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(54) **TOBACCO SHEET**

(57) A tobacco sheet having a density of 1.0 g/cm^3 or less. The tobacco sheet is preferably a laminate sheet.

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Description

TECHNICAL FIELD

[0001] The present invention relates to a tobacco sheet.

BACKGROUND ART

[0002] There have been proposed numerous techniques concerning non-combustion smoking articles for inhaling a flavor component generated through heating of a tobacco sheet (Patent Literature (PTL) 1, for example).

CITATION LIST

PATENT LITERATURE

[0003] PTL 1: Japanese Patent No. 5292410

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] Non-combustion smoking articles generally do not exhibit satisfactorily high delivery efficiency or the like as compared with conventional combustion-type smoking articles. For this reason, it has been investigated how the satisfaction in use of non-combustion smoking articles can be enhanced. Concerning the satisfaction in use, the present inventors have found that high response at the beginning of inhalation, in other words, delivery of sufficient flavor components at the beginning of inhalation enhances the satisfaction in use. In view of this, the object of the present invention is to provide a tobacco sheet that attains delivery of sufficient flavor components at the beginning of inhalation.

SOLUTION TO PROBLEM

[0005] The present inventors have found that the above-mentioned problem can be resolved by setting the density of a tobacco sheet to a particular range. In other words, the object is attained by the present invention below.

(1) A tobacco sheet having a density of 1.0 g/cm^3 or less.
(2) The sheet according to (1), being a pressure-formed sheet.
(3) The sheet according to (1) or (2), having been produced from a wet powder which contains tobacco particles having D90 of 200 μm or more and a liquid medium and which has a water content of 50 weight% or more.
(4) The sheet according to any of (1) to (3), containing tobacco particles having D90 of 300 μm or more.
(5) The sheet according to (4), containing tobacco particles having D90 of 500 μm or more.
(6) A heat-not-burn smoking article including the tobacco sheet according to any of (1) to (5) above or a material derived therefrom.
(7) A method of producing according to any of (1) to (5), including:

step 1 of preparing a mixture by kneading at least tobacco particles, a binder, and a medium;
step 2 of preparing a wet sheet by rolling the mixture or extruding the mixture from a die; and
step 3 of drying the wet sheet.

(8) The method according to (7), where the medium contains water.
(9) The method according to (7) or (8), where the step 2 includes preparing a laminate sheet in which a wet sheet exists between two substrate films.
(10) The method according to any of (7) to (9), where the step 1 includes kneading at least a tobacco material, a binder, and a medium in a single-screw or a multi-screw kneader.
(11) The method according to any of (7) to (10), where the mixture contains 20 to 80 weight% of a medium relative to the total amount of the mixture.

ADVANTAGEOUS EFFECTS OF INVENTION

[0006] According to the present invention, it is possible to provide a tobacco sheet that attains delivery of sufficient

flavor components at the beginning of inhalation.

BRIEF DESCRIPTION OF DRAWINGS

[0007]

Fig. 1 is a schematic view of exemplary tobacco segments using a tobacco sheet.
Fig. 2 is a schematic cross-sectional view of an exemplary heat-not-burn smoking system.
Fig. 3 is a schematic cross-sectional view of an exemplary heat-not-burn flavor inhaler article.

DESCRIPTION OF EMBODIMENTS

[0008] Hereinafter, the present invention will be described in detail. In the present invention, the expression of "X to Y" includes the lower and the upper limits of X and Y.

1. Tobacco Sheet

[0009] A tobacco sheet is a sheet to be used for a smoking article and contains at least a tobacco material and a binder.

(1) Binders

[0010] A binder is an adhesive for binding a tobacco material together or for binding a tobacco material and other components. In the present invention, common binders may be used. Examples of such binders include polysaccharides, such as guar gum and xanthan gum, and cellulose derivatives, such as CMC (carboxymethyl cellulose), CMC-Na (carboxymethyl cellulose sodium salt), and HPC (hydroxypropyl cellulose). The upper limit for the binder content is preferably 6 weight% or less on dry weight basis (weight after removing water contained, the same applies hereinafter) relative to the dry weight of a tobacco sheet. Meanwhile, the lower limit is preferably 1 weight% or more and more preferably 3 weight% or more. When the amount of binder exceeds the upper limit or is less than the lower limit, the above-mentioned effects could not be exerted satisfactorily.

[0011] Exemplary binders include polysaccharides, proteins, and synthetic polymers. Hereinafter, concrete examples of these binders will be described. In the present invention, these binders may also be used in combination.

1) Polysaccharides

1-1) Cellulose Derivatives

[Cellulose Ethers]

[0012] Methyl cellulose, ethyl cellulose, hydroxyethyl cellulose, hydroxymethyl ethyl cellulose, hydroxypropyl cellulose, hydroxypropyl methyl cellulose, benzyl cellulose, trityl cellulose, cyanoethyl cellulose, carboxymethyl cellulose, carboxyethyl cellulose, aminoethyl cellulose

[Cellulose Esters]

[0013]

Organic acid esters: cellulose acetate, cellulose formate, cellulose propionate, cellulose butyrate, cellulose benzoate, cellulose phthalate, tosyl cellulose
Inorganic acid esters: cellulose nitrate, cellulose sulfate, cellulose phosphate, cellulose xanthate

1-2) Naturally Occurring Polysaccharides

[Plant-derived]

[0014] Guar gum, tara gum, locust bean gum, tamarind seed gum, pectin, gum arabic, gum tragacanth, gum karaya, gum ghatti, arabinogalactan, flaxseed gum, cassia gum, psyllium seed gum, artemisia seed gum

[Algae-derived]

[0015] Carrageenan, agar, alginic acid, propylene glycol alginate, furcellaran, *Gloiopelfis furcata* extract

[Microorganism-derived]

[0016] Xanthan gum, gellan gum, curdlan, pullulan, Agrobacterium succinoglycan, welan gum, Macrophomopsis gum, rhamsan gum

[Crustacea-derived]

[0017] Chitin, chitosan, glucosamine

[Starch Derivatives]

