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(54) WATER-REPELLING FABRIC, AND TEXTILE PRODUCT

(57) The invention addresses the problem of providing a water-repellent cloth that is excellent in water repellency as well as stretchability and also a textile product using the water-repellent cloth. A means for resolution is a water-repellent cloth given water repellent processing, and the cloth is configured to include a composite yarn containing a stretch fiber and an ultrafine fiber having a single fiber fineness of 1 dtex or less.

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Description

Technical Field

[0001] The present invention relates to a water-repellent cloth that is excellent in water repellency as well as stretchability, and also to a textile product using the water-repellent cloth.

Background Art

[0002] Conventionally, cloths having water repellency have been demanded in the fields of sportswear, casual clothing, umbrella fabrics, and the like, and water repellents such as fluorine-based water repellents have been attached to cloths (see, e.g., PTL 1 and PTL 2).

[0003] In addition, in recent years, in order to be environmentally friendly, cloths using a fluorine-free water repellent without using a compound that may affect living organisms (e.g., perfluorooctanoic acid, perfluorooctane sulfonate, etc.) have been proposed (see, e.g., PTL3).

[0004] However, these cloths have been problematic in that they are not sufficient in terms of stretchability.

Citation List

Patent Literature

[0005]

[PTL 1] JP-A-60-94645
[PTL 2] JP-A-61-70043
[PTL 3] JP-A-2017-145521

Summary of Invention

[0006] The invention has been accomplished against the above background. An object thereof is to provide a water-repellent cloth that is excellent in water repellency as well as stretchability, and also a textile product using the water-repellent cloth.

Solution to Problem

[0007] The present inventors have conducted extensive research to solve the above problems and, as a result, found that in a water-repellent cloth given water repellent processing, by skillfully devising fibers that constitute the cloth, etc., a water-repellent cloth that is excellent in water repellency as well as stretchability can be obtained. As a result of further extensive research, they have accomplished the invention.

[0008] Thus, the invention provides "a water-repellent cloth given water repellent processing, the water-repellent cloth being characterized in that the cloth includes a composite yarn containing a stretch fiber and an ultrafine fiber having a single fiber fineness of 1 dtex or less."

[0009] At this time, it is preferable that the stretch fiber is a conjugate fiber made of two components joined in a side-by-side manner or an eccentric sheath-core manner or is a polytrimethylene terephthalate fiber. In addition, it is preferable that the cloth is a woven fabric having a cover factor CF of 1,000 or more. Note that the cover factor CF is defined by the following formula.

$$CF = (DWp/1.1)^{1/2} \times MWp + (DWf/1.1)^{1/2} \times MWf$$

[DWp is the warp total fineness (dtex), MWp is the warp weaving density (yarns/2.54 cm), DWf is the weft total fineness (dtex), and MWf is the weft weaving density (yarns/2.54 cm).]

[0010] In the water-repellent cloth of the invention, it is preferable that a surface of the cloth has formed thereon fine fiber loops composed of the ultrafine fiber. In addition, it is preferable that a surface of the cloth has a water-repellent roll-off angle of 15° or less. In addition, it is preferable that the degree of water repellency measured in accordance with JIS L1092-2009 7.2, Test for Resistance to Surface Wetting (Spray Method), is Level 4 or higher. In addition, it is preferable that after 10 washes as specified in JIS L0217-1995 (using the JAFET standard combination detergent), the degree of water repellency measured in accordance with JIS L1092-2009 7.2, Test for Resistance to Surface Wetting

(Spray Method), is Level 3 or higher. In addition, it is preferable that the stretchability in the warp direction or the weft direction measured in accordance with JIS L1096-2010 8.16, B Method, is 10% or more. In addition, it is preferable that the recovery of stretchability in the warp direction or the weft direction measured in accordance with JIS L1096-2010 8.16, B-1 Method, is 85% or more. In addition, it is preferable that the tear strength in the warp direction or the weft direction measured in accordance with JIS L1096-2010 8.17, D Method, is 7 N or more.

[0011] In addition, the invention provides a textile product using the water-repellent cloth described above. Advantageous Effects of Invention

[0012] According to the invention, a water-repellent cloth that is excellent in water repellency as well as stretchability and also a textile product using the water-repellent cloth are obtained.

Description of Embodiments

[0013] Hereinafter, embodiments of the invention will be described in detail. The water-repellent cloth of the invention is a water-repellent cloth given water repellent processing. The cloth includes a composite yarn, and the composite yarn contains an ultrafine fiber having a single fiber fineness of 1 dtex or less (more preferably 0.00002 to 0.8 dtex, and particularly preferably 0.001 to 0.5 dtex) and a stretch fiber. Because of such a configuration, fine fiber loops composed of the ultrafine fiber are formed on the cloth surface, whereby lotus leaf-like fine irregularities are formed on the cloth surface, resulting in excellent water repellency. In addition, at the same time, due to the effect of the stretch fiber, the cloth is also excellent in stretchability. Here, when the single fiber fineness of the ultrafine fiber is more than 1 dtex, fine fiber loops are not formed; therefore, this is undesirable. In addition, for the formation of fine fiber loops, it is preferable that the ultrafine fiber is a non-crimped fiber. For example, when the ultrafine fiber is a false-twist crimped yarn, fine fiber loops may not be formed.

