

# EVALUATION OF EFFECTIVE JUTE DYEING PROCESS WITH BASIC DYE AND REACTIVE DYE

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## Abstract

In this thesis, the reactive dye was applied to jute fabric for achieving good color fastness property to rubbing, washing and perspiration. Color fastness property to rubbing, washing and perspiration of jute fabric dyed with basic and reactive dyes were evaluated and compared in this study. Results show that, the jute fabric dyed with reactive dye could overcome the short coming of poor color fastness property to rubbing, washing and perspiration due to jute fabric dyeing with basic dye. Finally, the advantages of saving production cost and getting diversified products from jute because of improving color fastness were implemented throughout this system.

**Index Terms:** Jute fabric, Reactive dye, Basic dye, Color fastness

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## 1. INTRODUCTION

Jute, a vegetable fiber that can be spun into sackcloth, used to be the “golden fibre” of Bangladesh. It brought much need foreign income to the impoverished nation. But it lost its luster in the 1986 after synthetic materials like polythene & plastics were introduced. Now the material fibre has made a spectacular come back. Diversified jute products are becoming more & more valuable to the customer today. Among these are espadrilles, soft sweeter & cardigans, floor covering, home textiles, high performance technical textiles, geotextiles & more. Jute is mostly dyed with basic dye because it has material affinity to this dye. As a cellulosic fibre, jute may have to well respond to Reactive dye. The reactive dyes offer a wide range of dyes with varying shades, fastness, and costs with high brilliancy, easy applicability and reproducibility [1]. In case of dyeing of jute with reactive dyes, anionic dyes react with hydroxyl groups of the fibre by either substitution or addition reactions. Many studies [2-3] have been devoted to improve the substantivity of cellulosic fibre for reactive dyes. A few efforts were made to improve the light fastness [4]. So we are going to make a comparative study of fastness properties of dyed jute fabric with both Basic & Reactive dye with different shade %.

## 2. METHODS AND MATERIALS

### 2.1 Materials

The jute fabric was collected from local market in Dhaka, Bangladesh whose specification was EPI 12, PPI 12, warp and weft count 8 lb/spindle, GSM 260 Hessian yarn.

### 2.2 Methods

Scoured and bleached [5] woven jute fabric was taken for dyeing with the help of an electronic balance. For sample, combine scouring & bleaching of jute fabric was done before dyeing. The sample was dyed 0.5% ,1% ,1.5% ,2% ,3% ,4% ,5% shade with basic dye i.e DYACRYL BLUE FRL 500%, DYACRYL RED X-B 250%, DYACRYL YELLOW X-8LG 250%, DYSIN-CHEM LIMITED at 90°C for 40 minutes and reactive dye NOVACRON® BLUE-FN-R, NOVACRON® RED-FN-01 and NOVACRON® YELLOW-FN-2R, Huntsman, Swiss Colors Bangladesh Ltd. at 60°C for 40 minutes by Infrared Lab dyeing machine, Sandolab, Supermat, Copower Technology Co. Ltd. Taiwan [6]. At first dyed jute fabrics were conditioned in 65% RH and at 20°C for 24 h before testing according to ASTM D1776 [7]

#### 2.2.1 Fastness Tests

The color fastness of the dyed jute fabric rubbing, wash and perspiration tests were assessed using ISO test methods [8].

##### 2.2.1.1 Color Fastness to Rubbing

The dyed jute specimens were assessed rubbing fastness by Crock master, model 670 hand driven, James H. Heal, UK at ISO-105×12. The staining of the rubbing cloths were assessed by the Grey scale.

### 2.2.1.2 Color Fastness to Washing

The dyed jute specimens were washed in a Gyrowash, model 415/8, James H. Heal, UK at ISO 105C03 method . The change in color of the specimen and the staining of the adjacent fabric.

