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(54) **SPUN YARN**

GARN

FILE

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(56) References cited:
JP-A- 9 031 796
JP-A- 2001 254 240
JP-A- 2003 227 043

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Description

TECHNICAL FIELD

[0001] The present invention relates to a spun yarn excellent in a warmth retaining property.

BACKGROUND ART

[0002] Conventionally, fibers used for warmth-retaining clothing aim to improve solely one of a performance for hygroscopically generating heat or a performance for preventing heat from escaping from a human body, and clothing using such fibers is insufficient for maintaining the warmth-retaining property for a long time because one of the above performances is inferior even if the other performance is excellent.

[0003] For example, as a warmth-retaining underwear used in a cold winter season, there has been known an underwear mixedly knitted with a spandex elastic yarn covered with nylon fibers and a cotton yarn, an underwear made of synthetic fibers such as hollow polyester fibers and acrylic fibers, or an underwear made of wool.

[0004] Also, for the purpose of positively warming a human body, clothing using acrylate-type hygroscopically heat-generating fibers (see Japanese Examined Patent Publication No. H7-59762), clothing using cellulose-type hygroscopic heat-generating fibers wherein water-soluble vinyl polymer is introduced into cellulose (see Japanese Patent No. 2898623), and so on, have been known.

[0005] However, as such acrylate-type hygroscopically heat-generating fibers and cellulose hygroscopically heat-generating fibers are insufficient in performance for preventing heat from escaping out of the human body, they are unsatisfactory in a warmth-retaining property for a long time use.

[0006] In addition, there are problems in that, as the above-mentioned acrylate-type hygroscopically heat-generating fibers are pink in color, they are not always dyeable in optional colors as well as the breaking strength of a knitted or woven fabric made thereof becomes insufficient.

[0007] Also, as the acrylate-type hygroscopically heat-generating fibers and the cellulose type hygroscopically heat-generating fibers are low in moisture-absorbing speed and moisture-releasing speed, there is a problem in that a response is delayed in the moisture control properties of the clothing. Further, the acrylate-type hygroscopically heat-generating fibers and the cellulose fibers wherein a vinyl compound is introduced are expensive.

[0008] As described above, clothing solely made of the hygroscopically heat-generating fibers is insufficient in warmth-retaining performance and in fabric performance.

[0009] To solve such problems, it was thought that the hygroscopically heat-generating fibers could be mixedly spun together with other fibers. In such a case, to obtain a high warmth-retaining property by the mixed spinning with conventional fibers, it is necessary to use the hygroscopically heat-generating fibers at a relatively high mixture ratio. However, it is impossible to use the hygroscopically heat-generating fibers at a high mixture ratio in the daily-use clothing such as underwear, whereby only a small amount of hygroscopically generated heat is possible.

[0010] Accordingly, spun yarns excellent in hygroscopically heat-generating performance as well as capable of exhibiting a superior warmth-retaining property and fabric performance have been desired.

[0011] On the other hand, in Japanese Unexamined Patent Publication No. 2002-294564, acrylic-type ultra-fine fibers having a fineness in a range from 0.1 to 1.3 dtex are disclosed, wherein a ratio of the fibers having the number of microcrimps of 1 or less is 70% or more and a sedimentation time in water after the hydrophilic treatment is 10 seconds or less. When these fibers are mixed with the hygroscopically heat-generating fibers, yarn defects such as neps or others are often generated because of the poor fiber-opening caused by the fiber fineness, whereby it is impossible to obtain a practically usable spun yarn.

[0012] JP-A-9-031796 discloses a spun yarn comprising

(1) 10 % by weight or more of hydrophobic synthetic fibers (polyester, acrylic) having a fiber fineness in a range from 0.33 to 5.5 dtex (0.3 to 5.0 den), and
(2) 20 % by weight or more of hygroscopically heat-generating fibers (polyacrylate) having an amount of hygroscopically generated heat (a calorific value) of 20 J/g or more.

[0013] It also discloses the use of polyacrylic fibers at the hydrophobic synthetic fibers.

