



Eco-Friendly Dyeing on Rayon Fabric with Biomordants

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Abstract: Due to the various environmental factors technological developments are shifting towards utilization of less/non polluting chemicals and also towards biodegradable products. Keeping in view of the above facts the objective of present work was to perform the whole dyeing process with natural resources. Turmeric rhizome (*Curcuma longa*), catechu bark (*Senegalia catechu*) and marigold flower (*Tagetes erecta*) taken as dye source along with biomordants as myrobalan (*Terminalia chebula*), alum and pomegranate rind (*Punica granatum*). These natural dyes and bio mordant combinations were used to colour rayon fabric. Findings exhibited that all the natural dye with biomordants not only improved the colour fastness but also gave a variety of shades. The shades of fabric depend on specific dye and its combination with mordant.

Keywords: Mordants, Natural dyes, Rayon fabric,

I. INTRODUCTION

Natural dyes have been parts and parcels of men's life, since time immemorial. Natural dyes are those colourants that are obtained from natural sources such as plants, minerals, animals and microorganisms (Yusuf et al., 2017). But the unexpected discovery of the synthetic dye "Mauveine" by Sir W.H. Perkin in 1856 sounded the death knell of natural dyes industries of the world (Samanta, 2020). Almost all synthetic dyes that are made up of petrochemicals affect flora, fauna and human health also (Sharma, 2017). Thus, the partial use of dyeing and printing material also causes environmental pollution as well as hazardous effects on workers and buyers. Whereas, natural dyes are highly environmentally friendly and pose no serious threat to human life as well as the ecosystem. If the textile industry uses natural dyes and biomordants for printing and dyeing instead of synthetic ones it will be eco-friendly for the environment. Dyeing is the process of imparting colour to textile material. Natural dyes required a fixing agent to attach to fabric that is called mordant (Haji, 2010). Generally, synthetic mordants have been applied with natural dyes. But here mordant also have been derived from plant parts.

In present work natural dyes are extracted from turmeric (*Curcuma longa*) rhizome, marigold (*Tagetes erecta*) flowers, catechu (*Senegalia catechu*) barks and applied with biomordants such as alum, pomegranate rind and myrobalan to dye the fabric. These dyes and biomordants were used to colour the fabric at different temperature and time to obtain different colour shades on fabric.

II. MATERIALS AND METHODS

2.1 Fabric selection: Rayon fabrics were purchased from Samta textiles, Malwa mill Indore for dyeing.

Selection of dye and mordants: turmeric rhizome (*Curcuma longa*), *Tagetes erecta* flowers and *Senegalia catechu* bark were taken as dye. However, *Punica granatum* rind, alum and *Terminalia chebula* dry fruit were used for mordanting.

2.2 Extraction of dye: The samples were collected and prepared in powder form then dissolved in water and left for one day. After one day above dye solution boiled at 80°C to 90°C temperature for 60 minutes then it was filtered to obtain crude dye stuff. Same process was followed for preparation of bio mordant (Win & Swe, 2008).

Scouring of Fabric: First of all rayon fabric kept in water for one day and washed with tap water and then put in a pot with detergent solution and allowed to boil on 60°C temperature for 30 min. The scouring fabric washed thoroughly with tap water and dried at room temperature (Vankar et al., 2009).

2.3 Dyeing of Fabric: Dyeing of rayon was performed at 80°C for 50 minute using fixed amount of each extract in dyeing pot (Table 1) Dyed samples were extensively washed by cold water to remove any unfixed dyed material and finally dried at ambient temperature.

Table 1: Condition for dyeing on Rayon fabric

Dye concentration	Mordant concentration	Temperature	Time	M:L
20%	20%	80 0 C	50 Min	1:50

2.4 Colourfastness Test: Colourfastness are the ability of dye to retain on fabric during washing, light exposure and perspiration etc. Two parameters for checking the quality of dyed fabrics were tested as follows (Samanta & Agarwal, 2009; Ansari & Iqbal, 2021)):

2.4.1 Washing Fastness: The tests were performed with ISO: 105 C10-2006 (A1) Method. The testing was done by The Bombay Textile Research Association (BTRA), Mumbai.

2.4.2 Light Fastness: The tests were performed with IS: 2454: 1985 Method. The testing was done by The Bombay Textile Research Association (BTRA), Mumbai.

