(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 406 427 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
31.07.2024 Bulletin 2024/31

(21) Application number: **23788446.5**

(22) Date of filing: **03.02.2023**

(51) International Patent Classification (IPC):
A24D 3/06 *(2006.01)* ***A24D 3/10*** *(2006.01)*
A24D 3/14 *(2006.01)* ***A24D 3/02*** *(2006.01)*
A24D 1/02 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
A24D 1/02; A24D 3/02; A24D 3/06; A24D 3/10; A24D 3/14

(86) International application number:
PCT/KR2023/001566

(87) International publication number:
WO 2023/200091 (19.10.2023 Gazette 2023/42)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **14.04.2022 KR 20220046164**

(71) Applicants:
- **KT & G Corporation**
  Daejeon 34337 (KR)
- **Kolon Industries, Inc.**
  Seoul 07793 (KR)

(72) Inventors:
- **HA, Sung Hoon**
  Daejeon 34128 (KR)
- **MA, Kyeng Bae**
  Daejeon 34128 (KR)
- **YANG, Jin Chul**
  Daejeon 34128 (KR)
- **LEE, Jun Hui**
  Daejeon 34128 (KR)
- **CHEONG, Bong Su**
  Daejeon 34128 (KR)
- **SEO, Seung Dong**
  Gumi-si, Gyeongsangbuk-do 39366 (KR)
- **LEE, Jeong Hun**
  Gumi-si, Gyeongsangbuk-do 39366 (KR)
- **JEONG, Jong Cheol**
  Gumi-si, Gyeongsangbuk-do 39366 (KR)
- **JIN, Sang Woo**
  Gumi-si, Gyeongsangbuk-do 39366 (KR)
- **HWANG, Yeong Nam**
  Gumi-si, Gyeongsangbuk-do 39366 (KR)

(74) Representative: **Ter Meer Steinmeister & Partner Patentanwälte mbB**
Nymphenburger Straße 4
80335 München (DE)

(54) CIGARETTE FILTER COMPRISING LYOCELL TOW AND MANUFACTURING METHOD THEREOF

(57) A cigarette filter which includes lyocell tow made of a plurality of lyocell fibers and a binder configured to bond the lyocell fibers to each other is provided. The cigarette filter according to one embodiment of the present disclosure reduces each of tar and nicotine, which are delivered through cigarette smoke, 70 wt% to 95 wt%. The cigarette filter according to one embodiment of the present disclosure has a resistance to draw of 80 mmWG to 200 mmWG. The cigarette filter according to one embodiment of the present disclosure is filled with the lyocell tow at a packing density of 0.2 g/mL to 0.6 g/mL. The cigarette filter according to one embodiment of the present disclosure addresses basic material-related problems, such as low hardness, of the lyocell tow and, further, has excellent filtration functionality as a filter.

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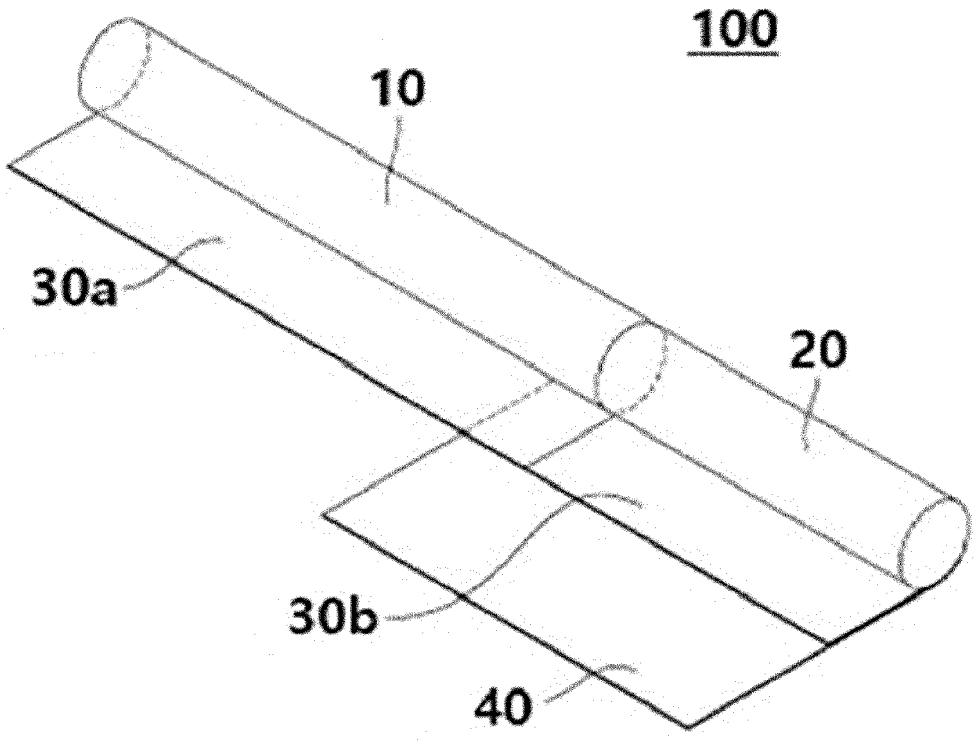
FIG. 1



Description

[Technical Field]

[0001] The present disclosure relates to a cigarette filter including lyocell tow and a production method thereof, and more particularly, to a cigarette filter which includes lyocell tow and a binder and has an excellent effect of reducing tar and nicotine and a method of producing the cigarette filter.

[Background Art]

[0002] Generally, in order to manufacture a cigarette, first, various types of tobacco leaves are mixed and processed to have a desired flavor and taste. Then, the processed tobacco leaves are cut to produce cut tobacco leaves, and the cut tobacco leaves are wrapped by cigarette paper to produce a filter-free cigarette. Next, a filter is attached to the filter-free cigarette as necessary.

[0003] The cigarette paper may be produced using flax, wood pulp, and the like, and combustibility and the taste of tobacco are required to be maintained during burning of the cigarette. A cigarette filter may include activated carbon, a flavoring material, and the like, may be made of a mono-filter or a multi-filter, and is wrapped by cigarette filter wrapping paper. A cut tobacco leaf portion and the cigarette filter may be connected by tipping paper, and the tipping paper may include fine holes.

