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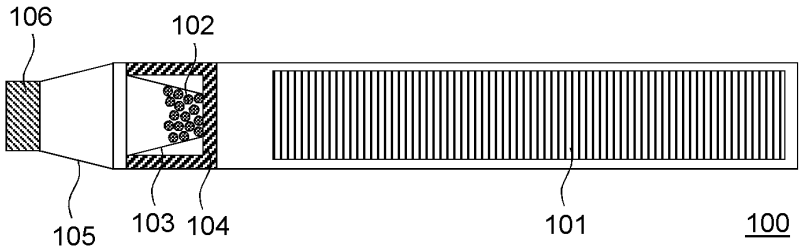
(54) **HEAT-NOT-BURN SMOKING ARTICLE, METHOD FOR USING SAME, AND HEAT-NOT-BURN SMOKING SYSTEM**

(57) Provided is a heat-not-burn smoking article in which filtration of a smoking flavor component through a filter is reduced even in use at a heating temperature of 230°C or lower. A heat-not-burn smoking article according to the present invention includes a tobacco filler containing tobacco and an aerosol former; and a filter disposed downstream of the tobacco filler, where the tobacco filler is a tobacco filler that provides an aerosol having a pH of 7.8 or less.

Fig. 1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a heat-not-burn smoking article, a method of using the smoking article, and a heat-not-burn smoking system.

BACKGROUND ART

[0002] As a substitute for a common combustion smoking article that utilizes combustion for smoking, a heat-not-burn smoking article that utilizes heating instead of combustion has been developed in recent years (Patent Literature (PTL) 1, for example). In such a heat-not-burn smoking article, a tobacco filler contains, in addition to tobacco, an aerosol former for generating an aerosol upon heating. During inhalation, an aerosol is also inhaled together with a smoking flavor component.

[0003] In a heat-not-burn smoking article, the tobacco filler is typically heated at a temperature exceeding 230°C. By heating at a temperature exceeding 230°C, cellulose, hemicellulose, lignin, and so forth contained in tobacco undergo thermal decomposition to form various thermal decomposition products, thereby yielding a complex smoking flavor.

CITATION LIST

PATENT LITERATURE

[0004]

PTL 1: WO 2017/203686
PTL 2: Japanese Unexamined Patent Application Publication (Translation of PCT Application) No. 2009-502136

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0005] When the tobacco filler is heated at a temperature exceeding 230°C in a heat-not-burn smoking article, various thermal decomposition products are formed upon thermal decomposition and incorporated into aerosol particles. Consequently, the volatility of aerosol particles as well as the volatility of a smoking flavor component contained in aerosol particles are lowered.

[0006] Meanwhile, when the tobacco filler is heated at a temperature of 230°C or lower, the above-mentioned thermal decomposition occurs only marginally, thereby reducing the amount of thermal decomposition products incorporated into aerosol particles. For this reason, the volatility of aerosol particles increases. In addition, the volatility of a smoking flavor component contained in aerosol particles also increases, thereby readily volatilizing the smoking flavor component from aerosol particles into a gas. In this case, when passing through a filter disposed downstream of the tobacco filler, an aerosol is subjected to mechanical filtration of aerosol particles (hereinafter, also referred to as "mechanical filtration"), in which aerosol particles are filtered through physical contact with a filter, as well as to trapping of a smoking flavor component through adsorption (hereinafter, also referred to as "adsorption filtration"), in which a smoking flavor component gas volatilized from aerosol particles is trapped through adsorption onto a filter surface. Consequently, filtration of a smoking flavor component through a filter increases without supplying a sufficient amount of the smoking flavor component to a user.

[0007] To resolve this problem, it would be possible to adopt, for example, a configuration without a filter (PTL 2, for example). However, a heat-not-burn smoking article without a filter considerably differs in smoking mode, due to the low resistance to draw, from a common heat-not-burn smoking article including a filter. This makes a user feel difficulty in inhaling in some cases.

[0008] An object of the present invention is to provide a heat-not-burn smoking article in which filtration of a smoking flavor component through a filter is reduced even in use at a heating temperature of 230°C or lower.

SOLUTION TO PROBLEM

[0009] A heat-not-burn smoking article according to the present invention includes

a tobacco filler containing tobacco and an aerosol former; and

a filter disposed downstream of the tobacco filler, where
the tobacco filler is a tobacco filler that provides an aerosol having a pH of 7.8 or less.

[0010] A method of using a heat-not-burn smoking article according to the present invention, includes heating to 230°C or lower the tobacco filler of the heat-not-burn smoking article according to the present invention.

[0011] A heat-not-burn smoking system according to the present invention includes

the heat-not-burn smoking article according to the present invention; and
a heating device for heating the tobacco filler.

ADVANTAGEOUS EFFECTS OF INVENTION

[0012] According to the present invention, it is possible to provide a heat-not-burn smoking article in which filtration of a smoking flavor component through a filter is reduced even in use at a heating temperature of 230°C or lower.

BRIEF DESCRIPTION OF DRAWINGS

[0013]

Fig. 1 is a cross-sectional view of a heat-not-burn smoking article according to a first embodiment of the present invention.
Fig. 2 is a cross-sectional view of a heat-not-burn smoking article according to a second embodiment of the present invention.
Fig. 3 is a schematic view of an exemplary heat-not-burn smoking system according to the present invention in (a) the state before inserting a heat-not-burn smoking article into a heating device and in (b) the state of heating the heat-not-burn smoking article inserted into the heating device.
Fig. 4 is a graph plotting the relationship between indicator of increase in filtration and smoking flavor grade in Examples 10 and 11 as well as Comparative Examples 5 to 8.
Fig. 5 is a graph plotting the relationship between aerosol pH and indicator of increase in filtration in Examples 1 to 11 as well as Comparative Examples 1 to 8.
Fig. 6 is a schematic view of a pod and a heating device used in Reference Examples 1 to 5.

DESCRIPTION OF EMBODIMENTS

[Heat-not-burn Smoking Article]

[0014] A heat-not-burn smoking article according to the present invention includes a tobacco filler containing tobacco and an aerosol former; and a filter disposed downstream of the tobacco filler. Here, the tobacco filler is a tobacco filler that provides an aerosol having a pH of 7.8 or less.

[0015] The present inventors found possible, by setting the aerosol pH to 7.8 or less, to reduce filtration of a smoking flavor component through a filter and to supply a sufficient amount of the smoking flavor component to a user even when a heat-not-burn smoking article is used at a heating temperature of 230°C or lower.

[0016] As mentioned above, when a conventional heat-not-burn smoking article is used at a heating temperature of 230°C or lower, thermal decomposition of components contained in tobacco occurs only marginally, thereby reducing the amount of thermal decomposition products incorporated into aerosol particles. For this reason, the volatility of aerosol particles as well as the volatility of a smoking flavor component contained in aerosol particles increase. In this case, when passing through a filter, an aerosol is subjected to mechanical filtration, in which aerosol particles are mechanically filtered through a filter, as well as to adsorption filtration, in which a smoking flavor component gas volatilized from aerosol particles is trapped through adsorption onto a filter surface. Consequently, filtration of a smoking flavor component through a filter increases.

[0017] In the heat-not-burn smoking article according to the present invention, the tobacco filler provides an aerosol having a pH of 7.8 or less. For this reason, an aerosol solution within aerosol particles is acidic and forms acid-base bonds with a basic smoking flavor component, such as nicotine. Consequently, the volatility of the smoking flavor component contained in aerosol particles decreases and the smoking flavor component tends to remain within aerosol particles. Accordingly, even when the heat-not-burn smoking article is used at a heating temperature of 230°C or lower, it is possible to reduce adsorption filtration of a smoking flavor component gas and, as a result, to reduce filtration of the smoking flavor component through a filter.

[0018] In the present invention, the pH of an aerosol generated from the tobacco filler is 7.8 or less, preferably 7.5 or

less, more preferably 7.3 or less, and further preferably 7.0 or less. The lower limit of the aerosol pH range is not particularly limited and may be 4.0 or greater since the aerosol pH is typically 4.0 or greater even when all the components contained in a tobacco filler have migrated into the aerosol.

[0019] In the present invention, the term "aerosol" encompasses aerosol particles containing a smoking flavor component derived from tobacco as well as a gas surrounding the aerosol particles. Further, the "pH of an aerosol" indicates the pH of a solution obtained by directly collecting, in an impinger added with 10 mL of ultrapure water, 10 to 15 mg of an aerosol at 30°C or lower before passing through a filter. Hereinafter, the details of the present invention will be described.

