

Study on the Dyeing Performances of Jute Fabrics Dyed with Extracted Natural Dyes from Jackfruit Leaf and Teak Leaf

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Abstract: Firstly, used hydrogen peroxide in traditional method for Scouring and bleaching process. Then for grey jute fabrics are dyed by individually natural colors which was extracted from jackfruit and teak leaves. After that, lighter shade is being obtained without any adding mordant and then observed that amount of dye taking up being increased with increasing percentage of mordant. The color output was enhanced by mordanting potash Alum. We know small entrepreneurs' craftsmen are very much interested to make some aesthetic products by jute fibre and fabric as since as those are being lucrative in small cottage, nest, sandal etc. by jute fibre and fabric. So here color fastness is much necessary and color fastness work are compared between teak leaves and jackfruits leaves.

Keywords: Jute, Natural dye, Teak leaves, Jackfruit leaf's

INTRODUCTION

Now a days environment conscious researcher gives more concentration about the natural products. To address the environmental problems which is produced by synthetic dyes, a number of manufacturers of dyes and small-scale export companies have recently begun exploring the potential of regularly employing natural dyes for fabric dyeing and printing [1]. Jute fabric is typically colored by using synthetic dyes, however small efforts have been undertaken to dye jute fiber using natural dyes instead of synthetic ones [1]. Jute has many advantages like biodegradable, easily adaptation and affordable fibre etc. Due to its biocompatibility, high tensile strength, and improved breathability, this fiber is becoming more and more popular [2]. Scientist has discovered jutton fabrics which is also compatible with our daily life. It also has certain disadvantages, including a tendency to branch of poor washability, roughness in feel, and susceptibility to yellowing when exposed to sunshine [3]. As a result of growing environmental

consciousness and an effort to avoid some toxic chemical dyes, the application of non-allergenic, non-toxic, and environmentally friendly natural dyes on textiles has assumed a major significance in recent years [4]. Synthetic coloring of textiles has a significant detrimental influence on the environment, including dyes and end consumers [5]. To prevent the hazardous and health risks connected with textile dyes, which are mostly used in textiles and to protect our environment, the use of fiber and dye from natural origin in the textile industry is currently a concern of many nations and organizations [6]. Natural dyes are more environmentally friendly and have superior degradation rate [7]. The coloring of jute fiber is mostly caused by its cellulose component, which makes up around 60% of its composition [8]. Jute fiber may be combined with various natural and artificial fibers, and it can be colored using cellulosic dyes from the natural, basic, vat, sulfur, reactive, and pigment dye families [9]. Although natural colors are substituted by synthetic colors now a days, still natural color hold its unique properties and attractiveness [9]. Synthetic dyes cause environmental issues throughout manufacture, application, and usage of colored products [10]. There are some limitations on the use of natural dyes [11], such as associated with availability, color yield, repeatability of shade, and technical issues such limitations shade, non-standardized manufacturing and dyeing techniques, insufficient fastness qualities, and so on [12]. In broad sense, it is somewhat difficult to apply natural dye as bulk volume. For why it is convenient for artisanal, craftsman-level, small-scale, and cottage level dyers have generally used natural dyes and also small-scale traders and manufacturers engaged in the creation and marketing of very valuable eco-friendly textiles [13]. Synthetic colors include amines that are harmful to the environment and carcinogenic [14]. However, all-natural dye are not ecofriendly in nature, they may have metallic source [4]. Natural dyes also used in food color such as teak leaf used in food color of beef sausage and found a good antimicrobial component [15]. Natural dye color fastness is not good, and have no found standard color recipe [15]. Both teak leaves

and jackfruit leaves produce good color and available in Bangladesh. So My object is to find the color fastness result between two dyed sample of jute fabrics in where natural dyeing was extracted from jackfruit leaf and teak leaves.

2. Material and Method

2.1 Material

- plain-woven jute fabric which GSM 200 was taken. Sample measurement 23cm x 20cm was taken
- Natural colorants obtained from plants such as jackfruit and teak leaves were used as natural dye.
- Hydrogen peroxide, Sodium hydroxide, sodium sulfate, silicate, acetic acid, non ionic detergent was used. All these chemicals were of analytical grade.
- Natural dyes from jackfruit and teak leaves.
- Mordant ferrous sulfate (FeSO₄.7H₂O) and copper sulfate pentahydrate (CuSO₄.5H₂O) are used.

2.2 Method

2.2.1 Extraction of natural dye:

Teak and jackfruit leaf were cut into small pieces and immersed in soft water (1 gram of leaves in 1.5 liters of water) and therefore were separately simmered for 3.5 hours. During the extraction procedure, the dye components found in the natural colorants were transported to the aqueous solution. During extraction period the temperature is about 90- 100⁰ Centigrade. From about forty kg leafs jackfruit found mere amount natural color which is in producing powder form. There has a disadvantage too. Because if this extracted natural color would be keep in liquid form for a long period, it sets bad odor. This liquid natural color also produce fungus if temperature is not maintained.



