ULTRAVIOLET RESISTANT FINISH ON COTTON FABRIC USING NATURAL DYEING

Ms.C.Premalatha,M.Tech, Janarthanan S P, Thilakeswaran S, Thiyagu S

K S Rangasamy College of Technology, Tiruchengode, Tamil Nadu, India

Abstract

In today's world, with people's increasing tendencies towards environmental consciousness and healthy living, the need for UV protection is becoming very high. People spend lot of money in the cosmetics with SPF in the market. Providing the UV protection in fabrics is a good idea that too when it comes in doing with natural dyes, it becomes less harmful. It indicates what fraction of the sun's ultraviolet rays can penetrate the fabric. Having a pretty UPF in our fabrics can help a way lot. Natural agents are preferred because of their availability.

Keywords: Punica granatum, Punicaceae & Pomegranate Peel

Introduction

Ultraviolet resistant baby wear are mainly used in summer time, it protects us from disease. Our project work deals with the development of ultraviolet organic baby wear made up of organic cotton using natural dyes.

Environmental issues are becoming more crucial all over world. Textile processing industry is characterized not only by the large volume of water required for various unit operations but also by the variety of chemicals used for various processes.

Organic cotton fabrics are generally understood as cotton that is grown from plants without chemical fertilizers or pesticides which are not genetically modified, though organic cotton has less environmental impact than conventional cotton and it costs more for its production Natural dyes can exhibit better biodegradability and generally have a higher compatibility with the environment. Natural dyes are obtained from substances such as flowers, trees, shrubs, buries,lichens, shellfish, leaves, insects and minerals.

COMMON PROPERTIES OF POMEGRANATE PEEL, GREEN TEA LEAVES AND TAMARIND SHELL POWDER

The three common properties are listed below

- Anti-Microbial
- Anti-Fungal
- Anti-Oxidant

MATERIALS AND METHODOLOGY

Organic cotton was purchased in fabric stage from the fabric dealer, Erode, Tamil Nadu which is of 80s count since the end use is going to be used for baby wear.

Selection of fabric:

The count of the fabric is 80s and it manufacturers by power loom. Its picks per inch is 68 and Ends per inches 76. It's a plain weave.

Selection of dye:

- Pomegranate peel
- Green tea leaves
- Tamarind shell powder

Pomegranate peel, Green tea leaves and Tamarind shell powder have been collected from local area and it is used as natural eco-friendlydyeing agent. The specified three (Pomegranate peel, Green tea leaves and Tamarind shell powder) herbs were selected because of the following aspects as per the literature review, Pomegranate peel are antioxidant and antibacterial in nature. Green tea leaves demonstrated character Bio active compound of antioxidant activity and Tamarind shell powder has antiviral and mordant activities in nature. Main active principle constituents of Green tea leaves are Polyphenols, Caffeine, polypeptides, amino acids, carbohydrates and lipids. Structure of pomegranate peel and the structure of Green tea leaves are shown in Fig1a&1b.

Figure 1a: Green Tea Leaves

Figure 1b: Pomegranate Peel

Extraction of natural dye solution from Pomegranate peel

Pomegranate fresh peel was boiled in 1litre of water for about 2-3 hours. Then it is filtered using nylon cloth. We have taken 0.5% of dye extracted from Pomegranate peel (Figure 1b)

Extraction natural dye solution from Green tea leaves

Fresh Green tea leaves were boiled in 1litre of water for about 2-3 hours. Then the extracted dye solution is filtered using nylon cloth. We have taken 1.5% of dye from Green Tea Leaves (Figure 1a)

Extraction natural powder from Tamarind shell

Tamarind shells are shadow dried and ground well to fine powder. The Tamarind Shell is used to mordant the dyed fabric by post mordanting process, to enhance the fixation of the dyes and to achieve the expected outcome of the project.

Application of Natural Dyes on Organic Cotton fabric

The dyeing of organic cotton fabric was done in the bath with liquor ratio 1:20 with 10gpl of dye solution using Laboratory winch dyeing machine. The yarn was loaded into bath at 900°C to 1200°C for 2-3 hours. The dyed fabric was washed thoroughly in cold water and then squeezed and shade dried.

