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(54)

METHOD FOR MOLDING COMBUSTIBLE HEAT SOURCE FOR SMOKING ARTICLE,
COMBUSTIBLE HEAT SOURCE MANUFACTURED THEREBY, AND SMOKING ARTICLE
COMPRISING SAME

- (57) The present disclosure relates to a method of molding a combustible heat source and provides a method of molding a combustible heat source, the method including: step S1 of preparing a combustible heat source composition including a carbon powder, an organic binder, and an ignition accelerator; step S2 of treating glycerin or propylene glycol on the combustible heat source composition; and step S3 of compressing and molding the composition after the treatment, in which the compressing in step S3 is performed at a strength of 0.5 to 10 MPa.

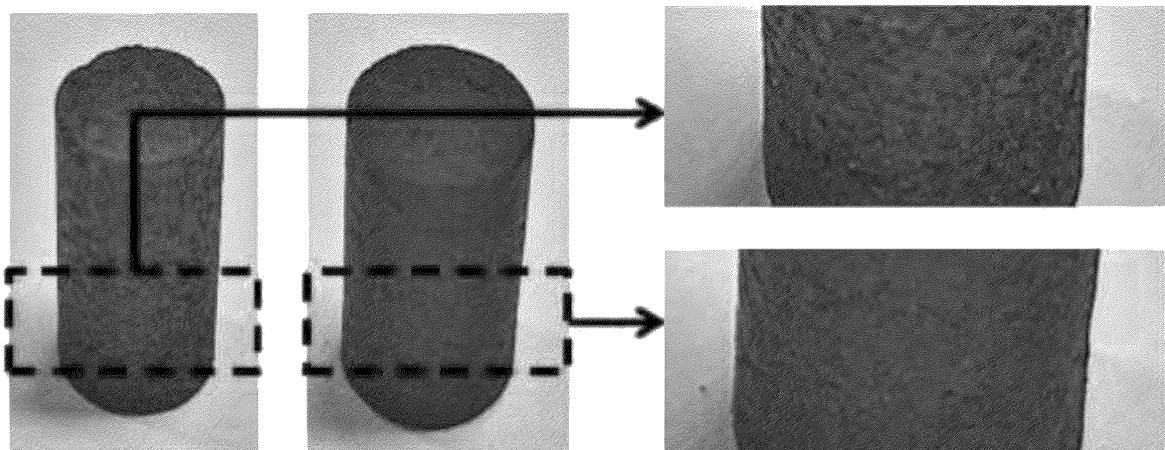


FIG. 2

Description

Technical Field

5 [0001] The present disclosure relates to a method of molding a combustible heat source for a smoking article, a combustible heat source manufactured by the method, and a smoking article including the same.

Background Art

10 [0002] A number of smoking articles which are heated rather than combusted have recently been proposed. Unlike conventional smoking articles, these non-combustion type smoking articles are used by sucking an aerosol generated by heating a smoking article medium without burning the smoking article medium. As one of these types of heating-type smoking articles, there is a smoking article product to which a carbon heat source is applied.

15 [0003] A smoking article to which the carbon heat source is applied generates an aerosol by heat transfer from the carbon heat source to a smoking article medium located downstream of the carbon heat source.

[0004] The smoking article product, to which the carbon heat source is applied, is used for smoking similarly to a traditional smoking article, unlike general heating-type electronic smoking articles using a dedicated device, so that consumers' smoking convenience and satisfaction may be expected to be improved.

20 Prior Art Document

Patent Document

25 [0005] (Patent Document 1) Korean Laid-open Patent Publication No. 2020-0030364

Disclosure of the Invention

Technical Goals

30 [0006] An object of the present disclosure is to provide a method of molding a combustible heat source having excellent combustion persistency, the combustible heat source, and a smoking article including the heat source.

Technical Solutions

35 [0007] The present disclosure provides a method of molding a combustible heat source, the method including:

step S 1 of preparing a combustible heat source composition including a carbon powder, an organic binder, and an ignition accelerator;

step S2 of treating glycerin or propylene glycol on the combustible heat source composition; and

40 step S3 of compressing and molding the composition after the treatment,

in which step S3 is performed at a pressure of P_O , and

the P_O is 1.5 to 2 times greater than a compression strength P_W in a case where moisture is treated.

45 [0008] In an implementation example of the present disclosure, the heat source may have a diameter of 7 to 8 millimeters (mm) and a length of 10 to 12 nanometers (nm).

[0009] In another implementation example of the present disclosure, the compression strength P_O in step S3 may be 0.5 to 10 megapascals (MPa).

[0010] In still another implementation example of the present disclosure, the P_O may be 1.5 to 3.0 MPa.

[0011] In still another implementation example of the present disclosure, the P_W may be 0.5 to 1.5 MPa.

50 [0012] In still another implementation example of the present disclosure, the oil may be treated in an amount of 0.8 to 2 parts by weight with respect to 100 parts by weight of a solid content of the combustible heat source composition.

[0013] In still another implementation example of the present disclosure, the heat source may be ignited within 30 seconds, and combustion may continue for 140 seconds or longer.

[0014] In addition, the present disclosure provides a combustible heat source molded by the method described above.

55 [0015] Furthermore, the present disclosure provides a smoking article including the combustible heat source described above.