[0020] The configuration of the heat-not-burn smoking article according to the present invention is not particularly limited provided that a tobacco filler and a filter disposed downstream of the tobacco filler are included. The heat-not-burn smoking article according to the present invention may be, for example, a heat-not-burn smoking article according to the first or the second embodiment described hereinafter.

(Tobacco Filler)

[0021] The tobacco filler according to the present invention is not particularly limited as long as tobacco and an aerosol former are contained and an aerosol having a pH of 7.8 or less is provided. As described hereinafter, the tobacco filler preferably further contains an organic acid. Moreover, the tobacco filler may further contain a volatile flavor component, water, and so forth. The tobacco filler may be a tobacco filler that can generate, for example, an aerosol containing a smoking flavor component having an amino group, where the amino group forms a salt at 230°C or lower.

[0022] As the types of tobacco, oriental, flue-cured, burley, and domestic, regardless of *Nicotiana tabacum* varieties or *Nicotiana rustica* varieties, may be blended as appropriate for an intended taste and used. The details of the types of tobacco are disclosed in "Tobacco no Jiten (Dictionary of Tobacco), Tobacco Academic Studies Center, March 31, 2009." Among these, oriental or flue-cured varieties are preferable for the tobacco. In other words, the tobacco preferably includes at least one of an oriental variety and a flue-cured variety. Oriental and flue-cured varieties reduce migration of basic substances into aerosol particles due to the low nitrogen content and can lower the pH of an aerosol due to the high content of organic acids or the like. To further lower the pH of an aerosol, the tobacco contains at least one of an oriental variety and a flue-cured variety at preferably 50 mass% or more, more preferably 60 mass% or more, further preferably 70 mass% or more, and particularly preferably 100 mass%, which means that the tobacco consists of at least one of an oriental variety and a flue-cured variety. Exemplary sections to be used include leaves (shreds), stalks, stems, veins (shreds), roots, and flowers.

[0023] The form of tobacco is not particularly limited, and any form, such as tobacco shreds, regenerated sheets, or dust, is applicable to the filler. For example, dry tobacco leaves shredded into a width of 0.8 to 1.2 mm may be used. In this case, the shreds have a length of about 5 to 20 mm Moreover, those prepared by uniformly pulverizing dry tobacco leaves into an average particle size of about 20 to 200 μm, forming into sheets, and shredding the sheets into a width of 0.8 to 1.2 mm may also be used. In this case, the shreds have a length of about 5 to 20 mm Further, the above-mentioned formed sheets may be gathered without shredding and used as a filler. Furthermore, a plurality of cylindrically formed sheets may be arranged concentrically.

[0024] There are a plurality of conventional methods for pulverizing tobacco and forming into uniform sheets. Such sheets include a sheet made by a papermaking process; a cast sheet made by uniformly mixing with a suitable solvent, such as water, thinly casting the resulting uniform mixture on a metal sheet or a metal sheet belt, and drying; and a rolled sheet formed by extruding a uniform mixture with a suitable solvent, such as water, into a sheet shape. The details of the types of uniform sheets are disclosed in "Tobacco no Jiten (Dictionary of Tobacco), Tobacco Academic Studies Center, March 31, 2009."

[0025] The content of tobacco in the tobacco filler is not particularly limited but is preferably 20 to 90 mass%, more preferably 50 to 90 mass%, and further preferably 70 to 90 mass% relative to 100 mass% of the tobacco filler. When the content is 20 mass% or more, a sufficient amount of a smoking flavor component can be supplied. Meanwhile, when the content is 90 mass% or less, other components excluding tobacco can be included in appropriate amounts.

[0026] The aerosol former is not particularly limited provided that an aerosol can be generated upon heating, and examples include polyhydric alcohols, such as glycerol, propylene glycol, triethylene glycol, tetraethylene glycol, and 1,3-butanediol; aliphatic carboxylic acid esters, such as methyl stearate, dimethyl dodecanedioate, and dimethyl tetradecanedioate; triethyl citrate; and triacetin. These may be used alone or in combination. As the concentration of generated aerosol particles is lower, a smoking flavor component volatilizes more readily from an aerosol. For this reason, the present technique is particularly effective for glycerol, which is a former having a low amount of volatilization at a heating temperature of 230°C or lower.

[0027] The content of an aerosol former in the tobacco filler is not particularly limited but is preferably 10 to 90 mass%, more preferably 10 to 50 mass%, and further preferably 10 to 30 mass% relative to 100 mass% of the tobacco filler. When the content is 10 mass% or more, a sufficient amount of an aerosol can be generated and supplied. Meanwhile,

when the content is 90 mass% or less, other components excluding an aerosol former can be included in appropriate amounts.

[0028] To lower the pH of an aerosol, the tobacco filler according to the present invention preferably further contains an organic acid. Such an organic acid is a second organic acid to be added to the tobacco filler unlike an organic acid (first organic acid) contained in tobacco. The organic acid may be an edible organic acid and is not particularly limited provided that the pH of an aerosol can be lowered to 7.8 or less. Examples include levulinic acid and benzoic acid. These may be used alone or in combination.

[0029] The boiling point of the organic acid is preferably 300°C or lower, more preferably 280°C or lower, and further preferably 250°C or lower. When the organic acid has a boiling point of 300°C or lower, the organic acid readily volatilizes even when a heat-not-burn smoking article is used at a heating temperature of 230°C or lower, thereby increasing the amount of the organic acid contained in aerosol particles. Consequently, the pH of an aerosol can be lowered further. The lower limit of the boiling point range of the organic acid is not particularly limited and may be 150°C or higher, for example. The "boiling point" in the present invention indicates a boiling point at a pressure of 760 mmHg and is a value measured through distillation, for example.

[0030] The organic acid preferably has a first acid dissociation constant of preferably 4.0 to 5.0, more preferably 4.1 to 4.8, and further preferably 4.2 to 4.5. When the organic acid has a first acid dissociation constant of 4.0 to 5.0, the organic acid tends to undergo acid-base reactions with a basic smoking flavor component within aerosol particles, thereby forming salts further readily. For this reason, the volatility of the smoking flavor component contained in aerosol particles is lowered further. Consequently, it possible to further reduce filtration of the smoking flavor component through a filter. In the present invention, the term "first acid dissociation constant" indicates an acid dissociation constant in water at 25°C and is a value measured, for example, by acid-base titration, absorption spectroscopy, or capillary electrophoresis.

[0031] A product of a value of the boiling point (°C) of the organic acid and a value of the first acid dissociation constant of the organic acid is preferably 1,000 to 1,200, more preferably 1,020 to 1,150, and further preferably 1,040 to 1,100. When the product value is 1,000 to 1,200, the volatility of the organic acid at a heating temperature of 230°C or lower and the acid strength suitable for acid-base reactions with a smoking flavor component are well balanced. Consequently, it is possible to further lower the volatility of a smoking flavor component contained in aerosol particles and thus to further reduce filtration of the smoking flavor component through a filter.

[0032] The organic acid is preferably solid at 25°C. When the organic acid is solid at 25°C, the organic acid can exist within aerosol particles in a stable manner due to the low volatility. Consequently, it is possible to further lower the pH of an aerosol.

[0033] The organic acid is preferably soluble in the aerosol former at 25°C. When the organic acid is soluble in the aerosol former at 25°C, the organic acid can exist uniformly within aerosol particles and can effectively attain the bonded state with a smoking flavor component. Consequently, it is possible to further lower the volatility of the smoking flavor component contained in aerosol particles and thus to further reduce filtration of the smoking flavor component through a filter. Herein, whether an organic acid is soluble in an aerosol former at 25°C is determined by adding 10 mg of the organic acid to 1,000 mg of the aerosol former at 25°C, stirring, and visually checking the solubility. When the resulting solution is colorless and transparent or the majority of the organic acid added is invisible due to dissolution, the organic acid is determined as "soluble." Since a solution of a polyol, such as glycerol, is difficult to measure at room temperature due to the high viscosity, it is desirable to observe the solution after appropriately dissolving once at a high temperature, followed by cooling to room temperature.

[0034] When the tobacco filler contains an organic acid (second organic acid), the content of the organic acid (second organic acid) in the tobacco filler is not particularly limited provided that the pH of an aerosol is 7.8 or less. Although different depending on the type or the like of an organic acid, the content may be 0.1 to 20 mass% or may also be 0.5 to 10 mass% relative to 100 mass% of the tobacco filler, for example.

