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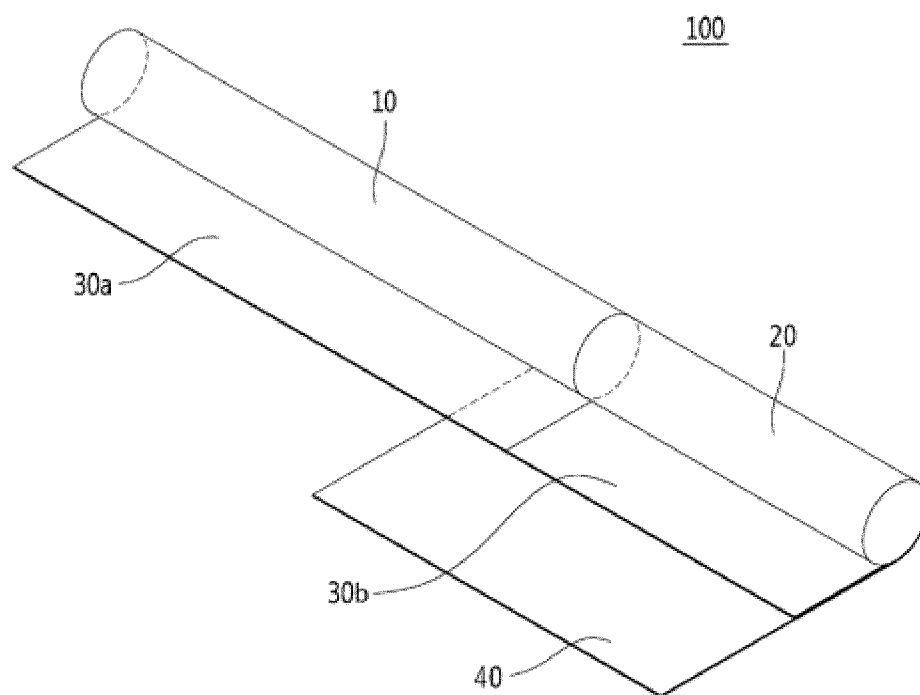
(54) **FILTER FOR SMOKING ARTICLE CONTAINING LYOCELL TOW, MANUFACTURING METHOD, AND SMOKING ARTICLE COMPRISING SAME**

(57) Provided are a smoking article filter, a manufacturing method thereof, and a smoking article. The smoking article filter includes lyocell tow including a plurality of

lyocell fibers, and a phenol functional additive dispersed in the lyocell tow and including a phenol reducing material and a hydrophobic emulsion.

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FIG. 1



Description

[Technical Field]

5 **[0001]** The present invention relates to a smoking article filter in which a phenol functional additive, which includes a phenol reducing material and a hydrophobic emulsion, is added to lyocell tow to improve a remaining amount of the phenol reducing material, a method of manufacturing the smoking article filter, and a smoking article including the smoking article filter.

10 [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
15 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
20 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 (PEG), triethyl citrate (TEC), triacetin (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 and TEC is added to cellulose acetate which is
25 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, since lyocell fibers are hydrophilic, even in a case where the phenol reducing material is added to the lyocell fibers, the hydrophilic lyocell fibers are not plasticized. Accordingly, in the case where the phenol reducing material, which also conventionally serves as a plasticizer for cellulose acetate fibers, is applied to the lyocell fibers, the phenol
30 reducing material is unable to serve as a plasticizer for the lyocell fibers and is not chemically bonded to the lyocell fibers. Accordingly, there is an advantage in that biodegradability of the lyocell fibers is not reduced, but since it is difficult for the added phenol reducing material to stably settle on (bond to) the lyocell fibers, there is a problem in that the amount of the phenol reducing material remaining in a cigarette filter to which lyocell tow made of lyocell fibers is applied is not sufficient.

[0006] Accordingly, there is a need for a method of allowing a phenol reducing material added to hydrophilic lyocell tow to stably settle on the lyocell tow to increase the amount of the phenol reducing material remaining in a cigarette filter to which
35 the lyocell tow is applied.

[Disclosure]

40 [Technical Problem]

[0007] One object of the present invention is to provide a smoking article filter including lyocell tow in which a phenol reducing material mixed with a hydrophobic emulsion is added to the lyocell tow so that the phenol reducing material uniformly and stably settles on the lyocell tow, thereby minimizing the loss of the phenol reducing material, improving a
45 remaining amount of the phenol reducing material, and having an excellent phenol reducing effect.

[0008] Another object of the present invention is to provide a method of manufacturing a smoking article filter including lyocell tow in which a process of adding a phenol functional additive, which includes a phenol reducing material and a hydrophobic emulsion, to lyocell fibers included in the lyocell tow is performed so that the phenol reducing material can uniformly and stably settle on the lyocell tow.

[0009] Also, the another object of the present invention is to provide a method of manufacturing a smoking article filter including lyocell tow in which, in a process of treating lyocell fibers with an emulsion during a process of manufacturing the lyocell tow, the emulsion is added using a mixed solution of a hydrophobic emulsion and a phenol reducing material, thereby not requiring an additional process and improving the efficiency of the manufacturing process.

[0010] Still another object of the present invention is to provide a smoking article including a smoking article filter to which lyocell tow, to which a phenol functional additive obtained by mixing a phenol reducing material and a hydrophobic emulsion is added, is applied, thereby minimizing the loss of the phenol reducing material, improving a remaining amount of the phenol reducing material, and having an excellent phenol reducing effect.

