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(71) Applicant: **Japan Tobacco, Inc.**
Tokyo 105-8422 (JP)

(72) Inventors:
- **ISHIKAWA, Nobuyuki**
  Tokyo 130-8603 (JP)
- **KAGAWA, Shinjiro**
  Tokyo 130-8603 (JP)
- **KUBOTA, Hiroyuki**
  Tokyo 130-8603 (JP)

(74) Representative: **Isarpatent**
Patent- und Rechtsanwälte Behnisch Barth Charles
Hassa Peckmann & Partner mbB
Friedrichstrasse 31
80801 München (DE)

(54) LOW TAR MENTHOL CIGARETTE

(57) A low tar menthol cigarette which comprises a tobacco rod and a filter wrapped in tipping paper and has a tar content of 5 mg or less. The filter includes a single segment constituted by cellulose acetate tow. The draw resistance of the filter is 25 to 80 mmH_2O/27 mm, while the ventilation ratio of air flowing in from ventilation holes formed in the tipping paper is 55% or greater. Menthol is added to the filter.

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Description

[Technical Field]

[0001] The present invention relates to a filter cigarette which has a low amount of tar and to which menthol is added.

[Background Art]

[0002] Methods are known that involve adjusting the inflow amount of air in filter cigarettes by providing ventilation holes in the filter, for the purpose of adjusting components in smoke during smoking.

[0003] Adjusting the draw resistance of a filter in accordance with the amount of a component in smoke is a known feature in ordinary filter cigarettes.

[0004] Patent Document 1 discloses a filter cigarette having a filter that has a draw resistance of 50 mmH_2O/100 mm (corresponding to 13.5 mmH_2O/27 mm) and a ventilation ratio in the range of 20 to 80%.

[0005] Patent Document 2 discloses a filter cigarette having two filter segments and having the feature of adjusting the two filter segments, so that one of the two has a greater draw resistance than the other, and adjusting to a predetermined range of the amount of air inflow from tipping paper with which the filter is wrapped, whereby sufficient smoking satisfaction is afforded as a result, despite lowering of the concentration of nicotine and tar in mainstream smoke.

[0006] The demand for menthol cigarettes has been growing year by year in the Japanese market, and high-menthol cigarettes, hitherto not conventionally marketed, have been introduced. Patent Document 3 discloses, as a method for adding various menthol flavors to a filter, a method that involves adding, to acetate tow, a flavoring liquid resulting from dissolving or dispersing menthol in a plasticizer that is used in the production process of the filter.

[0007] Patent Document 4 discloses means for causing menthol to be held in a flavor carrier and preventing a decrease in the amount of menthol with the passage of days.

[0008] Patent Document 5 illustrates means for preventing a decrease in the amount of menthol with the passage of days, by using a sheet having aroma retention properties.

[0009] Patent Document 6 discloses a method for producing a filter, to which addition and sorption of a flavor are implemented beforehand, in order to prevent the drop in a menthol amount in smoke with the passage of days, or the like.

[Citation List]

[Patent Literature]

[0010]

[Patent Document 1] Japanese Utility Model Application Publication No. S62-86894
[Patent Document 2] Japanese Patent Application Publication No. H11-069965
[Patent Document 3] Japanese Examined Patent Publication No. S43-28077
[Patent Document 4] Japanese Patent Application Publication No. 2012-29637
[Patent Document 5] WO 2011/118040
[Patent Document 6] WO 2012/004853

[Summary of Invention]

[Technical Problem]

[0011] In the invention disclosed in Patent Document 1, the draw resistance of a filter and the inflow proportion of air through perforations provided in tipping paper are adjusted to lie within a predetermined range, but the purpose of doing so is unclear.

[0012] In the invention disclosed in Patent Document 2, the product draw resistance of a cigarette is increased while the amount of nicotine and tar as components in smoke are reduced, to afford as a result sufficient smoking satisfaction.

[0013] As substances in filters for cigarettes, it is ordinary to use filters with low draw resistance in filter cigarettes having a low ventilation ratio and high tar amount, and to use filters with high draw resistance in filter cigarettes having a high ventilation ratio and low tar amount.

[0014] Ongoing research is being conducted on the draw resistance and ventilation ratio (air inflow amount) of filters, as described above, but no attempts have been made to adjust draw resistance and ventilation ratio specializing in filter cigarettes having added menthol, in particular filter cigarettes having a low tar amount.

[0015] The amount of menthol in smoke during smoking of a filter cigarette having menthol is adjusted by way of the

flavoring amount of menthol that is added to the cigarette. When the amount of flavor added to the cigarette is simply increased, the menthol having coloring matter of tobacco dissolved therein seeps into the cigarette paper that covers shredded tobacco of the cigarette, and becomes adhered to the cigarette paper, thereby giving rise to an undesirable external appearance. The amount of menthol in smoke increases in proportion to the tar amount in the cigarette, and hence the amount of menthol in smoke decreases ordinarily in so-called low tar cigarettes having a tar amount of 5 mg or less. The only countermeasure herein is a method that involves adding to the cigarette the largest possible amount of menthol that does not give rise to problems of restrictor element spotting and the like.

[0016] In the method disclosed in Patent Document 3 a problem arises in that menthol added to a filter portion undergoes sorption in the tow of the filter during storage of the product, and the amount of menthol in smoke drops significantly with the passage of days.

[0017] The means disclosed in Patent Document 4 is problematic in that, for instance, costs are higher on account of the use of a flavor carrier, and in that suitability for production is complex and difficult given the need for providing separately a carrier addition process, in a case where the carrier is added to the interior of the filter.

