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Application of onion peel extract on protein and cellulosic Fibers: A comparative study

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Abstract
The aqueous medium was used to extract the dye from the dry outer skins of onions and used for dyeing of wool (protein fibre) and cotton (cellulosic fibre) fabric samples in neutral and acidic/alkaline medium. Wool was dyed in acidic medium whereas cotton was dyed in alkaline medium. Pre mordanting with natural and chemical mordants was done at room temperature. It was found that wool dyed samples gave the better results in terms of the effect of different mordants, dye absorption, brightness and colour variation. On the other hand, cotton gave dull pastel shades. Also, wool samples showed good to excellent colour fastness properties against washing, perspiration, crocking and light fastness as compared to cotton samples. Finally, on comparing between dyeing of wool and cotton with onion peel extract, it was derived that wool had better substantivity towards onion peel extract as compared to cotton.

Keywords: aqueous medium, outer skins of onions, substantivity

1. Introduction
Natural dyes are known for their use in colouring of food substrate, leather as well as natural protein fibres like wool, silk and cellulosic fibres like cotton as major areas of application since pre-historic times. Natural dyes comprise of those colorants that are obtained from animal or vegetable matter with chemical processing [5]. Although, synthetic dyes are less expensive, easy to use and produced in greater variety of shades [13], the use of non-allergic, non-toxic and ecofriendly natural dyes on textiles has become a matter of significant importance due to the increased environmental awareness in order to avoid some hazardous synthetic dyes [12].

In this study a comparison was made between the dyeing of a pre mordanted protein fibre (i.e., wool) and a cellulosic fibre (i.e. cotton) with onion peel extract with respect to the visual appearance of the shades obtained and their colour fastness properties with different mordants.

2. Methodology and Materials
Dry onion peel was used as a source of dye. Cotton and wool fabric samples were used as a substrate on which dyeing was Done. Sodium carbonate and acetic acid were used to maintain the pH of dye bath. Both natural (*Hared*, *Super*, Eucalyptus) and chemical ($CuSO_4$, $FeSO_4$) mordants were used. Wash fastness tester, Light fastness tester, Crock meter and Perspirometer were used to assess the colour fastness properties of the dyed samples.

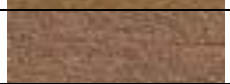
Dye extraction was carried out in neutral medium at pH 7. 10g of dry onion peel was added to 500ml of water. The liquor was kept at 100° C for 1 hour. Extracted dye was sieved through nylon cloth and some amount of water was added to maintain the volume of the extracted dye solution to 500ml. The colour of the extract was reddish brown. The sieved dye was used for dyeing of wool and cotton in neutral and acidic/alkaline medium. The dye bath was prepared as per MLR (for wool = 1:40 MLR, for cotton = 1:50 MLR)

With 1/2 volume of water and 1/2 volume of the extracted dye solution. Mordanting was done at room temperature for 1 hour and MLR was kept same as for dyeing.

3. Results and Discussion

Table1: Pre mordanting on wool and cotton samples dyed in neutral and acidic/alkaline medium

Mordants	Medium of dyeing	Shades of wool	Medium of dyeing	Shades of cotton
Super	Neutral		Neutral	
	Acidic		Alkaline	
Hared	Neutral		Neutral	
	Acidic		Alkaline	
Eucalyptus	Neutral		Neutral	

	Acidic		Alkaline	
$Cuso_4$	Neutral		Neutral	
	Acidic		Alkaline	
$FeSO_4$	Neutral		Neutral	
	Acidic		Alkaline	

Comparison between the visual assessment of wool and cotton

From the table 1, it can be concluded that protein fibre (wool) showed better results as compared to cellulosic fibre (cotton). Wool showed better results in terms of shade variation obtained with different mordants, dye absorption and brightness of colour. On the other hand, cotton did not show much colour variation and dull, pastel shades were obtained which means that they had poor colour absorption with respect to Onion Peel Extract.

Comparison between the wash fastness of wool and cotton

Results indicate that, in general the wash fastness was marginally lower for cotton samples (rated between 3 and 4) as compared to the wool samples which were rated between 4 and 5 as shown in table 2(a) – 2(d).

Comparison between the perspiration fastness of wool and cotton

In general, the perspiration fastness of both wool and cotton was observed almost similar with gray scale rating between 4 and 5 as shown in table 2(a) – 2(d).

Comparison between the crock fastness of wool and cotton

Results indicate that, in general the crock fastness of wool was observed comparatively better with gray scale rating between 4 and 5. On the other hand, for cotton, crock fastness was slightly less and the samples were rated between 3 and 5 as shown in table 2(a) – 2(d).

