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(54) **TOBACCO SHEET FOR NON-COMBUSTION HEATING-TYPE FLAVOR INHALER, NON-COMBUSTION HEATING-TYPE FLAVOR INHALER, AND NON-COMBUSTION HEATING-TYPE FLAVOR INHALATION SYSTEM**

(57) This tobacco sheet for a non-combustion heating-type flavor inhaler contains a tobacco powder having a cumulative 90% particle diameter (D90) of at least 200 μm in a volume-based particle size distribution as measured by a dry laser diffraction method.

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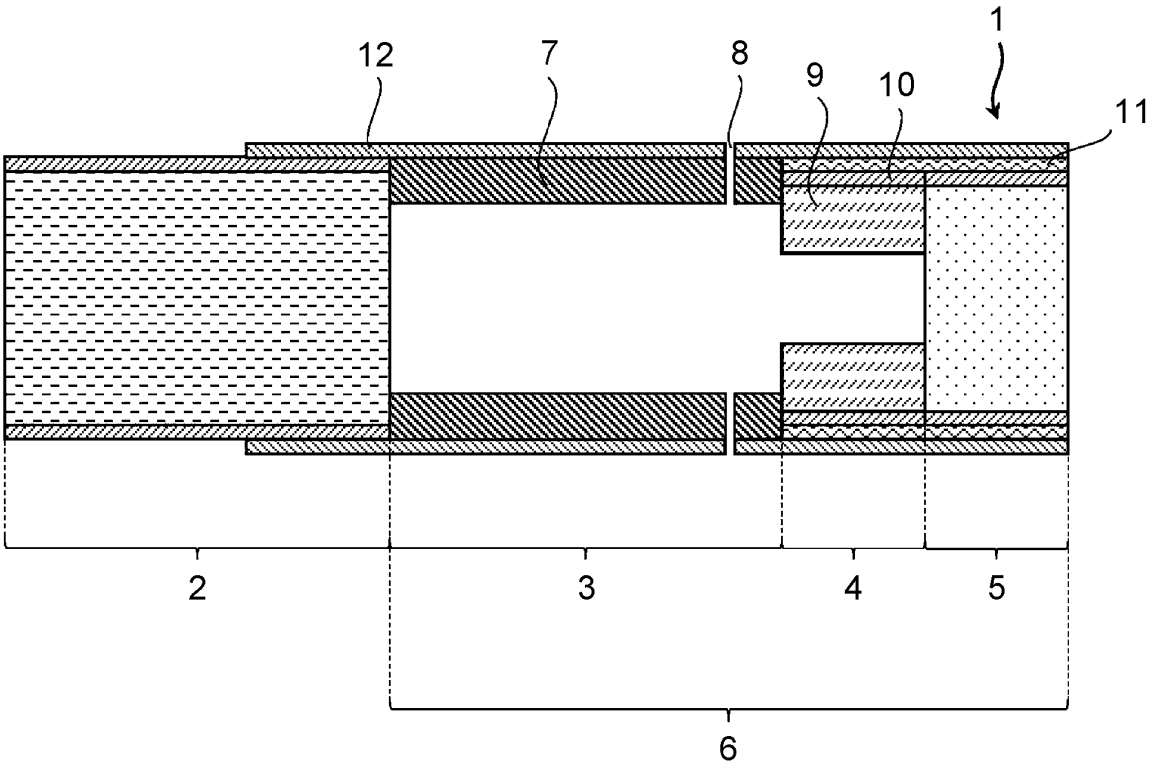
Fig. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to a tobacco sheet for a non-combustion heating-type flavor inhaler, a non-combustion heating-type flavor inhaler, and a non-combustion heating-type flavor inhalation system.

BACKGROUND ART

[0002] In combustion-type flavor inhalers (cigarettes), tobacco fillers including leaf tobacco are burned to obtain the flavor. As an alternative to combustion-type flavor inhalers, a non-combustion heating-type flavor inhaler configured to deliver flavor by heating a flavor source, such as a tobacco sheet, instead of combustion thereof, has been reported. The heating temperature of the non-combustion heating-type flavor inhaler is lower than the combustion temperature of the combustion-type flavor inhaler, and is, for example, about 400°C or lower. As described above, the heating temperature of the non-combustion heating-type flavor inhaler is low, thus, an aerosol-generating agent can be added to the flavor source in the non-combustion heating-type flavor inhaler from the viewpoint of increasing the amount of smoke. The aerosol-generating agent is vaporized by heating to generate aerosol. The aerosol is supplied to a user along with a flavor component, such as a tobacco component, so that the user can obtain sufficient flavor.

[0003] The non-combustion heating-type flavor inhaler can include, for example, a tobacco-containing segment filled with a tobacco sheet or the like, a cooling segment, and a filter segment. The length of the tobacco-containing segment of the non-combustion heating-type flavor inhaler in the axial direction is usually shorter than the length of the tobacco-containing segment of the combustion-type flavor inhaler in the axial direction in relation to the heater. Thus, in the non-combustion heating-type flavor inhaler, a large amount of, for example, tobacco sheet is filled in the section of the short tobacco-containing segment in order to ensure the amount of aerosol generated during heating. To fill a large amount of, for example, tobacco sheet in a short section, in the non-combustion heating-type flavor inhaler, a tobacco sheet having a low filling capacity, that is, high density, is usually used. The filling capacity is a value indicating a volume when a shredded tobacco sheet having a predetermined mass is compressed at a predetermined pressure for a predetermined time. For example, Patent Literatures 1 and 2 disclose tobacco sheets for use in non-combustion heating-type flavor inhalers.

CITATION LIST

PATENT LITERATURE

[0004]

PTL 1: Japanese Patent No. 5969923
PTL 2: International Publication No. 2020/058814

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0005] However, the inventors have found that, when considering the heating method, the heating capacity of the heater, and the generation of aerosol, the total heat capacity of the tobacco-containing segment increases when a tobacco sheet having a low filling capacity (high density) is used, and thus the tobacco sheet filled in the tobacco-containing segment does not sufficiently contribute to the generation of aerosol depending on the heating method and the capacity of the heater. To solve the above-described problem, it is conceivable to reduce the total heat capacity of the tobacco-containing segment.

[0006] To reduce the total heat capacity of the tobacco-containing segment, the inventors have conducted studies on (1) a reduction in the specific heat of the tobacco raw material contained in the tobacco sheet, and (2) the use of a tobacco sheet having a high filling capacity (low density). However, with respect to (1), it is difficult to reduce the specific heat of the tobacco raw material itself; thus, it was considered effective to reduce the total heat capacity of the tobacco-containing segment by (2). Therefore, it is desired to develop a high-filling-capacity (low-density) tobacco sheet suitable for a non-combustion heating-type flavor inhaler.

[0007] The present invention aims to provide a high-filling-capacity tobacco sheet for a non-combustion heating-type flavor inhaler, a non-combustion heating-type flavor inhaler containing the tobacco sheet, and a non-combustion heating-type flavor inhalation system.

SOLUTION TO PROBLEM

[0008] The present invention includes the following embodiments.

First Aspect

[0009] A tobacco sheet for a non-combustion heating-type flavor inhaler contains a tobacco powder having a 90% cumulative particle size (D90) of 200 μm or more in a volume-based particle size distribution measured by dry laser diffractometry.

Second Aspect

[0010] The tobacco sheet for the non-combustion heating-type flavor inhaler described in the first aspect further contains a fructan.

Third Aspect

[0011] In the tobacco sheet for the non-combustion heating-type flavor inhaler described in the first or second aspect, the fructan is selected from the group consisting of inulin-type fructans, levan-type fructans, branched fructans, fructo-oligosaccharides, and mixtures thereof.

Fourth Aspect

[0012] The tobacco sheet for the non-combustion heating-type flavor inhaler described in any one of the first to third aspects further contains:

a saturated fatty acid-based additive,
in which the additive is selected from the group consisting of a saturated fatty acid having a molar mass of 200 to 350 g/mol, an ester of the saturated fatty acid, and a combination thereof, and
its content is 0.01% to 3% by mass based on the dry matter mass of the sheet.

Fifth Aspect

[0013] In the tobacco sheet for the non-combustion heating-type flavor inhaler described in the fourth aspect, each of the saturated fatty acid and the ester of the saturated fatty acid is a single compound.

Sixth Aspect

[0014] A tobacco-containing segment contains, as fillers:

the sheet described in any one of the first to fifth aspects; and
paper,
in which the total amount of lignin and hemicellulose contained in the paper is 0.1% to 10% by mass.

Seventh Aspect

[0015] A tobacco-containing segment contains, as fillers:

the sheet described in any one of the first to fifth aspects; and
paper containing an aerosol-generating agent.

Eighth Aspect

[0016] A non-combustion heating-type flavor inhaler includes:

a tobacco-containing segment containing the tobacco sheet for the non-combustion heating-type flavor inhaler described in any one of the first to fifth aspects, or
the tobacco-containing segment described in the sixth or seventh aspect.

Ninth Aspect

[0017] A non-combustion heating-type flavor inhalation system includes:

the non-combustion heating-type flavor inhaler described in the eighth aspect; and
a heating device configured to heat the tobacco-containing segment.

ADVANTAGEOUS EFFECTS OF INVENTION

[0018] According to the present invention, it is possible to provide a high-filling-capacity tobacco sheet for a non-combustion heating-type flavor inhaler, a non-combustion heating-type flavor inhaler containing the tobacco sheet, and a non-combustion heating-type flavor inhalation system.

BRIEF DESCRIPTION OF DRAWINGS

[0019]

Fig. 1 is a cross-sectional view illustrating an example of the non-combustion heating-type flavor inhaler according to the present embodiment.
Fig. 2 illustrates an example of a non-combustion heating-type flavor inhalation system according to the present embodiment, in which (a) is a cross-sectional view illustrating a state before a non-combustion heating-type flavor inhaler is inserted into a heating device, and (b) is a cross-sectional view illustrating a state in which the non-combustion heating-type flavor inhaler is inserted into the heating device and heated.
Fig. 3A illustrates an embodiment of a tobacco segment.
Fig. 3B illustrates an embodiment of a tobacco segment.
Fig. 3C illustrates an embodiment of a tobacco segment.
Fig. 3D illustrates an embodiment of a tobacco segment.
Fig. 3E illustrates an embodiment of a tobacco segment.
Fig. 4 is a graph illustrating the relationship between the inulin-type fructan or fructose content (% by mass) and the sensory evaluation (flavor or smoke flavor inhibition) in reference examples.
Fig. 5 illustrates graphs each illustrating the relationship between the inulin-type fructan or fructose content (% by mass) and the persistence of an inhibitory effect on smoke flavor inhibition in reference examples.

DESCRIPTION OF EMBODIMENTS

[Tobacco Sheet for Non-combustion Heating-Type Flavor Inhaler]

[0020] A tobacco sheet for a non-combustion heating-type flavor inhaler according to the present embodiment (hereinafter, also referred to as a "tobacco sheet") contains a tobacco powder having a 90% cumulative particle size (D90) of 200 μm or more in a volume-based particle size distribution measured by dry laser diffractometry.
[0021] In the tobacco sheet according to the present embodiment, since the D90 of the tobacco powder measured by the dry laser diffractometry is 200 μm or more, the gap between the tobacco powder particles in the tobacco sheet is large, and the gap is presumed to contribute to the improvement of the filling capacity of the tobacco sheet. The tobacco sheet according to the present embodiment preferably further contains an aerosol-generating agent and a forming agent. When the mixing ratio of these components is within a predetermined range, the filling capacity of the tobacco sheet is further improved.

(Tobacco Powder)

[0022] Examples of the tobacco powder contained in the tobacco sheet according to the present embodiment include leaf tobacco, midribs, and residual stems. These may be used alone or in combination of two or more. These can be used as the tobacco powder by shredding them into a predetermined size. Regarding the size of the tobacco powder, the 90% cumulative particle size (D90) in the volume-based particle size distribution measured by dry laser diffractometry is 200 μm or more, preferably 350 μm or more, more preferably 500 μm or more. The upper limit of the range of D90 can be, but is not particularly limited to, for example, 2,000 μm or less.
[0023] Regarding the size of the tobacco powder, the 50% cumulative particle size (D50) in the volume-based particle size distribution measured by dry laser diffractometry is preferably 40 μm or more, more preferably 100 μm or more, still more preferably 200 μm or more, from the viewpoint of further improving the filling capacity of the tobacco sheet.

The upper limit of the range of D50 can be, but is not particularly limited to, for example, 1,000 μm or less. In the present embodiment, the measurement of D90 and D50 by the dry laser diffractometry can be performed using, for example, a Mastersizer (trade name, available from Malvern Panalytical of Spectris Co., Ltd.).

[0024] The proportion of the tobacco powder contained in 100% by mass of the tobacco sheet is preferably 45% to 95% by mass. When the proportion of the tobacco powder is 45% or more by mass, a tobacco aroma can be sufficiently generated during heating. In addition, when the proportion of the tobacco powder is 95% or less by mass, a sufficient amount of an aerosol-generating agent and a forming agent can be contained. The proportion of the tobacco powder is more preferably 50% to 93% by mass, still more preferably 55% to 90% by mass, particularly preferably 60% to 88% by mass.

(Aerosol-Generating Agent)

[0025] The tobacco sheet according to the present embodiment preferably further contains an aerosol-generating agent from the viewpoint of increasing the amount of smoke during heating. Examples of the aerosol-generating agent include glycerine, propylene glycol, and 1,3-butanediol. These may be used alone or in combination of two or more.

[0026] When the tobacco sheet contains the aerosol-generating agent, the proportion of the aerosol-generating agent contained in 100% by mass of the tobacco sheet is preferably 4% to 50% by mass. When the proportion of the aerosol-generating agent is 4% or more by mass, aerosol can be generated in sufficient quantity during heating. When the proportion of the aerosol-generating agent is 50% or less by mass, a sufficient amount of aerosol can be generated during heating from the viewpoint of heat capacity. The proportion of the aerosol-generating agent is more preferably 6% to 40% by mass, still more preferably 8% to 30% by mass, particularly preferably 10% to 20% by mass.

(Forming Agent)

[0027] The tobacco sheet according to the present embodiment preferably further contains a forming agent from the viewpoint of ensuring the shape. Examples of the forming agent include polysaccharides, proteins, and synthetic polymers. These may be used alone or in combination of two or more. Examples of the polysaccharides include cellulose derivatives and naturally occurring polysaccharides.

[0028] Examples of the cellulose derivatives include cellulose ethers, such as methyl cellulose, ethyl cellulose, hydroxyethyl cellulose, hydroxymethylethyl cellulose, hydroxypropyl cellulose, hydroxypropylmethyl cellulose, benzyl cellulose, trityl cellulose, cyanoethyl cellulose, carboxymethyl cellulose, carboxyethyl cellulose, and aminoethyl cellulose; organic acid esters, such as cellulose acetate, cellulose formate, cellulose propionate, cellulose butyrate, cellulose benzoate, cellulose phthalate, and tosyl cellulose; and esters of inorganic acids, such as cellulose nitrate, cellulose sulfate, cellulose phosphate, and cellulose xanthate.

