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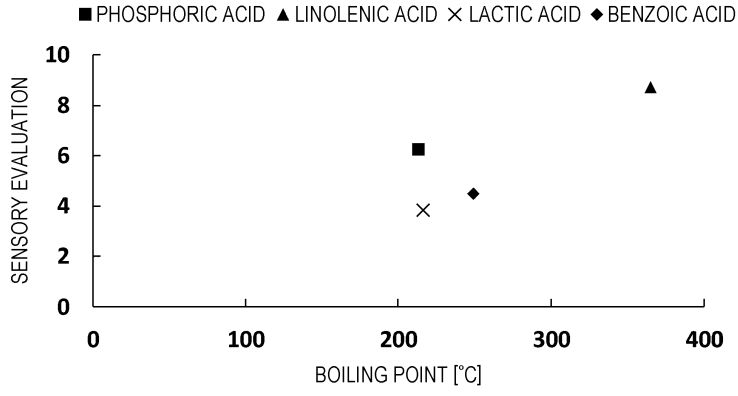
(54) CARTRIDGE FOR HEAT-NOT-BURN TOBACCO PRODUCT AND HEAT-NOT-BURN TOBACCO PRODUCT

(57) The present invention provides: a cartridge for a heat-not-burn tobacco product including a tobacco filler, a container body for the tobacco filler, and a filtration medium, the container body being cylindrical and having the filtration medium positioned at at least one end thereof, the cartridge being such that an atomized aerosol is capable of passing therethrough from one end to the other end, and the tobacco filler containing 0.25-5.50 wt% inclusive of an acid having a boiling point of 120-250°C inclusive, where the total weight of the tobacco filler is deemed to be 100 wt%; and a heat-not-burn tobacco product that includes the cartridge.

FIG. 17



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Description

Technical Field

[0001] The present invention relates to a cartridge for a heat-not-burn tobacco product and a heat-not-burn tobacco product including the cartridge in a detachable manner.

Background Art

[0002] Heat-not-burn tobacco products that atomize aerosol sources without combustion are known (e.g., PTL 1 and PTL 2). Such a heat-not-burn tobacco product includes an atomizing unit that atomizes an aerosol source and a cartridge having a tobacco filler-containing flavor source. For example, the cartridge is replaceable and joined to the atomizing unit. The aerosol atomized by the atomizing unit then passes through the cartridge while being in contact with the flavor source in the cartridge, and as a result, a flavor component is delivered to the user together with the aerosol.

[0003] It is known that when the heat-not-burn tobacco products disclosed in PTL 1 and PTL 2 are used, the tobacco filler-containing flavor source in the cartridge is heated to about 30°C to 40°C.

[0004] In the field of heat-not-burn tobacco products, the amount of flavor component delivered to the user may be insufficient as compared to ordinary cigarettes as described above, or the user may feel the "flavor inhibition" described later; thus, it has been desired to suppress the flavor inhibition while ensuring at least a certain amount of flavor component delivered. To solve these problems, a technique has been reported (PTL 3) in which an acid with a primary acid dissociation constant of 4.0 or more and 6.0 or less and a boiling point of 366°C or higher and 600°C or lower is added to a tobacco filler for a heat-not-burn tobacco, the tobacco filler including shredded tobacco and an aerosol-generating liquid, that is, an aerosol source.

Citation List

Patent Literature

[0005]

PTL 1: International Publication No. 2016/075748
PTL 2: International Publication No. 2016/075749
PTL 3: International Publication No. 2017/203686

Summary of Invention

Technical Problem

[0006] Neither PTL 1 nor PTL 2 has discussed the problems specific to heat-not-burn tobacco products, that is, the problem in that the amount of flavor component delivered to the user is insufficient as compared to ordinary cigarettes, and the problem in that the user feels the flavor inhibition.

[0007] PTL 3 states that in an embodiment where the tobacco filler including shredded tobacco and an aerosol source is heated to 160°C to 170°C, the amount of evaporating flavor component is sufficient and the flavor inhibition is suppressed. However, PTL 3 has not discussed whether, in an embodiment where a tobacco filler-containing flavor source in a cartridge is heated, during use, to about 30°C to 40°C by an aerosol generating from an atomizing unit disposed outside the cartridge as in the heat-not-burn tobacco products disclosed in PTL 1 and PTL 2, the effect of addition of the acid to the flavor source is produced.

[0008] Thus, it is an object of the present invention to provide a cartridge for a heat-not-burn tobacco product, the cartridge being able to suppress the flavor inhibition while ensuring the amount of flavor component delivered to the user in a heat-not-burn tobacco product having a configuration in which a tobacco filler in the cartridge is heated by an aerosol generating from an atomizing unit disposed outside the cartridge, and a heat-not-burn tobacco product.

Solution to Problem

[0009] The present inventors have conducted intensive studies and found that by incorporating a specific amount of an acid having a specific boiling point into a tobacco filler in a cartridge for a heat-not-burn tobacco product, the flavor inhibition can be suppressed while ensuring the amount of flavor component delivered to the user, thereby accomplishing the present invention.

[0010] Thus, the gist of the present invention is as follows.

[1] A cartridge for a heat-not-burn tobacco product, including a tobacco filler, a container for the tobacco filler, and a filtration medium,

wherein the container is tubular, and the filtration medium is disposed at at least one end of the container,
the cartridge allows passage of an atomized aerosol from one end to the other end of the cartridge, and
the tobacco filler contains an acid having a boiling point of 120°C or higher and 250°C or lower in an amount of 0.25 wt% or more and 5.50 wt% or less relative to a total weight of the tobacco filler taken as 100 wt%.

[2] The cartridge according to [1], wherein the tobacco filler contains the acid in an amount of 0.25 wt% or more and 5.00 wt% or less relative to the total weight of the tobacco filler taken as 100 wt%.
[3] The cartridge according to [1] or [2], wherein the acid is an organic acid.
[4] The cartridge according to any one of [1] to [3], wherein the acid has an acid dissociation constant pK_a of 3.0 to 6.0.
[5] The cartridge according to any one of [1] to [4], wherein the acid is benzoic acid or lactic acid.
[6] The cartridge according to any one of [1] to [5], wherein the acid is lactic acid.
[7] The cartridge according to any one of [1] to [6], wherein the tobacco filler is composed of tobacco granules.
[8] A heat-not-burn tobacco product including:

an atomizer that atomizes an aerosol source without combustion; and
the cartridge according to any one of [1] to [7] disposed in a detachable manner,
wherein the cartridge has an inhalation end, and
at least a portion of the tobacco filler contained in the cartridge is heated at a temperature lower than the boiling point of the acid upon contact with an aerosol atomized by the atomizer.

[9] The heat-not-burn tobacco product according to [8], wherein the tobacco filler is heated at a temperature of 20°C or higher and lower than 120°C.
[10] The heat-not-burn tobacco product according to [8] or [9], wherein the heat-not-burn tobacco product has an aerosol flow path extending in a predetermined direction, and
the atomizer is disposed on an upstream side of the aerosol flow path, and the cartridge is disposed on a downstream side of the aerosol flow path.

Advantageous Effects of Invention

[0011] According to the present invention, a cartridge for a heat-not-burn tobacco product, the cartridge being able to suppress the flavor inhibition while ensuring the amount of flavor component delivered to the user in a heat-not-burn tobacco product having a configuration in which a tobacco filler in the cartridge is heated by an aerosol generating from an atomizing unit disposed outside the cartridge, and a heat-not-burn tobacco product can be provided.

Brief Description of Drawings

[0012]

[Fig. 1] Fig. 1 is a sectional view of a heat-not-burn tobacco product 1 according to an embodiment.
[Fig. 2] Fig. 2 is a sectional view of a power supply unit 10 according to an embodiment.
[Fig. 3] Fig. 3 is a sectional view of an atomizing unit 20 according to an embodiment.
[Fig. 4] Fig. 4 illustrates the internal structure of the atomizing unit 20 according to an embodiment.
[Fig. 5] Fig. 5 is a sectional view of a cartridge 30 according to an embodiment.
[Fig. 6] Fig. 6 is an exploded perspective view of the cartridge 30 according to an embodiment.
[Fig. 7] Fig. 7 is a sectional view (sectional view taken along line A-A of Fig. 5) of a container 31 for a tobacco filler according to an embodiment.
[Fig. 8] Fig. 8 is a sectional view (sectional view taken along line B-B of Fig. 7) of the container 31 for a tobacco filler according to an embodiment.
[Fig. 9] Fig. 9 illustrates an example of the shape of an aperture 32A according to an embodiment.
[Fig. 10] Fig. 10 illustrates an example of the shape of an aperture 32A according to an embodiment.
[Fig. 11] Fig. 11 illustrates an example of the shape of an aperture 32A according to an embodiment.
[Fig. 12] Fig. 12 illustrates an example of the shape of an aperture 32A according to an embodiment.
[Fig. 13] Fig. 13 illustrates the state of joining between a first cartridge 20 and a second cartridge 30 according to

an embodiment.

[Fig. 14] Fig. 14 is a sectional view taken along line C-C in Fig. 13.

[Fig. 15] Fig. 15 is a graph showing the relationship between the acid content of tobacco fillers and the amount of flavor component (here, nicotine) generated.

[Fig. 16] Fig. 16 is a graph showing the relationship between the acid content of tobacco fillers and the amount of flavor component (here, nicotine) generated.

[Fig. 17] Fig. 17 shows the results of sensory evaluation of the effect of suppressing the flavor inhibition due to the presence of an acid in a tobacco filler, with the vertical axis representing sensory evaluation results and the horizontal axis representing acid boiling point.

[Fig. 18] Fig. 18 shows the results of sensory evaluation of the effect of suppressing the flavor inhibition due to the presence of an acid in a tobacco filler, with the vertical axis representing sensory evaluation results and the horizontal axis representing acid strength (acid dissociation constant pK_a).

Description of Embodiments

[0013] Although embodiments of the present invention will be described in detail below, these descriptions are examples (representative examples) of embodiments of the present invention, and the present invention is not limited to the contents of the descriptions as long as it does not depart from the spirit thereof.

[0014] In this DESCRIPTION, when a range is expressed using numerical values or physical property values with "to" interposed therebetween, the values before and after "to" are meant to be included in the range. It should be noted that the drawings are schematic, and the sizes and the like of elements are not drawn to scale.

<Heat-not-bum tobacco product>

[0015] A cartridge for a heat-not-burn tobacco product according to an embodiment of the present invention includes a tobacco filler, a container for the tobacco filler, and a filtration medium. The container is tubular, and the filtration medium is disposed at at least one end of the container. As used herein, the term tubular includes not only cylindrical shapes but also shapes such as elliptic cylinders, polygonal cylinders, and rounded polygonal cylinders. The cartridge allows passage of an atomized aerosol from one end to the other end of the cartridge. The tobacco filler contains an acid having a boiling point of 120°C or higher and 250°C or lower in an amount of 0.25 wt% or more and 5.50 wt% or less relative to the total weight of the tobacco filler taken as 100 wt%.

[0016] In general, a cartridge in a heat-not-burn tobacco product is sometimes referred to as a "consumable material" because it is disposed of after use.

[0017] The heat-not-burn tobacco product includes an atomizer that atomizes an aerosol source without combustion and includes the cartridge in a detachable manner. The cartridge has an inhalation end, and at least a portion of the tobacco filler contained in the cartridge is heated at a temperature lower than the boiling point of the acid upon contact with an aerosol atomized by the atomizer.

[0018] When a user of the heat-not-burn tobacco product inhales on the inhalation end of the cartridge, an atomized aerosol and the tobacco filler contained in the cartridge comes into contact with each other. As a result of this, a flavor component and the acid contained in the tobacco filler are delivered to the user together with the atomized aerosol, with the amount of flavor component being ensured and the flavor inhibition being suppressed.

[0019] Preferably, the heat-not-bum tobacco product has an aerosol flow path extending in a predetermined direction, and the atomizer and the cartridge are disposed on the upstream side and the downstream side, respectively, of the aerosol flow path. With this configuration, the atomized aerosol and the tobacco filler are efficiently brought into contact with each other, thus improving the effect of suppressing the flavor inhibition while ensuring the amount of flavor component.

[0020] A heat-not-burn tobacco product according to an embodiment of the present invention will be described with reference to the drawings. Fig. 1 is a sectional view of a heat-not-burn tobacco product 1 according to an embodiment. Fig. 2 is a sectional view of a power supply unit 10 according to an embodiment. Fig. 3 is a sectional view of an atomizing unit 20 according to an embodiment. Fig. 4 illustrates the internal structure of the atomizing unit 20 according to an embodiment. It should be noted, however, that a reservoir 21, which will be described later, is omitted in Fig. 4. Fig. 5 is a side view of a cartridge 30 according to an embodiment. Fig. 6 is an exploded perspective view of the cartridge 30 according to an embodiment. Fig. 7 is a sectional view (sectional view taken along line A-A of Fig. 5) of a container 31 for a tobacco filler according to an embodiment. Fig. 8 is a sectional view (sectional view taken along line B-B of Fig. 7) of the container 31 for a tobacco filler according to an embodiment. It should be noted, however, that a tobacco filler 31A, which will be described later, is omitted in Fig. 6.

[0021] As illustrated in Fig. 1, the heat-not-bum tobacco product 1 has a shape extending in a predetermined direction A which is a direction from a non-inhalation end toward an inhalation end. The heat-not-burn tobacco product 1 is a

device for inhaling a flavor without combustion.

[0022] Specifically, the heat-not-burn tobacco product 1 includes the power supply unit 10, the atomizing unit 20, and the cartridge 30. The atomizing unit 20 is attachable to and detachable from the power supply unit 10, and the cartridge 30 is attachable to and detachable from the atomizing unit 20. In other words, the atomizing unit 20 and the cartridge 30 are each replaceable.

[0023] As illustrated in Fig. 2, the power supply unit 10 has a shape extending in the predetermined direction A and at least includes a battery 11. The battery 11 may be a disposable battery or a rechargeable battery. The initial value of the output voltage of the battery 11 is preferably 1.2 V or more and 4.2 V or less. The battery capacity of the battery 11 is preferably 100 mAh or more and 1000 mAh or less.

[0024] As illustrated in Fig. 3 and Fig. 4, the atomizing unit 20 has a shape extending in the predetermined direction A. The atomizing unit 20 includes a reservoir 21, an atomizer 22, a flow path forming body 23, an outer frame body 24, and an end cap 25. The atomizing unit 20 has, as an aerosol flow path extending in the predetermined direction A, a first flow path 20X disposed downstream of the atomizer 22. It should be noted that in the aerosol flow path, the side close to the atomizer 22 is referred to as upstream, and the side away from the atomizer 22 is referred to as downstream.

[0025] The reservoir 21 stores an aerosol source 21A. The reservoir 21 is located around the flow path forming body 23 in a section perpendicular to the first flow path 20X (the predetermined direction A). In an embodiment, the reservoir 21 is located in a space between the flow path forming body 23 and the outer frame body 24. The reservoir 21 is formed of, for example, a porous body such as a resin web or cotton. The reservoir 21 may be constituted by a tank for holding the aerosol source 21A in liquid form. The aerosol source 21A is not particularly limited, and extracts from various natural products and/or components thereof can be selected depending on the intended use. Examples include liquids such as glycerol, propylene glycol, triacetin, 1,3-butanediol, and mixtures thereof.

[0026] The atomizer 22 atomizes the aerosol source 21A without combustion by using electric power supplied from the battery 11. In an embodiment, the atomizer 22 is constituted by a heating wire (coil) wound at a predetermined pitch, and the atomiz er 22 is preferably constituted by a heating wire having a resistance value of 1.0 Ω or more and 3.0 Ω or less. The predetermined pitch is not less than a value at which the heating wire will not come into contact with itself, and is preferably a small value. The predetermined pitch is preferably, for example, 0.40 mm or less. The predetermined pitch is preferably constant in order to stabilize the atomization of the aerosol source 21A. The predetermined pitch is the interval between the centers of heating wires adjacent to each other.

[0027] The flow path forming body 23 has a shape extending in the predetermined direction A. The flow path forming body 23 has a tubular shape that forms the first flow path 20X extending in the predetermined direction A.

[0028] The outer frame body 24 has a shape extending in the predetermined direction A. The outer frame body 24 has a tubular shape in which the flow path forming body 23 is accommodated. In an embodiment, the outer frame body 24 extends downstream of the end cap 25 and accommodates a portion of the cartridge 30.

