



A STUDY ON THE COLOR FASTNESS PROPERTIES OF DENIM FABRIC DYED WITH ECO – FRIENDLY DYES

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ABSTRACT: The main purpose of the study is to compare the colour fastness properties of Denim fabric dyed with three natural dyes namely Natural Indigo, Manjistha and Pomegranate Peel. The dye uptake was assessed in terms of general appearance, brilliance of colour, evenness of colour and texture by means of visual inspection. The colour fastness properties of the dye when subjected to laundering, pressing (dry and wet), crocking (dry and wet), and perspiration (acid and alkaline) were assessed and analysed using ANOVA method. From the analysis of the results, it was concluded that Pomegranate Peel dyed samples exhibited remarkable colour fastness properties followed by Natural Indigo dye and Manjistha dyed samples.

KEYWORDS: Laboratory Tests, Color Fastness Tests, Natural Dyes.

INTRODUCTION

Colour is one of the elements of nature that made the human living more aesthetic and fascinating in the world. Dyeing is one of the processes of decorating textiles with different dyestuffs either natural or synthetic. It is high time that we have to take the issue of natural dyes seriously. The role of synthetic dyes in polluting the environment and the reported carcinogenicity of certain diazo dyes make the synthetic dyes highly unpopular and poorly accepted. There is an urgent need to replace them now with the natural dyes.

OBJECTIVES OF THE STUDY

1. To dye the denim fabric with three natural dyes, extracted from Pomegranate Peels, Natural Indigo and Manjistha.
2. To study the general appearance, brilliance of colour, evenness of dye and texture by means of visual inspection for the three dyed fabrics.
3. To study the colourfastness properties of the dyed samples by subjecting them to laundering, pressing, crocking (dry and wet), perspiration (acid and alkaline).
4. To assess the significance of data using ANOVA test.

EXPERIMENTAL PROCEDURE

The main purpose of the study is to compare the colour fastness properties of denim fabric dyed with three natural dyes namely Manjistha, Pomegranate peel and Indigo. The dye uptake was assessed in terms of general appearance, brilliance of colour, evenness of colour and texture by means of visual inspection. Laboratory test were conducted to study the colour fastness properties after subjecting to laundering, pressing (dry and wet), crocking (dry and wet), sunlight and perspiration (acid and alkaline).

SELECTION OF FABRIC

100% denim fabric was selected for the study.

SELECTION OF DYE

Natural dyes extracted from Manjistha root and Pomegranate peel and Indigo were selected for the study.

PREPARATION OF THE FABRICS

The fabric required a very simple treatment to remove impurities and other superficial finishing agents present on them.

Soaping Treatment - One metre denim cloth was soaked in 5 litres of boiled water with 5g of soap powder for 2 hours. The cloth was then taken out, rinsed and dried at room temperature.

SELECTION OF MORDANTS AND MORDANTING METHODS

Myrobolan and Alum were selected as mordants with pre mordanting technique.

Myrobolan - The cloth was dipped in water, boiled with 100g of myrobolan and crushed well by hand for 10 minutes. Then the shade dried cloth was treated with alum solution.

Alum - The cloth was dipped in 25g alum solution and soaked for 15 minutes by rotating. The cloth was taken out, squeezed and stretched evenly and dyed.

EXTRACTION AND PREPARATION OF NATURAL DYE

The calculated amount of Manjistha root was soaked in water over night. The root was crushed and allowed to boil for an hour with temperature at 80°C. Then the residue was strained to obtain dye liquid. The same procedure was adopted to Natural Indigo and Pomegranate peel to obtain the dye liquid.

PREPARATION OF THE DYE

Weight of denim	100gms
The material to liquor ratio	1:30
Dye requirements	30 gms/ltr of Manjistha and 20gms of Natural Indigo and 50gms of Pomegranate Peel
Temperature	80°C
Duration	1hr

DYEING PROCEDURE

Cold water was added to make the filtered dye to 5 litres. The solution is heated. When the solution has reached the boiling point, the cloth treated with double mordant technique was dipped into the natural dye solution and was kept at boiling point for about 10 to 15 minutes. Then the cloth was taken out and rinsed well with cold water thoroughly, squeezed and dried in shade.

