

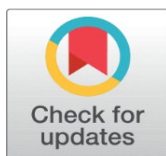
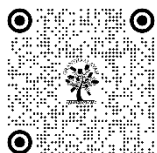
DESIGNING OF UV PROTECTIVE CLOTHING FOR KIDS

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ABSTRACT

The most secure protection against ultraviolet (UV) radiation exposure is offered by textiles, such as different kinds of apparel, caps, and umbrellas. Clothing is the most effective way to protect against UV radiation (UVR) exposure. Different fabrics have different levels of dyeing with natural, synthetic or artificial fibres depending on their properties. While reviewing, the researcher found that some natural dyes are in appealing colours which have UV-protective properties and obtained excellent results. The creation of these natural colours was done by utilizing fruit peel, plant-based dyes, vegetable dyes, dry fruits, and pulses. Other researchers investigated these natural hues. Researcher is utilizing these findings to create UV-protective clothing by using a wide range of natural colours. There are several companies in the market which provide UV protective clothing using artificial colours but they don't use any designing element for kids wear. Skin of kids is more delicate; therefore, they require special attention and protection from the sun. The objective of this study is to produce designer and protective clothing with natural dye that have the necessary UV protection. Five different tie-dye techniques were used in this study to develop clothing that protects young girls from UV rays. By examining their structural, aesthetic, and functional aspects, it was determined that protective clothing designs were accepted by the mothers and their caretakers.

Keywords: Natural Dye, Tanning, UPF, UV Protective Clothing

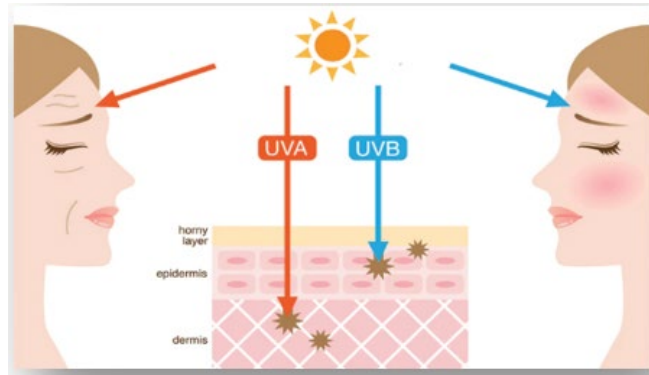
1. INTRODUCTION

It is well known that long-term and acute damage to the skin, eyes, and immune system can result from excessive UV light exposure [Grifoni et al. \(2011\)](#) Reducing their exposure to UV light is essential to avoiding these dangers to their health. [Feng et al. \(2007\)](#)

2. UV RADIATION

The three primary types of electromagnetic radiation are ultraviolet (UV), visible light (VIS), and infrared (IR). Heat is one aspect of infrared radiation that is

not visible to the naked eye. VIS is the wavelength range of general illumination. [Bashari et al. \(2019\)](#)



UV radiation is split into **three** distinct bands:

- 1) UVA (320–400 nm)
- 2) UVB (280–320 nm)
- 3) UVC (200–280 nm)

In decreasing wavelength and increasing energy order. Varying UV light wavelengths and energies are associated with different impacts on biological tissue. [Bashari et al. \(2019\)](#)

2.1. ULTRAVIOLET A RADIATION

Due to its longer wavelength than UVB, UVA is less affected by weather and altitude. UVA can penetrate skin more deeply than UVB and does not react with window glass. Calculations show that 50% of UVA exposure takes place in the shadow. It is less effective than UVB at causing erythema but more successful at causing both immediate and delayed tanning, as well as pigment darkening. [Korać & Khambholja \(2011\)](#) It is well recognized that UVA radiation can cause serious side effects such as skin cancer, photoaging, immunosuppression, and eye damage. [Khan et al. \(2020\)](#).

2.2. ULTRAVIOLET B RADIATION

There are several factors that affect how much solar UVB and UVA reach the earth's surface, such as latitude, altitude, season, time of day, cloud cover, and the ozone layer. The highest altitudes and the equator are exposed to the most radiation. [Khan et al. \(2020\)](#) The ratio of UVA to UVB on Earth's surface is 20:1. The peak hours for UV radiation are from 10 a.m. to 4 p.m. 96.5% of the UV spectrum that reaches the earth's surface during the summer is UVA, while 3.5% is UVB. [Korać & Khambholja \(2011\)](#) UVB is mostly linked to sunburn and erythema. Both photo carcinogenesis and immunosuppression could result from it. [Khan et al. \(2006\)](#)

2.3. ULTRAVIOLET C RADIATION

Although UVC has the largest energy content and the greatest potential to cause biological harm, it appears to have little biological impact and is unrelated to sun exposure for humans. [Feng et al. \(2007\)](#) This is a result of the ozone layer's effective UVC filter. [Hou et al. \(2013\)](#)

The safest protection comes from textiles, which include various clothes, headgear-like caps, shade structures like awnings and umbrellas, and newborn carrier coverings. Even though some solar radiation still passes through the fabric more readily due to multiple scatterings, lighter colors reflect solar radiation more effectively than darker ones. [Khan et al. \(2020\)](#) The composition of the fabric greatly affects the degree of UV protection because different fiber types have varying capacities to absorb radiation. Recent research indicates that synthetic textiles like polyester offer superior UV protection, but they are uncomfortable to wear in warm weather because they reject water and retain heat [Bashari et al. \(2019\)](#).

