained separately according to the dissociation process described above.

35 They can subsequently be mixed such that this mixture of fibers from various plants passes through the papermaking machine so as to constitute the fibrous support. It is also possible to obtain fibers from various plants together by bringing together one or more parts of the various plants and then subjecting them to the dissociation process described above. The temperature of the water will then be adapted to the plants to be treated and, in particular, to the plant requiring the highest temperature of the water for extracting the extract of this plant. This alternative embodiment is very advantageous since it makes it possible to obtain the fibers of the various plants without carrying out several dissociation processes in parallel.

[0072] Typically, the plant extract may be an extract of various plants.

[0073] The extract of various plants can be obtained by mixing various plant extracts obtained separately according to the dissociation process described above. It is also possible to obtain the extract of various plants by bringing together one or more parts of the various plants and then subjecting them to the dissociation process described above. The temperature of the water will then be adapted to the plants to be treated and, in particular, to the plant requiring the highest temperature of the water for extracting the extract of this water-soluble plant. This alternative embodiment is very advantageous since it makes it possible to obtain the extract of various plants without carrying out several processes in parallel. In these two situations, the extracts of various plants are involved in step a).

50 **[0074]** The solution may be formed during step a) by mixing in a solvent, in particular water, nicotine, the aerosol-generating agent, the plant extract comprising non-volatile organic acid. Accordingly, the salt of nicotine is formed *in-situ* in the solution by reaction between non-volatile organic acid and the nicotine. In particular; during this step a):

- the nicotine, the aerosol-generating agent and the plant extract may be mixed to form a mixture,
- 55 - the solvent, in particular water, is then added to this mixture to form the solution.

The solution may be heated, if necessary, between 40°C and 60°C. This heating step favors the solubilization of the components in the solution.

[0075] Typically, the plant extract can be concentrated before being mixed during step a). A device such as a vacuum evaporation device can be used to concentrate the plant extract.

[0076] Typically, step b) can be carried out by impregnation or by spraying, in particular by impregnation. Typically, the impregnation can be carried out by means of a size press.

[0077] Typically, the drying step c) can be carried out by infrared ramp, American battery drying drums, hot-air drying in a tunnel drier, a vertical drier, a fluidized-bed drier, a pneumatic drier, in particular in a tunnel drier.

[0078] The paper sheet produced at step c) may be shaped in particulate form, in the form of crimped sheet, in shredded form.

[0079] The paper sheet of the invention may be used in an aerosol generating system.

[0080] Thus, it is also proposed a consumable for an aerosol generating system comprising a paper sheet according to the invention as defined above.

[0081] For the purposes of the present invention, the term "consumable" denotes the paper sheet according to the invention as such, a pouch comprising the paper sheet according to the invention, a capsule comprising the paper sheet according to the invention or a stick for a heating device comprising the paper sheet according to the invention.

[0082] For the purposes of the present application, the expression "aerosol generating system" denotes any device which allows the formation of an aerosol intended to be inhaled by a consumer. The aerosol provides nicotine to the consumer. Moreover, thanks to the aerosol generating system, the formation of harmful constituents during combustion is avoided, thereby very significantly reducing the consumer's exposure to said harmful constituents.

[0083] Typically, an aerosol generating system comprises, in the direction of the air flow, an air inlet, a heating body, a lodging intended to put in place and hold the consumable of the invention, and an air outlet intended to be introduced into the mouth of the user. The air inlet, the heating body, the lodging and the air outlet are typically connected at least fluidically to one another.

[0084] When the aerosol generating system is used, air is sucked into the aerosol generating system via the air inlet by the user; the air sucked in then passes through the heated portion so as to obtain heated air; on contact with the paper sheet of the invention comprising the aerosol-generating agent, held in the lodging, an aerosol is formed and is then inhaled by the user.

[0085] The aerosol generating system can be a device for heating tobacco without burning it (such as IQOS™ or glo™), an herb vaporizer (such as Pax®), or an hybrid technology (such as Ploom™ Tech).

[0086] The consumable is adapted to be introduced into a dedicated lodging of the aerosol generating system, and those skilled in the art will know how to adapt the consumable according to the dedicated lodging of the aerosol generating system.

