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(71) Applicant: **Japan Tobacco Inc.**

Tokyo 105-6927 (JP)

(72) Inventor: **TANAKA, Yasuo**

Tokyo 130-8603 (JP)

(74) Representative: **Hoffmann Eitle**

Patent- und Rechtsanwälte PartmbB

Arabellastraße 30

81925 München (DE)

(54) **FRAGRANCE-CONTAINING SHEET FOR HEATING-TYPE FLAVOR INHALER, AND
HEATING-TYPE FLAVOR INHALER**

(57) This fragrance-containing sheet for a heating-type flavor inhaler comprises: agar; at least one sugar compound selected from the group consisting of sugars and sugar alcohols; and an emulsifier.

EP 3 973 794 A1

Description

FIELD

5 **[0001]** The present invention relates to a flavorant-containing sheet for a heating-type flavor inhaler, and a heating-type flavor inhaler.

BACKGROUND

10 **[0002]** A flavorant-containing sheet for a smoking article containing a polysaccharide, a flavorant, and an emulsifier is known (WO 2012/118032). Such a flavorant-containing sheet contains a flavorant with the flavorant being coated with a polysaccharide, and thus exhibits a high flavorant storage stability. The flavorant-containing sheet is prepared by spreading a raw material slurry containing a polysaccharide, a flavorant, and an emulsifier onto a substrate, followed by drying. The prepared flavorant-containing sheet is cut, and the resulting cut pieces are mixed with cut tobacco and
15 incorporated as a tobacco filler into a smoking article such as cigarette.

SUMMARY

TECHNICAL PROBLEM

20 **[0003]** The present inventors applied, to the heating-type flavor inhaler, the flavorant-containing sheet for smoking articles, and newly found the problem that a flavorant cannot be released sufficiently. An object of the present invention is to provide a technique relating to a flavorant-containing sheet for use in a heating-type flavor inhaler.

SOLUTION TO PROBLEM

25 **[0004]** According to a first aspect, there is provided a flavorant-containing sheet for a heating-type flavor inhaler, comprising:

30 agar;
at least one saccharide compound selected from the group consisting of saccharides and sugar alcohols;
a flavorant; and
an emulsifier.

35 **[0005]** According to a second aspect, there is provided a heating-type flavor inhaler, comprising:

cut pieces of the above-described flavorant-containing sheet;
a tobacco material;
an aerosol source; and
40 a heater configured to heat the aerosol source to generate an aerosol, and to release a flavor component from the cut pieces and the tobacco material by an action of the aerosol.

ADVANTAGEOUS EFFECTS OF INVENTION

45 **[0006]** According to the present invention, it is possible to provide a technique relating to a flavorant-containing sheet for use in a heating-type flavor inhaler.

BRIEF DESCRIPTION OF THE DRAWINGS

50 **[0007]**

FIG. 1 is a perspective view showing an example of a heating-type flavor inhaler;
FIG. 2 is a view showing an internal structure of a flavor inhalation article;
FIG. 3 is a view showing an internal structure of an aerosol generation device;
55 FIG. 4 is a graph showing a flavorant release temperature and flavorant retention rate of a flavorant-containing sheet containing agar and glucose;
FIG. 5 is a graph showing a flavorant release temperature and flavorant retention rate of a flavorant-containing sheet containing agar and sucrose;

FIG. 6 is a graph showing a flavorant release temperature and flavorant retention rate of a flavorant-containing sheet containing agar and fructose;

FIG. 7 is a graph showing a flavorant release temperature and flavorant retention rate of a flavorant-containing sheet containing agar and sorbitol;

FIG. 8 is a graph showing a flavorant release temperature and flavorant retention rate of a flavorant-containing sheet containing agar and xylose;

FIG. 9 is a graph showing a flavorant release temperature and flavorant retention rate of a flavorant-containing sheet containing agar and galactose;

FIG. 10 is a graph showing a flavorant release temperature and flavorant retention rate of a flavorant-containing sheet containing agar and mannose;

FIG. 11 is a graph showing a flavorant release temperature and flavorant retention rate of a flavorant-containing sheet containing agar and maltose;

FIG. 12 is a graph showing a flavorant release temperature and flavorant retention rate of a flavorant-containing sheet containing agar and trehalose;

FIG. 13 is a graph showing a flavorant release temperature and flavorant retention rate of a flavorant-containing sheet containing agar and lactose;

FIG. 14 is a graph showing a flavorant release temperature and flavorant retention rate of a flavorant-containing sheet containing agar and raffinose;

FIG. 15 is a graph showing a flavorant release temperature and flavorant retention rate of a flavorant-containing sheet containing gellan gum and glucose;

FIG. 16 is a graph showing a flavorant release temperature and flavorant retention rate of a flavorant-containing sheet containing gellan gum and sucrose; and

FIG. 17 is a graph showing an amount of menthol delivered in each puff.

DETAILED DESCRIPTION

[0008] Hereinafter, the present invention will be described in detail, and the following description is intended to describe the invention and is not intended to limit the invention.

<1. Flavorant-Containing Sheet for Heating-Type Flavor Inhaler>

[0009] A flavorant-containing sheet for a heating-type flavor inhaler (hereinafter also referred to as a flavorant-containing sheet) includes:

- agar;
- at least one saccharide compound selected from the group consisting of saccharides and sugar alcohols;
- a flavorant; and
- an emulsifier.

[0010] The flavorant-containing sheet can be produced by kneading, in water, a raw material containing (i) agar, (ii) at least one saccharide compound selected from the group consisting of saccharides and sugar alcohols, (iii) a flavorant, and (iv) an emulsifier to prepare a raw material slurry, and spreading the raw material slurry onto a substrate, followed by drying.

[0011] Hereinafter, each component of the flavorant-containing sheet will be described.

(i) Agar

[0012] Agar serves to fix and coat a flavorant dispersed in a flavorant-containing sheet. A blending amount of agar in the raw material slurry is preferably 10 to 50% by mass, and more preferably 15 to 45% by mass, with respect to a total mass (i.e., dry matter mass) of components other than water in the raw material slurry.

(ii) Saccharide Compound

[0013] A saccharide compound is at least one selected from the group consisting of saccharides and sugar alcohols. "Saccharides" include monosaccharides and oligosaccharides, but do not include polysaccharides such as starch or glycogen. Examples of the "saccharides" include glucose, sucrose, fructose, xylose, galactose, mannose, maltose, trehalose, lactose, and raffinose. A "sugar alcohol" refers to an alcohol obtained by reducing a carbonyl group of a saccharide to a hydroxy group. Examples of the "sugar alcohols" include sorbitol.

[0014] Preferably, the saccharide compound is at least one selected from the group consisting of monosaccharides, oligosaccharides, and sugar alcohols. "Oligosaccharides" are, for example, disaccharides, trisaccharides, tetrasaccharides, or pentasaccharides.

[0015] More preferably, the saccharide compound is at least one selected from the group consisting of monosaccharides, disaccharides, trisaccharides, and sugar alcohols. Further preferably, the saccharide compound is at least one selected from the group consisting of monosaccharides, disaccharides, trisaccharides, and monosaccharide alcohols. A "monosaccharide alcohol" refers to an alcohol obtained by reducing a carbonyl group of a monosaccharide to a hydroxy group.

[0016] Further preferably, the saccharide compound is at least one selected from the group consisting of glucose, sucrose, fructose, sorbitol, xylose, galactose, mannose, maltose, trehalose, lactose and raffinose. Further preferably, the saccharide compound is at least one selected from the group consisting of glucose, sucrose, fructose, sorbitol, xylose, galactose and mannose. Most preferably, the saccharide compound is sorbitol.

[0017] A blending amount of the saccharide compound in the raw material slurry is preferably 10% by mass or more, more preferably 10 to 500% by mass, further preferably 10 to 300% by mass, and further preferably 10 to 200% by mass, with respect to agar in the raw material slurry. To remarkably exhibit the effect by addition of the saccharide compound, a blending amount of the saccharide compound in the raw material slurry is preferably 40% by mass or more, more preferably 40 to 500% by mass, further preferably 50 to 500% by mass, further preferably 50 to 300% by mass, and further preferably 50 to 200% by mass, with respect to agar in the raw material slurry.

[0018] Since the saccharide compound and agar remain in the flavorant-containing sheet while the blending amounts are maintained as they are, a content (% by mass) of the saccharide compound in the flavorant-containing sheet is preferably 10% by mass or more, more preferably 10 to 500% by mass, further preferably 10 to 300% by mass, and further preferably 10 to 200% by mass, with respect to agar. To remarkably exhibit the effect by addition of the saccharide compound, a content (% by mass) of the saccharide compound in the flavorant-containing sheet is preferably 40% by mass or more, more preferably 40 to 500% by mass, further preferably 50 to 500% by mass, further preferably 50 to 300% by mass, and further preferably 50 to 200% by mass, with respect to agar.

[0019] When the flavorant-containing sheet contains a saccharide compound, a temperature at which the flavorant-containing sheet is heated to release a flavorant (hereinafter also referred to as a flavorant release temperature) can be lowered. As described above, when the flavorant-containing sheet contains a saccharide compound, the flavorant can be released at a lower heating temperature, and therefore, when the flavorant-containing sheet is applied to a heating-type flavor inhaler, a sufficient flavor can be provided to a user.

[0020] In particular, sorbitol can significantly lower the flavorant release temperature even at a low addition amount (see FIG. 7). Therefore, the content of sorbitol in the flavorant-containing sheet is preferably 10% by mass or more, more preferably 10 to 500% by mass, further preferably 10 to 300% by mass, and further preferably 10 to 200% by mass, with respect to agar. In order to significantly lower the flavorant release temperature of the flavorant-containing sheet through addition of sorbitol, the content of sorbitol in the flavorant-containing sheet is preferably 10% by mass or more, more preferably 10 to 500% by mass, further preferably 20 to 500% by mass, further preferably 30 to 500% by mass, further preferably 40 to 500% by mass, further preferably 50 to 500% by mass, further preferably 50 to 300% by mass, and further preferably 50 to 200% by mass, with respect to agar.

[0021] The saccharide compound is, when incorporated as a tobacco filler into a smoking article such as a cigarette, combusted and produces a burnt smell, but in the present invention, the saccharide compound is incorporated into a heating-type flavor inhaler and is not combusted. Therefore, in the present invention, a burnt smell due to combustion does not occur, and a relatively large amount of the saccharide compound (e.g., an amount of the saccharide compound equal to or more than that of agar) can be blended into the flavorant-containing sheet.

(iii) Flavorant

[0022] A flavorant is not limited, and any flavorant can be used as long as it is used for a heating-type flavor inhaler. Main examples of the flavorant include: menthol; leaf tobacco extract; natural plant flavorants (e.g., cinnamon, sage, herb, chamomile, kudzu (*Pueraria lobata*), hydrangeae dulcis folium, clove, lavender, cardamom, caryophyllus, nutmeg, bergamot, geranium, honey essence, rose oil, lemon, orange, cassia bark, caraway, jasmine, ginger, coriander, vanilla extract, spearmint, peppermint, cassia, coffee, celery, cascarrilla, sandalwood, cocoa, ylang-ylang, fennel, anise, licorice, St John's bread, prune extract, and peach extract); saccharides (e.g., glucose, fructose, isomerized saccharide, and caramel); cocoa (e.g., powder and extract); esters (e.g., isoamyl acetate, linalyl acetate, isoamyl propionate, and linalyl butyrate); ketones (e.g., menthone, ionone, damascenone, and ethyl maltol); alcohols (e.g., geraniol, linalool, anethole, and eugenol); aldehydes (e.g., vanillin, benzaldehyde, and anisaldehyde); lactones (e.g., γ -undecalactone and γ -nonalactone); animal flavorants (e.g., musk, ambergris, civet, and castoreum); and hydrocarbons (e.g., limonene and pinene). These flavorants may be used as solids, or may be used by being dissolved or dispersed in a suitable solvent such as propylene glycol, ethyl alcohol, benzyl alcohol, or triethyl citrate. A flavorant which easily forms a dispersion state in a

solvent by addition of an emulsifier, such as a hydrophobic flavorant and oil-soluble flavorant, may be preferably used. These flavorants may be used alone or in combination. According to a preferred embodiment, the flavorant includes at least one flavorant component selected from the group consisting of menthol, citral, limonene, and ethyl butyrate.

[0023] The blending amount of the flavorant in the raw material slurry can be appropriately selected depending on the type of the flavorant, and is, for example, 50 to 500% by mass with respect to a mass of agar in the raw material slurry. For example, if the flavorant is a flavorant containing menthol as a main component (i.e., a flavorant containing menthol at a proportion of 70 to 100% by mass), the blending amount of the flavorant in the raw material slurry is preferably 250 to 500% by mass, and more preferably 300 to 450% by mass, with respect to a mass of agar in the raw material slurry. Alternatively, if the flavorant is a flavorant containing menthol and containing a flavorant component other than menthol as a main component (i.e., a flavorant containing menthol in a proportion of 33% by mass or less and a flavorant component other than menthol in a proportion of 67% by mass or more), the blending amount of the flavorant in the raw material slurry is preferably 50 to 250% by mass, and more preferably 75 to 200% by mass, with respect to a mass of agar in the raw material slurry.