[0018] Starch, sodium starch glycolate, pregelatinized starch, dextrin

2) Proteins

[0019] Wheat gluten, rye gluten

3) Synthetic polymers

[0020] Polyphosphoric acid, sodium polyacrylate, polyvinylpyrrolidone

(2) Tobacco Particles

[0021] A tobacco sheet of the present invention contains tobacco particles as a tobacco material. Tobacco particles are particulate tobacco-derived materials, and examples include particles obtained through pulverization of leaf tobacco (pulverized leaf tobacco). By using tobacco particles having a particular particle size, it is possible to lower the density of a tobacco sheet. The upper limit for the particle size D90 is not limited but is preferably 5 mm or less, more preferably 3 mm or less, and further preferably 1 mm or less in view of handling properties and so forth. Meanwhile, the lower limit for the particle size D90 is also not limited but is preferably 200 μm or more, more preferably 300 μm or more, further preferably 400 μm or more, and particularly preferably 500 μm or more. Moreover, the upper limit for the average particle size D50 is preferably 1500 μm or less, 1000 μm or less, or 500 μm or less, and the lower limit is preferably 50 μm or more, more preferably 100 μm or more, and further preferably 120 μm or more. Pulverization may be performed using a common grinding mill as dry grinding or wet grinding. The resulting pulverized leaf tobacco is thus referred to as leaf tobacco particles as well. In the present invention, the particle size is obtained by a laser diffraction/scattering method and is concretely measured using a laser diffraction particle size analyzer (LA-950 from Horiba, Ltd., for example). Further, the type of tobacco is not limited, and flue-cured, burley, oriental, and domestic may be used, and others such as *Nicotiana tabacum* varieties or *Nicotiana rustica* varieties, for example, may be used. The amount of tobacco particles in a tobacco sheet is not particularly limited but is preferably 50 to 95 weight% and more preferably 60 to 90 weight% on dry weight basis.

(3) Aerosol Formers

[0022] A tobacco sheet may contain an aerosol former. An aerosol former is a material that generates an aerosol through vaporization upon heating and subsequent cooling or that generates an aerosol through atomization. A common aerosol former may be used, and examples include those having a boiling point above 100°C, such as polyhydric alcohols such as glycerol, propylene glycol (PG), triethyl citrate (TEC), and triacetin. The amount of aerosol former in a tobacco sheet is preferably 1 to 40 weight% and more preferably 10 to 20 weight% on dry weight basis (weight after removing water contained, the same applies hereinafter). When the amount of aerosol former exceeds the upper limit, the production of tobacco sheets could become difficult. Meanwhile, when the amount is less than the lower limit, smoky feeling could deteriorate.

(4) Emulsifiers

[0023] A tobacco sheet may contain an emulsifier. An emulsifier enhances affinity between an aerosol former, which

is lipophilic, and a tobacco material, which is hydrophilic. For this reason, the addition of an emulsifier is effective particularly when a lipophilic aerosol former is used. Any common emulsifier may be used, and examples include emulsifiers having HLB of 8 to 18. The amount of emulsifier is not particularly limited but is preferably 0.1 to 3 parts by weight and more preferably 1 to 2 parts by weight on dry weight basis relative to 100 parts by weight of a tobacco sheet.

(5) Fibers

[0024] A tobacco sheet of the present invention, in an embodiment, does not contain fibers derived from tobacco or fibers derived from materials other than tobacco (cellulose, for example). In this embodiment, it is possible to avoid undesirable effects on smoking flavor, such as odd taste, exerted by these fibers. However, since completely excluding such fibers is not practical, the amount of these fibers in a tobacco sheet is preferably 1.0 weight% or less and more preferably 0.5 weight% or less on dry weight basis. Further, a tobacco sheet of the present invention, in another embodiment, contains fibers derived from tobacco or fibers derived from materials other than tobacco. A tobacco sheet preferably contains such fibers since the sheet tends to become brittle, in particular, when the size of tobacco particles becomes large. In this case, the (total) content in the sheet is 0.5 to 2.0 weight% on dry weight basis. In this embodiment, the fibers enhance the strength of the tobacco sheet, resulting in excellent balance between smoking flavor and strength. In the present invention, fibers derived from tobacco indicate pulp formed through beating of a tobacco raw material using a grinder or the like and are thus different from the above-described tobacco particles.

(6) Flavors

[0025] A tobacco sheet may contain a flavor. A flavor is a substance that provides aroma or taste. Such a flavor may be a natural flavor or a synthetic flavor. One flavor or a mixture of a plurality of flavors may be used. Any flavor commonly used for smoking articles may be used, and concrete examples will be described hereinafter. A flavor may be incorporated into a sheet for a smoking article in an amount such that the smoking article can provide preferable aroma or taste. For example, the amount in a tobacco sheet is preferably 1 to 30 weight% and more preferably 2 to 20 weight%.

