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(54) **FILTER FOR SMOKING ARTICLE**

(57) The present invention addresses the problem of providing a filter for a smoking article, or the like, which does not reduce, more than necessary, components affecting flavor which are contained in mainstream smoke, and which does not release aroma components other than an aroma component which is attributable to tobacco smoke. The foregoing problem is solved by a filter for

a smoking article, the filter comprising a filter segment which does not release aroma components and which has a porous material that includes: inactive particles which do not selectively reduce components contributing to flavor with respect to raw tar in tobacco smoke; and a non-fibrous binder resin.

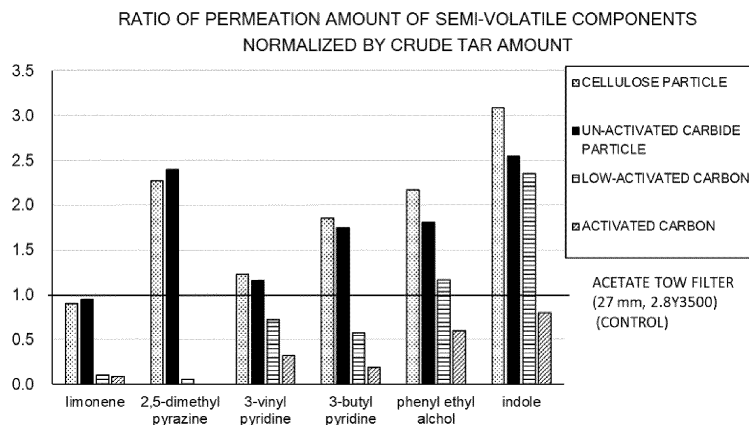


Fig. 1

Description

[Technical Field]

[0001] The present invention relates to a filter for a smoking article.

[Background Art]

[0002] Research and development have been actively conducted to provide filters with a function of removing, during smoking, only unnecessary components out of the components contained in tobacco smoke, or a function of imparting specific flavor and taste to tobacco smoke when using a filter cigarette.

[0003] As a means for achieving this, it is known to prepare a porous substance including a material for adjusting the components contained in tobacco smoke and use the porous substance as a constituent material of the filter (see, for example, Patent Document 1 to 4).

[0004] Materials for adjusting components contained in tobacco smoke are exemplified by active particles (Patent Document 1 to 3) and a plurality of organic particles derived from natural materials (Patent Document 4).

[0005] Also known is a cigarette filter having a filter plug including a filter material in which filtration rate controlling particles selected from cellulose particles, cellulose triacetate particles, and mixtures thereof are dispersed in a tow of cellulose acetate fibers (Patent Document 5).

[Citation List]

[Patent Document]

[0006]

[Patent Document 1] Japanese Translation of PCT Application No. 2016-510993

[Patent Document 2] Japanese Translation of PCT Application No. 2014-509833

[Patent Document 3] Japanese Patent Application Publication No. 2013-215196

[Patent Document 4] Japanese Translation of PCT Application No. 2016-510995

[Patent Document 5] WO 2013/084661

[Summary of Invention]

[Technical Problem]

[0007] When a porous substance including active particles described in Patent Document 1 to 3 is used as a constituent material of a filter, carbon monoxide and phenol in tobacco smoke can be reduced but other mainstream smoke components are also reduced.

[0008] Meanwhile, when a porous substance including a plurality of organic particles derived from a natural ma-

terial is used as a constituent material of a filter, as described in Patent Document 4, the user feels flavor and taste which are different from the original flavor and taste of tobacco smoke.

[0009] Further, with the filter material described in Patent Document 5, since the filtration rate controlling particles such as cellulose particles are dispersed inside the tow of cellulose acetate fibers and the occupation ratio of the tow of cellulose acetate fibers in the filter is large, the mainstream smoke components may be reduced more than necessary.

[0010] As indicated above, according to the techniques described in Patent Document 1 to 3 and 5, in addition to carbon monoxide and phenol, the mainstream smoke components are also reduced. As a result, the user cannot enjoy smoking.

[0011] Further, according to the technique described in Patent Document 4, since the user feels flavor and taste which are different from the original flavor and taste obtained from tobacco smoke, the flavor and taste during smoking cannot be satisfactory.

[0012] With the foregoing in view, the present invention provides a filter for a smoking article or the like in which the components affecting the flavor and taste contained in the mainstream smoke are not reduced more than necessary and aroma components other than the aroma components originating from the tobacco smoke are not released

[Solution to Problem]

[0013] As a result of intensive research by the inventors of the present invention, it has been found that the abovementioned problem can be resolved by a filter for a smoking article, the filter comprising a filter segment including a porous material containing an inert particle neither releasing any aroma component nor selectively reducing any component contributing to flavor and taste relative to crude tar in tobacco smoke and a nonfibrous binder resin.

[0014] Thus, the present invention is as follows.

[1] A filter for a smoking article, the filter comprising a filter segment including a porous material containing an inert particle neither releasing any aroma component nor selectively reducing any component contributing to flavor and taste relative to crude tar in tobacco smoke and a nonfibrous binder resin.

[2] The filter for a smoking article according to [1], wherein the inert particle is thermally stable at 150°C.

[3] The filter for a smoking article according to [1] or [2], wherein the inert particle is at least one selected from a cellulose particle, an un-activated carbide particle, a calcium carbonate particle, and an aluminum nitride particle.

[4] The filter for a smoking article according to [3], wherein the un-activated carbide particle has a benzene adsorption ability of from 0.5 to 0.7 measured

according to JIS K 1474.