[0024] The content of the flavorant in the flavorant-containing sheet immediately after preparation can be appropriately changed depending on the type of the flavorant, and is, for example, 35 to 80% by mass with respect to the total mass of the flavorant-containing sheet. For example, if the flavorant is a flavorant containing menthol as a main component, the content of the flavorant in the flavorant-containing sheet immediately after preparation is preferably 50 to 80% by mass, and more preferably 65 to 78% by mass, with respect to the total mass of the flavorant-containing sheet. Alternatively, if the flavorant is a flavorant containing menthol and containing a flavorant component other than menthol as a main component, the content of the flavorant in the flavorant-containing sheet immediately after preparation is preferably 35 to 70% by mass, and more preferably 40 to 65% by mass, with respect to the total mass of the flavorant-containing sheet. The content of the flavorant in the flavorant-containing sheet can be measured according to the method described in the section "(1-3) Evaluation of Flavorant Retention Rate" of Example 1 described later.

(iv) Emulsifier

[0025] Any emulsifier can be used as the emulsifier as long as it can disperse the flavorant in the raw material slurry. As the emulsifier, for example, lecithin, specifically, SUN LECITHIN A-1 (Taiyo Kagaku Co., Ltd.), may be used. As the emulsifier, esters selected from the group consisting of glycerin fatty acid esters, polyglycerin fatty acid esters, sorbitan fatty acid esters, propylene glycol fatty acid esters, and sucrose fatty acid esters may be used in addition to lecithin. Examples of the glycerin fatty acid esters include fatty acid monoglycerides such as monoglyceride monostearate or monoglyceride succinate; examples of the polyglycerin fatty acid esters include pentaglycerin monostearate; examples of the sorbitan fatty acid esters include sorbitan monostearate; examples of the propylene glycol fatty acid esters include propylene glycol monostearate; and examples of the sucrose fatty acid esters include sucrose stearic acid ester.

[0026] The content of the emulsifier in the raw material slurry is preferably 0.5 to 10% by mass, and more preferably 1.0 to 8.0% by mass, with respect to the mass of agar in the raw material slurry. Since the emulsifier and agar remain in the flavorant-containing sheet while the blending amounts are maintained as they are, the content of the emulsifier in the flavorant-containing sheet is preferably 0.5 to 10% by mass, more preferably 1.0 to 8.0% by mass, with respect to the mass of agar in the flavorant-containing sheet.

(v) Other Components

[0027] The flavorant-containing sheet may contain water. That is, water contained in the raw material slurry may remain in the flavorant-containing sheet after drying. When water is left in the flavor-containing sheet, the moisture content is preferably less than 10% by mass, more preferably 3 to 9% by mass, and further preferably 3 to 6% by mass, with respect to the total mass of the sheet. The moisture content of the flavorant-containing sheet can be determined using GC-TCD as described below.

[0028] First, after a flavorant-containing sheet is weighed, a predetermined amount of methanol (reagent of special grade or higher) is added and sealed, followed by shaking (at 200 rpm) for 40 minutes. The resulting mixture is left overnight, shaken again (at 200 rpm) for 40 minutes, and allowed to stand. The supernatant after standing is used as a measurement solution.

[0029] The measurement solution is analyzed by GC-TCD and quantified by the calibration curve method. The conditions of GC-TCD may be set to, for example, the following conditions.

GC-TCD; 6890 gas chromatograph, manufactured by Hewlett Packard
Column; HP Polapack Q (packed column)
Constant Flow mode 20.0 mL/min
Injection; 1.0 μ L

EP 3 973 794 A1

Inlet; EPC purge packed column inlet Heater; 230°C
Gas; He Total flow; 21.1 mL/min
Oven; 160°C (hold 4.5 min) → (60°C/min) → 220°C (hold 4.0 min)
Detector; TCD detector

Reference Gas (He) flow rate; 20 mL/min
Make up gas (He) 3.0 mL/min

Signal rate; 5 Hz

[0030] The flavorant-containing sheet may contain additional components, if necessary. For example, the flavorant-containing sheet may contain a humectant. Examples of the humectant include glycerin, hyaluronic acid, and magnesium chloride. Further, the flavorant-containing sheet may also contain a colorant. For the colorant, cocoa, caramel, food additive dyes such as Blue No. 2, polyphenols such as chlorogenic acid, melanoidin, and the like, may be used.

[0031] The flavorant-containing sheet has a thickness of, for example, from 0.04 to 0.2 mm, preferably, 0.05 to 0.10 mm.

(vi) Advantageous Effects

[0032] As described above, the flavorant-containing sheet contains a saccharide compound, and thus has a lower flavorant release temperature than that of a flavorant-containing sheet containing no saccharide compound. In a preferred embodiment, the flavorant-containing sheet has a flavorant release temperature of 240°C or less. In a more preferred embodiment, the flavorant-containing sheet has a flavorant release temperature of 140 to 240°C. In a still more preferred embodiment, the flavorant-containing sheet has a flavorant release temperature of 150 to 200°C.

[0033] Furthermore, according to the technique disclosed in this specification, the flavorant release temperature can be controlled by changing an addition amount of the saccharide compound. In particular, when sorbitol is used as the saccharide compound, the flavorant release temperature can be lowered in proportion to the addition amount of the saccharide compound (see FIG. 7). Therefore, the technique disclosed in this specification can be regarded not only as "a technique for lowering a release temperature of a flavorant component from a flavorant-containing sheet", but also as "a technique for controlling a release temperature of a flavorant component from a flavorant-containing sheet".

[0034] As used herein, the "flavorant release temperature" of the flavorant-containing sheet refers to a temperature determined according to the method described below.

[0035] The flavorant-containing sheet can be heated to a predetermined temperature by a heater in the heating-type flavor inhaler to release the flavorant. A temperature at which the flavorant-containing sheet is heated to release the flavorant, i.e., a "flavorant release temperature", is a physical property value of the flavorant-containing sheet, and can be determined by measuring a release temperature of the flavorant component with a "thermogravimetry-mass spectrometry simultaneous measurement apparatus (hereinafter, "TG-MS")" described below.

[0036]

Measurement of "Release Temperature of Flavorant Component" by TG-MS

Differential thermobalance-photo ionization mass spectrometry simultaneous measurement apparatus, Thermo Mass Photo 410/S, Rigaku Co., Ltd.

Atmosphere: He gas (flow rate: 300 mL/min)

Sample container; Pt (reference sample is an empty Pt container)

Temperature rise: room temperature → (10°C/min) → 800°C

Ion measurement; Photo Ionization (SEM 1800V) Measurement mass range (m/z); 25 to 150

[0037] The TG-MS measurement is an analysis method in which a sample is heated to increase its temperature, heat absorption and generation and weight change at a predetermined temperature are measured by "differential thermal analysis and thermobalance (thermal analysis)", and simultaneously, a condition of a component release from the sample at the predetermined temperature is identified by "mass spectrometry (MS)". Based on this measurement, it is possible to obtain knowledge about a heating temperature at which a flavorant component (e.g., menthol) is released from the sample. Specifically, a flavorant component (e.g., menthol) contained in the flavorant-containing sheet is identified by mass spectrometry (MS) spectrum, the MS thermogram (horizontal axis: temperature, vertical axis: ion intensity) is superimposed on the thermal analysis result (TG thermogram, horizontal axis: temperature, vertical axis: weight loss), and the temperature at the start of release of the flavorant component shown by the MS thermogram can be determined as a "release temperature of the flavorant component".

[0038] When the flavorant contained in the flavorant-containing sheet is composed of one flavorant component, the "release temperature of the flavorant component" can be determined as the "flavorant release temperature" of the

flavorant-containing sheet. Alternatively, when the flavorant contained in the flavorant-containing sheet is composed of a plurality of types of flavorant components, a temperature range (T_1 to T_2 °C) sandwiched between a minimum value (T_1 °C) and a maximum value (T_2 °C) of the release temperature of each flavorant component can be determined as the "flavorant release temperature" of the flavorant-containing sheet. When the flavorant is composed of a plurality of types of flavorant components, the flavorant-containing sheet contains the plurality of types of flavorant components with them being coated with agar, and a coating of agar is melted or decomposed by heating, thereby releasing the plurality of types of flavorant components. Therefore, it is assumed that unless each flavorant component has an excessively high boiling point, the plurality of types of flavorant components are released without an excessively large time difference, and the difference between the minimum value (T_1 °C) and the maximum value (T_2 °C) is usually not so large.

<2. Preparation Method of Flavorant-Containing Sheet>

[0039] The flavorant-containing sheet may be prepared by, according to the known technique, kneading the raw material including agar, the saccharide compound, the flavorant, and the emulsifier in water to prepare a raw material slurry, and spreading the raw material slurry onto the substrate, followed by drying.

[0040] The composition of the raw material slurry may be, for example, 350 to 1000 g of agar, 40 to 1000 g of the saccharide compound, 400 to 3000 g of the flavorant, and 10 to 80 g of the emulsifier, for 10 liters of water. Kneading of the raw material can be carried out by the known emulsification technique using a homogenizer while heating to 60 to 100°C. The obtained raw material slurry has a viscosity of, for example, 10,000 [mPa·s/60°C] or less, preferably 1,000 to 10,000 [mPa·s/60°C], and more preferably 1,000 to 5,000 [mPa·s/60°C].

[0041] The obtained raw material slurry can be spread on a substrate so that the thickness of the sheet obtained after drying is, for example, about 0.04 to 0.2 mm. Thereafter, the raw material slurry is dried until reaching the desired moisture content (for example, less than 10% by mass, preferably 3 to 9% by mass, and more preferably 3 to 6% by mass), whereby a flavorant-containing sheet can be produced.

[0042] An aqueous solution of agar has properties that it is gelled when cooled to a specific temperature or lower (e.g., about 30°C), and once gelled, it does not easily return to a sol state even when the temperature is increased afterward to reach the gel transition temperature, and can maintain the gelled state. Therefore, when the raw material slurry contains agar, the sheet can be produced in a short time by once cooling and gelling the raw material slurry and drying the gelled raw material at a high temperature. Specifically, after the raw material slurry is spread on the substrate, the raw material slurry is once cooled to a sample temperature of 0 to 40°C to be gelled, and then the gelled raw material can be heated at a sample temperature of 70 to 100°C to be dried.

<3. Heating-Type Flavor Inhaler>

[0043] The flavorant-containing sheet described above can be, for example, cut into a size equivalent to that of ordinary cut tobacco, and the resulting cut pieces can be incorporated into a heating-type flavor inhaler (hereinafter also simply referred to as a "flavor inhaler"). The cut pieces of the flavorant-containing sheet are, for example, cut pieces of a flavorant-containing sheet having a thickness of 0.04 to 0.2 mm, preferably 0.05 to 0.10 mm, with a long side of 2.0 to 7.0 mm and a short side of 0.5 to 2.0 mm.

[0044] The cut pieces of the flavorant-containing sheet (hereinafter also simply referred to as "cut pieces") may be used alone as a flavor source of a flavor inhaler, or may be used in combination with a tobacco material such as cut tobacco as a flavor source of a flavor inhaler. In the latter case, the cut pieces can be incorporated into the flavor inhaler in an amount of 4 to 20% by mass with respect to the total mass of the tobacco material and the cut pieces. When the cut pieces are incorporated into the flavor inhaler in an amount of 4% by mass or more with respect to the total mass of the cut tobacco and the cut pieces, variation in the distribution of the flavorant in the flavor inhaler can be suppressed.

[0045] As described above, when the flavorant-containing sheet contains the saccharide compound, the flavorant release temperature can be lowered. According to Examples described later, in the flavorant-containing sheet, it was possible to lower the flavorant release temperature to a temperature of 240°C or lower. Since the heating temperature of the heating-type flavor inhaler is, for example, 150°C to 250°C, the heating-type flavor inhaler including the flavorant-containing sheet described above can provide a sufficient flavor to a user.

[0046] Examples of the heating-type flavor inhaler include:

a carbon heat source-type inhaler that heats a tobacco filler with combustion heat of a carbon heat source (see, for example, WO 2006/073065);

an electric heating-type inhaler having a flavor inhalation article and a heating device for electrically heating the flavor inhalation article (see, for example, WO 2010/110226); or

a liquid atomizing-type inhaler in which a liquid aerosol source is heated by a heater to generate an aerosol and a flavor is inhaled together with the aerosol (see, for example, WO 2015/046385).

[0047] That is, according to another aspect, there is provided a heating-type flavor inhaler that includes:

cut pieces of the flavorant-containing sheet described above;
 an aerosol source; and
 an aerosol generator configured to heat the aerosol source to generate an aerosol and release a flavor component from the cut pieces by an action of the aerosol.