[0029] Examples of the naturally occurring polysaccharides include plant-derived polysaccharides, such as guar gum, tara gum, locust bean gum, tamarind seed gum, pectin, arabic gum, tragacanth gum, karaya gum, ghatti gum, arabinogalactan, flax seed gum, cassia gum, psyllium seed gum, and artemisia seed gum; algae-derived polysaccharides, such as carrageenan, agar, alginic acid, propylene glycol alginate, furcellaran, and oyster thief extracts; microorganism-derived polysaccharides, such as xanthan gum, gellan gums, curdlan, pullulan, Agrobacterium succinoglycan, welan gum, macrophomopsis gum, and rhamsan gum; crustacean-derived polysaccharides, such as chitin, chitosan, and glucosamine; and starches, such as starches, sodium starch glycolate, pregelatinized starch, and dextrin.

[0030] Examples of the proteins include cereal proteins, such as wheat gluten and rye gluten. Examples of the synthetic polymers include polyphosphoric acid, sodium polyacrylate, and polyvinylpyrrolidone.

[0031] When the forming agent is contained in the tobacco sheet, the proportion of the forming agent contained in 100% by mass of the tobacco sheet is preferably 0.1% to 15% by mass. When the proportion of the first forming agent is 0.1% or more by mass, the mixture of raw materials can be formed into a sheet shape. When the proportion of the forming agent is 15% or less by mass, other raw materials can be sufficiently used for ensuring a function required for the tobacco-containing segment of the non-combustion heating-type flavor inhaler. The proportion of the forming agent is more preferably 0.2% to 13% by mass, still more preferably 0.5% to 12% by mass, particularly preferably 1% to 10% by mass.

(Reinforcing Agent)

[0032] The tobacco sheet according to the present embodiment can further contain a reinforcing agent from the viewpoint of further improving physical properties. Examples of the reinforcing agent include fibrous materials, such as fibrous pulp, insoluble fibers, and fibrous synthetic cellulose, and liquid materials having a surface coating function of forming a film when dried, such as an aqueous suspension of pectin. These may be used alone or in combination of two or more.

[0033] When the tobacco sheet contains a reinforcing agent, the proportion of the reinforcing agent contained in 100% by mass of the tobacco sheet is preferably 4% to 60% by mass. Within this range, other raw materials can be sufficiently used for ensuring the functions required for the tobacco-containing segment of the non-combustion heating-type flavor inhaler. The proportion of the reinforcing agent is more preferably 4.5% to 55% by mass, still more preferably 5% to 50% by mass.

(Humectant)

[0034] The tobacco sheet according to the present embodiment can further contain a humectant from the viewpoint of quality retention. Examples of the humectant include sugar alcohols, such as sorbitol, erythritol, xylitol, maltitol, lactitol, mannitol, and reduced maltose syrup. These may be used alone or in combination of two or more.

[0035] When the humectant is contained in the tobacco sheet, the proportion of the humectant contained in 100% by mass of the tobacco sheet is preferably 1% to 15% by mass. Within this range, other raw materials can be sufficiently used for ensuring the functions required for the tobacco-containing segment of the non-combustion heating-type flavor inhaler. The proportion of the humectant is more preferably 2% to 12% by mass, still more preferably 3% to 10% by mass.

(Other Components)

[0036] The tobacco sheet according to the present embodiment can contain, in addition to the tobacco powder, the aerosol-generating agent, the forming agent, the reinforcing agent, and the humectant, a flavor agent, such as a flavoring agent or a taste enhancer, a coloring agent, a wetting agent, a preservative, a diluent, such as an inorganic substance, and so forth, as needed.

(Filling Capacity)

[0037] The tobacco sheet according to the present embodiment preferably has a filling capacity of 190 cc/100 g or more. When the filling capacity is 190 cc/100 g or more, the total heat capacity of the tobacco-containing segment of the non-combustion heating-type flavor inhaler can be sufficiently reduced, and the tobacco sheet filled in the tobacco-containing segment can further contribute to aerosol generation. The filling capacity is more preferably 210 cc/100 g or more, more preferably 230 cc/100 g or more. The upper limit of the filling capacity range is not particularly limited, but can be, for example, 800 cc/100 g or less. The filling capacity is a value measured with DD-60A (trade name, available from Borgward) after a tobacco sheet is shredded into a size of 0.8 mm $\times$ 9.5 mm and left in a conditioning room at 22°C and 60% for 48 hours. The measurement is performed by placing 15 g of the shredded tobacco sheet in a cylindrical container having an inside diameter of 60 mm and determining the volume when the shredded tobacco sheet is compressed for 30 seconds with a load of 3 kg.

(Configuration of Tobacco Sheet)

[0038] In the present embodiment, the "tobacco sheet" is a sheet obtained by forming components constituting the tobacco sheet, such as tobacco powder, into a sheet shape. Here, the term "sheet" refers to a shape having a pair of substantially parallel main surfaces and side surfaces. The length and width of the tobacco sheet are not particularly limited, and can be appropriately adjusted according to the mode of filling. The thickness of the tobacco sheet is preferably, but not particularly limited to, 100 to 1,000 μm, more preferably 150 to 600 μm, in view of the balance between heat transfer efficiency and strength.

(Method for Manufacturing Tobacco Sheet)

[0039] The tobacco sheet according to the present embodiment can be produced by a known method such as a rolling method or a casting method. Various tobacco sheets manufactured by such a method are disclosed in detail in "Encyclopedia of Tobacco, Tobacco Academic Studies Center, March 31, 2009".

<Rolling Method>

[0040] An example of a method for manufacturing a tobacco sheet by a rolling method is a method including the following steps.

(1) A step of mixing water, a tobacco powder, an aerosol-generating agent, a forming agent, and a reinforcing agent to prepare a mixture.

(2) A step of rolling the mixture with rolling rollers.
(3) A step of drying the rolled article with a dryer.

When the tobacco sheet is manufactured by this method, the surfaces of the rolling rollers may be heated or cooled, and the number of rotations of the rolling rollers may be adjusted, depending on the purpose. The distance between the rolling rollers may be adjusted. One or more rolling rollers may be used in order to provide a tobacco sheet having a desired basis weight.

<Casting Method>

[0041] An example of a method for manufacturing a tobacco sheet by a casting method is a method including the following steps.

(1) A step of mixing water, a tobacco powder, an aerosol-generating agent, a forming agent, and pulp to prepare a mixture.

(2) A step of thinly spreading (casting) and drying the mixture to form a tobacco sheet.

[0042] When the tobacco sheet is manufactured by this method, a step of removing some components, such as nitrosamine, by irradiating a slurry prepared by mixing water, the tobacco powder, the aerosol-generating agent, the forming agent, and the pulp with ultraviolet rays or X-rays may be added.

[Non-Combustion Heating-Type Flavor Inhaler]

[0043] The non-combustion heating-type flavor inhaler according to the present embodiment includes a tobacco-containing segment containing the tobacco sheet according to the present embodiment and so forth. The non-combustion heating-type flavor inhaler according to the present embodiment includes the tobacco-containing segment filled with the high-filling-capacity tobacco sheet according to the present embodiment and so forth. Thus, the total heat capacity of the tobacco-containing segment can be sufficiently reduced, and the tobacco sheet filled in the tobacco-containing segment can further contribute to aerosol generation.

[0044] Fig. 1 illustrates an example of the non-combustion heating-type flavor inhaler according to the present embodiment. A non-combustion heating-type flavor inhaler 1 illustrated in Fig. 1 includes a tobacco-containing segment 2 filled with the tobacco sheet according to the present embodiment or the like, a tubular cooling segment 3 having perforations 8 on the circumference, a center-hole segment 4, and a filter segment 5. The non-combustion heating-type flavor inhaler according to the present embodiment may include other segments in addition to the tobacco-containing segment, the cooling segment, the center-hole segment, and the filter segment.

[0045] The length of the non-combustion heating-type flavor inhaler according to the present embodiment in the axial direction is preferably, but not particularly limited to, 40 mm or more and 90 mm or less, more preferably 50 mm or more and 75 mm or less, still more preferably 50 mm or more and 60 mm or less. The circumference of the non-combustion heating-type flavor inhaler is preferably 16 mm or more and 25 mm or less, more preferably 20 mm or more and 24 mm or less, still more preferably 21 mm or more and 23 mm or less. In an embodiment, for example, the tobacco-containing segment has a length of 20 mm, the cooling segment has a length of 20 mm, the center-hole segment has a length of 8 mm, and the filter segment has a length of 7 mm. The length of the filter segment can be selected in the range of 4 mm to 10 mm. In this case, the airflow resistance of the filter segment is selected so as to be 15 mmH_2O/segment or more and 60 mmH_2O/segment or less. The lengths of these individual segments can be appropriately changed in accordance with manufacturing suitability, required quality, and so forth. Even if the filter segment alone is disposed downstream of the cooling segment without using the center-hole segment, the flavor inhaler can function as a non-combustion heating-type flavor inhaler.

(Tobacco-Containing Segment)

[0046] In the tobacco-containing segment 2, a wrapping paper (hereinafter, also referred to as a "wrapper") is filled with, for example, the tobacco sheet according to the present embodiment. A method for filling the tobacco sheet or the like in the wrapping paper (hereinafter, also referred to as a "wrapper") is not particularly limited. For example, the tobacco sheet or the like may be wrapped in the wrapper, or the tobacco sheet or the like may be filled in a tubular wrapper. When the tobacco sheet has a shape, such as a rectangular shape, having a longitudinal direction, the tobacco sheet or the like may be packed in such a manner that its longitudinal direction is an unspecified direction in the wrapper, or may be packed so as to be aligned in the axial direction of the tobacco-containing segment 2 or in a direction

perpendicular to the axial direction.

(Cooling Segment)

[0047] In an embodiment, as illustrated in Fig. 1, the cooling segment 3 can include a tubular member 7. The tubular member 7 may be, for example, a cardboard tube formed by processing cardboard into a tubular shape.

[0048] The tubular member 7 and mouthpiece lining paper 12 described below are provided with perforations 8 penetrating therethrough. The presence of the perforations 8 allows outside air to be introduced into the cooling segment 3 during inhalation. Thus, the vaporized aerosol component produced by heating the tobacco-containing segment 2 comes into contact with the outside air to reduce its temperature, thus liquefying to form an aerosol. The diameter of (length across) each perforation 8 is not particularly limited, and may be, for example, 0.5 mm or more and 1.5 mm or less. The number of the perforations 8 is not particularly limited. One perforation or two or more perforations may be used. For example, the multiple perforations 8 may be provided on the circumference of the cooling segment 3.

[0049] The amount of outside air introduced through the perforations 8 is preferably 85% or less by volume, more preferably 80% or less by volume, based on the volume of the entire gas inhaled by a user. When the proportion of the amount of outside air is 85% or less by volume, a decrease in flavor due to dilution with outside air can be sufficiently inhibited. In other words, this is also referred to as a ventilation ratio. The lower limit of the range of the ventilation ratio is preferably 55% or more by volume, more preferably 60% or more by volume, from the viewpoint of cooling performance.

[0050] The cooling segment may also be a segment including a crimped, pleated, gathered, or folded sheet of a suitable component material. The cross-sectional profile of such an element may exhibit randomly oriented channels. The cooling segment may also include a bundle of longitudinally extending tubes. Such a cooling segment can be formed, for example, by wrapping a pleated, gathered, or folded sheet material with wrapping paper.

[0051] The length of the cooling segment in the axial direction can be, for example, 7 mm or more and 28 mm or less, and can be, for example, 18 mm. The cooling segment can be substantially circular in its axial cross-sectional shape. The diameter can be, for example, 5 mm or more and 10 mm or less, and can be, for example, about 7 mm.

(Center-Hole Segment)

[0052] The center-hole segment includes a filling layer having one or multiple hollow portions and an inner plug wrapper (inner wrapping paper) covering the filling layer. For example, as illustrated in Fig. 1, the center-hole segment 4 includes a second filling layer 9 having a hollow portion and a second inner plug wrapper 10 covering the second filling layer 9. The center-hole segment 4 has a function of increasing the strength of a mouthpiece segment 6. The second filling layer 9 can be, for example, a rod, having an inside diameter of ø1.0 to ø5.0 mm, formed by hardening densely packed cellulose acetate fibers containing a 6% or more by mass and 20% or less by mass plasticizer containing triacetin based on the mass of the cellulose acetate. The second filling layer 9 has a high fiber filling density, so that air or aerosol flows only in the hollow portion during inhalation, and hardly flows in the second filling layer 9. Since the second filling layer 9 inside the center-hole segment 4 is a fiber-filled layer, the feeling of touch from the outside during use is less likely to cause the user to feel uncomfortable. The center-hole segment 4 need not include the second inner plug wrapper 10, and the shape of the center-hole segment 4 may be maintained by thermoforming.

(Filter Segment)

[0053] The configuration of the filter segment 5 is not particularly limited, and the filter segment 5 may be formed of a single filling layer or multiple filling layers. The outside of the filling layer may be wrapped with one or more sheets of wrapping paper. The flow resistance per segment of the filter segment 5 can be appropriately changed in accordance with, for example, the amount of filler and the material of the filler filled in the filter segment 5. For example, when the filler is formed of cellulose acetate fibers, the flow resistance can be increased by increasing the amount of cellulose acetate fibers filled in the filter segment 5. When the filler is formed of cellulose acetate fibers, the filling density of the cellulose acetate fibers can be 0.13 to 0.18 g/cm^3. The airflow resistance is a value measured by an airflow resistance measuring device (trade name: SODIMAX, available from SODIM).

[0054] The circumference of the filter segment 5 is not particularly limited, but is preferably 16 to 25 mm, more preferably 20 to 24 mm, still more preferably 21 to 23 mm. The length of the filter segment 5 in the axial direction can be selected from 4 to 10 mm, and is selected in such a manner that the airflow resistance is 15 to 60 mmH_2O/segment. The length of the filter segment 5 in the axial direction is preferably 5 to 9 mm, more preferably 6 to 8 mm. The cross-sectional shape of the filter segment 5 is not particularly limited, and may be, for example, circular, elliptical, polygonal, or the like. To the filter segment 5, flavoring agent-containing breakable capsules or flavoring agent beads may be added, or a flavoring agent may be directly added.

[0055] As illustrated in Fig. 1, the center-hole segment 4 and the filter segment 5 can be connected using an outer

plug wrapper (outer wrapping paper) 11. The outer plug wrapper 11 can be, for example, a tubular sheet of paper. The tobacco-containing segment 2, the cooling segment 3, and the center-hole segment 4 that has been connected to the filter segment 5 can be connected using the mouthpiece lining paper 12. These can be connected, for example, by applying an adhesive, such as a vinyl acetate adhesive, to the inner surface of the mouthpiece lining paper 12, placing the three segments, and wrapping them. These segments may be connected in multiple steps with multiple sheets of lining paper.

[Non-Combustion Heating-Type Flavor Inhalation System]

[0056] A non-combustion heating-type flavor inhalation system according to the present embodiment includes the non-combustion heating-type flavor inhaler according to the present embodiment and a heating device configured to heat the tobacco-containing segment of the non-combustion heating-type flavor inhaler. The non-combustion heating-type flavor inhalation system according to the present embodiment may have another configuration other than the non-combustion heating-type flavor inhaler according to the present embodiment and the heating device.

[0057] Fig. 2 illustrates an example of the non-combustion heating-type flavor inhalation system according to the present embodiment. The non-combustion heating-type flavor inhalation system illustrated in Fig. 2 includes the non-combustion heating-type flavor inhaler 1 according to the present embodiment, and a heating device 13 configured to, from the outside, heat the tobacco-containing segment of the non-combustion heating-type flavor inhaler 1.

