



US 20240260639A1

(19) **United States**

(12) **Patent Application Publication**
KOIDE et al.

(10) **Pub. No.: US 2024/0260639 A1**

(43) **Pub. Date: Aug. 8, 2024**

(54) **MATERIAL FOR FLAVOR INHALATION ARTICLE, HEATING-TYPE FLAVOR INHALATION ARTICLE, AND PRODUCTION METHOD FOR MATERIAL FOR FLAVOR INHALATION ARTICLE**

(30) **Foreign Application Priority Data**

Oct. 18, 2021 (JP) 2021-170059

Nov. 19, 2021 (JP) 2021-188296

Publication Classification

(51) **Int. Cl.**

A24B 15/10 (2006.01)

A24B 7/00 (2006.01)

A24B 15/18 (2006.01)

A24D 1/20 (2006.01)

A24F 40/20 (2006.01)

(52) **U.S. Cl.**

CPC *A24B 15/10* (2013.01); *A24B 7/00*

(2013.01); *A24B 15/186* (2013.01); *A24D 1/20*

(2020.01); *A24F 40/20* (2020.01)

(71) Applicant: **Japan Tobacco Inc.**, Tokyo (JP)

(72) Inventors: **Akihiro KOIDE**, Tokyo (JP);
Kimitaka UCHII, Tokyo (JP); **Yusuke NANASAKI**, Tokyo (JP)

(73) Assignee: **Japan Tobacco Inc.**, Tokyo (JP)

(21) Appl. No.: **18/636,284**

(22) Filed: **Apr. 16, 2024**

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2022/038512, filed on Oct. 17, 2022.

(57) **ABSTRACT**

This material is for a flavor inhalation article and is obtained by mixing a cellulosic base material and nicotine.