[0004] General cigarette filters use cellulose acetate tow in which cellulose extracted from wood pulp is acetylated. As an alternative material thereof, for example, development of tow using lyocell fibers in which the cellulose itself is fiberized, unlike in cellulose acetate, is progressing.

[0005] In a case in which a cigarette filter is manufactured using tow using the lyocell fibers, the hardness of the cigarette filter is low and thus is unsuitable, and it is necessary to improve the hardness of the tow for the tow to be utilized as the cigarette filter. Examples of a method of improving the hardness of the filter include a method using a hardener and a method using a plasticizer. The method using a hardener is a method in which the fiber strands are bonded using a binder-like material to impart hardness to the filter, thus hardening the filter. The method using a plasticizer is a method in which the fibers themselves are partially dissolved or plasticized using a specific material to form bonding points between the fibers and then the fibers are plasticized. The conventional cellulose acetate utilizes a plasticizer (triacetin or triethyl citrate). However, since there is currently no plasticizer for lyocell fibers, the hardness thereof is improved by utilizing a hardener in most cases.

[0006] As described above, insufficient physical properties of lyocell fibers, such as insufficient hardness, may be improved by utilizing an additional additive or the like. However, unlike cellulose acetate whose functionality as a cigarette filter has been confirmed, when lyocell fibers, which is a novel material, are applied to an actual cigarette filter, there is a need to examine the inherent filtration functionality of the cigarette filter.

[0007] The inventors of the present disclosure have completed the present disclosure after recognizing the technical challenge with regards to the filtration functionality of the cigarette filter to which the lyocell fibers are applied and carrying out continuous research on ways to more appropriately apply the lyocell fibers to secure such functionality.

[Disclosure]/[Technical Problem]

[0008] The present disclosure is directed to providing a cigarette filter including lyocell tow as an eco-friendly material and capable of addressing basic material-related problems, such as low hardness, of the lyocell tow and having improved filtration functionality as a filter.

[Technical Solution]

[0009] A first aspect of the present disclosure provides a cigarette filter which includes lyocell tow made of a plurality of lyocell fibers and a binder configured to bond the lyocell fibers to each other.

[0010] In one embodiment of the present disclosure, tar and nicotine delivered through cigarette smoke may each be reduced 70 wt% to 95 wt%.

[0011] In one embodiment of the present disclosure, the cigarette filter may have a resistance to draw of 80 mmWG to 200 mmWG.

[0012] In one embodiment of the present disclosure, the cigarette filter may be filled with the lyocell tow at a packing density of 0.2 g/mL to 0.6 g/mL.

[0013] In one embodiment of the present disclosure, the binder may be hydroxypropyl methylcellulose, hydroxypropyl cellulose, polyvinyl alcohol, ethylene vinyl acetate, polyvinyl acetate, polyvinylpyrrolidone, polyester, or a combination thereof.

[0014] In one embodiment of the present disclosure, the binder may be included at 0.1 parts by weight to 5 parts by weight based on 100 parts by weight of the lyocell tow.

[0015] In one embodiment of the present disclosure, the cigarette filter may further include a binder solvent, and the binder solvent may be water, a monohydric alcohol, a polyhydric alcohol, or a combination thereof.

[0016] In one embodiment of the present disclosure, the monohydric alcohol may be methanol, ethanol, propanol, or a combination thereof.

[0017] In one embodiment of the present disclosure, the polyhydric alcohol may be a diol having a C1-C4 alkylene group.

[0018] In one embodiment of the present disclosure, the polyhydric alcohol may be included at 0.5 parts by weight to 25 parts by weight based on 100 parts by weight of the lyocell tow.

[0019] A second aspect of the present disclosure provides a method of producing the above-described cigarette filter, the method including using a plurality of lyocell fibers to produce lyocell tow, mixing a binder and a solvent to prepare a binder solution, performing drying after spraying the binder solution on the lyocell tow, and wrapping the lyocell tow, in which the lyocell fibers are bonded by the binder, with wrapping paper to produce the cigarette filter.

[Advantageous Effects]

[0020] While including lyocell tow which is an eco-friendly material, a cigarette filter according to one embodiment of the present disclosure overcomes existing, material-related problems of lyocell tow and has excellent hardness.

[0021] The cigarette filter according to one embodiment of the present disclosure has a better effect of reducing tar and nicotine than the conventional cellulose acetate cigarette filter.

[0022] The effect of reducing tar and nicotine can be achieved just by replacing an existing cigarette filter with the cigarette filter according to one embodiment of the present disclosure without controlling other components such as a smoking material portion or wrapping paper when producing a cigarette that delivers tar and nicotine at a certain level or lower according to a smoker's preferences. Thus, processability or the like can be improved when producing the product.

[Description of Drawings]

[0023] FIG. 1 is a view illustrating a schematic configuration of a smoking article according to one embodiment of the present disclosure.

[Modes of the Invention]

[0024] Hereinafter, embodiments will be described in detail with reference to the illustrative drawings. 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 embodiments, when detailed description of a known related configuration or function is considered to hinder the understanding of the embodiments, the detailed description thereof will be omitted.

[0025] Also, in describing components of the embodiments, terms such as first, second, A, B, (a), and (b) may be used. Such terms are only 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.

[0026] A component including a common function with a component included in any one embodiment will be described using the same name in another embodiment. Unless the context clearly indicates otherwise, description made in any one embodiment may apply to another embodiment and a repeated description will be omitted.

[0027] In this specification, a "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, cut tobacco leaves, and reconstituted tobacco. A smoking material may include a volatile compound. The smoking article may include several segments each having functionality, and such segments are indicated as "... portions." In this specification, the smoking article may not only be a combustion-type cigarette but also be a heating-type cigarette used together with an aerosol generation device (not illustrated) such as an electronic cigarette device.

[0028] In this specification, the terms "upstream" and "downstream" are terms used to indicate relative positions of segments constituting a smoking article, based on a direction in which a user draws air using the smoking article. The smoking article includes an upstream end portion (that is, a portion through which air enters) and a downstream end portion (that is, a portion through which air exits) opposite the upstream end portion. When using the smoking article, the user may hold the downstream end portion of the smoking article in his/her mouth. The downstream end portion is

disposed downstream of the upstream end portion. Meanwhile, the term "end portion" may also be replaced with the term "end."

