A study on the UV Protection of Bamboo Blended woven fabrics for maternity wear

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Abstract:Sunlight is very essential for human health as the human body requires it to produce vitamin- D which improves the blood circulation and immunity to pathogens. At the same time, the ultraviolet (UV) rays present in the sunlight is potential to cause severe damage to human on prolonged exposure. UV rays are classified into UV-A, UV-B and UV-C category with wavelength range of 320-400nm, 280-320nm and 100-280nm, respectively. UV-C does not reach earth due to shorter wave length and UV-A reaches earth but does not harm significantly. UV-B component is harmful to human being and animals with potential risk of skin cancer, eye cataract etc. Even plant kingdom is also affected by UV-B exposure.

Index Terms: Sunlight, human body, wavelength, skin cancer

1. INTRODUCTION

Clothing is one among the most important three basic needs in every human life. It protects our body from various climates and gives us a good appearance . Consumers are becoming increasingly very much conscious to environmental friendly consumer goods and much concerned about the green activities. This tendency for eco friendly come into contact with the skin for a prolonged period of the time says Dharani et al (2010). Cotton is an important textile fiber for human clothing and certain other needs ever since the fiber of the cotton plant was first observed and identified for its potential and the art of hand spinning and its numerous other uses were identified.

Bamboo is an important forest biomass resource. Bamboo textiles have many fanatics' properties when used as textile materials such as high tenacity, excellent thermal conductivity, resistant to bacteria, and high water and perspiration adsorption(US Department of Agriculture). Yarns of bamboo fiber provide the desirable properties of high absorbency, antibacterial and soft feel in textiles and made ups. Bamboo textile products are having high demands in the market because of their antibacterial nature, biodegradable properties, high moisture absorption capacity, softness and UV protective capacity, breathability and fast drying behavior, bamboo fiber ensure comfort in various applications Currently, regenerated bamboo fibers are used in apparels including undergarments, sports textile, t-shirts and socks.tey are also suitable for hygienic products and sanitary napkins, absorbing pads, masks, bandages and surgical gowns says Saravanan (2007).

Bamboo can be spun purely or blended with other material such as cotton, hemp, silk, lyocell, and modal. Cotton has been one of the most human friendly plants with its soft, luxury and hygienic touch to the skin. The purpose of blending is to produce yarn with such qualities that cannot be obtained by using one type of fiber alone says Farrelly David(1984). Blending is also practiced for reasons of economic production, shortage of natural fiber, better performance in spinning, to improve the yarn strength, yarn evenness, imperfection level etc the combination bamboo and cotton proved as a supreme blends components for modern and luxurious life tells Sowmya et.al(2017). Polyester fibers are long chain polymers produced from elements derived from coal, air, water, and petroleum. As defined by the FTC, these fibers are chemically composed of "at least 85 percent by weight of an ester of a substituted aromatic carboxylic acid, but not restricted to substituted terephthalate units and para substituted hydroxybenzoate units."

The linear fiber forming polymers put his initials effort on polyester by poly condensation method. The polyester was aliphatic polyesters, made from dibasic acids like adipic acids and glycols. The melting points of the polymers were below 100^{o} c having molecular weight in the range of 2500-5000. It is only a short step onwards to prepare the first high molecular weight, high melting polyester in 1940. This polymer is poly (ethylene terephthalate) or poly (oxyethylene oxy terephthaloyl) or simply PET.

2. MATERIALS AND METHODS

This chapter shows the details of materials used the methods of fabric development, methods for analyzing the performance of yarn and fabric samples along with the details of testing instruments and techniques.

2.1 Materials

The details of the materials used in this study are described below. Bamboo is the main fibre used in the study blended with staple fibres of cotton, modal and polyester. The physical and mechanical properties of fibers are given in the Table 2.1.

