Moisture Management and Drying Properties of Double Face Knitted Fabrics

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Abstract. This study presents the drying time and moisture spreading characteristics of double face interlock fabrics, which were knitted by the combination of polyester, cotton and viscose yarns. The results revealed that polyester-cotton samples showed the lowest drying time and better moisture transfer capability among all tested fabric, when the polyester face is placed inside of the garment. Also, a relationship was determined between water spreading and drying properties.

1. Introduction

The human body is in constant interaction with its surroundings and it tries to maintain a balanced temperature around 37°C. If the thermal equilibrium condition deteriorates, the body will attempt to lose or gain heat. The increment or decrement of the body temperature due to environmental changes or activity levels is controlled by hypothalamus. In the case of heat increase, the basic responses are to accelerate the blood flow in skin vessels (vasodilation) or the output of water vapour and liquid sweat on skin surface for reducing inner temperature of body (sweating) [1]. Although the sweating process is one of most important weapons for thermal regulation system, it is also a potential cause of discomfort feeling. Particularly, textile garments allow very little microclimate areas on skin, which prevents quickly dispersing to atmosphere. Also wet textile surface by absorbing liquid cools faster than skin and causes irritating cold feeling at the time of contact. Therefore, the properties expected from a comfortable textile product are to allow efficiently the transportation of heat and moisture in the condition of thermal imbalance, to remove quickly the liquid sweat with capillary effect to outer surface and to spread it to a wide area on fabric [1, 2].

It is very difficult for a conventional textile product to fulfil these complex functions. For example, hydrophobic fibres quickly spreads the moisture which leads to faster drying, however wet feeling can not be prevented. On the other hand, highly hygroscopic fibres have good moisture absorbency, but weak drying efficiency [3]. Therefore, the thermoregulation effect of double face fabric structures formed by combining different layers with different properties is thought to be better than single layer structure. Due to this synergistic effect of different moisture transfer mechanisms of each type of fibres within double face composite fabric structure, highly comfortable products are expected to be obtained, especially for sportswear and inner garments. From this point of view, this study aims to reveal the effects of the combination of different yarn types on moisture management and drying characteristics of double face knitted fabrics.
2. Experimental
Double face interlock fabrics were knitted using polyester, cotton and viscose yarns (Ne 30/1, αe 3.5). Moisture management properties were tested by MMT (SDL Atlas) according to AATCC TM 195. Drying properties were investigated through water drop method [4] in a laboratory scale climate chamber (BINDER) in which the ambient air conditions were set to 35 °C and 65% RH.

3. Results and Discussion
According to the MMT test results, moisture spreading speed and spreading radius of PES-CO and PES-CV samples were found to be higher compared to other fabrics composed of one type of yarn.

As expected PES-PES fabrics dried faster than CO-CO and CV-CV fabrics. The results of the fabrics including different yarns on both sides (PES-CO, PES-CV) revealed that, when wetting occur on the hydrophobic surface, a faster drying was achieved compared to wetting on hydrophilic surfaces (CO or CV). Moreover, it was observed that PES-CO samples showed excellent drying behaviour which has the lowest drying time among all tested fabric, even PES-PES fabrics. This situation showed that there is a strict correlation between moisture spreading capability and drying properties.

| Table 1. Drying and water spreading properties of double face knitted fabrics |
|-------------------------------------------------|
| Notation  | Face side | Back side | Mean drying time (min) | Water spreading speed (mm/s) | Water spreading radius (mm) |
|-----------|-----------|-----------|------------------------|-----------------------------|-----------------------------|
|           |           |           |                        | top/bottom                  | top/bottom                  |
| PES-PES   | Polyester | Polyester | 22.5                   | 2.7 / 2.8                   | 25 / 25                     |
| CO-CO     | Cotton    | Cotton    | 31.5                   | 0.8 / 0.9                   | 15 / 10                     |
| CV-CV     | Viscose   | Viscose   | 40.5                   | 1.3 / 1.3                   | 10 / 10                     |
| PES-CO    | Polyester | Cotton    | 21.0                   | 4.7 / 3.8                   | 30 / 30                     |
| PES-CV    | Polyester | Viscose   | 30.0                   | 4.8 / 3.8                   | 30 / 30                     |

4. Conclusion
In this study, moisture management and drying properties of double face knitted fabrics were investigated. The results showed that drying behaviour and moisture transfer capacity can be improved by the combination of polyester and cotton yarns in the double face structure, which will provide the rapid transmission of the sweat.

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References
[1] Angelova R A 2016 Textiles and Human Thermophysiological Comfort in the Indoor Environment (Florida: Taylor & Francis Group) 328
[2] Song G 2011 Improving Comfort in Clothing (Cambridge: The Textile Institute/Woodhead Publishing) 459
[3] Uttam D 2013 Engineering and Applied Sciences Research 4 34-40
[4] Cay A, Gurlek G, Oglakcioglu N 2017 Drying Technol 35 509-521

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