[0029] The end cap 25 is a cap that closes the space between the flow path forming body 23 and the outer frame body 24 from the downstream side. The end cap 25 suppresses the aerosol source 21A stored in the reservoir 21 from leaking to the cartridge 30.

[0030] As illustrated in Fig. 5 and Fig. 6, the cartridge 30 of the heat-not-burn tobacco product 1 includes a tobacco filler 31A, a container 31 for the tobacco filler, and a filtration medium 32. The cartridge 30 is mounted to the heat-not-burn tobacco product 1. In an embodiment, the cartridge 30 is joined to the atomizing unit 20. Specifically, a portion of the cartridge 30 is accommodated in the outer frame body 24 of the atomizing unit 20 as described above.

[0031] The cartridge 30 has a shape extending in the predetermined direction A. The cartridge 30 has, as an aerosol flow path, a second flow path 30X disposed downstream of the first flow path 20X.

[0032] Therefore, the heat-not-burn tobacco product 1 has aerosol flow paths (20X and 30X) extending in the predetermined direction A. The atomizer 22 is disposed on upstream side of the aerosol flow paths, and the cartridge 30 is disposed on the downstream side of the aerosol flow paths. An aerosol atomized by the atomizer 22 passes through the second flow path 30 of the cartridge 30.

[0033] In Fig. 5, the filtration medium 32 is disposed at both upstream and downstream ends of the container 31, but the present invention is not limited to this configuration. That is, a configuration in which the filtration medium is present at only one of the upstream and downstream ends of the container is also included in the embodiments of the present invention.

[0034] The filtration medium is not particularly limited as long as it has a function of not allowing the tobacco filler to pass therethrough but allowing the atomized aerosol and the flavor component generated from the tobacco filler to pass therethrough. For example, a mesh body having a plurality of apertures or a filter used in a prevalent cigarette can be used. The mesh body and the filter will be described later.

[0035] When the filtration medium is present on the downstream side of the container, a cap may be provided to prevent the filtration medium from falling out of the container. The cap has an opening narrower than the width of the filtration medium in order to prevent falling off of the filtration medium while allowing the atomized aerosol to pass therethrough. As illustrated in Fig. 5 and Fig. 6, in an embodiment, a cap 33 is disposed on the downstream side of the

filtration medium 32 disposed downstream of the container 31.

[0036] In Fig. 6, the shape of a section perpendicular to the predetermined direction of the cartridge 30 is shown as a circle, but this shape need not be a circle and may be a polygon, a rounded polygon, an ellipse, or the like. As described above, the container constituting the cartridge is tubular, and the term "tubular" includes not only cylindrical shapes but also shapes such as polygonal cylinders, rounded polygonal cylinders, and elliptic cylinders. The width of the cartridge is defined as follows: when the shape of the section is a circle, it is a diameter of the circle; when the shape of the section is an ellipse, it is a major axis of the ellipse; and when the shape of the section is a polygon or rounded polygon, it is a diameter of a circumscribed circle of the polygon or rounded polygon or a major axis of a circumscribed ellipse of the polygon or rounded polygon.

[0037] For example, in the configuration illustrated in Fig. 5, the length of the cartridge 30 is indicated by h, and the maximum width of the cartridge 30 is indicated by w.

[0038] The cartridge preferably, but not necessarily, satisfies a shape having an aspect ratio, as defined below, of 1 or greater.

$$\text{Aspect ratio} = h/w$$

[0039] In Fig. 5, w is the maximum width of the cartridge 30, and h is the length of the cartridge 30. When $h \geq w$ is satisfied, the aspect ratio is 1 or greater, which is preferable but not essential, and embodiments where $w > h$ is satisfied are also included in the present invention.

[0040] The length h in the predetermined direction of the cartridge is not particularly limited, and is typically, for example, 5 mm or more, preferably 10 mm or more. The length h is typically 40 mm or less, preferably 30 mm or less, more preferably 25 mm or less.

[0041] The maximum width w of the cartridge is not particularly limited, and is 20 mm or less, preferably 15 mm or less, more preferably 10 mm or less. The minimum value of the width of the cartridge is typically 5 mm or more.

[0042] When the length and the width of the cartridge are in the above ranges, the amount of flavor component delivered to the user can be ensured while maintaining good airflow resistance during use of the heat-not-burn tobacco product according to an embodiment of the present invention.

[0043] The cartridge is detachably mounted to the heat-not-burn tobacco product. The cartridge has an inhalation end. The inhalation end is preferably located at the downstream end of the cartridge. At least a portion of the tobacco filler contained in the cartridge is heated upon contact with an aerosol atomized by the atomizer.

[0044] The heating temperature for atomizing the aerosol source is not particularly limited as long as the aerosol source can be atomized, and may be, for example, 100°C or higher, 150°C or higher, 200°C or higher, or 250°C or higher, and may be, for example, 400°C or lower, 350°C or lower, or 300°C or lower

[0045] The temperature at which the tobacco filler is heated is preferably lower than the boiling point of an acid contained in the tobacco filler described later from the viewpoint of sufficiently suppressing the flavor inhibition and ensuring the amount of flavor component delivered to the user while ensuring the amount of flavor component delivered to the user. The lower limit of the temperature at which the tobacco filler is heated may be, for example, 20°C or higher, 30°C or higher, or 40°C or higher The upper limit of the temperature at which the tobacco filler is heated is not particularly limited as long as it is lower than the boiling point of the acid contained in the tobacco filler, and when a resin is used as the material for the container for accommodating the tobacco filler, the upper limit may be, for example, lower than 120°C, 100°C or lower, or 50°C or lower from the viewpoint of heat resistance of the container and from the viewpoint of maintaining the effect of suppressing the flavor inhibition due to the acid contained in the tobacco filler. These lower limits and upper limits of the temperature at which the tobacco filler is heated can be employed in any combination.

<Acid contained in tobacco filler>

[0046] The tobacco filler contained in the cartridge for the heat-not-burn tobacco product according to an embodiment of the present invention contains an acid having a boiling point of 120°C or higher and 250°C or lower in an amount of 0.25 wt% or more and 5.0 wt% or less relative to the total weight of the tobacco filler taken as 100 wt%.

[0047] If the acid is contained not in the tobacco filler but in, for example, the aerosol source, the heating wire constituting the atomizer comes into direct contact with the acid, which may increase the likelihood that the heating wire corrodes or cause a change in acid due to heat generated by the heating wire to reduce the effect of suppressing the flavor inhibition.

[0048] However, when the tobacco filler contains the acid having a specific boiling point in a specific amount, the above-described problems such as corrosion of the heating wire and reduction of the effect of suppressing the flavor inhibition can be avoided, while the amount of flavor component delivered to the user can be ensured and the flavor inhibition can be suppressed during use of the heat-not-burn tobacco product.

[0049] The flavor inhibition generally means that when a heat-not-burn tobacco product is used, the user receives a

stimulus different from the stimulus peculiar to tobacco or experiences a physiological spontaneous reaction such as "choking". This is probably because a component that inhibits flavor when present in a gas phase is contained, and it is considered that when a heat-not-burn tobacco product is used, the user feels the flavor inhibition when the balance between the amount of such a flavor-inhibiting component in the gas phase and the amount of atomized aerosol is lost.

[0050] One known method of suppressing the flavor inhibition is addition of an acid into the tobacco filler, and the mechanism thereof is considered as follows. Specifically, the flavor-inhibiting component and the acid contained in the tobacco filler are released into a gas phase upon heating and bonded to each other in the gas phase, thus reducing the possibility of bonding to organs of an inhaling user where the user receives the flavor inhibition, that is, organs from the oral cavity to the trachea and further from the trachea to the lung.

[0051] The present inventors considered that in the above mechanism, it is important that when the tobacco filler is heated, a sufficient amount of acid for bonding to the flavor-inhibiting component is released into the gas phase. Thus, among various acids usable as food additives, an acid suitable for suppressing the flavor inhibition during use of the heat-not-burn tobacco product according to an embodiment of the present invention was searched based on its boiling point, and as a result, it was found that an acid having a boiling point of 120°C or higher and 250°C or lower is suitable for suppressing the flavor inhibition.

[0052] When the boiling point of the acid is lower than 120°C, the peculiar smell of the acid itself may affect the flavor, the acid may volatilize during the period of storage of the cartridge, and upon heating of the tobacco filler during use of the heat-not-burn tobacco product according to the present invention, most of the acid volatilizes at the initial stage of the use, so that the effect of suppressing the flavor inhibition cannot be produced throughout the use from the initial stage to the last stage. When the boiling point of the acid is higher than 250°C, it is greatly different from the temperature at which the tobacco filler is heated in the heat-not-burn tobacco product according to the present invention, and the amount of acid released into a gas phase is insufficient, thus making it difficult to suppress the flavor inhibition.

[0053] To produce the effect of suppressing the flavor inhibition throughout the use of the heat-not-burn tobacco product from the initial stage to the last stage even when the temperature at which the tobacco filler is heated is increased, the boiling point of the acid is preferably 150°C or higher, more preferably 175°C or higher, particularly preferably 200°C or higher On the other hand, to ensure a sufficient amount of acid released into a gas phase, the boiling point of the acid is preferably 240°C or lower, preferably 230°C or lower, particularly preferably 220°C or lower.

[0054] The term "boiling point" as used herein means a boiling point under a pressure of 760 mmHg.

[0055] The content of the acid is 0.25 wt% or more and 5.50 wt% or less relative to the total weight of the tobacco filler taken as 100 wt%.

[0056] It is generally considered that an acid added to a tobacco filler binds to a flavor component in the tobacco filler and forms a salt to stabilize. It is also considered that the thus stabilized salt of the acid and the flavor component is less easily released into a gas phase even when heated. Therefore, when the content of the acid relative to the tobacco filler is excessively high, the amount of flavor component delivered to the user tends to be insufficient during use of a heat-not-burn tobacco product.

[0057] When the content of the acid is in the above range, the amount of flavor component delivered to the user can be ensured during use of the heat-not-burn tobacco product according to an embodiment of the present invention. However, when the content of the acid is less than 0.25 wt%, the flavor inhibition cannot be sufficiently suppressed. When the content of the acid is more than 5.50 wt%, the amount of flavor component delivered to the user cannot be sufficiently ensured. In addition, when the content of the acid is more than 5.00 wt%, handling at the time of adding the acid is difficult.

[0058] The content of the acid relative to the total weight of the tobacco filler taken as 100 wt% is preferably 0.50 wt% or more, more preferably 0.75 wt% or more, from the viewpoint of sufficiently producing the effect of the flavor inhibition, and is preferably 4.00 wt% or less from the viewpoint of sufficiently ensuring the amount of flavor component delivered to the user. The content of the acid is more preferably 3.00 wt% or less from the viewpoint of providing a better flavor.

[0059] The acid preferably has an acid dissociation constant pK_a of 3.0 or more and 6.0 or less, more preferably 3.5 or more and 5.0 or less.

[0060] In general, smaller values of the acid dissociation constant pK_a indicate stronger acids.

[0061] When the acid dissociation constant pK_a of the acid is in the above range, the acid is not so strong, and thus is easy to handle and exhibits high production suitability when added to the tobacco filler. When a relatively strong acid having an acid dissociation constant pKa of less than 3.0 is added to the tobacco filler, the acid may strongly bind to the flavor component, thus leading to a reduction in the amount of flavor released into a gas phase upon heating.

[0062] The acid dissociation constant pK_a of an acid in this DESCRIPTION is a primary acid dissociation constant measured in water at 25°C, and, for example, values shown in Table 1 of International Publication No. 2017/203686 can be used.

[0063] The acid may be any acid that satisfies the physical property values described above, and, for example, the following acids can be used.

[0064] Inorganic acids such as phosphoric acid; organic acids such as lactic acid, benzoic acid, levulinic acid, pyruvic

acid, and linolenic acid.

[0065] Of these, organic acids are preferred, and lactic acid and benzoic acid are more preferred.

[0066] Lactic acid exists as two enantiomers: L-lactic acid and D-lactic acid. One of them may be used, both of them may be used in combination, or racemic (DL) lactic acid may be used.

[0067] The above acids may be used alone or in combination of two or more.

[0068] The cartridge for the heat-not-burn tobacco product includes the tobacco filler. The tobacco filler contains a flavor component. The content of the flavor component is not particularly limited, but to help confirm the effect of suppressing the flavor inhibition, the content of the flavor component is 1.0 wt% or more and 10.0 wt% or less, preferably 1.5 wt% or more and 8.0 wt% or less, more preferably 2.0 wt% or more and 6.5 wt% or less, relative to the total weight of the tobacco filler taken as 100 wt%.

[0069] Examples of the flavor component include nicotine, and the nicotine contained in the tobacco filler can be quantified by a method according to the German Institute for Standardization DIN 10373.

[0070] The tobacco filler contains the acid. The tobacco filler may contain the acid in the following manner. For example, the acid may be uniformly distributed in the entire tobacco filler, or the acid may be locally present in a part of the tobacco filler.

[0071] As used herein, the term "tobacco filler" refers to aged tobacco leaves (hereinafter "processed tobacco leaves") prepared in various forms for use in the heat-not-burn tobacco product and packed in an object to be filled in a predetermined manner Here, the term "aged tobacco leaves" refers to tobacco leaves that have undergone aging and yet to be processed into various forms for use in the heat-not-burn tobacco product. The term "object to be filled" refers to a container described later.

[0072] Hereinafter, how harvested tobacco leaves are processed into various forms for use in the heat-not-burn tobacco product will be described in detail, but the tobacco filler of the present invention is not limited to this description.

<Tobacco varieties>

[0073] Various varieties of tobaccos can be used in the heat-not-burn tobacco product. Examples include flue-cured tobacco, burley tobacco, oriental tobacco, domestic tobacco, nicotiana-tabacum tobacco, and nicotiana-rustica tobacco. These varieties can be used alone or may be blended during the process from the harvesting of tobacco leaves to the processing of aged tobacco leaves into various forms (i.e., processed tobacco leaves) for use in the heat-not-burn tobacco product in order to achieve the desired flavor.

[0074] Details of the tobacco varieties are disclosed in "Tabako-no-Jiten (Encyclopedia of Tobacco) by Tobacco Academic Studies Center, March 31, 2009".

[0075] In general, the term "blend" means a mixture of tobaccos belonging to the same variety or different varieties, but in this DESCRIPTION, combination of different aged tobacco leaves or different processed tobacco leaves is sometimes referred to as "blend". In particular, blending of tobaccos belonging to the same variety but having different grades is sometimes referred to as "cross-blending".

[0076] For each tobacco variety, tobacco leaves are graded according to characteristics such as origin, location in the plant, color, surface condition, size, and shape. Tobacco leaves are believed to contain more than 300 chemical components, and tobaccos of different varieties have different chemical properties. Tobaccos belonging to the same variety but having different grades may have different chemical properties.

[0077] Thus, the above blending or cross-blending may be performed to obtain processed tobacco leaves having desired characteristics and desired chemical properties.

<Processing of tobacco leaves>

[0078] Examples of treatments to which the harvested tobacco leaves are subjected at an early stage include curing, treatment in a raw material plant, and aging.

[0079] Tobacco leaves are generally subjected to a treatment called curing at an early stage after being harvested. Curing usually includes drying, moisture conditioning, and other steps and also includes activation of various enzymes contained in the tobacco leaves.

[0080] The tobacco leaves subjected to curing are packed in a case, stored in a warehouse for a certain period of time, and then transported to a raw material plant.

[0081] To obtain tobacco leaves with a low content of benzo[a]pyrene and low-molecular-weight carboxylic acid and a high content of a specific flavor component, the harvested tobacco leaves may be subjected to a treatment described in International Publication No. 2018/139068 instead of the above-described curing.

[0082] The tobacco leaves transported to the raw material plant are unpacked and then usually subjected to treatments such as moisture conditioning, stripping, and separation to become laminae, midribs, and others. After this, the redried laminae, midribs, and others are cased and stored in a warehouse for a long period of time. This process of long-term

storage in a warehouse is also referred to as aging. The period of aging, which varies depending on the variety of the tobacco used, the target flavor of the heat-not-burn tobacco product, and the temperature during aging, is typically one year or more and two years or less. As defined above, tobacco leaves that have undergone aging are referred to as aged tobacco leaves.