DISCLOSURE OF THE INVENTION

[0014] The present inventors have studied to solve the above-mentioned problems, and found that a spun yarn using special ultra-fine fibers, as hydrophobic synthetic fibers, together with hygroscopically heat-generating fibers, is excellent in hygroscopically heat-generating performance as well as a warmth-retaining property, to produce the present invention.

[0015] That is, the present invention is a spun yarn comprising

(1) 10 to 80 % by weight of hydrophobic synthetic fibers having a fiber fineness in a range from 0.1 to 1.6 dtex, and
(2) 20 to 90 % by weight of hygroscopically heat-generating regenerated cellulose fibers having an amount of hygroscopically generated heat of 15 J/g or more when the environment changes from 20 °C and 40 % RH to 20 °C and 90 % RH and having a fiber fineness of 0.6 to 2.2 dtex.

[0016] The present invention will be described below in more detail.

[0017] The inventive spun yarn is a clothing material excellent both in the performance for hygroscopically generating heat and the performance for preventing heat from escaping from the human body (hereinafter the combination of these two performances is referred to as a total warmth-retaining performance). The clothing made of the spun yarn can retain the warmth for a long time.

[0018] The total warmth-retaining performance is a body temperature retaining ability while a person is wearing the clothing, which is an index for indicating total warmth felt by the person wearing the same. As described later, the total warmth-retaining performance is obtained by measuring the body temperature retaining ability when the environment of the fibers changes from the temperature of 22°C and the relative humidity of 52%RH to the temperature of 22°C and the relative humidity of 90%RH. The relative humidity of 52%RH is an average humidity at Tokyo in February (from 1961 to 1990), and the relative humidity of 90%RH supposes a situation in which the human body is sweated during the physical exercise. As a model experiment, it is represented by an amount of energy necessary for maintaining a hot plate at 32°C which is equivalent to a skin temperature when the clothing is being worn.

[0019] The hydrophobic synthetic fibers used for the inventive spun yarn have a fiber fineness in a range from 0.1 to 1.6 dtex, preferably from 0.5 to 1.3 dtex, more preferably from 0.5 to 1.1 dtex. If the fiber fineness is within such a range, a diameter of interfiber space becomes sufficiently small to reduce the air-permeability, whereby it is difficult to move air to increase the dead air which improves the ability for avoiding the escaping of heat from the human body as well as maintaining the hygroscopically heat-generating effect of the hygroscopically heat-generating fibers for a long time. To improve the total warmth-retaining performance by increasing the dead air, the fiber fineness is preferably smaller. If the fiber fineness exceeds 1.6 dtex, the diameter of the interfiber space becomes larger to worsen the total warmth-retaining performance. Also, the skin is irritated during the use to result in uncomfortable touch. Contrarily, if the fiber fineness is smaller than 0.1 dtex, the bending rigidity of the fiber becomes low to reduce the substantial interfiber space due to the addition of the wearing pressure of clothing, whereby the total warmth-retaining performance is worsened.

[0020] To further enhance the total warmth-retaining performance, the hydrophobic synthetic fibers used for the present invention preferably contain texturized fibers of 50% by weight or more of a total amount the hydrophobic synthetic fibers. The texturized hydrophobic synthetic fibers includes those preliminarily treated with heat and/or tension prior to being spun into a spun yarn and then shrinks in the yarn by the application of heat to be bulky.

[0021] The hydrophobic synthetic fibers used for the inventive spun yarn include, for example, polyester fibers, polyamide fibers, polyvinyl alcohol fibers, polyolefin fibers, polyacrylic fibers, fluoroolefine fibers or others. Of them, the polyacrylic fibers having a large shrinkage and excellent in bulkiness are preferably used for the purpose of facilitating the total warmth-retaining property. While these fibers may be either in a staple form or in a filament form, the staple form capable of increasing the interfiber space is more preferable. Further, antistatic fibers added to the hydrophobic synthetic fibers with electro-conductive material are preferably used for improving the antistatic property.

[0022] The hygroscopically heat-generating fibers used for the inventive spun yarn has 15 J/g or more of an amount of hygroscopically generated heat when the environment is changed from the temperature of 20°C and the relative humidity of 40%RH to the temperature of 20°C and the relative humidity of 90%RH. Such fibers generate heat in the fiber product using the spun yarn containing the same by adsorbing gaseous or liquid sweat perspirating from a skin surface of the wearer due to insensible perspiration.