[0087] The paper sheet according to the invention, as consumable, can be shaped so as to be adapted to the dedicated lodging of the aerosol generating system. For example, it may be in particulate form, in the form of crimped sheet, in the form of shredded sheet, in particular in the form of shredded sheet having a width from 0.5 mm to 1 mm.

[0088] The pouch can be made of paper with an inner volume and the paper sheet according to the invention is contained in the inner volume. In the inner volume, the paper sheet according to the invention may be shaped, in particular in particulate form, in the form of creped sheet, in the form of shredded sheet.

[0089] The paper sheet according to the invention may in particular be in the form of shredded sheet in a stick for an aerosol generating system.

[0090] According to one embodiment, the paper sheet included in the consumable may be able to be obtained by the process according to the invention as defined above.

[0091] It is also proposed a use of a paper sheet according to the invention as defined above or of a consumable according to the invention as defined above in an aerosol generating system.

[0092] The paper sheet according to the invention as defined above may also be used as a wrapper paper.

[0093] It is also proposed a consumable as defined above for use thereof in an aerosol generating system.

Examples

Example 1: Manufacturing of paper sheets.

Examples 1-1 to 1-5: according to the invention

[0094] The following protocol is used to manufacture the paper sheets of Examples 1-1 to 1-5 presented in Table 1 below.

[0095] For Example 1-3: The cellulose-based fibers are passed through a laboratory papermaking machine to obtain a base web.

[0096] For Examples 1-1, 1-2, 1-4 and 1-5 : The cellulose-based fibers and the plant fibers are passed through a laboratory papermaking machine to obtain a base web.

[0097] For Example 1-5 : the salicylic acid is mixed with nicotine to form a mixture. Glycerol and the plant extract are then added to this mixture to form a second mixture. This final mixture is heated to 48°C and stirred up to complete solubilisation to form a solution.

[0098] For Examples 1-1 to 1-4 : Glycerol, nicotine and the plant extract are mixed to form a mixture. This final mixture is heated to 48°C and stirred up to complete solubilisation to form a solution.

[0099] The solution is added to the base web by impregnation in a size press so as to obtain, after drying, the paper sheet.

Example 1-6 not according to the invention

[0100] The following protocol is used to manufacture the paper sheet of Example 1-6 presented in Table 1 below.

[0101] The cellulose-based fibers and the plant fibers are passed through a laboratory papermaking machine to obtain a base web.

[0102] The citric acid is mixed with nicotine to form a first mixture. Glycerol and plant extract are mixed with nicotine to form a second mixture. Water is added to this second mixture. This final mixture is heated to 48°C and stirred up to complete solubilisation to form a solution.

[0103] The solution is added to the base web by impregnation in a size press so as to obtain, after drying, the paper sheet.

Example 2

Determination of nicotine release

[0104] Paper sheets of Examples 1-1 to 1-5 and Example 1-6 are stored during 11 days under the following conditions: 40°C, 60% Relative Humidity.

[0105] The total content by weight of solids of nicotine of these examples is then measured by Gas Chromatography coupled with Flame Ionization Detector (GC-FID). For each paper sheet, no loss of nicotine has been observed after storage.

[0106] The results, presented in Table 1, demonstrate that the nicotine is stabilized in the paper sheet according to the present invention having a pH between 3.5 and 4.8.

Assessment of the taste of the aerosol generated.

[0107] Furthermore, for each paper sheet, the taste of the aerosol generated from the paper sheet has been assessed. The results, presented in Table 1, demonstrate the aerosol generated from the paper sheet of Example 1-6 (not according to the invention) has an unpleasant, harsh and pungent taste, whereas the paper sheets of Examples 1-1 to 1-5 (according to the invention) generate an aerosol providing nicotine in a satisfactory manner and having no unpleasant harshness and acidic taste, *i.e.* an aerosol which is satisfactory to the user.