[0058] Fig. 2(a) illustrates a state before the non-combustion heating-type flavor inhaler 1 is inserted into the heating device 13, and Fig. 2(b) illustrates a state in which the non-combustion heating-type flavor inhaler 1 is inserted into the heating device 13 and heated. The heating device 13 illustrated in Fig. 2 includes a body 14, a heater 15, a metal tube 16, a battery unit 17, and a control unit 18. The body 14 has a tubular recessed portion 19. The heater 15 and the metal tube 16 are arranged on the inner surface of the recessed portion 19 at a position corresponding to the tobacco-containing segment of the non-combustion heating-type flavor inhaler 1 to be inserted into the recessed portion 19. The heater 15 can be an electrical resistance heater. Electric power is supplied from the battery unit 17 by instructions from the control unit 18, which controls the temperature, to heat the heater 15. The heat generated from the heater 15 is conducted to the tobacco-containing segment of the non-combustion heating-type flavor inhaler 1 through the metal tube 16 having high thermal conductivity.

[0059] In Fig. 2(b), there is a gap between the outer circumference of the non-combustion heating-type flavor inhaler 1 and the inner circumference of the metal tube 16 because it is schematically illustrated. However, actually, it is desirable that there is no gap between the outer circumference of the non-combustion heating-type flavor inhaler 1 and the inner circumference of the metal tube 16 in order to achieve efficient heat conduction. The heating device 13 heats the tobacco-containing segment of the non-combustion heating-type flavor inhaler 1 from the outside, but may heat it from the inside.

[0060] The heating temperature by the heating device is not particularly limited, but is preferably 400°C or lower, more preferably 150°C or higher and 400°C or lower, still more preferably 200°C or higher and 350°C or lower. The heating temperature refers to the temperature of the heater of the heating device.

[0061] The non-combustion heating-type flavor inhaler is required to reduce smoke flavor inhibition (stimulation) or discomfort. The smoke flavor inhibition refers to stimulation to the oral cavity or throat upon inhalation. Hereinafter, a tobacco sheet for a non-combustion heating-type flavor inhaler in which smoke flavor inhibition or discomfort is reduced will be described.

[Embodiment 1]

[0062] In this embodiment, the tobacco sheet for a non-combustion heating-type flavor inhaler contains fructan. When the tobacco sheet is used for smoking, fructan is thermally decomposed to continuously generate a sweet aroma. The generated sustained sweet aroma can continuously inhibit the smoke flavor inhibition from the early stage to the late stage of the smoking behavior.

[0063] The fructan is not particularly limited, and an inulin-type fructan, a levan-type fructan, a branched fructan, a fructo-oligosaccharide, or a combination of two or more thereof can be used. Among these, the inulin-type fructan is preferred from the viewpoint of cost reduction.

[0064] Without being bound by theory, it is presumed that when the fructan of the present embodiment generates a sweet aroma by a caramelization reaction, there are the following features.

[0065] Fructan is composed of multiple monosaccharides bonded, and has a molecular structure larger than monosaccharides and disaccharides. For this reason, when fructan undergoes a caramelization reaction, it is considered that fructan undergoes a multi-stage decomposition process in which fructan is decomposed into sugars having relatively small molecules such as monosaccharides and disaccharides, and then these monosaccharides and disaccharides undergo a caramelization reaction to generate a sweet aroma. When monosaccharides and disaccharides undergo a caramelization reaction, these sugars are considered to undergo a caramelization reaction to directly generate a sweet

aroma. Thus, fructan is considered to be able to generate a sweet aroma at a slower rate and for a longer period of time than monosaccharides and disaccharides because of a larger number of decomposition steps. In the present embodiment, it is considered that these features relating to the caramelization reaction of fructan can continuously inhibit the smoke flavor inhibition from the early stage to the late stage of the smoking behavior.

[0066] In some embodiments, the fructan content based on the tobacco powder can be, but is not particularly limited to, 0.1% to 5% by mass, 0.3% to 3.5% by mass, or 0.5% to 3% by mass. A higher fructan content is more preferred from the viewpoint of suppression of the smoke flavor inhibition and the viewpoint of the persistence of the inhibition of the smoke flavor inhibition. An excessively higher fructan content may reduce flavor. Thus, the fructan content is preferably 0.5% to 3% by mass from the viewpoint of achieving the inhibition of the smoke flavor inhibition and the persistence thereof and providing flavor.

[0067] In this embodiment, the raw material of the tobacco powder may further contain tobacco leaves, aged tobacco leaves, processed tobacco leaves, tobacco fillers, non-tobacco materials, or a combination of two or more thereof.

<Tobacco Leaves, Aged Tobacco Leaves, and Processed Tobacco Leaves>

[0068] The term "tobacco leaves" is used as a generic term for harvested tobacco leaves before they are subjected to aging as described below. In an embodiment, aging includes curing. Tobacco leaves that have undergone aging and have not yet been processed into various forms used in tobacco products (such as shredded tobacco, tobacco sheets, and tobacco granules, described below) are referred to as "aged tobacco leaves". The aged tobacco leaves processed into various forms used in tobacco products are referred to as "processed tobacco leaves".

[0069] Examples of the form of processed tobacco leaves used in tobacco products include "shredded tobacco" obtained by shredding aged tobacco leaves into a predetermined size. Further examples thereof may include "tobacco sheets" and "tobacco granules". A composition containing aged tobacco leaves that have been ground to a predetermined particle size (hereinafter also referred to as a "fine tobacco powder") is formed into sheets to obtain the "tobacco sheets" and into granules to obtain the "tobacco granules". The "fine tobacco powder" is also one form of processed tobacco leaves.

[0070] Examples of the non-tobacco materials can include roots (including scaly roots (scaly bulbs), tuberous roots (potatoes), bulbs, and so forth), stems, tubers, skins (including stem bark, tree bark, and so forth), leaves, and flowers (including petals, pistils, stamens, and so forth), seeds, and fruits of plants; and tree trunks and branches.

[0071] A method for manufacturing a fructan-containing tobacco sheet is not limited. In some embodiments of the present application, the tobacco sheet can be manufactured by preparing the above-described tobacco sheet and supplying fructan from the outside.

[Embodiment 2]

[0072] In this embodiment, the tobacco sheet for the non-combustion heating-type flavor inhaler contains a saturated fatty acid-based additive.

[0073] In this embodiment, the tobacco sheet may contain a material derived from Oriental variety. In this case, the amount of material derived from the Oriental variety is preferably 10% or less by mass based on the tobacco powder. When the amount of material derived from the Oriental variety is within this range, a smoke taste with a further reduced discomfort can be provided. From this viewpoint, the upper limit of the amount is preferably 8% or less by mass, more preferably 5% or less by mass. The lower limit thereof is preferably 0.1% or more by mass, more preferably 2% or more by mass, still more preferably 3% or more by mass.

[0074] The saturated fatty acid-based additive is selected from the group consisting of a saturated fatty acid having a molar mass of 200 to 350 g/mol, an ester of the saturated fatty acid, and a combination thereof. The saturated fatty acid reduces discomfort during smoking. The ester of the saturated fatty acid is prepared from an alcohol and a saturated fatty acid having a molar mass of 200 to 350 g/mol; thus, the molar mass of the ester varies in accordance with the molar mass of the alcohol. In one embodiment, the molar mass of the ester is 210 to 1,300 g/mol. The ester of a saturated fatty acid typically has a lower vapor pressure than the fatty acid; thus, the effect of reducing discomfort during smoking lasts throughout smoking. Hereinafter, the discomfort reduction effect during smoking is also referred to simply as a discomfort reduction effect.

[0075] From the viewpoint of achieving the above effect, the lower limit of the molar mass of the ester of the saturated fatty acid is preferably 240 g/mol or more, more preferably 270 g/mol or more. The upper limit is preferably 1,140 g/mol or less, 1,112 g/mol or less, 300 g/mol or less, or 290 g/mol or less.

[0076] The saturated fatty acid-based additive content is 0.01% to 3% by mass based on the total dry matter mass of the tobacco powder (assuming that the dry matter mass is 100% by mass). When the content is less than the lower limit, the discomfort reduction effect is not sufficient. When the content is more than the upper limit, the sense of offensive odor increases. From this viewpoint, the lower limit of the content is preferably 1% or more by mass, and the upper limit

thereof is preferably 2% or less by mass. The dry matter mass is the mass excluding a medium described below, and is preferably the mass of the residue when the composition is dried at 100°C for 5 hours.

[0077] Each of the saturated fatty acid and the fatty acid moiety in the ester preferably has 12 to 20 carbon atoms, more preferably 15 to 19 carbon atoms. When the number of carbon atoms is within this range, the discomfort reduction effect is more noticeable.

[0078] In the saturated fatty acid-based additive, the solubility of the saturated fatty acid in water is preferably 0.15 mg/g or less, more preferably 0.12 mg/g or less. The lower limit thereof is not limited and may be 0 mg/g, but is preferably 0.05 mg/g or more.

[0079] Specific preferred examples of the saturated fatty acid include octanoic acid, decanoic acid, myristic acid, palmitic acid, stearic acid, and nonadecanoic acid. Among these, palmitic acid, stearic acid, or nonadecanoic acid is preferred from the viewpoint of easy availability and providing the discomfort reduction effect. The saturated fatty acid may be a mixture, but is preferably a single substance that is not a mixture. In this embodiment, the term "single substance (single compound)" includes a case where the compound is a pure substance and a case where the compound contains incidental impurities. Thus, in one embodiment, the saturated fatty acid consists only of palmitic acid. If the saturated fatty acid is a single substance, when the tobacco composition of the present invention is formed into a formed product such as a sheet, the dispersibility of the saturated fatty acid in the formed product is improved.

[0080] Preferred specific examples of the ester of the saturated fatty acid (hereinafter, also referred to simply as "ester") include the alkyl ester and sugar ester of the saturated fatty acid described above. An alkyl moiety is preferably derived from a linear, branched, or cyclic alkyl group having 1 to 10 carbon atoms, such as a methyl group. The sugar moiety is preferably derived from a disaccharide such as sucrose. Preferred examples of the ester include sucrose palmitate and methyl palmitate. The saturated fatty acid moiety in the ester is preferably derived from a single saturated fatty acid for the reasons described above. The alcohol moiety in the ester need not be a single moiety, but is preferably a single moiety for the reasons described above. The ester also functions as an emulsifier.

[0081] In one embodiment, the saturated fatty acid-based additive contains the saturated fatty acid and the ester. In this case, the discomfort reduction effect can be advantageously maintained longer. In addition, the type of saturated fatty acid-based additive can be appropriately selected, in accordance with, for example, the tobacco raw material used. Thus, this embodiment also has an advantage of being versatile.

[0082] The whole or part of the saturated fatty acid-based additive is preferably in the form of a powder. When the saturated fatty acid-based additive is in the form of a powder, the dispersibility of the saturated fatty acid-based additive in a formed article such as a sheet is improved as described below. The size thereof is not limited. However, for example, the D50 is preferably 30 to 120 μm, more preferably 50 to 100 μm. In addition, from the viewpoint of the dispersibility, the saturated fatty acid-based additive preferably has a higher degree of crystallinity than waxes and natural fats and oils.

[0083] The tobacco sheet may contain liquid sugar. The liquid sugar is sugar in liquid form. When the tobacco sheet contains the liquid sugar, the sweet taste is improved in addition to the reduction of discomfort during smoking. From this viewpoint, the liquid sugar content is preferably 3% to 10% by mass, more preferably 5% to 8% by mass, based on the dry matter mass in the tobacco composition.

[0084] The tobacco sheet may contain a natural botanical flavoring agent. When the tobacco sheet contains the natural botanical flavoring agent, the sweet taste is improved in addition to the discomfort reduction effect. From this viewpoint, the content of the natural botanical flavoring agent is preferably 0.5% to 3% by mass, more preferably 2% to 3% by mass, based on the dry matter mass in the tobacco composition. As the natural botanical flavoring agent, those known in the tobacco field can be used, and licorice is preferred in the present invention. Licorice is a sweetener derived from Spanish licorice, which belongs to the genus Glycyrrhiza of the legume family.

[0085] The amount of nicotine contained in the tobacco sheet according to the present embodiment is not limited, but can be 2% or more by mass based on the dry matter mass of the tobacco sheet in one embodiment. Typically, the discomfort during smoking tends to increase as the amount of nicotine increases. In the present embodiment, however, the discomfort reduction effect is provided as described above. Thus, when the amount of nicotine is within the above range, the effect of the present embodiment becomes more pronounced. The upper limit of the amount of nicotine is practically, but not limited to, 3% or less by mass.

[0086] In another embodiment, the amount of nicotine may be 1.5% or less by mass. When the amount of nicotine is within the above range, a milder smoke flavor can be imparted. The lower limit of the amount of nicotine is practically, but not limited to, 0.1% or more by mass. Nicotine contained in the tobacco sheet may be derived from the tobacco powder, or may be derived from other components.

[0087] The tobacco sheet in the present embodiment can contain the above-described aerosol-generating agent. The amount of aerosol-generating agent is preferably 12% or less by mass, more preferably 11% or less by mass, based on the dry matter mass of the tobacco sheet. The lower limit thereof is not limited and may be 0% by mass, and is preferably 1% or more by mass. An amount of aerosol-generating agent of more than the upper limit may result in a difficulty in producing the sheet. An amount of less than the lower limit may result in a reduction in smoke sensation.

[0088] When the tobacco sheet contains a binder, the strength of the sheet is improved. The binder is an adhesive

for binding fibers together. As the binder, those known in the art can be used. Examples of the binder include thickening polysaccharides, such as gums, modified celluloses, and modified starches. The amount of binder is appropriately adjusted in accordance with the intended use, and can be, for example, about 1% to 10% by mass based on the dry matter mass of the tobacco sheet.

[0089] The tobacco sheet in the present embodiment is manufactured by a freely-selected method. For example, when the mixture is prepared, a saturated fatty acid-based additive is mixed to prepare a mixture containing the additive, and a sheet can be manufactured by the above-described method using the mixture. In this case, it is preferable to use a saturated fatty acid-based additive in powder form and to perform mixing so as to maintain the powder form. The tobacco sheet manufactured in this manner has good dispersibility of the aerosol-generating agent. Good dispersibility indicates that the saturated fatty acid-based additive is uniformly dispersed. The mixing step is preferably performed at a temperature equal to or lower than the melting point of the saturated fatty acid-based additive. For example, this step can be performed at 10°C to 50°C.

[0090] The mixture (also referred to as "slurry") containing the saturated fatty acid-based additive is preferably prepared by a method including the following step.

[0091] A step of mixing the tobacco raw material or the fibrous tobacco material, a saturated fatty acid-based additive that is partially or entirely in the form of a powder, and a medium in such a manner that the powder is maintained in a powder state, to form a slurry.

[0092] In this method, the slurry is prepared while the saturated fatty acid-based additive is maintained in a powder state. Thereby, the dispersibility of component (B) is improved when a formed article is formed. The size of the powder is as described above. The phrase "the saturated fatty acid-based additive is maintained in a powder state" indicates that the whole or part of the saturated fatty acid-based additive is maintained in a powder state.

[0093] Examples of the medium include water and hydrophilic organic solvents. The most preferable medium is water in view of handling.

[0094] In this method, first, solid materials at room temperature are each formed into a powder by pulverization or the like. The resulting powders are mixed to prepare a powder mixture. Liquid or pasty materials at room temperature, such as a medium, are mixed to prepare a liquid mixture. A step of mixing the powder mixture and the liquid mixture is preferably included.

