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(54) **RECONSTITUTED TOBACCO FOR NON-COMBUSTION HEATING-TYPE FLAVOR INHALER AND METHOD FOR MANUFACTURING SAME, NON-COMBUSTION HEATING-TYPE FLAVOR INHALER, AND NON-COMBUSTION HEATING-TYPE FLAVOR INHALING SYSTEM**

(57) Provided is a reconstituted tobacco enabling control of power consumption per one non-combustion-heating-type flavor inhaler during use. The reconstituted tobacco for a non-combustion-heating-type flavor inhaler contains a tobacco material and a tobacco com-

ponent, wherein the tobacco material has a maximum absorbance of 0.40 or more in the wavelength range of 3200 to 3600 cm⁻¹ in a FT-IR analysis, and the specific heat of the tobacco material is 5 mJ/mg·°C or less.

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Description

TECHNICAL FIELD

[0001] The present invention relates to a reconstituted tobacco for a non-combustion-heating-type flavor inhaler and a method for manufacturing the reconstituted tobacco, a non-combustion-heating-type flavor inhaler, and a non-combustion-heating-type flavor inhaling system.

BACKGROUND ART

[0002] A combustion-type flavor inhaler (cigarette) generates flavor through combustion of a tobacco filler containing leaf tobacco. A non-combustion-heating-type flavor inhaler, which generates flavor by heating a tobacco filler instead of combusting the tobacco filler, has been proposed as an alternative of the combustion-type flavor inhaler. The heating temperature of the non-combustion-heating-type flavor inhaler is lower than the combustion temperature of the combustion-type flavor inhaler and is, for example, about 400°C or lower. Since the non-combustion-heating-type flavor inhaler is heated at low temperature, an aerosol generator, such as glycerine, is added to a tobacco filler in the non-combustion-heating-type flavor inhaler in order to increase the amount of smoke. The aerosol generator vaporizes due to heating to generate an aerosol. The aerosol, along with flavor components such as tobacco components, is supplied to the user, and the user can enjoy a satisfactory flavor.

[0003] A non-combustion-heating-type flavor inhaler can be used when a tobacco-containing segment filled with a tobacco filler is heated by, for example, a heater in a heating device. The heating device typically includes a battery unit, and the battery unit supplies electric power to heat a heater. From the viewpoint of user convenience, it is desirable to reduce the electric power consumption when using a non-combustion-heating-type flavor inhaler with a heating device to increase the operational time and the number of flavor inhalers that can be used.

[0004] PTL 1 discloses that a black liquor with a high vanillin content is obtained by digesting a tobacco raw material under alkaline conditions.

CITATION LIST

PATENT LITERATURE

[0005] PTL 1: Japanese Patent No. 6019216

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0006] One of the methods for reducing electric power consumption without changing product size is to improve a tobacco material contained in a non-combustion-heating-type flavor inhaler to reduce the electric power consumption per non-combustion-heating-type flavor inhaler.

[0007] The present invention is directed to: a reconstituted tobacco that can reduce electric power consumption per non-combustion-heating-type flavor inhaler during use; a non-combustion-heating-type flavor inhaler; and a non-combustion-heating-type flavor inhaling system.

SOLUTION TO PROBLEM

[0008] The present invention includes the following embodiments.

[1] A reconstituted tobacco for a non-combustion-heating-type flavor inhaler, the reconstituted tobacco including a tobacco material and a tobacco component,

wherein the tobacco material has a maximum absorbance of 0.40 or more at wavelengths from 3200 to 3600 cm⁻¹ in FT-IR analysis, and
the tobacco material has a specific heat of 5 mJ/mg·°C or less.

[2] The reconstituted tobacco according to [1], wherein an amount of water absorption when the tobacco material is immersed in water at 23°C for 900 seconds is from 4.0 to 6.0 g/g.

[3] The reconstituted tobacco according to [1] or [2], wherein the tobacco material has an angle of repose of 40° or less.

[4] The reconstituted tobacco according to any one of [1] to [3] including a tobacco extract obtained by extracting the tobacco component from a tobacco raw material.

[5] The reconstituted tobacco according to any one of [1] to [4], further including a binder.

[6] The reconstituted tobacco according to any one of [1] to [5], further including a fiber material.

[7] The reconstituted tobacco according to any one of [1] to [6], wherein the reconstituted tobacco is a reconstituted tobacco in sheet form, or a reconstituted tobacco in a form of sheet shreds obtained by shredding the reconstituted tobacco in sheet form.

[8] A non-combustion-heating-type flavor inhaler including a tobacco-containing segment filled with the reconstituted tobacco according to any one of [1] to [7].

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

the non-combustion-heating-type flavor inhaler according to [8]; and
a heating device that heats the tobacco-containing segment.

[10] A method for manufacturing the reconstituted tobacco according to any one of [1] to [7], the method including:

a step of extracting a tobacco component from a tobacco raw material to obtain a tobacco extract and a tobacco residue;

a step of subjecting the tobacco residue to an alkaline digestion treatment and then adjusting pH to 4.0 to 6.5; and

a step of adding the tobacco extract back to the tobacco residue after pH adjustment.

[11] The method according to [10], wherein the alkaline digestion treatment involves adding an alkali metal hydroxide to the tobacco residue and heating the tobacco residue at 130 to 230°C for 5 minutes to 6 hours.

ADVANTAGEOUS EFFECTS OF INVENTION

[0009] According to the present invention, there can be provided: a reconstituted tobacco that can reduce electric power consumption per non-combustion-heating-type flavor inhaler during use; a non-combustion-heating-type flavor inhaler; and a non-combustion-heating-type flavor inhaling system.

BRIEF DESCRIPTION OF DRAWINGS

[0010]

[Fig. 1] Fig. 1 is a cross-sectional view of an example non-combustion-heating-type flavor inhaler according to an embodiment.

[Fig. 2] Fig. 2 is a cross-sectional view of an example non-combustion-heating-type flavor inhaling system according to an embodiment, wherein Fig. 2(a) illustrates the non-combustion-heating-type flavor inhaler before being inserted into a heating device, and Fig. 2(b) illustrates the non-combustion-heating-type flavor inhaler that is inserted into the heating device and heated.

[Fig. 3] Fig. 3 is a graph showing the nicotine delivery level for each puff in Example 1, Comparative Example 1, and Comparative Example 3.

[Fig. 4] Fig. 4 is a graph showing the glycerine delivery level for each puff in Example 1, Comparative Example 1, and Comparative Example 3.

[Fig. 5] Fig. 5 is a graph showing the rate of nicotine transfer to mainstream smoke per electric power consumption (energy) versus the specific heat of a base material of a reconstituted tobacco in Example 1, Comparative Example 1, and Comparative Example 3.

DESCRIPTION OF EMBODIMENTS

[0011] A reconstituted tobacco according to this embodiment is a reconstituted tobacco for a non-combustion-heating-type flavor inhaler wherein the reconstituted tobacco includes a tobacco material and a tobacco component. The tobacco material has a maximum absorbance of 0.40 or more at wavelengths from 3200 to 3600 cm⁻¹ in FT-IR analysis. The tobacco material has a specific heat of 5 mJ/mg·°C or less.

[0012] The inventors of the present invention have considered that the use of a tobacco material with a low specific heat as a tobacco material in a non-combustion-heating-type flavor inhaler can improve the heating efficiency and, as a result, can reduce electric power consumption per non-combustion-heating-type flavor inhaler. As a result of diligent study, the inventors of the present invention have found that the electric power consumption per non-combustion-heating-type flavor

inhaler can be reduced by using a reconstituted tobacco containing a tobacco component and a tobacco material having a maximum absorbance of 0.40 or more at wavelengths from 3200 to 3600 cm^{-1} in FT-IR analysis and a specific heat of 5 $\text{mJ/mg} \cdot ^\circ\text{C}$ or less as a tobacco material for a non-combustion-heating-type flavor inhaler. In FT-IR analysis, the absorption at wavelengths from 3200 to 3600 cm^{-1} is attributed to the stretching vibration of hydroxyl groups. For example, the alkaline digestion treatment and subsequent neutralization treatment of a tobacco raw material can increase the amount of hydroxyl groups in the resulting tobacco material and increase the maximum absorbance described above. Since the tobacco raw material is neutralized after the alkaline digestion treatment in this case, the increase in the maximum absorbance is not caused by free OH but by hydroxyl groups covalently bonded to the tobacco material. The inventors of the present invention thus have found that when the amount of hydroxyl groups in the tobacco material is a certain level or more, the tobacco material has a low specific heat. The use of the tobacco material as a base material of a reconstituted tobacco can reduce the specific heat of the reconstituted tobacco and allows the temperature of the reconstituted tobacco to increase with less electric power during heating of the reconstituted tobacco. Therefore, the electric power consumption per non-combustion-heating-type flavor inhaler can be reduced. The term "reconstituted tobacco" refers to a tobacco material that has been reconstituted by mixing a tobacco component with other materials.