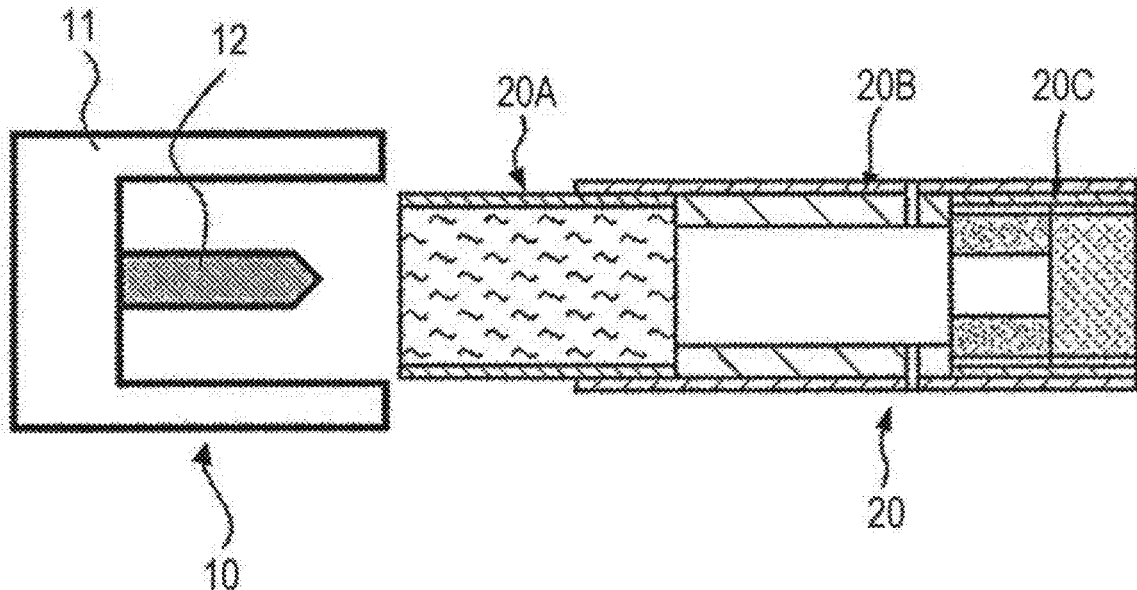


Fig. 1

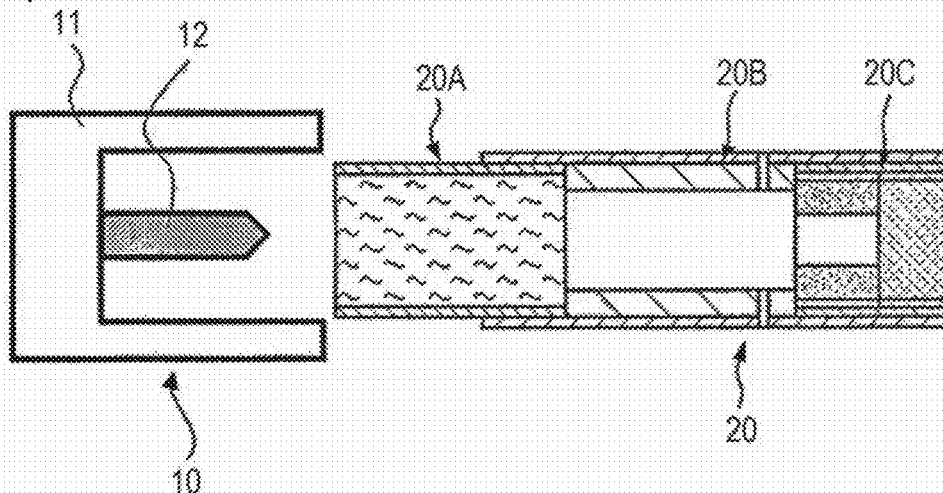


Fig. 2

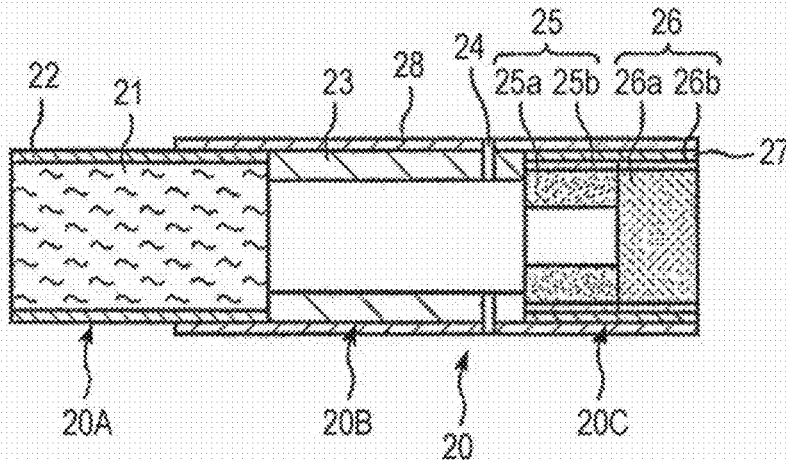


Fig. 3

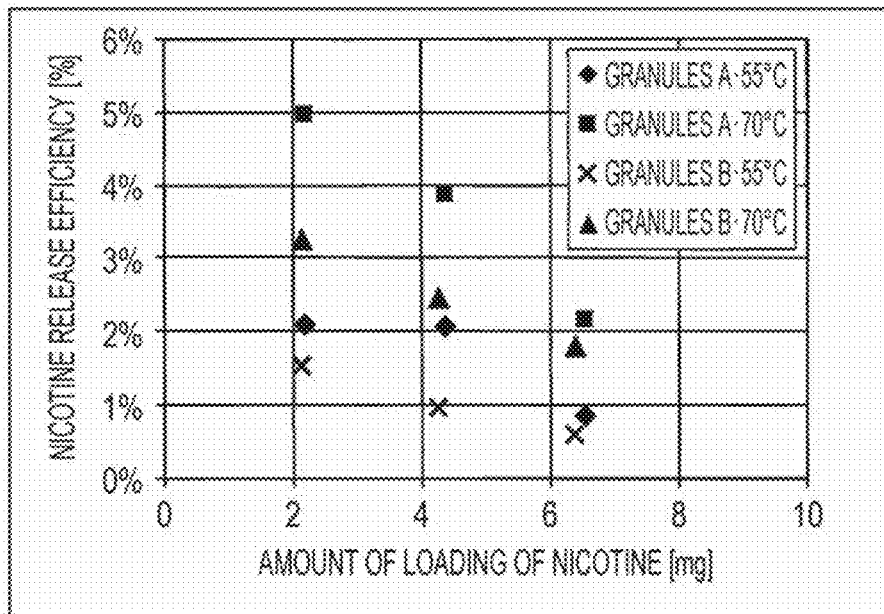


Fig. 4

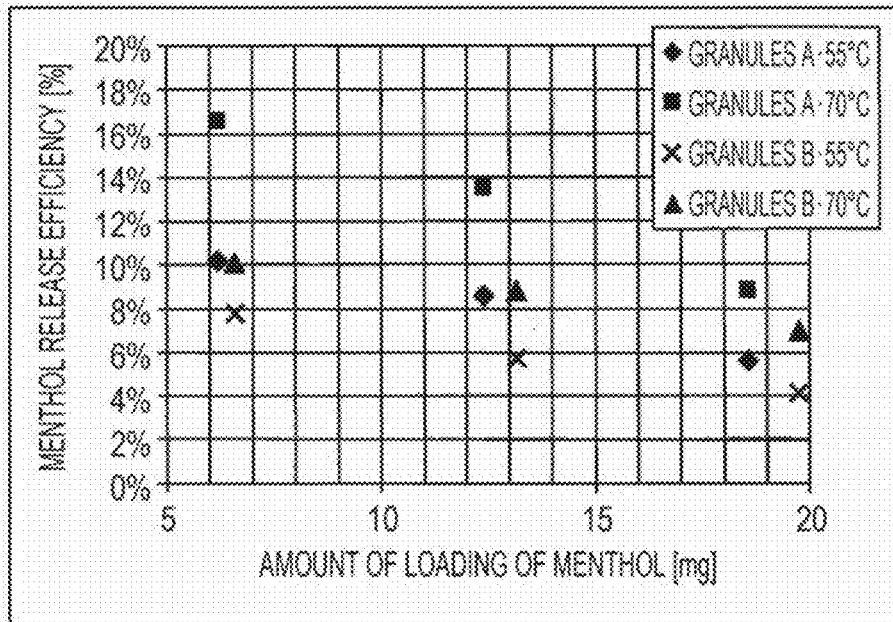
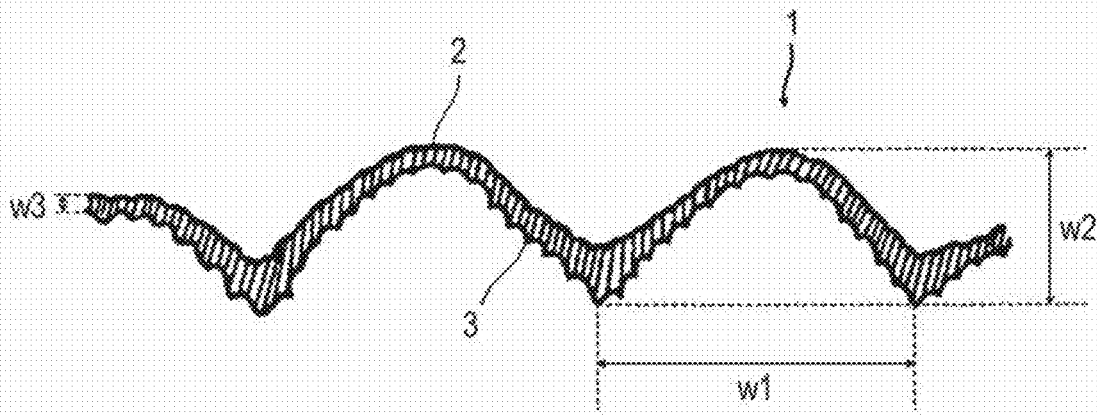


Fig. 5



**MATERIAL FOR FLAVOR INHALATION
ARTICLE, HEATING-TYPE FLAVOR
INHALATION ARTICLE, AND PRODUCTION
METHOD FOR MATERIAL FOR FLAVOR
INHALATION ARTICLE**

CROSS-REFERENCE TO RELATED
APPLICATIONS

[0001] The present application is a Continuation of International Patent Application No. PCT/JP2022/038512 filed on Oct. 17, 2022, which contains subject matter related to Japanese Patent Application No. 2021-170059 filed in the Japan Patent Office on Oct. 18, 2021, Japanese Patent Application No. 2021-188296 filed in the Japan Patent Office on Nov. 19, 2021, the entire contents of each are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present invention relates to a material for a flavor inhalation article, to a heating-type flavor inhalation article, and to a method for producing the material for a flavor inhalation article.

BACKGROUND ART

[0003] In recent years, heating-type flavor inhalation articles have been provided that enable inhalation of a tobacco component without involving combustion so that the generation of smoke can be inhibited.

[0004] Materials for a flavor inhalation article that form heating-type flavor inhalation articles contain nicotine, with some of the materials also containing menthol added thereto as a flavoring agent. The materials for a flavor inhalation article include a cellulosic base material, a tobacco extract, and, if necessary, a polyol that serves as an aerosol-source material. Devices for heating heating-type flavor inhalation articles are typically used at a temperature of 200° C. or greater. Many such devices are designed to enable polyol-derived smoke to be inhaled and enjoyed. Patent Literature 1, for example, discloses a heating-type flavor inhalation article in which a material for a flavor inhalation article is to be heated based on a specific temperature profile including a temperature region of 200° C. or greater.

CITATION LIST

Patent Literature

[0005] PTL 1: International Publication No. 2018/019855

SUMMARY OF INVENTION

Technical Problem

[0006] The inventors conceived an idea that if smoking can be enjoyed at a lower temperature, user convenience can be enhanced. Unfortunately, with heating-type flavor inhalation articles of the related art, it was difficult to provide a sense of satisfaction unless the material for the flavor inhalation article was heated to 200° C. or greater, as described in Patent Literature 1. Under the circumstances, an object of the present invention is to provide a material for use in a heating-type flavor inhalation article, the material being usable at a low heating temperature.

Solution to Problem

[0007] The present inventors diligently conducted studies to achieve the object and, consequently, discovered that the object can be achieved by mixing the cellulosic base material with the nicotine. Accordingly, the present invention was completed. Specific aspects of the present invention are as follows.

First Aspect

[0008] A material for a flavor inhalation article, the material being a material formed by mixing a cellulosic base material with nicotine.

Second Aspect

[0009] The material for a flavor inhalation article according to the first aspect, in which the material for a flavor inhalation article is a tobacco sheet for a non-combustion heating-type flavor inhaler, and a cross section of the tobacco sheet in a thickness direction thereof has a corrugated shape.

Third Aspect

[0010] The material for a flavor inhalation article according to the second aspect, in which the tobacco sheet further includes an aerosol-source material.

Fourth Aspect

[0011] A method for producing the material for a flavor inhalation article according to the second or third aspect, the method including the steps of preparing a mixture containing the cellulosic base material, an aerosol-source material, a first forming agent, and a second forming agent; rolling the mixture to form a rolled product; cutting the rolled product into strips and thus imparting a corrugated shape to the strips, by using a rotary roller cutter pressed against the rolled product; and supplying the nicotine from outside of the cellulosic base material to provide at least a portion of the nicotine to a surface of the cellulosic base material.

Fifth Aspect

[0012] A non-combustion heating-type flavor inhaler including a tobacco-containing segment that includes the material for a flavor inhalation article according to any one of the first to third aspects.

Sixth Aspect

[0013] A non-combustion heating-type flavor inhalation system including the non-combustion heating-type flavor inhaler according to the fifth aspect; and a heating device that heats the tobacco-containing segment.

Advantageous Effects of Invention

[0014] The material for a flavor inhalation article of the present invention can be used at a low heating temperature.

BRIEF DESCRIPTION OF DRAWINGS

[0015] FIG. 1 is a schematic cross-sectional view of an exemplary non-combustion heating-type smoking system.

[0016] FIG. 2 is a schematic cross-sectional view of an exemplary non-combustion heating-type flavor inhalation article.

[0017] FIG. 3 is a graph showing a relationship between an amount of loading of nicotine and a nicotine release efficiency, regarding Examples.

[0018] FIG. 4 is a graph showing a relationship between an amount of loading of menthol and a menthol release efficiency, regarding the Examples.

[0019] FIG. 5 is a cross-sectional view in a thickness direction of an exemplary tobacco sheet according to a first embodiment.

DESCRIPTION OF EMBODIMENTS

[0020] A material for a flavor inhalation article and a method for producing the material for a flavor inhalation article, according to the present application, will be described below.

1. Material for Flavor Inhalation Article

[0021] In some embodiments of the present application, a material for a flavor inhalation article is a material formed by mixing a cellulosic base material with nicotine.

[0022] The mixing of the cellulosic base material with the nicotine may be carried out by any method. Preferably, the mixing is carried out by supplying the nicotine from outside of the cellulosic base material. In the instance where the nicotine is supplied from outside of the cellulosic base material, at least a portion of the nicotine is consequently present on a surface of the cellulosic base material. Accordingly, the nicotine can be more easily released to an outside of the material for a flavor inhalation article than in the instance in which the nicotine is present in an inner portion of the cellulosic base material. As a result, the nicotine can be sufficiently released even at a heating temperature lower than temperatures used in the related art, for example, 200° C. or greater. Note that the cellulosic base material may have a large number of pores on the surface (have a porous shape), and in this instance, the surface of the cellulosic base material includes an interior portion of the pores.

[0023] The cellulosic base material may be any cellulosic base material, examples of which include tobacco leaves, aged tobacco leaves, processed tobacco leaves, tobacco-filled members, non-tobacco materials, and mixtures of any two or more of these materials. Among these, non-tobacco-derived cellulose materials are preferable from the standpoint of avoiding impurities; however, a tobacco-derived cellulose may be used provided that an amount of impurities therein is low.

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

[0024] In this specification, “tobacco leaves” is a general term that refers to tobacco leaves that have been harvested but have not yet undergone aging, which will be described later. Examples of forms of the aging include curing.

[0025] In contrast, the “aged tobacco leaves” are tobacco leaves that have undergone aging but have not yet been processed into various forms for use in tobacco products (examples of the forms include shredded tobacco, tobacco sheets, and tobacco granules, which will be described later). Furthermore, the “processed tobacco leaves” are tobacco

leaves resulting from the processing of aged tobacco leaves into various forms for use in tobacco products.

[0026] Examples of forms of the processed tobacco leaves for use in tobacco products include shredded tobacco, which is pieces of tobacco resulting from the shredding of aged tobacco leaves into pieces having a predetermined size. Other examples include tobacco sheets, which can be obtained by forming a composition into a sheet shape, and tobacco granules, which can be obtained by forming the composition into a granular shape, the composition containing aged tobacco leaves that have been ground to have a predetermined particle size (such materials are hereinafter also referred to as “fine powdered tobacco”). The fine powdered tobacco is a form of processed tobacco leaves.

<Tobacco-Filled Member>

[0027] The tobacco-filled member is a member in which processed tobacco leaves in a predetermined form have been loaded in a filler receptacle. The filler receptacle is the object into which processed tobacco leaves are to be loaded. The filler receptacle is a part of a tobacco product. Examples of the filler receptacle include, but are not limited to, cylindrical members formed from wrapping paper; and casings having an air inlet and an air outlet.

[0028] The processed tobacco leaves that are loaded in a filler receptacle may be in any of the following forms: a form in which the processed tobacco leaves are loaded by being wrapped with wrapping paper such that the processed tobacco leaves are located inside (this form is hereinafter also referred to as a “tobacco rod”); and a form in which the processed tobacco leaves are loaded in a flow channel of a casing having an air inlet and an air outlet (this form is hereinafter also referred to as a “tobacco cartridge”). These forms are non-limiting examples.

