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# (54) FRAGMENT OF FRAGRANCE-CONTAINING SHEET FOR SMOKING GOODS

(57) A cut piece of a flavor-containing sheet comprising a non-volatile matrix and a flavor dispersed in the non-volatile matrix, characterized in that the cut piece has a hexahedral shape; a ratio of an area of cutting planes to a volume is 3.0 or less; a ratio of a length of a long side to that of a short side is 10 or less; and the length of the long side is less than a diameter of a cigarette rod to be produced.

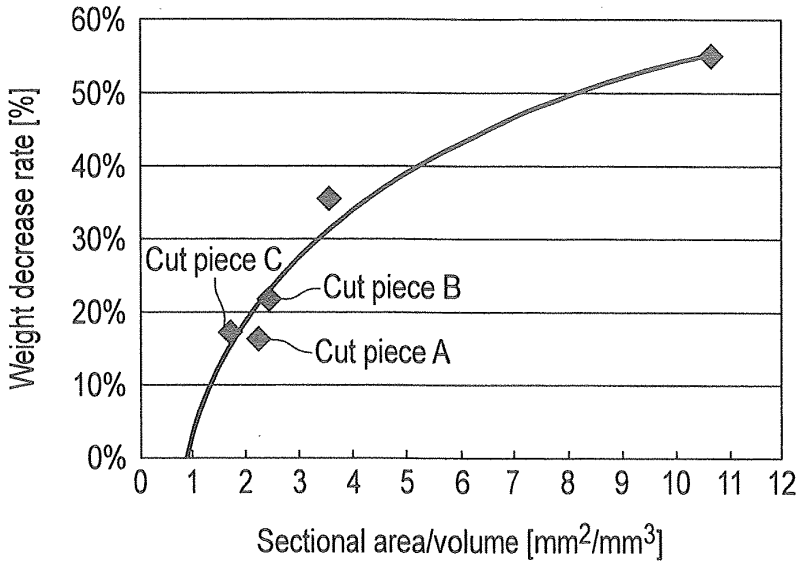


FIG. 1

EP 2 832 243 A1

## Description

### Technical Field

**[0001]** The present invention relates to a cut piece of a flavor-containing sheet for a smoking article.

### Background Art

**[0002]** A flavor-containing sheet in which a volatile flavor such as menthol is dispersed in a non-volatile matrix such as a polysaccharide, a polyol or an ether polymer is known (for example, Patent Documents 1 and 2). In the flavor-containing sheet, the volatile flavor is dispersed in the matrix in the state of droplet-shaped particles of tens of micrometers, which suppresses the volatilization of the flavor. When the flavor-containing sheet is used, the flavor-containing sheet is cut, and the obtained cut pieces are mixed with cut tobacco. The obtained mixture is wrapped to form a cigarette rod, and the smoking taste of the flavor is added to the smoking taste of the cut tobacco during smoking.

### Prior Art Documents

#### Patent Documents

**[0003]**

Patent Document 1: International Publication No. WO2009-021018
Patent Document 2: International Publication No. WO2009-142159

### Summary of Invention

**[0004]** According to the present invention, there is provided a cut piece of a flavor-containing sheet comprising a non-volatile matrix and a flavor dispersed in the non-volatile matrix, characterized in that the cut piece has a hexahedral shape; a ratio of an area of cutting planes to a volume is 3.0 or less; a ratio of a length of a long side to that of a short side is 10 or less; and the length of the long side is less than a diameter of a cigarette rod to be produced.

**[0005]** The cut piece of the flavor-containing sheet of the present invention maintains a sufficient flavor content. Further, the cut piece suppresses the volatilization of the flavor during storage, and has a shape which is not easily crushed by a mechanical external force.

### Brief Description of Drawings

**[0006]**

FIG. 1 shows the relationship between a weight decrease rate of a flavor and a sectional area/volume ratio of a cut piece of a flavor-containing sheet.
FIG. 2 shows particle sizes before and after forced crush of the cut pieces of the flavor-containing sheet.
FIG. 3 shows particle sizes before and after forced crush of the cut pieces of the flavor-containing sheet.
FIG. 4 shows particle sizes before and after forced crush of the cut pieces of the flavor-containing sheet.

