

UTILISATION OF FRUITPEELS TO IMPROVE UV PROTECTIVE PROPERTIES OF KHADI COTTON FABRIC

DEEPTI PARGAI¹ & SHAHNAZ JAHAN²

¹Research Scholar, Department of Clothing and Textiles,

G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India

²Professor, Department of Clothing and Textiles,

G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India

ABSTRACT

Skin cancer, tanning of the skin, early sign of skin ageing and suppression of the immune system are being diagnosed as a harmful effect of UV radiation, hence the need for UV protection measures are on rise, to avoid harmful incidences of UV radiation. Fabric generally covers most of the part of the skin, so that it can provide protection against UV radiation, but there are several factors which affect the ability of a fabric to protect the skin from UV radiation. The majority of the fabric present in the market for clothing purpose, does not have sufficient ability to provide protection against the UV radiation. Hence there is a need to add UV protective properties to the fabric. Various synthetic, UV absorbers are available in the market, which are being used to increase the UV protective properties of the fabric, but the environmental pollution and toxicity of the water resources are becoming a major problem while using these synthetic absorbers. Therefore, the present study was aimed to find out an eco-friendly way, to make a fabric UV protective. In the present study, peels of different fruits were utilized to incorporate UV protection properties of the fabric. The extracts of fruit peels were applied to the cotton fabric, using the exhaust method. As a result, Good to very good UV protection properties were achieved. Hence, it can be concluded that, fruit peels have potential to be used as an UV protective finish, for the cotton fabric, which would not only protect the skin against harmful UV rays, but also help in utilizing the waste of fruits in a productive term.

KEYWORDS: Exhaust Method, UV Absorbers, UV Index, UV Protective Finish, UV Radiation, UPF

INTRODUCTION

Sun plays an important role in many life giving activities, like photosynthesis in plants and also helps in the synthesis of vitamin D in human beings. Within these sun rays, there is in invisible Ultraviolet (UV) radiation which cannot be felt. It has been confirmed by various scientists and dermatologists that, various skin problems like tanning of the skin, early signs of skin ageing and skin cancer are being diagnosed, due to over exposure to UV radiation. A report released by **WHO, in 2006** has concluded that, Globally, excessive solar UVR exposure caused the loss of approximately 1.5 million DALYs (0.1% of the total global burden of disease) and 60,000 premature deaths in the year 2000. A tool, i.e. UV index has been developed by the combined effort of various organizations, with the collaboration of the World health organization to estimate how much damage can be caused by the UV radiation. High UV Index means, high risk of damage from the sun rays. It ranges from 2 to 11+. Minimum UV Index ranges i.e., two indicates negligible or low risk,

but 11+ indicates a very high risk. The UV index range has also been categorized by Indian Institute of Tropical meteorology (IITM) of India, for Indians (**Table-1**).

Table 1: UV Index and Associated Risk Level (Source: ESSO-IITM)

UV index range	Risk Level	Health Advisory
1-4	No Risk	No health risk to General public
3 to 5	Low Risk	Little risk of harm from unprotected sun exposure. It is advisable to use UV-protective accessories for sensitive people, general public less likely to be affected.
6 to 9	Medium Risk	Sensitive people are at medium risk of harm from direct exposure to sun. It is advisable to use UV-protective accessories by general public as well.
>10	High Risk	All people are at high risk of harm. It is advisable to avoid direct sun exposure.

IITM has reported that, high UV Index is being recorded in many cities of India like Delhi, Pune, Hyderabad, Chennai etc. The avoidance of sun rays cannot be possible by so many people, so there should be such kind of protective measures, that can provide protection against the harmful effect of UV radiation. Sunscreen is available in the market to avoid the harmful effect of UV rays, but have some limitations. Therefore, clothing which covers the skin can become a good choice, for providing protection against UV rays. As the SPF (Sun protection factor) is used to determine the UV protective ability of a sunscreen, similarly the UPF (Ultraviolet Protection Factor) is commonly used to measure the UV protection ability of a fabric, which implies how much a fabric can give protection from the UV rays. Fabric as such may not be able to provide effective protection and should be treated with UV blocking agents, to ensure that the fabric deflect the harmful UV rays. Several UV blocking agents are being developed, to improve the UV protective ability of the fabric, but environmental problems are also being caused by using these absorbers. Hence, there is a need to find an eco-friendly way, to improve the UV protective properties of the fabric.

By-products and peels wastes from fruit and juice industry, are being produced in large amount which represents a serious threat; as they exert an effect on environment. Peels are generally considered as the principal waste part, which represents around fifty percent of the fruit mass. According to *Zavala et al. (2010)*, fruit industry waste like peels and seeds contain a large amount of phenolic compounds, while *Rudra et al. 2015* reviewed that, the fruit peels have more phenolic compounds as compare to the pulp and juice part. It has also been reported that, phenolic compounds can act as UV absorbers, which signifies that, these have potential to act as UV absorbers. Hence, considering all the above points, it is needed to find out a measure that can not only provide protection against harmful UV rays, but also help in minimizing the other environmental problems such as accumulation of waste and toxicity of synthetic UV absorbers. Considering all above points, extract of fruit peels was applied to the cotton fabric samples, to improve the UV protection properties of the fabric so that, it can protect the human skin from the damage caused by UV radiation.

