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International Journal of Current Research
Vol. 5, Issue, 01, pp. 215-217, January, 2013

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

Effect of Plasma Treatment on Cotton/Micro Denier Polyester Blends

[1*]Rajalakshmi, M., [2]Koushik, C. V. and [3]Paramasivam, S.

[1]Department of Fashion Technology, SSM College of Engineering, Komarapalayam, Namakkal 638 183, India
[2]Department of Fashion Technology, Sona College of Technology, Salem 636005, India
[3]Department of Textile Technology, SSM College of Engineering, Komarapalayam, Namakkal 638183 India

ARTICLE INFO

Article History:
Received 10 October, 2012
Received in revised form
19th November, 2012
Accepted 04th December, 2012
Published online 14th January, 2013

Key words:
Micro denier polyester,
Plasma,
Wickability,
Air permeability etc.,

ABSTRACT

The textile industry is searching for innovative production techniques to improve the product quality. Nowadays, Micro fibers have set new trends in the textile industry and manmade fibers were upgraded to be superior to natural fibers both in appearance and also in the other physical and comfort properties. The blending of the micro denier polyester fibre along with cotton fibre is a popular one for research and it gives valuable performance with the main component fibre properties and additional micro polyester fibre properties. The research work shows that the part of micro polyester fibres improves the fabric properties in the aspects of better drape, softness, shrink resistance, high strength and good insulation against atmosphere conditions, good absorbency, good wicking property, good air permeability and environment friendly. This paper deals with the study of surface modification of 100% micro denier polyester, 100% cotton and 65/35 micro polyester / cotton fabrics by plasma treatment. The various properties improvement in the above fabrics was discussed and conclusion was made based on the performance of plasma treatment on the subjected fabrics.

INTRODUCTION

Blending of fibres is usually made with different fibres having dissimilarity in their properties, with a view to achieving or improving certain characters of the yarn or its processing performances. Fabric produced from the blended yarn might have better characteristics than what could be obtained in a fabric produced from a single fibre. The blending of cotton is done to develop drape properties, comfortability, durability, dyeability and many other properties of the fabric products. Any successful attempt to blended this fibre with cotton would be a breakthrough in the field of textile (Salam *et al*., 2007; Prakash *et al*., 2011; Duckett *et al*., 1979; Gupta *et al*., 1975). Plasma treatment is a trend of new technique for surface modification. Plasma is an ionized form of gas and can be created using a controlled level of AC or DC power and an ionizing gas medium. It is an ensemble of randomly moving, charged atomic particles with a sufficient particle density to remain, on average, electrically neutral. Plasmas are used in very diverse applications, ranging from manufacturing integrated circuits used in the microelectronics industry through treating polymer films to the destruction of toxic waste. In textiles, the gas plasma treatments of materials alter their surface character without affecting their bulk properties. This plasma treatment offers an alternative method of surface treatment to the coating technologies conventionally applied. Some of the gases used for plasma are argon, nitrogen, oxygen, ammonia, carbon dioxide, fluro carbons, helium, etc. and are used to impart different functional finish effects on the surface of the fabric such as Wickability, Air permeability, flame retardency, water repellency etc.,

MATERIALS AND METHODS

In this experiment, three different fabrics were taken for study i.e., 100% micro denier polyester, 100% cotton and 65/35 micro denier polyester / cotton. The micro denier polyester fibre was purchased from Reliance Industries Ltd, Coimbatore. 100% cotton fibre was purchased from M/s. Sri Ramachandra Textiles, Tirupur. The mean cotton fibre properties are as follows: fibre length 28.1 mm, fibre length uniformity ratio 48.4%, fibre fineness 3.6 µg/in and moisture content 6.1%. The micro polyester fibre chosen for the study had the following fibre quality characteristics: length 40 mm, linear density 0.8 denier. From the above fibres, three varieties of yarn samples were made at the TIFAC- CORE Textile Research Centre and Centre of Excellence for Textiles, Kumaraguru College of Technology (KCT), Coimbatore, Tamilnadu, India. The process steps of fibre blending, lap production, carding, drawing, rove-preparation and spinning were controlled to result in blended yarn of linear density 30^{s}Ne.

In the Cotton /Polyester blends, polyester fibre play a vital role in the textile applications in all areas from the life saving medical textiles to the geo-textiles (Pınar Duru Baykal *et al*., 2006). The advantages of polyester over other fibres are strength, lustre, aesthetics, economics, consistency in quality and ready availability (Pan *et al*., 2000). But, it has low moisture regain 0.4% as compared to cotton 8%. The polyester fabric will absorb and wick less water. In order to overcome these limitations, micro-fibres were introduced to improve the polyester wick ability, and thereby dry the material quickly. This is the ultimate requirement for active sportswear. This blending with micro polyester gives good comfort, Drape, durability, dye ability and other properties to fabric products. The plain woven fabrics were produced using sample loom with a reed space of 67 inches, fabric width of 63 inches, equal Ends per inch and Picks per inch of 64. The final out put fabric width is 58 inches with the equal EPI and PPI of 68. The fabric samples were given plasma treatment in TIFAC- CORE Textile Research Centre and Centre of Excellence for Textiles, Kumaraguru College of Technology (KCT), Coimbatore, Tamilnadu, India. The gas used for the plasma treatment is Oxygen. The present study was conducted in order to find out the impact of plasma treatment on cotton/micro polyester fabric and quality characteristics also.