[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]

- 5 **[0012]** One embodiment for achieving the one object provides a smoking article filter including: lyocell tow including a plurality of lyocell fibers; and a phenol functional additive dispersed in the lyocell tow and including a phenol reducing material and a hydrophobic emulsion.
- [0013]** Also, the phenol reducing material may include one or more of triethyl citrate (TEC) and polyethylene glycol (PEG).
- 10 **[0014]** Also, the phenol reducing material may include one of triethyl citrate (TEC) and polyethylene glycol (PEG), and the content of the phenol reducing material relative to the weight of the lyocell tow may range from 0.5 wt% to 15 wt%.
- [0015]** Also, the content of the phenol reducing material relative to the weight of the lyocell tow may range from 1 wt% to 6 wt%.
- [0016]** Also, the phenol reducing material may include triethyl citrate (TEC) and polyethylene glycol (PEG), and the content of the phenol reducing material relative to the weight of the lyocell tow may range from 10 wt% to 30 wt%.
- 15 **[0017]** Also, the content of the phenol reducing material relative to the weight of the lyocell tow may range from 15 wt% to 25 wt%.
- [0018]** Also, the phenol functional additive may be dispersed in the lyocell tow using a brush type method or a spray type method.
- 20 **[0019]** Also, the lyocell tow in which the phenol functional additive is dispersed may be manufactured by injecting a mixed solution of the phenol reducing material and the hydrophobic emulsion onto the lyocell fibers using the spray type method and drying the mixed solution.
- [0020]** The smoking article filter may be manufactured by injecting a mixed solution of the phenol reducing material and the hydrophobic emulsion onto the lyocell tow, which is manufactured using the lyocell fibers, using the brush type method and drying the mixed solution.
- 25 **[0021]** One embodiment for achieving the another object provides a method of manufacturing a smoking article filter, the method including: preparing a plurality of lyocell fibers; preparing a mixed solution by mixing a phenol reducing material and a hydrophobic emulsion; manufacturing lyocell tow in which a phenol functional additive including the phenol reducing material and the hydrophobic emulsion is dispersed by injecting the mixed solution onto the plurality of lyocell fibers and drying the mixed solution; and wrapping the lyocell tow in which the phenol functional additive is dispersed with wrapping paper, wherein the phenol reducing material includes one or more of triethyl citrate (TEC) and polyethylene glycol (PEG).
- 30 **[0022]** Another embodiment for achieving the another object provides a method of manufacturing a smoking article filter, the method including: preparing lyocell tow including a plurality of lyocell fibers; preparing a mixed solution by mixing a phenol reducing material and a hydrophobic emulsion; dispersing a phenol functional additive including the phenol reducing material and the hydrophobic emulsion in the lyocell tow by injecting the mixed solution onto the lyocell tow and drying the mixed solution; and wrapping the lyocell tow in which the phenol functional additive is dispersed with wrapping paper, wherein the phenol reducing material includes one or more of triethyl citrate (TEC) and polyethylene glycol (PEG).
- 35 **[0023]** One embodiment for achieving the still another object provides a smoking article including a smoking material portion, a filter portion, and a wrapper, wherein the filter portion includes lyocell tow including a plurality of lyocell fibers and a phenol functional additive dispersed in the lyocell tow and including a phenol reducing material and a hydrophobic emulsion, and the phenol reducing material includes one or more of triethyl citrate (TEC) and polyethylene glycol (PEG).
- 40

[Advantageous Effects]

- 45 **[0024]** According to a smoking article filter according to one embodiment, by adding a phenol reducing material mixed with a hydrophobic emulsion to lyocell tow, the phenol reducing material uniformly and stably settles on the lyocell tow, and thus the loss of the phenol reducing material can be minimized, a remaining amount of the phenol reducing material can be improved, and the phenol reducing performance of the smoking article filter to which the lyocell fibers are applied can be improved.
- 50 **[0025]** According to a smoking article filter according to some embodiments, by adding a phenol reducing material mixed with a hydrophobic emulsion to lyocell tow, the hydrophobic emulsion settles on lyocell fibers constituting the lyocell tow, and thus surfaces of the lyocell fibers become hydrophobic, and it is possible to prevent moisture from penetrating into the lyocell tow during storage of the lyocell tow.
- 55 **[0026]** 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]

[0027] 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]

[0028] 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.

[0029] 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.

[0030] 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.

[0031] 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.

[0032] 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.

[0033] First, some terms used herein will be clarified.

[0034] 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.

[0035] In the present specification, "smoking material" may refer to any type of material that may be used in a smoking article.

[0036] 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.

[0037] In the present specification, "longitudinal direction" may refer to a direction corresponding to a longitudinal axis of a smoking article.

[0038] Hereinafter, various embodiments of the present disclosure will be described in detail with reference to the accompanying drawings.

[0039] FIG. 1 is a view illustrating a schematic configuration of a smoking article according to one embodiment of the present invention.

[0040] 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.

[0041] 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 smoking article filter portion 20 (a smoking article filter 20 or a filter portion 20).

[0042] 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.

[0043] The present invention relates to the smoking article filter 20 (or the smoking article filter portion 20) included in the smoking article 100, and the smoking article filter 20 according to one embodiment of the present invention includes lyocell tow including a plurality of lyocell fibers and a phenol functional additive dispersed in the lyocell tow and including a phenol reducing material and a hydrophobic emulsion. 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.

[0044] In an exemplary embodiment, 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."

[0045] In an exemplary embodiment, 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.

[0046] In one embodiment, the phenol functional additive may include a phenol reducing material and a hydrophobic emulsion. The phenol functional additive may be formed to be dispersed in the lyocell tow through a process of injecting a mixed solution, which is prepared by mixing the phenol reducing material and the hydrophobic emulsion, onto the lyocell fibers or the lyocell tow and then drying the mixed solution during the process of manufacturing the smoking article filter.

[0047] In some embodiments, the phenol functional additive may be dispersed in the lyocell tow by injecting a mixed solution, which is prepared by mixing the phenol reducing material and the hydrophobic emulsion, onto the lyocell fibers or the lyocell tow using a brush type method or a spray type method and drying the mixed solution.

[0048] As will be described below, the mixed solution prepared by mixing the phenol reducing material and the hydrophobic emulsion may be injected onto the lyocell fibers during the process of manufacturing the lyocell tow or may be injected onto the lyocell tow manufactured using lyocell fibers during the process of manufacturing the smoking article filter 20.

