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Analyses Of Colourfastness by Natural Dye on Three Different Natural Fabrics

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Abstract
The natural dye is derived from the natural sources like plants, animals and insects. The colourfastness of the natural dye on the natural fabrics is subjected to the different set of conditions. This article is a comparative study of three different cotton fabrics ie., Kala Cotton *(Gossypium herbaceum*), Banana Cotton *(Musa acuminata x Gossypium)* and Bamboo Cotton *(Bambusa vulgaris x Gossypium)*. These fabrics are dyed using the combination of Madder and Pomegranate *(Punica granatum)*. The colourfastness of the material will be tested against wet and dry crocking. Thus, to find the better impact of natural dye to the different cotton fabrics.

Keywords: Natural dye, Gossypium herbaceum, Musa acuminata x Gossypium, Bambusa vulgaris x Gossypium, Madder, Pomegranate, Colourfastness.

Introduction

The oldest known form of dyeing is arguably the use of natural dyes. Natural dye was initially used by humans as a thought tool to create artwork that reflected both their environment and themselves. While natural dyes have been used to color textiles since ancient times, the discovery of mauve colorant in the 19th century led to the replacement of natural dyes with synthetic ones. Any color, pigment, or material derived from organic materials—plants, animals, or minerals—is considered a natural dye because it is a sustainable bioresource with little negative impact on the environment. Their usage in coloring textiles, food substrate, natural protein fibers like wool, silk, and cotton, leather, as well as food ingredients and cosmetics, has been known since antiquity. (10)

Pomegranate which is scientifically known as Punica granatum, this belongs to the Punicacea family. It was originally native to Persia and now grows throughout all warm countries (Goodarzian and Ekrami, 2010). About 19% of the pomegranate rind contains tannin, along with pelletitine (Adeel et al., 2009; Tiwari et al., 2010). Granatonine, which is found in the alkaloid form Nmethyl granatonine, is the primary coloring agent in pomegranate peels (Goodarzian and Ekrami, 2010). The dye gets its color from this compound. We will be able to comprehend the coloring compound's structural chemistry through its study. (4)

Since ancient times, colorants derived from the roots of different Rubia plant species have been used as dyes. These dyes are commonly referred to as "madder," although there are actually several recognized species with global origins. Madder was a useful dye for red, according to dyers in ancient Egypt, Greece, and Rome were familiar with it. However, dyeing recipes didn't start to appear in print until the 16th century. Dyers were aware that different varieties of madder could yield varying shades. (9)

Grown under rain and irrigation, cotton (Gossypium hirsutim) is a kharif1 crop valued for its cash and fiber yields. The entire climatic water requirement for cotton is between 700 and 1000 mm, depending on when it is sown, as well as factors like soil type, region, genotype, and farmer management. Cotton is a naturally occurring fiber, but because of its high-water requirements, it is important to minimize water use if you want to ensure its sustainability. On the other hand, a significant amount of Indian cotton and 99 percent of cotton grown in West Africa are rain-fed. 24% of all pesticides used worldwide are used on cotton crops alone. Reduced use of pesticides, fertilizers, and water is the biggest challenge to cotton farming's sustainability. In organic cotton farming, natural methods are employed to control weeds and pests instead of chemical fertilizers, growth regulators, defoliants, or pesticides. Cotton's toxicity profile is singularly reduced to zero through organic production. (11)

One of the ligno-cellulosic, fine, strong, glossy, and natural bast fibers derived from the pseudo-stem of the banana plant, banana fiber has comparatively good mechanical qualities. The multi-cellular nature of banana fibers results in increased stiffness, decreased cohesiveness, and increased irregularity, which are inherent drawbacks. Hemicellulose and lignin are used to cement the individual cells together to create a complex fiber (8). Because 20–30% adhered lignin makes it difficult to spin the fiber in textile processes, lignin must be eliminated by degumming; otherwise, low-quality product will be the outcome. (3)

