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(71) Applicant: **Japan Tobacco Inc.**
Tokyo 105-6927 (JP)

(72) Inventors:
- **KOIDE, Akihiro**
  Tokyo 130-8603 (JP)
- **UCHII, Kimitaka**
  Tokyo 130-8603 (JP)
- **MATSUDA, Takahiro**
  Tokyo 130-8603 (JP)
- **HASHIMOTO, Ayaka**
  Tokyo 130-8603 (JP)

(74) Representative: **Hoffmann Eitle**
Patent- und Rechtsanwälte PartmbB
Arabellastraße 30
81925 München (DE)

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

(57) Provided is a tobacco sheet for a non-combustion heating flavor inhaler, the tobacco sheet including a fibrous material.

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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 inhaling system.

BACKGROUND ART

[0002] In a combustion-type flavor inhaler (cigarette), a tobacco filler, including leaf tobacco or a tobacco sheet, is combusted to obtain a flavor. For example, Patent Literature 1 discloses a tobacco sheet for use in a combustion-type flavor inhaler. As an alternative to the combustion-type flavor inhaler, a non-combustion heating-type flavor inhaler has been proposed in which a flavor source, such as a tobacco sheet, is not combusted but heated to obtain a flavor. The heating temperature of a non-combustion heating-type flavor inhaler is lower than the combustion temperature of a combustion-type flavor inhaler and is approximately 400°C or less, for example. Since a non-combustion heating-type flavor inhaler has a low heating temperature, an aerosol generator can be added to a flavor source in the non-combustion heating-type flavor inhaler from the perspective of increasing the amount of smoke. An aerosol generator is vaporized by heating and generates an aerosol. A user is supplied with the aerosol together with a flavor component, such as a tobacco component, and can obtain a sufficient flavor.

[0003] Such a 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. In relation to a heater, the tobacco-containing segment of the non-combustion heating-type flavor inhaler typically has a shorter axial length than the tobacco-containing segment of the combustion-type flavor inhaler. Thus, in the non-combustion heating-type flavor inhaler, the short tobacco-containing segment is filled with a large amount of tobacco sheet to ensure the amount of aerosol generated during heating. To fill the short segment with a large amount of tobacco sheet, the tobacco sheet in the non-combustion heating-type flavor inhaler typically has a low bulkiness or a high density. The bulkiness is a value indicating a volume of a predetermined mass of shredded tobacco sheets compressed at a certain pressure for a certain period. For example, Patent Literature 2 discloses a tobacco sheet for use in a non-combustion heating-type flavor inhaler.

CITATION LIST

PATENT LITERATURE

[0004]

PTL 1: Japanese Examined Patent Application Publication No. 60-45914
PTL 2: Japanese Patent No. 5969923

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0005] However, the present inventors have found that, in terms of the heating system, the heating capability of a heater, and aerosol generation, the use of a tobacco sheet with a low bulkiness (high density) increases the total heat capacity of the tobacco-containing segment and, depending on the heating method and the capability of a heater, the tobacco sheet filled in the tobacco-containing segment does not contribute sufficiently to aerosol generation. To solve this 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 present inventors have studied (1) reducing the specific heat of a tobacco raw material contained in a tobacco sheet and (2) using a tobacco sheet with a high bulkiness (low density). However, it is difficult to reduce the specific heat of the tobacco raw material itself in (1), and it was considered effective to reduce the total heat capacity of the tobacco-containing segment in (2). It is therefore desirable to develop a tobacco sheet with a high bulkiness (low density) suitable for use in a non-combustion heating-type flavor inhaler.

[0007] It is an object of the present invention to provide a tobacco sheet with a high bulkiness 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 inhaling system.

SOLUTION TO PROBLEM

[0008] The present invention includes the following aspects.

Aspect 1

[0009] A tobacco sheet for a non-combustion heating-type flavor inhaler, the tobacco sheet containing a fibrous material.

Aspect 2

[0010] The sheet according to Aspect 1, having a density of 1.0 g/cm^3 or less.

Aspect 3

[0011] The sheet according to Aspect 1 or 2, which is a press-formed sheet.

Aspect 4

[0012] The sheet according to any one of Aspects 1 to 3, containing:

a humectant;
a binder; and
an optional flavoring and taste agent,
wherein the sheet has an air permeability of more than 0 CORESTA units.

Aspect 5

[0013] The sheet according to Aspect 4, wherein the air permeability is 500 CORESTA Units or more.

Aspect 6

[0014] A non-combustion heating-type flavor inhaler comprising a tobacco-containing segment containing the tobacco sheet for a non-combustion heating-type flavor inhaler according to any one of Aspects 1 to 5.

Aspect 7

[0015] A non-combustion heating-type flavor inhaling system including:

the non-combustion heating-type flavor inhaler according to Aspect 6; and
a heating device for heating the tobacco-containing segment.

ADVANTAGEOUS EFFECTS OF INVENTION

[0016] The present invention can provide a tobacco sheet with a high bulkiness 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 inhaling system.

BRIEF DESCRIPTION OF DRAWINGS

[0017]

[Fig. 1] Fig. 1 is a cross-sectional view of an example of a non-combustion heating-type flavor inhaler according to the present embodiment.
[Fig. 2] Fig. 2 is a cross-sectional view of an example of a non-combustion heating-type flavor inhaling system according to the present embodiment, illustrating (a) a state before a non-combustion heating-type flavor inhaler is inserted into a heating device and (b) a state in which the non-combustion heating-type flavor inhaler is inserted into the heating device and is heated.

[Fig. 3] Fig. 3 is a view of an embodiment of a tobacco segment.
[Fig. 4] Fig. 4 is a graph of a release profile.

DESCRIPTION OF EMBODIMENTS

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

[0018] 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 fibrous material. Containing a fibrous material, the tobacco sheet according to the present embodiment is bulky and has a high bulkiness. Thus, the tobacco sheet according to the present embodiment can be used to reduce the total heat capacity of a tobacco-containing segment, and the tobacco sheet filled in the tobacco-containing segment can contribute sufficiently to aerosol generation. Furthermore, the tobacco sheet according to the present embodiment preferably further contains a tobacco raw material, an aerosol generator, and a shaping agent, and the blending ratio of these is set in a predetermined range to further improve the bulkiness of the tobacco sheet.

(Fibrous Material)

[0019] The fibrous material contained in the tobacco sheet according to the present embodiment may be any material with a fiber shape, such as a fiber. The fibrous material is, for example, fibrous pulp, a fibrous tobacco material, fibrous synthetic cellulose, or the like. These may be used alone or in combination. Among these, fibrous pulp is preferred as the fibrous material from the perspective of fiber stiffness.

[0020] The fibrous material content per 100% by mass of the tobacco sheet preferably ranges from 5% to 50% by mass. A fibrous material content of 5% by mass or more can result in a bulkiness capable of securing the function. A fibrous material content of 50% by mass or less can result in sufficient tobacco aroma and aerosol generated during heating. The fibrous material content more preferably ranges from 5% to 47% by mass, still more preferably 5% to 45% by mass, particularly preferably 5% to 40% by mass.

(Tobacco Raw Material)

[0021] When the fibrous material is other than the fibrous tobacco material, the tobacco sheet according to the present embodiment can further contain a tobacco raw material. The tobacco raw material may be any tobacco raw material containing a tobacco component and is, for example, a tobacco powder or a tobacco extract. The tobacco powder is, for example, leaf tobacco, midribs, residual stems, or the like. These may be used alone or in combination. These can be cut into a predetermined size and used as a tobacco powder. For the size of the tobacco powder, the cumulative 90% particle diameter (D90) in a volume-based particle size distribution as measured by a dry laser diffraction method is preferably 200 μm or more, from the perspective of further improving the bulkiness. The tobacco extract is, for example, a tobacco extract produced by coarsely grounding leaf tobacco, mixing and stirring the ground leaf tobacco with a solvent, such as water, to extract a water-soluble component from the leaf tobacco, and drying under vacuum and concentrating the resulting water extract.

[0022] The tobacco raw material content per 100% by mass of the tobacco sheet preferably ranges from 30% to 91 % by mass. A tobacco raw material content of 30% by mass or more can result in sufficient tobacco aroma generated during heating. A tobacco raw material content of 91% by mass or less can result in a sufficient amount of aerosol generator or shaping agent contained. The tobacco raw material content more preferably ranges from 50% to 90% by mass, still more preferably 55% to 85% by mass, particularly preferably 60% to 80% by mass.

(Shaping Agent)

[0023] When the fibrous material is other than a fibrous shaping agent, such as the fibrous synthetic cellulose, the tobacco sheet according to the present embodiment preferably further contains a shaping agent from the perspective of ensuring the shape. The shaping agent is, for example, a polysaccharide, a protein, a synthetic polymer, or the like. These may be used alone or in combination. The polysaccharide is, for example, a cellulose derivative or a naturally occurring polysaccharide.

[0024] The cellulose derivative is, for example, a cellulose ether, such as methyl cellulose, ethyl cellulose, hydroxyethyl cellulose, hydroxymethylethyl cellulose, hydroxypropyl cellulose, hydroxypropylmethyl cellulose, benzyl cellulose, trityl cellulose, cyanoethyl cellulose, carboxymethyl cellulose, carboxyethyl cellulose, or aminoethyl cellulose; an organic acid ester, such as cellulose acetate, cellulose formate, cellulose propionate, cellulose butyrate, cellulose benzoate, cellulose phthalate, or tosyl cellulose; a mineral acid ester, such as cellulose nitrate, cellulose sulfate, cellulose phosphate, or

cellulose xanthate; or the like.

[0025] The naturally occurring polysaccharide is, for example, a plant-derived polysaccharide, such as guar gum, tara gum, locust bean gum, tamarind seed gum, pectin, gum arabic, gum tragacanth, karaya gum, ghatti gum, arabinogalactan, flaxseed gum, cassia gum, psyllium seed gum, or Artemisia seed gum; an algae-derived polysaccharide, such as carrageenan, agar, alginic acid, a propylene glycol alginate ester, furcellaran, or a Colpomenia sinuosa extract; a microbial polysaccharide, such as xanthan gum, gellan gum, curdlan, pullulan, Agrobacterium succinoglycan, welan gum, Macrophomopsis gum, or rhamsan gum; a crustacean polysaccharide, such as chitin, chitosan, or glucosamine; a starch, such as starch, sodium starch glycolate, pregelatinized starch, or dextrin; or the like.

[0026] The protein is, for example, a grain protein, such as wheat gluten or rye gluten. The synthetic polymer is, for example, polyphosphoric acid, sodium polyacrylate, polyvinylpyrrolidone, or the like.

[0027] When the tobacco sheet contains a shaping agent, the shaping agent content per 100% by mass of the tobacco sheet preferably ranges from 0.1% to 15% by mass. When the shaping agent content is 0.1% by mass or more, a raw material mixture can be easily formed into a sheet. When the shaping agent content is 15% by mass or less, another raw material for ensuring a function required for the tobacco-containing segment of the non-combustion heating-type flavor inhaler can be sufficiently used. The shaping agent content more preferably ranges from 0.2% to 13% by mass, still more preferably 0.5% to 12% by mass, particularly preferably 1% to 10% by mass.

(Aerosol Generator)

[0028] The tobacco sheet according to the present embodiment preferably further contains an aerosol generator from the perspective of increasing the amount of smoke during heating. The aerosol generator is, for example, glycerin, propylene glycol, 1,3-butanediol, or the like. These may be used alone or in combination.

[0029] When the tobacco sheet contains an aerosol generator, the aerosol generator content per 100% by mass of the tobacco sheet preferably ranges from 5% to 50% by mass. An aerosol generator content of 5% by mass or more can result in sufficient aerosol in terms of amount generated during heating. An aerosol generator content of 50% by mass or less can result in sufficient aerosol in terms of heat capacity generated during heating. The aerosol generator content more preferably ranges from 6% to 45% by mass, still more preferably 8% to 40% by mass, particularly preferably 10% to 30% by mass.