[0026] From a viewpoint of imparting satisfactorily perceived flavor, exemplary flavors include, but are not particularly limited to, acetanisole, acetophenone, acetylpyrazine, 2-acetylthiazole, 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, cedarwood oil, celery seed oil, chamomile oil, cinnamaldehyde, cinnamic acid, cinnamyl alcohol, cinnamyl cinnamate, citronella oil, DL-citronellol, clary sage extract, cocoa, coffee, cognac oil, coriander oil, cuminaldehyde, davana oil, δ-decalactone, γ-decalactone, decanoic acid, dill 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, ethyl vanillin, ethyl vanillin 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, 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 γ-lactone, 4-hydroxy-4-(3-hydroxy-1-butenyl)-3,5,5-trimethyl-2-cyclohexen-1-one, 4-(p-hydroxyphenyl)-2-butanone, 4-hydroxyundecanoic acid sodium salt, immortelle absolute, β-ionone, isoamyl acetate, isoamyl butyrate, isoamyl phenylacetate, isobutyl acetate, isobutyl phenylacetate, jasmine absolute, kola nut tincture, labdanum oil, terpeneless lemon oil, licorice extract, linalool, linalyl acetate, lovage root oil, maltol, maple syrup, menthol, menthone, L-menthyl acetate, p-methoxybenzaldehyde, methyl 2-pyrrolyl ketone, methyl anthranilate, methyl phenylacetate, methyl salicylate, 4'-methylacetophenone, methyl cyclopentenolone, 3-methylvaleric acid, mimosa absolute, molasses, myristic acid, nerol, nerolidol, γ-nonalactone, nutmeg oil, δ-octalactone, octanal, octanoic acid, orange flower oil, orange oil, oris root oil, palmitic acid, ω-pentadecalactone, peppermint oil, petitgrain Paraguay oil, phenethyl alcohol, phenethyl phenylacetate, phenylacetic acid, piperonal, plum extract, propenylguaethol, propyl acetate, 3-propylidenephthalide, prune juice, pyruvic acid, 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-oxatricyclo[8.3.0.0.(4.9)]tridecane, 2,3,5,6-tetramethylpyrazine, thyme oil, tomato extract, 2-tridecanone, triethyl citrate, 4-(2,6,6-trimethylcyclohex-1-enyl)but-2-en-4-one, 2,6,6-trimethylcyclohex-2-ene-1,4-dione, 4-(2,6,6-trimethylcyclohexa-1,3-dienyl)but-2-en-4-one, 2,3,5-trimethylpyrazine, γ-undecalactone, γ-valerolactone, vanilla extract, vanillin, veratraldehyde, violet leaf absolute, N-ethyl-p-menthane-3-carboxamide (WS-3), ethyl 2-(p-menthane-3-carboxamido)acetate (WS-5), sugars (sucrose, fructose, and so forth), cocoa powder, carob powder, coriander powder, licorice powder, orange peel powder, rose hip powder, chamomile flower powder, lemon verbena powder, peppermint powder, leaf powder, spearmint powder, black tea powder, natural plant flavors (jasmine oil, lemon oil, vetiver

oil, lovage oil, for example), esters (menthyl acetate, isoamyl propionate, for example), and alcohols (phenethyl alcohol, cis-6-nonen-1-ol, for example). These flavors may be used alone or in combination of two or more.

(7) Characteristics and Forms of Tobacco Sheet

1) Density

[0027] A tobacco sheet of the present invention has a density of 1.0 g/cm^3 or less. A tobacco sheet having such a low density can attain delivery of sufficient flavor components at the beginning of inhalation. The reason is not limited but is presumably because a low-density tobacco sheet can lower the filling density of tobacco filler in a smoking article, thereby increasing the heat received per weight. In addition, costs can also be reduced by lowering the filling density. In view of these, the density is preferably 0.95 g/cm^3 or less and more preferably 0.75 g/cm^3 or less. The lower limit for the density is not limited but is preferably 0.5 g/cm^3 or more in view of strength and so forth. In the present invention, the density is calculated from basis weight (weight per unit area) and thickness. A tobacco sheet of the present invention has an air permeability of preferably 0 CORESTA Unit (CU).

2) Thickness

[0028] The thickness of a tobacco sheet is not limited, but the upper limit is preferably 1500 μm or less, more preferably 1000 μm or less, and further preferably 500 μm or less. Meanwhile, the lower limit is preferably 20 μm or more, more preferably 100 μm or more, and further preferably 150 μm or more.

(8) Tobacco Segment

[0029] A tobacco segment used for a smoking article can be produced from a tobacco sheet. The tobacco segment includes, in an embodiment, a tubular wrapper and a tobacco sheet spirally rolled and packed within the wrapper (see Fig. 1 (A)). In the figure, 20A is a tobacco segment, 1 is a tobacco sheet, and 22 is a wrapper, which is typically paper. The tobacco segment preferably has a rod shape, and the length may be set to about 15 to 80 mm and the diameter to about 5 to 10 mm. Further, the tobacco segment 20A in Fig. 1 (A) may also be cut to have an aspect ratio (length/diameter) of about 0.5 to 1.2 (see Fig. 1 (B)).

[0030] The tobacco segment 20A includes, in another embodiment, a tubular wrapper 22 and a tobacco sheet 1 folded and packed within the wrapper. The ridges formed through folding extend almost parallel to the longitudinal direction of the segment (see Fig. 1 (C)). The tobacco segment 20A preferably has a rod shape, and the length may be set to about 15 to 80 mm and the diameter to about 5 to 10 mm. In this embodiment, the tobacco sheet 1 has preferably been processed in advance by surface creasing, such as pleating or crimping.

[0031] The tobacco segment 20A includes, in another embodiment, a tubular wrapper 22 and a cut piece 1c of a tobacco sheet, which is packed within the wrapper (see Fig. 1 (D)). The tobacco segment 20A preferably has a rod shape, and the length may be set to about 15 to 80 mm and the diameter to about 5 to 10 mm. The size of a cut piece is not limited, but the length of the longest side may be set to about 2 to 20 mm and the width to about 0.5 to 1.5 mm, for example.

[0032] The tobacco segment 20A includes, in another embodiment, a tubular wrapper 22 and strand-type shreds packed within the wrapper (see Fig. 1 (E)). Such strand-type shreds are packed with the longitudinal direction almost parallel to the longitudinal direction of the wrapper 22. The width of a strand-type shred may be set to about 0.5 to 1.5 mm.

[0033] The tobacco segment 20A includes, in another embodiment, a tubular wrapper 22 and tobacco shred filler randomly packed within the wrapper. Tobacco shreds are shredded products and thus differ from strand-type shreds.

2. Production Method

[0034] A tobacco sheet can be produced by any method but is preferably produced by a method including the following steps of:

step 1 of preparing a mixture by kneading at least tobacco particles, a binder, and a medium;
step 2 of preparing a wet sheet by rolling the mixture or extruding the mixture from a die; and
step 3 of drying the wet sheet.

[0035] A sheet formed as above under applied pressure is referred to as "pressure-formed sheet," and such "pressure-formed sheets" encompass a "laminate sheet" and an "extruded sheet" as described hereinafter. A laminate sheet is a sheet obtained by rolling a mixture once or more using a roller into a target thickness, followed by drying to a target

water content. An extruded sheet is a sheet obtained by extruding a mixture from a T die or the like at a target thickness, followed by drying to a target water content. A pressure-formed sheet may be produced by rolling and extrusion in combination. For example, a mixture may be formed into a sheet through extrusion, further followed by rolling.

