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(54) **WATER-REPELLENT WOVEN FABRIC AND FIBER PRODUCT**

(57) A task is to provide a water-repellent woven fabric and a fiber product, each having not only excellent water repellency but also excellent spun-like appearance and spun-like hand feeling, and means for solution is a woven fabric which has been subjected to water repellency-imparting processing, in which the woven fabric comprises a sheath-core manner combined filament yarn, in which the core part comprises a non-crimped yarn, and in which a yarn length difference between the core part and the sheath part is 25% or more.

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Description

Technical Field

[0001] The present invention relates to a woven fabric comprising a sheath-core manner combined filament yarn, and having not only excellent water repellency but also excellent spun-like appearance and spun-like hand feeling, and a fiber product.

Background Art

[0002] Conventionally, a cloth having water repellency and using a combined filament yarn has been proposed (for example, PTLs 1 and 2). However, a conventional cloth is unsatisfactory in view of achieving both water repellency and spun-like appearance and hand feeling.

Citation List

Patent Literature

[0003]

PTL 1: JP2019-183307A
PTL 2: WO2021/215319

Summary of Invention

Technical Problem

[0004] An object of the present invention is to provide a water-repellent woven fabric comprising a sheath-core manner combined filament yarn, and having not only excellent water repellency but also excellent spun-like appearance and spun-like hand feeling, and a fiber product.

Solution to Problem

[0005] The present inventor has conducted extensive and intensive studies with a view toward achieving the above-mentioned task. As a result, the present invention has been completed. Thus, the following invention is provided.

1. A water-repellent woven fabric which has been subjected to water repellency-imparting processing, the woven fabric comprising a sheath-core manner combined filament yarn, in which the core part comprises a non-crimped yarn, and in which a yarn length difference between the core part and the sheath part is 25% or more.
2. The water-repellent woven fabric according to item 1 above, in which each of the core part and the sheath part comprises a polyester fiber.
3. The water-repellent woven fabric according to item 1 or 2 above, in which the non-crimped yarn disposed in the core part is composed of a cationically dyeable polyester.
4. The water-repellent woven fabric according to any one of items 1 to 3 above, in which, in the sheath-core manner combined filament yarn, the core part and the sheath part are multifilament in which the number of filaments is 10 to 200.
5. The water-repellent woven fabric according to any one of items 1 to 4 above, in which the sheath-core manner combined filament yarn has been subjected to interlacing so that the number of interlaces becomes 30/m or more.
6. The water-repellent woven fabric according to any one of items 1 to 5 above, in which, in the sheath-core manner combined filament yarn, the number of filaments of the sheath part is larger than that of the core part.
7. The water-repellent woven fabric according to any one of items 1 to 6 above, in which, in the sheath-core manner combined filament yarn, the sheath part has a single fiber fineness of 0.1 to 1.5 dtex, the single fiber fineness of the sheath part is equivalent to or smaller than the single fiber fineness of the core part, and the ratio of the single fiber fineness between the sheath part and the core part is 0.5 to 2.0.
8. The water-repellent woven fabric according to any one of items 1 to 7 above, which has a fine unevenness formed in the surface of the woven fabric.
9. The water-repellent woven fabric according to any one of items 1 to 8 above, which has been subjected to water repellency-imparting processing using, as a water repellent, a non-fluorine water repellent comprising a hydrocarbon

compound or a silicone compound.

10. The water-repellent woven fabric according to any one of items 1 to 9 above, which has a warp cover factor in the range of from 700 to 1,800 and a weft cover factor in the range of from 700 to 2,000,

in which the warp cover factor (warp CF) and the weft cover factor (weft CF) are defined by the following respective formulae:

$$\text{Warp CF} = (DWp/1.1)^{1/2} \times MWp$$

$$\text{Weft CF} = (DWf/1.1)^{1/2} \times MWf$$

wherein DWp is a warp yarn total fineness (dtex), MWp is a warp yarn weaving density (the number of yarns/2.54 cm), DWf is a weft yarn total fineness (dtex), and MWf is a weft yarn weaving density (the number of yarns/2.54 cm).

11. The water-repellent woven fabric according to any one of items 1 to 10 above, which has a water-repellency rolling angle of 15 degrees or less.

12. The water-repellent woven fabric according to any one of items 1 to 11 above, which has a water repellency of class 4 or higher, as measured in accordance with JIS L 1092-2009 7.2 Water repellency test (spray method).

13. The water-repellent woven fabric according to any one of items 1 to 12 above, which has a water repellency of class 3 or higher, as measured in accordance with JIS L 1092-2009 7.2 Water repellency test (spray method) with respect to the woven fabric which has been subjected to 10 times washing described in JIS L0217-1995 (using the JAFET standard detergent).

14. A fiber product which is obtained using the water-repellent woven fabric according to any one of items 1 to 13 above, in which the fiber product is selected from the group consisting of sportswear, outerwear, underwear, menswear, womenswear, clothing for nursing care, work clothing, a car seat skin material, and a bedding article.

Advantageous Effects of Invention

[0006] In the present invention, there are obtained a water-repellent woven fabric and a fiber product, each having not only excellent water repellency but also excellent spun-like appearance and spun-like hand feeling.

Description of Embodiments

[0007] Hereinbelow, an embodiment of the present invention will be described in detail. First, the woven fabric of the invention comprises a sheath-core manner combined filament yarn (hereinafter, frequently referred to simply as "combined filament yarn") having a core part (referred to also as "core yarn") and a sheath part (referred to also as "sheath yarn"), and, in the combined filament yarn, the core part comprises a non-crimped yarn (preferably a non-crimped multifilament). When a crimped yarn, such as a false-twisted crimped yarn, is disposed in the core part, there is a disadvantage in that the yarn length difference between the core part and the sheath part cannot be increased.

[0008] The term "non-crimped" means that a yarn has not been subjected to crimping, such as false-twisted crimping, and the yarn has a crimp degree of 5% or less (more preferably 0%), as measured by the method described below.

(Method for measuring a crimp degree)

[0009] A yarn to be tested is wound round a counter wheel having a circumference of 1.125 m to prepare a hank having a dry fineness of 3,333 dtex. The hank is suspended by a hanging nail of a scale plate, and an initial load of 6 g is applied to the lower portion of the hank, and a load of 600 g is further applied to the hank and a length L0 of the hank at that time is measured. Immediately after then, the load is removed from the hank, and the hank is taken away from the hanging nail of the scale plate, and the hank is immersed in boiling water for 30 minutes to cause the yarn to be crimped. The boiling water-treated hank is removed from the boiling water, and water contained in the hank is absorbed by filter paper and removed from the hank, and the hank is air-dried at room temperature for 24 hours. The air-dried hank is suspended by a hanging nail of a scale plate, and a load of 600 g is applied to the lower portion of the hank, and, after one minute, a length L1a of the hank is measured, and then, the load is removed from the hank, and, after one minute, a length L2a of the hank is measured. A crimp degree (CP) of the filament yarn under test is calculated from the following formula:

$$CP\ (\%) = ((L1a - L2a)/L0) \times 100$$

[0010] In the combined filament yarn, the sheath part may comprise a non-crimped yarn, but preferably comprises a crimped yarn, such as a false-twisted crimped yarn. By virtue of having such a construction of the yarn, the cloth has a fine unevenness formed in the surface thereof, and thus has not only excellent water repellency but also excellent spun-like appearance and spun-like hand feeling.

