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

(11) EP 3 779 011 A1

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

(43) Date of publication:
17.02.2021 Bulletin 2021/07

(21) Application number: **19826613.2**

(22) Date of filing: **14.06.2019**

(51) Int Cl.:
D04H 1/4258 *(2012.01)* ***D01F 8/02*** *(2006.01)*
D01D 5/253 *(2006.01)* ***A45D 44/00*** *(2006.01)*

(86) International application number:
PCT/KR2019/007218

(87) International publication number:
WO 2020/004843 (02.01.2020 Gazette 2020/01)

(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 MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **29.06.2018 KR 20180075232**

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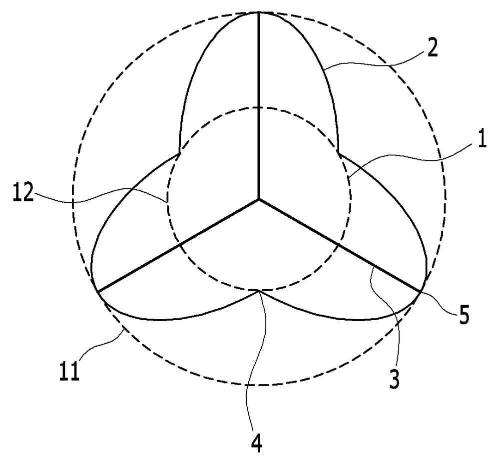
(54) NONWOVEN FABRIC ASSEMBLY AND SHEET MASK USING SAME

(57) The present disclosure relates to a nonwoven fiber assembly and a mask pack sheet using the same, and specifically, to a nonwoven fiber assembly which has excellent bending characteristics for a use in an industrial material, having a pleasant feel and a soft gloss property for a use in clothes or interior decoration, having excellent physical properties such as transparency, skin adhesiveness, absorbency and retention of a solvent such as water, and a smooth surface feeling for use in a sheet mask nonwoven fiber assembly, and includes a lyocell fiber having a large specific surface area, and a mask pack sheet using the nonwoven fiber assembly.

【FIG. 1】



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Description

[TECHNICAL FIELD]

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application claims the benefit of Korean Patent Application No. 10-2018-0075232 filed on June 29, 2018 with the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference in its entirety.

[0002] The present disclosure relates to a nonwoven fiber assembly including lyocell fibers and a mask pack sheet using the same.

[BACKGROUND ART]

[0003] A fiber refers to a natural or man-made linear material that is flexible and thin when viewed in shape, and has a high ratio of length to thickness. Fibers are classified into long fibers, semi-long fibers, and staple fibers in terms of the shape thereof, and are classified into natural fibers and man-made fibers in terms of the raw material thereof.

[0004] Fibers have had a close relationship with human life since old times, and natural fibers such as cotton, linen, wool, and silk have been used as the main raw material for clothes. The use of fibers has extended beyond a clothing material to an industrial material in accordance with the advancement of science and technology since the industrial revolution. In order to meet the rapidly growing demand for fibers due to cultural development and the increase in population, man-made fibers have been developed as novel fiber materials.

[0005] Among these man-made fibers, regenerated fibers have not only an excellent tactile sense and wearing sensation but also a very fast water-absorbing and discharging ability, compared to cotton, and thus have been frequently used as the raw material of clothes. In particular, among these regenerated fibers, rayon fibers have excellent gloss and color development and realize the same tactile sense as natural fibers, and further, rayon fibers are considered to be a material that is harmless to the human body, and accordingly, have been used extensively in the past. However, rayon fibers have the characteristics of materials that often cause shrinkage and wrinkles, the manufacturing process thereof is complicated, and a lot of chemicals are used during a process for dissolving wood pulp, which causes problems in the working environment, and environmental pollution during wastewater treatment.

[0006] Accordingly, studies have been made to find fibers that are not harmful to the environment and the human body and have excellent physical properties compared to other fibers. Recently, lyocell fibers produced from natural pulp and amine oxide hydrate have been proposed. Lyocell fibers have excellent fiber properties such as tension properties and tactile sense, compared to existing regenerated fibers, and also do not generate any pollutants during the production process thereof, an amine oxide-based solvent used to form the lyocell fibers may be recycled, and may be biodegradable when discarded. Accordingly, lyocell fibers have been used in various fields as environment-friendly fibers.

[0007] However, currently, lyocell fibers can be produced only in the form of products having a circular section, and it is expected that lyocell fibers may exhibit various physical properties depending on the cross-sectional shape thereof. Further, the technology related to the non-woven fiber aggregate containing a lyocell fiber is disclosed in Japanese Unexamined Patent Publication No. 2009-540140.

[0008] However, even if such a technique is used, there is a problem that various properties such as swelling properties, interfacial adhesion properties, and quick-drying properties are not excellent because there is no effect of increasing the specific surface area due to an increase in the space occupancy ratio.

[DETAILED DESCRIPTION OF THE INVENTION]

[Technical Problem]

[0009] It is an object of the present disclosure to provide a nonwoven fiber assembly having excellent bending properties, pleasant touch and soft gloss properties, and excellent physical properties such as transparency, skin adhesion, absorption and retention of a solvent such as water, and smooth surface feeling.

[0010] It is another object of the present disclosure to provide a mask pack sheet which is excellent in transparency, skin adhesion, absorption and retention of a solvent such as water, and smooth surface feeling by using the above-mentioned nonwoven fiber aggregate.

[Technical Solution]

[0011] Provided herein is a nonwoven fiber assembly including a lyocell fiber prepared by spinning a lyocell spinning dope containing a cellulose pulp and an N-methylmorpholine-N-oxide aqueous solution, wherein a cross-section of lyocell monofilaments included in the lyocell fiber includes a plurality of protrusions, wherein the plurality of protrusions come in contact with a virtual first circle and a virtual second circle contained inside the virtual first circle, and are integrally formed around the virtual second circle, and the end thereof has a shape in contact with the first virtual circle.

[0012] Also provided herein is a mask pack sheet using the above-mentioned nonwoven fiber aggregate.

[0013] Hereinafter, a nonwoven fiber assembly and a mask pack sheet using the same according to a specific embodiment of the present disclosure will be described in more detail.

[0014] Terms such as first or second may be used to describe various components, and such terms are used only to distinguish one component from another.