[0018] As in the case of the invention disclosed in Patent Document 4, in the invention disclosed in Patent Document 5 as well costs are higher, the invention being also problematic, for instance, in terms of suitability for cigarette production on account of the addition of a sheet having aroma retention properties to shredded tobacco of the cigarette.

[0019] The invention disclosed in Patent Document 6 describes a method for increasing the menthol addition amount to a filter, as a method for increasing the amount of menthol in smoke. However, the method requires selecting a plasticizer in which menthol dissolves, in order to add the menthol to the plasticizer of the filter. Menthol is poorly soluble in triacetin, which is ordinarily used as a plasticizer, and accordingly it is necessary to prepare a flavoring liquid by dissolving menthol through mixing with a solvent such as polyethylene glycol. When a comparatively large amount of menthol is to be added, there arise concerns of seeping of the flavoring liquid, and of the influence exerted on the hardness and the like of the filter, since in this case there are required large amounts of a plasticizer and of a solvent capable of dissolving menthol. In the case of deliberate sorption of menthol into the filter, the effect elicited just through addition of the menthol mixed in the plasticizer is low, while addition takes a comparatively long time. When adding menthol together with a plasticizer to acetate fibers, therefore, it is necessary to perform for instance a high-temperature treatment. However, these processes must be provided as separate steps during or after production of the filter, and are thus hardly found to be suitable for actual processes.

[0020] There are no extant examples of studies of the draw resistance of a filter and of the ventilation ratio in a filter cigarette associated with menthol concentration in smoke during smoking, and a technique was demanded that should afford a higher amount of menthol in smoke during smoking in particular of low tar cigarettes, among menthol products, while achieving enhanced stability of the amount of menthol in smoke after storage.

[0021] The present invention succeeds in affording a higher amount of menthol in smoke during smoking and in providing a low tar menthol cigarette exhibiting little change in the amount of menthol in smoke after storage.

[Solution to Problem]

[0022] As a result of diligent research, the inventors found that the above problems can be solved by a low tar menthol cigarette having a tobacco rod portion and a filter portion wrapped with tipping paper, the cigarette having a tar amount of 5 mg or less, wherein the filter portion includes a single segment made up of cellulose acetate tow, an draw resistance of the filter portion is 25 to 80 mmH_2O/27 mm and a ventilation ratio of air inflow through ventilation holes pierced in the tipping paper is 55% or higher, and menthol is added to the filter portion, and arrived at the present invention on the basis of that finding.

[0023] Specifically, the present invention is as follows.

[1] A low tar menthol cigarette having a tobacco rod portion and a filter portion wrapped with tipping paper, the cigarette having a tar amount of 5 mg or less, wherein the filter portion has a single segment made up of cellulose acetate tow; the draw resistance of the filter portion is 25 to 80 mmH_2O/27 mm and the ventilation ratio of air inflow through ventilation holes pierced in the tipping paper is 55% or higher; and menthol is added to the filter portion.

[2] The low tar menthol cigarette of [1], wherein the menthol addition amount in the filter portion is 8 mg/cigarette or greater per low tar menthol cigarette.

[3] The low tar menthol cigarette of [1] or [2], wherein the tobacco rod portion or filter portion has a restrictor element.

[4] The low tar menthol cigarette of [3], wherein the resistance element is a capsule or an orifice.

[5] The low tar menthol cigarette of any one of [1] to [4], wherein the draw resistance of the filter portion is 25 to 80 mmH_2O/27 mm and the ventilation ratio of air inflow is 70% or higher.

[6] The low tar menthol cigarette of any one of [1] to [5], wherein the circumference of the low tar menthol cigarette is 20.0 to 27.0 mm.

[Effects of Invention]

[0024] The low tar menthol cigarette of the present invention affords a higher amount of menthol in smoke during smoking and exhibits little change in the amount of menthol in smoke after storage.

[Brief Description of Drawings]

[0025]

[Fig. 1]
Fig. 1 is a diagram illustrating the relationship between the storage period of a filter cigarette and the reduction rate of the amount of menthol in smoke.
[Fig. 2]
Fig. 2 is a diagram illustrating the relationship between initial menthol addition amount and released proportion of menthol in a filter cigarette after storage.

[Description of Embodiments]

[0026] The present invention will be explained next in detail on the basis of embodiments, examples and so forth. However, the present invention is not limited to the embodiments, examples and so forth below, and may accommodate arbitrary modifications without departing from the gist of the invention.

[0027] The low tar menthol cigarette of the present invention is a filter cigarette having a tobacco rod portion and a filter portion wrapped with tipping paper, wherein the filter portion has a single segment made up of cellulose acetate tow; the draw resistance of the filter portion is 25 to 80 mmH_2O/27 mm and the ventilation ratio of air inflow through ventilation holes pierced in the tipping paper is 55% or higher; and menthol is added to the filter portion.

[0028] Known implementations can be used in the tobacco rod. Known types of shredded tobacco for cigarettes can be used without particular limitations. The shredded tobacco is then wrapped with cigarette paper to yield the tobacco rod. A restrictor element such as capsules or orifices may be disposed inside the tobacco rod for the purpose of adjusting the draw resistance of the low tar menthol cigarette (filter cigarette).

[0029] The filter portion that makes up the low tar menthol cigarette of the present invention is wrapped with tipping paper. The tipping paper that can be used in the present invention is not particularly limited, and may be air-impermeable tipping paper.

