

Antifungal activity of fabrics knitted by metalized Silver/Polyester composite yarn

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Abstract. In this study, antifungal properties of fabric knitted from metalized silver/polyester composite yarn were investigated. Intermingling is an alternative technique for yarn blending process. Yarns having different features can be combined by feeding the same intermingling jet. This process is defined as commingling. In the study, intermingling process was used to produce metalized silver/polyester composite yarn. Commingled yarns were knitted to single jersey fabrics by IPM brand sample type circular knitting machine. Antifungal activity test was applied to samples against *Aspergillus Niger* according to AATCC 30 test procedure. It has been identified that the application provides antifungal activity to fabric.

1. Introduction

Silver, is an inorganic compounds with a high bactericidal activity, have been widely applied in medicine to inhibit colonization by the bacteria on prostheses, dental materials, and wound dressing, and to reduce infections in burn treatments [1-3]. Antimicrobial activity mechanisms of silver are given in Table 1.

Table 1. Antimicrobial activity mechanisms of some inorganic compounds [1]

The active substances	Antimicrobial activity	Mechanisms of antimicrobial activity
Inorganic compounds metals such as silver, zinc, copper, metal oxides such as titanium dioxide, metal salts	gram positive, gram negative bacteria, fungi, viruses	Inhibition of DNA replication, denaturation of proteins, abnormal functioning of the cytoplasmic membrane, outflow of the low molecular masses intracellular components from cell, disruption of transport of electrons and protons

Intermingling process is used to produce composite yarn in this study. Increasing economic constraints on the textile industry brought forward alternative and less expensive methods to conventional techniques. Intermingling is an alternative technique for yarn blending process [4]. Yarns having different features can be combined by feeding the same intermingling jet. This process is defined as commingling. The commingling process diagram is given in Figure 1.



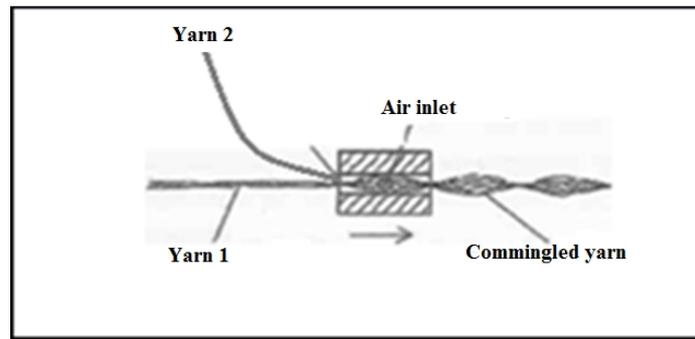


Figure 1. Commingling process diagram

2. Material and Method

2.1. Material

In this research, it is aimed to investigate antifungal properties of fabrics knitted by metalized silver/polyester composite yarn. For this purpose, standard textured polyester yarns were commingled with silver metalized polyamide yarn. The properties of filaments used in the study are given in the Table 2.

Table 2. Properties of components of composite yarn

Yarn Type	Specifications
Textured Polyester	795 denier/144 filament
Metallized Silver polyamide	30 denier/10 filament

2.2. Method

Metal filaments were commingled with 795 denier textured polyester yarn by Hemax brand HMX114 intermingling machine. Intermingling pressure was set at 5 bar and the speed was set at 150 m / min. Intermingling machine's unit and commingling process diagram are shown in Figure 2.