[0083] The treatment in which tobacco leaves are processed into laminae, midribs, and others and then cased and aged may be referred to as post-stripping aging. On the other hand, a treatment in which the tobacco leaves transported to the raw material plant are cased and aged without performing stripping or separation, and stripping and separation are performed after the aging may be referred to as post-aging stripping.

<Processed tobacco leaves>

[0084] The aged tobacco leaves are processed into various forms for use in the heat-not-burn tobacco product to become processed tobacco leaves. Examples of the processed tobacco leaves include " shredded tobacco" obtained by shredding the aged tobacco leaves to a predetermined size. Examples also include "tobacco granules" and "tobacco sheet" obtained by forming a composition containing the aged tobacco leaves crushed to a predetermined particle size (hereinafter also referred to as "fine tobacco powder") into a specific shape. The "fine tobacco powder" is also one form of the processed tobacco leaves.

[0085] The processed tobacco leaves need not be in the form of "fine tobacco powder", "tobacco granules", "shredded tobacco", or "tobacco sheet" and may be in various forms obtained by processing the aged tobacco leaves. Hereinafter, "tobacco granules", "shredded tobacco", and "tobacco sheet" will be described in detail.

<Tobacco granules>

[0086] Tobacco granules are obtained by forming a composition containing the aged tobacco leaves and others into a granular shape.

[0087] The material for the tobacco granules is not particularly limited, and examples thereof include (a) fine tobacco powder, (b) moisture, (c) at least one flavor enhancer selected from the group consisting of potassium carbonate and sodium hydrogen carbonate, and (d) at least one binder selected from the group consisting of pullulan, hydroxypropylcellulose (HPC), guar gum, xanthan gum, CMC (carboxymethylcellulose), and CMC-Na (sodium salt of carboxymethylcellulose).

[0088] The tobacco granules contain fine tobacco powder (component (a)). The average particle size of the fine tobacco powder used for the tobacco granules is preferably, but not necessarily, 20 μm or more and 300 μm or less. The material mixture for the tobacco granules contains the fine tobacco powder typically in an amount of 20 wt% or more and 80 wt% or less.

[0089] The tobacco granules contain moisture (component (b)). The moisture is for maintaining the integrity of the tobacco granules.

[0090] The material mixture for the tobacco granules contains the moisture typically in an amount of 3 wt% or more and 13 wt% or less.

[0091] The tobacco granules may contain the moisture typically in such an amount that the weight loss on drying will be 5 wt% or more and 17 wt% or less.

[0092] The weight loss on drying refers to a weight change before and after drying of a sample, the drying being performed in a manner that a portion of the sample is collected for measurement, and the sample is completely dried (e.g., dried at a constant temperature (105°C) for 15 minutes) by evaporating all the moisture in the collected sample. Specifically, it refers to the proportion (wt%) of the sum of the amount of moisture contained in a sample and the amount of volatile component volatilized under the above drying conditions to the weight of the sample. That is, the weight loss on drying (wt%) can be expressed by the following equation.

$$\text{Weight loss on drying (wt\%)} = \{(\text{weight of sample before complete drying}) - (\text{weight of sample after complete drying})\}$$

$$\times 100/\text{weight of sample before complete drying}$$

[0093] The tobacco granules contain a flavor enhancer (component (c)). The flavor enhancer adjusts the pH of the tobacco granules to the alkaline side to facilitate the release of the flavor component from the tobacco granules, thus providing a flavor that may be satisfactory to the user. The flavor enhancer is not particularly limited as long as it can adjust the pH of the tobacco granules to the alkaline side, and examples include potassium carbonate, sodium carbonate, sodium hydrogen carbonate, and mixtures thereof. In the present invention, the tobacco filler contains the above-de-

scribed acid. The pH of the tobacco granules before addition of the acid is typically 8.5 or more and 11.0 or less, and is preferably 9.0 or more and 10.0 or less to provide a good flavor.

[0094] The material mixture for the tobacco granules may contain the flavor enhancer typically in an amount of 5 wt% or more and 20 wt% or less.

[0095] The tobacco granules contain a binder (component (d)). The binder binds together the tobacco granule components to maintain the integrity of the tobacco granules. The binder is composed of pullulan, HPC, guar gum, xanthan gum, CMC, CMC-Na, or a mixture thereof, but is not limited thereto.

[0096] The material mixture for the tobacco granules may contain the binder typically in an amount of 0.5 wt% or more and 15 wt% or less.

[0097] The tobacco granules may contain additional components in addition to the components (a), (b), (c), and (d). Examples of the additional components include a volatile flavor (component (e)). The volatile flavor is solid or liquid and can exhibit a flavor feeling even upon heating at 100°C or lower. Any flavor having such characteristics can be used. The "flavor feeling" means that when the heat-not-burn tobacco is used, a flavor derived from the flavor used can be felt.

[0098] Examples of components of the volatile flavor include 1-menthol, natural vegetable flavors (e.g., cognac oil, orange oil, jasmine oil, spearmint oil, peppermint oil, anise oil, coriander oil, lemon oil, chamomile oil, labdanum, vetiver oil, rose oil, and lovage oil), esters (e.g., menthyl acetate, isoamyl acetate, linalyl acetate, isoamyl propionate, butyl butyrate, and methyl salicylate), ketones (e.g., menthone, ionone, and ethyl maltol), alcohols (e.g., phenylethyl alcohol, anethole, cis-6-nonen-1-ol, and eucalyptol), aldehydes (e.g., benzaldehyde), and lactones (e.g., ω-pentadecalactone), among which 1-menthol, anethole, menthyl acetate, eucalyptol, ω-pentadecalactone, and cis-6-nonen-1-ol are preferably used. These flavors may be used alone or in combination of two or more.

[0099] The volatile flavor contained in the tobacco granules may be used in solid form, or may be used in the form of a solution or dispersion in an appropriate solvent such as propylene glycol, ethyl alcohol, benzyl alcohol, water, or glycerol. Preferably, a flavor that readily forms a dispersed state in a solvent upon addition of an emulsifier, such as a hydrophobic flavor or an oil-soluble flavor, can be used. These flavors may be used alone or as a mixture.

[0100] The material mixture for the tobacco granules may contain the volatile flavor (component (e)) typically in an amount of 0.5 wt% or more and 30 wt% or less. The component (e) may be added by direct kneading with the components (a), (b), (c), and (d), or may be added to these components in such a manner that component (e) is accommodated into a known inclusion host compound such as cyclodextrin to prepare an inclusion compound, which is then kneaded with the components.

[0101] The volatile flavor content of the tobacco granules obtained from the above raw material mixture is not particularly limited, and to impart a good flavor feeling, the volatile flavor content is typically 100 ppm or more, preferably 1000 ppm or more, more preferably 5000 ppm or more, and typically 10000 ppm or less, preferably 25000 ppm or less, more preferably 40000 ppm or less.

[0102] The tobacco granules may be formed by any method, and is obtained by, for example, mixing the components (a), (b), (c), and (d) and optionally the component (e), kneading them, granulating the resulting kneaded product with a wet extrusion granulator (into a long pillar shape), and then sizing the granules into a short pillar shape or a spherical shape.

[0103] The average particle size (D50) of the formed tobacco granules is typically 0.2 mm or more and 1.2 mm or less, preferably 0.2 mm or more and 1.0 mm or less, more preferably 0.2 mm or more and 0.8 mm or less.

[0104] In the extrusion granulation, the kneaded product is preferably extruded at a pressure of 2 kN or more at an ambient temperature. As a result of the extrusion at high pressure, the temperature of the kneaded product at the outlet of the extrusion granulator rises rapidly in an instantaneous manner from the ambient temperature to, for example, 90°C or higher and 100°C or lower, and moisture and volatile components evaporate by 2 wt% or more and 4 wt% or less. Therefore, the water added to make the kneaded product can be used in an amount larger than the desired amount of moisture in the resulting tobacco granules by the amount of evaporation.

<Shredded tobacco>

[0105] Shredded tobacco are obtained by shredding aged tobacco leaves or the like to a predetermined size. The aged tobacco leaves used for the shredded tobacco may be, but not necessarily, obtained through stripping and separation into laminae and midribs. The shredded tobacco may also be obtained by shredding a tobacco sheet described later to a predetermined size (hereinafter also referred to as "shredded tobacco sheet"). In addition, a blend of shredded tobacco sheet and shredded tobacco obtained by shredding aged tobacco leaves may be used as the shredded tobacco.

[0106] The shredded tobacco may have any size and may be formed by any method. For example, the aged tobacco leaves or tobacco sheet may be shredded to a width of 0.5 mm or more and 2.0 mm or less and a length of 3 mm or more and 10 mm or less. Shredded tobacco having such a size are preferred from the viewpoint of packing into a container described later.

[0107] Alternatively, the aged tobacco leaves or tobacco sheet may be shredded to a width of 0.5 mm or more and 2.0 mm or less and a length similar to that of a container, for example, 10 mm or more and 40 mm or less (hereinafter

also referred to as "strand-type shreds"). From the viewpoint of ease of formation, the strand-type shreds are preferably formed from a tobacco sheet.

[0108] The moisture content of the shredded tobacco is not particularly limited. For example, the moisture content is typically 10 wt% or more and 15 wt% or less, preferably 11 wt% or more and 13 wt% or less, relative to the total weight of the shredded tobacco. Such a moisture content does not result in a great moisture change during and after production, thus requiring less process control during production and causing less quality deterioration after production.

[0109] The shredded tobacco may contain a flavor.

[0110] The type of the flavor is not particularly limited, and those listed above for the tobacco granules can be used.

[0111] The content of the flavor in the shredded tobacco is not particularly limited, and to impart a good flavor feeling, the content of the flavor is typically 10000 ppm or more, preferably 20000 ppm or more, more preferably 25000 ppm or more, and typically 70000 ppm or less, preferably 50000 ppm or less, more preferably 40000 ppm or less, still more preferably 30000 ppm or less.

<Tobacco sheet>

[0112] A tobacco sheet is obtained by forming a composition containing aged tobacco leaves and the like into a sheet shape. The aged tobacco leaves used for the tobacco sheet may be, but not necessarily, obtained through stripping and separation into laminae and midribs. As used herein, the term "sheet" refers to a shape having a pair of substantially parallel principal surfaces and a pair of substantially parallel side surfaces.

[0113] The tobacco sheet can be formed by a known method such as a papermaking method, a casting method, or a rolling method.

[0114] Examples of the method of forming the tobacco sheet by a papermaking method include a method including the following steps.

(1) A step of coarsely crushing aged tobacco leaves, mixing the crushed aged tobacco leaves with a solvent such as water, and stirring the mixture to extract a water-soluble component from the aged tobacco leaves.
(2) A step of separating the water-soluble component into a water extract and a residue.
(3) A step of concentrating the water extract by drying under reduced pressure.
(4) A step of adding pulp to the residue and tiberizing the resulting product with a refiner to obtain a mixture (homogenization step).
(5) A step of forming the fiberized mixture of the residue and pulp into a sheet.
(6) A step of adding the concentrated water extract to the formed sheet and performing drying to form a tobacco sheet.

[0115] When the tobacco sheet is formed by this method, a step of removing some components such as nitrosamines may be performed (see Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 2004-510422).

[0116] Examples of the method of forming the tobacco sheet by a casting method include a method including the following steps.

(1) A step of mixing water, pulp, and a binder with crushed aged tobacco leaves to obtain a mixture (homogenization step).
(2) A step of thinly spreading (casting) and drying the mixture to form a tobacco sheet.

[0117] When the tobacco sheet is formed by this method, a step of removing some components such as nitrosamines by irradiating a slurry obtained by mixing water, pulp, and a binder with crushed tobacco leaves with ultraviolet rays or X-rays may be performed.

[0118] Examples of the method of forming the tobacco sheet by a rolling method include a method including the following steps.

(1) A step of mixing water, pulp, and a binder with crushed aged tobacco to obtain a mixture (homogenization step).
(2) A step of rolling the mixture with a plurality of reduction rollers.
(3) A step of peeling the rolled product on one of the reduction rollers with a doctor knife, transferring the rolled product to a net conveyor, and drying the rolled product with a dryer.

[0119] When the tobacco sheet is formed by this method, the surface of the reduction rollers may be heated or cooled, or the number of rotations of the reduction rollers may be adjusted, depending on the purpose. By adjusting the interval between the reduction rollers, a tobacco sheet having a desired basis weight can be obtained.

[0120] In addition to the above forming methods, a method including the following steps, as described in International

Publication No. 2014/104078, can be used to form a nonwoven tobacco sheet.

(1) A step of mixing fine tobacco powder and a binder to obtain a mixture (homogenization step).
(2) A step of sandwiching the mixture between nonwoven fabrics.
(3) A step of forming the stack into a certain shape by heat welding to obtain a nonwoven tobacco sheet.

[0121] In each of the homogenization steps described in the above methods, preferably, the average fiber length of tobacco fibers contained in the mixture is 200 μm or more and 1000 μm or less, and the freeness of the mixture is 20°SR or more and 50°SR or less, from the viewpoint of obtaining a tobacco sheet having a certain level of strength. The average fiber length of tobacco fibers is determined by automated optical analysis (JIS P 8226-2) using unpolarized light at a fiber count of 20000 or more. The freeness is determined by the Schopper-Riegler method (JIS P 8121).

[0122] The length and width of the tobacco sheet are not particularly limited and can be appropriately adjusted according to how the tobacco sheet is packed into an object to be filled described later.

[0123] The thickness of the tobacco sheet is not particularly limited, and is preferably 150 μm or more and 1000 μm or less, more preferably 200 μm or more and 600 μm or less, in view of the balance between heat transfer efficiency and strength.

[0124] The composition of the tobacco sheet is not particularly limited, and, for example, the content of the fine tobacco powder is preferably 50 to 95 wt% relative to the total weight of the tobacco sheet. The tobacco sheet may contain a binder, and examples of the binder include pullulan, HPC, guar gum, xanthan gum, CMC, and CMC-Na. The amount of binder is preferably 1 to 10 wt% relative to the total weight of the tobacco sheet.

[0125] The tobacco sheet may further contain other additives. Examples of the additives include a filler such as pulp. The content of the filler is not particularly limited and is preferably 1 wt% or more and 10 wt% or less relative to the total weight of the tobacco sheet.

[0126] The tobacco sheet may contain a flavor. As the flavor, those listed above for the tobacco granules can be used.

[0127] The content of the flavor in the tobacco sheet is not particularly limited, and to impart a good flavor feeling, the content of the flavor is typically 10000 ppm or more, preferably 20000 ppm or more, more preferably 25000 ppm or more, and typically 70000 ppm or less, preferably 50000 ppm or less, more preferably 40000 ppm or less, still more preferably 30000 ppm or less.

<Tobacco filler>

[0128] The tobacco filler refers to processed tobacco leaves, that is, tobacco granules, shredded tobacco, or a tobacco sheet described above, packed in an object to be filled ("container" in the present invention) in a predetermined manner.

[0129] The tobacco filler is accommodated in a container described later to form the cartridge. The tobacco filler constituting the cartridge preferably has a height of about 5 mm to about 40 mm and a width of about 5 mm to 20 mm.

[0130] The filling ratio of the tobacco filler in the cartridge may be appropriately set according to, for example, the form of processed tobacco leaves to be packed, the target flavor, and airflow resistance.

[0131] In an embodiment of the present invention, the filling ratio of the tobacco filler in the cartridge is typically 40 vol% or more, preferably 50 vol% or more, more preferably 60 vol% or more. The filling ratio is typically 80 vol% or less, preferably 70 vol% or less. When the filling ratio is less than 40 vol%, it is difficult to ensure a sufficient amount of flavor component. By contrast, when the filling ratio is more than 80 vol%, the pressure effect at the time of inhalation increases to make it difficult to inhale, and the production efficiency decreases. The filling ratio is calculated as the ratio of the volume of the tobacco filler to the total volume of a part of the container that accommodates the tobacco filler.

[0132] The content of the tobacco filler per cartridge is not particularly limited. For example, in the case of a container having a volume of 1.106 cm^3, the content of the tobacco filler may be 200 mg/cartridge or more and 800 mg/cartridge or less, and is preferably, for example, 250 mg/cartridge or more and 600 mg/cartridge or less.