[0030] An air inflow means made up of a plurality of perforations (ventilation holes) pierced along the circumferential direction of the filter to be wrapped is provided in the tipping paper; as a result, it becomes possible to adjust the ventilation ratio of air inflow through the ventilation holes that are pierced in the tipping paper of the low tar menthol cigarette. Examples of implementations of the perforations include, for instance, providing the perforations in the form of one or more rows in the circumferential direction of the filter.

[0031] The air permeability of the tipping paper having formed therein a plurality of pierced perforations ranges ordinarily from 100 to 7000 C. U. Herein, C. U. denotes flow rate (mL (0.001 L)) through 1 cm^2 (100 mm^2) of tipping paper in 1 minute (60 seconds) for a differential pressure of 100 mmH_2O (980.665 Pa).

[0032] The ventilation ratio of air inflow of the low tar menthol cigarette of the present invention is 55% or higher. The ventilation ratio is preferably 61% or higher, more preferably 70% or higher. Under such a ventilation ratio the smoker can feel more intensely the flavor of menthol. As described below, the draw resistance of the filter for such a ventilation ratio is 80 mmH_2O/27 mm or smaller.

[0033] The ventilation ratio of air inflow in the present invention denotes the ratio, in percentage, of the flow rate of air taken up into the filter cigarette, through the tipping paper (having an air inflow means), with respect to the flow rate of air at the mouth end, upon inhalation of the filter cigarette (product) at a standard flow rate of 17.5 cm^3/sec.

[0034] The ventilation ratio of air inflow can be adjusted for instance through modification of the size, count, and number of rows of the above plurality of perforations, or through modification of air permeability by changing the material of the tipping paper. For instance, the position of the perforations may be set at 12 to 20 mm from the mouth end.

[0035] The draw resistance of the filter portion denotes, in the present invention, a differential pressure PD (mmH_2O) at the filter portion upon inhalation at a flow rate of 17.5 cm^3/sec, from one end of the filter portion having the side face thereof covered with air-impermeable rubber so as to preclude inflow of air.

[0036] The filter portion that makes up the low tar menthol cigarette of the present invention may include a single segment. Specifically, the filter portion that is used in the filter cigarette of the present invention has one single segment made up of cellulose acetate tow. The segment made up of cellulose acetate tow may have a restrictor element such as capsules, orifices or the like.

[0037] In a case where a restrictor element such as capsules or orifices is present in the filter portion, the draw

resistance of the filter portion of the low tar menthol cigarette of the present invention takes as a reference the draw resistance of the filter itself not including the restrictor element.

[0038] The shapes of the capsules and orifices are not particularly limited, and known shapes may be resorted to herein.

[0039] The material that constitutes the single segment made up of the cellulose acetate tow of the filter portion used in the present invention is cellulose acetate. Examples of implementations of cellulose acetate fibers that make up cellulose acetate tow include, for instance, fibers having a single-fiber fineness of about 1.0 to 8.0 denier and a total fineness of 15000 to 70000 denier. Examples of the cross-sectional shape of the fibers include, for instance, circular, oval, Y-shaped, X-shaped and I-shaped cross-sections. Examples of the filter interior include, for instance, an interior uniformly filled with cellulose acetate tow.

[0040] The draw resistance of the filter portion used in the low tar menthol cigarette of the present invention is of 25 to 80 mmH_2O/27 mm. The "27 mm" used in the units of draw resistance denotes the lengthspotting of the filter portion in the longitudinal direction.

[0041] A draw resistance of the filter of 25 mmH_2O/27 mm or greater allows for sufficient filtering of smoke during smoking. On the other hand, a draw resistance of the filter of 80 mmH_2O/27 mm or smaller allows efficiently reducing the filtration rate of menthol without incurring excessive filtering of smoke during smoking. The density of the filter is low, and hence menthol is not adsorbed readily during storage.

[0042] The menthol concentration in the smoke can be kept within a desired range when the draw resistance of the filter lies within the above range and when the ventilation ratio of the filter cigarette is set to lie within the predetermined range described below. This effect can be made yet more prominent in a case where the draw resistance of the filter portion is 25 to 50 mmH_2O/27 mm and the ventilation ratio of air inflow is 70% or higher.

[0043] As conventionally known, the draw resistance of the filter can be adjusted for instance by selecting properly the total fineness (filling amount) and the single-fiber fineness of the cellulose acetate tow. Specifically, the draw resistance can be reduced when the specifications of the cellulose acetate tow involve increasing the single-fiber fineness and reducing the total fineness.

[0044] Examples of the value of tow weight used in the filter, with the length of the filter set to 27 mm, include for instance 0.100 to 0.200 g; herein, the density of the filter can be adjusted by regulating the weight within this range.

[0045] In the low tar menthol cigarette of the present invention, implementations of draw resistance per one low tar menthol cigarette (draw resistance per filter cigarette) include an draw resistance in the range of about 20 to 70 mmH_2O, in the case where no restrictor element is present.

[0046] Herein the term draw resistance of one filter cigarette denotes a differential pressure PD (mmH_2O) per filter cigarette, including the effect of ventilation, upon inhalation at a flow rate of 17.5 cm^3/sec from one end of the filter. That is, the draw resistance of one filter cigarette is the draw resistance measured in the product state in which the tobacco rod portion and the filter portion are connected.

[0047] The tar amount of the low tar menthol cigarette of the present invention is 5 mg or less. The term tar amount in the present invention refers to the amount of tar inhaled by the smoker during smoking.

[0048] In order to bring the tar amount to 5 mg or less, i.e. to bring the target tar amount to 5 mg or less, there can be modified the composition of the shredded tobacco in the tobacco rod, the draw resistance in the filter portion, or the ventilation ratio of the low tar menthol cigarette.