Fig: 1 Natural Dye color extracting from teak leaves.

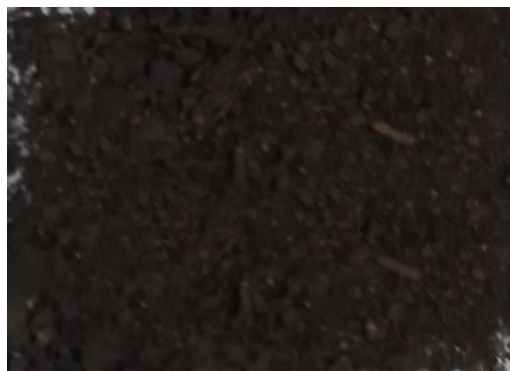


Fig: 2 Natural Dye color in powder form extracting from jackfruit leaves.

2.2.2 Bleaching of Grey Jute Fabric:

At first, grey jute fabric need to be bleached for one hour at 80-85⁰ C in a reaction container, maintaining liquid ratio 1:20.

Amount of chemical are given below:

- Hydrogen peroxide 2 volumes
- Lisapol.....1(g/L)
- Sodium silicate.....(8 g/L)

P^h of bath would maintain 10. After that washed 3-4 times by normal temperature water and then being neutralized with acetic acid 3 (ml/L).

2.2.3 Mordanting

Bleached jute fabrics being mordanted with pentahydrate copper sulfate with different concentrations like as 1%, 3% and 4%. During this experiment temperature maintained 80⁰ centigrade and material to liquid ratio was 1:25.

2.2.4 Dyeing of jute fabrics with natural dye

Bleached mordanted jute fabrics are dyed by the following recipe:

Natural dyeing recipe:

Extracted dyed jackfruit leafs color.....20% (owf)	Extracted dyed teak leafs color.....20% (owf)
Time.....1H	Time.....1H
Temp.....90 ⁰ C	Temp.....90 ⁰ C
Liquor ratio ... 1:25	Liquor ratio ... 1:30
Potash alum –3-4%	Glauber salt.....5gm/L
Glauber salt.....5gm/L	Potash Alum –3-4%
pH of bath5	pH of bath5

Characterization of dyed sample

Dyed jute sample were characterized by the following criteria.

Fastness determination

Sun Light Fastness, wash fastness, rubbing fastness values were carried out on visual inspection and D-65, crock meter.

3. Results and Discussion:

After dyeing from extraction of teak and jackfruits leaves, teak leaves exhibit better result by wash fastness, light fastness. To make dye stuff colorfast, adding mordant to get desired color

Pictorial view of Dyed jute fabrics



Fig: 3 Raw jute Fabrics after bleaching.



Fig: 4 Dyed fabrics from jackfruits leaves.



Fig: 5 Dyed Jute Fabrics from teak leaves.

Table-1 Calorimetric value of dyed jute fabric

Sample	D65		
	L*	a*	b*
Raw jute fabric	67.02	5.19	17.91
Dyed jute fabrics from teak leaves	35.9	10.9	4.7
Dyed jute fabrics from jackfruits leaves	55	8.2	9.34

Color Fastness to washing Result

Dyed jute sample exhibits good color fastness to wash results. The teak leaves color shows a good fastness than jackfruit leaves with adding both mordanting.

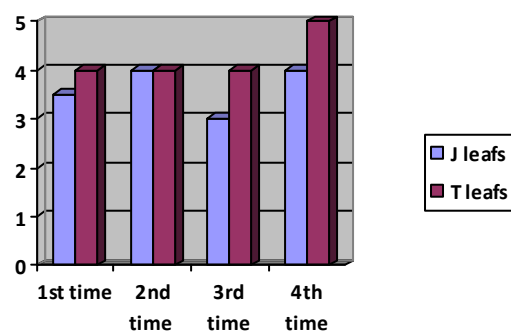


Fig: 6 Comparison of Color fastness to wash test results.

Color fastness to Light Fastness Results

Each dyed fabric shows a good light fastness in sun which was exposed to 48 hrs. This was evaluated by comparison between two dyed fabric and teak leaves show good light fastness results. Then it tested according light fastness grade. In different time, moderate fading is observed for both.

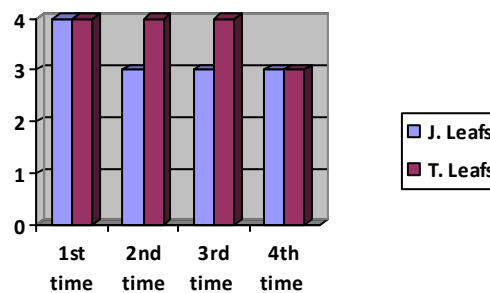


Fig: 7 Comparison of Color fastness to light fastness test results.