[0095] From the viewpoint of satisfactorily dispersing the powdery saturated fatty acid-based additive in the medium, the viscosity of the slurry at 25°C is preferably 100,000 to 200,000 (mPa·s). The viscosity is measured with a Brookfield type viscometer (DV-I prime available from Brookfield) using a spindle No. LV4 at a rotational speed of 1.0 rpm.

[Embodiment 3]

[0096] In this embodiment, the tobacco-containing segment (hereinafter, also referred to simply as "tobacco segment") contains paper or paper containing an aerosol-generating agent. The outline of the tobacco segment in this embodiment is illustrated in Fig. 3A. A tobacco segment 20A contains a tobacco filler 21 and a wrapper 22 wrapped around the filler 21. The tobacco filler 21 includes a tobacco sheet T and paper P. In this figure, the tobacco sheet T is in the form of strands obtained by cutting it, and the paper P is also in the form of strands. The strands may be obtained by cutting a sheet in which the tobacco sheet T and the paper P are laminated.

[0097] Fig. 3B illustrates an embodiment in which a sheet-like tobacco filler 21 is spirally packed in the wrapper 22. The sheet-like tobacco filler 21 may be a sheet obtained by laminating the tobacco sheet T and the paper sheet P, or may be a sheet obtained by bonding side surfaces of the tobacco sheet T and the paper sheet P to each other or bonding portions near the side surfaces to each other.

[0098] Fig. 3C illustrates an embodiment in which the sheet-like tobacco filler 21 is folded and packed in the wrapper 22. The sheet-like tobacco filler 21 may be a sheet obtained by laminating the tobacco sheet T and the paper sheet P, or may be a sheet obtained by bonding side surfaces of the tobacco sheet T and the paper sheet P to each other or bonding portions near the side surfaces to each other.

[0099] Fig. 3D illustrates an embodiment in which the shredded tobacco filler 21 is filled in the wrapper 22. This figure illustrates a manner in which shreds obtained from the tobacco sheet T and shredded paper P are prepared and filled. The shreds may be obtained by shredding a laminated sheet of the tobacco sheet T and the paper P.

[0100] Fig. 3E illustrates an embodiment in which the sheet-like tobacco filler 21 is compressed and rounded from the longitudinal and transverse directions and then filled into the wrapper 22. The sheet-like tobacco filler 21 may be a sheet obtained by laminating the tobacco sheet T and the paper sheet P, or may be a sheet obtained by bonding side surfaces of the tobacco sheet T and the paper sheet P to each other or bonding portions near the side surfaces to each other.

(1) Paper

(1-1) Embodiment 3-1

[0101] In Embodiment 3-1, a tobacco segment contains, as fillers, a tobacco sheet, and paper in which the total amount of lignin and hemicellulose is 0.1% to 10% by mass. The fillers are fillers for tobacco segments. Lignin is a high-molecular-weight phenol compound contained in, for example, wood. Hemicellulose is an insoluble polysaccharide contained in the cell wall. When the total amount is within this range, an offensive odor (such as a fiber odor) during smoking can be reduced. That is, in this embodiment, the effect of diluting the smoke flavor can be provided without significantly impairing the original smoke flavor. From this viewpoint, the upper limit of the total amount of lignin and hemicellulose contained is preferably 9.0% or less by mass.

[0102] Although lignin and hemicellulose are measured by known methods, they are preferably measured by the following method in the present invention.

[Quantification of Hemicellulose]

[0103]

1) The paper is subjected to a solvent extraction with water as a solvent and the residue is separated. The residue is subjected to cryogenic grinding with, for example, liquid nitrogen, thereby preparing sample A.
2) The sample A is allowed to react with an enzyme, and then the reaction product is recovered.
3) The reaction product is hydrolyzed, and the absorbance of the hydrolysate is measured at a wavelength of 490 nm to quantify hemicellulose.

[0104] In Step 1), for example, a Thermo Scientific™ Dionex™ ASE™ Accelerated Solvent Extractor System (Model: ASE-350) can be used.

[0105] Step 2) can be specifically performed as described below.

[0106] In a screw bottle, 50 mg of the sample A is placed, followed by the addition of 8.5 ml of ultrapure water (ML-Q water) and 0.5 ml of a pancreatin solution. The mixture is shaken at 40°C and 125 rpm for 16 hours. The pancreatin solution is the supernatant obtained by adding 8 g of pancreatin to 100 ml of 0.1 M phosphate buffer with a pH of 6.4, stirring the mixture for 1 hour, and centrifuging the mixture at 8,000 rpm for 30 minutes. The sample liquid is then transferred to a 15-ml centrifuge tube using ML-Q water and centrifuged at 8,000 rpm for 15 minutes to remove the supernatant. This washing is repeated three times. After washing, 10 ml of an aqueous solution of 5% sulfuric acid is added thereto, and hydrolysis is performed at 100°C for 2.5 hours. After the completion of the hydrolysis reaction, the sample is allowed to cool to room temperature. The precipitate is then filtered off, and the filtrate is collected in a 250-ml volumetric flask. After thoroughly washing the residue on the filter paper with ML-Q water, the volume is adjusted to 250 ml. This solution is used as a sample for hemicellulose measurement. Then 500 μl of the sample is transferred to a 20-ml test tube, and 500 μl of an aqueous solution of 5% phenol and 2.5 ml of concentrated sulfuric acid are added thereto. The mixture is vigorously stirred for 10 seconds. The sample is allowed to stand at room temperature for 20 minutes or more. The absorbance is measured at a wavelength of 490 nm with a spectrophotometer to quantify hemicellulose.

[Quantification of Lignin]

[0107]

i) The sample A is prepared.
ii) The sample A is refluxed in an aqueous acid solution, and the sample after the reflux treatment is separated by filtration.
iii) The filtered sample is dried and then weighed to determine the amount of lignin.

[0108] Steps ii) and iii) can be specifically performed as described below.

[0109] In a screw bottle, 100 mg of the sample A is placed, followed by the addition of 4 ml of 72% sulfuric acid. The sample is completely immersed in sulfuric acid and then shaken at 30°C and 200 rpm for 4 hours. Next, 157.2 ml of ultrapure water (ML-Q water) is added in such a manner that the sulfuric acid concentration after dilution is 4%. The mixture is transferred to a recovery flask and heated to reflux in an oil bath at 110°C for 2 hours. After cooling to room temperature, filtration is performed. The resulting sample is dried with a rotary dryer and weighed.

[0110] The density of the paper used in this embodiment is preferably 0.05 to 0.8 (g/cm^3), more preferably 0.1 to 0.6

(g/cm^3). The density is measured by a known method and is preferably determined from the following formula.

$$\text{Density } (g/cm^3) = \text{weight } (g)/\text{area } (cm^2)/\text{thickness } (cm)$$

[0111] The amount of paper used in this embodiment is preferably 5% to 70% by mass, more preferably 10% to 50% by mass, still more preferably 15% to 40% by mass, based on the dry matter mass of the tobacco sheet. When the amount of paper contained is within this range, the smoke flavor can be diluted to an appropriate level without impairing the original smoke flavor. The dry matter mass is the mass of the residue when the tobacco sheet is dried at 100°C for 5 hours in one embodiment.

[0112] The paper used in the present embodiment is not limited as long as the total amount of lignin and hemicellulose contained is within the above range, and for example, tobacco paper such as a wrapper, and printing paper such as high-quality printing paper and medium-quality printing paper can be used. However, from the viewpoint of inhibiting the generation of an offensive odor, non-coated paper or slightly coated paper is preferred. The paper used in the present embodiment may contain or need not contain an aerosol-generating agent described below. The amount may be in the range described in Embodiment 3-2, or may be in a range other than this.

(1-2) Embodiment 3-2

[0113] As Embodiment 3-2, the tobacco segment includes, as fillers, a tobacco sheet, and paper containing an aerosol-generating agent. The aerosol-generating agent is a material that is vaporized by heating and cooled to generate an aerosol or generates an aerosol by atomization. In this embodiment, the use of the paper containing the aerosol-generating agent can provide the effect of diluting the smoke flavor without reducing the amount of smoke. As the aerosol-generating agent, those described above can be used. The amount thereof is preferably 3% to 20% by mass, more preferably 5% to 15% by mass, based on the dry matter mass of the paper. An amount of aerosol-generating agent of more than the upper limit may result in, for example, staining on the tobacco segment. An amount of less than the lower limit may result in a reduction in smoke sensation. The aerosol-generating agent can be added to the paper by, for example, impregnation or spraying.

[0114] The amount of paper containing aerosol-generating agent is preferably 5% to 75% by mass, more preferably 10% to 50% by mass, still more preferably 15% to 40% by mass, based on the dry matter mass of the tobacco sheet.

[0115] The paper used in this embodiment is not limited, and may be the paper described in Embodiment 3-1. The density of the paper before addition of the aerosol-generating agent used in the present embodiment may be in the range described in Embodiment 3-1, or may be in a range other than this. The amount of lignin and hemicellulose contained in the paper used in the present embodiment is not limited, and may be in the range described in Embodiment 3-1, or may be in a range other than this.

(1-3) Shape and so Forth

[0116] In any of the embodiments, the shape of the paper is not limited as long as the paper is easily mixed with the tobacco sheet. In one embodiment, the paper is in the form of a sheet, shred, or strand. In a preferred embodiment, the paper and the tobacco sheet have the same shape. In a most preferred embodiment, shredded paper and shredded tobacco sheet are used.

[0117] In addition, the paper may contain a flavoring agent, such as menthol, which is commonly used in the art.

EXAMPLES

[0118] While specific examples of the present embodiment will be described below, the present invention is not limited thereto.

[Example 1]

[0119] Tobacco lamina (leaf tobacco) was dry-ground with a Hosokawa Micron ACM machine to obtain a tobacco powder. With regard to the tobacco powder, the 50% cumulative particle size (D50) and the 90% cumulative particle size (D90) in the volume-based particle size distribution measured by a dry laser diffractometry using a Mastersizer (trade name, available from Malvern Panalytical of Spectris Co., Ltd.) were 57 μm and 216 μm, respectively.

[0120] The tobacco powder was used to produce a tobacco sheet by a rolling method. Specifically, 87 parts by mass of the tobacco powder, 12 parts by mass of glycerine serving as an aerosol-generating agent, and 1 part by mass of carboxymethyl cellulose serving as a forming agent were mixed and kneaded by an extruder. The kneaded product was

formed into a sheet shape with two pairs of metal rollers and dried in a hot air circulation oven at 80°C to provide a tobacco sheet. The tobacco sheet was shredded with a shredder to a size of 0.8 mm × 9.5 mm.

[0121] The filling capacity of the shredded tobacco sheet was measured. Specifically, the shredded tobacco sheet was allowed to stand in a conditioning room at 22°C and 60% RH for 48 hours, and then the filling capacity was measured with DD 60A (trade name, available from Borgward). The measurement was performed by placing 15 g of the shredded tobacco sheet in a cylindrical container having an inside diameter of 60 mm, and determining the volume when the tobacco sheet was compressed for 30 seconds with a load of 3 kg. Table 1 presents the results. In Table 1, the filling capacity is indicated by the rate of increase in filling capacity (%) with respect to a reference value of the filling capacity of Comparative example 1 described below.

[Example 2]

[0122] A tobacco sheet was manufactured and evaluated in the same manner as in Example 1, except that the 50% cumulative particle size (D50) and the 90% cumulative particle size (D90) of the tobacco powder used were 121 μm and 389 μm, respectively, in the volume-based particle size distribution measured by the dry laser diffractometry. Table 1 presents the results.

[Example 3]

[0123] A tobacco sheet was manufactured and evaluated in the same manner as in Example 1, except that the 50% cumulative particle size (D50) and the 90% cumulative particle size (D90) of the tobacco powder used were 225 μm and 623 μm, respectively, in the volume-based particle size distribution measured by the dry laser diffractometry. Table 1 presents the results.

[Comparative Example 1]

[0124] A tobacco sheet was manufactured and evaluated in the same manner as in Example 1, except that the 50% cumulative particle size (D50) and the 90% cumulative particle size (D90) of the tobacco powder used were 32 μm and 84 μm, respectively, in the volume-based particle size distribution measured by the dry laser diffractometry. Table 1 presents the results.

[Table 1]

	Tobacco powder (dry laser diffractometry)				Rate of increase in filling capacity (%)
	D50 (μm)	D90 (μm)	D[4,3] (μm)	D[3,2] (μm)	
Example 1	57	216	140	30	5
Example 2	121	389	205	50	8
Example 3	225	623	327	85	10
Comparative example 1	32	84	41	20	-
D[3,2]: surface area (weighted) mean diameter D[4,3]: volume (weighted) mean diameter					

[0125] As presented in Table 1, each of the tobacco sheets of Examples 1 to 3, which are tobacco sheets according to the present embodiment, had an improved filling capacity, compared with the tobacco sheet of Comparative example 1 in which the D90 of the tobacco powder measured by the dry laser diffractometry was less than 200 μm. In Examples 1 to 3, the tobacco sheets were manufactured by the rolling method. However, the filling capacity was also improved when the tobacco sheets were each produced in the same manner by the casting method.

[Reference Example 1a]

1. Preparation of Smoking Composition Sheet

[0126] A tobacco sheet (smoking composition sheet) produced by a known papermaking method was prepared. The tobacco sheet was filled in a wrapper to form a smoking segment, and a non-combustion heating-type flavor inhaler illustrated in Fig. 1 was prepared.

2. Preparation of Fructan- or Fructose-Containing Smoking Composition Sheet

[0127] First, 10 g of inulin-type fructan (available from Fuji Nihon Seito Corporation, product name: Fuji FF) was mixed with 90 g of a mixture of propylene glycol and water (propylene glycol: water = 1:9 (ratio by mass)), thereby preparing a solution of inulin-type fructan. The same tobacco sheet as in 1. was prepared. The solution of inulin-type fructan was added using a syringe so as to spread throughout the entire tobacco sheet, thereby providing sheets each having an inulin-type fructan content of 0.5%, 1.0%, 2.0%, 3.0%, or 3.5% by mass based on the entire smoking composition sheet (containing inulin-type fructan) after the addition.

[0128] In addition, 10 g of fructose (available from Happo Shokusan Co., Ltd., product name: fructose) was mixed with 90 g of a mixture of propylene glycol and water (propylene glycol: water = 1:9 (ratio by mass)), thereby preparing a fructose solution. The same tobacco sheet as in 1. was prepared. The solution of fructose was added using a syringe so as to spread throughout the entire tobacco sheet, thereby providing sheets each having a fructose content of 0.5%, 1.0%, 2.0%, 3.0%, or 3.5% by mass based on the entire smoking composition sheet (containing fructose) after the addition.

[0129] The fructan-containing smoking composition sheet or the fructose-containing smoking composition sheet produced as described above was filled in a wrapper to form a smoking segment to prepare a non-combustion heating-type flavor inhaler illustrated in Fig. 1.

[0130] The inulin-type fructan is a type of fructan. The smoking composition sheet containing the inulin-type fructan corresponds to the example of the present application. Fructose is a type of monosaccharide. The smoking composition sheet containing fructose corresponds to the comparative example of the present application.

3. Evaluation of Flavor and Smoke Flavor Inhibition

[0131] Each of the non-combustion heating-type flavor inhalers prepared as described in 1 or 2 above was installed in a non-combustion external heating-type smoking system illustrated in Fig. 3.