Effects

[0016] Since a conventional combustible heat source was manufactured by a compression molding method, it had a limitation in that an excessive increase of an internal density of a combustible body affects combustion persistency. Accordingly, the present disclosure provides an optimal molding method of performing compression molding in a mixed form in which oil/moisture is applied, and the heat source molded by the method of the present disclosure has excellent roughness of a surface and thus has excellent combustion persistency, compared to the conventional heat source.

Brief Description of Drawings

[0017]

FIG. 1 is a view showing external appearances of a combustible heat source according to a moisture content of the present disclosure.

FIG. 2 is a view showing results of confirming that a surface is improved by adjusting a pressure of the present disclosure.

Best Mode for Carrying Out the Invention

[0018] Demand for heating-type electronic smoking articles is increasing. Most heating-type electronic smoking articles have a device in the structure of "device + dedicated stick". As a new type of smoking article, a product having a smoking form similar to those of general smoking articles is being developed by applying a carbon-based heat source to the tip of the smoking article. Accordingly, the present disclosure has attempted to develop a combustible heat source that may have a smoking form (ignition, smoking start point) similar to those of the general smoking articles.

[0019] Existing combustible heat sources are mainly manufactured by compression molding. The combustible heat source may be manufactured using only powder by a powder molding metallurgy method, but an internal density of a combustion body may be excessively increase, which may affect combustion persistency, and therefore, it is desirable to perform compression molding in a mixed form in which oil/moisture is applied. Accordingly, the present disclosure proposes a method of molding a combustible heat source according to oil/moisture and a mixing pressure.

[0020] The present disclosure provides a method of molding a combustible heat source, the method including:

step S1 of preparing a combustible heat source composition including a carbon powder, an organic binder, and an ignition accelerator;

step S2 of treating glycerin or propylene glycol on the combustible heat source composition; and

step S3 of compressing and molding the composition after the treatment,

in which step S3 is performed at a pressure of P_O , and

a compression strength P_O is 1.5 to 2 times greater than a compression strength P_W in a case where moisture is treated.

[0021] In addition, the present disclosure may provide a combustible heat source molded by the method described above, and a smoking article including the heat source.

[0022] Hereinafter, the present disclosure will be described in more detail.

[0023] Step S1 of the present disclosure is a step of preparing a combustible heat source composition. The combustible heat source composition may include a carbon powder, an organic binder, and an ignition accelerator. In addition, the heat source composition may further include moisture (water). As the heat source composition includes the moisture, it may function as a binder at the time of compression. The water may be included in an amount of 1% to 1.2% with respect to a solid content.

[0024] Step S2 of the present disclosure is a step of treating glycerin or propylene glycol as oil, in order to optimize an internal density of the combustible heat source. Desirably, propylene glycol having more excellent combustion persistency may be used. The oil may increase ignitability at the time of heating so that the combustion may be performed smoothly.

[0025] Step S3 of the present disclosure is a step of compressing the composition and finally molding it in the form of a heat source.

[0026] In the present disclosure, it was confirmed that, when oil is treated, a surface roughness of the heat source is greatly improved when a stronger pressing pressure is applied, compared to when the moisture is treated.

[0027] Accordingly, in step S2, a compression strength is defined as P_O , and a compression strength when moisture is treated is defined as P_W . That is, P_O , which is a compression strength in step S3 of the present disclosure, may have a value 1.5 to 2 times greater than P_W , which is the compression strength when moisture is treated. For example, if a

pressure when moisture is treated is 1.2 megapascals (MPa), a pressure when oil is treated may be 2.0 MPa.

[0028] In another implementation example of the present disclosure, the P_o may be 0.5 to 10 MPa, and P_w may be 0.5 to 1.5 MPa. Desirably, in order to manufacture a heat source having a diameter of 7 to 8 millimeters (mm) and a length of 10 to 12 nanometers (nm), P_o may be 1.5 to 3.0 MPa.

[0029] The heat source may be ignited within 30 seconds, and the combustion may continue for 140 seconds or longer. In the present disclosure, the size of the heat source may include a diameter of 7 to 8 mm and a length of 10 to 12 nm, and the present disclosure proposes a desirable method of molding a heat source having the diameter and length described above. A heat source having a size within the above range has a size suitable for use as a smoking article applied with a combustible heat source.

[0030] In still another implementation example of the present disclosure, the oil may be treated in an amount of 0.8 to 2 parts by weight with respect to 100 parts by weight of a solid content of the combustible heat source composition. More desirably, when the oil is treated in an amount of 1 to 1.5 parts by weight, excellent surface roughness and moldability are obtained.

[0031] Therefore, the present disclosure may provide a combustible heat source manufactured by the method described above.

[0032] The combustible heat source to be used in a smoking article according to the present disclosure may have a carbon content of at least about 50%. For example, in the smoking article according to the present disclosure, the combustible heat source may include a combustible carbon-based heat source of at least about 60 dry weight%, at least about 70 dry weight%, or at least about 80 dry weight% of the combustible heat source.