(Reinforcing Agent)

[0030] When the fibrous material is other than a fibrous reinforcing agent, such as the fibrous pulp, the tobacco sheet according to the present embodiment may further contain a reinforcing agent from the perspective of further improving physical properties. The reinforcing agent is, for example, a liquid material with a surface coating function of forming a film when dried, such as an aqueous suspension of pulp or pectin, or the like. These may be used alone or in combination.

[0031] When the tobacco sheet contains a reinforcing agent, the reinforcing agent content per 100% by mass of the tobacco sheet preferably ranges from 0.1% to 20% by mass. At a reinforcing agent content in this range, another raw material for ensuring a function required for the tobacco-containing segment of the non-combustion heating-type flavor inhaler can be sufficiently used. The reinforcing agent content more preferably ranges from 0.2% to 18% by mass, still more preferably 0.5% to 15% by mass.

(Humectant)

[0032] The tobacco sheet according to the present embodiment can further contain a humectant from the perspective of quality preservation. The humectant is, for example, a sugar alcohol, such as sorbitol, erythritol, xylitol, maltitol, lactitol, mannitol, or reduced maltose syrup, or the like. These may be used alone or in combination.

[0033] When the tobacco sheet contains a humectant, the humectant content per 100% by mass of the tobacco sheet preferably ranges from 1 % to 15% by mass. In this range, another raw material for ensuring a function required for the tobacco-containing segment of the non-combustion heating-type flavor inhaler can be sufficiently used. The humectant content more preferably ranges from 2% to 12% by mass, still more preferably 3% to 10% by mass.

(Other Components)

[0034] The tobacco sheet according to the present embodiment can contain, in addition to the fibrous material, the tobacco raw material, the shaping agent, the aerosol generator, the reinforcing agent, and the humectant, if necessary, a flavoring and seasoning agent, such as a flavoring agent or a taste agent, a colorant, a wetting agent, a preservative, a diluent, such as an inorganic substance, and/or the like.

(Bulkiness)

[0035] The tobacco sheet according to the present embodiment preferably has a bulkiness of 190 cc/100 g or more. When the bulkiness 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 a tobacco sheet filled in the tobacco-containing segment can contribute more to aerosol generation. The bulkiness is more preferably 210 cc/100 g or more, still more preferably 230 cc/100 g or more. The upper limit of the bulkiness is, for example, but not limited to, 800 cc/100 g or less. The bulkiness is a value measured with DD-60A (trade name, manufactured by Borgwaldt KC Inc.) after the tobacco sheet is cut into a size of 0.8 mm x 9.5 mm and is allowed to stand in a conditioned room at 22°C and 60% for 48 hours. The measurement is performed by putting 15 g of the shredded tobacco sheet into a cylindrical vessel with an inside diameter of 60 mm and determining the volume of the tobacco sheets compressed at a load of 3 kg for 30 seconds.

(Structure of Tobacco Sheet)

[0036] In the present embodiment, the "tobacco sheet" is a component constituting a tobacco sheet formed into a sheet shape. The term "sheet", as used herein, refers to a shape with a pair of approximately 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 filling form. The thickness of the tobacco sheet is preferably, but not limited to, in the range of 100 to 1000 μm, more preferably 150 to 600 μm, in terms of the balance between heat transfer efficiency and strength.

(Method for Manufacturing Tobacco Sheet)

[0037] The tobacco sheet according to the present embodiment can be produced, for example, by a known method, such as a rolling method or a casting method. Details of various tobacco sheets produced by such a method are disclosed in "Tabako no jiten (Tobacco Dictionary), Tobacco Academic Studies Center, March 31, 2009".

<Rolling Method>

[0038] A method for producing a tobacco sheet by a rolling method may include the following steps, for example.

(1) A step of mixing water, a tobacco powder, an aerosol generator, a shaping agent, and fibrous pulp to prepare a mixture.
(2) A step of feeding the mixture to a rolling roller for rolling.
(3) A step of peeling off a rolled product on the rolling roller with a doctor knife, transferring the rolled product to a net conveyor, and drying the rolled product with a dryer.

[0039] When a tobacco sheet is produced by this method, depending on the purpose, the surface of each rolling roller may be heated or cooled, or the number of revolutions of each rolling roller may be adjusted. A tobacco sheet with a desired basis weight can be formed by adjusting the distance between rolling rollers.

<Casting Method>

[0040] A method for producing a tobacco sheet by a casting method may include the following steps, for example.

(1) A step of mixing water, a tobacco powder, an aerosol generator, a shaping agent, and fibrous pulp to prepare a mixture.

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

[0041] This method for producing a tobacco sheet may further include a step of irradiating a slurry, which is prepared by mixing water, a tobacco powder, an aerosol generator, a shaping agent, and fibrous pulp, with ultraviolet radiation or X-ray radiation to remove a component, such as a nitrosamine.

[Non-Combustion Heating-Type Flavor Inhaler]

[0042] A 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. Since the non-combustion heating-type flavor inhaler according to the present embodiment includes the tobacco-containing segment filled with the tobacco

sheet with a high bulkiness according to the present embodiment, the total heat capacity of the tobacco-containing segment can be sufficiently reduced, and the tobacco sheet filled in the tobacco-containing segment can contribute more to aerosol generation.

[0043] 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, a tubular cooling segment 3 with a hole 8 on the periphery, a center hole segment 4, and a filter segment 5. The non-combustion heating-type flavor inhaler according to the present embodiment may have another segment, in addition to the tobacco-containing segment, the cooling segment, the center hole segment, and the filter segment.

[0044] The non-combustion heating-type flavor inhaler according to the present embodiment may have any axial length and preferably has an axial length of 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 non-combustion heating-type flavor inhaler preferably has a circumferential length of 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. 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 or more and 10 mm or less. The airflow resistance of the filter segment is selected in the range of 15 mmH_2O/seg or more and 60 mmH_2O/seg or less per segment. The length of each segment can be appropriately changed according to the manufacturability, quality requirements, and the like. Only the filter segment on the downstream side of the cooling segment without the center hole segment can also function as a non-combustion heating-type flavor inhaler.

(Tobacco-Containing Segment)

[0045] The tobacco-containing segment 2 is filled with the tobacco sheet according to the present embodiment in a wrapping paper (hereinafter also referred to as a "wrapper"). The wrapping paper may be filled with the tobacco sheet by any method, for example, by wrapping the tobacco sheet with the wrapper or by filling a tubular wrapper with the tobacco sheet. When the shape of the tobacco sheet has a longitudinal direction like a rectangular shape, the tobacco sheet may be packed such that the 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)

[0046] As illustrated in Fig. 1, the cooling segment 3 may be constituted by a tubular member 7. The tubular member 7 may be, for example, a paper tube prepared by processing a thick paper into a cylindrical shape.

[0047] The tubular member 7 and a mouthpiece lining paper 12 described later have a hole 8 passing therethrough. The hole 8 allows the outside air to be introduced into the cooling segment 3 during inhalation. This brings a vaporized aerosol component generated by heating the tobacco-containing segment 2 into contact with the outside air, lowers the temperature of the vaporized aerosol component, liquefies the vaporized aerosol component, and forms an aerosol. The hole 8 may have any diameter (full length), for example, a diameter in the range of 0.5 mm or more and 1.5 mm or less. The number of holes 8 may be, but is not limited to, one or two or more. For example, a plurality of holes 8 may be provided on the periphery of the cooling segment 3.

[0048] The amount of outside air introduced through the hole 8 is preferably 85% by volume or less, more preferably 80% by volume or less, of the volume of the whole gas inhaled by the user. When the amount of outside air is 85% by volume or less, it is possible to sufficiently reduce the decrease in flavor due to dilution with the outside air. This is also referred to as a ventilation ratio. The lower limit of the ventilation ratio is preferably 55% by volume or more, more preferably 60% by volume or more, in terms of cooling performance.

[0049] The cooling segment may be a segment including a sheet of an appropriate constituent material that is wrinkled, pleated, gathered, or folded. A cross-sectional profile of such an element may have randomly oriented channels. The cooling segment may also include a bundle of longitudinally extending tubes. Such a cooling segment may be formed, for example, by wrapping a pleated, gathered, or folded sheet material with a wrapping paper.

[0050] The cooling segment can have an axial length of, for example, 7 mm or more and 28 mm or less, for example, 18 mm. Furthermore, the cooling segment can be substantially circular in its axial cross-sectional shape and can have a diameter of, for example, 5 mm or more and 10 mm or less, for example, approximately 7 mm.

(Center Hole Segment)

[0051] The center hole segment is composed of a fill layer with one or more hollow portions and an inner plug wrapper

(inner wrapping paper) covering the fill layer. For example, as illustrated in Fig. 1, the center hole segment 4 is composed of a second fill layer 9 with a hollow portion and a second inner plug wrapper 10 covering the second fill layer 9. The center hole segment 4 has a function of increasing the strength of the mouthpiece segment 6. The second fill layer 9 may be, for example, a rod with an inside diameter of φ1.0 mm or more and φ5.0 mm or less in which cellulose acetate fibers are densely packed and a plasticizer containing triacetin is added in an amount of 6% by mass or more and 20% by mass or less of the mass of cellulose acetate and is hardened. The fibers in the second fill layer 9 have a high packing density, and air or an aerosol flows only through the hollow portion during inhalation and rarely flows through the second fill layer 9. The second fill layer 9 inside the center hole segment 4 is a fiber fill layer, and the touch from the outside during use rarely causes discomfort to the user. The center hole segment 4 may have no second inner plug wrapper 10 and may maintain its shape by thermoforming.

(Filter Segment)

[0052] The filter segment 5 may have any structure and may be composed of one or more fill layers. The outer side of the fill layer(s) may be wrapped with one or more wrapping papers. The airflow resistance per segment of the filter segment 5 can be appropriately changed depending on the amount, material, and the like of filler in the filter segment 5. For example, when the filler is cellulose acetate fibers, increasing the amount of cellulose acetate fibers in the filter segment 5 can increase the airflow resistance. When the filler is cellulose acetate fibers, the packing density of the cellulose acetate fibers may range from 0.13 to 0.18 g/cm^3. The airflow resistance is a value measured with an airflow resistance measuring instrument (trade name: SODIMAX, manufactured by SODIM).

[0053] The filter segment 5 may have any circumferential length, which preferably ranges from 16 to 25 mm, more preferably 20 to 24 mm, still more preferably 21 to 23 mm. The axial length of the filter segment 5 can be selected from 4 to 10 mm and is selected to have an airflow resistance in the range of 15 to 60 mmH_2O/seg. The filter segment 5 preferably has an axial length in the range of 5 to 9 mm, more preferably 6 to 8 mm. The filter segment 5 may have any cross-sectional shape, for example, a circular shape, an elliptical shape, a polygonal shape, or the like. A breakable capsule containing a flavoring agent, flavoring agent beads, or a flavoring agent may be added directly to the filter segment 5.

[0054] 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 may be, for example, cylindrical paper. The tobacco-containing segment 2, the cooling segment 3, and the connected center hole segment 4 and filter segment 5 can be connected using the mouthpiece lining paper 12. These connections can be made, for example, by applying an adhesive agent, such as a vinyl acetate adhesive agent, to the inner surface of the mouthpiece lining paper 12, inserting the three segments therein, and wrapping the three segments. These segments may be connected multiple times with a plurality of lining papers.

[Non-Combustion Heating-Type Flavor Inhaling System]

[0055] A non-combustion heating-type flavor inhaling system according to the present embodiment includes the non-combustion heating-type flavor inhaler according to the present embodiment and a heating device for heating the tobacco-containing segment of the non-combustion heating-type flavor inhaler. The non-combustion heating-type flavor inhaling system according to the present embodiment may have another constituent, in addition to the non-combustion heating-type flavor inhaler according to the present embodiment and the heating device.

[0056] Fig. 2 illustrates an example of the non-combustion heating-type flavor inhaling system according to the present embodiment. The non-combustion heating-type flavor inhaling system illustrated in Fig. 2 includes the non-combustion heating-type flavor inhaler 1 according to the present embodiment and a heating device 13 for heating the tobacco-containing segment of the non-combustion heating-type flavor inhaler 1 from the outside.

