Color Build up on Jute Fabric with Reactive Dye after Bleaching and Mercerizing

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Abstract—*In this work color build up effect on jute fabrics with reactive dye (Hot brand) before and after bleaching and mercerizing were studied. Better color builds up observed in mercerized fabrics. As in mercerization higher dye absorption was taken place. We studied about jute fabric which is dyed with reactive dye. Before dyeing we completed the pretreatment of jute fabric. In the pretreatment process, first we did singeing after that desizing, scouring, bleaching and mercerization according to sequence.Then we finished dyeing process in laboratory for this project. Ultimately we got color building jute fabric.*

Keywords—Color, Reactive dye, Bleaching and Mercerizing.

I. INTRODUCTION

The technical jute fiber consists of strands i.e. bast bundle fiber assemble in parallel manner with overlapping to produce filaments throughout the length of the stalk. It is also physically coarse, meshy, harsh, and irregular in length and diameter. On account of their properties, jute is used for making traditional products such as ropes, cords, hessian, sacking, and carpet backing cloth (CBC) etc. Jute fiber bundle contains cells or ultimate fibers which are joined together with natural cementing materials as lignin and hemi-cellulose etc. Similarly each ultimate fiber is composed of a large number of smaller units known as fibrils and these are arranged in right-handed spirals. The fibrils are again made up of molecular chains, closely held together. These are known as micells. Though lignin and other non-cellulosic materials are abundant in the middle lamella, they are also found in other parts of the cell wall. The uses of jute materials are gradually decreasing due to keen competition from synthetic products. So, non-traditional and value added products are shout in wider scale. The presence of wax, pectin and mineral matters in jute creates some problems in dyeing, printing and finishing. For these reason various treatment like scouring, mercerizing and bleaching are required for better dyeing, printing and finishing of jute and jute products for diversified use of jute products.

II. CHEMICAL COMPOSITION OF JUTE FIBER

Chemically jute fiber contains-
α-cellulose, ligninmatters and traces of tannin and coloring matters. , Hemicelluloses, waxes, pectin, protein, mineral.

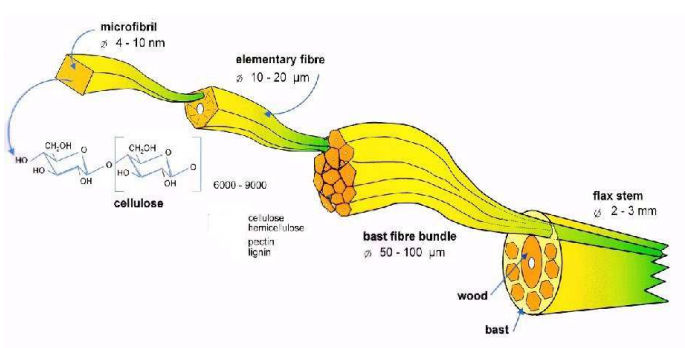


Fig. 1: Jute Fiber internal structure

III. DESIZING OF JUTE FABRIC

Enzymatic Desizing:

Enzymatic desizing is the classical desizing process of degrading starch size on cotton fabrics using enzymes. Enzymes are complex organic, soluble bio-catalysts, formed by living organisms that catalyze chemical reaction in biological processes.

Tabel 1: Recipe of desizing

Recipe	Amount
Enzyme	4 cc/l
Sequestering agent	4gm/l
Salt	12gm/l
Acetic acid	2cc/l

Temp.	(60-70) c
Time	(30-45) min
P^H	6-7
M:L	1:10

IV. SCOURING AND BLEACHING

Scouring:

Scouring is a process of removing the impurities from the fiber to produce hydrophilic and clean fabric.

Bleching of Jute:

Although jute fibres contain considerable amount of impurities, jute materials are generally bleached without prior scouring due to its alkali sensitivity.