[0015] According to one embodiment of the present disclosure, there can be provided a nonwoven fiber assembly including a lyocell fiber prepared by spinning a lyocell spinning dope containing cellulose pulp and an N-methylmorpholine-N-oxide aqueous solution, wherein the cross-section of lyocell monofilaments included in the lyocell fiber includes a plurality of protrusions, wherein the plurality of protrusions are in contact with a virtual first circle and a virtual second circle contained inside the virtual first circle, but are integrally formed around the virtual second circle, and the end thereof has a shape in contact with the first virtual circle.

[0016] The lyocell fiber is produced from natural pulp and amine oxide hydrate, and may have fiber properties such as superior tension properties and tactile sense compared to conventional regenerated fibers. Further, the lyocell fiber corresponds to a hydrophilic material, and has a higher specific surface area as a single fiber fineness is reduced, and thus, has a superior water absorbing ability. When a nonwoven fiber aggregate containing a lyocell fiber is impregnated with a liquid composition such as water and an essence, the absorbency of the nonwoven fiber assembly may be increased, and the retention power of the liquid composition in the nonwoven fiber assembly may also be increased.

[0017] However, conventional lyocell fibers can produce only products having a circular cross-section, and the lyocell fiber having a circular cross-section has a problem in that it does not have the effect of increasing the specific surface area and thus is not excellent in various properties such as swelling properties, interfacial adhesion properties, and quick-drying properties. Therefore, in order to solve the above-mentioned problems, the present inventors developed a nonwoven fiber assembly including a lyocell fiber having a large specific surface area, and found that such as nonwoven fiber assembly can exhibit physical properties that could not be provided from a conventional nonwoven fiber assembly including a lyocell fiber having a circular cross-section, thereby completing the present disclosure.

[0018] Further, the lyocell fiber contained in the nonwoven fiber aggregate is produced by spinning a lyocell spinning dope containing a cellulose pulp and an N-methylmorpholine-N-oxide aqueous solution. In particular, it was confirmed that the use of N-methylmorpholine-N-oxide aqueous solution leads to the effect of more easily dissolving cellulose pulp in the lyocell spinning dope.

[0019] Furthermore, the nonwoven fiber aggregate can be used for industrial materials due to its excellent bending properties, can be used for clothing or interior purposes due to its good texture and soft gloss properties, and can be used as a nonwoven fiber assembly for a mask pack due to its excellent physical properties such as transparency, skin adhesion, absorption and retention of a solvent such as water, and a smooth surface feeling.

[0020] The lyocell fiber contained in the nonwoven fiber assembly according to the one embodiment includes one or more lyocell multifilaments, and these lyocell multifilaments may include one or more lyocell monofilaments.

[0021] The lyocell monofilament may have a multi-lobal cross-section, and specifically, the multi-lobal cross-section means a shape including a plurality of protrusions 2.

[0022] FIG. 1 is a view schematically showing a cross-section of the lyocell monofilament. According to this, the multi-lobal cross-section of the lyocell monofilament may have a shape of a plurality of protrusions 2 integrally formed around one central part 1.

[0023] Specifically, the multi-lobal cross-section can define the size and shape within the range of: a virtual first circle 11 connecting end points of each of the plurality of projections 2 and a virtual second circle 12 included inside the virtual first circle 11. At this time, in the virtual first circle 11 and the virtual second circle 12, a radius of the virtual first circle 11 is larger than that of the virtual second circle 12, and the center of the virtual first circle may be identical to the center of the second circle.

[0024] The multi-lobal cross-section includes a plurality of protrusions 2, and the plurality of protrusions 2 are formed integrally with the central part 1 overlapping with the virtual second circle 12, wherein an end 5 of each protrusion comes in contact with the virtual first circle 11 and a concave part 4 formed between the protrusions may have a shape in contact with the virtual second circle 12.

[0025] Further, in order to maximize the specific surface area of the lyocell fiber, the multi-lobal cross-section may include 2 or more or 3 or more protrusions.

[0026] The virtual first circle 11 may have a radius of 6.0 to 7.8 μm, 6.5 to 7.7 μm, or 7.0 to 7.5 μm. When the radius of the virtual first circle is less than 6.0 μm, it is impossible to implement a multi-lobal cross-sectional shape, and when the radius of the virtual first circle is more than 7.8 μm, it may be difficult to form a monofilament having fineness suitable as fiber products.

[0027] Meanwhile, the virtual second circle 12 may have a radius of 1.8 to 2.1 μm. When the radius of the virtual second circle is less than 1.8 μm, it is impossible to implement a multi-lobal cross-sectional shape, and when the radius of the virtual second circle is more than 2.1 μm, it may be difficult to form a monofilament having fineness suitable for fiber products.

[0028] Since the lyocell monofilament has a multi-lobal cross-section as described above, the lyocell fiber may have a space occupancy ratio of 150 to 300 % or 150 to 200 %, as defined by Equation 1 below.

<Equation 1>

Space occupancy ratio (%) = (Area of first virtual circle/ Cross-sectional area of lyocell monofilament) X 100

[0029] The space occupancy ratio means a ratio of a space that the monofilament substantially occupies in the fiber due to the plurality of protrusions of the multi-lobal cross-section. That is, if the cross-section of the monofilament included in the lyocell fiber is a circular cross-section, the cross-sectional area of the actual monofilament is the same as the area of the virtual first circle, and therefore, the space occupancy ratio defined as above is 100 %. However, in the case of the lyocell fiber having a multi-lobal cross-section including a protrusion, the actual area occupied by the fiber is increased by the protrusion. Therefore, it can be seen that as the space occupancy ratio increases, the specific surface area of the fiber increases.

[0030] In addition, lyocell fibers satisfying the above-described space occupancy ratio may be excellent in several properties such as swelling properties, interfacial adhesion properties, and quick-drying properties due to the effect of increasing the specific surface area.

[0031] The lyocell fiber included in the nonwoven fiber assembly according to the one embodiment is a fiber produced by spinning a lyocell spinning dope containing a cellulose pulp and an N-methylmorpholine-N-oxide aqueous solution.

[0032] Since the lyocell fiber is produced by spinning a lyocell spinning dope containing N-methylmorpholine-N-oxide, it exhibits the effect of more easily dissolving a cellulose pulp in the lyocell spinning dope.

[0033] Specifically, the lyocell spinning dope may contain 6 to 16 % by weight of cellulose pulp, and 84 to 94 % by weight of an N-methylmorpholine-N-oxide aqueous solution. For example, the weight ratio of the cellulose pulp and the N-methylmorpholine-N-oxide aqueous solution may be 6:94 to 16:84, 8:92 to 14:86, or 10:90 to 12:88.