[0049] In one embodiment, the phenol reducing material corresponds to a substance that can specifically reduce phenols generated during smoking, and types of the phenol reducing material may include one or more of polyethylene glycol (PEG) and triethyl citrate (TEC). However, the phenol reducing material is not limited thereto and may be any other substance as long as the substance can reduce phenols generated during smoking.

[0050] The smoking article filter according to the present invention is manufactured by mixing the phenol reducing material and the hydrophobic emulsion and injecting the mixed solution thereof onto the lyocell tow and thus may have an excellent phenol reducing effect. As will be described below, since the hydrophobic emulsion and the phenol reducing material are mixed and the mixed solution thereof is added to the lyocell tow in the smoking article filter according to the present invention, the smoking article filter according to the present invention may have a greater effect of reducing phenols generated during smoking than a smoking article filter to which the phenol reducing material is not added. Specifically, the content of phenols in smoke that has passed through the smoking article filter including the phenol reducing material according to the present invention may be reduced by 49% or more, 50% or more, 51% or more, or 52% or more compared to the content of phenols in smoke that has passed through the smoking article filter not including the phenol reducing material.

[0051] In some embodiments, the phenol reducing material may include one of polyethylene glycol (PEG) and triethyl citrate (TEC). In the case where the phenol reducing material includes one of polyethylene glycol (PEG) and triethyl citrate (TEC), the content of the phenol reducing material relative to the weight of the lyocell tow may range from 0.5 wt% to 15 wt%, 0.5 wt% to 12 wt%, 0.5 wt% to 10 wt%, 0.5 wt% to 8 wt%, 1 wt% to 6 wt%, 2 wt% to 5 wt%, 2.1 wt% to 4.9 wt%, or 2.25 wt% to 4.8 wt%.

[0052] In some embodiments, the phenol reducing material may include triethyl citrate (TEC). In the case where the phenol reducing material includes triethyl citrate (TEC), the content of triethyl citrate (TEC) relative to the weight of the lyocell tow may range from 0.5 wt% to 15 wt%, 0.5 wt% to 12 wt%, 0.5 wt% to 10 wt%, 0.5 wt% to 8 wt%, 1 wt% to 6 wt%, 2 wt% to 5 wt%, 2.1 wt% to 4.8 wt%, or 2.3 wt% to 4.7 wt%.

[0053] In some embodiments, the phenol reducing material may include triethyl citrate (TEC), and the triethyl citrate (TEC) may be added by being injected together with the hydrophobic emulsion in the process of manufacturing lyocell tow. Specifically, triethyl citrate (TEC) may be added by being injected onto the lyocell fibers together with the hydrophobic emulsion during the process of manufacturing the lyocell tow, and in this case, the content of triethyl citrate (TEC) relative to the weight of the lyocell tow may range from 2.5 wt% to 4.9 wt%, 2.6 wt% to 4.8 wt%, or 2.7 wt% to 4.75 wt%, preferably, from 2.75 wt% to 2.85 wt%, 4.65 wt%, or 4.75 wt%.

[0054] In some other embodiments, the phenol reducing material may include triethyl citrate (TEC), and the triethyl citrate (TEC) may be added by being injected together with the hydrophobic emulsion in the process of manufacturing the smoking article filter using lyocell tow. Specifically, triethyl citrate (TEC) may be added by being injected together with the hydrophobic emulsion onto the lyocell tow manufactured using lyocell fibers during the process of manufacturing the

smoking article filter, and in this case, the content of triethyl citrate (TEC) relative to the weight of the lyocell tow may range from 2 wt% to 4.5 wt%, 2.1 wt% to 4.4 wt%, or 2.2 wt% to 4.3 wt%, preferably, from 2.25 wt% to 2.35 wt%, 4.15 wt%, or 4.25 wt%.

[0055] In some embodiments, the phenol reducing material may include polyethylene glycol (PEG).

[0056] In some embodiments, polyethylene glycol (PEG) included in the phenol reducing material has a weight average molecular weight (MW) in a range of 100 to 10,000, preferably in a range of 100 to 8,000, more preferably in a range of 100 to 2,000, and most preferably in a range of 500 to 700. In a case where the phenol functional additive dispersed in the lyocell tow includes polyethylene glycol (PEG) having a weight average molecular weight (MW) in the above range as the phenol reducing material, the phenol reducing performance of the smoking article filter manufactured using the lyocell tow may be excellent.

[0057] In a case where the phenol reducing material includes polyethylene glycol (PEG), the content of polyethylene glycol (PEG) relative to the weight of the lyocell tow may range from 0.5 wt% to 15 wt%, 0.5 wt% to 12 wt%, 0.5 wt% to 10 wt%, 0.5 wt% to 8 wt%, 1 wt% to 6 wt%, 2 wt% to 5 wt%, 2.2 wt% to 4.95 wt%, 2.35 wt% to 4.9 wt%, or 2.4 wt% to 4.85 wt%.

[0058] In some embodiments, the phenol reducing material may include polyethylene glycol (PEG), and the polyethylene glycol (PEG) may be added by being injected together with the hydrophobic emulsion in the process of manufacturing lyocell tow. Specifically, polyethylene glycol (PEG) may be added by being injected together with the hydrophobic emulsion onto the lyocell fibers during the process of manufacturing the lyocell tow, and in this case, the content of polyethylene glycol (PEG) relative to the weight of the lyocell tow may range from 2.6 wt% to 4.95 wt%, 2.7 wt% to 4.9 wt%, or 2.75 wt% to 4.85 wt%, preferably, from 2.8 wt% to 2.85 wt%, 4.8 wt%, or 4.85 wt%.

[0059] In some other embodiments, the phenol reducing material may include polyethylene glycol (PEG), and the polyethylene glycol (PEG) may be added by being injected together with the hydrophobic emulsion in the process of manufacturing the smoking article filter using lyocell tow. Specifically, polyethylene glycol (PEG) may be added by being injected together with the hydrophobic emulsion onto the lyocell tow manufactured using lyocell fibers during the process of manufacturing the smoking article filter, and in this case, the content of polyethylene glycol (PEG) relative to the weight of the lyocell tow may range from 2.1 wt% to 4.6 wt%, 2.2 wt% to 4.5 wt%, 2.3 wt% to 4.4 wt%, or 2.4 wt% to 4.35 wt%, preferably, from 2.4 wt% to 2.5 wt%, 4.25 wt%, or 4.35 wt%.