[0057] 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 is 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 recess 19. The heater 15 and the metal tube 16 are arranged on the inner side surface of the recess 19 at a position corresponding to the tobacco-containing segment of the non-combustion heating-type flavor inhaler 1 inserted into the recess 19. The heater 15 may be an electrical resistance heater and is heated by an electric power supplied from the battery unit 17 according to an instruction from the control unit 18 for temperature control. Heat generated by the heater 15 is transferred to the tobacco-containing segment of the non-combustion heating-type flavor inhaler 1 through the metal tube 16 with high thermal conductivity.

[0058] Although there is a space between the outer circumference of the non-combustion heating-type flavor inhaler 1 and the inner circumference of the metal tube 16 in schematically illustrated Fig. 2(b), it is actually desirable that for efficient heat transfer there be no space between the outer circumference of the non-combustion heating-type flavor

inhaler 1 and the inner circumference of the metal tube 16. 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.

[0059] The heating temperature of the heating device is preferably, but is not limited to, 400°C or less, more preferably 150°C or more and 400°C or less, still more preferably 200°C or more and 350°C or less. The heating temperature refers to the temperature of the heater of the heating device.

[0060] Furthermore, the present inventors have found that high response at the beginning of inhalation, that is, sufficient delivery of a flavor component at the beginning of inhalation enhances the use satisfaction. Thus, a tobacco sheet with higher use satisfaction is described below as a first embodiment.

[0061] Furthermore, known tobacco sheets have no or very low air permeability. To control the component release from such a sheet, for example, the sheet has been rolled to change the loading amount of the composition, the density of the composition, or the like. However, such a known method has a threshold value in the loading amount and the density to maintain the rolled shape and disadvantageously has a narrow applicable range in product design. In view of the above circumstances, a tobacco sheet that can have a good profile is described below as a second embodiment.

[First Embodiment]

[0062] In a first embodiment, a tobacco sheet with a high bulkiness and higher use satisfaction is described. The tobacco sheet according to the present embodiment has a density of 1.0 g/cm^3 or less.

(1) Binder

[0063] The binder is a type of the shaping agent described above and is an adhesive agent for binding tobacco materials to each other or binding a tobacco material to another component. In the present embodiment, a known binder can be used. Such a binder is, for example, a polysaccharide, such as guar gum or xanthan gum, or a cellulose derivative, such as carboxymethyl cellulose (CMC), a carboxymethyl cellulose sodium salt (CMC-Na), or hydroxypropyl cellulose (HPC). The binder content based on dry mass (mass excluding water mixed therein, the same applies hereinafter) preferably has an upper limit of 6% by mass or less and preferably has a lower limit of 1% by mass or more, more preferably 3% by mass or more, based on the dry mass of the tobacco sheet. At an amount of binder higher than the upper limit or lower than the lower limit, the effects described above may not be sufficiently exhibited.

[0064] A binder used in the present embodiment may be a polysaccharide, a protein, or a synthetic polymer. Specific examples of these are described below. In the present embodiment, these binders may be used in combination.

1) Polysaccharide

1-1) Cellulose Derivative

[Cellulose Ether]

[0065] Methyl cellulose, ethyl cellulose, hydroxyethyl cellulose, hydroxymethylethyl cellulose, hydroxypropyl cellulose, hydroxypropylmethyl cellulose, benzyl cellulose, trityl cellulose, cyanoethyl cellulose, carboxymethyl cellulose, carboxyethyl cellulose, or aminoethyl cellulose

[Cellulose Ester]

[0066] Organic acid ester: cellulose acetate, cellulose formate, cellulose propionate, cellulose butyrate, cellulose benzoate, cellulose phthalate, or tosyl cellulose

[0067] Mineral acid ester: cellulose nitrate, cellulose sulfate, cellulose phosphate, or a cellulose xanthate salt

1-2) Naturally Occurring Polysaccharide

[Plant-Derived]

[0068] Guar gum, tara gum, locust bean gum, tamarind seed gum, pectin, gum arabic, gum tragacanth, karaya gum, ghatti gum, arabinogalactan, flaxseed gum, cassia gum, psyllium seed gum, or Artemisia seed gum

[Algae-Derived]

[0069] Carrageenan, agar, alginic acid, propylene glycol alginate ester, furcellaran, or a Colpomenia sinuosa extract

[Microorganism-Derived]

[0070] Xanthan gum, gellan gum, curdlan, pullulan, Agrobacterium succinoglycan, welan gum, Macrophomopsis gum, or rhamsan gum

[Crustacea-Derived]

[0071] Chitin, chitosan, or glucosamine

[Starch]

[0072] Starch, sodium starch glycolate, pregelatinized starch, or dextrin

2) Protein

[0073] Wheat gluten or rye gluten

3) Synthetic Polymer

[0074] Polyphosphoric acid, sodium polyacrylate, or polyvinylpyrrolidone

(2) Tobacco Material

[0075] The tobacco material used in the present embodiment may be the fibrous tobacco material or the tobacco raw material. In the present embodiment, more specifically, shredded dried tobacco leaves, ground leaf tobacco, or the like can be used as a tobacco material other than the fibrous tobacco material. The ground leaf tobacco is particles produced by grinding leaf tobacco. The particle diameter D90 of the ground leaf tobacco is preferably 200 μm or more as described above and can preferably has an upper limit of 1000 μm or less, more preferably 50 to 500 μm. The average particle size D50 thereof can preferably range from 20 to 1000 μm, more preferably 50 to 500 μm. The grinding can be performed with a known grinder and may be dry grinding or wet grinding. Thus, the ground leaf tobacco is also referred to as leaf tobacco particles. In the present embodiment, the particle size is determined by a laser diffraction-scattering method and is, more specifically, measured with a laser diffraction particle size distribution measuring apparatus (for example, LA-950 manufactured by Horiba, Ltd.). The type of tobacco may be, but is not limited to, flue-cured varieties, burley varieties, oriental varieties, native varieties, other varieties belonging to Nicotiana tabacum varieties or Nicotiana rustica varieties, or the like. The amount of the tobacco material in the tobacco sheet is preferably, but not limited to, in the range of 50% to 95% by mass, more preferably 60% to 90% by mass, based on dry mass.

(3) Aerosol Generator

[0076] Also in the present embodiment, a known aerosol generator can be used, and examples thereof include polyhydric alcohols, such as glycerin and propylene glycol (PG), and those with a boiling point of more than 100°C, such as triethyl citrate (TEC) and triacetin. In the present embodiment, the amount of the aerosol generator in the tobacco sheet preferably ranges from 5% to 40% by mass, more preferably 10% to 20% by mass, based on dry mass (mass excluding water mixed therein, the same applies hereinafter). When the amount of the aerosol generator is higher than the upper limit, it may be difficult to produce a tobacco sheet. When the amount of the aerosol generator is lower than the lower limit, smoke sensitivity may decrease.

(4) Emulsifier

[0077] In the present embodiment, the tobacco sheet may contain an emulsifier. The emulsifier increases the affinity between the aerosol generator, which is lipophilic, and the tobacco material, which is hydrophilic. Thus, the addition of the emulsifier is effective particularly when a lipophilic aerosol generator is used. The emulsifier can be a known emulsifier and is, for example, an emulsifier with an HLB value in the range of 8 to 18. The amount of the emulsifier is preferably, but not limited to, in the range of 0.1 to 3 parts by mass, more preferably 1 to 2 parts by mass, based on dry mass with respect to 100 parts by mass of the tobacco sheet.

(5) Flavoring Agent

[0078] In the present embodiment, the tobacco sheet may contain a flavoring agent. The flavoring agent is a substance that provides an aroma or flavor. The flavoring agent may be a natural flavoring agent or a synthetic flavoring agent. The flavoring agent may be one type of flavoring agent or a mixture of multiple types of flavoring agents. The flavoring agent may be any flavoring agent commonly used in smoking articles, and specific examples thereof are described below. The flavoring agent can be contained in a sheet for a smoking article in such an amount that the smoking article can provide a favorable aroma or flavor. For example, the amount of the flavoring agent in the tobacco sheet preferably ranges from 1% to 30% by mass, more preferably 2% to 20% by mass.

[0079] The flavoring agent may be of any type and, from the perspective of imparting flavor sense, may be acetoanisole, acetophenone, acetylpyrazine, 2-acetylthiazole, an alfalfa extract, amyl alcohol, amyl butyrate, trans-anethole, star anise oil, apple juice, Peru balsam oil, beeswax absolute, benzaldehyde, benzoin resinoid, benzyl alcohol, benzyl benzoate, benzyl phenylacetate, benzyl propionate, 2,3-butanedione, 2-butanol, butyl butyrate, butyric acid, caramel, cardamom oil, carob absolute, β-carotene, carrot juice, L-carvone, β-caryophyllene, cassia bark oil, cedar wood oil, celery seed oil, chamomile oil, cinnamaldehyde, cinnamic acid, cinnamyl alcohol, cinnamyl cinnamate, citronella oil, DL-citronellol, a clary sage extract, cocoa, coffee, cognac oil, coriander oil, cumin aldehyde, davana oil, δ-decalactone, γ-decalactone, decanoic acid, dill herb oil, 3,4-dimethyl-1,2-cyclopentanedione, 4,5-dimethyl-3-hydroxy-2,5-dihydrofuran-2-one, 3,7-dimethyl-6-octenoic acid, 2,3-dimethylpyrazine, 2,5-dimethylpyrazine, 2,6-dimethylpyrazine, ethyl 2-methylbutyrate, ethyl acetate, ethyl butyrate, ethyl hexanoate, ethyl isovalerate, ethyl lactate, ethyl laurate, ethyl levulinate, ethyl maltol, ethyl octanoate, ethyl oleate, ethyl palmitate, ethyl phenylacetate, ethyl propionate, ethyl stearate, ethyl valerate, ethylvanillin, ethylvanillin glucoside, 2-ethyl-3,(5 or 6)-dimethylpyrazine, 5-ethyl-3-hydroxy-4-methyl-2(5H)-furanone, 2-ethyl-3-methylpyrazine, eucalyptol, fenugreek absolute, genet absolute, gentian root infusion, geraniol, geranyl acetate, grape juice, guaiacol, a guava extract, γ-heptalactone, γ-hexalactone, hexanoic acid, cis-3-hexen-1-ol, hexyl acetate, hexyl alcohol, hexyl phenylacetate, honey, 4-hydroxy-3-pentenoic acid lactone, 4-hydroxy-4-(3-hydroxy-1-butenyl)-3,5,5-trimethyl-2-cyclohexen-1-one, 4-(p-hydroxyphenyl)-2-butanone, sodium 4-hydroxyundecanoate, immortelle absolute, β-ionone, isoamyl acetate, isoamyl butyrate, isoamyl phenylacetate, isobutyl acetate, isobutyl phenylacetate, jasmine absolute, kola nut tincture, labdanum oil, lemon terpeneless oil, a licorice extract, linalool, linalyl acetate, lovage root oil, maltol, maple syrup, menthol, menthone, L-menthyl acetate, p-methoxybenzaldehyde, methyl-2-pyrrolylketone, methyl anthranilate, methyl phenyl acetate, methyl salicylate, 4'-methylacetophenone, methylcyclopentenolone, 3-methylvaleric acid, mimosa absolute, molasses, myristic acid, nerol, nerolidol, γ-nonalactone, nutmeg oil, δ-octalactone, octanal, octanoic acid, orange flower oil, orange oil, orris root oil, palmitic acid, ω-pentadecalactone, peppermint oil, petitgrain Paraguay oil, phenethyl alcohol, phenethyl phenylacetate, phenylacetic acid, piperonal, a plum extract, propenyl guaethol, propyl acetate, 3-propylidenephthalide, prune fruit juice, pyruvic acid, a raisin extract, rose oil, rum, sage oil, sandalwood oil, spearmint oil, styrax absolute, marigold oil, tea distillate, α-terpineol, terpinyl acetate, 5,6,7,8-tetrahydroquinoxaline, 1,5,5,9-tetramethyl-13-oxacyclo(8.3.0.0(4.9))tridecane, 2,3,5,6-tetramethylpyrazine, thyme oil, a tomato extract, 2-tridecanone, triethyl citrate, 4-(2,6,6-trimethyl-1-cyclohexenyl)2-buten-4-one, 2,6,6-trimethyl-2-cyclohexene-1,4-dione, 4-(2,6,6-trimethyl-1,3-cyclohexadienyl)2-buten-4-one, 2,3,5-trimethylpyrazine, γ-undecalactone, γ-valerolactone, a vanilla extract, vanillin, veratraldehyde, violet leaf absolute, N-ethyl-p-menthane-3-carboamide (WS-3), ethyl-2-(p-menthane-3-carboxamide)acetate (WS-5), sugar (sucrose, fructose), a cocoa powder, a carob powder, a coriander powder, a licorice powder, an orange peel powder, a rose hip powder, a chamomile flower powder, a lemon verbena powder, a peppermint powder, a leaf powder, a spearmint powder, a black tea powder, a natural plant flavoring agent (for example, jasmine oil, lemon oil, vetiver oil, lovage oil), an ester (for example, menthyl acetate, isoamyl propionate, or the like), or an alcohol (for example, phenylethyl alcohol, cis-6-nonene-1-ol, or the like). These flavoring agents may be used alone or in combination.