[0033] In an embodiment of the present disclosure, at least one binder may be combined with the heat source. Desirably, the at least one binder is an organic binder. Well-known suitable organic binders include, but are not limited to, gums (e.g., guar gum), modified cellulose and cellulose derivatives (e.g., methyl cellulose, carboxymethyl cellulose, hydroxypropyl cellulose, and hydroxypropyl methylcellulose) flour, starch, sugar, vegetable oil, and a combination thereof.

[0034] Additionally, the combustible heat source to be used in the smoking article according to the present disclosure may include at least one additive, in order to improve properties of the combustible heat source. Suitable additives include additives that promote consolidation of the combustible heat source (e.g., sintering aids), additives that promote the ignition of the combustible heat source (e.g., oxidizing agents, such as perchlorate, chlorate, nitrate, peroxide, permanganate, zirconium, and a combination thereof), additives that promote the combustion of the combustible heat source (e.g., potassium and potassium salts, such as potassium citrate), and additives that promote the decomposition of one or more gases manufactured by the combustion of the combustible heat source (e.g., catalysts such as, CuO , Fe_2O_3 , and Al_2O_3), but are not limited thereto.

[0035] In addition, the combustible heat source may further include an ignition aid. As used herein, the term "ignition aid" is used to indicate a substance that releases one or both energy or oxygen during the ignition of the combustible heat source, a speed of release of one or both energy and oxygen by the substance is not limited by ambient oxygen diffusion. That is, the speed of release of one or both energy and oxygen by the substance during the ignition of the combustible heat source is substantially independent of a speed at which ambient oxygen may reach the substance. As used herein, the term "ignition aid" is also used to indicate an elemental metal that releases energy during the ignition of the combustible heat source, and a temperature of the ignition of the elemental metal is lower than about 500°C and a temperature of the combustion of the elemental metal is at least about 5 kJ/g. The ignition aid may be an alkali metal salt (an alkali metal citrate salt, alkali metal acetate salt, alkali metal succinate salt, etc.), an alkali metal halide salt (an alkali metal chloride salt, etc.), an alkali metal carbonate salt, or an alkali metal phosphate salt of carboxylic acids, which are believed to modify carbon combustion.

[0036] Examples of suitable oxidizing agents include, but are not limited to, nitrate such as, for example, potassium nitrate, calcium nitrate, strontium nitrate, sodium nitrate, barium nitrate, lithium nitrate, aluminum nitrate, and iron nitrate; nitrite; other organic and inorganic nitro compounds; chlorate such as, for example, sodium chlorate and potassium chlorate; perchlorate such as, for example, sodium perchlorate; chlorite; bromate such as, for example, sodium bromate and potassium bromate; perbromate; bromite; borate such as, for example, sodium borate and potassium borate; ferrate such as, for example, barium ferrate; ferrite; manganate such as, for example, potassium manganate; permanganate such as, for example, potassium permanganate; organic peroxide such as, for example, benzoyl peroxide and acetone peroxide; inorganic peroxide such as, for example, hydrogen peroxide, strontium peroxide, magnesium peroxide, calcium peroxide, barium peroxide, zinc peroxide, and lithium peroxide; superoxide such as, for example, potassium superoxide and sodium superoxide; iodate; periodate; iodite; sulfate; sulfite; other sulfoxides; phosphate; phosphinate; phosphite; and phosphonate.

[0037] While advantageously improving the ignition and combustion performance of the combustible heat source, undesirable decomposition and reaction products may be generated when the smoking article is used by including ignition and combustion additives. For example, the decomposition of nitrate included in the combustible heat source to aid the ignition allows a nitrogen oxide to be formed. As the combustible heat source is included in the smoking article according to the present disclosure, advantageously, during the use thereof, the decomposition and reaction products

are substantially prevented or suppressed from entering into air sucked through the smoking article according to the present disclosure.

[0038] A combustible carbonaceous heat sources to be used in the smoking article according to the present disclosure may be manufactured as described in the prior art well-known to those skilled in the art.

[0039] The combustible carbonaceous heat source to be used in the smoking article according to the present disclosure may be formed by desirably mixing at least one carbon-containing material with at least one binder and other additives, if included, and pre-forming this mixture into a desired shape. The mixture of the at least one carbon-containing material, the at least one binder, and the optional other additives may be pre-formed into a desired shape using any suitable known ceramic forming methods, such as, for example, slip casting, extrusion molding, injection molding, or mold compression. In a certain desirable implementation example, the mixture is pre-formed into a desired shape by pressurization, extrusion, or a combination thereof.

[0040] Desirably, the mixture of the at least one carbon-containing material, the at least one binder, and the other additives may be pre-formed into an elongate rod. However, it is understood that the mixture of the at least one carbon-containing material, the at least one binder, and the other additives may be pre-formed into other desired shapes.

[0041] In an embodiment of the present disclosure, the combustible heat source may desirably have a porosity between about 20% and about 80%, and more desirably between about 20% and 60%. More desirably, the combustible heat source may have a porosity between about 50% and about 70%, when the porosity is measured, for example, by mercury porosimetry or helium pycnometry. The required porosity may be easily achieved while the method of manufacturing the heat source is performed using the conventional methods and technologies.

[0042] Advantageously, the combustible heat source to be used in the smoking article according to the present disclosure has an apparent density between about 0.6 g/cm³ and about 1 g/cm³.