[0029] Examples of the tobacco-filled member include a tobacco-filled member formed of shredded tobacco loaded in a filler receptacle (hereinafter also referred to as a “first tobacco-filled member”); a tobacco-filled member formed of a tobacco sheet loaded in a filler receptacle (hereinafter also referred to as a “second tobacco-filled member”); and a tobacco-filled member formed of tobacco granules loaded in a filler receptacle (hereinafter also referred to as a “third tobacco-filled member”).

[0030] Examples of the non-tobacco material include roots of plants (including scaly roots (scaly bulbs), root tubers (potatoes), bulbs, and the like), stems, tubers, barks (including stem barks, tree bark, and the like), leaves, flowers (including petals, pistils, stamens, and the like), seeds, tree trunks, and tree branches.

[0031] A content of the cellulosic base material may be, without limitation, 0.1 to 80 wt. % based on a total weight of the material for a flavor inhalation article. Such a content is preferable from the standpoint of shape stability. The content is more preferably 1 to 75 wt. % and most preferably 5 to 50 wt. %.

[0032] The nicotine may be selected from the group consisting of, without limitation, synthetic nicotine, isolated nicotine, and combinations thereof.

[0033] The content of the nicotine may be, without limitation, as follows: the lower limit of the content is preferably 2 wt. % or greater, and the upper limit of the content may be 10 wt. % or less, 8 wt. % or less, or 7 wt. % or less, based on the total weight of the material for a flavor inhalation article. The lower and upper limits may be selected from the

standpoint of a nicotine concentration in typical tobacco. The numerical ranges of the content of nicotine are applicable to the content of nicotine added from an outside, the content of tobacco-derived nicotine, and the sum of these contents.

[0034] In some embodiments, the material for a flavor inhalation article may further include menthol. In the instance where the material for a flavor inhalation article further includes menthol, a refreshing cooling sensation can be provided.

[0035] In the instance where the material for a flavor inhalation article includes menthol, the content of the menthol may be, without limitation, as follows: the lower limit of the content is preferably 6 wt. % or greater, and the upper limit of the content may be 25 wt. % or less, 23 wt. % or less, or 20 wt. % or less, based on the total weight of the material for a flavor inhalation article. The lower and upper limits may be selected from the standpoint of a concentration in common tobacco products.

[0036] In some embodiments, the material for a flavor inhalation article may further include an additional component, which may be myristic acid, palmitic acid, or a mixture thereof.

[0037] The material for a flavor inhalation article may be provided, without limitation, in the form of granules or a sheet (tobacco granules or a tobacco sheet). Among these, granules are preferable from the standpoint of stabilizing the weight of loading. Since the cellulosic base material that is used is preferably a tobacco-derived raw material, the material for a flavor inhalation article is more preferably tobacco granules or a tobacco sheet and particularly preferably tobacco granules. These will be described in detail below.

<Tobacco Granules>

[0038] As discussed above, the tobacco granules can be prepared by forming a composition containing aged tobacco leaves into a granular shape.

<Method for Forming Tobacco Granules>

[0039] The tobacco granules may be formed by any method and, for example, can be prepared as follows: fine powdered tobacco, nicotine, a flavor-developing aid, and a binder, plus, if desired, an aerosol-source material and a flavoring agent, are mixed together, water is added to the mixture, which is then kneaded, the resulting kneaded product is granulated to form granules (having a long columnar shape) in a wet extrusion-granulation machine, and subsequently, the granules are milled into a short columnar shape or a spherical shape. The tobacco granules contain both nicotine derived from the tobacco-derived raw material and nicotine that has been added.

[0040] Preferably, the extrusion-granulation is carried out by extruding the kneaded product at ambient temperature and a pressure of 2 kN or greater. The extrusion at a high pressure causes the kneaded product at the outlet of the extrusion-granulation machine to have a temperature that is instantaneously rapidly increased to, for example, 90° C. to 100° C. from the ambient temperature, and as a result, 2 to 4 wt. % of water and volatile components evaporate. Accordingly, the amount of the water that is added for use in the preparation of the kneaded product can be larger by an amount corresponding to the amount of evaporation than the

amount of water desired to be present in the tobacco granules that are the final product.

[0041] The tobacco granules resulting from the extrusion-granulation may further be dried to adjust the water content, if necessary. For example, in an instance where a loss on drying of the tobacco granules resulting from the extrusion-granulation is measured, and the loss on drying is higher than a desired loss on drying (e.g., 5 wt. % or greater and 17 wt. % or less), the tobacco granules may be further dried to achieve the desired loss on drying. The drying conditions (temperature and time) for achieving a desired loss on drying can be set as follows: drying conditions (temperature and time) necessary to reduce the loss on drying by a predetermined value are preliminarily determined, and the conditions are used as the basis for the setting.

<Tobacco Sheet>

[0042] As discussed above, the tobacco sheet can be prepared by forming a composition containing aged tobacco leaves and the like into a sheet shape. The aged tobacco leaves that are used in the tobacco sheet may be, for example, without limitation, destemmed tobacco leaves in which laminae have been separated from midribs. In this specification, the term “sheet” refers to a shape that has a pair of generally parallel major surfaces and has side surfaces.

<Method for Forming Tobacco Sheet>

[0043] The tobacco sheet may be formed by any method, and an example of the method is as follows: fine powdered tobacco, nicotine, a flavor-developing aid, and a binder, plus, if desired, an aerosol-source material and a flavoring agent, are mixed together, water is added to the mixture, which is then kneaded, and the resulting kneaded product is formed with a method known in the art, such as a papermaking method, a casting method, or a rolling method. Various types of tobacco sheets formed by such methods are disclosed in detail in “Encyclopedia of Tobacco, Tobacco Academic Studies Center, 2009. 3. 31”.

[0044] When the material for a flavor inhalation article is in the form of granules, the granules may have a particle size of, without limitation, greater than or equal to 250 μm, which is preferable from the standpoint of improving nicotine and/or menthol release efficiencies, which will be described later. The particle size is more preferably 250 to 850 μm and most preferably 250 to 500 μm. The smaller the particle size of the granules, the higher the nicotine and/or menthol release efficiencies that will be described later. Furthermore, the granules may have an average particle size (D50) of, without limitation, 250 to 450 μm, which is preferable from the standpoint of improving the nicotine and/or menthol release efficiencies that will be described later. The average particle size is more preferably 250 to 400 μm and most preferably 250 to 300 μm.

[0045] The particle size and the average particle size (D50) of the granules can be measured based on a laser diffraction method, under dry conditions, by using a scattering particle size distribution analyzer (Partica, manufactured by Yamato Scientific Co., Ltd.).

[0046] When the material for a flavor inhalation article is in the form of granules, the granules may have a surface area per granule of, without limitation, 0.1 to 2.5 mm², which is preferable from the standpoint of improving the nicotine

and/or menthol release efficiencies that will be described later. The surface area is more preferably 0.1 to 1.5 mm² and most preferably 0.1 to 0.8 mm². The smaller the surface area per granule of the granules, the higher the nicotine and/or menthol release efficiencies that will be described later. The surface area per granule of the granules can be calculated according to equation (1) below, assuming that the granules are spheres.

$$S = 4\pi r^2 \quad (1)$$

[0047] S: surface area per granule of the granules

[0048] π : ratio of the circumference of a circle to its diameter

[0049] r: radius of granule (value obtained by multiplying the particle size of the granule by 1/2)

[0050] In some embodiments, the material for a flavor inhalation article may have a nicotine release efficiency per 10 inhalations associated with heating and inhalation at 55° C. Without limitation, the lower limit of the nicotine release efficiency is preferably 0.6% or greater, and the upper limit thereof may be 5.0% or less, 2.5% or less, or 2.1% or less.

[0051] In some embodiments, the material for a flavor inhalation article may have a nicotine release efficiency per 10 inhalations associated with heating and inhalation at 70° C. Without limitation, the lower limit of the nicotine release efficiency is preferably 1.8% or greater, and the upper limit thereof may be 6.0% or less, 5.5% or less, or 5.0% or less.

[0052] In some embodiments, the material for a flavor inhalation article may have a menthol release efficiency per 10 inhalations associated with heating and inhalation at 55° C. Without limitation, the lower limit of the menthol release efficiency is preferably 4% or greater, and the upper limit thereof may be 15.0%, 13.0%, or 10.2%.

[0053] In some embodiments, the material for a flavor inhalation article may have a menthol release efficiency per 10 inhalations associated with heating and inhalation at 70° C. Without limitation, the lower limit of the menthol release efficiency is preferably 7% or greater, and the upper limit thereof may be 20.0% or less, 18.0% or less, or 16.6% or less.

[0054] In some embodiments, the material for a flavor inhalation article may have a total particulate matter (TPM) content associated with heating and inhalation of the material at 55° C. Without limitation, the total particulate matter content may be selected from 0.5 to 10.0 mg, 0.7 to 7.0 mg, and 0.8 to 5.0 mg, from the standpoint of an amount of loading.

[0055] In some embodiments, the material for a flavor inhalation article may have a total particulate matter (TPM) content associated with heating and inhalation of the material at 70° C. Without limitation, the total particulate matter content may be selected from 0.8 to 15.0 mg, 1.0 to 10.0 mg, and 1.3 to 7.8 mg, from the standpoint of an amount of loading.

[0056] The nicotine or menthol release efficiency per 10 inhalations associated with heating and inhalation at 55° C. or 70° C. and the total particulate matter (TPM) content associated with heating and inhalation of the material at 55° C. or 70° C. can be calculated with a method described in the “(Analysis of Nicotine and Menthol Released from Tobacco Granules)” section of the Examples section provided below.

2. Method for Producing Material for Flavor Inhalation Article

[0057] In some embodiments, the material for a flavor inhalation article described in the “1.” section can be produced with a production method that includes a step of preparing the cellulosic base material and the nicotine and a step of supplying the nicotine from outside of the cellulosic base material to provide at least a portion of the nicotine to a surface of the cellulosic base material.