[0060] In some embodiments, the phenol reducing material may include both polyethylene glycol (PEG) and triethyl citrate (TEC). In the case where the phenol reducing material includes polyethylene glycol (PEG) and triethyl citrate (TEC), the content of the phenol functional additive relative to the weight of the lyocell tow may range from 5 wt% to 30 wt%, 7 wt% to 28 wt%, 10 wt% to 25 wt%, 12 wt% to 23 wt%, 15 wt% to 20 wt%, 16 wt% to 19.5 wt%, or 16.5 wt% to 19 wt%.

[0061] In some embodiments, the phenol reducing material may include polyethylene glycol (PEG) and triethyl citrate (TEC), and the phenol reducing material including the polyethylene glycol (PEG) and triethyl citrate (TEC) may be added by being injected together with the hydrophobic emulsion in the process of manufacturing lyocell tow. Specifically, polyethylene glycol (PEG) and triethyl citrate (TEC) may be added by being injected together with the hydrophobic emulsion onto the lyocell fibers during the process of manufacturing lyocell tow, and in this case, the total content of polyethylene glycol (PEG) and triethyl citrate (TEC) relative to the weight of the lyocell tow may range from 16 wt% to 20 wt%, 17 wt% to 19 wt%, or 18.5 wt% to 19 wt%.

[0062] In one embodiment, the hydrophobic emulsion may be an emulsion applied to lyocell fibers and developed exclusively for lyocell, unlike emulsions used in general fibers. The hydrophobic emulsion may include a hydrophobic component for the phenol reducing material to uniformly and stably settle on the hydrophilic lyocell fibers or lyocell tow. The hydrophobic emulsion is a component harmless to the human body and may also be used in food.

[0063] Since the phenol reducing material is mixed with the hydrophobic emulsion and added to the lyocell tow constituting the smoking article filter according to the present invention, compatibility between the phenol reducing material and the hydrophilic lyocell surface is improved, and thus the phenol reducing material may stably settle on the lyocell surface due to the hydrophobic emulsion. Accordingly, it is possible to prevent a decrease in content of the phenol reducing material that settles and stays on surfaces of the lyocell fibers or a surface of the lyocell tow, and as a result, it is possible to provide a smoking article filter with excellent phenol reducing performance.

[0064] Also, since the surfaces of the lyocell fibers or surface of the lyocell tow may become hydrophobic by mixing the hydrophobic emulsion and the phenol reducing material and adding the mixture to the hydrophilic lyocell tow, the saliva of the smoker may be delayed from penetrating into the filter during smoking to prevent a phenomenon in which the shape of the smoking article filter including lyocell tow is changed due to the saliva of the smoker and the hardness of the smoking article filter is lowered, and the ability to preserve the smoking article filter may be improved.

[0065] In some embodiments, the hydrophobic emulsion may further include a compound which may serve as a type of lubricant or oil. The hydrophobic emulsion may include a component that imparts lubricity to lyocell fibers added to a crimper in a crimping process during the process of manufacturing lyocell tow, but the present invention is not limited thereto.

[0066] In some embodiments, a smoking article filter including lyocell tow in which the phenol functional additive is dispersed has a hardness of 70% or more. In an exemplary embodiment, the hardness of the smoking article filter may

range from 70% to 90%, 75% to 90%, 80% to 90%, or 85% to 90%. 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.

[0067] Hereinafter, a method of manufacturing the above-described smoking article filter will be described.

<First manufacturing method> Manufacturing lyocell tow by injecting mixed solution of phenol reducing material and hydrophobic emulsion onto lyocell fibers

[0068] A method of manufacturing the smoking article filter according to one embodiment includes preparing a plurality of lyocell fibers, preparing a mixed solution by mixing a phenol reducing material and a hydrophobic emulsion, manufacturing lyocell tow in which a phenol functional additive including the phenol reducing material and the hydrophobic emulsion is dispersed by injecting the mixed solution onto the plurality of lyocell fibers and drying the mixed solution, and wrapping the lyocell tow in which the phenol functional additive is dispersed with wrapping paper, wherein the phenol reducing material includes one or more of triethyl citrate (TEC) and polyethylene glycol (PEG).

[0069] Since the above manufacturing method basically relates to a method of manufacturing the above-described smoking article filter, description of parts that have been described in detail above will be omitted, and hereinafter, features of the manufacturing method will be described in more detail.

[0070] First, a plurality of lyocell fibers are prepared.

[0071] Then, a phenol reducing material and a hydrophobic emulsion are mixed to prepare a mixed solution. The phenol reducing material may include one or more of triethyl citrate (TEC) and polyethylene glycol (PEG).

[0072] In some embodiments, in a case where the phenol reducing material includes both polyethylene glycol (PEG) and triethyl citrate (TEC), a ratio of the content of triethyl citrate (TEC) added to the mixed solution to the content of polyethylene glycol (PEG) added to the mixed solution may range from 0.2 to 5.0.

[0073] Then, the mixed solution of the phenol reducing material and the hydrophobic emulsion is injected onto surfaces of the lyocell fibers. In one embodiment, the mixed solution may be directly injected onto the surfaces of the lyocell fibers by a spray type method. The spray type method is a method in which a liquid is injected through a spray nozzle.

[0074] In some embodiments, the amount of the mixed solution injected onto the lyocell fibers may be 15 wt% or less relative to the weight of the lyocell tow, but the present invention is not limited thereto.

[0075] Meanwhile, in this operation, since the phenol reducing material made of triethyl citrate (TEC) or polyethylene glycol (PEG) is mixed with the hydrophobic emulsion and the mixed solution is injected onto the lyocell fibers, hydrophobicity is imparted to the hydrophilic surfaces of the lyocell fibers by the hydrophobic emulsion, and thus the phenol reducing material may uniformly and stably settle on the surfaces of the lyocell fibers.