[0043] The combustible heat source has a mass desirably between about 300 mg and about 500 mg and more desirably between about 400 mg and about 450 mg.

[0044] The combustible heat source has a length desirably between about 7 mm and about 17 mm, more desirably between about 7 mm and about 15 mm, and most desirably between about 7 mm and about 13 mm.

[0045] The combustible heat source has a diameter desirably between about 5 mm and about 9 mm and more desirably between about 7 mm and about 8 mm.

[0046] The combustible heat source desirably has a substantially uniform diameter. However, the combustible heat source may alternatively be tapered so that the diameter of a rear portion of the combustible heat source is greater than the diameter of a front portion thereof. In such implementation examples, the rear portion of the combustible heat source has a transverse cross-sectional area of at least about 60% of a transverse cross-sectional area of the smoking article.

[0047] It is particularly desirable that the combustible heat source is substantially cylindrical. The combustible heat source may be, for example, a circular cross-sectional cylindrical or tapered cylindrical form or a substantially elliptical cross-sectional cylindrical or tapered cylindrical form.

[0048] Accordingly, the combustible heat source may be used in the smoking article applied with the combustible heat source.

[0049] The "smoking article" may refer to any product that may be smoked or any product that may provide a smoking experience, regardless of whether the product is based on tobacco, tobacco derivatives, expanded tobacco, reconstituted tobacco, or tobacco substitutes. For example, the smoking article may refer to an article that may be smoked to generate an aerosol, such as a cigarette, a cigar, a cigarillo, and the like.

[0050] The smoking article may include a combustible heat source composed of the composition, a medium portion, a thermally conductive wrapper, cigarette paper, a cooling portion, a filter portion, etc., and the combustible heat source; the medium portion; the cooling portion; and the filter portion may be aligned in order based on the longitudinal direction, but the order can be freely changed except for the case where the combustible heat source is located upstream. In addition to this, additional configurations may be further included or one or more of the above-described configurations may be omitted. The smoking article may have a diameter of, for example, 4 mm to 10 mm, and a circumference of 14 mm to 29 mm. In addition, the smoking article may have a length of 45 mm to 100 mm.

[0051] The medium portion may include, for example, at least one of cut tobacco, cut reconstituted tobacco leaves, smoking article leaves, expanded smoking article, and nicotine extract. The medium portion may contain a nicotine component. In addition to the medium portion, an aerosol generating material may be further contained. The aerosol generating material may include polyhydric alcohols, esters of polyhydric alcohols such as glycerol mono-, di- or triacetate, and aliphatic esters of mono-, di- or esters of polycarboxylic acids such as dimethyl dodecanedioate and dimethyl tetradecanedioate. More specifically, the aerosol generating material may include, for example, at least one of glycerin, propylene glycol, ethylene glycol, dipropylene glycol, diethylene glycol, triethylene glycol, tetraethylene glycol, and oleyl alcohol. For example, the medium portion may include cut reconstituted tobacco leaves immersed in glycerin. However, this is an example and the present disclosure is not necessarily limited to above description.

[0052] The medium portion may have a length between about 5 mm and about 20 mm, and more desirably between about 8 mm and about 12 mm. The medium portion is surrounded by paper or other wrapper and may be in the form of

a plug or portion containing a material capable of releasing volatile compounds in response to heating. As described above, when the medium portion is in the form of a plug or portion, the entire plug or portion including any wrapper is considered to be the medium portion.

[0053] The cooling portion may contain a cooling material. The cooling portion includes a tubular hollow body with an open end, and may cool airflow passing through the heat source and the medium portion. The cooling portion may be made of a polymer material or a biodegradable polymer material and may have a cooling function. For example, the cooling portion may be paper, cardboard, plastic, and may be, for example, cellulose acetate, ceramic, and a combination thereof. Additionally, the cooling portion may include a corrugated sheet of material selected from the group consisting of metal foil, polymeric material, and substantially non-porous paper or cardboard. In certain implementation examples, an aerosol cooling element may also include a corrugated sheet of material selected from the group consisting of polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), polyethylene terephthalate (PET), polylactic acid (PLA), cellulose acetate (CA), and aluminum foil. The cooling portion may have a length between about 5 mm and about 30 mm, more desirably between about 8 mm and about 25 mm, but the length may be freely adjusted in consideration of the temperature of heat generated from a heatable heat source.

[0054] The filter portion contains a filter material, and the shape of the filter portion is not limited. For example, the filter portion may be a cylinder-type rod or a tube-type rod including a hollow therein. Alternatively, the filter portion may be a recess-type rod. If the filter portion is composed of a plurality of segments, at least one of the plurality of segments may be manufactured in a different shape. For example, the filter portion may include a filter tow in a fibrous form, a filamentous form, or both. The fibrous form and the filamentous form may each include at least one of a polymer, paper, cellulose acetate, activated carbon, and carbon, but is not limited thereto. The filter portion, for example, may have a length of 5 to 20 mm.

[0055] In addition to this, the filter portion may further include a tipping paper in contact with the mouth, which surrounds the filter material. The tipping paper may have one or more perforations formed therein.

[0056] The filter portion may be manufactured to generate flavor. In an example, a flavoring liquid may be sprayed onto the filter material or separate fibers coated with the flavoring liquid may be inserted into the filter portion.