[0049] Implementations of a tar amount of 5 mg or less include adjusting the tar amount as appropriate to lie for instance in the range of 0.5 to 5 mg. The low tar menthol cigarette of the present invention allows conveying a sufficient flavor feel of menthol to the smoker, even for such a low tar amount.

[0050] The measurement of the tar amount in the filter cigarette involves for instance one measurement per 20 cigarettes, in accordance with ISO smoking conditions (ISO 4387). Gas chromatography is used in the measurements.

[0051] Menthol is added to the filter of the low tar menthol cigarette of the present invention. Implementations of the addition site of menthol in the filter include for instance addition of menthol in a proportion of 10 to 100 vol% of the cellulose acetate tow that makes up the filter. Addition methods include for instance a method that involves addition of the menthol beforehand to the cellulose acetate tow of the filter, before making of the filter cigarette, and a method that involves adding the menthol after making of the filter cigarette.

[0052] The method for adding menthol is not particularly limited, and a known method can be resorted to herein. Menthol may be synthetic or derived from natural sources.

[0053] The amount of menthol that is added to the filter of the low tar menthol cigarette of the present invention is preferably 8 mg/cigarette or greater. The amount of menthol in the smoke after storage is rendered yet more stable when the addition amount of menthol is 8 mg/cigarette or greater. The feature of the amount of menthol in the smoke after storage being more stable denotes herein that the release amount of menthol from the filter portion during smoking, after storage of the filter cigarette, is kept close to a given release amount despite the storage time that has elapsed. That addition amount of menthol to the filter portion is more preferably 10 mg/cigarette or greater, and particularly preferably 12 mg/cigarette or greater. The upper limit of the menthol amount may be for instance 20 mg/cigarette or less.

[0054] A filter having a length of for instance 15 to 35 mm in the axial direction (longitudinal direction) can be utilized

as a filter for use in the low tar menthol cigarette of the present invention.

[0055] The circumference of the low tar menthol cigarette of the present invention can be embodied for instance as a circumference of 20.0 to 27.0 mm, more preferably a circumference of 24.0 to 26.0 mm. These ranges are suitable for securing a high menthol concentration in the smoke, and stably preserving the menthol concentration after storage.

[0056] The total length of the low tar menthol cigarette of the present invention can be embodied for instance as a total length of 80 to 100 mm.

<Method for producing a low tar menthol cigarette>

[0057] The low tar menthol cigarette of the present invention can be produced in accordance with known methods, except that herein the menthol is added to the filter, there is utilized a filter with a predetermined range of draw resistance, and moreover the ventilation ratio of air inflow is set to a predetermined range.

[0058] A known method can be resorted to also when a restrictor element such as an orifice is built into the tobacco rod.

[0059] Examples of the implementation of the tobacco rod portion that makes up the low tar menthol cigarette of the present invention include for instance a tobacco rod portion having the shredded tobacco that forms the tobacco rod, and cigarette paper for wrapping the shredded tobacco. Known materials and shapes of the foregoing may be utilized, without limitations, so long as the tobacco rod portion is of low tar as prescribed in the present invention.

[0060] The range of the circumference of the tobacco rod portion may be for instance identical to the circumference of the low tar menthol cigarette of the present invention, described above.

[0061] The length of the tobacco rod portion in the axial direction may be for instance of 50 to 75 mm.

Examples

[0062] The present invention will be explained in more specific terms by way of examples. Within the gist the present invention, however, the present invention is not limited to the disclosure of the examples below.

<Example 1>

Examples 1 and 2, and Comparative examples 1 and 2

[0063] With a view to verifying the increase in the amount of menthol in smoke derived from a cigarette design with low draw resistance in the filter and with high ventilation ratio of air inflow, there were produced cigarettes having the filter draw resistance and ventilation ratio given in Table 1, and the amount of menthol in smoke and tar amount per cigarette were measured. Herein, the produced filters were used for cigarette making after having undergone stabilization by being stored for 3 weeks under conditions of temperature 22°C and humidity 60%, to elicit sufficient sorption of the menthol into the cellulose acetate tow. The produced cigarettes were packaged in normal aluminum, were stored for 3 weeks under conditions of temperature 22°C and humidity 60%, and the amount of menthol in smoke and the tar amount were measured. The tow specifications in the table denote the single-fiber fineness, cross-sectional shape and total fineness of the cellulose acetate tow, where for instance 5.9 Y 35000 denotes a single-fiber fineness of 5.9 denier, a cross-sectional shape being a Y-shape, and a total fineness of 35000 denier.

[0064] The cigarettes used in the test had a total length of 84 mm and a filter length of 27 mm. The shredded tobacco used herein was an American blend type, the filling weight of the shredded tobacco was set to 0.580 g, and the shredded tobacco was flavored with 12000 ppm of menthol with respect to the shredded tobacco weight. The draw resistance and ventilation proportion in the filter of the cigarettes were set in such a manner that the tar amount at the filter outlet was 5 mg.