[0133] The manner in which the processed tobacco leaves are packed in the container varies depending on the form of the processed tobacco leaves. Hereinafter, tobacco granules packed in the container will be described in detail as a "tobacco filler (A)", shredded tobacco packed in the container as a "tobacco filler (B)", and a tobacco sheet packed in the container as a "tobacco filler (C)".

<Tobacco filler (A)>

[0134] The tobacco filler (A) is composed of tobacco granules packed or disposed in the container.

[0135] The tobacco granules may be immovably packed or movably disposed in the cartridge.

[0136] The phrase "immovably packed" means that the tobacco granules are densely packed in the container so as not to move even if the cartridge is moved up, down, left, or right. The phrase "movably disposed" means that the tobacco granules moves in the container when the cartridge is moved up, down, left, or right. Therefore, when the tobacco

granules are movably disposed, the tobacco filler (A) has fluidity.

<Tobacco filler (B)>

[0137] The tobacco filler (B) is composed of shredded tobacco packed in the container.

[0138] The manner in which the tobacco filler (B) is packed in the container is not particularly limited, and shredded tobacco other than strand-type shreds are typically packed in the container in random directions. The strand-type shreds are packed such that the longitudinal direction thereof is substantially parallel to the longitudinal direction of the container.

<Tobacco filler (C)>

[0139] The tobacco filler (C) is composed of a tobacco sheet packed in the container. The number of tobacco sheets may be one, or two or more.

[0140] When the tobacco filler (C) is composed of a single tobacco sheet, for example, a tobacco sheet having a side whose length is similar to the longitudinal length of the container may be packed while being folded multiple times in parallel with the longitudinal direction of the container (what is called a gathered sheet). Alternatively, the tobacco sheet having a side whose length is similar to the longitudinal length of the container may also be packed while being wound in a direction perpendicular to the longitudinal direction of the container.

[0141] When the tobacco filler (C) is composed of two or more tobacco sheets, for example, a plurality of tobacco sheets each having a side whose length is similar to the longitudinal length of the container may be packed while being wound in a direction perpendicular to the longitudinal direction of the container so as to be concentrically disposed.

[0142] The phrase "concentrically disposed" means being disposed such that the centers of all the tobacco sheets are located at substantially the same position. The number of tobacco sheets is not particularly limited and may be, for example, two, three, four, five, six, or seven.

[0143] The tobacco filler (C) can be produced by providing a plurality of tobacco sheets having different widths, preparing a stack whose width is reduced from the bottom to the top, and winding the stack by inserting it into a winding tube. According to this production method, the plurality of tobacco sheets extend in the long axis direction of the cartridge and are concentrically disposed around the longitudinal axis.

[0144] In the above-described method of producing the tobacco filler (C), the stack is preferably prepared such that a non-contact portion is formed between adjacent ones of the tobacco sheets after winding. If there is a non-contact portion (gap) between the plurality of tobacco sheets, where the tobacco sheets are not in contact with each other, a flavor passage can be secured to increase the delivery efficiency of a flavor component. At the same time, since heat from the heater can be transferred to outer tobacco sheets through a contact portion between the plurality of tobacco sheets, high heat transfer efficiency can be ensured.

[0145] To provide a non-contact portion between the plurality of tobacco sheets, where the tobacco sheets are not in contact with each other, the stack can be prepared by, for example, using embossed tobacco sheets, performing stacking without bonding together the entire surfaces of adjacent tobacco sheets, performing stacking with adjacent tobacco sheets partially bonded together, or performing stacking with adjacent tobacco sheets entirely or partially bonded together in a light manner such that they are separated after being wound.

[0146] From the viewpoint of stable delivery of the flavor component, the tobacco filler is preferably composed of tobacco granules (i.e., the "tobacco filler (A)").

[0147] The tobacco fillers (A) to (C) described above may optionally contain an aerosol-source material as an aerosol source. The type of the aerosol-source material is not particularly limited, and extracts from various natural products and/or components thereof can be selected depending on the intended use. Examples of the aerosol-source material include glycerol, propylene glycol, triacetin, 1,3-butanediol, and mixtures thereof, but are not limited to.

[0148] When each tobacco filler contains the aerosol-source material, the content thereof is, for example, 15 wt% or less relative to 100 wt% of the tobacco filler. In another embodiment, it is 10 wt% or less, and in still another embodiment, it is 8 wt% or less. As described above, the tobacco filler may contain no aerosol-source material (0 wt%).

[0149] The timing of addition of the acid to the tobacco fillers (A) to (C) described above is not particularly limited. The acid may be added when processed tobacco leaves (i.e., tobacco granules, shredded tobacco, or a tobacco sheet) are formed or may be added when or after the processed tobacco leaves are packed in the container.

[0150] The method of adding the acid to the tobacco fillers described above is also not particularly limited.

[0151] For example, the acid may be added in such a manner that a syringe needle is inserted into a central portion of the tobacco filler packed in the container through an opening of the container, and a solution containing the acid is jetted into the tobacco filler. According to this addition method, the acid can be uniformly distributed over the entire tobacco filler because the solution containing the acid permeates the entire tobacco filler.

[0152] Alternatively, a solution of the acid may be applied to the surface of processed tobacco leaves formed into a pillar shape before being packed in the container. According to this addition method, the surface of the tobacco filler can

contain the acid in a large amount.

[0153] Alternatively, for example, the acid may be added in such a manner that aged tobacco leaves or processed tobacco leaves are supplied to a flavoring machine equipped with a rotor, and a solution of the acid is sprayed under rotational stirring to mix with the tobacco leaves. According to this addition method, the acid can be uniformly added to the entire tobacco filler.

[0154] In the above addition methods, not only water but also ethanol, propylene glycol, or the like can be used as a solvent for the acid, but propylene glycol is preferably used because of its high affinity for the acid.

<Container>

[0155] The container for accommodating the tobacco filler is tubular and forms an aerosol flow path extending in a predetermined direction. As illustrated in Fig. 7, the container 31 for accommodating the tobacco filler 31A forms the second flow path 30X extending in the predetermined direction A. The tobacco filler 31A that imparts a flavor to an aerosol is accommodated in the second flow path 30X. Here, in a section perpendicular to the aerosol flow path (the predetermined direction A), the size of the first flow path 20X is preferably small in order to secure the volume of the reservoir 21 for storing the aerosol source 21A. Accordingly, in the case where the cartridge 30 is accommodated in the outer frame body 24 having a constant sectional area through the aerosol flow path (the predetermined direction A), the size of the second flow path 30X consequently tends to be larger than the size of the first flow path 20X described above.

[0156] In Fig. 8, the section of the container 31 perpendicular to the predetermined direction A is shown as a circle, but this shape need not be a circle. The shape of the section of the container perpendicular to the predetermined direction may be a polygon, a rounded polygon, a circle, an ellipse, or the like. That is, the term tubular includes not only cylindrical shapes but also shapes such as elliptic cylinders, polygonal cylinders, and rounded polygonal cylinders.

[0157] In an embodiment, the container 31 preferably has a protrusion 31E that protrudes from the outer edge of the upstream end (here, the filtration medium 32) of the container 31 in the section perpendicular to the aerosol flow path (the predetermined direction A) toward the upstream side (in the embodiment, the flow path forming body 23 side or the end cap 25 side), as illustrated in Fig. 6 and Fig. 7. The protrusion 31E may be provided continuously along the outer edge of the upstream end (here, a mesh body 32) of the container 31 or may be provided intermittently along the outer edge of the container 31. When there is a clearance between the outer frame body 24 and the container 31, the protrusion 31E is preferably provided continuously along the outer edge of the upstream end (here, the mesh body 32) of the container 31. This configuration can suppress an aerosol from staying in the space formed upstream of a tapered portion 31T.

[0158] In an embodiment, the outer wall surface of the container 31 preferably includes the tapered portion 31T that flares from upstream to downstream, as illustrated in Fig. 6 and Fig. 7. The tapered portion 31T is only required to be included in a part of the outer wall surface of the container 31. The taper angle α of the tapered portion 31T is, for example, about five degrees.

[0159] In an embodiment, the inner wall surface of the container 31 is preferably provided with a rib 31R extending in the predetermined direction A from upstream to downstream, as illustrated in Fig. 7. The number of the ribs 31R is preferably, but not necessarily, two or more. The downstream end of the rib 31R preferably does not reach the downstream end of the container 31. For example, in the predetermined direction A, a length L2 from the filtration medium 32 to the downstream end of the rib 31R is shorter than a length L1 from the filtration medium 32 to the downstream end of the container 31. In other words, in a state where the filtration medium 32 is inserted in the container 31, the downstream end of the rib 31R is preferably in contact with the filtration medium 32 without reaching the downstream end of the container 31.

[0160] The filtration medium 32 may be disposed only upstream (on the non-inhalation side) or only downstream (on the inhalation side) of the tobacco filler 31A in the container 31, or both. The configuration in which the filtration medium 31 is disposed both upstream and downstream of the tobacco filler 31A has an advantage in that even if the tobacco filler 31A having fluidity is used, the tobacco filler 31A will not fall out of the cartridge. When the tobacco filler 31A has no fluidity, the tobacco filler can be kept in the cartridge by disposing the filtration medium 32 either upstream or downstream of the tobacco filler 31A.

[0161] As described above, a mesh body having a plurality of apertures or a filter as used in a prevalent cigarette can be used as the filtration medium 32.

[0162] When a mesh body having a plurality of apertures is used as the filtration medium 32, the mesh body is preferably disposed upstream (on the non-inhalation side) of the tobacco filler 31A. In an embodiment, the mesh body is disposed at the upstream end of the container 31. When the mesh body is provided in the container 31 that is very small, the container 31 and the mesh body are preferably formed by integral molding from the viewpoint of ensuring the strength of the mesh body. That is, in an embodiment, the mesh body is a part of the container 31. In such an embodiment, the container 31 and the mesh body are preferably made of a resin or a metal. As the resin, for example, one or more resins selected from polypropylene, polyethylene terephthalate, polyethylene resins, and ABS resins can be used. As the metal,

stainless steel can be used from the viewpoint of corrosion resistance. From the viewpoint of moldability and texture, it is preferable to use a resin, and it is preferable to use polypropylene as the resin. When made of a resin, the container 31 and the mesh body are formed by metal molding or injection molding. When made of a metal, the container 31 and the mesh body are formed of stainless steel (SUS).

[0163] In an embodiment, the mesh body has a plurality of apertures 32A as illustrated in Fig. 8. Each of the plurality of apertures 32A is not particularly limited as long as it has a size that does not allow the tobacco filler 31A to pass therethrough, and may have, for example, a polygonal shape with an interior angle of 180° or less. When having such a shape, each of the plurality of apertures 32A has a minimum width Wmin that is the smallest width and a maximum width Wmax that is the largest width, each width passing through the centroid of each of the plurality of apertures 32A. The minimum width Wmin is smaller than the lower limit of the size of raw material pieces constituting the tobacco filler 31A. Specifically, since the raw material pieces constituting the tobacco filler 31A are actually non-spherical, the minimum width Wmin is preferably smaller than 1/2 of the lower limit of the size of raw material pieces constituting the tobacco filler 31A from the viewpoint of suppressing falling off of the raw material pieces. The maximum width Wmax is larger than the minimum width Wmin. For example, the maximum width Wmax is preferably larger than the lower limit of the size of the raw material pieces. Alternatively, the maximum width Wmax is preferably not less than $\sqrt{2}$ times and not more than 6 times the minimum width Wmin. That is, each of the plurality of apertures 32A has a shape different from a circle. Furthermore, each of the plurality of apertures 32A preferably has a quadrangular shape because the raw material pieces are less likely to be caught in the apertures 32A. Each side of the quadrangular shape of the apertures 32A may include a non-linear portion that occurs through the formation of the apertures 32A. Each apex of the quadrangular shape of the apertures 32A may include a curved portion that occurs through the formation of the apertures 32A.

[0164] Here, each of the plurality of apertures 32A preferably has a shape selected from a square, a rectangle, a rhombus, a hexagon, and an octagon, as illustrated in Fig. 9 to Fig. 12. The shape of each of the plurality of apertures 32A may be of one type as illustrated in Fig. 9 to Fig. 11, or may be of two types as illustrated in Fig. 12. The shape of each of the plurality of apertures 32A may be of three or more types. From the viewpoint of, for example, the arrangement efficiency and the ease of formation of the plurality of apertures 32A, each of the plurality of apertures 32A preferably has a quadrangular shape.

[0165] In the examples illustrated in Fig. 9 to Fig. 12, the plurality of apertures 32A are preferably disposed such that the sides of apertures 32A adjacent to each other are parallel with each other. The interval P between the apertures 32A adjacent to each other is preferably 0.15 mm or more and 0.30 mm or less. In this case, the thickness of the mesh body is preferably 0.1 mm or more and 1 mm or less.

[0166] In an embodiment, all the apertures of the mesh body are preferably the apertures 32A described above, but this embodiment is not intended to be restrictive. The apertures of the mesh body may include an aperture other than the apertures 32A described above.

[0167] When a filter is used as the filtration medium 32, the filter is preferably coarse enough to prevent passage of the tobacco filler and disposed downstream (on the inhalation side) of the tobacco filler. In this case, the cap is provided downstream (on the inhalation side) of the filter.

[0168] The filter is composed of predetermined fibers and may be, for example, an acetate filter obtained by processing cellulose acetate tow into a cylindrical shape. The single yarn fineness and the total fineness of the cellulose acetate tow are not particularly limited, and in the case of an acetate filter having a circumference of 24.5 mm, the single yarn fineness is preferably 5 g/9000 m or more and 20 g/9000 m or less, and the total fineness is preferably 12000 g/9000 m or more and 35000 g/9000 m or less. The fibers of the cellulose acetate tow may have a Y-shaped cross-section or an R-shaped cross-section. In the case of a filter filled with cellulose acetate tow, triacetin may be added in an amount of 5 wt% or more and 10 wt% or less relative to the weight of the cellulose acetate tow in order to improve filter hardness. The processing of cellulose acetate tow into a cylindrical shape may be performed by winding up the cellulose acetate tow with filter plug wrapping paper. The physical properties of the filter plug wrapping paper are not particularly limited, and, for example, highly air-permeable paper having an air permeability of 1000 C.U. or more may be used. Examples of such highly air-permeable paper include, but are not limited to, LPWS-OLL (air permeability: 1300 C.U., basis weight: 26.5 gsm, thickness: 48 μm) manufactured by NIPPON PAPER PAPYLIA CO., LTD.

[0169] In addition to the acetate filter as described above, a filter filled with a sheet of paper or nonwoven fabric composed mainly of pulp, that is, what is called a paper filter, may also be used.

[0170] In the production of the filter, adjustment of airflow resistance and addition of additives (e.g., known absorbents, flavors, and flavor retention materials) can be appropriately designed.

[0171] In each of the embodiments described above, the container 31 (including the mesh body, here), the filter, and the cap 33 are preferably bonded or welded to each other.

[0172] In another embodiment, the tobacco filler and the filtration medium can be wrapped with wrapping paper to provide a cartridge. That is, in this embodiment, the container in each of the embodiments described above is made of wrapping paper.

[0173] The configuration of the wrapping paper is not particularly limited and may be a commonly used configuration.

[0174] The wrapping paper may be composed mainly of pulp. The pulp may be made of wood pulp such as softwood pulp or hardwood pulp, or may be pulp produced by mixing non-wood pulp commonly used for wrapping paper for tobacco articles, such as flax pulp, hemp pulp, sisal pulp, and esparto.

[0175] Examples of types of pulp that can be used include chemical pulp, ground pulp, chemiground pulp, and thermomechanical pulp produced by kraft cooking, acidic·neutral·alkaline sulfite cooking, soda chlorine cooking, or the like.

[0176] Using the above-described pulp, the texture is arranged to be uniform in a papermaking process using a Fourdrinier paper machine, a cylinder paper machine, a cylinder-tanmo complex paper machine, or the like, thereby producing the wrapping paper. If necessary, a wet paper-strengthening agent may be added to impart water resistance to the wrapping paper, or a sizing agent may be added to adjust the state of printing on the wrapping paper. Furthermore, internal additives for papermaking such as aluminum sulfate, various anionic, cationic, nonionic, or amphoteric yield enhancers, freeness improvers, and paper-strengthening agents, and additives for paper manufacturing such as dyes, pH adjusters, antifoaming agents, pitch control agents, and slime control agents may be added.