[0023] The hygroscopically heat-generating fibers used for the inventive spun yarn are regenerated cellulose fibers (polynosic rayon, viscose rayon, cuprammonium rayon, Lyocell or others).

[0024] The regenerated cellulose fibers are preferable in comparison with other fibers imparted with a hygroscopically heat-generating property by chemical modification as the function permanently continues. Also, as they have a high response, in hygroscopic heat generation, in comparison with wool or others, they are particularly favorable as hygroscopically heat-generating fibers used for the present invention.

[0025] As the hygroscopically heat-generating fibers used for the inventive spun yarn are small in fiber fineness and thus have a large surface area, a quick response of hygroscopic heat generation is obtainable and, practically, the amount of heat generated by the hygroscopic heat generation becomes large and the temperature resulting therefrom is high. That is, the ability of the hygroscopically heat-generating fibers is sufficiently exhibited. The fiber fineness is within a range from 0.6 to 2.2 dtex, more preferably from 0.8 to 1.6 dtex. When the fiber fineness is within the above-mentioned range, the skin touch is comfortable and the response of the hygroscopic heat generation, as well as the production efficiency, become high. Contrarily, when the fiber fineness exceeds 2.2 dtex, not only the response of the

hygroscopic heat generation is lowered but also the skin is irritated when it touches the fibers to result in uncomfortable feeling. The hygroscopically heat-generating fibers may be in a filament form or a staple form. If antistatic fibers, produced by adding to the hygroscopic heat-generating fibers an electro-conductive material, are used the antistatic property is favorably improved.

[0026] The inventive spun yarn contains 10% by weight or more of hydrophobic synthetic fibers having the fiber fineness in a range from 0.1 to 1.6 dtex. If the content is 10% by weight or more, it is sufficient for inhibiting the escaping of heat out of the human body. The content of the hydrophobic synthetic fibers having the fiber fineness in a range from 0.1 to 1.6 dtex is preferably 30% by weight or more, more preferably 40% by weight or more. In view of the balance between the insurance of the amount of hygroscopically generated heat and the prevention of the heat escaping, the content of the hydrophobic synthetic fibers is 10 % to 80% by weight, more preferably 10 % to 70 % by weight, further more preferably 10 % to 60 % by weight.

[0027] To obtain a sufficient amount of generated heat, the content of the hygroscopically heat-generating fibers is in a range from 20 to 90% by weight. A favorable content of the hygroscopically heat-generating fibers varies in accordance with kinds of fibers. For example, when regenerated cellulose fibers (having the amount of hygroscopically generated heat of 16 J/g) are used as the hygroscopically heat-generating fibers in the present invention, the content thereof in the spun yarn is preferably in a range from 30 to 60% by weight, more preferably from 40 to 50% by weight. Alternatively, when regenerated cellulose fibers treated with methacrylic acid (having the amount of hygroscopically generated heat of 32 J/g) are used, the content thereof in the spun yarn is preferably in a range from 20 to 60% by weight.

[0028] To obtain an excellent total warmth-retaining performance, it is important that the fibers are collected to form a spun yarn. By forming the spun yarn, numerous spaces are generated between the respective fibers constituting the spun yarn, whereby characteristic properties of the hydrophobic synthetic fibers and the hygroscopic heat-generating fibers are combined together to further facilitate the total warmth-retaining performance of the fiber product using the inventive spun yarn.

[0029] According to the inventive spun yarn, fibers other than the above-mentioned hydrophobic synthetic fibers and the hygroscopic heat-generating fibers may be used in an amount of less than 50% by weight. The kinds of the other fibers are not limitative but various fibers usable in fiber products or the like may be optionally adopted.

[0030] The amount of hygroscopically generated heat from the inventive spun yarn is preferably 4.8 J/g or more, and the clothing using the inventive spun yarn exhibits such an excellent total warmth-retaining performance as 8.1 $W/m^2 \cdot °C$ or less.