[0013] The reconstituted tobacco according to this embodiment can contain, for example, a binder, a fiber material, and an aerosol generator, in addition to the tobacco material and the tobacco component.

(Tobacco Material)

[0014] The tobacco material according to this embodiment has a maximum absorbance of 0.40 or more at wavelengths from 3200 to 3600 cm^{-1} in FT-IR analysis. When the maximum absorbance in the wavelength range of 3200 to 3600 cm^{-1} , which is attributed to the stretching vibration of hydroxyl groups, is 0.40 or more, the tobacco material has a reduced specific heat, and the entire reconstituted tobacco has a reduced specific heat, so that the electric power consumption per non-combustion-heating-type flavor inhaler can be reduced. The maximum absorbance at the wavelengths from 3200 to 3600 cm^{-1} is preferably 0.42 or more, more preferably 0.45 or more. The upper limit of the range of the maximum absorbance at the wavelengths from 3200 to 3600 cm^{-1} is not limited and may be, for example, 1.0 or less.

[0015] The FT-IR analysis of the tobacco material can be conducted by using the following method. A sample of the tobacco material is brought into close contact with a diamond crystal for ATR measurements, and the infrared absorption spectrum is measured. A Fourier transform infrared spectrometer (product name: Thermo Scientific Nicolet iS50, available from Thermo Scientific) can be used as a measurement device. The measurement can be performed under the following conditions: measurement method: ATR method, resolution: 4 cm^{-1} , the number of scans: 32 times ($n = 2$).

[0016] A method for allowing the tobacco material to have a maximum absorbance of 0.40 or more involves, for example, the alkaline digestion treatment and subsequent neutralization of the tobacco raw material. Examples of the tobacco raw material include leaf tobacco, tobacco leaf veins, stems, roots, flowers, and other parts. These tobacco raw materials may be in shredded or powder form. The type of leaf tobacco is not limited, and any type of leaf tobacco can be used. Examples of the type of leaf tobacco include yellow varieties, Burley varieties, local varieties, oriental leaves, and other varieties, and fermented leaves thereof. These tobacco raw materials may be used singly or in combination of two or more. In particular, the tobacco raw material to be treated with alkaline digestion is preferably a tobacco residue remaining after extraction of the tobacco component from the tobacco raw material into a tobacco extract. This is because the use of the tobacco residue, which is usually discarded, can reduce the environmental impact and also offers cost advantages. In addition, the obtained tobacco extract can be used as a tobacco component in the reconstituted tobacco. The method of alkaline digestion treatment and neutralization is, for example, the method of alkaline digestion treatment and neutralization in a method for manufacturing a reconstituted tobacco according to this embodiment described below.

[0017] The tobacco material has a specific heat of 5 $\text{mJ/mg} \cdot ^\circ\text{C}$ or less. The tobacco material having a specific heat of 5 $\text{mJ/mg} \cdot ^\circ\text{C}$ or less can sufficiently reduce the specific heat of the entire reconstituted tobacco and can thus reduce the electric power consumption per non-combustion-heating-type flavor inhaler. The specific heat is preferably 4 $\text{mJ/mg} \cdot ^\circ\text{C}$ or less, more preferably 3 $\text{mJ/mg} \cdot ^\circ\text{C}$ or less, still more preferably 2 $\text{mJ/mg} \cdot ^\circ\text{C}$ or less. The specific heat is preferably as low as possible. The lower limit of the range of the specific heat is not limited and may be, for example, 0.1 $\text{mJ/mg} \cdot ^\circ\text{C}$ or more. The tobacco material may have a specific heat of 5 $\text{mJ/mg} \cdot ^\circ\text{C}$ or less, for example, when the maximum absorbance at wavelengths from 3200 to 3600 cm^{-1} is 0.40 or more in FT-IR analysis.

[0018] The specific heat of the tobacco material is represented by the maximum specific heat capacity ($\text{mJ/mg} \cdot ^\circ\text{C}$) up to 300 $^\circ\text{C}$, as measured by DSC (differential scanning calorimetry). For example, the specific heat can be measured by using a differential scanning calorimeter (product name: DSC7020, available from Hitachi High-Tech Science Corporation) under the following conditions. Heating rate: 10 $^\circ\text{C}/\text{min}$, holding time: 2 min, pan: Al, sample mass: 10 mg, reference: Al_2O_3 .

[0019] The amount of water absorption when the tobacco material is immersed in water at 23 $^\circ\text{C}$ for 900 seconds is preferably from 4.0 to 6.0 g/g. When the amount of water absorption is from 4.0 to 6.0 g/g, the tobacco material is less sticky and has good handling properties, and it is easy to feed the raw material during the feeding process. It is also easy to perform rolling-up during rolling-up in the manufacture of the non-combustion-heating-type flavor inhaler. The amount of

water absorption is more preferably from 4.2 to 5.8 g/g, still more preferably from 4.5 to 5.5 g/g.

[0020] The amount of water absorption of the tobacco material can be measured by using the following method. A $\phi 55 \times 80$ mm stainless steel tube with 19 holes having a diameter of 1 mm is prepared as a tubular container. A piece of filter paper is placed in the tubular container, and 3 to 6 g of a sample of the tobacco material is placed on the filter paper. Tap water is poured into a bath, and the tubular container is placed in the bath. The mass is measured after 900 seconds to determine the amount of water absorption per gram. The measurement is performed three times, and the average value is used as the amount of water absorption.

[0021] The tobacco material preferably has an angle of repose of 40° or less. The angle of repose of 40° or less is preferred from a manufacturing perspective because it is easy to feed the raw material during the feeding process in the manufacture of the reconstituted tobacco. The angle of repose is more preferably from 10° to 40° , still more preferably from 20° to 30° .

[0022] The angle of repose of the tobacco material can be measured by using the following method. A sample of the tobacco material is dropped through a funnel from 4 cm above a $25 \text{ mm} \times 25 \text{ mm}$ measuring table (PEEK material). When the sample is dropped to the extent that the sample spills from the table, the sample is photographed, and the angle is measured by using image analysis software (microscope available from Keyence Corporation). This measurement is performed three times, and the average value is used as the value of the angle of repose.

[0023] The amount of the tobacco material in the reconstituted tobacco is preferably from 20 to 80 mass%, more preferably from 20 to 65 mass%, still more preferably from 30 to 50 mass%, relative to the mass (100%) of the reconstituted tobacco.

(Tobacco Component)

[0024] The tobacco component is derived from tobacco in the tobacco raw material and mainly includes components that contribute to the inhaling flavor. The reconstituted tobacco according to this embodiment may contain the tobacco component as a simple substance, but preferably contains the tobacco component as a tobacco extract obtained by extracting the tobacco component from the tobacco raw material. Since the tobacco residue remaining after obtaining the tobacco extract can be used as a raw material for the tobacco material in this case, the environmental impact can be reduced, and it also offers cost advantages. The amount of the tobacco component in the reconstituted tobacco can be appropriately set according to the desired flavor.

(Binder)

[0025] The reconstituted tobacco according to this embodiment preferably contains a binder. When the reconstituted tobacco contains the binder, the raw material can be bonded together and the reconstituted tobacco can be formed into a desired shape. Examples of the type of binder include, but are not limited to, guar gum, xanthan gum, CMC (carboxymethyl cellulose), CMC-Na (carboxymethyl cellulose sodium salt), waxy corn starch, and potato starch. These binders may be used singly or in combination of two or more. The amount of the binder in the reconstituted tobacco is preferably from 1 to 10 mass%, more preferably from 3 to 6 mass%, relative to the mass (100 mass%) of the reconstituted tobacco.