[0011] The combined filament yarn preferably has a total fineness in the range of from 20 to 150 dtex (more preferably 30 to 130 dtex). When the total fineness of the combined filament yarn is smaller than the above range, there is a danger that snagging is likely to occur. On the other hand, when the total fineness of the combined filament yarn is larger than the above range, it is likely that the woven fabric has hard hand feeling and has too large a fiber areal weight.

[0012] Further, in the combined filament yarn, the number of filaments of the core part and/or the sheath part is preferably in the range of from 10 to 200 (more preferably 20 to 90). In the combined filament yarn, it is preferred that the number of filaments of the sheath part is larger than that of the core part. Further, in the combined filament yarn, the core part and/or the sheath part preferably has a total fineness of 10 to 60 dtex (more preferably 15 to 40 dtex).

[0013] An effect of the sheath part in the combined filament yarn resides in that when the core yarn largely shrinks due to the heat treatment, the sheath yarn expands in a minipile form, so that a fine uneven structure is formed in the surface of the woven fabric, improving the water repellency of the outer layer of the fabric, simultaneously with imparting spun-like hand feeling and spun-like appearance like cotton to the surface of the woven fabric. Further, for improving the water repellency effect and imparting the spun-like appearance and spun-like hand feeling, the sheath part preferably has a single fiber fineness of 3.0 dtex or less (more preferably 0.001 to 1.8 dtex). Especially, the sheath part preferably has a single fiber fineness of 0.1 to 1.5 dtex (more preferably 0.1 to 0.4 dtex). Particularly, it is preferred that the single fiber fineness of the sheath part is equivalent to or smaller than the single fiber fineness of the core part, and the ratio of the single fiber fineness between the sheath part and the core part is 0.5 to 2.0. Further, with respect to the sheath part, examples of single fiber cross-sectional shapes include a circular cross-section, an elliptic cross-section, triangle, rectangle, a cruciform shape, a flattened shape, a flattened shape having a shoulder, an H-shape, and a W-shape.

[0014] On the other hand, an effect of the core part resides in that the core yarn largely shrinks due to the heat treatment to cause the sheath yarn to have a minipile structure, so that the resultant woven fabric exhibits spun-like appearance and spun-like hand feeling and maintains water repellency.

[0015] In view of the shrinkage force, the non-crimped yarn disposed in the core part preferably has a single fiber fineness of 0.5 dtex or more, more preferably in the range of from 0.9 to 2.2 dtex. When the single fiber fineness of the non-crimped yarn is smaller than the above range, the obtained woven fabric has soft hand feeling, but is likely to have unsatisfactory shrinkage force. On the other hand, when the single fiber fineness of the non-crimped yarn is larger than the above range, there is a disadvantage in that the resultant woven fabric has hard hand feeling, making it difficult to obtain an intended woven fabric. With respect to the cross-sectional shape of the fiber constituting the core part, there is no particular limitation, and the cross-section of the fiber may be the above-mentioned irregular-shaped cross-section or a circular cross-section.

[0016] With respect to the type of the polymer forming the core yarn and/or sheath yarn, a polyester or an aliphatic polyamide (such as nylon 6 or nylon 66) is preferred. Especially, more preferred examples include polyethylene terephthalate (PET), polytrimethylene terephthalate (PTT), polybutylene terephthalate (PBT), polylactic acid, and a polyester having the third component copolymerized therewith. The polyester may be a material-recycled or chemical-recycled polyester. Further, the polyester may be a polyester obtained using a catalyst containing a specific phosphorus compound and titanium compound as described in JP2004-270097A or JP2004-211268A. The polymer, if necessary, may contain one member or two more members of a micropore forming agent, a cationic dye assist agent, a color protection agent, a heat stabilizer, a fluorescent brightener, a matting agent, a coloring agent, a moisture absorber, and inorganic fine particles in such an amount that the effects aimed at by the present invention are not sacrificed. Particularly, it is preferred that the polymer contains a matting agent in an amount of 0.1% by weight or more (more preferably 0.3 to 2.0% by weight), based on the weight of the polymer, because the resultant woven fabric is advantageously improved in impermeability. Specifically, a semi-dull polyester, a full-dull polyester, or a cationically dyeable polyester is preferred. It is preferred that the polyester contains a cationic dye assist agent (such as an ester-forming metal sulfonate compound) because when the resultant woven fabric is subjected to acidic treatment as described in WO2011/048888 pamphlet, anti-fungus and deodorization properties are imparted to the woven fabric. Further, it is preferred that the core part is formed from a cationically dyeable polyester and the sheath part is formed from a cationically non-dyeable polyester so as to cause the core part and the sheath part to have different dyeabilities, because spun-like appearance of the woven fabric can be obtained due to a difference in dyeing properties.

[0017] In the method for producing the woven fabric of the invention, a non-crimped yarn for core part and a yarn for sheath part (preferably a multifilament) are first prepared. In this instance, for obtaining an increased yarn length difference between the core part and the sheath part, it is necessary that the boiling water shrinkage of the core part be larger than the boiling water shrinkage of the sheath part. For example, the non-crimped yarn for core part is preferably a yarn obtained by cold-drawing a polyester undrawn yarn (UDY) or a polyester partially oriented yarn (POY), which has a large boiling water shrinkage.

[0018] Then, the non-crimped yarn for core part and the yarn for sheath part are paralleled, and subjected to air filament combining method, such as interlacing, or twisting method, obtaining a combined filament yarn (preferably an air combined filament yarn). With respect to the obtained combined filament yarn, it is preferred that the combined filament yarn has been subjected to interlacing so that the number of interlaces becomes 30/m or more (more preferably 60 to 200/m).

[0019] In view of the snag resistance of the woven fabric, the combined filament yarn preferably has a boiling water shrinkage of 40% or more (more preferably 40 to 60%). When the boiling water shrinkage of the combined filament yarn is smaller than 40%, there is a danger that the combined filament yarn does not satisfactorily shrink in the dyeing step, so that the woven fabric is reduced in density. When such a woven fabric having a reduced density is caught by a keen edge, it is likely that the yarn in the fabric is pulled out, and the snag resistance becomes poor. On the other hand, when the boiling water shrinkage (BWS) of the combined filament yarn is larger than 60%, shrinkage of the combined filament yarn in the dyeing step becomes large, so that the resultant woven fabric has an increased density. As a result, the woven fabric has an improved snag resistance, but is likely to have too hard hand feeling.