[0031] In the present invention, as the hydrophobic synthetic fibers and the hygroscopically heat-generating fibers, both having a small fiber fineness, are mixedly spun, there is a problem, for practical use, in that many yarn defects such as neps are liable to be generated in the resultant spun yarn, because of the worse fiber-opening, if the conventional mixing method is employed. The present inventors have solved such a problem by finding suitable spinning conditions for avoiding the generation of yarn defects such as neps, whereby the inventive spun yarn has been obtained.

[0032] The suitable spinning conditions in the present invention will be described below.

(1) Humidity control in carding process:

[0033] The humidity is preferably in a range from 60 to 70%RH. In the spinning process of hydrophobic fibers, a high humidity condition of 75%RH or higher is favorable for the purpose of avoiding the generation of static electricity. On the other hand, in the spinning process of hygroscopically heat-generating fibers, a low humidity condition of 50%RH or lower is preferable for the purpose of improving the fiber opening. Surprisingly, in the inventive spun yarn, the present inventors have found that the humidity is optimally controlled in a narrow range of 65±5%RH. If it exceeds 70%RH, fibers fall down into spaces between carding needles to result in yarn defects caused by a worse fiber-opening. Contrarily, if the humidity is lower than 60%RH, the static electricity is liable to be generated.

(2) Delivery control of carded sliver:

[0034] While a delivery rate of a carded sliver is generally 5 g/m in the conventional spinning process for the hydrophobic synthetic fibers, it is preferably in a range from 3.0 to 4.0 g/m according to the present invention.

(3) Drawing process:

[0035] A double drawing such as a three-step drawing is preferable.

(4) Fine spinning process:

[0036] A load (in a range from approximately 157 to 167 N/2sp) larger than in the conventional cotton spinning process

(in a range from approximately 118 to 147 N/2sp) is preferably applied between a pair of front rollers while observing the delivery conditions.

[0037] The number of yarn defects in the spun yarn is measured by the following method.

[0038] A length and a thickness of a nep portion are measured by using Classimat II (made by Zellweger Uster Co. Ltd.). The length is classified into 4 levels (A to D) and the thickness is classified into 4 levels (1 to 4) so that total 16 quality levels are defined by the combination of the length and the thickness. Of them, 10 quality levels are defined as the yarn defects (A4, B3, B4, C2, C3, C4, D1, D2, D3 and D4). The number of yarn defects is preferably 30 points/100,000 m or less, more preferably 15 points/100,000 m or less, further more preferably 10 points/100,000 m or less, most preferably 5 points/100,000 m or less.

[0039] While the inventive spun yarn is a composite of special hydrophobic synthetic fibers and hygroscopically heat-generating fibers, the composite form thereof is not restricted but includes a mixed spun yarn in which different kinds of staple fibers are mixed together on a so-called carding stage, a sheath/core yarn formed of staple fibers and filament fibers, and/or a so-called silofil yarn in which filament fibers are wound around a bundle of staple fibers. A twist multiplier is preferably at a lower level as an interfiber space increases to enhance the total warmth-retaining performance. Also, the spun yarn may be a single yarn, a double yarn, a three-plied yarn or others. The spun yarn may be post-twisted.

[0040] The inventive spun yarn may be used for manufacturing woven/knitted fabrics or fiber products. For example, it is used for forming clothings, blankets, scarves, mufflers, hats, gloves, socks, kneeling cushions or others which are excellent in warmth-retaining property. The inventive spun yarn may be used as part of a fabric or a sewn product.

BEST MODE FOR CARRYING OUT THE INVENTION

[0041] The present invention will be described furthermore based on the preferred embodiments, but should not be limited thereto.

[0042] In this regard, the measurements and/or estimations are as follows:

(1) Amount of hygroscopically generated heat of fibers and spun yarn.

[0043] A test piece is dried at 90°C in a dryer for three hours. A weight of the dried test piece is W_0 (g).

[0044] Then, the sufficiently dried test piece is placed in a test piece room into which is introduced nitrogen gas (20°C, 0%RH) by using a differential scanning calorimeter (DSC) to equilibrate the test piece. Thereafter, nitrogen gas (20°C, relative humidity A%RH wherein A is larger than 10) is introduced into the test piece room. Under the circumstance, a total amount of heat Q (J) is measured, which is generated from the beginning of the heat generation until the thermal equilibrium has been attained.

