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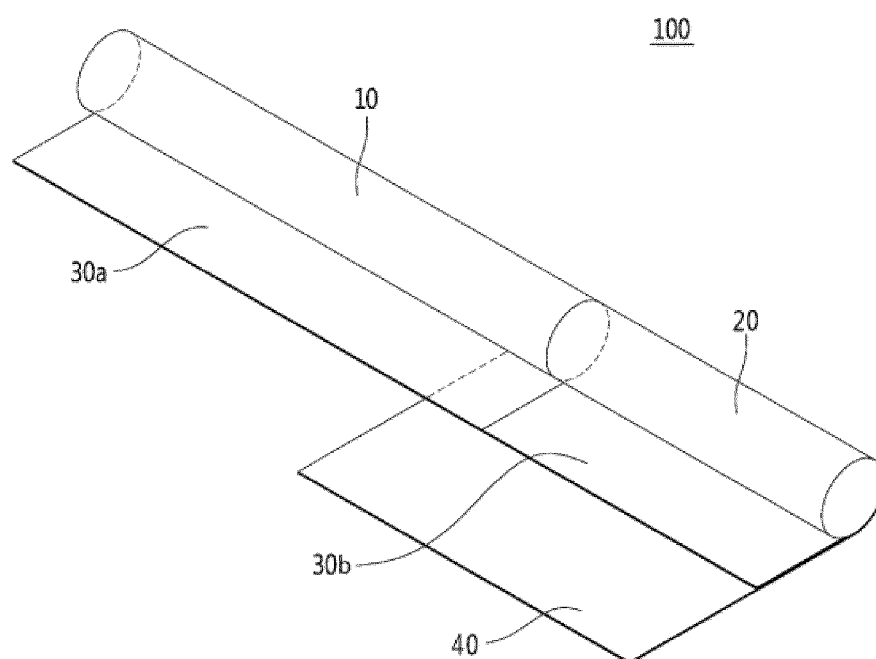
(54) **SMOKING PRODUCT FILTER COMPRISING LYOCCELL TOW, AND SMOKING PRODUCT COMPRISING SAME**

(57) Provided are a smoking article filter and a smoking article. The smoking article filter includes a filter portion including lyocell tow including lyocell fibers and a phenol reducing material dispersed in the lyocell tow,

and a filter portion wrapper wrapped around the filter portion and treated to be grease-resistant, wherein the filter portion wrapper has a basis weight ranging from 30 gsm to 180 gsm.

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FIG. 1



Description

[Technical Field]

[0001] The present invention relates to a smoking article filter, which includes a filter portion including lyocell tow in which a phenol reducing material is dispersed and a filter portion wrapper wrapped around the filter portion and formed of wrapping paper having a basis weight in a predetermined range and treated to be grease-resistant (that is, grease-resistant hard wrapping paper), and a smoking article including the smoking article filter.

[Background Art]

[0002] Typical cigarette filters include cellulose acetate tow formed by extracting cellulose from wood pulp and acetylating the extracted cellulose. Also, cigarette filters are assembled into cigarette products, distributed to consumers, provided for smoking, and then finally discarded after smoking is completed. Also, some cigarette filters are directly discarded as manufacturing residue from a cigarette filter manufacturing plant. This cigarette filter waste is collected as refuse and landfilled for disposal. In addition, in some cases, smoked cigarettes are left in the natural environment without being collected as refuse.

[0003] Accordingly, in recent years, research for replacing cellulose acetate tow with an eco-friendly material to protect the natural environment and reduce costs has been carried out. For example, the development of tow using lyocell fibers in which the cellulose itself is fiberized, unlike cellulose acetate, is in progress.

[0004] In manufacturing a smoking article filter, a phenol reducing material that can specifically reduce phenols generated during smoking is added to reduce phenols in mainstream smoke. Conventionally, it is known that polyethylene glycol (hereinafter referred to as "PEG"), triethyl citrate (hereinafter referred to as "TEC"), triacetin (hereinafter referred to as "TA"), and the like are added as a phenol reducing material to cellulose acetate tow. In a case where a phenol reducing material composed of PEG, TEC, and TA is added to cellulose acetate which is hydrophobic, there is a problem in that the phenol reducing material also serves as a plasticizer for cellulose acetate fibers and causes the cellulose acetate fibers, which are hydrophobic, to bond to each other, thus reducing biodegradability.

[0005] Meanwhile, in a case where a phenol reducing material such as PEG, TEC, and TA is added to lyocell fibers, the lyocell fibers are not plasticized. Accordingly, adding a phenol reducing material such as PEG, TEC, and TA to lyocell fibers has been found to reduce phenols in mainstream smoke while not degrading biodegradability.

[0006] Meanwhile, in the case where a phenol reducing material such as PEG, TEC, and TA is added to lyocell fibers to reduce phenols in mainstream smoke, since plasticization does not occur in lyocell tow including lyocell fibers, there is a problem in that the hardness of the lyocell tow is decreased, which may cause the filter to collapse. In order to address the problem of reduced hardness, a solution has been presented in which, when manufacturing a smoking article filter, wrapping paper having a high basis weight, which is referred to as "hard wrapping paper," is used as a filter portion wrapper surrounding lyocell tow in order to impart a predetermined hardness to the smoking article filter.

[0007] Meanwhile, although hard wrapping paper has a higher basis weight compared to general wrapping paper and imparts a predetermined hardness to a smoking article filter, there is a problem in that a phenol reducing material dispersed in lyocell tow spreads from a filter portion including lyocell tow to the filter wrapping paper (hereinafter, "filter portion wrapper") and is absorbed therein such that phenol reducing performance of the smoking article filter is decreased.

[Disclosure]

[Technical Problem]

[0008] One object of the present invention is to provide a smoking article filter in which a filter portion wrapper is made of wrapping paper having a basis weight of a predetermined value or more and a surface treated to be grease-resistant (that is, grease-resistant hard wrapping paper), thereby addressing a fundamental hardness problem that lyocell tow has.

[0009] Another object of the present invention is to provide a smoking article filter in which a filter portion wrapper is made of wrapping paper having a basis weight of a predetermined value or more and a surface treated to be grease-resistant (that is, grease-resistant hard wrapping paper), thereby minimizing a delivered amount of a phenol reducing material that spreads from a filter portion, which includes lyocell tow and the phenol reducing material dispersed in the lyocell tow, to the filter portion wrapper, thus more effectively removing components such as phenols present in cigarette smoke during smoking and having excellent biodegradability.

[0010] Still another object of the present invention is to provide a smoking article in which a filter portion wrapper wrapped around a filter portion including lyocell tow is made of wrapping paper having a basis weight of a predetermined value or more and a surface treated to be grease-resistant (that is, grease-resistant hard wrapping paper), thereby addressing a hardness problem that lyocell tow has and minimizing a delivered amount of a phenol reducing material that spreads from

the lyocell tow to the filter portion wrapper, thus more effectively removing components such as phenols present in cigarette smoke during smoking and having excellent biodegradability.

[0011] The objects of the present invention are not limited to those mentioned above, and other unmentioned objects can be clearly understood by those of ordinary skill in the art to which the present invention pertains from the description below.