[0177] The basis weight of a base paper of the wrapping paper is, for example, typically 20 gsm or more, preferably 25 gsm or more. On the other hand, the basis weight is typically 65 gsm or less, preferably 50 gsm or less, more preferably 45 gsm or less.

[0178] The thickness of the wrapping paper having the above-described characteristics is not particularly limited, and from the viewpoint of rigidity, air permeability, and ease of adjustment in paper manufacturing, the thickness is typically 10 μm or more, preferably 20 μm or more, more preferably 30 μm or more, and typically 100 μm or less, preferably 75 μm or less, more preferably 50 μm or less.

[0179] The shape of the wrapping paper of the heat-not-burn tobacco may be square or rectangular.

[0180] The length of one side of the wrapping paper may be about 12 to 70 mm, and the length of the other side may be 15 to 28 mm, preferably 22 to 24 mm, more preferably about 23 mm.

[0181] When the tobacco filler and the filtration medium are wrapped with the wrapping paper into a pillar shape, for example, the filtration medium is disposed on the upstream (non-inhalation side) end and the downstream (inhalation side) end of the wrapping paper in an unrolled state, the tobacco filler is disposed between the filtration media, and then an end portion of the wrapping paper along the predetermined direction A and an end portion on the opposite side are superposed on each other by about 2 mm and glued together, thereby forming a pillar shape, in which the tobacco filler and the filtration medium are wrapped.

[0182] In addition to the above-described pulp, the wrapping paper may contain a filler. The filler content may be 10 wt% or more and less than 60 wt% relative to the total weight of the wrapping paper, and is preferably 15 wt% or more and 45 wt% or less. In the wrapping paper, the filler content is preferably 15 wt% or more and 45 wt% or less in the above preferred basis weight range (25 gsm or more and 45 gsm or less).

[0183] Furthermore, when the basis weight is 25 gsm or more and 35 gsm or less, the filler content is preferably 15 wt% or more and 45 wt% or less, and when the basis weight is more than 35 gsm and 45 gsm or less, the filler content is preferably 25 wt% or more and 45 wt% or less.

[0184] As the filler, calcium carbonate, titanium dioxide, kaolin, or the like can be used, and from the viewpoint of, for example, improvements in flavor and brightness, calcium carbonate is preferably used.

[0185] Various auxiliary agents other than the base paper and the filler may be added to the wrapping paper, and, for example, a water resistance improver can be added to improve water resistance. Examples of water resistance improvers include wet paper-strengthening agents (WS agent) and sizing agents. Examples of wet paper-strengthening agents include urea formaldehyde resins, melamine formaldehyde resins, and polyamide epichlorohydrin (PAE). Examples of sizing agents include rosin soap, alkyl ketene dimers (AKD), alkenyl succinic anhydride (ASA), and highly saponified polyvinyl alcohols having a degree of saponification of 90% or more.

[0186] A paper-strengthening agent may be added as the auxiliary agent, and examples include polyacrylamide, cationic starch, oxidized starch, CMC, polyamide epichlorohydrin resins, and polyvinyl alcohols. In particular, oxidized starch is known to improve air permeability when used in a very small amount (Japanese Unexamined Patent Application Publication No. 2017-218699).

[0187] The wrapping paper may be coated as appropriate.

[0188] A coating agent may be added to at least one of the two surfaces, the front surface and the back surface, of the wrapping paper. The coating agent is not particularly limited, and a coating agent capable of forming a film on a surface of paper to reduce liquid permeability is preferred. Examples include alginic acid and salts thereof (e.g., sodium salts), polysaccharides such as pectin, cellulose derivatives such as ethylcellulose, methylcellulose, carboxymethylcellulose, and nitrocellulose, and starch and derivatives thereof (e.g., ether derivatives such as carboxymethyl starch, hydroxyalkyl starch, and cationic starch, and ester derivatives such as starch acetate, starch phosphate, and starch octenyl succinate).

<State of joining>

[0189] Hereinafter, the state of joining between an atomizing unit and a cartridge according to an embodiment will be described. Fig. 13 illustrates the state of joining between the atomizing unit 20 and the cartridge 30 according to an embodiment. Fig. 14 is a sectional view taken along line C-C in Fig. 13. It should be noted, however, that in Fig. 13, the reservoir 21, the atomizer 22, the tobacco filler 31A, the filtration medium 32, and the cap 33 are omitted.

[0190] As illustrated in Fig. 13, an aerosol flow control chamber G for controlling the flow of an aerosol supplied from the first flow path 20X is provided between the first flow path 20X and the second flow path 30X so as to suppress an uneven flow of the aerosol in the second flow path 30X. In an embodiment, the aerosol flow control chamber G is formed between the downstream end of the flow path forming body 23 and the upstream end of the container 31. Specifically, the aerosol flow control chamber G is formed between the end cap 25 and the filtration medium 32 on the upstream side.

[0191] Here, the filling ratio of the flavor source 31A accommodated in the container 31 need not be 100% relative to the volume of the flavor source container 31. That is, a vacant space may be left in the container 31. Needless to say, the aerosol flow control chamber G is different from the vacant space which is left because the filling ratio of the tobacco filler 31A is not 100 vol%.

[0192] In an embodiment, in a section perpendicular to the predetermined direction A, when distances from the outer periphery of the first flow path 20X to the outer surface of the second flow path 30X on straight lines extending from the centroid of the first flow path 20X to the outer side of the first flow path 20X are referred to as shift distances, a length LG of the aerosol flow control chamber G in the predetermined direction A may be determined in consideration of the largest shift distance among the shift distances. That is, the length LG of the aerosol flow control chamber G may be determined according to the largest shift distance. To suppress an uneven flow of the aerosol flowing in the flavor source container 31, the length LG of the aerosol flow control chamber G preferably increases as the largest shift distance increases. The length LG of the aerosol flow control chamber G is preferably not less than 1/10 of the largest shift distance.

[0193] For example, as illustrated in Fig. 14, when the first flow path 20X and the second flow path 30X are coaxial circles in the section perpendicular to the predetermined direction A, the length LG of the aerosol flow control chamber G in the predetermined direction A is determined according to the difference between a radius R1 of the first flow path 20X and a radius R2 of the second flow path 30X (i.e., the shift distance).

[0194] In an embodiment, the container 31 has the protrusion 31E that protrudes from the outer edge of the upstream end (here, the filtration medium 32) of the container 31 in the section perpendicular to the aerosol flow path (the predetermined direction A) toward the upstream side (in the embodiment, the flow path forming body 23 side or the end cap 25 side), as described above. That is, the container 31 has the protrusion 31E (first protrusion) as a spacer for forming the aerosol flow control chamber G.

[0195] In an embodiment, the entire downstream end of the flow path forming body 23 (the first flow path 20X) is preferably exposed to the aerosol flow control chamber G. The entire upstream end of the container 31 (the second flow path 30X) is preferably exposed to the aerosol flow control chamber G. With this configuration, the flow of an aerosol guided from the first flow path 20X to the second flow path 30X can be efficiently controlled by the aerosol flow control chamber G.

[0196] The aerosol flow control chamber G preferably does not include a portion extending upstream of the downstream end of the flow path forming body 23 (the first flow path 20X). The aerosol flow control chamber G preferably does not include a portion extending downstream of the upstream end of the container 31 (the second flow path 30X). This configuration can suppress an aerosol from staying in an unnecessary space.

[0197] The inner wall surface defining the aerosol flow control chamber G is preferably continuous without a step from the outer edge of the downstream end of the flow path forming body 23 (the first flow path 20X) to the outer edge of the upstream end of the container 31 (the second flow path 30X).

[0198] In an embodiment, as illustrated in Fig. 13 and Fig. 14, in a section perpendicular to the aerosol flow path (the predetermined direction A), an outer periphery 25out of the end cap 25 is preferably in contact with an inner wall surface 24 in of the outer frame body 24, and an inner periphery 25in of the end cap 25 is preferably located between an outer periphery 23out of the flow path forming body 23 and an inner periphery 23in of the flow path forming body 23. With this configuration, it is difficult to remove the end cap 25 from the downstream side. In addition, the end cap 25 is less likely to interfere with the flow path forming body 23 when the end cap 25 is disposed inside the outer frame body 24.

<Method of measuring acid content of tobacco filler>

[0199] The acid content of the tobacco filler can be measured as follows: mainstream smoke generated in an inhalation test described in <Method of quantifying flavor components below is collected on a Cambridge filter pad (CFP), the Cambridge filter pad is then placed in a screw tube, the screw tube is shaken (200 rpm) for 20 minutes with isopropanol added, and a portion of the resulting extract is measured using a high-performance liquid chromatograph (HPLC-UV/Vis) equipped with an ultraviolet-visible spectrophotometer under the following conditions.

Column: Inertsil (registered trademark) ODS-3 (manufactured by GL Sciences Inc., 5 μm, 150 mm × 4.6 ID)
Column temperature: 40°C
Sample injection volume: 20 μL
Mobile phase: acetonitrile:methanol:citrate buffer = 20:10:70

(The citrate buffer (pH 4.66) is obtained by making up 0.6 g of trisodium citrate dihydrate and 0.7 g of citric acid dihydrate to 1 L with ultrapure water.)

Flow rate: 1 mL/min

UV: 230 nm

Calibration curve range: 0.0999 μg/mL to 9.99 μg/mL

<Method of quantifying flavor component>

[0200] The quantification of the flavor component (here, nicotine) contained in the tobacco filler of the heat-not-burn tobacco product described above is performed under the following inhalation test conditions.

[0201] A cartridge accommodating a tobacco filler is mounted to a heat-not-burn tobacco product (e.g., Ploom TECH+ (registered trademark)) in which an atomizing unit and a battery unit are coupled to each other, and a current is applied to an atomizer of the atomizing unit to generate heat, thereby atomizing an aerosol source. Thereafter, automatic inhalation is performed using a single-port automatic inhalation machine manufactured by Borgwaldt under the conditions of a flow rate of 55 cc/2 seconds and an inhalation interval of 30 seconds. Mainstream smoke generated during the inhalation is collected on a Cambridge filter pad, and the Cambridge filter pad is removed after 25 puff actions.

[0202] The components collected on the Cambridge filter pad obtained by the inhalation test are extracted by means of shaking for 40 minutes in a methanol solvent. The extract is subjected to GC-FID to quantify nicotine.

<Temperature at which tobacco filler is heated in inhalation test>

[0203] The maximum temperature at which the tobacco filler in the cartridge is heated in the above-described inhalation test of the heat-not-burn tobacco product is measured with a thermocouple (model TI-SP-K manufactured by Toa Electric Inc.) inserted into a desired measurement location of the tobacco filler.

[0204] After the cartridge in which the thermocouple is inserted into the tobacco filler is mounted to the heat-not-burn tobacco product, the temperature change over time at the desired measurement location of the tobacco filler is measured and recorded during the above-described inhalation test.

EXAMPLES

[0205] The present invention will be described more specifically with reference to Examples, but the present invention is not limited by the description of the following Examples without departing from the spirit thereof.

<Production of tobacco filler 1>

[Materials for tobacco filler 1]

[0206]

- Crushed aged tobacco leaves (fine tobacco powder): flue-cured tobacco, average particle size 70 μm, 62.56 wt%
- Water: 15.94 wt%
- Flavor enhancer: potassium carbonate, 6.75 wt%
- Binder: hydroxypropylcellulose (HPC), 4.75 wt%
- Acid: solution of lactic acid (racemic) in propylene glycol, 10 wt%

[0207] The crushed aged tobacco leaves (fine tobacco powder), the flavor enhancer, and the binder were provided as materials and mixed together, after which water was added to the mixture. The resulting mixture was kneaded, and the resulting kneaded product was granulated with a wet extrusion granulator (manufactured by DALTON Corporation; mesh size, 0.8 mm) to obtain tobacco granules.

[0208] The contents of the components in the above materials were as follows: crushed tobacco leaves (fine tobacco

powder), 69.51 wt%; water, 17.71 wt%; flavor enhancer, 7.5 wt%; binder, 5.28 wt%.

[0209] Thereafter, lactic acid was added to the tobacco granules obtained such that the content of lactic acid was 0.25 wt% relative to the total weight of the tobacco granules to produce a tobacco filler 1. Specifically, a solution of lactic acid in propylene glycol prepared by dissolving, in propylene glycol, lactic acid in an amount of 2.5 wt% relative to the total weight of propylene glycol was added in an amount of 10 wt% relative to the total weight of the tobacco granules. The tobacco granules were added in such a manner that the tobacco granules obtained were put into a flavoring machine equipped with a rotor, and the solution of lactic acid in propylene glycol was sprayed under rotational stirring.

<Production of tobacco fillers 2 to 15>

[0210] Tobacco fillers 2 to 15 were prepared under the same conditions except that the type of acid and the content of the acid in the tobacco filler 1 were changed. For the tobacco filler 11, no acids were added. The type of acid and the content of the acid in the tobacco fillers 1 to 15 are shown in Table 1.

<Production of cartridges 1 to 15>

[Container and filtration medium used]

[0211] A container in which a mesh body was disposed on the upstream side and an acetate tow filter was disposed on the downstream side was used.

[0212] The container was formed by integral molding with the mesh body and had a hollow pillar shape. The container and the mesh body were made of polypropylene resin. The container had a length in the predetermined direction A of 22.9 mm, a maximum width in a direction perpendicular to the predetermined direction A of 9.5 mm, and an internal volume of 1.106 cm^3. The apertures of the mesh body had a rectangular lattice shape, a maximum width of 0.19 mm, and a minimum width of 0.17 mm. The interval between apertures adjacent to each other was 0.235 mm, and the thickness of the mesh body was 0.4 mm.

[0213] The filter was produced as a cylindrical filter having a circumference of 25 mm, a height of 4.75 mm, and an airflow resistance 175 mmH_2O from a cellulose acetate tow having a single yarn fineness of 12 g/9000 m and a total yarn fineness of 28000 g/9000 m with a filter plug wrapping paper (manufactured by NIPPON PAPER PAPYLIA CO., LTD., name: LPWS-OLL, air permeability: 1300 C.U., basis weight: 26.5 gsm, thickness: 48 μm) by using a Hauni filter rod maker (KDF2). After the tobacco filler described later was accommodated in the above container, the filter produced was disposed on the downstream side of the container and fixed with a cap having an opening.

[0214] The tobacco fillers 1 to 15 were each accommodated in the above container produced by integral molding with the mesh body, and the containers were each sealed with the acetate tow filter and the cap to produce cartridges 1 to 15.

[Table 1]

Tobacco filler No.	Cartridge No.	Type of acid	Content of acid (wt%)
1	1	lactic acid	0.25
2	2	lactic acid	0.50
3	3	lactic acid	1.00
4	4	lactic acid	1.50
5	5	lactic acid	2.00
6	6	lactic acid	2.50
7	7	benzoic acid	1.00
8	8	benzoic acid	2.50
9	9	phosphoric acid	1.00
10	10	linolenic acid	1.00
11	11	-	0.00
12	12	lactic acid	3.00
13	13	lactic acid	4.00
14	14	lactic acid	5.00

(continued)

Tobacco filler No.	Cartridge No.	Type of acid	Content of acid (wt%)
15	15	lactic acid	5.50

<Quantification of flavor components

[0215] The quantification of the flavor component (here, nicotine) generated from the tobacco filler 1 contained in the cartridge 1 produced was performed under the following inhalation test conditions.

[0216] The cartridge 1 was mounted to a heat-not-burn tobacco product (product name: Ploom TECH+ (registered trademark), manufactured by Japan Tobacco Inc.) in which an atomizing unit and a battery unit were coupled to each other, and a current was applied to an atomizer of the atomizing unit to generate heat, thereby atomizing an aerosol source. Thereafter, automatic inhalation was performed using a single-port automatic inhalation machine manufactured by Borgwaldt under the conditions of a flow rate of 55 cc/3 seconds and an inhalation interval of 30 seconds. Mainstream smoke generated during the inhalation was collected on a Cambridge filter pad, and the Cambridge filter pad was removed after 25 puff actions.

[0217] The components collected on the Cambridge filter pad obtained by the inhalation test were extracted by means of shaking for 60 minutes in an ethanol solvent. The extract was subjected to GC-FID to quantify nicotine.

