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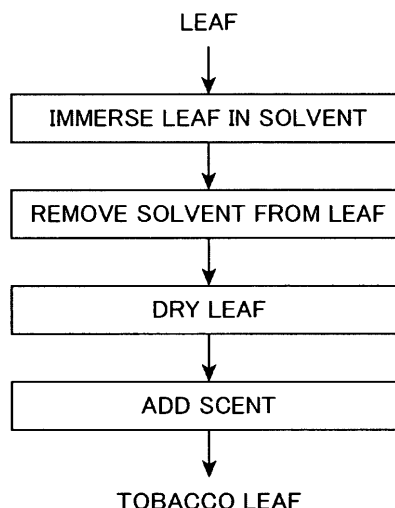
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(54) **METHOD FOR PRODUCTION OF TOBACCO LEAF**

(57) A present invention provides a method for reducing harmful substances and carcinogenic substances contained in a tobacco leaf. According to the present invention, the harmful substances and the carcinogenic substances are removed beforehand by washing a shredded leaf with a solvent, so that the tobacco leaf having a small amount of the harmful substances and the carcinogenic substances contained therein is pro-

duced. The cigarette produced by such a method of the present invention reduces an amount of the harmful substances and an amount of the carcinogenic substances contained in primary smoke and second-hand smoke in a case of the tobacco smoking, and reduces an amount of the harmful substances and an amount of the carcinogenic substances to be taken into a body compared with a cigarette produced in a conventional manner.

FIG. 1



Description**Technical Field**

5 [0001] The present invention relates to a method for producing a tobacco leaf having a small amount of harmful substances and carcinogenic substances contained in smoke generated from the tobacco leaf in a case of tobacco smoking.

Background Art

10 [0002] A tobacco product has been found throughout the world since introduction thereof in the Western in late fifteenth century. The tobacco product has continued to be favored as an article of taste although health problems caused by the tobacco product have been reported in the recent years. The tobacco product is generally produced by blending various species of aged tobacco leaves, shredding the blended leaves, and adding scent agents or moisture. Such shredded tobacco leaves are tasted in the form of a cigar rolled and wrapped therewith or are tasted using a pipe or a smoke tube, but are most commonly tasted in the form of a cigarette, in which the shredded tobacco leaves are rolled and wrapped with paper.

15 [0003] Such tobacco products, however, have been revealed that primary smoke thereof contains not only harmful substances such as carbon monoxide or hydrogen cyanide and nicotine or tar but also carcinogenic substances such as benzopyrene or nitrosamine. According to epidemiologic study, such harmful and carcinogenic substances are proven to cause a respiratory disease or a circulatory system disease and cancer. Moreover, the harmful and the carcinogenic substances are contained in second-hand smoke. Consequently, a person near a tobacco smoker can inhale the smoke exhaled from the tobacco smoker, causing health damages to the person near the tobacco smoker.

20 [0004] In attempting to solve such a problem, for example, a cigarette using a processed substance made of a palm shell is proposed (e.g., Patent Document 1). Such process substances of the palm shell are expected to generate activated carbon by carbonization thereof in a case of tobacco smoking, so that the activated carbon absorbs the harmful and the carcinogenic substances contained in the primary smoke, thereby reducing the risk of health damages of the smoker.

25 [0005] Patent Document 1: Japanese Patent Laid-Open Publication No. 2001-252063.

30 [0006] In addition to the Patent Document 1, a method for suppressing an intake of the harmful substances and the carcinogenic substances is proposed. However, such a method and the Patent Document 1 do not remove the harmful and the carcinogenic substances directly from the tobacco leaf. Consequently, the problem of the harmful and the carcinogenic substances generated in the smoke by smoking tobacco is not fundamentally solved.

Disclosure of the Invention

35 [0007] The present invention is proposed in consideration of the aforementioned conventional situations, and provides a method for reducing harmful substances and carcinogenic substances contained in a tobacco leaf.

40 [0008] According to the method for producing the tobacco leaf of the present invention, the leaf shredded is washed with a solvent.