Tabel 2: Recipe of Scouring and Bleaching

Recipe	Amount
Caustic soda	8gm/l
Hydrogen per oxide	7cc/l
Wetting agent	2cc/l
Detergent	2cc/l
Sequestering agent	2cc/l
Stabilizer(sodium silicate)	2cc/l
Temp.	(85-90) c
Time	(40-60) min
P^H	10.5-11
M:L	1:40

V. MERCERIZATION

Liquid Ammonia Mercerization: The scoured and dried fabric is treated with liquid Ammonia at -33 deg celcius for 10 minutes followed by neutralization with 1 gpl Sulphuric acid.

Caustic Mercerization: Alternately Jute fabric can also be mercerized by a treatment with 17.5 W/V caustic Soda at room temperature for 10 minutes followed by neutralization with Sulpuric acid 10 gm/l. The acid should be thoroughly washed with overflow water and dried in air.

VI. DYEING OF JUTE FABRIC FOR VALUE ADDED PRODUCTS

Water:

Water is the main medium for transportation of dye to the fibre surface and, from the fibre surface to the inside of the fibre through the fibre pores. Water is also responsible for swelling of the fibre. Water used for dyeing of jute fabric must be soft so that the dyestuffs and other auxiliaries can get easily solubilised.

Machineries:

Machineries are needed for even dye application, penetration and fixation of dyes on the jute fabric. Jute fabric can be dyed by either exhaustion method or padding method. Exhaustion method is more popular due to the simplicity of the application. Mainly a machine known as "JIGGER" is used for dyeing of jute fabric by exhaustion method.

Heating system:

Different temperatures are needed during different steps of dyeing i.e., dye solubilisation, dye application, dye fixation, washing of dyed fabric, soaping, stripping, after treatment etc., to achieve optimum colour yield and fastness properties of the dyed fabric.

Mechanism of dyeing of jute

The principles of application of different dyestuffs to jute fibre are given in brief:

1. Physical adsorption of water soluble dyestuffs from an aqueous medium to jute fabric by reversible attachment to active sites present in the fibre. Direct dyes are held in jute fibre by hydrogen bonding.
2. Mechanical retention of water insoluble dyestuffs in the jute fibre as in the case of vat and sulphur dyes. The dyestuffs are applied by temporary solubilisation before application to jute fibre and then reconverted to the insoluble form inside the fibre after the application.
3. In case of reactive dyes, the dyes are held on the fibre by forming a covalent bond.

VII. THE BASIC REQUIREMENT FOR DYEING OF JUTE FABRIC:

The basic requirements for dyeing of jute fabric are as follows:

Dyestuff:

Colored compound must contain certain unsaturated groups (nitro, azo, keto etc) which are known as chromophores and the compound containing chromophore is called a chromogen.

Dyestuff auxiliaries:

Different chemicals like salts, acids, alkalis, surface active agents, sequestering agents, buffering agents, oxidizing agents, reducing agents, etc.,
are used during dyeing of jute fabric are popularly known as dyestuff auxiliaries.

Jute fabric:

A well prepared jute fabric is needed for good dyeing. The fabric should be well scoured and bleached so that the dyes are applied evenly on the fabric.

Performance of dyed Jute fabric

Direct, reactive, vat, sulphur dyes can be applied on jute fabric to produce variety of shade depending on the end use requirement.

Table 3 : Performance of dyed jute fabric

Dyes Applied	Performance
Direct	Process is very simple and cost of dyeing is low. It produces moderate to low wash fastness and moderate to high light fastness
Reactive	Process is simple and cost of dyeing is moderate. It produces high wash fastness and moderate to high light fastness. It produces bright colours.
Sulphur	Process is slightly complex and cost of dyeing is low. It produces very high wash fastness and moderate light fastness
Vat	Process is complex and cost of dyeing is high. It produces very high wash and light fastness.

VIII. DYEING OF JUTE FABRIC WITH REACTIVE DYE

Standard recipe of reactive dye:

There are three types of reactive dye are used.

1. Cold brand
2. Medium brand
3. Hot brand

In our work we used hot brand reactive dye.