[5] The filter for a smoking article according to [3], wherein the cellulose particle, the calcium carbonate particle, and the aluminum nitride particle has a BET specific surface area of 10 m²/g or less.

[6] The filter for a smoking article according to any one of [1] to [5], wherein the inert particle has a particle diameter of from 10 to 70 meshes according to JIS Z8801-1 (2006).

[7] The filter for a smoking article according to any one of [1] to [6], wherein the inert particle has a specific gravity of 5 g/cm³ or less.

[8] The filter for a smoking article according to any one of [1] to [7], wherein the binder resin is a thermoplastic resin.

[9] The filter for a smoking article according to any one of [1] to [8], wherein the filter segment including the porous material containing the inert particle and the nonfibrous binder resin includes no plasticizer.

[10] The filter for a smoking article according to any one of [1] to [9], wherein the inert particle and the nonfibrous binder resin are at a weight ratio of from 70:30 to 80:20 in the porous material.

[Effects of Invention]

[0015] According to the present invention, there is provided a filter for a smoking article or the like, in which the components affecting the flavor and taste contained in the mainstream smoke are not reduced more than necessary and aroma components other than the aroma components originating from the tobacco smoke are not released.

[Brief Description of the Drawings]

[0016]

[Fig. 1] Fig. 1 is a diagram showing measurement results of a ratio of a permeation amount of semi-volatile components normalized by a crude tar amount.

[Fig. 2] Fig. 2 is a schematic diagram showing an example of an embodiment of a filter for a smoking article.

[Fig. 3] Fig. 3 is a schematic diagram showing another example of an embodiment of a filter for a smoking article.

[Description of Embodiments]

[0017] Hereinafter, the present invention will be described in detail with reference to embodiments, examples, and the like, but the present invention is not limited to the following embodiments and examples, and the like and may be implemented while being arbitrarily changed without departing from the gist of the present invention.

<Inert particle neither releasing any aroma component nor selectively reducing any component contributing to flavor and taste relative to crude tar in tobacco smoke>

[0018] The filter for a smoking article according to an embodiment of the present invention comprises a filter segment including a porous material containing an inert particle (simply referred to hereinbelow as "inert particle") neither releasing any aroma component nor selectively reducing any component contributing to flavor and taste relative to crude tar in tobacco smoke and a nonfibrous binder resin.

[0019] The inert particle is completely different in properties from the active particles described in the above-mentioned Patent Document 1 to 3 and the organic particles derived from a natural material described in Patent Document 4.

[0020] Specifically, while the active particles described in Patent Document 1 to 3 have a property of demonstrating adsorptivity or a property of inducing chemical reactions with respect to components contributing to flavor and taste, the inert particle used in the embodiment of the present invention has lower ability to adsorb components contributing to flavor and taste which is than the active particles described in Patent Document 1 to 3 and does not induce chemical reactions with the components contributing to flavor and taste.

[0021] In addition, the organic particles derived from a natural material which are described in Patent Document 4 themselves release flavor and taste, whereas the inert particle used in the embodiment of the present invention does not itself release flavor and taste.

[0022] The "components contributing to flavor and taste", as referred to herein, are semi-volatile components contained in tobacco smoke, and can be more specifically exemplified by limonene, 2,5-dimethylpyrazine, 3-vinylpyridine, 3-butylpyridine, phenylethyl alcohol, and indole.

[0023] The inert particle according to the embodiment of the present invention, when used in a filter for a smoking article, does not selectively reduce any component contributing to flavor and taste, specifically, the above-mentioned semi-volatile components, relative to crude tar in tobacco smoke.

[0024] In the present specification, "not selectively reducing relative to crude tar in tobacco smoke" means that the delivery amount of semi-volatile components normalized by a crude tar amount which is determined by the below-described method for measuring the delivery amount of semi-volatile components, which is performed with respect to the filter for a smoking article according to the embodiment of the present invention, is larger than that of the below-described typical filter for a smoking article.

[0025] A filter (airflow resistance is 85 mmH₂O/27 mm) including about 7% by weight of triacetin as a plasticizer in a cellulose acetate fiber bundle is used as a typical (control) filter.

(Smoking Test)

[0026] The permeation amount (delivery amount) of a semi-volatile component is measured as follows.

[0027] Automatic smoking is performed using an automatic smoking device (RM20D, manufactured by Borgwaldt KC Inc.) under the conditions of a suction capacity of 35.0 mL/2 sec, a suction time of 2 sec/puff, and a suction frequency of 1 puff/min, the crude tar is collected using a Cambridge filter (CM-133, manufactured by Borgwaldt KC Inc.), and the smoke passing through the Cambridge filter is collected in 10 mL of methanol cooled to -70°C with a coolant composed of dry ice and isopropanol. Further, d-32 pentadecane as an internal standard substance is contained in the methanol solution at a concentration of 5 µg/mL.

[0028] The Cambridge filter that collected the crude tar and 10 mL of the methanol solution that collected the cigarette smoke are transferred to a serum bottle and shaken for 30 min. After shaking, the supernatant is collected and used as an analytical sample.

[0029] The analytical sample is analyzed by gas chromatograph mass spectrometry (GC-MSD). Agilent 7890A (Agilent Technologies Inc.) is used for GC and Agilent 5975C (Agilent Technologies Inc.) is used for MSD.

[0030] The inert particle does not release an aroma component. "Not releasing an aroma component", as referred to herein, means that, unlike organic particles derived from a natural material, such as described in Patent Document 4, there is no aroma component inherent to the inert particle.