[Technical Solution]

[0012] One embodiment for achieving one object provides a smoking article filter including: a filter portion including lyocell tow including lyocell fibers and a phenol reducing material dispersed in the lyocell tow; and a filter portion wrapper wrapped around the filter portion and treated to be grease-resistant, wherein the filter portion wrapper has a basis weight ranging from 30 gsm to 180 gsm.

[0013] Also, the phenol reducing material may include at least one or more of triethyl citrate (TEC), polyethylene glycol (PEG), and triacetin (TA).

[0014] Also, the filter portion wrapper may have a basis weight ranging from 40 gsm to 160 gsm.

[0015] Also, the filter portion wrapper may have a basis weight ranging from 70 gsm to 150 gsm.

[0016] Also, a hardness of the filter portion may range from 93% to 99%.

[0017] Also, the filter portion wrapper may have a grease resistance of 8 or more based on a 3M Kit Test.

[0018] Also, a rate at which the phenol reducing material is delivered to the filter portion wrapper may range from 1% to 13%, the rate at which the phenol reducing material is delivered to the filter portion wrapper may be defined as a percentage value of a weight of the phenol reducing material included in the filter portion wrapper to the overall weight of the phenol reducing material included in the smoking article filter, and the overall weight of the phenol reducing material included in the smoking article filter may be a sum of a weight of the phenol reducing material included in the filter portion and the weight of the phenol reducing material included in the filter portion wrapper.

[0019] Also, the rate at which the phenol reducing material is delivered to the filter portion wrapper may range from 2% to 5%.

[0020] One embodiment for achieving another object provides a smoking article including: a smoking material portion; and a smoking article filter disposed downstream of the smoking material portion, wherein the smoking article filter includes a filter portion including lyocell tow including lyocell fibers and a phenol reducing material dispersed in the lyocell tow and a filter portion wrapper wrapped around the filter portion and treated to be grease-resistant, and the filter portion wrapper has a basis weight ranging from 30 gsm to 180 gsm.

[Advantageous Effects]

[0021] According to a smoking article filter and a smoking article including the same according to one embodiment, since a filter portion wrapper wrapped around a filter portion including lyocell tow in which a phenol reducing material is dispersed is made of wrapping paper having a basis weight of a predetermined value or more and a surface treated to be grease-resistant (that is, grease-resistant hard wrapping paper), it is possible to address a fundamental hardness problem that lyocell tow has.

[0022] Also, according to a smoking article filter and a smoking article including the same according to one embodiment, since a filter portion wrapper wrapped around lyocell tow in which a phenol reducing material is dispersed is made of wrapping paper having a basis weight of a predetermined value or more and a surface treated to be grease-resistant (that is, grease-resistant hard wrapping paper), a delivered amount of the phenol reducing material that spreads from a filter portion to the filter portion wrapper is minimized, and thus the content of the phenol reducing material remaining in the filter portion can be optimized, and components such as phenols present in cigarette smoke can be more effectively removed during smoking.

[0023] In addition, according to a smoking article filter and a smoking article including the same according to one embodiment, since a phenol reducing material such as PEG, TEC, and TA does not act as a plasticizer for lyocell tow despite being added to the lyocell tow, it is possible to provide a smoking article filter having excellent biodegradability while having phenol reducing performance and a smoking article including the same.

[0024] Advantageous effects according to the technical spirit of the present disclosure are not limited to those mentioned above, and other unmentioned advantageous effects can be clearly understood by those of ordinary skill in the art from the description above.

[Description of Drawings]

[0025] FIG. 1 is a view illustrating a schematic configuration of a smoking article according to one embodiment of the present invention.

[Modes of the Invention]

[0026] Hereinafter, exemplary embodiments of the present disclosure will be described in detail with reference to the accompanying drawings. Advantages and features of the present disclosure and methods of achieving the same should become clear with embodiments described in detail below with reference to the accompanying drawings. However, the technical spirit of the present disclosure is not limited to the following embodiments and may be implemented in various different forms. The following embodiments are only provided to make the technical spirit of the present disclosure complete and completely inform those of ordinary skill in the art to which the present disclosure pertains of the scope of the present disclosure. The technical spirit of the present disclosure is defined only by the scope of the claims.

[0027] In assigning reference numerals to components of each drawing, it should be noted that the same reference numerals are assigned to the same components wherever possible even when the components are illustrated in different drawings. Also, in describing the present disclosure, when it is determined that the detailed description of a known related configuration or function may obscure the gist of the present disclosure, the detailed description thereof will be omitted.

[0028] Unless otherwise defined, all terms including technical or scientific terms used herein have the same meaning as commonly understood by those of ordinary skill in the art to which the present disclosure pertains. Terms defined in commonly used dictionaries should not be interpreted in an idealized or overly formal sense unless expressly so defined herein. Terms used herein are for describing the embodiments and are not intended to limit the present disclosure. In the specification, a singular expression includes a plural expression unless the context clearly indicates otherwise.

[0029] Also, in describing components of the present disclosure, terms such as first, second, A, B, (a), and (b) may be used. Such terms are only used for distinguishing one component from another component, and the essence, order, sequence, or the like of the corresponding component is not limited by the terms. In a case in which a certain component is described as being "connected," "coupled," or "linked" to another component, it should be understood that, although the component may be directly connected or linked to the other component, still another component may also be "connected," "coupled," or "linked" between the two components.

[0030] The terms "comprises" and/or "comprising" used herein do not preclude the presence or addition of one or more components, steps, operations, and/or devices other than those mentioned.

[0031] First, some terms used herein will be clarified.

[0032] In the present specification, "smoking article" may refer to any product that can be smoked or any product that can provide a smoking experience, regardless of whether the product is based on tobacco, tobacco derivatives, expanded tobacco, reconstituted tobacco, or tobacco substitutes. For example, smoking articles may include products that can be smoked, such as cigarettes, cigars, and cigarillos.

[0033] In the present specification, "smoking material" may refer to any type of material that may be used in a smoking article.

[0034] In the present specification, "upstream" or "upstream direction" may refer to a direction moving away from an oral region of a smoker, and "downstream" or "downstream direction" may refer to a direction approaching the oral region of the smoker.

[0035] In the present specification, "longitudinal direction" may refer to a direction corresponding to a longitudinal axis of a smoking article.

[0036] Hereinafter, various embodiments of the present disclosure will be described in detail with reference to the accompanying drawings.

[0037] FIG. 1 is a view illustrating a schematic configuration of a smoking article according to one embodiment of the present invention.

[0038] Throughout the specification, "smoking article" may refer to anything capable of generating an aerosol, such as tobacco (cigarettes) and cigars. The smoking article may include an aerosol-generating material or an aerosol-forming substrate. Also, the smoking article may include a solid material based on tobacco raw materials, such as reconstituted tobacco leaves, shredded tobacco, and reconstituted tobacco. A smoking material may include volatile compounds.

[0039] Also, throughout the specification, "upstream" or "upstream direction" refers to a direction moving away from an oral region of a user smoking a smoking article 100, and "downstream" or "downstream direction" refers to a direction approaching the oral region of the user smoking the smoking article 100. For example, in the smoking article 100 illustrated in FIG. 1, a smoking material portion 10 is disposed upstream or in an upstream direction of a filter portion 20 included in a smoking article filter.