[0218] Also for the cartridge 2 to 8 and 11 to 15 produced, the inhalation test was performed under the same conditions as described above to quantify the flavor component (here, nicotine) generated from the tobacco fillers 2 to 8 and 11 to 15. A graph showing the ratios of the amounts of flavor components generated from the tobacco fillers 1 to 8 to the amount of flavor component generated from the tobacco filler 11 as expressed in percentage is shown in Fig. 15. A graph showing the ratios of the amounts of flavor components generated from the tobacco fillers 1 to 6 and 12 to 15 to the amount of flavor component generated from the tobacco filler 11 as expressed in percentage is shown in Fig. 16. The tobacco fillers 1 to 6 and 12, in each of which the ratio of the amount of flavor component generated was more than 70% of the tobacco filler 11, tended to have more excellent flavors.

<Measurement of temperature of tobacco filler during inhalation test>

[0219] The maximum heating temperature of the tobacco filler 1 in the cartridge 1 during the above-described inhalation test of the heat-not-burn tobacco product was measured with a thermocouple (model TI-SP-K manufactured by Toa Electric Inc.) inserted into the center of the tobacco filler 1. The measurement was made in the vicinity of the upstream end of the tobacco filler. The maximum heating temperature of the tobacco filler 1 was found to be 40°C.

<Sensory test>

[0220] Using the cartridge 3 as Example 1, the cartridge 7 as Example 2, the cartridge 9 as Example 3, the cartridge 10 as Comparative Example 1, and the cartridge 11 as Comparative Example 2, a sensory test of the flavor inhibition was performed on these cartridges by six panelists (A to F).

[0221] The cartridges of Examples and Comparative Examples were each mounted to a heat-not-burn tobacco product (product name: Ploom TECH+ (registered trademark), manufactured by Japan Tobacco Inc.), and a power button was pushed to generate an atomized aerosol from an atomizer, after which inhalation was started. The number of puff actions was 10.

[0222] After the inhalation, each panelist scored the flavor inhibition of the cartridges of Comparative Example 1 and Examples 1 to 3 with reference to the flavor inhibition of the cartridge of Comparative Example 2 scored as "10", and the average of the scores was calculated. When the average was 8 or less, it was evaluated that the flavor inhibition was suppressed. The results are shown in Table 2 and Figs. 17 and 18.

[Table 2]

	Type of acid	Evaluation score						
		A	B	C	D	E	F	Average
Example 1	lactic acid	5	4	2	3	3	5	3.7
Example 2	benzoic acid	6	6	4	3	4	3	4.3
Example 3	phosphoric acid	6	6	6	7	7		6.4

(continued)

	Type of acid	Evaluation score						
		A	B	C	D	E	F	Average
Comparative Example 1	linolenic acid	8	10	10	7	7		8.4
Comparative Example 2	-	10	10	10	10	10	10	10.0

Reference Signs List

[0223]

1	heat-not-burn tobacco product
10	battery unit
11	battery
20	atomizing unit
20X	first flow path
21	reservoir
21A	aerosol source
22	atomizer
23	flow path forming body
23in	inner periphery of flow path forming body
23out	outer periphery of flow path forming body
24	outer frame body
24in	inner wall surface of outer frame body
25	end cap
25in	inner periphery of end cap
25out	outer periphery of end cap
G	aerosol flow control chamber
30	cartridge
30X	second flow path
31	container
31A	tobacco filler
31E	protrusion
31R	rib
31T	tapered portion
32	filtration medium
32A	aperture
P	interval
33	cap

Claims

1. A cartridge for a heat-not-burn tobacco product, comprising a tobacco filler, a container for the tobacco filler, and a filtration medium,

wherein the container is tubular, and the filtration medium is disposed at at least one end of the container, the cartridge allows passage of an atomized aerosol from one end to the other end of the cartridge, and the tobacco filler contains an acid having a boiling point of 120°C or higher and 250°C or lower in an amount of 0.25 wt% or more and 5.50 wt% or less relative to a total weight of the tobacco filler taken as 100 wt%.

2. The cartridge according to Claim 1, wherein the tobacco filler contains the acid in an amount of 0.25 wt% or more and 5.00 wt% or less relative to the total weight of the tobacco filler taken as 100 wt%.

3. The cartridge according to Claim 1 or 2, wherein the acid is an organic acid.

4. The cartridge according to any one of Claims 1 to 3, wherein the acid has an acid dissociation constant pK_a of 3.0 to 6.0.

5. The cartridge according to any one of Claims 1 to 4, wherein the acid is benzoic acid or lactic acid.

6. The cartridge according to any one of Claims 1 to 5, wherein the acid is lactic acid.

7. The cartridge according to any one of Claims 1 to 6, wherein the tobacco filler is composed of tobacco granules.

8. A heat-not-burn tobacco product comprising:

an atomizer that atomizes an aerosol source without combustion; and
the cartridge according to any one of Claims 1 to 7 disposed in a detachable manner,
wherein the cartridge has an inhalation end, and
at least a portion of the tobacco filler contained in the cartridge is heated at a temperature lower than the boiling point of the acid upon contact with an aerosol atomized by the atomizer.

9. The heat-not-burn tobacco product according to Claim 8, wherein the tobacco filler is heated at a temperature of 20 °C or higher and lower than 120°C.

10. The heat-not-bum tobacco product according to Claim 8 or 9, wherein the heat-not-burn tobacco product has an aerosol flow path extending in a predetermined direction, and
the atomizer is disposed on an upstream side of the aerosol flow path, and the cartridge is disposed on a downstream side of the aerosol flow path.