[0014] As the ultrafine fiber, polyester fibers, acrylic fibers, nylon fibers, rayon fibers, and acetate fibers, as well as natural fibers such as cotton, wool, silk, and the like and combinations thereof, are usable. Polyester fibers include conjugate fibers containing at least one polyester component. At this time, examples of conjugate fibers include side-by-side conjugate fibers, eccentric sheath-core conjugate fibers, sheath-core conjugate fibers, and islands-in-sea conjugate fibers. In addition, nylon fibers include Nylon 6 fibers and Nylon 66 fibers.

[0015] As polyester fiber-forming polyesters, polyesters in which the main acid component is terephthalic acid, and the main glycol component is at least one member selected from the group consisting of C_{2-6} alkylene glycols, that is, ethylene glycol, trimethylene glycol, tetramethylene glycol, pentamethylene glycol, and hexamethylene glycol, are preferable. Among them, a polyester whose main glycol component is ethylene glycol (polyethylene terephthalate) and a polyester whose main glycol component is trimethylene glycol (polytrimethylene terephthalate) are particularly preferable.

[0016] Such a polyester may have a copolymerized component in a small amount (usually 30 mol % or less) as necessary. At this time, as bifunctional carboxylic acids used other than terephthalic acid, for example, aromatic, aliphatic, and alicyclic bifunctional carboxylic acids such as isophthalic acid, naphthalenedicarboxylic acid, diphenyldicarboxylic acid, diphenoxyethanedicarboxylic acid, β-hydroxyethoxybenzoic acid, p-oxybenzoic acid, 5-sodium sulfoisophthalic acid, adipic acid, sebacic acid, and 1,4-cyclohexanedicarboxylic acid can be mentioned. In addition, as diol compounds other than the above glycols, for example, aliphatic, alicyclic, and aromatic diol compounds such as cyclohexane-1,4-dimethanol, neopentyl glycol, bisphenol A, and bisphenol S, polyoxyalkylene glycols, and the like can be mentioned.

[0017] The polyester may be synthesized by an arbitrary method. For example, in the case of polyethylene terephthalate, its production is possible through a first-stage reaction in which terephthalic acid and ethylene glycol are directly subjected to an esterification reaction, a lower alkyl ester of terephthalic acid, such as dimethyl terephthalate, and ethylene glycol are subjected to a transesterification reaction, or terephthalic acid and ethylene oxide are allowed to react, thereby producing a glycol ester of terephthalic acid and/or an oligomer thereof, and a second-stage reaction in which the product of the first-stage reaction is heated under reduced pressure to cause a polycondensation reaction until the desired degree of polymerization is reached. In addition, the polyester may also be a material-recycled or chemically recycled polyester, or alternatively a polyester obtained using a catalyst containing a specific phosphorus compound or titanium compound as described in JP-A-2004-270097 or JP-A-2004-211268. Further, a biodegradable polyester such as polylactic acid or stereocomplex polylactic acid is also possible.

[0018] In addition, when the ultrafine fiber contains a UV absorber in an amount of 0.1 wt% or more (preferably 0.1 to 5.0 wt%) based on the fiber weight, the cloth is provided with UV-shielding properties; therefore, this is preferable. Examples of such UV absorbers include benzoxazine-based organic UV absorbers, benzophenone-based organic UV absorbers, benzotriazole-based organic UV absorbers, and salicylic-acid-based organic UV absorbers. Among them, benzoxazine-based organic UV absorbers are particularly preferable in that they do not decompose at the spinning stage.

[0019] Preferred examples of such benzoxazine-based organic UV absorbers include those disclosed in JP-A-62-11744, such as 2-methyl-3,1-benzoxazin-4-one, 2-butyl-3,1-benzoxazin-4-one, 2-phenyl-3,1-benzoxazin-4-one, 2,2'-ethylenebis(3,1-benzoxazin-4-one), 2,2'-tetramethylenebis(3,1-benzoxazin-4-one), 2,2'-p-phenylenebis(3,1-benzoxazin-4-one), 1,3,5-tri(3,1-benzoxazin-4-on-2-yl)benzene, and 1,3,5-tri(3,1-benzoxazin-4-on-2-yl)naphthalene.

[0020] In addition, when the ultrafine fiber contains a delusterant (titanium dioxide) in an amount of 1 wt% or more (preferably 0.2 to 4.0 wt%) based on the fiber weight, the cloth has improved anti-see-through properties; therefore, this is preferable.

[0021] Further, as necessary, the ultrafine fiber may also contain one or more kinds of micropore-forming agents (organic metal sulfonates), coloring inhibitors, heat stabilizers, flame retardants (diantimony trioxide), fluorescent brighteners, coloring pigments, antistatic agents (metal sulfonates), moisture absorbents (polyoxyalkylene glycols), antibacterial agents, and other inorganic particles.