(Fiber Material)

[0026] The reconstituted tobacco according to this embodiment preferably contains a fiber material. When the reconstituted tobacco contains the fiber material, the reconstituted tobacco is easy to form during shaping and can maintain its shape. Examples of the type of fiber material include, but are not limited to, pulp. The pulp may be wood pulp, such as softwood pulp and hardwood pulp, or may be a combination of wood pulp and non-wood pulp commonly used in wrapping paper for tobacco products, such as flax pulp, sisal pulp, or esparto. The amount of the fiber material in the reconstituted tobacco is preferably from 1 to 15 mass%, more preferably from 3 to 10 mass%, relative to the mass (100 mass%) of the reconstituted tobacco.

(Aerosol Generator)

[0027] The reconstituted tobacco according to this embodiment can contain an aerosol generator. The aerosol generator refers to a material that generates aerosol when cooled after heating. Examples of the aerosol generator include polyhydric alcohols, such as glycerine, propylene glycol, sorbitol, xylitol, and erythritol; and triacetin, and 1,3-butanediol. These aerosol generators may be used singly or in combination of two or more. The amount of the aerosol generator in the reconstituted tobacco is preferably from 5 to 40 mass%, more preferably from 10 to 25 mass%, relative to the mass (100 mass%) of the reconstituted tobacco.

(Other Materials)

[0028] The reconstituted tobacco according to this embodiment can contain other materials, such as a flavoring agent, in addition to the tobacco material, the tobacco component, the binder, the fiber material, and the aerosol generator. The type of flavoring agent is not limited and particularly preferably menthol in order to impart a good flavor. Flavoring agents may be used singly or in combination of two or more. The amount of other materials in the reconstituted tobacco is preferably 10 mass% or less, more preferably 5 mass% or less, relative to the mass (100 mass%) of the reconstituted tobacco. The reconstituted tobacco according to this embodiment may not contain other materials.

(Shape of Reconstituted Tobacco)

[0029] The reconstituted tobacco according to this embodiment is preferably a reconstituted tobacco in sheet form, or a reconstituted tobacco in a form of sheet shreds obtained by shredding the reconstituted tobacco in sheet form. When the reconstituted tobacco is in sheet form, the tobacco material, the tobacco component, the binder, the aerosol generator, and other components can be homogenized, and the aerosol generator and the flavor component can be efficiently heated and atomized during heating. When the reconstituted tobacco is in the form of sheet shreds, it is also possible to obtain manufacturing suitability, such as improved efficiency during rolling-up. When the reconstituted tobacco is in sheet form, the length and width of the sheet is not limited and can be adjusted according to the filling manner. When the reconstituted tobacco is in the form of sheet shreds, for example, the width of the sheet shreds can be from 0.4 to 1.5 mm, and the length of the sheet shreds can be from 5 to 15 mm. The thickness of the sheet or sheet shreds is preferably from 50 to 800 μm , more preferably from 100 to 600 μm , from the balance between heat transfer efficiency and strength.

[0030] The reconstituted tobacco according to this embodiment may be a non-woven tobacco sheet (laminate sheet). The laminate sheet is obtained by sandwiching a mixture containing the tobacco material, the tobacco component, and the binder between nonwoven fabrics and forming the resulting laminate into a certain shape by heat fusing.

<Method for Manufacturing Reconstituted Tobacco>

[0031] A method for manufacturing the reconstituted tobacco according to this embodiment includes the following steps: a step (hereinafter also referred to as "extraction step") of extracting a tobacco component from a tobacco raw material to obtain a tobacco extract and a tobacco residue; a step (hereinafter also referred to as "alkaline digestion treatment step") of subjecting the tobacco residue to an alkaline digestion treatment and then adjusting pH to 4.0 to 6.5; and a step (hereinafter also referred to as "adding back step") of adding the tobacco extract back to the tobacco residue after pH adjustment. According to the foregoing method, the reconstituted tobacco according to this embodiment can be manufactured easily and efficiently. In addition, environmental impact and costs can be reduced. The method according to this embodiment may include other steps, such as a forming step, in addition to the extraction step, the alkaline digestion treatment step, and the adding back step.

(Extraction Step)

[0032] This step involves extracting a tobacco component from a tobacco raw material to obtain a tobacco extract and a tobacco residue. Any method can be used to extract the tobacco component from the tobacco raw material, and the tobacco component can be extracted by, for example, immersing the tobacco raw material in a solvent. Alternatively, the vapor generated by heating the tobacco raw material to volatilize the tobacco component from the tobacco raw material may be collected.

[0033] When the tobacco component is extracted by immersing the tobacco raw material in a solvent, the solvent may be, for example, water, an alcohol, such as ethanol, or ethyl acetate. The extraction temperature and the extraction time may be, for example, from 10 to 60°C for 1 to 3 hours, depending on the extraction solvent. When the vapor generated by heating the tobacco raw material to volatilize the tobacco component from the tobacco raw material is collected, the heating temperature for the tobacco material may be, for example, from 150 to 300°C. Any method can be used to collect the vapor and, for example, the following method may be used: the generated vapor is collected by cooling; the generated vapor is passed through a solvent, such as distilled water, ethanol, hexane, 2-propanol, 1-propanol, propylene glycol, or glycerine, and collected in the solvent; or the generated vapor is collected by using, for example, an adsorbent, a column, or a filter, and the tobacco component is then eluted.

(Alkaline Digestion Treatment Step)

[0034] This step involves subjecting the tobacco residue obtained in the extraction step to an alkaline digestion treatment and then adjusting pH to 4.0 to 6.5. The alkaline digestion treatment refers to the addition of an alkaline

substance to the raw material followed by heat treatment. The alkaline digestion treatment includes the kraft pulping method using a mixture of sodium hydroxide and sodium sulfate, the soda pulping method using a sodium hydroxide aqueous solution, the acid sulfite method using bisulfite and sulfur dioxide gas, and the neutral sulfite method using sodium hydroxide and bisulfite. The alkaline substance is preferably, but not necessarily, an alkali metal hydroxide, such as sodium hydroxide. The alkaline substance may be added as an aqueous solution of the alkaline substance. When the alkaline substance is added as an aqueous solution (chemical solution) of the alkaline substance, for example, the ratio of the tobacco residue (g) to the chemical solution (mL) is preferably from 1:2 to 1:100, more preferably from 1:3 to 1:100, still more preferably from 1:3 to 1:50, yet still more preferably from 1:5 to 1:50, yet still more preferably from 1:10 to 1:50, although the amount of the chemical solution added depends on the pH of the chemical solution.

[0035] The alkaline digestion treatment is typically performed at 120°C to 180°C. In this embodiment, the alkaline digestion treatment can also be performed at the typical temperatures described above, but preferably at 130°C to 230°C, more preferably at 150°C to 180°C. The treatment time for the alkaline digestion treatment is not limited as long as the tobacco residue is sufficiently evaporated. The treatment time is, for example, preferably from 5 minutes to 6 hours, more preferably from 30 minutes to 6 hours, still more preferably from 1 hour to 6 hours, depending on the pH of the chemical solution used and other factors.

[0036] After the alkaline digestion treatment, the pH of the tobacco residue is adjusted to 4.0 to 6.5. The pH can be adjusted by using a pH adjuster, such as citric acid, hydrochloric acid, sulfuric acid, or nitric acid. The pH is preferably from 4.5 to 6.0, more preferably from 5.0 to 6.0. The pH of the tobacco residue can be measured by using the following method. Ultrapure water (10 mL) is added to 1 g of a sample of the tobacco residue, followed by shaking at 200 rpm for 10 minutes. The pH of the resulting liquid is measured with a benchtop pH meter (product name: SS211, available from HORIBA, Ltd.).

(Adding Back Step)

[0037] This step involves adding the tobacco extract back to the tobacco residue after pH adjustment. In this step, the tobacco component previously extracted from the tobacco raw material is returned to the tobacco residue. The tobacco residue with reduced specific heat is used as a base material, and the tobacco component is returned to the base material to obtain the reconstituted tobacco with a low specific heat. Any method can be used to add the tobacco extract back to the tobacco residue. For example, the tobacco extract can be added back to the tobacco residue by adding the tobacco extract to the tobacco residue and mixing them so that the tobacco residue is impregnated with the tobacco extract. After the adding back, the tobacco residue containing the tobacco extract may be dried.