(a) A moisture content H_A (%) in the test piece at 20°C and A%RH is determined by the following formula:

$$H_A\ (\%) = \{(W_A - W_0)/W_0\} \times 100$$

wherein W_A (g) represents a weight of the test piece which is dried for three hours at 90°C and then placed in an air-conditioned vessel maintained at 20°C and A%RH for 24 hours or longer.

(b) A moisture content H_{40} (%) in the test piece at 20°C and 40%RH is determined by the following formula:

$$H_{40}\ (\%) = \{(W_{40} - W_0)/W_0\} \times 100$$

wherein W_{40} (g) represents a weight of the test piece which is dried for three hours at 90°C and then placed in an air-conditioned vessel maintained at 20°C and 40%RH for 24 hours or longer.

(c) A moisture content H_{90} (%) in the test piece at 20°C and 90%RH is determined by the following formula:

$$H_{90}\ (\%) = \{(W_{90} - W_0)/W_0\} \times 100$$

wherein W_{90} (g) represents a weight of the test piece which is dried for three hours at 90°C and then placed in an air-conditioned vessel maintained at 20°C and 90%RH for 24 hours or longer.

[0045] From the above measurements, the amount of hygroscopically generated heat is determined by the following

formula:

$$\text{Amount of hygroscopically generated heat (J/g)} = Q \times (H_{90} - H_{40}) / (W_0 \times H_A)$$

(2) Total warmth-retaining performance

[0046] A test piece is prepared as follows:

[0047] A circular rib fabric is knitted from a spun yarn by using a circular knitting machine (20G, 21 inch diameter: manufactured by Fukuhara Seiki (K.K.)), then boiled in a wince dyeing machine at 97°C for 30 minutes while adding surfactant (Scourol (registered trade mark: manufactured by Kao (K.K.)) of 2g/l, and thereafter sufficiently rinsed with water. The resultant fabric is dehydrated for 1 minute by a centrifugal dehydrator. After wrinkles are manually smoothed out, the fabric is cut to a size capable of being treated by a drier, and dried therein at 60°C in a flat state. The resultant knitted fabric is cut into pieces of 15 cm square.

[0048] The test pieces are placed one night and day in an environmental test room conditioned to 22°C and 52%RH, after which the total warmth-retaining performance is measured as described bellow.

[0049] The test piece is accommodated in an air conditioning equipment maintained at 22°C and 52%RH and placed on a hot plate (Thermo Labo II (registered trade mark: manufactured by Katoh Tech (K.K.))) maintained at a constant temperature of 32°C for 15 minutes, during which the test piece is being exposed to a rectified air stream flowing from above at 15 cm/sec and discharged in one direction. Subsequently, the environment in the air-conditioning equipment is changed to 22°C and 90%RH in 15 minutes, and the test piece is held stationary in this state for 15 minutes.

[0050] Electric power necessary for maintaining the hot plate on which the test piece is placed at 32°C is measured for 30 minutes from the beginning of the change of the temperature. The total warmth-retaining performance is represented by an average value per one minute. A unit thereof is $W/m^2 \cdot °C$. The smaller this value is, the better the warmth-retaining performance becomes.

(Example 1)

[0051] A spun yarn of 1/64 Nm was obtained by using, as hydrophobic synthetic fibers, anti-pilling type acrylic fibers (Cashmilon (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.0 dtex and a fiber length of 51 mm, and as hygroscopically heat-generating fibers, cuprammonium rayon fibers (Bemberg (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.4 dtex, a fiber length of 51 mm and an amount of hygroscopically generated heat of 16 J/g, which were mixed together at a ratio of 60% by weight of the former and 40% by weight of the latter under the following conditions. The resultant spun yarn had the amount of hygroscopically generated heat of 7.2 J/g.