(1) Step 1

[0036] In this step, tobacco particles, a binder, and a medium are kneaded. An aerosol former, an emulsifier, or a flavor may also be added as necessary. The amounts of the respective components to be added are adjusted to attain the above-mentioned amounts. The medium preferably primarily contains, for example, water or a water-soluble organic solvent having a boiling point below 100°C, such as ethanol, and is more preferably water or ethanol.

[0037] This step can be performed by kneading the respective components but is preferably performed through 1) pulverization of a raw material (classified leaf tobacco, for example), 2) preparation of a wet powder, and 3) kneading.

1) Pulverization

[0038] In this step, although tobacco particles pulverized in advance to have the above-described particle size may be used as well, a raw material in an embodiment is coarsely crushed, followed by fine grinding using a grinding mill (ACM-5 from Hosokawa Micron Corporation, for example) to prepare tobacco particles having the above-described particle size. The particle size is measured using a laser diffraction particle size analyzer, such as Mastersizer (from Malvern Panalytical Ltd.).

2) Preparation of Wet Powder

[0039] The pulverized tobacco raw material (tobacco particles, for example) is added with a binder and, as necessary, additives, such as a flavor and a lipid, and mixed. Since the mixing is preferably dry blending, a mixer is preferably used as a mixing apparatus. Subsequently, the resulting dry blend is added with water or another medium and, as necessary, glycerol or another aerosol former and mixed using a mixer to prepare a wet powder (powder in the wet state). The amount of medium in the wet powder may be set to preferably 20 to 80 weight% and further preferably 20 to 40 weight% and is appropriately adjusted by step 2. For example, the amount of medium may be set to 20 to 60 weight% or 20 to 50 weight% in the case of performing rolling in step 2 and to 20 to 80 weight% in the case of performing extrusion. The solid concentration of a wet powder is preferably 50 to 90 weight%. A particularly preferable embodiment uses a wet powder which contains tobacco particles having D90 of 200 μm or more and a liquid medium including water (more preferably water as a liquid medium) and which has a water content of 50 weight% or more.

3) Kneading

[0040] The wet powder is kneaded using a kneader (DG-1 from Dalton Corporation, for example). The kneading is preferably performed until the medium permeates through the entire powder. For example, kneading is preferably performed until a mixture becomes uniform in color under visual observation.

(2) Step 2

[0041] In this step, a wet sheet is prepared by rolling the mixture (wet powder) or extruding the mixture from a die. For example, the mixture is sandwiched between two substrate films and rolled into a predetermined thickness (over 100 μm) by passing through a pair of rollers using a calendaring machine (from Yuri Roll Machine Co., Ltd., for example), thereby obtaining a laminate in which a wet sheet exists between two substrate films. The substrate films are preferably non-adhesive films, such as fluoropolymer films. Such rolling using rollers may be performed a plurality of times. Further, it is also possible to form a wet sheet on a substrate by extruding the mixture (wet powder) from a die (preferably T die) provided with a predetermined gap. A common material, such as a glass sheet, a metal sheet, or a plastic sheet, may be used as the substrate. A common extruder can be used for extrusion.

(3) Step 3

[0042] In this step, the wet sheet is dried. For example, this step can be performed for a laminate through the following procedure. 1) Either substrate film is released. 2) The resulting laminate is dried using a circulation dryer. The drying temperature may be room temperature but is preferably 50°C to 100°C, and the drying time may be set to 1 to 2 minutes. 3) Subsequently, a tobacco sheet is obtained by releasing the other substrate film and further drying under the above-mentioned conditions. By performing drying like this, it is possible to avoid attachment of the tobacco sheet to other

substrates. A tobacco sheet thus obtained is also referred to as "laminate sheet." Such a laminate sheet is preferable since the sheet exhibits surface smoothness and can suppress generation of detached shreds when comes into contact with other members. Further, this method is suitable for the production of a sheet of 300 μm or less.

[0043] In the case of extrusion, the wet sheet on a substrate is dried with air or heating. The drying conditions are as mentioned above. A tobacco sheet thus obtained is also referred to as "extruded sheet." Such an extruded sheet is preferable since the sheet exhibits surface smoothness and can suppress generation of detached shreds when comes into contact with other members. This method is suitable for the production of a sheet of 200 μm or more.

3. Smoking Articles

[0044] Exemplary smoking articles include flavor inhaler articles, in which a user tastes a flavor through inhalation, and smokeless tobacco (smokeless smoking articles), in which a user places the product directly in the nasal or oral cavity to taste a flavor. Flavor inhaler articles are broadly divided into non-combustion smoking articles and combustion-type smoking articles represented by conventional cigarettes. A tobacco sheet of the present invention is suitable for flavor inhaler articles.

[0045] Exemplary combustion-type flavor inhaler articles include cigarettes, pipes, kiseru or Japanese smoking pipes, cigars, and cigarillos.

[0046] A heat-not-burn flavor inhaler article may be heated by a heating device separate from the article or may be heated by a heating device integrated with the article. In the former flavor inhaler article (separate-type), a heat-not-burn flavor inhaler article and a heating device are also collectively referred to as "heat-not-burn smoking system." Hereinafter, an exemplary heat-not-burn smoking system will be described with reference to Figs. 2 and 3.

[0047] Fig. 2 is a schematic cross-sectional view of an exemplary heat-not-burn smoking system and illustrates the state before inserting a heater 12 into a tobacco segment 20A of a heat-not-burn flavor inhaler article 20. During use, the heater 12 is inserted into the tobacco segment 20A. Fig. 3 is a cross-sectional view of a heat-not-burn flavor inhaler article 20.

[0048] As illustrated in Fig. 2, the heat-not-burn smoking system includes a heat-not-burn flavor inhaler article 20 and a heating device 10 for heating the tobacco segment 20A from the inside. However, the heat-not-burn smoking system is not limited to the structure in Fig. 2.

[0049] The heating device 10 illustrated in Fig. 2 includes a body 11 and a heater 12. Although not illustrated, the body 11 may include a battery unit and a control unit. The heater 12 may be an electric resistance heater and is inserted into the tobacco segment 20A to heat the tobacco segment 20A.