(6) Characteristics and Form of Tobacco Sheet

1) Density

[0080] The tobacco sheet according to the present embodiment has a density of 1.0 g/cm^3 or less. A tobacco sheet with such a low density can achieve sufficient delivery of a flavor component at the beginning of inhalation. Although the reason for this is not limited, it is surmised that a tobacco sheet with a low density can reduce the packing density of a tobacco filler in a smoking article and can therefore increase the amount of heat received per mass. Furthermore, a decrease in packing density can achieve cost reduction. From these perspectives, the density is preferably 0.95 g/cm^3 or less, more preferably 0.75 g/cm^3 or less. The lower limit of the density is preferably, but not limited to, 0.5 g/cm^3 or more from the perspective of strength or the like. In the present invention, the density is calculated from the basis weight (mass per unit area) and the thickness. The tobacco sheet according to the present embodiment preferably has an air permeability of 0 CORESTA units.

2) Thickness

[0081] The tobacco sheet may have any thickness, but the upper limit is preferably 1500 μm or less, more preferably 1000 μm or less, still more preferably 500 μm or less. The lower limit is preferably 20 μm or more, more preferably 100 μm or more, still more preferably 150 μm or more.

(7) Tobacco segment

[0082] A tobacco segment for use in a smoking article can be produced from a tobacco sheet. In one embodiment, the tobacco segment includes a tubular wrapper and a tobacco sheet helically packed in the wrapper (see Fig. 3(A)). In the figure, 20A denotes a tobacco segment, T denotes a tobacco sheet, and 22 denotes a wrapper, which is typically paper. The tobacco segment is preferably rod-like and may have a length in the range of approximately 15 to 80 mm and a diameter in the range of approximately 5 to 10 mm. Furthermore, the tobacco segment 20A illustrated in Fig. 3 (A) may be cut to have an aspect ratio (length/diameter) in the range of approximately 0.5 to 1.2 (see Fig. 3(B)).

[0083] In another embodiment, the tobacco segment 20A has a tubular wrapper 22 and a tobacco sheet T folded and packed in the wrapper. A ridgeline formed by folding is approximately parallel to the longitudinal direction of the segment (see Fig. 3(C)). The tobacco segment 20A is preferably rod-like and may have a length in the range of approximately 15 to 80 mm and a diameter in the range of approximately 5 to 10 mm. In the present embodiment, the tobacco sheet T is preferably subjected to surface wrinkling, such as pleating or crimping, in advance.

[0084] In another embodiment, the tobacco segment 20A has the tubular wrapper 22 and cut pieces of the tobacco sheet T packed in the wrapper (see Fig. 3(D)). The tobacco segment 20A is preferably rod-like and may have a length in the range of approximately 15 to 80 mm and a diameter in the range of approximately 5 to 10 mm. Each cut piece may have any size and, for example, may have a longest side length in the range of approximately 2 to 20 mm and a width in the range of approximately 0.5 to 1.5 mm.

[0085] In another embodiment, the tobacco segment 20A has the tubular wrapper 22 and shredded strands packed in the wrapper (see Fig. 3(E)). The shredded strands are packed such that the longitudinal direction thereof is approximately parallel to the longitudinal direction of the wrapper 22. Each shredded strand may have a width in the range of approximately 0.5 to 1.5 mm.

[0086] In another embodiment, the tobacco segment 20A has the tubular wrapper 22 and a shredded tobacco filler randomly packed in the wrapper. Shredded tobacco is cut shreds and is different from shredded strands.

[Manufacturing Method]

[0087] The tobacco sheet according to the present embodiment can be produced by any method, preferably a method including the following steps.

[0088] Step 1 of kneading at least a fibrous material, an optional tobacco material, a binder, and a medium to prepare a mixture.

[0089] Step 2 of flattening the mixture or extruding the mixture through a die to prepare a wet sheet.

[0090] Step 3 of drying the wet sheet.

[0091] A sheet formed by applying pressure in this manner is referred to as a "press-formed sheet", and the "press-formed sheet" includes a "laminated sheet" and an "extruded sheet", as described later. The laminated sheet is a sheet produced by flattening the mixture one or more times to a target thickness using a roller and then drying the mixture to a target water content. The extruded sheet is a sheet produced by extruding the mixture through a T-die or the like to a target thickness and then drying the mixture to a target water content. In a press-formed sheet, flattening and extrusion may be combined. For example, the mixture may be extruded and then further flattened to form a sheet.

(1) Step 1

[0092] In this step, the fibrous material, the optional tobacco material, the binder, and the medium are kneaded. If necessary, an aerosol generator, an emulsifier, or a flavoring agent may also be added. The amount of each component is adjusted to achieve the amount described above. The medium is preferably, for example, composed mainly of water or a water-soluble organic solvent with a boiling point of less than 100°C, such as ethanol, and is more preferably water or ethanol.

[0093] This step can be performed by kneading the components and is preferably performed through 1) grinding of a raw material (for example, a single leaf), 2) preparation of a wet powder, and 3) kneading.

1) Grinding

[0094] Preferably, a raw material is coarsely ground and is then finely ground using a grinder (for example, ACM-5 manufactured by Hosokawa Micron Corporation). The particle diameter D90 after the fine grinding preferably ranges from 20 to 1000 μm. The particle size is measured with a laser diffraction particle size analyzer, such as Mastersizer (manufactured by malvem).

2) Preparation of Wet Powder

[0095] A binder and an optional additive agent, such as a flavoring agent or a lipid, are added to and mixed with the ground tobacco raw material (for example, leaf tobacco particles). This mixing is preferably dry blending, and a mixer is preferably used as a mixing machine. A medium, such as water, and an optional aerosol generator, such as glycerin, are then added to the dry blend and are mixed using a mixer to prepare a wet powder (a powder in a wet state). The amount of the medium in the wet powder can range from 20% to 80% by mass, preferably 20% to 40% by mass, and the wet powder is appropriately adjusted in the step 2. For example, the amount of the medium can range from 20% to 50% by mass in the case of flattening and 20% to 80% by mass in the case of extrusion in the step 2. The wet powder preferably has a solid concentration in the range of 50% to 90% by mass. In a particularly preferred embodiment, a wet powder to be used contains tobacco particles with a D90 of 200 μm or more and a liquid medium containing water (more preferably, a liquid medium composed of water) and has a water content of 50% by mass or more.

3) Kneading

[0096] The wet powder is kneaded with a kneader (for example, DG-1 manufactured by Dalton Corporation). The kneading is preferably performed until the medium is wholly dispersed. For example, the kneading is preferably performed until the color of the mixture is visually uniform.

(2) Step 2

[0097] In this step, the mixture (wet powder) is flattened or extruded through a die to prepare a wet sheet. For example, the mixture sandwiched between two substrate films can be passed between a pair of rollers to a predetermined thickness (more than 100 μm) using a calender (for example, manufactured by Yuri Roll Machine Co., Ltd.) and can be flattened to form a laminate of a wet sheet sandwiched between the two substrate films. The substrate film is preferably a non-adhesive film, such as a fluorinated polymer film. The flattening using a roller can be performed multiple times. Alternatively, the mixture (wet powder) may be extruded through a die (preferably a T-die) with a predetermined gap to form a wet sheet on a substrate. The substrate may be a known substrate, such as a glass sheet, a metal sheet, or a plastic sheet. A known extruder can be used for the extrusion.

(3) Step 3

[0098] In this step, the wet sheet is dried. For example, the laminate can be subjected to this step by the following procedure. 1) One of the substrate films is peeled off. 2) The laminate is dried with a forced-air dryer. The drying temperature may be room temperature and preferably ranges from 50°C to 100°C, and the drying time can range from 1 to 2 minutes. 3) The remaining substrate film is then peeled off, and drying is further performed under the conditions described above to produce a tobacco sheet. Such drying can prevent the tobacco sheet from adhering to another substrate. The tobacco sheet thus produced is also referred to as a "laminated sheet". The laminated sheet is preferred because it has a smooth surface and can have fewer fallen shreds when coming into contact with another member. This method is suitable for the production of a sheet of 300 μm or less.

[0099] In extrusion, the wet sheet on the substrate is dried by air drying or heating. The drying conditions are as described above. The tobacco sheet thus produced is also referred to as an "extruded sheet". The extruded sheet is preferred because it has a smooth surface and can have fewer fallen shreds when coming into contact with another member. This method is suitable for the production of a sheet of 200 μm or more.

[Second Embodiment]

[0100] In a second embodiment, a tobacco sheet with a high bulkiness that can have a good profile is described below. The tobacco sheet according to the present embodiment contains a fibrous material, an optional tobacco material, a humectant, a binder, and an optional flavoring and taste agent, and has an air permeability of more than 0 CORESTA units.

(1) Humectant

[0101] The humectant in the present embodiment is a material for imparting moisture to the tobacco sheet and is also the aerosol generator that is vaporized by heating and is cooled to generate an aerosol or that generates an aerosol by atomization. The humectant in the present embodiment may be a polyhydric alcohol, such as glycerin or propylene glycol (PG); or a triester, such as triethyl citrate (TEC) or triacetin. The humectant in the present embodiment preferably has a boiling point of more than 100°C. The amount of the humectant in the tobacco sheet preferably ranges from 1% to 40% by mass, more preferably 10% to 20% by mass, based on dry mass (mass excluding water mixed therein, the same applies hereinafter). When the amount of the humectant is higher than the upper limit, it may be difficult to produce a tobacco sheet. When the amount of the humectant is lower than the lower limit, smoke sensitivity may decrease.

(2) Binder

[0102] In the present embodiment, the binder described in the first embodiment can be used.

(3) Flavoring and Taste Agent

[0103] The flavoring and taste agent is a material that imparts a flavor, preferably a flavoring agent. The flavoring agent may be one described above.

(4) Aerosol Generator

[0104] In the present embodiment, the tobacco sheet may contain the aerosol generator described in the first embodiment.

(5) Shaping Aid

[0105] The fibrous material has a function as a shaping aid. When the fibrous material is used as a shaping aid, the amount of the shaping aid to be added preferably ranges from 0.5% to 2.0% by mass in the tobacco sheet. More specifically, the tobacco sheet containing a shaping aid can have an effect of ensuring the strength of the sheet, an effect of reducing the stickiness of the sheet, or the like, and the tobacco sheet containing a flavoring agent, which can be carried by a shaping aid, can have an effect of improving the ability of the sheet to carry the flavoring agent or the like.