Comparison between the light fastness of wool and cotton

Results indicate that, in general the light fastness was marginally lower for cotton samples (rated between 4 and 6) as compared to the wool samples. The light fastness of wool was observed with blue wool rating ranged from 6 – 7 as shown in table 2(a) – 2(d).

Table 2(a): Fastness ratings of pre mordanted wool samples dyed in neutral medium

Mordants	Wash Fastness			Alkaline Perspiration			Acidic Perspiration			Dry Crocking		Wet Crocking		Light Fast-ness
	CC	CS		CC	CS		CC	CS		CC	CS	CC	CS	
		C	W		C	W		C	W					
Supari	5	5	4/5	4/5	5	5	4/5	4/5	4/5	5	4/5	5	4/5	7
Harad	5	4/5	4/5	5	5	4/5	4/5	5	5	4/5	4/5	4/5	4	7
Eucalyptus	5	5	4/5	4/5	5	5	4/5	5	5	5	5	5	5	6
$CuSO_4$	5	5	4/5	4/5	5	5	5	5	5	4/5	4	4/5	4	7
$FeSO_4$	5	4/5	4/5	5	5	5	5	5	5	5	4	4	4	6

CC = Colour Change, CS = Colour Staining, C = Staining of Cotton, W = Staining of Wool

Table 2(b): Fastness ratings of pre mordanted wool samples dyed in acidic medium

Mordants	Wash Fastness			Alkaline Perspiration			Acidic Perspiration			Dry Crocking		Wet Crocking		Light Fast-ness
	CC	CS		CC	CS		CC	CS		CC	CS	CC	CS	
		C	W		C	W		C	W					
Supari	5	5	5	4/5	5	4/5	5	4/5	4/5	5	4/5	5	4	7
Harad	5	5	5	5	5	4/5	5	5	4/5	5	4	5	4	7
Eucalyptus	5	5	5	4/5	5	5	5	5	4/5	5	4/5	5	4	7
$CuSO_4$	5	5	5	5	5	4	4/5	5	4/5	5	4	5	4	7
$FeSO_4$	5	5	4/5	4/5	5	4/5	4/5	5	5	4/5	4	4	3	6

CC = Colour Change, CS = Colour Staining, C = Staining of Cotton, W = Staining of Wool

Table 2(c): Fastness ratings of pre mordanted cotton samples dyed in neutral medium

Mordants	Wash Fastness			Alkaline Perspiration			Acidic Perspiration			Dry Crocking		Wet Crocking		Light Fast-ness
	CC	CS		CC	CS		CC	CS		CC	CS	CC	CS	
		C	W		C	W		C	W					
Supari	3	4/5	5	4	5	4/5	4/5	5	5	4/5	4/5	5	4	6
Harad	3	5	5	4/5	5	5	4	5	5	5	4/5	5	4	6
Eucalyptus	3/4	5	5	4/5	5	5	4/5	5	5	5	4/5	5	4/5	5
$CuSO_4$	3/4	5	5	4	4/5	4/5	4/5	5	4/5	5	4	4/5	4	6
$FeSO_4$	2/3	4/5	5	4/5	5	5	4/5	5	5	4/5	3	4	2/3	4

CC = Colour Change, CS = Colour Staining, C = Staining of Cotton, W = Staining of Wool

Table 2(d): Fastness ratings of pre mordanted cotton samples dyed in alkaline medium

Mordants	Wash Fastness			Alkaline Perspiration			Acidic Perspiration			Dry Crocking		Wet Crocking		Light Fast-ness
	CC	CS		CC	CS		CC	CS		CC	CS	CC	CS	
		C	W		C	W		C	W					
Supari	4	5	5	5	5	5	4	5	5	5	4/5	4/5	4	6
Harad	4	5	5	4/5	5	5	4/5	5	5	5	4/5	4/5	4/5	6
Eucalyptus	4	5	5	5	5	5	4	5	5	5	3/4	4/5	3/4	6
$CuSO_4$	3/4	5	5	5	5	5	4	5	5	5	3/4	4	3/4	6
$FeSO_4$	3	5	5	4/5	5	5	5	5	5	4/5	4	4	4	4

CC = Colour Change, CS = Colour Staining, C = Staining of Cotton, W= Staining of Wool

4. Conclusion

From the study it can be derived that although results of dyeing with onion peel extract is better for protein fibre (wool) as compared to cellulosic fibre (cotton), it can be used for both the categories as all the dyed samples revealed good fastness properties with respect to wash, perspiration, crocking and light. On visual assessment, it was found that almost all of the mordanted samples of wool exhibited a good and attractive general appearance. However, cotton gave dull pale and pastel shades. Thus, it can be concluded that onion peel extract can be used as a good source of natural dye for both protein and cellulosic fibres.

5. Reference

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