[0050] A tobacco sheet of the present invention is highly effective when the tobacco segment 20A is heated from the inside as illustrated in Fig. 2. Since the tobacco sheet comes into direct contact with a heater in such a heating mode, it is possible to further increase the heat received per sheet weight. Consequently, delivery of sufficient flavor components is readily attained at the beginning of inhalation. However, the embodiment of the heat-not-burn flavor inhaler article 20 is not limited to this. In another embodiment, the tobacco segment 20A is heated from the outside.

[0051] The heating temperature by the heating device 10 is not particularly limited but is preferably 400°C or lower, more preferably 50°C to 400°C, and further preferably 150°C to 350°C. Herein, the heating temperature means the temperature of the heater 12 in the heating device 10.

[0052] As illustrated in Fig. 3, the heat-not-burn flavor inhaler article 20 (hereinafter, simply referred to as "flavor inhaler article 20") has a cylindrical shape. The flavor inhaler article 20 has a circumferential length of preferably 16 to 27 mm, more preferably 20 to 26 mm, and further preferably 21 to 25 mm. The entire length (length in the horizontal direction) of the flavor inhaler article 20 is not particularly limited but is preferably 40 to 90 mm, more preferably 50 to 75 mm, and further preferably 50 to 60 mm.

[0053] The flavor inhaler article 20 comprises a tobacco segment 20A, a filter section 20C that forms a mouthpiece, and a connection section 20B that connects the tobacco segment 20A and the filter section 20C.

[0054] The tobacco segment 20A is cylindrical. The entire length (length in the axial direction) is, for example, preferably 5 to 100 mm, more preferably 10 to 50 mm, and further preferably 10 to 25 mm. The cross-sectional shape of the tobacco segment 20A is not particularly limited but may be circular, elliptic, or polygonal, for example.

[0055] The tobacco segment 20A includes a tobacco sheet or a material derived therefrom 21 and a wrapper 22 wrapped therearound. The wrapper 22 may be a tobacco sheet 1 of the present invention.

[0056] The filter section 20C is cylindrical. The filter section 20C includes a rod-shaped first segment 25 filled with cellulose acetate fibers and a rod-shaped second segment 26 similarly filled with cellulose acetate fibers. The first segment 25 is positioned on the side of the tobacco segment 20A. The first segment 25 may have a hollow portion. The second segment 26 is positioned on the mouth side. The second segment 26 is solid. The first segment 25 comprises a first filling layer (cellulose acetate fibers) 25a and an inner plug wrapper 25b wrapped around the first filling layer 25a. The second segment 26 comprises a second filling layer (cellulose acetate fibers) 26a and an inner plug wrapper 26b wrapped around the second filling layer 26a. The first segment 25 and the second segment 26 are joined by an outer

plug wrapper 27. The outer plug wrapper 27 is bonded to the first segment 25 and the second segment 26 using a vinyl acetate emulsion adhesive, for example.

[0057] The length of the filter section 20C may be set to 10 to 30 mm, for example, the length of the connection section 20B to 10 to 30 mm, for example, the length of the first segment 25 to 5 to 15 mm, for example, and the length of the second segment 26 to 5 to 15 mm, for example. The lengths of these individual segments are examples and may be changed appropriately depending on production feasibility, required quality, the length of the tobacco segment 20A, and so forth.

[0058] For example, the first segment 25 (center hole segment) comprises a first filling layer 25a having one or more hollow portions and an inner plug wrapper 25b that covers the first filling layer 25a. The first segment 25 acts to enhance the strength of the second segment 26. The first filling layer 25a of the first segment 25 is, for example, cellulose acetate fibers packed at high density. The cellulose acetate fibers are, for example, added with 6 to 20 mass%, based on the mass of cellulose acetate, of a plasticizer including triacetin and hardened. The hollow portion of the first segment 25 has an inner diameter of ø1.0 to ø5.0 mm, for example.

[0059] The first filling layer 25a of the first segment 25 may be formed, for example, at a relatively high filling density of fibers or at a filling density of fibers comparable to the second filling layer 26a of the second segment 26 described hereinafter. Consequently, air and an aerosol flow only through the hollow portion and hardly flow within the first filling layer 25a during inhalation. For example, when it is desirable to suppress reduction in aerosol components through filtration in the second segment 26, it is also possible to shorten the second segment 26 and extend the first segment 25 by the corresponding length.

[0060] Replacing the shortened second segment 26 by the first segment 25 is effective for increasing the amount of aerosol components to be delivered. Since the first filling layer 25a of the first segment 25 is a fiber filling layer, the touch from the outside during use does not cause any discomfort to a user.

[0061] The second segment 26 comprises a second filling layer 26a and an inner plug wrapper 26b that covers the second filling layer 26a. The second segment 26 (filter segment) is filled with cellulose acetate fibers at common density and thus exhibits typical filtration performance of aerosol components.

[0062] The first segment 25 and the second segment 26 may be different in filtration performance of an aerosol (mainstream smoke) released from the tobacco segment 20A. Further, at least either of the first segment 25 and the second segment 26 may contain a flavor. The structure of the filter section 20C is optional and may be a structure having a plurality of segments as mentioned above or a structure of a single segment. In the case in which the filter section 20C is formed from one segment, the filter section 20C may comprise either the first segment or the second segment.

[0063] The connection section 20B is cylindrical. The connection section 20B includes a cylindrically formed paper tube 23 of cardboard, for example. The connection section 20B may be filled with a cooling member for cooling an aerosol. Exemplary cooling members include a polymer sheet of polylactic acid, for example, and such a sheet may be folded and packed therein. Further, a support may be provided between the tobacco segment 20A and the connection section 20B for suppressing the displacement of the tobacco segment 20A. Such a support may be formed of a common material, such as a center hole filter like the first segment 25.

[0064] A wrapper 28 is cylindrically wrapped around the tobacco segment 20A, the connection section 20B, and the filter section 20C to join these components integrally. On either side (inner side) of the wrapper 28, almost the whole surface or the whole surface excluding near a ventilation hole portion 24 is coated with a vinyl acetate emulsion adhesive. A plurality of ventilation hole portions 24 are formed by laser processing from the outside after the tobacco segment 20A, the connection section 20B, and the filter section 20C are integrated by the wrapper 28.