Recipe of hot brand reactive dye are represented.

Dye Stuff	**X% owf ***
Salt	80 g/l
Soda ash	20 g/l
Wetting agent	1cc/l
Sequesturing agent	1cc/l
Levelling agent	1cc/l
P^H	9-11
Temperature	80^0c – 90^0c
Time	1- 1.30 hrs
M:L	1:50

[*owf=on the weight of fabric]

IX. PROCEDURE OF JUTE FABRIC DYEING WITH REACTIVE DYE

1.set the dye bath with substrate at 40^0c and add salt dye and other auxiliaries then run the dye bath for 10 mint.

2.Raise the temperature above 80-100 ^{0}c for 5 mint and add alkali at the same time.

3.Run the bath for 60-90 mint at the same temperature.

4.Drop the fabrics from the dye bath and carry on the after treatment process.

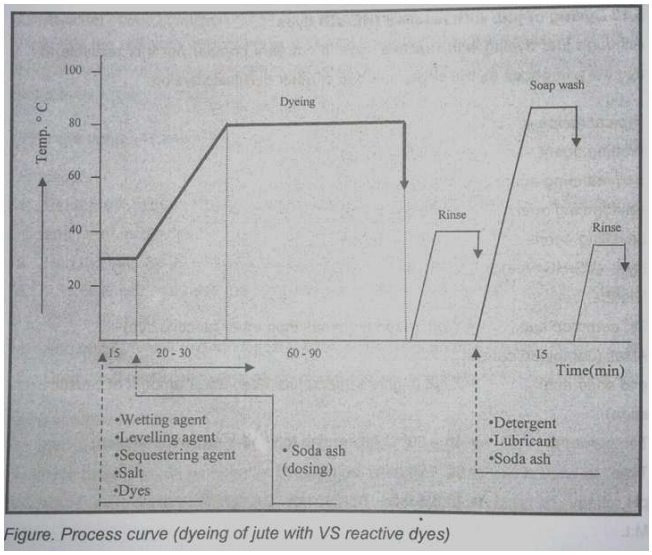


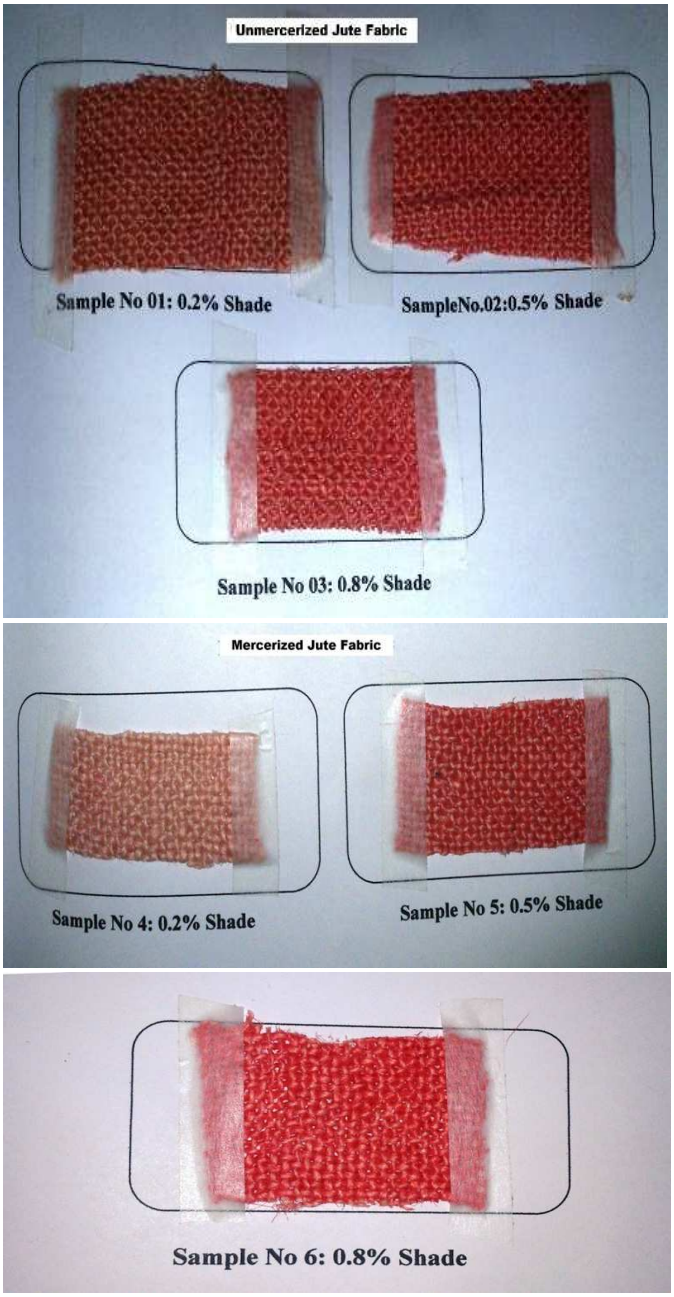
Figure 2: Process Curve (Dyeing of jute vs reactive dye)