### Description of Embodiments

**[0007]** Hereinafter, embodiments of the present invention will be described in detail.

**[0008]** A cut piece of a flavor-containing sheet of the present invention is cut out from the flavor-containing sheet. In the flavor-containing sheet, a flavor such as menthol is dispersed in a non-volatile matrix such as a polysaccharide. The flavor-containing sheet is described in, for example, International Publication No. WO2009-142159. In particular, in the flavor-containing sheet, a flavor is dispersed in a matrix of a polysaccharide gel. Examples of the polysaccharide include a single component of carrageenan, agar, gellan gum, tamarind gum, psyllium seed gum or konjak glucomannan; or a combination of two or more polysaccharides selected from the group consisting of carrageenan, locust bean gum, guar gum, agar, xanthan gum, gellan gum, tamarind gum, tara gum, konjak glucomannan, starch, cassia gum and psyllium seed gum. Since the above-mentioned polysaccharide can form a gel by cooling, it is not necessary to add a gelling agent such as a metal chloride to the polysaccharide. Examples of the flavor include lipophilic flavors such as 1-menthol or mint oil. The flavor-containing sheet can be obtained by mixing a polysaccharide with water, heating the mixture to prepare an aqueous solution of the polysaccharide, adding a flavor and preferably an emulsifier to the aqueous solution,

stirring the solution to emulsify the flavor, casting the obtained emulsion on a substrate, and drying the emulsion by heat. Lecithin, a sugar ester or the like can be used as the emulsifier. The drying by heat can be performed at a temperature of 70°C to 200°C. In the flavor-containing sheet thus obtained, the flavor is dispersed in the form of particles in the non-volatile matrix. The flavor-containing sheet can contain 18% by weight or more of the flavor, and preferably 60% by weight or more. Usually, the flavor-containing sheet contains 65% by weight or less of the flavor.

**[0009]** A cut piece is cut out from the flavor-containing sheet. The shape of the cut piece is a hexahedron, preferably a rectangular prism, for example, a regular quadrangular prism, and more preferably a cube.

**[0010]** Herein, in regard to the shape of the cut piece, a short side is defined as x; a long side is defined as y; and a thickness is defined as t. In the present invention, the short side and the long side are defined as the short side and long side of a square formed by projecting the hexahedron in the thickness direction.

**[0011]** In this case, a ratio r of the long side/short side, an area A of cutting planes, a volume V of the cut piece, a ratio $\alpha$ of the area of the cutting planes/volume are represented by the following formulae. The area A of the cutting planes means the total area of the four cutting planes of the cut piece which are obtained by cutting the flavor-containing sheet in the longitudinal and latitudinal directions along the thickness direction.

**[0012]** Ratio r of long side/short side

$$r = y/x \text{ (in the case of } y \geq x) \quad \ldots (1)$$

**[0013]** Area A of cutting planes

$$A = 2xt + 2yt \quad \ldots (2)$$

**[0014]** Volume V of cut piece

$$V = xyt \quad \ldots (3)$$

**[0015]** Ratio $\alpha$ of area of cutting planes/volume

$$\alpha = (2xt + 2yt)/xyt$$
$$= 2(x + y)/xy \quad \ldots (4)$$

**[0016]** The fact that the ratio $\alpha$ of the area of the cutting planes/volume is set to a certain value or less is represented by the following formulae.

$$\alpha \geq 2(x + y)/xy \quad \ldots (4')$$

$$\alpha \geq 2/x + 2/y \quad \ldots (4'')$$

**[0017]** When the formula (1) is substituted for the formula (4") to obtain the relationship among y, $\alpha$, and r, the following formula is obtained.

$$r \leq (\alpha y - 2)/2 \quad \ldots (5)$$

**[0018]** In the present invention, the ratio of the area of the cutting planes to the volume of the cut piece is 3.0 or less; the ratio of the length of the long side to that of the short side is 10 or less; and the length of the long side is less than the diameter of a cigarette rod to be produced. More preferably, in the cut piece having a hexahedron shape, the ratio of the area of the cutting planes to the volume of the cut piece is 2.0 or less; the ratio of the length of the long side to that of the short side is 5 or less; and the length of the long side is 1/2 or less of the diameter of the cigarette rod to be produced. Usually, when the shape of the cut piece is a quadrangular prism, the short side is 1.0 mm to 2.0 mm.