[0035] The tobacco filler according to the present invention may contain, as necessary, a volatile flavor component from a viewpoint of imparting a smoking flavor. The volatile flavor component is not particularly limited and examples include, from a viewpoint of imparting a satisfactory smoking flavor, acetanisole, acetophenone, acetylpyrazine, 2-acetylthiazole, alfalfa extract, amyl alcohol, amyl butyrate, trans-anethole, star anise oil, apple juice, Peru balsam oil, beeswax absolute, benzaldehyde, benzoin resinoid, benzyl alcohol, benzyl benzoate, benzyl phenylacetate, benzyl propionate, 2,3-butanedione, 2-butanol, butyl butyrate, butyric acid, caramel, cardamom oil, carob absolute, β-carotene, carrot juice, L-carvone, β-caryophyllene, cassia bark oil, cedarwood oil, celery seed oil, chamomile oil, cinnamaldehyde, cinnamic acid, cinnamyl alcohol, cinnamyl cinnamate, citronella oil, DL-citronellol, clary sage extract, cocoa, coffee, cognac oil, coriander oil, cuminaldehyde, davana oil, δ-decalactone, γ-decalactone, decanoic acid, dill oil, 3,4-dimethyl-1,2-cyclopentanedione, 4,5-dimethyl-3-hydroxy-2,5-dihydrofuran-2-one, 3,7-dimethyl-6-octenoic acid, 2,3-dimethylpyrazine, 2,5-dimethylpyrazine, 2,6-dimethylpyrazine, ethyl 2-methylbutyrate, ethyl acetate, ethyl butyrate, ethyl hexanoate, ethyl isovalerate, ethyl lactate, ethyl laurate, ethyl levulinate, ethyl maltol, ethyl octanoate, ethyl oleate, ethyl palmitate, ethyl phenylacetate, ethyl propionate, ethyl stearate, ethyl valerate, ethyl vanillin, ethyl vanillin glucoside, 2-ethyl-3,(5 or 6)-dimethylpyrazine, 5-ethyl-3-hydroxy-4-methyl-2(5H)-furanone, 2-ethyl-3-methylpyrazine, eucalyptol,

fenugreek absolute, genet absolute, gentian root infusion, geraniol, geranyl acetate, grape juice, guaiacol, guava extract, γ-heptalactone, γ-hexalactone, hexanoic acid, cis-3-hexen-1-ol, hexyl acetate, hexyl alcohol, hexyl phenylacetate, honey, 4-hydroxy-3-pentenoic acid γ-lactone, 4-hydroxy-4-(3-hydroxy-1-butenyl)-3,5,5-trimethyl-2-cyclohexen-1-one, 4-(p-hydroxyphenyl)-2-butanone, 4-hydroxyundecanoic acid sodium salt, immortelle absolute, β-ionone, isoamyl acetate, isoamyl butyrate, isoamyl phenylacetate, isobutyl acetate, isobutyl phenylacetate, jasmine absolute, kola nut tincture, labdanum oil, terpeneless lemon oil, licorice extract, linalool, linalyl acetate, lovage root oil, maltol, maple syrup, menthol, menthone, L-menthyl acetate, p-methoxybenzaldehyde, methyl 2-pyrrolyl ketone, methyl anthranilate, methyl phenylacetate, methyl salicylate, 4'-methylacetophenone, methyl cyclopentenolone, 3-methylvaleric acid, mimosa absolute, molasses, myristic acid, nerol, nerolidol, γ-nonalactone, nutmeg oil, δ-octalactone, octanal, octanoic acid, orange flower oil, orange oil, oris root oil, palmitic acid, ω-pentadecalactone, peppermint oil, petitgrain Paraguay oil, phenethyl alcohol, phenethyl phenylacetate, phenylacetic acid, piperonal, plum extract, propenylguaethol, propyl acetate, 3-propylidenephthalide, prune juice, pyruvic acid, raisin extract, rose oil, rum, sage oil, sandalwood oil, spearmint oil, styrax absolute, marigold oil, tea distillate, α-terpineol, terpinyl acetate, 5,6,7,8-tetrahydroquinoxaline, 1,5,5,9-tetramethyl-13-oxatricyclo[8.3.0.0.(4.9)]tridecane, 2,3,5,6-tetramethylpyrazine, thyme oil, tomato extract, 2-tridecanone, triethyl citrate, 4-(2,6,6-trimethylcyclohex-1-enyl)but-2-en-4-one, 2,6,6-trimethylcyclohex-2-ene-1,4-dione, 4-(2,6,6-trimethylcyclohexa-1,3-dienyl)but-2-en-4-one, 2,3,5-trimethylpyrazine, γ-undecalactone, γ-valerolactone, vanilla extract, vanillin, veratraldehyde, violet leaf absolute, and extracts of tobacco plants (tobacco leaf, tobacco stem, tobacco flower, tobacco root, and tobacco seed). Among these, menthol is particularly preferable. These volatile flavor components may be used alone or in combination.

[0036] When the tobacco filler contains a volatile flavor component, the content of the volatile flavor component in the tobacco filler is not particularly limited but may be, from a viewpoint of imparting a satisfactory smoking flavor, typically 10,000 to 50,000 ppm and preferably 20,000 to 40,000 ppm based on the mass of the tobacco filler.

[0037] The filling density of the tobacco filler is not particularly limited but is typically 250 to 520 mg/cm^3 and preferably 320 to 420 mg/cm^3 from a viewpoint of ensuring the performance of a heat-not-burn smoking article and imparting a satisfactory smoking flavor.

(Filter)

[0038] The filter according to the present invention is not particularly limited provided that the filter acts as a filter and is disposed downstream (mouth end side in aerosol flow) of the tobacco filler. Exemplary materials of the filter include cellulose, such as cellulose acetate, polypropylene, poly lactic acid, and paper primarily made of pulp. These may be used alone or in combination. As the filter, an acetate filter containing cellulose acetate is preferable.

[0039] The filter has a resistance to draw of preferably 250 to 450 mmH_2O/120 mm, more preferably 270 to 430 mmH_2O/120 mm, and further preferably 300 to 400 mmH_2O/120 mm When the filter has a resistance to draw of 250 mmH_2O/120 mm or more, mechanical filtration of aerosol particles through the filter increases while correspondingly and relatively reducing the ratio of a smoking flavor component gas subjected to adsorption filtration. Consequently, the amount of a smoking flavor component contained in each aerosol particle increases. Meanwhile, when the filter has a resistance to draw of 450 mmH_2O/120 mm or less, filtration of aerosol particles per se can be reduced while increasing the amount of aerosol particles supplied to a user. Accordingly, when the filter has a resistance to draw within the range of 250 to 450 mmH_2O/120 mm, the amount of a smoking flavor component contained in each aerosol particle and the amount of aerosol particles supplied to a user are balanced, thereby imparting a sufficient smoking flavor. The resistance to draw of the filter can be changed appropriately by the materials of the filter, the amount to be filled, and so forth. In the present invention, the resistance to draw of a filter is a value measured as a pressure difference of air at room temperature (22°C) and 1.05 L/min of air.

[0040] The amount of a plasticizer contained in the filter is preferably 9.0 mass% or less relative to 100 mass% of the filter. To adjust the hardness, a filter is generally added with a plasticizer. However, a plasticizer typically exhibits high affinity with a smoking flavor component and thus promotes adsorption filtration of a smoking flavor component gas through the filter. When the amount of a plasticizer contained in the filter is 9.0 mass% or less, it is possible to further reduce adsorption filtration of a smoking flavor component gas through the filter. The amount of a plasticizer contained in the filter is more preferably 6.0 mass% or less, further preferably 3.0 mass% or less, and particularly preferably 0.0 mass%, which means that the filter does not contain any plasticizer.

[0041] Exemplary plasticizers include, but are not particularly limited to, triacetin and phthalate esters. These may be used alone or in combination. Among these, the plasticizer is preferably triacetin since filtration of a smoking flavor component through the filter can be reduced further effectively.

[0042] The amount of a humectant contained in the filter is preferably 9.0 mass% or less relative to 100 mass% of the filter. To ensure moisture retention, a filter is added with a humectant in some cases. However, many humectants are typically hydrophilic, exhibit high affinity with a smoking flavor component, and thus promote adsorption filtration of a smoking flavor component gas through the filter. When the amount of a humectant contained in the filter is 9.0 mass%

or less, it is possible to further reduce adsorption filtration of a smoking flavor component gas through the filter. The amount of a humectant contained in the filter is more preferably 6.0 mass% or less, further preferably 3.0 mass% or less, and particularly preferably 0.0 mass%, which means that the filter does not contain any humectant.

[0043] Exemplary humectants include, but are not particularly limited to, propylene glycol, glycerol, and 1,3-butanediol. These may be used alone or in combination. Among these, the humectant is preferably propylene glycol since filtration of a smoking flavor component through the filter can be reduced further effectively.