[0040] Further, in the specification, a case where the smoking article 100 is a combustion-type cigarette is described as an example. However, the present invention is not limited thereto, and the smoking article 100 may also be a heating-type cigarette or the like that is used together with an aerosol generation device (not illustrated) such as an electronic cigarette device.

[0041] Referring to FIG. 1, the smoking article 100 includes the smoking material portion 10, the filter portion 20, a smoking material portion wrapper 30a, a filter portion wrapper 30b, and tipping paper 40. The smoking article filter may include the filter portion 20 and the filter portion wrapper 30b wrapped around the filter portion 20. In the smoking article

100, the smoking material portion 10 is positioned upstream of the filter portion 20.

[0042] The smoking material portion 10 may be filled with a smoking material such as raw tobacco leaves, reconstituted tobacco leaves, or a mixture of tobacco leaves and reconstituted tobacco leaves. A processed smoking material may be filled in the smoking material portion 10 in the form of a sheet or shredded tobacco. The smoking material portion 10 may have the form of a longitudinally extending rod whose length, circumference, and diameter are not particularly limited, but the length, circumference, and diameter may be adjusted to sizes generally used in the art in consideration of the amount of smoking material filled therein, user preferences, or the like.

[0043] The smoking material portion 10 may include at least one aerosol-generating material among glycerin, propylene glycol, ethylene glycol, dipropylene glycol, diethylene glycol, triethylene glycol, tetraethylene glycol, and oleyl alcohol. The smoking material portion 10 may contain other additives such as a flavoring agent, a wetting agent, and/or an acetate compound. The aerosol-generating material and the additive may be contained in the smoking material.

[0044] The smoking material portion 10 may be wrapped with the smoking material portion wrapper 30a. Some of the cigarette smoke generated in a typical combustion process of the smoking material portion 10 is released into the atmosphere through the smoking material portion wrapper 30a before passing through the cigarette filter, and sidestream smoke gives an unpleasant feeling to people exposed thereto. There have been various attempts to reduce sidestream smoke such as filling conventional cigarette paper with a filler such as magnesium oxide, titanium oxide, cerium oxide, aluminum oxide, calcium carbonate, and zirconium carbonate. However, when sidestream smoke is reduced by simply applying such a filler, tobacco smoke taste degradation, combustion interruption, ash integrity degradation, or the like may occur, and it is difficult to address the above-mentioned problem through suitable combinations of materials contained in the filler. A filler in which magnesium oxide (MgO and/or $\text{Mg}(\text{OH})_2$) and calcium carbonate (CaCO_3) are mixed is applied to the smoking material portion wrapper 30a according to one embodiment of the present invention in order to prevent tobacco smoke taste degradation, ash integrity degradation, and combustion interruption while reducing sidestream smoke.

[0045] The smoking article filter may be disposed downstream of the smoking material portion 10. The filter portion 20 of the smoking article filter is disposed downstream of the smoking material portion 10 and serves as a filter through which an aerosol material generated in the smoking material portion 10 passes right before being inhaled by the user. The filter portion 20 may be manufactured using various materials or manufactured in various forms. The filter portion 20 according to one embodiment of the present invention may basically include lyocell tow in which a phenol reducing material is dispersed in a plurality of lyocell fibers. The smoking article filter including the lyocell tow may replace all or part of the filter portion 20 of existing smoking articles, and when the smoking article filter replaces part of the filter portion 20, a filter material that is used conventionally may be used together. For example, a cellulose acetate filter, a hollow tube filter, or the like may be used as the conventional filter material.

[0046] The filter portion 20 is illustrated as a mono filter formed of a single filter in FIG. 1, but the present invention is not limited thereto. For example, the filter portion 20 may be provided as a dual filter, a triple filter, or the like, which includes two or more filters, in order to increase filter efficiency.

[0047] In some embodiments, when the filter portion 20 is provided as a dual filter, a triple filter, or the like, the filter (hereinafter, "lyocell filter") of the present invention that includes lyocell tow including lyocell fibers and a phenol reducing material dispersed in the lyocell tow may be applied as any one filter of the plurality of filters, and a cellulose acetate filter and/or a paper filter may be applied as the other or another filter of the plurality of filters. In this case, a length of the lyocell filter of the present invention may be 25% to 50% of the overall length of the filter portion 20. Also, although not illustrated, a crushable capsule (not illustrated) having a structure in which a liquid including a flavoring is wrapped with a film may be further included in the filter portion 20.

[0048] The filter portion wrapper 30b may be wrapped around the filter portion 20 to package the filter portion 20. The filter portion wrapper 30b may be manufactured using hard wrapping paper having grease resistance. The filter portion wrapper 30b will be described in detail below. Although the present invention is not limited thereto, an aluminum foil may be further included at an inner surface of the filter portion wrapper 30b that faces the filter portion 20.

[0049] The smoking material portion 10 wrapped with the smoking material portion wrapper 30a and the filter portion 20 wrapped with the filter portion wrapper 30b may be wrapped together with the tipping paper 40. As illustrated in FIG. 1, the tipping paper 40 may be wrapped around at least a portion (for example, a partial downstream region) of the smoking material portion wrapper 30a and an outer periphery of the filter portion wrapper 30b. In other words, at least a portion of the smoking material portion 10 and the filter portion 20 may be further wrapped with the tipping paper 40 and physically combined.

[0050] According to one embodiment of the present invention, the tipping paper 40 may be made of nonporous wrapping paper that has not been treated to be grease-resistant, but the present invention is not limited thereto. Also, the tipping paper 40 may include an incombustible material to prevent a phenomenon in which the filter portion 20 burns, but the present invention is not limited thereto.

[0051] Also, although not illustrated in the drawing, the smoking article 100 may further include a hollow tube structure which is a tubular structure including a hollow formed therein. The hollow tube structure may be disposed downstream of

the lyocell filter.

[0052] In some embodiments, perforations may be formed in the hollow tube structure, but the present invention is not limited thereto. Perforations may not be formed in the hollow tube structure. In some embodiments, when perforations are formed in the hollow tube structure, the perforations may be formed at a position spaced 10 mm to 15 mm from the downstream end of the smoking article 100 in the upstream direction.

[0053] Hereinafter, the smoking article filter according to one embodiment of the present invention will be described in detail.

[0054] The present invention relates to the smoking article filter included in the smoking article 100, and the smoking article filter according to one embodiment of the present invention includes the filter portion 20 including lyocell tow including lyocell fibers and a phenol reducing material dispersed in the lyocell tow and the filter portion wrapper 30b wrapped around the filter portion 20.

[0055] The lyocell fibers are eco-friendly fibers made of cellulose extracted from wood pulp. The lyocell tow refers to a bundle formed by cross-connecting adjacent lyocell fibers.

[0056] In some embodiments, the lyocell fibers may have a shaped cross-section. The shaped cross-section is defined as a cross-section having a shape including a plurality of protrusions instead of having a circular shape. For example, a cross-section having a shape in which a plurality of protrusions extend from the center may be referred to as "shaped cross-section."