[0058] The method for producing the material for a flavor inhalation article may be one in which a tobacco-derived material is used as the cellulosic base material, the tobacco-derived material is preliminarily formed to have a form of tobacco granules or a tobacco sheet, and nicotine is supplied to such a cellulosic base material from the outside. Such a process may be used to provide the final product of the material for a flavor inhalation article that is in the form of tobacco granules or a tobacco sheet.

[0059] The supplying of the nicotine from outside of the cellulosic base material may be carried out, for example, without limitation, by performing spraying under a pressure condition of 0.1 MPa. In the instance where the supplying of nicotine is carried out by spraying, the pressure condition is preferably 0.05 to 2.5 MPa, more preferably 0.05 to 2.0 MPa, and most preferably 1.00 to 1.50 MPa, without limitation. When the pressure for supplying nicotine is within any of the mentioned numerical ranges, the nicotine can be efficiently deposited onto the surface of the cellulosic base material, and as a result, the nicotine and/or menthol release efficiencies can be further improved.

3. Flavor Inhalation Article

[0060] In some embodiments, a flavor inhalation article containing the material for a flavor inhalation article described in the “1.” section can be provided; in particular, the flavor inhalation article may be a heating-type flavor inhalation article.

[0061] In the present application, the “flavor inhalation article” refers to an inhalation article that allows users who inhale the inhalation article to taste a flavor. Flavor inhalation articles can be generally classified into combustion-type flavor inhalation articles, which are represented by conventional cigarettes, and non-combustion-type flavor inhalation articles.

[0062] Examples of the combustion-type flavor inhalation articles include cigarettes, pipes, hookahs, cigars, and cigarillos.

[0063] The non-combustion heating-type flavor inhalation article (heating-type flavor inhalation article) may be heated by a heating device separate from the article or by a heating device integral with the article. Regarding the former flavor inhalation article (that uses a separate heating device), the non-combustion heating-type flavor inhalation article and the heating device may be collectively referred to as a “non-combustion heating-type smoking system”. An example of the non-combustion heating-type smoking system will be described below with reference to FIGS. 1 and 2.

[0064] FIG. 1 is a schematic cross-sectional view of an example of a non-combustion heating-type smoking system. FIG. 1 illustrates a state in which a heater 12 has not yet been inserted into a smoking segment 20A of a non-combustion heating-type flavor inhalation article 20. In use, the heater 12

is inserted into the smoking segment 20A. FIG. 2 is a cross-sectional view of the non-combustion heating-type flavor inhalation article 20.

[0065] As illustrated in FIG. 1, the non-combustion heating-type smoking system includes the non-combustion heating-type flavor inhalation article 20 and a heating device 10, which heats the smoking segment 20A from an inside. Note that the non-combustion heating-type smoking system is not limited to the configuration of FIG. 1.

[0066] The heating device 10, illustrated in FIG. 1, includes a body 11 and a heater 12. The body 11 may include a battery unit and a control unit, which are not illustrated. The heater 12 may be an electrical resistance heater. The heater 12 is configured to be inserted into the smoking segment 20A to heat the smoking segment 20A.

[0067] In FIG. 1, the smoking segment 20A is illustrated as being configured to be heated from the inside; however, the non-combustion heating-type flavor inhalation article 20 is not limited to this form, and, in a different form, the smoking segment 20A is configured to be heated from an outside.

[0068] The heating temperature provided by the heating device 10 is preferably less than or equal to 400° C., more preferably 50 to 400° C., and even more preferably 150 to 350° C., without limitation. The heating temperature is the temperature of the heater 12 of the heating device 10.

[0069] As illustrated in FIG. 2, the non-combustion heating-type flavor inhalation article 20 (hereinafter referred to simply as a “flavor inhalation article 20”) has a cylindrical shape. A length of the circumference of the flavor inhalation article 20 is preferably 16 mm to 27 mm, more preferably 20 mm to 26 mm, and even more preferably 21 mm to 25 mm. A total length (length in a horizontal direction) of the flavor inhalation article 20 is preferably 40 mm to 90 mm, more preferably 50 mm to 75 mm, and even more preferably 50 mm to 60 mm, without limitation.

[0070] The flavor inhalation article 20 is made up of the smoking segment 20A, a filter portion 20C, which constitutes an inhalation port, and a connecting portion 20B, which connects the smoking segment 20A to the filter portion 20C.

[0071] The smoking segment 20A is cylindrical. A total length (length in an axial direction) is, for example, preferably 5 to 100 mm, more preferably 10 to 50 mm, and even more preferably 10 to 25 mm. The smoking segment 20A may have any cross-sectional shape, examples of which include circular shapes, elliptical shapes, and polygonal shapes.

[0072] The smoking segment 20A includes a smoking composition sheet or a material derived therefrom, designated as 21, and includes a wrapper 22, which is wrapped around the sheet or the material.

[0073] The filter portion 20C has a cylindrical shape. The filter portion 20C includes a first segment 25 and a second segment 26. The first segment 25 is rod-shaped and formed of a cellulose acetate fiber loaded therein. Similarly, the second segment 26 is rod-shaped and formed of a cellulose acetate fiber loaded therein. The first segment 25 is located closer to the smoking segment 20A. The first segment 25 may have a hollow portion. The second segment 26 is located closer to the inhalation port. The second segment 26 is solid. The first segment 25 is made up of a first filler layer (cellulose acetate fiber) 25a and an inner plug wrapper 25b, which is wrapped around the first filler layer 25a. The

second segment 26 is made up of a second filler layer (cellulose acetate fiber) 26a and an inner plug wrapper 26b, which is wrapped around the second filler layer 26a. The first segment 25 and the second segment 26 are connected to each other by an outer plug wrapper 27. The outer plug wrapper 27 is bonded to the first segment 25 and the second segment 26 with a vinyl acetate emulsion-based adhesive or the like.

[0074] A length of the filter portion 20C may be, for example, 10 to 30 mm, the length of the connecting portion 20B may be, for example, 10 to 30 mm, the length of the first segment 25 may be, for example, 5 to 15 mm, and the length of the second segment 26 may be, for example, 5 to 15 mm. The lengths of the segments are merely illustrative and may be appropriately changed in accordance with, for example, manufacturability, a required quality, and the length of the smoking segment 20A.

[0075] The first segment 25 (center hole segment) is, for example, made up of the first filler layer 25a, which has one or more hollow portions, and an inner plug wrapper 25b, which covers the first filler layer 25a. The first segment 25 serves to enhance the strength of the second segment 26. The first filler layer 25a of the first segment 25 contains, for example, a cellulose acetate fiber densely loaded therein. The cellulose acetate fiber contains a triacetin-containing plasticizer added thereto in an amount of, for example, 6 to 20 wt. % based on the weight of the cellulose acetate, and, accordingly, the cellulose acetate fiber has been cured. The hollow portion of the first segment 25 has an inside diameter q of 1.0 to 5.0 mm, for example.

[0076] The first filler layer 25a of the first segment 25 may be formed, for example, at a relatively high fiber fill density or may have a fiber fill density comparable to that of the second filler layer 26a of the second segment 26, which will be described below. Accordingly, during the inhalation, the air and an aerosol flow only through the hollow portion, with the first filler layer 25a being substantially free of air or an aerosol flowing therethrough. If, for example, it is desired to reduce a reduction in an aerosol component due to filtration in the second segment 26, one possible way is, for example, to shorten the length of the second segment 26 and lengthen the first segment 25 by the corresponding amount.

[0077] Making up for the reduction in the second segment 26 with the first segment 25 is effective for increasing an amount of delivery of the aerosol component. Since the first filler layer 25a of the first segment 25 is a layer filled with a fiber, users do not experience an uncomfortable feeling during use when they touch the first segment 25 from an outside.

[0078] The second segment 26 is made up of the second filler layer 26a and an inner plug wrapper 26b, which covers the second filler layer 26a. The second segment 26 (filter segment) contains a cellulose acetate fiber loaded at a typical density and has a filtration capacity for typical aerosol components.

[0079] The first segment 25 and the second segment 26 may have different filtration capacities for filtering the aerosol (mainstream smoke) emitted from the smoking segment 20A. At least one of the first segment 25 and the second segment 26 may contain a flavoring agent. The filter section 20C may have any structure. The structure may include multiple segments as described above or may be formed of a single segment. The filter portion 20C may be

formed of one segment. In this instance, the filter portion 20C may be formed of either the first segment or the second segment.

[0080] The connecting portion 20B has a cylindrical shape. The connecting portion 20B includes, for example, a cardboard tube 23, which may be made of cardboard or the like formed to have a cylindrical shape. The connecting portion 20B may be filled with a cooling member for cooling the aerosol. Examples of the cooling member include a sheet of a polymer, such as polylactic acid, and the sheet may be folded to be loaded. In addition, a support portion that inhibits changes in the position of the smoking segment 20A may be provided between the smoking segment 20A and the connecting portion 20B. The support portion may be formed of a material known in the art, which may be a center hole filter, such as that of the first segment 25.

[0081] The wrapper 28 is wrapped, in a cylindrical form, around the outer sides of the smoking segment 20A, the connecting portion 20B, and the filter portion 20C to integrally connect these together. One surface (inner surface) of the wrapper 28 includes a vinyl acetate emulsion-based adhesive applied to the entire area or substantially entire area of the one surface, excluding the vicinity of a vent portion 24. The vent portion 24 is formed by performing laser processing from an outside after the smoking segment 20A, the connecting portion 20B, and the filter portion 20C are integrated with one another with the wrapper 28.

[0082] The vent portion 24 includes two or more through-holes that extend through the connecting portion 20B in a thickness direction thereof. The two or more through-holes are formed to be disposed in a radial manner as viewed from above an extension of a central axis of the flavor inhalation article 20. In the present embodiment, the vent portion 24 is provided in the connecting portion 20B. Alternatively, the vent portion 24 may be provided in the filter portion 20C. In the present embodiment, the two or more through-holes are arranged in one line on one circle with regular intervals. Alternatively, the through-holes may be arranged in two lines on two circles with regular intervals, or one or two lines of vent portions 24 may be arranged non-continuously or irregularly. When the user holds the inhalation port in his or her mouth for inhalation, the ambient air is drawn into the mainstream smoke through the vent portion 24. Note that the vent portion 24 need not be provided.