[0048] The aerosol generator may be built into an inhalation article that the user inhales, or may be provided as a device separate from the inhalation article that the user inhales. The aerosol generator is, for example, a carbon heat source, or a heater. The aerosol generator may directly or indirectly heat the cut pieces and the aerosol source. For example, the aerosol generator may directly heat a mixture of the cut pieces and the aerosol source by being disposed adjacent to the mixture of the cut pieces and the aerosol source, or may indirectly heat the cut pieces by disposing the aerosol source upstream of the cut pieces, heating the aerosol source to generate an aerosol, and passing the aerosol through the cut pieces.

[0049] According to a preferred embodiment, there is provided a heating-type flavor inhaler that includes:

cut pieces of the flavorant-containing sheet described above;
 a tobacco material;
 an aerosol source; and
 an aerosol generator configured to heat the aerosol source to generate an aerosol, and to release a flavor component from the cut pieces and the tobacco material by an action of the aerosol.

[0050] The flavor inhaler includes a tobacco material in addition to the cut pieces as a flavor source that releases a flavor component. The tobacco material is, for example, cut tobacco. The cut pieces may be present in the flavor inhaler in a state of being mixed with the tobacco material, or may be present in the flavor inhaler at a section separate from the tobacco material (for example, upstream or downstream of the tobacco material). The aerosol source may be present in the flavor inhaler in a state of being mixed with the cut pieces and the tobacco material, or may be present in the flavor inhaler at a section separate from the cut pieces and the tobacco material (for example, upstream of the cut pieces and the tobacco material).

[0051] In this embodiment as well, the aerosol generator may directly or indirectly heat the cut pieces, the tobacco material, and the aerosol source. For example, the aerosol generator may directly heat a mixture of the cut pieces, the tobacco material, and the aerosol source by being disposed adjacent to the mixture, or may indirectly heat the cut pieces and the tobacco material by disposing the aerosol source upstream of the cut pieces and the tobacco material, heating the aerosol source to generate an aerosol, and passing the aerosol through the cut pieces and the tobacco material.

[0052] In this embodiment as well, the aerosol generator may be built into an inhalation article that the user inhales, or may be provided as a device separate from the inhalation article that the user inhales.

[0053] According to a more preferred embodiment, the aerosol generator is provided as a device separate from the inhalation article that the user inhales. That is, according to a more preferred embodiment, there is provided a heating-type flavor inhaler that includes:

a flavor inhalation article including cut pieces of the flavorant-containing sheet described above, a tobacco material, and an aerosol source; and
 an aerosol generation device to which the flavor inhalation article is detachably attached, and configured to heat the flavor inhalation article to generate an aerosol from the aerosol source and to release a flavor component from the cut pieces and the tobacco material by an action of the aerosol.

[0054] Hereinafter, an example of the heating-type flavor inhaler will be described with reference to FIGS. 1 to 3. FIG. 1 is a perspective view showing an example of a heating-type flavor inhaler. FIG. 2 is a view showing an internal structure of a flavor inhalation article. FIG. 3 is a view showing an internal structure of an aerosol generation device.

[0055] As shown in FIG. 1, a flavor inhaler 100 includes:

a flavor inhalation article 110 including cut pieces of a flavorant-containing sheet, a tobacco material, and an aerosol source; and
 an aerosol generation device 120 to which the flavor inhalation article 110 is detachably attached, and configured to heat the flavor inhalation article 110 to generate an aerosol from the aerosol source and to release a flavor component from the cut pieces and the tobacco material by an action of the aerosol.

[0056] The flavor inhalation article 110 is a replaceable cartridge and has a columnar shape extending along the

longitudinal direction. The flavor inhalation article 110 is configured to generate an aerosol and a flavor component by being heated while inserted into the aerosol generation device 120.

[0057] As shown in FIG. 2, the flavor inhalation article 110 includes a base portion 11A including a filler 111 and a first wrapping paper 112 which is wrapped around the filler 111, and a mouthpiece portion 11B forming an end opposite to the base portion 11A. The base portion 11A and the mouthpiece portion 11B are connected by a second wrapping paper 113.

[0058] The mouthpiece portion 11B includes a paper tube portion 114, a filter portion 115, and a hollow segment portion 116 disposed between the paper tube portion 114 and the filter portion 115. The paper tube portion 114 is a paper tube formed by wrapping paper into a cylindrical shape, and has a hollow inside. The filter portion 115 includes a filter material such as acetate tow. The hollow segment portion 116 includes a filling layer having one or more hollow channels. The filter material of the filter portion 115 and the filling layer of the hollow segment portion 116 are connected by being covered with a plug wrapper 117. The filling layer is formed of fibers and has a high filling density of fibers, and therefore, during inhalation, air or aerosol flows only through the hollow channel and hardly flows through the filling layer. In the flavor inhalation article 110, when it is desired to reduce the decrease of aerosol components through filtration in the filter portion 115, it is effective to shorten the length of the filter portion 115 and replace it with the hollow segment portion 116 in order to increase a delivery amount of aerosol.

[0059] Although the mouthpiece portion 11B is composed of three segments, the mouthpiece portion 11B may be composed of one or two segments, or may be composed of four or more segments. For example, the hollow segment portion 116 may be omitted, and the paper tube portion 114 and the filter portion 115 may be disposed adjacent to each other to form the mouthpiece portion 11B.

[0060] The longitudinal length of the flavor inhalation article 110 is preferably 40 to 90 mm, more preferably 50 to 75 mm, and further preferably 50 to 60 mm. The circumference of the flavor inhalation article 110 is preferably 15 to 25 mm, more preferably 17 to 24 mm, and further preferably 20 to 23 mm. In addition, in the longitudinal direction of the flavor inhalation article 110, the base portion 11A may have a length of 20 mm, the paper tube portion 114 may have a length of 20 mm, the hollow segment portion 116 may have a length of 8 mm, and the filter portion 115 may have a length of 7 mm, and lengths of these individual segments can be changed as appropriate according to manufacturing suitability, required quality, and the like.

[0061] The filler 111 includes cut pieces of the flavorant-containing sheet, a tobacco material, and an aerosol source. The aerosol source is heated at a predetermined temperature to generate an aerosol. The aerosol source may be, for example, glycerin, propylene glycol, triacetin, 1,3-butanediol, and a mixture thereof. The content of the aerosol source in the filler 111 is not particularly limited, and from the viewpoint of generating a sufficient amount of aerosol and providing a good smoking flavor, the content is usually 5% by mass or more, and preferably 10% by mass or more, and usually 50% by mass or less, preferably 20% by mass or less.

[0062] The filler 111 includes cut pieces of the flavorant-containing sheet and a tobacco material as a flavor source. The cut pieces of the flavorant-containing sheet are as described above. The tobacco material is, for example, cut tobacco. The material of cut tobacco is not particularly limited, and publicly known materials such as lamina and stem can be used. When the base portion 11A has a circumference of 22 mm and a length of 20 mm, the content of the filler 111 in the flavor inhalation article 110 is, for example, 200 to 400 mg, and preferably 250 to 320 mg. The moisture content of the filler 111 is, for example, 8 to 18% by mass, and preferably 10 to 16% by mass. Such a moisture content suppresses occurrence of a stain on the wrapping paper and improves roll-up machinability during production of the base portion 11A. The size of cut tobacco used as the filler 111 and the method for preparing the same are not particularly limited. For example, dried tobacco leaf cut to have a width of 0.8 to 1.2 mm may be used. Alternatively, dried tobacco leaf may be pulverized and homogenized to have an average particle size of about 20 to 200 μm , processed into a sheet, and then cut to have a width of 0.8 to 1.2 mm. Further, the above sheet-processed material that is gathered instead of being cut may be used as the filler 111.

[0063] For the first wrapping paper 112, the second wrapping paper 113, and the plug wrapper 117, the same wrapping paper, tipping paper, and plug wrapper as those used in cigarette can be used.

[0064] As shown in FIG. 3, the aerosol generation device 120 includes an insertion hole 130 into which the flavor inhalation article 110 can be inserted. That is, the aerosol generation device 120 includes an inner cylindrical member 132 constituting the insertion hole 130. The inner cylindrical member 132 may be formed of a heat conductive member such as aluminum or stainless steel (SUS).

[0065] Further, the aerosol generation device 120 may include a lid portion 140 that closes the insertion hole 130. The lid portion 140 is configured to be slidable between a state where the insertion hole 130 is closed and a state where the insertion hole 130 is exposed (see FIG. 1).

[0066] The aerosol generation device 120 may include an air flow path 160 communicating with the insertion hole 130. One end of the air flow path 160 is connected to the insertion hole 130, while the other end of the air flow path 160 communicates with the outside (outside air) of the aerosol generation device 120 at a portion different from the insertion hole 130.

[0067] The aerosol generation device 120 may include a lid portion 170 that covers an end portion of the air flow path 160 on the side communicating with the outside air. The lid portion 170 can cover the end portion of the air flow path 160 on the side communicating with the outside air, or can expose the air flow path 160.

[0068] The lid portion 170 does not air-tightly close the air flow path 160 even in a state of covering the air flow path 160. That is, even in a state where the lid portion 170 covers the air flow path 160, the outside air can flow into the air flow path 160 via the vicinity of the lid portion 170.

[0069] In a state where the flavor inhalation article 110 is inserted into the aerosol generation device 120, the user holds one end portion of the flavor inhaler 110, specifically, the mouthpiece portion 11B illustrated in FIG. 2, and performs an inhalation action. The outside air flows into the air flow path 160 through the user's inhalation action. The air flowing into the air flow path 160 passes through the flavor inhalation article 110 in the insertion hole 130 and is guided into an oral cavity of the user.

[0070] The aerosol generation device 120 may include a temperature sensor in the air flow path 160 or on an outer surface of a wall portion constituting the air flow path 160. The temperature sensor may be, for example, a thermistor, a thermocouple, or the like. When the user inhales with the mouthpiece portion 11B of the flavor inhalation article 110, the internal temperature of the air flow path 160 or the temperature of the wall portion constituting the air flow path 160 decreases because of the influence of the air flowing through the air flow path 160 from the lid portion 170 side toward the heater 30 side. The temperature sensor can detect the user's inhalation action by measuring this temperature drop.

[0071] The aerosol generation device 120 includes a battery 10, a control unit 20, and a heater 30. The battery 10 stores electric power used in the aerosol generation device 120. The battery 10 may be a chargeable and dischargeable secondary battery. The battery 10 may be, for example, a lithium ion battery.

[0072] The heater 30 may be provided around the inner cylindrical member 132. The space accommodating the heater 30 and the space accommodating the battery 10 may be separated from each other by a partition wall 180. This can prevent the air heated by the heater 30 from flowing into the space accommodating the battery 10. Therefore, an increase in the temperature of the battery 10 can be suppressed.

[0073] The heater 30 preferably has a tubular shape capable of heating the outer periphery of the columnar flavor inhalation article 110. The heater 30 may be, for example, a film heater. The film heater may include a pair of film-like substrates and a resistance heating element sandwiched between the pair of substrates. The film-like substrate is preferably made of a material excellent in heat resistance and electrical insulating properties, and is typically made of polyimide. The resistance heating element is preferably made of one or two or more metal materials such as copper, nickel alloy, chromium alloy, stainless steel, and platinum rhodium, and may be formed of, for example, a base material made of stainless steel. Further, in order to connect the resistance heating element to a power source by a flexible printed circuit (FPC), copper plating may be applied to a connection portion and a lead portion thereof.

[0074] Preferably, a heat-shrinkable tube may be provided outside the heater 30. The heat-shrinkable tube is a tube that shrinks in a radial direction through heat, and is made of, for example, a thermoplastic elastomer. The heater 30 is pressed against the inner cylindrical member 132 by the contraction action of the heat-shrinkable tube. This increases the adhesion between the heater 30 and the inner tubular member 132, thereby increasing conduction of the heat from the heater 30 to the flavor inhalation article 110 via the inner tubular member 132.

[0075] The aerosol generation device 120 may include a tubular thermal insulator on the outer side of the heater 30 in the radial direction, preferably on the outer side of the heat-shrinkable tube. The thermal insulator may serve to prevent the outer surface of the housing of the aerosol generation device 120 from reaching an excessively high temperature by blocking the heat of the heater 30. The thermal insulator may be made of an aerogel such as a silica aerogel, a carbon aerogel, or an alumina aerogel. The aerogel as a thermal insulator may typically be a silica aerogel having high thermal insulation performance and relatively low manufacturing costs. However, the thermal insulator may be a fiber-based thermal insulator such as glass wool or rock wool, or a foam-based thermal insulator such as urethane foam or phenolic foam. Alternatively, the thermal insulator may be a vacuum thermal insulator.

[0076] The thermal insulator may be provided between the inner tubular member 132 facing the smoking article 110 and the outer tubular member 134 outside the thermal insulator. The outer tubular member 134 may be formed of a heat conductive member such as aluminum or stainless steel (SUS). It is preferable that the thermal insulator be provided in the sealed space.