[0034] When the content of cellulose pulp in the lyocell spinning dope is too small, it is difficult to implement the fiber properties, and when the content of cellulose pulp is too high, it may be difficult to dissolve it in an aqueous solution. Further, when the content of the N-methylmorpholine-N-oxide aqueous solution in the lyocell spinning dope is too small, there is a problem that the dissolution viscosity is greatly increased, and when the content of the N-methylmorpholine-N-oxide aqueous solution is too large, the spinning viscosity may be significantly lowered, and it may be difficult to prepare uniform fibers in the spinning step.

[0035] Further, the cellulose pulp may contain 85 to 97 % by weight, 89 to 95 % by weight, or 92 to 94 % by weight of alpha-cellulose. Further, the degree of polymerization (DPw) of the cellulose pulp may be 600 to 1700, 700 to 1600, or 800 to 1300.

[0036] In the N-methylmorpholine-N-oxide aqueous solution, the weight ratio of N-methylmorpholine-N-oxide to water may be 93:7 to 85:15. When the weight ratio of the N-methylmorpholine-N-oxide to water is more than 93:7, the dissolution temperature becomes high, and thus, the decomposition of cellulose may occur when the cellulose is dissolved. And when the weight ratio is less than 85:15, the dissolution performance of the solvent may be deteriorated, and the dissolution of the cellulose may be difficult.

[0037] The lyocell fiber produced by spinning the lyocell spinning dope described above may be produced in the form of staple fibers, and this can be used for a nonwoven fiber assembly for a mask pack because important physical properties for a mask pack, for example, skin adhesion, essence absorption and retention, soft touch, etc., are very superior to other materials.

[0038] The fineness of the lyocell fiber may be 1.0 to 1.5 denier. When the fineness of the lyocell fiber is less than 1.0 denier, there is a problem that the production of lyocell fibers is difficult, and when the fineness of the lyocell fiber is more than 1.5 denier, there are no superior characteristics because it is a general fineness applied to a mask pack, and physical properties such as skin adhesion and essence absorption power shows general levels.

[0039] The fineness is defined by Equation 2 below, and can be obtained using the actual lyocell monofilament cross-sectional area obtained through cross-sectional analysis and the density of the lyocell fiber (1.49 g/cm^2).

<Equation 2>

$$\text{Fineness (De)} = [\text{Monofilament cross-sectional area of lyocell fiber } (\mu m^2) \times \text{Density of lyocell fiber } (g/cm^3) \times 9000 (m)]/1{,}000{,}000$$

[0040] In addition, the lyocell fiber may be a staple fiber, and the fiber length may be 36 to 40 mm, or 37 to 39 mm. When the lyocell fiber is used as a nonwoven fiber aggregate within the fiber length range, processability in a carding step during the production process of the nonwoven fiber aggregate can be excellent.

[0041] Further, the number of crimps of the lyocell fiber may be 5 to 20 cpi or 8 to 12 cpi. When the number of crimps is too small, entanglement between fibers is low in the carding step during the production process of the nonwoven fiber assembly, which causes a process problem, and when the number of crimps is too large, there arises a problem that the opening is not properly performed in the carding step during the production process of the nonwoven fiber aggregate.

[0042] Further, an oil content of the lyocell fiber may be 0.1 to 0.4 % by weight, or 0.2 to 0.3 % by weight. When the oil satisfies the range of weight percent, it can reduce the friction generated in the process of forming filaments described later into a crimp tow, a crimp between fibers can be properly formed, and carding properties can be improved during production of the nonwoven fiber assembly.

[0043] The nonwoven fiber assembly of the one embodiment including the lyocell fiber has a thinner thickness of the nonwoven fiber assembly compared to a general circular cross-sectional fiber at the same unit weight. Consequently, when this is used in a mask pack, it has high absorption power for solvents such as essence, and thus, is also excellent in the essence retaining power and can exhibit a remarkable effect compared to other materials.

[0044] Meanwhile, the basis weight of the nonwoven fiber aggregate may be 30 to 60 g/m^2, 35 to 55 g/m^2, or 40 to 50 g/m^2. Also, the thickness of the nonwoven fiber assembly may be 0.3 to 0.6 mm, 0.35 to 0.58 nm, or 0.4 to 0.55 mm. The thickness of the nonwoven fiber assembly is a physical property that varies depending on the single fiber fineness of the staple fiber fineness and the basis weight of the nonwoven fiber assembly. The lower the single fiber fineness of the staple fiber and the smaller the basis weight of the nonwoven fiber aggregate, the thinner the thickness may be. The basis weight and thickness range refer to the optimum range for improving the absorption rate, transparency, and adhesion of the liquid composition among the nonwoven fiber aggregates containing the lyocell fibers satisfying the fineness, fiber length, number of crimps, and oil content of the lyocell fibers.

[0045] Moreover, the nonwoven fiber aggregate may have a water absorption rate of 1000 to 1600 %, 1100 to 1600 %, or 1300 to 1600 %. As described above, the lyocell fiber has hydrophilicity and thus has a higher water absorption rate than other fibers, but when satisfying the properties of the lyocell fiber and satisfying the basis weight and thickness range of the nonwoven fiber assembly, the water absorption rate of the nonwoven fiber aggregate including the lyocell fiber may be in compliance with the above range.

[0046] Further, the nonwoven fiber aggregate may have transparency of 80 to 84 % after water treatment, and transparency of 88 to 94 % after essence treatment. As for the transparency of the nonwoven fiber assembly, the fineness of the lyocell fiber is 1.0 to 1.4 denier which corresponds to a fine fineness, and the thickness of the nonwoven fiber aggregate including the lyocell fiber also becomes thin, whereby, when a liquid composition such as water and essence is treated on the nonwoven fiber aggregate, it can have a soft touch and transparency within the above transparency range. Meanwhile, treating the nonwoven fiber aggregate with water or essence means that the nonwoven fiber aggregate is supported or immersed in a liquid composition such as water or essence.

[0047] Further, the nonwoven fiber assembly may have skin adhesion of 3.6 to 4.2 gf after water treatment, and skin adhesion of 4.5 to 5.3 gf after essence treatment. The skin adhesion of the nonwoven fiber assembly also satisfies the characteristics of the lyocell fiber, and the above range may be satisfied by the basis weight and the thickness of the nonwoven fiber aggregate including this. Meanwhile, treating the nonwoven fiber aggregate with water or essence means that the nonwoven fiber aggregate is supported or immersed in a liquid composition such as water or essence. The skin adhesion is a measurement of adhesive force that appears when a nonwoven fiber aggregate treated with moisture or essence is attached to human skin and then detached.