[0065] The ventilation hole portion 24 includes two or more penetrating holes in the thickness direction of the connection section 20B. Two or more penetrating holes are formed in radial arrangement when viewed from the extension of the central axis of the flavor inhaler article 20. The ventilation hole portion 24 is provided on the connection section 20B in this embodiment but may be provided on the filter section 20C. Moreover, two or more penetrating holes of the ventilation hole portion 24 are provided aligning in one row or on one ring at certain intervals in this embodiment but may be provided aligning in two rows or on two rings at certain intervals. Further, the ventilation hole portion 24 in one or two rows may be provided aligning discontinuously or irregularly. When a user inhales with the mouthpiece in the mouth, external air is taken into mainstream smoke through the ventilation hole portion 24. Nevertheless, the ventilation hole portion 24 need not necessarily be provided.

EXAMPLES

[Example 1]

[0066] Tobacco leaves were pulverized to attain D90 of 400 μm using a grinding mill (ACM-5 from Hosokawa Micron Corporation), thereby yielding leaf tobacco particles. The D90 was measured using Mastersizer (from Malvern Panalytical Ltd.). The leaf tobacco particles and Sunrose F20HC (cellulose ether from Nippon Paper Industries Co., Ltd.) as a binder

were dry-blended using a mixer. Subsequently, the resulting dry blend was added with glycerol as an aerosol former and water as a medium and mixed using a mixer to prepare a wet powder. The composition of the respective components is as shown in Table 1.

[0067] The wet powder was kneaded six times at room temperature using a kneader (DG-1 from Dalton Corporation) to yield a mixture. The die shape was circular or square, and the screw rotation speed was set to 60 rpm.

[0068] The wet powder was sandwiched between two Teflon™ films (Nitoflon® No. 900UL from Nitto Denko Corporation) and rolled at four stages using a calendaring machine (from Yuri Roll Machine Co., Ltd.) to attain a predetermined thickness (over 100 μm), thereby preparing a 250 μm-thick laminate having a layered structure of film/wet sheet/film. The roll gaps for the first to the fourth stages were respectively set to 1100 μm, 500 μm, 300 μm, and 200 μm. The roll gap for the fourth stage is smaller than the thickness of the finally obtained sheet. This is because the sheet released from the pressure between the rollers expanded near the final thickness.

[0069] The laminate, after releasing one Teflon™ film therefrom, was dried at 80°C for 1 to 2 minutes using a circulation dryer. Subsequently, a wet sheet after releasing the other film was dried under the same conditions to produce a tobacco sheet of the present invention, and the tobacco sheet was evaluated.

[Table 1]

[0070]

Table 1 Composition in Example 1

	Pulverized tobacco leaves	Glycerol	Binder	Water
Feed weight proportion [WB weight%]	55.8	9.7	2.5	32
Water content of each component [weight%]	11.8	13	5.4	100
Feed weight proportion [DB weight%] (proportion in finished sheet composition)	82	14	4	-
Weight in wet powder [g]	98.4	16.8	4.8	80
Weight proportion in wet powder [WB weight%]	49.2	8.4	2.4	40
*WB: wet-based DB: dry-based				

[0071] In Table 1, "weight in wet powder" represents the dry weight for the pulverized tobacco leaves, glycerol, and the binder and represents for water the total amount of the feed weight and the weight of water contained in the pulverized tobacco leaves, glycerol, and the binder.

[Examples 2 and 3]

[0072] Tobacco sheets were produced and evaluated in the same manner as Example 1 except for using leaf tobacco particles having D90 of 600 μm and 800 μm, respectively.

[Comparative Examples 1 and 2]

[0073] Tobacco sheets were produced and evaluated in the same manner as Example 1 except for using leaf tobacco particles having D90 of 80 μm and 200 μm, respectively.

[Example 4]

[0074] A tobacco sheet was produced and evaluated in the same manner as Example 1 except for using leaf tobacco particles having D90 of 200 μm and changing the weight proportion of water in the wet powder to 50 WB weight%.

[Comparative Examples 3 and 4]

[0075] Tobacco sheets were produced and evaluated in the same manner as Example 1 except for using leaf tobacco particles having D90 of 200 μm and changing the weight proportion of water in the wet powder to 30 and 40 WB weight%,

respectively. These results are shown in Table 3. The "amount of water in wet powder" in Table 3 corresponds to the amount of water represented as "weight proportion in wet powder" in Table 1.

[Example 5 and Comparative Example 5]

[0076] According to a conventional casting process, tobacco sheets (Example 5) having a sheet density of 0.75 g/cm^3 or 0.96 g/cm^3 and a tobacco sheet (Comparative Example 5) having a sheet density of 1.19 g/cm^3 were produced respectively. As a result of conducting smoking tests using these tobacco sheets, it was confirmed that a smoking article using either the sheet of Example 5 satisfactorily delivers flavor components at the beginning of inhalation as compared with a smoking article using the sheet of Comparative Example 5. In light of this, it was presumed that a smoking article using any tobacco sheet obtained in Examples 1 to 3 also satisfactorily delivers flavor components at the beginning of inhalation.

[0077] Hereinafter, the evaluation methods will be described.

[Smoking Test]

[0078] An internal-heating non-combustion smoking system illustrated in Fig. 2 was prepared. Subsequently, a Cambridge filter was connected to the mouth end. A tobacco sheet produced in each example was cut into shreds. The shreds were packed within a wrapper 22 of 12 mm in length and 7 mm in diameter at 70 volume% to prepare a tobacco segment 20A. The system was subjected to a smoking test using a smoking machine. Specifically, a sample was subjected to automatic smoking by an automatic smoking machine (R-26 from Borgwaldt KC Inc.) under the conditions of puff volume of 27.5 mL/s, puff duration of 2 s/puff, puff frequency of 2 puffs/min, and 14 puffs. The resulting particulate matter in tobacco smoke per puff was collected by a Cambridge filter (CM-133 from Borgwaldt KC Inc.). The Cambridge filter after the smoking test was shaken in 10 mL of methanol (GR-grade, from Wako Pure Chemical Industries, Ltd.) to obtain an analysis sample. From the analysis sample, 1 μL was collected by a microsyringe and analyzed by GC-MS (GC-MSD, GC: 7890A, MS: 5975C from Agilent Technologies, Inc.).

