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FEASIBILITY OF DYEING JUTE AND JUTE-COTTON UNION FABRIC USING NOVACRON DYES

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Abstract: **Reactive dye is widely used in textile field. Novacron dyes is one of them. Dyeing method has the advantage of running continuous production. With small amount of dye consumption with simple application technique and less waste water contamination, we can save energy, time, water and labour employment and ultimately increase the production rate. The affinity of dyes of small molecular weight is low and diffusion rate inside cellulosic fibres is high. Novacron dyes have higher molecular size, so in dyeing it becomes effective in jute and jute-cotton union fabric. All cellulosic fibres like jute and jute-cotton union can be dyed by continuous method with very good fastness properties.**

Keywords: *color fastness; unfixed dye; color loss; fixation; bleached fabric.*

1. INTRODUCTION

Jute is an ancient natural fibre and various products from it are continued to be used all over the world. It is a lingo cellulosic bast fibre comprising 58-63% cellulose, 12-14% lignin and 22-24% hemicelluloses [1]. It occupied a world market for quite a long time because of its unique properties like high strength, rough handling advantage, environment friendliness, easy degradability etc. Jute is automatically harsh because of its low wax content and also lignified nature [1]. Some fibres, for example, cotton and rayon, react with synthetic resin components such as aldehydes and ketons to produce new bonding products, durable stiff finsihes, regarded as synthetic resin group [2]. We see jute is the second most important vegetable fibre after cotton because of its uses. Bales of raw cotton, sacks, and coarse cloth can be made by jute.

Jute is replaced by synthetic materials but it has so many advantages, for example, jute is a biodegradable fibre. On the other hand, synthetic materials are not suitable for such use as planting trees. Synthetic materials can be planted directly. Erosion can be prevented by jute cloth. Twine or rope can be can be made by single or blended fibre. Cheap cloth can be made by using jute and coarse yarn. Imitation silk can be prepared by fine fine thread, paper and pulp can be prepared by jute fibre. Wood was widely used in the past but jute is replacing it day by day. Cotton is used to make different products like woven cloth for highly absorbent bath towels and denim for blue jeans. Cambric is popularly used in the manufacture of blue work shirts, corduroy, seersucker, and cotton twill. Socks, underwear, and most T-shirts are made from cotton. Bed sheets also often are made from cotton. Cotton also is used to make yarn used in crochet and knitting. Fabric also can be made from recycled or recovered cotton that otherwise would be thrown away during the spinning, weaving, or cutting process. While many fabrics are made completely of cotton, some materials blend cotton with other fibers, including rayon and synthetic fibers such as polyester.

It can be used for both woven and knitted fabrics and blended with elastine to produce streatchier yarn for knit fabrics and jeans. Good fabric can be produced by blending cotton and linen. Its blend is wrinkle resistant and generate more heat. It is also lighter and stronger than cotton. Cotton has a more complex structure than other fibres. Naturally matured cotton fiber is a single; it has a multilayer cell and it develops surface layer of cotton seed. It has the following different parts [3].

1. The outer layer is cuticle. It contains different materials.
2. Primary wall is thin cell wall. It is mainly cellulosic.
3. The first layer of secondary wall is winding layer, also called the S_1 layer. It is different

in structure from both the primary wall and the remainder of the secondary wall. Cotton grows where long, hot dry summers with plenty of sunshine and low humidity. Fine fibre is *Gossypium arboreum,* is finer but suitable for processing. On the other hand, *Gossypium hirsutum,* is long staple which is suitable for machine production. We can be planted cotton from September to mid-November and during the month of March to June the crop has harvested. The seed pod of cotton plant is cotton boll and attached to each other of seeds are fibres of thousands.

Recently Bangladesh Jute Research Institute have developed some technologies for production of some sophisticated textile materials from jute such as furnishing fabrics, blanket, sweater, knitting wool substitute, prayer mats etc. Which increase the importance of diversification of end uses of jute. So, non conventional products like these are bought in wider textile fields at present. Such attempts need improvement of the associated drawbacks of jute fibres in various directions. The one bath dyeing method (continuous dyeing method) may be one of them.

Liquor ratio is less than 1:1 in continuous dyeing method. Substantivity and liquor ratio are not so important. Adsorption process is occurred between fibre and dyestuff reaction which is necessary for substantivity of cellulose. pH plays an important role in dyeing process [4].