[0048] Further, the nonwoven fiber aggregate may have an oil content of 0.001 % by weight or less relative to 100 % by weight of the nonwoven fiber aggregate. The nonwoven fiber aggregate may exhibit the above-described content since most of the oil contained in the lyocell fiber is washed away during water-jet entanglement of the spunlace process in the production process of the nonwoven fiber assembly.

[0049] According to another embodiment of the present disclosure, there is provided a mask pack sheet using the above-mentioned nonwoven fiber assembly.

[0050] As described above, the nonwoven fiber aggregate has high absorption and retention power for solvents such as water or essence, since the transparency and skin adhesion are high even after treatment with solvents such as water or essence. Thus, the mask pack sheet using such a nonwoven fiber assembly has very excellent effects compared to other materials, in terms of transparency, skin adhesion, essence absorption and retention, and soft texture, which are the most important properties of the mask pack sheet.

[0051] Further, the mask pack sheet not only has excellent skin adhesion and wearing feeling even in the facial area having many winkles, but also is excellent in the absorbency of liquid compositions such as moisture and essence, so it can effectively supply nutrition to the facial area.

[0052] The method for producing the nonwoven fiber assembly used herein may be a generally known method for producing a nonwoven fiber aggregate. Specifically, the method may include: (S1) spinning a lyocell spinning dope containing a cellulose pulp and an N-methylmorpholine-N-oxide aqueous solution; (S2) coagulating the lyocell spinning dope spun in step (S1) to obtain a lyocell multifilament; (S3) water-washing the lyocell multifilament obtained in step (S2); (S4) oil-treating the lyocell multifilament washed in step (S3); (S5) crimping the lyocell multifilament oil-treated in step (S4) through a stuffer box to obtain a crimped tow; (S6) drying and cutting the crimped tow obtained in step (S5) to obtain a lyocell staple fiber; and (S7) producing the lyocell staple fiber obtained in step (S6) into a nonwoven fiber aggregate.

[Step (S1)]

[0053] Step (S1) is a step of spinning a lyocell spinning dope containing a cellulose pulp and an N-methylmorpholine-N-oxide aqueous solution, and the content/weight ratio of the cellulose pulp and N-methylmorpholine-N-oxide aqueous solution contained in the lyocell spinning dope, the content of alpha-cellulose, the degree of polymerization of the cellulose pulp, and the content of water in the N-methylmorpholine-N-oxide aqueous solution are the same as described above with respect to the nonwoven fiber assembly of the one embodiment.

[0054] The spinning of the lyocell spinning dope may be performed while the lyocell spinning dope is discharged from the spinning nozzle of the spinneret, and the spinning dope discharged from the spinning nozzle may have a filament shape (form). At this time, the spinneret may serve to discharge the spinning dope having the filament form into a coagulation solution in a coagulation tank through an air gap section. The step of discharging the spinning dope from the spinneret may be performed at a spinning temperature of 80 to 130 °C.

[0055] The spinneret may be a spinneret in which a plurality of the unit holes are formed when a plurality of holes are set to be one unit hole in the shape of the spinneret hole. In this case, the number of holes included in the unit hole may be the same as the number of protrusions of the multi-lobal cross-section. For example, in order to produce a lyocell fiber including a monofilament having a multi-lobal cross-section including three protrusions, the number of holes included in the unit hole may be three.

[Step (S2)]

[0056] Step (S2) is a step of coagulating the lyocell spinning dope spun in step (S1) to obtain a lyocell multifilament. The coagulation of step (S2) may include primary coagulation using air quenching (Q/A) for coagulating the dope by supplying cold air to the spinning dope; and secondary coagulation of immersing and coagulating the primarily coagulated spinning dope in a coagulation solution.

[0057] After the discharge of the spinning dope through the spinneret in step (S1), the spinning dope may pass through the air gap zone between the spinneret and the coagulation bath. In the air gap zone, cold air is supplied from an air-cooling part positioned inside the donut-shaped spinneret toward the outside of the spinneret, whereby the spinning dope may be primarily coagulated through air quenching using cold air.

[0058] In this case, the factors that have an influence on the physical properties of the lyocell multifilament obtained in step (S2) include the temperature and the wind velocity of the cold air in the air gap zone, and the coagulating in step (S2) may be performed by supplying the cold air at a temperature of 4 to 15 °C and a wind velocity of 30 to 120 m/s to the spinning dope.

[0059] When the temperature of the cold air upon primary coagulation is lower than 4 °C, the surface of the spinneret may be cooled, and the cross-section of the lyocell multifilament may become non-uniform and spinning processability may deteriorate. And when the temperature is higher than 15 °C, primary coagulation using the cold air is not sufficient, thus deteriorating spinning processability.

[0060] Also, when the wind velocity of the cold air upon primary coagulation is less than 5 m/s, primary coagulation using the cold air is not sufficient and spinning processability is deteriorated, which causes yarn breakage. And when the wind velocity thereof exceeds 60 m/s, the spinning dope discharged from the spinneret may be shaken by the air, and spinning processability may thus deteriorate.

[0061] After primary coagulation using air quenching, the spinning dope is supplied into the coagulation bath containing the coagulation solution to undergo secondary coagulation. In order to appropriately carry out secondary coagulation, the temperature of the coagulation solution may be set to 30 °C or less. This is to properly maintain the coagulation rate because the temperature for secondary coagulation is not excessively high. Here, the coagulation solution can be prepared and used with a conventional composition in the technical field to which the present disclosure belongs, and thus is not particularly limited.

[Step (S3)]

[0062] Step (S3) is a step of water-washing the lyocell multifilament obtained in step (S2).

[0063] Specifically, the lyocell multifilament obtained in step (S2) is supplied into a draw roller and then into a water-washing bath and is thus water-washed.

[0064] In the step of water-washing the multifilament, a water-washing solution at 0 to 100 °C may be used, taking into consideration the recovery and reuse of the solvent after the water-washing. The water-washing solution may include water, and may further include other additives as necessary.

[Step (S4)]

[0065] Step (S4) is a step of oil-treating the lyocell multifilament water-washed in step (S3), and drying is conducted after oil treatment.

