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Improving the Colour Fastness of the Selected Natural Dyes on Cotton (Improving the sunlight fastness and washfastness of the eucalyptus bark dye on cotton)

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Part-V

Abstract: *This paper reports the improving the colourfastness of the natural dye with dye fixing agents, extraction of the colourants from natural sources; effects of different mordants and mordanting methods; selection of fixing agents; dyeing variables; post-treatment process and analysis of colour improvement parameters with fixing agents for cotton dyed with natural dye; assessed colour improvement with colourfastness test.*
Key words: *Eucalyptus Bark natural dye, fixing agents, coloufastness, shade variations with dye fixing agents*

I. Introduction:

In India, dyes from natural sources have ancient history and can trace their route to antiquity. It is interesting to note that India is one of the few civilizations to perfect the art of fixing natural dye to the cloth. Indian textiles were greatly valued and sought after for their colours and enduring qualities. Like most ancient Indian arts and crafts, part of the knowledge and expertise of natural dyes has traditionally passed down from the master crafts man to his disciples. Even though scientists have paid considerable attention in the post independence period to study the plants in relation to their pharmaceutical use, very little attention was paid to study the plants as sources of dyes and colourants. The reason for this is perhaps the advent of synthetic dyes. . But no specific study was reported on improving the colour fastness property of natural dyes with dye fixing agents.

II. Materials and methods used in this study were given below:

In this article we review improving the colourfastness properties of natural dyes with 5 dye fixing agents. Eco-friendly mordants such as alum, stannous chloride and ferrous sulphate. Eucalyptus Bark dye was selected for the study as this source produce fugitive colours on cotton. A pre- treatment with myrobalan was given for better dye uptake. After dyeing the sample were post treated with 5 dye fixing agents such as alum, ammonia, lime juice and calcium chloride for better colourfastness of natural dyes on cotton.

The dye extraction and treating procedures were standardized based on the procedures suggested by AICRP-Home science (1997). The treatments were given to the cotton samples and evaluation of treated samples in terms of colour fastness to sun light , washing, crocking and perspiration before and after treatment was undertaken by following the standard procedures laid down by Bureau of Indian standard Test Series IS 768-1956 for colour change and is 769-1956 for staining using geometric grey scale. The results were analyzed based on the colour fastness of control samples to find out the impact of the treatments.

Alkaline method was suitable for extraction of dye from Eucalyptus Bark. The optimum time for extraction of dye liquor from the Bark 60 minutes. A dye material concentration of 4 percent (2g/g of fabric) was selected. The optimum time for dyeing was 45 minutes for both then dye. Cotton fabric was pre treated with 20 per cent myrobalan concentration. Increase the tannin deposition which intern increased the depth of the shade obtained.

To improve the colour fastness 5 per cent solution of fixing was selected. Based on absorption values, depth of the shade and appearance three concentrations for each mordant was selected. In case of alum 5, 10, and 15 per cent and 1, 2, and 3 per cent concentrations of stannous chloride and ferrous sulphate mordants for cotton were selected for pre mordanting cotton fabric. Evaluation of colourfastness of test fabrics with **t**wo colour fastness tests were carried out on cotton fabric to evaluate the colours obtained from Eucalyptus Bark and also assess improvement in colour of the fabric treated with fixing agents

The most common serviceable conditions such as the following were selected for evaluation of the colourfastness of fabrics.

III. Evaluation Of Colourfastness Tests:

3.1. Sunlight fastnesses of Eucalyptus Bark dye on cotton:

Table -1 Sunlight Fastness Properties Of Eucalyputs Bark Dye On Cotton

Dye percentage: 3% Mordants: Alum, stannous chloride, ferrous sulphate Extraction medium: alkaline alkali conc: 1g/100ml.
Dye Extraction Time: 60 min. Mordanting time: 30 min.
Dyeing time: 45 min.

Mordant	Mordant conc. G/100g of fabric	Fastness Grades					
		control	T1	T2	T3	T4	T5
Alum	5	6	7	8	7	7	7
	10	6	6	8	7	8	7
	15	6	7	8	7	8	7
Stannous Chloride	1	5	7	7	7	5	7
	2	6	7	7	6	6	7
	3	6	7	7	7	6	7
Ferrous Sulphate	1	5	7	6	8	7	7
	2	6	7	6	7	7	7
	3	6	8	7	7	7	8

Note: Vinegar (CH_3COOH), T2-Alum ($AlK(SO_4)_2$, T3-Ammonia (NH_3),T4- Lime juice,T5- Calcium Chloride ($CaCl_2$).

The sun light fastness of Eucalyptus Bark dye on cotton mordanted eco-friendly mordants and post-treated with various fixing agents.