[0020] The woven fabric of the invention may be comprised only of the combined filament yarn, or may be comprised of the combined filament yarn and another yarn. The another yarn used in the woven fabric may be a stretchable yarn composed of a polyurethane fiber, a conjugate fiber having two components bonded in a side-by-side form or in an eccentric sheath-core manner, a polytrimethylene terephthalate fiber, a false-twisted crimped yarn, or the like, or a non-stretchable yarn, such as a non-crimped multifilament.

[0021] Further, with respect to the above-mentioned another yarn, in view of obtaining excellent hand feeling, it is preferred that the single fiber fineness is in the range of from 0.00002 to 3.0 dtex (more preferably 0.1 to 2.0 dtex, especially preferably 0.3 to 1.0 tex), the total fineness is in the range of from 30 to 150 dtex, and the number of filaments is in the range of from 50 to 200.

[0022] The conjugate fiber is preferably a conjugate fiber composed of at least one component which is polytrimethylene terephthalate, polybutylene terephthalate, or polyethylene terephthalate. Specifically, examples of combinations of the two components include polytrimethylene terephthalate and polytrimethylene terephthalate; polytrimethylene terephthalate and polyethylene terephthalate; polyethylene terephthalate and polyethylene terephthalate; and polyethylene terephthalate and polybutylene terephthalate.

[0023] The term "polytrimethylene terephthalate" means a fiber composed of a polyester having trimethylene terephthalate units as a main repeating unit, and containing trimethylene terephthalate units in an amount of 50 mol% or more, preferably 70 mol% or more, further preferably 80 mol% or more, especially preferably 90 mol% or more. Accordingly, the conjugate fiber contains polytrimethylene terephthalate containing, as the third component, an additional acid component and/or glycol component in a total amount in the range of 50 mol% or less, preferably 30 mol% or less, further preferably 20 mol% or less, especially preferably 10 mol% or less.

[0024] Polytrimethylene terephthalate is produced by subjecting terephthalic acid or a functional derivative thereof and trimethylene glycol or a functional derivative thereof to condensation in the presence of a catalyst under appropriately reaction conditions.

[0025] Examples of the third components added include aliphatic dicarboxylic acids (such as oxalic acid and adipic acid), alicyclic dicarboxylic acids (such as cyclohexanedicarboxylic acid), aromatic dicarboxylic acids (such as isophthalic acid and sodium isophthalate), aliphatic glycols (such as ethylene glycol, 1,2-trimethylene glycol, and tetramethylene glycol), alicyclic glycols (such as cyclohexane glycol), aromatic dioxy compounds (such as hydroquinone bisphenol A), aliphatic glycols including aromatic (such as 1,4-bis(β-hydroxyethoxy)benzene), and aliphatic oxycarboxylic acids (such as p-oxybenzoic acid).

[0026] The polyethylene terephthalate may be one which has the third component copolymerized therewith. Alternatively, the polyethylene terephthalate may be one which has been material-recycled or chemical-recycled. Further alternatively, the polyethylene terephthalate may be one which is obtained using a catalyst containing a specific phosphorus compound and titanium compound as described in JP2004-270097A or JP2004-211268A.

[0027] The above-mentioned polytrimethylene terephthalate, polyethylene terephthalate, polybutylene terephthalate, and the like may contain one member or two more members of a micropore forming agent, a cationic dye assist agent, a color protection agent, a heat stabilizer, a fluorescent brightener, a matting agent, a coloring agent, a moisture absorber, and inorganic fine particles.

[0028] The conjugate fiber can be produced by, for example, the method descried in JP2009-46800A.

[0029] With respect to the fiber other than the sheath-core manner combined filament yarn, which constitutes the woven fabric, there is no particular limitation, but a polyester fiber composed of a polyester is preferred. As examples of the polyester, there can be mentioned a polyester comprising terephthalic acid as a major acid component, and at least one glycol selected from the group consisting of alkylene glycols having 2 to 6 carbon atoms, i.e., ethylene glycol, trimethylene glycol, tetramethylene glycol, pentamethylene glycol, and hexamethylene glycol, especially preferably ethylene glycol as a major glycol component.

[0030] The polyester, if necessary, may have a small amount (generally 30 mol% or less) of a copolymerizable

component. With respect to the copolymerizable component, examples of difunctional carboxylic acids used other than terephthalic acid include aromatic, aliphatic, or alicyclic difunctional carboxylic acids, such as isophthalic acid, naphthalenedicarboxylic acid, diphenyldicarboxylic acid, diphenoxyethanedicarboxylic acid, β-hydroxyethoxybenzoic acid, P-oxybenzoic acid, sodium 5-sulfoisophthalate, adipic acid, sebacic acid, and 1,4-cyclohexanedicarboxylic acid. Examples of diol compounds other than the above-mentioned glycols include aliphatic, alicyclic, or aromatic diol compounds and polyoxyalkylene glycols, such as cyclohexane-1,4-dimethanol, neopentyl glycol, bisphenol A, and bisphenol S.

[0031] The polyester may be one which is synthesized by an arbitrary method. For example, a synthesis of polyethylene terephthalate is described below. Polyethylene terephthalate can be produced through a reaction of the first stage in which terephthalic acid and ethylene glycol are directly subjected to esterification reaction, or a lower alkyl ester of terephthalic acid, such as dimethyl terephthalate, and ethylene glycol are subjected to transesterification reaction, or terephthalic acid and ethylene oxide are reacted to form a glycol ester of terephthalic acid and/or a lower polymer thereof; and a reaction of the second stage in which the reaction product obtained on the first stage is subjected to polycondensation reaction by heating under a reduced pressure until a desired degree of polymerization is achieved. Alternatively, the polyester may be a material-recycled or chemical-recycled polyester. Further alternatively, the polyester may be an aliphatic polyester, such as polylactic acid or stereocomplex polylactic acid.

[0032] The polyester, if necessary, may contain one or more members of a matting agent (titanium dioxide), a micropore forming agent (organic sulfonic acid metal salt), a color protection agent, a heat stabilizer, a flame retardant (antimony trioxide), a fluorescent brightener, a coloring pigment, an antistatic agent (sulfonic acid metal salt), a moisture absorber (polyoxyalkylene glycol), an anti-fungus agent, and other inorganic particles. Particularly, it is preferred that the polyester contains a matting agent in an amount of 0.2% by weight or more (more preferably 0.2 to 2.5% by weight), based on the weight of the polyester, because an ultraviolet light screening effect or impermeability is imparted to the woven fabric.