**[0019]** The cut piece of the flavor-containing sheet obtained as described above is mixed with cut tobacco. The obtained mixture is wrapped by a cigarette paper to prepare a cigarette rod. Usually, the diameter of the cigarette rod is 3 mm to 10 mm.

Examples

**[0020]** Hereinafter, the present invention will be described with reference to some Examples. However, the present invention is not limited to these Examples.

Example 1

**[0021]** 3680 parts by weight of polysaccharides (gellan gum and tamarind gum) in total were added to 80000 parts by weight of water, and sufficiently stirred at 80°C to dissolve the polysaccharides in water. 18400 parts by weight of a flavor (1-menthol) and an emulsifier aqueous solution containing 74 parts by weight of an emulsifier (lecithin) in 1398 parts by weight of water were added to the polysaccharide aqueous solution. The obtained mixture was sufficiently emulsified by means of a homogenizer. The emulsified slurry was cast into a sheet form on a substrate, and dried at 70°C. The thickness of the dried flavor-containing sheet was 0.1 mm. The flavor-containing sheet was cut to a size of 1 mm × 10 mm to prepare cut pieces. 3% by weight of the cut pieces were mixed with cut tobacco. The mixture is wrapped by a cigarette paper to prepare a cigarette rod (Example 1).

**[0022]** On the other hand, 1-menthol was dissolved in a solvent, and the obtained solution was sprayed onto the cut tobacco. After the cut tobacco was dried, the cut tobacco was wrapped by a cigarette paper in the same manner as in the above method to prepare a cigarette rod (Comparative Example 1).

**[0023]** After the cigarette rod obtained above was stored in a thermostat under an atmosphere of 50°C during a predetermined period, a flavor residual ratio (a charge amount was defined as 100%) was measured in the following manner. The results are shown in the following Table 1.

<Measurement of Flavor Residual Ratio>

Measurement of Menthol Content of Menthol-Containing Sheet

**[0024]** The menthol content of the menthol-containing sheet was measured by GC-FID as follows.

**[0025]** First, 0.1 g of the cut tobacco with which the menthol-containing sheet was mixed was weighed. 10 mL of methanol (a new reagent of special grade or higher grade was dispensed without exposing it to the air to eliminate the influence of the water absorption in the air) was added to the cut tobacco in a 50 mL closed container (screw pipe), followed by shaking (200 rpm) for 40 minutes. The obtained mixture was left overnight, shaken (200 rpm) for 40 minutes again, and allowed to stand. The supernatant was used as a measurement solution (by 10-fold diluting it with methanol for GC measurement).

**[0026]** The measurement solution was analyzed by the following GC-FID and quantified according to a calibration curve method.

GC-FID; 6890N gas chromatograph, manufactured by Agilent Technologies, Inc.
Column; DB-WAX, 30 m × 530 μm × 1 μm

Constant pressure mode, 5.5 psi (velocity; 50 cm/sec)

Injection; 1.0 μL
Inlet; Spritless mode 250°C, 5.5 psi
Oven; 80°C → (10°C/minute) → 170°C (hold 6.0 minutes) [maximum 220°C]
Detector; FID detector, 250°C ($H_2$; 40 mL/minute, air; 450 mL/minute)
Signal rate; 20 Hz

[Table 1]

Table 1: Flavor residual ratio

| Cigarette rod | Flavor residual ratio | | | | |
|---|---|---|---|---|---|
| | 2 days after storage | 6 days after storage | 30 days after storage | 55 days after storage | 90 days after storage |
| Comparative example 1 | 65 weight % | 36 weight % | 4 weight % | 3 weight % | 2 weight % |
| Example 1 | 59 weight % | 61 weight % | 43 weight % | 44 weight % | 40 weight % |

**[0027]** As apparent from Table 1, the cut pieces of the flavor-containing sheet had a flavor residual ratio far higher than that of the case where the flavor was directly added to the cut tobacco.