[0044] The cross-sectional shape of the filter on the plane perpendicular to the flow direction of an aerosol (axial direction) is not particularly limited and may be circular, elliptic, or polygonal, for example. When the filter is cylindrical, the perimeter length of the filter is not particularly limited but is preferably 17 to 27 mm and more preferably 20 to 25 mm in view of resistance to draw to be exhibited and manufacturing feasibility. The length of the filter in the flow direction of an aerosol (axial direction) is not particularly limited and may be 4 to 10 mm, for example. Moreover, the filter may be provided with a hole for introducing diluent air.

(Heating Temperature)

[0045] In the heat-not-burn smoking article according to the present invention, the heating temperature of the tobacco filler is 230°C or lower, preferably 220°C or lower, more preferably 200°C or lower, and further preferably 180°C or lower.

[0046] According to the experimental results by Czegeny et al. described in the Journal of Analytical and Applied Pyrolysis (2009, 85, 47-53), it is reported that tobacco of a Virginia blend, which is often used for a heat-not-burn smoking article, exhibits increasing loss in mass from 230°C due to pyrolysis, the first peak at 300°C, and the second peak at around 450°C. As mentioned above, when the heating temperature of the tobacco filler is 230°C or lower, thermal decomposition of components contained in tobacco occurs only marginally, thereby reducing the amount of thermal decomposition products incorporated into aerosol particles. For this reason, the volatility of aerosol particles as well as the volatility of a smoking flavor component contained in aerosol particles increase. In this case, the present invention is further effectively applicable since adsorption filtration of a smoking flavor component gas occurs through the filter, in addition to mechanical filtration of aerosol particles.

[0047] The lower limit of the heating temperature range of the tobacco filler is not particularly limited and may be, for example, 22°C or higher or may also be 100°C or higher. In the present invention, the "heating temperature" indicates the highest temperature of the tobacco filler itself and indicates, for example, the highest temperature measured by inserting a thermocouple into the tobacco filler.

(First Embodiment)

[0048] Fig. 1 is a cross-sectional view of a heat-not-burn smoking article according to the first embodiment of the present invention. The cylindrical heat-not-burn smoking article 100 illustrated in Fig. 1 includes a battery 101, a tobacco filler 102, a pod 103 that holds the tobacco filler 102, a heater 104 that can heat the pod 103, a mouthpiece 105, and a filter 106. Heat generated at the heater 104 by the power supplied from the battery 101 is transferred to the tobacco filler 102 inside the pod 103 to vaporize, by the heat, a smoking flavor component and an aerosol former contained in the tobacco filler 102. An aerosol containing the generated smoking flavor component is supplied to a user through the mouthpiece 105 and the filter 106.

(Second Embodiment)

[0049] Fig. 2 is a cross-sectional view of a heat-not-burn smoking article according to the second embodiment of the present invention. The cylindrical heat-not-burn smoking article 200 illustrated in Fig. 2 includes a tobacco-containing segment 201 and a mouthpiece segment 202. The mouthpiece segment 202 includes a cooling segment 203, a center hole segment 204, and a filter segment 205. During use, the tobacco-containing segment 201 including a tobacco filler 206 is heated to vaporize a smoking flavor component and an aerosol former contained in the tobacco filler 206. An aerosol contacting the generated smoking flavor component is supplied to a user through the cooling segment 203, the center hole segment 204, and the filter segment 205 that includes a filter 212. Here, the positions of the cooling segment 203 and the center hole segment 204 may be switched, and the positions of the center hole segment 204 and the filter segment 205 may also be switched. Further, the mouthpiece segment 202 may lack the center hole segment 204.

[0050] The tobacco-containing segment 201 includes the tobacco filler 206 and a tubular wrapper 207 that covers the tobacco filler 206. A method of packing the tobacco filler 206 within the wrapper 207 is not particularly limited. For example, the tobacco filler 206 may be wrapped in the wrapper 207 or the tubular wrapper 207 may be filled with the tobacco filler 206. When the shape of tobacco has a longitudinal direction as in a rectangle, tobacco may be packed with the longitudinal direction randomly aligned within the wrapper 207 or may be packed with the longitudinal direction aligned with the axial direction or the direction perpendicular to the axial direction of the tobacco-containing segment

201. A smoking flavor component and an aerosol former contained in the tobacco filler 206 are vaporized by heating the tobacco-containing segment 201 and moved to the mouthpiece segment 202 through inhalation.

[0051] The cooling segment 203 comprises a tubular member 208. The tubular member 208 may be a paper tube of cylindrically processed cardboard, for example. The tubular member 208 and a mouthpiece lining paper 215 described hereinafter are provided with a perforation 209 passing therethrough. Due to the presence of the perforation 209, external air is introduced inside the cooling segment 203 during inhalation. Consequently, a vaporized aerosol component generated through heating of the tobacco-containing segment 201 comes into contact with external air and liquefies due to the lowering temperature, thereby forming an aerosol containing aerosol particles. The size (diameter) of the perforation 209 is not particularly limited and may be 0.5 to 1.5 mm, for example. The number of the perforation 209 is also not particularly limited and may be one or two or more. For example, a plurality of perforations 209 may be provided on the perimeter of the cooling segment 203.

[0052] The center hole segment 204 comprises a filling layer 210 having a hollow portion and a first inner plug wrapper 211 that covers the filling layer 210. The center hole segment 204 acts to increase the strength of the mouthpiece segment 202. The filling layer 210 may be, for example, a rod highly densely filled with cellulose acetate fibers. Since the filling layer 210 has a high filling density of fibers, an aerosol flows only through the hollow portion and hardly flows within the filling layer 210 during inhalation. Since the filling layer 210 inside the center hole segment 204 is a fiber-filled layer, a user rarely feels odd by touch from the outside during use. Here, the center hole segment 204 may lack the first inner plug wrapper 211 and retain its shape through thermoforming.

[0053] The filter segment 205 comprises the filter 212 and a second inner plug wrapper 213 that covers the filter 212. Since the filter 212 is present all the way up to the end in the filter segment 205, the end has an appearance similar to a common combustion smoking article.

[0054] The center hole segment 204 and the filter segment 205 are joined with an outer plug wrapper 214. The outer plug wrapper 214 may be a cylindrical paper, for example. Moreover, the tobacco-containing segment 201, the cooling segment 203, and the connected center hole segment 204 and filter segment 205 are joined with the mouthpiece lining paper 215. These three segments may be joined, for example, by applying a glue, such as a vinyl acetate-based glue, to the inner surface of the mouthpiece lining paper 215 and wrapping the lining paper around these segments. These segments may also be joined separately using a plurality of lining papers.

[Method of Using Heat-not-burn Smoking Article]

[0055] The method of using a heat-not-burn smoking article according to the present invention, includes heating to 230°C or lower the tobacco filler of the heat-not-burn smoking article according to the present invention. As mentioned above, when the heating temperature of the tobacco filler is 230°C or lower, thermal decomposition of components contained in tobacco occurs only marginally, thereby reducing the amount of thermal decomposition products incorporated into aerosol particles. For this reason, the volatility of aerosol particles as well as the volatility of a smoking flavor component contained in aerosol particles increase. In this case, adsorption filtration of a smoking flavor component gas occurs through the filter, in addition to mechanical filtration of aerosol particles. The method according to the present invention can reduce adsorption filtration of the smoking flavor component gas. Consequently, it is possible to reduce filtration of a smoking flavor component through the filter even in use at a heating temperature of 230°C or lower.

[0056] The method of using a heat-not-burn smoking article according to the present invention is not particularly limited in modes except for heating to 230°C or lower the tobacco filler of the heat-not-burn smoking article according to the present invention. The heating temperature of the tobacco filler is 230°C or lower, preferably 220°C or lower, more preferably 200°C or lower, and further preferably 180°C or lower. The lower limit of the heating temperature range of the tobacco filler is not particularly limited and may be, for example, 22°C or higher or may also be 100°C or higher.

[Heat-not-burn Smoking System]

[0057] A heat-not-burn smoking system according to the present invention includes the heat-not-burn smoking article according to the present invention; and a heating device for heating the tobacco filler. Since the heat-not-burn smoking article according to the present invention is included, the heat-not-burn smoking system can reduce filtration of a smoking flavor component through a filter even when the tobacco filler is heated to 230°C or lower by the heating device. The heat-not-burn smoking system according to the present invention is not particularly limited provided that the heat-not-burn smoking article according to the present invention and the heating device are included and may have other configurations.