(Forming Step)

[0038] In the method according to this embodiment, the obtained reconstituted tobacco may be formed into a sheet, sheet shreds, or other shapes. For example, the tobacco residue containing the tobacco component obtained in the adding back step, the binder, and the fiber material can be mixed and formed into a sheet shape by using a known method, such as a papermaking method, a casting method, or a rolling method. The reconstituted tobacco in sheet form can also be shredded and formed into sheet shreds.

[Non-Combustion-Heating-Type Flavor Inhaler]

[0039] The non-combustion-heating-type flavor inhaler according to this embodiment includes a tobacco-containing segment filled with the reconstituted tobacco according to this embodiment. Since the non-combustion-heating-type flavor inhaler according to this embodiment includes the tobacco-containing segment filled with the reconstituted tobacco according to this embodiment, the temperature of the tobacco-containing segment can be raised with less electric power during heating of the tobacco-containing segment. Therefore, the electric power consumption per non-combustion-heating-type flavor inhaler can be reduced.

[0040] Fig. 1 illustrates an example of the non-combustion-heating-type flavor inhaler according to this embodiment. A non-combustion-heating-type flavor inhaler 1 illustrated in Fig. 1 includes a tobacco-containing segment 2 filled with the reconstituted tobacco according to this embodiment, a tubular cooling segment 3 having a perforation 8 on its circumference, a center hole segment 4, and a filter segment 5. The non-combustion-heating-type flavor inhaler according to this embodiment may include other segments, in addition to the tobacco-containing segment, the cooling segment, the center hole segment, and the filter segment.

[0041] The axial length of the non-combustion-heating-type flavor inhaler according to this embodiment is preferably, but not necessarily, 40 mm or more and 90 mm or less, more preferably 50 mm or more and 75 mm or less, more preferably 50 mm or more and 60 mm or less. The length of the circumference of the non-combustion-heating-type flavor inhaler is preferably 16 mm or more and 25 mm or less, more preferably 20 mm or more and 24 mm or less, still more preferably 21 mm or more and 23 mm or less. In one aspect, for example, the tobacco-containing segment has a length of 20 mm, the

cooling segment has a length of 20 mm, the center hole segment has a length of 8 mm, and the filter segment has a length of 7 mm. The length of the filter segment can be selected in the range of 4 mm or more and 10 mm or less. The ventilation resistance of the filter segment in this case can be selected in the range of 15 mmH₂O/seg or more and 60 mmH₂O/seg or less per segment. The length of each segment can be appropriately changed according to manufacturing suitability, required quality, and other factors. Furthermore, even if only the filter segment is placed downstream of the cooling segment without the center hole segment, the flavor inhaler can still function as a non-combustion-heating-type flavor inhaler.

(Tobacco-Containing Segment)

[0042] In the tobacco-containing segment 2, the reconstituted tobacco according to this embodiment is filled in a sheet of wrapping paper (hereinafter also referred to as a wrapper). Any method can be used to fill the reconstituted tobacco in the wrapping paper. For example, the reconstituted tobacco may be wrapped with the wrapper, or the reconstituted tobacco may be filled in a tubular wrapper. When the reconstituted tobacco has a shape with a longitudinal direction, such as a rectangle, the reconstituted tobacco may be filled such that the longitudinal direction is randomly oriented in the wrapper, or may be filled such that the longitudinal direction is aligned in the axial direction of the tobacco-containing segment 2 or in the direction perpendicular to the axial direction.

(Cooling Segment)

[0043] Referring to Fig. 1, the cooling segment 3 is composed of a tubular member 7 in one aspect. The tubular member 7 may be, for example, a paper tube made by processing cardboard into a tubular shape.

[0044] The tubular member 7 and a mouthpiece lining paper 12 described below have a perforation 8 penetrating both the tubular member 7 and the mouthpiece lining paper 12. The perforation 8 allows outside air to be introduced into the cooling segment 3 during inhalation. With this structure, the vaporized aerosol components generated by heating the tobacco-containing segment 2 come into contact with outside air and decrease in temperature so that the vaporized aerosol components become liquid to form aerosol. The perforation 8 may have any diameter (diameter length), and may have a diameter of, for example, of 0.5 mm or more and 1.5 mm or less. The number of perforations 8 is not limited, and may be one or two or more. For example, the cooling segment 3 may have a plurality of the perforations 8 on its circumference.

[0045] The amount of outside air introduced through the perforation 8 is preferably 85 vol% or less, more preferably 80 vol% or less, of the volume of the whole gas inhaled by the user. When the proportion of the outside air is 85 vol% or less, it is possible to sufficiently reduce the loss of flavor caused by dilution with outside air. This proportion is also referred to as ventilation ratio. The lower limit of the range of the ventilation ratio is preferably 55 vol% or more, more preferably 60 vol% or more, from the viewpoint of cooling performance.

[0046] The cooling segment may include a wrinkled, pleated, gathered, or folded sheet made of a suitable material. The cross-sectional profile of such an element may show randomly oriented channels. The cooling segment may also include a bundle of longitudinally extending tubes. Such a cooling segment can be formed by, for example, wrapping a pleated, gathered, or folded sheet material with a sheet of wrapping paper.

[0047] The axial length of the cooling segment may be, for example, 7 mm or more and 28 mm or less, and may be, for example, 18 mm. The cooling segment may have a substantially circular axial cross-section. The diameter of the axial cross-section may be, for example, 5 mm or more and 10 mm or less, and may be, for example, about 7 mm.

(Center Hole Segment)

[0048] The center hole segment includes a filler layer having one or more hollows and an inner plug wrapper (inner wrapping paper) covering the filler layer. For example, referring to Fig. 1, the center hole segment 4 includes a first filler layer 9 having a hollow and a first inner plug wrapper 10 covering the first filler layer 9. The center hole segment 4 has the function of increasing the strength of a mouthpiece segment 6. The first filler layer 9 may be, for example, a rod that has an inside diameter of $\phi 1.0$ mm or more and $\phi 5.0$ mm or less and that is formed by densely filling a cellulose acetate fiber and adding 6 mass% or more and 20 mass% or less of a triacetin-containing plasticizer relative to the mass of the cellulose acetate followed by curing. Since the first filler layer 9 has a high fiber filling density, air or aerosol flows through only the hollow and hardly flows in the first filler layer 9 during inhalation. Since the first filler layer 9 inside the center hole segment 4 is a fiber-filled layer, the touch feeling from outside during use is less likely to make the user uncomfortable. The center hole segment 4 may retain its shape through hot molding instead of having the first inner plug wrapper 10.

(Filter Segment)

[0049] The filter segment 5 may have any structure and may include one or more filler layers. The filler layer may be

wrapped with one or more sheets of wrapping paper. The ventilation resistance per segment of the filter segment 5 can be appropriately changed by, for example, changing the amount and material of the filler filled in the filter segment 5. For example, when the filler is cellulose acetate fiber, the ventilation resistance can be increased by increasing the amount of cellulose acetate fiber filled in the filter segment 5. When the filler is cellulose acetate fiber, the filling density of the cellulose acetate fiber may be from 0.13 to 0.18 g/cm³. The ventilation resistance is measured by using a ventilation resistance meter (product name: SODIMAX, available from SODIM).

[0050] The length of the circumference of the filter segment 5 is not limited, and preferably from 16 to 25 mm, more preferably from 20 to 24 mm, still more preferably from 21 to 23 mm. The axial length of the filter segment 5 can be selected in the range of 4 to 10 mm such that the ventilation resistance of the filter segment 5 becomes 15 to 60 mm H₂O/seg. The axial length of the filter segment 5 is preferably from 5 to 9 mm, more preferably from 6 to 8 mm. The cross-sectional shape of the filter segment 5 is not limited, and may be, for example, a circular, elliptical, or polygonal shape. Flavoring agent-containing destructible capsules, flavoring agent beads, or a flavoring agent may be directly added to the filter segment 5.

[0051] Referring to Fig. 1, the center hole segment 4 can be connected to the filter segment 5 with an outer plug wrapper (outer wrapping paper) 11. The outer plug wrapper 11 may be, for example, paper having a tubular shape. The tobacco-containing segment 2, the cooling segment 3, and the center hole segment 4 connected to the filter segment 5 can be connected to each other with the mouthpiece lining paper 12. These connections are established by, for example, applying a vinyl acetate glue or other glues to the inner surface of the mouthpiece lining paper 12 and wrapping the three segments with the mouthpiece lining paper 12. These segments may be connected to each other with multiple sheets of the lining paper multiple times.