### 2.2.1.3 Color Fastness to Perspiration

The perspiration test solution was prepared by 0.5 gm l-Histidine mono- hydrochloride mono-hydrate (C<sub>6</sub>H<sub>9</sub>O<sub>2</sub>N<sub>3</sub>HC1.H<sub>2</sub>O), 5 gm Sodium chloride (NaCl), 2.5 gm Disodiumhydrogen orthophosphate (Na<sub>2</sub>HP0<sub>4</sub>.2H<sub>2</sub>O) and 1000 ml of distilled water where the pH was adjusted to 8[9]. The jute specimen was cut to 10cm×4cm with stitch with same multifiber and wetted in the above perspiration solution at room temperature, with a fiber-liquor ratio of 1:50 and time of 30 min. Then this composite test specimen was placed between two glass plates under a pressure of 5 kg and was heated in an oven for 4 hrs at 37 ± 2°C. The specimen was removed and dried in open air. The contrast between the basic dyed jute and reactive dyed jute sample was compared with the Grey scale according to ISO 105 E04 method [10].

### 2.2.1.4 Measurement of Dye Absorbency

Color was evaluated in terms of k/s values, ΔE and CIE Lab coordinates (Illuminant D65/10° observer) with a Data color 650 spectrophotometer.

## 3. RESULT & DISCUSSION

### 3.1 Measurement of k/s value

Dye absorbency for a particular shade can be determined by K/S value. Grater K/S value represents high dye concentration inside the fibre and vice versa.

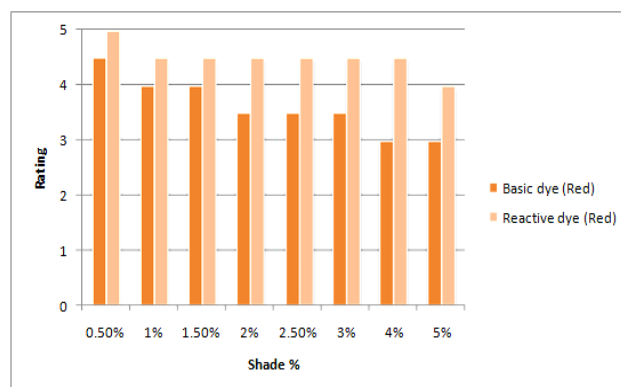
**Table-1:** K/S value of basic and reactive dyed sample of different shade.

Color	Dye	K/S value				
		Shade %	0.5%	1%	2%	3%
Red	Basic	17	18	20.5	20	22
	Reactive	2	4.5	11	15	18
Yellow	Basic	10.5	11.5	15	18	19
	Reactive	3	9.5	14	16	16.5
Blue	Basic	16	17	20.5	24	24
	Reactive	2.5	6	14	19	22

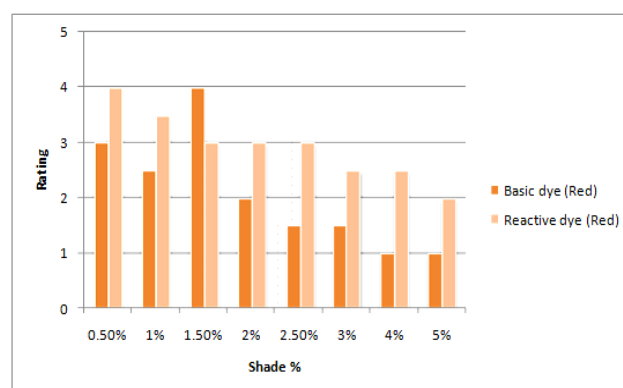
Dye absorbency was measured by the K/S value which is shown by the above figure. In this experiment, the K/S value was measured before washing to understand the absorbency of dye molecule by sample dyed jute fabric. The above figure shows that K/S value of basic dyed fabric is higher than reactive dyed fabric i.e. dye absorbency is better in case of basic dye than reactive dye.