[0058] The heat-not-burn smoking system according to the present invention is applicable, for example, to a case in which a heat-not-burn smoking article lacks a heating mechanism for heating the tobacco filler. As an example, the heat-not-burn smoking system is applicable to the heat-not-burn smoking article according the second embodiment. For example, the heat-not-burn smoking system illustrated in Fig. 3 includes the heat-not-burn smoking article 300 according

to the second embodiment and a heating device 301 for heating a tobacco-containing segment of the heat-not-burn smoking article 300 from the outside. Fig. 3 (a) illustrates the state before inserting the heat-not-burn smoking article 300 into the heating device 301, and Fig. 3 (b) illustrates the state of heating the heat-not-burn smoking article 300 inserted into the heating device 301. The heating device 301 illustrated in Fig. 3 includes a body 302, a heater 303, a metal tube 304, a battery unit 305, and a control unit 306. The body 302 has a tubular recess 307, and the heater 303 and the metal tube 304 are arranged on the inner side surface of the recess 307 at a position corresponding to the tobacco-containing segment of the heat-not-burn smoking article 300 inserted into the recess 307. The heater 303 may be an electric resistance heater, and heating by the heater 303 is performed by supplying power from the battery unit 305 in accordance with instructions from the control unit 306, which controls temperature. Heat generated by the heater 303 is transferred to the tobacco-containing segment of the heat-not-burn smoking article 300 through the metal tube 304 having a high thermal conductivity. In the schematic view of Fig. 3 (b), a gap exists between the outer perimeter of the heat-not-burn smoking article 300 and the inner perimeter of the metal tube 304. However, such a gap between the outer perimeter of the heat-not-burn smoking article 300 and the inner perimeter of the metal tube 304 is actually and desirably absent for the purpose of efficient heat transfer. Although the heating device 301 heats the tobacco-containing segment of the heat-not-burn smoking article 300 from the outside, the heating device may be a heating device for heating from the inside.

[0059] The heating temperature of the tobacco filler by the heating device is 230°C or lower, preferably 220°C or lower, more preferably 200°C or lower, and further preferably 180°C or lower. The lower limit of the heating temperature range of the tobacco filler is not particularly limited and may be, for example, 22°C or higher or may also be 100°C or higher.

EXAMPLES

[0060] Hereinafter, the present invention will be described further specifically by means of working examples. However, the present invention is by no means limited by these working examples.

[Example 1]

(Preparation to Tobacco Filler)

[0061] A tobacco filler sample was prepared by adding 100 mg of glycerol as an aerosol former to 100 mg of tobacco shreds consisting of 50 mg of a burley variety (Japan) and 50 mg of a flue-cured variety (Japan), followed by mixing. As the tobacco shreds, those having a sieve opening diameter of 0.5 mm or less obtained by pulverizing dry tobacco leaves in advance using a mixer for home use and by shaking with a sieve (trade name: AS200, from Retsch GmbH) at an amplitude of 1.5 mm/g for 2 minutes were used.

(Evaluation of Filtration through Filter)

[0062] The tobacco filler sample was placed by attaching to a pod designed for a heat-not-burn smoking article illustrated in Fig. 1 (refer to Japanese Unexamined Patent Application Publication No. 2014-76065) and stored under conditions of 22°C and 60% humidity for 2 days or more. Later, the pod was mounted to a heating device of the heat-not-burn smoking article, and a smoking test was performed. Specifically, a smoking machine (trade name: RM-26, from Borgwaldt) was connected to the mouth end of the heat-not-burn smoking article, and the sample inside the pod was preheated by the heating device for 2 minutes. The heating temperature of the tobacco filler (during stable operation) was confirmed to be about 160°C to 170°C through prior measurement using a thermocouple. Subsequently, 15 puffs were performed under predetermined smoking conditions (55 mL/2 s, smoking interval of 30 s). At the same time, components that had passed through a filter provided at the mouth end were collected using a Cambridge pad (44 mmø, from Borgwaldt). As the filter, an acetate filter of 3.5Y35000 (resistance to draw: 284 mmH_2O/120 mm, triacetin content: 9.0 mass%, filter length: 14 mm) was used. From the amount of each component trapped by the acetate filter (amount trapped by filter) and the amount of each component collected, after passing through the filter, by the Cambridge pad (amount passing through filter), the filtration ratio of each component through the filter was calculated on the basis of the following formula (1).

Formula (1)

$$\text{Filtration ratio (\%)} = (\text{amount trapped by filter}) / (\text{amount trapped by filter} + \text{amount passing through filter}) \times 100$$

[0063] In the present working examples, easily measureable nicotine was selected as a representative smoking flavor component. Moreover, low-volatile glycerol was selected as an indicator component of filtration. Components trapped

by the acetate filter and components collected by the Cambridge pad were quantified using a GC-FID after subjecting to shaking extraction with methanol solvent for 40 minutes.

[0064] In the present working examples, an indicator of increase in filtration represented by the following formula (2) was used as an indicator of filtration.

Formula (2)

$$\text{Indicator of increase in filtration} = [\text{filtration ratio of nicotine (\%)}] / [\text{filtration ratio of glycerol (\%)}]$$

[0065] Due to the low vapor pressure, it is presumed that glycerol mostly exists in the particle phase after vaporization upon heating. Accordingly, mechanical filtration is predominant as the trapping mechanism inside the filter. When nicotine does not volatilize from glycerol aerosol particles, mechanical filtration of aerosol particles containing nicotine is predominant while hardly causing adsorption filtration, in which nicotine gas component is adsorbed onto the filter surface or pores. In this case, the filtration ratio of nicotine is comparable to the filtration ratio of glycerol to yield the indicator of increase in filtration of about 1. Meanwhile, when nicotine volatilizes from glycerol aerosol particles, adsorption filtration, in which nicotine gas component volatilized from aerosol particles is adsorbed onto the filter surface or pores, occurs in addition to mechanical filtration of the aerosol particles containing nicotine. In this case, the filtration ratio of nicotine is greater than the filtration ratio of glycerol to yield the indicator of increase in filtration of significantly greater than 1. As shown in Table 2 and Fig. 4 described hereinafter, it is revealed that the indicator of increase in filtration correlates with the smoking flavor grade and that a user intensely senses a smoking flavor component at the indicator of increase in filtration of 1.35 or less. Accordingly, it was considered that filtration of a smoking flavor component through the filter is significantly reduced to supply a sufficient amount of the smoking flavor component to a user when the indicator of increase in filtration is 1.35 or less.

(Measurement of Aerosol pH)

[0066] The pH of an aerosol was measured, using a pH meter (trade name: LAQUA, from Horiba, Ltd.), as the pH of a solution obtained by directly collecting, in an impinger added with 10 mL of ultrapure water, 10 to 15 mg of the aerosol at 30°C or lower before passing through a filter.

[0067] The results of the filtration ratios of nicotine and glycerol through the filter, the indicator of increase in filtration, and the aerosol pH are shown in Table 1.

[Examples 2 to 9, Comparative Examples 1 to 4]

[0068] Each tobacco filler sample was prepared in the same manner as Example 1 except for changing the type and amount of tobacco as shown in Table 1, and the filtration ratios of nicotine and glycerol, the indicator of increase in filtration, and the aerosol pH were measured and assessed. The results are shown in Table 1.

[Table 1]

	Tobacco type and amount	Filtration ratio of nicotine (%)	Filtration ratio of glycerol (%)	Indicator of increase in filtration (-)	Aerosol pH (-)
Ex. 1	Burley (Japan) 50 mg Flue-cured (Japan) 50 mg	51.3	46.2	1.10	7.61
Ex. 2	Burley (Japan) 50 mg Oriental (Turkey) 50 mg	40.7	34.7	1.18	7.79
Ex. 3	Flue-cured (Japan) 100 mg	37.7	33.5	1.13	7.46
Ex. 4	Flue-cured (U.S.) 100 mg	44.9	41.5	1.08	7.23
Ex. 5	Flue-cured (Brazil) 100 mg	38.2	33.4	1.10	7.25
Ex. 6	Oriental (Turkey) 100 mg	32.6	33.1	1.00	6.54
Ex. 7	Flue-cured leaf shreds (Japan) 100 mg	42.3	37.4	1.13	7.45

(continued)

	Tobacco type and amount	Filtration ratio of nicotine (%)	Filtration ratio of glycerol (%)	Indicator of increase in filtration (-)	Aerosol pH (-)
Ex. 8	Burley (Japan) 25 mg Flue-cured (Japan) 75 mg	42.4	39.7	1.07	7.23
Ex. 9	Burley (Japan) 40 mg Oriental (Turkey) 60 mg	40.6	37.8	1.08	7.22
Comp. Ex. 1	Burley (Japan) 100 mg	63.9	41.4	1.54	9.47
Comp. Ex. 2	Burley (U.S.) 100 mg	55.5	33.9	1.63	9.72
Comp. Ex. 3	Burley (Brazil) 100 mg	56.7	32.8	1.72	9.52
Comp. Ex. 4	Burley (Japan) 75 mg Flue-cured (Japan) 25 mg	51.3	33.2	1.54	8.79

[0069] As shown in Table 1, it was found that Examples 1 to 9, in which the aerosol pH is 7.8 or less, exhibit the indicator of increase in filtration of 1.35 or less and thus significantly reduce filtration of a smoking flavor component through the filter while supplying a sufficient amount of the smoking flavor component to a user. Moreover, it was also found that oriental and flue-cured varieties are preferable as tobacco. Meanwhile, it was found that Comparative Examples 1 to 4, in which the aerosol pH exceeds 7.8, exhibit the indicator of increase in filtration exceeding 1.35 and thus increase filtration of a smoking flavor component through the filter. In this case, it is presumed that adsorption filtration, in which a smoking flavor component gas volatilized from aerosol particles is trapped through adsorption onto a filter surface, readily occurs through the filter in addition to mechanical filtration of aerosol particles.