[0029] The present disclosure relates to a cigarette filter that may be applied to a smoking article. According to one embodiment of the present disclosure, the cigarette filter includes lyocell tow made of a plurality of lyocell fibers and a binder configured to bond the lyocell fibers to each other. The lyocell fibers are eco-friendly fibers made of cellulose extracted from wood pulp. The lyocell tow refers to a bundle formed by cross-linking adjacent lyocell fibers. According to one embodiment of the present disclosure, the lyocell fibers may have a size in a range of 1.0 denier to 12.0 denier. According to one embodiment of the present disclosure, the lyocell fiber bundle constituting the lyocell tow may have a size in a range of 15,000 denier to 45,000 denier. A binder suitable for the lyocell fibers may be mixed with a solvent to prepare a binder solution, and the binder solution may be sprayed on the lyocell tow and then dried so that the lyocell tow is formed with a structure having a certain level of hardness or higher.

[0030] The cigarette filter according to one embodiment of the present disclosure has an excellent effect of reducing tar and nicotine delivered through cigarette smoke. Cellulose acetate is a material that has been used for a long time as a cigarette filter material in the art, and performance of a cigarette filter using cellulose acetate may be one standard in evaluating the performance of a cigarette filter in the art. When produced to have the same resistance to draw, the cigarette filter according to one embodiment of the present disclosure has a better effect of reducing tar and nicotine than a cigarette filter using cellulose acetate. Specifically, the content of tar and nicotine components in smoke that has passed through the cigarette filter according to one embodiment of the present disclosure is less than 90 wt% based on the content of tar and nicotine in smoke that has passed through the cigarette filter using cellulose acetate. Since material characteristics of the lyocell fiber material do not necessarily ensure that the lyocell fiber material has a better effect of reducing tar and nicotine than the cellulose acetate material, the cigarette filter according to one embodiment of the present disclosure has technical significance in the art.

[0031] The cigarette filter according to one embodiment of the present disclosure reduces each of tar and nicotine delivered through cigarette smoke 70 wt% to 95 wt%. The reduction rate is a value obtained by comparing weights of tar and nicotine in cigarette smoke before and after the cigarette smoke passes through the cigarette filter. Specifically, the tar and nicotine reduction rate may be 70 wt% or more, 72 wt% or more, 74 wt% or more, 76 wt% or more, 78 wt% or more, 80 wt% or more, 82 wt% or more, 84 wt% or more, 86 wt% or more, 95 wt% or less, 94 wt% or less, 93 wt% or less, 92 wt% or less, 91 wt% or less, or 90 wt% or less. In a case in which tar and nicotine in cigarette smoke are reduced by the above range, tar and nicotine may be at a level suitable for smoking by a smoker.

[0032] The cigarette filter according to one embodiment of the present disclosure has a resistance to draw of 80 mmWG to 200 mmWG. The resistance to draw refers to the static pressure difference between the two ends of a sample when it is traversed by an air flow under a normal condition in which a volumetric flow rate is 17.5 mm per second at a discharge end. The resistance to draw may be measured using the method defined in ISO 6565:2002. Specifically, the resistance to draw may be 80 mmWG or higher, 85 mmWG or higher, 90 mmWG or higher, 95 mmWG or higher, 100 mmWG or higher, 200 mmWG or lower, 190 mmWG or lower, 180 mmWG or lower, 170 mmWG or lower, 160 mmWG or lower, or 150 mmWG or lower and may be in a range of 80 mmWG to 200 mmWG, 90 mmWG to 180 mmWG, or 100 mmWG to 150 mmWG. Within the above range, the tar and nicotine reduction functionality of the cigarette filter including lyocell tow may be further improved.

[0033] The cigarette filter according to one embodiment of the present disclosure is filled with the lyocell tow at a packing density of 0.2 g/mL to 0.6 g/mL. The hardness or filtration performance of the filter may be improved with an increase in the packing density of the lyocell tow, but the packing density may be controlled to an appropriate level because a high packing density may block an air flow path in the cigarette. Specifically, the packing density may be 0.2 g/mL or higher, 0.22 g/mL or higher, 0.24 g/mL or higher, 0.26 g/mL or higher, 0.28 g/mL or higher, 0.3 g/mL or higher, 0.6 g/mL or lower, 0.58 g/mL or lower, 0.56 g/mL or lower, 0.54 g/mL or lower, 0.52 g/mL or lower, or 0.5 g/mL or lower and may be in a range of 0.2 g/mL to 0.6 g/mL, 0.24 g/mL to 0.56 g/mL, or 0.3 g/mL to 0.5 g/mL. Within the above range, the tar and nicotine reduction functionality of the cigarette filter including lyocell tow may be further improved.

[0034] Although the above-described packing density may be a result of taking the resistance to draw of the cigarette filter as well as the tar and nicotine reduction effect thereof into consideration, since the hardness of the cigarette filter may be low at the above packing density, a separate hardness improver is required. As one type of hardness improver, a binder may be used, and the binder bonds the lyocell fibers to each other to impart a certain level of hardness or higher to the lyocell tow. Any ordinary material known in the art that is suitable for application to the lyocell fibers may be freely used as the binder. According to one embodiment of the present disclosure, hydroxypropyl methylcellulose (HPMC), hydroxypropyl cellulose (HPC), polyvinyl alcohol (PVA), ethylene vinyl acetate (EVA), polyvinyl acetate (PVAc), polyvinylpyrrolidone (PVP), polyester, or a combination thereof may be used as the binder. Specifically, HPMC, polyester, or a combination thereof may be used as the binder.

[0035] The polyester is a synthetic resin formed by a reaction between a polyfunctional organic acid and a polyhydric alcohol and has appropriate resistance against water and various compounds. According to one embodiment of the present disclosure, the polyester is a copolymer of an aromatic monomer and an aliphatic monomer. The aromatic

monomer adds structural stability to the polyester, and the aliphatic monomer adds structural flexibility to the polyester, such that, the polyester including the aromatic monomer and the aliphatic monomer may easily adhere to other components such as the lyocell fibers and add functionality as a binder. The aromatic monomer may be a polyfunctional organic acid or polyhydric alcohol, and likewise, the aliphatic monomer may be a polyfunctional organic acid or polyhydric alcohol.