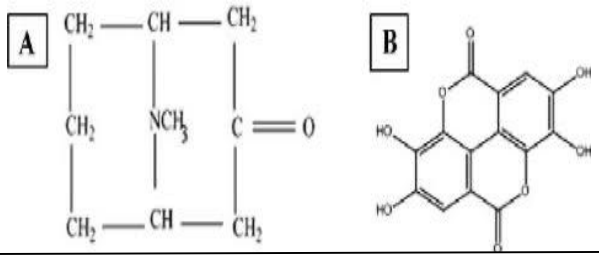

Figure 1: The Chemical Structure of Pomegranate Peel

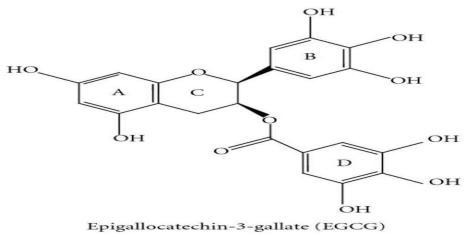

Figure 2: The Chemical Structure of Green Tea Leaves

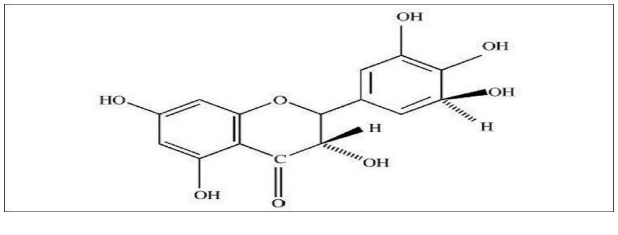

Figure 3: Chemical Structure of Tamarind Shell

Figure 4: Washing Fastness Tester

Figure 2a: Pomegranate Peel.

Figure 2b: Green Tea Leaves.

Figure 2c:
Tamarind Shell

Figure 3a: Color Fastness to Washing

Figure 3b: Color fastness to Rubbing

Evaluation of color fastness

Colorfastness to washing

Wash fastness of all dyed samples was measured by the ISO 3 testing method. Dyed samples were taken, stitched with one of the shorter side and was put to the bath containing 5gpl of soap, 3gpl of sodium carbonate and 1:50 MLR ratio at 60°C for 30 minutes. Then the specimen was washed with hot water and then it was dried. **(Figure 3a)**

Colorfastness to rubbing

Rubbing fastness of all dyed samples was measured by dry and wet rubbing method. The dyed sample was fastened to the flat base of the crock meter and we can take 5 cm×5 cm was mounted on the rubbing finger. Then the handle was rotated to ten complete turns at the rate of one turn per second to slide the covered finger back and forth twenty times..**(Figure 3b)**

Ultraviolet Test

In vitro UV-protection factor was determined on three samples (3 cm × 1 cm) cut from the centre of each fabric, dyed, dyed-mordant 1, dyed and washed, fixed in common slide frame and placed in a Jasco UV/VIS Spectrophotometer V-560, equipped with an integrating sphere to measure both direct and diffuse transmitted light. The sample was positioned at right angles to the light beams. Transmission measurements were made in the 250–400 nm range with a 1 nm step.

Antimicrobial Test

The antimicrobial efficacy of a compound will vary when it is present in solution and when it is held intimately by a textile substrate. In the next set of experiments the antimicrobial activity of dyed specimens was tested. The 1 inch^2 fabric (dyed and undyed) was introduced in the 100 mL nutrient broth inoculated with the desired microbe and incubated at 37 °C overnight (16 h).