[Example 10]

[0070] A tobacco filler sample was prepared by adding 100 mg of glycerol as an aerosol former and 10 mg of levulinic acid as an organic acid to 100 mg of tobacco shreds of a burley variety (Japan), followed by mixing. Otherwise, the filtration ratios of nicotine and glycerol, the indicator of increase in filtration, and the aerosol pH were measured and assessed in the same manner as Example 1. Moreover, the solubility of an acid (organic acid, inorganic acid) in glycerol and the effects on a smoking flavor were evaluated by the following methods. The results are shown in Table 2.

(Evaluation of Solubility of Acids in Glycerol)

[0071] The solubility of 10 mg of an acid in 1,000 mg of glycerol at 25°C was visually evaluated. The evaluation was made by 5 grades from 1 of "no dissolution" to 5 of "complete dissolution." Herein, a grade of 3 or higher was regarded as "soluble."

(Evaluation of Effects on Smoking Flavor)

[0072] Smoking was performed by five panelists under the same conditions as the above-described evaluation of filtration through a filter, and sensory evaluation of the effects on a smoking flavor was made by 7 grades from 1 to 7 (1: sensed not at all, 7: extremely intense). The average of the evaluation by the five panelists was regarded as smoking flavor grade. When tobacco raw materials vary, it is difficult to evaluate or compare the effects on a smoking flavor since the entire balance of a smoking flavor varies considerably. For this reason, this evaluation was not performed for Examples 1 to 9 and Comparative Examples 1 to 4. The smoking flavor grade herein represents a sensory evaluation result including the overall taste and flavor derived from leaf tobacco.

[Example 11, Comparative Examples 5 to 8]

[0073] Each tobacco filler sample was prepared in the same manner as Example 10 except for changing the acid (organic acid, inorganic acid) as shown in Table 2. For each sample, the indicator of increase in filtration and the aerosol

pH were measured, and the solubility of an acid in glycerol and the effects on a smoking flavor were evaluated. The results are shown in Table 2 together with, as a reference, the results of Comparative Example 1, which is not added with an acid.

[Table 2]

	Added acid	b.p. (°C)	First acid dissociation constant (-)	b.p. × first acid dissociation constant (-)	Indicator of increase in filtration (-)	Aerosol pH (-)	Solubility (-)	Smoking flavor grade (-)
Ex. 10	Levulinic acid	245	4.44	1088	1.15	7.70	5	3.3
Ex. 11	Benzoic acid	249	4.21	1048	0.84	5.93	5	4.1
Comp. Ex. 1	-	-	-	-	1.54	9.47	-	2.4
Comp. Ex. 5	Nonadecanoic acid	383	5.10	1953	1.63	9.14	1	2.1
Comp. Ex. 6	Phosphoric acid	213	1.97	420	1.39	8.54	5	1.9
Comp. Ex. 7	Pyruvic acid	165	2.50	413	1.50	8.29	5	2.5
Comp. Ex. 8	Adipic acid	338	4.42	1494	1.47	9.28	3	2.2

[0074] As shown in Table 2, it was found that Examples 10 and 11, in which the aerosol pH was lowered to 7.8 or less by adding levulinic acid or benzoic acid as an organic acid, exhibit the indicator of increase in filtration of 1.35 or less, significantly reduced filtration of a smoking flavor component through the filter, and an intense smoking flavor. It is considered possible to have lowered the aerosol pH to 7.8 or less since levulinic acid and benzoic acid have the boiling point of 300°C or lower, the first acid dissociation constant of 4.0 to 5.0, the product of the value of the boiling point (°C) and the value of the first acid dissociation constant of 1,000 to 1,200 as well as are soluble in glycerol as an aerosol former and are solid at 25°C.

[0075] Meanwhile, it was found that Comparative Examples 1 and 5 to 8, to which no acid, nonadecanoic acid, phosphoric acid, pyruvic acid, or adipic acid was added, exhibit the aerosol pH exceeding 7.8, the indicator of increase in filtration exceeding 1.35, and a weak smoking flavor. It is considered that these acids were ineffective since the boiling point, the first acid dissociation constant, and/or the product of the value of the boiling point (°C) and the value of the first acid dissociation constant fall outside the above-mentioned ranges; or these acids are less soluble in glycerol or are not solid at 25°C.

[0076] Fig. 5 shows a graph plotting the relationship between aerosol pH and indicator of increase in filtration in Examples 1 to 11 as well as Comparative Examples 1 to 8. Fig. 5 reveals that the aerosol pH and the indicator of increase in filtration are highly correlated.

[Example 12]

[0077] An acetate filter having a resistance to draw of 176 mmH_2O/120 mm, triacetin content of 9.0 mass%, and a circumference of 24.1 mm was used as a filter. Triacetin was added to the filter by feeding, as a spot, triacetin to the inner center of the filter using a microsyringe and allowing to stand still for 1 hour or more. Except for this, the filtration ratios of nicotine and glycerol and the indicator of increase in filtration were measured and assessed in the same manner as Example 1 (aerosol pH: 7.61). In this example, as an indicator of the ratio of smoking flavor components contained in aerosol particles, the indicator of the smoking flavor content represented by the following formula (3) was used. When the indicator of the smoking flavor content is high, the ratio of nicotine to glycerol that has passed through the filter is high, thereby indicating that the ratio of smoking flavor components typified by nicotine is high. The results are shown in Table 3.

Formula (3)

Indicator of smoking flavor content = [100 − filtration ratio of nicotine (%)] / [100 − filtration ratio of glycerol (%)]

[Examples 13 to 16]

[0078] Except for changing the resistance to draw of the filter as shown in Table 3, the filtration ratios of nicotine and glycerol, the indicator of increase in filtration, and the indicator of the smoking flavor content were measured and assessed in the same manner as Example 12. The results are shown in Table 3.

[Examples 17 to 20]

[0079] Except for using a filter containing propylene glycol in the mass ratio shown in Table 3 in place of 9.0 mass% of triacetin, the filtration ratios of nicotine and glycerol, the indicator of increase in filtration, and the indicator of the smoking flavor content were measured and assessed in the same manner as Example 12. The results are shown in Table 3.

[Example 21]

[0080] Except for adding no triacetin to the filter, the filtration ratios of nicotine and glycerol, the indicator of increase in filtration, and the indicator of the smoking flavor content were measured and assessed in the same manner as Example 12. The results are shown in Table 3.

[Table 3]

	Resistance to draw (mmH_2O/120 mm)	Additive		Filtration ratio of nicotine (%)	Filtration ratio of glycerol (%)	Indicator of increase in filtration (-)	Indicator of smoking flavor content (-)
		Type	Ratio (mass%)				
Ex. 12	176	Triacetin	9.0	42.0	31.1	1.35	0.84
Ex. 13	284			51.3	46.2	1.10	0.91
Ex. 14	384			54.1	46.4	1.17	0.86
Ex. 15	420			59.0	53.1	1.11	0.88
Ex. 16	582			62.0	53.4	1.16	0.81
Ex. 17	284	Propylene glycol	16.0	57.4	43.0	1.34	0.75
Ex. 18			9.0	53.8	45.7	1.18	0.85
Ex. 19			6.0	49.7	42.1	1.17	0.87
Ex. 20			3.0	50.8	44.8	1.13	0.89
Ex. 21		-	0.0	43.5	41.8	1.04	0.97

[0081] As shown in Table 3, it was found concerning the resistance to draw of a filter that the indicator of the smoking flavor content is high at the resistance to draw of 250 to 450 mmH_2O/120 mm Moreover, it was also found that a lower mass ratio of triacetin or propylene glycol in a filter is preferable, and specifically, 9.0 mass% or less is preferable.