[0083] The heating-type flavor inhalation article may include a pouch containing the material for a flavor inhalation article described in the “1.” section. The pouch may be any pouch known in the art provided that the pouch can enclose the filler, is water-insoluble, and is permeable to liquids (water, saliva, and the like) and water-soluble components present in the filler. Examples of pouches that can be used include nonwoven fabric pouches. Examples of a material of the pouch include cellulosic nonwoven fabrics, and a commercially available nonwoven fabric may be used. A pouch product can be prepared as follows. A sheet made of a material such as that just mentioned is formed into a bag shape, the filler is loaded into the bag, and the bag is sealed, for example, by heat sealing.

[0084] The sheet may have any basis weight. Typically, the basis weight is 12 gsm or greater and 54 gsm or less, and preferably, 24 gsm or greater and 30 gsm or less. The sheet may have any thickness. Typically, the thickness is 100 μm or greater and 300 μm or less, and preferably, 175 μm or greater and 215 μm or less.

[0085] At least one of inner and outer surfaces of the pouch may include a water-repellent material partially applied thereto. Preferably, the water-repellent material is a water-repellent fluororesin. Specific examples of this type of water-repellent fluororesin include AsahiGuard (registered trademark), manufactured by AGC Inc. Water-repellent fluororesins are applied, for example, to packaging materials for food or products containing a fat or an oil, such as confectionery, dairy products, ready-made dishes, fast food, and pet food. Accordingly, this type of water-repellent fluororesin is safe even if it is applied to a pouch that is to be placed in the oral cavity. The water-repellent material is not limited to a fluororesin and may be, for example, a material having water repellency such as a paraffin resin, a silicone-based resin, or an epoxy-based resin.

[0086] A non-combustion heating-type flavor inhaler may include a tobacco-containing segment, in which a tobacco sheet or the like is loaded, a cooling segment, and a filter segment, as described above. The term “flavor inhaler” has the same meaning as the “flavor inhalation article”, and these terms are interchangeably used. A length in an axial direction of the tobacco-containing segment of the non-combustion heating-type flavor inhaler is shorter than the length in the axial direction of the tobacco-containing segment of a typical combustion-type flavor inhaler because of a relationship with the heater. For this reason, non-combustion heating-type flavor inhalers contain a large amount of a tobacco sheet in the short section of the tobacco-containing segment so as to ensure an amount of the aerosol that is generated during heating. In order for a large amount of a tobacco sheet to be contained in the short section, non-combustion heating-type flavor inhalers typically use a low-filling-capacity, that is, high-density, tobacco sheet. Note that the filling capacity is a value representing a volume of a predetermined weight of shredded pieces of a tobacco sheet that have been compressed at a given pressure for a given time period.

[0087] The present inventors took into consideration heating methods, the heating ability of the heater, and the generation of aerosols and discovered that if a low-filling-capacity (high-density) tobacco sheet is used, a total heat capacity of the tobacco-containing segment increases, and that, as a result, the tobacco sheet contained in the tobacco-containing segment does not sufficiently contribute to aerosol generation in some cases, depending on the heating method and the ability of the heater. One possible solution to this problem is to reduce the total heat capacity of the tobacco-containing segment.

[0088] The present inventors studied the following approaches to reduce the total heat capacity of the tobacco-containing segment: (1) to reduce the specific heat of a tobacco raw material that is included in the tobacco sheet; and (2) to use a high-filling-capacity (low-density) tobacco sheet. It appeared that since reducing the specific heat of the tobacco raw material itself, as stated in (1), is difficult, reducing the total heat capacity of the tobacco-containing segment, as stated in (2), is effective. Accordingly, a preferred first embodiment is described below in which the material for a flavor inhalation article is a high-filling-capacity (low-density) tobacco sheet that is suitable for use in a non-combustion heating-type flavor inhaler.

First Embodiment

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

[0089] A tobacco sheet for a non-combustion heating-type flavor inhaler (hereinafter also referred to as a “tobacco sheet”) of the present embodiment is one in which a cross section of the sheet in a thickness direction thereof has a corrugated shape. Since the tobacco sheet of the present embodiment has a corrugated shape in a cross section in the thickness direction, the tobacco sheet is bulky and has a high filling capacity. Accordingly, using the tobacco sheet of the present embodiment can reduce the total heat capacity of the tobacco-containing segment, thereby enabling the tobacco sheet contained in the tobacco-containing segment to sufficiently contribute to aerosol generation. Furthermore, it is preferable that the tobacco sheet of the present embodiment additionally include an aerosol-source material and one or more forming agents. When these materials are present in proportions within specified ranges, the filling capacity of the tobacco sheet is further improved.

(Shape of Tobacco Sheet)

[0090] The tobacco sheet of the present embodiment has a corrugated shape in a cross section in the thickness direction. That is, if the tobacco sheet of the present embodiment is cut in the thickness direction along one of planar directions, the cross section has a corrugated shape. The one of the planar directions may be, for example, a longitudinal direction or lateral direction of the tobacco sheet. The “corrugated” shape may be any shape that is vertically wavy, and the peak of the wave may have a straight shape or a curved shape. Furthermore, the wave may be a regular or irregular wave.

[0091] An example of the cross-sectional shape of the tobacco sheet of the present embodiment in the thickness direction is illustrated in FIG. 5. A tobacco sheet **1**, illustrated in FIG. 5, has a wave **2** in a cross section in the thickness direction. A width w_1 of the wave **2** is preferably within a range of 0.1 to 10.0 mm, without limitation. A height w_2 of the wave **2** is preferably within a range of 0.1 to 5.0 mm, without limitation. A thickness w_3 of the tobacco sheet **1** is preferably within a range of 100 to 1000 μm . As illustrated in FIG. 5, the wave **2** may have a serrated shape **3**. When the wave **2** has a serrated shape **3**, more spaces can be formed in a mixture of the tobacco sheet because the tips of the serrated shape come into contact with each other, and as a result, the filling capacity can be further improved. The tobacco sheet of the present embodiment may have any size in the planar directions. For example, the tobacco sheet may have a length of 5.0 to 40.0 mm and a width of 0.5 to 2.0 mm.

(Tobacco Raw Material)

[0092] The tobacco raw material included in the tobacco sheet of the present embodiment is a type of the cellulosic base material described above and is tobacco-derived. Examples of the tobacco raw material include tobacco powders. Examples of the tobacco powders include powders of leaf tobacco, powders of midribs, and powders of remaining stalks. These may be used alone or in a combination of two or more. These may be shredded to have a predetermined size so that they can be used as tobacco powders. Regarding a size of the tobacco powders, a cumulative 90%

particle size (D90) thereof in a volume-based particle size distribution measured with a dry laser diffraction method may be greater than or equal to 200 μm , which is preferable from the standpoint of further improving the filling capacity. In the instance where the tobacco raw material is a tobacco powder, a percentage of the tobacco powder in the tobacco sheet is preferably 45 to 95 wt. %, more preferably 50 to 93 wt. %, and even more preferably 60 to 85 wt. %, based on a total weight of the tobacco sheet.

(Nicotine)

[0093] The nicotine may be any of the types of nicotine previously mentioned. In the present embodiment, the nicotine may be a nicotine-containing tobacco extract. Examples of the tobacco extract include a tobacco extract that can be obtained as follows: leaf tobacco is crushed, the crushed leaf tobacco is mixed with a solvent, such as water, and stirred to extract a water-soluble component from the leaf tobacco, and the resulting water extract is dried under reduced pressure to be concentrated.

(Aerosol-Source Material)

[0094] From the standpoint of increasing the amount of smoke during heating, it is preferable that the tobacco sheet of the present embodiment further include an aerosol-source material. Examples of the aerosol-source material include glycerines, propylene glycols, and 1,3-butanediol. These may be used alone or in a combination of two or more.

[0095] In the instance where an aerosol-source material is included in the tobacco sheet, the percentage of the aerosol-source material in the tobacco sheet is preferably 4 to 50 wt. % based on the total weight of the tobacco sheet. When the percentage of the aerosol-source material is greater than or equal to 4 wt. %, a sufficient aerosol, in terms of an amount, can be generated during heating. When the percentage of the aerosol-source material is less than or equal to 50 wt. %, a sufficient aerosol, in terms of a heat capacity, can be generated during heating. The percentage of the aerosol-source material is more preferably 6 to 40 wt. %, even more preferably 8 to 30 wt. %, and particularly preferably 10 to 20 wt. %.

(Forming Agent)

[0096] From the standpoint of ensuring a shape, it is preferable that the tobacco sheet of the present embodiment further include a forming agent. The forming agent is a type of a binder, which is mentioned above. The forming agent that may be further included in the tobacco sheet may include a first forming agent and a second forming agent. This is preferable, in particular, from the standpoint of being able to sufficiently ensure both an ability of the tobacco sheet to retain the aerosol-source material and an ability thereof to maintain the corrugated shape. The first forming agent and the second forming agent may be of different types or may be of the same type and be in different forms. Examples of the first forming agent include polysaccharides, proteins, and synthetic polymers. Examples of the polysaccharides include cellulose derivatives and naturally occurring polysaccharides.

[0097] Examples the cellulose derivatives include cellulose ethers, such as methyl celluloses, ethyl celluloses, hydroxyethyl celluloses, hydroxymethylethyl celluloses, hydroxypropyl celluloses, hydroxypropylmethyl celluloses,

benzyl celluloses, trityl celluloses, cyanoethyl celluloses, carboxymethyl celluloses, carboxyethyl celluloses, and aminoethyl celluloses; organic acid esters, such as cellulose acetate, cellulose formate, cellulose propionate, cellulose butyrate, cellulose benzoate, cellulose phthalate, and tosyl-celluloses; and inorganic acid esters, such as cellulose nitrate, cellulose sulfate, cellulose phosphate, and cellulose xanthate.