[0009] According to the method for producing the tobacco leaf of the present invention, the shredded leaf is immersed in the solvent and washed, so that a large amount of the harmful substances and the carcinogenic substances is removed from the shredded leaf and is eluted with the solvent. That is, the tobacco leaf having a small amount of the harmful substances and the carcinogenic substances can be produced. A cigarette made of such a tobacco leaf reduces an amount of the harmful substances and the carcinogenic substances in the primary smoke and the second-hand smoke in a case of tobacco smoking, so that an amount of the harmful and the carcinogenic substances to be taken into a body is smaller than that of a cigarette produced in a conventional manner.

45 [0010] According to the tobacco leaf production method of the present invention, an ethanol solution can be used as a solvent. The harmful and the carcinogenic substances contained in the leaf can be fat-soluble and water-soluble. Usage of the ethanol solution can allow the harmful and the carcinogenic substances of the fat-soluble or the water-soluble to be reduced or removed and eluted with the ethanol solution.

50 [0011] According to the present invention, the harmful substances and the carcinogenic substances are reduced or removed beforehand by washing the shredded leaf with the solvent, so that the tobacco leaf having a small amount of the harmful and the carcinogenic substances is produced. The cigarette made of such a tobacco leaf reduces an amount of the harmful and the carcinogenic substances in the primary smoke in a case of tobacco smoking, so that an amount of the harmful and the carcinogenic substances to be taken into a body becomes smaller than that of a cigarette produced in a conventional manner.

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Brief Description of the Drawings

[0012]

FIG 1 is a flowchart illustrating an example method for producing a tobacco leaf according to the present invention, and FIG. 2 is another flowchart illustrating an example method for producing the tobacco leaf according to the present invention.

Best Mode for carrying out the Invention

[0013] Referring to FIG 1, an example procedure for producing the tobacco leaf according the present invention is illustrated. According to the present invention, a term of "leaf" or "leaves" represents a leaf or leaves of tobacco in a shredded state after application of drying and aging processes thereto, and a term of the "tobacco leaf" or "tobacco leaves" represents a leaf or leaves after application of each of the processes described later thereto. Generally, the tobacco leaf is wrapped with paper, thereby forming a cigarette. The present invention provides a method for producing the tobacco leaf having harmful substances and carcinogenic substances reduced or removed therefrom by washing the shredded leaf with the solvent and eluting the harmful and carcinogenic substances with the solvent.

[0014] The smoke generated in a case of tobacco smoking contains the harmful substances such as tar, nicotine, aldehyde, acetone, ammonia, hydrogen cyanide, carbon monoxide, carbon dioxide, nitrogen oxide, and phenol, and the carcinogenic substances such as benzopyrene, nitrosamine, quinoline, hydrazine, 2-naphthylamine, 4-aminobiphenyl, and ortho-toluidine. Most of the harmful substances and the carcinogenic substances are originally contained in the leaf.

[0015] According to the tobacco leaf production method of the present invention, the shredded leaf is immersed in the solvent, for example, in ethanol, and is washed with the solvent as illustrated in FIG. 1. Therefore, the harmful substances and the carcinogenic substances are reduced or removed from the shredded leaf. Herein, the solvent to be used has an affinity with the harmful substances and the carcinogenic substances contained in the leaf, and can be any solvent capable of extracting such substances. The solvent to be used is preferably a nontoxic solvent.

[0016] A density of the ethanol in which the tobacco leaf to be immersed can be changed as needed according to, for example, dryness or taste ingredient retention of the tobacco leaf to be produced, and is preferably greater than or equal to fifty (50) percent. Where the ethanol density is greater than or equal to fifty (50) percent, a great amount of the harmful substances and the carcinogenic substances can be removed from the leaf and eluted with the solvent. Moreover, natural flavor of the tobacco can be preserved, and the drying process to be performed later can be facilitated.