Vinegar post-treated cottons showed improved sunlight fastness incase of all mordanted samples except 10 per cent alum mordanted samples over control. Incase of stannous chloride and ferrous sulphate mordants, the lowest concentration of mordant had contributed only good fastness to sunlight. Majority of the Eucalyptus **B**ark dyed cottons mordanted with alum, stannous chloride and ferrous sulphate cottons showed very good resistance to sunlight fastness.

Vinegar post-treated cottons showed improved sunlight fastness in case of mordanted samples except 10 per cent alum mordanted samples over control. Very good to out standing sunlight fastness was observed in these mordanted cottons. Alum, stannous chloride and ferrous sulphate mordanted cottons showed excellent resistance to sunlight fastness where as 10 per cent alum mordanted samples exhibited very good fastness to sunlight. Three per cent ferrous sulphate mordanted cottons displayed out standing sunlight fastness.

Alum post-treated cottons showed much improved sunlight fastness in majority of the mordanted samples when compared to control. Alum pre-mordanted and post-treated cottons attained out standing sunlight fastness. Excellent sunlight fastness was found in stannous chloride mordanted samples. Ferrous sulphate mordanted cottons showed very good to excellent resistance to sunlight.

Post-treatment with ammonia showed improvement in sunlight fastness in all mordanted samples over control. The fastness increased with the increase in mordant concentration. Stannous chloride mordanted cottons showed very good to excellent fastness to sunlight. Incase of 1 per cent ferrous sulphate mordanted samples; outstanding fastness to sunlight was observed.

The cream shades obtained by pre-mordanting cottons with various mordants and post-treatment with lime juice also registered improvement in sunlight fastness over the control. Incase of alum and ferrous sulphate mordanetd samples very good to out standing fastness in all mordanted samples was noticed. No colour change was observed in case of stannous chloride mordanted cottons. The fastness grades of stannous chloride ranged from good to very good resistance to sunlight. Ferrous sulphate mordanted samples exhibited excellent resistance to sunlight fastness. This was one of the treatments, which improved the sunlight fastness of alum mordanted samples besides brightening the shades.

Post-treatment with calcium chloride showed improvement in sunlight fastness in all mordanted cottons over control. Excellent understanding sunlight fastness was observed in all mordanted samples. Two per cent stannous chloride mordanted sample did not show any improvement. When compared to control, alum, stannous chloride and ferrous sulphate mordanted samples showed excellent resistance to sunlight fastness except 3 per cent of ferrous sulphate mordanted cotton. Three per cent ferrous sulphate mordanted sample exhibited out standing fastness to sunlight.

3.2 Wash fastnesses of Eucalyptus Bark dye on cotton:

Table-2 Wash Fastness Properties Of Eucalyputs Bark Dye On Cotton

Dye percentage: 3% Mordants: Alum, stannous chloride, ferrous sulphate Extraction medium: alkaline alkali conc. 1g/100ml.

Dye Extraction Time: 60 min. Mordanting time: 30 min.

Dyeing time: 45 min.

Mordant	Mordant conc. G/100g of fabric	Control			T1			T2			T3			T4			T5		
		CC	CS		CC	CS		CC	CS		CC	CS		CC			CC	CS	
			C	S		C	S		C	S		C	S	C		S		C	S
Alum	5	4	4	3/4	5	3	5	5	4	5	5	4	4	5	6	4	5	4	4
	10	4	3/4	3	5	3	5	5	3	3/4	5	4	4	5	6	4	5	4	4
	15	4	3/4	3	5	4	4	5	3	3/4	5	3	4	5	6	4	5	4	4
Stannous Chloride	1	4	4	3/4	5	4	5	5	4	5	5	4	5	5	6	4	4	4	3/4
	2	4	4	3	5	4	5	4	4	5	5	4	5	5	6	4	4	4	3/4
	3	4	4	3	5	4	5	5	4	5	5	4	5	5	6	4	4	4	3/4
Ferrous Sulphate	1	4	4	3/4	5	5	5	4	4	5	5	4	4	4	4	4	5	3	4
	2	4	3	3	5	4	5	4	4	5	5	4	5	4	4	4	5	3	4
	3	4	3	3	5	4	5	4	4	5	5	4	5	4	4	4	5	3	4

Note: Vinegar, CH3COOH), T2-Alum $AlK(SO_4)_2$, T3-Ammonia (NH_3),T4- Lime juice,T5- Calcium Chloride ($CaCl_2$).

Wash fastness of Eucalyptus Bark dye on cotton:

The wash fastness of Eucalyptus Bark dye on cotton mordanted with eco-friendly mordants and treated with various fixing agents.

