International Journal of Academic Research and Development
ISSN: 2455-4197, Impact Factor: RJIF 5.22
www.academicsjournal.com
Volume 2; Issue 3; May 2017; Page No. 121-123

Effect of chemical mordants on cellulosic fibres dyed with onion peel extract

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Abstract
The study was carried out to investigate the feasibility of chemical mordants on cellulosic fibres (i.e., cotton) dyed with onion peel extract which is an unconventional source of natural dye. The colour value of the dyed samples and also the colour fastness properties with respect to wash, perspiration, crock and light was assessed. The results showed that the dyed samples gave dull pastel shades. The cotton samples dyed in neutral medium exhibited more dye exhaustion and colour variation as compared to the samples dyed in alkaline medium. As far as colour fastness properties are concerned, all the dyed samples showed fairly good results.

Keywords: natural dye, neutral medium, pastel shades, onion peel, mordants

1. Introduction
Environment and human health considerations are becoming increasingly important especially in the textile front. Textile industry is characterized by the high consumption of resources like water, fuel and a variety of chemicals in a long process sequence that generates a significant amount of waste. The main environmental problems associated with textile industry are typically those associated with water body pollution caused by the discharge of untreated effluents. Natural dyes are considered to be ecologically safe and do not harm the environment. Natural dyes produce very uncommon, soothing and soft shades as compared to synthetic dyes. [3]. India is rich in natural wealth and there are ample scopes to explore and revive application of natural dyes on textiles, having more and more scientific knowledge base available. Though major emphasis is to modify or invent new synthetic dyes which are non-polluting or least polluting, the revival and use of natural dyes is also being looked into. The reason being, these dyes are least toxic, less polluting and most eco-friendly [7]. Therefore, to obtain newer shades with acceptable colour fastness behaviour and reproducible colour yield, appropriate scientific techniques need to be derived from scientific studies on dyeing methods, dyeing kinetics and compatibility of selective natural dyes. [6].
In the present study, dry outer skins of onions were used for colouring cotton fabric samples mordanted with chemical mordants. It was an effort to utilize the waste material in an efficient manner which could minimize the cost of dyeing. Evaluation of the dyed samples for their colour value and colour fastness properties was done and result was noticed.

2. Materials Used
Fabric: Cotton (GSM: 98, Thread Count: 83x70, Cambric, Plain Weave)

Dye: Dry Onion Peel was procured from the local vegetable market

Chemical: Sodium Carbonate

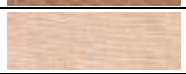
Mordants: Chemical Mordants ($CuSO_4$, $FeSO_4$, Pb $(CH_3COOH)_2$, $SnCl_2$)

Instruments: Launderometer, Perspirometer, Crockmeter and Light fastness tester

3. Methodology
The dye was extracted from onion peel in neutral medium. The samples were pre and post mordanted with chemical mordants. Dyeing was done in neutral and alkaline medium. For mordanting, samples were entered into the solution of mordant (10% owf) at room temperature for 1 hour. The dye bath was prepared with MLR of 1:50 with 1/2 volume of water and 1/2 volume of the extracted dye solution. The fabric was entered into the dye bath at temperature of 45° C. Then, the temperature was raised to 100°C in 30 minutes and maintained for half an hour. After dyeing samples were rinsed and dried. All the samples were evaluated for their colour values and colour fastness properties with respect to wash, perspiration, crock and light fastness.

4. Results & Discussion
4.1. Effect of mordanting methods and pH of dyeing on colour value of samples
In both pre and post mordanting methods, cotton samples dyed in neutral medium were darker than the samples dyed in alkaline medium as shown in table 1. This indicates that the dye exhaustion was more in neutral medium. On comparing pre and post mordanted cotton samples, it was observed that, on an average, post mordanted samples exhibited more dye exhaustion as compared to pre mordanted samples which is clearly evident from the table. In terms of colour variation, pre mordanted samples dyed in alkaline medium showed no colour variation whereas, in all the other cases, colour variation was noticed.

Table 1: Effect of chemical mordants on samples dyed in neutral and alkaline medium

Mordants	Medium of Dyeing	Shades Obtained on Pre Mordanting	Shades Obtained on Post Mordanting
$CuSO_4$	Neutral		
	Alkaline		
$FeSO_4$	Neutral		
	Alkaline		
$Pb(CH_3COOH)_2$	Neutral		
	Alkaline		
$SnCl_2$	Neutral		
	Alkaline		

4.2. Effect of mordanting methods and pH of dyeing on colour fastness of samples

Wash fastness

The pre and post mordanted samples dyed in alkaline medium had better wash fastness properties with grey scale rating ranging from 3 to 4 [tables 2(a) and 2(b)]. On an average, pre mordanted samples dyed in alkaline medium exhibited more colour fastness than all other samples.

Perspiration Fastness

The pre and post mordanted cotton samples dyed in both neutral and alkaline mediums had good to excellent perspiration fastness properties ranging from 4 to 5 as shown in table 2(a) and 2(b).

Crock Fastness

On an average, all the samples showed good to excellent fastness to crocking with gray scale rating between 4/5 and 5 as shown in table 2(a) and 2(b).

Light Fastness

Light fastness results of the cotton samples exhibited fairly good fastness properties under all application conditions. The light fastness or the blue wool rating of dyed cotton samples ranged from 4 – 6, which is clearly evident from the tables 2(a) and 2(b). On an average, all pre mordanted cotton samples dyed in alkaline medium exhibited best results and were rated as 6, except $FeSO_4$ which was rated as 4.

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

Mordants	Wash Fastness		Perspiration Fastness		Crock Fastness		Light Fastness	
	neutral	alkaline	neutral	alkaline	neutral	alkaline	neutral	alkaline
$CuSO_4$	3/4	¾	4/5	4	5	5	6	6
$FeSO_4$	2/3	3	4/5	5	4/5	4/5	4	4
$Pb(Ch_3COOH)_2$	2/3	¾	4/5	4	5	5	5	6
$SnCl_2$	2/3	¾	5	4/5	4/5	5	5	6

Table 2(b): Fastness ratings of post mordanted samples dyed in neutral and alkaline medium

Mordants	Wash Fastness		Perspiration Fastness		Crock Fastness		Light Fastness	
	neutral	alkaline	neutral	alkaline	neutral	alkaline	neutral	alkaline
$CuSO_4$	3/4	3	4	4	5	4/5	6	5
$FeSO_4$	2	3	4/5	4/5	4/5	4	4	4
$Pb(Ch_3COOH)_2$	3/4	3	4	4	4/5	4/5	4	4

5. Conclusion

From the study, it can be concluded that the use of unconventional sources for dyeing of textiles can make the dyeing process cheaper and eco-friendly. In the study, chemical mordants were used which resulted in providing the colour variation on dyeing the cotton with onion peel extract. It was an effort to utilize the waste material in an efficient manner which could minimize the cost of dyeing.

6. References

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