[0066] The oil treatment may be performed in a manner in which the lyocell multifilament is completely immersed in oil and the amount of oil attached to the multifilament is maintained uniform by squeezing rollers provided to the entry and discharge rolls of an oil treatment device. The oil functions to reduce the friction of the filaments upon contact with the drying roller and the guide and in the crimping process, and also facilitates the formation of the crimps between the fibers.

[Step (S5)]

[0067] Step (S5) is a step of crimping the lyocell multifilament oil-treated in step (S4) to obtain a crimped tow.

[0068] The "crimping" means applying crimps to multifilament. Specifically, the crimping may be performed using a stuffer box, thereby obtaining a crimped tow having 30 to 40 crimps per inch.

[0069] In step (S5), crimping is performed by applying steam and pressure to the lyocell multifilament.

[0070] Specifically, the lyocell multifilament is passed through a steam box and supplied with steam at 0.1 to 1.0 kgf/cm^2 to raise the temperature and moisture of the multifilament, and is then pressed at a pressure of 1.5 to 2.0 kgf/cm^2 using a press roller, thereby forming crimps in the stuffer box.

[0071] In this case, when the amount of supplied steam is less than 0.1 kgf/cm^2, crimps are not efficiently formed, and when the amount thereof exceeds 1.0 kgf/cm^2, the temperature in the stuffer box is raised to 120 °C or higher, and thus the filaments are attached to each other and do not pass through the stuffer box. In addition, when the pressure that is applied to the press roller is less than 1.5 kgf/cm^2, the desired number of crimps is not formed, and when the pressure applied thereto exceeds 2.0 kgf/cm^2, the pressing force is too strong, making it difficult to pass the filaments through the stuffer box.

[Step (S6)]

[0072] Step (S6) is a step of drying and cutting the crimped tow obtained in step (S5) to obtain a lyocell staple fiber.

[0073] The crimped tow may be dried using a lattice dryer and then subjected to a cutting step to form a lyocell staple fiber.

[Step (S7)]

[0074] Step (S7) is a step of producing the lyocell staple fiber obtained in step (S6) into a nonwoven fiber aggregate.

[0075] The lyocell staple fiber may be water-jet entangled in a carding and spunlace manner to produce a nonwoven fiber assembly.

[ADVANTAGEOUS EFFECTS]

[0076] According to the present disclosure, a nonwoven fiber aggregate and a mask pack sheet using the same can be provided in which the nonwoven fiber aggregate can exhibit physical properties that could not be provided in the conventional nonwoven fiber aggregate including a lyocell fiber having a circular cross-section, whereby it is used for industrial materials due to its excellent bending properties, it is used for clothing or interior purposes due to its excellent tactile sense and soft gloss characteristics, and it is used as a nonwoven fiber assembly for mask packs due to its excellent physical properties such as transparency, skin adhesion, moisture absorption and retention, and smooth surface feeling.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[0077]

FIG. 1 is a view schematically showing a cross-section of a lyocell monofilament contained in a nonwoven fiber assembly according to the one embodiment.

FIG. 2a is a photograph of a cross-section of the lyocell fiber produced according to Preparation Example 1, FIG. 2b is a photograph of a cross-section of the lyocell fiber produced according to Preparation Example 2, and FIG. 2c is a photograph of a cross-section of the lyocell fiber prepared according to Preparation Example 3.

[DETAILED DESCRIPTION OF THE EMBODIMENTS]

[0078] Hereinafter, the present disclosure will be described in more detail with reference to the following examples. However, the following examples are for illustrative purposes only, and the present disclosure is not limited thereby. It will be apparent to those of ordinary skill in the art that the scope of the invention is not limited to or by these examples.

[PREPARATION EXAMPLE]

Preparation Example 1

[0079] Cellulose pulp having a degree of polymerization (DPw) of 820 and an alpha-cellulose content of 93.9 % was mixed with an N-methylmorpholine-N-oxide/H_2O mixed solvent containing 0.01 wt% of propyl gallate (in a weight ratio of cellulose pulp:N-methylmorpholine-N-oxide/H_2O = 90:10), thus preparing a spinning dope having a concentration of 12 wt % for producing a lyocell material.

[0080] First, a spinning nozzle of a spinneret having a plurality of unit holes, each including three holes, was prepared, and the spinning dope was maintained at a spinning temperature of 110 °C in the spinning nozzle. The spinning dope was then spun while adjusting the discharge amount and spinning speed of the spinning dope so that a single fiber fineness of the lyocell monofilament was 1.2 denier. The spinning dope in filament form discharged from the spinning nozzle was supplied to a coagulation solution in a coagulation bath via an air gap zone, thereby preparing a lyocell multifilament.

[0081] At this time, in the air gap zone, the spinning dope was primarily coagulated using cold air at a temperature of 8 °C and a wind speed of 10 m/s. On the other hand, as the coagulation solution, a solution having a temperature of 25 °C and a concentration of 85 wt% water and 15 wt% N-methylmorpholine-N-oxide was used.

[0082] The lyocell multifilaments drawn in the air layer through a draw roller were water-washed using a water-washing solution sprayed using a water-washing device, thereby removing residual N-methylmorpholine-N-oxide. The lyocell multifilaments were uniformly impregnated with oil and allowed the filaments to have an oil content of 0.2 %, and were then dried at 150 °C using a drying roller, thus preparing a lyocell fiber including a multifilament made of monofilaments having a multi-lobal cross-section containing three protrusions.

Preparation Example 2

[0083] The lyocell fiber including a multifilament made of a monofilament having a multi-lobal cross-section containing three protrusions was prepared in the same manner as in Preparation Example 1, with the exception that the single fiber fineness of the lyocell monofilament was set to be 1.4 denier.

Preparation Example 3

[0084] The lyocell fiber including a multifilament made of a monofilament having a multi-lobal cross-section containing three protrusions was prepared in the same manner as in Preparation Example 1, with the exception that the single fiber fineness of the lyocell monofilament was set to be 1.5 denier.

Preparation Example 4

[0085] The lyocell fiber including a multifilament made of a monofilament having a multi-lobal cross-section containing three protrusions was prepared in the same manner as in Preparation Example 1, with the exception that the single fiber fineness of the lyocell monofilament was set to be 2.5 denier.