The Eucalyptus **B**ark dyed control exhibited good resistance to colour change due to washing irrespective of the mordant used. The resistance to colour staining varies as per the mordant used. While alum mordanted cottons showed good to fair resistance to staining on cotton composite fabric, stannous chloride mordanted samples showed good resistance and ferrous sulphate mordanted samples exhibited fair to good resistance. All mordanted samples displayed fair resistance to staining on silk composite fabric. However, lower concentration of the mordant exhibited good resistance to staining on silk composite fabric.

Vinegar post-treated cottons exhibited excellent resistance to colour change due to washing, irrespective of the mordant used. However, the resistance to colour staining varied as per the mordant used. On cotton composite fabric, alum and stannous chloride mordanted cottons showed fair to good resistance to staining, while ferrous sulphate mordanted samples exhibited good to excellent resistance to staining on cotton. All most all mordanted samples exhibited excellent resistance to staining on silk composite fabric. When compared to control, post-treatment with vinegar had helped in improving the resistance to colour change due to washing. The resistance to staining on both cotton and silk composite fabrics were found to be improved.

Alum post-treated cottons showed good to excellent resistance colour change due to washing. Resistance to staining varied as per the mordant used. Alum and stannous chloride pre- mordanted samples exhibited excellent resistance to colour change due to washing. Good resistance to colour change was found in all ferrous sulphate mordanted samples. The resistance to colour staining was good on cotton composite fabric incase of stannous chloride and ferrous sulphate mordanted samples. Alum mordanted samples showed fair to good resistance to staining. All mordanted samples except 10 and 15 per cent stannous chloride mordanted samples exhibited excellent resistance to staining silk composite fabric. When compared to control, alum post-treated cottons registered improvement in resistance to colour change due to washing. The resistance to staining was also improved by post-treatment with alum in all mordanted samples.

Post-treatment with ammonia exhibited excellent resistance to colour change in all mordanted samples due to washing. Fair to good resistance to staining was found on cotton composite fabric and good to excellent resistance to staining was noticed on silk composite fabrics. Majority of the mordanted samples showed good to excellent resistance to staining on both cotton and silk composite fabric. When compared to control post-treatment with ammonia showed improved wash fastness of eucalyptus bark dye. Resistance to colour staining was also improved due to post-treatment with ammonia.

Post-treatment with lime juice had registered good to excellent resistance to colour change with absolutely no staining on both cotton and silk composite fabrics. Excellent resistance to colour change was found in case of alum and stannous chloride moradted samples with absolutely no staining on cotton composite fabric. Ferrous sulpahte moradnted cotton exhibited good resistance to colour change with good resistance to staining on cotton due to washing. All mordanted samples exhibited good resistance to staining on silk composite fabrics. When compared to control the wash fastness of eucalyptus bark dye on cotton was improved.

After post-treatment with calcium chloride, good to excellent resistance to colour change due to washing was observed in samples mordanted with various eco-friendly mordants and dyed in eucalyptus bark. Resistance to staining varied as per the mordant used. Excellent resistance to colour change was found both in alum and ferrous sulphate mordanted samples. Stannous chloride mordanted samples showed good resistance to colour change. Incase of alum and stannous chloride mordanted samples good resistance to staining was observed on cotton. Ferrous sulphate mordanted samples sowed fair resistance to staining on cotton composite fabric. Good resistance to staining was noticed on all silk composite fabrics. When compared to control, post-treatment with calcium chloride exhibited improved resistance to colour change due to washing with increased resistance to staining in all mordanted samples.

IV. Conclusion:

Among the mordanted Eucalyptus Bark dyed post-treated cottons, vinegar post-treatment had contributed in deepening the dye shade and leveled dyeing incase of alum and ferrous sulphate mordanted samples. It was found and suitable for stannous chloride mordanted samples. The sunlight fastness was improved in case of all mordanted samples over control. Improved resistance to colour change with increased resistance to staining on both cotton and silk composite fabric due to washing over control was noticed.

Alum post-treatment had contributed for even dyeing and increased in the depth of shade incase of stannous chloride and ferrous sulphate mordanted samples. Improved sunlight fastness was observed in majority of the mordanted samples over control. Improvement in wash fastness was registered in all mordanted samples. Ammonia post-treatment had not contributed for production of good shades in all mordanted samples. The sunlight fastness and wash fastness of all mordanted cottons improved.

Lime juice post-treatment had contributed for production of better shades in all mordanted samples with leveled dyeing. The sunlight fastness of alum and ferrous sulphate mordanted cottons improved and graded as very good to out standing. The fastness of eucalyptus bark dye improved over control.

Calcium chloride post-treated samples had not contributed for obtaining better shades but even dyeing was found in all mordanted samples. The sunlight fastness was improved in all mordanted cottons over control. Improved resistance to colour change due to washing was observed incase of alum and ferrous sulphate mordanted samples.

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