A Study on The Ultraviolet Finish on Bamboo/Cotton Woven Fabric Using Biopolymer

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Abstract - **The protection of human skin against ultraviolet radiation is very important problem and over recent years researches have shown an increasing interest in this area. The growing consumer awareness of the dangers of the sun has influenced textile industry. In this study, the treated and untreated samples are characterized using FESEM and FT-IR. The effectiveness of the treatment is assessed using the standardized tests, such as UV visible spectrophotometer and the ultraviolet protection factor both before and after washing of the treated samples was also analyzed. It is found that biopolymer ultraviolet finish can be efficiently given to bamboo/cotton woven fabrics. Biopolymer finished sample showed similar UPF value, providing excellent ultraviolet protection when compared to the untreated sample. The ultraviolet tests indicate a significant improvement in the UV absorbing activity in the biopolymer treated fabrics.**

Keywords: Bamboo/cotton fabric, ultraviolet protection, biopolymer, FESEM, FT-IR.

I. INTRODUCTION

Textiles have such a significance role in our regular breathes that everyone needs to understand about some point of textile growth. 'Sustainability' in textiles refers to the usage of environmental and friendly methods for the production of fabrics. This means establishing practices that conserve energy and natural resources and minimize negative environmental, economic and social effects(1).

Bamboo fabric is having high demand in the market because of their antibacterial nature, softness, biodegradable properties, high moisture absorption capacity and Ultraviolet Protection capability(4). Cotton is the most popular and highly used fiber amongst the fibers, hence admired and adopted by the consumers all over the world right from the ancient period of development. Cotton is called as "King of fibers" and is composed of highly preferred conventional and versatile natural cellulosic fiber in the array of the world textile economy. It is known for its fascinating feel, comfort and versatility(5).

The consumers want products that enable them to stay in the sun for a longer period of time. Most products are targeted at a specific market and nearly every manufacturer has a complete range of products. The most recent introductions have focused on products for children, athletes, or for those who want UVA protection. Apart from drastically reducing exposure to the sun, the most frequently recommended form of UV protection is the use of sunscreen, hats and proper selection of clothing(2).

In recent years, large attention has been devoted to biopolymers because of their biocompatibility and biological functions and consequently, they are used in textile, biomedical and pharmaceutical fields. Some marine animals such as prawns and fishes possess some compounds which exhibit antimicrobial activity. Chitosan is effective natural antimicrobial agents derived from chitin. Biopolymers which are polymers that are generated from renewable natural sources are often biodegradable and non toxic to produce(3). The present work addresses the application of Chitosan biopolymer on bamboo/cotton woven fabrics to develop ultraviolet resistant fabric suitable for garments and thereby protecting it from ultraviolet radiation.

II. MATERIALS AND METHODS

The bamboo and cotton fabric has good properties of withstanding severe treatments especially, during dyeing and finishing. For the study, 30's combed bamboo and cotton yarn were weaved in bit loom with 20 inches width. The term 'pre-treatment' summarizes all types of basic finishes such as desizing, scouring and bleaching the fabric. The pretreatment processes such as biodesizing, bioscouring and biobleaching were done on bamboo/cotton blended fabrics.

EXTRACTION OF CHITOSAN FROM SHELL OF THE CRABS

The crab exoskeletons collected were placed in Ziploc bags and refrigerated overnight. Moisture content was determined on the crab waste by first crushing exoskeletons into smaller pieces using a meat tenderizer. Approximately ten grams of wet samples of crushed crab's exoskeletons were placed on foil paper and measured using a Mettle balance. There were five measurements made of the weight of the wet crushed crab exoskeletons

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samples. The samples were then labeled and oven-dried for four consecutive days at 65°C until constant weight.