[0017] After the shredded leaf is immersed in the solvent for a prescribed time period, for example, forty (40) hours, the leaf is pulled out to remove the solvent adhered thereto. In a process of removing the solvent, a centrifugal filtration device can be used. Usage of the centrifugal filtration device can allow the solvent to be removed from the leaf quickly. The leaf is dried after removal of the solvent therefrom.

[0018] After the leaf is dried, a scent agent can be added to the leaf. In a case where the scent agent is added, the dried leaf is immersed for a prescribed time period in scent agent solution in which the scent agent or agents are eluted with the ethanol having the density of ninety (90) percent or greater, thereby adding the scent agents to the leaf. Since the harmful and the carcinogenic substances are washed with the solvent and are reduced or removed from the leaf, the scent agent to be added can emphasize the scent thereof. Herein, the moisture may be added and adjusted.

[0019] The tobacco leaf of the present invention is produced as described above. In the course of the tobacco leaf production, the leaf is washed with the solvent, so that the harmful substances and the carcinogenic substances are reduced or removed from the leaf. Accordingly, an amount of the harmful substances and the carcinogenic substances contained in the tobacco leaf to be produced is reduced. Therefore, the cigarette made of the tobacco leaf produced by the present invention has a smaller amount of the harmful substances and the carcinogenic substances contained in the smoke generated by the tobacco smoking compared with a cigarette produced in a conventional manner, thereby reducing an intake amount of such harmful and carcinogenic substances by a tobacco smoker and a person near the tobacco smoker. Moreover, combination use of a charcoal filter capable of absorbing the smoke with the tobacco leaf produced by the present invention allows the intake amount of the harmful substances and the carcinogenic substances by the tobacco smoker to be further reduced.

[0020] Such a reduction in the intake amount of the harmful substances and the carcinogenic substances is expected to reduce an incidence rate of cancer including a respiratory system. Moreover, in a case where the tobacco smoker smokes the cigarette produced by the present invention, discomfort caused by the tar in a mouth or a nose thereof is eased; natural flavor of the tobacco is tasted compared with smoking of the conventional cigarette; and recovery from nicotine addiction is expected.

[0021] According to the tobacco leaf production method of the present invention, the shredded leaf can be washed with water before being washed with the solvent as illustrated in FIG. 2. The shredded leaf can be immersed for a prescribed time period in the water having relatively little amount of impurities. Therefore, the water-soluble harmful

substances and the water-soluble carcinogenic substances contained in the leaf can be eluted with the water and reduced or removed from the leaf.

[0022] After the leaf is immersed in the water for the prescribed time period, the leaf is pulled out to remove the water adhered thereto. In a process of removing the water (also referred to as a dewatering process), the centrifugal filtration device can be used. Usage of the centrifugal filtration device can allow the water to be removed from the leaf quickly. After removable of the water, the leaf is immersed in and washed with the solvent. The shredded leaf is washed with the water before being washed with the solvent, so that the harmful substances and the carcinogenic substances are further removed from the leaf.

Examples

[0023] Examples of the present invention are described below. However, the present invention is not limited thereto.

[0024] In a first example, a cigarette produced by a tobacco leaf washed with the ethanol solution having an ethanol density of 90 percent is provided. Herein, the production of the cigarette of the first example is described as follows. A leaf having a weight of 50.1 grams taken out from a cigarette called "Mild Seven (trademark) Extra Lights" commercially available in the market was immersed in 500 milliliters of 90 percent ethanol solution at room temperature for two days. The ethanol was separated from the leaf using the centrifugal filtration device (available from Kokusan Co. Ltd., Japan). Subsequently, the leaf was left at room temperature for at least three days and was dried. After the leaf was dried, a weight of the tobacco leaf became 38.3 grams (approximately 76 percent). The dried tobacco leaf was rolled using a hand-roll device such that each cigarette had the leaf of 0.55 grams, and a filter having little absorbability was applied to the rolled tobacco leaf, thereby providing the cigarette of the first example.