[0098] Examples of the naturally occurring polysaccharides include plant-derived polysaccharides, such as guar gums, tara gums, locust bean gums, tamarind seed gums, pectins, gum arabic, gum tragacanth, karaya gums, Ghatti gums, arabinogalactans, flax seed gums, *Cassia* gums, *psyllium* seed gums, and mugwort seed gums; algae-derived polysaccharides, such as carrageenans, agars, alginic acids, propylene glycol alginate, furcellerans, and fukuronori extracts; microorganism-derived polysaccharides, such as xanthan gums, gellan gums, curdlans, *pullulans*, *agrobacterium* succinoglycan, welan gums, macrophomopsis gums, and rhamsan gums; crustacean-derived polysaccharides, such as chitins, chitosans, and glucosamines; and starches, such as starches, sodium starch glycolate, pregelatinized starches, and dextrans.

[0099] Examples of the proteins include grain proteins, such as wheat gluteins and rye gluteins. Examples of the synthetic polymers include polyphosphoric acids, sodium polyacrylate, and polyvinylpyrrolidone. Any of the polysaccharides, proteins, synthetic polymers, and the like that may be used as the first forming agent may also be used as the second forming agent although the second forming agent may be different from the first forming agent.

[0100] In the instance where a first forming agent is included in the tobacco sheet, the percentage of the first forming agent in the tobacco sheet is preferably 0.1 to 15 wt. % based on the total weight of the tobacco sheet. When the percentage of the first forming agent is greater than or equal to 0.1 wt. %, the mixture of the raw materials can be easily formed into a sheet shape. When the percentage of the first forming agent is less than or equal to 15 wt. %, one or more additional raw materials for ensuring functions needed in the tobacco-containing segment of the non-combustion heating-type flavor inhaler can be sufficiently used. The percentage of the first forming agent is more preferably 0.1 to 12 wt. %, even more preferably 0.1 to 10 wt. %, and particularly preferably 0.1 to 7 wt. %.

[0101] In the instance where a second forming agent is included in the tobacco sheet, the percentage of the second forming agent in the tobacco sheet is preferably 0.1 to 15 wt. % based on the total weight of the tobacco sheet. When the percentage of the second forming agent is greater than or equal to 0.1 wt. %, the mixture of the raw materials can be easily formed into a sheet shape. When the percentage of the second forming agent is less than or equal to 15 wt. %, one or more additional raw materials for ensuring the functions needed in the tobacco-containing segment of the non-combustion heating-type flavor inhaler can be sufficiently used. The percentage of the second forming agent is more preferably 0.1 to 12 wt. %, even more preferably 0.1 to 10 wt. %, and particularly preferably 0.1 to 7 wt. %.

[0102] In the instance where the first forming agent and the second forming agent are of the same type and in different forms, the first forming agent may be a powder, and the second forming agent may be a solution, a slurry, or the like, for example. In a method for producing the tobacco

sheet that will be described later, for example, a forming agent that serves as the first forming agent may be a powder that is directly mixed, and a forming agent that serves as the second forming agent may be dispersed in a solvent, such as water, or swollen with the solvent, to be mixed. Even with such a method, it is possible to produce effects similar to those produced by the use of two forming agents of different types.

(Reinforcing Agent)

[0103] The tobacco sheet of the present embodiment may further include a reinforcing agent so as to further improve physical properties. Examples of the reinforcing agent include fibrous materials, such as fibrous pulp and fibrous synthetic celluloses, and liquid materials that form a film when dried and thus have a function of surface coating, such as pectin suspensions. These may be used alone or in a combination of two or more.

[0104] In the instance where a reinforcing agent is included in the tobacco sheet, the percentage of the reinforcing agent in the tobacco sheet is preferably 4 to 40 wt. % based on the total weight of the tobacco sheet. When the percentage is within the range, one or more additional raw materials for ensuring the functions needed in the tobacco-containing segment of the non-combustion heating-type flavor inhaler can be sufficiently used. The percentage of the reinforcing agent is more preferably 4.5 to 35 wt. % and even more preferably 5 to 30 wt. %.

(Humectant)

[0105] The tobacco sheet of the present embodiment may further include a humectant so as to maintain a quality. Examples of the humectant include sugar alcohols, such as sorbitol, erythritol, xylitol, maltitol, lactitol, mannitol, and reduced maltose starch syrup. These may be used alone or in a combination of two or more.

[0106] In the instance where a humectant is included in the tobacco sheet, the percentage of the humectant in the tobacco sheet is preferably 1 to 15 wt. % based on the total weight of the tobacco sheet. When the percentage is within the range, one or more additional raw materials for ensuring the functions needed in the tobacco-containing segment of the non-combustion heating-type flavor inhaler can be sufficiently used. The percentage of the humectant is more preferably 2 to 12 wt. % and even more preferably 3 to 10 wt. %.

(Other Components)

[0107] The tobacco sheet of the present embodiment may include not only the tobacco raw material, the aerosol-source material, the forming agent (first and second forming agents), the reinforcing agent, and the humectant but also, if necessary, a flavoring agent, a seasoning, such as a taste-imparting substance, a coloring agent, a wetting agent, a preservative, a diluent, such as an inorganic material, and the like.

(Filling Capacity)

[0108] Preferably, the tobacco sheet of the present embodiment has a filling capacity of greater than or equal to 190 cc/100 g. When the filling capacity is greater than or equal to 190 cc/100 g, the total heat capacity of the tobacco-containing segment of the non-combustion heating-type

flavor inhaler can be sufficiently reduced, and, consequently, the tobacco sheet contained in the tobacco-containing segment can be more conducive to aerosol generation. The filling capacity is more preferably greater than or equal to 210 cc/100 g and even more preferably greater than or equal to 230 cc/100 g. The filling capacity may have any upper limit of its range, and the upper limit may be, for example, 800 cc/100 g or less. The filling capacity is a value measured as follows. The tobacco sheet is shredded to a size of 0.8 mm×20 mm and allowed to stand in a conditioning chamber at 22° C. and 60% for 48 hours, and subsequently, a measurement is performed with a DD-60A (trade name), manufactured by Borgwaldt. The measurement is carried out by placing 15 g of the shredded tobacco sheet into a cylindrical container having an inside diameter of 60 mm, compressing the shredded tobacco sheet at a load of 3 kg for 30 seconds, and determining the resulting volume.

[Method for Producing Tobacco Sheet]

[0109] The method for producing the tobacco sheet of the present embodiment may, for example, include a step of preparing a mixture containing a tobacco raw material, an aerosol-source material, a first forming agent, and a second forming agent, the tobacco raw material serving as the cellulosic base material; a step of rolling the mixture to form a rolled product; and a step of cutting the rolled product into strips and thus imparting a corrugated shape to the strips, by using a rotary roller cutter pressed against the rolled product. The process of imparting a corrugated shape is also referred to as a rippling process. The tobacco sheet of the present embodiment can be produced, for example, with the following method.

[0110] (1) A step of preparing a mixture by mixing water, a tobacco raw material, an aerosol-source material, first and second forming agents, and a reinforcing agent together.

[0111] (2) A step of feeding the mixture into multiple rolling rollers and rolling the mixture, to form a rolled product.

[0112] (3) A step of cutting the rolled product into strips and thus imparting a corrugated shape to the strips, by using a rotary roller cutter pressed against the rolled product.

[0113] The sheet cut into strips by the rotary roller cutter experiences a resistive force when the sheet is removed from the rollers, and as a result, a corrugated shape and a serrated shape, as illustrated in FIG. 5, are imparted to the sheet. In instances where the rolled product is not cut with a rotary roller cutter, the rolled product on the rolling rollers may be, for example, removed with a doctor knife; in this case, the rolled product experiences a resistive force when it is removed from the rollers, and, consequently, a corrugated shape and a serrated shape can similarly be imparted. Furthermore, in instances where the tobacco sheet is produced with the above-described method, a surface of the rolling rollers may be heated or cooled, and/or a rotational speed of the rolling rollers may be adjusted, depending on the purpose. Furthermore, a distance between the rolling rollers may be adjusted so that a tobacco sheet having a desired basis weight can be obtained.

[0114] An additional step of supplying the nicotine from outside of the cellulosic base material to provide at least a portion of the nicotine to a surface of the cellulosic base

material may be provided between steps (1) and (2), between steps (2) and (3), or after step (3).

EXAMPLES

[0115] The present invention will be experimentally described with reference to Examples below. In the following description, the Examples below should not be construed as limiting the scope of the present invention.

(Preparation of Tobacco Granules)

[0116] Shredded burley tobacco with a nicotine concentration of 0.01%, which was heated at 120° C. and washed with water four times, was ground in a mill, and subsequently, the ground product was sieved with a 50- μ m mesh sieve, to give fine powdered tobacco having a size of less than 50 μ m. 1000 g of the thus obtained fine powdered tobacco, 50 g of CMC (carboxymethyl cellulose), and 100 g of glycerine were mixed together, 300 g of water was added to the resulting mixture, and then, the mixture was kneaded. The obtained kneaded product was fed into a wet extrusion-granulation machine (TDG-80A-1, manufactured by Dalton Corporation) and granulated under conditions including a pressure of 250 kN and a temperature of 80° C. to form granules having a long columnar shape. Subsequently, the granules were milled into a spherical shape to give tobacco granules (spherical shape) (particle size: 250 to 500 μ m, average particle size (D50): 352 μ m).

[0117] Furthermore, tobacco granules (spherical shape) (particle size: 500 to 850 μ m, average particle size (D50): 643 μ m) were obtained in the same manner, except that the granulation conditions for the wet extrusion-granulation machine were changed to a pressure of 200 kN and a temperature of 75° C.

[0118] The particle size of the granules was measured as follows. After the granules were dried at 100° C. for 2 hours, the measurement was performed based on a laser diffraction method, under dry conditions, by using a scattering particle size distribution analyzer (Partica, manufactured by Yamato Scientific Co., Ltd.).