Table 2.1 Physical properties of Bamboo, Cotton, Modal and Polyester fibers

Fibre	Staple length (mm)	Fibre fineness (dTex)	Dry Tenacity (cN/Tex)	Wet Tenacity (cN/Tex)	Initial Modulus (cN/Tex)	Elongation at break (%)	Moisture regain (%)
Bamboo	38	1.21	22-25	13-17	780	14-24	13

Cotton	28	1.23	20-43	27-56	795	6-10	7-8
Modal	38	1.23	24-36	12-24	880	13-25	8-9
Polyester	38	1.20	41-57	38-45	620	20-50	0.4-0.5

3. RESULTS & DISCUSSION:

3.1 Effect of Fibre Type and blend ratio on Ultra Violet Protection Characteristics of Woven Fabrics

The test results of UV blocking values of UV-A, UV-B and Ultra Violet Protection Factor (UPF) for the bamboo blended woven fabric samples produced both Pad dry and Dip dry methods are shown in Table 4.1

The table shows the blocking percentage of UV-A and UV-B rays. Though both the rays reach earth, UV-B is harmful to humans than UV-A. The overall protection capability of fabric is expressed as Ultraviolet Protection Factor (UPF).

Table 3.1 UV blocking values of woven fabrics

					Pad Dry			Dip Dry		
.No	**Sample No**	**Sample Details**	**Ends per cm**	**Picks per cm**	**UV-A block (%)**	**UV-B block (%)**	**UPF**	**UV-A block (%)**	**UV-B block (%)**	**UPF**
1	BC1W	Bamboo/Cotton (30:70)	28	24	85.2	90.2	12	82.5	89.7	9
2	BC2W	Bamboo/Cotton (50:50)	28	25	90	93.8	14	84.1	91.9	10
3	BC3W	Bamboo/Cotton (70:30)	29	24	92.4	95.1	15	85.2	93.6	10
4	BM1W	Bamboo/Modal (30:70)	27	24	93.7	95.8	47	90.7	94.3	26
5	BM2W	Bamboo/Modal (50:50)	28	24	95.5	98.2	60	93.8	97.9	32
6	BM3W	Bamboo/Modal (70:30)	28	25	96	98.6	61	95.2	98.3	38
7	BP1W	Bamboo/Polyester (30:70)	27	25	87.5	93.6	14	82.5	90.1	11
8	BP2W	Bamboo/Polyester (50:50)	29	24	90.4	95.1	16	86.8	94.1	12
9	BP3W	Bamboo/Polyester (70:30)	28	25	91.2	95.6	16	87.4	94.8	12

3.2 Effect of blend ratio

From the Table 4.1 it is clear that the UV blocking values namely UV-A, UV-B and UPF increases with increase in bamboo percentage in all the blends namely bamboo/cotton, bamboo/modal and bamboo/polyester The UV blocking percentage values of all the woven fabrics treated with pad dry technique is depicted in graphical form in figure s 3.1,3.2,and 3.3