[0025] In a second example, a cigarette produced by a tobacco leaf washed with 99.5 percent ethanol solution is provided. Herein, the production of the cigarette of the second example is described as follows. The leaf substantially similar to the first example was used, and the 99.5 percent ethanol solution was used instead of the 90 percent ethanol solution. The tobacco leaf was produced by a method substantially similar to the first example, and a filter having little absorbability was applied to the rolled tobacco leaf, thereby providing the cigarette of the second example.

[0026] In a third example, a cigarette produced by a tobacco leaf washed with 50 percent ethanol solution is provided. Herein, the production of the cigarette of the third example is described as follows. The leaf substantially similar to the first example was used, and the 50 percent ethanol solution was used instead of the 90 percent ethanol solution. After washing and drying processes, the moisture of the leaf was adjusted such that a weight of the leaf became equal to that of the leaf prior to the washing process, and a charcoal filter having absorbability was applied, thereby providing the cigarette of the third example.

[0027] In a fourth example, a cigarette produced by a tobacco leaf washed with 90 percent ethanol solution is provided. Herein, production of the cigarette of the fourth example is described as follows. The tobacco leaf was produced as similar to the first example, and a charcoal filter having absorbability was applied, thereby providing the cigarette of the fourth example.

[0028] In a fifth example, a cigarette produced by a tobacco leaf washed with 50 percent ethanol solution is provided. Herein, production of the cigarette of the fifth example is described as follows. A leaf was taken out from a cigarette called "Mild Seven (trademark) One" commercially available in the market, and the tobacco leaf was produced by the method substantially similar to the third example. A charcoal filter having absorbability is applied to the rolled tobacco leaf, thereby providing the cigarette of the fifth example.

[0029] In a comparative example, a non-washed cigarette is provided. Herein, the production of the non-washed cigarette is described as follows. A leaf was taken out from a cigarette called "Mild Seven (trademark) Extra Lights" commercially available in the market for comparison with the above examples. The leaf was rolled using the hand-roll device such that each cigarette had the leaf of 0.6 grams, and a charcoal filter having absorbability was applied to the rolled tobacco leaf, thereby providing the cigarette of the comparative example.

[0030] A description is now given of a method for measuring a weight of each of the nicotine, tar, N-nitrosodimethylamine, and benzo(a) pyrene contained in the smoke of the cigarettes of the first, second and third examples.

[0031] A glass fiber filter (ADVANTEV, GB-100R, 47mm) was attached to a metal folder. Herein, a weight of the glass fiber filter was measured beforehand. The smoke generated from a prescribed number of the cigarettes was absorbed to and collected on the glass fiber filter. After collection of the smoke, the weight of the glass fiber filter was measured, and a weight difference between before and after collection of the smoke was determined to be a weight of all particle substances. The substances on the glass fiber filter were ultrasonically extracted using dichloromethane (available from Kanto Chemical Co. Inc., Japan), and extraction liquid was concentrated to a total of 10 milliliters.

[0032] For the nicotine measurement, two cigarettes were smoked, and the extraction liquid having the absorbed and collected particles was used. In the extraction liquid having a volume of 0.1 milliliter, 50 nanograms of biphenyl d₁₀ (available from Kanto Chemical Co. Inc., Japan for environmental analyses) serving as an internal standard substance was added to make a sample solution for the nicotine density measurement. A gas chromatograph mass spectrometer

(Trace 2000 Ultra available from Thermo Electron Co. Ltd., Japan) was used to measure the weight of the nicotine per cigarette for the nicotine density measurement.

[0033] For the tar amount, the weight of nicotine was subtracted from the weight of all particle substances attached to the glass fiber filter, thereby calculating the tar amount per cigarette.

[0034] For the N-nitrosodimethylamine measurement, ten cigarettes were smoked, and the extraction liquid having the absorbed and collected particles was used. In the extraction liquid having a volume of 0.1 milliliter, 50 nanograms of naphthalene d₈ (available from Kanto Chemical Co. Inc., Japan for environmental analyses) serving as the internal standard substance was added to make a sample solution for the N-nitrosodimethylamine density measurement. The gas chromatograph mass spectrometer (Trace 2000 Ultra available from Thermo Electron Co. Ltd., Japan) was used to measure the weight of the N-nitrosodimethylamine per cigarette for the N-nitrosodimethylamine density measurement.