[0033] Then, the above-mentioned combined filament yarn and, if necessary, another yarn are woven using a loom (for example, a water jet loom) or the like.

[0034] In this instance, the sheath-core manner combined filament yarn may be disposed in the warp yarn and the weft yarn, or the sheath-core manner combined filament yarn may be disposed in only one of the warp yarn and the weft yarn. The weave structure of the woven fabric is not limited, and preferred examples of weave structures include a plain weave structure, a twill weave structure, and a satin weave structure. Further, the weave structure of the woven fabric may be a double weave structure.

[0035] Then, the resultant fabric is appropriately subjected to dyeing or water repellency-imparting processing, obtaining a woven fabric. The fiber for core part contained in the combined filament yarn largely shrinks due to heat history including dyeing, so that the combined filament yarn has a sheath-core manner structure. With respect to the obtained woven fabric, it is important that a yarn length difference between the core part and the sheath part contained in the combined filament yarn is 25% or more (more preferably 40 to 80%, especially preferably 50 to 70%). Further, for achieving 25% or more of a yarn length difference between the core part and the sheath part contained in the combined filament yarn, for example, as a non-crimped yarn for core part, a yarn obtained by cold-drawing a polyester undrawn yarn (UDY) or a polyester partially oriented yarn (POY) is used, and meanwhile, as a yarn for sheath part, a non-crimped drawn yarn obtained by spinning and drawing (hot drawing) a polyester by a general method, or a false-twisted crimped yarn is used.

[0036] With respect to a method for measuring a yarn length difference between the core part and the sheath part, as preferred examples of methods, there can be mentioned the following methods.

(Method 1 for measuring a yarn length difference)

[0037] A tubular knitted fabric is first knitted using a combined filament yarn, and subjected to dyeing, and then the resultant tubular knitted fabric is immersed in an aqueous sodium hydroxide solution, and heated and then dried to reduce the core yarn in amount. Then, with respect to a length (L1) at predetermined wales of the combined filament yarn withdrawn from the tubular knitted fabric before reducing the core yarn in amount and a length (L2) at the same wales of the combined filament yarn withdrawn from the tubular knitted fabric after reducing the core yarn in amount, a predetermined load is applied to each of the yarns and a length (L1) and a length (L2) are measured, and a yarn length difference is calculated from the following formula:

$$\text{Yarn length difference (\%)} = (L2 - L1)/L1 \times 100$$

[0038] LA is a length (cm) of the non-crimped yarn A for core part, and LB is a length (cm) of the yarn B for sheath part.

[0039] When a sheath-core manner combined filament yarn is removed from a woven fabric and a yarn length difference between the core part and the sheath part is measured, the following method is preferred.

(Method 2 for measuring a yarn length difference)

[0040] A combined filament yarn is withdrawn from a woven fabric, and a load of 0.1 cN (0.1 g) x total fineness (dtex) of the combined filament yarn is fitted to the combined filament yarn, and the yarn is cut into pieces with a length of 5 cm, and a non-crimped yarn A for core part (single fiber) and a yarn B for sheath part (single fiber) are taken away from the cut combined filament yarn, and a load of 0.1 cN (0.1 g) x single fiber fineness (dtex) is applied to each of the yarns, and lengths of the yarns are measured, and a yarn length difference (%) is calculated from the following formula:

$$\text{Yarn length difference (\%)} = (LB - LA)/LA \times 100$$

[0041] LA is a length (cm) of the non-crimped yarn A for core part, and LB is a length (cm) of the yarn B for sheath part.

[0042] Then, the woven fabric is subjected to water repellency-imparting processing (a water repellent is applied to the woven fabric). With respect to the water repellent, a non-fluorine water repellent comprising a hydrocarbon compound or a silicone compound is preferred. Specifically, with respect to the hydrocarbon compound, an aliphatic hydrocarbon, an aliphatic carboxylic acid, an olefin, a polyacrylate, a polymethacrylate, or the like can be used. With respect to the silicone compound, amino-modified silicone, epoxy-modified silicone, carboxy-modified silicone, or the like can be used. Preferred examples of commercially available hydrocarbon compounds include Neoseed NR-158, NR-7080, manufactured by Nicca Chemical Co., Ltd.; and Unidyne XF5001, XF5002, manufactured by Daikin Industries, Ltd. Preferred examples of commercially available silicone compounds include Neoseed NR-8000, manufactured by Nicca Chemical Co., Ltd. The surface of the woven fabric is preferably treated using a processing agent at a pickup of about 50 to 90% in which the processing agent contains a water repellent and, if necessary, has mixed thereinto an antistatic agent, a melamine resin, and a catalyst so that the concentration of the water repellent is about 3 to 15% by weight. As examples of the method for treating the surface of the woven fabric with a processing agent, there can be mentioned a padding method and a spray method. Especially, in view of causing the processing agent to penetrate the inside of the woven fabric, a padding method is preferred. The pickup means a ratio (%) of the weight of the processing agent to the weight of the woven fabric (which does not have the processing agent applied thereto).

[0043] With respect to the antistatic agent, preferred is a polyester resin containing a polyethylene glycol group, an urethane resin containing a polyethylene glycol group, a reaction product of a polycationic compound containing a polyethylene glycol group and diglycidyl ether, or the like. The antistatic agent may be an antistatic compound, e.g., an anionic surfactant, such as a higher alcohol sulfate salt, a sulfated oil, a sulfonic acid salt, or a phosphate salt; a cationic surfactant, such as an amine salt type, a quaternary ammonium salt, or an imidalin type quaternary salt; a nonionic surfactant, such as a nonionic surfactant of a polyethylene glycol type or a polyhydric alcohol ester type; or an amphoteric surfactant, such as an amphoteric surfactant of an imidalin type quaternary salt, an alanine type, or a betaine type.

[0044] Further, when a compound having anionic properties is fixed to the fabric prior to the water repellency-imparting processing, adhesion of the water repellent having cationic properties is improved, so that the resultant woven fabric is improved in durability. Examples of the compounds having anionic properties include a sulfonic group-containing compound and a phenolic compound.

[0045] With respect to the heat treatment, at least one treatment of a dry heat treatment and a wet heat treatment is preferably conducted under conditions at a temperature of 50 to 180°C for 0.1 to 30 minutes. The heat treatment may be a steaming treatment. In such a steaming treatment, saturated steam at 80 to 160°C or superheated steam is preferably used. In the steaming treatment, the treatment time is preferably in the range of from several seconds to several tens of minutes. After conducting the steaming treatment, if necessary, water washing, warm water washing, or reduction cleaning may be performed.