Natural fibers are most frequently used in lighter products like summer clothing and caps and in heavier materials like draperies and shade structures. The overwhelming majority of studies on the UV-blocking properties of natural fibers have been on cotton and Khadi fabrics. The UV protection properties of natural colors paired with natural materials have not been the subject of numerous investigations. [Bashari et al. \(2019\)](#) Considering that some natural dyes are naturally antimicrobial and that the use of non-toxic, non-allergic, and environmentally beneficial natural dyes on textiles has become more and more popular as a result of growing environmental awareness, removing the need for artificial colouring. [Grifoni et al. \(2011\)](#)

It is important to acquire further knowledge regarding the UV-protective functional properties of numerous natural colors. We created UV-protective clothing for kids using natural dyes due to this combination—natural fabrics and the UV protection qualities of natural dyes. [Pargai et al. \(2020\)](#). It's a perfect fusion of design and textiles. [Grifoni et al. \(2011\)](#)

UV protection properties of natural dyes + Natural Fabric + Designing of garments = **Designing UV-protective clothes using natural dyes for kids wear**

[Rather et al. \(2021\)](#) showed that bio-mordanted samples exhibited a higher level of UV protection. These results could be explained by the kind and degree of interactions that exist between the wool, dye, and mordant. The use of metal salts and other bio mordants may affect colorimetric data, improve wash fastness, and produce stunning tints with distinctive tones and hues. Additionally, the study noted that the procedure of dyeing wool cloth treated with leftover peanut skins improved UV protection and had great antibacterial ability against harmful strains. According to the author, this dyeing method has further used in anti-UV and might be a viable substitute for waste management. [Li et al. \(2023\)](#)

[Pargai et al. \(2020\)](#) found all the functional characteristics of natural dyes to offer fabrics antibacterial, UV protection, insect repellent, and other properties. These characteristics can shield individuals from UV rays, germs, microbes, and other hazardous insects, among other negative environmental consequences. This research will specifically look at the origins of these functional characteristics and talk about the approaches that are currently being used to investigate these characteristics of natural dyes. The author claims that studies on the potential health benefits of natural dyes have been conducted and that these colors are environmentally friendly and biodegradable. Knowing the right interactions between cloth, natural dye, and mordant can help overcome this stability-related issue and improve the performance of natural dyes in the future. There are several methods that may be used to increase the endurance of the functional properties of dyes, such as microencapsulation and surface modification (plasma treatment, UV irradiation, etc.). Additionally, this would lead to a more stable, functioning property. It's also important to fix issues with the extraction and application of natural colors. According to the author, understanding the complete life cycle of













natural colors requires knowledge from other scientific fields. To get results that are more noteworthy in terms of color and practical aspects, teamwork is thus required.







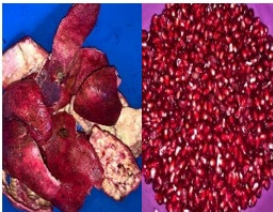



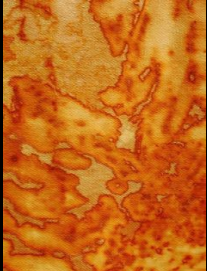




According to Pargai & Sharma (2017), fruit peels have the potential to be utilized as a UV protective finish for cotton garments. This would help make good use of fruit waste while simultaneously shielding the skin from harmful UV radiation. **Rungruangkitkrai et al. (2020)**



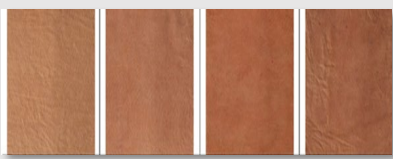
In the present work, **Salah et al. (2013)** investigated the alkaline peel fractions as a UV protective agent, dye, and multifunctional antibacterial on the cotton substrate. The results collected demonstrated that mercerized textiles exhibited superior UV protection, high dye absorption, and outstanding antibacterial activity when compared to control and unmercerized cotton fabrics. This is due to the fibers' enlargement producing a greater dye absorption, which lowers the intermediate layer and, consequently, the UV transmittance. **Das (2010)**

Globally, the method of dyeing textiles with natural dyes is growing in popularity. This is because artificial colouring can result in allergic reactions and other negative effects, which is why many nations have environmental regulations in place. **Pargai et al. (2020)** In addition to being safe, non-toxic, and biodegradable, natural dyes provide extraordinarily elegant and smooth colors. Metal salts can be used as a mordant to improve the fastness of natural dyed fabrics, which are usually not very effective. **Sarkar (2004)**

After examining, the following natural dyes have the ability to protect us from UV rays:

S. No	Name of natural dye	Picture	Sample	Colour
1.	Madder			 Gives Shades of Orange
2.	Walnut			 Gives Shades of Brown
3.	Indigo			 Gives Shades of Indigo Blue
4.	Myrobolan			 Gives shades of Yellow

5.	Peanut Skin			
6.	Onion Skin			
7.	Pomegranate			
				Gives Shades of Pink
8.	Orange peel			
				Gives Shades of Orange
9.	Black Rice Pigment			
				Gives Shades of grey & Black

S. No	Designs	Natural Dye	Features/Stylelines
1.		Walnut and peanut skin Natural dye was used to create a design of UV protective clothing with a tie and dye technique for kids to wear.  	A designer top with corset is embellished with tie-neck collar, is paired with gauchon pants is also embellished with buttons and pockets.

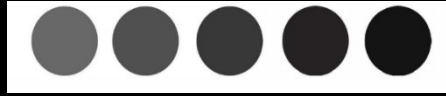
Designing of UV Protective Clothing for Kids

2.



Black rice pigment of Natural dye was used to create a design of UV protective clothing with a tie and dye technique for kids to wear.

An illusion round neckline dress is adorned with flounce and knot belt.

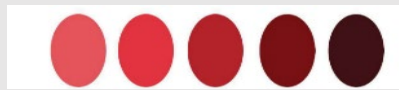


3.



Madder & Orange peel Natural dye was used to create a design of UV protective clothing with a tie and dye technique for kids to wear.

A sweetheart neckline top with virago sleeves, is paired with high-waisted pant.



4.



Indigo Natural dye was used to create a design of UV protective clothing with a tie and dye technique for kids to wear.

A dangree outfit is adorned with patch work and side pockets



5.



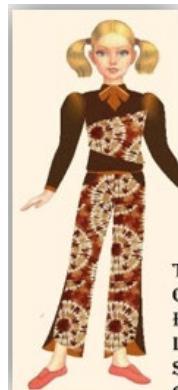
Madder & black rice pigment Natural dye was used to create a design of UV protective clothing with a tie and dye technique for kids to wear.

A designer top with jacket which have notched collar and horizontal yoke, is paired with frilled skirt.



Design 1				
S. No	Ranking	%Percentage	Respondents	Rank
1.	Excellent	40%	22	1 st
2.	Very Good	29.1%	16	-
3.	Good	21.8%	12	-
4.	Average	9.1%	5	-
5.	Poor	-	-	-
Design 2				
6.	Excellent	16.4%	9	-
7.	Very Good	34.5%	19	2 nd
8.	Good	27.2%	15	-
9.	Average	10.9%	6	-
10.	Poor	10.9%	6	-
Design 3				
11.	Excellent	14.5%	8	-
12.	Very Good	21.8%	12	-
13.	Good	32.7%	18	3 rd
14.	Average	20%	11	-
15.	Poor	10.9%	6	-
Design 4				
16.	Excellent	34.5%	19	-
17.	Very Good	16.4%	9	-
18.	Good	25.5%	14	-
19.	Average	16.4%	9	4 th
20.	Poor	7.3%	4	-
Design 5				
21.	Excellent	32.7%	18	-
22.	Very Good	16.4%	9	-
23.	Good	20%	11	-
24.	Average	10.9%	6	-
25.	Poor	20%	11	5 th

It was found that design No. 1 ranked first because of the natural dye colour used to give UV protection. The designer look is more appealing. The colour combination and tie-and-dye technique were appreciated by respondents. Even gives a protective or trendy look in a discrete manner.



It was found that design No. 2 ranked in the 2nd position because of the natural dye and tie and dye effect, which was used in a contrasting way. The casual look of the design is appreciated by respondents.



- Certain specifications, such as color, silhouette, design features, and overall appearance, should be included in these illustrations.
- In the same way, additional variables that may be examined include protection and comfort.
- Based on the review, researchers discover a wide range of natural color dyes for the procedure of dying. With the help of these dyes, researchers discover very good and great UPF testing results on cotton and khadi fabric.
- Within this article, Kid's products will be developed with a range of fashion components to finish their designer appearance.

3. CONCLUSION

The current study comes to the conclusion that khadi and cotton fabrics' UV protection is improved by adding natural dyes. In addition to offering UV protection, incorporating waste (plants, fruits, vegetables, and pulses) into cotton fabric would sustainably maintain the environment. The goal of the project is to develop environmentally sustainable, kid-friendly UV protection clothing. The purpose of this research is to give society a UV protection fabric that is practical and completely trustworthy—something that secures mom's desire. It might be difficult for mothers to choose products that are less hazardous for kids. Products for kids will be created as part of this paper, utilizing a variety of fashion elements to complete their look. Further research has been extended to create ethnic or western collections for girls; more study has been done.

4. FINDINGS

- Designing UV-protective clothes using natural dyes for kids to wear.
- Researchers researched the UV protection properties of naturally dyed textiles.
- If the cover factor allowed, fabric provided excellent UV protection after just dying.

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