[0076] Then, the lyocell fibers onto which the mixed solution is injected are dried to manufacture lyocell tow in which the phenol functional additive including the phenol reducing material and the hydrophobic emulsion is dispersed on the surfaces of the lyocell fibers. The drying process may be performed at room temperature or a high temperature using a general method known in the art.

[0077] Then, the manufactured lyocell tow in which the phenol functional additive is dispersed is wrapped with wrapping paper to manufacture a smoking article filter. When needed, the lyocell tow may be cut into sizes suitable for application to a smoking article filter using a mechanical roll, a cutter, or the like.

<Second manufacturing method> Manufacturing filter by injecting mixed solution of phenol reducing material and hydrophobic emulsion onto lyocell tow manufactured using lyocell fibers

[0078] A method of manufacturing the smoking article filter according to another embodiment includes preparing lyocell tow including a plurality of lyocell fibers, preparing a mixed solution by mixing a phenol reducing material and a hydrophobic emulsion, dispersing a phenol functional additive including the phenol reducing material and the hydrophobic emulsion in the lyocell tow by injecting the mixed solution onto the lyocell tow and drying the mixed solution, and wrapping the lyocell tow in which the phenol functional additive is dispersed with wrapping paper, wherein the phenol reducing material includes one or more of triethyl citrate (TEC) and polyethylene glycol (PEG).

[0079] That is, the method of manufacturing the smoking article filter according to another embodiment is different from the previously described manufacturing method in that the mixed solution of the phenol reducing material and the hydrophobic emulsion is injected onto the lyocell tow manufactured using lyocell fibers. Hereinafter, for convenience of description, differences from the previously-described method of manufacturing the smoking article filter according to one embodiment will be mainly described.

[0080] First, lyocell tow is manufactured using lyocell fibers. A process of manufacturing lyocell tow using lyocell fibers may be performed using a general method known in the art. For example, a process such as treating lyocell fibers with an

emulsion or imparting crimps to lyocell fibers may be performed to manufacture lyocell tow using lyocell fibers.

[0081] Then, a phenol reducing material and a hydrophobic emulsion are mixed to prepare a mixed solution.

[0082] Then, the prepared mixed solution is injected onto a surface of the lyocell tow manufactured using lyocell fibers. In one embodiment, the mixed solution may be indirectly injected onto the surface of the lyocell tow using a brush type method. The brush type method is a method in which a liquid is injected by splashing the liquid through the rotation of a brush roller.

[0083] Meanwhile, in this operation, since the phenol reducing material made of triethyl citrate (TEC) or polyethylene glycol (PEG) is mixed with the hydrophobic emulsion and the mixed solution is injected onto the lyocell tow, hydrophobicity is imparted to the hydrophilic surface of the lyocell tow by the hydrophobic emulsion, and thus the phenol reducing material may uniformly and stably settle on the surface of the lyocell tow.

[0084] Then, the lyocell tow onto which the mixed solution is injected is dried to disperse the phenol functional additive including the phenol reducing material and the hydrophobic emulsion in the lyocell tow. Then, the lyocell tow in which the phenol functional additive is dispersed is wrapped with wrapping paper.

[0085] 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.

Comparative Example 1

[0086] Using filter manufacturing equipment manufactured by TYM Co., Ltd. (whose operational mechanism is the same as cellulose acetate (CA) tow filter manufacturing equipment), lyocell tow including a plurality of lyocell fibers was wrapped with wrapping paper to manufacture a smoking article filter having a weight of about 865 mg and a circumference of about 24.58 mm.

Example 1

[0087] A smoking article filter was manufactured in the same manner as in Comparative Example 1 except that a mixed solution of a hydrophobic emulsion and TEC was added (injected). Specifically, a mixed solution was prepared by mixing a hydrophobic emulsion and 11.3 wt% of TEC relative to the weight of lyocell tow. The mixed solution was injected onto the same lyocell tow as the lyocell tow of Comparative Example 1 and dried to manufacture a smoking article filter.

Example 2

[0088] A smoking article filter was manufactured in the same manner as in Comparative Example 1 except that a mixed solution of a hydrophobic emulsion and PEG was added (injected). Specifically, a mixed solution was prepared by mixing a hydrophobic emulsion and 2.8 wt% of PEG relative to the weight of lyocell tow. The mixed solution was injected onto the same lyocell tow as the lyocell tow of Comparative Example 1 and dried to manufacture a smoking article filter.

Example 3

[0089] A smoking article filter was manufactured in the same manner as in Comparative Example 1 except that a mixed solution of a hydrophobic emulsion, PEG, and TEC was added (injected). Specifically, a mixed solution was prepared by mixing a hydrophobic emulsion, 11.3 wt% of TEC relative to the weight of lyocell tow, and 2.8 wt% of PEG relative to the weight of the lyocell tow. The mixed solution was injected onto the same lyocell tow as the lyocell tow of Comparative Example 1 and dried to manufacture a smoking article filter.

[Experimental Example 1]: Physical evaluation comparison of smoking article filters according to addition of mixed solution

[0090] Physical properties of the smoking article filters according to Comparative Example 1 and Examples 1 to 3 were evaluated, and results thereof are shown in Table 1 below.

[Table 1]

Information	Weight (mg)	Circumference (mm)	Resistance to draw (mmWG)
Comparative Example 1	865	24.58	148
Example 1 (11.3% TEC)	871	24.57	146.6

(continued)

Information	Weight (mg)	Circumference (mm)	Resistance to draw (mmWG)
Example 2 (2.8% PEG)	866	24.59	148
Example 3 (11.3% TEC+2.8% PEG)	877	24.6	147.1

[0091] As shown in Table 1 above, it can be seen that the smoking article filters according to Examples 1 to 3 manufactured by injecting the mixed solution of a phenol reducing material and the hydrophobic emulsion onto the lyocell tow have similar values in terms of all of resistance to draw, weight, and circumference compared to the smoking article filter according to Comparative Example 1 in which an additive was not added to the lyocell tow. Accordingly, it can be seen that physical properties of the smoking article filters to which lyocell tow, in which a phenol functional additive including a phenol reducing material and a hydrophobic emulsion is dispersed, is applied are maintained.