[0046] Further, it is preferred that the woven fabric is subjected to calendering in at least one of the steps before and after the water repellency-imparting processing step because the woven fabric having a lotus leaf-like surface is easily obtained, achieving excellent water repellency. Conditions for the calendering are preferably such that the temperature is in the range of 130°C or higher (more preferably 140 to 195°C) and the linear pressure is in the range of from 200 to 20,000 N/cm (more preferably 200 to 1,000 N/cm).

[0047] Further, in at least one of the steps before and after the water repellency-imparting processing step, dyeing, alkali reduction processing, or raising may be conducted according to a general method. Further, an ultraviolet light screening agent, an anti-fungus agent, a deodorant, an insectifuge, a phosphorescent material, a retroreflective material, a negative ion generator, or the like may be additionally applied to the woven fabric.

[0048] It is preferred that the woven fabric has a warp cover factor in the range of from 700 to 1,800 and a weft cover factor in the range of from 700 to 2,000 because further excellent water repellency can be obtained.

[0049] The warp cover factor (warp CF) and the weft cover factor (weft CF) are defined by the following respective formulae:

$$\text{Warp CF} = (\text{DWp}/1.1)^{1/2} \times \text{MWp}$$

$$\text{Weft CF} = (\text{DWf}/1.1)^{1/2} \times \text{MWf}$$

wherein DWp is a warp yarn total fineness (dtex), MWp is a warp yarn weaving density (the number of yarns/2.54 cm), DWf is a weft yarn total fineness (dtex), and MWf is a weft yarn weaving density (the number of yarns/2.54 cm).

[0050] The woven fabric obtained as mentioned above has not only excellent water repellency but also excellent spun-like appearance and spun-like hand feeling. With respect to the obtained woven fabric, it is preferred that the woven fabric has a water-repellency rolling angle of 15 degrees or less (more preferably 5 to 15 degrees).

[0051] The water-repellency rolling angle is an angle at which the droplet of water starts rolling when 0.2 cc of water is slowly applied to a planar specimen to be measured, which is fitted onto a horizontal flat plate, and the flat plate is allowed to gradually slope at a uniform rate.

[0052] Further, it is preferred that the woven fabric has a water repellency of class 4 or higher, as measured in accordance with JIS L1092-2009 7.2 Water repellency test (spray method). Furthermore, it is preferred that the woven fabric has a water repellency of class 3 or higher, as measured in accordance with JIS L1092-2009 7.2 Water repellency test (spray method) with respect to the woven fabric which has been subjected to 10 times washing described in JIS L0217-1995 (using the JAFET standard detergent).

[0053] With respect to the fiber areal weight of the woven fabric, there is no particular limitation, but, from the viewpoint of softness, and in view of the use of the fabric, the fiber areal weight of the woven fabric is preferably 80 to 200 g/m^2 (more preferably 30 to 95 g/m^2). When the fiber areal weight of the woven fabric is more than 200 g/m^2, the woven fabric used as wear (clothing) is likely to be too heavy.

[0054] Next, the fiber product of the present invention is obtained using the above-described woven fabric, in which the fiber product is selected from the group consisting of sportswear, outerwear, underwear, menswear, womenswear, clothing for nursing care, work clothing, a car seat skin material, and a bedding article. The fiber product uses the above-described woven fabric, and therefore has not only excellent water repellency but also excellent spun-like appearance and spun-like hand feeling.

Examples

[0055] Hereinbelow, the present invention will be described in more detail with reference to the following Examples, which should not be construed as limiting the scope of the invention. In the following Examples, physical properties were measured in accordance with the methods described below.

(1) Fiber areal weight

[0056] A fiber areal weight was measured in accordance with JIS L1096-2010.

(2) Yarn length difference

[0057] A tubular knitted fabric was knitted using a combined filament yarn, and then subjected to dyeing, and subsequently, 3.75 g of the tubular knitted fabric was immersed in 250 ml of a 50 g/L aqueous sodium hydroxide solution, and the temperature was increased at 2°C/minute, and kept at 80°C for 270 minutes, and then the fabric was dried to reduce the core yarn in amount. Then, with respect to a length (L1) at 50 wales of the combined filament yarn withdrawn from the tubular knitted fabric before reducing the core yarn in amount and a length (L2) at 50 wales of the combined filament yarn withdrawn from the tubular knitted fabric after reducing the core yarn in amount, a load of 3.6 g was applied to each of the yarns and a length (L1) and a length (L2) were measured, and a yarn length difference was calculated from the following formula:

$$\text{Yarn length difference (\%)} = (L2 - L1)/L1 \times 100$$

(3) Cover factor

[0058] A warp cover factor (warp CF) and a weft cover factor (weft CF) were calculated from the following respective formulae:

$$\text{Warp CF} = (\text{DWp}/1.1)^{1/2} \times \text{MWp}$$

$$\text{Weft CF} = (\text{DWf}/1.1)^{1/2} \times \text{MWf}$$

wherein DWp is a warp yarn total fineness (dtex), MWp is a warp yarn weaving density (the number of yarns/2.54 cm), DWf is a weft yarn total fineness (dtex), and MWf is a weft yarn weaving density (the number of yarns/2.54 cm).

(4) Hand feeling

[0059] A woven fabric was evaluated, in terms of the spun-like hand feeling like cotton, on a scale of four ratings, i.e., especially excellent (A), excellent (B), ordinary (C), and poor (D).

(5) Appearance

[0060] A woven fabric was evaluated, in terms of the spun-like appearance like cotton, on a scale of four ratings, i.e., especially excellent (A), excellent (B), ordinary (C), and poor (D).

(6) Total evaluation

[0061] A woven fabric was evaluated, in terms of the spun-like hand feeling and spun-like appearance, on a scale of four ratings, i.e., especially excellent (A), excellent (B), ordinary (C), and poor (D).

(7) Water repellency

[0062] A water repellency (class) was measured in accordance with JIS L1092-2009 7.2 Water repellency test (spray method).

(8) Water repellency (water-repellency rolling angle)

[0063] 0.2 cc of water was slowly applied to a planar specimen to be measured, which was fitted onto a horizontal flat plate, and the flat plate was allowed to gradually slope at a uniform rate, and an angle with which the droplet of water started rolling was measured and determined as a water-repellency rolling angle. The smaller the water-repellency rolling angle, the more excellent the water repellency.