Preparation Example 5

[0086] The lyocell fiber including multifilaments made of monofilaments having a circular cross-section with a cross-sectional diameter of 11.93 μm was prepared in the same manner as in Preparation Example 1, with the exception that one circular hole was set as a unit hole, a spinneret in which a plurality of unit holes were formed was used, and the wind speed upon air quenching was set to 15 m/s, so that the single fineness of the lyocell monofilament was set to be 1.5 denier.

Preparation Example 6

[0087] The lyocell fiber including a multifilament made of a monofilament having a circular cross-section with a cross-sectional diameter of 13.78 μm was prepared in the same manner as in Preparation Example 5, with the exception that the single fiber fineness of the lyocell monofilament was set to be 2.0 denier.

[0088] For the lyocell fibers prepared in Preparation Examples 1 to 6, the cross-sectional shape, the cross-sectional area, the fineness, and the space occupancy ratio of the lyocell monofilaments contained in the lyocell fibers were measured and calculated through the following methods, and the results are set forth in Table 1 below.

(1) Cross-sectional shape of the monofilament contained in lyocell fiber

[0089] A few bundles of fibers were sampled and then rolled together with black cotton. The resultant fiber was processed to be thin and then inserted into a hole in a plate that was used to transversely cut the fiber. Subsequently, the fiber was cut using a razor blade in a way such that the shape of the section thereof was not changed.

[0090] The cut section of the fiber was magnified (x500) and observed using an optical microscope (BX51, manufactured by Olympus Corporation), and the image of the section was stored using a digital camera. The desired cross-sectional image was designated, and the length and area of the major axis and minor axis, fiber thickness, and cross-sectional circumference length were analyzed using an image of the cross-section of the fiber according to the Olympus soft imaging solution program.

(2) Fineness

[0091] The fineness of the lyocell fiber was calculated from the cross-sectional area of the monofilament of the real lyocell fiber, which was obtained from the cross-section analysis, and the density (1.49 g/cm^2) of the lyocell fiber was determined using the following Equation 2.

<Equation 2>

$$\text{Fineness (De)} = [\text{Cross-sectional area of monofilament of lyocell fiber } (\mu m^2) \times \text{Density of lyocell fiber } (g/cm^3) \times 9000\ (m)]/1{,}000{,}000$$

(3) Space Occupancy Ratio

[0092] The space occupancy ratio of the lyocell fiber was calculated using the following Equation 1.

<Equation 1>

$$\text{Space occupancy ratio (\%)} = (\text{Area of first virtual circle/sectional area of monofilament included in lyocell fiber}) \times 100$$

[Table 1]

	Cross-sectional shape of lyocell monofilament				Fineness (De)	L1/L2	Space occupancy ratio (%)	Remarks
	Virtual first circle radius (L1,μm)	Virtual second circle radius (L2,μm)	Virtual first circle area (μm^2)	Cross-sectional shape of actual lyocell monofilament (μm^2)				
Preparation Example 1	7.35	1.8	169.72	89.56	1.2	4.1	189.5	multi-lobal cross-section
Preparation Example 2	7.7	2.0	186.27	104.97	1.4	3.9	177.4	multi-lobal cross-section
Preparation Example 3	7.8	2.1	191.13	112.13	1.5	3.7	170.4	multi-lobal cross-section
Preparation Example 4	8.0	3.2	201.06	185.77	2.5	2.5	108.23	multi-lobal cross-section
Preparation Example 5	5.965		111.86		1.5	1	100	Circular cross-section
Preparation Example 6	6.89	149.14			2.0	1	100	Circular cross-section

[0093] As shown in Table 1, it was confirmed that the lyocell fibers of Preparation Examples 1 to 4 consisting of monofilaments having a multi-lobal cross-section including three protrusions had a larger space occupancy ratio as compared with the lyocell fibers of Preparation Example 5 and Preparation Example 6 made of a monofilament having a circular cross-section.

[0094] At this time, FIGS. 2a to 2c are photographs of cross-sections of the lyocell fibers of Preparation Examples 1 to 3, respectively.

[0095] From these results, it was confirmed that the lyocell fibers of Preparation Examples 1 to 4 each had a large specific surface area, and that the lyocell fibers of Preparation Examples 1 to 4 can be widely applied to fields requiring a large specific surface area.

<EXAMPLE>

Example 1

[0096] While passing the lyocell fiber prepared in Preparation Example 1 through a steam box (pressure condition of 0.2 kgf/cm^2), it was subjected to a preheating state in which temperature was imparted to the tow, and pressed using a stuffer box compression roller at a pressure of 2.0 kgf/cm^2, thereby preparing a crimped tow in a stuffer box, which was dried through a lattice dryer and then finally cut to prepare a lyocell staple fiber having a fiber length of 38 mm.

[0097] The prepared lyocell staple fiber was subjected to a carding and spunlace process to finally prepare a nonwoven fiber assembly. The raw material input and process speed were adjusted to match the basis weight of the nonwoven fiber aggregate to the values in Table 2, and the deviation of the basis weight of the nonwoven fiber aggregate was set to be in the range of $\pm$10 %.

Examples 2 to 4

[0098] The nonwoven fiber aggregate was prepared in the same manner as in in Example 1, except that the lyocell fibers prepared in Preparation Examples 2 to 4 were respectively used, and the basis weight was changed as in Table 2 below.

[0099] The physical property values of the prepared nonwoven fiber aggregate were measured by the following measurement methods, and are shown in Table 2 below.

Comparative Examples 1 and 2

[0100] The nonwoven fiber aggregate was prepared in the same manner as in in Example 1, except that the lyocell fibers prepared in Preparation Examples 5 and 6 were respectively used, and the basis weight was changed as in Table 2 below.

[0101] The physical property values of the prepared nonwoven fiber aggregate were measured by the following measurement methods, and are shown in Table 2 below.

<Measurement method>

(1) Basis weight (gsm = g/m^2)

[0102] The nonwoven fiber aggregate was sampled with a width of 5 cm and a length of 20 cm, the weight was measured, and the basis weight was calculated according to Equation 3 below.

<Equation 3>

$$\text{Basis weight} = \text{Weight measured value of nonwoven fiber aggregate sample} \times 100$$

(2) Thickness

[0103] Measured using Mitutoyo Thickness Gauge 2046F.

(3) Transparency

[0104] Sample pretreatment: The nonwoven fiber aggregate was immersed in water or essence for 10 minutes.

[0105] A haze meter (Nippon Denshoku Industry, NDH-5000), which is a light transmittance device, was used to measure the transparency of the nonwoven fiber aggregate, and the transmittance at a wavelength of nanometers was measured.