1) Air Permeability

[0106] The tobacco sheet according to the present embodiment has an air permeability of more than 0 CORESTA units, preferably 50 CORESTA Units or more, 100 CORESTA Units or more, 200 CORESTA Units or more, 300 CORESTA Units or more, or 400 CORESTA Units or more, more preferably 500 CORESTA Units or more. The upper limit thereof is preferably, but not limited to, 20,000 CORESTA units or less, more preferably 15,000 CORESTA units or less. The CORESTA Unit is defined as the air flow rate (cm^3) per cm^2 per minute at a pressure difference of 1 kPa. The air permeability can be measured with an air permeability meter PPM1000M manufactured by Cerulean. In the present invention, the air permeability is preferably measured by the following procedure. 1) A sheet is conditioned by standing it for 48 hours under the conditions of a room temperature of 22°C and a relative humidity of 60%. 2) The sheet is then cut into a size of 40 mm x 240 mm, and the amount of air passing from the front surface to the back surface is measured with the air permeability measuring device (PPM1000M manufactured by Cerulean) at a pressure difference of 1 kPa using a 2-cm^2 circular measuring head. 3) The measurement environment is set to room temperature (for example, 22°C) and a relative humidity of 60%.

[0107] In the present embodiment, a tobacco sheet with a specific air permeability can be used to achieve an initial profile. More specifically, delivery higher than delivery of known sheets can be achieved in an initial puff, and a profile can be achieved in which the delivery amount is less likely to decrease in the latter half of the puff as in known sheets. Although the reason for this is not limited, it is surmised that the sheet with high air permeability has a high release efficiency of the humectant from the sheet and generates an increased amount of aerosol formed from the humectant.

2) Thickness

[0108] The thickness of the tobacco sheet according to the present embodiment is preferably, but not limited to, in the range of 20 to 2000 μm, more preferably 100 to 1500 μm, still more preferably 100 to 1000 μm, in one embodiment.

3) Density

[0109] The tobacco sheet according to the present embodiment preferably has a density in the range of 0.5 to 2.0 g/cm^3, more preferably 0.5 to 1.0 g/cm^3. As described later, the tobacco sheet according to the present embodiment preferably has a pore provided physically or chemically, and the density herein is not the density of a portion excluding the pore but the density of the entire sheet including the pore. Furthermore, the tobacco sheet according to the present embodiment with a density of 1.0 g/cm^3 or less can achieve more sufficient delivery of a flavor component at the beginning of inhalation.

4) Pore

[0110] As described above, the tobacco sheet according to the present embodiment preferably has a pore formed by processing. The pore can be provided by physical or chemical processing. The former may be laser processing, cutting processing with a needle or the like, electrical perforation by local electrical discharge, or the like. The latter may be etching. The pore may have any shape, a circle, an ellipse, a polygon, or the like, and is preferably a through-hole. The size, number, and arrangement of pores are appropriately adjusted to achieve a desired air permeability. In one embodiment, the circumcircle of the pore has a diameter in the range of 0.1 to 0.8 mm. In one embodiment, pores are arranged in a lattice pattern on the sheet, and the shortest distance between adjacent pores ranges from approximately 0.2 to 0.8 mm.

(6) Tobacco Segment

[0111] A tobacco segment for use in a smoking article can be produced from a tobacco sheet. The tobacco segment in the present embodiment is as described above in the first embodiment.

[Manufacturing Method]

[0112] The tobacco sheet according to the present embodiment can be produced by any method, preferably a method including the following steps.

[0113] Step 1 of kneading at least a fibrous material, an optional tobacco material, a humectant, a binder, one or both of a flavoring and taste agent and a shaping aid, and a medium to prepare a mixture.

[0114] Step 2 of flattening the mixture or extruding the mixture through a die to prepare a wet sheet.

[0115] Step 3 of drying the wet sheet.

[0116] A sheet formed by applying pressure in this manner is referred to as a "press-formed sheet", and the "press-formed sheet" includes a "laminated sheet" and an "extruded sheet", as described later. The laminated sheet is a sheet produced by flattening the mixture one or more times to a target thickness using a roller and then drying the mixture to a target water content. The extruded sheet is a sheet produced by extruding the mixture through a T-die or the like to a target thickness and then drying the mixture to a target water content. In a press-formed sheet, flattening and extrusion may be combined. For example, the mixture may be extruded and then further flattened to form a sheet.

(1) Step 1

[0117] In this step, at least a fibrous material, an optional tobacco material, a humectant, a binder, one or both of a flavoring and taste agent and a shaping aid, and a medium are kneaded. If necessary, an emulsifier may be added. The amount of each component is adjusted to achieve the amount described above. The medium is preferably, for example, composed mainly of water or a water-soluble organic solvent with a boiling point of less than 100°C, such as ethanol, and is more preferably water or ethanol.

[0118] This step can be performed by kneading the components and is preferably performed through 1) grinding of a raw material (for example, a single leaf), 2) preparation of a wet powder, and 3) kneading.

1) Grinding

[0119] Preferably, a raw material is coarsely ground and is then finely ground using a grinder (for example, ACM-5 manufactured by Hosokawa Micron Corporation). The particle diameter D90 after the fine grinding preferably ranges from 20 to 1000 μm. The particle size is measured with a laser diffraction particle size analyzer, such as Mastersizer (manufactured by malvem).

2) Preparation of Wet Powder

[0120] A binder, one or both of a flavoring and taste agent and a shaping aid, and an optional additive agent, such as a lipid, are mixed. This mixing is preferably dry blending, and a mixer is preferably used as a mixing machine. A medium, such as water, and a humectant are then added to the dry blend and are mixed using a mixer to prepare a wet powder (a powder in a wet state). The amount of the medium in the wet powder can range from 20% to 80% by mass, preferably 20% to 40% by mass, and the wet powder is appropriately prepared in the step 2. For example, the amount of the medium can range from 20% to 50% by mass in the case of flattening and 20% to 80% by mass in the case of extrusion in the step 2. The wet powder preferably has a solid concentration in the range of 50% to 90% by mass.

3) Kneading

[0121] The wet powder is kneaded with a kneader (for example, DG-1 manufactured by Dalton Corporation). The kneading is preferably performed until the medium is wholly dispersed. For example, the kneading is preferably performed until the color of the mixture is visually uniform.

(2) Step 2

[0122] In this step, the mixture (wet powder) is flattened or extruded through a die to prepare a wet sheet. For example, the mixture sandwiched between two substrate films can be passed between a pair of rollers to a predetermined thickness (more than 100 μm) using a calender (for example, manufactured by Yuri Roll Machine Co., Ltd.) and can be flattened to form a laminate of a wet sheet sandwiched between the two substrate films. The substrate film is preferably a non-adhesive film, such as a fluorinated polymer film. Theflattening using a roller can be performed multiple times. Alternatively, the mixture (wet powder) may be extruded through a die (preferably a T-die) with a predetermined gap to form a wet sheet on a substrate. The substrate may be a known substrate, such as a glass sheet, a metal sheet, or a plastic sheet. A known extruder can be used for the extrusion.

(3) Step 3

[0123] In this step, the wet sheet is dried. For example, the laminate can be subjected to this step by the following procedure. 1) One of the substrate films is peeled off. 2) The laminate is dried with a forced-air dryer. The drying temperature may be room temperature and preferably ranges from 50°C to 100°C, and the drying time can range from 1 to 2 minutes. 3) The remaining substrate film is then peeled off, and drying is further performed under the conditions described above to produce a tobacco sheet. Such drying can prevent the tobacco sheet from adhering to another substrate. The sheet thus produced is also referred to as a "laminated sheet". The laminated sheet is preferred because it has a smooth surface and can have fewer fallen shreds when coming into contact with another member. This method is suitable for the production of a sheet of 300 μm or less.

[0124] In extrusion, the wet sheet on the substrate is dried by air drying or heating. The drying conditions are as described above. The tobacco sheet thus produced is also referred to as an "extruded sheet". The extruded sheet is preferred because it has a smooth surface and can have fewer fallen shreds when coming into contact with another member. This method is suitable for the production of a sheet of 200 μm or more.

[0125] Furthermore, the tobacco sheet can also be produced by a paper-making method, a casting method, a non-woven fabric coating method, or the like. The paper-making method is a method for making paper from a mixture containing a fibrous material, an optional tobacco material, a humectant, a binder, one or both of a flavoring and taste agent and a shaping aid, and water, and drying the paper to produce a sheet. The mixture needs to contain a fibrous material and is therefore preferably a fiberized tobacco raw material or preferably contains pulp as a shaping aid. A water extract extracted before a tobacco raw material is fiberized can be concentrated later and added back to a paper-made sheet. A sheet produced by this method is referred to as a paper-made sheet.

[0126] The casting method is a method for spreading (casting) a mixture containing a fibrous material, an optional tobacco material, a humectant, a binder, and one or both of a flavoring and taste agent and a shaping aid on a substrate, and drying the mixture to produce a sheet. If necessary, the mixture may contain a shaping aid and a medium, such as water. A sheet produced by this method is referred to as a cast sheet.

[0127] The non-woven fabric coating method is a method for applying a mixture containing a fibrous material, an optional tobacco material, a humectant, a binder, and one or both of a flavoring and taste agent and a shaping aid on a non-woven fabric to produce a sheet. A sheet produced by this method is referred to as a non-woven fabric sheet.

EXAMPLES

[0128] Although specific examples of the present embodiment are described below, the present invention is not limited to these examples.

[Example 1]

[0129] A tobacco lamina (leaf tobacco) was dry-ground with a Hosokawa Micron ACM machine to produce a tobacco powder. The tobacco powder had a cumulative 90% particle diameter (D90) of 200 μm in a volume-based particle size distribution as measured by a dry laser diffraction method using Mastersizer (trade name, manufactured by Spectris Co., Ltd., Malvern Panalytical).

[0130] The tobacco powder was used as a tobacco raw material to produce a tobacco sheet by the rolling method. More specifically, 77 parts by mass of the tobacco raw material, 12 parts by mass of glycerin as an aerosol generator, 1 part by mass of carboxymethyl cellulose as a shaping agent, and 10 parts by mass of fibrous pulp (a dry defibrated product of pulp manufactured by Canfor) as a fibrous material were mixed and kneaded with an extruder. The kneaded product was formed into a sheet using two pairs of metallic rolls and was dried in a hot air circulating oven at 80°C to produce a tobacco sheet. The tobacco sheet was shredded with a shredder to a size of 0.8 mm x 9.5 mm.

[0131] The bulkiness of the shredded tobacco sheet was measured. More specifically, after the shredded tobacco sheet was allowed to stand in a conditioned room at 22°C and 60% for 48 hours, the bulkiness was measured with DD-60A (trade name, manufactured by Borgwaldt KC Inc.). The measurement was performed by putting 15 g of the shredded tobacco sheet into a cylindrical vessel with an inside diameter of 60 mm and determining the volume of the tobacco sheets compressed at a load of 3 kg for 30 seconds. Table 1 shows the results. In Table 1, the bulkiness is shown by a rate of increase in bulkiness (%) with respect to the bulkiness of Comparative Example 1 described later.

[Comparative Example 1]

[0132] The tobacco powder was prepared in the same manner as in Example 1. The tobacco powder was used as a tobacco raw material to produce a tobacco sheet by the rolling method. More specifically, 87 parts by mass of the tobacco raw material, 12 parts by mass of glycerin as an aerosol generator, and 1 part by mass of carboxymethyl cellulose as a shaping agent were mixed and kneaded with an extruder. The kneaded product was formed into a sheet using two pairs of metallic rolls and was dried in a hot air circulating oven at 80°C to produce a tobacco sheet. The tobacco sheet was shredded with a shredder to a size of 0.8 mm x 9.5 mm. The bulkiness of the shredded tobacco sheet was measured in the same manner as in Example 1. Table 1 shows the results.