[Example 1]

[0064] A yarn (non-crimped yarn; 22 dtex/24 filaments) obtained by cold-drawing at a draw ratio of 1.6 times a cationically dyeable POY (partially oriented yarn) which is composed of, as a cationically dyeable polyester, polyethylene terephthalate having sodium 5-sulfoisophthalate copolymerized in an amount of 1.5 mol%, and which has a total fineness of 33 dtex/24 filaments, a breaking strength of 2.0 cN/dtex, and an elongation at break of 148%, and a polyethylene terephthalate (PET) false-twisted crimped yarn (titanium oxide content: 2.4%) (crimped yarn; 22 dtex/72 filaments), which has a circular cross-sectional shape of filament, were paralleled and subjected to interlacing with 2% overfeeding, obtaining a combined filament yarn having a yarn length difference of 55% (44 dtex/96 filaments; the number of interlaces: 106/m).

[0065] Then, the obtained combined filament yarn was disposed as a warp yarn and a weft yarn, and, using a water jet loom, a fabric of a plain weave structure (woven fabric comprised only of the combined filament yarn) was woven.

[0066] Subsequently, using a scouring apparatus, the woven fabric was subjected to open width scouring treatment at 95°C. Then, using a jet dyeing machine, the woven fabric was subjected to dyeing with a disperse dye at a temperature of 130°C, and then subjected to the below-shown water repellency-imparting processing. In the water repellency-imparting processing, the processing agent shown below was used, and the woven fabric was squeezed at a pickup of 80%, and dried at 130°C for 3 minutes, and then subjected to heat treatment at 170°C for 45 seconds.

<Composition of the processing agent>

[0067]

- Non-fluorine water repellent: 5.0 wt%
  (Neoseed NR-7080, manufactured by Nicca Chemical Co., Ltd.; hydrocarbon 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] The thus obtained water-repellent woven fabric had the following properties: fiber areal weight: 81 g/m^2; warp yarn density: 183 yarns/2.54 cm; weft yarn density: 155 yarns/2.54 cm; cover factor: 2,137; water repellency: class 4; and water repellency of the woven fabric which had been subjected to 10 times washing described in JIS L0217-1995 (using the JAFET standard detergent): class 3. Further, the water-repellent woven fabric had a fine uneven structure formed in the surface of the woven fabric, and had a water-repellency rolling angle of 10 degrees, a rating (A) for hand feeling, and a rating (A) for appearance, which indicates that the water-repellent woven fabric had not only excellent water repellency but also excellent spun-like appearance and spun-like hand feeling. The results of the evaluation are shown in Table 1.

[Example 2]

[0069] A yarn (non-crimped yarn; 22 dtex/24 filaments) obtained by cold-drawing at a draw ratio of 1.6 times a cationically dyeable POY (partially oriented yarn) which is composed of, as a cationically dyeable polyester, polyethylene terephthalate having sodium 5-sulfoisophthalate copolymerized in an amount of 1.5 mol%, and which has a total fineness of 33 dtex/36 filaments, a breaking strength of 2.0 cN/dtex, and an elongation at break of 148%, and a polyethylene terephthalate false-twisted crimped yarn (titanium oxide content: 2.4%) (crimped yarn; 22 dtex/72 filaments), which has a circular cross-sectional shape of filament, were paralleled and subjected to interlacing with 2% overfeeding, obtaining a combined filament yarn having a yarn length difference of 55% (44 dtex/96 filaments; the number of interlaces: 106/m).

[0070] Then, a polyester non-crimped yarn having a yarn strength of 4.9 cN/dtex and a total fineness of 11 dtex/10 filaments was disposed as a warp yarn, and the above-obtained combined filament yarn was disposed as a weft yarn, and, using a water jet loom, a fabric of a plain weave structure was woven.

[0071] Subsequently, using a scouring apparatus, the woven fabric was subjected to open width scouring treatment at 95°C. Then, using a jet dyeing machine, the woven fabric was subjected to dyeing with a disperse dye at a temperature of 130°C, and then subjected to the below-shown water repellency-imparting processing. In the water repellency-imparting processing, the processing agent shown below was used, and the woven fabric was squeezed at a pickup of 80%, and dried at 130°C for 3 minutes, and then subjected to heat treatment at 170°C for 45 seconds.

<Composition of the processing agent>

[0072]

- Non-fluorine water repellent: 5.0 wt%
  (Neoseed NR-7080, manufactured by Nicca Chemical Co., Ltd.; hydrocarbon 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%

[0073] The thus obtained water-repellent woven fabric had the following properties: fiber areal weight: 46 g/m^2; warp yarn density: 296 yarns/2.54 cm; weft yarn density: 138 yarns/2.54 cm; cover factor: 1,809; water repellency: class 4; and water repellency of the woven fabric which had been subjected to 10 times washing described in JIS L0217-1995 (using the JAFET standard detergent): class 3. Further, the water-repellent woven fabric had a fine uneven structure formed in the surface of the woven fabric, and had a water-repellency rolling angle of 15 degrees, a rating (A) for hand feeling, and a rating (A) for appearance, which indicates that the water-repellent woven fabric had not only excellent water repellency but also excellent spun-like appearance and spun-like hand feeling. The results of the evaluation are shown in Table 1.

[Example 3]

[0074] A yarn (non-crimped yarn; 33 dtex/36 filaments) obtained by cold-drawing at a draw ratio of 1.6 times a cationically dyeable POY (partially oriented yarn) which is composed of, as a cationically dyeable polyester, polyethylene terephthalate having sodium 5-sulfoisophthalate copolymerized in an amount of 1.5 mol%, and which has a fineness of 56 dtex/36 filaments, a breaking strength of 2.0 cN/dtex, and an elongation at break of 148%, and a polyethylene terephthalate drawn yarn (titanium oxide content: 2.4%) (non-crimped yarn; 22 dtex/72 filaments), which has a circular cross-sectional shape of filament, were paralleled and subjected to interlacing with 2% overfeeding, obtaining a combined

filament yarn having a yarn length difference of 58% (55 dtex/108 filaments).

[0075] Then, a polyester false-twisted crimped yarn (fineness: 56 dtex/72 filaments) obtained by a general POY/DTY method was disposed as a warp yarn, and the above-obtained combined filament yarn was disposed as a weft yarn, and, using a water jet loom, a fabric of a plain weave structure was woven.

[0076] Subsequently, using a scouring apparatus, the woven fabric was subjected to open width scouring treatment at 95°C. Then, using a jet dyeing machine, the woven fabric was subjected to dyeing with a disperse dye at a temperature of 130°C, and then subjected to the below-shown water repellency-imparting processing. In the water repellency-imparting processing, the processing agent shown below was used, and the woven fabric was squeezed at a pickup of 80%, and dried at 130°C for 3 minutes, and then subjected to heat treatment at 170°C for 45 seconds.