[0031] The specific gravity of the inert particles may be 5 g/cm³ or less. When the specific gravity of the inert particle is 5 g/cm³ or less, it is possible to suppress the weight of 4000 filters/box, which is the minimum packaging unit for filters, to less than 20 kg and suppress the work burden on the workers handling the filters (the following is presumed: filter length: 120 mm, filter inner circumference: 24.1 mm, filter void ratio *: 90%, inert particle filling weight ratio: 80%).

[0032] When the specific gravity is 5 g/cm³ or less, gold and platinum described in Patent Document 1 are not included. Further, the inert particle may typically have the specific gravity of 1 g/cm³ or more.

[0033] Also, it is preferable that the inert particle have a particle diameter of from 10 to 70 meshes according to JIS Z8801-1 (2006). Within such a particle diameter range, inert particles can be evenly present inside the porous material, and contribution is made to not selectively reducing the semi-volatile component.

[0034] It is preferable that the inert particle be thermally stable at 150°C. "Thermally stable", as referred to herein, means that the ability of not selectively reducing components contributing to flavor and taste relative to crude tar in tobacco smoke before heating to 150°C is not different from that after the heating, and that the inert particle does not deform when heated to 150°C.

[0035] As a result, an inert particle deformed at 150°C, for example, an inert particle constituted by a thermoplastic resin, does not fulfill this requirement. Also, an ion exchange resin such as described in Patent Document 3 does not satisfy this requirement.

[0036] Specific example of the inert particle can be at least one selected from a cellulose particle, an un-activated carbide particle, a calcium carbonate particle, and an aluminum nitride particle.

[0037] Each of these particles has a specific gravity of 5 g/cm³ or less and is thermally stable at 150°C.

(Cellulose Particle)

[0038] A cellulose particle can be prepared by compression molding a commercially available cellulose powder such as microcrystalline cellulose as a raw material by a compression type granulating apparatus, pulverizing the obtained molded body and classifying. A cellulose particle can be made with reference to WO 2013/084661. Alternatively, a commercially available cellulose molded body may be used.

[0039] The cellulose particles may have a volume-based median diameter (D50) of from 100 to 1700 µm, preferably 150 to 1500 µm, and more preferably 200 to 1300 µm.

[0040] The median diameter (D50) can be measured with a laser diffraction/scattering type particle diameter distribution (granulometric distribution) measuring device.

[0041] The bulk density of the cellulose particles may be from 0.05 to 1.00 g/cc, preferably 0.10 to 0.90 g/cc, and more preferably 0.15 to 0.85 g/cc.

[0042] The bulk density of the cellulose particles can be measured with, for example, a powder tester PT-X manufactured by Hosokawa Micron Corporation.

[0043] The BET specific surface area of the cellulose particle is preferably 10 m²/g or less, and more preferably equal to or less than the detection limit. Such a BET specific surface area is preferable from the viewpoint of ensuring satisfactory permeability of the cellulose particle to a semi-volatile component. The lower limit of the BET specific surface area of the cellulose particle may be more than 0 m²/g, for example.

(Un-activated Carbide Particle)

[0044] The un-activated carbide particle can be obtained by selecting a suitable carbide source such as a coconut shell and carbonizing it in a carbonization furnace at a temperature of from 500°C to 1000°C in an inert gas atmosphere. At this time, no activation processing is performed. The time for the carbonization treatment can be from 30 to 60 min. As a specific example thereof, the treatment described in Japanese Patent Application Publication No. S62-55068 can be used.

[0045] It is preferable that the un-activated carbide particle have a benzene adsorption ability of from 0.5 to 0.7

measured according to JIS K 1474. Such benzene adsorption ability is preferable from the viewpoint of ensuring good permeability of the un-activated carbide particle to a semi-volatile component.

(Calcium Carbonate Particle and Aluminum Nitride Particle)

[0046] A calcium carbonate particle and an aluminum nitride particle can be produced by granulating respective commercially available powders.

[0047] The calcium carbonate particle can be obtained, for example, by granulating a commercially available calcium carbonate powder having an average particle diameter of 6.3 μm or less.

[0048] Aluminum nitride can be obtained, for example, by granulating a commercially available powder having an average particle diameter of 2.5 μm or less.

[0049] In the granulation of the calcium carbonate particles and aluminum nitride particles, first compression molding is performed. Specifically, a powder of calcium carbonate or aluminum nitride is compression molded by a compression type granulating apparatus, and the obtained molded body is further pulverized and classified.

[0050] Thereafter, particles can be obtained by extrusion molding.

[0051] Specifically, calcium carbonate particles or aluminum nitride particles can be obtained by preparing a slurry by adding an appropriate solvent and, if necessary, a binder to the powder prepared as described above, extruding the slurry from a pierced container and cutting to a required size, and drying the solvent. Optionally, classification is thereafter performed.

[0052] It is preferable that the calcium carbonate particle and the aluminum nitride particle each have the BET specific surface area of 10 m^2/g or less. Such a BET specific surface area is preferable from the viewpoint of ensuring good permeability of the calcium carbonate particle and aluminum nitride particle to a semi-volatile component. Meanwhile, the lower limit of the BET specific surface area of the calcium carbonate particles and aluminum nitride particles can be 1 m^2/g .

[0053] The inert particle used in the embodiments of the present invention, including the inert particles exemplified above, can preferably have a particle diameter of from 10 to 70 mesh according to JIS Z 8801-1 (2006). Where an inert particle that does not pass through the 10 mesh sieve is used, the inert particle is likely to drop off from the cut end face of the filter. Further, where an inert particle passing through a sieve having an opening of 1 size smaller than a 70 mesh sieve is used, the inert particle blocks the air channel in the filter segment, the airflow resistance rises too much, and the inert particle can be not suitable for a filter for a smoking article.