[Non-Combustion-Heating-Type Flavor Inhaling System]

[0052] The non-combustion-heating-type flavor inhaling system according to this embodiment includes the non-combustion-heating-type flavor inhaler according to this embodiment, and a heating device that heats the tobacco-containing segment of the non-combustion-heating-type flavor inhaler. Since the non-combustion-heating-type flavor inhaling system according to this embodiment includes the non-combustion-heating-type flavor inhaler according to this embodiment, the electric power consumption per non-combustion-heating-type flavor inhaler can be reduced. The non-combustion-heating-type flavor inhaling system according to this embodiment may include other structures in addition to the non-combustion-heating-type flavor inhaler according to this embodiment and the heating device.

[0053] Fig. 2 illustrates an example of the non-combustion-heating-type flavor inhaling system according to this embodiment. Since the non-combustion-heating-type flavor inhaling system illustrated in Fig. 2 includes the non-combustion-heating-type flavor inhaler 1 according to this embodiment, and a heating device 13 that heats the tobacco-containing segment of the non-combustion-heating-type flavor inhaler 1 from outside.

[0054] Fig. 2(a) illustrates the non-combustion-heating-type flavor inhaler 1 before being inserted into the heating device 13, and Fig. 2(b) illustrates the non-combustion-heating-type flavor inhaler 1 that is inserted into the heating device 13 and heated. The heating device 13 illustrated in Fig. 2 includes a body 14, a heater 15, a metal tube 16, a battery unit 17, and a control unit 18. The body 14 has a cylindrical recess 19 and has the heater 15 and the metal tube 16 on the inner side surface of the recess 19 at a position corresponding to the tobacco-containing segment of the non-combustion-heating-type flavor inhaler 1 to be inserted into the recess 19. The heater 15 may be a heater using electrical resistance, and electric power is supplied from the battery unit 17 upon instructions from the control unit 18, which performs temperature control, to heat the heater 15. The heat generated by the heater 15 is transferred to the tobacco-containing segment of the non-combustion-heating-type flavor inhaler 1 through the metal tube 16 having high thermal conductivity.

[0055] In Fig. 2(b), the view is schematic, and a gap is present between the outer circumference of the non-combustion-heating-type flavor inhaler 1 and the inner circumference of the metal tube 16. Ideally, no gap is present between the outer circumference of the non-combustion-heating-type flavor inhaler 1 and the inner circumference of the metal tube 16 in order to efficiently transfer heat. The heating device 13 heats the tobacco-containing segment of the non-combustion-heating-type flavor inhaler 1 from outside, but may heat the tobacco-containing segment from inside.

[0056] The heating temperature of the heating device is preferably, but not necessarily, 400°C or lower, more preferably 150°C or higher and 400°C or lower, still more preferably 200°C or higher and 350°C or lower. The heating temperature refers to the temperature of the heater in the heating device.

EXAMPLES

[0057] The embodiments will be described below in more detail by way of Examples, but the embodiments are not limited to these Examples. The following methods were used to measure the maximum absorbance at wavelengths from 3200 to 3600 cm⁻¹ in FT-IR analysis, the amount of water absorption, the angle of repose, and the specific heat and evaluate the stickiness.

[Measurement of Maximum Absorbance at Wavelengths from 3200 to 3600 cm^{-1} in FT-IR Analysis]

[0058] The maximum absorbance at wavelengths from 3200 to 3600 cm^{-1} in the FT-IR analysis of the tobacco material was measured by using the following method. A sample of the tobacco material was brought into close contact with a diamond crystal for ATR measurements, and the infrared absorption spectrum was measured. A Fourier transform infrared spectrometer (product name: Thermo Scientific Nicolet iS50, available from Thermo Scientific) was used as a measurement device. The measurement was performed under the following conditions: measurement method: ATR method, resolution: 4 cm^{-1} , and the number of scans: 32 times ($n = 2$).

[Measurement of Amount of Water Absorption]

[0059] The amount of water absorption of the tobacco material was measured by using the following method. A $\phi 55 \times 80$ mm stainless steel tube with 19 holes having a diameter of 1 mm was prepared as a tubular container. A piece of filter paper was placed in the tubular container, and 3 to 6 g of a sample of the tobacco material was placed on the filter paper. Tap water was poured into a bath, and the tubular container was placed in the bath. The mass was measured after 900 seconds to determine the amount of water absorption per gram. The measurement was performed three times, and the average value was used as the amount of water absorption at each time point.

[Measurement of Angle of Repose]

[0060] The angle of repose of the tobacco material was measured by using the following method. A sample of the tobacco material was dropped through a funnel from 4 cm above a 25 mm $\times$ 25 mm measuring table (PEEK material). When the sample was dropped to the extent that the sample spilled from the table, the sample was photographed, and the angle was measured by using image analysis software (microscope available from Keyence Corporation). This measurement was performed three times, and the average value was used as the value of the angle of repose.

[Measurement of Specific Heat]

[0061] The maximum specific heat capacity ($\text{mJ/mg} \cdot ^\circ\text{C}$) up to 300 $^\circ\text{C}$ was measured as the specific heat of the tobacco material by DSC (differential scanning calorimetry). Specifically, the maximum specific heat capacity was measured by using a differential scanning calorimeter (product name: DSC7020, available from Hitachi High-Tech Science Corporation) under the following conditions. Heating rate: 10 $^\circ\text{C}/\text{min}$, holding time: 2 min, pan: Al, sample mass: 10 mg, reference: Al_2O_3 .

[Evaluation of Stickiness]

[0062] To evaluate the stickiness of the tobacco material, five panelists touched the tobacco material with their hands and evaluated the tobacco material using a five-point scale ($n = 1$). Specifically, the evaluation was conducted on a scale of 0 to 5, with "not sticky at all" giving a score of 0 and "very sticky" giving a score of 5. The panelists were well-trained, and it was confirmed that the thresholds for evaluating stickiness were equal and standardized among the panelists.

[Example 1]

(Preparation of Reconstituted Tobacco)

[0063] Yellow leaves were prepared as a tobacco raw material. An amount of water that was 12 times the mass of the tobacco raw material was added to the tobacco raw material, and the resulting mixture was stirred at 300 rpm and 50 $^\circ\text{C}$ for 1 hour. The extract was then collected by hand squeezing. The tobacco component was thus extracted from the tobacco raw material to obtain a tobacco extract and a tobacco residue. Next, 100 g/L of a 2 mol/L sodium hydroxide aqueous solution was added to the tobacco residue, and the resulting mixture was heated at 180 $^\circ\text{C}$ for 3 hours. The mixture was then adjusted to a pH of 5.6 by adding citric acid to obtain a tobacco material. The tobacco material was evaluated by using the above methods for measuring the maximum absorbance at wavelengths from 3200 to 3600 cm^{-1} in FT-IR analysis, the amount of water absorption, the angle of repose, and the specific heat, and evaluating the stickiness. The results are shown in Table 1.

[0064] The obtained tobacco material was used as a base material, and the tobacco extract was added back to the tobacco material. One hundred parts by mass of the tobacco material to which the tobacco extract had been added back, 3.7 parts by mass of guar gum used as a binder, 3.7 parts by mass of softwood pulp used as a fiber material, and 14.6 parts by mass of glycerine used as an aerosol generator were mixed and formed into a sheet shape by using a casting method. A

reconstituted tobacco in sheet form was prepared accordingly. The thickness, density, basis weight, glycerine content, and moisture content of the reconstituted tobacco were 428 μm , 0.67 mgWB/mm³, 285 gWB/m², 12.7 mass% WB, and 12.1 mass% WB, respectively.