[0132] Each of the thus-prepared flavor inhalers was evaluated for flavor and smoke flavor inhibition by 10 well-trained panelists. In the example and the comparative example, the "flavor" means a flavor obtained by combining a tobacco-derived flavor and a sweet flavor derived from inulin-type fructan or fructose.

[0133] The evaluation of the flavor and smoke flavor inhibition of each smoking test rod was performed by each panelist's evaluation based on the five-point scale in Table 1a below and calculating the average value of the 10 panelists. In the criteria in Table 1a below, a sheet equivalent to a sheet that does not contain the inulin-type fructan or fructose is rated 3. When the average value had a value of two decimal places, the average value was rounded to the nearest tenth to calculate the score. Tables 2a and 3a and Fig. 5 present the evaluation results.

[Table 1a]

	Markedly reduced	Reduced	Unchanged	Increased	Markedly increased
Flavor	1	2	3	4	5
Smoke flavor inhibition	1	2	3	4	5

[Table 2a]

	Inulin-type fructan content (% by weight)											
	0%		0.5%		1.0%		2.0%		3.0%		3.5%	
Panelist/ Sensory item	Flavor	Smoke flavor inhibition	Flavor	Smoke flavor inhibition	Flavor	Smoke flavor inhibition	Flavor	Smoke flavor inhibition	Flavor	Smoke flavor inhibition	Flavor	Smoke flavor inhibition
Panelist 1	3	3	4	3	3	2	2	2	2	1	1	1
Panelist 2	3	3	2	3	2	2	1	1	1	1	1	1
Panelist 3	3	3	3	3	3	2	2	1	2	1	1	1
Panelist 4	3	3	3	3	2	2	2	1	1	1	1	1
Panelist 5	3	3	3	2	3	1	2	1	2	1	2	1
Panelist 6	3	3	3	3	2	2	2	2	1	1	1	1
Panelist 7	3	3	3	2	2	2	2	2	2	1	2	1
Panelist 8	3	3	3	3	3	2	2	2	1	1	1	1
Panelist 9	3	3	3	2	3	2	2	1	2	1	1	1
Panelist 10	3	3	2	2	2	1	1	1	1	1	1	1
Average	3.0	3.0	2.9	2.6	2.5	1.8	1.8	1.4	1.5	1.0	1.2	1.0
Variance	0	0	0.29	0.24	0.25	0.16	0.16	0.24	0.25	0	0.16	0

[Table 3a]

	Fructose content (% by weight)											
	0%		0.5%		1.0%		2.0%		3.0%		3.5%	
Panelist/ Sensory item	Flavor	Smoke flavor inhibition	Flavor	Smoke flavor inhibition	Flavor	Smoke flavor inhibition	Flavor	Smoke flavor inhibition	Flavor	Smoke flavor inhibition	Flavor	Smoke flavor inhibition
Panelist 1	3	3	4	3	4	3	3	3	3	3	3	2
Panelist 2	3	3	3	3	2	2	2	2	2	2	2	2
Panelist 3	3	3	3	3	3	2	3	2	3	2	3	2
Panelist 4	3	3	3	3	2	2	2	2	2	2	2	2
Panelist 5	3	3	3	3	3	3	3	3	2	2	2	2
Panelist 6	3	3	4	3	4	3	3	2	2	2	2	2
Panelist 7	3	3	3	2	3	2	2	2	2	2	2	2
Panelist 8	3	3	3	3	3	2	3	2	2	2	2	2
Panelist 9	3	3	3	2	3	2	3	2	2	2	2	2
Panelist 10	3	3	3	3	3	3	3	3	3	2	2	2
Average	3.0	3.0	3.2	2.8	3.0	2.4	2.7	2.3	2.3	2.1	2.2	2.0
Variance	0	0	0.16	0.16	0.4	0.24	0.21	0.21	0.21	0.09	0.16	0

[0134] As described above, the smoking composition sheets containing inulin-type fructant correspond to the example of the present application, whereas the smoking composition sheets containing fructose correspond to the comparative example of the present application.

[0135] The results presented in Table 2a and Fig. 4 indicated that a higher inulin-type fructant content resulted in a lower value of the smoke flavor inhibition, indicating that the smoke flavor inhibition was succesfully inhibited. In particular, it was found that when the inulin-type fructan content was 3.0% or more by mass, the value of the smoke flavor inhibition was 1, and the smoke flavor inhibition was very strongly inhibited. Thus, it was found that a higher inulin-type fructan content was preferred from the viewpoint of inhibiting the smoke flavor inhibition. It was found that as the inulin-type fructan content increased, the flavor tended to decrease. When the flavor is regarded as important, the value of the flavor is preferably 1.5 or more. Thus, it was found that the inulin-type fructan content is preferably 0.5% to 3% by mass from the viewpoint of achieving both the flavor and an inhibitory effect on smoke flavor inhibition.

[0136] The results presented in Table 3a and Fig. 4 indicated that the addition of fructose was also effective in inhibiting the smoke flavor inhibition to a certain extent. However, as compared with the inulin-type fructan presented in Table 2a and Fig. 4, fructose was found to have a low and insufficient effect of inhibiting the smoke flavor inhibition.

[0137] Regarding fructose, the panelists commented that the smoke flavor inhibition increased in the latter half of smoking (the effect of inhibiting the smoke flavor inhibition did not last for a long time). For this reason, as described in Reference Example 2a below, a comparative experiment was conducted on inulin-type fructan and fructose in terms of the persistence of an inhibitory effect on smoke flavor inhibition.

[Reference Example 2a]

1. Evaluation of Persistence of Inhibitory Effect on Smoke Flavor Inhibition

[0138] A non-combustion heating-type flavor inhaler prepared in the same manner as in "2. Preparation of Fructan- or Fructose-Containing Smoking Composition Sheet" in Reference example 1a was installed in a non-combustion external heating-type smoking system illustrated in Fig. 3.

[0139] Each of the thus-prepared flavor inhalers was evaluated for the persistence of an inhibitory effect on smoke flavor inhibition by 10 well-trained panelists. The persistence of the inhibitory effect on the smoke flavor inhibition of each smoking test rod was evaluated as follows: The inhibitory effect on the flavor and taste until the latter half of smoking and the absence of the inhibitory effect on the smoke flavor inhibition after smoking were evaluated by each panelist according to the five-point scale presented in Table 4a below, and the average value of 10 panelists was calculated. When the average value had a value of two decimal places, the average value was rounded to the nearest tenth to calculate the score.

[0140] According to the criteria in the following Table 4a, when the persistence of the inhibitory effect on the smoke flavor inhibition in accordance with the difference in inulin-type fructan content is evaluated, a sheet equivalent to a sheet containing 2.0% by mass of fructose is rated 3. When the persistence of the inhibitory effect on the smoke flavor inhibition in accordance with the difference in fructose content is evaluated, a sheet equivalent to a sheet containing 2.0% by mass of inulin-type fructan is rated 3.

[0141] Tables 5a and 6a and Fig. 5 present evaluation results.

[Table 4a]

	Very low	Low	Unchanged	High	Very high
Persistence of inhibitory effect on smoke flavor inhibition	1	2	3	4	5

[Table 5a]

	Comparative subject (2.0% by weight of fructose)	Inulin-type fructan content (% by weight)				
		0.5%	1.0%	2.0%	3.0%	3.5%
Panelist/Sensory item	Persistence of inhibitory effect on smoke flavor inhibition					
Panelist 1	3	3	4	4	5	5
Panelist 2	3	3	4	5	5	5
Panelist 3	3	3	4	4	5	5
Panelist 4	3	3	4	4	5	5

(continued)

	Comparative subject (2.0% by weight of fructose)	Inulin-type fructan content (% by weight)				
		0.5%	1.0%	2.0%	3.0%	3.5%
Panelist/Sensory item	Persistence of inhibitory effect on smoke flavor inhibition					
Panelist 5	3	4	4	4	5	5
Panelist 6	3	3	4	4	5	5
Panelist 7	3	4	3	4	5	5
Panelist 8	3	3	4	4	5	5
Panelist 9	3	4	4	4	5	5
Panelist 10	3	4	4	5	5	5
Average	3.0	3.4	3.9	4.2	5.0	5.0
Variance	0	0.24	0.09	0.16	0	0

[Table 6a]

	Comparative subject (2.0% by weight of inulin-type fructan)	Fructose content (% by weight)				
		0.5%	1.0%	2.0%	3.0%	3.5%
Panelist/ Sensory item	Persistence of inhibitory effect on smoke flavor inhibition					
Panelist 1	3	1	1	1	2	2
Panelist 2	3	1	1	1	2	2
Panelist 3	3	1	1	2	1	1
Panelist 4	3	1	2	1	2	2
Panelist 5	3	1	1	2	1	1
Panelist 6	3	1	1	1	1	1
Panelist 7	3	2	2	2	2	2
Panelist 8	3	1	1	2	1	2
Panelist 9	3	2	2	2	2	2
Panelist 10	3	1	1	1	1	1
Average	3.0	1.2	1.3	1.5	1.5	1.6
Variance	0	0.16	0.21	0.25	0.25	0.24

[0142] The results presented in Table 5a and Fig. 5 indicated that the inulin-type fructan, at any content of 0.5% to 3.5% by mass, was excellent in terms of the persistence of the inhibitory effect on the smoke flavor inhibition, compared with the comparative fructose at 2.0% by mass.

[0143] The results presented in Table 6a and Fig. 5 indicated that fructose, at any content of 0.5% to 3.5% by mass, was inferior to 2.0% by mass of the inulin-type fructan in terms of the persistence of the inhibitory effect on the smoke flavor inhibition. The inulin-type fructan undergoes a process of thermal decomposition before the generation of a sweet flavor through a caramelization reaction. Thus, the inulin-type fructan is thought to slowly generate a sweet flavor over a long period of time. In contrast, fructose is considered to generate a sweet flavor in a short time through a caramelization reaction. The sweet flavor inhibits the smoke flavor inhibition. Thus, the difference in the generation time of the sweet flavor was considered to result in the difference in the persistence of the inhibitory effect on the smoke flavor inhibition.

[0144] The above results indicated that the inulin-type fructan was superior to fructose in terms of the persistence of the inhibitory effect on the smoke flavor inhibition.

[0145] From the above, it was found that the tobacco material of this example continuously inhibited the smoke flavor

inhibition from the early stage to the late stage of smoking behavior (excellent in the persistence of the inhibitory effect on the smoke flavor inhibition).

[Reference Example 1b]

[0146] A tobacco sheet produced by papermaking was provided as component (A). The sheet contained a tobacco material and 15% by mass of vegetable glycerine as an aerosol-generating agent. A saturated fatty acid presented in Table 1b was provided as component (B) and sprayed onto the sheet. The amount of component (B) added based on the dry matter mass of the tobacco composition (the total of the tobacco sheet produced by papermaking and the component (B)) is presented in Table 1b. For example, in Example A1, the amount of octanoic acid added was 1.0% by mass based on the dry matter mass of the tobacco composition.

[Table 1b]

Example	Additive	Amount added % by mass	Sensory evaluation result (Ave, n = 10) Score difference from Comparative example A (no additive) for discomfort
A1	Octanoic acid	1.0	-21.0
A2	Decanoic acid	1.2	-26.8
A3	Myristic acid	1.0	-31.2
A4-1	Palmitic acid	0.01	-31.0
A4-2	Palmitic acid	0.1	-29.7
A4-3	Palmitic acid	1.1	-41.2
A4-4	Palmitic acid	1.9	-50.8
A4-5	Palmitic acid	5.7	-54.9
A5	Stearic acid	1.0	-17.6
A6	Nonadecanoic acid	1.0	-25.9

[0147] After drying the sheet, multiple slits were made therein. The resulting sheet was wrapped to provide a tobacco rod. At this time, the longitudinal direction of the slit was parallel to the longitudinal direction of the tobacco segment. The tobacco rod was used to produce a non-combustion heating-type tobacco flavor inhaler having the structure illustrated in Fig. 1. The length of each segment was described below.

Tobacco segment: 12 mm
Center-hole portion: 8 mm
Cardboard tube: 20 mm
Acetate filter: 40 mm

[0148] A smoking test was conducted by heating the non-combustion heating-type tobacco flavor inhaler under the following conditions using a hollow cylindrical heater having an outside diameter of 3.2 mm and an inside diameter of 1.3 mm.

Voltage: Applied voltage set to 3.0 V
Temperature profile: 320°C constant
Preheating time (before start of smoking): heating for 30 seconds after insertion of the heater into a wrapped portion

[0149] A test was conducted by 10 well-trained panelists by the visual analog scale (category scale) method using a non-combustion heating-type tobacco flavor inhaler produced without adding the component (B) (see a reference comparative example below) as a comparative subject. Table 1b presents the results. A lower value of the score difference indicates less discomfort.

[Reference Comparative Example 1b]

[0150] A non-combustion heating-type tobacco flavor inhaler was produced in the same manner as in Reference Example 1b, except that the component (B) was not used.

[Reference Example 2b]

[0151] The following materials were provided.

Component (A): tobacco lamina (other than Oriental variety) and tobacco lamina (Oriental variety)
Component (B): palmitic acid and sucrose palmitate
Others: licorice, liquid sugar, softwood pulp, glycerine, and binder (guar gum)

[0152] A non-combustion heating-type tobacco flavor inhaler was produced and evaluated by the following procedure.

1) The tobacco lamina was ground with a Lab Mill to prepare a fine tobacco powder having a raw material particle size D90 of 100 μm.
2) Granular palmitic acid and sucrose palmitate were ground with the Lab Mill to prepare a powder.
3) The softwood pulp was ground with the Lab Mill.
4) These powdered materials were placed in a Ken mixer and mixed by stirring.
5) In the mixer, liquid or paste-like materials, such as water, glycerine, licorice, liquid sugar, and a binder were placed in a disperser (available from Primix Corporation) and mixed for 30 minutes.
6) The pulp was added to this mixture, and the mixture was dispersed for 30 minutes with the disperser (available from Primix Corporation).
7) The powder mixture prepared in 4) was added to the dispersion of 6), and mixed for 30 minutes with a disperser (available from Primix Corporation).
8) The mixture prepared in 7) was cast on an iron plate.
9) The iron plate on which the cast film was formed was placed in a forced-air dryer set at 80°C and dried for 30 minutes. The cast film was then peeled off from the iron plate to provide a sheet-like tobacco composition. The sheet had a thickness of 150 μm and a basis weight of 150 g/m^2.
10) The sheet-like tobacco composition was shredded to provide a shredded tobacco composition measuring 1 mm × 10 mm.
11) A predetermined amount of shredded tobacco composition was wrapped with wrapping paper to a size of ø7 × 20 mm to produce a single wrap.
12) The single wrap was used as a tobacco rod, thereby resulting in a non-combustion heating-type tobacco flavor inhaler illustrated in Fig. 2.
13) The non-combustion heating-type tobacco flavor inhaler was inserted into a heating device (available from Japan Tobacco Inc., PloomS), heated, and subjected to smoking evaluation. Sensory evaluation was performed by well-trained panelists. Table 2b presents the evaluation results.

[Reference Comparative Example 2b]

[0153] A non-combustion heating-type tobacco flavor inhaler was produced and evaluated in the same manner as in Reference example 2b, except that the amounts of respective components were changed as given in Table 2b.