[0035] For the benzo(a) pyrene measurement, ten cigarettes were smoked, and the extraction liquid having the absorbed and collected particles was used. After 50 nanograms of the benzo(a) pyrene-d₁₂ (available from Cambridge Isotope Laboratories, Inc., USA) serving as the internal standard substance was added to the extraction liquid having a volume of 5 milliliters, the liquid was concentrated and eluted with hexane. The hexane solution was applied to silica gel column. After being washed with 15 milliliters of the hexane, the silica gel column was eluted with 100 milliliters of 5 percent acetone-hexane solution. The elution solution was concentrated to make a test solution for the benzo (a) pyrene measurement. The gas chromatograph mass spectrometer (Trace 2000 Ultra available from Thermo Electron Co. Ltd., Japan) was used to measure the weight of the benzo (a) pyrene per cigarette for the benzo (a) pyrene density measurement.

[0036] The cigarettes of the first, second, and comparative example were measured regarding the nicotine, tar, N-nitrosodimethylamine, and benzo (a) pyrene contained therein while the cigarette of the third example was measured regarding the N-nitrosodimethylamine contained therein. A result of such measurements is shown in TABLE 1.

[0037]

[0037] TABLE 1

	EXAMPLE 1	EXAMPLE 2	EXAMPLE 3	COMPARATIVE EXAMPLE
NICOTINE [mg/cigarette]	0.27	0.33		0.91 ^{*1}
TAR [mg/cigarette]	15	17		21 ^{*1}
N-NITROSODIMETHYLAMINE [ng/cigarette]	13	9.0	N.D. ^{*1}	5.2 ^{*1}
BENZO (a) PYRENE [ng/cigarette]	16	17		22 ^{*1}

*1 : CHARCOAL FILTER USED

N.D. : DETECTION LIMIT OR BELOW

[0038] As shown in TABLE 1, the cigarettes of the first and second examples reduced the amount of the nicotine by 64 to 70 percent, the amount of the tar by 19 to 28 percent, and the amount of the benzo pyrene by 22 to 27 percent compared with the cigarette of the comparative example. Each of the cigarettes of the first and second examples contained the N-nitrosodimethylamine, the amount of which was larger than that of the N-nitrosodimethylamine contained in the comparative example. Such a large amount of the N-nitrosodimethylamine contained in each of the first and second examples may be caused by not using the charcoal filter. The cigarette using the charcoal filter of the third example contained the N-nitrosodimethylamine having an amount smaller than or equal to 3.0 nanograms, that is, the amount of the N-nitrosodimethylamine is smaller than or equal to a detection limit.

[0039] A description is now given of a measurement result of the tar amounts and the nicotine amounts contained in the primary smoke and the second-hand smoke of the cigarette of the fourth example.

[0040] The smoke generated from the cigarette of the forth example was divided into the second-hand smoke rising from a lit portion of the cigarette and the primary smoke being inhaled through the charcoal filter. Each of the second-hand smoke and the primary smoke was collected by a vacuum trap having methanol as trap liquid. The amounts of the nicotine and the tar contained in the collected primary smoke and the second-hand smoke were measured by a gas chromatography-mass spectrometry (GC-MS). Similarly, the primary and second-hand smoke of the comparative ex-

ample cigarette was measured for comparison. A result of the measurements is shown in TABLE 2.

[0041] The nicotine amount was calculated by adjusting 10 mg/L of the nicotine solution and determining a peak area ratio provided by GC-MS using the adjusted nicotine solution as reference standard. The tar amount was calculated by adjusting 50 mg/L of the tar solution with coal tar (a reagent grade) and determining a peak area ratio provided by GC-MC using the adjusted tar solution as reference standard. A result of the measurements is stated in TABLE 2.