[Reference Example 1]

[0082] A tobacco filler sample was prepared in the same manner as Comparative Example 1. The sample was placed within a pod designed for the heat-not-burn smoking article illustrated in Fig. 1 by attaching to the bottom of the pod, on which a ventilation hole (5 mmø) had been made, and was stored under conditions of 22°C and 60% humidity for 2 days or more. Subsequently, as illustrated in Fig. 6, the pod 600 was heated using the heating device 602 having the ceramic heater 601 (4.0 mmø) at the heating temperature of the tobacco filler (not illustrated) inside the pod 600 of 175°C. The ceramic heater 601 having the heating section 603 was placed inside the jig 604 made of SUS, and the heating device 602 was provided with holes 605 (0.5 mmø) as ventilation holes. The heating temperature of the tobacco filler was checked using a thermocouple, and the output of the heating device 602 was adjusted such that the temperature of the tobacco filler became the set temperature (175°C). At this heating temperature, filtration through a filter was evaluated in the same manner as Example 1. The results are shown in Table 4.

[Reference Examples 2 to 5]

[0083] Except for changing the heating temperature of the tobacco filler as shown in Table 4, filtration through a filter was evaluated in the same manner as Reference Example 1. The results are shown in Table 4.

[Table 4]

	Heating temperature of tobacco filler (°C)	Filtration ratio of nicotine (%)	Filtration ratio of glycerol (%)	Indicator of increase in filtration (-)	Aerosol pH (-)
Ref. Ex. 1	175	66.0	23.3	2.82	9.09
Ref. Ex. 2	200	56.9	24.4	2.79	9.54
Ref. Ex. 3	212	72.2	25.9	2.33	9.61
Ref. Ex. 4	225	45.1	27.4	1.67	9.66
Ref. Ex. 5	250	41.7	41.3	1.00	9.09

[0084] As shown in Table 4, when the heating temperature of the tobacco filler exceeds 230°C as in Reference Example 5, the indicator of increase in filtration is 1.0 and mechanical filtration of aerosol particles through the filter is predominant. Meanwhile, as shown in Reference Examples 1 to 4, it is understood that when the heating temperature of the tobacco filler is 230°C or lower although the aerosol pH is not significantly different from Reference Example 5, the indicator of increase in filtration is greater than 1.35 and adsorption filtration, in which a smoking flavor component gas volatilized from aerosol particles is trapped through adsorption onto a filter surface, readily occurs through the filter in addition to mechanical filtration of aerosol particles. This is because, when the tobacco filler is heated at a temperature of 230°C of lower, thermal decomposition of components contained in tobacco occurs only marginally, thereby reducing the amount of thermal decomposition products incorporated into aerosol particles. In this case, it is needed to suppress volatilization of a smoking flavor component from aerosol particles. Accordingly, the present invention is effectively applicable to such a case.

REFERENCE SIGNS LIST

[0085]

100 Heat-not-burn smoking article

101 Battery
102 Tobacco filler
103 Pod
104 Heater

105 Mouthpiece
106 Filter
200 Heat-not-burn smoking article
201 Tobacco-containing segment
202 Mouthpiece segment
203 Cooling segment
204 Center hole segment
205 Filter segment
206 Tobacco filler
207 Wrapper
208 Tubular member
209 Perforation
210 Filling layer
211 First inner plug wrapper
212 Filter
213 Second inner plug wrapper
214 Outer plug wrapper
215 Mouthpiece lining paper
300 Heat-not-burn smoking article
301 Heating device
302 Body
303 Heater
304 Metal tube
305 Battery unit
306 Control unit
307 Recess
600 Pod
601 Ceramic heater
602 Heating device
603 Heating section
604 Jig
605 Hole

Claims

1. A heat-not-burn smoking article comprising

a tobacco filler containing tobacco and an aerosol former; and
a filter disposed downstream of the tobacco filler, wherein
the tobacco filler is a tobacco filler that provides an aerosol having a pH of 7.8 or less.

2. The heat-not-burn smoking article according to Claim 1, wherein a heating temperature of the tobacco filler is 230°C or lower.

3. The heat-not-burn smoking article according to Claim 1 or 2, wherein the tobacco includes at least one of an oriental variety and a flue-cured variety.

4. The heat-not-burn smoking article according to any one of Claims 1 to 3, wherein the tobacco filler further contains an organic acid.

5. The heat-not-burn smoking article according to Claim 4, wherein the organic acid has a boiling point of 300°C or lower.

6. The heat-not-burn smoking article according to Claim 4 or 5, wherein the organic acid has a first acid dissociation constant of 4.0 to 5.0.

7. The heat-not-burn smoking article according to any one of Claims 4 to 6, wherein a product of a value of the boiling point (°C) of the organic acid and a value of the first acid dissociation constant of the organic acid is 1,000 to 1,200.

8. The heat-not-burn smoking article according to any one of Claims 4 to 7, wherein the organic acid is solid at 25°C.

9. The heat-not-burn smoking article according to any one of Claims 4 to 8, wherein the organic acid is soluble in the aerosol former at 25°C.

10. The heat-not-burn smoking article according to any one of Claims 4 to 9, wherein the organic acid includes at least one of benzoic acid and levulinic acid.

11. The heat-not-burn smoking article according to any one of Claims 1 to 10, wherein the filter has a resistance to draw of 250 to 450 mmH_2O/120 mm

12. The heat-not-burn smoking article according to any one of Claims 1 to 11, wherein an amount of a plasticizer contained in the filter is 9.0 mass% or less.

13. The heat-not-burn smoking article according to Claim 12, wherein the plasticizer is triacetin.

14. The heat-not-burn smoking article according to any one of Claims 1 to 13, wherein an amount of a humectant contained in the filter is 9.0 mass% or less.

15. The heat-not-burn smoking article according to Claim 14, wherein the humectant is propylene glycol.

16. A method of using a heat-not-burn smoking article, comprising heating to 230°C or lower the tobacco filler of the heat-not-burn smoking article according to any one of Claims 1 to 15.

17. A heat-not-burn smoking system comprising

the heat-not-burn smoking article according to any one of Claims 1 to 15; and
a heating device for heating the tobacco filler.

18. The heat-not-burn smoking system according to Claim 17, wherein a heating temperature of the tobacco filler by the heating device is 230°C or lower.

Fig. 1

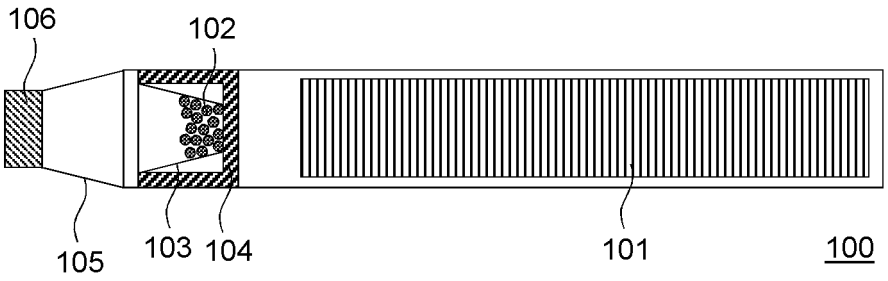
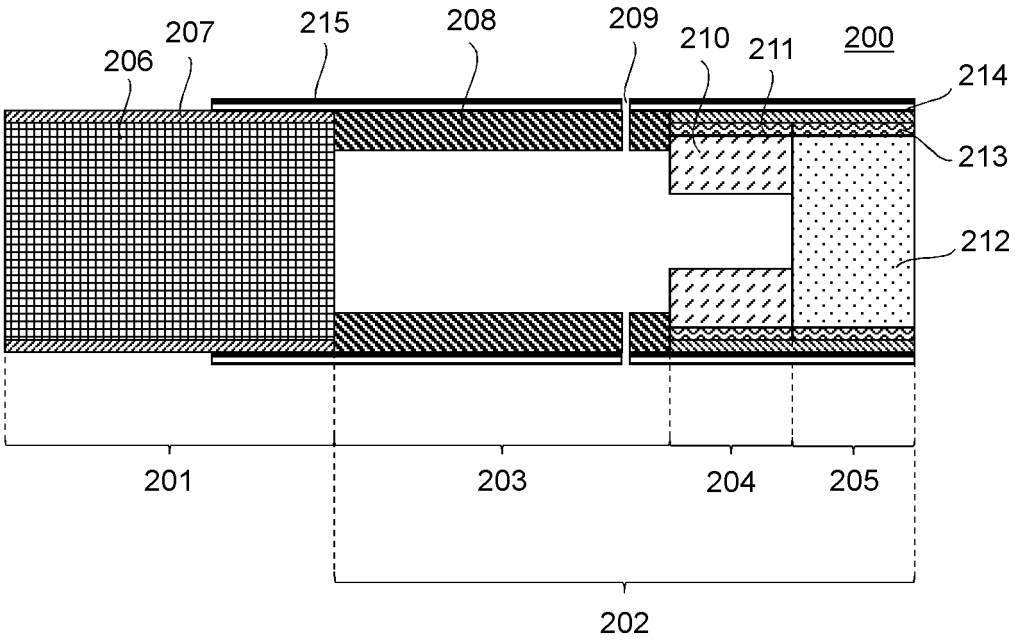