[0022] Meanwhile, as the stretch fiber, a fiber composed of one polytrimethylene terephthalate component, a conjugate fiber made of two components joined in a side-by-side manner or an eccentric sheath-core manner, an elastic fiber (polyurethane-based fiber, polyether ester-based fiber, moisture-absorbing elastomer fiber, etc.), an undrawn polyester fiber, a false-twist crimped yarn, or the like is preferable.

[0023] Here, the conjugate fiber is preferably a conjugate fiber in which at least one component is composed of polytrimethylene terephthalate, polybutylene terephthalate, or polyethylene terephthalate. Specifically, examples of such two components include polytrimethylene terephthalate and polytrimethylene terephthalate, polytrimethylene terephthalate and polyethylene terephthalate, polyethylene terephthalate and polyethylene terephthalate, and polyethylene terephthalate and polybutylene terephthalate.

[0024] Here, polytrimethylene terephthalate refers to a fiber made of a polyester whose main repeating unit is a trimethylene terephthalate unit, in which the trimethylene terephthalate unit is 50 mol% or more, preferably 70 mol% or more, still more preferably 80 mol% or more, and particularly preferably 90 mol% or more. Therefore, polytrimethylene terephthalate containing another acid component and/or another glycol component as a third component in a total amount within a range of 50 mol% or less, preferably 30 mol% or less, still more preferably 20 mol% or less, and particularly preferably 10 mol% or less, is contained.

[0025] Polytrimethylene terephthalate is produced by condensing terephthalic acid or a functional derivative thereof and trimethylene glycol or a functional derivative thereof in the presence of a catalyst under appropriate reaction conditions.

[0026] As third components to be added, aliphatic dicarboxylic acids (oxalic acid, adipic acid, etc.), alicyclic dicarboxylic acids (cyclohexanedicarboxylic acid, etc.), aromatic dicarboxylic acids (isophthalic acid, sodium sulfoisophthalic acid, etc.), aliphatic glycols (ethylene glycol, 1,2-trimethylene glycol, tetramethylene glycol, etc.), alicyclic glycols (cyclohexane glycol, etc.), aromatic dioxy compounds (hydroquinone bisphenol A, etc.), aromatic-containing aliphatic glycols (1,4-bis(β-hydroxyethoxy)benzene, etc.), aliphatic oxycarboxylic acids (p-oxybenzoic acid, etc.), and the like can be mentioned.

[0027] The polyethylene terephthalate may be obtained by the copolymerization of three components or may also be obtained by material recycling or chemical recycling. Further, it may also be obtained using a catalyst containing a specific phosphorus compound or titanium compound as described in JP-A-2004-270097 or JP-A-2004-211268.

[0028] The polytrimethylene terephthalate, polyethylene terephthalate, polybutylene terephthalate, and the like described above may contain one or more kinds of micropore-forming agents, cationic dye dyeable agents, coloring inhibitors, heat stabilizers, fluorescent brighteners, delusterants, colorants, moisture absorbents, and inorganic fine particles.

[0029] The conjugate fiber can be produced, for example, by the method described in JP-A-2009-46800.

[0030] In the stretch fiber, the single fiber fineness is not particularly limited, but is preferably within a range of 0.00002 to 5.0 dtex (more preferably 0.1 to 3.0 dtex, and particularly preferably 1.1 to 2.5 dtex).

[0031] In addition, in the ultrafine fiber and/or the stretch fiber, as the single-fiber cross-sectional shape, in addition to a round cross-section, the cross-section may also be elliptical, triangular, quadrangular, cross-shaped, flat, flat with constrictions, H-shaped, W-shaped, or the like, for example.

[0032] The water-repellent cloth of the invention includes a composite yarn containing the ultrafine fiber and the stretch fiber. At this time, the method for producing the composite yarn is not particularly limited. For example, it is possible that the ultrafine fiber, the stretch fiber, and other fibers as necessary are aligned, and then air-mingled by air-texturing (interlacing processing or Taslan® processing) or composite false-twisted. The air-mingling method is particularly preferable.

[0033] At this time, the composite yarn is preferably an entangled yarn that has been subjected to interlacing processing to have 1 to 150 entanglements/m.

[0034] In addition, when the three kinds of fibers are combined, the overfeed rate may be suitably changed. In addition, it is also possible that two kinds of fibers are first combined, and then the other yarn is combined in the subsequent step.

[0035] In the composite yarn, the total fineness is preferably within a range of 40 to 180 dtex.

[0036] The cloth of the invention includes the composite yarn. At this time, the composite yarn is preferably contained in an amount of 30 wt% or more (most preferably 100 wt%) based on the cloth weight.

[0037] In the cloth of the invention, the structure of the cloth is not particularly limited, but a woven fabric is preferable in order to obtain excellent water repellency. At this time, the structure of the woven fabric is not particularly limited. For example, examples thereof include three foundation weaves such as a plain weave, a twill weave, and a satin weave, modified weaves, one-side backed weaves such as a warp-backed weave and a weft-backed weave, and warp velvet. Also with respect to the number of layers, the structure may be monolayer or multilayer including two or more layers.