[0057] In some embodiments, the lyocell fibers may have a Y-shaped cross-section with three protrusions branching from the center, a cross-shaped cross-section with four protrusions, a star-shaped cross-section with five protrusions, or an O-shaped cross-section, but the present invention is not limited thereto.

[0058] In one embodiment, the phenol reducing material corresponds to a substance that can specifically reduce phenols generated during smoking, and the phenol reducing material may include at least one or more of polyethylene glycol (hereinafter referred to as "PEG"), triethyl citrate (hereinafter referred to as "TEC"), and triacetin (hereinafter referred to as "TA").

[0059] In some embodiments, the phenol reducing material may include only PEG, include only TEC, or include both PEG and TEC. However, the phenol reducing material additionally added to at least one of the PEG, TEC, and TA is not limited thereto and may be any other substance as long as the substance can reduce phenols generated during smoking.

[0060] In some embodiments, the phenol reducing material may be uniformly dispersed in lyocell tow and may be distributed throughout the entire region of the lyocell tow constituting the filter portion 20.

[0061] The phenol reducing material may be applied on surfaces of lyocell fibers constituting lyocell tow. Meanwhile, at least one of PEG, TEC, and TA, which are examples of the phenol reducing material according to one embodiment, may also serve as a plasticizer for cellulose acetate fibers but not act as a plasticizer for lyocell fibers. Accordingly, in a case where at least one of PEG, TEC, and TA is included as a phenol reducing material, even when the phenol reducing material is applied on surfaces of lyocell fibers, the lyocell fibers may not be plasticized by the phenol reducing material.

[0062] The smoking article filter to which lyocell tow is applied according to the present invention includes at least one or more phenol reducing materials of PEG, TEC, and TA dispersed in the lyocell tow and thus may have a greater effect of reducing phenols generated during smoking, compared to a smoking article filter to which the phenol reducing material is not added.

[0063] In some embodiments, PEG included in the phenol reducing material may have a weight average molecular weight (MW) in a range of 50 to 10,000, 50 to 2,500, 200 to 2,000, 500 to 700, or a weight average molecular weight (MW) of 600.

[0064] In some embodiments, in a case where the phenol reducing material includes TEC and PEG, a ratio between the content of TEC and the content of PEG may range from 7:3 to 9:1, but the present invention is not limited thereto.

[0065] In a case where the phenol reducing material dispersed in the lyocell tow of the smoking article filter includes PEG, phenol reducing performance may vary according to the molecular weight of the PEG. Specifically, in a case where PEG dispersed in the lyocell tow has a weight average molecular weight (MW) in the above-mentioned range, the phenol reducing performance of the smoking article filter manufactured using the lyocell tow may be excellent. Preferably, in a case where PEG dispersed in the lyocell tow has a weight average molecular weight (MW) of 600, the phenol reducing performance of the smoking article filter manufactured using the lyocell tow may be the best, but the molecular weight of the PEG is not limited thereto.

[0066] The filter portion wrapper 30b may be disposed to be wrapped around the filter portion 20. The filter portion wrapper 30b may be made of (manufactured using) grease-resistant hard wrapping paper that has a basis weight of a predetermined value or more and is treated to be grease-resistant.

[0067] Meanwhile, since the filter portion wrapper 30b is made of hard wrapping paper having a basis weight of a predetermined value or more, the filter portion wrapper 30b may not only serve as a packaging material that is wrapped around the filter portion 20 including lyocell tow, but also serve to impart hardness of a predetermined level or more to the smoking article filter according to the present invention.

[0068] Specifically, in a case where the filter portion 20 is made of lyocell tow in which at least one or more phenol

reducing materials of PEG, TEC, and TA is/are dispersed, since lyocell fibers are not plasticized by the phenol reducing material, the hardness of the lyocell tow may be decreased. Accordingly, the filter portion wrapper 30b wrapped around the filter portion 20 may be made of hard wrapping paper having a basis weight of a predetermined value or more to supplement the hardness of the smoking article filter.

[0069] In some embodiments, the filter portion wrapper 30b may include wrapping paper having a basis weight ranging from 30 gsm to 180 gsm, 35 gsm to 170 gsm, 40 gsm to 160 gsm, 50 gsm to 158 gsm, 60 gsm to 155 gsm, 70 gsm to 150 gsm, or 75 gsm to 150 gsm. Since the filter portion wrapper 30b is made of wrapping paper having a high basis weight, the hardness of the filter portion 20 including the lyocell tow in which the phenol reducing material is dispersed may be supplemented with the filter portion wrapper 30b, and the hardness of the smoking article filter may become a hardness of a predetermined level or more. In this way, it is possible to address the problem of the hardness of the smoking article filter being decreased.

[0070] In some embodiments, the filter portion wrapper 30b may be manufactured using grease-resistant wrapping paper that has been treated to be grease-resistant. A grease-resistant coating material may be coated on wrapping paper having a basis weight of a predetermined value or more by a size-press method to impart grease resistance to the filter portion wrapper 30b. In an exemplary embodiment, the grease-resistant coating material may include a fluoroacrylate copolymer, but the grease-resistant coating material is not limited thereto and may be any other substance as long as the substance can impart grease resistance to hard wrapping paper.

[0071] The filter portion wrapper 30b may include a first surface (or an inner surface) that faces the filter portion 20 and a second surface (or an outer surface) that is opposite to the first surface (inner surface), and at least one of the inner surface and outer surface of the filter portion wrapper 30b may be treated to be grease-resistant.

[0072] In an exemplary embodiment, only the inner surface of the filter portion wrapper 30b may be treated to be grease-resistant such that only the inner surface of the filter portion wrapper 30b has grease resistance, only the outer surface of the filter portion wrapper 30b may be treated to be grease-resistant such that only the outer surface of the filter portion wrapper 30b has grease resistance, or both the inner surface and the outer surface of the filter portion wrapper 30b may be treated to be grease-resistant such that both the inner surface and the outer surface have grease resistance.

[0073] Since the filter portion wrapper 30b is manufactured using wrapping paper that has been treated to be grease-resistant, a delivery rate of a phenol reducing material that spreads from lyocell tow, in which the phenol reducing material is dispersed, to the filter portion wrapper 30b may be minimized, compared to when the filter portion wrapper 30b is manufactured using wrapping paper that has not been treated to be grease-resistant (that is, wrapping paper that does not have grease resistance). Specifically, since the filter portion wrapper 30b is treated to be grease-resistant and thus the filter portion wrapper 30b has grease resistance, a phenol reducing material moving from the lyocell tow to the filter portion wrapper 30b of the phenol reducing material dispersed in the lyocell tow may be prevented from spreading to the filter portion wrapper 30b. Accordingly, the phenol reducing material in the lyocell tow may be prevented from being absorbed into the filter portion wrapper 30b. Therefore, it is possible to address a problem of the filter portion wrapper 30b becoming wet due to the phenol reducing material and the hardness of the smoking article filter being decreased, or the amount of the phenol reducing material remaining in the lyocell tow being decreased.