(4) Absorbency

[0106] The nonwoven fiber aggregate was immersed in water or essence for 10 minutes, the weight before/after immersion was measured, and the ability of the nonwoven fiber aggregate to absorb water or essence was calculated according to Equation 4 below.

<Equation 4>

$$\text{Absorbency (\%)} = \{(\text{Weight of nonwoven fiber assembly after immersion} - \text{Weight of nonwoven fiber assembly before immersion}) / \text{Weight of nonwoven fiber assembly before immersion}\} \times 100$$

(5) Skin adhesion

[0107] The nonwoven fiber assembly was cut into a size of 25 mmx150 mm, immersed in water or essence for 10 minutes, and then attached to a human arm. Immediately after adhesion, the nonwoven fiber aggregate was detached from the skin using an Instron device (Instron-3365), and the adhesive strength (unit gf) was determined.

[Table 2]

	Lyocell fiber	Basis weight (gsm)	Thickness (mm)	Transparency (%)	Absorbency (%)	Skinadhesion (gf)
Example 1	Preparation Example 1	40	0.42	Water: 84 essence: 92	Water: 1200 essence: 1400	Water: 3.8 essence: 4.9
Example 2	Preparation Example 2	50	0.49	Water: 82 essence: 90	Water: 1300 essence: 1500	Water: 3.7 essence: 4.7
Example 3	Preparation Example 3	60	0.56	Water: 80 essence: 88	Water: 1400 essence: 1600	Water: 4.0 essence: 5.1
Example 4	Preparation Example 4	40	0.45	Water: 80 essence: 90	Water: 1000 essence: 1200	Water: 3.5 essence: 4.5
Comparative Example 1	Preparation Example 6	40	0.4	Water: 79 essence: 88	Water: 950 essence: 1100	Water: 3.3 essence: 4.3
Comparative Example 2	Preparation Example 7	60	0.52	Water: 78 essence: 86	Water: 1000 essence: 1150	Water: 3.5 essence: 4.5

[0108] As shown in Table 2, it was confirmed that the nonwoven fabric assemblies of Examples 1 to 4 in which a multilobal cross-section containing a plurality of protrusions, particularly the plurality of protrusions come in contact with a virtual first circle and a virtual second circle contained inside the virtual first circle, and are integrally formed around the virtual second circle, and the end thereof has a shape in contact with the first virtual circle, exhibits excellent performance in terms of transparency, water absorption, and adhesion while being thinner than the nonwoven fiber aggregates of Comparative Examples 1 and 2.

[0109] While the present disclosure has been particularly shown and described with reference to specific embodiments thereof, it will be apparent to those skilled in the art that this specific description is merely of a preferred embodiment and that the scope of the invention is not limited thereby. It is therefore intended that the scope of the invention be defined by the claims appended hereto and their equivalents.

[Explanation of Reference Numerals]

[0110] 1: central part, 2: protrusion, 3: major axis of protrusion, 4: concave part of protrusion, 5: end of protrusion, 11: virtual first circle, 12: virtual second circle

Claims

1. A nonwoven fiber assembly comprising a lyocell fiber prepared by spinning a lyocell spinning dope containing a cellulose pulp and an N-methylmorpholine-N-oxide aqueous solution,
   wherein a cross-section of lyocell monofilaments included in the lyocell fiber includes a plurality of protrusions, and the plurality of protrusions come in contact with a virtual first circle and a virtual second circle contained inside the virtual first circle, and are integrally formed around the virtual second circle, and the end thereof has a shape in

contact with the first virtual circle.

2. The nonwoven fiber assembly according to claim 1, wherein the lyocell spinning dope contains 6 to 16 % by weight of cellulose pulp, and 84 to 94 % by weight of an N-methylmorpholine-N-oxide aqueous solution.

3. The nonwoven fiber assembly according to claim 1, wherein the cellulose pulp contains 85 to 97 % by weight of alpha-cellulose, and has a degree of polymerization (DPw) of 600 to 1700.

4. The nonwoven fiber assembly according to claim 1, wherein the lyocell fiber has a space occupancy ratio of 150 to 300 % as defined by Equation 1 below:

<Equation 1>

Space occupancy ratio (%) = (Area of first virtual circle / Cross-sectional area of lyocell monofilament) X 100.

5. The nonwoven fiber assembly according to claim 1, wherein the virtual first circle has a radius of 6.0 to 7.8 μm.

6. The nonwoven fiber assembly according to claim 1, wherein the virtual second circle has a radius of 1.8 to 2.1 μm.

7. The nonwoven fiber assembly according to claim 1, wherein a center of the virtual first circle may be identical to a center of the second circle.

8. The nonwoven fiber assembly according to claim 1, wherein the lyocell fiber has fineness of 1.0 to 1.5 denier.

9. The nonwoven fiber assembly according to claim 1, wherein the lyocell fiber has a fiber length of 36 to 40 mm.

10. The nonwoven fiber assembly according to claim 1, wherein the number of crimps of the lyocell fiber is 5 to 20 cpi.

11. The nonwoven fiber assembly according to claim 1, wherein an oil content of the lyocell fiber is 0.1 to 0.4 % by weight relative to 100 % by weight of the lyocell fiber.

12. The nonwoven fiber assembly according to claim 1, wherein a basis weight of the nonwoven fiber aggregate is 30 to 60 g/m^2.

13. The nonwoven fiber assembly according to claim 1, wherein the nonwoven fiber assembly has a thickness of 0.3 to 0.6 mm.

14. The nonwoven fiber assembly according to claim 1, wherein the nonwoven fiber aggregate has a water absorption rate of 1000 to 1600 % relative to the weight of the lyocell fiber.

15. The nonwoven fiber assembly according to claim 1, wherein the nonwoven fiber aggregate has transparency of 80 to 84 % after water treatment.

16. The nonwoven fiber assembly according to claim 1, wherein the nonwoven fiber aggregate has transparency of 88 to 94 % after essence treatment.