(Spinning conditions)

[0052] The atmosphere in the carding room was controlled at 25°C and 65%RH, and a unit weight of delivered sliver was controlled to be 3.5 g/m by decreasing a supply rate of cotton to a carding engine and the rotational speed thereof in comparison with the conventional cotton spinning process. In the drawing process, a plurality of auto-levelers were used so that a three-step drawing is carried out while avoiding the mixture of neps into the roving process as much as possible. In the fine spinning process, a load applied to a pair of front rollers was approximately 157 to 167 N/2sp.

(Example 2)

[0053] A spun yarn of 1/64 Nm was obtained by using, as hydrophobic synthetic fibers, acrylic fibers (Cashmilon (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.0 dtex and a fiber length of 51 mm and textured acrylic fibers (Cashmilon (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 0.9 dtex and a fiber length of 51 mm, and as hygroscopically heat-generating fibers, cuprammonium rayon fibers (Bemberg (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.4 dtex, a fiber length of 51 mm and an amount of hygroscopically generated heat of 16 J/g, which were mixed together at a ratio of 25% by weight of the former, 35% by weight of the second and 40% by weight of the latter in the same manner as in Example 1. The resultant spun yarn had the amount of hygroscopically generated heat of 7.2 J/g.

(Example 3)

[0054] A spun yarn of 1/64 Nm was obtained by using, as hydrophobic synthetic fibers, anti-pilling type acrylic fibers (Cashmilon (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.0 dtex and a fiber length of 51 mm, and as hygroscopically heat-generating fibers, cuprammonium rayon (Bemberg (registered trade mark): manufactured by Asahi Kasei (K.K.)) of 56 dtex/30 filaments having an amount of hygroscopically generated heat of 16 J/g, which were mixed together at a ratio of 71% by weight of the former and 29% by weight of the latter by a silofil method. At this time, the carding and drawing processes were carried out in the same manner as in Example 1. The resultant spun yarn had the amount of hygroscopically generated heat of 5.6 J/g.

(Example 4)

[0055] A spun yarn of 1/64 Nm was obtained by using, as hydrophobic synthetic fibers, anti-pilling type acrylic fibers (Cashmilon (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.0 dtex and a fiber length of 51 mm, and as hygroscopically heat-generating fibers, staple fibers obtained by treating cuprammonium rayon fibers (Bemberg (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.7 dtex and a fiber length of 51 mm with methacrylic acid so that an amount of hygroscopically generated heat is 32 j/g, which were mixed together at a ratio of 80% by weight of the former and 20% by weight of the latter in the same manner as in Example 1. The resultant spun yarn had the amount of hygroscopically generated heat of 7.5 J/g.

(Example 5)

[0056] A spun yarn of 1/64 Nm was obtained by using, as hydrophobic synthetic fibers, anti-pilling type acrylic fibers (Cashmilon (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.5 dtex and a fiber length of 51 mm, and, as hygroscopically heat-generating fibers, cuprammonium rayon fibers (Bemberg (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.4 dtex, a fiber length of 51 mm and an amount of hygroscopically generated heat of 16 J/g, which were mixed together at a ratio of 60% by weight of the former and 40% by weight of the latter in the same manner as in Example 1. The resultant spun yarn had the amount of hygroscopically generated heat of 7.2 J/g.

(Example 6)

[0057] A spun yarn of 1/64 Nm was obtained by using, as hydrophobic synthetic fibers, polyester fibers of W-shaped cross-section (Technofine (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.4 dtex and a fiber length of 38 mm, and, as hygroscopically heat-generating fibers, cuprammonium rayon fibers (Bemberg (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.4 dtex, a fiber length of 38 mm and an amount of hygroscopically generated heat of 16 J/g, which were mixed together at a ratio of 60% by weight of the former and 40% by weight of the latter in the same manner as in Example 1. The resultant spun yarn had the amount of hygroscopically generated heat of 6.8 J/g.

(Example 7)

[0058] A spun yarn of 1/64 Nm was obtained by using, as hydrophobic synthetic fibers, anti-pilling type acrylic fibers (Cashmilon (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.0 dtex and a fiber length of 51 mm and, as hygroscopically heat-generating fibers, viscose rayon fibers having a fiber fineness of 2.0 dtex, a fiber length of 51 mm and an amount of hygroscopically generated heat of 16 J/g, which were mixed together at a ratio of 60% by weight of the former and 40% by weight of the latter in the same manner as in Example 1. The resultant spun yarn had the amount of hygroscopically generated heat of 7.1 J/g.