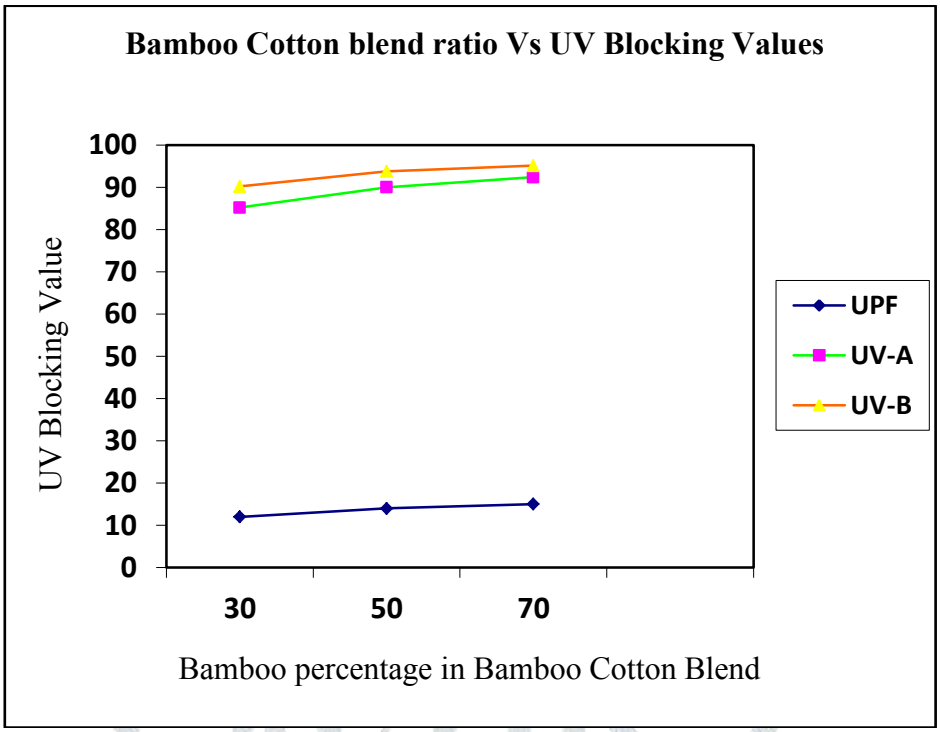

Fig 3.1 Effect of Blend ratio on UV Blocking Values in Bamboo Cotton Blends (Pad Dry)

From the figure 3.1 it is clearly seen that Bamboo/Cotton 70:30 blend ratio shows much higher UV blocking values when compared to other blend ratios of 50:50 and 30:70.

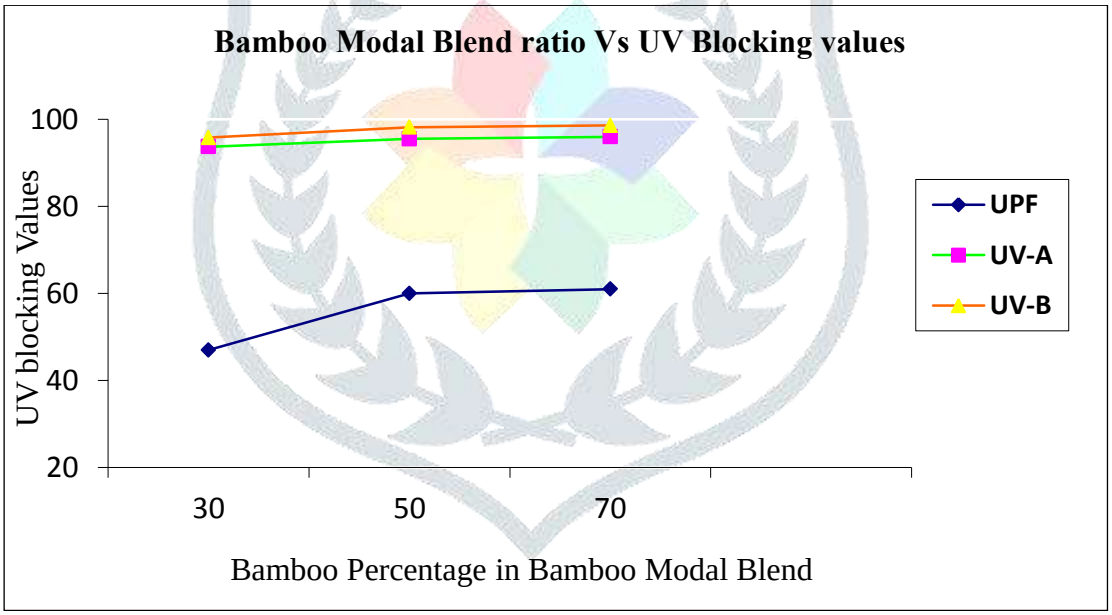

Fig 3.2 Effect of Blend ratio on UV Blocking Values in Bamboo Modal Blends (Pad Dry)

From the figure 3.2 it is clearly seen that Bamboo/Modal 70:30 blend ratio shows much higher UV blocking values when compared to other blend ratios of 50:50 and 30:70.