[0042]

TABLE 2

		EXAMPLE 4	COMPARATIVE EXAMPLE
NICOTINE [mg/cigarette]	PRIMARY SMOKE	0.05* ¹	0.16* ¹
	SECOND-HAND SMOKE	0.37* ¹	1.44* ¹
TAR [mg/cigarette]	PRIMARY SMOKE	0.14* ¹	0.23* ¹
	SECOND-HAND SMOKE	0.90* ¹	1.03* ¹
*1: CHARCOAL FILTER USED			

[0043] As shown in TABLE 2, the cigarette of the fourth example reduced the nicotine amount by 69 percent and the tar amount by 39 percent in the primary smoke. Moreover, the cigarette of the fourth example reduced the nicotine amount and the tar amount by 74 percent and 13 percent, respectively, in the second-hand smoke.

[0044] A description is given of a measurement result of the nicotine amounts contained in the primary smoke and the second-hand smoke of the cigarette of the fifth example.

[0045] The smoke of two cigarettes each having the tobacco leaf of 0.6 grams was divided into the second-hand smoke rising from the lit portion and the primary smoke being inhaled through the charcoal filter. Each of the second-hand and primary smoke was collected by a vacuum trap having methanol as trap liquid. The amounts of the nicotine contained in the collected primary smoke and the second-hand smoke were measured by the gas chromatography-mass spectrometry (GC-MS). Similarly, the primary and second-hand smoke of the two comparative example cigarettes was measured for comparison. A result of the measurements is shown in TABLE 3.

[0046]

TABLE 3

		EXAMPLE 5	COMPARATIVE EXAMPLE
NICOTINE [mg/2 cigarettes]	PRIMARY SMOKE	0.22* ¹	0.15* ¹
	SECOND-HAND SMOKE	0.35* ¹	3.9* ¹
*1 : CHARCOAL FILTER USED			

[0047] As shown in TABLE 3, the cigarette of the fifth example reduced the nicotine amount in the second-hand smoke by approximately 10 percent compared with the comparative example. The nicotine amount in the primary smoke of the cigarette of the fifth example, however, was larger than that in the primary smoke of the comparative example. Since a weight of the leaf of the fifth example was reduced by approximately 60 percent by washing the leaf with the ethanol solution (the washing process), the tobacco leaf equivalent to 1 gram prior to the washing process was substantially used, causing an increase in the nicotine amount. Since the nicotine amount in the primary smoke is adjustable by a filter, the cigarette of the fifth example can improve the nicotine amount in the primary smoke in a case where the charcoal filter to be used for the fifth example is substantially the same as the charcoal filter used for the comparative example.

[0048] According to the results above, usage of the solvent is proven to allow the harmful substances and the carcinogenic substances contained in the leaf to be reduced and the harmful substances and the carcinogenic substances contained in the smoke of the cigarette produced by rolling the tobacco leaf to be reduced.

Claims

1. A method for producing a tobacco leaf comprising a step of washing a shredded leaf with a solvent.
2. The method for producing the tobacco leaf according to claim 1, wherein the solvent is an ethanol solvent.

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3. The method for producing the tobacco leaf according to claim 1, wherein the solvent is an ethanol solvent having a density of greater than or equal to 50 percent.
- 5 4. The method for producing the tobacco leaf according to claim 1, wherein the shredded tobacco leaf is washed with water before being washed with the solvent.
5. The method for producing the tobacco leaf according to claim 1, wherein scent is added to the leaf washed with the solvent.