[0054] In the embodiment of the present invention, only one kind of the above specific inert particle may be used, or two or more kinds may be used in combination.

[0055] Examples of combinations of two or more kinds

include a combination including a cellulose particle and an un-activated carbide particle, a combination including a cellulose particle and a calcium carbonate particle, a combination including a cellulose particle and an aluminum nitride particle, a combination including an un-activated carbide particle and a calcium carbonate particle, and a combination including an un-activated carbide particle and an aluminum nitride particle.

10 <Binder Resin>

[0056] The porous material of the filter segment of the filter for a smoking article according to the embodiment of the present invention includes a nonfibrous binder resin. "Nonfibrous", as referred to herein, means that the resin is not fibrous like a cellulose acetate tow.

[0057] As the binder resin, for example, a thermoplastic resin can be mentioned.

[0058] Examples of the thermoplastic resin include, but are not limited to, polyolefins, polyesters, polyamides (or nylon), polyacrylates, polystyrene, polyvinyl, polytetrafluoroethylene (PTFE), polyether ether ketone (PEEK), copolymers thereof, derivatives thereof, combinations thereof, and the like. Examples of polyolefins include, but are not limited to, polyethylene, polypropylene, polybutylene, polymethylpentene, copolymers thereof, derivatives thereof, combinations thereof, and the like. Examples of suitable polyethylene further include low-density polyethylene, linear low-density polyethylene, high-density polyethylene, copolymers thereof, derivatives thereof, combinations thereof, and the like.

[0059] Examples of suitable polyesters include polyethylene terephthalate, polybutylene terephthalate, polycyclohexylenedimethylene terephthalate, polytrimethylene terephthalate, copolymers thereof, derivatives thereof, combinations thereof, and the like.

[0060] Examples of suitable polyacrylates include, but are not limited to, polymethyl methacrylate, copolymers thereof, derivatives thereof, combinations thereof, and the like.

[0061] Examples of suitable polystyrenes include, but are not limited to, polystyrene, acrylonitrile butadiene styrene, styrene acrylonitrile, styrene butadiene, styrene maleic anhydride, copolymers thereof, derivatives thereof, combinations thereof, and the like.

[0062] Examples of suitable polyvinyls include, but are not limited to, ethylene vinyl acetate, ethylene vinyl alcohol, polyvinyl chloride, copolymers thereof, derivatives thereof, combinations thereof, and the like.

[0063] In the embodiment of the present invention, it is preferable to use at least one of polyethylene, a copolymer of polyethylene, a derivative of polyethylene, and a combination thereof as the binder resin.

[0064] Polyethylene can be exemplified by GUR (registered trademark) polymers marketed by Celanese Corporation. such as GUR (registered trademark) 2000 series (2105, 2122, 2122-5, 2126), GUR (registered trademark) 4000 series (4120, 4130, 4150, 4170, 4012,

4122-5, 4022-6, 4050-3/4150-3), GUR (registered trademark) 8000 series (8110, 8020), and GUR (registered trademark) X series (X143, X184, X168, X172, X192).

[0065] The melt flow rate of the binder resin used in the embodiment of the present invention is preferably 3.5 g/10 min or less and more preferably 2.0 g/10 min or less at 190°C and 15 kg.

[0066] The binder resin used in the embodiment of the present invention can be in the form of particles. The particles can be in the form of powder, pellets or fine particles.

[0067] When the binder resin is in the form of particles, the range of the diameter thereof may be from about 0.1 nm to 5000 μm , preferably from about 10 nm to 500 μm , and more preferably from about 100 nm to 300 μm .

[0068] The binder resin used in the embodiment of the present invention may have a bulk density of from 0.10 g/cm³ to 0.55 g/cm³, preferably from 0.17 g/cm³ to 0.50 g/cm³, and more preferably from 0.20 g/cm³ to 0.47 g/cm³.

<Porous Material>

[0069] A porous material according to the embodiment of the present invention is a constituent element of at least one filter segment constituting the filter for a smoking article according to the embodiment of the present invention.

[0070] The porous material according to the embodiment of the present invention contains the specific inert particle and the binder resin described above, and any method can be used for producing the porous material.

[0071] For example, the specific inert particles and the binder resin are mixed and placed in a mold having an appropriate shape. The mold is heated to the melting point of the binder resin or above, for example, in one embodiment to about 150°C to 300°C, and held for sufficient time and at sufficient temperature to heat the mold and the contents thereof to a desired temperature.

[0072] The substance is thereafter taken out of the mold and cooled to room temperature, thereby producing a porous material having voids formed therein.

[0073] The void volume ratio of the porous material can be, for example, from 40% to 90%. Within this void volume ratio range, it is possible to suitably adjust the airflow resistance and the permeation amount of semi-volatile components in tobacco smoke. The shape of the porous material is not particularly limited but can be exemplified by a cylindrical shape which makes it possible to calculate the void volume ratio on the basis of the description of Patent Document 2. The length of the porous material in the airflow direction is not particularly limited and can be exemplified by from about 3 to 30 mm.

[0074] In the filter segment having the porous material according to the embodiment of the present invention, since the inert particle is fixed in the porous material by the binder resin, the inert particle does not escape from the filter segment when the filter segment having the po-

rous material, or a filter for a smoking article including the filter segment, or a smoking article including the filter for a smoking article is transported.