[Table 2b]

	Tobacco composition, dry basis, % by weight									Sensory evaluation results
	A		B		Other additives					
	Tobacco (other than Oriental)	Tobacco (Oriental)	Palmitic acid	Sucrose palmitate	Licorice	Liquid sugar	Pulp	Glycerine	Binder (guargum)	
Example B1	75%	-	3%	3% -	-	-	5%	12%	5%	Discomfort was reduced as compared with B1 for comparative example.
Example B2	75%	-	-	3%	-	-	5%	12%	5%	Discomfort was reduced as compared with B1 for comparative example.
Example B3	72%	-	3%	3%	-	-	5%	12%	5%	Discomfort was reduced as compared with B1 for comparative example.
Example B4	72%	-	3%	-	3%	-	5%	12%	5%	
Example B5	70%	-	3%	-	-	5%	5%	12%	5%	
Example B6	72%	3%	3%	-	-	-	5%	12%	5%	
Example B7	67%	3%	3%	-	-	5%	5%	12%	5%	
Example B8	64%	3%	3%	-	3%	5%	5%	12%	5%	
Example B9	61%	3%	3%	3%	3%	5%	5%	12%	5%	
Comparative example B1	78%	-	-	-	-	-	5%	12%	5%	used as reference
Comparative example B2	67%	4%	-	-	3%	5%	5%	12%	5%	
Comparative example B3	75%	-	-	-	3%	-	5%	12%	5%	
Comparative example B4	73%	-	-		-	5%	5%	12%	5%	
Comparative example B5	74%	4%	-	-	-	-	5%	12%	5%	
% = % by mass										

[0154] It is clear from the above that the tobacco formulation of this example reduces discomfort during smoking.

[Reference Comparative Example 1c]

[0155] A tobacco sheet produced by a known papermaking method was provided. The tobacco sheet was filled in a wrapper to form a tobacco segment, and a non-combustion heating-type flavor inhaler illustrated in Fig. 1 was prepared. The article was subjected to a smoking test by 10 well-trained panelists (average age: 40).

[Reference Example 1c and Reference Comparative Example 2c]

[0156] Paper in which the total amount of lignin and hemicellulose contained was 0.1% to 10% by mass (materials 1 to 7) and paper in which the total amount thereof was more than 10% by mass (materials 8 to 10) were provided. The same tobacco sheet and paper as provided in Reference comparative example 1c were shredded into pieces having a width of 0.3 to 2.0 mm and a length of 3 to 50 mm. The shredded pieces of paper and the shredded pieces of tobacco sheet were mixed in a ratio by mass of 80:20. A non-combustion heating-type flavor inhaler was prepared in the same manner as in Reference comparative example 1c and subjected to a smoking test. Based on the results of Reference comparative example 1c, the smoke flavor and the amount of smoke were evaluated according to the following criteria.

1: Markedly reduced
2: Reduced
3: Unchanged (reference)
4: Increased
5: Markedly increased

[0157] The fiber odor was evaluated according to the following criteria.

1: None (reference)
2: Very low
3: Low
4: Moderate
5: Strong

[Table 1c]

	Reference comparative example 1c	Reference example 1c					Reference comparative example 2c				
	Ref	Material 1	Material 2	Material 3	Material 4	Material 5	Material 6	Material 7	Material 8	Material 9	Material 10
Total amount of lignin and hemicellulose contained (% by weight)	-	0.15	3.1	5.2	7.3	8	8.5	9.7	11.2	12.5	15.8
Basis weight (g/m^2)		37.5	75.0		95.0	33.0	80.2	70.3			
Thickness (mm)		0.585	0.537		0.618	0.050	0.589	0.431			
Density (g/cm^3)		0.06	0.14	0.69	0.15	0.66	0.14	0.16			
Sensory evaluation (average)											
Flavor	3.0	3.0	2.6	2.4	2.4	2.4	2.2	2.0	1.5	1.3	1.1
Amount of smoke	3.0	2.8	2.6	2.5	2.6	2.6	2.4	2.0	1.7	1.4	1.2
Fiber odor	1.0	1.2	1.3	1.4	1.4	1.4	1.6	2.5	3.5	4.2	4.7

[Reference Example 2c and Reference Comparative Example 3c]

[0158] A non-combustion heating-type flavor inhaler was prepared and subjected to a smoking test in the same manner as in Reference example 1c, except that the tobacco sheet and the material 5 were blended in the amounts given in Table 2c.

[Table 2c]

	Reference comparative example 1c	Reference example 2c				Reference comparative example 3c			
		Level 1	Level 1.5	Level 2	Level 2.5	Level 3	Level 4	Level 5	Level 6
Tobacco: material 5 (ratio by weight)	-	95:5	85:15	80:20	60:40	50:50	25:75	20:80	5:95
Total amount of lignin and hemicellulose contained (mg)		1.02	3.05	4.06	8.31	10.16	15.24	16.24	19.3
Sensory evaluation (average)									
Flavor	3.0	2.9	2.6	2.4	2.3	2.1	1.4	1.2	1.0
Amount of smoke	3.0	3.0	2.8	2.6	2.5	2.2	1.5	1.2	1.0
Fiber odor	1.0	1.2	1.3	1.4	1.7	2.3	3.7	4.5	5.0

[Reference Example 3c]

[0159] The tobacco sheet and material 5 were blended in the amounts given in Table 3c. However, 10% by mass of glycerine serving as an aerosol-generating agent was added to the material 5 based on the dry matter mass. A non-combustion heating-type flavor inhaler was prepared in the same manner as in Reference example 1c, except that the blend was used. Then a smoking test was conducted.

[Table 3c]

	Reference comparative example 1c	Reference example 3c					
		Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Tobacco: material 5 (ratio by weight)	-	95:5	80:20	50:50	25:75	20:80	5:95
Total amount of lignin and hemicellulose contained (mg)		1.02	4.06	10.16	15.24	16.26	19.3
Sensory evaluation (average)							
Flavor	3.0	2.9	2.5	2.4	2.0	1.3	1.1
Amount of smoke	3.0	3.0	2.8	2.6	2.5	2.0	1.7
Fiber odor	1.0	1.3	1.5	2.2	2.9	4.1	4.8

[Quantification of Hemicellulose]

[0160]

1) The paper was subjected to a solvent extraction (solvent: water) with a Thermo Scientific™ Dionex™ ASE™ Accelerated Solvent Extractor System (Model: ASE-350), thereby separating the residue. The residue was subjected

to cryogenic grinding with, for example, liquid nitrogen, thereby preparing sample A.
2) In a screw bottle, 50 mg of the sample A was placed, followed by the addition of 8.5 ml of ultrapure water (ML-Q water) and 0.5 ml of a pancreatin solution. The mixture was shaken at 40°C and 125 rpm for 16 hours. The sample liquid was then transferred to a 15-ml centrifuge tube using ML-Q water and centrifuged at 8,000 rpm for 15 minutes to remove the supernatant. This washing is repeated three times. After washing, 10 ml of an aqueous solution of 5% sulfuric acid was added thereto, and hydrolysis is performed at 100°C for 2.5 hours. After the completion of the hydrolysis reaction, the sample was allowed to cool to room temperature. The precipitate was then filtered off, and the filtrate was collected in a 250-ml volumetric flask. After thoroughly washing the residue on the filter paper with ML-Q water, the volume was adjusted to 250 ml. This solution was used as a sample for hemicellulose measurement.
3) Then 500 μl of the sample was transferred to a 20-ml test tube, and 500 μl of an aqueous solution of 5% phenol and 2.5 ml of concentrated sulfuric acid were added thereto. The mixture was vigorously stirred for 10 seconds. The sample was allowed to stand at room temperature for 20 minutes or more. The absorbance was measured at a wavelength of 490 nm with a spectrophotometer to quantify hemicellulose.

[Quantification of Lignin]

[0161]

i) The sample A was prepared.
ii) In a screw bottle, 100 mg of the sample A was placed, followed by the addition of 4 ml of 72% sulfuric acid. The sample was completely immersed in sulfuric acid and then shaken at 30°C and 200 rpm for 4 hours. Next, 157.2 ml of ultrapure water (ML-Q water) was added in such a manner that the sulfuric acid concentration after dilution was 4%. The mixture was transferred to a recovery flask and heated to reflux in an oil bath at 110°C for 2 hours.
iii) After the mixture that had been subjected to reflux treatment was allowed to cool to room temperature, filtration was performed. The resulting sample was dried with a rotary dryer and weighed to determine the amount of lignin.

[0162] It is clear that the tobacco segment of the present example can moderately dilute the smoke flavor.

[0163] Embodiments are described below.

[1] A tobacco sheet for a non-combustion heating-type flavor inhaler contains a tobacco powder having a 90% cumulative particle size (D90) of 200 μm or more in a volume-based particle size distribution measured by dry laser diffractometry.
[2] In the tobacco sheet for the non-combustion heating-type flavor inhaler described in [1], the tobacco powder is at least one tobacco raw material selected from the group consisting of leaf tobacco, midribs, and residual stems.
[3] In the tobacco sheet for the non-combustion heating-type flavor inhaler described in [1] or [2], the proportion of the tobacco powder contained in 100% by mass of the tobacco sheet is 45% to 95% by mass.
[4] In the tobacco sheet for the non-combustion heating-type flavor inhaler described in any one of [1] to [3], the tobacco sheet further contains an aerosol-generating agent.
[5] In the tobacco sheet for the non-combustion heating-type flavor inhaler described in [4], the aerosol-generating agent is at least one selected from the group consisting of glycerine, propylene glycol, and 1,3-butanediol.
[6] In the tobacco sheet for the non-combustion heating-type flavor inhaler described in [4] or [5], the proportion of the aerosol-generating agent contained in 100% by mass of the tobacco sheet is 4% to 50% by mass.
[7] In the tobacco sheet for the non-combustion heating-type flavor inhaler described in any one of [1] to [6], the tobacco sheet further contains a forming agent.
[8] In the tobacco sheet for the non-combustion heating-type flavor inhaler described in [7], the forming agent is at least one selected from the group consisting of polysaccharides, proteins, and synthetic polymers.
[9] In the tobacco sheet for the non-combustion heating-type flavor inhaler described in [7] or [8], the proportion of the forming agent contained in 100% by mass of the tobacco sheet is 0.1% to 15% by mass.
[10] A non-combustion heating-type flavor inhaler includes a tobacco-containing segment containing the tobacco sheet for the non-combustion heating flavor inhaler described in any one of [1] to [9].
[11] A non-combustion heating-type flavor inhalation system includes:

the non-combustion heating-type flavor inhaler described in [10]; and
a heating device configured to heat the tobacco-containing segment.

[1a] A tobacco material contains a fructan.
[2a] In the tobacco material described in [1a], the fructan is selected from the group consisting of inulin-type fructans, levan-type fructans, branched fructans, fructo-oligosaccharides, and mixtures thereof.

[3a] In the tobacco material described in [1a] or [2a], the amount of the fructan contained in the entire tobacco material is 0.5% to 3% by mass.
[4a] The tobacco material described in any one of [1a] to [3a] further contains a tobacco sheet or shredded tobacco.
[5a] A heating-type smoking article contains the tobacco material described in any one of [1a] to [4a].
[1b] A tobacco composition contains:

(A) a tobacco material; and
(B) a saturated fatty acid-based additive,

in which the component (B) is selected from the group consisting of a saturated fatty acid having a molar mass of 200 to 350 g/mol, an ester of the saturated fatty acid, and a combination thereof, and the component (B) is contained in an amount of 0.01% to 3% by mass based on the dry matter mass in the composition.

[2b] In the composition described in [1b], each of the saturated fatty acid and the ester of the saturated fatty acid in the component (B) is a single compound.
[3b] In the composition described in [1b] or [2b], the fatty acid moiety in each of the saturated fatty acid and the ester, which are the component (B), has 12 to 20 carbon atoms.
[4b] The composition described in any one of [1b] to [3b] further contains 1% to 10% by mass of liquid sugar based on the dry matter mass in the composition.
[5b] In the composition described in any one of [1b] to [4b], the component (A) contains 10% or less by mass of a material derived from an Oriental variety.
[6b] The composition described in any one of [1b] to [5b] further contains 0.5% to 3% by mass of a natural botanical flavoring agent based on the dry matter mass in the composition.
[7b] In the composition described in any one of [1b] to [6b], nicotine is contained in an amount of 2% or more by mass based on the dry matter mass in the composition.
[8b] In the composition described in any one of [1b] to [6b], nicotine is contained in an amount of 1.5% or less by mass based on the dry matter mass in the composition.
[9b] The composition described in any one of [1b] to [8b] further contains 12% or less by mass of an aerosol-generating agent based on the dry matter mass in the composition.
[10b] A sheet is composed of the tobacco composition described in any one of [1b] to [9b].
[11b] A method for producing the tobacco composition described in any one of [1b] to [10b] includes:
a step of mixing the component (A), the component (B) that is partially or entirely in the form of a powder, and a medium in such a manner that the powder is maintained in a powder state, to form a slurry.
[12b] The production method described in [11b] further includes setting the viscosity of the slurry to 100,000 to 200,000 (mPa·s) .
[1c] A tobacco segment for heating contains, as fillers:

a tobacco material, and
paper,
in which the total amount of lignin and hemicellulose contained in the paper is 0.1% to 10% by mass.

[2c] A tobacco segment for heating contains, as fillers:

a tobacco material, and
paper containing an aerosol-generating agent.

[3c] In the tobacco segment described in [1c], the total amount of lignin and hemicellulose contained is 9.0% or less by mass.
[4c] In the tobacco segment described in [1c] or [3c], the amount of paper contained is 5% to 70% by mass based on the dry matter mass of the tobacco material.
[5c] In the tobacco segment described in [4c],
the amount of paper contained is 15% to 40% by mass based on the dry matter mass of the tobacco material.
[6c] In the tobacco segment described in any one of [1c] to [5c], the paper has a density of 0.05 to 0.8 [g/cm^3].
[7c] In the tobacco segment described in [2c] or [6c], the amount of paper contained is 5% to 75% by mass based on the dry matter mass of the tobacco material.
[8c] In the tobacco segment described in any one of [1c] and [3c] to [6c], the paper contains an aerosol-

generating agent.

[9c] A non-combustion heating-type flavor inhaler includes the tobacco segment described in any one of [1c] to [8c].

[10c] A method for producing the tobacco segment described in any one of [1c] to [8c] includes mixing the paper with the tobacco material.

REFERENCE SIGNS LIST

[0164]

1	non-combustion heating-type flavor inhaler
2	tobacco-containing segment
3	cooling segment
4	center-hole segment
5	filter segment
6	mouthpiece segment
7	tubular member
8	perforation
9	second filling layer
10	second inner plug wrapper
11	outer plug wrapper
12	mouthpiece lining paper
13	heating device
14	body
15	heater
16	metal tube
17	battery unit
18	control unit
19	recessed portion
20A	tobacco-containing segment
21	filler
22	wrapper
T	tobacco sheet
P	paper

Claims

1. A tobacco sheet for a non-combustion heating-type flavor inhaler, comprising a tobacco powder having a 90% cumulative particle size (D90) of 200 μm or more in a volume-based particle size distribution measured by dry laser diffractometry.

2. The tobacco sheet for the non-combustion heating-type flavor inhaler according to claim 1, further comprising a fructan.