[Table 1]

	Examples 1-1 to 1-5					Example 1-6
	according to the invention					not according to the invention
Example	1-1	1-2	1-3	1-4	1-5	1-6
Cellulose-based fibers	Wood pulp	Wood pulp	Wood pulp	Wood pulp	Wood pulp	Wood pulp
Total content by weight of solids of cellulose-based fibers	15%	15%	57.5%	15%	15%	15%
Plant of the plant fibers	Illicium verum (star anise)	Black tea	No plant fibers	(1) Illicium verum (star anise) (2) Green tea	Gingko Biloba	Sweet mint

(continued)

	Examples 1-1 to 1-5					Example 1-6
	according to the invention					not according to the invention
Example	1-1	1-2	1-3	1-4	1-5	1-6
Total content by weight of solids of plant fibers	40.7%	43%	0%	(1) 25.4% (2) 17%	42.2%	29.4%
Added Organic acid (Total content by weight of solids)	No organic acid added	No organic acid added	No organic acid added	No organic acid added	Salicylic acid (1.7%)	Citric acid (3.9%)
Plant of the plant extract	Illicium verum (star anise)	Illicium verum (star anise)	Illicium verum (star anise)	(3) Illicium verum (star anise) (4) Green tea 60/40 (v/v)	Gingko biloba	Sweet mint
Total content by weight of solids of plant extract	23.1%	23.1%	23.4%	23.5%	22.3%	28.4%
Total content by weight of solids of nicotine	1.8%	1.8%	1.6%	1.6%	1.6%	2.0%
Total content by weight of solids of glycerol	19.4%	17.1%	17.5%	17.5%	17.2%	21.3%
pH of the plant extract with nicotine	4.5	4.7	4.4	4.3	4.4	3.8
pH of the paper sheet	4.5	4.6	4.6	4.5	4.8	4.8
Nicotine stability	yes	yes	yes	yes	yes	yes
Harsh/pungent taste	no	no	no	no	no	yes

Claims

1. A paper sheet comprising:

- a fibrous support comprising cellulose-based fibers,
- an aerosol-generating agent,
- nicotine, a salt of nicotine or mixtures thereof,
- a plant extract,

characterized in that:

- the plant extract comprises a non-volatile organic acid,
- the paper sheet has a pH from 3.5 to 4.9, and
- the total content by weight of solids of volatile organic acids in the paper sheet is less than 1%.

2. Paper sheet according to claim 1, wherein the non-volatile organic acid is shikimic acid.

3. Paper sheet according to claim 1 or 2, wherein the fibers of the fibrous support consist of cellulose-based fibers.

4. Paper sheet according to claim 1 or 2, wherein the fibrous support further comprises plant fibers.

5. Paper sheet according to any one of claims 1 to 4, wherein the total content by weight of solids of nicotine in the

paper sheet is from 0.1% to 8%.

6. Paper sheet according to any one of claims 1 to 5, wherein the plant of the plant extract is selected from the group consisting of *Illicium verum*, *Ginkgo biloba*, *Triticum aestivum*, *Tanacetum parthenium* and mixtures thereof.

7. Process for producing a paper sheet as defined in any one of claims 1 to 6, comprising the following steps:

a) forming a solution comprising:

- the aerosol-generating agent,
- the nicotine, the salt of nicotine or mixtures thereof, and
- the plant extract,

b) bringing the solution into contact with a base web produced from a fibrous support to obtain a wet paper sheet, and

c) drying the wet paper sheet to produce the paper sheet.

8. Consumable for an aerosol generating system comprising a paper sheet as defined in any one of claims 1 to 6.



EUROPEAN SEARCH REPORT

Application Number

EP 25 30 5552

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2024/225079 A1 (DUROT NATHALIE [FR] ET AL) 11 July 2024 (2024-07-11) * paragraphs [0049], [0074], [0123] - [0125]; claims 1,10,12,14 * -----	1-8	INV. D21H17/02 A24D1/02 D21H17/14 D21H17/00 D21H27/00
			TECHNICAL FIELDS SEARCHED (IPC)
			D21H A24F A24D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		8 September 2025	Ponsaud, Philippe
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

1
EPO FORM 1503 03.82 (P24C01)

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 25 30 5552

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

08-09-2025

10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
	US 2024225079 A1	11-07-2024	US 2024225079 A1	11-07-2024
15			WO 2024149850 A1	18-07-2024

20				
25				
30				
35				
40				
45				
50				
55				

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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

- WO 2016026810 A [0004]
- WO 2016207407 A [0004]
- WO 2019043119 A [0005]