Example 2

**[0028]** 5200 parts by weight of polysaccharides (gellan gum and tamarind gum) were added to 70000 parts by weight of water, and sufficiently stirred at 80°C to dissolve the polysaccharides in water. 13000 parts by weight of 1-menthol as a flavor, 455 parts by weight of a colorant (caramel color and cocoa powder), and an emulsifier aqueous solution containing 105 parts by weight of an emulsifier (lecithin) in 1995 parts by weight of water were added to the polysaccharide aqueous solution. The obtained mixture was sufficiently emulsified by means of a homogenizer. The emulsified slurry was cast into a sheet form on a substrate, and dried at 70°C. The thickness of the dried flavor-containing sheet was 0.1 mm.

**[0029]** The flavor-containing sheet was cut into quadrangular prism shapes having various sizes to prepare cut pieces. The sizes of the cut pieces prepared were as follows.

Cut piece A, short side: 1 mm, long side: 10 mm, long side/short side ratio: 10
Cut piece B, short side: 1 mm, long side: 5 mm, long side/short side ratio: 5
Cut piece C, short side: 2 mm, long side: 3 mm, long side/short side ratio: 1.5

**[0030]** Each cut piece was left in a thermostat at a temperature of 50°C for 1 hour in order to accelerate the volatilization of the flavor, and the weight decrease rate of the flavor was measured. The relationship between the weight decrease rate and the sectional area/volume ratio of the cut piece is shown in FIG. 1. As apparent from the results shown in FIG. 1, in order to suppress the volatilization of the flavor, the sectional area per volume of the cut piece should be decreased. If the weight decrease rate of the flavor is 30% or less under the acceleration condition, a concentration of the flavor contained in a cigarette rod is regarded as such a level that the incidence of the problem of the appearance of the cigarette (incidence of a stain on a cigarette paper) is decreased. Therefore, in consideration of application of the cut piece to tobacco, the sectional area/volume of the cut piece is 3 or less; and desirably the sectional area/volume of the cut piece is 2 or less, wherein the weight decrease rate of the flavor is 20% or less.

**[0031]** The average particle size of the cut pieces A, B and C was measured, wherein the weight decrease rate was 30% or less. After that, each of the cut pieces A, B, and C was put into a small mill (trade name: Labo Millser Plus). After the cut piece was subjected to a milling treatment for 5 seconds, the average particle size was measured. Further, the milled sample was put into a cylindrical container having an inner diameter of 60 mm. A load of 3.0 kg was applied from above, and balkiness at that time (after crush) (i.e., a compression volume per 1 gram of the cut piece in the case where the load was applied) was measured. Average particle size distributions are shown in FIGS. 2 to 4. FIG. 2 shows the result of the cut piece A; FIG. 3 shows the result of the cut piece B; and FIG. 4 shows the result of the cut piece C. In FIGS. 2 to 4, line 'a' represents a particle size before crush, and line 'b' represents a particle size after crush. The average particle size of the cut pieces A to C before and after crush and the bulkiness are shown in Table 2.

[Table 2]

Table 2

| Cut piece | Average particle size | | | Bulkiness (cc/g) |
|---|---|---|---|---|
| | Before crush | After crush | Change of particle size (Difference between particle sizes before and after crush) | |
| A | 1.872 mm | 1.064 mm | 0.808 mm | 2.83 |

(continued)

| Cut piece | Average particle size | | | Bulkiness (cc/g) |
|---|---|---|---|---|
| | Before crush | After crush | Change of particle size (Difference between particle sizes before and after crush) | |
| B | 1.538 mm | 0.860 mm | 0.678 mm | 2.59 |
| C | 1.766 mm | 1.325 mm | 0.441 mm | 2.22 |