LABORATORY TESTS**PREPARATION OF THE TEST SAMPLES**

Colour Fastness to Laundering - Samples measuring 10" by 4" were taken for the test. A piece of white cotton material having the same dimension attached to the test specimen was used to find out the color transference. The samples were soaked in half teaspoon of "surf excel" soap powder dissolved in 500ml of water for 1 hour. They were then rinsed in cold water and dried at room temperature in the laboratory. The specimens were evaluated for color change and color transference using gray scale.

Colour Fastness to Pressing

Wet Pressing - The test specimens measuring 5" by 5" were cut from the dyed fabrics. The dyed test specimens were soaked in tap water and squeezed to retain 100% moisture. An un-dyed piece of white cotton fabric having the same dimension was then placed on the test specimen and ironed with a thermostatic iron for 30 seconds. They were examined for color change and color transference using gray scale.

Dry Pressing - The same procedure was followed but the specimens were not wet before being subjected to the tests. The specimens were examined for color change and color transference using gray scale.

Colour Fastness To Crocking - This test determines the color fastness of the dyed samples, to dry and wet crocking.

Dry Crocking - This test was done with the help of a device called Crock Meter. The test samples each measuring 20" by 4" were placed on the base of crock meter. A square white piece of cloth measuring 4" by 4" was mounted on the Crocker. Then, the Crocker was lowered on the dyed samples and 20 strokes were made. The specimens were examined for color change and color transference using gray scale.

Wet Crocking - For wet crocking, the white piece of cloth measuring 4"by 4" was thoroughly wet in distilled water and was mounted on the Crocker and the experiment was carried out in the same manner as that of the dry crocking test. The specimens were examined for color change and color transference using gray scale.

STATISTICAL ANALYSIS:

The results obtained were subjected to statistical analysis. The analysis was done using Analysis of Variance (ANOVA). The statistical significance was analysed by formulating a null hypothesis.