[0075] Further, since the filter for a smoking article according to the embodiment of the present invention is provided with the filter segment having the porous material, the filtration rate of tar and nicotine per airflow resistance of the filter is lowered (delivery to the user is facilitated). In addition, it is possible to design a filter for a smoking article having a high ventilation rate at a low filtration rate when the amount of tar during smoking is made constant, and the amount of generated carbon monoxide can be reduced.

[0076] In the porous material according to the embodiment of the present invention, it is preferable that the inert particle and the nonfibrous binder resin be at a weight ratio of from 70:30 to 80:20. By including the inert particles and the nonfibrous binder resin in such ranges, it is possible to provide voids inside the porous material with an appropriate void ratio, and it is possible to adjust suitably the airflow resistance and the permeation amount of semi-volatile components in tobacco smoke.

[0077] With the porous material according to the embodiment of the present invention, there is no need to use a plasticizer such as triacetin which has been used for conventional filters for smoking articles. This makes it possible to prevent semi-volatile components in tobacco smoke from being removed by being adsorbed by the plasticizer.

<Filter for Smoking Article>

[0078] The filter for a smoking article of the present invention comprises at least the above-described filter segment having the porous material (hereinafter also simply referred to as "segment having the porous material").

[0079] The filter segment having the porous material can have a circumferential length and a length in the airflow direction similar to the circumferential length and the length in the airflow direction of the filter constituting the conventional filter cigarette.

[0080] For example, the circumferential length can be from 16 to 26 mm and preferably from 24 to 26 mm. This corresponds to the filter segment diameter of from 5.1 to 8.3 mm and from 7.6 to 8.3 mm, respectively.

[0081] The filter segment having the porous material may have the abovementioned circumferential length, but this filter segment is not limited to the size of the filter included in the conventional filter cigarette and may also have a circumferential length and a length in the airflow direction suitable for other smoking articles to be described hereinbelow.

[0082] The filter segment having the porous material may be wrapped around the outer circumferential surface thereof with a web paper for a filter to be described hereinbelow.

[0083] The filter for a smoking article according to the

embodiment of the present invention may include, in addition to the above-described filter segment having the porous material, a filter segment (hereinafter can be also referred to as "conventional filter segment") constituted by a cellulose acetate tow similar to that of the filter constituting the conventional filter cigarette.

[0084] As an example of a configuration according to one embodiment, the conventional filter segment is arranged at the suction end side, and the above-described filter segment having the porous material is arranged between a tobacco rod having a tobacco cut and the conventional filter segment.

[0085] A filter for a smoking article can be produced by connecting the filter segment having the porous material and the conventional filter segment by using molding paper. This configuration is shown in Fig. 2. This configuration is also referred to as a dual segment.

[0086] When a dual segment is used, the porous material is not exposed at the suction end, so that the appearance can be improved. It is also possible to prevent the porous material from directly contacting the user's mouth.

[0087] In the configuration according to another possible embodiment of the present invention, the conventional filter segment is arranged on the suction end side, the filter segment having the porous material is arranged so as to be adjacent to the conventional filter segment, and the conventional filter segment is further arranged between the filter segment having the porous material and a tobacco rod having a tobacco cut. This configuration is shown in Fig. 3. This configuration is also referred to as a triple segment. When the triple segment is used, it is possible to prevent the porous material from being deteriorated by the transmission of high-temperature heat from the tobacco rod side to the porous material.

[0088] The number of filter segments constituting the filter for a smoking article according to the embodiment of the present invention may be not only 2 as shown in Fig. 2, or 3 as shown in Fig. 3, but also 4 or more. In that case, two or more filter segments each having the porous material can be provided.

[0089] Figs. 2 and 3 show the configurations when a filter cigarette is used as a smoking article, but the smoking article may be other than a filter cigarette as will be described hereinbelow, and in this case, the configuration be changed as appropriate. Thus, an embodiment in which the filter without the tobacco rod is appropriately used as the filter for a smoking article according to the embodiment of the present invention in other smoking articles can be also mentioned.

[0090] It is to be noted that the outer surface of the filter formed by joining the filter segments may be wrapped with tip paper.

[0091] In the case where the filter segment is composed of a cellulose acetate tow, the single yarn fineness, total fineness, and cross-sectional shape of the cellulose acetate tow are not particularly limited.

[0092] The filter segment other than the filter segment

having the porous material may be configured of a material other than the cellulose acetate tow.

[0093] It is possible to design, as appropriate, the adjustment of airflow resistance and addition of additives (known adsorbents, flavors, flavor holding materials, and the like) to the cellulose acetate tow or other material.

[0094] Tip paper, molding paper, and web paper for wrapping the outer surface of filters used in the conventional filter cigarettes can be used for the filter for a smoking article according to the present embodiment. Here, the web paper is in direct contact with the porous material or the filter tow or the like and is wrapped in a cylindrical shape. The molding paper is used to fix a plurality of filter sections when there is a plurality of filter segments wrapped with the web paper. The tip paper is used to connect the filter for a smoking article to a tobacco rod when the smoking article has the tobacco rod.

[0095] The tip paper can be provided with ventilation holes for adjusting the presence ratio of tobacco smoke and air to be inhaled during smoking of the smoking article (the ventilation holes are shown by dotted lines in the tip paper shown in Fig. 2 and 3). The arrangement of the ventilation holes is not particularly limited. For example, the ventilation holes can be arranged in one row or two rows in the circumferential direction of the smoking article. The pitch of the ventilation holes, the size of the holes, and the method for opening the holes are not particularly limited.