**[0032]** The results shown in FIGS. 2 to 4 and Table 2 confirmed that the more the ratio of the long side/short side of the cut piece approached 1, the less the cut piece was influenced by crush. Therefore, in order to suppress/control the volatilization of the flavor from the cut piece, the shape of the cut piece is determined by first specifying the sectional area of cutting planes based on the sectional area/volume ratio, and thereafter decreasing the long side/short side ratio, thereby suppressing the occurrence of the crush section. Furthermore, when a cigarette is produced by an existing cigarette making machine, the cut tobacco with which the cut pieces of the flavor-containing sheet are blended is adsorption-conveyed by an adsorption band of the cigarette making machine. Even when the cut piece is adsorbed at a right angle to a conveying direction, it is preferable that the cut piece can pass without being bent in the subsequent step. Therefore, in consideration of the case where the cut piece is disposed in the central part of the tobacco rod, the size of the long side of the cutting plane of the cut piece is desirably less than the diameter of the cigarette rod in order to prevent the crush of the cut piece in making the cigarette.

**[0033]** Actually, the cut piece A or the cut piece C was mixed in an amount of 5% with the cut tobacco, and the obtained mixture was wrapped to prepare a cigarette rod having a circumference length of 25.2 mm. The cigarette rod was cut open, and all the cut pieces were collected. However, very few cut pieces were crushed into small pieces.

## Claims

1. A cut piece of a flavor-containing sheet comprising a non-volatile matrix and a flavor dispersed in the non-volatile matrix, **characterized in that** the cut piece has a hexahedral shape; a ratio of an area of cutting planes to a volume is 3.0 or less; a ratio of a length of a long side to that of a short side is 10 or less; and the length of the long side is less than a diameter of a cigarette rod to be produced.

2. The cut piece of the flavor-containing sheet according to claim 1, **characterized in that** the ratio of the area of the cutting planes to the volume is 2.0 or less; the ratio of the length of the long side to that of the short side is 5 or less; and the length of the long side is 1/2 or less of the diameter of the cigarette rod to be produced.
The cut piece of a flavor-containing sheet, **characterized in that**
when, in regard to a shape of the cut piece, the short side is defined as x, the long side is defined as y, a thickness is defined as t, a ratio of the long side/short side is defined as r, the area of the cutting planes is defined as A, the volume of the cut piece is defined as V, and a ratio of the area of the cutting planes/volume is $\alpha$, the following formulae hold:

$$r = y/x \text{ (in the case of } y \geq x) \quad \ldots (1),$$

$$A = 2xt + 2yt \quad \ldots (2),$$

$$V = xyt \quad \ldots (3),$$

and

$$\alpha = 2(x + y)/xy \quad \ldots (4);$$

and
the cut piece has y, $\alpha$, and r which satisfy the following formula:

$$r \leq (\alpha y - 2)/2 \quad \ldots \quad (5).$$

3. The cut piece of the flavor-containing sheet according to claim 1, **characterized in that** the cut piece has a quadrangular prism shape.

4. The cut piece of the flavor-containing sheet according to claim 1, **characterized in that** the non-volatile matrix comprises a polysaccharide.

5. The cut piece of the flavor-containing sheet according to claim 1, **characterized in that** the flavor comprises 1-menthol.

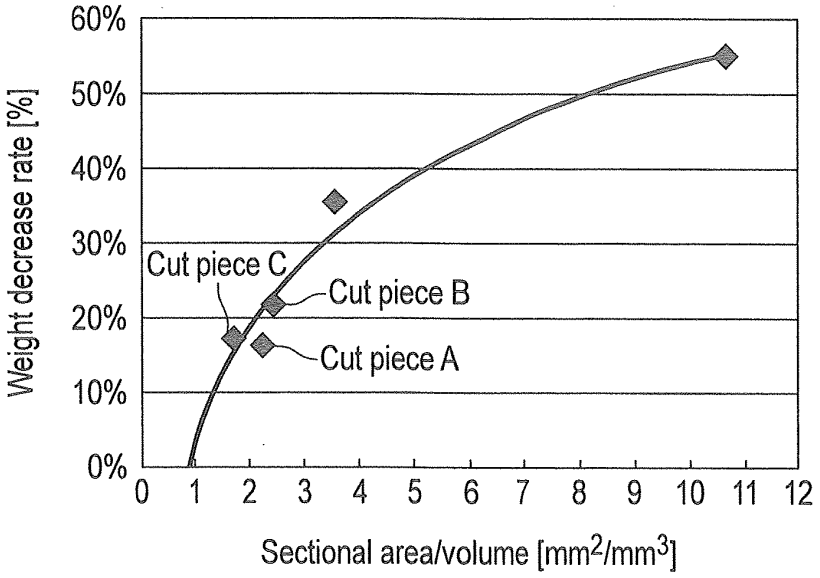
60%
50%
40%
30%
20%
10%
0%
Weight decrease rate [%]
Cut piece C
Cut piece B
Cut piece A
0 1 2 3 4 5 6 7 8 9 10 11 12
Sectional area/volume [mm2/mm3]

