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(54) **Title:** YARN SUITABLE FOR KNITTING FABRICS

(57) **Abstract:** The present disclosure relates to a yarn comprising a blend of polyester fibre (A) having shrinkage capacity in the range of 20 to 22 % and a polyester fibre (B) having shrinkage capacity in the range of 2 to 3 %, the shrinkage capacities being measured at a temperature of 130 °C for a time period ranging from 30 minutes to 35 minutes. The shrinkage capacity of the yarn of the present disclosure ranges from 15 to 18 % and the ratio of A to B ranges from 1:2 to 2:1.



YARN SUITABLE FOR KNITTING FABRICS**FIELD:**

The present disclosure relates to a yarn suitable for knitting fabrics.

DEFINITION:

As used in the present disclosure, the following words and phrases are generally intended to have the meaning as set forth below, except to the extent that the context in which they are used indicate otherwise.

The expression “high shrinkage” or “high shrinkable” for the purpose of the present disclosure includes a polymer having a shrinkage capacity of at least 20 %.

The expression “low shrinkage” or “low shrinkable” for the purpose of the present disclosure includes a polymer having a shrinkage capacity below 20 %.

BACKGROUND:

Bulky yarns are used in knitting to produce garments like sweaters, cardigans and the like. The desired thermal insulation or warmth in the knitted garments can only be achieved by using bulky yarns. The fibres of the yarn, the yarn thickness and the level of yarn twist are critical in achieving the desired thermal insulation. Traditionally, such garments were made of wool which was eventually replaced by acrylic fibres for economic reasons. However, the cost of the acrylic fibres has increased with increase in demand of acrylic fibres, thereby, nullifying the cost benefit of replacing wool fibre with the acrylic fibre. Therefore, there is a need for an economical viable substitute for acrylic fibres. Several polyester fibres have been suggested to replace acrylic fibres.

EP1860217 suggests a fabric prepared from two types of yarns namely a) natural or synthetic fibre, and b) polyetherester fibre made from polyetherester elastomer, which is different in self-elongating property upon absorbing water and capable of facilitating air-permeability when wetted with water. The ratio of the first type of yarn to the second type of yarn is adjusted to 0.9 or less.

JP2000220055 suggests a woven knitted fabric consisting 3-50 wt% fused fiber such as a sheath-core fiber having low melting co-polyester and greater than 30 wt% highly shrinkable polyester staple fibers having 18-80% dry-heat shrinkage factor.

JP2002294534 suggests a bulky woven/knitted fabric consisting of a blend of high-shrinkage staple fibers having shrinkage factor greater than 40% and cellulosic staple fibers.

Some of the fibres suggested for making knitted fabrics contain acrylic acid at least partially, while others require the fibres to be specially treated due to which the suggested fabrics are still costly. Further, the yarn/fabric is either too bulky or cannot provide the desired level of warmth.

Therefore, there is a felt need for an economic substitute for the use of acrylic acid or special raw material which is capable of providing optimum bulk which in turn is capable of providing maximum warmth.

Accordingly, the present invention provides a yarn made from polyester fibre which is economical, possesses a desired shrinkage factor and is capable of providing a desired warmth.

OBJECTS:

Some of the objects of the present disclosure, which at least one embodiment herein satisfies, are as follows:

An object of the present disclosure is to provide a yarn made from polyester fibres which can be knitted into fabric.

Another object of the present disclosure is to provide a yarn which can be easily processed to achieve a desired dye depth.

Still another object of the present disclosure is to provide a yarn which can be used to at least partially substitute acrylic fibres or wool fibres.

Yet another object of the present disclosure is to provide a process for preparing a yarn having shrinkage capacity suitable for knitting fabrics.

Other objects of the present invention will be more apparent to a person skilled in the art from the description provided hereinafter.

SUMMARY:

The present disclosure provides a yarn having acceptable levels of shrinkage capacity, suitable for knittable applications. The yarn is prepared from two types of polyester fibres (A and B) different in shrinkage factor/capacity, blended in the ratio of 1:2 to 2:1.