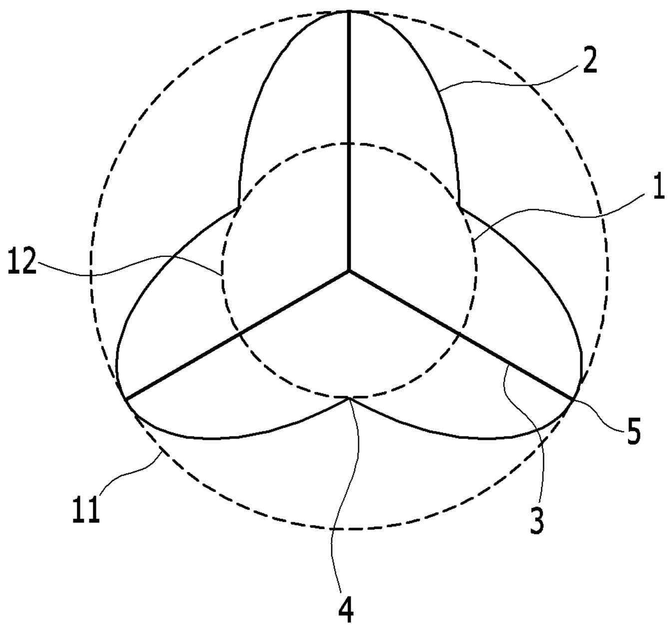
17. The nonwoven fiber assembly according to claim 1, wherein the nonwoven fiber aggregate has skin adhesion of 3.6 to 4.2 gf after water treatment.

18. The nonwoven fiber assembly according to claim 1, wherein the nonwoven fiber aggregate has skin adhesion of 4.5 to 5.3 gf after essence treatment.

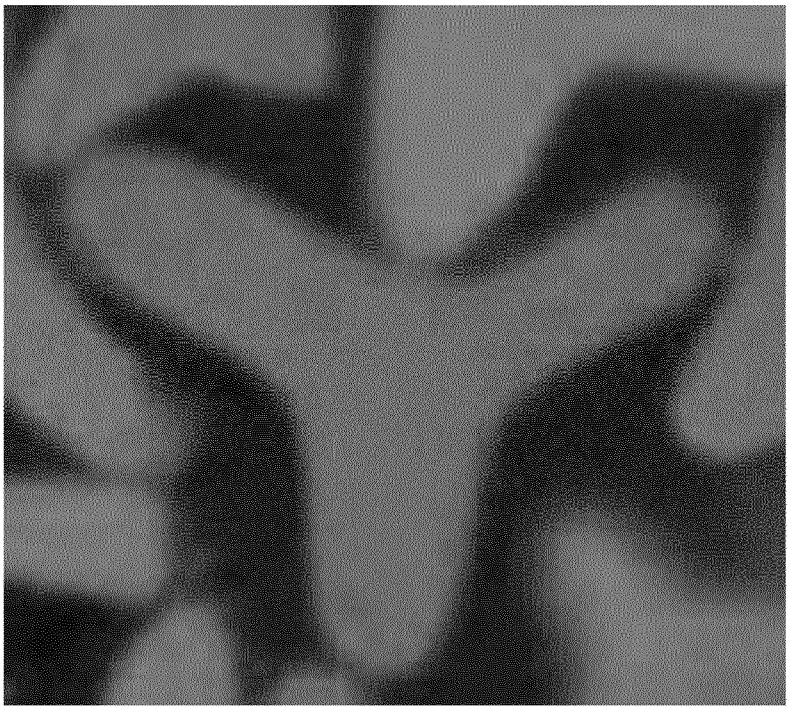
19. The nonwoven fiber assembly according to claim 1, wherein the nonwoven fiber aggregate has an oil content of 0.001 % by weight or less relative to 100 % by weight of the nonwoven fiber aggregate.

20. A mask pack sheet using the nonwoven fiber assembly according to claim 1.

【FIG. 1】

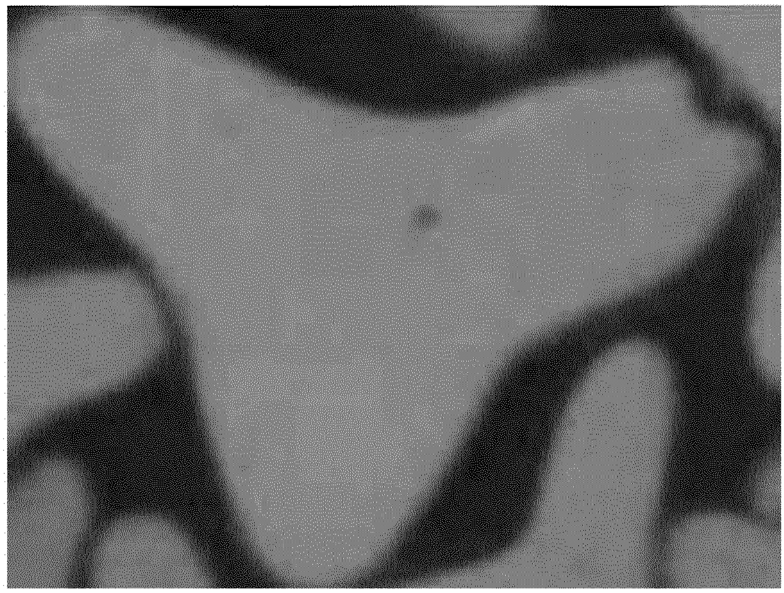


【FIG. 2a】



【FIG. 2b】

【FIG. 2c】



INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR2019/007218

A. CLASSIFICATION OF SUBJECT MATTER

D04H 1/4258(2012.01)i, D01F 8/02(2006.01)i, D01D 5/253(2006.01)i, A45D 44/00(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)

D04H 1/4258; D01D 10/06; D01D 5/088; D01D 5/253; D01F 2/00; D01F 2/02; D04H 1/4374; D04H 1/498; D01F 8/02; A45D 44/00

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: cellulose pulp, N-methylmorpholine-N-oxide aqueous solution, lyocell fiber, non-woven fiber aggregates

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y		13,15-18
Y	KR 10-2015-0030699 A (KURARAY KURAFLEX CO., LTD.) 20 March 2015 See paragraphs [0015], [0062], [0103]; and claim 1.	13,15-18
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A	KR 10-2017-0079531 A (KOLON INDUSTRIES, INC.) 10 July 2017 See the entire document.	1-20

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

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

Date of the actual completion of the international search	Date of mailing of the international search report
04 OCTOBER 2019 (04.10.2019)	**04 OCTOBER 2019 (04.10.2019)**
Name and mailing address of the ISA/KR Korean Intellectual Property Office Government Complex Daejeon Building 4, 189, Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea Facsimile No. +82-42-481-8578	Authorized officer Telephone No.

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Information on patent family members

International application No.
PCT/KR2019/007218

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