[0077] The control unit 20 may include a control board, a CPU, a memory, and the like. The aerosol generation device 120 may include a notification unit for notifying the user of various kinds of information under the control of the control unit 20. The notification unit may be, for example, a light emitting element such as an LED, a vibration element, or a combination thereof.

[0078] Upon detecting an activation request from the user, the control unit 20 starts power supply from the battery 10 to the heater 30. The activation request from the user is made by, for example, an operation of a push button or a slide switch by the user, or an inhalation action of the user. The activation request of the user may be made by pressing a push button 150. More specifically, the activation request of the user may be made by pressing the push button 150 in a state where the lid portion 140 is opened. Alternatively, the activation request of the user may be made by detection

of an inhalation action of the user. The user's inhalation action can be detected by, for example, a temperature sensor as described above.

<4. Preferred Embodiments>

[0079] The preferred embodiments are summarized below.

[A1] A flavorant-containing sheet for a heating-type flavor inhaler, comprising:

agar;
at least one saccharide compound selected from the group consisting of saccharides and sugar alcohols;
a flavorant; and
an emulsifier.

[A2] The flavorant-containing sheet according to [A1], wherein the saccharide compound is at least one selected from the group consisting of monosaccharides, oligosaccharides, and sugar alcohols.

[A3] The flavorant-containing sheet according to [A1] or [A2], wherein the saccharide compound is at least one selected from the group consisting of monosaccharides, disaccharides, trisaccharides, and sugar alcohols.

[A4] The flavorant-containing sheet according to any one of [A1] to [A3], wherein the saccharide compound is at least one selected from the group consisting of monosaccharides, disaccharides, trisaccharides, and monosaccharide alcohols.

[A5] The flavorant-containing sheet according to any one of [A1] to [A4], wherein the saccharide compound is at least one selected from the group consisting of glucose, sucrose, fructose, sorbitol, xylose, galactose, mannose, maltose, trehalose, lactose, and raffinose.

[A6] The flavorant-containing sheet according to any one of [A1] to [A5], wherein the saccharide compound is at least one selected from the group consisting of glucose, sucrose, fructose, sorbitol, xylose, galactose, and mannose.

[A7] The flavorant-containing sheet according to any one of [A1] to [A6], wherein the saccharide compound is sorbitol.

[A8] The flavorant-containing sheet according to any one of [A1] to [A7], wherein the flavorant is menthol, citral, limonene, or ethyl butyrate.

[A9] The flavorant-containing sheet according to any one of [A1] to [A8], wherein the saccharide compound is contained in an amount of 10% by mass or more, preferably 10 to 500% by mass, more preferably 10 to 300% by mass, and further preferably 10 to 200% by mass, with respect to agar.

[A10] The flavorant-containing sheet according to any one of [A1] to [A9], wherein the saccharide compound is contained in an amount of 40% by mass or more, preferably 40 to 500% by mass, more preferably 50 to 500% by mass, further preferably 50 to 300% by mass, and further preferably 50 to 200% by mass, with respect to agar.

[A11] The flavorant-containing sheet according to any one of [A1] to [A8], wherein the saccharide compound is sorbitol, and sorbitol is contained in an amount of 10% by mass or more, preferably 10 to 500% by mass, more preferably 10 to 300% by mass, and further preferably 10 to 200% by mass, with respect to agar.

[A12] The flavorant-containing sheet according to any one of [A1] to [A8], wherein the saccharide compound is sorbitol, and sorbitol is contained in an amount of 10% by mass or more, preferably 10 to 500% by mass, more preferably 20 to 500% by mass, further preferably 30 to 500% by mass, further preferably 40 to 500% by mass, further preferably 50 to 500% by mass, further preferably 50 to 300% by mass, and further preferably 50 to 200% by mass, with respect to agar.

[A13] The flavorant-containing sheet according to any one of [A1] to [A12], wherein a content of the flavorant in the flavorant-containing sheet immediately after preparation is 35 to 80% by mass with respect to a total mass of the flavorant-containing sheet.

[A14] The flavorant-containing sheet according to any one of [A1] to [A13], wherein a content of the flavorant in the flavorant-containing sheet immediately after preparation is 50 to 80% by mass, preferably 65 to 78% by mass, with respect to a total mass of the flavorant-containing sheet, when the flavorant is a flavorant containing menthol as a main component.

[A15] The flavorant-containing sheet according to any one of [A1] to [A13], wherein a content of the flavorant in the flavorant-containing sheet immediately after preparation is 35 to 70% by mass, preferably 40 to 65% by mass, with respect to a total mass of the flavorant-containing sheet, when the flavorant is a flavorant containing menthol and containing a flavorant component other than menthol as a main component.

[A16] The flavorant-containing sheet according to any one of [A1] to [A15], having a flavorant release temperature of 240°C or lower, preferably 140 to 240°C, more preferably 150 to 200°C.

[A17] The flavorant-containing sheet according to any one of [A1] to [A16], having a thickness of 0.04 to 0.15 mm, preferably 0.05 to 0.10 mm.

[B1] A heating-type flavor inhaler, comprising cut pieces of the flavorant-containing sheet according to any one of [A1] to [A17].

[B2] The heating-type flavor inhaler according to [B1], wherein the heating-type flavor inhaler is a carbon heat source-type inhaler, an electric heating-type inhaler, or a liquid atomizing-type inhaler.

[B3] The heating-type flavor inhaler according to [B1] or [B2], further comprising a tobacco material.

[B4] A heating-type flavor inhaler, comprising:

cut pieces of the flavorant-containing sheet according to any one of [A1] to [A17];

an aerosol source; and

an aerosol generator configured to heat the aerosol source to generate an aerosol, and to release a flavor component from the cut pieces by an action of the aerosol.

[B5] A heating-type flavor inhaler, comprising:

cut pieces of the flavorant-containing sheet according to any one of [A1] to [A17];

a tobacco material;

an aerosol source; and

an aerosol generator configured to heat the aerosol source to generate an aerosol, and to release a flavor component from the cut pieces and the tobacco material by an action of the aerosol.

[B6] A heating-type flavor inhaler, comprising:

a flavor inhalation article comprising cut pieces of the flavorant-containing sheet according to any one of [A1] to [A17], a tobacco material, and an aerosol source; and

an aerosol generation device to which the flavor inhalation article is detachably attached, and configured to heat the flavor inhalation article to generate an aerosol from the aerosol source, and to release a flavor component from the cut pieces and the tobacco material by an action of the aerosol.

[B7] The heating-type flavor inhaler according to any one of [B4] to [B6], wherein the aerosol source is selected from the group consisting of glycerin, propylene glycol, triacetin, 1,3-butanediol, and a mixture thereof.

[B8] The heating-type flavor inhaler according to any one of [B3] and [B5] to [B7], wherein the cut pieces are contained in an amount of 4 to 20% by mass with respect to a total mass of the tobacco material and the cut pieces.

[B9] The heating-type flavor inhaler according to any one of [B1] to [B8], wherein the cut pieces have a thickness of 0.04 to 0.15 mm, preferably 0.05 to 0.10 mm

[B10] The heating-type flavor inhaler according to any one of [B1] to [B9], wherein the cut pieces have a long side of 2.0 to 7.0 mm and a short side of 0.5 to 2.0 mm.

[C1] A method of preparing the flavorant-containing sheet according to any one of [A1] to [A17], the method comprising:

kneading a raw material including agar, a saccharide compound, a flavorant, and an emulsifier in water to prepare a raw material slurry;

spreading the raw material slurry onto a substrate; and

drying the spread raw material slurry.

[C2] A method of preparing the flavorant-containing sheet according to any one of [A1] to [A17], the method comprising:

kneading a raw material including agar, a saccharide compound, a flavorant, and an emulsifier in water to prepare a raw material slurry;

spreading the raw material slurry onto a substrate;

cooling the spread raw material slurry to a sample temperature of 0 to 40°C to be gelled; and

heating the gelled raw material at a sample temperature of 70 to 100°C to be dried.

EXAMPLES

[Example 1]

[0080] In Example 1, the flavorant release temperature and flavorant retention rate of the flavorant-containing sheet were examined.

(1-1) Preparation of Flavorant-Containing Sheet

[Agar-Based Sheet]

5 **[0081]** A flavorant-containing sheet including agar, a saccharide compound, menthol, and an emulsifier was prepared. As the saccharide compound, glucose, sucrose, fructose, sorbitol, xylose, galactose, mannose, maltose, trehalose, lactose or raffinose was used.

[0082] The composition of the raw material slurry was as follows.

10 Distilled water : 100 parts by mass
 Agar: 4 parts by mass
 Saccharide compound: changed as follows
 Menthol: 20 parts by mass
 Emulsifier: 0.2 parts by mass

15 **[0083]** 12 g of agar (special grade, Wako Pure Chemical Industries, Ltd.) was introduced into 300 mL of distilled water at room temperature, and stirred for 5 to 10 minutes on a boiling water bath boiled with a stove, thereby dissolving agar in the distilled water. In the resulting aqueous agar solution, 60 g of menthol (TAKASAGO INTERNATIONAL CORPO-
 20 RATION) and the predetermined amount of saccharide compound were dissolved, 0.6 g of lecithin (SUN LECITHIN A-1, Taiyo Kagaku Co., Ltd.) was added, and the mixture was homogenized at 4000 rpm for 10 minutes using a homogenizer (DMM type, manufactured by A-Tech Japan), thereby preparing a raw material slurry.

[0084] The addition amount of the saccharide compound was changed as follows.

25 1.2 g (mass ratio to agar: 0.1)
 2.4 g (mass ratio to agar: 0.2)
 3.6 g (mass ratio to agar: 0.3)
 4.8 g (mass ratio to agar: 0.4)
 6.0 g (mass ratio to agar: 0.5)
 12 g (mass ratio to agar: 1)
 30 24 g (mass ratio to agar: 2)
 60 g (mass ratio to agar: 5)

[0085] The obtained raw material slurry was thinly spread onto a substrate (20 × 20 cm) to have a thickness of 1 mm. The spread slurry was subjected to cold air of about 10°C generated by a spot cooler (SS-25DD-1, manufactured by
 35 SUIDEN CO., LTD.) for about 2 to 3 minutes to be once cooled to about 20°C. The sample temperature of the gelled raw material was measured and confirmed by a non-contact thermometer (PT-7LD, manufactured by OPTEX CO., LTD.). Thereafter, hot air (hot air temperature: 100°C) generated by a hot air generator (New Hot Blaster MS5841-6D, manufactured by Miyamoto Seisakusho Co., Ltd.) was applied to the entire surface of the gel for 15 minutes to dry the
 40 gel, thereby preparing a flavorant-containing sheet having a total thickness of 0.2 mm or less. The prepared flavorant-containing sheet had a thickness of 0.2 mm or less, and a moisture content of about 4%.

[Gellan Gum-Based Sheet]

[0086] A flavorant-containing sheet including gellan gum, a saccharide compound, menthol, and an emulsifier was
 45 prepared. As the saccharide compound, glucose or sucrose was used.

[0087] The composition of the raw material slurry was as follows.

50 Distilled water : 100 parts by mass
 Gellan gum : 4 parts by mass
 Saccharide compound : changed as follows
 Menthol : 20 parts by mass
 Emulsifier : 0.2 parts by mass

55 **[0088]** A gellan gum-based sheet was prepared according to the same procedure as the agar-based sheet except that 12 g of gellan gum (KELCOGEL, San-Ei Gen F.F.I, Inc.) was stirred with 300 mL of distilled water while warming to 80°C to dissolve the gellan gum in the distilled water and the resulting aqueous gellan gum solution was used in place of the aqueous agar solution.

[0089] The addition amount of the saccharide compound was changed as follows.

12 g (mass ratio to gellan gum: 1)

24 g (mass ratio to gellan gum: 2)

[0090] The prepared flavorant-containing sheet had a thickness of 0.2 mm or less, and a moisture content of about 4%.

(1-2) Measurement of Flavorant Release Temperature

[0091] The prepared flavorant-containing sheet was cut into a size of 1 mm × 10 mm to obtain cut pieces. Using the obtained cut pieces, the "flavorant release temperature" of the flavorant-containing sheet was determined as follows.

[0092]

Measurement of "Release Temperature of Flavorant Component" by TG-MS

Differential thermobalance-photo ionization mass spectrometry simultaneous measurement apparatus, Thermo Mass Photo 410/S, Rigaku Co., Ltd.

Atmosphere: He gas (flow rate: 300 mL/min)

Sample container; Pt (reference sample is an empty Pt container)

Temperature rise: room temperature → (10°C/min) → 800°C

Ion measurement; Photo Ionization (SEM 1800V) Measurement mass range (m/z); 25 to 150

[0093] The flavorant component (i.e., menthol) contained in the flavorant-containing sheet was identified by mass spectrometry (MS) spectrum, its MS thermogram (horizontal axis: temperature, vertical axis: ion intensity) was superimposed on the thermal analysis result (TG thermogram, horizontal axis: temperature, vertical axis: weight loss), and the temperature at the start of release of menthol shown by the MS thermogram was determined as a "release temperature of the flavorant component". In this example, since the flavorant was composed of one flavorant component, the release temperature of the flavorant component measured here was determined as the "flavorant release temperature" of the flavorant-containing sheet.