[Experimental Example 2]: Evaluation of phenol reducing performance of smoking article filters according to addition of mixed solution

[0092] Smoking articles were manufactured using the smoking article filters of Comparative Example 1 and Examples 1 to 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, and 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 2 below.

[Table 2]

Information	Comparative Example 1	Example 1 (11.3% TEC)	Example 2 (2.8% PEG)	Example 3 (11.3 % TEC+2.8% PEG)
Catechol (μg)	94.6	88.30	81.5	88.8
Hydroquinone (μg)	105.4	103.5	99.8	106.3
m+p cresols (μg)	23.5	17.1	16.6	106.3
o-Cresol (μg)	10.2	6.6	6.5	5.1
Phenol (μg)	43.4	29.0	26.5	21.9
Resorcinol (μg)	2.7	2.5	2.4	2.5

[0093] As shown in Table 2 above, it can be seen that 43.4 μ g of phenol was detected in the smoke of the smoking article manufactured using the smoking article filter of Comparative Example 1 in which the mixed solution of a phenol reducing material and the hydrophobic emulsion was not added to the lyocell tow, and 29 μ g of phenol, 26.5 μ g of phenol, and 21.9 μ g of phenol were detected in the smoke of the smoking articles manufactured using the smoking article filters of Examples 1 to 3 manufactured by injecting the mixed solution of a phenol reducing material and the hydrophobic emulsion onto the lyocell tow. It can be seen that a phenol reducing effect is greater by about 50% or more in Examples 1 to 3 compared to Comparative Example 1.

Comparative Example 2

[0094] A smoking article filter was manufactured by directly injecting a hydrophobic emulsion onto lyocell fibers using a spray type method and drying the hydrophobic emulsion to manufacture lyocell tow, and then wrapping the manufactured lyocell tow with wrapping paper.

Example 4

[0095] A smoking article filter was manufactured in the same manner as in Comparative Example 2 except that a mixed solution of the hydrophobic emulsion and 3 wt% of TEC relative to the weight of the lyocell tow was injected onto the lyocell fibers and dried to manufacture the lyocell tow.

Example 5

[0096] A smoking article filter was manufactured in the same manner as in Example 4 except that 5 wt% of TEC relative to the weight of the lyocell tow was included in the mixed solution injected onto the lyocell fibers.

Example 6

[0097] A smoking article filter was manufactured in the same manner as in Example 4 except that 3 wt% of PEG relative to the weight of the lyocell tow was included as a phenol reducing material in the mixed solution injected onto the lyocell fibers.

Example 7

[0098] A smoking article filter was manufactured in the same manner as in Example 6 except that 5 wt% of PEG relative to the weight of the lyocell tow was included in the mixed solution injected onto the lyocell fibers.

Example 8

[0099] A smoking article filter was manufactured in the same manner as in Comparative Example 2 except that the mixed solution injected onto the lyocell fibers included both TEC and PEG as a phenol reducing material, and 20 wt% of the phenol reducing material was included relative to the weight of the lyocell tow.

Comparative Example 3

[0100] A smoking article filter was manufactured by indirectly injecting a hydrophobic emulsion onto lyocell tow manufactured using lyocell fibers using a brush type method and drying the hydrophobic emulsion, and then wrapping the lyocell tow with wrapping paper.

Example 9

[0101] A smoking article filter was manufactured in the same manner as in Comparative Example 3 except that a mixed solution of the hydrophobic emulsion and 3 wt% of TEC relative to the weight of the lyocell tow was injected onto the lyocell tow.

Example 10

[0102] A smoking article filter was manufactured in the same manner as in Example 9 except that 5 wt% of TEC relative to the weight of the lyocell tow was included in the mixed solution injected onto the lyocell tow.

Example 11

[0103] A smoking article filter was manufactured in the same manner as in Example 9 except that 3 wt% of PEG relative to the weight of the lyocell tow was included as a phenol reducing material in the mixed solution injected onto the lyocell tow.

Example 12

[0104] A smoking article filter was manufactured in the same manner as in Example 11 except that 5 wt% of PEG relative to the weight of the lyocell tow was included in the mixed solution injected onto the lyocell tow.

Example 13

[0105] A smoking article filter was manufactured in the same manner as in Comparative Example 3 except that the mixed solution injected onto the lyocell tow included both TEC and PEG as a phenol reducing material, and 20 wt% of the phenol reducing material was included relative to the weight of the lyocell tow.

[Experimental Example 3]: Analysis of amount of phenol reducing material remaining in smoking article filters

[0106] In order to measure the amount of a phenol reducing material remaining in the smoking article filters of Comparative Examples 2 and 3 and Examples 4 to 13, 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 wrapping paper, the lyocell tow portion was removed from the smoking article filters and the weight of the 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. Results thereof are shown in Table 3 below.

[Table 3]

		Added amount of phenol reducing material (wt%)	Remaining amount of phenol reducing material (wt%)
Injecting mixed solution onto lyocell fibers (spray method)	Comparative Example 2	0	0
	Example 4	3	2.81
	Example 5	5	4.70
	Example 6	3	2.83
	Example 7	5	4.82
	Example 8	20	18.75
Injecting mixed solution onto lyocell tow (brush method)	Comparative Example 3	0	0
	Example 9	3	2.30
	Example 10	5	4.21
	Example 11	3	2.44
	Example 12	5	4.30
	Example 13	20	16.78

[0107] As shown in Table 3 above, it can be seen that the amounts of a phenol reducing material remaining in the smoking article filters are different according to a method of injecting the mixed solution of the hydrophobic emulsion and the same amount of phenol reducing material. Specifically, it can be seen that the amount of phenol reducing material remaining in the lyocell tow was greater in Examples 4 to 8 in which a phenol reducing material was mixed with the hydrophobic emulsion, and the mixed solution was injected onto the lyocell fibers using the spray method, compared to Examples 9 to 13 in which a phenol reducing material was mixed with the hydrophobic emulsion, and the mixed solution was injected onto the lyocell tow using the brush method. This is considered to be due to the fact that, by injecting the mixed solution onto the lyocell fibers using the spray method during the process of manufacturing lyocell tow, the mixed solution can be more uniformly applied compared to when the brush method is used, and a surface area of lyocell on which the mixed solution may settle increases in the case where the mixed solution is injected onto the lyocell fibers, compared to the case where the mixed solution is injected onto the lyocell tow.