[0036] According to one embodiment of the present disclosure, the aromatic monomer is a dicarboxylic acid having a C5-C12 arylene group or heteroarylene group. As an example, the dicarboxylic acid having a C5-C12 arylene group or heteroarylene group may be phthalic acid, terephthalic acid, or isophthalic acid. According to one embodiment of the present disclosure, the aliphatic monomer is a diol having a C1-C6 alkylene group, a dicarboxylic acid having a C2-C12 alkylene group, or a combination thereof. As an example, the diol having a C1-C6 alkylene group may be ethylene glycol, and the dicarboxylic acid having a C2-C12 alkylene group may be sebacic acid. For polyester that can be formed by a condensation reaction between a carboxylic acid group and a hydroxyl group at a 1:1 ratio, as a monomer having a carboxylic acid group, the dicarboxylic acid having a C5-C12 arylene group or heteroarylene group, the dicarboxylic acid having a C2-C12 alkylene group, or a combination thereof may be used, and as a monomer having a hydroxyl group, the diol having a C1-C6 alkylene group may be used. The arylene group, heteroarylene group, or alkylene group is present in a substituted or unsubstituted state, and in the case of the substituted state, a substituent generally known in the art, such as a C1-C4 alkyl group, a C1-C4 alkoxy group, or a halogen group, may be substituted in the main chain of the arylene group, heteroarylene group, or alkylene group.

[0037] The binder may be applied to the lyocell tow in the form of a binder solution together with the solvent, and even when the lyocell tow is dried or left for a long time after the binder is applied thereto, the binder is positioned in between the lyocell fibers without leaking and improves the hardness of the lyocell tow. According to one embodiment of the present disclosure, the binder is included at 0.1 parts by weight to 5 parts by weight based on 100 parts by weight of the lyocell tow. Specifically, the content of the binder may be 0.1 parts by weight or more, 0.2 parts by weight or more, 0.3 parts by weight or more, 0.4 parts by weight or more, 5 parts by weight or less, 4.5 parts by weight or less, 4 parts by weight or less, 3.5 parts by weight or less, 3 parts by weight or less, or 2.5 parts by weight or less and may be in a range of 0.1 parts by weight to 5 parts by weight, 0.2 parts by weight to 4 parts by weight, or 0.3 parts by weight to 3 parts by weight. When applied within the above range, the binder may increase the hardness of the lyocell tow to an appropriate level while not degrading the basic function of the lyocell tow as a filter.

[0038] The solvent included in the cigarette filter is basically included in the binder solution to disperse the binder, and some of the solvent is removed when the lyocell tow is dried or left for a long time after the binder solution is sprayed on the lyocell tow. Water may be basically used as the solvent of the binder solution. A large amount of water as compared to the amount of binder may be used to dissolve the binder, but most of the water is removed by drying. Since the lyocell fibers are known as a hydrophilic material unlike cellulose acetate which is hydrophobic, moisture may adversely affect hardness. In order to compensate for the negative influence, the binder solution may be used along with water, or an alcohol component or the like may be used to replace water.

[0039] According to one embodiment of the present disclosure, the solvent includes a monohydric alcohol which is methanol, ethanol, propanol, or a combination thereof. The monohydric alcohol is a component that is more volatile than water, and a large amount of the monohydric alcohol may be lost after drying. However, in a case in which the lyocell tow is stored at room temperature without undergoing a drying process, a certain amount or higher of the monohydric alcohol may be detected in the final cigarette filter. The monohydric alcohol may not only replace water in the solvent of the binder solution and thus help improve the hardness of the cigarette filter, but also express additionally functionality when applied to the lyocell tow due to having sterilizing power. According to one embodiment of the present disclosure, the monohydric alcohol is included at 1 part by weight to 500 parts by weight based on 10,000 parts by weight of the lyocell tow. Since the monohydric alcohol is more volatile than polyhydric alcohol or water, the content of the monohydric alcohol is highly variable. However, in a case in which the drying process is reduced and the lyocell tow is stored at room temperature according to one embodiment of the present disclosure, since a certain amount or higher of the monohydric alcohol may be detected as compared to when the monohydric alcohol is not added, a lower limit of the above content range is considered more meaningful than the upper limit.

[0040] According to one embodiment of the present disclosure, the solvent includes a polyhydric alcohol. Here, the polyhydric alcohol refers to a compound including two or more hydroxyl groups. The polyhydric alcohol serves as a release agent during processing of the lyocell tow using a mechanical roll or the like, which is performed to apply the lyocell tow to the cigarette filter. Specifically, in a case in which the lyocell tow is processed using a mechanical roll or the like without a release agent, a phenomenon in which the lyocell tow is rolled around the mechanical roll or the like due to the adhesive strength of the binder or the like may occur. With the lyocell tow including a polyhydric alcohol, the occurrence of such a phenomenon may be reduced, and processability may be increased. Also, when applied to the lyocell tow, the polyhydric alcohol is positioned in between the lyocell fibers together with the binder and helps improve the hardness of the lyocell tow within a short time even when drying is not performed for a long time at a particularly high temperature. Accordingly, in a case in which the solvent including the polyhydric alcohol is used, since the drying time can be significantly shortened, processability in the production of the cigarette filter can be increased.

[0041] According to one embodiment of the present disclosure, the polyhydric alcohol is a diol having a C1-C4 alkylene group. The diol refers to a compound having two hydroxyl groups and is also referred to as a glycol. The two hydroxyl groups may be connected by the C1-C4 alkylene group, and here, the carbon number of the alkylene group refers to the number of carbons directly connected between the two hydroxyl groups. The alkylene group is present in a substituted or unsubstituted state, and in the case of the substituted state, a substituent generally known in the art, such as a C1-C3 alkyl group, a C1-C3 alkoxy group, or a halogen group, may be substituted in the main chain of the alkylene group. According to one embodiment of the present disclosure, the polyhydric alcohol may be propylene glycol. The propylene glycol is a polyhydric alcohol having a chain of an appropriate length and may be a more desirable compound due to having the above-described functionality.