[Evaluation]

[0065] The reconstituted tobacco in sheet form was filled in the tobacco-containing segment 2 of the non-combustion-heating-type flavor inhaler 1 illustrated in Fig. 1 to obtain a non-combustion-heating-type flavor inhaler. The non-combustion-heating-type flavor inhaler was subjected to a heating test, and the nicotine delivery level and the glycerine delivery level were measured. Specifically, the non-combustion-heating-type flavor inhaler 1 was inserted into the heating device 13 illustrated in Fig. 2, and the tobacco-containing segment was heated to 200°C. After 30 seconds of preheating, smoke was inhaled through the inhalation port of the non-combustion-heating-type flavor inhaler 1 to determine the nicotine and glycerine levels in the inhaled mainstream smoke. An inhalation machine (product name: RM-20, available from Borgwaldt) was used for inhalation. Inhalation (puffing) was performed once every 30 seconds, with 55 ml over 2 seconds per puff, for a total of 10 times, and the nicotine and glycerine levels were measured for each puff. The nicotine and glycerine levels were measured by using GC-FID. The nicotine delivery level for each puff and the glycerine delivery level for each puff are shown in Fig. 3 and Fig. 4, respectively. The rate of nicotine transfer to mainstream smoke per electric power consumption (energy) is shown in Table 1. However, nicotine and glycerine are shown as reference components selected from multiple components in the reconstituted tobacco in this embodiment, and it does not mean that nicotine and glycerine are specifically easy to deliver.

[Comparative Example 1]

[0066] Yellow leaves were prepared as a tobacco raw material. An amount of water that was 12 times the mass of the tobacco raw material was added to the tobacco raw material, and the resulting mixture was stirred at 300 rpm and 50°C for 1 hour. The extract was then collected by hand squeezing. The tobacco component was thus extracted from the tobacco raw material to obtain a tobacco extract and a tobacco residue. Next, the tobacco residue was placed in an oven, and the tobacco residue was heated at 230°C for 1 hour while a gas mixture of N₂:Air = 92%:8% (oxygen concentration: 1.7%) was circulated at 1 L/min. As a result, the tobacco residue was carbonized to obtain carbonized tobacco. The carbonized tobacco was evaluated by using the above methods for measuring the maximum absorbance at wavelengths from 3200 to 3600 cm⁻¹ in FT-IR analysis, the angle of repose, and the specific heat, and evaluating the stickiness. The results are shown in Table 1.

[0067] The obtained carbonized tobacco was used as a base material, and the tobacco extract was added back to the carbonized tobacco. One hundred parts by mass of the carbonized tobacco to which the tobacco extract had been added back, 3.7 parts by mass of guar gum used as a binder, 3.7 parts by mass of softwood pulp used as a fiber material, and 14.6 parts by mass of glycerine used as an aerosol generator were mixed and formed into a sheet shape by using a casting method. A reconstituted tobacco in sheet form was prepared accordingly. The reconstituted tobacco was used to produce and evaluate a non-combustion-heating-type flavor inhaler in the same manner as in Example 1. The results are shown in Fig. 3, Fig. 4, and Table 1.

[Comparative Example 2]

[0068] The tobacco extract obtained in Example 1 was added to activated carbon (product name: KURARAY COAL, available from Kuraray Co., Ltd.). The reconstituted tobacco in sheet form was prepared in the same manner as in Example 1, except that the activated carbon was used instead of the tobacco residue to which the tobacco extract had been added back. The measurement results for the specific heat and amount of water absorption for the activated carbon itself and the evaluation results for stickiness are shown in Table 1.

[Comparative Example 3]

[0069] The tobacco extract and the tobacco residue were obtained in the same manner as in Example 1. The tobacco extract was then added back to the tobacco residue without treating the tobacco residue with alkaline digestion. Otherwise, a reconstituted tobacco in sheet form was prepared and evaluated in the same manner as in Example 1. The measurement results for the physical properties of the tobacco residue itself are shown in Table 1. The evaluation results for the non-combustion-heating-type flavor inhaler are shown in Fig. 3, Fig. 4, and Table 1.

[Table 1]

	Base Material	Maximum Absorbance at Wavelengths from 3200 to 3600 cm^{-1} in FT-IR Analysis	Amount of Water Absorption (g/g)	Angle of Repose ($^{\circ}$)	Specific Heat (Maximum Specific Heat Capacity up to 300 $^{\circ}\text{C}$) ($\text{mJ/mg}\cdot^{\circ}\text{C}$)	Stickiness Evaluation	Rate of Nicotine Transfer to Mainstream Smoke Per Energy (%/J)
Example 1	tobacco residue treated with alkaline digestion	0.48	5.2	24.0	1.8	1.8	0.024
Comparative Example 1	carbonized tobacco	0.18	5.2	46.5	6.3	2.0	0.019
Comparative Example 2	activated carbon	-	1.3	-	15.8	4.8	-
Comparative Example 3	tobacco residue	0.24	4.9	53.8	6.6	1.6	0.018

[0070] Referring to Fig. 3 and Fig. 4, in Example 1 where the reconstituted tobacco was prepared using, as a base material, a tobacco material having a maximum absorbance of 0.40 or more at wavelengths from 3200 to 3600 cm^{-1} in FT-IR analysis and a specific heat of 5 $\text{mJ/mg}\cdot^{\circ}\text{C}$ or less, the nicotine and glycerine delivery levels were found to be high especially when the number of puffs increased in the evaluation of the non-combustion-heating-type flavor inhaler including the reconstituted tobacco. The rate of nicotine transfer to mainstream smoke per electric power consumption (energy) was also high accordingly (Table 1). In Comparative Examples 1 and 3 where the reconstituted tobacco was prepared using, as a base material, a tobacco material having a maximum absorbance of less than 0.40 at wavelengths from 3200 to 3600 cm^{-1} in FT-IR analysis or a specific heat of more than 5 $\text{mJ/mg}\cdot^{\circ}\text{C}$, the nicotine and glycerine delivery levels were lower than those in Example 1 in the evaluation of the non-combustion-heating-type flavor inhaler including the reconstituted tobacco (Fig. 3 and Fig. 4). For this, the rate of nicotine transfer to mainstream smoke per electric power consumption (energy) was lower than that in Example 1 (Table 1). The graph of Fig. 5, which shows the rate of nicotine transfer to mainstream smoke per electric power consumption (energy) versus the specific heat of the base material of the reconstituted tobacco, reveals that in Example 1, the rate of nicotine transfer to mainstream smoke per electric power consumption (energy) is improved because the tobacco material used as a base material has a maximum absorbance of 0.40 or more and a specific heat of 5 $\text{mJ/mg}\cdot^{\circ}\text{C}$ or less. Table 1 indicates that the base material of Example 1 has a lower angle of repose than the base materials of Comparative Examples 1 and 3. It is thus easier to feed the raw material during the feeding process, and the base material of Example 1 has better manufacturing suitability. Furthermore, the base material of Example 1 exhibited the amount of water absorption and stickiness evaluation similar to those of the base materials of Comparative Examples 1 and 3. This indicates that the base material does not significantly change in stickiness even after the alkaline digestion treatment and thus shows good handling properties, and it is thus easy to feed the raw material during the feeding process.

REFERENCE SIGNS LIST

[0071]

- 1 non-combustion-heating-type flavor inhaler
- 2 tobacco-containing segment
- 3 cooling segment
- 4 center hole segment
- 5 filter segment
- 6 mouthpiece segment
- 7 tubular member
- 8 perforation

- 9 first filler layer
- 10 first inner plug wrapper
- 11 outer plug wrapper
- 12 mouthpiece lining paper
- 5 13 heating device
- 14 body
- 15 heater
- 16 metal tube
- 17 battery unit
- 10 18 control unit
- 19 recess