[0074] In some embodiments, the filter portion wrapper 30b may have a grease resistance of 8 or more, 9 or more, 10 or more, or 11 or more based on a 3M Kit Test. The grease resistance of the filter portion wrapper 30b may be a value obtained by measuring the grease resistance of at least one of the outer surface and the inner surface of the filter portion wrapper 30b. In some embodiments, both the outer surface and the inner surface of the filter portion wrapper 30b may be treated to be grease-resistant, and a grease resistance of each of the outer surface and the inner surface of the filter portion wrapper 30b may be 8 or more, 9 or more, 10 or more, or 11 or more. Since the filter portion wrapper 30b is made of grease-resistant hard wrapping paper having the above-mentioned grease resistance, a delivered amount of the phenol reducing material that spreads from the lyocell tow to the filter portion wrapper 30b may be decreased.

[0075] Meanwhile, grease resistance measurement by the 3M Kit Test was performed as follows. Specifically, in order to analyze the grease resistance of wrapping paper, grease resistance measurement solutions were prepared using a universally used method and dropped onto a test piece, and after a predetermined amount of time had elapsed, grease resistance was determined from the highest kit number at which a grease mark was not left on the test piece. The solutions were prepared by mixing castor oil, toluene, and heptane in a predetermined ratio for each kit number as shown in Table 1 below.

[Table 1]

Kit number	Castor oil (mL)	Toluene (mL)	Heptane (mL)
1	200	0	0
2	180	10	10
3	160	20	20

(continued)

Kit number	Castor oil (mL)	Toluene (mL)	Heptane (mL)
4	140	30	30
5	120	40	40
6	100	50	50
7	80	60	60
8	60	70	70
9	40	80	80
10	20	90	90
11	0	100	100
12	0	90	110

[0076] A reagent of the lowest kit number was tested first on the test piece, one drop of the prepared reagent was dropped onto the test piece, the dropped reagent was removed using moisture-absorbing cotton or tissue after 15 seconds, and then whether a grease mark was formed was observed. When a grease mark was not formed, a reagent of the next lowest kit number was tested, and the experiment was continued until a grease mark was formed. The final kit number at which a grease mark was not formed was applied to evaluate oil resistance. As a result of evaluating the grease resistance of the aerosol-generating article according to the present disclosure, it was confirmed that the filter portion wrapper 30b according to an embodiment may have a grease resistance of 8 or more, 9 or more, 10 or more, or 11 or more based on the 3M Kit Test.

[0077] In some embodiments, the smoking article filter according to the present invention that includes the filter portion 20 and the filter portion wrapper 30b wrapped around the filter portion may have a hardness ranging from 93% to 99%, 93.5% to 98.5%, 94% to 98%, 94.3% to 97.8%, or 93.4% to 97%. The hardness of the smoking article filter is a numerical value of a degree to which a diameter of the smoking article filter is maintained when the smoking article filter is pressed with a force of a certain level in a direction perpendicular to the longitudinal direction of the smoking article filter and may be a percentage value of a ratio of a diameter of the smoking article filter after the force is applied to a diameter of the smoking article filter before the force is applied.

[0078] Specifically, in the smoking article filter according to the present invention, since the filter portion wrapper 30b wrapped around the filter portion 20 is made of grease-resistant hard wrapping paper having a basis weight of a predetermined value or more and having grease resistance, while the hardness of lyocell tow is supplemented, the phenol reducing material dispersed in the lyocell tow may be prevented from spreading to the filter portion wrapper 30b to prevent the filter portion wrapper 30b from becoming wet due to the phenol reducing material, and in this way, the smoking article filter may have a hardness in the above-mentioned range.

[0079] In one embodiment, the rate at which the phenol reducing material is delivered to the filter portion wrapper 30b, which is defined as a percentage value of a weight of the phenol reducing material included in the filter portion wrapper 30b to the overall weight of the phenol reducing material included in the smoking article filter, may range from 1% to 13%, 1.2% to 10%, 1.4% to 8%, 1.6% to 7%, 1.8% to 6%, 2% to 5%, or 3% to 4.5%. Meanwhile, the overall weight of the phenol reducing material included in the smoking article filter may be calculated as a sum of the weight of the phenol reducing material included in the filter portion 20 and the weight of the phenol reducing material included in the filter portion wrapper 30b.

[0080] Hereinafter, the configurations of the present invention and the advantageous effects according thereto will be described in more detail using examples and comparative examples. However, the examples are merely for describing the present invention in more detail, and the scope of the present invention is not limited to these examples.

Example 1

[0081] Using filter manufacturing equipment manufactured by TYM Co., Ltd. (whose operational mechanism is the same as cellulose acetate (CA) tow filter manufacturing equipment), a phenol reducing material including TEC was added onto lyocell tow by being injected 50 mg/rod, and then the lyocell tow having TEC dispersed therein was wrapped with grease-resistant hard wrapping paper having a basis weight of 75 gsm and having an inner surface and an outer surface whose grease resistance was 11 to manufacture a smoking article filter having a length of 126 mm. The grease resistance of the grease-resistant hard wrapping paper may be a value measured using the above-described grease resistance measuring method.

Example 2

[0082] A smoking article filter was manufactured in the same manner as in Example 1 except that PEG 600 was used as the phenol reducing material dispersed in the lyocell tow.

Comparative Example 1

[0083] A smoking article filter was manufactured in the same manner as in Example 1 except that general hard wrapping paper having a basis weight of 75 gsm and not treated to be grease-resistant was used as the wrapping paper wrapped around the lyocell tow.

Comparative Example 2

[0084] A smoking article filter was manufactured in the same manner as in Example 2 except that general hard wrapping paper having a basis weight of 75 gsm and not treated to be grease-resistant was used as the wrapping paper wrapped around the lyocell tow.

Experimental Example 1: Evaluation of amount of phenol reducing material delivered to filter portion wrapper

[0085] In order to measure the rate at which the phenol reducing material is delivered to the filter portion wrapper (that is, a characteristic of the phenol reducing material spreading to the filter portion wrapper) in Examples 1 and 2 and Comparative Examples 1 and 2, portions of the smoking article filters were randomly collected and the weights of filter samples were measured, and in order to measure the weight of the filter portion wrapper (that is, filter wrapping paper), the lyocell tow portion was removed from the collected portions of the smoking article filters and the weight of the filter portion wrapper (that is, filter wrapping paper) was measured. Then, 50 mL of an extraction solution included in an internal standard solution was added to each collected filter sample and stirred for 60 minutes to analyze the TEC component using GC-FID (DB-WAX column) and analyze the PEG component using a HPLD device in order to measure remaining amounts of the phenol reducing materials.

[0086] Then, a percentage value of the weight of the phenol reducing material included in the filter portion wrapper relative to the overall weight of the phenol reducing material included in the smoking article filter was calculated and rounded off to two decimal places to calculate the rate at which the phenol reducing material is delivered to the filter portion wrapper, and the measured remaining amount of the phenol reducing material and the calculated rate at which the phenol reducing material is delivered to the filter portion wrapper are shown in Table 2 and Table 3 below.