DETAILED DESCRIPTION:

The present disclosure provides a yarn for knitting fabrics. The yarn comprises a blend of two types of polyester fibres (A and B) of different shrinkage factors/capacities. The polyester fibre A possesses the shrinkage capacity in the range of 20 to 22 % when measured at a temperature of 130 °C for a time period ranging from 30 minutes to 35 minutes, whereas the shrinkage capacity of the polyester fibre B ranges from 2 to 3 % at a temperature of 130 °C for a time period ranging from 30 minutes to 35 minutes.

The ratio of the polyester fibres A and B can be varied to obtain a yarn having shrinkage capacity/factor ranging from 15 to 18 %. Accordingly, the ratio of polyester fibres A and B may be varied in the range of 1:2 to 2:1. Particularly, the ratio of the polyester fibre A to polyester fibre B is maintained at 1:1 for machine knitting, whereas for hand knitting the ratio of the polyester fibre A to polyester fibre B ranges from 1:2.5 to 1:1. Further, the yarn twist multiplier of 2.5 to 2.7 and 5 to 65 % turns per inch (tpi) for the single yarn obtained from the yarn of the present disclosure result in the desired bulk after dyeing.

The shrinkage capacity/factor of the yarn is the synergistic result of the ratio of the polyester fibres A and B, the yarn twist capacity and thickness of the respective fibres.

The yarn of the present disclosure is obtained by a selection of proper single and plied yarn twist levels based on experimental data, followed by selection of suitable yarn bulking and dyeing hardware and process conditions. The advantage of obtaining yarn by the aforesaid process/strategy is that it does not require any alteration or addition of downstream processing hardware.

The polyester fibre having shrinkage capacity in the range of 20 to 22 % is characterized by denier size in the range from 1.2 to 4, whereas the polyester fibre having shrinkage capacity in the range of 2 to 3% is characterized by denier size in the range from 1.5 to 4.

The polyester fibres useful for the purpose of the present disclosure are made from at least one polymer selected from the group consisting of polyethylene terephthalate, polybutylene terephthalate and polyethylene naphthalate. In an exemplary embodiment, the polyester fibre is polyethylene terephthalate.

The present disclosure is further illustrated herein below with the help of the following experiments. The experiments used herein are intended merely to facilitate an understanding of ways in which the embodiments herein may be practiced and to further enable those of skill in the art to practice the embodiments herein. Accordingly, the examples should not be construed as limiting the scope of embodiments herein. These laboratory scale experiments can be scaled up to an industrial/commercial scale.

Examples:**Standard test for determining the shrinkage percentage:**

For Fiber: Pre-tensioned fiber length is measured and the sample is subjected to a temperature of 130 °C for 30 minutes. Thereafter, the fiber length is measured under tension. The shrinkage percentage of fiber is calculated after determining the difference in length over the original length of the fiber.

Example 1: Preparation of yarn

PET fiber having shrinkage 20% and thickness 3 denier and PET fiber having shrinkage 3% and thickness 3 denier was blended in the proportion of 1:2 to obtain a yarn. Yarn twisting per inch was 2.6. In the next step, bulking and dyeing of the yarn in hank form was carried out in a high temperature, high pressure cabinet dyeing machine at dyeing temperature of 130 °C and holding time of 30 mins. The final yarn obtained after this step possesses shrinkage capacity of 17%.

Example 2: Preparation of yarn

PET fiber having shrinkage 21% and thickness 3 denier and PET fiber having shrinkage 3% and thickness 3 denier was blended in the proportion of 7:4 to obtain yarn for hand knitting. Yarn twisting per inch was 2.7. In the next step, bulking and dyeing of the yarn in hank form was carried out in a high temperature, high pressure cabinet dyeing machine at dyeing temperature of 130 °C and holding time of 30 mins. The final yarn obtained after this step possesses shrinkage capacity of 18%.

TECHNICAL ADVANCES AND ECONOMICAL SIGNIFICANCE

The present disclosure described herein above has several technical advantages including, but not limited to, the realization of:

- bulking and dyeing of fibre are done simultaneously;
- low processing cost; and
- yarn suitable for cold weather knitted garments.