[0057] The cooling portion and the filter portion may contain an aerosol modifier. For example, one or more of the cooling portion, filter portion, and tipping paper of the smoking article according to the present disclosure may contain one or more aerosol modifiers. Suitable aerosol modifiers may not be limited thereto, but may include a flavoring agent and a chemesthetic agent. The flavoring agent is used to describe any substance that, when used, imparts taste, aroma, or both thereof to aerosols generated by a tobacco material and an aerosol generating material of the smoking article.

[0058] In addition, the cigarette paper is composed of cellulose fibers obtained from wood, flax, or other materials, and may be wrapped around a medium portion, wrapped around the entire smoking article including the medium portion, or wrapped around a portion except for the filter portion. A base paper of the cigarette paper may have a thickness of about 30 μm to about 100 μm , and the base paper may have a basis weight of about 15 g/m² to about 80 g/m².

[0059] The smoking article according to the present disclosure may also include downstream one or more aerosol modifiers that are both a flavoring agent and a chemesthetic agent. For example, one or more of the cooling portion and filter portion of the smoking article according to the present disclosure may contain menthol or another flavoring agent that provides a cooling object sensory effect.

[0060] In addition, the smoking article including the combustible heat source may include a thermally conductive wrapper surrounding the combustible heat source and the medium portion. The thermally conductive wrapper may be completely wrapped around the heat source and the medium portion, partially wrapped around a portion of the heat source and a portion of the medium portion, or entirely wrapped around a portion of the heat source and the medium portion. The thermally conductive wrapper transfers heat generated from a combustible heat source to the tobacco material. The wrapper may be a metal foil wrapper such as an aluminum foil wrapper, a steel wrapper, an iron foil wrapper, and a copper foil wrapper; and a metal alloy foil wrapper, and the material thereof is not limited to the above materials, as long as it is a material capable of efficiently transferring heat.

[0061] A metal barrier may be formed between the heatable heat source and the medium portion. Here, the metal barrier may prevent direct contact of a combustible heat source portion with the medium portion, and may prevent some out of components generated in the combustible heat source portion from moving to the medium portion.

[0062] A thickness of the barrier may be appropriately adjusted to obtain good smoking performance. In a specific implementation example, the barrier may have a thickness between about 10 microns and about 500 microns. The barrier may include one or more metallic materials that are substantially thermally stable and non-combustible at the temperatures obtained by the combustible heat source upon ignition and combustion. Suitable materials are known in the art and are not limited thereto, but they include aluminum, copper, stainless steel, and combinations thereof.

[0063] Hereinafter, embodiments will be described in detail with reference to the accompanying drawings. However, various alterations and modifications may be made to the embodiments. Here, the embodiments are not construed as limited to the disclosure. The embodiments should be understood to include all changes, equivalents, and replacements within the idea and the technical scope of the disclosure.

[0064] The terminology used herein is for the purpose of describing particular embodiments only and is not to be limiting of the embodiments. The singular forms "a", "an", and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises/comprising" and/or "includes/including" when used herein, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components and/or groups thereof.

[0065] Unless otherwise defined, all terms including technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which example embodiments belong. It will be further understood that terms, such as those defined in commonly-used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0066] When describing the embodiments with reference to the accompanying drawings, like reference numerals refer to like components and a repeated description related thereto will be omitted. In the description of embodiments, detailed description of well-known related structures or functions will be omitted when it is deemed that such description will cause ambiguous interpretation of the present disclosure.

[Examples]

1. Production of Combustible Heat Source

[0067] According to the compositions shown in Table 1 below, a combustible heat source composition including charcoal and an excipient was prepared. The heat source was manufactured in the form of a cylinder with a diameter of 7 mm and a height of about 11 mm. Materials for manufacturing a heat source were prepared according to mixing ratios and then mixed using an atmospheric pressure mixer (ARE-310 from THINKY). When mixing, the materials were mixed at 1500 RPM for 1 minute each time each material was added.

[0068] The mixed powder was mixed at 1500 RPM for 5 minutes by adding appropriate amounts of moisture or oil in parts by weight shown in Table 1. The mixed sample was divided into about 0.6 g and compressed through a press to mold the sample in a cylinder shape. At this time, a pressure for the compression was set as the condition shown in Table 1. Particularly, in a case of Examples 2, 3, 5, and 6 in which oil was added, the compression was performed at a higher pressure than that in a case in which water was added.

[0069] The compressed sample was dried at 80°C for 30 minutes in a drying oven.

[Table 1]

	Solid mixing ratio (% , based on weight)			Oil and moisture content (parts by weight)			Pressure (MPa)
	Charcoal	Excipient	Total	Moisture	Glycerol	PG	
Example 1	70%	30%	100%	0	1	0	2.0
Example 2				0	0	1	2.0
Example 3				0	1.5	0	2.0
Example 4				0	0	1.5	2.0
Comparative Example 1				1	0	0	1.2
Comparative Example 2				1.2	0	0	1.2
Comparative Example 3				0	0.5	0	2.0
Comparative Example 4				0	0	0.5	2.0
Comparative Example 5				0	2	0	2.0
Comparative Example 6				0	0	2	2.0
Comparative Example 7				0	1	0	1.2
Comparative Example 8				0	0	1	1.2

2. Confirmation of Moldability of Combustible Heat Source

[0070] The external appearances of the manufactured heat source were confirmed and shown in FIG. 1. From FIG. 1, when 1% of the oil and moisture content is contained, good moldability was confirmed.