[Table 2]

Classification	Remaining amount of phenol reducing material (TEC) (mg/rod)		Rate at which TEC is delivered to filter portion wrapper (%)
	Filter portion wrapper	Entire filter	
Example 1	4.7	109.0	4.3
Comparative Example 1	32.8	123.8	26.5

[Table 3]

Classification	Remaining amount of phenol reducing material (PEG 600) (mg/rod)		Rate at which PEG 600 is delivered to filter portion wrapper (%)
	Filter portion wrapper	Entire filter	
Example 2	0.8	21.3	3.8
Comparative Example 2	3.6	25.1	14.3

[0087] As shown in Table 2 and Table 3 above, it can be seen that, despite the filter portion wrapper 30b being manufactured using hard wrapping paper having the same basis weight, the amount of the phenol reducing material delivered from the filter portion 20 to the filter portion wrapper 30b (that is, the amount of the phenol reducing material spreading from the filter portion 20 to the filter portion wrapper 30b) decreases when the filter portion wrapper 30b has

grease resistance. Specifically, it can be seen that, in Example 1 and Comparative Example 1 in which the same phenol reducing material, TEC, was included, the rate at which TEC was delivered from the filter portion 20 to the filter portion wrapper 30b significantly decreased to 4.3% in Example 1 compared to 26.5% in Comparative Example 1 due to the filter portion wrapper 30b having grease resistance, and in Example 2 and Comparative Example 2 in which the same phenol reducing material, PEG 600, was included, the rate at which PEG 600 was delivered from the filter portion 20 to the filter portion wrapper 30b significantly decreased to 3.8% in Example 2 compared to 14.3% in Comparative Example 2 due to the filter portion wrapper 30b having grease resistance. Accordingly, since the remaining amount of the phenol reducing material included in the filter portion 20 made of lyocell tow is increased when grease-resistant hard wrapping paper is used compared to when the general hard wrapping paper is used, the phenol reducing performance of the smoking article filter may be expected to be improved.

Example 3

[0088] A smoking article filter was manufactured in the same manner as in Example 1 except that the phenol reducing material including TEC was added onto lyocell tow by being injected 70 mg/rod instead of 50 mg/rod.

Comparative Example 3

[0089] A smoking article filter was manufactured in the same manner as in Comparative Example 1 except that the phenol reducing material was not injected into the lyocell tow (that is, the phenol reducing material was not added to the filter portion 20).

Experimental Example 2: Evaluation of phenol reducing performance of smoking article filter according to addition of phenol reducing material and grease resistance treatment of filter portion wrapper

[0090] Smoking articles were manufactured using the smoking article filters of Comparative Examples 1 and 3 and Examples 1 and 3, smoke components emitted during smoking using the cigarette smoking machine HAUNI LX20 manual (linear type) as a smoking device were collected using a Cambridge filter pad (CFP), and in order to extract substances from the smoke components collected on the CFP, 30 mL of 1% acetic acid was added and then stirred, the substances were filtered using a 0.45 μ m PVDF syringe filter and analyzed using an Alliance HPLC-FLD analysis device of Waters Corporation, and results thereof are shown in Table 4 below.

[Table 4]

	Amount of delivered smoke component (μ g/cig)	
	Phenol	m+p, o- cresols
Comparative Example 3	50.5	39.4
Comparative Example 1	27.9	22.9
Example 1	23.6	19.7
Example 3	18.5	16.1

[0091] As shown in Table 4 above, it can be seen that the amount of delivered phenol significantly decreased in Comparative Example 1 and Example 1 in which a phenol reducing material (specifically, TEC) was dispersed in lyocell tow, as compared to Comparative Example 3 in which a phenol reducing material was not added to lyocell tow. Also, it can be seen that, the amount of delivered phenol further decreased in the case of Example 1 in which the filter portion wrapper 30b was manufactured using grease-resistant hard wrapping paper, compared to Comparative Example 1 in which the filter portion wrapper 30b was manufactured using general hard wrapping paper. That is, it can be seen that a phenol reducing effect increases when a phenol reducing material (specifically, TEC) is added to the filter portion 20, compared to when the phenol reducing material is not added, and the phenol reducing effect is greater when the filter portion 20 is wrapped with the filter portion wrapper 30b manufactured using grease-resistant hard wrapping paper. Also, it can be seen that, compared to Example 1, the phenol reducing effect is greater in Example 3 in which the amount of added phenol reducing material (specifically, TEC) is larger.

[0092] From the above, it may be expected that, when the filter portion wrapper 30b is manufactured using grease-resistant hard wrapping paper, the amount of phenol reducing material spreading from lyocell tow to the hard wrapping paper decreases, and the amount of the phenol reducing material remaining in the lyocell tow becomes optimal such that the phenol reducing effect is excellent, compared to when the filter portion wrapper 30b is manufactured using general

hard wrapping paper.

Example 4

[0093] A smoking article filter was manufactured in the same manner as in Example 1 except that, as a phenol reducing material dispersed in the lyocell tow, TEC and PEG were included at a ratio of 8:2.

Comparative Example 4

[0094] A smoking article filter was manufactured in the same manner as in Example 4 except that general hard wrapping paper having a basis weight of 75 gsm and not treated to be grease-resistant was used as the wrapping paper wrapped around the lyocell tow.

Experimental Example 3: Evaluation of hardness of smoking article filter according to addition of phenol reducing material and grease resistance treatment of filter portion wrapper

[0095] Smoking articles were manufactured using the smoking article filters of Comparative Examples 3 and 4 and Example 4, the hardness of the manufactured smoking article filters was measured, and results thereof are shown in Table 5 below.

[Calculation Formula 1]

$$\text{Filter hardness (\%)} = [D - a] / D \times 100$$

[0096] Here, D represents a filter diameter (mm), and a represents a distance (mm) the filter moves downward (is pressed) due to a 300-g weight. Measured values necessary to calculate the hardness of the cigarette filter may be obtained using a device generally used in the art, and for example, DHT 200™ of Filtrona Co., Ltd. may be used. In measuring hardness, the applied force takes into account a force actually applied when a smoker holds a cigarette. A hardness value of 85% or more obtained through the cigarette filter according to one embodiment of the present invention is technically significant in that it shows that hardness can be secured at a level that allows the cigarette filter according to one embodiment of the present invention, which uses lyocell tow, which is an eco-friendly material, to replace the conventional cigarette filter made of cellulose acetate.

[Table 5]

	Comparative Example 3	Comparative Example 4	Example 4
Hardness (%)	94.2	92.5	94.5

[0097] As shown in Table 5 above, it can be seen that the hardness of the smoking article filter is higher in the case of Example 4 in which the filter portion wrapper 30b was manufactured using grease-resistant hard wrapping paper, compared to Comparative Example 4 in which the filter portion wrapper 30b was manufactured using general hard wrapping paper. Further, it can be seen that, in the case of Example 4 in which a phenol reducing material was added to lyocell tow, hardness is maintained at a similar level compared to Comparative Example 3 in which a phenol reducing material was not added to lyocell tow.

[0098] Although embodiments of the present disclosure have been described above with reference to the accompanying drawings, those of ordinary skill in the art to which the present disclosure pertains should understand that the present disclosure may be embodied in other specific forms without changing the technical spirit or essential features thereof. Therefore, the embodiments described above should be understood as being illustrative, instead of limiting, in all aspects. The protection scope of the present disclosure should be interpreted by the claims below, and any technical spirit within the scope equivalent to the claims should be interpreted as falling within the scope of rights of the technical spirit defined by the present disclosure.