[Table 1]

	Rate of increase in bulkiness (%)
Example 1	33
Comparative example 1	-

[0133] Table 1 shows that the tobacco sheet of Example 1, which is the tobacco sheet according to the present embodiment, had improved bulkiness as compared with the tobacco sheet without the fibrous material of Comparative Example 1. Although the tobacco sheet was produced by the rolling method in Example 1, the tobacco sheet produced by the casting method in the same manner also had improved bulkiness.

[0134] The first embodiment is described below with reference to Reference Example A and Reference Comparative Example A.

[Reference Example A1]

[0135] A tobacco leaf was ground with a grinder (ACM-5 manufactured by Hosokawa Micron Corporation) so as to have a D90 of 400 μm to produce leaf tobacco particles. D90 was measured with Mastersizer (manufactured by malvem). The leaf tobacco particles and a binder Sunrose F20HC (cellulose ether manufactured by Nippon Paper Industries Co., Ltd.) were dry-blended using a mixer. Glycerin as an aerosol generator and water as a medium were then added to the dry blend and were mixed using a mixer to prepare a wet powder. Table A1 shows the ratio of each component.

[0136] The wet powder was kneaded six times at room temperature using a kneading machine (DG-1 manufactured by Dalton Corporation) to prepare a mixture. The die shape was a circular rectangle, and the screw speed was 60 rpm.

[0137] The wet powder was sandwiched between two Teflon (registered trademark) films (Nitoflon (registered trade-

mark) No. 900UL manufactured by Nitto Denko Corporation) and was rolled in four stages to a predetermined thickness (more than 100 μm) using a calender (manufactured by Yuri Roll Machine Co., Ltd.) to prepare a laminate 250 μm in thickness with a layered structure of film/wet sheet/film. The roll gaps in the first to fourth stages were 1100 μm, 500 μm, 300 μm, and 200 μm, respectively. The roll gap in the fourth stage was larger than the thickness of the finally formed sheet because the sheet released from the pressure between the rollers expanded close to the final thickness.

[0138] One of the Teflon (registered trademark) films was peeled off from the laminate, and the laminate was dried with a forced-air dryer at 80°C for 1 to 2 minutes. The other film was then peeled off, and the wet sheet was dried under the same conditions to produce and evaluate the tobacco sheet according to the present embodiment.

[Table A1]

Table A1 Formulation in Reference Example A1

	Ground tobacco leaves	Glycerin	Binder	Water
Charged mass ratio [WB mass%]	55.8	9.7	2.5	32
Water content of component [mass%]	11.8	13	5.4	100
Charged mass ratio [DB mass%] (composition of finished sheet)	82	14	4	-
Mass in wet powder [g]	98.4	16.8	4.8	80
Mass ratio in wet powder [WB mass%]	49.2	8.4	2.4	40

*WB: wet basis
DB: dry basis

[0139] With respect to the mass in the wet powder in Table A1, the mass of ground tobacco leaves, glycerin, or the binder is a dry mass. The mass of water is the total of the mass of water charged and the mass of water in the ground tobacco leaves, glycerin, and binder.

[Reference Example A2, A3]

[0140] A tobacco sheet was produced and evaluated in the same manner as in Reference Example A1 except that leaf tobacco particles with a D90 of 600 μm or 800 μm were used.

[Reference Comparative Examples A1 and A2]

[0141] A tobacco sheet was produced and evaluated in the same manner as in Reference Example A1 except that leaf tobacco particles with a D90 of 80 μm or 200 μm were used.

[Reference Example A4]

[0142] A tobacco sheet was produced and evaluated in the same manner as in Reference Example A1 except that leaf tobacco particles with a D90 of 200 μm were used and the water content of the wet powder was 50 WB mass%.

[Reference Comparative Examples A3 and A4]

[0143] A tobacco sheet was produced and evaluated in the same manner as in Reference Example A1 except that leaf tobacco particles with a D90 of 200 μm were used and the water content of the wet powder was 30 or 40 WB mass%. Table A3 shows the results. "Amount of water in wet powder" in Table A3 corresponds to the amount of water based on the mass ratio in the wet powder in Table A1.

[Reference Example A5 and Reference Comparative Example A5]

[0144] A tobacco sheet with a sheet density of 0.75 g/cm^3 or 0.96 g/cm^3 (Reference Example A5) and a tobacco sheet with a sheet density of 1.19 g/cm^3 (Reference Comparative Example A5) were produced by the casting method in accordance with a routine method. The tobacco sheets were subjected to a smoking test. As a result, it was found that a smoking article including the sheet of Reference Example A5 was superior to a smoking article including the sheet of Reference Comparative Example A5 in terms of delivery of a flavor component at the beginning of inhalation. It is surmised from this that smoking articles including the tobacco sheets prepared in Reference Examples A1 to A3 also

exhibit good delivery of a flavor component at the beginning of inhalation.

Evaluation methods are described below.

[Smoking Test]

[0145] A non-combustion heating-type smoking system as illustrated in Fig. 2 was prepared. However, an internal-heating-type smoking system was used in this example. A Cambridge filter was then connected to the mouth end. The tobacco sheet prepared in each example was cut to prepare shreds. The shreds were packed at 70% by volume in a wrapper 22 with a length of 12 mm and a diameter of 7 mm to prepare a tobacco segment 20A. The system was subjected to a smoking test using a smoking machine. More specifically, the sample was automatically smoked with an automatic smoking machine (R-26 manufactured by Borgwaldt KC Inc.) under the conditions of a puff volume of 27.5 ml/s, a puff time of 2 s/puff, a puff frequency of 2 puff/min, and 14 puffs, and granular matter in tobacco smoke for each puff was collected with a Cambridge filter (CM-133 manufactured by Borgwaldt KC Inc.). The Cambridge filter after the smoking test was shaken in a 10 ml of methanol (manufactured by Wako Pure Chemical Industries, Ltd., special grade) to prepare an analytical sample. 1 μL of the analytical sample was taken with a microsyringe and was analyzed by gas chromatography-mass spectrometry (GC-MSD manufactured by Agilent, GC: 7890A, MS: 5975C).

[Density]

[0146] The tobacco sheet was cut into 55 mm square, and the mass (dry mass) was measured to calculate the mass per unit area (basis weight). The thickness was measured with a thickness gauge (manufactured by Mitutoyo Corporation), and the density was calculated from the basis weight and the thickness.

[Reference Example A5-1]

[0147] Reference Example A5 was reproduced. That is, a tobacco sheet was produced as follows:

1) A tobacco lamina was ground with a laboratory mill to prepare tobacco particles with a raw material particle diameter D90 of 300 μm.
2) Softwood pulp was disintegrated with a laboratory mill.
3) These powdered materials were mixed by stirring with a Ken mixer.
4) Water, glycerin, and a binder Sunrose F30MC (cellulose ether manufactured by Nippon Paper Industries Co., Ltd.) were mixed for 30 minutes with a disperser (manufactured by Primix Corporation).
5) The pulp was added to the mixture and was dispersed for 30 minutes with the disperser (manufactured by Primix Corporation).
6) The mixture prepared in 5) was cast on a steel sheet.
7) The steel sheet on which a cast film was formed was placed in a forced-air dryer set at 80°C and was dried for 30 minutes, and a tobacco sheet was then peeled off from the steel sheet.

[Table A2]

Table A2 Formulation in Reference Example A5-1

	Ground tobacco leaves	Glycerin	Binder	Pulp	Water
Charged mass ratio [WB mass%]	17.5	3.2	0.8	1.1	77.4
Water content of component [mass%]	11.8	13	5.4	6.4	100
Charged mass ratio [DB mass%] (composition of finished sheet)	77	14	4	5	-
Mass in wet powder [g]	154	28	8	10	800

[0148] With respect to the mass in the wet powder in Table A2, the mass of ground tobacco leaves, glycerin, or the binder is a dry mass. The mass of water is the total of the mass of water charged and the mass of water in the ground tobacco leaves, glycerin, and binder.

[Reference Example A6]

[0149] A tobacco sheet was produced and evaluated in the same manner as in Reference Example A5-1 except that leaf tobacco particles with a D90 of 80 μm were used. Table A3 shows the results.

[Table A3]

Table A3 Physical properties of sheet

	Raw material D90	Amount of water in wet powder	Density	Film production method
	μm	WB mass%	g/cm^3	
Reference Comparative Example A1	80	40	1.20	lamination method
Reference Comparative Example A2	200	40	1.11	
Reference Example A1	400	40	0.95	
Reference Example A2	600	40	0.74	
Reference Example A3	800	40	0.76	
Reference Comparative Example A3	200	30	1.24	
Reference Comparative Example A4	200	40	1.11	
Reference Example A4	200	50	0.91	
Reference Example A5-1	300	80	0.83	casting method
Reference Example A6	80	80	0.99	

[0150] The second embodiment is described below with reference to Reference Example Band Comparative Reference Example B.

[Reference Example B1]

[0151] A tobacco leaf was ground with a grinder (ACM-5 manufactured by Hosokawa Micron Corporation) so as to have a D90 of 70 μm to produce leaf tobacco particles. D90 was measured with Mastersizer (manufactured by malvem). The leaf tobacco particles and a binder carboxymethyl cellulose (Sunrose F30MC manufactured by Nippon Paper Industries Co., Ltd.) were dry-blended using a mixer. Glycerin as a humectant and water as a medium were then added to the dry blend and were mixed using a mixer to prepare a wet powder. Table B1 shows the ratio of each component.

[0152] The wet powder was kneaded six times at room temperature using a kneading machine (DG-1 manufactured by Dalton Corporation) to prepare a mixture. A T-die was used as a die, and the screw speed was 38.5 rpm.

[0153] The wet powder was sandwiched between two Teflon (registered trademark) films (Nitoflon (registered trademark) No. 900UL manufactured by Nitto Denko Corporation) and was rolled in four stages to a predetermined thickness (more than 100 μm) using a calender (manufactured by Yuri Roll Machine Co., Ltd.) to prepare a laminate 105 μm in thickness with a layered structure of film/wet sheet/film. The roll gaps in the first to fourth stages were 650 μm, 330 μm, 180 μm, and 5 μm, respectively. The roll gap in the fourth stage was larger than the thickness of the finally formed sheet because the sheet released from the pressure between the rollers expanded close to the final thickness.

[0154] One of the Teflon (registered trademark) films was peeled off from the laminate, and the laminate was dried with a forced-air dryer at 80°C for 1 to 2 minutes. The other film was then peeled off, and the wet sheet was dried under the same conditions to produce a sheet according to the present embodiment.

[0155] The sheet thus produced was allowed to stand for 48 hours under the conditions of a room temperature of 22°C and a relative humidity of 60%. The sheet was then provided with a plurality of apertures with a perforation size of 0.2 mm x 0.2 mm using a laser processing apparatus (manufactured by TROTEC). The apertures were disposed at regular intervals of 0.4 mm. Table B2 shows detailed conditions. The air permeability and release profile of the processed tobacco sheet thus produced were evaluated by the methods described later. Table B2 and Fig. 4 show the results. The

vertical axis of Fig. 4 represents the nicotine content normalized by the nicotine content per flavor smoking article. That is, the value x/y is plotted on the vertical axis, wherein x (g) denotes the nicotine content detected in one puff, and y (g) denotes the nicotine content per article (the total nicotine content in 1 to 14 puffs).

<Air Permeability>

[0156] The sheet after the perforation was allowed to stand for 48 hours under the conditions of a room temperature of 22°C and a relative humidity of 60%. The sheet was then cut into a size of 40 mm x 240 mm and was subjected to measurement with the air permeability measuring device (PPM1000M manufactured by Cerulean) under measurement conditions of a pressure difference of 1 kPa using a 2-cm^2 circular measuring head. The measurement environment was a room temperature of 22°C and a relative humidity of 60%. The air permeability was calculated as an air flow rate (cm^3) per cm^2 per minute at a pressure difference of 1 kPa.