<Smoking Articles>

[0096] The filter for a smoking article according to the embodiment of the present invention can be used for the following smoking articles.

[0097] A combustion type smoking article in which a tobacco filler is burned, for example, a filter cigarette; a non-combustion heating type smoking article in which a tobacco filler is heated without burning; and a non-heating type smoking article in which flavor and taste components of a tobacco filler are inhaled without burning or heating the tobacco filler. The non-combustion heating type smoking article can be exemplified by a carbon heat source inhalation device in which a tobacco filler is heated by combustion heat of a carbon heat source (see, for example, WO 2006/073065); an electric heating type inhalation device equipped with an inhalation device and a heating device for electrically heating the inhalation device (see, for example, WO 2010/110226); and a liquid atomizing type inhalation device in which a liquid aerosol source including a flavor and taste source is atomized by heating (see, for example, WO2015/046385). Another preferred application is to a non-combustion heating type smoking article in which an aerosol generating rod is used instead of a tobacco filler and a flavor component is generated by heating from the outside of the aerosol generating rod. Such a smoking article has a battery, an electric heating unit, and an aerosol generating rod member which is detachably plugged in. The electric heating unit

is a so-called heater and has a heat generating element. The heat generating element of the electric heating unit heats the aerosol generating rod and releases the flavor from the filler of the aerosol generating rod into the surrounding air. The heating temperature of the aerosol generating rod by the electric heating unit is, for example, 400 °C or less. The smoking articles having the aerosol generating rod member are described in detail in Japanese Patent No. 4889218 and Japanese Patent No. 4762247.

[0098] The filter for a smoking article according to the embodiment of the present invention can be used as a filter for these non-combustion heating type smoking articles.

[0099] A non-heating type smoking article can be exemplified by a flavor inhalation device which includes a suction holder and a tobacco filler filled in the main flow path of the suction holder and in which flavor and taste components of the tobacco filler are inhaled (see, for example, WO 2010/095659).

[0100] The filter for a smoking article according to the embodiment of the present invention can be appropriately used in the smoking articles exemplified hereinabove.

[0101] In this case, the shape of the filter segment having the porous material, the shape of the filter for a smoking article including the filter segment, and the like can be changed as appropriate.

[Examples]

[0102] The present invention will be described hereinbelow more specifically with reference to examples, but the present invention is not limited to the description of the examples, provided that the scope of the invention is not exceeded.

(Production Example 1)

<Preparation of Filter Segment Having Porous Material Containing Cellulose Particle and Polyethylene Resin>

[0103] A porous material using a cellulose particle as an inert particle and polyethylene as a binder resin was prepared.

[0104] The cellulose particles were produced by using a commercially available cellulose powder (ENDURANCE MCC VE-090, manufactured by FMC Corporation) as a raw material, compression molding by using a compression granulating apparatus (Roller Compactor TF-208, manufactured by Freund Corp.), pulverizing and classifying. The cellulose particles had a median diameter (D50) of 1190 μm, a bulk density of 0.832 g/cc, and a BET specific surface area equal to or less than the detection limit. The bulk density was measured with a powder tester PT-X manufactured by Hosokawa Micron Corporation. The cellulose particles (75 parts by weight) and polyethylene (GUR (registered trademark) 25 parts by weight, manufactured by Celanese Corporation) as

the binder resin were mixed, placed in a mold and heated to 200°C for 40 min. The material after heating was removed from the mold and cooled to obtain a porous material 1 having a circumferential length of 23.75 mm and a length of 20 mm.

(Production Example 2)

[0105] A porous material 2 was obtained in the same manner as in Production Example 1 except that un-activated carbide particles were used as inert particles, the weight thereof was 80 parts by weight, and the weight of polyethylene was 20 parts by weight. The benzene adsorption ability of the un-activated carbide particles was 0.6.

[0106] The un-activated carbide particles were obtained by subjecting coconut shells to carbonization treatment in an inert gas atmosphere in a carbonization furnace.

(Production Example 3)

[0107] A porous material 3 was obtained in the same manner as in Production Example 2 except that low-activated carbon prepared by a steam activation method was used instead of inert particles. The low-activated charcoal had a BET specific surface area of 725 m²/g.

(Production Example 4)

[0108] A porous material 4 was obtained in the same manner as in Production Example 2 except that activated carbon prepared by a steam activation method was used instead of inert particles. The BET specific surface area of the activated carbon was 1142 m²/g.

<Comparison of Permeation Amounts of Semi-volatile Components>

[0109] A tobacco rod including a tobacco cut was removed from a commercially available filter cigarette, and the above-described porous material (20 mm) as a filter segment and a cellulose acetate tow filter (7 mm; 5.5Y31000) were successively connected to the tobacco rod to prepare a filter cigarette for testing.

[0110] As a control, a filter cigarette was prepared by connecting a cellulose acetate tow filter (27 mm; 2.8Y35000) to the tobacco rod same as described hereinabove.

[0111] A smoking test was carried out using these filter cigarettes, and the amount of crude tar and also limonene, 2,5-dimethylpyrazine, 3-vinylpyridine, 3-butylpyridine, phenylethyl alcohol, and indole as semi-volatile components from among the components of tobacco smoke were selectively analyzed.

[0112] The smoking test was carried out using the equipment and conditions described above.

[0113] The results are shown in Fig. 1. The type of

semi-volatile component is indicated on the abscissa in Fig. 1. The ratio of the amount of the semi-volatile component normalized by the amount of crude tar in each sample to the control is indicated on the ordinate in Fig. 1, and a larger value thereof indicates that a smaller selective reduction has occurred (the permeation amount is large).

