Moisture Management Ability of Different Fabrics

Tingyue Cao, Hugh Gong

Departments of Materials, University of Manchester

Abstract

The moisture management ability of a fabric is an important indicator of the wearing comfort of a garment. In order to test this ability of different fibres and fabrics, three different fabrics

(A-95%cotton5%elastane,

B-65%polyester35%cotton,

C-95%polyester5%elastane) are selected for the tests.

The water absorption tests and the capillary effect tests are conducted to compare the moisture management abilities of different samples.

Introduction

Exercise is an essential part of human life and the post-epidemic era make a hit of sports. During exercise, the body produces a lot of heat and sweat. The moisture management ability of clothing is therefore an important factor in determining the comfort of the body.

In the beginning, clothes were made of natural fibres. However, with rising living standard, the demands on clothing fabrics became more demanding. The advent of man-made fibres has therefore played a huge role in improving the performance of clothing.

Natural fibres such as cotton and wool are hydrophilic and therefore more able to absorb moisture and water tends to remain on the surface of the fibres.

Synthetic fibres, on the other hand, are hydrophobic fibres and the surface of the fibres does not firmly lock in moisture, so synthetic fibres have a better ability to transport and release moisture.

Therefore, in terms of moisture management, the combination of natural and synthetic fibres performances better.

Methods

Pre-treatment:

All fabrics are washed according to the standard testing method to remove dust and grease, thus to ensure the accuracy of the data.

Water Absorption Capacity Test:

The fabrics are cut into several samples (10cm*10cm) after washing. Then these samples are dried for 10 hours at 80℃ in an oven. Measure the dry weight of the samples. After that, these the samples are immersed into a bath of distilled water for 5mins. Then, these samples are hanged vertically till no water droplet drip within 30 seconds. At last, the wet weight is measured as well.

The water absorption ratio of each fabric can be calculated according to the equation: *Water absorption ratio(%)=([wet weight–dry weight)/dry weight]*100%*

Capillary Effect Test:

The fabrics are cut into several stripes (2.5cm*30cm). Then the samples are equilibrated under standard atmospheric conditions for 24 hours. Hang and adjust the sample close to and parallel to the rule, with the lower end located about 15mm below "0" of the rule. Pour the test liquid into the container at the base of the device and adjust the beam so that the liquid level is at the zero level of the scale, ensuring that the lower end of the sample is submerged in the liquid and starting the timing. Measuring the wicking height each 10mins.

Figure 1 Part of the samples

Results

Sample A	Dry weight(g)	Wet weight*1(g)	Wet weight*2(g)	Wet weight*3(g)
1	2.508	7.196	7.155	7.268
2	2.501	7.167	7.125	7.084
3	2.570	7.734	7.586	7.583

Sample B	Dry weight(g)	Wet weight 1(g)	Wet wight 2(g)	Wet weight 3(g)
4	2.457	6.705	6.206	5.869
5	2.519	6.604	6.143	6.285
6	2.563	6.684	6.565	6.325

Sample C	Dry weight(g)	Wet weight 1(g)	Wet weight 2(g)	Wet weight 3(g)
7	2.524	5.402	5.637	5.617
8	2.515	5.513	5.526	5.462
9	2.522	5.621	5.486	5.378

Figure 2 The Dry and Wet Weights of Samples

Despite unavoidable errors (e.g. a small amount of water adhered to the clamps), the convergent results show that the water absorption properties of samples A and C remained at the same level in all three water absorption experiments, while sample B showed a gradual decrease in water absorption capacity over the three experiments.

Comparing the average water absorption of samples A, B and C, it is easy to see that sample A is the most absorbent, while sample C is the least absorbent.

Figure 4 leads to the conclusion that sample A has the best capillary effect, while sample B has the worst capillary effect.

It is the ratio of natural to synthetic fibres that accounts for such a large difference in water absorption capacity. Sample A contains 95% cotton fibres, while sample C is composed of synthetic fibres, which in turn proves the hydrophilicity of the natural fibres and the hydrophobicity of the synthetic fibres.