[0038] In addition, when the cover factor CF of the woven fabric defined by the following formula is 1,000 or more (preferably 1,500 to 4,000, and particularly preferably 2,300 to 3,500), even better water repellency can be obtained; therefore, this is preferable.

$$CF = (DWp/1.1)^{1/2} \times MWp + (DWf/1.1)^{1/2} \times MWf$$

[0039] Note that DWp is the warp total fineness (dtex), MWp is the warp weaving density (yarns/2.54 cm), DWf is the weft total fineness (dtex), and MWf is the weft weaving density (yarns/2.54 cm).

[0040] In addition, the weaving density is, in order to obtain excellent water repellency, preferably such that the warp density is not less than 110 yarns/2.54 cm (more preferably 120 to 170 yarns/2.54 cm) and the weft density is not less than 90 yarns/2.54 cm (more preferably 100 to 150 yarns/2.54 cm).

[0041] The cloth of the invention can be produced, for example, by the following method. That is, first, a cloth is knitted or woven using the composite yarn. At this time, the knitting or weaving method may be an ordinary method using an ordinary weaving machine (e.g., ordinary water jet loom, air jet loom, rapier loom, etc.) or knitting machine. In addition, the composite yarn may also be twisted with the twist coefficient represented by the following formula being about 30,000 or less (preferably 500 to 30,000). The number of twists is preferably within a range of 100 to 2,000 t/m.

$$(\text{Twist coefficient}) = \text{the number of twists } [t/m] \times (\text{fineness } [de])^{1/2}$$

[0042] Note that the fineness [de] is a product of the fineness [dtex] multiplied by 0.9.

[0043] Next, the cloth is subjected to a scouring treatment or dyeing processing (preferably a scouring treatment and dyeing processing). At this time, as a result of the heat treatment during the scouring treatment or dyeing processing, in the case where the stretch fiber is a conjugate fiber, the latent crimp of the conjugate fiber becomes apparent, whereby the cloth shrinks to increase the cloth density. At the same time, the ultrafine fiber becomes relatively long, and fine fiber loops composed of the ultrafine fiber are formed on the cloth surface.

[0044] Next, the cloth is subjected to water repellent processing. In such water repellent processing, the kind of water repellent is not particularly limited. For example, fluorine-based compounds are applicable, and examples also include environmentally friendly water repellents such as hydrocarbon-based compounds and silicone-based compounds. It is preferable that, as necessary, an antistatic agent, a melamine resin, and a catalyst are mixed to give a processing agent having a water repellent concentration of about 3 to 15 wt%, and the surface of the cloth is treated using the processing agent at a pick-up rate of about 50 to 90%. Examples of methods for treating the surface of the cloth with the processing agent include a padding method and a spray method. Among them, in order for the processing agent to penetrate the inside of the cloth, a padding method is preferable. The pick-up rate is the weight percentage (%) of the processing agent relative to the cloth (before processing agent application) weight.

[0045] Incidentally, as the antistatic agent, a polyester-based resin containing a polyethylene glycol group, a urethane-based resin containing a polyethylene glycol group, a reaction product of a polycationic compound containing a polyethylene glycol group and diglycidyl ether, or the like is preferable. Anionic surfactants such as higher alcohol sulfate ester salts, sulfated oils, sulfonate salts, and phosphate ester salts, cationic surfactants such as amine salt type, quaternary ammonium salts, and imidazole type quaternary salts, nonionic surfactants such as polyethylene glycol type and polyhydric alcohol ester type, antistatic compounds, e.g., amphoteric surfactants such as imidazole type quaternary salts, alanine type, and betaine type, are also applicable.

[0046] In addition, in at least either the pre-process or post-process of the water repellent processing step, conventional dyeing processing, alkaline weight reduction processing, and napping processing may be performed. Further, a UV shielding agent, an antibacterial agent, a deodorant, an insect repellent, a phosphorescent agent, a retroreflective agent, a negative ion generator, and the like may be additionally applied. Incidentally, in the case where the cloth contains a conjugate fiber, the latent crimp of the conjugate fiber becomes apparent (coiled) due to the thermal history of the dyeing processing or the like.

[0047] In the water-repellent cloth thus obtained, because the cloth includes the composite yarn, fine fiber loops composed of the ultrafine fiber are formed on the cloth surface, and lotus leaf-like fine irregularities are formed on the cloth surface. Then, such fine fiber loops form a microscopic layer of air, and thus excellent water repellency is exhibited when water droplets fall on the cloth surface. Incidentally, such an effect is sometimes referred to as "lotus effect".

[0048] At this time, as the water repellency, it is preferable that the water-repellent roll-off angle of the cloth surface is 20° or less (more preferably 15° or less, still more preferably 12° or less, and particularly preferably 5 to 11°) .

[0049] Note that the water-repellent roll-off angle is, when 0.2 cc of water is gently dropped onto a planar test sample mounted on a horizontal plate, and the flat plate is gently tilted at a constant speed, the angle at which the water droplet begins to roll.

[0050] In addition, it is preferable that the degree of water repellency measured in accordance with JIS L1092-2009 7.2, Test for Resistance to Surface Wetting (Spray Method), is Level 4 or higher. In addition, it is preferable that after 10 washes as specified in JIS L0217-1995 (using the JAFET standard combination detergent), the degree of water repellency measured in accordance with JIS L1092-2009 7.2, Test for Resistance to Surface Wetting (Spray Method), is Level 3 or higher.