X. AFTER TREATMENT

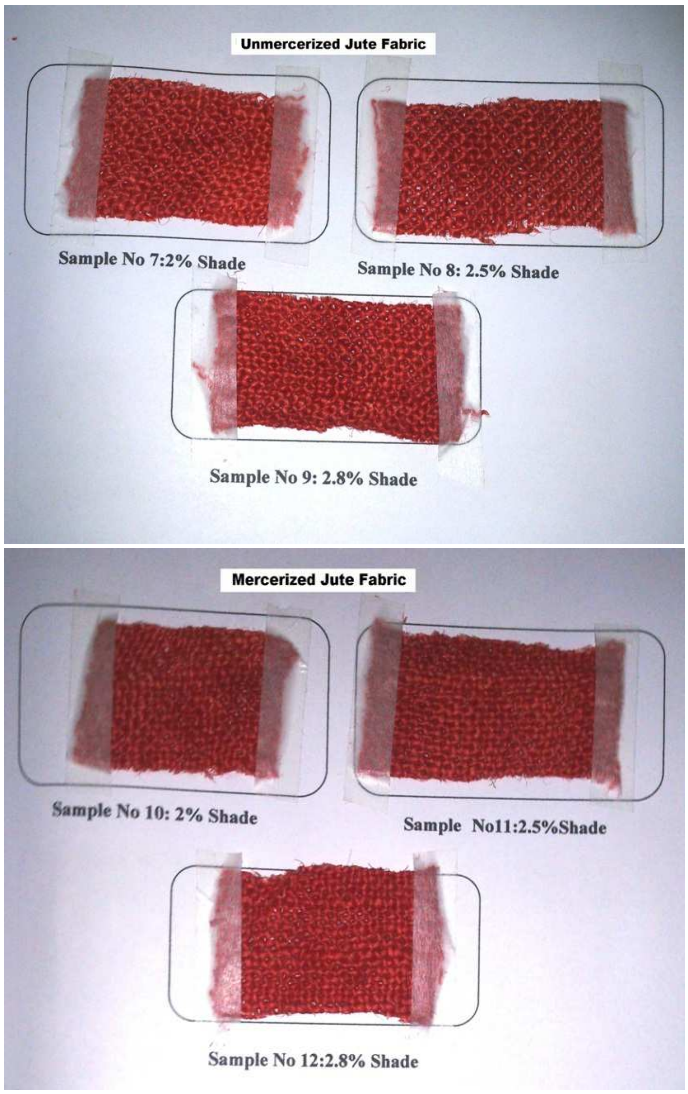
For better color fastness after treatment process is very important. First need completely removed alkalis by rising.Hot rinse for 10 mint at 40^0c.then it needs soap wash to confirm that free from unfixed dyes. Then give cold rinse for 10 mint .Then we dry the fabric.