ASSESSMENT OF ULTRAVIOLET PROTECTION FINISH

The standard test method is used to determine the Ultraviolet radiation blocked or transmitted by textile fabrics intended to be used for Ultraviolet Protection. This method provides procedures for measuring this fabric property with specimens in either the dry and wet status. Tested two specimens from each sample for the wet and dry testing. Each specimen was cut for at least 2.0 X 2.0 inches. Ultraviolet Protection factor is measured by the ratio of the average effective Ultraviolet radiation (UV-R) irradiance transmitted and calculated air to the average effective UV-R irradiance transmitted and calculated through fabric.

Standard chart for UPF rating for the fabric

UPF Rating	Protection Category	% Ultraviolet Radiation Blocked
0-10	Poor	Below 93.2
15 to 20	Good	93.3 – 95.9
25 to 35	Very Good	96.0 – 97.4
Above 40	Excellent	97.5 or more

EVALUATING UV PROTECTION ACTIVITY IN THE TREATED FABRIC BY (AATCC 183-1999)

The UV transmittance is the two finished fabric samples were determined using UV visible spectrophotometer. This standard test method was used to determine the UV radiation blocked or transmitted by textile fabrics intended to be used for UV protection. In this UV protection, analyzer specimens were tested in both wet and dry state.

FIELD EMISSION SCANNING ELECTRON MICROSCOPE (FESEM)

The surface morphology of controlled and finished fabric samples was analyzed using field emission scanning electron microscope[6]. The scanning electron microscope radiates high energy electrons in a focused beam to generate a variety of signals on the surface of the fabric samples.

FOURIER-TRANSFORM INFRARED SPECTROSCOPY (FT-IR)

Fourier transform infrared spectroscopy (FT-IR) was an analytical tool to identify the nature of chemicals that are coated on the fabric specimen. The Fourier Transform Infrared spectrometer is most useful for identifying active chemical components whether organic or inorganic.

III. RESULTS AND DISCUSSION

UV analysis of finished fabric

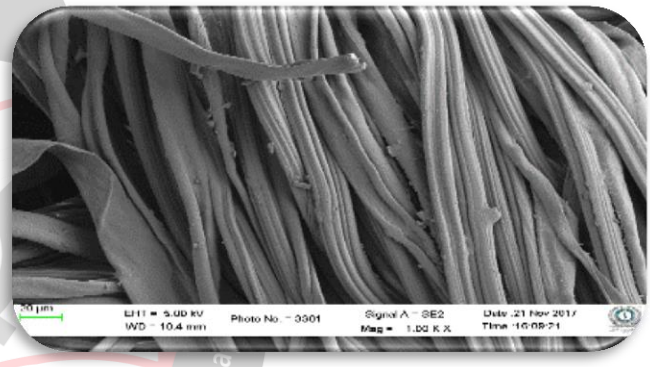
The ultraviolet protection of Bamboo/Cotton treated sample with Chiotsan bioplymer showing 94.3% of ultraviolet radiation blockage showing good protection category and 50++ of UPF range

Sl.no	Fabric Sample	UPF Range	%UV Radiation Blocked	Protection Category
1	Controlled (Untreated sample)	0	0	0
2	Chitosan	50++	94.31	Good

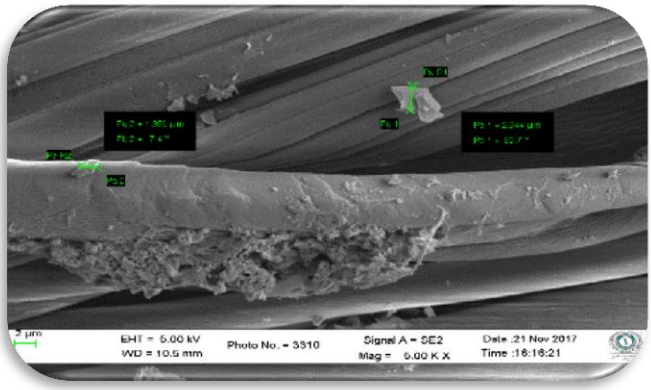
Analysis of the sample finished with the Chitosan Biopolymer by Fourier Transmission Scanning Electron Microscope (FESEM)

The surface topography of the Chitosan Biopolymer finished fabric sample was observed using Fourier transmission scanning electron microscope (FESEM). The characteristic of Chitosan sample finished by direct application method was analyzed.