Color fastness to Rub Fastness Results:

Fastness to rubbing refers to a textile's resistance to all types of rubbing and stains from other fabrics that are really being used. Both fabrics are tested by prowhite automatic crock meter color fastness tester. It is significantly noticeable color fastness result teak leaves than jackfruit leaves.

Color Fastness to Laundering Results

Several times about 20-50 times, different samples are laundered but no significant change was not found. But teak leaves dyed fabrics are less being fade than jackfruits dyed fabrics. It was seen by visualization process.

4. Conclusion:

Jute fabrics in different weave and design in grey condition are naturally golden-brown color. In this process two natural extracted dyes are used to dye for jute fabrics which are almost green like brown color. Both dyeing process absorptions improve by the adding more concentration of mordant. Here mordant play's significant role. In conclusion it can be said that natural color especially teak leaves would be great source for craftsman in substitute of synthetic color. In this research there is also limitation found. Because extracted natural color concentration is not maintained properly and if exists extracted natural color in liquid condition for a long period it will produce bad odor and growing fungus. In this research no finishing treatment is done. So finally need to do more research for finding accurate the levelness amount natural dye absorption by jute fabrics.

References

- [1] Chattopadhyay, S.N. & Pan, N.C. & Khan, A.. (2018). Printing of jute fabric with natural dyes extracted from manjistha, annatto and ratanjot. *Indian Journal of Fibre and Textile Research*. 43. 352-356.
- [2] Bhuiyan, M. A. R., Islam, A., Islam, S., Hossain, A., & Nahar, K. (2017, January 5). Improving dyeability and antibacterial activity of *Lawsonia inermis* L on jute fabrics by chitosan pretreatment. *Textiles and Clothing Sustainability*, 3(1). <https://doi.org/10.1186/s40689-016-0023-4>
- [3] Samanta, A. K., Mukhopadhyay, A., & Ghosh, S. K. (2020). Processing of jute fibres and its applications. *Handbook of Natural Fibres*, 49–120. <https://doi.org/10.1016/b978-0-12-818782-1.00002-x>
- [4] Samanta, Ashis & Agarwal, Priti. (2009). Application of natural dyes on textiles. *Indian Journal of Fibre and Textile Research*. 34. 384-399.
- [5] Chattopadhyay, S., Pan, N., Roy, A., Saxena, S., & Khan, A. (2013, August). Development of natural dyed jute fabric with improved colour yield and UV protection characteristics. *Journal of*

- the Textile Institute, 104(8), 808–818. <https://doi.org/10.1080/00405000.2012.758352>
- [6] Jahan, Nusrat & Ferdush, Jannatul & Ahmed, Sraboni & Akhter Himu, Humayra & Ara, Iffat. (2022). Sustainable Dyeing of Jute Fabric with Natural Dye Sources by Cold Pad Batch Technique. 1. 35-43.
- [7] Gumrukcu G, Ozgur M U & Gultekin C, *Asian J Chem*, 20(4) (2008) 2891-2902
- [8] Chattopadhyay, S. N., Pan, N. C., Roy, A. K., & Khan, A. (2015, March 1). Sustainable Coloration of Jute Fabric using Natural Dyes with Improved Color Yield and Functional Properties. *AATCC Journal of Research*, 2(2), 28–36. <https://doi.org/10.14504/ajr.2.2.4>
- [9] Hassan, M. N., Nayab-Ul-Hossain, A., Hasan, N., Rahman, M. I., & Mominul Alam, S. M. (2021, August 31). Physico-mechanical
- [10] Chattopadhyay, S. N., Pan, N. C., Roy, A. K., & Khan, A. 2014. Dyeing of Jute Fabric with Natural Dye Extracted from Annatto. *AATCC Journal of Research*, 1(3): 20–27.
- [11] Pan, N.C. & Chattopadhyay, S.N. & Day, A.. (2003). Dyeing of jute with natural dyes. *Indian Journal of Fibre and Textile Research*. 28. 339-342.
- [12] Giles, C. H. and R. B. McKay, *Textile Research Journal*, Vol. 33, 1963, pp528–577
- [13] Chavan R B, *Clothesline*, 42 (4) (1995) 96.
- [14] Samanta A K, Singhee D & Sethia M, *Proceedings, Convention of Natural Dyes*, edited by Deepti Gupta and M L Gulrajani (Department of Textile Technology, IIT Delhi), 2001, 20.
- [15] Arief, Irma & Suryati, Tuti & Wardhani, Pungky. (2014). Physicochemical and Organoleptic of Beef Sausages with Teak Leaf Extract (*Tectona grandis*) Addition as Preservative and Natural Dye.. *International Food Research Journal*. 21. 2033-2042.
- [16] Gupta, V. K. (2019). Fundamentals of natural dyes and its application on textile substrates. *Chemistry and technology of natural and synthetic dyes and pigments*, 2019.