[Table 1]

	Target tar amount (mg/cigarette)	Filterairflow resistance (mmH_2O/27 mm)	Tow specifications (denier)	Towweight (g/27 mm)	Ventilation proportion (%)	Filter flavoring amount (mg/27 mm)
Example 1	5	46	5.9 Y 35000	0.133	70.0	9.8
Example 2		79	2.8 Y 35000	0.137	63.5	10.0
Comp. ex. 1		101	2.5 Y 35000	0.141	59.2	9.9
Comp. ex. 2		137	1.9 Y 44000	0.152	47.0	9.9

[0065] Smoking test of the cigarettes was conducted according to ISO smoking conditions; for menthol measurement, the number of cigarettes per measurement was set to 20 cigarettes, and the measurement was repeated twice, while for tar measurement the number of cigarettes per measurement was set to 20 cigarettes and the measurement was carried out once. Regarding the amount of menthol and the tar amount in smoke, there were measured the menthol amount and tar amount per cigarette using GC-FID7693 (menthol measurement, nicotine measurement) by Agilent Technologies, and GC-TCD-7890A (moisture measurement) by Agilent Technologies. Regarding the ventilation ratio there was measured the air inflow as flowed in through the perforations of the tipping paper, using SODIMAX by SODIM SAS.

[0066] Four produced cigarettes given in Table 1 were subjected to sensory evaluation regarding the feel of menthol. The evaluation method involved, with Comparative example 1, which is the combination of most common conditions, being used as a control, performing for the other three cigarettes a two-alternative query on whether the cigarettes had higher, identical or lower menthol feel. The number of target subjects in the present evaluation was set to 10, and significant differences were checked, at a significance level of 5%, on the basis of cumulative binomially distributed probability (one-sided).

[0067] Table 2 sets out the amount of menthol in smoke and the tar amount, and also a value resulting from dividing the menthol amount by the tar amount (hereafter notated as M/T ratio). The M/T ratio allows providing an index of the difference in the menthol amount when there is obtained an identical tar amount. The amount of menthol in smoke increases ordinarily in proportion to the tar amount; accordingly, menthol amounts were compared herein through the use of a value normalized by tar amount. The table gives also the results of sensory evaluation in the form of whether or not a significant difference was obtained.

[Table 2]

	Tar (mg/cigarette)	Menthol (mg/cigarette)	M/T ratio (-)	Sensory evaluation Significant difference (-)
Example 1	4.9	1.20	0.245	Yes
Example 2	4.9	1.10	0.224	Yes
Comp. ex. 1	4.8	1.02	0.213	-
Comp. ex. 2	4.9	0.99	0.202	No

[0068] Table 2 revealed that, in the cigarette design, the amount of menthol in smoke and the M/T ratio take on higher values and with decreasing draw resistance in the filter and increasing ventilation ratio of air inflow. This can be ascribed to differences in filtration rate between tar and menthol, in the relationship between the draw resistance and the ventilation ratio of the filter. When using a filter having low draw resistance, specifically, the amount of menthol that condenses / adsorbs onto the tow fibers of the filter decreases due to the smallness of the total amount of tow, in addition to physical smoke filtration phenomena inside the filter, and there increase the amount of menthol in smoke and the M/T ratio. In a design with high ventilation ratio, the time of passage of smoke through the filter interior is longer, and the filtration rate of tar and menthol is ordinarily higher. In filters with low draw resistance, where the total amount of tow is small, however, the filtration rate of menthol hardly rises, and the M/T ratio increases. As a result, the filtration rate of menthol can be reduced with respect to the filtration rate of tar. Results obtained in the sensory evaluation as well revealed differences in a menthol sensation. The menthol feel in Examples 1 and 2 was observed to be significantly higher than that in

Comparative example 1.

[0069] In a conceivably more preferred range of the present examples and comparative examples, the draw resistance of the filter is 80 mmH_2O/27 mm or smaller, and the ventilation ratio 55% or higher, and preferably 61% or higher. In a conceivably yet more preferred range, the conditions in Example 1 are 50 mmH_2O/27 mm or less and ventilation ratio 70% or higher. In terms of the actual production process of the filter, a realistically achievable range of draw resistance amenable for production is 25 mmH_2O/27 mm or greater. The material of the filter is characterized by being made up of cellulose acetate tow.

[0070] It was thus demonstrated that the amount of menthol in smoke increases in a cigarette design with a high ventilation ratio of air inflow. Cigarettes having a filter length of 27 mm were used in the present examples, but the examples are not limited to such an implementation, and the same effect can be expected for arbitrary lengths. The conditions in the present examples included a cigarette circumference of 24.8 mm, but the same effect can be expected for a circumference band in the vicinity of that of the present examples, specifically a circumference in the range of 20.0 mm to 27.0 mm, more preferably in the range of 24.0 mm to 26.0 mm.

<Reference examples 1 to 4>

[0071] With a view to verifying that the amount of menthol in smoke upon storage of a menthol-flavored filter is rendered stable through the use of a filter having low draw resistance, the storage period of the filter and the storage period in the cigarette packaged form were modified, and there was tested the amount of menthol in smoke accompanying a modification of the storage period of the filter and the cigarettes, for the draw resistance and filter flavoring amount of the filter as given in Table 3. In order to eliminate the influence of other factors, the test was performed by modifying only the draw resistance of the filter, without providing ventilation holes in the filter portion.

[0072] Except for the storage conditions of the filter and for the draw resistance and the ventilation ratio, the test was carried out according to the same procedure as in Examples 1 and 2 and Comparative examples 1 and 2.

[Table 3]

	Filter airflow resistance (mmH_2O/27 mm)	Tow specifications (denier)	Tow weight (g/27 mm)	Filter flavoring amount (mg/27 mm)
Ref. ex. 1	54	5.0 Y 35000	0.138	10.0
Ref. ex. 2	93	2.8 Y 35000	0.143	9.6
Ref. ex. 3	107	2.5 Y 35000	0.150	9.8
Ref. ex. 4	143	1.9 Y 44000	0.158	10.5

[0073] Table 4 illustrates the conditions of the storage period of the filter and of the cigarette packaged form. As a storage condition of shortest period, the filter may be used for producing a cigarette immediately after production of the filter, without storage of the cigarette in packaged form (condition A); in a storage condition of longest period, the filter is stored for 2 months after being produced, and is then used to produce a cigarette, after which the cigarette in packaged form is stored for a further 2 months (condition G). The amount of menthol in smoke and the tar amount were measured for the cigarettes having undergone conditions A to G.