Claims

- 15 1. A reconstituted tobacco for a non-combustion-heating-type flavor inhaler, the reconstituted tobacco comprising a tobacco material and a tobacco component,
 - wherein the tobacco material has a maximum absorbance of 0.40 or more at wavelengths from 3200 to 3600 cm^{-1} in FT-IR analysis, and
 - 20 the tobacco material has a specific heat of 5 $\text{mJ/mg} \cdot ^\circ\text{C}$ or less.
- 2. The reconstituted tobacco according to claim 1, wherein an amount of water absorption when the tobacco material is immersed in water at 23°C for 900 seconds is from 4.0 to 6.0 g/g.
- 25 3. The reconstituted tobacco according to claim 1 or 2, wherein the tobacco material has an angle of repose of 40° or less.
- 4. The reconstituted tobacco according to any one of claims 1 to 3 comprising a tobacco extract obtained by extracting the tobacco component from a tobacco raw material.
- 30 5. The reconstituted tobacco according to any one of claims 1 to 4, further comprising a binder.
- 6. The reconstituted tobacco according to any one of claims 1 to 5, further comprising a fiber material.
- 7. The reconstituted tobacco according to any one of claims 1 to 6, wherein the reconstituted tobacco is a reconstituted tobacco in sheet form, or a reconstituted tobacco in a form of sheet shreds obtained by shredding the reconstituted tobacco in sheet form.
- 35 8. A non-combustion-heating-type flavor inhaler comprising a tobacco-containing segment filled with the reconstituted tobacco according to any one of claims 1 to 7.
- 40 9. A non-combustion-heating-type flavor inhaling system comprising:
 - the non-combustion-heating-type flavor inhaler according to claim 8; and
 - a heating device that heats the tobacco-containing segment.
- 45 10. A method for manufacturing the reconstituted tobacco according to any one of claims 1 to 7, the method comprising:
 - a step of extracting a tobacco component from a tobacco raw material to obtain a tobacco extract and a tobacco residue,
 - 50 a step of subjecting the tobacco residue to an alkaline digestion treatment and then adjusting pH to 4.0 to 6.5; and
 - a step of adding the tobacco extract back to the tobacco residue after pH adjustment.
- 11. The method according to claim 10, wherein the alkaline digestion treatment involves adding an alkali metal hydroxide to the tobacco residue and heating the tobacco residue at 130 to 230°C for 5 minutes to 6 hours.
- 55