[Experimental Example 4]: Evaluation of phenol reducing performance of smoking article filters according to type and content of phenol reducing material

[0108] Smoking articles were manufactured using the smoking article filters of Comparative Examples 2 and 3 and Examples 4 to 13, 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, and 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]

		Phenol (ug/cig)
Injecting mixed solution onto lyocell fibers (spray method)	Comparative Example 2	41.87
	Example 4	23.93
	Example 5	20.91
	Example 6	23.10
	Example 7	19.89
	Example 8	6.80
Injecting mixed solution onto lyocell tow (brush method)	Comparative Example 3	42.57
	Example 9	31.46
	Example 10	30.31
	Example 11	30.87
	Example 12	29.87
	Example 13	10.60

[0109] As shown in Table 4 above, it can be seen that the amount of delivered phenol significantly decreased in Examples 4 to 13 in which the mixed solution of a phenol reducing material and the hydrophobic emulsion was added to the lyocell tow, compared to Comparative Examples 2 and 3 in which the mixed solution of a phenol reducing material and the hydrophobic emulsion was not added to the lyocell tow. Specifically, it can be seen that a phenol reducing effect is greater by about 49% or more or 50% or more in Examples 4 to 13 compared to Comparative Examples 2 and 3.

[0110] Also, it can be seen that the phenol reducing effect is improved with an increase in content of a phenol reducing material when smoking article filters are manufactured by injecting the mixed solution of the hydrophobic emulsion and the same phenol reducing material. Specifically, it can be seen that, between Example 4 and Example 5 in which the same phenol reducing material was injected together with the hydrophobic emulsion using the same method, the phenol reducing effect was greater in Example 5, between Example 6 and Example 7, the phenol reducing effect was greater in Example 7, between Example 9 and Example 10, the phenol reducing effect was greater in Example 10, and between Example 11 and Example 12, the phenol reducing effect was greater in Example 12.

[0111] Also, in the case where smoking article filters are manufactured by injecting the mixed solution of the hydrophobic emulsion and the same amount of phenol reducing material, it can be seen that the phenol reducing effect is greater when PEG is included as a phenol reducing material, compared to when TEC is included as a phenol reducing material. Specifically, it can be seen that, between Example 4 and Example 6 in which the same content of phenol reducing material was injected together with the hydrophobic emulsion using the same method, the phenol reducing effect was greater in Example 6, between Example 5 and Example 7, the phenol reducing effect was greater in Example 7, between Example 9 and Example 11, the phenol reducing effect was greater in Example 11, and between Example 10 and Example 12, the phenol reducing effect was greater in Example 12.

[0112] Also, it can be seen that phenol reducing performance is different according to an operation or method of injecting the mixed solution of the hydrophobic emulsion and the same amount of phenol reducing material. Specifically, it can be seen that the phenol reducing effect is greater when the mixed solution is injected onto the lyocell fibers using the spray method compared to when the mixed solution is injected onto the lyocell tow using the brush method. Specifically, it can be seen that, between Example 4 and Example 9 in which the same content of the same type of phenol reducing material was injected together with the hydrophobic emulsion, the phenol reducing effect was greater in Example 4, between Example 5 and Example 10, the phenol reducing effect was greater in Example 5, between Example 6 and Example 11, the phenol reducing effect was greater in Example 6, between Example 7 and Example 12, the phenol reducing effect was greater in Example 7, and between Example 8 and Example 13, the phenol reducing effect was greater in Example 8.

[0113] The above-described smoking article filter 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 invention. The smoking article 100 includes the smoking material portion 10 and the filter portion 20, and the above-described smoking article filter is applied to the filter portion 20 of the smoking article 100. In the smoking article 100, the smoking material portion 10 is positioned upstream of the filter portion 20.

[0114] 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. 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.

[0115] The filter portion 20 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 basically includes the above-described cigarette filter including lyocell tow in which a plurality of lyocell fibers are bonded using a binder. The cigarette filter including the lyocell tow may replace all or part of the filter portion 20 of existing smoking articles, and when the cigarette 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.

[0116] 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.

[0117] 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 fibers and a phenol functional additive 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.

[0118] 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 included in the filter portion 20.

[0119] The exterior of the smoking material portion 10 and the filter portion 20 may be wrapped with a wrapper 30a or 30b.

[0120] The smoking material portion 10 may be wrapped with a 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.

[0121] 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.

[0122] 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 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. 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.

[0123] 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.

[0124] 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.

[0125] 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.

[0126] 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:

lyocell tow including a plurality of lyocell fibers; and

a phenol functional additive dispersed in the lyocell tow and including a phenol reducing material and a hydrophobic emulsion.

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

3. The smoking article filter of claim 2, wherein:

the phenol reducing material includes one of triethyl citrate (TEC) and polyethylene glycol (PEG); and the content of the phenol reducing material relative to the weight of the lyocell tow ranges from 0.5 wt% to 15 wt%.

4. The smoking article filter of claim 3, wherein the content of the phenol reducing material relative to the weight of the lyocell tow ranges from 1 wt% to 6 wt%.

5. The smoking article filter of claim 2, wherein:

the phenol reducing material includes triethyl citrate (TEC) and polyethylene glycol (PEG); and the content of the phenol reducing material relative to the weight of the lyocell tow ranges from 10 wt% to 30 wt%.