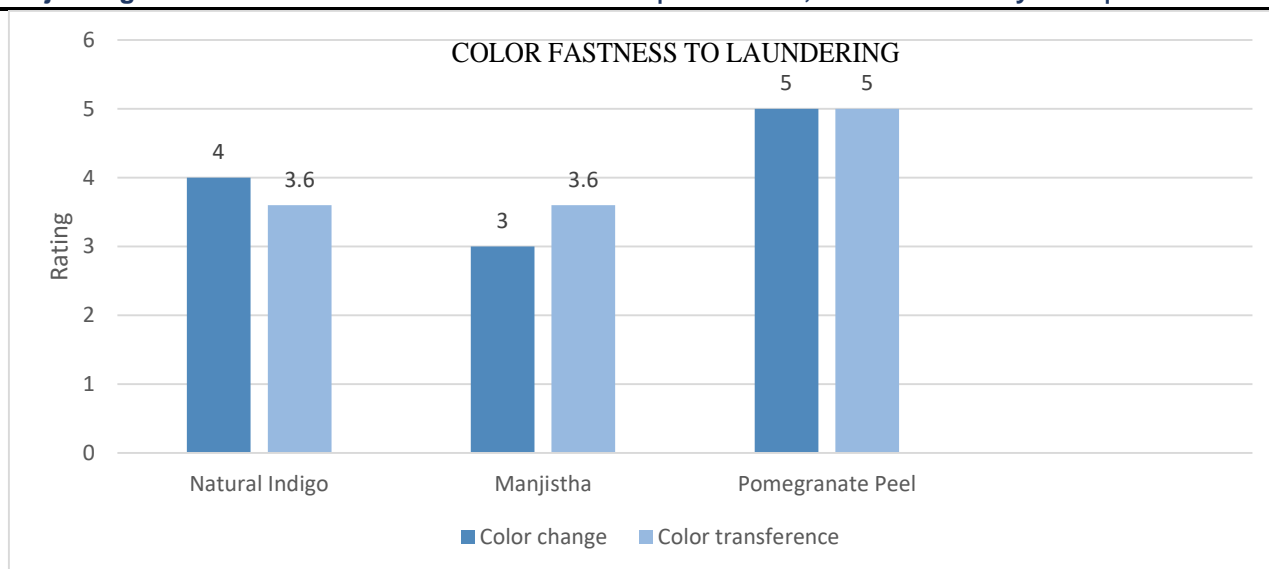
RESULTS AND DISCUSSION

COLOUR FASTNESS TO LAUNDERING

Colour Change - The mean value of colour change of the denim fabric dyed with Natural Indigo, Manjistha and Pomegranate Peel was found to be 4, 3 and 5 respectively, and was rated as “Very Good”, “Good” and “Excellent” for the three dyes. From the table it was clear that the denim fabric showed “Very Little”, “Little” and “negligible” rate of colour change when subjected to laundering.

Colour Transference - The mean value of colour transference of the denim fabric was found to be 3.6 was rated as “Good” for both Natural Indigo and Manjistha and 5 for Pomegranate Peel rated as “Excellent”. Hence “Little” and “negligible” rate of colour transference was observed for the dyed samples respectively.

DYES	LAUNDERING					
	COLOR CHANGE			COLOR TRANSFERENCE		
	Rating	'F' Value	'p' Value	Rating	'F' Value	'p' Value
Natural Indigo	4	2.25	0.41	3.6	0.6	0.0216837*
Manjistha	3	1.06	0.26	3.6	0.6	
Pomegranate Peel	5	3.18	0.44	5	1.4	



* Significant at 5% level

COLOUR TRANSFERENCE - The average ratings for colour transference of the denim fabric dyed with three natural dyes found to be 0.0216837.

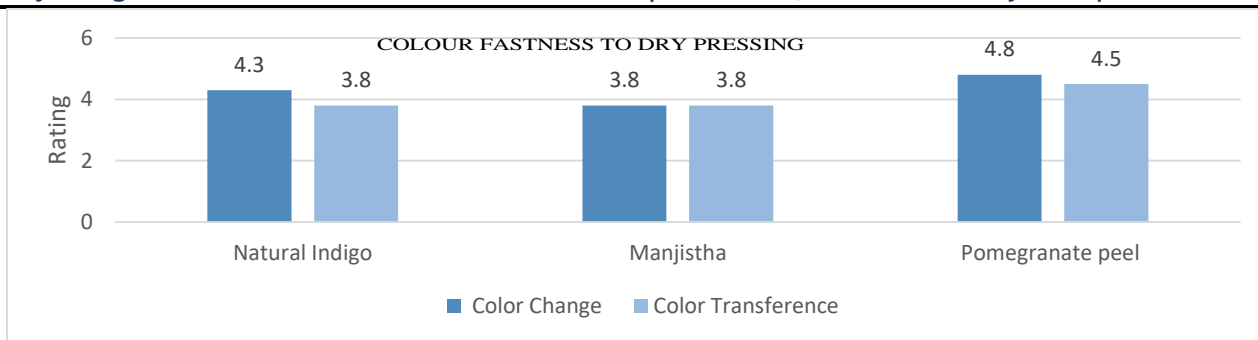
COLOUR FASTNESS TO PRESSING

COLOUR FASTNESS TO DRY PRESSING

Colour Change - The mean value of colour change of the denim fabric dyed with both Natural Indigo and Pomegranate Peel was found to be 4.3, 4.8 was rated as “Very Good” and 3.8 for Manjistha was rated as “Good” for the three dyes. From the table it was clear that the denim fabric showed “Very Little” and “Little” rate of colour change when subjected to pressing.