[0071] In addition, results evaluated according to the following criteria were shown in Table 2.

<Surface State>

[0072]

A: Good.

B: There are cracks and broken parts on the surface.

C: There are many cracks and broken parts on the surface.

<Moldability>

[0073]

A: Excellently molded

B: Hardness is weak and sticky and crumbly properties are obtained.

C: The materials adheres to a wall of a container and is not molded.

EP 4 324 340 A1

[Table 2]

	Surface state	Moldability
Example 1	A	A
Example 2	A	A
Example 3	A	A
Example 4	A	A
Comparative Example 1	C	C
Comparative Example 2	C	C
Comparative Example 3	C	B
Comparative Example 4	C	B
Comparative Example 5	B	C
Comparative Example 6	B	C
Comparative Example 7	C	B
Comparative Example 8	C	B

[0074] As can be seen from the results of Table 2, when the 1% to 1.5% of oil was included as in Examples 1 to 4, good surface roughness and moldability were confirmed. In contrast, in Comparative Examples 1 and 2 in which 1% and 1.2% of moisture is included, respectively, it was confirmed that the moldability was slightly poor due to cracked, broken, and crumbly surface during the molding, and in Comparative Examples 3 and 4 in which 0.5% of oil is included, it was confirmed that the molding was completed but the surface was cracked and broken. In Comparative Examples 5 and 6 in which 2% of oil is included, no breaking part was observed on the surface, but the molding was not performed smoothly due to weak hardness and the materials adhering to the wall of the container. In addition, a result of being smaller compared to other heat sources in size was also confirmed.

[0075] As shown in FIG. 2, in Example 2 in which a pressure of 2 MPa was applied, it was confirmed that the surface roughness was greatly improved compared to Comparative Example 8 in which a pressure of 1.2 MPa was applied.

[0076] In Comparative Examples 7 and 8 in which a pressure of 2.0 MPa was applied, surface cracks were confirmed. Accordingly, it is found that, when oil is added, the surface roughness is greatly improved by increasing the pressure, compared to a case where moisture is added.

3. Confirmation of Combustion Results of Combustible Heat Source

[0077] The manufactured heat source was ignited and then burned to show observation results in Table 3 below.

[Table 3]

	Ignitability	Combustion maintenance/surface combustion speed	Shape maintenance after combustion
Example 1	O Combustion started in 16s	Surface combustion (takes 180s)	O
Example 2	O Combustion started in 14s	Surface combustion (takes 160s)	O
Example 3	O Combustion started in 11s	Surface combustion (takes 150s)	O
Example 4	O Combustion started in 12s	Surface combustion (takes 135s)	O
Comparative Example 1	Δ Combustion started in 40s	Δ Combustion stop	X

(continued)

	Ignitability	Combustion maintenance/surface combustion speed	Shape maintenance after combustion
Comparative Example 2	X Ignition failure	X Ignition failure	X
Comparative Example 3	Δ Combustion started in 42s	Δ Generation of large amount of smoke	X
Comparative Example 4	X Ignition failure	X (Ignition failure)	X
Comparative Example 5	Δ Combustion started in 30s Breakage occurrence	Δ Generation of large amount of smoke	X
Comparative Example 6	Δ Combustion started in 30s	Δ Generation of large amount of smoke	X
	Breakage occurrence		
Comparative Example 7	Δ Combustion started in 20s	Δ Breakage occurrence, generation of large amounts of smoke	X
Comparative Example 8	Δ Combustion started in 20s	Δ Breakage occurrence, generation of large amounts of smoke	X

[0078] As can be seen from the results of Table 3, when an appropriate pressure was applied and 1% to 1.5% of oil was included as in Examples 1 to 4, good ignitability and combustibility were confirmed. In contrast, in a heat source including moisture, the ignitability was reduced and cracking occurred, and in Comparative Examples 3 and 4 in which 0.5% of oil was included, the ignition was not possible or started slowly, and the surface was cracked and broken. In addition, in Comparative Examples 5 and 6 in which 2% of oil was included, the ignition was smoothly performed, but the combustion was not stably performed due to its small size.

[0079] Furthermore, in Comparative Examples 7 and 8 in which a pressure was applied as small as 1.2 MPa, the ignition was rapidly performed, but a result of surface cracking and smoke generation was obtained.

[0080] While the example embodiments are described with reference to drawings, it will be apparent to one of ordinary skill in the art that various alterations and modifications in form and details may be made in these example embodiments without departing from the spirit and scope of the claims and their equivalents. For example, suitable results may be achieved if the described techniques are performed in a different order and/or if components in a described system, architecture, device, or circuit are combined in a different manner and/or replaced or supplemented by other components or their equivalents.

[0081] Therefore, other implementations, other embodiments, and equivalents to the claims are also within the scope of the following claims.