XI. SAMPLE PRESENTATION

Light shade% sample No 1, 2, 3, 4, 5, 6.



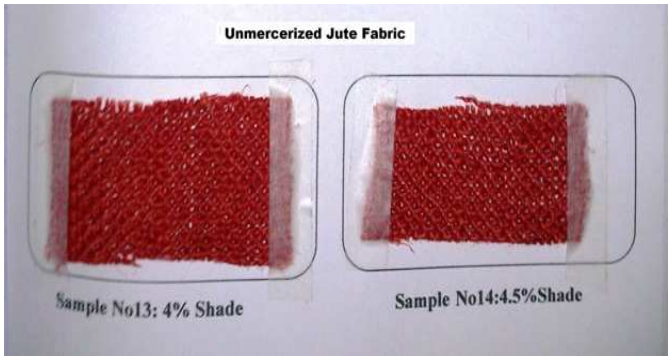
Medium Shade % sample No 7, 8, 9, 10, 11, 12.

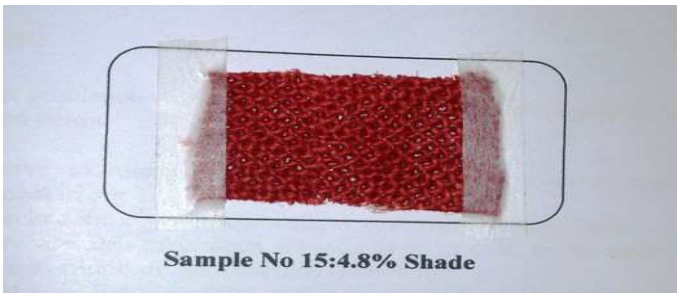


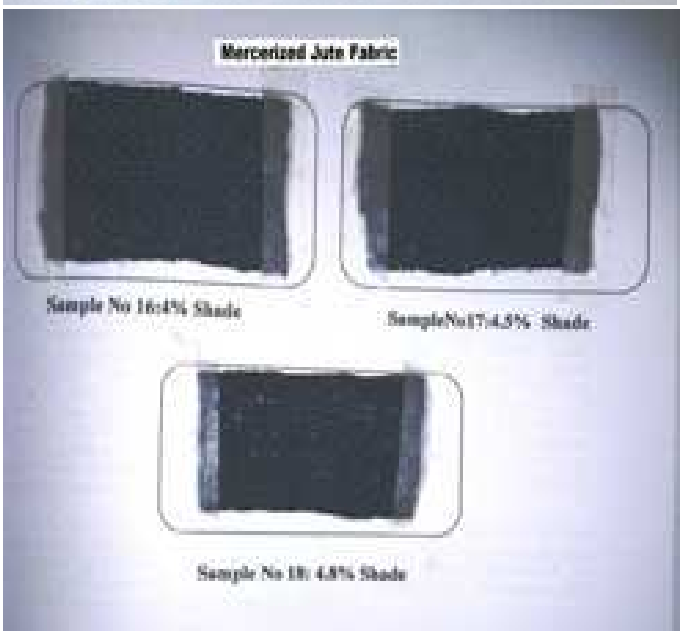
XII. RESULTS AND DISCUSSION

We made this project on three shade%. In every shade% we evaluate six samples where we maintained the recipes with the amount of soda. Because of different amount of soda, the P^H of the dye bath changes. As a result there has been significant change in shade. When the difference of P^H is more than we can clearly observe that there has been change between the samples**.**

Deep shade% sample No 13, 14, 15, 16, 17, 18







XIII. CONCLUSION

Pretreatment of jute fabric is the most important for the production of reproducible shade as final shade is mainly dependent on the substrate.Jute can be dyed with direct, reactive, vat, sulphur dye. After treatment of dyed jute fabric produces optimum fastness characteristics. Hence, production of good quality dyed jute product is now a reality.

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