The purpose of the maximum harmonization of the padding and fixation steps is to produce dyed fabric which meets the consumers requirements with respect to handle, appearance, fastness and optimum dye fixation where good washing off properties are also of great importance. Compared to exhaust dyeing method the one bath dyeing requires the least amount of mechanical, electrical and thermal energy. The labour requirements are also very low. Some authors also developed some dyeing methods for jute using different classes of dyes in variable condition. The behavior of dyes when applied from a mixture is in many cases quite different from their behavior when applied as individual components [5]. Bleach is difficult in case of Jute. In alkaline media degradation occurs with treating chlorine solution. The best varieties, however, have comparatively little color and can be dyed without bleaching [6].To the production of pure white materials, is necessary to removal and destruction of natural and adventitious coloring matter. Jute is the cheapest textile fiber and is used in great quantities.

In the light of above study the present work has been undertaken to find out an effective one bath dyeing method with pigment dyes and assess the extent of their fixation on jute and the resulting color fastness to washing, rubbing and light. Reactive Dyes is a new class of dyes and form covalent bonds with those fibres which possess hydroxyl or amino groups. Novacron colours are intended primarily for use on cellulose. The fixed dye concentration is calculated from the absorbance of this mixture (A_{uf}) and that of the initial bath (A_0)

C_{fixed} [%] =100(1-A_{uf}/A_0)

Hydrolized Dye [%]=(A_{uf}/A_0)*1oo

As the temperature increases the rate of this hydrolysis becomes greater and for this reason, when dissolving the dyestuff and during its application in the dye bath, the temperature should not rise above 40^0C (104^0F). Dawson, Fern, and preston concluded that under dyeing conditions both the mono-and dihydroxy compounds were formed with a tendency for the formation of the letter to predominate as the time in alkaline solution increases [7].Dyeing and affinity is dependent on dye selection such as Indigo dyes has poor wash and rubbing fastness on Jeans and produced washed down effect on different fabric. On the other hand vat and reactive dye has excellent wash fastness properties on cotton. Reactive dye has chromophore group and directly reacting with fibre.

We use reactive dye because it has covalent dyes and it directly react with cellulose and it a permanent bond. Between hot and cold reactive dye, cold reactive is easy to apply because it work in room temperature. One functional group of dyestuffs has low fixation for this reason two or more reactive groups has developed. The dyestuff which contains two or more functional group is called bifunctional dyestuffs. Some dyestuff is two monochlorotriazines, triazines and vinyl sulfone group. Among all the group bifunctional dyes has a tolerance character. some bifunctionals dye has created for better fastness quality and fixation degree[8].Fabric word has come from latin which roots is Proto Indo European language. Latin faber has generated noun fabrica stems and artisan works based on hard materials, which itself is derived from the Proto-Indo-European dhabh-, meaning 'to fit together [9] .

The factors which causes the dye to become absorbed by textile fibre are considered together with the ways in which they are employed by color chemists to produce dyes of good resistance to washing treatments [10].

Different color is widely used to dye textiles specially fabrics. A lot of water is needed for dyeing process for each number of fabrics/yarns. We can

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produce fabric by rearranging colored yarn in weaving machine as well as colored stich. With the help of resist dyeing methods, tying off, wax design on cloth and different printing process we can produce different pattern. At present woodblock printing is widely used in India which was exist in the past. White or pale textile can be produced by bleaching [11].

2. Materials and Methods

Dyeing with Reactive dyes by semi continuous method:

The bleached fabric was dyed with Reactive dyes using a suitable recipe, applying technique

Recipe:

1. Lissapol N (wetting agent) -1 g/l
2. Novacron Blue FNR -2 g/l
3. Salt -50 g/l
4. Soda - -12 g/l

The fabrics were padded with the above formulation giving pick up 90%, dried and cured at different temperatures like 110^0C, 120^0C, 130^0C, 140^0C ,150^0C, 160^0C for 1 minute in order to find out the optimum condition (temperature) for dye fixation. The other bleached fabrics were dyed with four kinds of Reactive dyes as mentioned above and cured at 150^0C for 1 minute which is the optimum condition for dye fixation.