[Table 4]

Condition	Filter storage condition	Cigarette package storage condition	Storage environment (temperature /humidity)
A	No storage	No storage	
B	3 weeks	No storage	
C		3 weeks	
D		2 months	22°C/60%

(continued)

Condition	Filter storage condition	Cigarette package storage condition	Storage environment (temperature /humidity)
E	2 months	No storage	
F		3 weeks	
G		2 months	

[0074] The test results are given in Table 5 and Fig. 1. The reduction rate given in Table 5 is a value denoting the reduction rate of the M/T ratio for each condition, in a comparison with respect to the M/T ratio of condition A in which there is no filter storage or storage in a cigarette packaged form. Fig. 1 illustrates the reduction rate of the M/T ratio for each condition.

[Table 5]

	Item	C	B	C	D	E	F	G
Ref. ex. 1	Tar (mg/cigarette)	14.3	14.3	14.3	14.3	13.8	13.8	13.8
	Menthol (mg/cigarette)	2.60	2.20	1.92	1.94	1.94	1.86	1.78
	M/T ratio (-)	0.18	0.15	0.13	0.14	0.14	0.13	0.13
	Reduction rate (%)	0	17	28	22	22	28	28
Ref. ex. 2	Tar (mg/cigarette)	11.5	11.5	11.5	11.5	11.8	11.8	11.8
	Menthol (mg/cigarette)	2.52	2.12	1.84	1.63	1.80	1.71	1.60
	M/T ratio (-)	0.22	0.18	0.16	0.14	0.15	0.14	0.14
	Reduction rate (%)	0	16	27	35	30	34	38
Ref. ex. 3	Tar (mg/cigarette)	11.0	11.0	11.0	11.0	11.0	11.0	11.0
	Menthol (mg/cigarette)	2.73	2.51	2.17	1.95	2.07	1.96	1.70
	M/T ratio (-)	0.25	0.23	0.20	0.18	0.19	0.18	0.15
	Reduction rate (%)	0	8	21	29	24	28	38
Ref. ex. 4	Tar (mg/cigarette)	8.3	8.3	8.3	8.3	9.0	9.0	9.0
	Menthol (mg/cigarette)	2.40	2.02	1.65	1.54	1.76	1.60	1.50
	M/T ratio (-)	0.29	0.24	0.20	0.19	0.20	0.18	0.17
	Reduction rate (%)	0	16	31	35	32	39	42

[0075] As Table 5 and Fig. 1 reveal, results were obtained wherein the longer the storage period of the filter and the storage period of the cigarette in the packaged form, the smaller becomes the obtained value of menthol amount. A result was observed whereby the larger the draw resistance of the filter, the greater is the reduction rate of the M/T ratio. Reference examples 2 to 4 exhibit a greater reduction rate of the M/T ratio than that of Reference example 1, which satisfies the requirement of filter draw resistance of claim 1. It is deemed that this arises from fact that since the tow weight of a filter having low draw resistance is low, sorption of menthol in the filter can accordingly be reduced with respect to that in a filter having high draw resistance, and thus the release efficiency per unit menthol amount is higher.

[0076] The above results demonstrated that the amount of menthol in smoke can be readily maintained stably through the use of a filter having low draw resistance. This effect can be likewise achieved also in a case where the filter with low draw resistance is combined with a condition of high proportion of ventilation. A cigarette can be produced thus that affords a high amount of menthol in the smoke and in which menthol is readily maintained stably after storage.

<Reference examples 5 to 8>

[0077] With a view to verifying that the amount of menthol in the smoke is rendered more stable in a case where the menthol flavoring amount contained in one cigarette is 8 mg or greater, a test was carried out in which the filter draw

resistance was fixed and the menthol flavoring amount in the filter and the storage period of the filter were modified. Table 6 illustrates the menthol flavoring amount in the filter. As in Reference examples 1 to 4, the test was performed by modifying only the draw resistance of the filter, without providing ventilation holes in the filter portion, in order to eliminate the influence of other factors.

[Table 6]

	Filter airflow resistance (mmH_2O/27 mm)	Tow specifications (denier)	Tow weight (g/27 mm)	Filter flavoring amount (mg/27 mm)
Ref. ex. 5	80	2.8 Y 35000	0.140	1.8
Ref. ex. 6				4.2
Ref. ex. 7				8.7
Ref. ex. 8				13.3

[0078] The storage environment of the filter was set to a temperature of 22°C and humidity of 60%, as in Reference examples 1 to 4, and the test was carried out under a condition of storage period from an instance of no storage (notated as 0 W), through storage of 2 weeks (notated as 2 W), 5 weeks (notated as 5 W) and 2 months (notated as 2 M) at the longest. A comparison was performed with respect to a released proportion that denotes, in percentage, the proportion of released menthol, as the amount of menthol in smoke, from the menthol flavoring amount in the filter. The influence of filter storage alone was assessed by modifying only the storage period of the filter, without storage in the cigarette packaged form. A further reduction in the released proportion derived from further storage in the cigarette packaged form is to be expected on the basis of earlier Reference examples 1 to 4. In the present test, therefore, the shredded tobacco in the tobacco rod portion is not flavored with menthol, the latter being thus released from the filter portion alone. Except for the menthol flavoring amount in the shredded tobacco / filter, the ventilation ratio and the storage period of the filter, the test was carried in accordance with the same procedure as in Examples 1 and 2 and Comparative examples 1 and 2. The test results are given in Table 7 and Fig. 2.