***Corresponding author:** rajalakshmi.aft@gmail.com

RESULTS AND DISCUSSION

- The wickability is improved after plasma treatment for all the three samples. out of three samples, 65/35 blended fabric shows comparatively more in wicking property.
- The air permeability is improved after plasma treatment for all the three samples. Out of three samples, 100% cotton and 65/35 blended fabric shows moderate increase in air permeability.
- Also there is no change in bulk properties of the three samples before and after plasma treatment which is an essential requirement of the plasma treatment.

Table 1. Physical Properties of the Fabrics Before Plasma Treatment

Physical properties	100% Cotton		100% Micro Polyester		65/35 Micro Polyester / Cotton	
Count	30s Ne		30s Ne		30s Ne	
GSM (gms)	101		100		99	
Thickness(mm)	0.28		0.28		0.29	
Crimp %	Warp way 10.6%	Weft Way 11.5%	Warp way 11%	Weft way 11.8%	Warp way 10.5%	Weft way 11.6%
Tensile Strength (lbs)	8.28	17.18	9.21	10.23	6.45	9.1
Tearing Strength (kgs)	740	836	878	934	573	873

Table 2. Physical Properties of the Fabrics After Plasma Treatment

Physical properties	100% Cotton		100% Micro Polyester		65/35 Micro Polyester / Cotton	
GSM (gms)	103		100		117	
Thickness(mm)	0.29		0.32		0.29	
Crimp %	Warp way 8.28 %	Weft Way 17.18 %	Warp way 9.21%	Weft way 10.23 %	Warp way 6.45 %	Weft way 9.1 %
Tensile Strength (lbs)	8.29	17.20	9.22	10.24	6.45	9.2
Tearing Strength (kgs)	740	836	878	934	573	873

Table 3. Wickability Test Results Before and After Plasma Treatment

	Wickability in mm after 24 hours		
	100% Cotton	100% Micro Polyester	65/35 Micro Polyester / Cotton
Before Plasma Treatment	80	30	0
After Plasma Treatment	135	140	160

Table 4. Air Permeability Test Results Before and After Plasma Treatment

	Air Permeability (cc/ sq. cm/sec)		
	100% Cotton	100% Micro Polyester	65/35 Micro Polyester / Cotton
Before Plasma Treatment	49.9	90.2	80.5
After Plasma Treatment	63.6	79.1	84.1

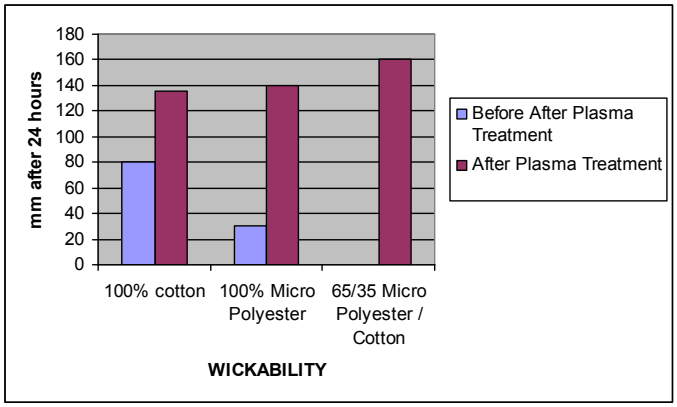

Fig 1. Comparison of Wickability Test Results Before and After Plasma Treatment

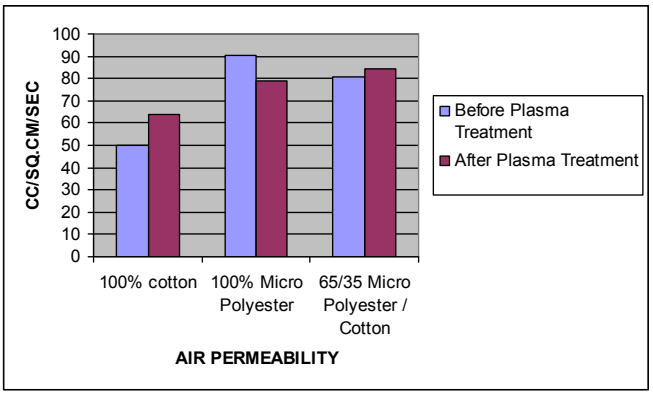

Fig 2. Comparison of Air Permeability Test Results Before & After Plasma Treatment

Conclusion

Compared with current traditional finishing processes, plasmas have the crucial advantage of reduced usage of chemicals, water and energy. They also offer the possibility to obtain typical textile finishes (e.g. hydrophilic, oleophobic, antibacterial) without changing the key textile properties (hand, softness, flexibility, etc.). This paper concludes that the wicking property and air permeability of 100% cotton, 100% micro denier polyester and 65/35 micro denier polyester / cotton fabric samples were improved after the plasma treatment. Meanwhile the physical properties of the above samples didn't show much change in their nature after plasma treatment.

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