[0051] The water-repellent cloth of the invention includes the composite yarn, the composite yarn contains the stretch fiber, and thus the cloth also has stretchiness (stretchability). At this time, it is preferable that the stretchability in the warp direction or the weft direction (preferably the warp direction and the weft direction) measured in accordance with JIS L1096-2010 8.16, B Method, is 10% or more (more preferably 10 to 30%). In addition, it is preferable that the recovery of stretchability in the warp direction or the weft direction (preferably the warp direction and the weft direction) measured in accordance with JIS L1096-2010 8.16, B-1 Method, is 85% or more.

[0052] In addition, in the water-repellent cloth of the invention, it is preferable that the tear strength in the warp direction or the weft direction (preferably the warp direction and the weft direction) measured in accordance with JIS L1096-2010 8.17, D Method, is 7 N or more (more preferably 20 to 100 N). In addition, in terms of lightweightness, it is preferable that the weight per unit of the cloth is 200 g/m^2 or less (more preferably 100 to 180 g/m^2).

[0053] Next, the textile product of the invention includes the water-repellent cloth described above. Because the textile product includes the cloth described above, its water repellency and stretchability are excellent. Incidentally, such textile products include umbrella fabrics and garments. Then, such garments include down garments, badminton shirts, running shirts, soccer pants, tennis pants, basketball pants, table tennis pants, badminton pants, running pants, golf pants, undershirts for various sports, innerwear for various sports, sweaters, T-shirts, jerseys, sweatshirts, windbreakers, jackets, dustproof garments, medical gowns, and the like.

EXAMPLES

[0054] Next, examples and comparative examples of the invention will be described in detail, but the invention is not limited thereto. Incidentally, measurement items in the Examples were measured by the following methods.

(1) Stretchability
Stretchability (%) was measured in accordance with JIS L1096-2010 8.16, B Method.
(2) Recovery of Stretchability
Recovery of stretchability (%) was measured in accordance with JIS L1096-2010 8.16, B-1 Method.
(3) Tear Strength of Woven Fabric
Tear strength (N) was measured in accordance with JIS L1096-2010 8.17, D Method.
(4) Cover Factor
The cover factor CF of a woven fabric was calculated by the following formula.

$$CF = (DWp/1.1)^{1/2} \times MWp + (DWf/1.1)^{1/2} \times MWf$$

Note that DWp is the warp total fineness (dtex), MWp is the warp weaving density (yarns/2.54 cm), DWf is the weft total fineness (dtex), and MWf is the weft weaving density (yarns/2.54 cm).
(5) Water Repellency (Water-Repellent Roll-Off Angle)
0.2 cc of water was gently dropped onto a planar test sample mounted on a horizontal plate, and the flat plate was gently tilted at a constant speed. The angle at which the water droplet began to roll was defined as the water-repellent roll-off angle. Incidentally, the smaller the water-repellent roll-off angle, the better the water repellency, and an angle of 25° or less is rated as pass.
(6) Degree of Water Repellency
The degree of water repellency (level) was measured in accordance with JIS L1092-2009 7.2, Test for Resistance to Surface Wetting (Spray Method).
(7) Weight per Unit of Woven Fabric
The weight per unit (g/m^2) of a woven fabric was measured in accordance with JIS L1096-2010 8.3.

[Example 1]

[0055] Polyethylene terephthalate was spun at a spinning temperature of 300°C, taken up at 4,000 m/min, and, without being wound up once, successively drawn to 1.3 times its original length, thereby giving a polyester multifilament of 70 dtex/144 fil (ultrafine fiber formed of a non-crimped fiber) in which the filament transverse cross-sectional shape was a round cross-section.

[0056] In addition, in the method described in JP-A-2009-46800, Example 24, only the total fineness and the number of filaments were changed, and a conjugate fiber (stretch fiber) having a total fineness of 56 dtex/36 fil made of a polytrimethylene terephthalate (PTT) component and a polyethylene terephthalate (PET) component joined in a side-by-side manner was obtained.

[0057] Next, the non-crimped yarn and the conjugate fiber (stretch fiber) were combined and subjected to an air-entangling treatment, thereby giving a composite yarn (total fineness: 126 dtex/180 fil).

[0058] Next, using the composite yarn as warp and weft, a woven fabric having a plain structure (woven fabric composed only of the composite yarn) was woven using an ordinary water jet loom weaving machine.

[0059] Next, the woven fabric was subjected to an open-width scouring treatment at 95°C using a scouring apparatus. Next, dyeing processing with a disperse dye was performed at a temperature of 130°C using a jet dyeing machine, and then the following water repellent processing was performed. In the water repellent processing, the following processing agent was used, and the liquid was squeezed out at a pick-up rate of 80%, followed by drying at 130°C for 3 minutes and then a heat treatment at 170°C for 45 seconds.