Fig. 1

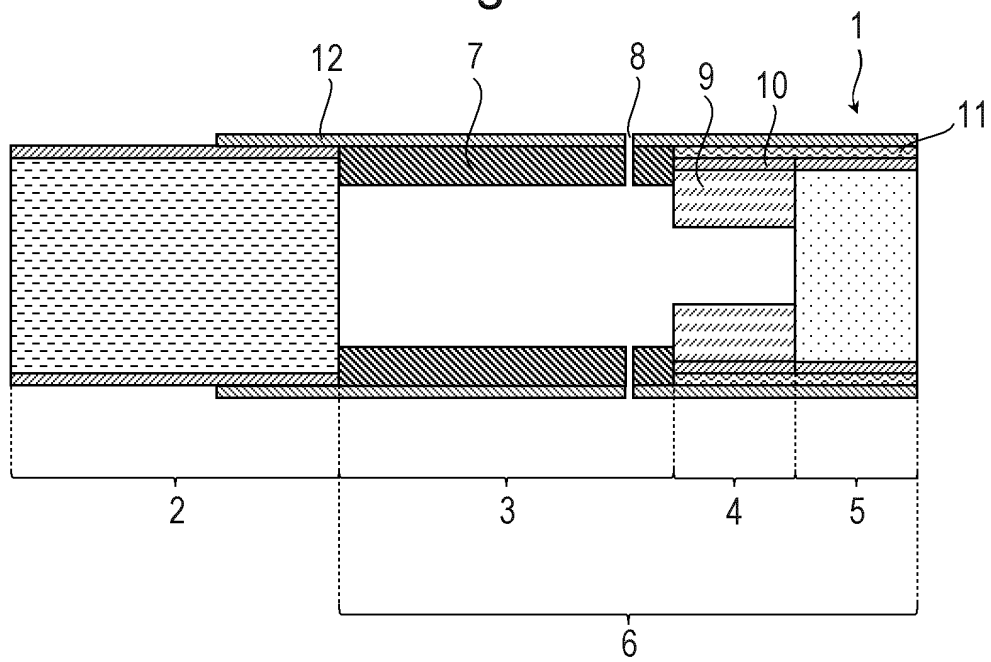


Fig. 2

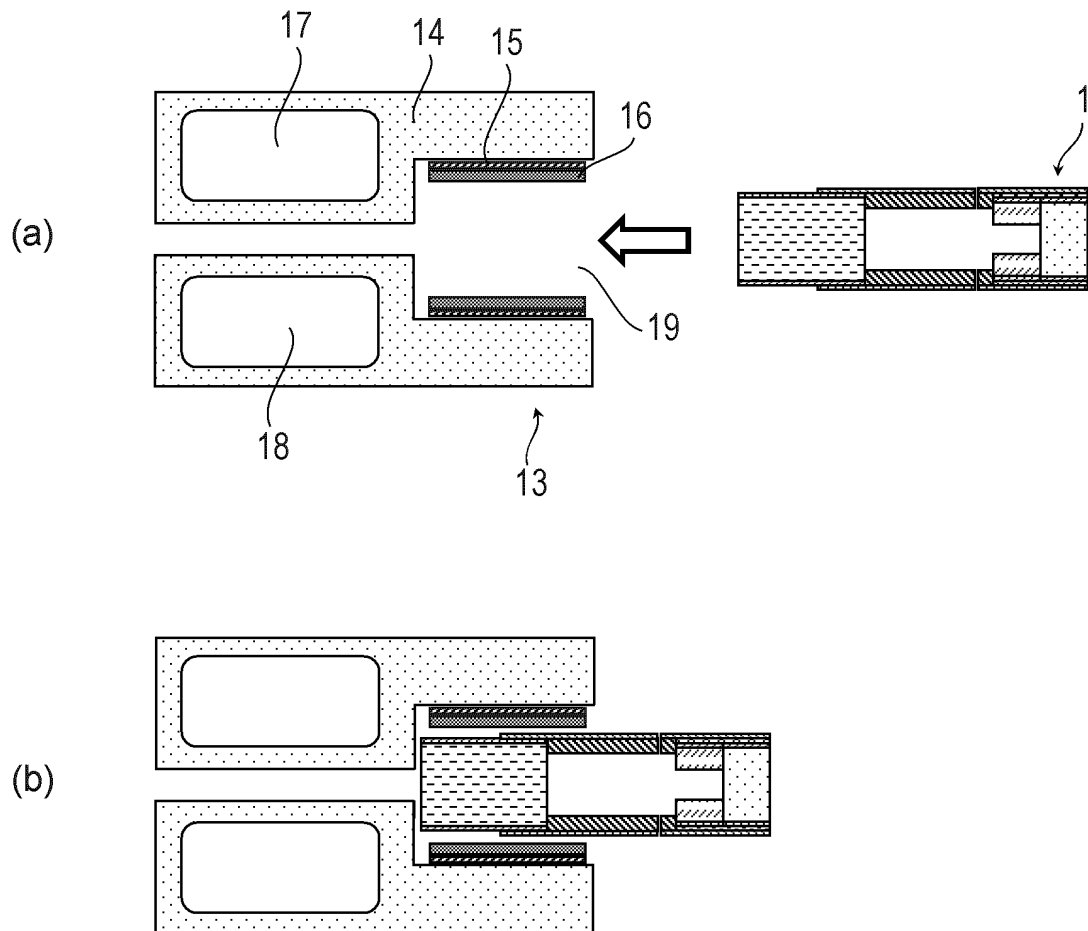


Fig. 3

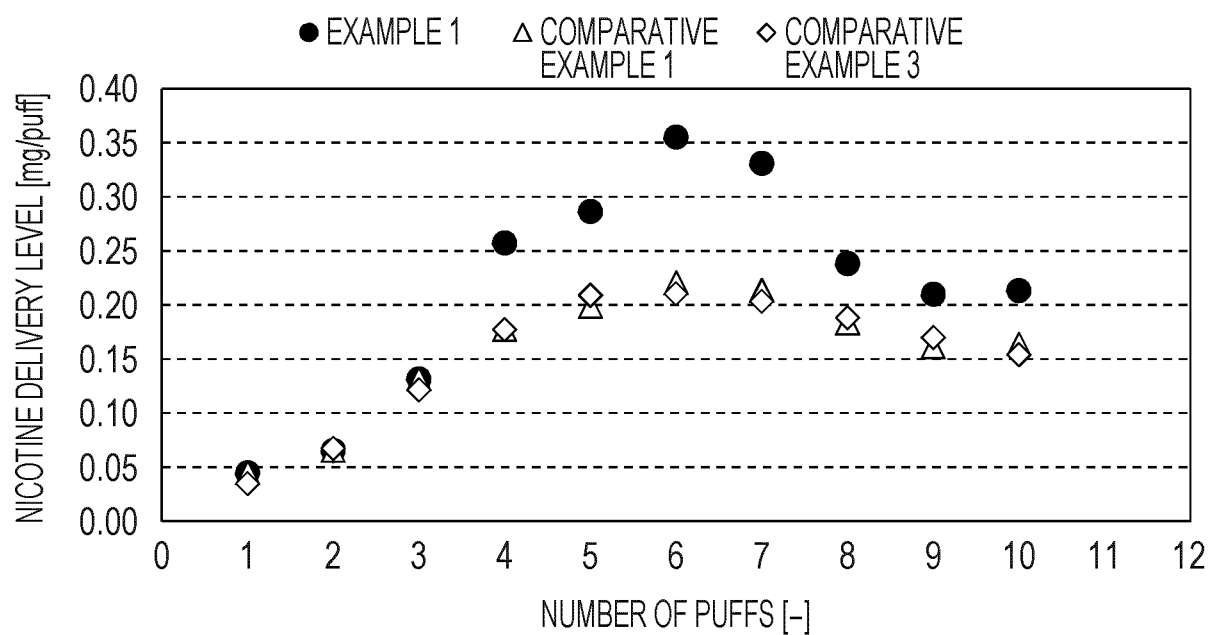


Fig. 4

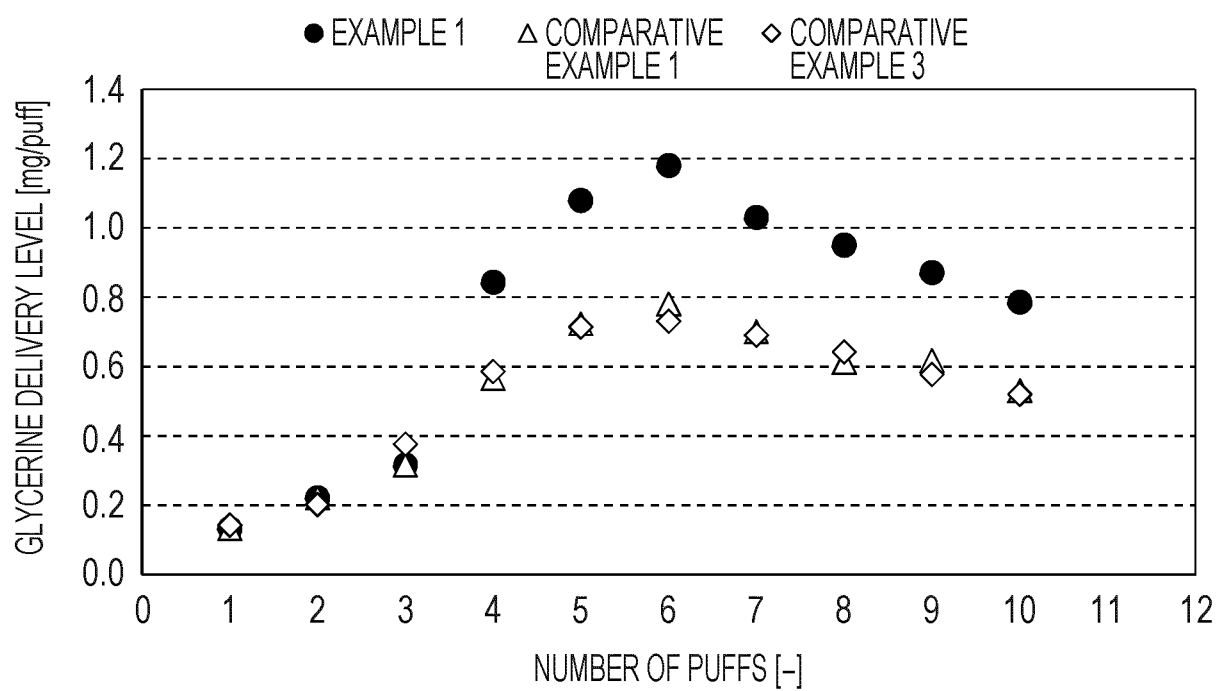
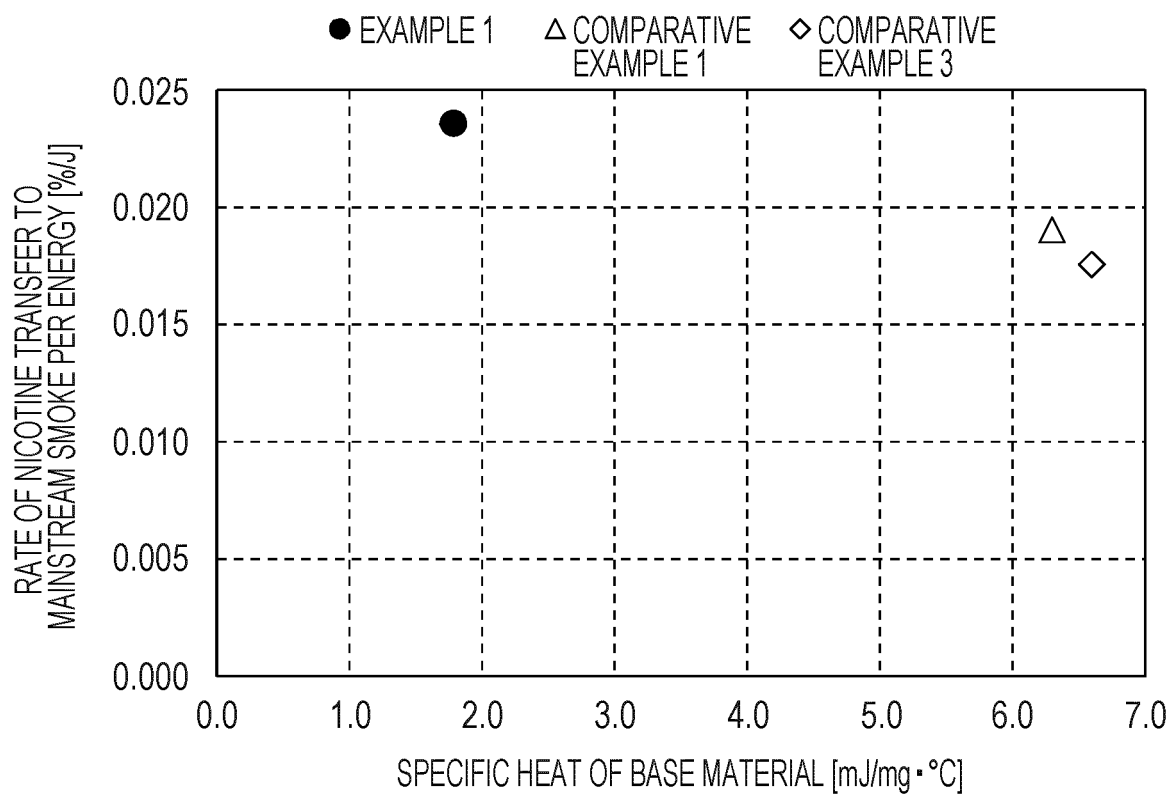


Fig. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2022/029285

A. CLASSIFICATION OF SUBJECT MATTER

A24B 3/14(2006.01)i; *A24B 5/12*(2006.01)i; *A24D 1/20*(2020.01)i
FI: A24B3/14; A24B5/12; A24D1/20

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)

A24B3/14; A24B5/12; A24D1/20

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

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2022
Registered utility model specifications of Japan 1996-2022
Published registered utility model applications of Japan 1994-2022

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2022/138261 A1 (JAPAN TOBACCO INC.) 30 June 2022 (2022-06-30) entire text, all drawings	1-11
A	WO 2019/097641 A1 (JAPAN TOBACCO INC.) 23 May 2019 (2019-05-23) entire text, all drawings	1-11
A	CN 112385890 A (HUBEI CHINA TOBACCO INDUSTRY CO., LTD.) 23 February 2021 (2021-02-23) entire text, all drawings	1-11
A	JP 6019216 B2 (JAPAN TOBACCO INC.) 02 November 2016 (2016-11-02) entire text, all drawings	1-11

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

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

09 September 2022

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/JP2022/029285

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WO 2019/097641 A1	23 May 2019	EP 3711494 A1 entire text, all drawings	
CN 112385890 A	23 February 2021	(Family: none)	
JP 6019216 B2	02 November 2016	US 2015/0292152 A1 entire text, all drawings WO 2014/148611 A1 EP 2977511 A1 CN 105189858 A	

REFERENCES CITED IN THE DESCRIPTION

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