Claims

1. A smoking article filter comprising:

a filter portion including lyocell tow including lyocell fibers and a phenol reducing material dispersed in the lyocell tow; and
a filter portion wrapper wrapped around the filter portion and treated to be grease-resistant,
wherein the filter portion wrapper has a basis weight ranging from 30 gsm to 180 gsm.

5 2. The smoking article filter of claim 1, wherein the phenol reducing material includes at least one or more of triethyl citrate (TEC), polyethylene glycol (PEG), and triacetin (TA).

10 3. The smoking article filter of claim 1, wherein the filter portion wrapper has a basis weight ranging from 40 gsm to 160 gsm.

4. The smoking article filter of claim 3, wherein the filter portion wrapper has a basis weight ranging from 70 gsm to 150 gsm.

15 5. The smoking article filter of claim 1, wherein a hardness of the filter portion ranges from 93% to 99%.

6. The smoking article filter of claim 1, wherein the filter portion wrapper has a grease resistance of 8 or more based on a 3M Kit Test.

20 7. The smoking article filter of claim 1, wherein:

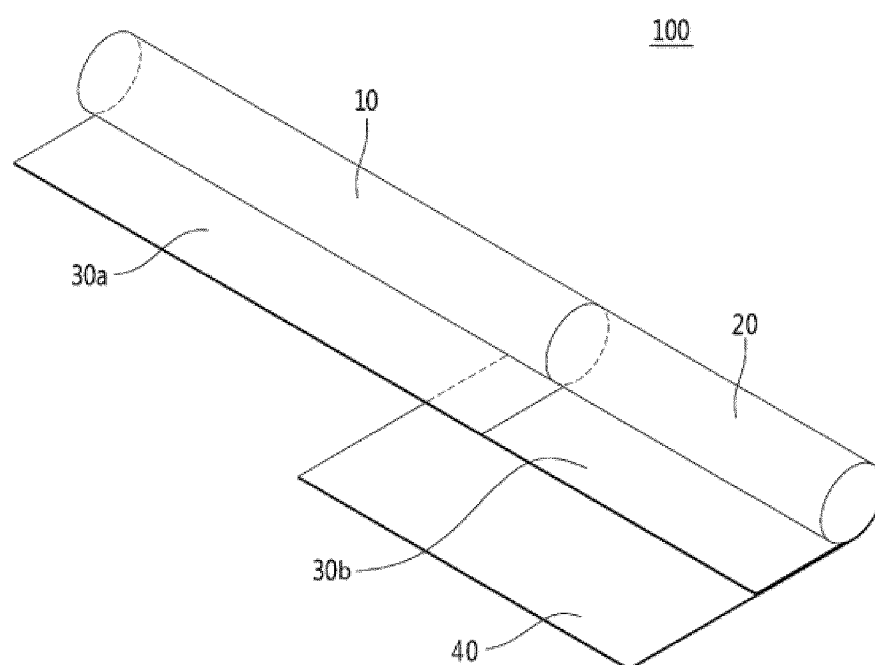
25 a rate at which the phenol reducing material is delivered to the filter portion wrapper ranges from 1% to 13%;
the rate at which the phenol reducing material is delivered to the filter portion wrapper is defined as a percentage value of a weight of the phenol reducing material included in the filter portion wrapper to the overall weight of the phenol reducing material included in the smoking article filter; and
the overall weight of the phenol reducing material included in the smoking article filter is a sum of a weight of the phenol reducing material included in the filter portion and the weight of the phenol reducing material included in the filter portion wrapper.

30 8. The smoking article filter of claim 7, wherein the rate at which the phenol reducing material is delivered to the filter portion wrapper ranges from 2% to 5%.

9. A smoking article comprising:

35 a smoking material portion; and
a smoking article filter disposed downstream of the smoking material portion, wherein the smoking article filter includes a filter portion including lyocell tow including lyocell fibers and a phenol reducing material dispersed in the lyocell tow and a filter portion wrapper wrapped around the filter portion and treated to be grease-resistant, and the filter portion wrapper has a basis weight ranging from 30 gsm to 180 gsm.

FIG. 1



INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER

A24D 3/06(2006.01)i; A24D 3/10(2006.01)i; A24D 3/02(2006.01)i; A24D 3/04(2006.01)i; A24D 1/04(2006.01)i;
A24D 1/02(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)

A24D 3/06(2006.01); A24D 3/02(2006.01); A24D 3/10(2006.01); D01D 5/088(2006.01); D01F 2/00(2006.01);
D21H 27/08(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(smoking), 필터(filter), 라이오셀(lyocell), 세그먼트(segment), 페놀(phenol)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2022-018180 A1 (DELFORTGROUP AG) 27 January 2022 (2022-01-27) See claims 1-24; and page 8.	1-9
Y	KR 10-2014-0051910 A (DELFORTGROUP AG) 02 May 2014 (2014-05-02) See claims 1 and 2; and paragraph [0026].	1-9
Y	KR 10-2016-0002603 A (KOLON INDUSTRIES, INC. et al.) 08 January 2016 (2016-01-08) See claim 11; and paragraph [0067].	5
A	KR 10-2016-0104962 A (KT & G CORPORATION et al.) 06 September 2016 (2016-09-06) See entire document.	1-9
A	KR 10-2000-0068304 A (WEYERHAEUSER COMPANY) 25 November 2000 (2000-11-25) See entire document.	1-9

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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“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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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2024/001514

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
WO 2022-018180 A1	27 January 2022	BR 112023000478 A2	31 January 2023
		CN 116133538 A	16 May 2023
		DE 102020119388 A1	27 January 2022
		DE 102020119388 B4	17 August 2023
		EP 4064884 A1	05 October 2022
		JP 2023-534469 A	09 August 2023
		KR 10-2023-0043104 A	30 March 2023
		US 2023-0284678 A1	14 September 2023
KR 10-2014-0051910 A	02 May 2014	BR 112013032652 A2	24 January 2017
		BR 112013032652 B1	09 March 2021
		CN 103717803 A	09 April 2014
		CN 103717803 B	14 October 2015
		EP 2551407 A1	30 January 2013
		EP 2551407 B1	19 June 2013
		ES 2421621 T3	04 September 2013
		JP 2014-525995 A	02 October 2014
		MY 159314 A	30 December 2016
		PL 2551407 T3	29 November 2013
		US 2014-0137880 A1	22 May 2014
		US 2015-0059996 A1	05 March 2015
		US 8939155 B2	27 January 2015
		US 9115471 B2	25 August 2015
		WO 2013-013786 A1	31 January 2013
KR 10-2016-0002603 A	08 January 2016	CN 106661768 A	10 May 2017
		CN 106661768 B	07 May 2019
		EP 3162925 A1	03 May 2017
		EP 3162925 A4	14 March 2018
		EP 3162925 B1	05 June 2019
		JP 2017-520689 A	27 July 2017
		JP 6495344 B2	03 April 2019
		KR 10-2211219 B1	03 February 2021
		US 11103003 B2	31 August 2021
		US 2017-0156394 A1	08 June 2017
		WO 2016-003145 A1	07 January 2016
KR 10-2016-0104962 A	06 September 2016	KR 10-1765291 B1	04 August 2017
KR 10-2000-0068304 A	25 November 2000	CN 100343427 C	17 October 2007
		CN 100402741 C	16 July 2008
		CN 100460594 C	11 February 2009
		CN 1081684 C	27 March 2002
		CN 1108401 C	14 May 2003
		CN 1191395 C	02 March 2005
		CN 1200152 C	04 May 2005
		CN 1219918 C	21 September 2005
		CN 1219919 C	21 September 2005
		CN 1224736 C	26 October 2005
		CN 1230579 C	07 December 2005
		CN 1238015 A	08 December 1999
		CN 1244734 C	08 March 2006
		CN 1293723 A	02 May 2001
		CN 1306111 C	21 March 2007