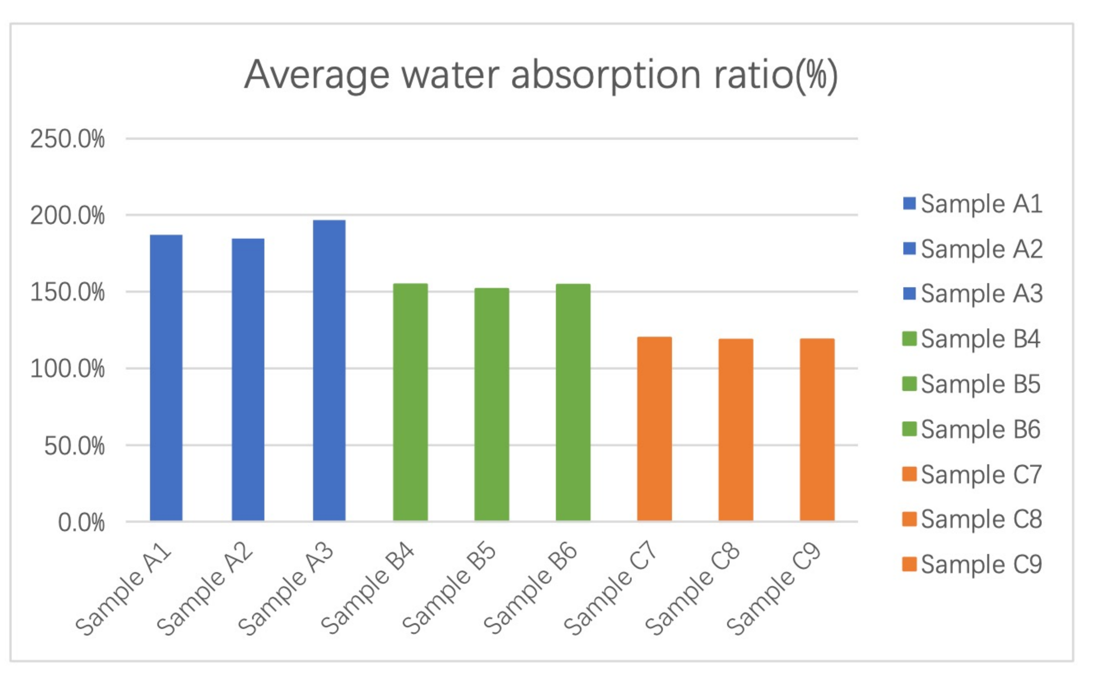

Figure 3 The Average Water Absorption Ratio

	10min	20min	30min
Sample A	11.9cm	14.1cm	15.6cm
Sample B	8.1cm	10.0cm	10.8cm
Sample C	11.1cm	13.6cm	15.3cm

Figure 4 The Avarage Wicking Height of 3 Samples

Conclusion

For this project, moisture management capabilities can be simply divided into two capabilities - the water absorption ability and the capillary effect. Capillary water within a fabric is created by surface adsorption. When a fabric is immersed in water, a large amount of capillary water forms between the fibres, which is a factor that cannot be ignored in terms of the amount of moisture absorbed by the fabric. Throughout the results of the experiment, Sample A, which has the highest natural fibre content, showed the best water absorption performance, both in terms of water absorption and capillary effect of the fabric. At the same time, there are many factors that judge the wearing comfort of a sportswear, such as drying speed and softness ...... but when it comes to water absorption, natural fibres have a clear advantage.

References

1. Su, C.-I. et al. (2007). Moisture Absorption and Release of Profiled Polyester and Cotton Composite Knitted Fabrics. *Textile research journal*, 77(10), pp.764–769.
2. Troynikov, O. and Wardiningsih, W. (2011). Moisture management properties of wool/ polyester and wool/bamboo knitted fabrics for the sportswear base layer. *Textile research journal*, 81(6), pp.621–631.