6. The smoking article filter of claim 5, wherein the content of the phenol reducing material relative to the weight of the lyocell tow ranges from 15 wt% to 25 wt%.

7. The smoking article filter of claim 1, wherein the phenol functional additive is dispersed in the lyocell tow using a brush type method or a spray type method.

8. The smoking article filter of claim 7, wherein the lyocell tow in which the phenol functional additive is dispersed is manufactured by injecting a mixed solution of the phenol reducing material and the hydrophobic emulsion onto the lyocell fibers using the spray type method and drying the mixed solution.

9. The smoking article filter of claim 7, wherein the smoking article filter is manufactured by injecting a mixed solution of the phenol reducing material and the hydrophobic emulsion onto the lyocell tow, which is manufactured using the lyocell fibers, using the brush type method and drying the mixed solution.

10. A method of manufacturing a smoking article filter, the method comprising:

preparing a plurality of lyocell fibers;

preparing a mixed solution by mixing a phenol reducing material and a hydrophobic emulsion;

manufacturing lyocell tow in which a phenol functional additive including the phenol reducing material and the hydrophobic emulsion is dispersed by injecting the mixed solution onto the plurality of lyocell fibers and drying the mixed solution; and

wrapping the lyocell tow in which the phenol functional additive is dispersed with wrapping paper,

wherein the phenol reducing material includes one or more of triethyl citrate (TEC) and polyethylene glycol (PEG).

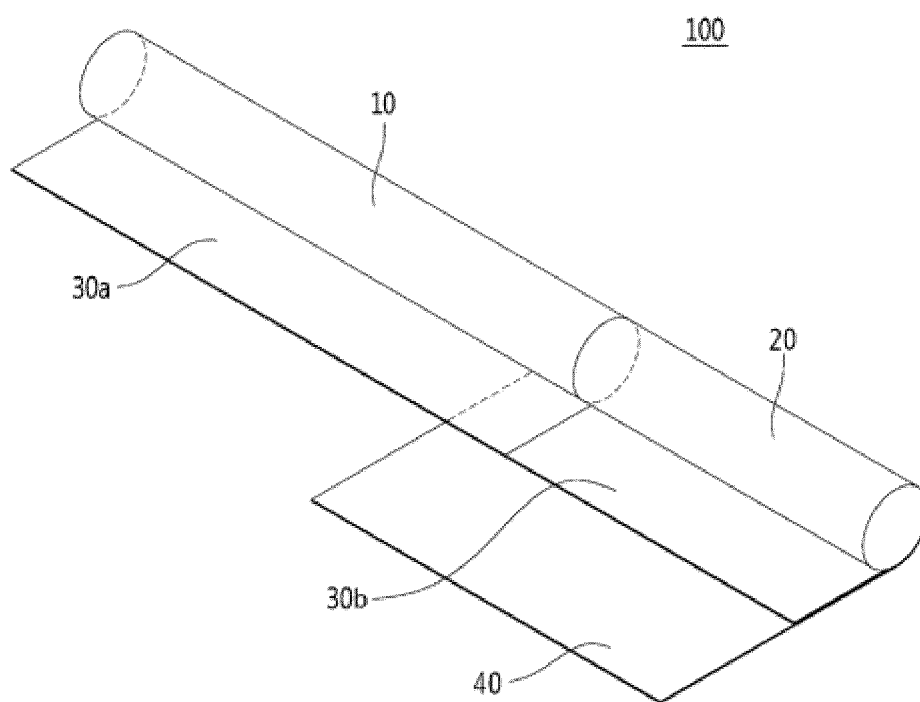
11. A method of manufacturing a smoking article filter, the method comprising:

preparing lyocell tow including a plurality of lyocell fibers;
preparing a mixed solution by mixing a phenol reducing material and a hydrophobic emulsion;
dispersing a phenol functional additive including the phenol reducing material and the hydrophobic emulsion in
the lyocell tow by injecting the mixed solution onto the lyocell tow and drying the mixed solution; and
5 wrapping the lyocell tow in which the phenol functional additive is dispersed with wrapping paper,
wherein the phenol reducing material includes one or more of triethyl citrate (TEC) and polyethylene glycol (PEG).

12. A smoking article comprising:

10 a smoking material portion;
a filter portion; and
a wrapper,
wherein the filter portion includes lyocell tow including a plurality of lyocell fibers and a phenol functional additive
dispersed in the lyocell tow and including a phenol reducing material and a hydrophobic emulsion, and
15 the phenol reducing material includes one or more of triethyl citrate (TEC) and polyethylene glycol (PEG).

FIG. 1



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2024/001511

A. CLASSIFICATION OF SUBJECT MATTER

A24D 3/06(2006.01)i; A24D 3/10(2006.01)i; A24D 3/14(2006.01)i; A24D 3/04(2006.01)i; A24D 3/02(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 3/04(2006.01); A24D 3/08(2006.01); A24D 3/10(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: 라이오셀 (lyocell), 필터 (filter), 섬유 (fiber), 페놀 (phenol), 분산 (dispensing)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 10-2029981 B1 (KT & G CORPORATION) 08 October 2019 (2019-10-08) See claims 1, 6, 10, 13, 15 and 17-18; and figures 1-3.	1-12
Y	JP 2015-523079 A (PHILIP MORRIS PRODUCTS S.A.) 13 August 2015 (2015-08-13) See claims 6-7; and figures 1-2.	1-12
A	KR 10-2006-0081267 A (KT & G CORPORATION) 12 July 2006 (2006-07-12) See entire document.	1-12
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A	WO 2022-018180 A1 (DELFORTGROUP AG) 27 January 2022 (2022-01-27) See entire document.	1-12

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

* Special categories of cited documents:

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“D” document cited by the applicant in the international application

“E” earlier application or patent but published on or after the international filing date

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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

Date of the actual completion of the international search

21 May 2024

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Name and mailing address of the ISA/KR

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/KR2024/001511

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