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FIG. 1

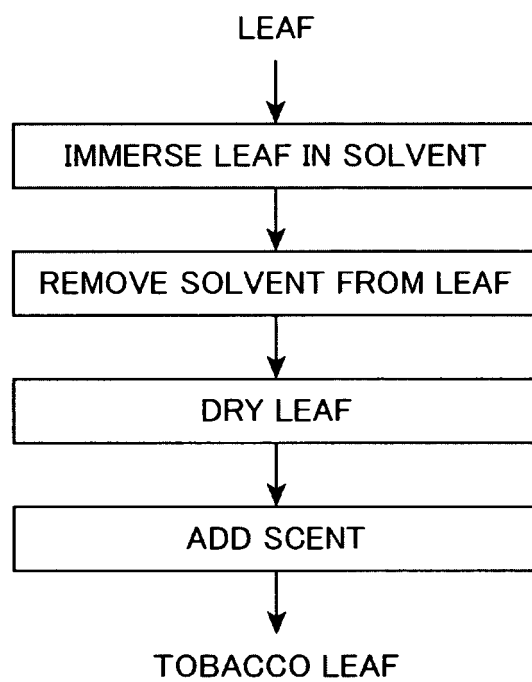
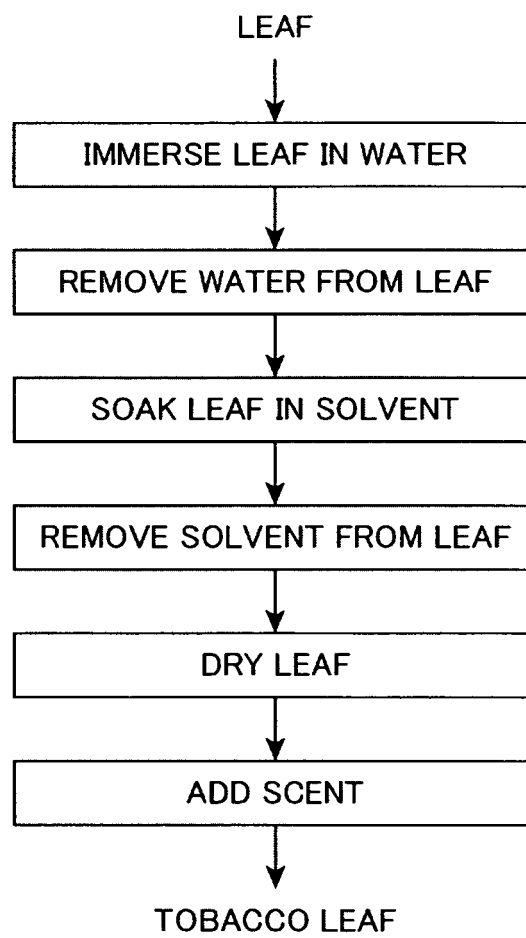


FIG. 2



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2007/071957

A. CLASSIFICATION OF SUBJECT MATTER

A24B15/24 (2006.01) i, A24B15/28 (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)

A24B15/24, A24B15/28

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	1996-2008
Kokai Jitsuyo Shinan Koho	1971-2008	Toroku Jitsuyo Shinan Koho	1994-2008

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

WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 52-1098 A (AMF, Inc.), 06 January, 1977 (06.01.77), Full text & US 4200113 A & GB 1532083 A & DE 2613569 A & FR 2314677 A & CH 603082 A & NL 7604516 A & SE 7604231 A & CA 1015629 A & ZA 7601553 A	1-5
X	JP 46-8440 B1 (Nippon Senbai Kosha), 03 March, 1971 (03.03.71), Full text; all drawings (Family: none)	1-5

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

* Special categories of cited documents:

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Date of the actual completion of the international search
05 February, 2008 (05.02.08)Date of mailing of the international search report
12 February, 2008 (12.02.08)Name and mailing address of the ISA/
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2007/071957

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	JP 2006-180715 A (Japan Tobacco Inc.), 13 July, 2006 (13.07.06), Full text; all drawings (Family: none)	1, 2 3-5
Y	JP 1-235571 A (R.J. Reynolds Tobacco Co.), 20 September, 1989 (20.09.89), Full text; all drawings & US 5005593 A & EP 326370 A2 & NO 890333 A & AU 2755288 A & PT 89543 A & FI 890339 A & BR 8900198 A & CN 1034479 A & DK 11989 A	1-5
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REFERENCES CITED IN THE DESCRIPTION

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