[0042] The polyhydric alcohol may be applied to the lyocell tow in the form of a binder solution together with the binder and other solvents. The polyhydric alcohol remains unchanged in the lyocell tow or the cigarette filter to which the lyocell tow is applied even before and after drying is performed, thus imparting the above-described functionality, such as improving the processability as well as the hardness. According to one embodiment of the present disclosure, the polyhydric alcohol is included at 0.5 parts by weight to 25 parts by weight based on 100 parts by weight of the lyocell tow. Specifically, the content of the polyhydric alcohol may be 0.5 parts by weight or more, 0.6 parts by weight or more, 0.7 parts by weight or more, 0.8 parts by weight or more, 0.9 parts by weight or more, 1 part by weight or more, 25 parts by weight or less, 20 parts by weight or less, 15 parts by weight or less, 10 parts by weight or less, or 5 parts by weight or less and may be in a range of 0.5 parts by weight to 10 parts by weight, 0.7 parts by weight to 7 parts by weight, or 1 part by weight to 5 parts by weight. When applied within the above range, the polyhydric alcohol may impart additional functionality to the cigarette filter while not degrading the basic function of the lyocell tow as a filter.

[0043] The cigarette filter including the lyocell tow according to one embodiment of the present disclosure has excellent hardness due to the lyocell fibers being bonded by the binder. According to one embodiment of the present disclosure, the cigarette filter has a hardness of 85% or higher. Specifically, the hardness of the cigarette filter may be 85% or higher, 86% or higher, 87% or higher, 88% or higher, or 89% or higher. The hardness of the cigarette filter is a numerical value of a degree to which a diameter of the cigarette filter is maintained when the cigarette filter is pressed with a force of a certain magnitude in a vertical direction. Specifically, the hardness of the cigarette filter may be calculated by Equation 1 below.

[Equation 1]

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

[0044] 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. For example, Filtrona's DHT 200™ may be used. In measuring the hardness, the force applied takes into consideration an actual force applied when a smoker grips a cigarette. The hardness value of 85% or higher that is obtained through the cigarette filter according to one embodiment of the present disclosure has technical significance in that it shows hardness can be secured at a level that the conventional cigarette filter made of cellulose acetate can be replaced with the cigarette filter made of the lyocell tow which is an eco-friendly material. Also, with the cigarette filter according to one embodiment of the present disclosure, an excellent hardness value of 85% or higher may be implemented as described above even after the elapse of time sufficient for the binder to settle at room temperature without undergoing a drying process at high temperature. Thus, the processability in product manufacturing can be significantly improved.

[0045] The cigarette filter described above may be produced through the following production method. The production method includes using lyocell fibers to produce lyocell tow, mixing a binder and a solvent to prepare a binder solution, performing drying after spraying the binder solution on the lyocell tow, and wrapping the lyocell tow, in which the lyocell fibers are bonded by the binder, with wrapping paper to produce the cigarette filter. Since the production method basically relates to a method of producing the cigarette filter described above, description of the content described in detail above will be omitted, and features of the production method will be described in more detail below.

[0046] First, a plurality of lyocell fibers are used to produce lyocell tow. The produced lyocell tow has the shape of a bundle formed by cross-linking adjacent lyocell fibers. Here, inflating the tow through blooming is additionally performed. When the tow is inflated through the blooming operation, a binder solution which is sprayed afterwards may easily penetrate between the lyocell fibers constituting the lyocell tow.

[0047] Then, a binder and a solvent are mixed to prepare a binder solution. The binder solution is a substance sprayed on the lyocell tow to improve functionality, such as hardness, of the lyocell tow. Since some components of the binder solution may be lost through the drying process after the binder solution is sprayed, the composition of the binder solution may differ from the composition of the components constituting the cigarette filter. Since the binder may be embodied according to the above-described content, and components of the binder are not particularly lost even after drying, the

amount of the binder supplied to the lyocell tow through spraying remains almost unchanged even in the final cigarette filter. The solvent includes water, and some of the water is lost in the drying process. In a case in which the binder solution is prepared using only the binder and water, the content obtained by excluding the content of the binder from the entire content of the binder solution is the content of water. According to one embodiment of the present disclosure, the binder is included at 5 parts by weight to 40 parts by weight based on 100 parts by weight of the binder solution. Specifically, the content of the binder may be 5 parts by weight or more, 6 parts by weight or more, 7 parts by weight or more, 8 parts by weight or more, 9 parts by weight or more, 10 parts by weight or more, 40 parts by weight or less, 35 parts by weight or less, 30 parts by weight or less, 25 parts by weight or less, or 20 parts by weight or less and may be in a range of 5 parts by weight to 40 parts by weight, 7 parts by weight to 30 parts by weight, or 10 parts by weight to 20 parts by weight. When the binder solution is formed with the content of the binder within the above range, it is easy to spray and apply the binder solution onto the lyocell tow.

[0048] In a case in which the solvent includes a polyhydric alcohol, the solvent includes water as well as a polyhydric alcohol. In a case in which the entire solvent is constituted by a polyhydric alcohol, the viscosity may be too high, and it may not be easy to disperse the binder. Water may be included as much as a remaining amount of a ratio occupied by the solvent such as a polyhydric alcohol and is partially lost in the drying process. According to one embodiment of the present disclosure, the polyhydric alcohol is included at 5 parts by weight to 50 parts by weight based on 100 parts by weight of the binder solution. Specifically, the content of the polyhydric alcohol may be 5 parts by weight or more, 6 parts by weight or more, 7 parts by weight or more, 8 parts by weight or more, 9 parts by weight or more, 10 parts by weight or more, 50 parts by weight or less, 45 parts by weight or less, 40 parts by weight or less, 35 parts by weight or less, or 30 parts by weight or less and may be in a range of 5 parts by weight to 50 parts by weight, 7 parts by weight to 40 parts by weight, or 10 parts by weight to 30 parts by weight. When applied within the above range, the polyhydric alcohol may impart additional functionality to the cigarette filter while not degrading the basic function of the lyocell tow as a filter.

[0049] The solvent may further include a monohydric alcohol. The monohydric alcohol is a component that is more volatile than water, and a large amount of the monohydric alcohol may be lost after drying. However, in a case in which the lyocell tow is stored at room temperature without undergoing a drying process, a certain amount or higher of the monohydric alcohol may be detected in the final cigarette filter. The monohydric alcohol is a component that can replace water in the solvent of the binder solution and may control the content of water in the final cigarette filter. According to one embodiment of the present disclosure, the monohydric alcohol is methanol, ethanol, propanol, or a combination thereof. Specifically, the monohydric alcohol may be ethanol.