106
102
105
103
104
101
100

Fig. 2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202

Fig. 3

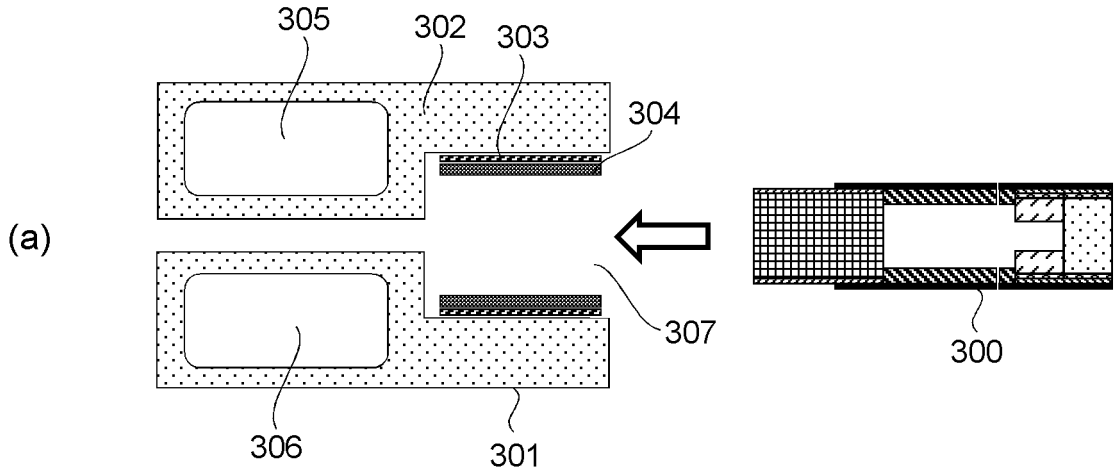


Fig. 4

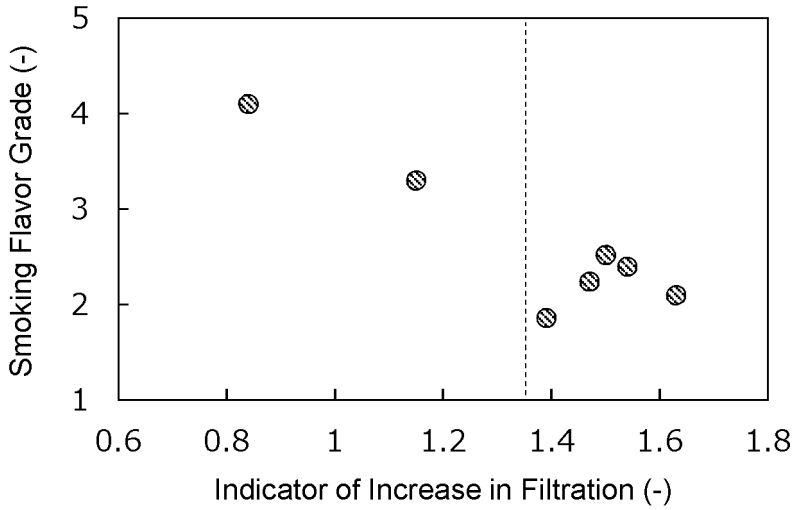

Smoking Flavor Grade (-)
5
4
3
2
1
0.6
0.8
1
1.2
1.4
1.6
1.8
Indicator of Increase in Filtration (-)

Fig. 5

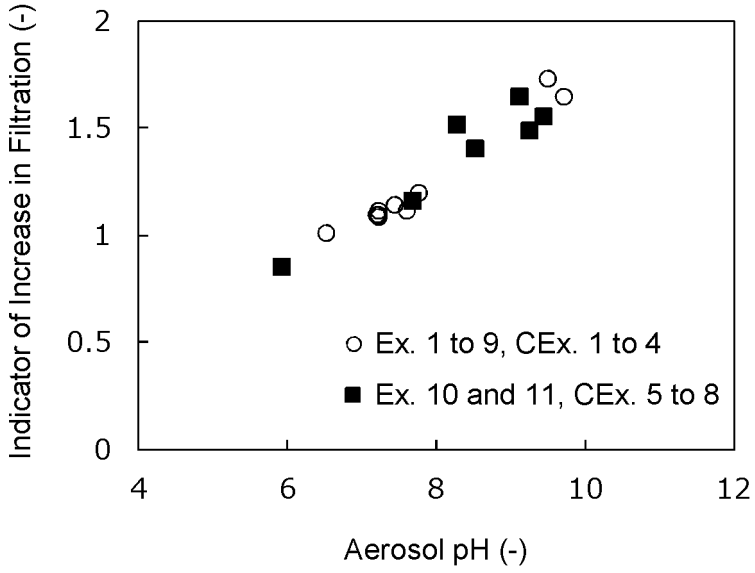
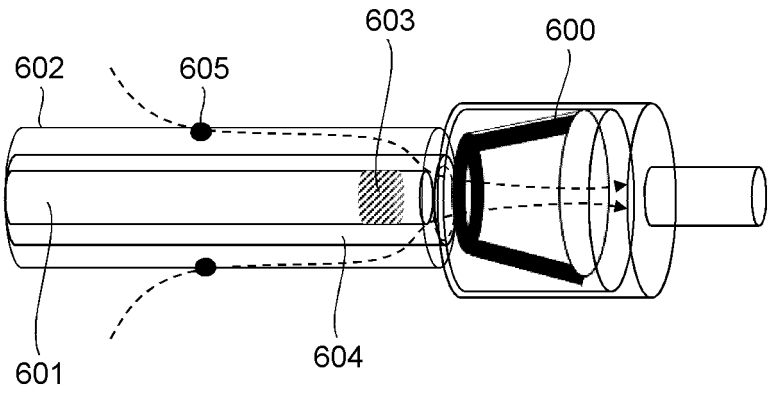

Indicator of Increase in Filtration (-)
2
1.5
1
0.5
0
4
6
8
10
12
Aerosol pH (-)
Ex. 1 to 9, CEx. 1 to 4
Ex. 10 and 11, CEx. 5 to 8

Fig. 6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/014005

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. A24F47/00(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int. Cl. A24F47/00

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2019
Registered utility model specifications of Japan	1996-2019
Published registered utility model applications of Japan	1994-2019

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2017/203686 A1 (JAPAN TOBACCO INC.) 30 November 2017, claim 1, paragraphs [0009]-[0014], fig. 1 & US 2019/0090531 A1, claim 1, paragraphs [0025]-[0039], fig. 1	1-18
Y	US 2015/0027468 A1 (ALTRIA CLIENT SERVICES INC.) 29 January 2015, paragraphs [0045], [0046], [0063], fig. 2 & WO 2015/013135 A1	1-18
Y	JP 2018-513674 A (PHILIP MORRIS PRODUCTS S.A.) 31 May 2018, paragraph [0045] & US 2018/0042304 A1, paragraph [0045] & WO 2016/156213 A1	5-15

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

* Special categories of cited documents:
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"P" document published prior to the international filing date but later than the priority date claimed
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17.06.2019	25.06.2019
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/014005

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2015-156806 A (JAPAN TOBACCO INC.) 03 September 2015, paragraphs [0056], [0057] & WO 2013/187245 A1	11-15
Y	JP 2016-512033 A (R. J. REYNOLDS TOBACCO COMPANY) 25 April 2016, paragraph [0066] & US 2014/0261487 A1, paragraph [0075] & WO 2014/159982 A1	12-15
Y	JP 2018-523476 A (PHILIP MORRIS PRODUCTS S.A.) 23 August 2018, paragraphs [0007]-[0013] & US 2019/0000135 A1, paragraphs [0007]-[0013] & WO 2017/025924 A1	14-15

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2017203686 A **[0004]**
- JP 2009502136 W **[0004]**
- JP 2014076065 A **[0062]**

Non-patent literature cited in the description

- Tobacco no Jiten (Dictionary of Tobacco). Tobacco Academic Studies Center, 31 March 2009 **[0022] [0024]**
- **CZEGENY et al.** *Journal of Analytical and Applied Pyrolysis,* 2009, vol. 85, 47-53 **[0046]**