[0119] Solutions were each sprayed onto 50 g of each set of the thus obtained tobacco granules from outside of the granules with a spraying device (a glass spray, manufactured by AS One Corporation) under a pressure condition of 0.1 MPa. One of the solutions was a solution in which 1 g of nicotine ((-)-nicotine, manufactured by FUJIFILM Wako Pure Chemical Corporation) was dissolved in 10 g of water, and the other was a solution in which 10 g of menthol (1-menthol, manufactured by FUJIFILM Wako Pure Chemical Corporation) was dissolved in 10 g of propylene glycol (PG) that was heated at 50° C. or greater. In this manner, the following two sets of tobacco granules were obtained: tobacco granules with 2.179 mg of nicotine and 6.190 mg of menthol, per 100 mg of the granules, being present on a surface of the granules (a nicotine content was 2.179 wt. %, and a menthol content was 6.190 wt. %, based on the total weight of the tobacco granules; the particle size was 250 to 500 μ m, and the average particle size (D50) was 352 μ m) (hereinafter referred to as "tobacco granules A"); and tobacco granules with 2.125 mg of nicotine and 6.584 mg of menthol, per 100 mg of the granules, being present on a surface of the granules (the nicotine content was 2.125 wt. %, and a menthol content was 6.584 wt. %, based on the total weight of the tobacco granules; the particle size was 500 to

850 μm , and the average particle size (D50) was 643 μm) (hereinafter referred to as “tobacco granules B”).

[0120] The surface area per granule of tobacco granules A and tobacco granules B was calculated according to equation (1), described above in the “1. Material for Flavor Inhalation Article” section. The results were 0.196 to 0.785 mm^2 (average: 0.442 mm^2) for tobacco granules A and 0.785 to 2.270 (average: 1.431 mm^2) for tobacco granules B.

(Analysis of Nicotine and Menthol Released from Tobacco Granules)

[0121] 100 mg, 200 mg, or 300 mg of tobacco granules A or B, obtained as described above, were loaded into an empty bottomless cylinder (material: paper, inside diameter: approximately 6.8 mm), and subsequently, an acetate filter (manufactured by Japan Filter Technology, Ltd.) was placed on both ends of the cylinder to hermetically enclose the tobacco granules. A glass fiber filter (Cambridge Filter 44 mm (trade name), manufactured by Borgwaldt) and a smoking machine (single-holder smoking machine, manufactured by Borgwaldt) were placed next to one of the acetate filters that were placed on the cylinder, with the glass fiber filter being closer to the cylinder than the smoking machine. The cylinder containing the tobacco granules was heated from the outside with a heater (set temperature: 55° C. or 70° C.)

[0123] Oven temperature: the temperature was maintained at 150° C. for 1.3 minutes, and the temperature was then increased at 70° C./min to 240° C. and maintained for 5 minutes.

[0124] Column: DB-WAX (trade name), 10 m \times 0.18 mm \times 0.18 μm , manufactured by Agilent Technologies

[0125] Detector: FID

[0126] The difference in weight of the glass fiber filter, between before and after the smoking, was calculated by subtracting the pre-smoking weight of the glass fiber filter from the post-smoking weight of the glass fiber filter, and the difference in weight was designated as the amount of total particulate matter (TPM) present in the vapor and aerosol inhaled by the smoking machine.

[0127] Furthermore, for the nicotine and the menthol, individually, a ratio of the amount of collection of nicotine or menthol per 10 puffs to the amount of loading of nicotine or menthol (amount of collection per 10 puffs/amount of loading \times 100) (hereinafter, the ratio is referred to as a “release efficiency per 10 inhalations”) was calculated.

[0128] The results obtained are shown in Table 1 and FIGS. 3 and 4.

TABLE 1

Example	Temperature of heater	Particle size [μm]	Amount of loading of tobacco granules [mg]	Amount of loading of nicotine [mg]	Amount of loading of menthol [mg]	TPM [mg]	Amount of collection of nicotine per 10 puffs [mg]	Amount of collection of menthol per 10 puffs [mg]	Nicotine release efficiency per 10 inhalations	Menthol release efficiency per 10 inhalations
1	70° C.	500 to 850	300	6.374	19.752	5.00	0.115	1.375	1.8%	7.0%
2			200	4.250	13.168	2.90	0.105	1.165	2.5%	8.8%
3		100	2.125	6.584	1.30	0.069	0.666	3.3%	10.1%	
4	55° C.	250 to 500	300	6.536	18.570	7.80	0.142	1.633	2.2%	8.8%
5			200	4.358	12.380	4.60	0.169	1.678	3.9%	13.6%
6		100	2.179	6.190	1.90	0.108	1.027	5.0%	16.6%	
7	55° C.	500 to 850	300	6.374	19.752	2.60	0.039	0.816	0.6%	4.1%
8			200	4.250	13.168	1.60	0.041	0.759	1.0%	5.8%
9		100	2.125	6.584	1.00	0.033	0.512	1.5%	7.8%	
10	55° C.	250 to 500	300	6.536	18.570	5.00	0.056	1.049	0.9%	5.6%
11			200	4.358	12.380	3.00	0.090	1.061	2.1%	8.6%
12		100	2.179	6.190	0.80	0.046	0.629	2.1%	10.2%	

to generate a vapor and an aerosol, and the generated vapor and aerosol were inhaled with the smoking machine. The inhalation was performed by inhaling a total of 10 puffs in accordance with the CIR (Canadian Intense smoking regime); specifically, the condition of 55 ml and 2 seconds per puff was used (the puff interval was 30 seconds with an inhalation duration of 2 seconds and a downtime of 28 seconds). After 10 puffs were inhaled, the nicotine and menthol collected on the glass fiber filter were quantified. In this manner, values of an amount of collection (amount of inhalation) of nicotine or menthol per 10 puffs were obtained. The quantification was carried out as follows: the collected component was extracted by shaking, which was performed under the conditions of 20 minutes and 200 rpm, with 10 ml of isopropanol (IPA) being used as an extractant, and the resulting extract was analyzed by GC under the following conditions.

<Conditions for GC Analysis>

[0122] Inlet temperature: 240° C.

[0129] The materials for a flavor inhalation article of Examples 1 to 12 are materials for a flavor inhalation article that were formed by mixing a cellulosic base material with nicotine.

[0130] As is apparent from the results shown in Table 1 and FIGS. 3 and 4, the materials for a flavor inhalation article of Examples 1 to 12 were capable of easily releasing nicotine, as indicated by the nicotine release efficiency per 10 inhalations of 1.8% or greater that was achieved even at the heating temperature of 70° C., which is lower than the heating temperature of 200° C. or greater used in the related art. As is also apparent, the materials for a flavor inhalation article of Examples 1 to 12 were capable of easily releasing menthol, as indicated by the menthol release efficiency per 10 inhalations of 7% or greater that was achieved even at the low heating temperature of 70° C.

[0131] As is also apparent, even at the very low heating temperature of 55° C., reduced from 70° C., the materials for a flavor inhalation article of Examples 1 to 12 were still

capable of easily releasing nicotine, as indicated by the nicotine release efficiency per 10 inhalations of 0.6% or greater. As is also apparent, even at the very low heating temperature of 55° C., the materials for a flavor inhalation article of Examples 1 to 12 were still capable of easily releasing menthol, as indicated by the menthol release efficiency per 10 inhalations of 4% or greater.

[0132] It is believed that since the materials for a flavor inhalation article of Examples 1 to 12 were formed by supplying nicotine and menthol from outside of the tobacco granules, the nicotine and the menthol were present on the surface of the materials for a flavor inhalation article and within the pores formed in the surface. It is believed that the nicotine and the menthol present on the surface of the materials for a flavor inhalation article and within the pores could be released more easily because they were located closer to an external surface than nicotine and the like that were attributable to the original components of the materials for a flavor inhalation article and were, therefore, present in an inner region. Thus, it is believed that even at a low heating temperature, nicotine and menthol were sufficiently released to the outside, which resulted in high release efficiencies.

[0133] Furthermore, as is apparent from the results shown in Table 1 and FIGS. 3 and 4, tobacco granules A, which had a smaller particle size than tobacco granules B, which had a large particle size, had a tendency to have a high nicotine release efficiency per 10 inhalations, at the same heating temperature. Regarding this point, it is believed that the smaller the particle size of the tobacco granules, the greater the total surface area of all the tobacco granules, provided that the amounts of loading of the tobacco granules are the same. Thus, it is believed that when the surface area is large, the amount of nicotine that is present on the surface of the tobacco granules and is therefore released increases, and that, consequently, the nicotine release efficiency increases.

[0134] As is also apparent, the lower the amount of loading of nicotine, the greater the tendency for the nicotine release efficiency per 10 inhalations to increase. Regarding this point, it is believed that the lower the amount of loading of nicotine, the thinner the layer of nicotine that is deposited on the surface of the tobacco granules, provided that the particle sizes of the tobacco granules are the same. It is believed that when the layer of nicotine is thick, nicotine that is present in a lower region of the layer cannot be easily released. It is believed that when the layer of nicotine is thin, nicotine can be easily released from the entire layer, which results in an increase in the nicotine release efficiency.

[0135] These tendencies observed regarding nicotine were also observed in the menthol release efficiency. It is thought that these tendencies in the menthol release efficiency are due to similar reasons for the tendencies of the nicotine.

[0136] Thus, it is apparent that the materials for a flavor inhalation article of the present application can be used at low heating temperatures.

[0137] The first embodiment will be described below with reference to a Reference Example and the like.

Reference Example 1

[0138] Tobacco laminae (leaf tobacco) were dry-ground in a Hosokawa Micron ACM to give a tobacco powder. Regarding the tobacco powder, the cumulative 90% particle size (D90) in a volume-based particle size distribution measured with a dry laser diffraction method was measured

with a Mastersizer (trade name) (from Malvern Panalytical division of Spectris Co., Ltd.), and the result was 200 μm .