[0050] The monohydric alcohol may be included at a certain level or higher in order to replace water. According to one embodiment of the present disclosure, the monohydric alcohol is included at 5 parts by weight to 60 parts by weight based on 100 parts by weight of the binder solution. Specifically, the content of the monohydric alcohol may be 5 parts by weight or more, 6 parts by weight or more, 7 parts by weight or more, 8 parts by weight or more, 9 parts by weight or more, 10 parts by weight or more, 60 parts by weight or less, 55 parts by weight or less, 50 parts by weight or less, 45 parts by weight or less, 40 parts by weight or less, 35 parts by weight or less, or 30 parts by weight or less and may be in a range of 5 parts by weight to 60 parts by weight, 7 parts by weight to 45 parts by weight, or 10 parts by weight to 30 parts by weight. When applied within the above range, the monohydric alcohol may reduce the content of water in the cigarette filter to a numerical value that is significant in terms of effects.

[0051] The binder solution prepared according to the above-described content is sprayed on the lyocell tow. The binder solution may be sprayed on the lyocell tow to an extent that material-related problems, such as low hardness, of the lyocell tow can be addressed while not degrading the basic function of the lyocell tow as a filter. According to one embodiment of the present disclosure, 5 parts by weight to 30 parts by weight of the binder solution based on 100 parts by weight of the lyocell tow is sprayed on the lyocell tow. Specifically, the amount of sprayed binder solution may be 5 parts by weight or more, 6 parts by weight or more, 7 parts by weight or more, 8 parts by weight or more, 9 parts by weight or more, 10 parts by weight or more, 30 parts by weight or less, 28 parts by weight or less, 26 parts by weight or less, 24 parts by weight or less, 22 parts by weight or less, or 20 parts by weight or less and may be in a range of 5 parts by weight to 30 parts by weight, 7 parts by weight to 24 parts by weight, or 10 parts by weight to 20 parts by weight. When the binder solution is sprayed within the above range, the functionality, such as hardness, of the lyocell tow can be improved. A method of spraying the binder solution may be a method generally used in the art and is not particularly limited. For example, nozzle spraying, brush spraying, electrospraying, or the like may be utilized to spray the binder solution.

[0052] After spraying the binder solution on the lyocell tow, the lyocell tow is dried to allow the binder to settle and the lyocell fibers to be bonded to each other by the binder. Such a drying process may be performed at room temperature or high temperature using a common method in the art. The lyocell tow, in which the lyocell fibers are bonded by the binder, is wrapped with wrapping paper to produce a cigarette filter. Using a mechanical roll, a cutter, or the like, the lyocell tow may be processed into dimensions suitable for application to the cigarette filter as necessary. The degree to which the cigarette filter is filled with the lyocell tow may be controlled according to the above-described content.

[0053] The cigarette filter described above may be applied to a smoking article. FIG. 1 is a view illustrating a schematic configuration of a smoking article according to one embodiment of the present disclosure. A smoking article 100 includes a smoking material portion 10 and a filter portion 20, and the cigarette filter described above is applied to the filter portion 20 of the smoking article 100. In the smoking article 100, the smoking material portion 10 is disposed upstream of the filter portion 20.

[0054] 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. The processed smoking material may be filled in the form of sheets or cut tobacco leaves in the smoking material portion 10. The smoking material portion 10 may have the form of a longitudinally extending rod whose length, circumference, and diameter are not particularly limited but may be controlled to sizes generally used in the art in consideration of the amount of filled smoking material, preferences of a user, or the like. 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 additives may be contained in the smoking material.

[0055] The filter portion 20 is disposed downstream of the smoking material portion 10 to serve 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 made of various materials or in various forms. The filter portion 20 according to one embodiment of the present disclosure basically includes the above-described cigarette filter including lyocell tow in which a plurality of lyocell fibers are bonded by a binder. The cigarette filter including the lyocell tow may partially or entirely replace the filter portion 20 of the conventional smoking article, and in a case in which the cigarette filter partially replaces the filter portion 20, a conventionally-used filter material may be used together. For example, as the conventional filter material, a cellulose acetate filter, a hollow tubular filter, or the like may be used.

[0056] The filter portion 20 is illustrated as a mono filter formed of a single filter in FIG. 1, but the present disclosure is not limited thereto. For example, the filter portion 20 may be provided as a dual filter which includes two acetate filters, a triple filter, or the like in order to increase filter efficiency. Also, although not illustrated, a crushable capsule (not illustrated), which has a structure in which a flavor-containing liquid filled therein is wrapped by a film, may be included inside the filter portion 20.

[0057] The outside of the smoking material portion 10 and the filter portion 20 may be wrapped with a wrapper 30a or 30b.

[0058] The smoking material portion 10 may be wrapped with a smoking material portion wrapper 30a. Some of the cigarette smoke generated in the combustion process of a general smoking material portion 10 is released into the atmosphere through the smoking material portion wrapper 30a before passing through a cigarette filter, and such sidestream smoke causes discomfort to non-smokers who are exposed to secondhand smoke. Various attempts have been made to reduce sidestream smoke, including adding a filler such as magnesium oxide, titanium oxide, cerium oxide, aluminum oxide, calcium carbonate, or zirconium carbonate to conventional cigarette paper, but when the sidestream smoke is reduced by simply applying the filler, a tobacco smoke taste may be degraded, combustion may be interrupted, ash integrity may be degraded, or the like, and there is difficulty in addressing such problems through an appropriate combination of materials in the filler. In order to prevent the degradation of a tobacco smoke taste and ash integrity and the interruption of combustion while reducing sidestream smoke, a filler in which magnesium oxide (MgO and/or $Mg(OH)_2$) and calcium carbonate ($CaCO_3$) are mixed is applied to the smoking material portion wrapper 30a according to one embodiment of the present disclosure.

[0059] The filter portion 20 may be wrapped with a filter portion wrapper 30b. The filter portion wrapper 30b may be manufactured using grease-resistant wrapping paper, and an aluminum foil may be further included at an inner surface of the filter portion wrapper 30b.