[Table 7]

	Item	Time 0 W	Time 2 W	Time 5 W	Time 2 M
Ref. ex. 5	Tar (mg/cigarette)	12.0	11.9	11.9	11.6
	Menthol (mg/cigarette)	0.83	0.75	0.70	0.58
	Released proportion (%)	44	40	37	31
Ref. ex. 6	Tar (mg/cigarette)	12.6	12.0	11.8	11.8
	Menthol (mg/cigarette)	1.61	1.49	1.22	1.20
	Released proportion (%)	39	36	29	29
Ref. ex. 7	Tar (mg/cigarette)	13.7	13.0	12.9	12.7
	Menthol (mg/cigarette)	2.72	2.23	2.24	2.03
	Released proportion (%)	31	25	25	23
Ref. ex. 8	Tar (mg/cigarette)	14.1	13.4	13.7	13.5
	Menthol! (mg/cigarette)	3.24	3.22	3.41	2.98
	Released proportion (%)	24	24	26	22

[0079] As Table 7 and Fig. 2 reveal, the greater the menthol flavoring amount in the filter, the more stable becomes the Released proportion accompanying changes over time. It is found that resistance against change with time is greater in Reference examples 7 and 8 than that in Reference examples 5 and 6. That is because by increasing the amount of added menthol to be equal to or greater than the menthol amount that undergoes sorption in the tow it becomes possible

to reduce the influence exerted by sorption of menthol. It is deemed that this effect can be made yet more prominent when using a filter having yet lower draw resistance than that of Reference examples 5 to 8, since in that case it is possible to reduce the menthol amount itself through sorption in the tow. The above results demonstrated that the amount of menthol in the smoke is rendered stable in a case where the menthol flavoring amount contained in one cigarette is 8 mg or greater. A more preferable menthol flavoring amount in the filter is 10 mg or greater, and yet more preferably, 12 mg or greater, corresponding to the condition in Reference example 8.

<Example 3 and Comparative examples 3 and 4>

[0080] Examples 1 and 2 and Comparative examples 1 and 2 involve a comparative test with respect to a tar amount of 5 mg. In order to verify that the present technique is effective also when the target is a low tar amount of 1 mg, a test was conducted in the same way as in Examples 1 and 2 and Comparative examples 1 and 2, taking as a reference the test given in Table 8. Sensory evaluation was also conducted in the same way as above.

[Table 8]

	Target tar amount (mg/cigarette)	Filter airflow resistance (mmH_2O/27 mm)	Tow specifications (denier)	Tow weight (g/27 mm)	Ventilation proportion (%)	Filter flavoring amount (mg/27 mm)
Example 3	1	50	5.9Y35000	0.138	85	9.7
Comp. ex. 3		100	2.5Y35000	0.143	86	9.8
Comp. ex. 4		150	1.9Y44000	0.165	81	9.8

[0081] The test results are given in Table 9, which sets out the M/T ratio besides the amount of menthol and the tar amount in smoke.

[Table 9]

	Tar (mg/cigarette)	Menthol (mg/cigarette)	M/T ratio (-)	Sensory evaluation Significant difference (-)
Example 3	1.3	0.55	0.42	Yes
Comp. ex. 3	0.8	0.30	0.36	-
Comp. ex. 4	1.0	0.29	0.29	No

[0082] Table 9 revealed that Example 3 exhibited the highest menthol amount, and exhibited the highest result also in a comparison based on the M/T ratio. The evaluation of feeling of menthol by sensory evaluation yielded also a significantly higher menthol feel in Example 3. As in the evaluation of Examples 1 and 2 and Comparative examples 1 and 2 carried out above, it is found that a significant difference arises given the large difference in the values of menthol amount. This indicated that the present technique is effective also within ranges of very low tar amount.

Claims

1. A low tar menthol cigarette having a tobacco rod portion and a filter portion wrapped with tipping paper, the cigarette having a tar amount of 5 mg or less, wherein
the filter portion includes a single segment made up of cellulose acetate tow;
a draw resistance of the filter portion is 25 to 80 mmH_2O/27 mm and a ventilation ratio of air inflow through ventilation holes pierced in the tipping paper is 55% or higher; and menthol is added to the filter portion.

2. The low tar menthol cigarette according to claim 1,
wherein the menthol addition amount in the filter portion is 8 mg/cigarette or greater per low tar menthol cigarette.

