Evaluation of physical and mechanical properties of cotton covered polypropylene-core yarns and fabrics

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REZUMAT – ABSTRACT – INHALTSANGABE

Evaluarea proprietăților fizice și mecanice ale firelor cu miez polipropilenic și înveliș din bumbac și ale materialelor realizate din acestea

În lucrare sunt analizați parametrii fizico-mecanici ai firelor filate cu miez din polipropilenă și înveliș din bumbac și ai materialelor realizate din aceste fire. Țesăturile au fost realizate pe mașini convenționale de filat cu inele, ușor modificate, din fire filate cu miez și fire din 100% bumbac, având același factor de torsiune și aceeași finețe – în bătătură, și fire de bumbac – în urzeală. De asemenea, au fost măsurate permeabilitatea la aer, revenirea din șifonare, proprietățile de tracțiune, rigiditatea la încovoiere, capilaritatea, precum și transferul termic și cel de umiditate ale materialelor. S-a observat că, prin utilizarea filamentului polipropilenic ca miez, proprietățile fizice și mecanice ale firelor filate cu miez și, respectiv, ale materialelor au fost optimizate, în comparație cu materialele realizate din fire din 100% bumbac. Transferul termic și cel de umiditate ale materialelor au fost mai mici la materialele realizate din fire filate cu miez.

Cuvinte-cheie: polipropilenă, fir filat cu miez, proprietăți mecanice, proprietăți fizice

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In this work, cotton-covered polypropylene core-spun yarns were produced using modification of conventional ring spinning frame. Woven fabrics were prepared using the core-spun and 100% cotton yarns with same count and twist factor as weft and cotton yarns in warp. To study the physical and mechanical parameters of core spun yarns and fabrics the tensile properties, real count and diameters of yarns was evaluated. Besides, the air permeability, crease recovery, tensile properties, bending rigidity, wicking rate and heat and moisture transfer of fabrics were measured. It is observed that using polypropylene filament as core part is an effective parameter on physical and mechanical properties of core-spun yarns and fabrics. Air permeability, crease recovery angle, bending rigidity, wicking rate and tensile properties of core-spun yarn fabrics was increased compare with 100% cotton yarn fabrics. Heat and moisture transfer was reduced in core-spun yarn fabrics.

Key-words: polypropylene, core-spun yarn, mechanical properties, physical properties

Bewertung der physischen und mechanischen Eigenschaften der Garnen mit Polypropylen-Kern und Baumwollummantelung und der daraus produzierten Materialien

In der Arbeit werden die physisch-mechanischen Parameter der Garne gesponnen mit Polypropylen-Kern und Baumwollummantelung analysiert, sowie der Materialien produziert aus diesen Garnen. Die Gewebe wurden auf leicht modifizierten konventionellen Ring-spinnmaschienen realisiert, aus Kerngarnen und Garnen aus 100% Baumwolle mit demselben Drehungsfakor und derselben Feinheit – im Schuss, und Baumwollgarnen – in der Kette. Gleichfalls wurde die Luftpermeabilität, die Knitterholungsfähigkeit, die Zugeigenschaften, die Durchbiegungssteifigkeit, die Kapilarität, sowie der Wärmetransfer und die Materialfeuchtigkeit gemessen. Man hat festgestellt, dass durch Anwendung des Polypropylenischen Filamentes mit Kern, die physischen und mechanischen Eigenschaften der Kerngarnen und der entsprechenden Materialien optimiert wurden, im Vergleich mit den Materialien realisiert aus 100% Baumwollgarnen. Der Wärme- und Feuchtigkeitstransfer der Materialien waren kleiner bei Materialien realisiert aus Kerngarnen.

Stichwörter: Polypropylen, Kerngarnen, mechanische Eigenschaften, physische Eigenschaften

Core spinning is a technique by which fibers are twisted around an existing yarn, either filament or staple spun yarn, to produce a sheath core structure, in which the already formed yarn is the core. The production of core-spun yarns has been done successfully by many spinning systems such as ring, rotor, friction and air-jet. Core-spun yarns have been used to improve the strength, aesthetic, durability and functional properties of fabrics [1]. This relationship offers some unique properties in terms of appearance and performance as well as in dyeing and finishing characteristics. Some researchers such as Balasubramanian, Sawhney and Ruppenicker studied the physical and mechanical properties of core-spun yarns containing polyester and nylon filament yarns as core [2–5]. The properties of cotton blend fabrics from polyester core yarn have been studied by Harper et al. [6]. Ruppenicker et al compared the cotton/polyester core and staple blend yarns and fabrics [3] and structural and physical properties of cotton-covered nylon filament core-spun yarns was studied by Jeddi et al. [7]. The production of core-spun yarns using three strands method on Siro system was carried out by Pourahmad and et. al [8]. If we explore the research which has been done on core-spun yarns, it will be clear that there isn't any research on evaluation the physical and mechanical properties of core-spun yarns containing polypropylene filament yarns as core part. Moreover, Bilayered knitted fabrics with polypropylene inner and cotton outer were seen to provide better comfort, ideal for sportswear [9]. So our aim in this work was to evaluate the physical and mechanical properties of cotton covered polypropylene core yarns and woven fabrics containing these yarns as weft. Core-spun yarns and fabrics were compared with similar yarns and fabrics composed of 100% cotton fiber.

EXPERIMENTAL PART

Materials and methods

To produce 100% cotton and core-spun yarns, the cotton fibers had 4.3 micronair and 28 mm effective length. The count of roving was 0.8 Hank. Polypropylene filaments used as core were 70 dtex (30 f). The breaking tenacity and elongation at break was 30.96 cN/tex and, respectively, 44.92%. The technique that used to produce the cotton-polypropylene filament core-spun yarn is the same as that used by Ruppenicker et. al [3]. A conventional ring spinning frame was