III. RESULTS AND DISCUSSION

3.1 Colours obtained from natural dyes and biomordant combination

The above process of dyeing was done in combination of natural dyes and biomordants. 3 types of natural dyes extracts were taken in dyeing process such as Marigold flowers, Catechu bark and turmeric rhizome with 3 different biomordants as Alum , Myrobalan and Pomegranate rind. Developed colours on rayon were visually evaluated. Different shades of yellow colour were obtained from the dye extracted from turmeric . Similarly shades of brown colour were obtained from crude extract of catechu. Dye extracted from marigold flowers given varying shades of green tinge when applied on fabric in different combinations of mordants. Mordants were used in same ratio for all experiments of individual dyes, but their results appeared different with variation of mordants as alum, myrobalan and pomegranate rinds. The difference in shades of a single dye depends on variety of fixative agents, which have their own contribution to develop varying hues on textile material. Thus, mordant play a very important role in imparting colour to the fabric (Table 2).

Table 2 : Different colours obtained from natural dyes and biomordant combination on rayon fabric

Fabric	Dye extracted from natural sources	Mordant	Colour obtained	Colour Shade
Mulberry Silk	Curcuma longa rhizome	Alum	Yellow	
		Terminalia chebula	Canary	
		Punica granatum	Asparagus	
	Senegalia catechu bark	Alum	Dark Brown	
		Musa paradisiaca Sap	Light Brown	
		Terminalia chebula	Khaki	
		Punica granatum	Tortilla	
	Tagetes erecta flowers	Alum	Sage	


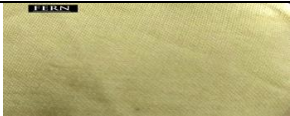
		Terminalia chebula	Laurel	
		Punica granatum	Fern	



Fig 1 : Shade card prepared by natural dyes and biomordants on rayon fabric

3.2 colour fastness of dyed Fabric

Colourfastness defined as having colour that will not run or fade with washing and sun exposure. Fastness ratings are normally evaluated by the grey scales for bleeding and for fading. They consist of five different grey colour gradations and are compared with the tested textile and its prescribed adjacent material. Fastness grades are as follow

1-Very Poor, 2- Poor, 3- Moderately Good, 4- Good, 5- Excellent.

Table 3 :-Washing and light fastness properties of dyed rayon fabrics.

Natural dyes and mordants used	Washing fastness	Light fastness
Senegalia catechu+Alum	3-4	2-3
Senegalia catechu+Punica granatum rind	3	2-3
Senegalia catechu+Terminalia chebula	3-4	3-4
Tagetes erecta+Alum	4-5	3-4
Tagetes erecta+Punica granatum rind	2	3
Tagetes erecta+Terminalia chebula	3-4	3-4
Curcuma longa+Alum	5	2-3
Curcuma longa+Punica granatum rind	2-3	2-3
Curcuma longa+Terminalia chebula	3	2-3

1-Very Poor, 2- Poor, 3- Moderately Good, 4- Good, 5- Excellent.

Table 3 is representing fastness properties of the rayon dyed fabric. All the washing fastness properties recorded an average value between moderately good to excellent except *Tagetes erecta* with *Punica granatum*. In light fastness, the average values are between range of poor to good. The results revealed that each dye and mordants combination act differently towards washing and light exposure.

IV CONCLUSION

The investigation revealed that natural dye can be used with biomordant successfully on rayon fabric. The results of whole dyeing process showed that the natural dyes extracted from Turmeric rhizome, marigold flower, catechu bark exhibited wide range of light to dark shades by using combination of different mordants. Most of the dye samples were showed moderately good fastness against washing and light. The study points out the possibilities exploring the commercial potential of these dyes in the vicinity of their growing region. Dyeing with these materials may also be carried out in order to satisfy the artistic creative urge. Here, it is also important to know the excellent property of studied dyes for their hues, beautiful shade as well as significant harmless contribution to both textile industries and environment. Hence, application of natural colouring agents on textile material gives a better opportunity of creating source of income and self employment without any harm due to their great economic values. Thus, there is scope of more research work in the field of natural dyeing for their use on commercial scale in an ecofriendly manner.

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