FIG. 1

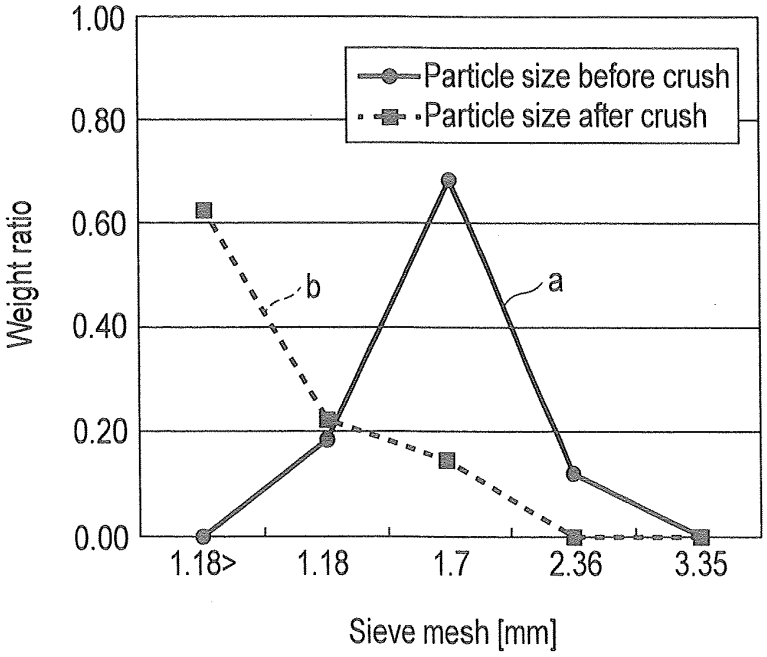
1.00
0.80
0.60
0.40
0.20
0.00
Weight ratio
Particle size before crush
Particle size after crush
a
b
1.18>
1.18
1.7
2.36
3.35
Sieve mesh [mm]

FIG. 2

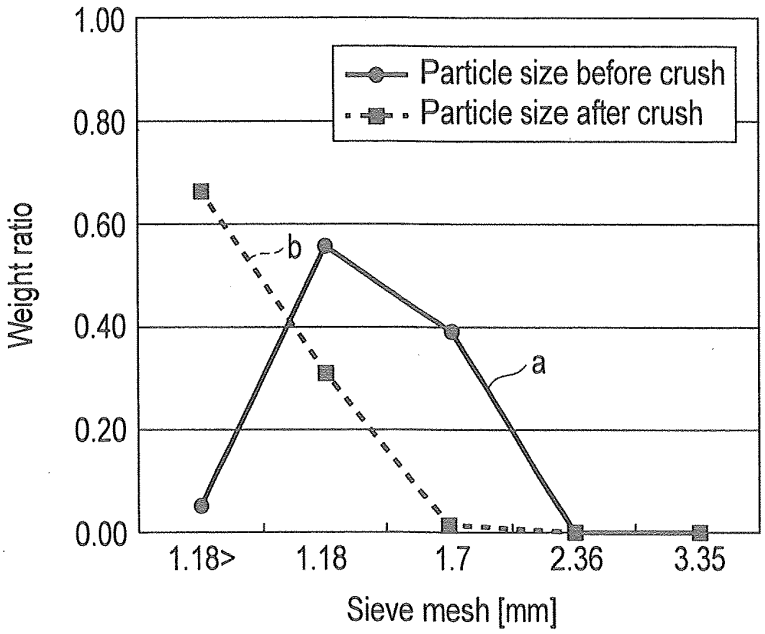
1.00
0.80
0.60
0.40
0.20
0.00
Weight ratio
Particle size before crush
Particle size after crush
b
a
1.18>
1.18
1.7
2.36
3.35
Sieve mesh [mm]