<Component Release Profile>

[0157]

1) The sheet after the perforation was allowed to stand for 48 hours under the conditions of a room temperature of 22°C and a relative humidity of 60%.
2) The thickness and basis weight were measured, and the sheet density was calculated.
3) The sheet was cut into a size of 55 mm x 0.8 mm.
4) A φ7.1 cigarette paper was filled with a cut sheet at a predetermined volume filling ratio and was cut into a 12 mm length.
5) The smoking segment (tobacco segment) with a 12 mm length, a filter, and a paper tube were connected to produce a roll for smoking test (flavor inhalation article).
6) A non-combustion heating-type smoking system as illustrated in Fig. 2 was prepared. However, an internal-heating-type smoking system was used in this example. A Cambridge filter was then connected to the mouth end. The sheet prepared in each example was cut to prepare shreds. The shreds were packed at 70% by volume in a wrapper 22 with a length of 12 mm and a diameter of 7 mm to prepare a tobacco segment 20A. The system was subjected to a smoking test using a smoking machine. More specifically, the sample was automatically smoked with an automatic smoking machine (R-26 manufactured by Borgwaldt KC Inc.) under the conditions of a puff volume of 27.5 ml/s, a puff time of 2 s/puff, a puff frequency of 2 puff/min, and 14 puffs, and granular matter in tobacco smoke for each puff was collected with a Cambridge filter (CM-133 manufactured by Borgwaldt KC Inc.). The Cambridge filter after the smoking test was shaken in a 10 ml of methanol (manufactured by Wako Pure Chemical Industries, Ltd., special grade) to prepare an analytical sample. 1 μL of the analytical sample was taken with a microsyringe and was analyzed by gas chromatography-mass spectrometry (GC-MSD manufactured by Agilent, GC: 7890A, MS: 5975C).

[Table B1]

Table B1 Formulation

	DB mass%	WB mass%
Ground tobacco leaves	85	60
Binder	3	2
Glycerin	12	8
Another additive agent	0	0
Water	-	30

DB: dry basis
WB: wet basis

[Reference Examples B2 to B4, Reference Comparative Example B1]

[0158] Sheets with air permeability as shown in Table B2 were prepared by changing the laser processing conditions. A roll for smoking test was prepared and evaluated in the same manner as in Reference Example B1 except that each

sheet was used and the filling ratio was changed. Fig. 4 shows the results.

[Table B2]

	Air permeability (CU)	Perforation intervals (mm)	Perforation size (mm x mm)	Perforation speed setting	Laser output	Volume filling ratio
Reference Comparative Example B1	0	0.4	0.2×0.2	10	15	65%
Reference Example B1	601	0.4	0.2×0.2	10	16.25	70%
Reference Example B2	4695	0.4	0.2×0.2	10	17.5	73%
Reference Example B3	12199	0.4	0.2×0.2	10	20	70%

[0159] As shown in the figure, a smoking article containing the sheet of the present embodiment can have a good profile with high delivery in an initial puff and with delivery comparable to known sheets even in the latter half.

[0160] The aspects are described below.

[1] A tobacco sheet for a non-combustion heating-type flavor inhaler, the tobacco sheet containing a fibrous material.
[2] The tobacco sheet for a non-combustion heating-type flavor inhaler according to [1], wherein the fibrous material content per 100% by mass of the tobacco sheet ranges from 5% to 50% by mass.
[3] The tobacco sheet for a non-combustion heating-type flavor inhaler according to [1] or [2], wherein the fibrous material is at least one selected from the group consisting of fibrous pulp, a fibrous tobacco material, and fibrous synthetic cellulose.
[4] The tobacco sheet for a non-combustion heating-type flavor inhaler according to [3], wherein the fibrous material is fibrous pulp.
[5] The tobacco sheet for a non-combustion heating-type flavor inhaler according to [4], wherein the tobacco sheet further contains a tobacco raw material.
[6] A method for manufacturing the tobacco sheet for a non-combustion heating-type flavor inhaler according to [5], wherein the tobacco raw material is at least one tobacco powder selected from the group consisting of leaf tobacco, midribs, and residual stems.
[7] The tobacco sheet for a non-combustion heating-type flavor inhaler according to [5] or [6], wherein the tobacco raw material content per 100% by mass of the tobacco sheet ranges from 30% to 91% by mass.
[8] The tobacco sheet for a non-combustion heating-type flavor inhaler according to any one of [4] to [7], wherein the tobacco sheet further contains a shaping agent.
[9] The tobacco sheet for a non-combustion heating-type flavor inhaler according to [8], wherein the shaping agent is at least one selected from the group consisting of polysaccharides, proteins, and synthetic polymers.
[10] The tobacco sheet for a non-combustion heating-type flavor inhaler according to [8] or [9], wherein the shaping agent content per 100% by mass of the tobacco sheet ranges from 0.1% to 15% by mass.
[11] The tobacco sheet for a non-combustion heating-type flavor inhaler according to any one of [1] to [10], wherein the tobacco sheet further contains an aerosol generator.
[12] The tobacco sheet for a non-combustion heating-type flavor inhaler according to [11], wherein the aerosol generator is at least one selected from the group consisting of glycerin, propylene glycol, and 1,3-butanediol.
[13] The tobacco sheet for a non-combustion heating-type flavor inhaler according to [11] or [12], wherein the aerosol generator content per 100% by mass of the tobacco sheet ranges from 5% to 50% by mass.
[14] A non-combustion heating-type flavor inhaler including a tobacco-containing segment containing the tobacco sheet for a non-combustion heating-type flavor inhaler according to any one of [1] to [13]
[15] A non-combustion heating-type flavor inhaling system including:

the non-combustion heating-type flavor inhaler according to [14]; and
a heating device for heating the tobacco-containing segment.

(1) A tobacco sheet with a density of 1.0 g/cm^3 or less.

(2) The sheet according to (1), which is a press-formed sheet.
(3) The sheet according to (1) or (2), which is produced from a wet powder containing tobacco particles with a D90 of 200 μm or more and a liquid medium and having a water content of 50% by mass or more.
(4) The sheet according to any one of (1) to (3), containing tobacco particles with a D90 of 300 μm or more.
(5) The sheet according to (4), containing tobacco particles with a D90 of 500 μm or more.
(6) A non-combustion heating-type smoking article containing the tobacco sheet according to any one of (1) to (5) or a material derived therefrom.
(7) The manufacturing method of the tobacco sheet according to any one of (1) to (5), including:

step 1 of kneading at least tobacco particles, a binder, and a medium to prepare a mixture;
step 2 of flattening the mixture or extruding the mixture through a die to prepare a wet sheet; and
step 3 of drying the wet sheet.

(8) The manufacturing method according to (7), wherein the medium includes water.
(9) The manufacturing method according to (7) or (8), wherein the step 2 includes preparing a laminated sheet including a wet sheet between two substrate films.
(10) The manufacturing method according to any one of (7) to (9), wherein the step 1 includes kneading at least a tobacco material, a binder, and a medium using a single-screw or multi-screw kneading machine.
(11) The manufacturing method according to any one of (7) to (10), wherein the mixture contains 20% to 80% by mass of the medium based on the total amount of the mixture

<1> A smoking composition sheet or a tobacco sheet, containing:

a humectant;
a binder; and
one or both of a flavoring and taste agent and a shaping aid,
wherein the sheet has an air permeability of more than 0 CORESTA units.

<2> The sheet according to <1>, wherein the air permeability is 500 CORESTA units or more.
<3> The sheet according to <1> or <2>, wherein the flavoring and taste agent is selected from the group consisting of tobacco, a flavoring agent, and a combination thereof.
<4> The sheet according to any one of <1> to <3>, wherein the humectant is a polyhydric alcohol.
<5> The sheet according to any one of <1> to <4>, wherein the binder is selected from the group consisting of a polysaccharide, a protein, a synthetic polymer, and a combination thereof.
<6> The sheet according to any one of <1> to <5>, wherein the shaping aid is pulp or non-woven fabric of plant fiber or synthetic fiber.
<7> The sheet according to any one of <1> to <6>, which is a press-formed sheet.
<8> The sheet according to any one of <1> to <6>, which has a plurality of pores formed by physical processing.
<9> The sheet according to any one of <1> to <7>, which has a plurality of pores formed by chemical processing.

REFERENCE SIGNS LIST

[0161]

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	hole
9	second fill 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 recess
20A tobacco-containing segment
21 filler
22 wrapper
T tobacco sheet

Claims

1. A tobacco sheet for a non-combustion heating-type flavor inhaler, the tobacco sheet containing a fibrous material.

2. The sheet according to claim 1, having a density of 1.0 g/cm^3 or less.

3. The sheet according to claim 1 or 2, which is a press-formed sheet.

4. The sheet according to any one of claims 1 to 3, comprising:

a humectant;
a binder; and
an optional flavoring and taste agent,
wherein the sheet has an air permeability of more than 0 CORESTA units.

5. The sheet according to claim 4, wherein the air permeability is 500 CORESTA Units or more.

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

7. A non-combustion heating-type flavor inhaling system comprising:

the non-combustion heating-type flavor inhaler according to claim 6; and
a heating device for heating the tobacco-containing segment.