Colour Transference - The mean value of colour transference of the denim fabric was found to be 3.8 for both Natural Indigo and Manjistha was rated as “Good” and 4.5 for Pomegranate Peel rated as “Very Good”. Hence “Little” and “Very Little” rate of colour transference was observed for the dyed samples respectively.

DYES	DRY PRESSING					
	COLOR CHANGE			COLOR TRANSFERENCE		
	Rating	‘F’ Value	‘p’ Value	Rating	‘F’ Value	‘p’ Value
Natural Indigo	4.3	1.21	0.41	3.8	1.06	0.001**
Manjistha	3.8	1.08	0.26	3.8	1.06	
Pomegranate Peel	4.8	2.25	0.44	4.5	3.13.	



** Significant at 1% level

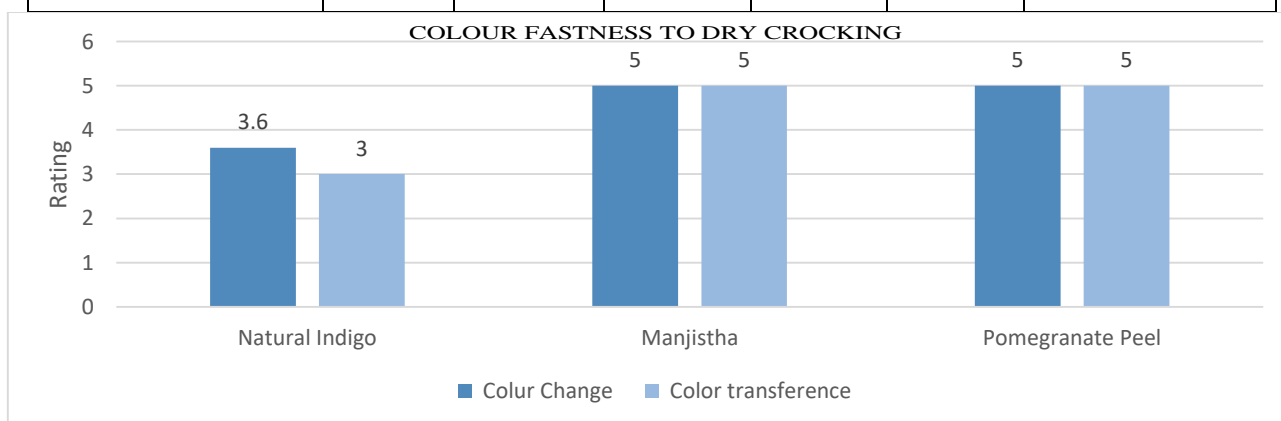
COLOUR FASTNESS TO CROCKING

COLOUR FASTNESS TO DRY CROCKING

Colour Change - The mean value of colour change of the denim fabric dyed with Natural Indigo found to be 3.6 was rated as “Good” and 5 for both Manjistha and Pomegranate peel was rated as “Excellent” for the three dyes. From the table it was clear that the denim fabric showed “Little” and “Negligible” rate of colour change when subjected to dry crocking.

Colour Transference - The mean value of colour transference of the denim fabric was found to be 2.2 for Natural Indigo was rated as “Fair” and 5 for both Pomegranate Peel and Manjistha was rated as “Excellent”. Hence “Appreciable” and “Negligible” rate of colour transference was observed for the dyed samples respectively.

DYES	DRY CROCKING					
	COLOR CHANGE			COLOR TRANSFERENCE		
	Rating	'F' Value	'p' Value	Rating	'F' Value	'p' Value
Natural Indigo	3.6	1.09	0.40	3	1.05	0.0035*
Manjistha	5	1.20	0.40	5	3.60	
Pomegranate Peel	5	1.20.	0.44	5	3.600	