<Composition of the processing agent>

[0077]

- Non-fluorine water repellent: 5.0 wt%
  (Neoseed NR-7080, manufactured by Nicca Chemical Co., Ltd.; hydrocarbon 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%

[0078] The thus obtained water-repellent woven fabric had the following properties: fiber areal weight: 77 g/m^2; warp yarn density: 168 yarns/2.54 cm; weft yarn density: 132 yarns/2.54 cm; cover factor: 2,122; water repellency: class 5; and water repellency of the woven fabric which had been subjected to 10 times washing described in JIS L0217-1995 (using the JAFET standard detergent): class 4. Further, the water-repellent woven fabric had a fine uneven structure formed in the surface of the woven fabric, and had a water-repellency rolling angle of 9 degrees, a rating (B) for hand feeling, and a rating (B) for appearance, which indicates that the water-repellent woven fabric had not only excellent water repellency but also excellent spun-like appearance and spun-like hand feeling. The results of the evaluation are shown in Table 1.

[Comparative Example 1]

[0079] A polyethylene terephthalate false-twisted crimped yarn (fineness: 44 dtex/48 filaments) obtained by a general POY/DTY method was disposed as a warp yarn and a weft yarn, and, using a water jet loom, a fabric of a plain weave structure (woven fabric comprised only of the combined filament yarn) was woven.

[0080] Subsequently, using a scouring apparatus, the woven fabric was subjected to open width scouring treatment at 95°C. Then, using a jet dyeing machine, the woven fabric was subjected to dyeing with a disperse dye at a temperature of 130°C, and then subjected to the below-shown water repellency-imparting processing. In the water repellency-imparting processing, the processing agent shown below was used, and the woven fabric was squeezed at a pickup of 80%, and dried at 130°C for 3 minutes, and then subjected to heat treatment at 170°C for 45 seconds.

<Composition of the processing agent>

[0081]

- Non-fluorine water repellent: 5.0 wt%
  (Neoseed NR-7080, manufactured by Nicca Chemical Co., Ltd.; hydrocarbon 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%

[0082] The thus obtained woven fabric had the following properties: fiber areal weight: 83 g/m^2; warp yarn density: 185 yarns/2.54 cm; weft yarn density: 158 yarns/2.54 cm; cover factor: 2,169; water repellency: class 4; and water repellency of the woven fabric which had been subjected to 10 times washing described in JIS L0217-1995 (using the JAFET standard detergent): class 2. Further, the woven fabric had a water-repellency rolling angle of 20 degrees, a rating (C) for hand feeling, and a rating (D) for appearance, and thus neither spun-like appearance nor spun-like hand feeling nor excellent

rolling properties of the droplet of water could be obtained. The results of the evaluation are shown in Table 1.

[Comparative Example 2]

[0083] A drawn yarn (non-crimped yarn; 33 dtex/12 filaments) being composed of a polyethylene terephthalate fiber and having a boiling water shrinkage of 13% and a drawn yarn (non-crimped yarn; 35 dtex/72 filaments) being composed of a polyethylene terephthalate fiber and having a boiling water shrinkage of 8% were paralleled and subjected to interlacing with 1.6% overfeeding, obtaining a combined filament yarn having a yarn length difference of 15% (69 dtex/84 filaments).

[0084] Then, the obtained combined filament yarn was disposed as a warp yarn and a weft yarn, and, using a water jet loom, a fabric of a plain weave structure (woven fabric comprised only of the combined filament yarn) was woven.

[0085] Subsequently, using a scouring apparatus, the woven fabric was subjected to open width scouring treatment at 95°C. Then, using a jet dyeing machine, the woven fabric was subjected to dyeing with a disperse dye at a temperature of 130°C, and then subjected to the below-shown water repellency-imparting processing. In the water repellency-imparting processing, the processing agent shown below was used, and the woven fabric was squeezed at a pickup of 80%, and dried at 130°C for 3 minutes, and then subjected to heat treatment at 170°C for 45 seconds.

<Composition of the processing agent>

[0086]

- Non-fluorine water repellent: 5.0 wt%
  (Neoseed NR-7080, manufactured by Nicca Chemical Co., Ltd.; hydrocarbon 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%

[0087] The thus obtained woven fabric had the following properties: fiber areal weight: 103 g/m^2; warp yarn density: 145 yarns/2.54 cm; weft yarn density: 132 yarns/2.54 cm; cover factor: warp: 1,143, weft: 1,040, total: 2,183; water repellency: class 4; and water repellency of the woven fabric which had been subjected to 10 times washing described in JIS L0217-1995 (using the JAFET standard detergent): class 2. Further, the woven fabric had a water-repellency rolling angle of 21 degrees, a rating (C) for hand feeling, and a rating (C) for appearance, and thus neither spun-like appearance and spun-like hand feeling nor excellent rolling properties of the droplet of water could be obtained. The results of the evaluation are shown in Table 1.

[Table 1-1]

		Example 1	Example 2	Example 3
	Warp yarn	Polyester combined filament yarn (44 dtex/96 filaments)	Polyester non-crimped yarn (11 dtex/10 filaments)	Polyester false-twisted crimped yarn (56 dtex/72 filaments)
	Weft yarn	Polyester combined filament yarn (44 dtex/96 filaments)	Polyester combined filament yarn (44 dtex/96 filaments)	Polyester combined filament yarn (55 dtex/108 filaments)
	Combined filament yarn constituent:Core	Cationically dyeable non-crimped yarn 22 dtex/24 filaments	Cationically dyeable non-crimped yarn 22 dtex/24 filaments	Cationically dyeable non-crimped yarn 33 dtex/36 filaments
	Sheath	Circular cross-sectional PET false-twisted crimped yarn 22 dtex/72 filaments	Circular cross-sectional PET false-twisted crimped yarn 22 dtex/72 filaments	Circular cross-sectional PET non-crimped yarn 22 dtex/72 filaments
	Core part single fiber fineness (dtex)	0.92	0.92	0.92

(continued)

		Example 1	Example 2	Example 3
	Sheath part single fiber fineness (dtex)	0.31	0.31	0.31
	Sheath/core total fineness ratio	1	1	1.5
	Yarn length difference (%)	55	55	58
Woven fabric	Structure	Plain	Plain	Plain
	Fiber areal weight (g/m^2)	81	46	77
	Warp yarn density (number of yarns/2.54 cm)	183	296	168
	Weft yarn density (number of yarns/2.54 cm)	155	138	132
	CF	2,137	1,809	2,122
	Water repellency (Class)	4	4	5
	Water repellency L10 (Class)	3	3	4
	Water-repellency rolling angle (Degree)	10	15	9
	Spun-like appearance	A	A	B
	Spun-like hand feeling	A	A	B
	Total evaluation	A	A	B

[Table 1-2]