[Density]

[0079] A tobacco sheet was cut into a 55 mm square, and the weight (dry weight) was measured to calculate the weight per unit area (basis weight). Further, the thickness was measured using a thickness meter (from Mitutoyo Corporation) to calculate a density from the basis weight and the thickness.

[Example 5A]

[0080] Example 5 above was reproduced. In other words, a tobacco sheet was produced as follows.

1) Tobacco lamina was pulverized in a lab mill to yield tobacco particles having a raw material particle size D90 of 300 μm.
2) Softwood pulp was disintegrated in a lab mill.
3) These powdered materials were placed in a Ken mixer and mixed by stirring.
4) Water, glycerol, and Sunrose F30MC (cellulose ether from Nippon Paper Industries Co., Ltd.) as a binder were placed in a disperser (from Primix Corporation) and mixed for 30 minutes.
5) The resulting mixture was added with the pulp and dispersed in the disperser (from Primix Corporation) for 30 minutes.
6) The mixture obtained in 5) was cast on an iron plate.
7) The iron plate on which the cast film had been formed was placed in a circulation dryer set at 80°C and dried for 30 minutes. Subsequently, a tobacco sheet was obtained by releasing from the iron plate.

[Table 2]

[0081]

Table 2 Composition in Example 5A

	Pulverized tobacco leaves	Glycerol	Binder	Pulp	Water
Feed weight proportion [WB weight%]	17.5	3.2	0.8	1.1	77.4

(continued)

	Pulverized tobacco leaves	Glycerol	Binder	Pulp	Water
Water content of each component [weight%]	11.8	13	5.4	6.4	100
Feed weight proportion [DB weight%] (proportion in finished sheet composition)	77	14	4	5	-
Weight in wet powder [g]	154	28	8	10	800

[0082] In Table 2, "weight in wet powder" represents the dry weight for the pulverized tobacco leaves, glycerol, and the binder and represents for water the total amount of the feed weight and the weight of water contained in the pulverized tobacco leaves, glycerol, and the binder.

[Example 6]

[0083] A tobacco sheet was produced and evaluated in the same manner as Example 5A except for using leaf tobacco particles having D90 of 80 μm. These results are shown in Table 3.

[Table 3]

[0084]

Table 3 Sheet Physical Properties

	Raw material D90	Amount of water in wet powder	Density	Production process
	μm	WB weight%	g/cm^3	
Comp. Ex. 1	80	40	1.20	Lamination process
Comp. Ex. 2	200	40	1.11	
Ex. 1	400	40	0.95	
Ex. 2	600	40	0.74	
Ex. 3	800	40	0.76	
Comp. Ex. 3	200	30	1.24	
Comp. Ex. 4	200	40	1.11	
Ex. 4	200	50	0.91	
Ex. 5A	300	80	0.83	Casting process
Ex. 6	80	80	0.99	

REFERENCE SIGNS LIST

[0085]

1 Tobacco sheet
1c Cut piece of tobacco sheet

10 Heating device
11 Body
12 Heater

20 Heat-not-burn flavor inhaler article
20A Tobacco segment
20B Connection section

20C Filter section

21 Tobacco sheet or material derived therefrom
22 Wrapper
23 Paper tube
24 Ventilation hole portion
25 First segment
25a First filling layer
25b Inner plug wrapper
26 Second segment
26a Second filling layer
26b Inner plug wrapper
27 Outer plug wrapper
28 Wrapper

Claims

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

2. The sheet according to Claim 1, being a pressure-formed sheet.

3. The sheet according to Claim 1 or 2, having been produced from a wet powder which comprises tobacco particles having D90 of 200 μm or more and a liquid medium and which has a water content of 50 weight% or more.

4. The sheet according to any of Claims 1 to 3, comprising tobacco particles having D90 of 300 μm or more.

5. The sheet according to Claim 4, comprising tobacco particles having D90 of 500 μm or more.

6. A heat-not-burn smoking article comprising the tobacco sheet according to any of Claims 1 to 5 or a material derived therefrom.

7. A method of producing according to any of Claims 1 to 5, comprising:

step 1 of preparing a mixture by kneading at least tobacco particles, a binder, and a medium;
step 2 of preparing a wet sheet by rolling the mixture or extruding the mixture from a die; and
step 3 of drying the wet sheet.

8. The method according to Claim 7, wherein the medium contains water.

9. The method according to Claim 7 or 8, wherein the step 2 includes preparing a laminate sheet in which a wet sheet exists between two substrate films.

10. The method according to any of Claims 7 to 9, wherein the step 1 includes kneading at least a tobacco material, a binder, and a medium in a single-screw or a multi-screw kneader.

11. The method according to any of Claims 7 to 10, wherein the mixture contains 20 to 80 weight% of a medium relative to the total amount of the mixture.