Form PCT/ISA/210 (patent family annex) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2024/001514

5

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
		CN 1348023 A	08 May 2002
		CN 1356412 A	03 July 2002
		CN 1356413 A	03 July 2002
		CN 1356414 A	03 July 2002
		CN 1425081 A	18 June 2003
		CN 1432087 A	23 July 2003
		CN 1446953 A	08 October 2003
		CN 1446954 A	08 October 2003
		CN 1446955 A	08 October 2003
		CN 1505703 A	16 June 2004
		CN 1517487 A	04 August 2004
		CN 1517490 A	04 August 2004
		CN 1517491 A	04 August 2004
		CN 1519424 A	11 August 2004
		CN 1522317 A	18 August 2004
		EP 0920548 A1	09 June 1999
		EP 0920548 B1	02 October 2002
		EP 1068376 A1	17 January 2001
		EP 1068376 B1	26 November 2003
		EP 1285110 A1	26 February 2003
		EP 1287191 A1	05 March 2003
		EP 1287191 B1	24 October 2007
		EP 1311717 A2	21 May 2003
		EP 1311717 B1	09 August 2006
		EP 1362935 A1	19 November 2003
		EP 1362935 B1	26 January 2011
		EP 1402092 A1	31 March 2004
		EP 1435403 A1	07 July 2004
		EP 1435403 B1	30 November 2005
		EP 1435404 A1	07 July 2004
		EP 1435404 B1	08 March 2006
		EP 1437428 A1	14 July 2004
		EP 1437428 B1	30 November 2005
		EP 1437428 B2	27 February 2008
		EP 1441050 A1	28 July 2004
		EP 1441050 B1	23 January 2008
		JP 2001-501260 A	30 January 2001
		JP 2002-506931 A	05 March 2002
		JP 2003-531313 A	21 October 2003
		JP 2003-532806 A	05 November 2003
		JP 2003-533602 A	11 November 2003
		JP 2004-211280 A	29 July 2004
		JP 2004-211281 A	29 July 2004
		JP 2004-211282 A	29 July 2004
		JP 2004-211283 A	29 July 2004
		JP 2007-046223 A	22 February 2007
		JP 2009-019326 A	29 January 2009
		JP 2012-046861 A	08 March 2012
		JP 2014-074261 A	24 April 2014
		JP 3965153 B2	29 August 2007

Form PCT/ISA/210 (patent family annex) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2024/001514

5

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
		JP 3965154 B2	29 August 2007
		JP 4012878 B2	21 November 2007
		JP 4015109 B2	28 November 2007
		JP 4018152 B2	05 December 2007
		JP 4134209 B2	20 August 2008
		JP 4593865 B2	08 December 2010
		JP 5491477 B2	14 May 2014
		JP 5752215 B2	22 July 2015
		KR 10-0471549 B1	07 March 2005
		KR 10-0547710 B1	31 January 2006
		KR 10-0558501 B1	07 March 2006
		KR 10-0558502 B1	07 March 2006
		KR 10-0564515 B1	29 March 2006
		KR 10-0564516 B1	29 March 2006
		KR 10-0566200 B1	29 March 2006
		KR 10-0676572 B1	30 January 2007
		KR 10-0750008 B1	16 August 2007
		KR 10-0834248 B1	30 May 2008
		KR 10-2001-0041615 A	25 May 2001
		KR 10-2002-0091205 A	05 December 2002
		KR 10-2003-0004395 A	14 January 2003
		KR 10-2003-0013421 A	14 February 2003
		KR 10-2003-0092092 A	03 December 2003
		KR 10-2004-0062397 A	07 July 2004
		KR 10-2004-0062398 A	07 July 2004
		KR 10-2004-0062399 A	07 July 2004
		KR 10-2004-0062400 A	07 July 2004
		US 2001-0028955 A1	11 October 2001
		US 2002-0034638 A1	21 March 2002
		US 2002-0036070 A1	28 March 2002
		US 2002-0037407 A1	28 March 2002
		US 2002-0041961 A1	11 April 2002
		US 2002-0060382 A1	23 May 2002
		US 2002-0064654 A1	30 May 2002
		US 2002-0076556 A1	20 June 2002
		US 2002-0081428 A1	27 June 2002
		US 2002-0088572 A1	11 July 2002
		US 2002-0148050 A1	17 October 2002
		US 2002-0155292 A1	24 October 2002
		US 2002-0160186 A1	31 October 2002
		US 2003-0025251 A1	06 February 2003
		US 2003-0025252 A1	06 February 2003
		US 2003-0183351 A1	02 October 2003
		US 2003-0186053 A1	02 October 2003
		US 2003-0186054 A1	02 October 2003
		US 2003-0186055 A1	02 October 2003
		US 6210801 B1	03 April 2001
		US 6221487 B1	24 April 2001
		US 6235392 B1	22 May 2001
		US 6306334 B1	23 October 2001

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/KR2024/001514

5

10

15

20

25

30

35

40

45

50

55

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
		US 6331354 B1	18 December 2001
		US 6440523 B1	27 August 2002
		US 6440547 B1	27 August 2002
		US 6444314 B1	03 September 2002
		US 6471727 B2	29 October 2002
		US 6491788 B2	10 December 2002
		US 6511930 B1	28 January 2003
		US 6514613 B2	04 February 2003
		US 6528163 B2	04 March 2003
		US 6596033 B1	22 July 2003
		US 6605350 B1	12 August 2003
		US 6685856 B2	03 February 2004
		US 6686039 B2	03 February 2004
		US 6686040 B2	03 February 2004
		US 6692827 B2	17 February 2004
		US 6706237 B2	16 March 2004
		US 6706876 B2	16 March 2004
		US 6773648 B2	10 August 2004
		US 6797113 B2	28 September 2004
		US 6861023 B2	01 March 2005
		US 7067444 B2	27 June 2006
		US 7083704 B2	01 August 2006
		US 7090744 B2	15 August 2006
		WO 01-088236 A3	27 February 2003
		WO 01-81664 A1	01 November 2001
		WO 01-86043 A1	15 November 2001
		WO 01-88236 A2	22 November 2001
		WO 02-086206 A1	31 October 2002
		WO 98-07911 A1	26 February 1998
		WO 99-47733 A1	23 September 1999

Form PCT/ISA/210 (patent family annex) (July 2022)