		Comparative Example 1	Comparative Example 2
	Warp yarn	Polyester false-twisted crimped yarn (44 dtex/48 filaments)	Polyester combined filament yarn (69 dtex/84 filaments)
	Weft yarn	Polyester false-twisted crimped yarn (44 dtex/48 filaments)	Polyester combined filament yarn (69 dtex/84 filaments)
	Combined filament yarn constituent:Core	-	Circular cross-sectional PET non-crimped yarn 33 dtex/12 filaments
	Sheath	-	Circular cross-sectional PET non-crimped yarn 35 dtex/72 filaments
	Core part single fiber fineness (dtex)	-	2.75
	Sheath part single fiber fineness (dtex)	-	0.46

(continued)

		Comparative Example 1	Comparative Example 2
	Sheath/core total fineness ratio	-	1
	Yarn length difference (%)	-	15
Woven fabric	Structure	Plain	Plain
	Fiber areal weight (g/m2)	83	103
	Warp yarn density (number of yarns/2.54 cm)	185	145
	Weft yarn density (number of yarns/2.54 cm)	158	132
	CF	2,169	2,183
	Water repellency (Class)	4	4
	Water repellency L10 (Class)	2	2
	Water-repellency rolling angle (Degree)	20	21
	Spun-like appearance	C	C
	Spun-like hand feeling	D	C
	Total evaluation	D	D

Industrial Applicability

[0088] In the present invention, there are provided a water-repellent woven fabric and a fiber product, each having not only excellent water repellency but also excellent spun-like appearance and spun-like hand feeling, and such a fabric and fiber product are of extremely great commercial significance.

Claims

1. A water-repellent woven fabric which has been subjected to water repellency-imparting processing, the woven fabric comprising a sheath-core manner combined filament yarn, wherein the core part comprises a non-crimped yarn, and wherein a yarn length difference between the core part and the sheath part is 25% or more.

2. The water-repellent woven fabric according to claim 1, wherein each of the core part and the sheath part comprises a polyester fiber.

3. The water-repellent woven fabric according to claim 1, wherein the non-crimped yarn disposed in the core part is composed of a cationically dyeable polyester.

4. The water-repellent woven fabric according to claim 1, wherein, in the sheath-core manner combined filament yarn, the core part and the sheath part are multifilament in which the number of filaments is 10 to 200.

5. The water-repellent woven fabric according to claim 1, wherein the sheath-core manner combined filament yarn has been subjected to interlacing so that the number of interlaces becomes 30/m or more.

6. The water-repellent woven fabric according to claim 1, wherein, in the sheath-core manner combined filament yarn, the number of filaments of the sheath part is larger than that of the core part.

7. The water-repellent woven fabric according to claim 1, wherein, in the sheath-core manner combined filament yarn, the sheath part has a single fiber fineness of 0.1 to 1.5 dtex, the single fiber fineness of the sheath part is equivalent to or smaller than the single fiber fineness of the core part, and the ratio of the single fiber fineness between the sheath

part and the core part is 0.5 to 2.0.

8. The water-repellent woven fabric according to claim 1, which has a fine unevenness formed in the surface of the woven fabric.

9. The water-repellent woven fabric according to claim 1, which has been subjected to water repellency-imparting processing using, as a water repellent, a non-fluorine water repellent comprising a hydrocarbon compound or a silicone compound.

10. The water-repellent woven fabric according to claim 1, which has a warp cover factor in the range of from 700 to 1,800 and a weft cover factor in the range of from 700 to 2,000,

wherein the warp cover factor (warp CF) and the weft cover factor (weft CF) are defined by the following respective formulae:

$$\text{Warp CF} = (DWp/1.1)^{1/2} \times MWp$$

$$\text{Weft CF} = (DWf/1.1)^{1/2} \times MWf$$

wherein DWp is a warp yarn total fineness (dtex), MWp is a warp yarn weaving density (the number of yarns/2.54 cm), DWf is a weft yarn total fineness (dtex), and MWf is a weft yarn weaving density (the number of yarns/2.54 cm).

11. The water-repellent woven fabric according to claim 1, which has a water-repellency rolling angle of 15 degrees or less.

12. The water-repellent woven fabric according to claim 1, which has a water repellency of class 4 or higher, as measured in accordance with JIS L1092-2009 7.2 Water repellency test (spray method).

13. The water-repellent woven fabric according to claim 1, which has a water repellency of class 3 or higher, as measured in accordance with JIS L1092-2009 7.2 Water repellency test (spray method) with respect to the woven fabric which has been subjected to 10 times washing described in JIS L0217-1995 (using the JAFET standard detergent).

14. A fiber product which is obtained using the water-repellent woven fabric according to any one of claims 1 to 13, wherein the fiber product is selected from the group consisting of sportswear, outerwear, underwear, menswear, womenswear, clothing for nursing care, work clothing, a car seat skin material, and a bedding article.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2024/040782

A. CLASSIFICATION OF SUBJECT MATTER

D03D 15/47(2021.01)i; ***D06M 13/02***(2006.01)i; ***D06M 15/643***(2006.01)i
FI: D03D15/47; D06M13/02; 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)

D03D1/00-27/18; D06M13/00-15/715

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 1971-2025
Registered utility model specifications of Japan 1996-2025
Published registered utility model applications of Japan 1994-2025

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.
Y	JP 2023-12164 A (TEIJIN FRONTIER CO., LTD.) 25 January 2023 (2023-01-25) claims 1-4, 6, 7, 12, paragraphs [0020], [0027], examples	1-14
Y	JP 63-152439 A (TEIJIN LIMITED) 24 June 1988 (1988-06-24) claims, page 3, lower left column, lines 17-20	1-14
Y	JP 2000-273741 A (TORAY IND INC.) 03 October 2000 (2000-10-03) claims, examples	1-14
Y	JP 2006-104617 A (TORAY IND INC.) 20 April 2006 (2006-04-20) claims, examples	1-14
Y	JP 2010-133052 A (TEIJIN FIBERS LIMITED) 17 June 2010 (2010-06-17) claims, paragraph [0031]	1-14
Y	JP 2012-122144 A (TEIJIN FIBERS LIMITED) 28 June 2012 (2012-06-28) claims, paragraph [0024]	1-14

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 January 2025	**28 January 2025**
Name and mailing address of the ISA/JP **Japan Patent Office (ISA/JP)** **3-4-3 Kasumigaseki, Chiyoda-ku, Tokyo 100-8915** **Japan**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2024/040782

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2019-183307 A (TEIJIN FRONTIER CO., LTD.) 24 October 2019 (2019-10-24) claims, paragraph [0032]	9, 11-13
Y	WO 2014/097935 A1 (TEIJIN FRONTIER CO., LTD.) 26 June 2014 (2014-06-26) claims	9, 11-13
Y	JP 2015-86489 A (TEIJIN FRONTIER CO., LTD.) 07 May 2015 (2015-05-07) claims	9, 11-13

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2024/040782

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