[0139] A tobacco sheet was produced from the tobacco powder, which was used as a tobacco raw material. Specifically, 70 parts by weight of the tobacco raw material, 12 parts by weight of glycerine as an aerosol-source material, 4 parts by weight of powdered carboxymethyl cellulose as a first forming agent, 1 part by weight of water-swollen carboxymethyl cellulose as a second forming agent, 5 parts by weight of fibrous pulp as a reinforcing agent, and 8 parts by weight of cocoa powder as a flavoring agent were mixed together and kneaded in an extrusion molding machine. The kneaded product was formed with two pairs of metal rollers into a sheet shape, to give a rolled product. The rolled product was cut into strips, and a corrugated shape was thus imparted to the strips, by using a rotary roller cutter for noodle making pressed against the rolled product. The strips were cut to a length of 20 mm and dried, to give a tobacco sheet having a length of 20 mm and a width of 0.8 mm. A cross section of the tobacco sheet in a thickness direction thereof had a cross-sectional shape as illustrated in FIG. 5.

[0140] The filling capacity of the obtained tobacco sheet was measured. Specifically, the tobacco sheet was allowed to stand in a conditioning chamber at 22° C. and 60% for 48 hours, and subsequently, the filling capacity was measured with a DD-60A (trade name), manufactured by Borgwaldt. The measurement was carried out by placing 15 g of the tobacco sheet into a cylindrical container having an inside diameter of 60 mm, compressing the tobacco sheet at a load of 3 kg for 30 seconds, and determining the resulting volume. The results are shown in Table 2. In Table 2, the filling capacity is indicated as a percentage (%) of increase in the filling capacity with respect to a reference value, which is the value of the filling capacity of a Comparative Reference Example 1, which is described below.

Comparative Reference Example 1

[0141] A rolled product was prepared in the same manner as in Reference Example 1. Subsequently, the rolled product was cut into strips by using a multiple-ring-type rotary cutter. The strips were cut to a length of 20 mm to give a tobacco sheet that had a length of 20 mm and a width of 0.8 mm and had no corrugated shape imparted thereto. The filling capacity of the obtained tobacco sheet was measured in the same manner as in Reference Example 1. The results are shown in Table 2.

TABLE 2

	Percentage of increase in filling capacity (%)
Reference Example 1	54
Comparative Reference Example 1	—

[0142] As indicated by the table, the tobacco sheet of Reference Example 1, which was a tobacco sheet of the present embodiment, had an improved filling capacity compared with the tobacco sheet of Comparative Reference Example 1, which had no corrugated shape imparted thereto.

[0143] Embodiments are described below.

[0144] [1] A material for a flavor inhalation article, the material being a material formed by mixing a cellulosic base material with nicotine.

- [0145] [2] The material for a flavor inhalation article according to [1], in which the nicotine is a component supplied from outside of the cellulosic base material, and at least a portion of the nicotine is present on a surface of the cellulosic base material.
- [0146] [3] The material for a flavor inhalation article according to [1] or [2], in which the nicotine is selected from the group consisting of synthetic nicotine, isolated nicotine, and combinations thereof.
- [0147] [4] The material for a flavor inhalation article according to any one of [1] to [3], in which a content of the nicotine is greater than or equal to 2 wt. % based on a total weight of the material for a flavor inhalation article.
- [0148] [5] The material for a flavor inhalation article according to any one of [1] to [4], further including menthol.
- [0149] [6] The material for a flavor inhalation article according to [5], in which the content of the menthol is greater than or equal to 6 wt. % based on the total weight of the material for a flavor inhalation article.
- [0150] [7] The material for a flavor inhalation article according to any one of [1] to [6], in which the material is in a form of granules or a sheet.
- [0151] [8] The material for a flavor inhalation article according to [7], in which the material is in the form of granules, and the granules have a particle size of greater than or equal to 250 μm .
- [0152] [9] The material for a flavor inhalation article according to [7] or [8], in which the material is in the form of granules, and the granules have a surface area per granule of 0.1 to 2.5 mm^2 .
- [0153] [10] The material for a flavor inhalation article according to any one of [1] to [9], in which a nicotine release efficiency per 10 inhalations associated with heating and inhalation at 55° C. is greater than or equal to 0.6%.
- [0154] [11] The material for a flavor inhalation article according to [5] or [6], in which a menthol release efficiency per 10 inhalations associated with heating and inhalation at 55° C. is greater than or equal to 4%.
- [0155] [12] The material for a flavor inhalation article according to any one of [1] to [11], in which a nicotine release efficiency per 10 inhalations associated with heating and inhalation at 70° C. is greater than or equal to 1.8%.
- [0156] [13] The material for a flavor inhalation article according to [5], [6], or [11], in which a menthol release efficiency per 10 inhalations associated with heating and inhalation at 70° C. is greater than or equal to 7%.
- [0157] [14] A heating-type flavor inhalation article including the material for a flavor inhalation article according to any one of [1] to [13].
- [0158] [15] The heating-type flavor inhalation article according to [14], further including a pouch containing the material for a flavor inhalation article.
- [0159] [16] The heating-type flavor inhalation article according to [15], in which the pouch is a nonwoven fabric pouch.
- [0160] [17] A method for producing the material for a flavor inhalation article according to any one of [1] to [13], the method including the steps of:
- [0161] providing the cellulosic base material and the nicotine; and
- [0162] supplying the nicotine from outside of the cellulosic base material to provide at least a portion of the nicotine to a surface of the cellulosic base material.
- [0163] (1) A tobacco sheet for a non-combustion heating-type flavor inhaler, which is a tobacco sheet including a tobacco raw material, and in which a cross section of the tobacco sheet in a thickness direction thereof has a corrugated shape.
- [0164] (2) The tobacco sheet for a non-combustion heating-type flavor inhaler according to (1), further including an aerosol-source material.
- [0165] (3) The tobacco sheet for a non-combustion heating-type flavor inhaler according to (2), in which the aerosol-source material is at least one selected from the group consisting of glycerines, propylene glycols, and 1,3-butanediol.
- [0166] (4) The tobacco sheet for a non-combustion heating-type flavor inhaler according to (2) or (3), in which a percentage of the aerosol-source material in the tobacco sheet is 4 to 50 wt. % based on a total weight of the tobacco sheet.
- [0167] (5) The tobacco sheet for a non-combustion heating-type flavor inhaler according to any one of (1) to (4), further including a first forming agent and a second forming agent.
- [0168] (6) The tobacco sheet for a non-combustion heating-type flavor inhaler according to (5), in which the first forming agent is at least one selected from the group consisting of polysaccharides, proteins, and synthetic polymers.
- [0169] (7) The tobacco sheet for a non-combustion heating-type flavor inhaler according to (5) or (6), in which the second forming agent is at least one selected from the group consisting of polysaccharides, proteins, and synthetic polymers and is different from the first forming agent.
- [0170] (8) The tobacco sheet for a non-combustion heating-type flavor inhaler according to any one of (5) to (7), in which the percentage of the first forming agent in the tobacco sheet is 0.1 to 15 wt. % based on the total weight of the tobacco sheet.
- [0171] (9) The tobacco sheet for a non-combustion heating-type flavor inhaler according to any one of (5) to (8), in which the percentage of the second forming agent in the tobacco sheet is 0.1 to 15 wt. % based on the total weight of the tobacco sheet.
- [0172] (10) A non-combustion heating-type flavor inhaler including a tobacco-containing segment that includes the tobacco sheet for a non-combustion heating-type flavor inhaler according to any one of (1) to (9).
- [0173] (11) A non-combustion heating-type flavor inhalation system including:
- [0174] the non-combustion heating-type flavor inhaler according to (10); and
- [0175] a heating device that heats the tobacco-containing segment.
- [0176] (12) A method for producing the tobacco sheet for a non-combustion heating-type flavor inhaler according to any one of (1) to (9), the method including the steps of:
- [0177] preparing a mixture containing the tobacco raw material, an aerosol-source material, a first forming agent, and a second forming agent;

[0178] rolling the mixture to form a rolled product; and
 [0179] cutting the rolled product into strips and thus imparting a corrugated shape to the strips, by using a rotary roller cutter pressed against the rolled product.

REFERENCE SIGNS LIST

- [0180] 1 tobacco sheet
- [0181] 2 wave
- [0182] 3 serrated shape
- [0183] 10 heating device
- [0184] 11 body
- [0185] 12 heater
- [0186] 20 non-combustion heating-type flavor inhalation article
- [0187] 20A smoking segment
- [0188] 20B connecting portion
- [0189] 20C filter portion
- [0190] 21 smoking composition sheet or material derived therefrom
- [0191] 22 wrapper
- [0192] 23 cardboard tube
- [0193] 24 vent portion
- [0194] 25 first segment
- [0195] 25a first filler layer
- [0196] 25b inner plug wrapper
- [0197] 26 second segment
- [0198] 26a second filler layer
- [0199] 26b inner plug wrapper
- [0200] 27 outer plug wrapper
- [0201] 28 wrapper

1. A material for a flavor inhalation article, the material being a material formed by mixing a cellulosic base material with nicotine, wherein

the material for a flavor inhalation article is a tobacco sheet for a non-combustion heating-type flavor inhalation article, and

a cross section of the tobacco sheet in a thickness direction thereof has a corrugated shape.

2. (canceled)

3. The material for a flavor inhalation article according to claim 1, wherein the tobacco sheet further comprises an aerosol-source material.

4. A method for producing the material for a flavor inhalation article according to claim 1, the method comprising the steps of:

preparing a mixture containing the cellulosic base material, an aerosol-source material, a first forming agent, and a second forming agent;

rolling the mixture to form a rolled product;

cutting the rolled product into strips and thus imparting a corrugated shape to the strips, by using a rotary roller cutter pressed against the rolled product; and

supplying the nicotine from outside of the cellulosic base material to provide at least a portion of the nicotine to a surface of the cellulosic base material.

5. A non-combustion heating-type flavor inhalation article comprising a tobacco-containing segment that comprises the material for a flavor inhalation article according to claim 1.

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

the non-combustion heating-type flavor inhalation article according to claim 5; and

a heating device that heats the tobacco-containing segment.

* * * * *