[0114] It follows from the results shown in Fig. 1 that in the sample having the porous material using the cellulose particle or the un-activated carbide particle as a filter segment, the permeation amount (delivery amount) of semi-volatile components was generally larger than that of the control, whereas in the sample having the porous material using low-activated carbon or activated carbon as a filter segment, the permeation amount (delivery amount) of semi-volatile components was generally smaller than that of the control.

[0115] These results indicate that the cellulose particle and un-activated carbide particle function as inert particles, whereas the low-activated carbon and activated carbon function as active particles (corresponding to those described in Patent Document 1 to 3).

<Evaluation of Sensory Properties>

[0116] For each filter cigarette for testing which semi-volatile components were measured, the ventilation ratio and the tar amount were adjusted to 37% and 10 mg, respectively, and sensory properties at the time of smoking were evaluated.

[0117] As a result, it was found that in the sample provided with the filter segment having the porous material including the inert particle, that is, the cellulose particle or the un-activated carbide particle, the flavor and taste originating from tobacco smoke increased, whereas in the sample provided with the porous material using the low-activated carbon or activated carbon, which is an active particle, as a filter segment, the flavor and taste originating from tobacco smoke decreased.

[0118] From the results obtained in measurement of semi-volatile components and sensory evaluation, it was confirmed that when using the filter for a smoking article according to the embodiment of the present invention, it is possible to cause selective permeation of semi-volatile components (without the removal thereof by the filter), thereby making it possible to give the user stronger flavor and taste inherent to tobacco leaves.

[0119] In addition, since the inert particle of the filter for a smoking article according to the embodiment of the present invention does not itself create flavor or taste (odorless), when the filter for a smoking article according to the embodiment of the present invention is used, the user can taste the unchanged characteristic flavor and taste inherent to tobacco leaves.

[Reference Signs List]

[0120]

- 1 Tobacco rod portion
- 2 Conventional filter segment
- 3 Filter segment having porous material
- 4 Wrapper
- 5 Molding paper
- 6 Tip paper
- 7 Filter

10 Claims

1. A filter for a smoking article, the filter comprising a filter segment including a porous material containing
 - an inert particle neither releasing any aroma component nor selectively reducing any component contributing to flavor and taste relative to crude tar in tobacco smoke and a nonfibrous binder resin.
2. The filter for a smoking article according to claim 1, wherein the inert particle is thermally stable at 150°C.
3. The filter for a smoking article according to claim 1 or 2, wherein the inert particle is at least one selected from a cellulose particle, an un-activated carbide particle, a calcium carbonate particle, and an aluminum nitride particle.
4. The filter for a smoking article according to claim 3, wherein the un-activated carbide particle has a benzene adsorption ability of from 0.5 to 0.7 measured according to JIS K 1474.
5. The filter for a smoking article according to claim 3, wherein the cellulose particle, the calcium carbonate particle, and the aluminum nitride particle has a BET specific surface area of 10 m²/g or less.
6. The filter for a smoking article according to any one of claims 1 to 5, wherein the inert particle has a particle diameter of from 10 to 70 meshes according to JIS Z8801-1(2006).
7. The filter for a smoking article according to any one of claims 1 to 6, wherein the inert particle has a specific gravity of 5 g/cm³ or less.
8. The filter for a smoking article according to any one of claims 1 to 7, wherein the binder resin is a thermoplastic resin.
9. The filter for a smoking article according to any one of claims 1 to 8, wherein the filter segment including the porous material containing the inert particle and the nonfibrous binder resin includes no plasticizer.

10. The filter for a smoking article according to any one of claims 1 to 9, wherein the inert particle and the nonfibrous binder resin are at a weight ratio of from 70:30 to 80:20 in the porous material.

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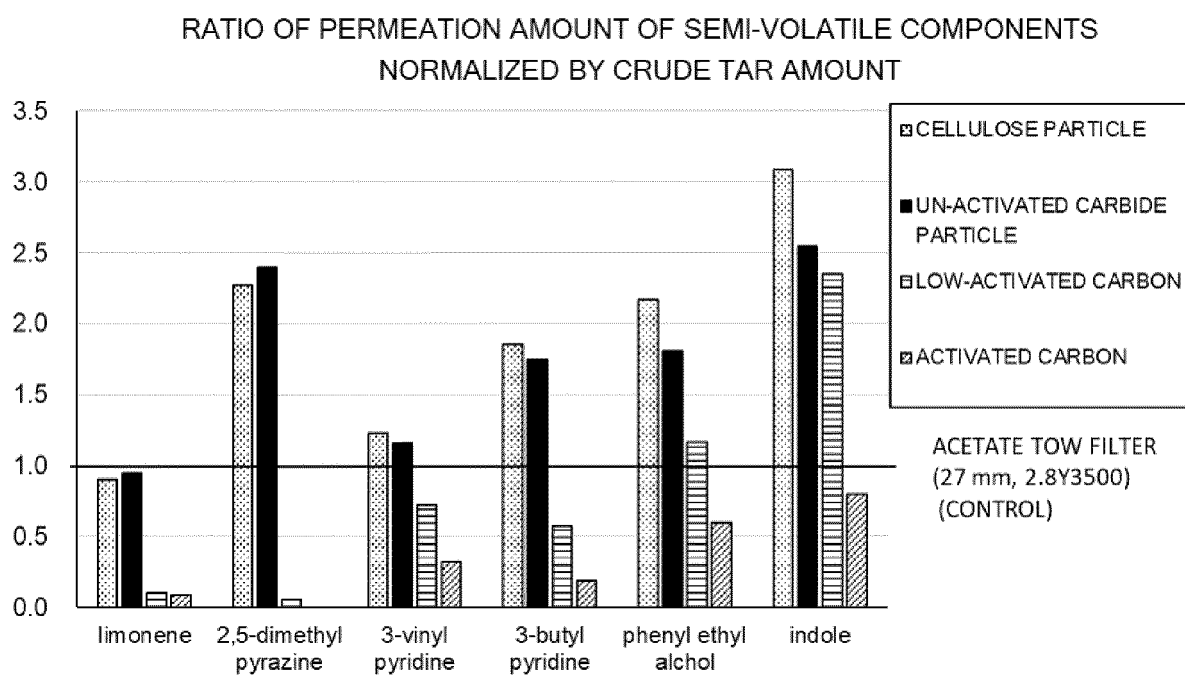