Fig. 1

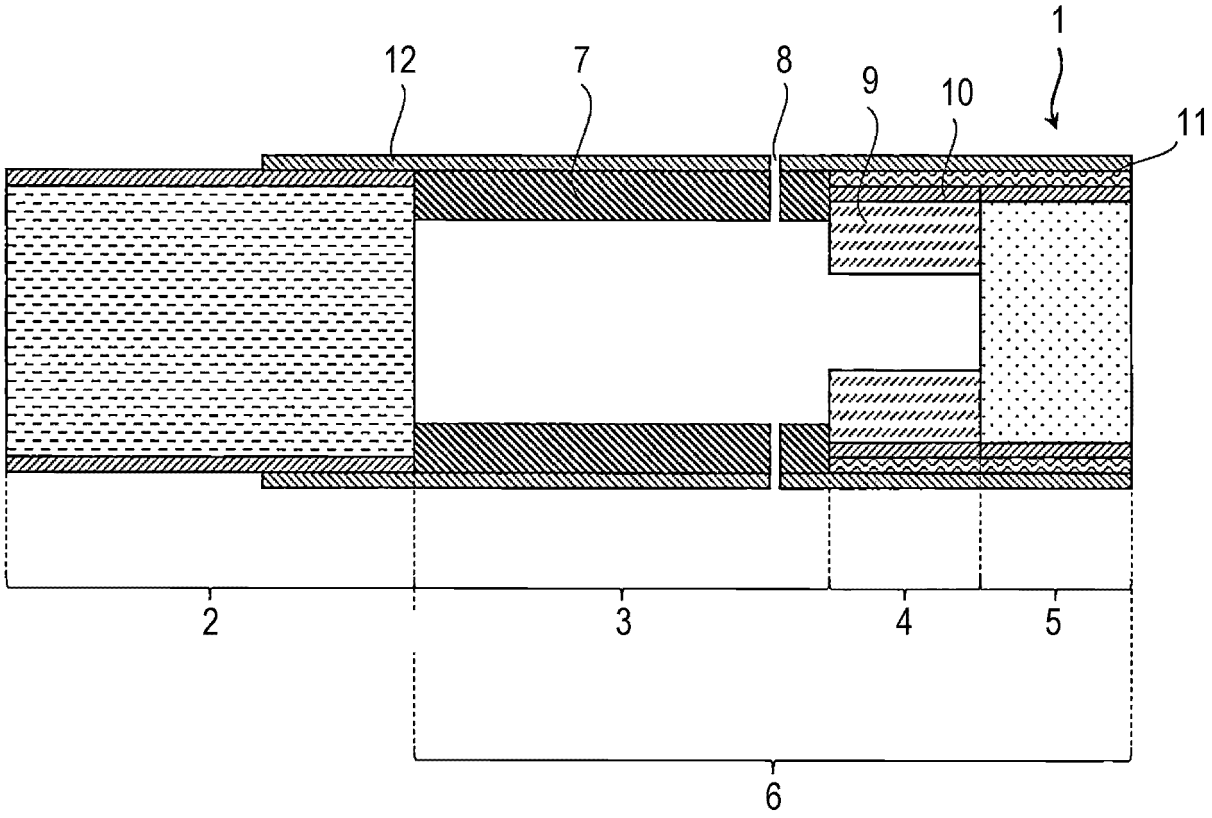


Fig. 2

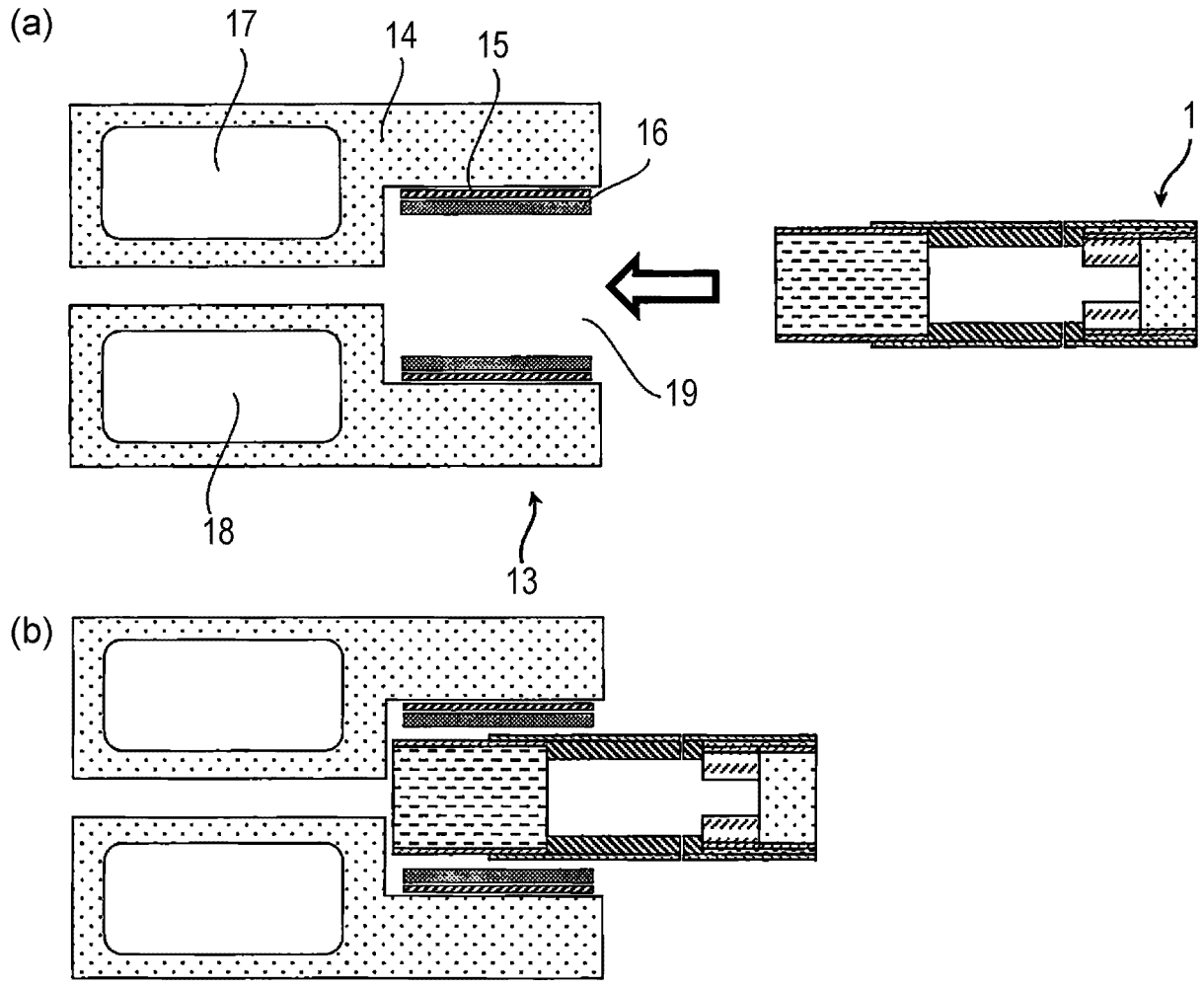


Fig. 3

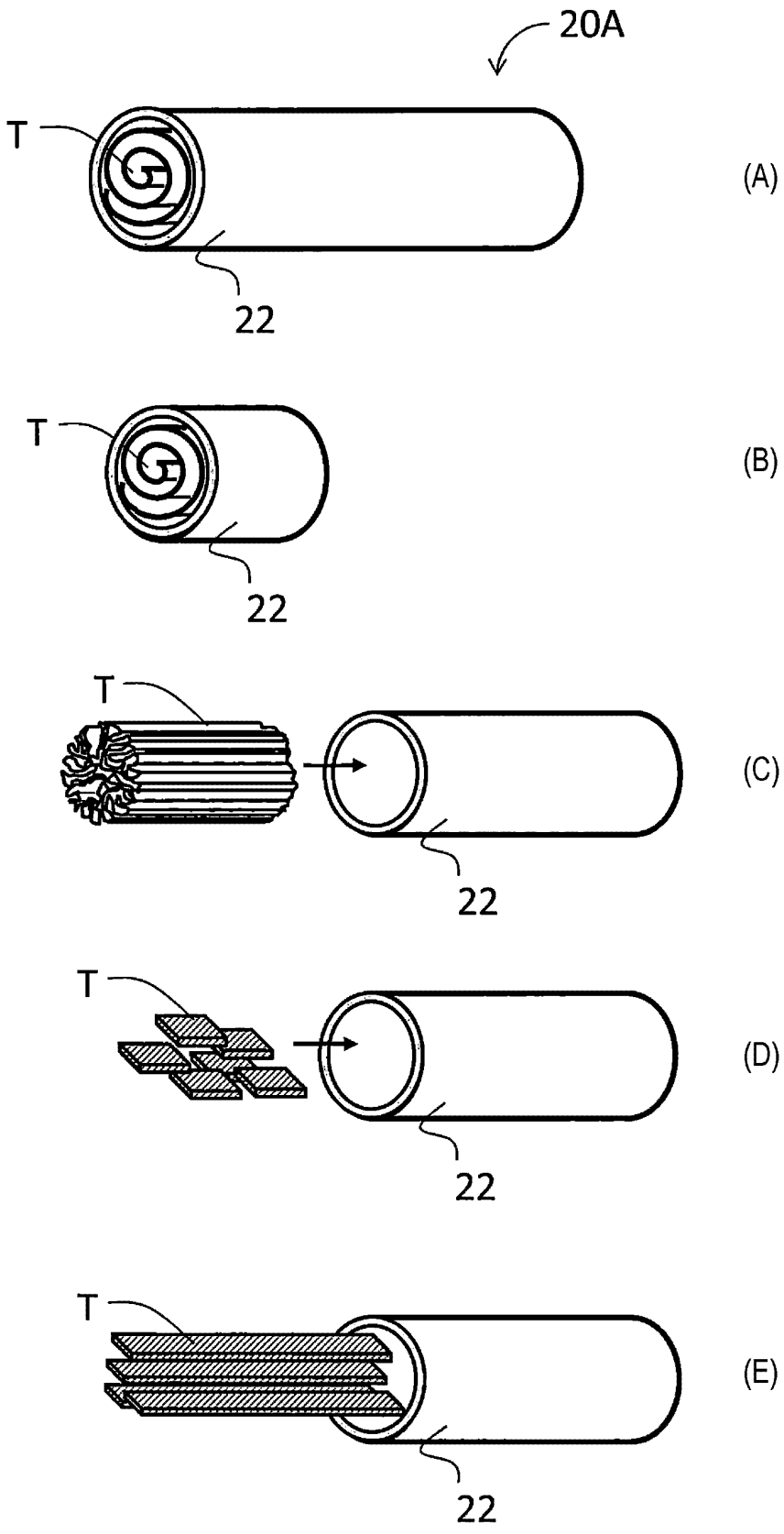
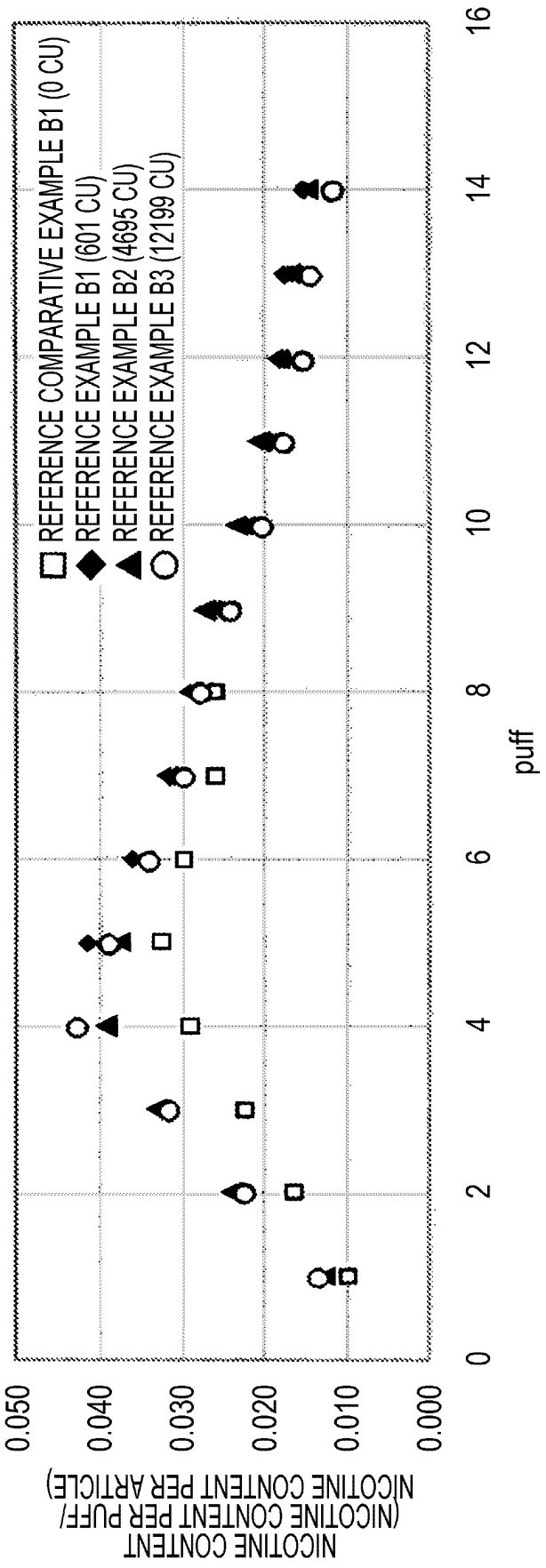


Fig. 4


REFERENCE COMPARATIVE EXAMPLE B1 (0 CU)
REFERENCE EXAMPLE B1 (601 CU)
REFERENCE EXAMPLE B2 (4695 CU)
REFERENCE EXAMPLE B3 (12199 CU)
NICOTINE CONTENT
(NICOTINE CONTENT PER PUFF/
NICOTINE CONTENT PER ARTICLE)
0.050
0.040
0.030
0.020
0.010
0.000
0
2
4
6
8
10
12
14
16
puff

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2022/025758

A. CLASSIFICATION OF SUBJECT MATTER

A24B 15/16(2020.01)i; ***A24B 3/14***(2006.01)i
FI: A24B15/16; A24B3/14

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)

A24B15/16; 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	JP 2021-507700 A (PHILIP MORRIS PRODUCTS S.A) 25 February 2021 (2021-02-25) in particular, paragraphs [0002], [0072], [0077], [0084], [0110], [0119], see fig. 1-2	1
Y		2-7
Y	WO 2020/074535 A1 (PHILIP MORRIS PRODUCTS S.A) 16 April 2020 (2020-04-16) in particular, see p. 10, lines 11-12	2-7
Y	WO 2020/148902 A1 (JAPAN TOBACCO INC) 23 July 2020 (2020-07-23) in particular, see paragraph [0004]	3-7

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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16 August 2022	**30 August 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
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International application No.
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REFERENCES CITED IN THE DESCRIPTION

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