3. The low tar menthol cigarette according to claim 1 or 2,

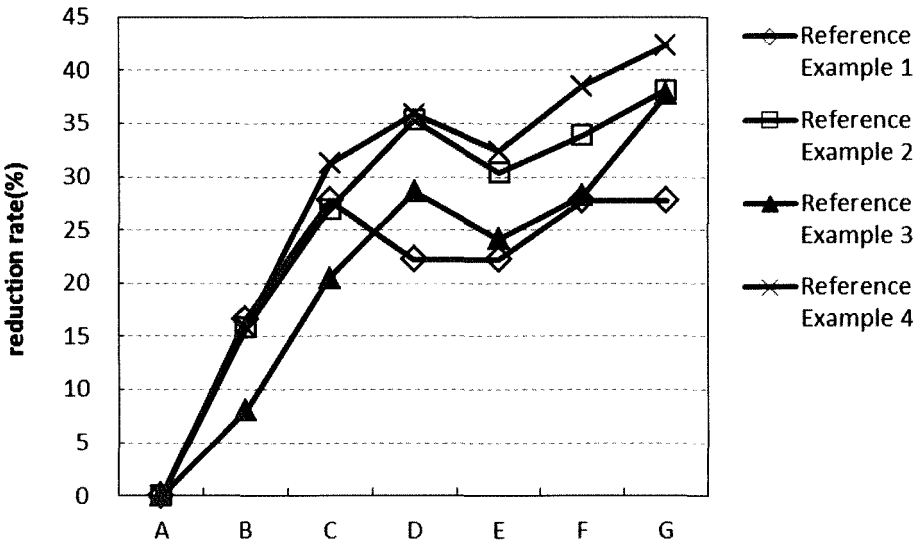
wherein the tobacco rod portion or filter portion has a restrictor element.

4. The low tar menthol cigarette according to claim 3,
wherein the restrictor element is a capsule or an orifice.

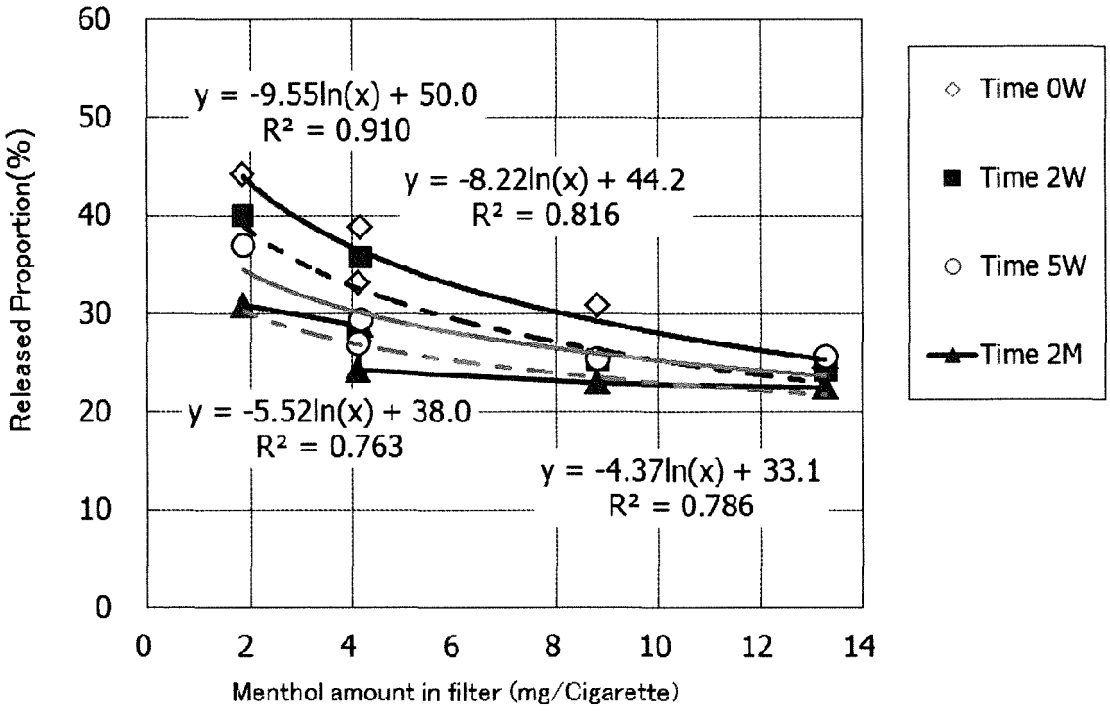
5. The low tar menthol cigarette according to any one of claims 1 to 4, wherein the draw resistance of the filter portion is 25 to 50 mmH_2O/27 mm and the ventilation ratio of air inflow is 70% or higher.

6. The low tar menthol cigarette of any one according to claims 1 to 5, wherein a circumference of the low tar menthol cigarette is 20.0 to 27.0 mm.

[Fig. 1]


45
40
35
30
25
20
15
10
5
0
reduction rate(%)
A
B
C
D
E
F
G
Reference Example 1
Reference Example 2
Reference Example 3
Reference Example 4

[Fig. 2]


60
50
40
30
20
10
0
Released Proportion(%)
y = -9.55ln(x) + 50.0
R² = 0.910
y = -8.22ln(x) + 44.2
R² = 0.816
y = -5.52ln(x) + 38.0
R² = 0.763
y = -4.37ln(x) + 33.1
R² = 0.786
0
2
4
6
8
10
12
14
Menthol amount in filter (mg/Cigarette)
Time 0W
Time 2W
Time 5W
Time 2M

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2015/059502

A. CLASSIFICATION OF SUBJECT MATTER
A24D3/04(2006.01)i, *A24D3/08*(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)
A24D3/04, A24D3/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2015
Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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A	JP 2010-528652 A (KT & G Corp.), 26 August 2010 (26.08.2010), paragraph [0055]	1-6
A	WO 2011/114946 A1 (Japan Tobacco Inc.), 22 September 2011 (22.09.2011), paragraph [0019]	1-6
A	JP 2000-93153 A (Mitsubishi Rayon Co., Ltd.), 04 April 2000 (04.04.2000), paragraph [0022]	1-6

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

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 June 2015 (22.06.15)	30 June 2015 (30.06.15)
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/JP2015/059502

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT
Information on patent family members

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PCT/JP2015/059502

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REFERENCES CITED IN THE DESCRIPTION

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