<Processing Agent Composition>

[0060]

- Fluorine-free water repellent: 5.0 wt%
  (Neoseed NR-7080 manufactured by Nichika Chemical Co., Ltd., hydrocarbon-based compound)
- Melamine resin: 0.3 wt%
  (SUMITEX Resin M-3 manufactured by Sumitomo Chemical Co., Ltd.)
- Catalyst: 0.3 wt%
  (SUMITEX Accelerator ACX manufactured by Sumitomo Chemical Co., Ltd.)
- Water: 94.4 wt%

[0061] In the water-repellent woven fabric thus obtained, the weight per unit was 153 g/m^2, the warp density was 123 yarns/2.54 cm, the weft density was 104/2.54 cm, the cover factor was 2,417, the tear strength was 46 N (warp) and 25 N (weft), the warp stretchability was 11%, the recovery of warp stretchability was 90%, the weft stretchability was 35%, the recovery of weft stretchability was 87%, and the roll-off angle was 9°. The surface of the water-repellent woven fabric had formed thereon fine fiber loops composed of the ultrafine fiber (lotus leaf-like fine irregularities), and the degree of water repellency of the water-repellent woven fabric was Level 4, while after 10 washes as specified in JIS L0217-1995 (using the JAFET standard combination detergent), the degree of water repellency was Level 3. In addition, because the water-repellent woven fabric had attached thereto the water repellent described above, the water-repellent woven fabric was an environmentally friendly woven fabric. A windbreaker (sportswear) was sewn using the water-repellent woven fabric, and a tester wore the windbreaker. As a result, the windbreaker was excellent in water repellency and stretchability.

[Example 2]

[0062] Polyethylene terephthalate was spun at a spinning temperature of 300°C, taken up at 4,000 m/min, and, without being wound up once, successively drawn to 1.3 times its original length, thereby giving a polyester multifilament of 70 dtex/144 fil (ultrafine fiber formed of a non-crimped fiber) in which the filament transverse cross-sectional shape was a round cross-section.

[0063] In addition, in the method described in JP-A-2009-46800, Example 24, only the total fineness and the number of filaments were changed, and a conjugate fiber (stretch fiber) having a total fineness of 56 dtex/36 fil made of a polytrimethylene terephthalate (PTT) component and a polyethylene terephthalate (PET) component joined in a side-by-side manner was obtained.

[0064] Next, the non-crimped yarn and the conjugate fiber (stretch fiber) were combined and subjected to an air-entangling treatment to give a composite yarn (total fineness: 126 dtex/180 fil).

[0065] Next, the yarn was twisted at Z 400 t/m, and then, using the composite yarn as warp and weft, a woven fabric having a plain structure (woven fabric composed only of the composite yarn) was woven using an ordinary water jet loom weaving machine.

[0066] Next, the woven fabric was subjected to an open-width scouring treatment at 95°C using a scouring apparatus. Next, dyeing processing with a disperse dye was performed at a temperature of 130°C using a jet dyeing machine, and then the following water repellent processing was performed. In the water repellent processing, the following processing agent was used, and the liquid was squeezed out at a pick-up rate of 80%, followed by drying at 130°C for 3 minutes and then a heat treatment at 170°C for 45 seconds.

<Processing Agent Composition>

[0067]

- Fluorine-free water repellent: 5.0 wt%
  (Neoseed NR-7080 manufactured by Nichika Chemical Co., Ltd., hydrocarbon-based compound)
- Melamine resin: 0.3 wt%
  (SUMITEX Resin M-3 manufactured by Sumitomo Chemical Co., Ltd.)
- Catalyst: 0.3 wt%
  (SUMITEX Accelerator ACX manufactured by Sumitomo Chemical Co., Ltd.)
- Water: 94.4 wt%

[0068] In the water-repellent woven fabric thus obtained, the weight per unit was 155 g/m^2, the warp density was 125 yarns/2.54 cm, the weft density was 106/2.54 cm, the cover factor was 2,459, the tear strength was 44 N (warp) and 24 N (weft), the warp stretchability was 11%, the recovery of warp stretchability was 91%, the weft stretchability was 36%, the recovery of weft stretchability was 88%, and the roll-off angle was 8°. The surface of the water-repellent woven fabric had formed thereon fine fiber loops composed of the ultrafine fiber (lotus leaf-like fine irregularities), and the degree of water repellency of the water-repellent woven fabric was Level 4, while after 10 washes as specified in JIS L0217-1995 (using the JAFET standard combination detergent), the degree of water repellency was Level 3. In addition, because the water-repellent woven fabric had attached thereto the water repellent described above, the water-repellent woven fabric was an environmentally friendly woven fabric. A windbreaker (sportswear) was sewn using the water-repellent woven fabric, and a tester wore the windbreaker. As a result, the windbreaker was excellent in water repellency and stretchability.

[Example 3]

[0069] Polyethylene terephthalate was spun at a spinning temperature of 300°C, taken up at 4,000 m/min, and, without being wound up once, successively drawn to 1.3 times its original length, thereby giving a polyester multifilament of 70 dtex/72fil (ultrafine fiber formed of a non-crimped fiber) in which the filament transverse cross-sectional shape was a round cross-section.