FIG. 1

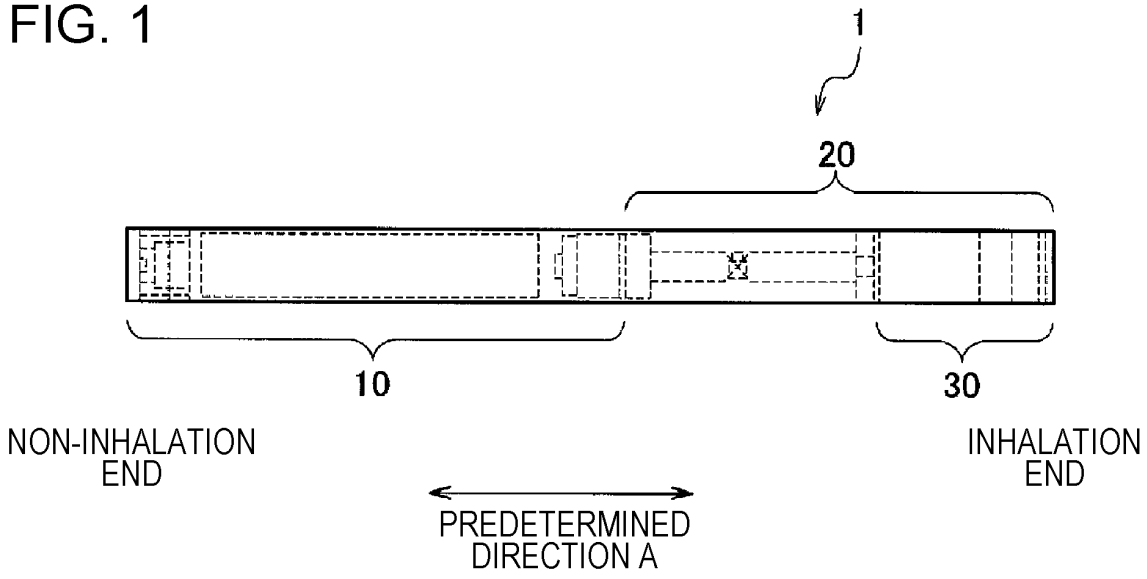


FIG. 2

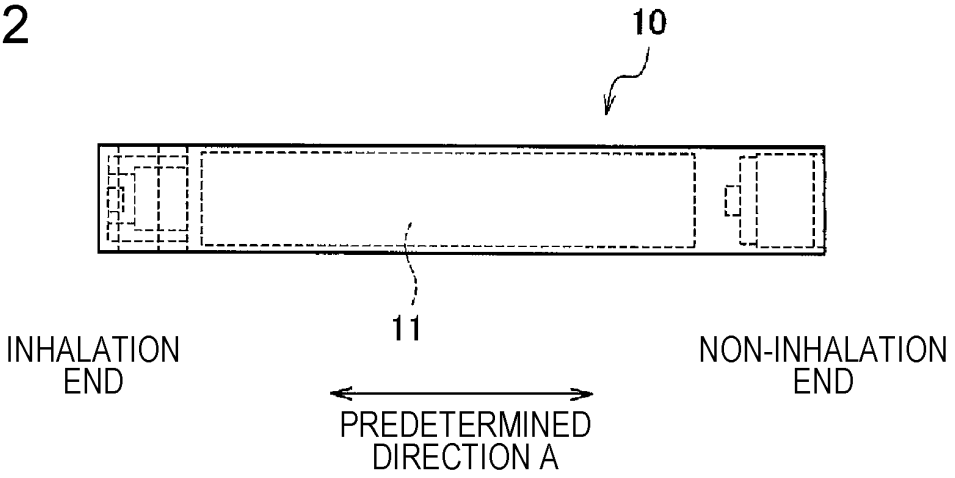


FIG. 3

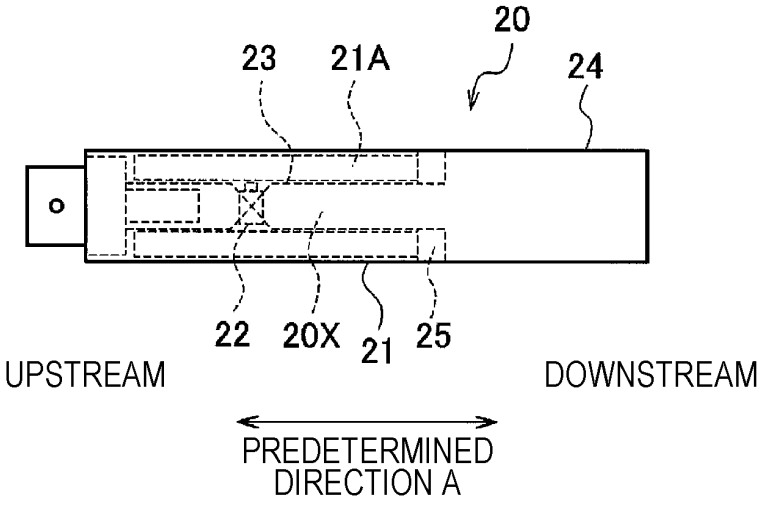


FIG. 4

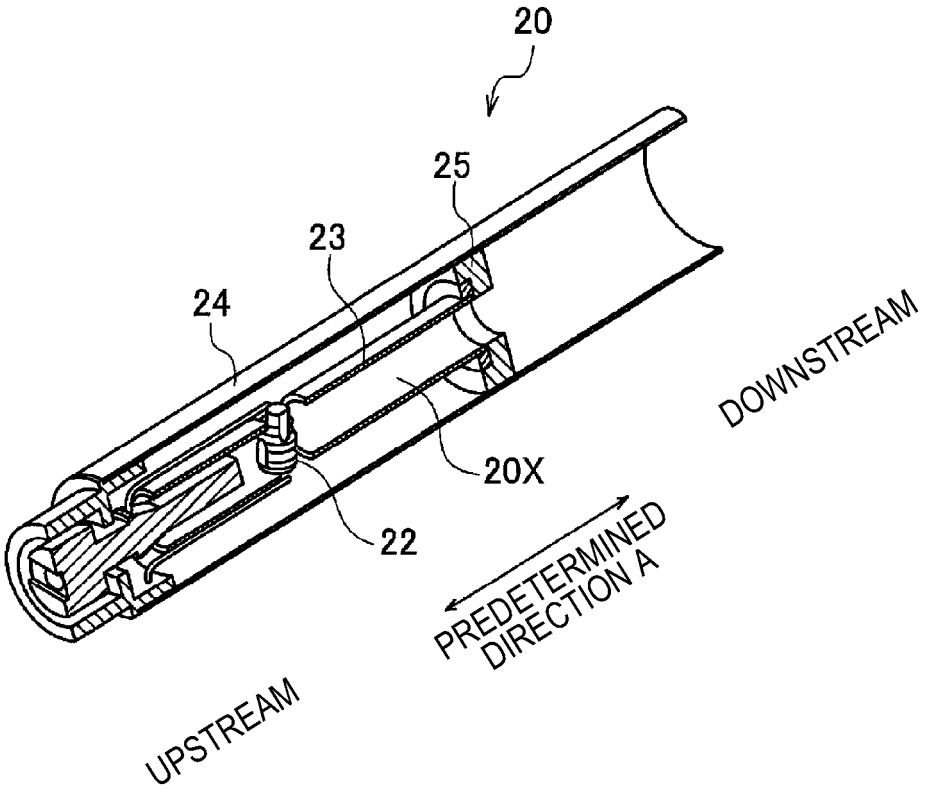

20
25
23
24
DOWNSTREAM
20X
22
PREDETERMINED DIRECTION A
UPSTREAM

FIG. 5

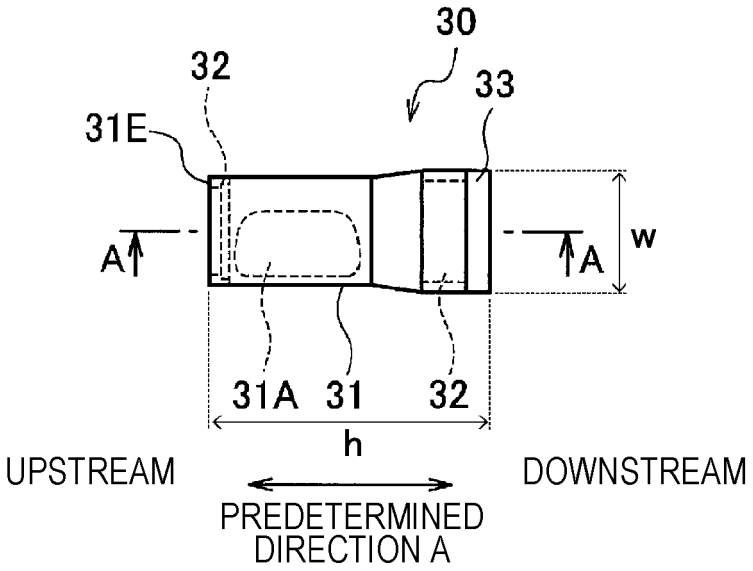

30
32
33
31E
A
A
w
31A
31
32
h
UPSTREAM
DOWNSTREAM
PREDETERMINED DIRECTION A

FIG. 6

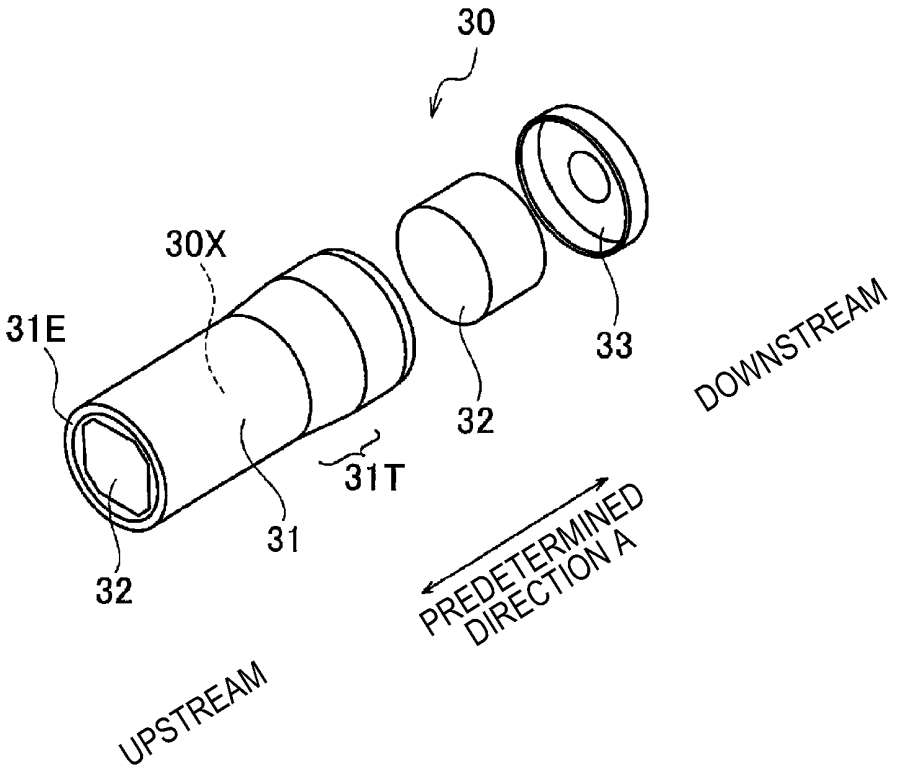

30
30X
31E
33
DOWNSTREAM
32
31T
31
PREDETERMINED DIRECTION A
32
UPSTREAM

FIG. 7

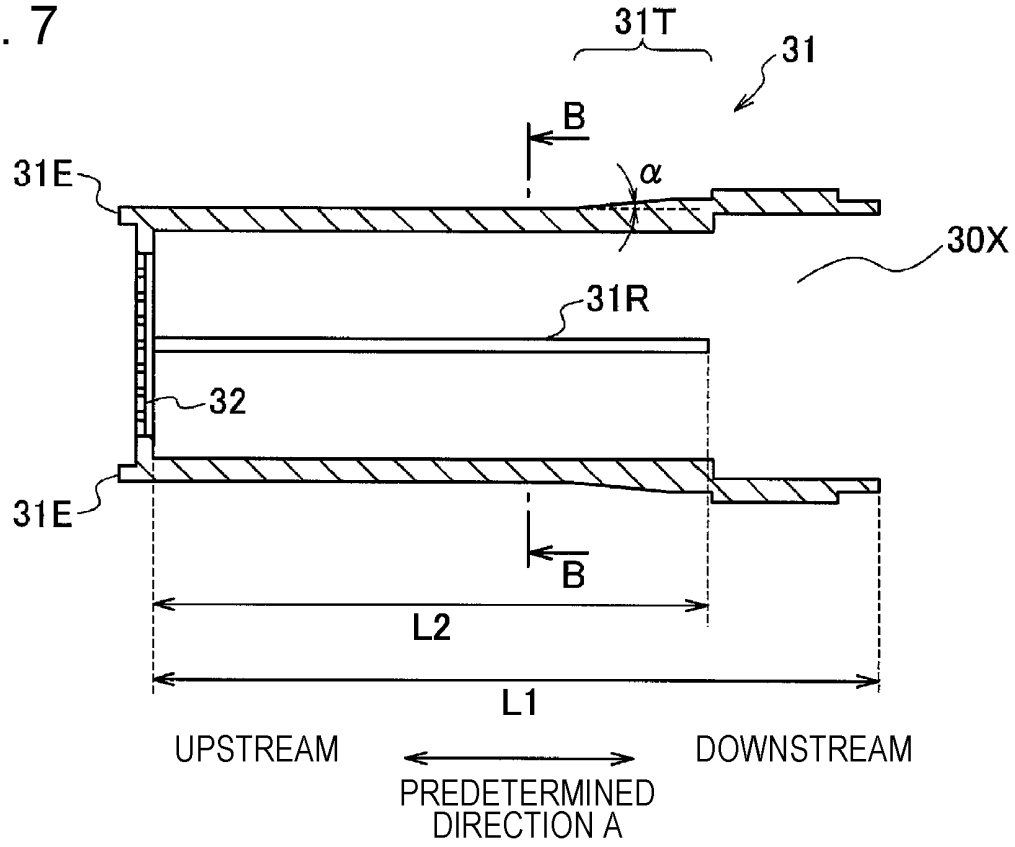

31T
31
B
31E
α
30X
31R
32
31E
B
L2
L1
UPSTREAM
DOWNSTREAM
PREDETERMINED DIRECTION A

FIG. 8

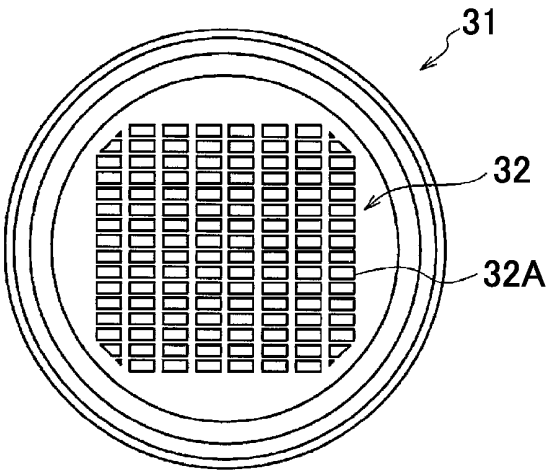


FIG. 9

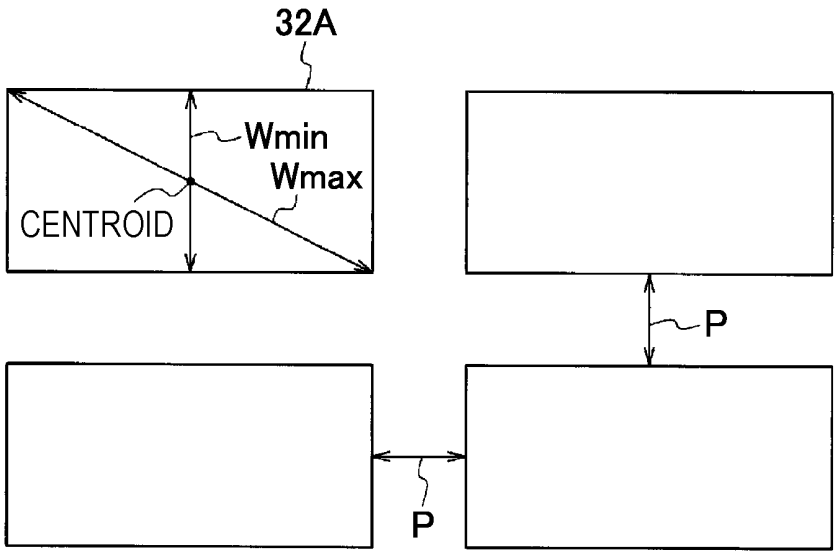


FIG. 10

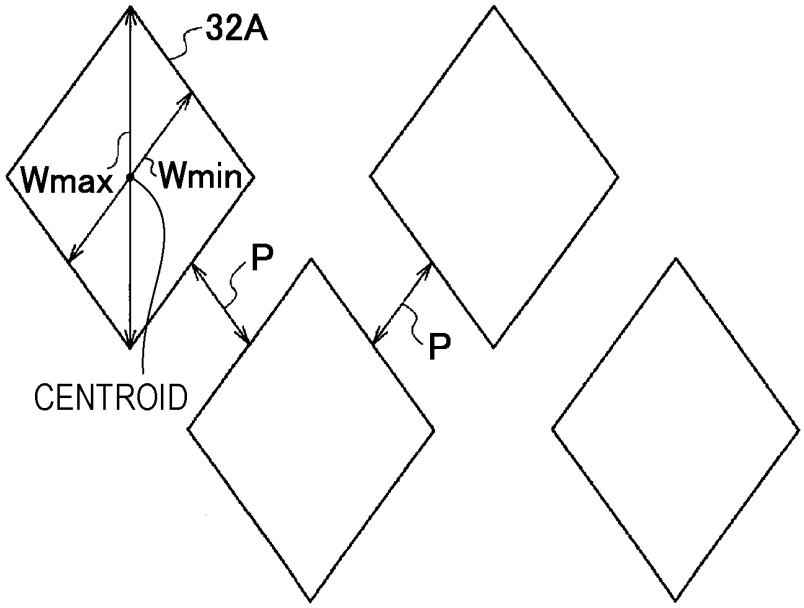


FIG. 11

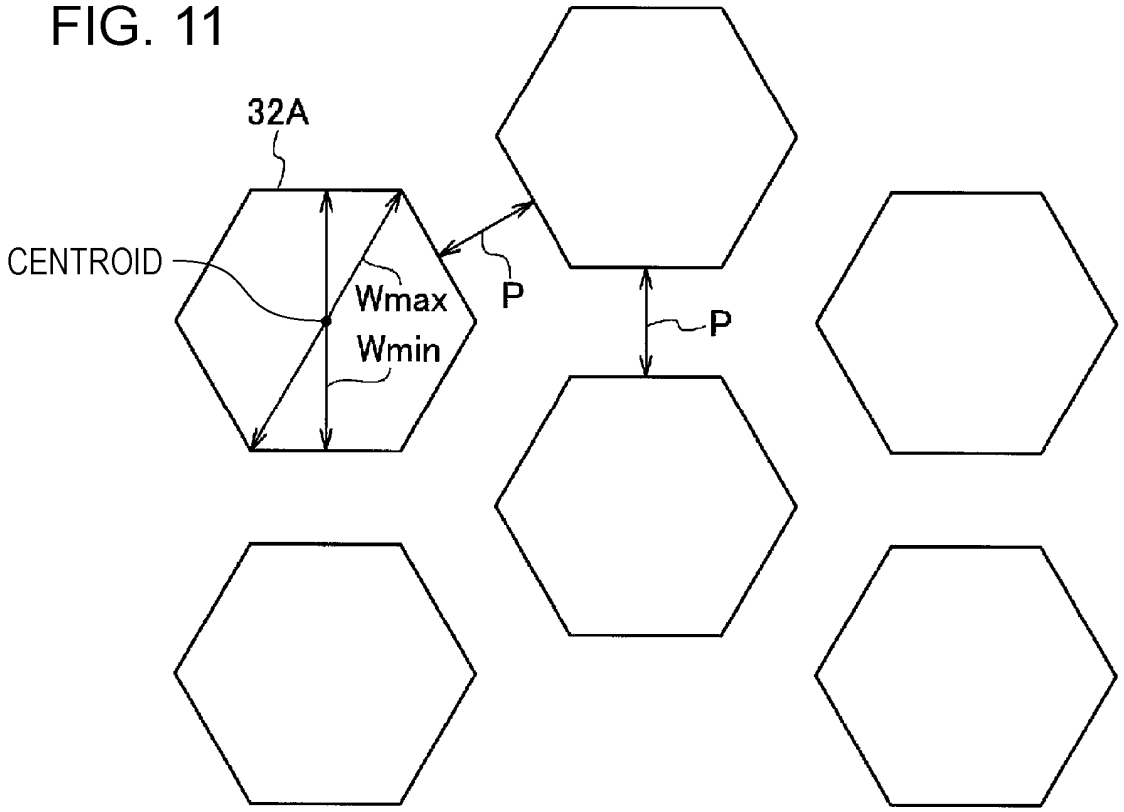

32A
CENTROID
Wmax
Wmin
P
P

FIG. 12

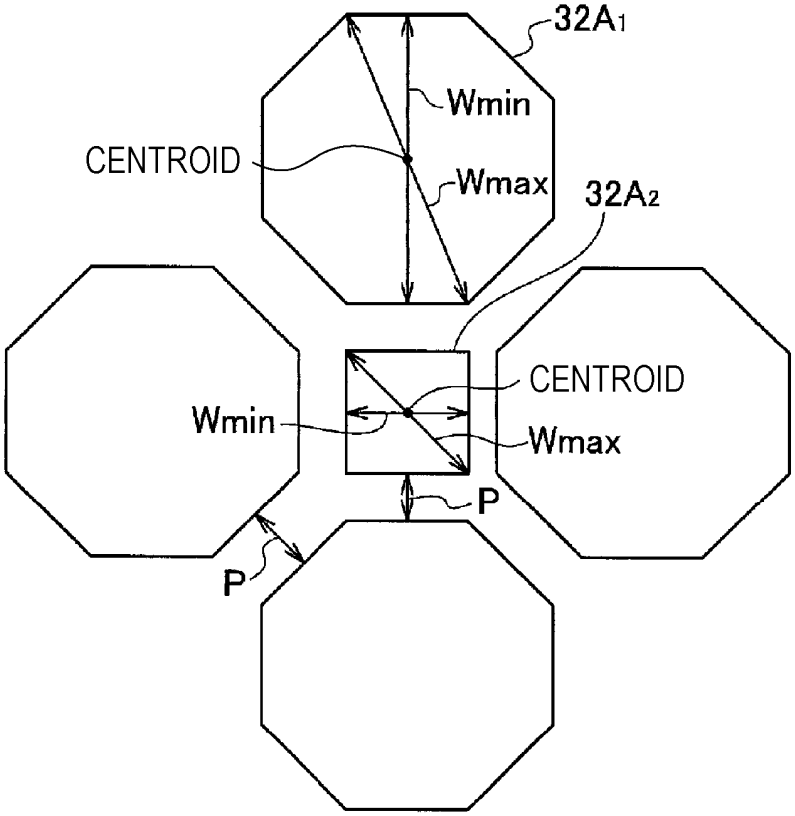

32A1
Wmin
CENTROID
Wmax
32A2
CENTROID
Wmin
Wmax
P
P

FIG. 13

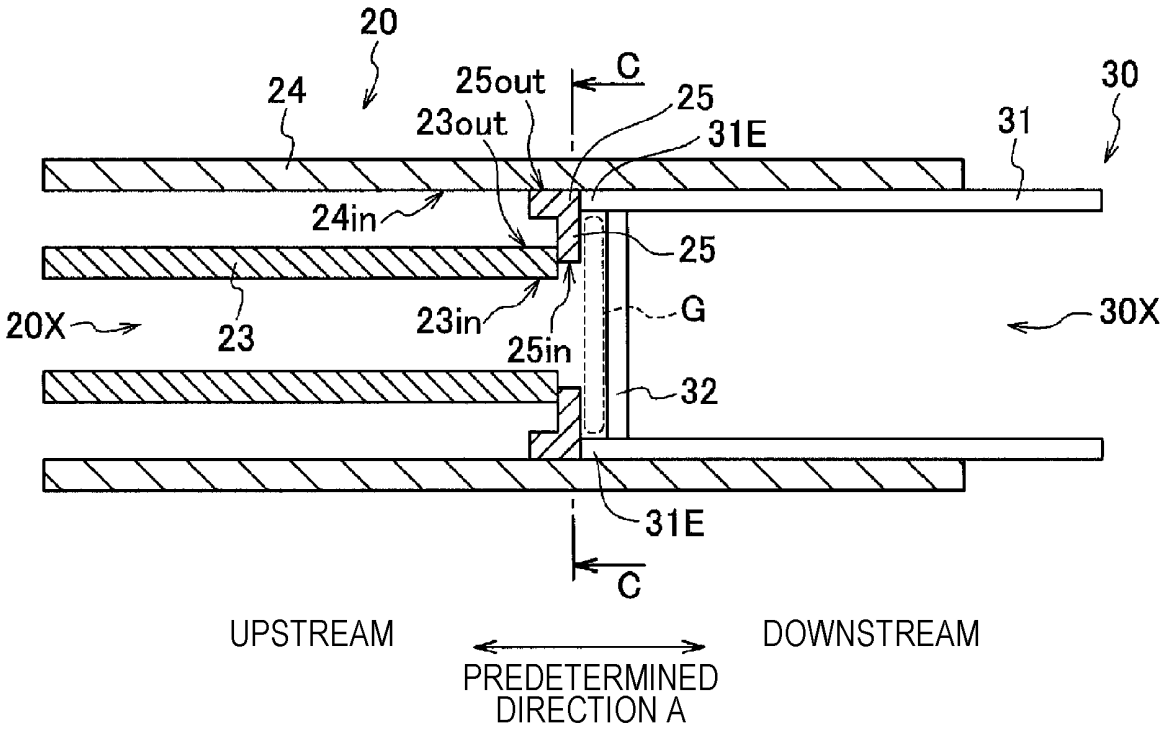

20
24
25out
C
25
30
23out
31E
31
24in
25
20X
23
23in
G
30X
25in
32
31E
C
UPSTREAM
DOWNSTREAM
PREDETERMINED
DIRECTION A