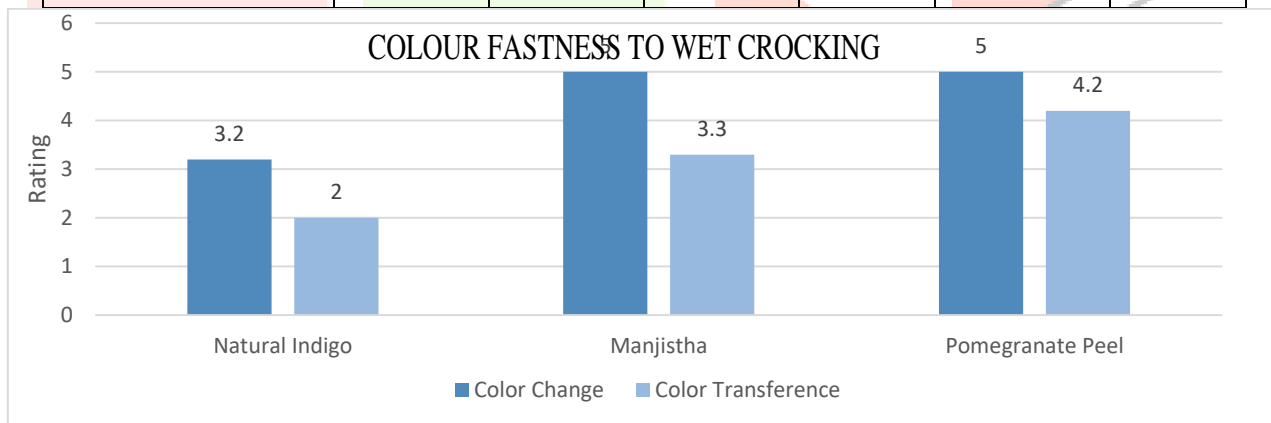
* Significant at 5% level

COLOUR FASTNESS TO WET CROCKING

Colour Change - The mean value of colour change of the denim fabric dyed with Natural Indigo found to be 3.2 was rated as “Good” and 5 for both Manjistha and Pomegranate peel was rated as “Excellent” for the three dyes. From the table it was clear that the denim fabric showed “Little” and “Negligible” rate of colour change when subjected to wet crocking.

Colour Transference - The mean value of colour transference of the denim fabric was found to be 2.2, 3.3 and 4.2 for Natural Indigo, Manjistha and Pomegranate Peel was rated as “Fair”, “Good” and “Very Good”. Hence “Appreciable”, “Good” and “Very Good” rate of colour transference was observed for the dyed samples respectively.

DYES	WET CROCKING					
	COLOR CHANGE			COLORTRANSFERENCE		
	Rating	‘F’ Value	‘p’ Value	Rating	‘F’ Value	‘p’ Value
Natural Indigo	3.2	1.05	0.38	2	1.20	1.0000
Manjistha	5	1.40	0.42	3.3	1.09	
Pomegranate Peel	5	1.40	0.42	4.2	1.22	