[0070] In addition, in the method described in JP-A-2009-46800, Example 24, only the total fineness and the number of filaments were changed, and a conjugate fiber (stretch fiber) having a total fineness of 33 dtex/24 fil made of a polytrimethylene terephthalate (PTT) component and a polyethylene terephthalate (PET) component joined in a side-by-side manner was obtained.

[0071] Next, the non-crimped yarn and the conjugate fiber (stretch fiber) were combined and subjected to an air-entangling treatment to give a composite yarn (total fineness: 100 dtex/96 fil).

[0072] Next, the yarn was twisted at Z 800 t/m, and then, using the composite yarn as warp and weft, a woven fabric having a twill structure (woven fabric composed only of the composite yarn) was woven using an ordinary water jet loom weaving machine.

[0073] Next, the woven fabric was subjected to an open-width scouring treatment at 95°C using a scouring apparatus. Next, dyeing processing with a disperse dye was performed at a temperature of 130°C using a jet dyeing machine, and then the following water repellent processing was performed. In the water repellent processing, the following processing agent was used, and the liquid was squeezed out at a pick-up rate of 80%, followed by drying at 130°C for 3 minutes and then a heat treatment at 170°C for 45 seconds.

<Processing Agent Composition>

[0074]

- Fluorine-free water repellent: 5.0 wt%
  (Neoseed NR-7080 manufactured by Nichika Chemical Co., Ltd., hydrocarbon-based compound)

- Melamine resin: 0.3 wt%
  (SUMITEX Resin M-3 manufactured by Sumitomo Chemical Co., Ltd.)
- Catalyst: 0.3 wt%
  (SUMITEX Accelerator ACX manufactured by Sumitomo Chemical Co., Ltd.)
- Water: 94.4 wt%

[0075] In the water-repellent woven fabric thus obtained, the weight per unit was 156 g/m^2, the warp density was 163 yarns/2.54 cm, the weft density was 130/2.54 cm, the cover factor was 2,459, the tear strength was 42 N (warp) and 37 N (weft), the warp stretchability was 12%, the recovery of warp stretchability was 96%, the weft stretchability was 21%, the recovery of weft stretchability was 90%, and the roll-off angle was 9°. The surface of the water-repellent woven fabric had formed thereon fine fiber loops composed of the ultrafine fiber (lotus leaf-like fine irregularities), and the degree of water repellency of the water-repellent woven fabric was Level 4, while after 10 washes as specified in JIS L0217-1995 (using the JAFET standard combination detergent), the degree of water repellency was Level 3. In addition, because the water-repellent woven fabric had attached thereto the water repellent described above, the water-repellent woven fabric was an environmentally friendly woven fabric. A windbreaker (sportswear) was sewn using the water-repellent woven fabric, and a tester wore the windbreaker. As a result, the windbreaker was excellent in water repellency and stretchability.

[Comparative Example 1]

[0076] The same procedure as in Example 1 was performed, except that the ultrafine fiber in Example 1 was changed in the number of filaments to a polyester multifilament of 70 dtex/36 fil (non-crimped fiber, single fiber fineness: 1.9 dtex), and the resulting composite yarn (total fineness: 126 dtex/72 fil) was used as warp and weft.

[0077] In the obtained water-repellent woven fabric, the weight per unit was 155 g/m^2, the warp density was 125 yarns/2.54 cm, the weft density was 105/2.54 cm, the cover factor was 2,449, the tear strength was 42 N (warp) and 27 N (weft), the warp stretchability was 12%, the recovery of warp stretchability was 92%, the weft stretchability was 33%, and the recovery of weft stretchability was 88%, which were excellent, but the roll-off angle was 18°. In addition, fine irregularities were not formed, and the degree of water repellency after 10 washes as specified in JIS L0217-1995 (using the JAFET standard combination detergent) was Level 2.

[Comparative Example 2]

[0078] The same procedure as in Example 1 was performed, except that the conjugate fiber (stretch fiber) in Example 1 was replaced with a polyester multifilament of 56 dtex/36 fil (non-crimped fiber) to give a composite yarn (total fineness: 126 dtex/180 fil), and then the composite yarn was used as warp and weft.

[0079] In the obtained water-repellent woven fabric, the weight per unit was 144 g/m^2, the warp density was 116 yarns/2.54 cm, the weft density was 98/2.54 cm, the cover factor was 2,279, and the tear strength was 35 N (warp) and 22 N (weft), which were excellent, but the stretchability was less than 10%. The roll-off angle was 12°.

[Comparative Example 3]

[0080] The same procedure as in Example 1 was performed, except that the water repellent processing in Example 1 was not performed. In the woven fabric thus obtained, the weight per unit was 154 g/m^2, the warp density was 124 yarns/2.54 cm, the weft density was 102/2.54 cm, the cover factor was 2,406, the tear strength was 30 N (warp) and 20 N (weft), the warp stretchability was 12%, the recovery of warp stretchability was 90%, the weft stretchability was 36%, the recovery of weft stretchability was 90%, and fine fiber loops composed of the ultrafine fiber (lotus leaf-like fine irregularities) were formed on the surface of the woven fabric. However, the degree of water repellency of the water-repellent woven fabric was Level 0, and, after 10 washes as specified in JIS L0217-1995 (using the JAFET standard combination detergent), the degree of water repellency was Level 0; that is, its water repellency was inferior.