MATERIAL AND METHODS

The khadi cotton fabric was procured from the Gandhi ashram, Pantnagar, Uttarakhand, for the present study. To ensure complete wetting and uniform absorbency of the peel extract and bleached khadi cotton fabric was subjected to scouring at 100⁰ C, for 60 minutes with 2 gpl detergent. M: L ratio was maintained as 1:50.

The peels were collected from juice corners. The details of collecting fruit peels are given in the **Table No. 2**. The collected peels were washed properly to remove dirt and other particles. The washed fruits peels were dried in shade. After drying, the peels were grinded using mortar-pestle and a domestic electric grinder.

The applications of extract of peels on fabric were done through exhaustion method, using water bath. Extraction of each fruit peel powder was carried out by taking 2 % of raw material with 1:50, M: L ratio, in distilled water at neutral pH and kept in separate beakers of water bath at 40° C for 30 minutes. The material to liquor ratio was maintained by adding distilled water, during an extraction time. After extraction, the solutions were filtered using filter paper. Cotton fabric samples were dipped in the filtered solutions of the extract for 30 minutes, at 40° C in separate beakers. These samples were then allowed to cool at room temperature, taken out of water bath, rinsed thoroughly in water and dried in shade. After preparing the samples the UPF testing was done.

Table 2: List of Fruits Peels Used in the Study

S. No.	Common Name / Hindi Name	English Name	Scientific Name
1	<i>Mosambi</i>	Sweet lime	<i>Citrus limmetta</i>
2	<i>Singhada</i>	Water caltrop	<i>Trapa natans</i>
3	<i>Kela</i>	Banana	<i>Musa</i>
4	<i>Seb</i>	Apple	<i>Malus domestica</i>
5	<i>Nimbu</i>	Lemon	<i>Citrus × limon</i>
6	<i>Santra</i>	Orange	<i>Citrus × sinensis</i>

UPF of the treated experimental fabric samples were determined by using **Lab sphere's UV transmittance Analyser**, at the **NITRA (Northern Institute of Textile Research Association)**, Ghaziabad, India. This instrument is based on the transmittance principle. The UV protection category was determined by the UPF values, described by Australian Standards / New Zealand AS/NZS 4399 (1996), given in **Table No. 3**.

Table 3: UPF Classification system Source: Australian Standards / New Zealand AS/NZS 4399 (1996)

UPF Range	UVR Protection Category	UPF Ratings
15 – 24	Good protection	15, 20
25 – 39	Very good protection	25, 30, 35
40 - 50, 50+	Excellent protection	40, 45, 50, 50+

RESULTS AND DISCUSSIONS

The results of UPF rating of khadi cotton fabric, treated with extracts of different fruit peels are presented in the **Table No. 4**. It is clear from the **Table No. 4** that, the UPF value of untreated khadi cotton fabric sample was found to be 9.9 which signify that the fabric did not possess any UV protection property. The UPF rating of fabric sample, treated with *lemon peel* extract was found to be highest i.e. 35.9 (Very good UV protection category), followed by UPF rating of fabric sample treated with *water caltrop* peel's extracts, which also showed **very good range** of protection with the UPF value of 30.9. The UPF of the fabric samples, treated with *citrus limetta* was also observed in the **very good range** of UV protection category. Whereas, the UPF of the fabric samples treated with an extract of the peels of banana, apple and orange was found to be 16.6, 24.3 and 21.2 respectively, which was observed in the **good range** of the UV protection category. It can be inferred from the results that, UPF rating of the cotton fabric sample was found to be improved after application of fruits peel's extracts. However, the fabric samples that have more UPF was found in the category of very good range, which will provide the protection against UV radiation for a longer time, when compared to the fabric samples that were observed in the good range.

Table 4: UPF of Khadi Cotton Fabric Treated with Extract of Fruits Peels

S. No.	Treated Cotton Fabric Samples	Ultra-Violet Protection Factor (UPF)	Uv Protection Category
1	Untreated fabric sample	9.9	Unprotected
2	Sweet lime peelstreated fabric	30.5*	Very good
3	Water caltrop peels treatedfabric	30.9	Very good
4	Banana peels treatedfabric	16.6	Good
5	Apple peels treatedfabric	24.3	Good
6	Lemon peels treatedfabric	35.9*	Very good
7	Orange peels finished fabric	21.2	Good

CONCLUSIONS

As the need for protection against UV rays has been increased in this era of climate change, it can be concluded from the present study that, the peels of fruits have the potential to enhance the UV protection properties of the fabric, which can protect the human skin against the harmful UV rays. An eco-friendly UV protective finish for fabric can be developed from the extract of the fruit peels.

REFERENCES

1. Zavala J.F; Dominguez, C.R; Vega. and Aguilar, G.; 2010. Antioxidant Enrichment and Antimicrobial Protection of Fresh-Cut Fruits Using Their Own Byproducts: Looking for Integral Exploitation. *J Food Sci.* 75 (8): 175–181. DOI: 10.1111/j. 1750-3841.2010.01792. x
2. Rudra, S. G.; Jyoti, N.; Jakhar, N. and Kaur, C. 2015. Food Industry Waste: Mine of Nutraceuticals. *International Journal of Science, Environment and Technology*, 4 (1): 205 – 229
3. Ministry of Earth Science. Government of India. 2015. Retrieved from http://www.moes.gov.in/writereaddata/files/LS_US_1738_9122015.pdf
4. World health organization (WHO). 2006. Retrieved from <http://www.who.int/mediacentre/news/notes/2006/np16/en/>