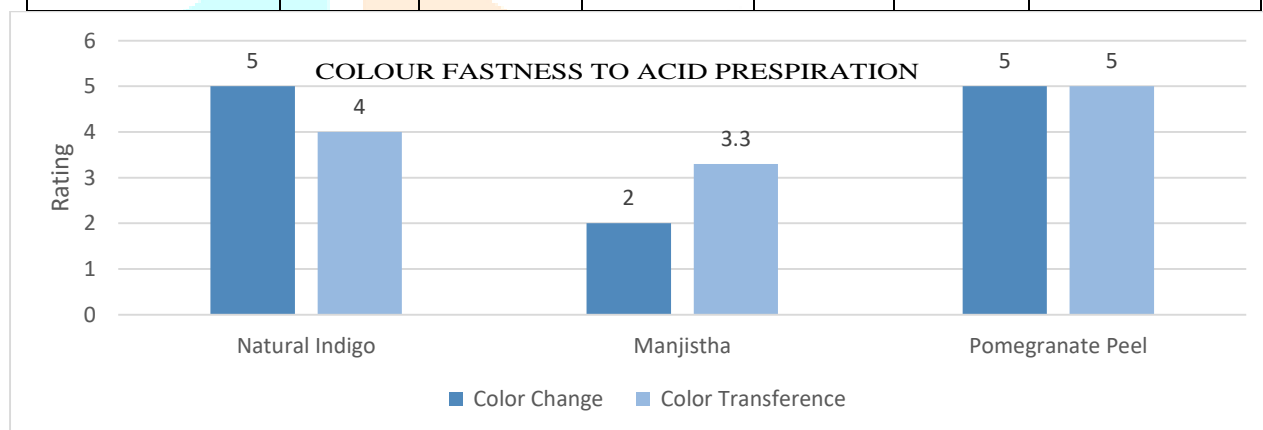
NS - Not Significant

COLOUR FASTNESS TO ACID PERSPIRATION

COLOUR CHANGE - The mean value of colour change of the denim fabric dyed with Natural Indigo, Pomegranate Peel and Manjistha was found to be 4, 5 and 3.3 was rated as “Very Good”, “Excellent” and “Good” for the three dyes. From the table it was clear that the denim fabric showed “Very Little”, “Negligible” and “Little” rate of colour change when subjected to acid perspiration.

COLOUR TRANSFERENCE - The mean value of colour transference of the denim fabric was found to be 4, 3.3 and 5 for Natural Indigo, Manjistha and Pomegranate Peel was rated as “Very Good”, “Good” and “Excellent”. Hence “Very Little”, “Little” and “Negligible” rate of colour transference was observed for the dyed samples respectively.

DYES	ACID PRESPARATION					
	COLOR CHANGE			COLOR RANSFERENCE		
	Rating	‘F’ Value	‘p’ Value	Rating	‘F’ Value	‘p’ Value
Natural Indigo	5	11.5000	0.0075**	4	6.2894	0.0033**
Manjistha	2			3.3		
Pomegranate Peel	5			5		



** Significant at 1% level

SUMMARY

1. With regard to colour fastness to brilliance of colour it was observed that the fabric dyed with Pomegranate Peel and Natural Indigo shows a positive result when compared with Manjistha.
2. With regard to colour fastness to laundering fabric dyed with Pomegranate Peel and Natural Indigo shows a positive result when compared with Manjistha.
3. With regard to colour fastness to dry pressing fabric dyed with Pomegranate Peel and Natural Indigo was better than Manjistha in terms of colour change. Where as in terms of colour transference Pomegranate Peel was better than Natural Indigo and Manjistha.
4. With regard to colour fastness to dry crocking fabric dyed with Manjistha and Pomegranate Peel was excellent when compared with Natural Indigo in terms of colour change and colour transference.
5. With regard to colour fastness to wet crocking fabric dyed with Manjistha and Pomegranate Peel was excellent when compared with Natural Indigo in terms of colour change.

6. With regard to colour fastness to wet crocking fabric dyed with Pomegranate Peel was very good when compared with Natural Indigo and Manjistha dyed samples in terms of colour transference.
7. With regard to colour fastness to acid perspiration fabric dyed with Pomegranate Peel was excellent when compared with Natural Indigo and Manjistha dyed samples in terms of colour change and colour transference.
8. With regard to colour fastness to alkaline perspiration dyed fabric, Manjistha and Pomegranate Peel was excellent when compared with Natural Indigo in terms of colour change. In term of colour transference pomegranate peel was excellent when compared with Natural Indigo and Manjistha dyed samples.

CONCLUSION

From the analysis of the results, it can be concluded that both Natural Indigo and Pomegranate Peel dyed fabric exhibited Very Good result for general appearance, brilliance of colour than Manjistha dyed fabric. With regard to Pomegranate Peel dyed samples they exhibited remarkable colour fastness properties when subjected to Laundering, Dry Pressing, Crocking (dry and wet), Acid and Alkaline Perspiration followed by Natural Indigo and Manjistha dyed samples. Hence it can be concluded that the eco - friendly dyes can be used in garments like shirts, pants and kids wear especially in denim fabric instead of using chemical dyes.

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