Testing: The dyed fabrics were tested for determination of washing, rubbing, and light fastness applying British standard method. Breaking strength of the fabrics was also measured.

Repeated extraction of unfixed dye determines dye fixation value. Wave length of maximum absorbance measures optical density. A coordination complex of dye is used in dyeing with the help of mordant or dye and is attached with fabric or tissue [12]. It is used for dyeing fabrics and intensify stains in cell or tissue preparations. In small batch dryer mordants is still used and widely displaced in industry [13].

Pretreatment of jute fabrics: In order to remove impurities like natural waxes, oils, peptic substances and natural coloring matters present in jute fibre, fabric was first scoured with 3% soda ash, 1.5% caustic soda and 1% wetting agent (percentage is based on the material) at 80-90_0C) for 1 $\frac{1}{2}$ hour . And then bleached with 12 gm/l hydrogen peroxide (35%), 7 gm/l sodium silicate and 1.5 gm/l soda ash at 80-90^0C for 1 hour giving liquor ratio of 1:20 [14]. The p^H was adjusted to 10-10.5 initially. The fabric was then has washed with hot water as well as also cold water and dried [15]. The fabric was cut into pieces for different sets of experiment.

The distance between the top and the bottom aprons should be adapted to the fiber mass to be drafted. Thus, the coarser the roving or the yarn, the wider the mouth opening should be. You can determine the most favourable setting by conducting preliminary trials. The dyed fabrics followed by curing at different temperatures for optimization were evaluated by determination of dye fixation (%), color fastness properties and tensile strength [16].Wash fastness is the ability of fabrics to retain the dyes used to color them [17]. In general, deeper and darker colors usually lead to an increase in the light fastness results of fabrics [18].

3. Results and Discussion

Table: 1 quantity and consumption of jute and jute-cotton union fabric using 3 dyestuffs

Name of Dyestuff	quantity	Consumption % in case of jute	Consumption% in case of jute-cotton union fabric
Novacron Blue FNR	2 g/l	71.23%	74.15%
Novacron Green	2 g/l	70.25%	72.19%
Novacron Yellow	2 g/l	68.51%	71.64%

Table 2: Dye fixation (%), Fastness properties and Breaking strength kgf. of dyed samples cured at diff. temp.

Dyed samples cured at diff. temp.	Dye fixation (%)	Fastness properties			Breaking strength kgf.
		Washing ISO-3	Rubbing	Light	
1.Orginal sample (bleached)	-	-	-	-	63.40
2. Dyed & Dried	53	3	3	5	61.12
3.Curied at 110^0C	65	3	3-4	5-6	61.23
4.Curied at 120^0C	78	3-4	4	5-6	60.45
5.Curied at 130^0C	80	4	4	5-6	60.55

6.Curied at 140^0C	84	4-5	4-5	5-6	58.14
7.Curied at 150^0C	88	4-5	4-5	6	58.20
8.Curied at 160^0C	90	5	5	6-7	57.50

Washing fastness, rubbing fastness, Light fastness and breaking strength have evaluated at controlled atmospheric condition, as well as maintaining controlled necessary data

Table 2: Fastness properties of Novacron dyes

Name of dyes	Washing	Rubbing	Light
Novacron Blue FNR	3	3-4	5
Novacron Green	4	4	5
Novacron Yellow	4-5	4-5	6

** Cured at 160^0C for 1minute.

4. Conclusion

Dye consumption in case of jute-cotton union fabric is more than jute fabric. The optimum condition was found out by determination of dye fixation (%), fastness properties as well as of breaking strength. It was observed that the dye fixation attained 90% (maximum) and washing, rubbing and light fastness attained 5, 5 and 6-7 respectively when the dyed fabrics were cured at 160^0C for 1 minute. Most of the cases the results are quite satisfactory when curing at 160^0C for 1 minute. There was remarkable difference in the fastness properties of Reactive dye. All results are good in case of jute-cotton union fabric than 100% jute fabric by using Novacron dye. Jute-coton dyeing method has the advantage of running continuous production with simple application technique, less waste water contamination, saving energy, time, water and labour employment and ultimately increase the production rate. So, the method can be considered economically viable for commercial application. Hence, jute and jute-cotton union fabric can be dyed by continuous method with very good fastness properties.

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