(Comparative example 1)

[0059] A spun yarn of 1/64 Nm was obtained by using, as hydrophobic synthetic fibers, acrylic fibers (Cashmilon (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.7 dtex and a fiber length of 51 mm, and, as hygroscopically heat-generating fibers, cuprammonium rayon fibers (Bemberg (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.4 dtex, a fiber length of 51 mm and an amount of hygroscopically generated heat of 16 J/g, which were mixed together at a ratio of 60% by weight of the former and 40% by weight of the latter in the same manner as in Example 1. The resultant spun yarn had the amount of hygroscopically generated heat of 7.2 J/g.

(Comparative example 2)

[0060] A spun yarn of 40/- in cotton yarn count was obtained by spinning cuprammonium rayon fibers (Bemberg (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.4 dtex, a fiber length of 51 mm and an amount of hygroscopically generated heat of 16 J/g in the same manner as in Example 1.

(Comparative example 3)

[0061] A spun yarn of 40/- in cotton yarn count was obtained by spinning staple fibers modified by treating cuprammonium rayon fibers (Bemberg (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.7 dtex and a fiber length of 51 mm with methacrylic acid so that an amount of hygroscopically generated heat is 32.0 J/g in the same manner as in Example 1.

(Comparative example 4)

[0062] A spun yarn of 1/64 Nm was obtained by spinning anti-pilling acrylic fibers (Cashmilon (registered trade mark): manufactured by Asahi Kasei (K.K.)) having a fiber fineness of 1.0 dtex, a fiber length of 51 mm and an amount of hygroscopically generated heat of 1.4 J/g in the same manner as in Example 1.

[0063] The structures of the spun yarns in Examples 1 to 7 and Comparative examples 1 to 4, the numbers of yarn defects such as neps and the total warmth-retaining performances are shown in Table 1.

Table 1

	Hydrophobic synthetic fibers				Hygroscopically heat-generating fibers				Spun yarn			Total warmth-retaining performance ($W/m^{2\cdot}°C$)
	Material	Fiber fineness (dtex)	Fiber length (mm)	Mixing ratio (wt%)	Material	Fiber fineness (dtex)	Fiber length (mm)	Mixing ratio (wt%)	Yarn count	Composite form	Number of yarn defects ($p/10^5m$)	
Ex.1	acrylic	1.0	51	60	cupra	1.4	51	40	1/64Nm	mix-spinning	3	7.4
Ex.2	acrylic bulky acryl	1.0 0.9	51	25 35	cupra	1.4	51	40	1/64Nm	mix-spinning	2	7.2
Ex.3	acrylic	1.0	51	71	cupra	1.9	filament	29	1/64Nm	silofil	2	7.9
Ex.4	acrylic	1.0	51	80	MA cellulose	1.7	51	20	1/64Nm	mix-spinning	3	7.6
Ex.5	acrylic	1.5	51	60	cupra	1.4	51	40	1/64Nm	mix-spinning	2	8.0
Ex.6	ester	1.4	38	60	cupra	1.4	38	40	1/64Nm	mix-spinning	4	8.1
Ex.7	acrylic	1.0	51	60	viscose	2.0	51	40	1/64Nm	mix-spinning	4	7.7
Com. Ex. 1	acrylic	1.7	51	60	cupra	1.4	51	40	1/64Nm	mix-spinning	2	8.4
Com. Ex. 2	-	-	-	-	cupra	1.4	51	100	40/-	-	16	10.2
Com. Ex. 3	-	-	-	-	MA cellulose	1.7	51	100	40/-	-	20	10.0
Com. Ex. 4	acrylic	1.0	51	100	-	-	-	-	1/64Nm	-	16	9.3
Note: cupra is cuprammonium rayon fibers, and MA cellulose is cellulose fibers treated with methacrylic acid.												