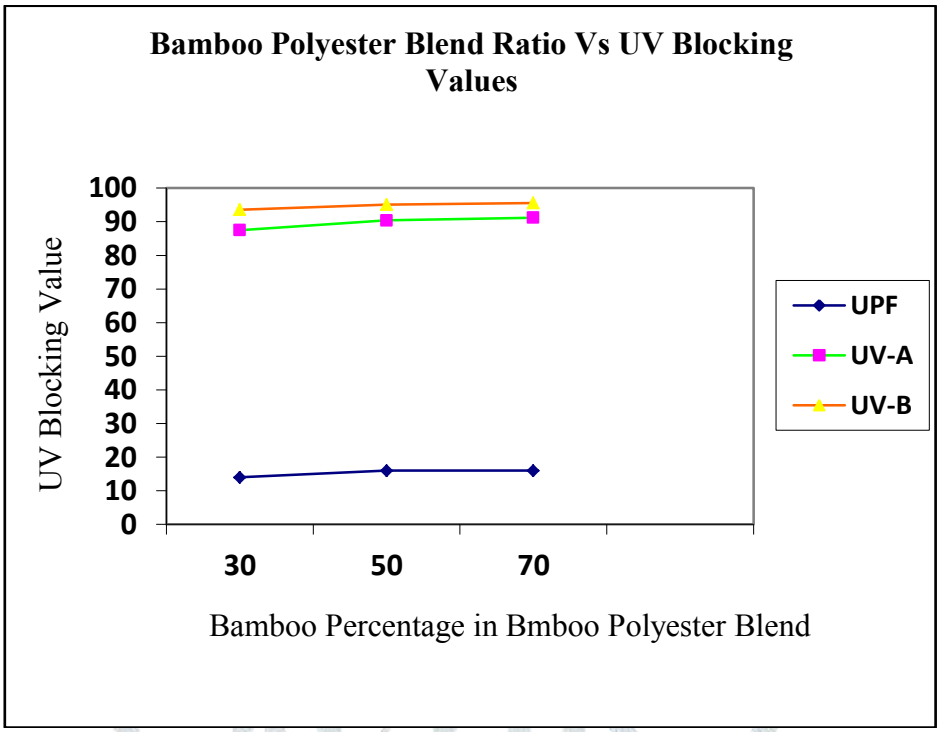

Fig 3.3 Effect of Blend ratio on UV Blocking Values in Bamboo Polyester Blends (Pad Dry)

From the figure 3.3 it is clearly seen that Bamboo/Polyester 70:30 blend shows much higher UV blocking values when compared to other blend ratios of 50:50 and 30:70.

3.3 Effect of fibre type.

Out of all the samples the Bamboo/Modal blend shows maximum UV blocking values .The Bamboo/Modal blend having 70:30 ratio pad dry fabric shows the maximum value of UPF of 61 However, the Bamboo/Modal blend having 70:30 ratio dip dry fabric shows only UPF of 38. But this the maximum value out of all dip dry samples.

The UV protection factor of all the woven fabrics fibre type wise treated with pad dry technique is depicted in graphical form in figure 3.4

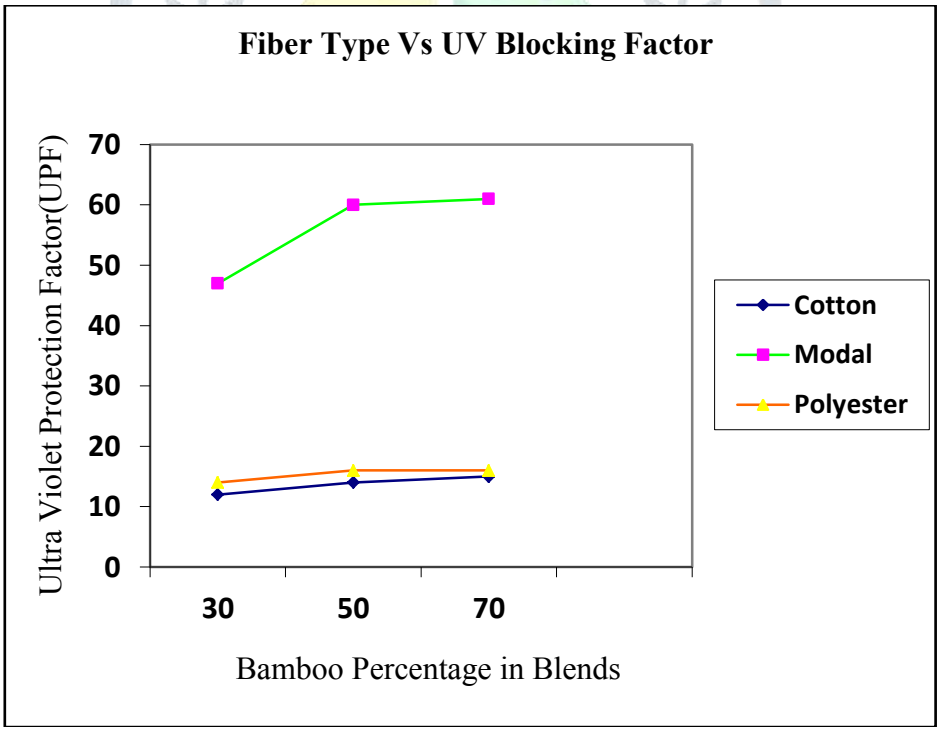

Fig 3.4 Effect of Fibre Blend on Ultra Violet Protection Factor (Pad dry)