Claims

1. A method of molding a combustible heat source, the method comprising:

step S1 of preparing a combustible heat source composition comprising a carbon powder, an organic binder, and an ignition accelerator;

step S2 of treating glycerin or propylene glycol on the combustible heat source composition; and

step S3 of compressing and molding the composition after the treatment,

wherein step S3 is performed at a pressure of P_O , and

the P_O is 1.5 to 2 times greater than a compression strength P_W in a case where moisture is treated.

2. The method of claim 1, wherein the heat source has a diameter of 7 to 8 millimeters (mm) and a length of 10 to 12 nanometers (nm).

3. The method of claim 1, wherein the P_O is 0.5 to 10 megapascals (MPa).

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4. The method of claim 3, wherein the P_O is 1.5 to 3.0 MPa.

5. The method of claim 1, wherein the P_W is 0.5 to 1.5 MPa.

5 6. The method of claim 1, wherein the oil is treated in an amount of 0.8 to 2 parts by weight with respect to 100 parts by weight of a solid content of the combustible heat source composition.

7. A combustible heat source molded by the method of molding a combustible heat source according to claim 1.

10 8. The combustible heat source of claim 7, wherein the heat source is ignited within 30 seconds, and combustion continues for 140 seconds or longer.

9. A smoking article comprising the combustible heat source of claim 7.

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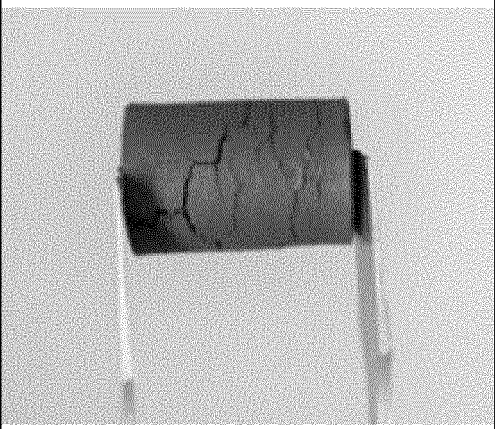
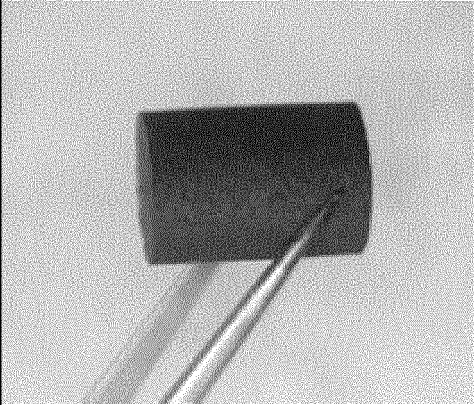
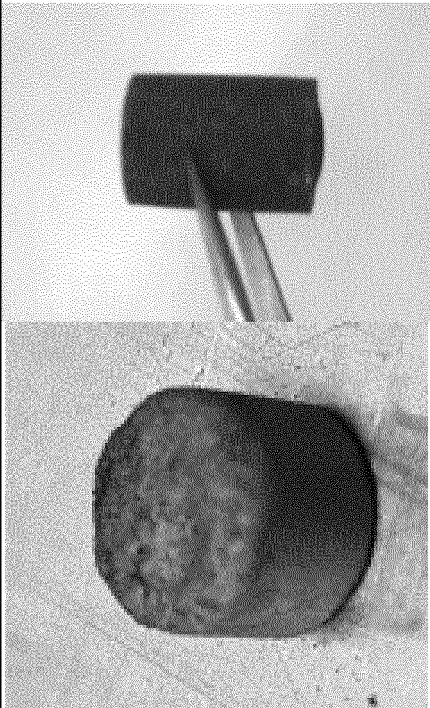
Oil and moisture 5%	
Oil and moisture 10%	
Oil and moisture 20%	