3. The tobacco sheet for the non-combustion heating-type flavor inhaler according to claim 1 or 2, wherein the fructan is selected from the group consisting of inulin-type fructans, levan-type fructans, branched fructans, fructo-oligosaccharides, and mixtures thereof.

4. The tobacco sheet for the non-combustion heating-type flavor inhaler according to any one of claims 1 to 3, further comprising a saturated fatty acid-based additive,

wherein the additive is selected from the group consisting of a saturated fatty acid having a molar mass of 200 to 350 g/mol, an ester of the saturated fatty acid, and a combination thereof, and
the content of the additives is 0.01% to 3% by mass based on dry matter mass of the sheet.

5. The tobacco sheet for the non-combustion heating-type flavor inhaler according to claim 4, wherein each of the saturated fatty acid and the ester of the saturated fatty acid is a single compound.

6. A tobacco-containing segment, comprising, as fillers:

the sheet according to any one of claims 1 to 5; and
paper,
wherein a total amount of lignin and hemicellulose contained in the paper is 0.1% to 10% by mass.

7. A tobacco-containing segment, comprising, as fillers:

the sheet according to any one of claims 1 to 5; and
paper containing an aerosol-generating agent.

8. A non-combustion heating-type flavor inhaler, comprising:

a tobacco-containing segment containing the tobacco sheet for the non-combustion heating-type flavor inhaler according to any one of claims 1 to 5, or
the tobacco-containing segment according to claim 6 or 7.

9. A non-combustion heating-type flavor inhalation system, comprising:

the non-combustion heating-type flavor inhaler according to claim 8; and
a heating device configured to heat the tobacco-containing segment.