(1-3) Evaluation of Flavorant Retention Rate

[0094] The prepared flavorant-containing sheet was cut into a size of 1 mm × 10 mm to obtain cut pieces. The obtained cut pieces were spread on a sample dish, and stored for 30 days in a constant temperature apparatus (DX600; Yamato Scientific, Co., Ltd.) set at 50°C. The flavorant content of each sample after storage was measured as follows.

[0095] Menthol contained in the flavorant-containing sheet immediately after preparation (0 day of storage) and in the flavorant-containing sheet 30 days after storage was extracted with methanol to prepare a measurement solution. Menthol in the measurement solution was quantified by GC-MSD.

[0096] 10 mL of methanol (reagent of special grade or higher) was added to 0.1 g of the cut pieces of the stored flavorant-containing sheet in a closed container (screw tube) of 50 mL capacity, followed by shaking (at 200 rpm) for 40 minutes. The resulting mixture was left overnight, shaken again (at 200 rpm) for 40 minutes, and allowed to stand. After standing, the supernatant was diluted at a dilution concentration suitable for GC measurement (here, ×1 to ×10 methanol dilution) to prepare a measurement solution. Methanol used for preparing the measurement solution contains 1,3-butanediol (special grade reagent; Wako Pure Chemical Industries, Ltd.) as an internal standard substance at a concentration of 0.05 mg/mL.

[0097] Menthol in the measurement solution prepared as described above was quantified by the following GC-MSD and the calibration curve method.

GC-MSD: 6890N gas chromatograph, manufactured by Agilent Technologies Inc.

Column: DB-1 60 m × 320 μm (1 μm)

Constant velocity mode 30 cm/sec

Oven; 40°C → (5°C/min) → 250°C (hold 5 min)

Injection; 1 μL

Insert liner; Agilent 4711 (250°C)

Inlet; Split mode 10:1 14 mL/min

5973 inert mass spectrometer manufactured by Agilent Technologies Inc.

Scan mode (30 to 300 amu·2.74 scans/sec)

Concentration of calibration curve solutions; 8 points of 0, 0.01, 0.05, 0.1, 0.3, 0.5, 0.7, and 1.0 [mg-menthol/mL]

[0098] The flavorant retention rate of each sample was calculated from the measurement value of the flavor content using the following equation.

$$\text{Flavorant retention rate (\%)} = \{(\text{flavorant content of flavorant-containing sheet after storage}) / (\text{flavorant content of flavorant-containing sheet immediately after preparation})\} \times 100$$

(1-4) Results

[Agar-Based Sheet]

[0099] FIGS. 4 to 14 show the flavorant release temperature and flavorant retention rate of the agar-based sheet. In FIGS. 4 to 14, the horizontal axis represents the addition amount of the saccharide compound as a mass ratio to agar. FIG. 4 shows the case where glucose was used, FIG. 5 shows the case where sucrose was used, FIG. 6 shows the case where fructose was used, FIG. 7 shows the case where sorbitol was used, FIG. 8 shows the case where xylose was used, FIG. 9 shows the case where galactose was used, FIG. 10 shows the case where mannose was used, FIG. 11 shows the case where maltose was used, FIG. 12 shows the case where trehalose was used, FIG. 13 shows the case where lactose was used, and FIG. 14 shows the case where raffinose was used.

[0100] In all cases where the saccharide compound was used, the agar-based sheet had a high flavorant retention rate and a sufficient amount of flavorant in the sheet after storage (see FIGS. 4 to 14).

[0101] Further, in the agar-based sheet, when no saccharide compound was added, the flavorant release temperature was 265°C, but when the saccharide compound was added, the flavorant release temperature could be lowered. In all cases where the saccharide compound was used, addition of the saccharide compound allowed the flavorant release temperature to be lowered to a temperature of 240°C or lower (see FIGS. 4 to 14). In particular, when glucose, sucrose, fructose, sorbitol, xylose, galactose, or mannose was used, the flavorant release temperature could be lowered to a temperature of 200°C or lower (see FIGS. 4 to 10). In particular, when fructose or sorbitol was used, the flavorant release temperature could be lowered to about 150°C (see FIGS. 6 and 7).

[0102] The heating temperature of the heating-type flavor inhaler is, for example, 150 to 250°C; therefore, when the above-described flavorant-containing sheet is applied to the heating-type flavor inhaler, a flavor can be sufficiently provided to a user.

[0103] In addition, in all cases where the saccharide compound was used, a clear decrease in the flavorant release temperature could be observed when the saccharide compound was added at a mass about 0.4 times or more that of agar (see FIGS. 4 to 14). In particular, when sorbitol was used, the flavorant release temperature could be lowered even with a small addition amount. That is, when sorbitol was added at a mass of 0.1 times or more that of agar, a clear decrease in the flavorant release temperature could be observed (see FIG. 7). According to the results of FIG. 7, the state could be observed in which in the agar-based sheet using sorbitol, the flavorant release temperature decreased in proportion to the addition amount of the saccharide compound (i.e., sorbitol). In particular, according to the results of FIG. 7, when the addition amount of sorbitol was in the range of 10% by mass to 50% by mass with respect to agar, it was possible to control the flavorant release temperature so as to decrease the flavorant release temperature in proportion to the addition amount of sorbitol. This indicates that the flavorant release temperature can be uniquely controlled by the addition amount of the saccharide compound in production of the flavorant-containing sheet. In other words, this technique can be regarded as "a technique for controlling a release temperature of a flavorant component from a flavorant-containing sheet".

[0104] The results of FIGS. 4 to 14 show that the content of the saccharide compound in the agar-based sheet is preferably 10% by mass or more, more preferably 10 to 500% by mass, further preferably 10 to 300% by mass, and further preferably 10 to 200% by mass, with respect to agar. The results of FIGS. 4 to 14 also show that in order to remarkably exhibit the effect by addition of the saccharide compound, the content of the saccharide compound in the agar-based sheet is preferably 40% by mass or more, more preferably 40 to 500% by mass, further preferably 50 to 500% by mass, further preferably 50 to 300% by mass, and further preferably 50 to 200% by mass, with respect to agar. In particular, as for sorbitol, the results of FIG. 7 show that the content of sorbitol in the agar-based sheet is preferably 10% by mass or more, more preferably 10 to 500% by mass, further preferably 10 to 300% by mass, and further preferably 10 to 200% by mass, with respect to agar. In addition, the results of FIG. 7 show that in order to significantly lower the flavorant release temperature of the agar-based sheet through addition of sorbitol, the content of sorbitol in the agar-based sheet is preferably 10% by mass or more, more preferably 10 to 500% by mass, further preferably 20 to 500% by mass, further preferably 30 to 500% by mass, further preferably 40 to 500% by mass, further preferably 50 to 500% by mass, further preferably 50 to 300% by mass, and further preferably 50 to 200% by mass, with respect to agar.

[0105] The present inventors also prepared the agar-based sheet in a similar manner using flavorants other than menthol, and measured the flavorant release temperature. As a result, the flavorant release temperature could be lowered

in the flavorant-containing sheet containing sorbitol at a mass of 0.5 times that of agar. Specifically, the flavorant release temperature could be lowered to 211°C when citral was used as the flavorant, to 189°C when ethyl butyrate was used as the flavorant, and to 204°C when limonene was used as the flavorant.

5 [Gellan Gum-Based Sheet]

[0106] FIGS. 15 and 16 show the flavorant release temperature and flavorant retention rate of the gellan gum-based sheet. In FIGS. 15 and 16, the horizontal axis represents the addition amount of the saccharide compound as a mass ratio to gellan gum. FIG. 15 shows the case where glucose was used, and FIG. 16 shows the case where sucrose was used.

10 **[0107]** The gellan gum-based sheet had a high flavorant retention rate, and retained a sufficient amount of flavorant in the sheet after storage. However, in the gellan gum-based sheet, even when the saccharide compound was added at a mass 1 or 2 times that of gellan gum, the flavorant release temperature could not be significantly lowered (see FIGS. 15 and 16).

15 [Example 2]

[0108] In Example 2, a flavorant-containing sheet was incorporated into a flavor inhalation article to determine the delivery amount of flavorant.

20 (2-1) Preparation of Tobacco Filler

[Tobacco Filler 1 (Example of Present Invention)]

[0109] The composition of the raw material slurry was as follows.

25

Distilled water: 100 parts by mass

Agar: 4 parts by mass

Sorbitol: 2 parts by mass

Menthol: 20 parts by mass

30

Emulsifier: 0.2 parts by mass

[0110] According to a method similar to that described in Example 1, a raw material slurry was prepared, and a flavorant-containing sheet was prepared. The prepared flavorant-containing sheet had a thickness of 0.2 mm or less, and had a moisture content of about 4%. The flavorant-containing sheet was cut into a size of 1 mm × 3 mm to obtain cut pieces.

35

[0111] The resulting cut pieces were spread on a sample dish, and stored for 30 days in a constant temperature apparatus (DX600; Yamato Scientific, Co., Ltd.) set at 50°C. After storage, 0.2 g of the cut pieces and 2.5 g of cut tobacco were mixed to prepare a tobacco filler 1 (example of the present invention).

40 [Tobacco Filler 2 (Comparative Example 1)]

[0112] 2.5 g of menthol was added to 100 g of cut tobacco and mixed to prepare a tobacco filler 2 (Comparative Example 1). The obtained tobacco filler 2 was incorporated into a flavor inhalation article without being stored, and the delivery amount of flavorant was examined.

45

[Tobacco Filler 3 (Comparative Example 2)]

[0113] The composition of the raw material slurry was as follows.

50

Distilled water: 100 parts by mass

Gellan gum: 4 parts by mass

Menthol: 20 parts by mass

Emulsifier: 0.2 parts by mass

55

[0114] According to a method similar to that described in Example 1, a raw material slurry was prepared, and a flavorant-containing sheet was prepared. The prepared flavorant-containing sheet had a thickness of 0.2 mm or less, and had a moisture content of about 4%. The flavorant-containing sheet was cut into a size of 1 mm × 3 mm to obtain cut pieces.

[0115] The resulting cut pieces were spread on a sample dish, and stored for 30 days in a constant temperature apparatus (DX600; Yamato Scientific, Co., Ltd.) set at 50°C. After storage, 0.2 g of the cut pieces and 2.5 g of cut tobacco were mixed to prepare a tobacco filler 3 (Comparative Example 2).

(2-2) Production of Flavor Inhalation Article

[0116] 0.26 g of the tobacco filler was wrapped with wrapping paper to prepare a tobacco rod. Using the obtained tobacco rod, a flavor inhalation article shown in FIG. 2 was produced by connecting a filter 115 containing 0.004 g of menthol in a filter material portion to the tobacco rod. A flavor inhalation article produced using the tobacco filler 1 is referred to as a "flavor inhalation article 1", a flavor inhalation article produced using the tobacco filler 2 is referred to as a "flavor inhalation article 2", and a flavor inhalation article produced using the tobacco filler 3 is referred to as a "flavor inhalation article 3".

(2-3) Measurement of Flavorant Delivery Amount

[0117] The produced flavor inhalation articles 1 to 3 were heated at a heater temperature of 230°C for 40 seconds by the aerosol generation device shown in FIG. 3. Thereafter, the flavor inhalation articles 1 to 3 were inhaled under the following inhalation conditions using the automatic smoking device (RM26, manufactured by Borgwaldt in Germany).

CIR (filter ventilation; open) conditions
55 mL/2 seconds
28-second interval
8 puffs

[0118] The mainstream smoke was collected for each puff, and the amount of menthol in the mainstream smoke for each puff was measured as follows.

[0119] Collection of the mainstream smoke per puff was performed as follows:

preparing eight Cambridge pad cartridge (for the number of puffs) by setting Cambridge pads for mainstream smoke (glass fiber filter pads, i.e., filter pads for collecting total particulate matters (TPMs) in tobacco smoke (components other than a gas phase among smoke components)) in dedicated cartridges;
attaching the aerosol generation device, on which the flavor inhalation article has been set and the preheating has been completed, on the Cambridge pad cartridge corresponding to each puff, and causing it to inhale using the automatic smoking device; and
performing this operation up to 8 puffs with the Cambridge pad cartridge replaced every puff, and the mainstream smoke (TPM) of every puff was collected.

[0120] 10 mL of methanol (reagent of special grade or higher) was added to the Cambridge pad to which the mainstream smoke (TPM) adhered, in a closed container (screw tube) of 50 mL capacity, followed by shaking (at 200 rpm) for 40 minutes. After being allowed to stand, the supernatant was taken out and used as a GC measurement solution. Methanol used to prepare the measurement solution contains 1,3-butanediol (Wako Pure Chemical Industries, Ltd., special grade) as an internal standard substance at a concentration of 0.05 mg/mL.