FIG. 14

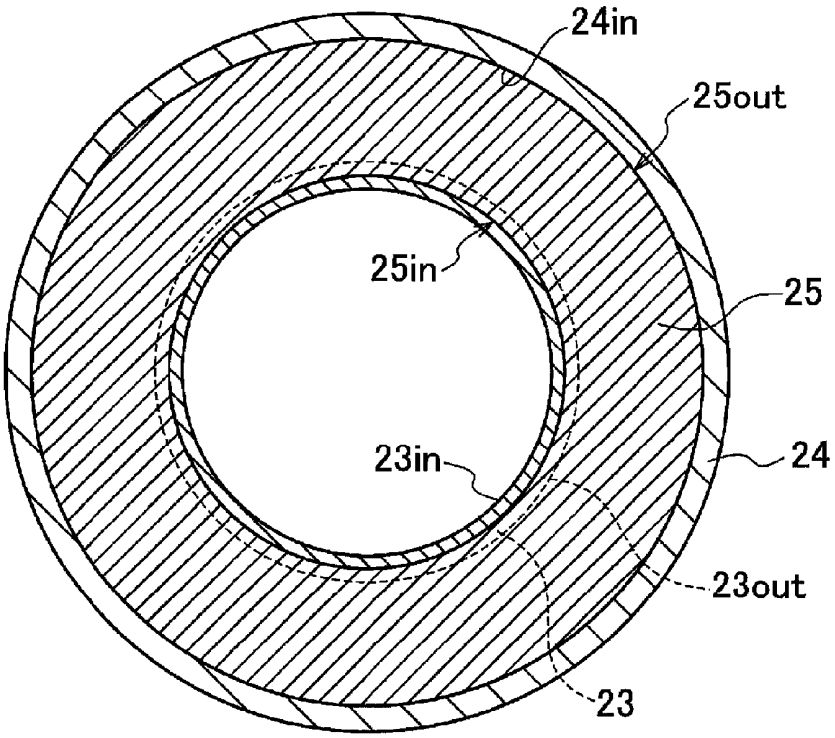

24in
25out
25in
25
23in
24
23out
23

FIG. 15

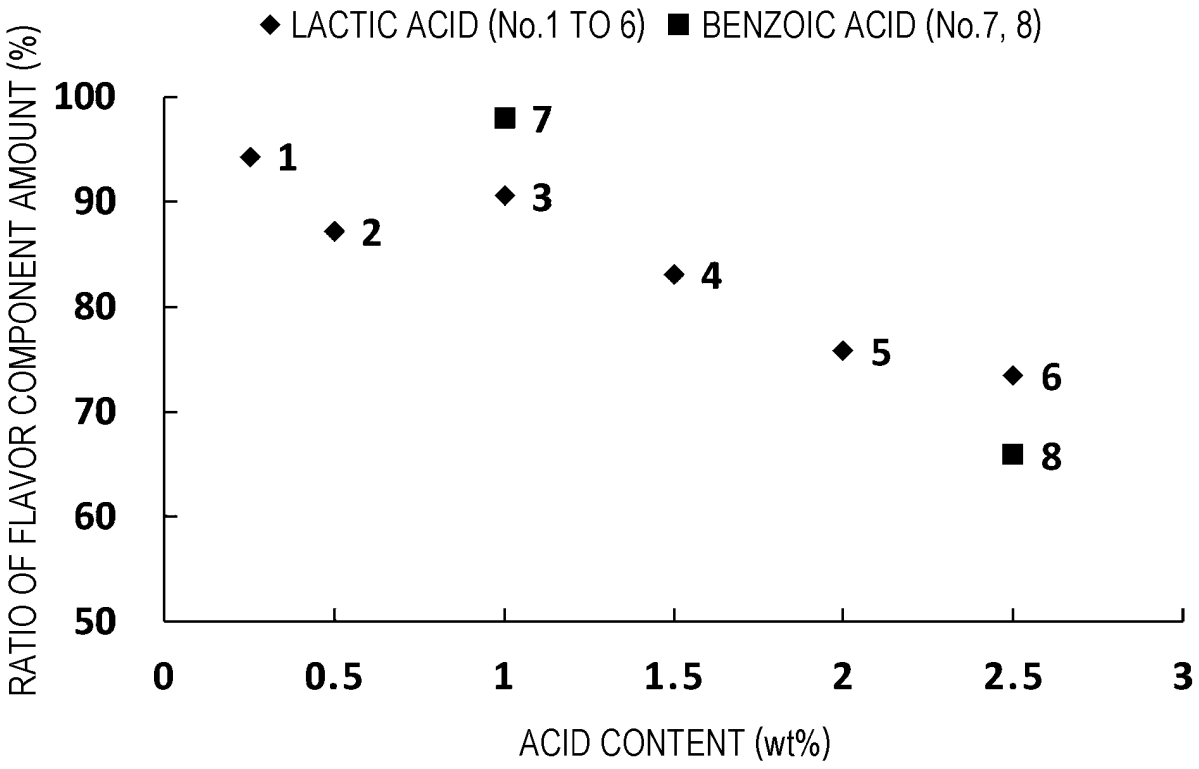

◆ LACTIC ACID (No.1 TO 6) ■ BENZOIC ACID (No.7, 8)
RATIO OF FLAVOR COMPONENT AMOUNT (%)
100
90
80
70
60
50
0
0.5
1
1.5
2
2.5
3
ACID CONTENT (wt%)
◆ 1
◆ 2
■ 7
◆ 3
◆ 4
◆ 5
◆ 6
■ 8

FIG. 16

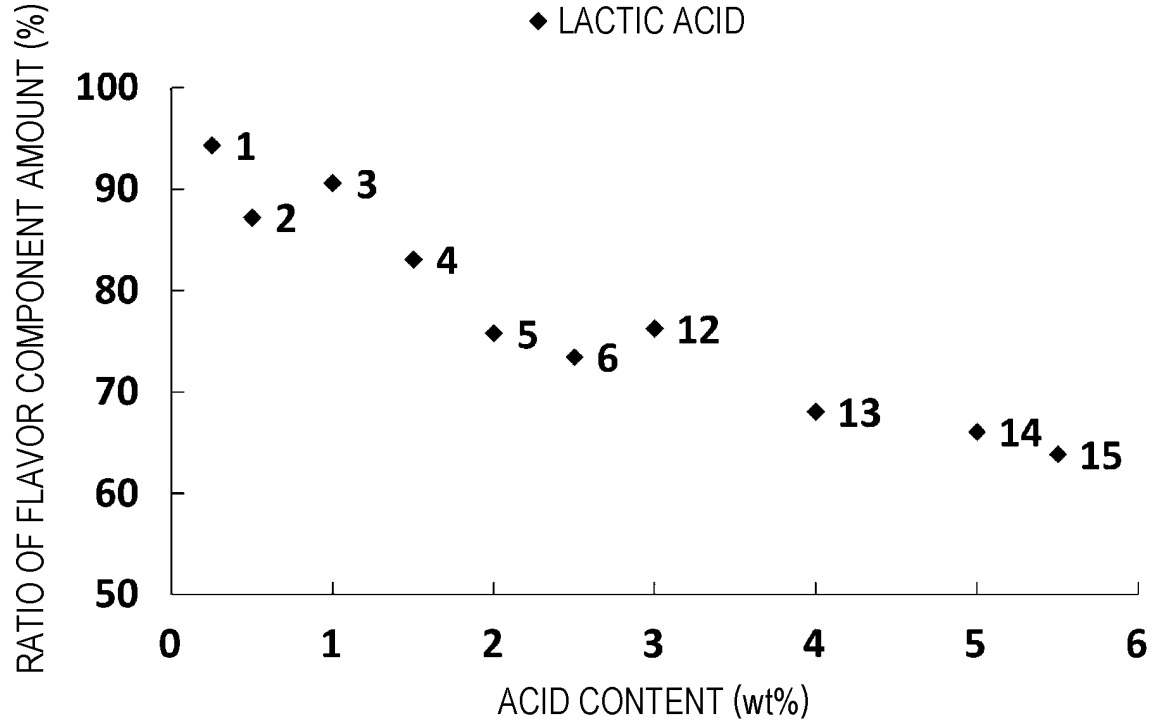

◆ LACTIC ACID
RATIO OF FLAVOR COMPONENT AMOUNT (%)
100
90
80
70
60
50
0
1
2
3
4
5
6
ACID CONTENT (wt%)
◆ 1
◆ 2
◆ 3
◆ 4
◆ 5
◆ 6
◆ 12
◆ 13
◆ 14
◆ 15

FIG. 17

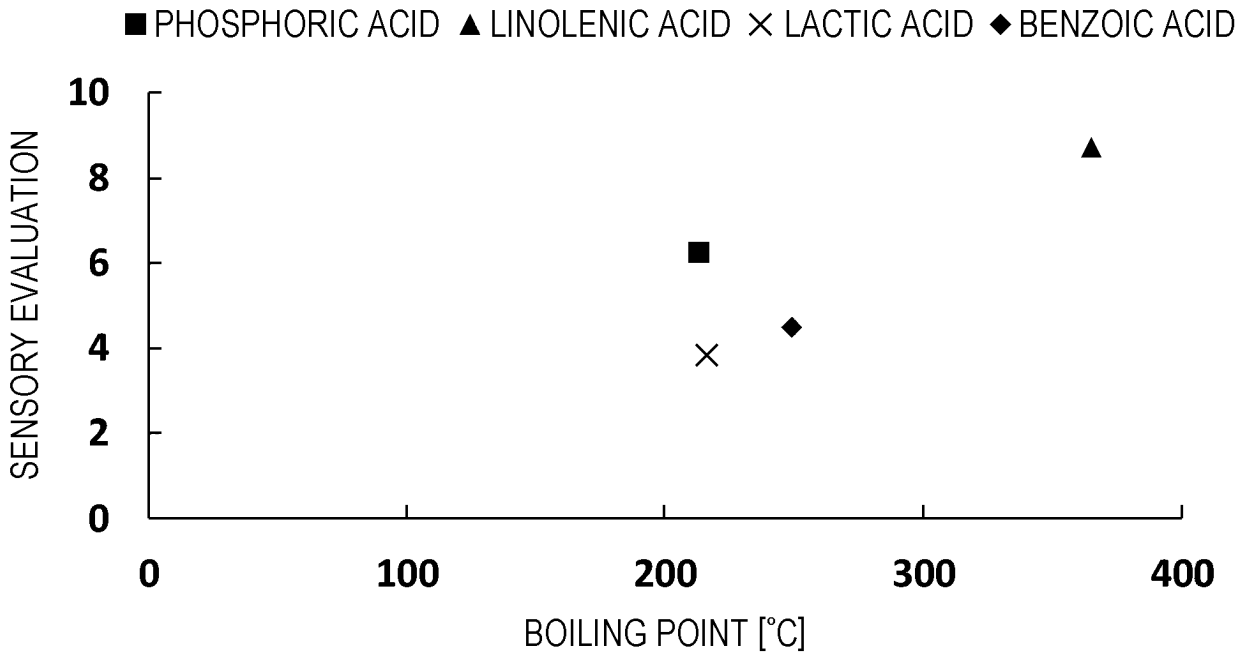
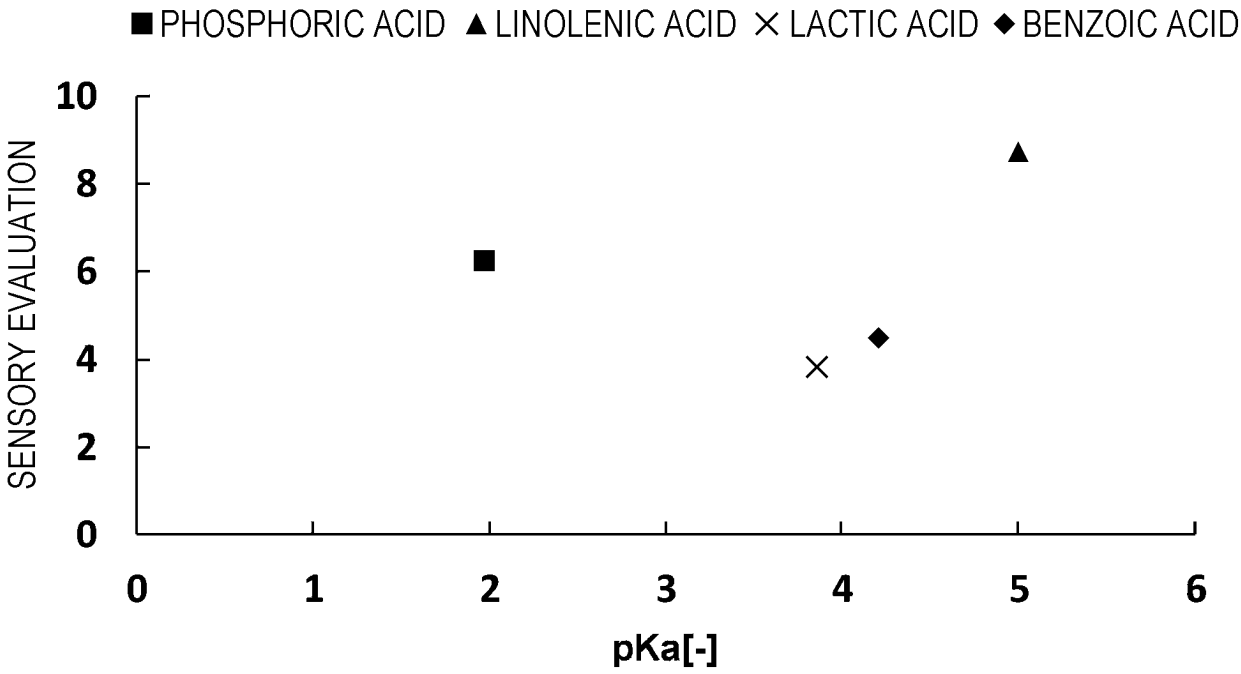

■PHOSPHORIC ACID ▲LINOLENIC ACID × LACTIC ACID ◆BENZOIC ACID
SENSORY EVALUATION
10
8
6
4
2
0
0
100
200
300
400
BOILING POINT [°C]

FIG. 18


■PHOSPHORIC ACID ▲LINOLENIC ACID × LACTIC ACID ◆BENZOIC ACID
SENSORY EVALUATION
10
8
6
4
2
0
0
1
2
3
4
5
6
pKa[-]

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2021/014275

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. A24B15/167(2020.01)i, A24F47/00(2020.01)i, A24F40/10(2020.01)i
FI: A24B15/167, A24F40/10, A24F47/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl. A24B15/167, A24F47/00, A24F40/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2021
Registered utility model specifications of Japan	1996-2021
Published registered utility model applications of Japan	1994-2021

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2016/075748 A1 (JAPAN TOBACCO INC.) 19 May 2016 (2016-05-19), particularly, paragraphs [0026]-[0041], fig. 1-6	1-10
Y	JP 2010-506594 A (R J REYNOLDS TOBACCO CO.) 04 March 2010 (2010-03-04), particularly, paragraphs [0049], [0069]	1-4, 7-10
Y	WO 2019/053598 A1 (RAI STRATEGIC HOLDINGS, INC.) 21 March 2019 (2019-03-21), particularly, page 13, lines 9-23	1-10
Y	WO 2016/178377 A1 (JAPAN TOBACCO INC.) 10 November 2016 (2016-11-10), particularly, paragraphs [0042]-[0044]	1-5, 7-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search 25 May 2021	Date of mailing of the international search report 08 June 2021
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2021/014275

WO 2016/075748 A1	19 May 2016	US 2017/0238605 A1 particularly, paragraphs [0054]-[0069], fig. 1-6 EP 3219212 A1 KR 10-2017-0078764 A CN 107072311 A
JP 2010-506594 A	04 March 2010	US 2008/0092912 A1 particularly, paragraphs [0071], [0090] WO 2008/108889 A1 CN 101557728 A
WO 2019/053598 A1	21 March 2019	US 2019/0082735 A1 KR 10-2020-0056431 A CN 111356377 A JP 2020-533994A A
WO 2016/178377 A1	10 November 2016	US 2018/0049477 A1 particularly, paragraphs [0066]-[0068] EP 3289895 A1 CN 107529832 A KR 10-2017-0132823 A

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REFERENCES CITED IN THE DESCRIPTION

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- WO 2016075749 A **[0005]**
- WO 2017203686 A **[0005] [0062]**
- WO 2018139068 A **[0081]**
- JP 2004510422 W **[0115]**
- WO 2014104078 A **[0120]**
- JP 2017218699 A **[0186]**

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- Tabako-no-Jiten (Encyclopedia of Tobacco). Tobacco Academic Studies Center, 31 March 2009 **[0074]**