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Application of Herbal Oil on Selected Regenerated Cellulosic Fabric for Evaluating the UV Protection Property

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Abstract

Increasing global competition in textiles has created many challenges in finishing criteria. The impact of UV rays on human skin leads to skin cancer, skin inflammation and sunburn. An innovative approach was made to introducing new novel eco-friendly herbal oil treated UV protective finish on Bamboo 100%, Tencel 100% and Bamboo/Tencel 50:50 fabrics. The three herbal oils were selected and treated on all the three fabrics. The fabrics are taken for UV test using a spectrophotometer. The untreated and treated fabrics are then evaluated. The result showed that Grape fruit oil enhance the UV protective property when compared to other oils in Bamboo & Tencel fabrics.

Keywords: Inflammation; Skin cancer; Herbal oil; Spectrophotometer; Bamboo fabric

Introduction

During the past decades, awareness of the effect and consequences of exposure to UV radiation and skin cancer has led to an increased effort in R&D focused on protection against UV rays. It has become all the more critical due to depletion of ozone layer in the stratosphere caused by enormous use of CFCs as coolants. Today, we talk about 'prevention is better than cure' leading to measures avoiding exposure to UV rays (especially when their intensity is the Highest), using natural and artificial protective shades, wearing suitable clothing, and last but not least, applying sunscreens. Effective protection can be the result of activity of only a single protective factor or of a combination of more factors. It is focused on UV protection obtained by wearing lightweight summer clothing, which would be fashionable, colored or figured, comfortable to wear, and at the same time offer protection against UV rays. UV radiation, which is harmful to the skin, constitutes 5% of the total incident sunlight on earth's surface (visible light 50% and IR radiation 45%). Even though its proportion is quite less, it has the highest quantum energy as compared to other radiations, being of the order of magnitude of organic molecules bond energy; hence it has tremendous detrimental effect on human skin [1]. The ultraviolet radiations are one of the electro-magnetic radiations emitted by the sun having wavelength in between 100 to 400 mm, which we cannot see or feel.

Types of UV radiations

UV radiations are categorized into three types, depending on their wavelengths.

UVA radiations: The UV rays in the range of 315 to 400 mm wavelength are called as UVA rays. They are known to produce vitamin D. They may cause little visible reaction on the skin, leads to intermediate tanning and premature ageing, wrinkling of skin and primary level of skin cancer.

UVB radiations: The UV radiations ranging from 280 to 315 mm are said to be UVB rays. They are more dangerous than UVA rays and have been implicated as major cause for sunburns and severe skin cancer named Malignant Melanoma. If not detected at earlier stage, it may cause death.

UVC radiations: The UV rays in between 100 to 280 mm wavelength are the UVC rays. As compared to UVA and UVB rays, they are richest in energy and extremely dangerous but fortunately they cannot reach on earth surface and get absorbed by the Ozone layer [2].

The problems of ozone depletion in the upper atmosphere have led to increased problems of exposure of skin to UV radiation. UV light is usually defined as electromagnetic radiation of wavelength of 40400 nm. A specialty finish for protecting the fabric from UV radiation has been developed that protects human underlying tissues from UV radiation [3].

The problems of ozone depletion in the upper atmosphere have led to increased problems of exposure of skin to UV radiation. UV light is usually defined as electromagnetic radiation of wavelength of 40400 nm. A specialty finish for protecting the fabric from UV radiation has been developed that protects human underlying tissues from UV radiation [3]. The uses of natural products such as chitosen and natural dyes for antimicrobial finishing of textiles materials have been widely reported. Other natural herbal products, such as Aloe vera, tea tree oil, eucalyptus oil and tulsi leaf (*Ocimum basilicum*) extracts can also be used for this purpose [4]. Bamboo fabrics made from pure bamboo fibre yarn has excellent wet permeability, moisture, moisture vapour transmission property, soft handle, good drape, easy dyeing and splendid colors [5]. Bamboo and Tencel fabric is very eco friendly and more hydrophilic in nature.

These fabrics have good workability. In this study an attempt has been made to utilize the herbal oil for UV protective finish on Bamboo 100%, Tencel 100% and Bamboo/Tencel 50:50 blended fabrics.

Materials and Methods

Materials

The Bamboo 100%, Tencel 100% and Bamboo/Tencel 50:50 with

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the following specification of yarn and fabric. Yarn count: 40s. Fabric type: Single jersey fabric. It was scoured, bleached and dyed to attain basic preparatory process.