[0064] As apparent from Table 1, while the knitted fabrics in Examples 1 to 7 have the total warmth-retaining performance in a range from 7.2 to 8.1 W/m^2·°C, those in Comparative examples 1 to 4 have the total warmth-retaining performance in a range from 8.4 to 10.2 W/m^2·°C. Therefrom, it is found that the knitted fabric using the inventive yarn is excellent in the warmth-retaining performance (a function for maintaining body temperature).

[0065] As the difference in warmth-retaining performance is apparently sensed by the wearer if there is a difference of approximately 0.2 W/m^2·°C or more, the clothing using the spun yarns of Examples 1 to 7 actually imparts a warmer feeling to the wearer than that using the spun yarns of Comparative examples 1 to 4.

CAPABILITY OF EXPLOITATION IN INDUSTRY

[0066] The inventive spun yarn is excellent both in hygroscopically heat-generating performance and a property for avoiding the escape of heat from the human body (that is, the total warmth-retaining performance), whereby it is a clothing material suitable for maintaining warmth for a long time.

Claims

1. A spun yarn comprising

(1) 10 to 80 % by weight of hydrophobic synthetic fibers having a fiber fineness in a range from 0.1 to 1.6 dtex, and
(2) 20 to 90 % by weight of hygroscopically heat-generating regenerated cellulose fibers having an amount of hygroscopically generated heat of 15 J/g or more when the environment changes from 20 °C and 40 % RH to 20 °C and 90 % RH and having a fiber fineness of 0.6 to 2.2 dtex.

2. A spun yarn as defined by claim 1, wherein the number of yarn defects is 30 points/100,000 m or less.

3. A spun yarn as defined by claim 1 or 2, wherein said hydrophobic synthetic fibers are polyacrylic fibers.

4. A woven/knitted fabric using said spun yarn as defined by any one of claims 1 to 3.

5. A fiber product using said spun yarn as defined by any one of claims 1 to 3.

Patentansprüche

1. Garn umfassend

(1) 10 bis 80 Gew.-% hydrophobe synthetische Fasern mit einer Faserfeinheit im Bereich von 0,1 bis 1.6 dtex und
(2) 20 bis 90 Gew.-% hygroskopisch wärmeerzeugende regenerierte Cellulosefasern mit einer hygroskopisch erzeugten Wärmemenge von 15 J/g oder mehr bei Änderung der Umgebung von 20° C und 40 % relativer Feuchte (RH) auf 20° C und 90 % relativer Feuchte (RH) und mit einer Faserfeinheit von 0,6 bis 2,2 dtex.

2. Garn nach Anspruch 1, wobei die Zahl von Garnfehlern 30 Punkte/100 000 m oder weniger ist.

3. Garn nach Anspruch 1 oder 2, wobei die hydrophoben synthetischen Fasern Polyacrylfasern sind.

4. Web-/Wirkware unter Verwendung eines in einem der Ansprüche 1 bis 3 angegebenen Garns.

5. Faserprodukt unter Verwendung des Garns wie in einem der Ansprüche 1 bis 3 angegeben.

Revendications

1. Filé comprenant :

(1) de 10 à 80 % en poids de fibres synthétiques hydrophobes ayant une finesse de fibre dans une plage allant de 0,1 à 1,6 dtex, et
(2) de 20 à 90 % en poids de fibres de cellulose régénérée, produisant de la chaleur hygroscopiquement, ayant

une quantité de chaleur produite hygroscopiquement supérieure ou égale à 15 J/g lorsque l'atmosphère ambiante passe de 20°C et de 40 % d'humidité relative à 20°C et à 90 % d'humidité relative et ayant une finesse de fibre de 0,6 à 2,2 dtex.

2. Filé tel que défini à la revendication 1, dans lequel le nombre de défauts de filé est inférieur ou égal à 30 points/100 000m.

3. Filé tel que défini à la revendication 1 ou 2, dans lequel les fibres synthétiques hydrophobes sont des fibres polyacryliques.

4. Etoffe tissée/tricotée utilisant le filé tel que défini à l'une quelconque des revendications 1 à 3.

5. Produit en fibres utilisant le filé tel que défini à l'une quelconque des revendications 1 à 3.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP H759762 B **[0004]**
- JP 2898623 B **[0004]**
- JP 2002294564 A **[0011]**
- JP 9031796 A **[0012]**