[0060] 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 by tipping paper 40. As illustrated in FIG. 1, the tipping paper 40 may wrap around at least a portion (for example, a partial downstream area) of the smoking material portion wrapper 30a and an outer periphery of the filter portion wrapper 30b. In other words, the filter portion 20 and at least a portion of the smoking material portion 10 may be further wrapped with the tipping paper 40 and physically combined with each other. According to one embodiment of the present disclosure, the tipping paper 40 may be made of nonporous wrapping paper not treated to be grease-resistant, but the present disclosure is not limited thereto. Also, the tipping paper 40 may include an incombustible material and thus prevent a phenomenon in which the filter portion 20 is burned, but the present disclosure is not limited thereto.

[0061] The smoking article according to one embodiment of the present disclosure has a tar delivery amount of less than 3.7 mg and a nicotine delivery amount of less than 0.36 mg. Such tar and nicotine delivery amounts are less compared to when a cellulose acetate filter is applied. Specifically, the tar delivery amount may be less than 3.7 mg, 3.6 mg or less, 3.5 mg or less, 3.4 mg or less, 3.3 mg or less, or 3.2 mg or less, and the nicotine delivery amount may be less than 0.36 mg, 0.35 mg or less, 0.34 mg or less, 0.33 mg or less, 0.32 mg or less, 0.31 mg or less, 0.3 mg or less,

or 0.29 mg or less. The smoking article according to one embodiment of the present disclosure is meaningful in that the tar and nicotine reduction effect thereof is better than a smoking article to which a cellulose acetate filter is applied.

[0062] Hereinafter, the configurations of the present disclosure and the advantageous effects according thereto will be described in more detail using examples and a comparative example. However, the examples are merely for describing the present disclosure in more detail, and the scope of the present disclosure is not limited by the examples.

Examples

Example 1

[0063] Using lyocell fibers each having a size of about 3.0 denier, lyocell tow in which a tow fiber bundle has a size of about 35,000 denier was produced. Also, a binder solution, which is a mixture of a binder and a solvent, was prepared. Specifically, the binder solution was prepared by adding 15 wt% polyester (a copolymer of phthalic acid and sebacic acid or ethylene glycol, weight-average molecular weight (M_W) = 3,000 to 6,000) to a 85 wt% solvent (a solvent in which 30 wt% propylene glycol and 55 wt% water are mixed) based on the entire weight of the binder solution. The prepared binder solution was sprayed on the lyocell tow through nozzle spraying. The binder solution was sprayed at 15 wt% based on the weight of the lyocell tow, and the lyocell tow was stored for 6 hours at room temperature to produce lyocell tow including a binder. The produced lyocell tow was wrapped with wrapping paper to produce a cigarette filter having an axial length of about 27 mm and a circumference of about 23.7 mm. The cigarette filter was filled with the lyocell tow at a packing density of about 0.4 g/mL, and here, the lyocell tow did not include the binder. The resistance to draw of the cigarette filter was measured to be about 112.5 mmWG when measured using a resistance-to-draw measurement device (Manufacturer: KARDIEN, Product Name: BWSPtHT-1).

Comparative Example 1

[0064] Instead of the lyocell tow, cellulose acetate tow with the same denier conditions was used. Instead of using the binder as a hardness improver, triethyl citrate (TEC) was used as a plasticizer. The plasticizer was sprayed on the cellulose acetate tow through nozzle spraying. 7 wt% of the plasticizer solution based on the weight of the cellulose acetate tow was sprayed on the cellulose acetate tow to produce cellulose acetate tow including the plasticizer. The produced cellulose acetate tow was wrapped with wrapping paper to produce a cigarette filter having an axial length of about 27 mm and a circumference of about 24.2 mm. The cigarette filter was filled with the cellulose acetate tow at a packing density of about 0.36 g/mL, and here, the cellulose acetate tow did not include the plasticizer. The resistance to draw of the cigarette filter was measured to be about 112.5 mmWG when measured using the resistance-to-draw measurement device (Manufacturer: KARDIEN, Product Name: BWSPtHT-1).

Experimental Examples

[0065] 580 mg of cut tobacco leaves were used to produce a smoking material portion. The cigarette filters produced according to each of Example 1 and Comparative Example 1 were combined with the smoking material portion to produce cigarettes. Hereinafter, a cigarette consisting of only the smoking material portion will be referred to as a cigarette of "Experimental Example 1," a cigarette produced by combining the smoking material portion with the cigarette filter produced according to Example 1 will be referred to as a cigarette of "Experimental Example 2," and a cigarette produced by combining the smoking material portion with the cigarette filter produced according to Comparative Example 1 will be referred to as a cigarette of "Experimental Example 3." Each of the cigarettes was smoked through a smoking device (Manufacturer: BORGWALDT, Product Name: RM2OH) to collect smoke, and then gas chromatography (GC) was performed to analyze components of the smoke. The component analysis results are shown in Table 1 below.

[Table 1]

	Cigarette filter	Tar (mg/cigarette)	Nicotine (mg/cigarette)
Experimental Example 1	None	24.4	2.1
Experimental Example 2	Example 1	3.2	0.29
Experimental Example 3	Comparative Example 1	3.7	0.36

[0066] According to Table 1 above, it was found that, in the case in which the cigarette filter according to Example 1 was applied (Experimental Example 2), despite the same resistance to draw, an effect of reducing tar and nicotine was

better compared to the case in which the cigarette filter according to Comparative Example 1 was applied (Experimental Example 3). Cigarettes that deliver tar and nicotine at a certain level or lower may be required according to smokers' preferences. In the case in which the cigarette filter according to Example 1 that has an excellent effect of reducing tar and nicotine is used, since tar and nicotine can be more easily reduced without controlling other components such as the smoking material portion or wrapping paper, processability or the like can be improved when producing the product.

[0067] The embodiments have been described above using only some examples and drawings, but those of ordinary skill in the art may make various modifications and changes to the embodiments from the above description. For example, appropriate results may be achieved even when operations described herein are performed in a different order from the method described herein, and/or components such as a system, a structure, a device, and a circuit described herein are coupled or combined in different forms from the method described herein or replaced or substituted with other components or their equivalents.

Claims

1. A cigarette filter comprising:

lyocell tow made of a plurality of lyocell fibers; and
a binder configured to bond the lyocell fibers to each other,
wherein tar and nicotine delivered through cigarette smoke are each reduced 70 wt% to 95 wt%.