Fig. 1

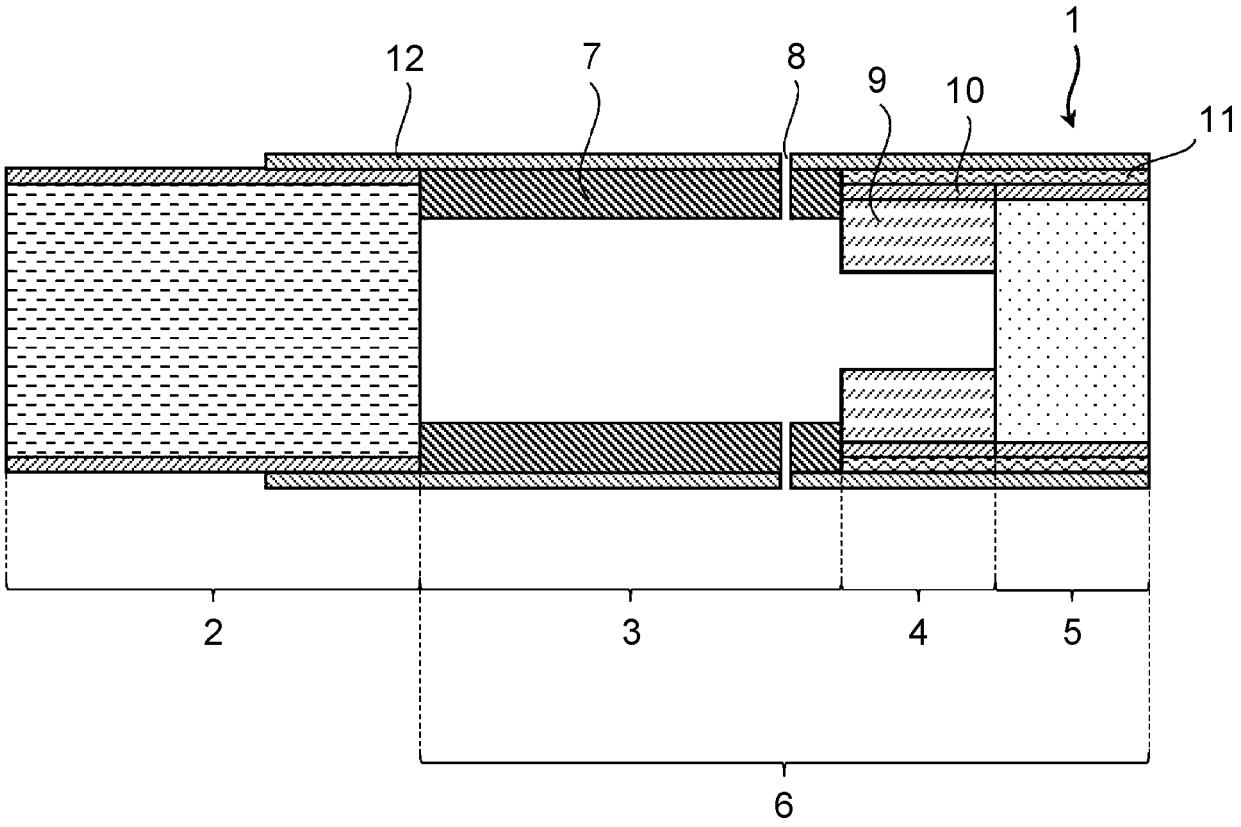


Fig. 2

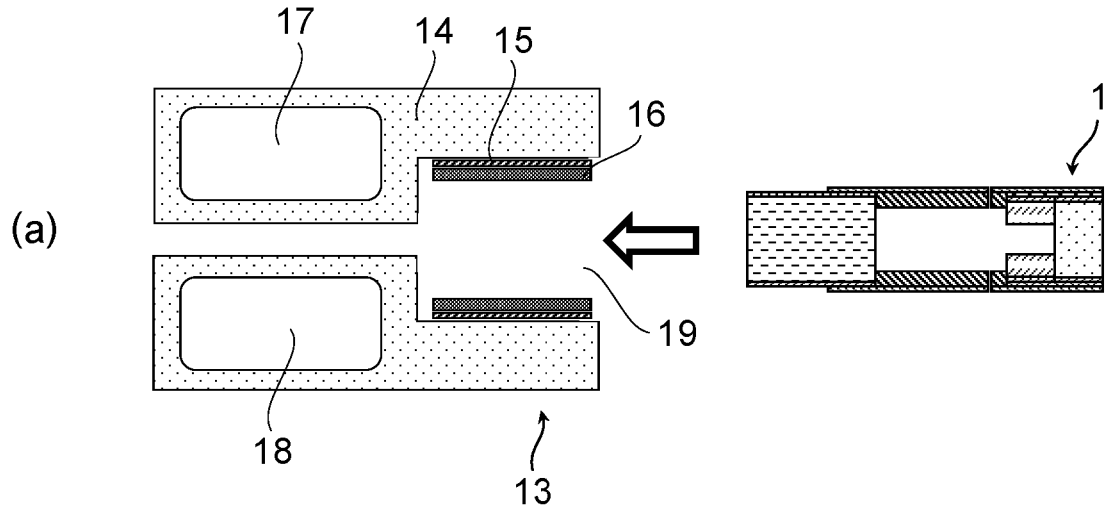


Fig. 3A

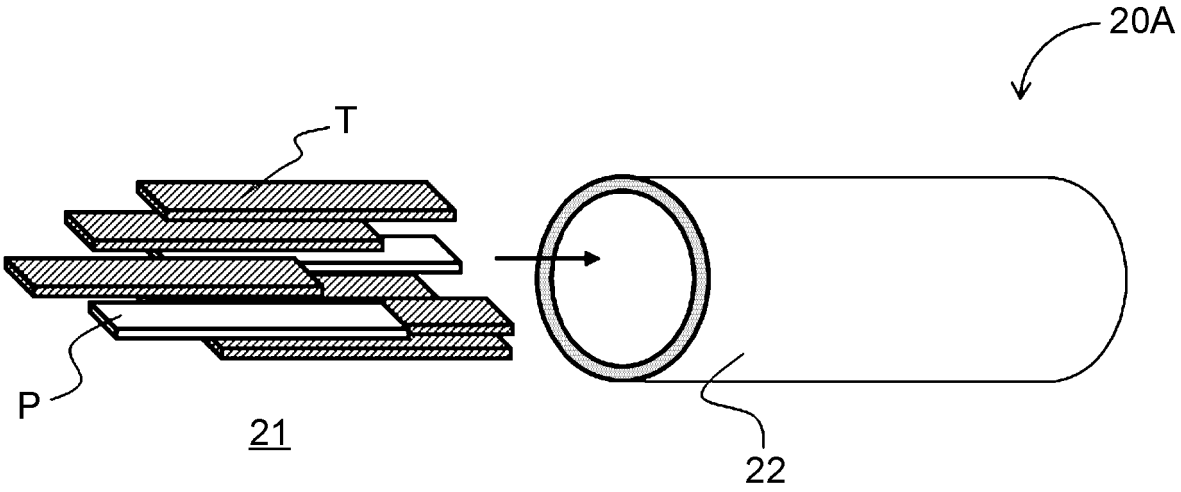


Fig. 3B

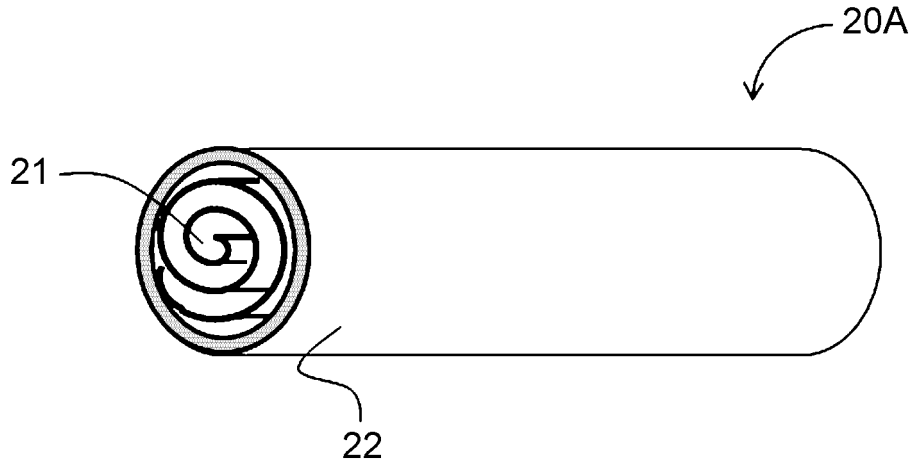


Fig. 3C

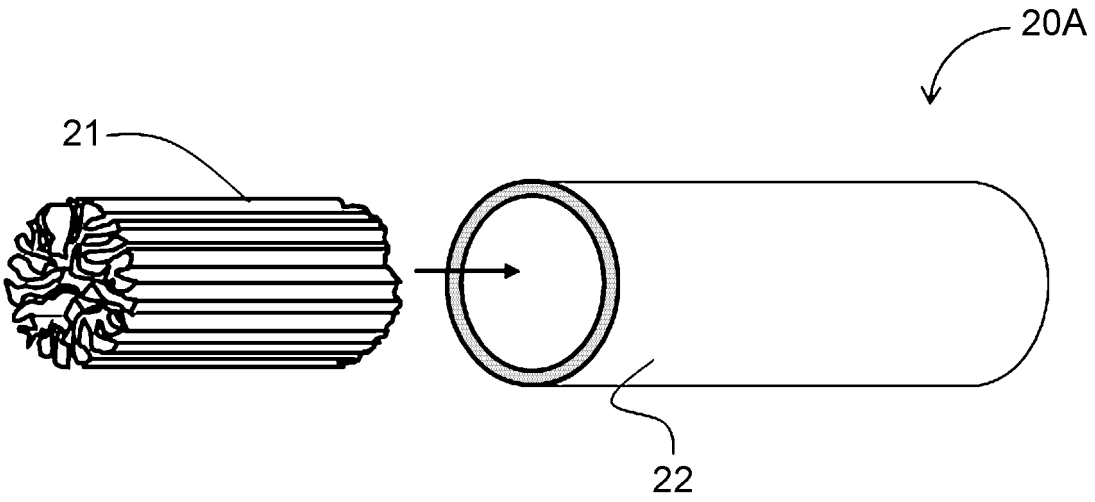


Fig. 3D

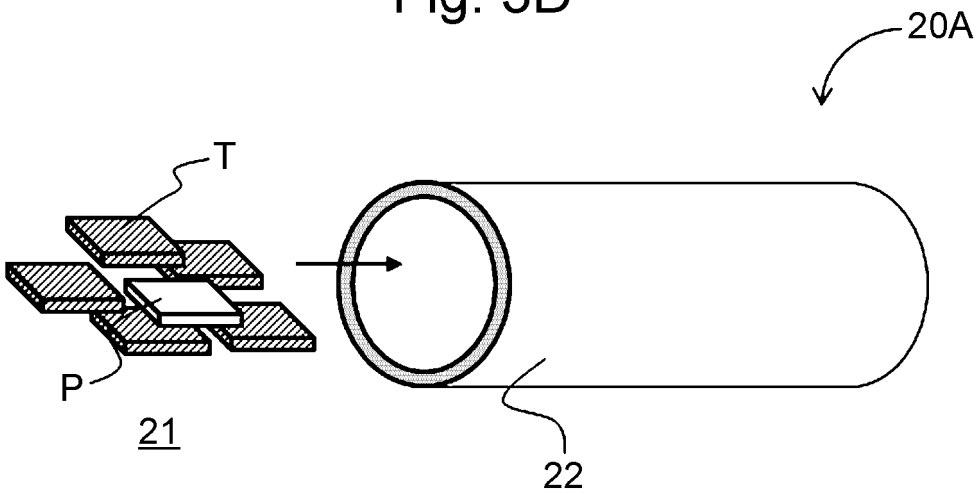


Fig. 3E

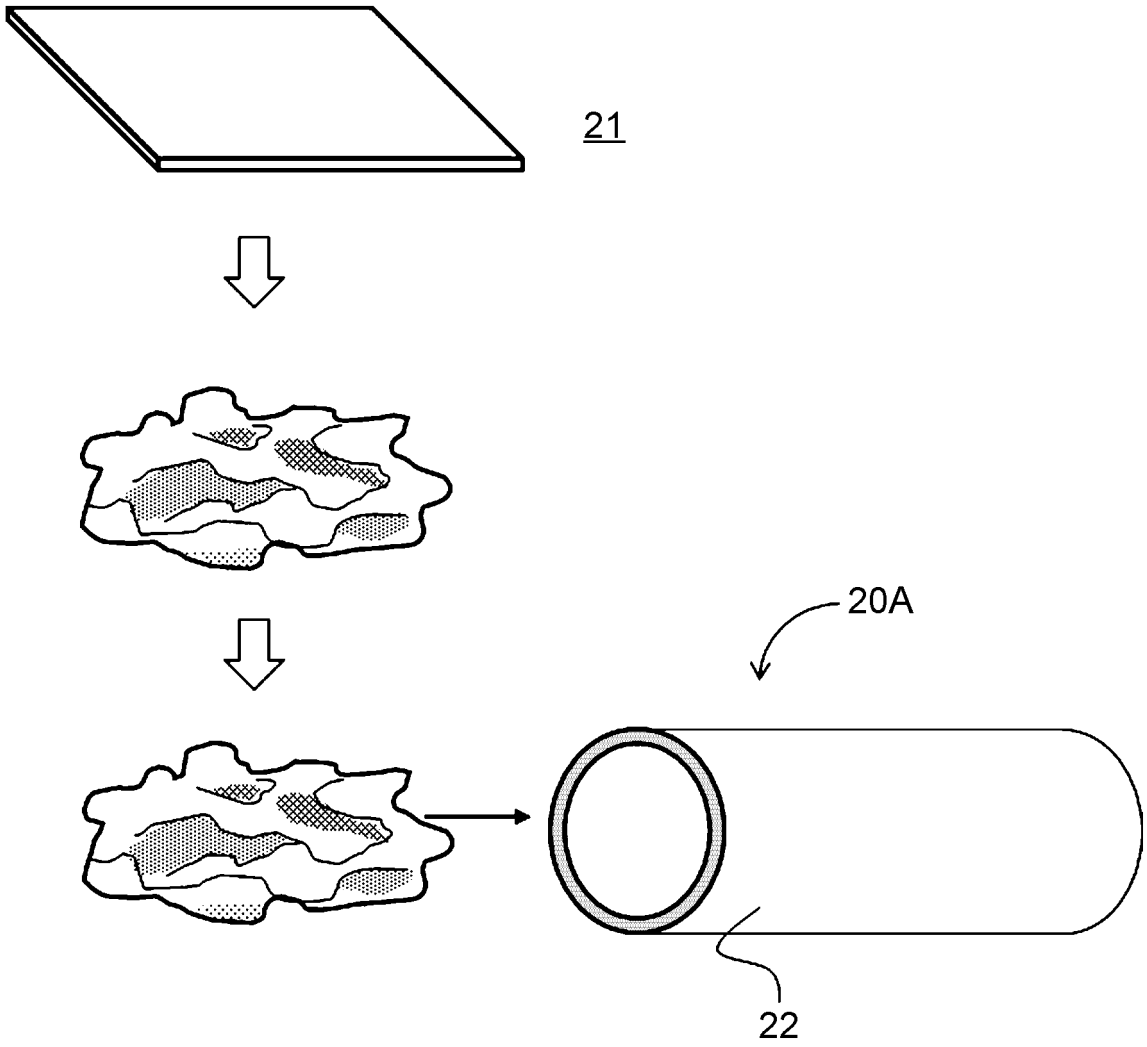


Fig. 4

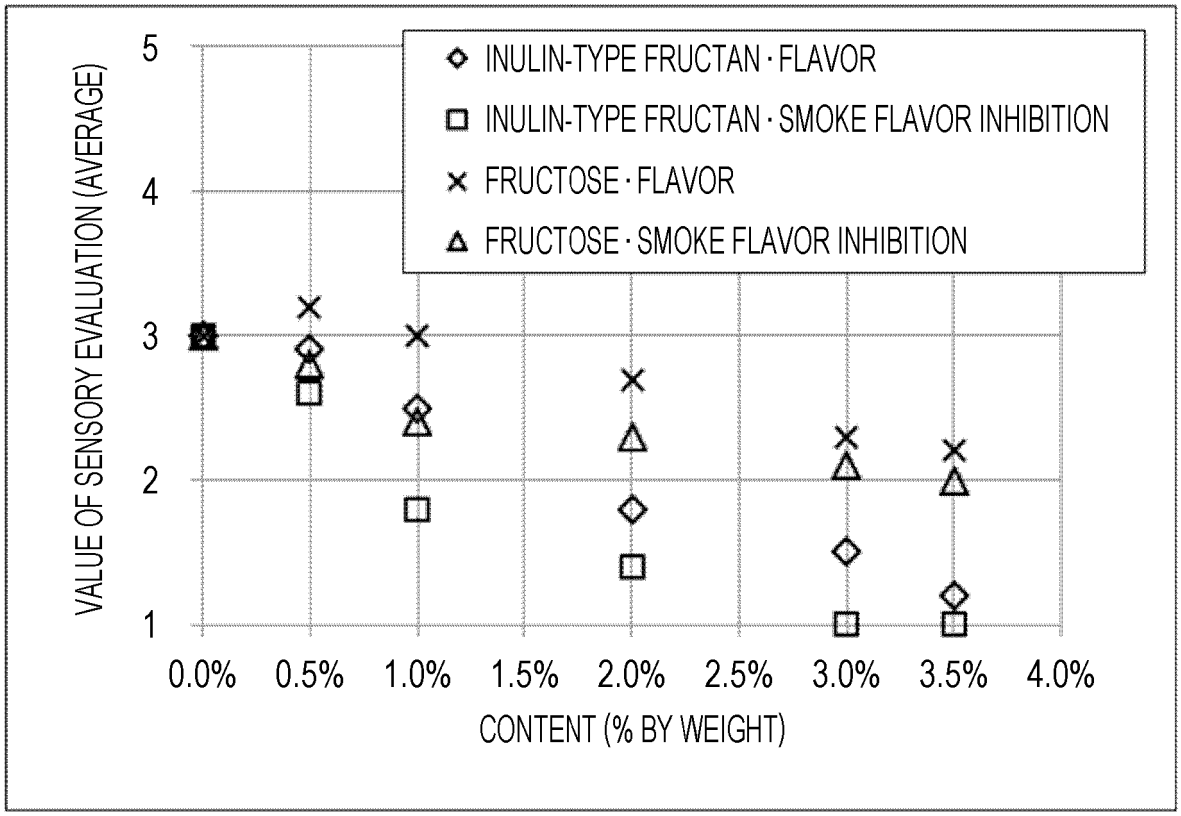
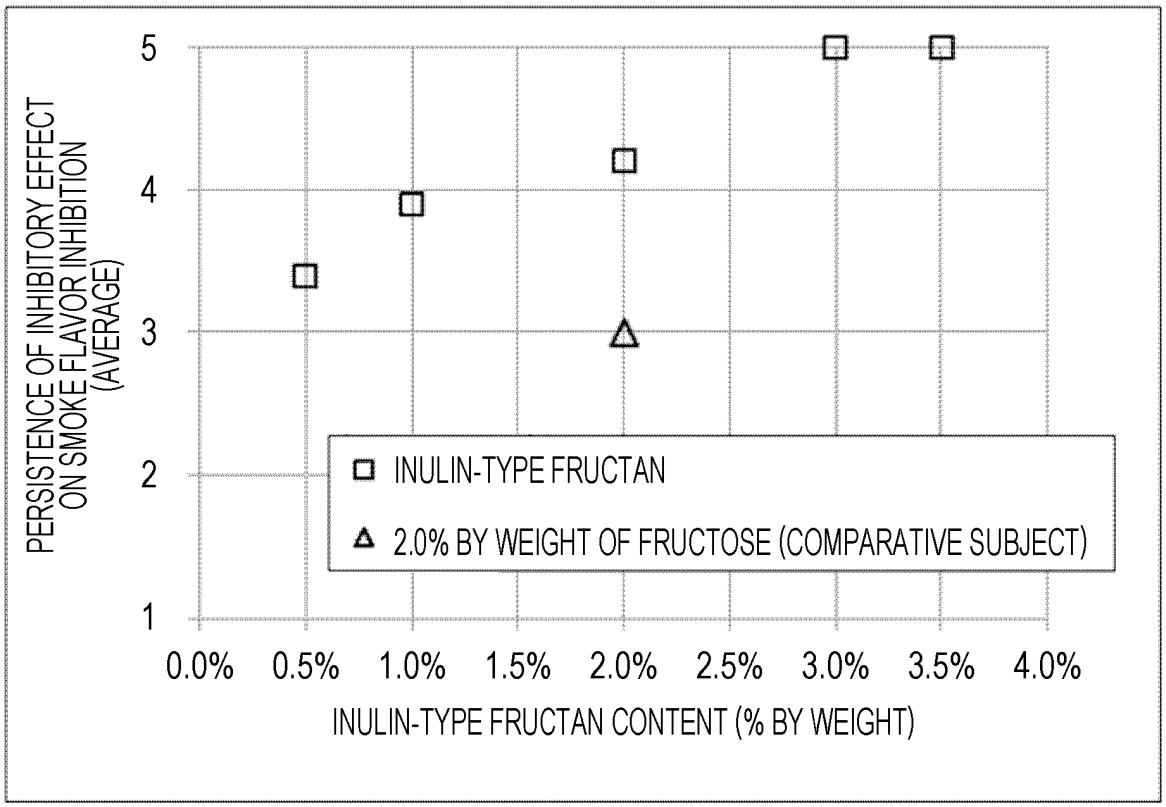
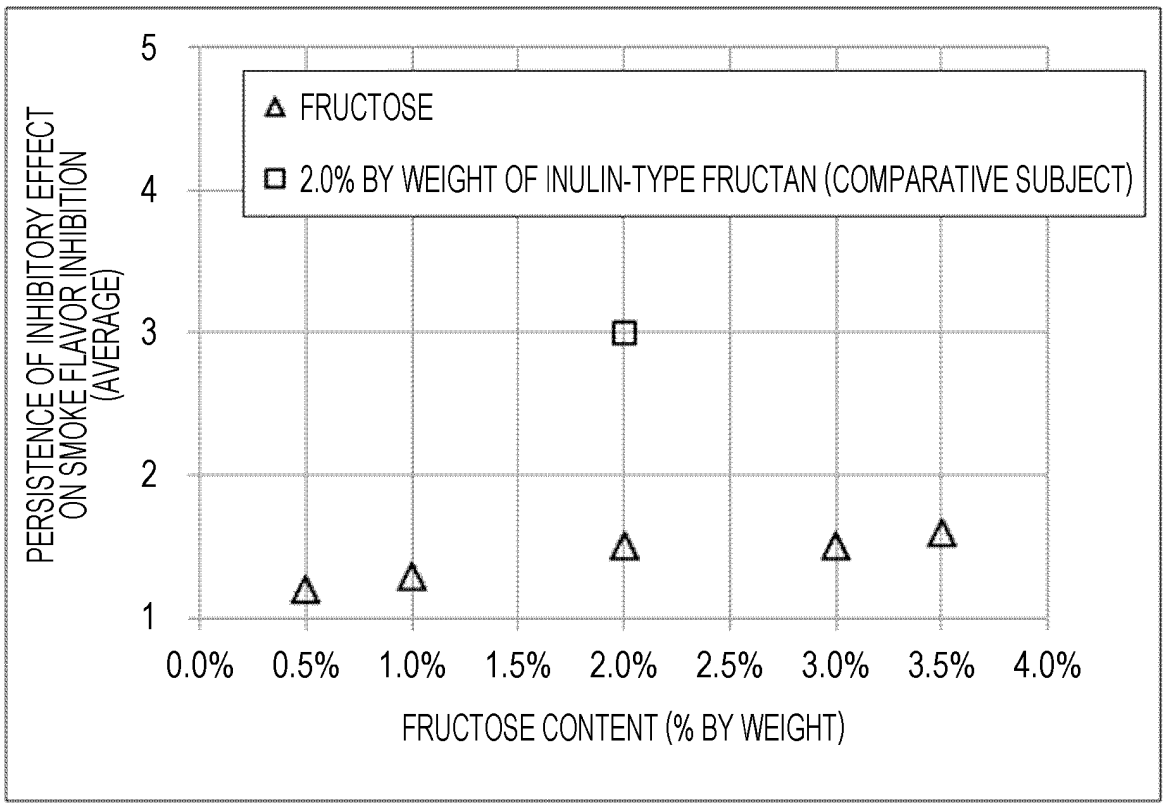

INULIN-TYPE FRUCTAN · FLAVOR
INULIN-TYPE FRUCTAN · SMOKE FLAVOR INHIBITION
FRUCTOSE · FLAVOR
FRUCTOSE · SMOKE FLAVOR INHIBITION
VALUE OF SENSORY EVALUATION (AVERAGE)
5
4
3
2
1
0.0%
0.5%
1.0%
1.5%
2.0%
2.5%
3.0%
3.5%
4.0%
CONTENT (% BY WEIGHT)

Fig. 5


PERSISTENCE OF INHIBITORY EFFECT ON SMOKE FLAVOR INHIBITION (AVERAGE)
5
4
3
2
1
INULIN-TYPE FRUCTAN
2.0% BY WEIGHT OF FRUCTOSE (COMPARATIVE SUBJECT)
0.0% 0.5% 1.0% 1.5% 2.0% 2.5% 3.0% 3.5% 4.0%
INULIN-TYPE FRUCTAN CONTENT (% BY WEIGHT)


PERSISTENCE OF INHIBITORY EFFECT ON SMOKE FLAVOR INHIBITION (AVERAGE)
5
4
3
2
1
FRUCTOSE
2.0% BY WEIGHT OF INULIN-TYPE FRUCTAN (COMPARATIVE SUBJECT)
0.0% 0.5% 1.0% 1.5% 2.0% 2.5% 3.0% 3.5% 4.0%
FRUCTOSE CONTENT (% BY WEIGHT)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2022/018909

A. CLASSIFICATION OF SUBJECT MATTER

D21H 17/23(2006.01)i; ***A24B 15/16***(2020.01)i; ***A24B 15/167***(2020.01)i; ***A24B 15/32***(2006.01)i; ***A24D 1/20***(2020.01)i; ***A24B 3/14***(2006.01)i
FI: A24B15/16; A24B15/32; D21H17/23; A24D1/20; A24B3/14; A24B15/167

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)

D21H17/23; A24B15/16; A24B15/167; A24B15/32; A24D1/20; A24B3/14

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 1971-2022
Registered utility model specifications of Japan 1996-2022
Published registered utility model applications of Japan 1994-2022

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.
X	WO 2020/100879 A1 (JAPAN TOBACCO INC.) 22 May 2020 (2020-05-22) paragraph [0019], fig. 5	1
Y		2-9
X	JP 6-46817 A (PHILIP MORRIS PROD. INC.) 22 February 1994 (1994-02-22) paragraphs [0033], [0045]	1
Y		2-9
Y	WO 2020/127261 A1 (JT INTERNATIONAL S.A.) 25 June 2020 (2020-06-25) page 2, lines 4-12, page 10, lines 1-11	1-9
Y	US 4510950 A (PHILIP MORRIS INCORPORATED) 16 April 1985 (1985-04-16) column 8, lines 64-68	1-9
Y	CN 101999751 A (CHINA TOBACCO HUBEI IND. LLC) 06 April 2011 (2011-04-06) paragraph [0034]	2-9

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

* Special categories of cited documents:
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
01 June 2022	**14 June 2022**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2022/018909

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2017-532006 A (PHILIP MORRIS PRODUCTS S.A.) 02 November 2017 (2017-11-02) paragraph [0049]	4-9
Y	US 2017/0042217 A1 (FERNANDEZ, Paola) 16 February 2017 (2017-02-16) paragraph [0004]	6-9
Y	JP 2009-502194 A (R.J. REYNOLDS TOBACCO CO.) 29 January 2009 (2009-01-29) paragraph [0040], fig. 3	7-9

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2022/018909

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
WO 2020/100879 A1	22 May 2020	EP 3881686 A1 paragraph [0019] KR 10-2021-0063415 A CN 113015446 A	
JP 6-46817 A	22 February 1994	US 5724998 A column 4, lines 9-13, column 5, lines 60-67 EP 565360 A2 CN 1077359 A KR 10-1993-0021114 A	
WO 2020/127261 A1	25 June 2020	EP 3897229 A1 KR 10-2021-0108364 A US 2021/401029 A1 JP 2022-512063 A	
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CN 101999751 A	06 April 2011	(Family: none)	
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US 2017/0042217 A1	16 February 2017	(Family: none)	
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REFERENCES CITED IN THE DESCRIPTION

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- JP 5969923 B **[0004]**
- WO 2020058814 A **[0004]**

Non-patent literature cited in the description

- Encyclopedia of Tobacco. Tobacco Academic Studies Center, 31 March 2009 **[0039]**