FIG. 1

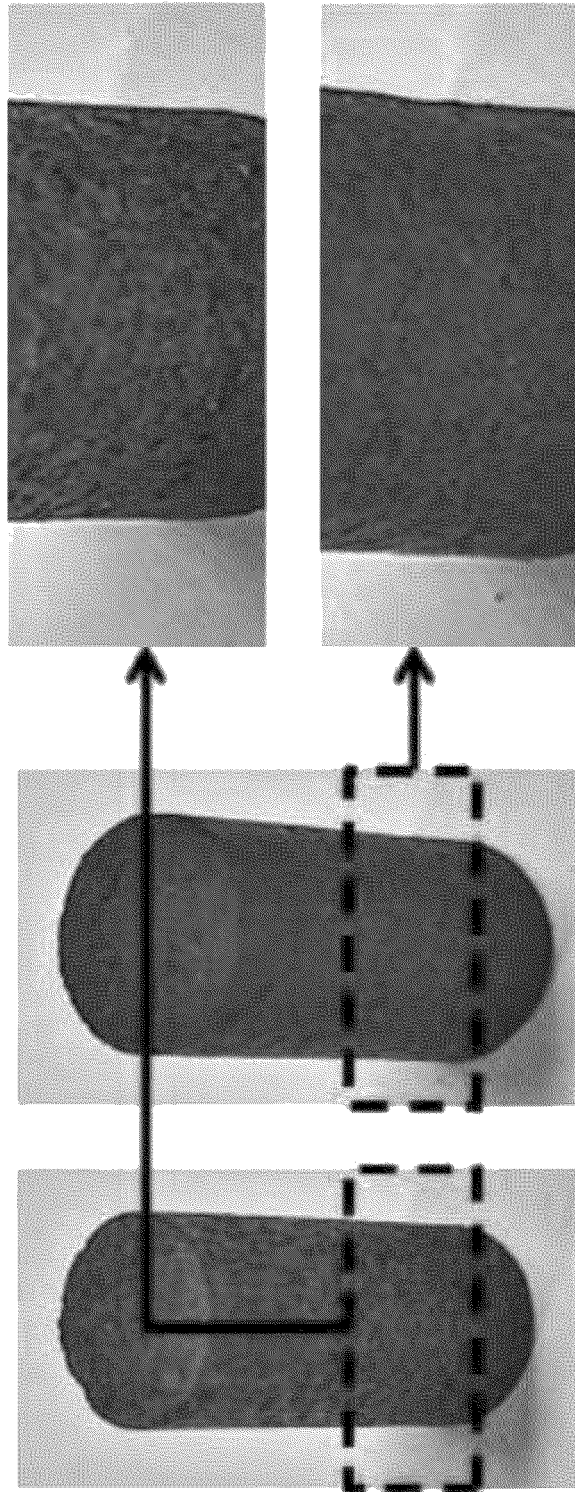


FIG. 2

INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2022/018967

A. CLASSIFICATION OF SUBJECT MATTER A24B 15/16(2006.01)i; A24B 15/28(2006.01)i; A24B 15/30(2006.01)i; A24D 1/22(2020.01)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) A24B 15/16(2006.01); A24B 15/18(2006.01); A24B 15/30(2006.01); A24F 13/08(2006.01); A24F 47/00(2006.01)																		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Korean utility models and applications for utility models: IPC as above Japanese utility models and applications for utility models: IPC as above																		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) eKOMPASS (KIPO internal) & keywords: 흡연(smoke), 에어로졸(aerosol), 성형(figuration), 유기(organic), 바인더(binder), 탄소(carbon), 글리세린(glycerin), 프로필렌글리콜(Propylene Glycol), 압축(press)																		
C. DOCUMENTS CONSIDERED TO BE RELEVANT																		
<table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>Y</td> <td>KR 10-2220688 B1 (PHILIP MORRIS PRODUCTS S.A.) 03 March 2021 (2021-03-03) See claims 1 and 12; and paragraphs [0030] and [0089]-[0109].</td> <td>1-9</td> </tr> <tr> <td>Y</td> <td>KR 10-2018-0051484 A (PHILIP MORRIS PRODUCTS S.A.) 16 May 2018 (2018-05-16) See claims 1, 12 and 14.</td> <td>1-9</td> </tr> <tr> <td>A</td> <td>WO 2020-202528 A1 (JAPAN TOBACCO INC. et al.) 08 October 2020 (2020-10-08) See entire document.</td> <td>1-9</td> </tr> <tr> <td>A</td> <td>KR 10-2316861 B1 (R. J. REYNOLDS TOBACCO COMPANY) 22 October 2021 (2021-10-22) See entire document.</td> <td>1-9</td> </tr> <tr> <td>A</td> <td>KR 10-2319572 B1 (DAICEL CORPORATION) 29 October 2021 (2021-10-29) See entire document.</td> <td>1-9</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	Y	KR 10-2220688 B1 (PHILIP MORRIS PRODUCTS S.A.) 03 March 2021 (2021-03-03) See claims 1 and 12; and paragraphs [0030] and [0089]-[0109].	1-9	Y	KR 10-2018-0051484 A (PHILIP MORRIS PRODUCTS S.A.) 16 May 2018 (2018-05-16) See claims 1, 12 and 14.	1-9	A	WO 2020-202528 A1 (JAPAN TOBACCO INC. et al.) 08 October 2020 (2020-10-08) See entire document.	1-9	A	KR 10-2316861 B1 (R. J. REYNOLDS TOBACCO COMPANY) 22 October 2021 (2021-10-22) See entire document.	1-9	A	KR 10-2319572 B1 (DAICEL CORPORATION) 29 October 2021 (2021-10-29) See entire document.	1-9
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☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.																		
<table border="0"> <tr> <td style="vertical-align: top;"> * Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "D" document cited by the applicant in the international application "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed </td> <td style="vertical-align: top;"> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "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 </td> </tr> </table>	* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "D" document cited by the applicant in the international application "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "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																
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<table border="1"> <tr> <td>Date of the actual completion of the international search 02 March 2023</td> <td>Date of mailing of the international search report 02 March 2023</td> </tr> </table>	Date of the actual completion of the international search 02 March 2023	Date of mailing of the international search report 02 March 2023																
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<table border="1"> <tr> <td> Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex-Daejeon Building 4, 189 Cheongsaro, Seo-gu, Daejeon 35208 Facsimile No. +82-42-481-8578 </td> <td> Authorized officer Telephone No. </td> </tr> </table>	Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex-Daejeon Building 4, 189 Cheongsaro, Seo-gu, Daejeon 35208 Facsimile No. +82-42-481-8578	Authorized officer Telephone No.																
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2022/018967

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