Fig. 1

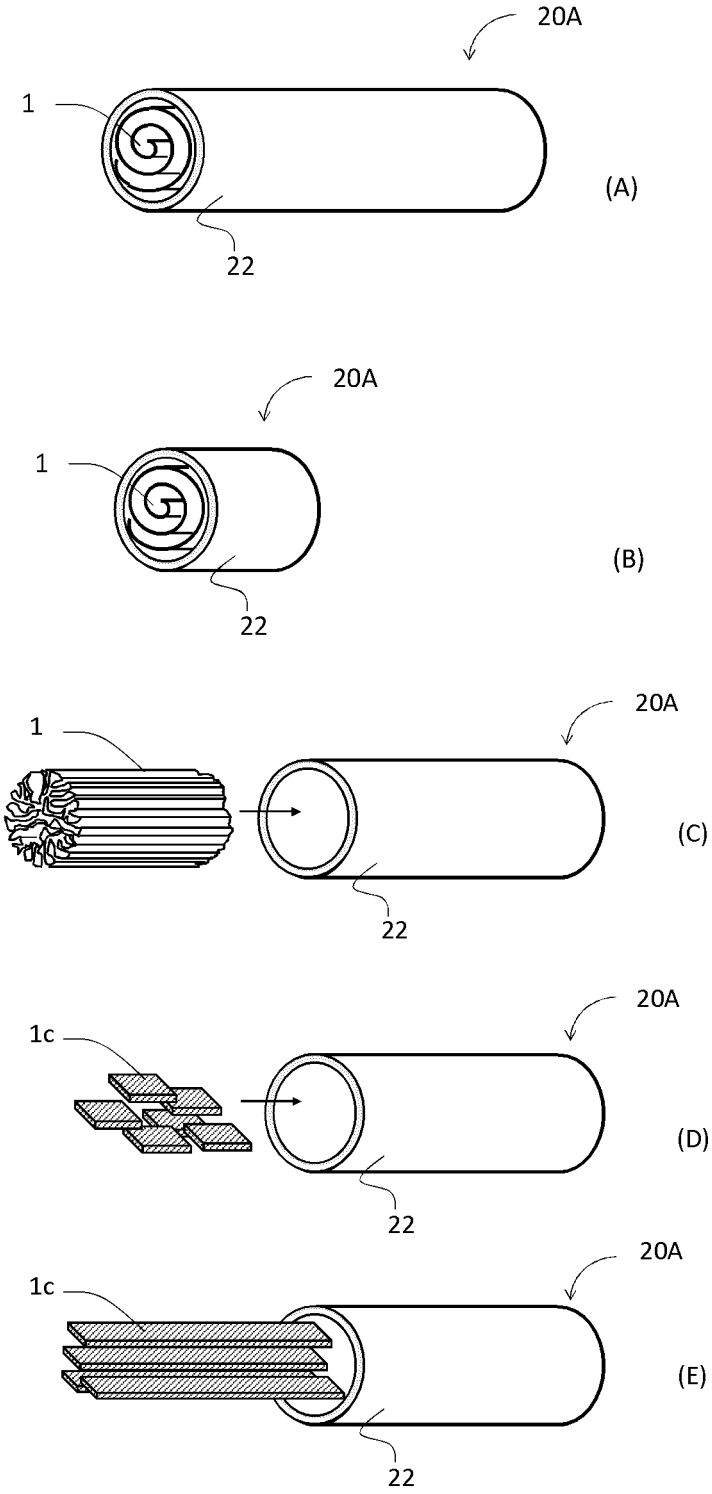

Fig. 2

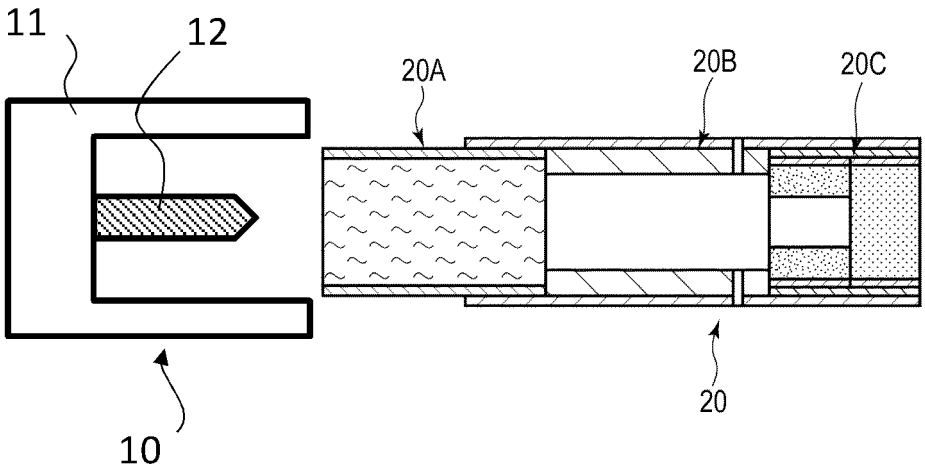
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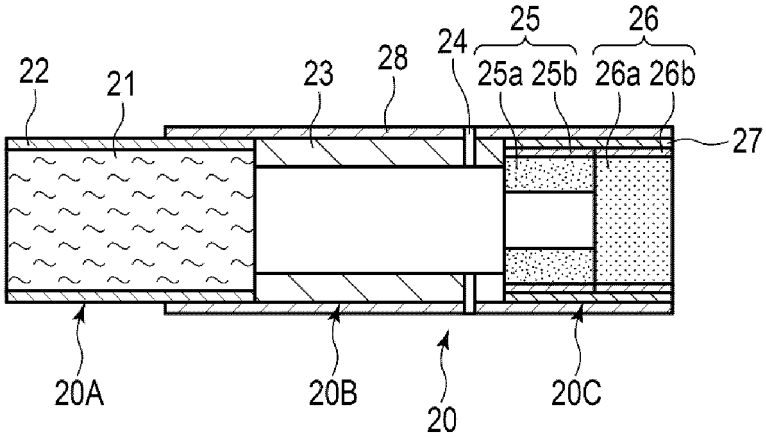
Fig. 3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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2021/036389

A. CLASSIFICATION OF SUBJECT MATTER

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

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)

A24B15/14; A24B3/14; A24F40/00; A24F47/00

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

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2020/074535 A1 (PHILIP MORRIS PRODUCTS S.A.) 16 April 2020 (2020-04-16) page 1, line 1 to page 33, line 10, fig. 1-9	1
Y		2-11
Y	WO 2020/148902 A1 (JAPAN TOBACCO INC) 23 July 2020 (2020-07-23) paragraphs [0003], [0016]	2-11
Y	WO 2020/089089 A1 (NERUDIA LIMITED) 07 May 2020 (2020-05-07) page 7, lines 6-8	9-11
Y	JP 2020-95953 A (IDEMITSU KOSAN CO) 18 June 2020 (2020-06-18) paragraph [0033]	10-11

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
10 November 2021	**22 November 2021**
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
Information on patent family members

International application No.
PCT/JP2021/036389

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REFERENCES CITED IN THE DESCRIPTION

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