The yarn prepared by the process of the present disclosure does not require any further downstream processing hardware.

Throughout this specification the word “comprise”, or variations such as “comprises” or “comprising”, will be understood to imply the inclusion of a stated element, integer or step, or group of elements, integers or steps, but not the exclusion of any other element, integer or step, or group of elements, integers or steps.

The use of the expression “at least” or “at least one” suggests the use of one or more elements or ingredients or quantities, as the use may be in the embodiment of the disclosure to achieve one or more of the desired objects or results.

Any discussion of documents, acts, materials, devices, articles or the like that has been included in this specification is solely for the purpose of providing a context for the disclosure. It is not to be taken as an admission that any or all of these matters form a part of the prior art base or were common general knowledge in the field relevant to the disclosure as it existed anywhere before the priority date of this application.

The numerical values mentioned for the various physical parameters, dimensions or quantities are only approximations and it is envisaged that the values higher/lower than the numerical values assigned to the parameters, dimensions or quantities fall within the scope of the disclosure, unless there is a statement in the specification specific to the contrary.

While considerable emphasis has been placed herein on the particular features of this disclosure, it will be appreciated that various modifications can be made, and that many changes can be made in the preferred embodiments without departing from the principles of the disclosure. These and other modifications in the nature of the disclosure or the preferred embodiments will be apparent to those skilled in the art from the disclosure herein, whereby it is to be distinctly understood that the foregoing descriptive matter is to be interpreted merely as illustrative of the disclosure and not as a limitation.

The foregoing description of the specific embodiments will so fully reveal the general nature of the embodiments herein that others can, by applying current knowledge, readily modify and/or adapt for various applications such specific embodiments without departing from the generic concept, and, therefore, such adaptations and modifications should and are intended to be comprehended within the meaning and range of equivalents of the disclosed embodiments. It is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation. Therefore, while the embodiments herein have been described in terms

of preferred embodiments, those skilled in the art will recognize that the embodiments herein can be practiced with modification within the spirit and scope of the embodiments as described herein.

CLAIMS:

1. A yarn comprising a blend of a polyester fibre (A) having shrinkage capacity in the range of 20 % to 22 % at a temperature of 130 °C for a time period ranging from 30 minutes to 35 minutes and a polyester fibre (B) having shrinkage capacity in the range of 2 % to 3 % at a temperature of 130 °C for a time period ranging from 30 minutes to 35 minutes;

wherein, the shrinkage capacity of the yarn ranges from 15 to 18 %; and
the ratio of A:B ranges from 1:2 to 2:1.

2. The yarn as claimed in claim 1, wherein the polyester fibres A and B are made from at least one polymer selected from the group consisting of polyethylene terephthalate, polybutylene terephthalate and polyethylene naphthalate.
3. The yarn as claimed in claim 1, wherein the polyester fibre having shrinkage capacity in the range of 20 % to 22 % is characterized by denier size in the range from 1.2 to 4.
4. The yarn as claimed in claim 1, wherein the polyester fibre having shrinkage capacity in the range of 2 % to 3 % is characterized by denier size in the range from 1.5 to 4.
5. The yarn as claimed in claim 1, wherein the twisting capacity of the yarn ranges from 2.5 to 2.7 and the turns range from 5 to 65 % turns per inch (tpi).
6. The yarn as claimed in claim 1, wherein the ratio of A:B is 1:1, said yarn is machine knittable.

7. The yarn as claimed in claim 1, wherein the ratio of A:B ranges from 1:2.5 to 1:1, said yarn is hand knittable.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IB2015/055612

A. CLASSIFICATION OF SUBJECT MATTER
D02G1/18, D01F6/62 Version=2015.01

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)

D02G, D01F

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

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

IPO Internal Database, PATSEER

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP0207489 A2 (SHIMAZU Takumi et al.) January 7, 1987. Whole document	1-7

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

* Special categories of cited documents:	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
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Information on patent family members

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Citation	Pub.Date	Family	Pub.Date
EP 0207489 A2	07-01-1987	EP 0207489 A3	13-01-1988