Untreated Sample



Treated Sample



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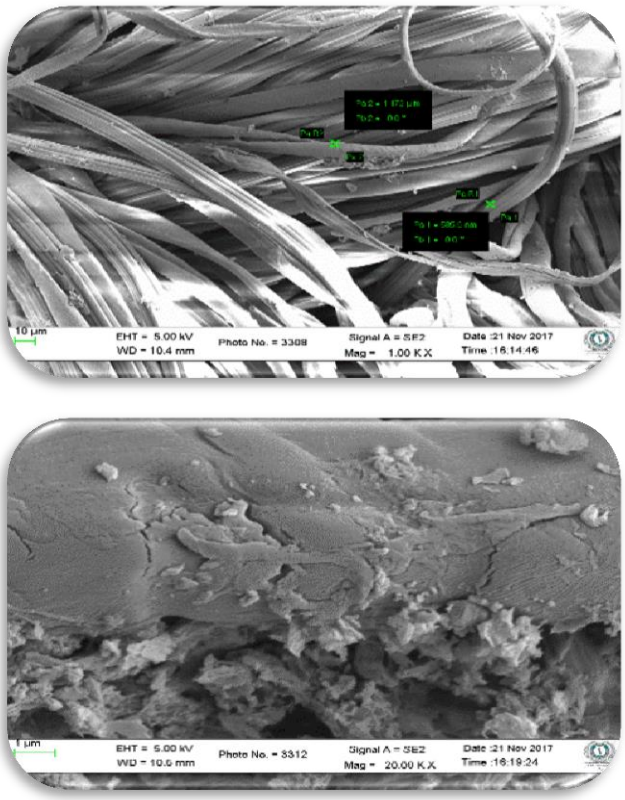
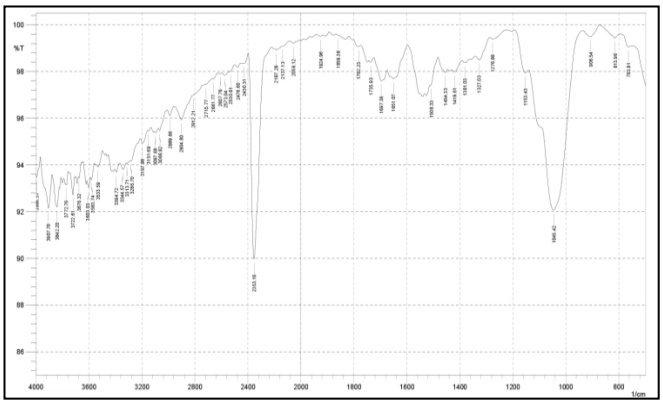


The Fourier transmission scanning electron microscopic images of bamboo/cotton woven fabric finished with Chitosan Biopolymer showed the clear deposition of extract on the inner surface of the fabric whereas, in untreated sample there is no deposition on the fabric. The imaging was done with different magnifications like 1.00KX, 1.24KX and 20.00KX.

Analysis of Fourier-Transform Infrared Spectroscopy (FT-IR) with Chitosan Biopolymer fabric sample

The functional group of the Chitosan Biopolymer finished fabric sample was identified by using Fourier-transform infrared spectroscopy (FT-IR).



The FT-IR spectrum was used to discover the functional group of the different components based on the peak value in the area of infrared radiation. The functional group identification is based on the FT-IR peaks attributed to the stretching and bending vibrations. The result of FT-IR analysis revealed the presence of alkenes, 1°, 2° amines, aliphatic amines, Alkenes, alkynes, aldehydes, alkynes, aromatics and nitro compounds.

IV. CONCLUSION

The present research is aimed at developing ultraviolet protection finish on bamboo/cotton fabric using biopolymer extract. Textiles, when coated with the selected biopolymer showed higher UPF rating against skin and this necessitates the development of stronger natural absorbers instead of chemically coated fabric.

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