2. The cigarette filter of claim 1, wherein the cigarette filter has a resistance to draw of 80 mmWG to 200 mmWG.

3. The cigarette filter of claim 1, wherein the cigarette filter is filled with the lyocell tow at a packing density of 0.2 g/mL to 0.6 g/mL.

4. The cigarette filter of claim 1, wherein the binder is hydroxypropyl methylcellulose, hydroxypropyl cellulose, polyvinyl alcohol, ethylene vinyl acetate, polyvinyl acetate, polyvinylpyrrolidone, polyester, or a combination thereof.

5. The cigarette filter of claim 1, wherein the binder is included at 0.1 parts by weight to 5 parts by weight based on 100 parts by weight of the lyocell tow.

6. The cigarette filter of claim 1, further comprising a binder solvent, wherein the binder solvent is water, a monohydric alcohol, a polyhydric alcohol, or a combination thereof.

7. The cigarette filter of claim 6, wherein the monohydric alcohol is methanol, ethanol, propanol, or a combination thereof.

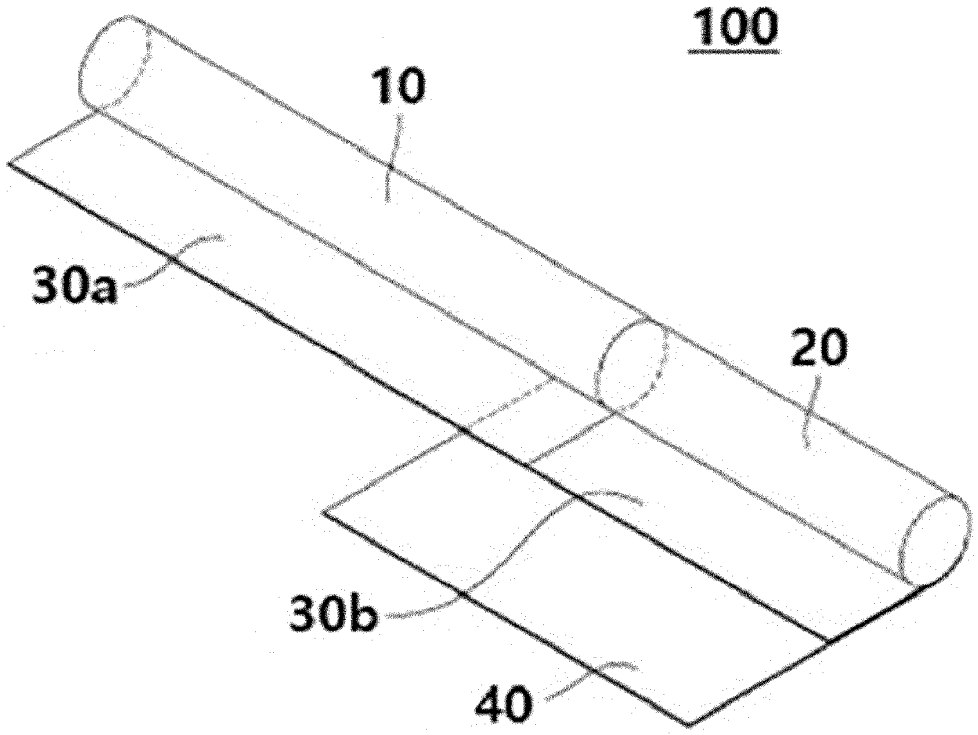
8. The cigarette filter of claim 6, wherein the polyhydric alcohol is a diol having a C1-C4 alkylene group.

9. The cigarette filter of claim 8, wherein the polyhydric alcohol is included at 0.5 parts by weight to 25 parts by weight based on 100 parts by weight of the lyocell tow.

10. A method of producing the cigarette filter of claim 1, the method comprising:

(1) using a plurality of lyocell fibers to produce lyocell tow;
(2) mixing a binder and a solvent to prepare a binder solution;
(3) performing drying after spraying the binder solution on the lyocell tow; and
(4) wrapping the lyocell tow, in which the lyocell fibers are bonded by the binder, with wrapping paper to produce the cigarette filter.

FIG. 1



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2023/001566

A. CLASSIFICATION OF SUBJECT MATTER

A24D 3/06(2006.01)i; **A24D 3/10**(2006.01)i; **A24D 3/14**(2006.01)i; **A24D 3/02**(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 3/04(2006.01); A24D 3/10(2006.01); A61L 24/00(2006.01); A61L 27/38(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: 필터(filter), 라이오셀(lyocell), 바인더(binder), 폴리에스테르(polyester), 프로필렌글리콜(propylene glycol)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 10-2015-0116612 A (KT & G CORPORATION et al.) 16 October 2015 (2015-10-16) See claim 1; and paragraphs [0005]-[0014], [0028], [0041], [0049]-[0052] and [0085].	1-7,10
Y		8,9
Y	WO 2022-018180 A1 (DELFORTGROUP AG) 27 January 2022 (2022-01-27) See page 8, line 35 - page 9, line 4.	8,9
A	KR 10-2016-0048738 A (KT & G CORPORATION et al.) 04 May 2016 (2016-05-04) See entire document.	1-10
A	KR 10-2014-0041664 A (SEOUL NATIONAL UNIVERSITY R&DB FOUNDATION) 04 April 2014 (2014-04-04) See entire document.	1-10

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

* 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

Date of the actual completion of the international search	Date of mailing of the international search report
18 May 2023	**19 May 2023**
Name and mailing address of the ISA/KR **Korean Intellectual Property Office** **Government Complex-Daejeon Building 4, 189 Cheongsa-ro, Seo-gu, Daejeon 35208** Facsimile No. **+82-42-481-8578**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2023/001566

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 10-2017-0075849 A (KOLON INDUSTRIES, INC. et al.) 04 July 2017 (2017-07-04) See entire document.	1-10

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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		WO 2015-156608 A1	15 October 2015
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		KR 10-2023-0043104 A	30 March 2023
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		WO 2015-156608 A1	15 October 2015
KR 10-2014-0041664 A	04 April 2014	KR 10-1381108 B1	11 April 2014
KR 10-2017-0075849 A	04 July 2017	KR 10-2296584 B1	01 September 2021

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