[0121] Menthol in the measurement solution prepared as described above was quantified by the calibration curve method using GC-MSD already described, and the quantified value was determined as a menthol delivery amount per puff in the mainstream smoke.

(2-4) Results

[0122] The amount of menthol delivered in each puff is shown in FIG. 17.

[0123] The flavor inhalation article 1 was able to release menthol in an amount similar to that of the flavor inhalation article 2 over a period of 8 puffs. The flavor inhalation article 2 is a flavor inhalation article including a tobacco filler prepared by adding menthol to cut tobacco, and is an example of an article having a high menthol delivery amount. Therefore, the above results of the flavor inhalation article 1 show that the flavorant-containing sheet of the present invention was able to retain a sufficient amount of menthol even after storage, and was able to release menthol retained in the sheet at the heating temperature (200°C) of the heating-type flavor inhaler.

[0124] The flavor inhalation article 3, on the other hand, was able to release half or less than the amount of menthol released by the flavor inhalation article 1 over a period of 8 puffs. The flavor inhalation article 3 included a flavorant-containing sheet, but the flavorant-containing sheet did not contain a saccharide compound (i.e., sorbitol), which differs

from the flavor inhalation article 1. The flavor inhalation article 3 also differs from the flavor inhalation article 1 in that it has a gellan gum-based sheet, not an agar-based sheet; however, in flavorant-containing sheets, gellan gum is known to be a material similar to agar in terms of serving the function of coating and retaining flavorants (see WO 2012/118032, WO 2012/118033, and Jpn. Pat. Appln. KOKAI Publication No. 2016-189700). Thus, the above results of the flavor inhalation article 3 show that because the flavorant-containing sheet did not contain a saccharide compound, the flavorant release temperature could not be lowered, and only a small amount of menthol could be released.

[0125] The above results demonstrated that the heating-type flavor inhaler including the flavorant-containing sheet of the present invention can provide a sufficient flavor to a user.

Claims

1. A flavorant-containing sheet for a heating-type flavor inhaler, comprising:

agar;
at least one saccharide compound selected from the group consisting of saccharides and sugar alcohols;
a flavorant; and
an emulsifier.

2. The flavorant-containing sheet according to claim 1, wherein the saccharide compound is at least one selected from the group consisting of monosaccharides, oligosaccharides, and sugar alcohols.

3. The flavorant-containing sheet according to claim 1 or 2, wherein the saccharide compound is at least one selected from the group consisting of monosaccharides, disaccharides, trisaccharides, and sugar alcohols.

4. The flavorant-containing sheet according to any one of claims 1 to 3, wherein the saccharide compound is at least one selected from the group consisting of glucose, sucrose, fructose, sorbitol, xylose, galactose, mannose, maltose, trehalose, lactose, and raffinose.

5. The flavorant-containing sheet according to any one of claims 1 to 4, wherein the flavorant comprises at least one flavorant component selected from the group consisting of menthol, citral, limonene, and ethyl butyrate.

6. The flavorant-containing sheet according to any one of claims 1 to 5, wherein the saccharide compound is contained in an amount of 10% by mass or more with respect to agar.

7. The flavorant-containing sheet according to any one of claims 1 to 6, having a flavorant release temperature of 240°C or lower.

8. A heating-type flavor inhaler, comprising:

cut pieces of the flavorant-containing sheet according to any one of claims 1 to 7;
a tobacco material;
an aerosol source; and
an aerosol generator configured to heat the aerosol source to generate an aerosol, and to release a flavor component from the cut pieces and the tobacco material by an action of the aerosol.

9. A heating-type flavor inhaler, comprising:

a flavor inhalation article comprising cut pieces of the flavorant-containing sheet according to any one of claims 1 to 7, a tobacco material, and an aerosol source; and
an aerosol generation device to which the flavor inhalation article is detachably attached, and configured to heat the flavor inhalation article to generate an aerosol from the aerosol source, and to release a flavor component from the cut pieces and the tobacco material by an action of the aerosol.