Herbal oils: Clove oil, Grape fruit oil, Pine oil are chosen for this study.

Methods

Finishing of the fabrics: All the three fabrics were immersed in Clove oil, Grape fruit oil and Pine oil separately for 15 min. The fabric was taken out of bath and squeezed. The fabric was finally dried in ambient air. The fabrics are taken for UV test using a spectrophotometer. The treated and treated fabrics are than evaluated with AATCC 183:2010 standard.

Evaluating UV protection activity for fabrics by AATCC 183:2010: This standard test method is used to determine the ultraviolet radiation blocked or transmitted by textile fabrics intended to be used for UV protection. This method provides procedures for measuring this fabric property with specimens in either the dry and wet status.

The transmission of ultraviolet radiation (UV-R) through a specimen is measured on a spectrophotometer at known wavelength intervals. The ultraviolet protection factor (UPF) is computed as the ratio of the erythemally weighted ultraviolet radiation (UV-R) irradiance at the detector with no specimen to the erythemally weighted UV-R irradiance at the detector with a specimen present. The erythemally weighted UV-R irradiance at the detector with no specimen present is equal to the summation between wavelength intervals of the measured spectral irradiance times the relative spectral effectiveness for the relevant erythemal action spectra times the UV-R weighting function of the appropriate solar radiation spectrum times the appropriate wavelength interval. The erythemally weighted UV-R irradiance at the detector with a specimen present is equal to the summation between wavelength intervals of the measured spectral irradiance times the relative spectral effectiveness for the relevant erythemal action spectrum times the spectral transmittance for the specimen times the wavelength interval. The percent blocking of UVA and UVB radiation is also calculated.

Results and Discussion

UV protection: blocking of erythemally weighed ultraviolet radiation through fabrics by AATCC 183:2010

From Table 1 it clearly shows that there is not much difference in treated and untreated samples. Therefore after dyed Bamboo and Tencel fabric has increased UV protection characteristics due to its natural UV protective property. Moreover Grape fruit oil finished Bamboo, Tencel and blended fabric enhances better UV protection property (Tables 2, and 3).

Knitting machine details	
Machine Type	Circular weft knitting Machine
Type of fabric	Single Jersey
Machine name	Knit Mac
Machine speed	28 rpm
Texture	32
Gauge	24
Cylindrical Diameter	16 inches
No of Feeders	21
Total no of feeders	1200 (needles)
Needle Type	Latch-Groz-Beckert

Table 1: Knitting machine details.

Parameter	Bamboo 100%	Tencel 100%	Bamboo/Tencel 50:50
Courses Per cm	17.20	17.99	18.54
Wales per cm	22.71	22.04	22.71
Stitch density per cm^2	390.612	396.499	421.043
Stitch length mm	0.24	0.23	0.25
Gsm	127	114	121
Kc	4.128	4.137	4.635
Kw	5.450	5.069	5.677
Ks=Kc*Kw	22.49	20.970	26.312
Tightness factor	16.01	16.01	15.37
Loop shape	0.757	0.816	0.816

Table 2: Dimensional property of fabrics.

S. NO	Fabrics	UV Radiation type	Untreated samples		Oil treated samples (% Blocking)					
					Clove oil		Grape fruit oil		Pine oil	
			Dry	Wet	Dry	Wet	Dry	Wet	Dry	Wet
1.	Bamboo 100%	A	85.975	95.645	88.168	96.445	89.375	97.098	87.005	95.066
		B	89.137	96.790	89.137	98.329	90.626	99.016	88.805	98.125
2.	Tencel 100%	A	89.933	91.982	91.535	93.877	92.083	96.032	90.246	96.056
		B	92.273	96.316	92.362	96.394	94.880	98.078	94.229	94.408
3	Bamboo/ Tencel 50:50	A	86.96	92.771	87.601	95.579	88.464	96.76	83.291	92.771
		B	90.700	96.647	91.503	98.125	89.597	98.078	85.643	96.641

Table 3: UV protection: blocking of erythemally weighed ultraviolet radiation through fabrics by AATCC 183:2010.

Conclusion

In this study it is concluded that Grape fruit oil treated fabrics enhances the UV protection property in wet condition compared to other oils and it is preferable for UV protective clothing and also suitable for summer clothing and swim wear. Hence grape fruit oil has a potential to protect UV radiation and it is suggested for all UV protective textile products. It is very eco-friendly.

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