Fig. 1

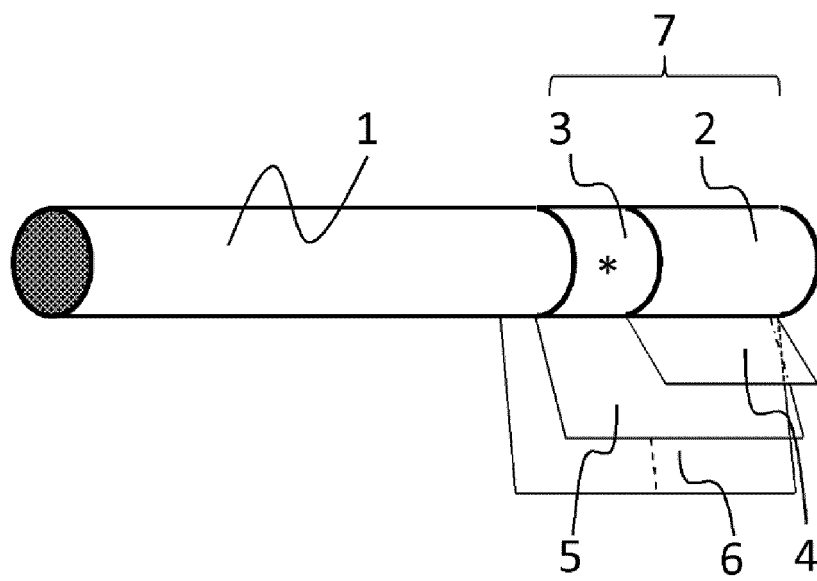


Fig. 2

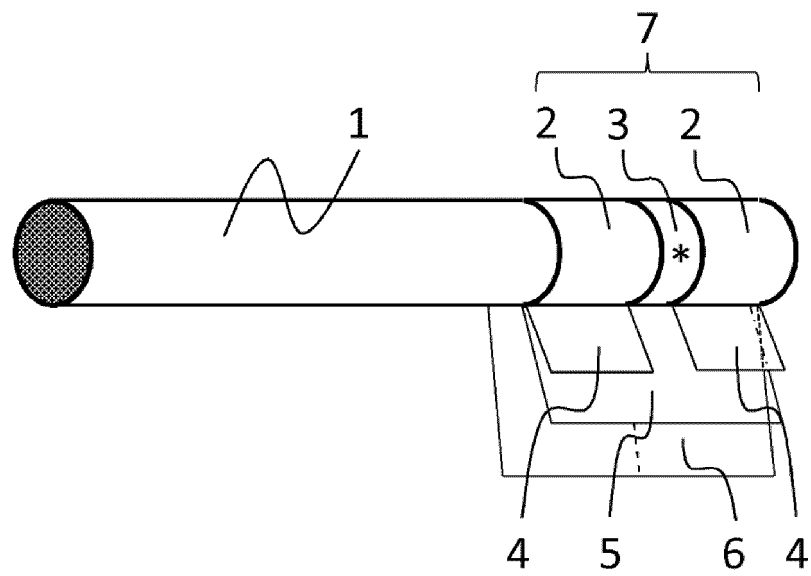


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/002585

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. A24D1/04 (2006.01) i, A24D3/04 (2006.01) i, A24D3/06 (2006.01) i
 FI: A24D3/04, A24D3/06, A24D1/04

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. A24D1/04, A24D3/04, A24D3/06

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 1971-2020

Registered utility model specifications of Japan 1996-2020

Published registered utility model applications of Japan 1994-2020

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 54-011299 A (MONSANTO LIMITED) 27.01.1979	1-3, 7-9
Y	(1979-01-27), specification, page 8, lower left column, line 1 to page 10, lower left column, line 13	3-6
Y	JP 62-055068 A (JAPAN TOBACCO INC.) 10.03.1987 (1987-03-10), specification, page 3, upper left column, lines 2-19	3-6
A	JP 49-006120 B1 (U.S. FILTER CORP.) 12.02.1974 (1974-02-12), entire text, all drawings	1-10

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

* Special categories of cited documents:

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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
11.03.2020

Date of mailing of the international search report
31.03.2020

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Japan Patent Office
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Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2020/002585

JP 54-011299 A	27.01.1979	US 4279848 A
		column 9, line 37 to column 12, line 20
JP 62-055068 A	10.03.1987	(Family: none)
JP 49-006120 B1	12.02.1974	DE 1432748 A

REFERENCES CITED IN THE DESCRIPTION

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- WO 2015046385 A [0097]
- JP 4889218 B [0097]
- JP 4762247 B [0097]
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