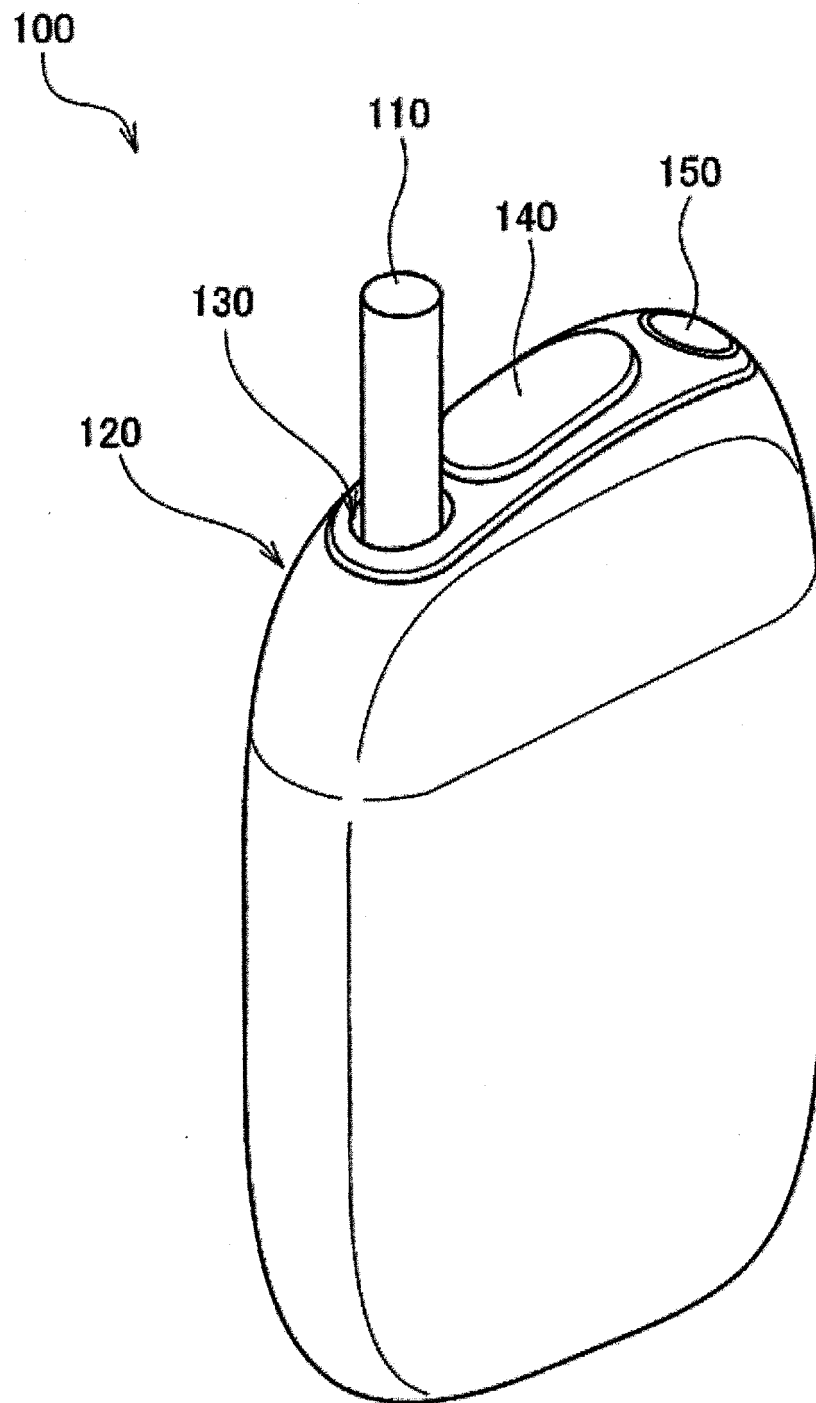


FIG. 1

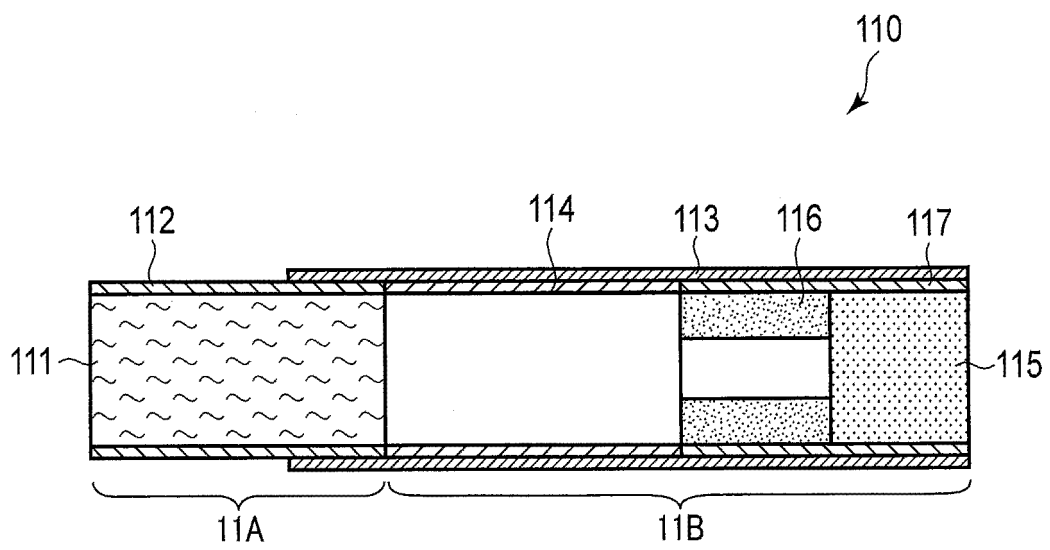


FIG. 2

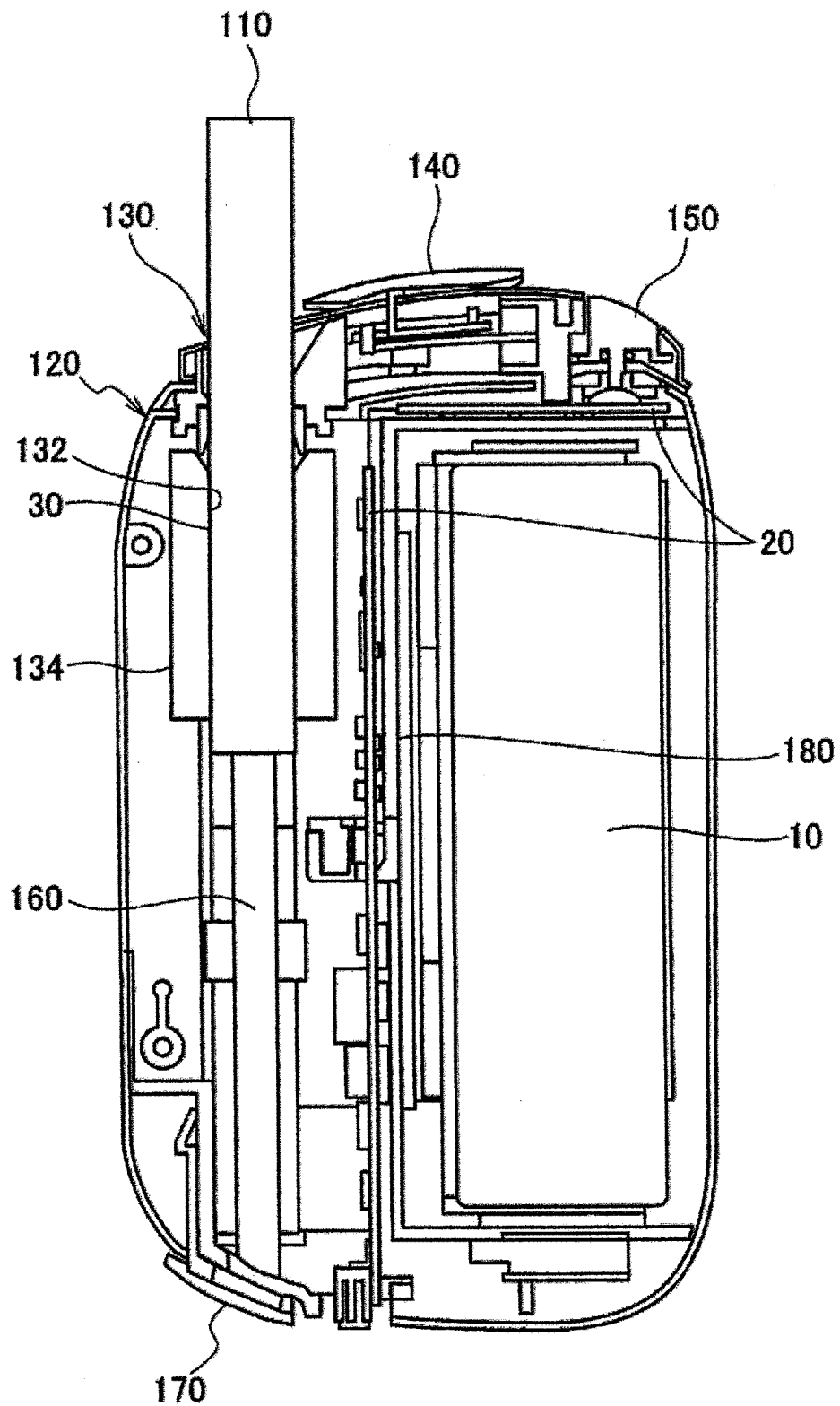


FIG. 3

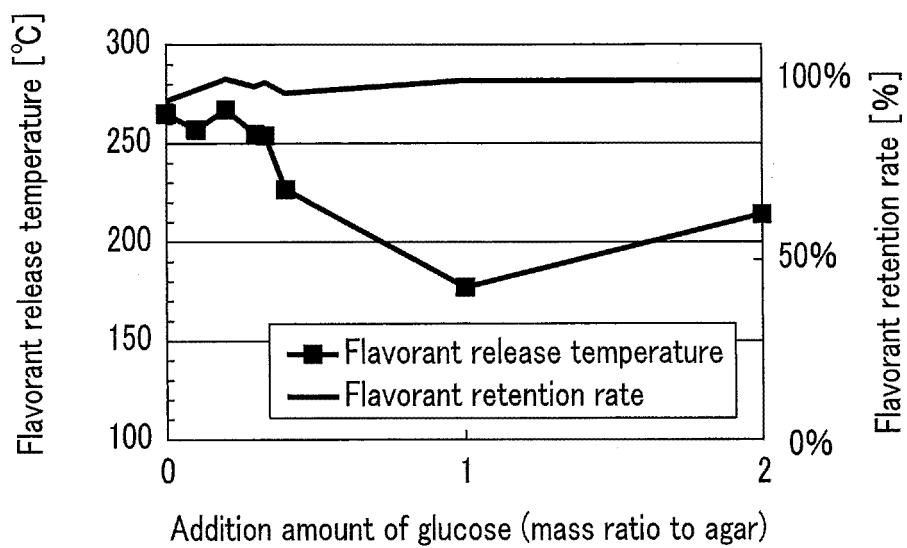


FIG. 4

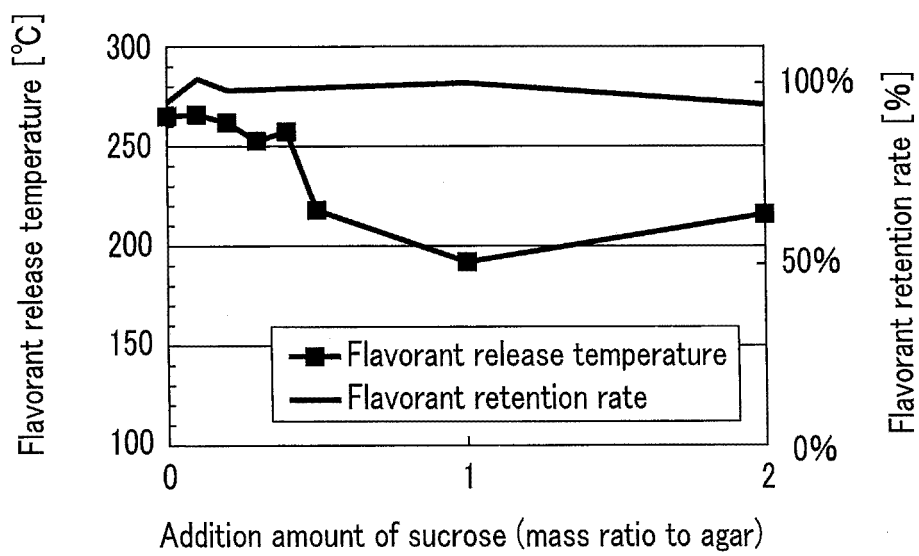


FIG. 5

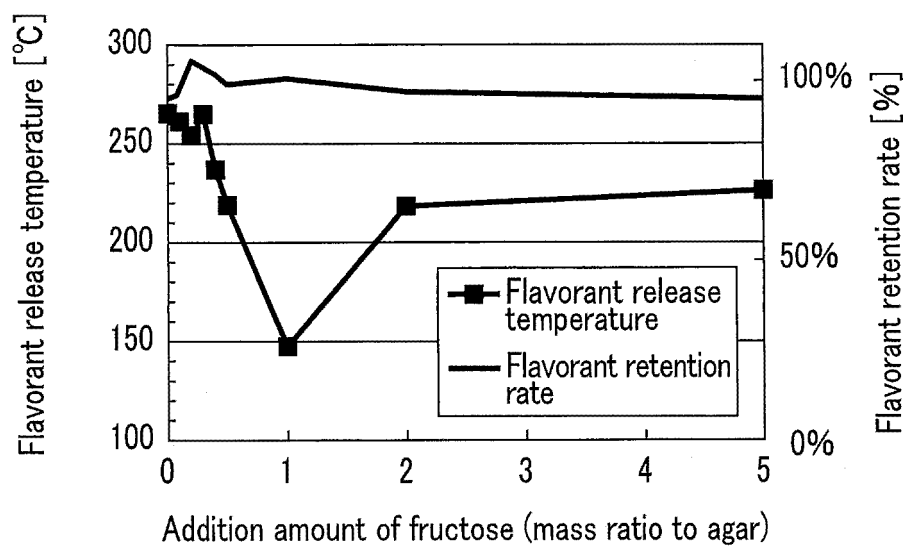


FIG. 6

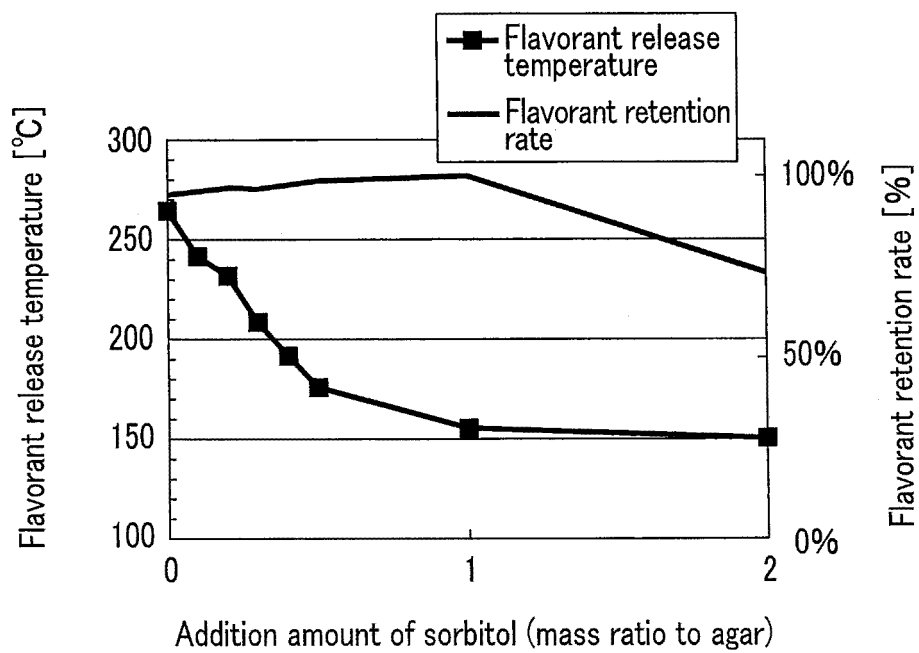


FIG. 7

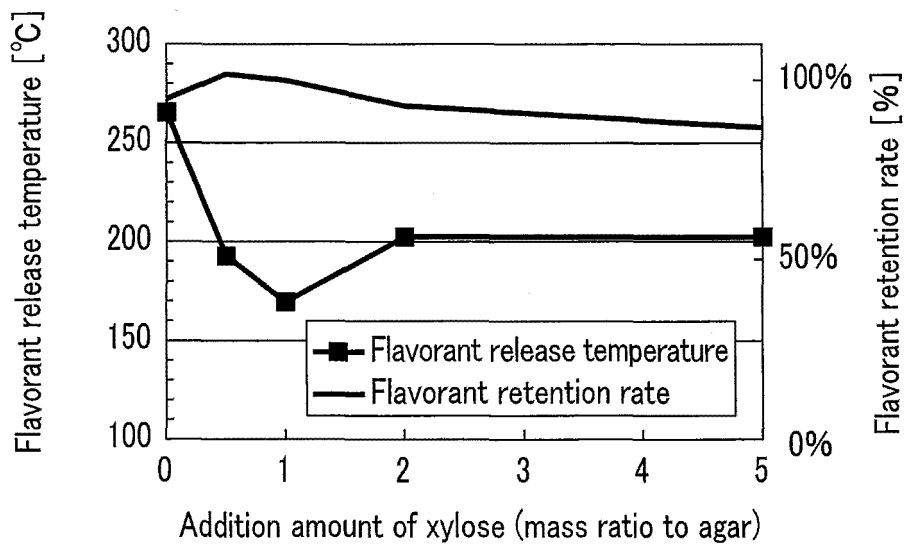


FIG. 8

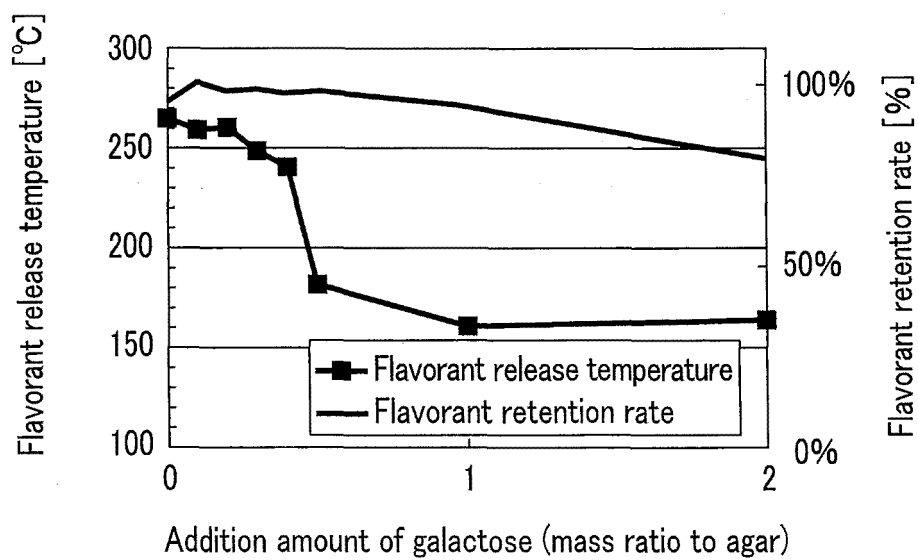


FIG. 9

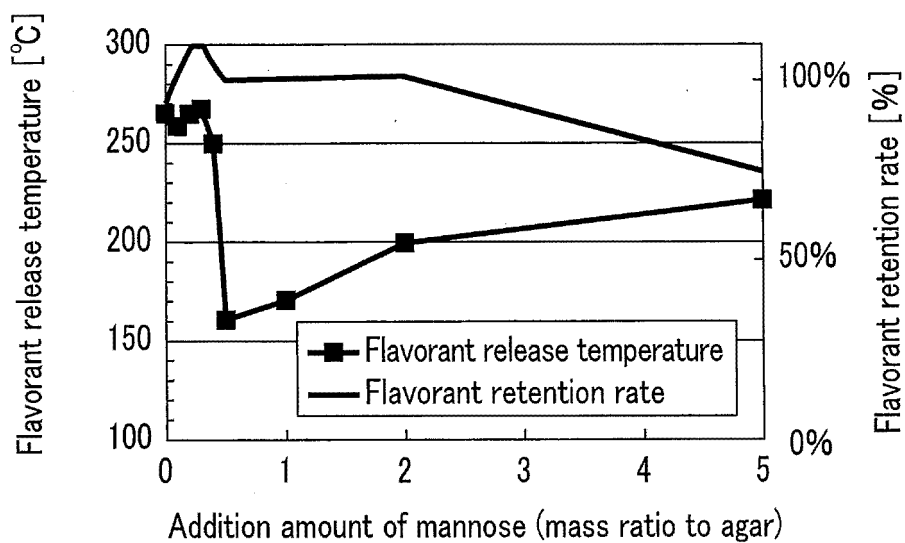


FIG. 10

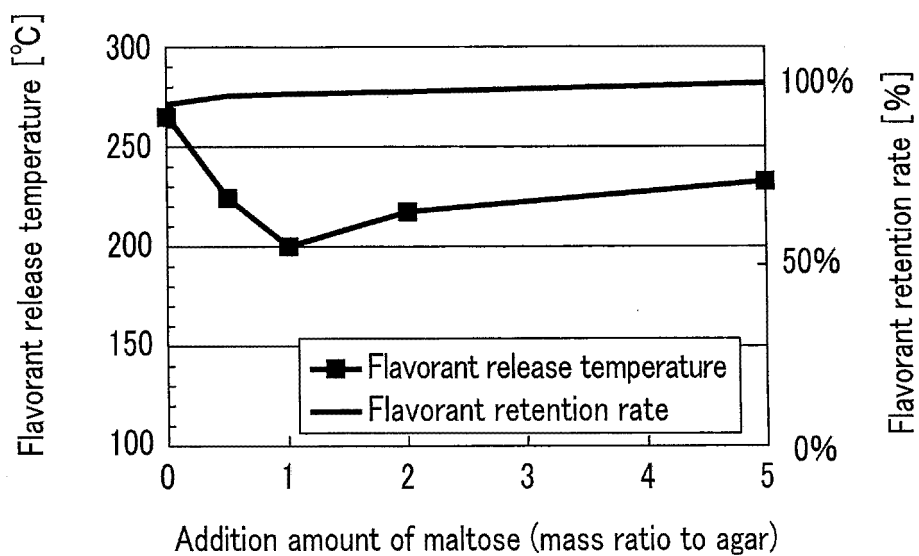


FIG. 11

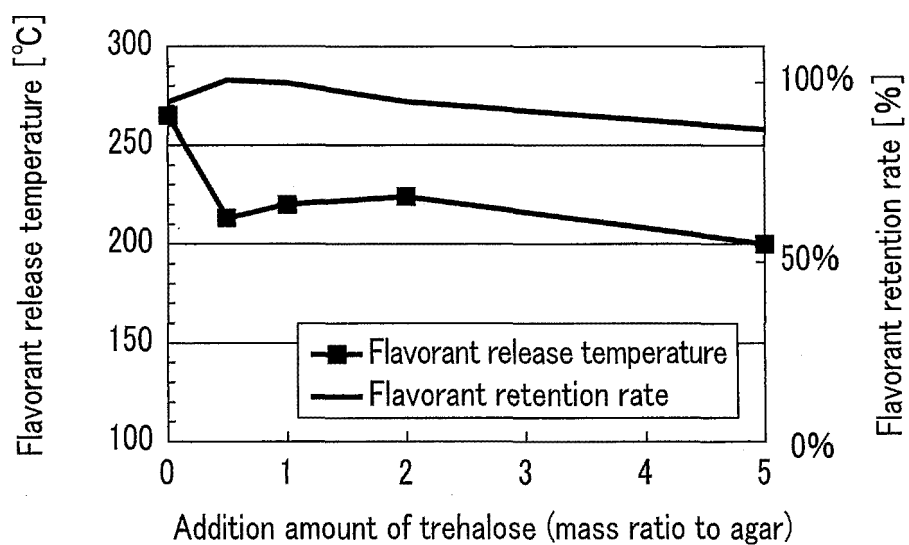


FIG. 12

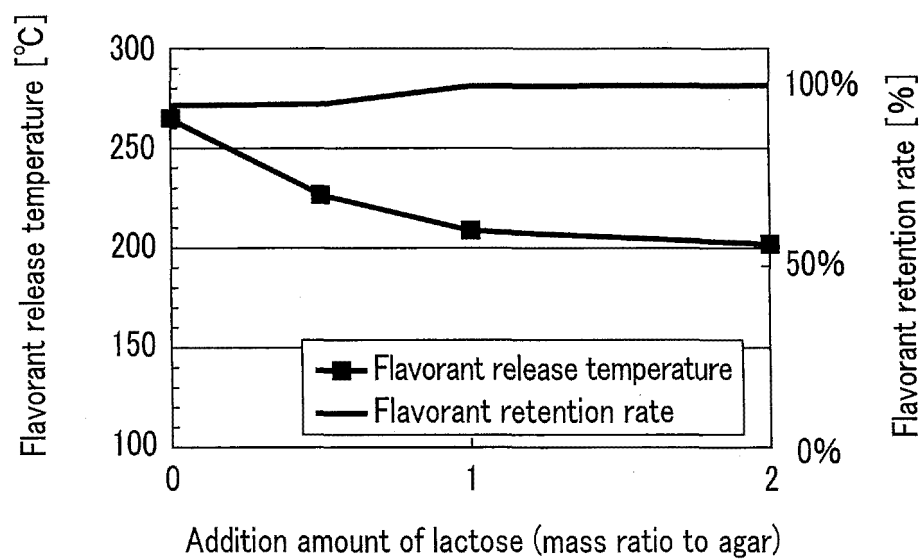


FIG. 13

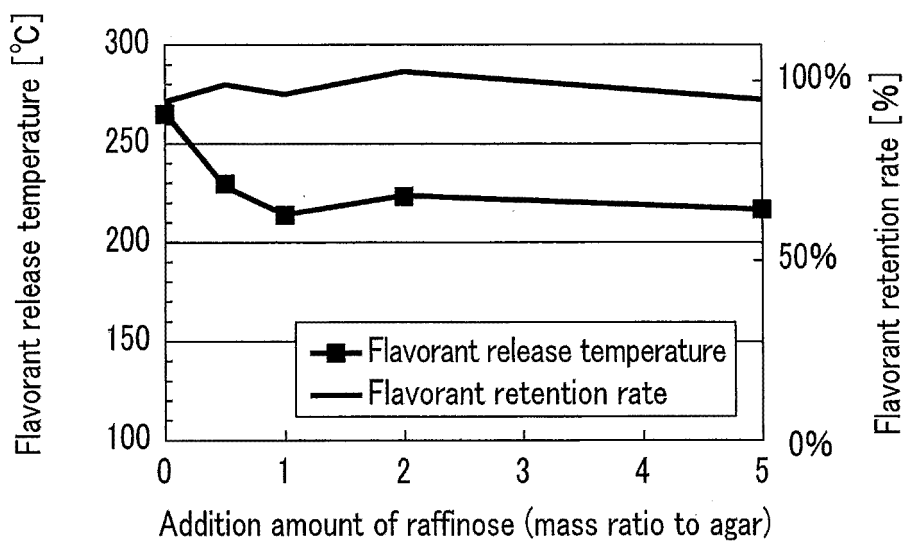


FIG. 14

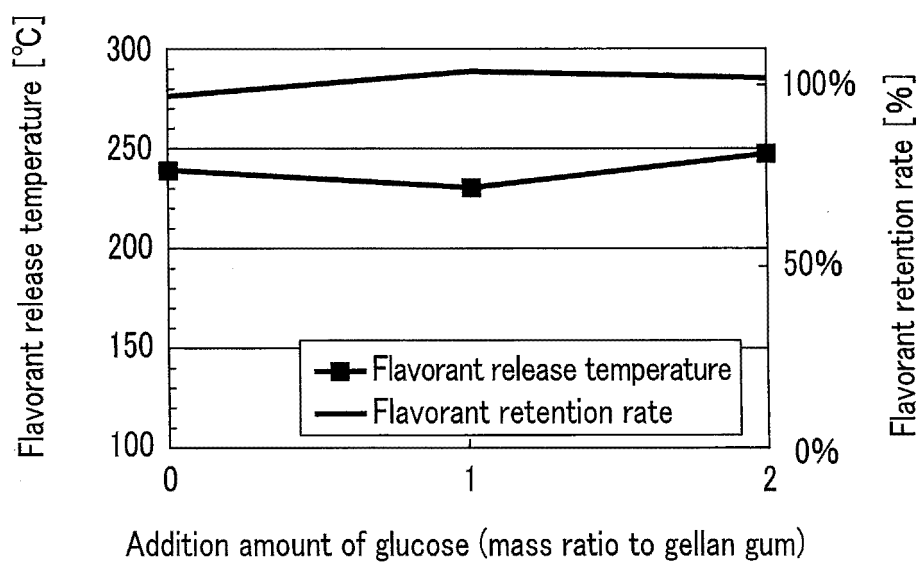


FIG. 15

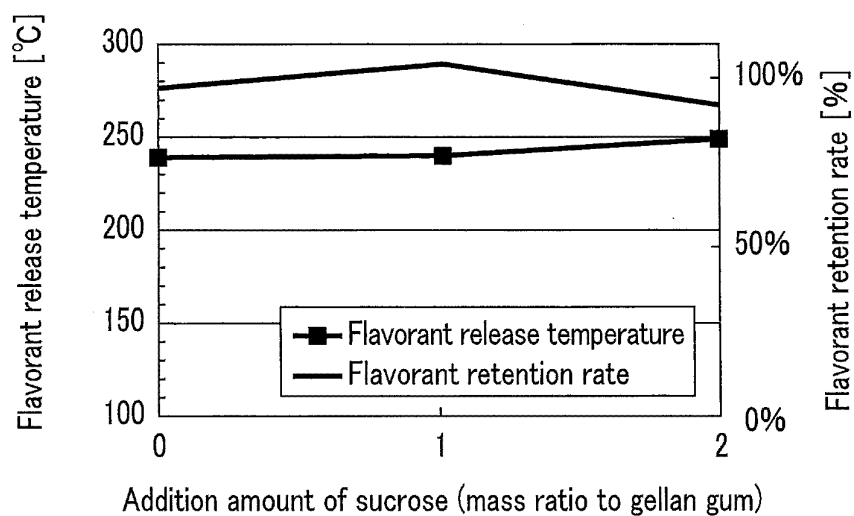


FIG. 16

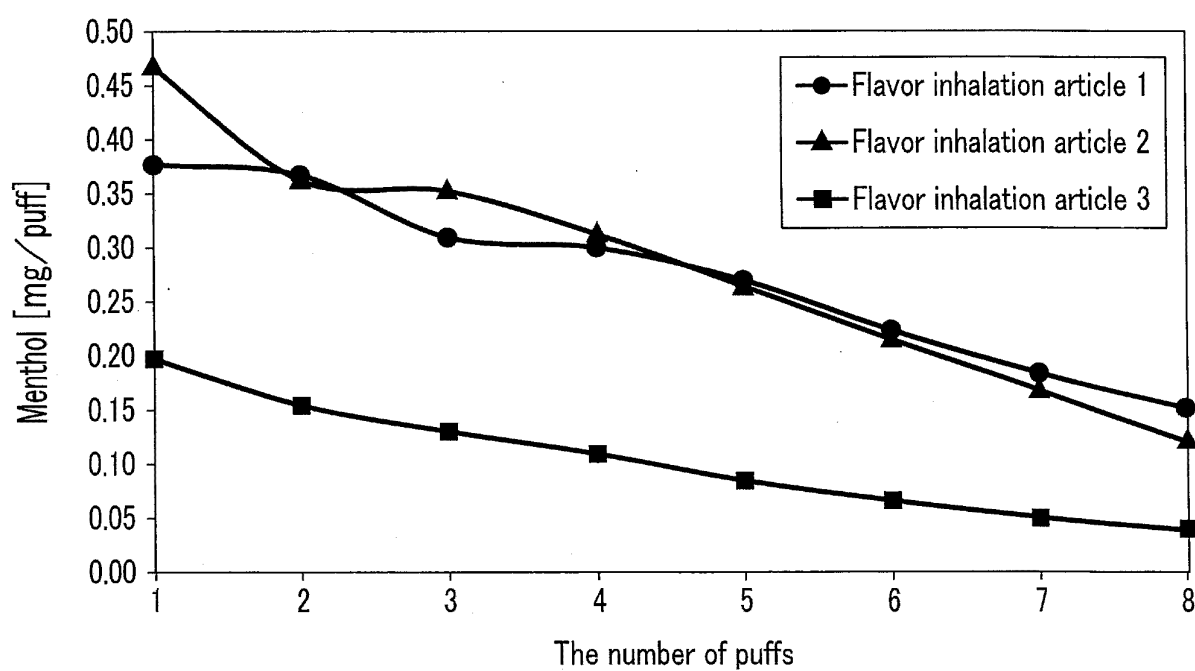


FIG. 17

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2019/020136

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. A24B15/30 (2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int. Cl. A24B15/30

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 1971-2019
Registered utility model specifications of Japan 1996-2019
Published registered utility model applications of Japan 1994-2019

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 2015-531793 A (RIGAS, Basil) 05 November 2015, paragraphs [0226]-[0251], [0304], [0305], fig. 1A-1G & US 2014/0088045 A1, paragraphs [0215]-[0240], [0287]-[0289], fig. 1A-1G & WO 2014/047569 A2 & CA 2885739 A1 & KR 10-2015-0084794 A & CN 104918621 A	1-9
X A	JP 2015-517818 A (PHILIP MORRIS PRODUCTS S.A.) 25 June 2015, paragraphs [0001], [0012]-[0115], fig. 1-4 & US 2015/0107610 A1, paragraphs [0001], [0011]-[0117], fig. 1-4 & WO 2013/178767 A1 & CA 2875187 A1 & CN 104379003 A & KR 10-2015-0021929 A	1, 5-9 2-4

☐ 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
05.08.2019

Date of mailing of the international search report
20.08.2019

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Telephone No.

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