### 3.2 Measurement of colorfastness to rubbing

This test was designed to determine the degree of color which may be transferred from the surface of a colored fabric to a specify test cloth for rubbing which could be dry and wet. The test was carried out by using crock meter followed by ISO 105\*12 method. Satisfactory results were obtained from the test of fastness to rubbing of reactive dyed jute. From the below comparison of color fastness to rubbing of jute fabric dyed with Reactive dye (Red) is better than the jute fabric dyed with Basic dye (Red) in both dry & wet condition. The dry and wet rubbing fastness results are shown below:



**Fig -1:** Color fastness to rubbing of jute fabric with basic & reactive dye in dry condition.



**Fig -2:** Color fastness to rubbing of jute fabric with basic & reactive dye in wet condition.

### 3.3 Fastness to Washing

The resistance of a material to change in any of its color characteristics, when subjected to washing is called color

fastness to washing. In the test, change in color of the textile and also staining of color on the adjacent fabric were assessed. The test was carried out by using Gyrowash followed by ISO 105 C03 method. Acceptable result was obtained to the color fastness to wash for both color changing and staining. The results are shown in fig.-3.

### 3.4 Fastness to Perspiration

The resistance of a material to change in any of its color characteristics, when subjected to perspiration is called color fastness to perspiration. In the test, change in color of the textile and also staining of color on the adjacent fabric were assessed. The test was carried out and acceptable result was obtained to the color fastness to wash for both color changing and staining. The results are shown in fig.-4.

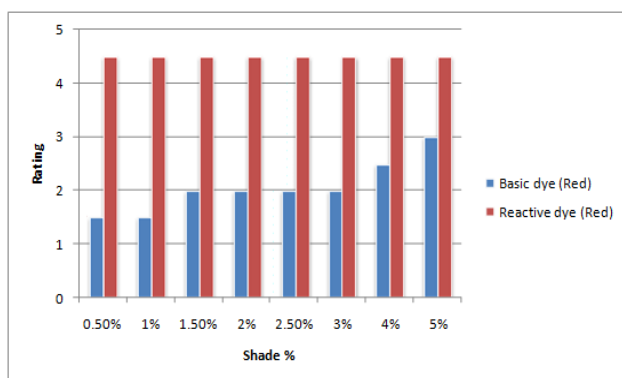


Fig -3: Color fastness to washing of jute fabric with basic & reactive dye.

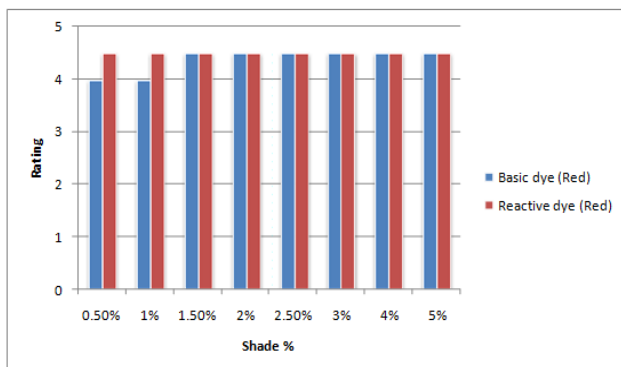


Fig -4: Color fastness to perspiration of jute fabric with basic & reactive dye.

From the above comparison of color fastness, it shows that color fastness to washing and color fastness to perspiration of jute fabric dyed with Reactive dye is better than the jute fabric dyed with Basic dye .

### CONCLUSIONS

Jute fiber is generally dyed with basic dye. But there were many limitations of jute dyeing with basic dye. So, many attempts were taken to dye jute fiber with reactive dye as

reactive dye provides wide range of facilities compared to the other. Jute fabric dyed with basic dye provides brilliant shade but the problem of these shades is lower fastness properties. Especially to rubbing & washing. Analyzing the above result & discussion, it is concluded that the problem which arises due to dyeing with basic dye can be overcome by dyeing with reactive dye. It is evident that reactive dye will give better result for jute dyeing than basic dye. It is recommended that the technique be put into practice. The exhaustion of dye was measured by determining K/S value measured in data color machine.

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