Industrial Applicability

[0081] The invention provides a water-repellent cloth that is excellent in water repellency as well as stretchability and also a textile product using the water-repellent cloth, and the industrial value thereof is extremely high.

Claims

1. A water-repellent cloth given water repellent processing, the water-repellent cloth being **characterized in that** the cloth includes a composite yarn containing a stretch fiber and an ultrafine fiber having a single fiber fineness of 1 dtex or less.

2. The water-repellent cloth according to claim 1, wherein the stretch fiber is a conjugate fiber made of two components joined in a side-by-side manner or an eccentric sheath-core manner or is a polytrimethylene terephthalate fiber.

3. The water-repellent cloth according to claim 1 or 2, wherein the cloth is a woven fabric having a cover factor CF of 1,000 or more, the cover factor CF being defined by the following formula:

$$CF = (DWp/1.1)^{1/2} \times MWp + (DWf/1.1)^{1/2} \times MWf$$

[DWp is the warp total fineness (dtex), MWp is the warp weaving density (yarns/2.54 cm), DWf is the weft total fineness (dtex), and MWf is the weft weaving density (yarns/2.54 cm).]

4. The water-repellent cloth according to any one of claims 1 to 3, wherein a surface of the cloth has formed thereon fine fiber loops composed of the ultrafine fiber.

5. The water-repellent cloth according to any one of claims 1 to 4, wherein a surface of the cloth has a water-repellent roll-off angle of 15° or less.

6. The water-repellent cloth according to any one of claims 1 to 5, wherein the degree of water repellency measured in accordance with JIS L1092-2009 7.2, Test for Resistance to Surface Wetting (Spray Method), is Level 4 or higher.

7. The water-repellent cloth according to any one of claims 1 to 6, wherein after 10 washes as specified in JIS L0217-1995 (using the JAFET standard combination detergent), the degree of water repellency measured in accordance with JIS L1092-2009 7.2, Test for Resistance to Surface Wetting (Spray Method), is Level 3 or higher.

8. The water-repellent cloth according to any one of claims 1 to 7, wherein the stretchability in the warp direction or the weft direction measured in accordance with JIS L1096-2010 8.16, B Method, is 10% or more.

9. The water-repellent cloth according to any one of claims 1 to 8, wherein the recovery of stretchability in the warp direction or the weft direction measured in accordance with JIS L1096-2010 8.16, B-1 Method, is 85% or more.

10. The water-repellent cloth according to any one of claims 1 to 8, wherein the tear strength in the warp direction or the weft direction measured in accordance with JIS L1096-2010 8.17, D Method, is 7 N or more.

11. A textile product comprising the water-repellent cloth according to any one of claims 1 to 10.

INTERNATIONAL SEARCH REPORT

International application No. PCT/JP2021/015409

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. D03D15/47(2021.01)i, D01F8/14(2006.01)i, D02G3/04(2006.01)i, D06M15/263(2006.01)i, D06M15/277(2006.01)i, D06M15/643(2006.01)i
FI: D03D15/00 D, D01F8/14 B, D02G3/04, D06M15/263, D06M15/277, D06M15/643
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)
Int. Cl. D03D15/47, D01F8/14, D02G3/04, D06M15/263, D06M15/277, D06M15/643

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2021
Registered utility model specifications of Japan	1996-2021
Published registered utility model applications of Japan	1994-2021

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	JP 5-163632 A (TEIJIN LTD.) 29 June 1993, claim 1, abstract, examples	1, 3-11 2
A	JP 2003-20541 A (NI TEIJIN SHOJI CO., LTD.) 24 January 2003, claim 1, abstract	1-11
A	JP 2006-161204 A (TORAY INDUSTRIES, INC.) 22 June 2006, claims, paragraph [0042]	1-11
A	JP 2-74673 A (UNITIKA LTD.) 14 March 1990, claim 1	1-11
A	WO 2018/092737 A1 (UNITIKA TRADING CO., LTD.) 24 May 2018, claims 1, 3	1-11

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA/	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No. PCT/JP2021/015409

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, X	JP 2020-186503 A (UNITIKA TRADING CO., LTD.) 19 November 2020, claims 8, 12, 14, paragraphs [0012], [0119]-[0122], examples 5-9	1-11

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2021/015409

Patent Documents referred to in the Report	Publication Date	Patent Family	Publication Date
JP 5-163632 A	29.06.1993	(Family: none)	
JP 2003-20541 A	24.01.2003	(Family: none)	
JP 2006-161204 A	22.06.2006	(Family: none)	
JP 2-74673 A	14.03.1990	(Family: none)	
WO 2018/092737 A1	24.05.2018	(Family: none)	
JP 2020-186503 A	19.11.2020	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 60094645 A **[0005]**
- JP 61070043 A **[0005]**
- JP 2017145521 A **[0005]**
- JP 2004270097 A **[0017] [0027]**
- JP 2004211268 A **[0017] [0027]**
- JP 62011744 A **[0019]**
- JP 2009046800 A **[0029] [0056] [0063] [0070]**