From the figure 3.4, it is clearly seen that bamboo modal blend fabrics show much higher UPF values compared to other blends namely bamboo/cotton and bamboo/polyester blends. For example the UPF value for Bamboo/Modal 70:30 sample is 61 when compared to the Bamboo/cotton 70:30 and Bamboo/polyester 70:30 samples whose UPF values are only 15 and 16 respectively.

3.4 Effect of Method of Finishing

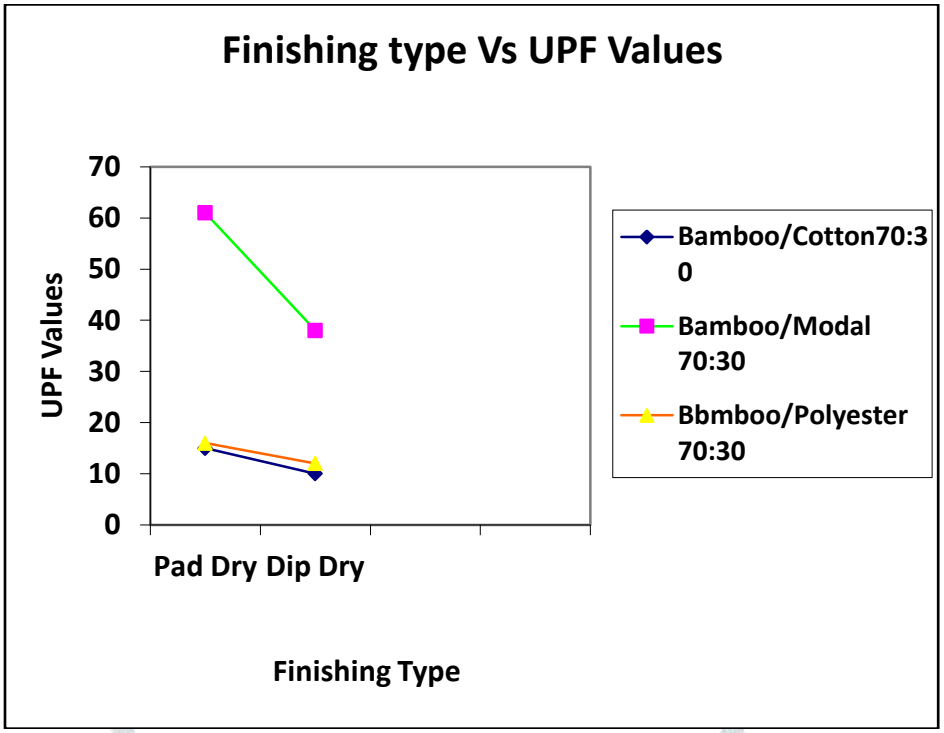

Fig. 3.5 Effect of Finishing type on UPF Values

From the figure 3.5, it is clear that UPF values of all the blends finished with Pad dry method is much higher than the values for fabrics finished with Dip dry method. For example the UPF value for Pad dry Bamboo/Modal blend 70:30 Percent is 61 when compared to UPF value of fabric finished with Dip dry is only 38.

4. CONCLUSION:

The UV protection properties of bamboo/cotton, bamboo/modal and bamboo/polyester fabrics developed by weaving were studied with three blend proportions. The influence of individual fibre characteristics and blend proportion were studied in detail. Bamboo/Modal blended woven with 70:30 proportion showed highest UV protection factor with UPF value of 61whereas UPF value for Bamboo/Cotton is 15 and for Bamboo/Polyester is 61.Out of Pad dry and dip dry finishing Dip dry finishing shows higher UPF values in all the cases. The UV-A and UV-B values for Bamboo modal blends are 3-5% higher than the Bamboo/Polyester and Bamboo/Cotton blends.

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