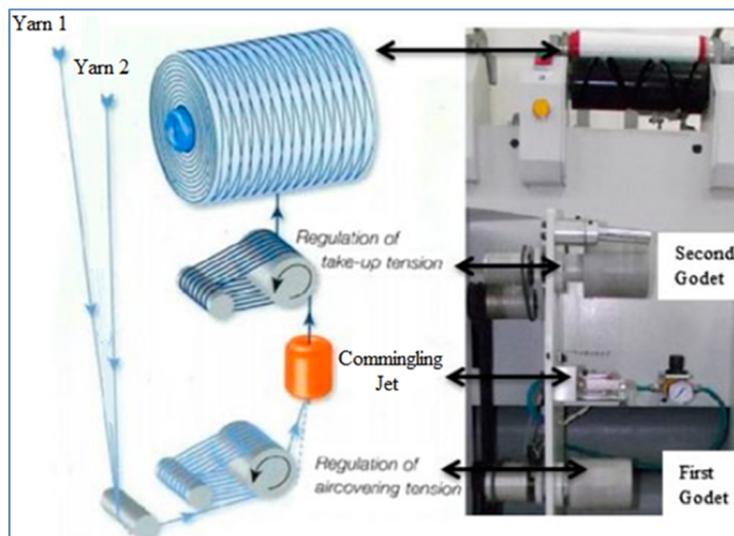


Figure 2. Intermingling machine's unit and process diagram

Image of composite yarn that was taken with a digital camera microscope at 20x magnification ratio are given in Figure 3.



Figure 3. Image of composite yarn

Composite yarn was knitted to single jersey fabrics by IPM brand sample type circular knitting machine. Laboratory type circular knitting machine's specifications are given in Table 3.

Table 3. Knitting machine's specifications

Producer	IPM Trade Co. Ltd.
Knitted Roller	3 ½-inch, single-head
Speed (rpm)	0-400
Machine gauge	18 needles/inch
Weave type	Single Jersey

Image of knitted fabric that was taken with a digital camera microscope at 20x magnification ratio are given in Figure 4.



Figure 4. Image of knitted fabric

Antifungal activity test was applied to sample against *Aspergillus Niger* according to AATCC 30 - Part 3. *Aspergillus Niger* can grow on textile products without causing measurable breaking strength loss within a laboratory experimental time frame. Nonetheless, their growth may produce

undesirable and unsightly effects. This procedure is used to evaluate textile specimens where growth of these fungi is important. In this method, treated textile samples are placed onto agar plates and are inoculated with spores of *Aspergillus* at 28 °C for 7 days. Results are assessed visually as there is fungal growth on sample or not [5].

3. Results and Discussion

According to test results, *A. Niger* can easily grow on knitted fabric by textured polyester. When metalized silver is added the yarn structure about 5 % by mass, product shows antifungal activity against *A. Niger*. Test samples are given in Figure 5. When Figure 5 is examined visually, it can be seen that there is no fungal growth on fabric knitted by metalized silver composite yarn. If the amount of metalized silver is increased in composite yarn, stronger resistance can be provided. As a result of research, it has been identified that the application provides antifungal activity to fabric.

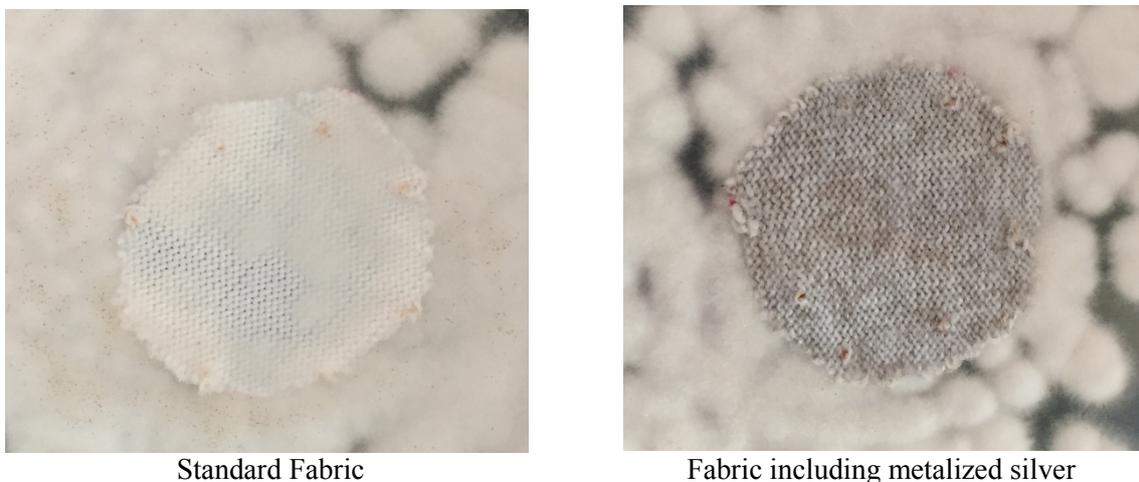


Figure 5. Antifungal activity test samples

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