FIG. 3

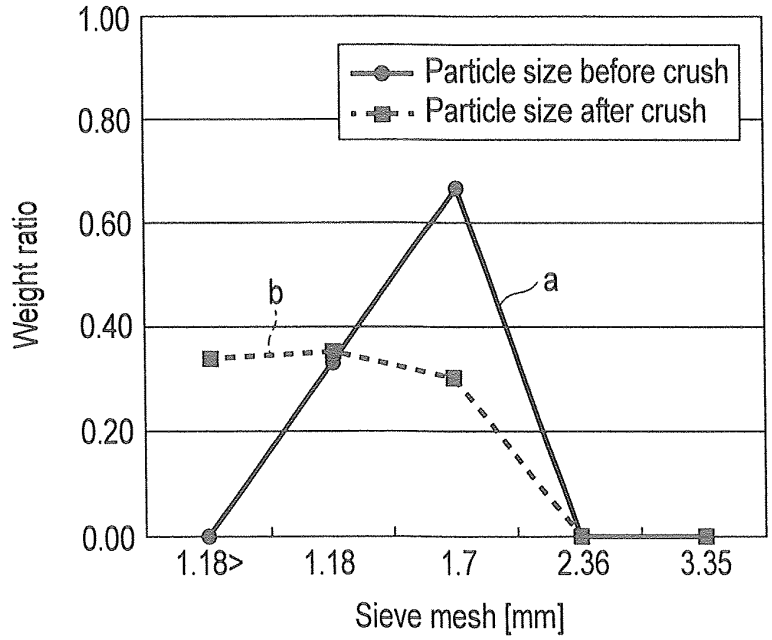
1.00
0.80
0.60
0.40
0.20
0.00
Weight ratio
Particle size before crush
Particle size after crush
b
a
1.18>
1.18
1.7
2.36
3.35
Sieve mesh [mm]

FIG. 4

**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/JP2013/059104

A. CLASSIFICATION OF SUBJECT MATTER
*A24B3/12*(2006.01)i, *A24B15/32*(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)
A24B3/12, A24B15/32

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 | 1996-2013 |
| Kokai Jitsuyo Shinan Koho | 1971-2013 | Toroku Jitsuyo Shinan Koho | 1994-2013 |

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | WO 2009/021018 A1 (LORILLARD LICENSING CO., L.L.C.), 12 February 2009 (12.02.2009), paragraphs [0014], [0041], [0088] & US 2009/0038629 A1 | 1-5 |
| Y | CD-ROM of the specification and drawings annexed to the request of Japanese Utility Model Application No. 12355/1993(Laid-open No. 64646/1994) (Kabushiki Kaisha New Moment), 13 September 1994 (13.09.1994), paragraph [0018] (Family: none) | 1-5 |

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

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 24 May, 2013 (24.05.13) | 04 June, 2013 (04.06.13) |
| Name and mailing address of the ISA/ Japanese Patent Office | Authorized officer |
| Facsimile No. | Telephone No. |

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**INTERNATIONAL SEARCH REPORT**

International application No.
PCT/JP2013/059104

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| Y | WO 2009/142159 A1 (Japan Tobacco Inc.), 26 November 2009 (26.11.2009), paragraphs [0022] to [0023] & US 2011/0061667 A1 & EP 2279677 A1 & CA 2724820 A1 & CN 102036575 A & KR 10-2010-0132057 A & TW 201016148 A & RU 2010151986 A | 4,5 |

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## REFERENCES CITED IN THE DESCRIPTION

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### Patent documents cited in the description


- WO 2009021018 A **[0003]**
- WO 2009142159 A **[0003] [0008]**