Results and Discussion

Colour fastness to washing

Colour fastness to washing of *Pomegranate peel, Green tea leaves* and Treatment of Green tea Leaves dyed organic cotton fabric is shown in the Table. It is found that the dyed sample shows good colour fastness

Color Fastness to Washing	Change in Color	Staining
Pomegranate Peel	4	4
Green Tea Leaves	4	4
Tamarind shell	4	3

NOTE: 1-Very poor, 2-Poor, 3-Medium, 4-Good, 5-Excellent

Colour fastness to Rubbing

Colour fastness to rubbing of *Pomegranate peel ,Green tea leaves* and Treatment of Green Tea Leaves dyed organic cotton fabric is shown in Table. It is found that the dyed sample shows good colour fastness

Color Fastness to Rubbing	Dry	Wet
Pomegranate Peel	4	4
Green Tea Leaves	4	4
Tamarind shell	3	4

NOTE: 1-Very poor, 2-Poor, 3-Medium, 4-Good, 5-Excellent

Ultraviolet In-Vitro measurement

Transmittance spectra of dyed samples (Fig. 5) pointed out how drapery fabrics were characterized by low transmittance values that ranged between 3 and 14% at 296 nm and between 9 and 21% at 396 nm. On the contrary apparel fabrics showed higher transmittance values mainly at low wavelengths, with values ranging between 25 and 55% and 30 and 40% at 296 and 396 nm, respectively.

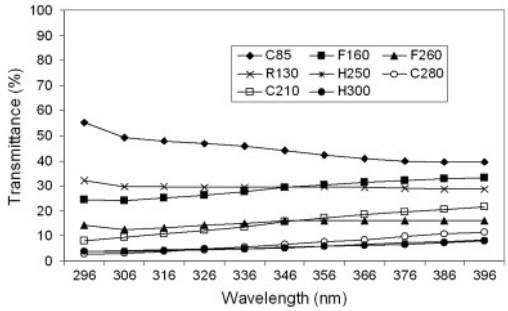

Figure 5: Wavelength of dyed samples

Antimicrobial activity of natural dyes

The effect of concentration of dye on antimicrobial activity was studied. The zone of inhibition (diameter) was recorded in each case. It was observed that increase in dye concentration leads to increased inhibition reflected by enhancement in diameter. It may be concluded that the dyes are highly effective antimicrobial agents as the MIC for most of these lies in region of 5–40 µg. The increase is much larger for *Quercus infectoria* than *Acacia catechu*. From the clear zone of inhibition obtained, it is apparent that the selected dyes are bactericidal in nature and not bacteriostatic.

Conclusion

Organic cotton fabric is an eco-friendly fabric that suits for children wear. Natural Organic cotton fabric dyed with pomegranate peel and green tea leaf extract are treated with tamarind shell powder. So, the natural dyed organic cotton fabric eliminates the harmful effects of the skin from allergies and rashes. It is found that the natural dyed organic cotton fabric shows good in color fastness to Washing, Rubbing and Ultraviolet and Antimicrobial.

References

- S.A.M. Hussein, H.H. Barakat, I. Merfort, M.A.M. Nawwar Tannins from the leaves of *Punica granatum* Photochemistry, 45 (1997), pp. 819-823
- L. Capjack, N. Kerr, S. Davis, R. Fedosejevs, K.L. Hatch, N.L. Marckee Protection of humans from ultraviolet radiation through the use of textiles: a review Family and Consumer Sciences Research Journal, 23 (1994), pp. 198-218
- P.C. Crews, S. Kachman, A.G. Beyer Influences on UVR transmission of dyed woven fabrics Textile Chemist and Colorist, 31 (1999), pp. 17-26
- K. Hoffmann, J. Laperre, A. Avermaete, P. Altmeyer, defined UV protection by apparel textiles Archives of Dermatology, 137 (2001), pp. 1089-1094
- R.P. Gallagher, T.K. Lee Adverse effects of ultraviolet radiation: a brief review Progress in Biophysics and Molecular Biology, 92 (2006), pp. 119-131
- T. Gambichler, J. Laperre, P. Altmeyer, K. Hoffmann UV-A and UV-B transmission of fabrics: critical wavelength based on absorbance and effective dose Exogenous Dermatology, 1 (2002), pp. 290-295
- Oger, B. (1996). "Fastness to Light and Washing of Direct Dyes for Cellulosic Textiles". Studies in Conservation. 41 (3): 129–135.
- ISO 105-B06, Textiles — Tests for colour fastness — Part B06: Colour fastness and ageing to artificial light at high temperatures: Xenon arc fading lamp test