Bamboo textile products are having high demands in the market because of their anti bacterial nature, biodegradable properties, high moisture absorption capacity, softness and UV protective capability (1). Bamboo has much to offer in its raw form. Its geographical range is wide spread and its uses are numerous. As a grass, it has a diverse network of growth patterns and can flourish in harsh climates. Nevertheless, many animal and plant species depend on bamboo (7). Bamboo is an antibacterial; relatively smooth fibre with low pilling and wrinkling, as well as high moisture sweat absorption, due to the micro gaps in its profile. Bamboo fabrics require less dyestuff than cotton fabrics in order to be dyed to the level desired, as they absorb the dyestuff better and faster and show the colour better. (6)

Materials and methods

Materials

The raw material for natural dye extractions are Pomegranate and Madder. The fabrics used here are Kala Cotton, Banana Cotton and Bamboo Cotton. The Colourfastness of the fabric which is to be dyed is evaluated in two methods using crock meter i.e., Dry Crocking and Wet Crocking.

Methods

Pomegranate peel was collected, washed and dried. After drying in room temperature the peel was ground into a fine powder. Madder roots were also collected and made into a fine powder which is then mixed with Pomegranate powder in the ratio of 50:50

100 g of dye stuff was assessed and reserved in a flask and 500ml of solvent (ethanol water) in the ratio 40:60 was added to it. The flask was heated in a water bath at 60°C for 60mins. The solution was then sieved to attain crude dyestuff.

Scouring of cotton fabrics i.e., Kala Cotton, Banana Cotton and Bamboo Cotton is made by washing it in a solution holding 0.5g/lit Sodium carbonate and 2g/lit non ionic detergent at 50°C intended for 25 mins, keeping the material liquor ratio at 1:40. The pre treated cotton fabrics were washed thoroughly in clean water and kept to dry at room temperature.

The processed cotton fabric was taken for dyeing using the dye stuff extracted from Pomegranate and Madder. Alum was used as the mordant for dyeing in the material liquor ratio of 1:40. The fabrics were soaked in clean water for 30mins before taking it to the dye bath. At dye stuff 4%, mordant 2%, material liquor ratio at 1:40, temperature at 80˚C for 60 mins the fabric was in the dye bath. The fabrics taken out from the dye bath and washed thoroughly in cold water.

Figure- 01 Crock meter

The process of rubbing a colored textile against a different fabric surface to transfer color is called crocking. Because many textiles transfer color more readily when wet, the amount of rubbing may depend on the moisture content. A crock meter is needed for the test, and the standard chromatic transference scale or gray scale for staining are used to evaluate color transfer.

The printed cloth performs extremely poorly in the rubbing fastness test. A precise choice of binders is essential for enhancing pigment printing's rubbing fastness. There are two parameters used to evaluate the rubbing fastness:

Dry: Rub the rubbing cloth ten times on the test sample of size l0 x 1" inch while applying a pressure of 9N (400 p/cm2) (to and fro).

Wet: Ten times, rub the test sample measuring 10 x 1 inch with rubbing cloth soaked in 100% pick-up demineralized water using a crock meter set to 9N (to and fro) pressure.

Result

The analyses of colourfastness by Natural Dye on Kala Cotton, Banana Cotton and Bamboo Cotton have been carried out to find which sample withstands the highest level of physical property.

S.No	Kala Cotton		Banana Cotton Fabric		Bamboo Cotton	
	Dry	Wet	Dry	Wet	Dry	Wet

1.	4\5	3\4	5	4\5	4\5	3\4
2.	4	3\4	4\5	4	4\5	4
3.	4\5	3\4	4\5	4	5	4\5
4.	5	4\5	5	4\5	5	4\5
5.	4\5	4	5	4\5	5	4\5
6.	4\5	4	4\5	4	5	4\5
7.	5	4\5	5	4\5	4\5	4
8.	5	4\5	4\5	4	4\5	4
9.	5	4\5	4\5	4	4\5	3\4
10.	4\5	4\5	4\5	4	4\5	3\4

Table 01: Comparison of Colourfastness

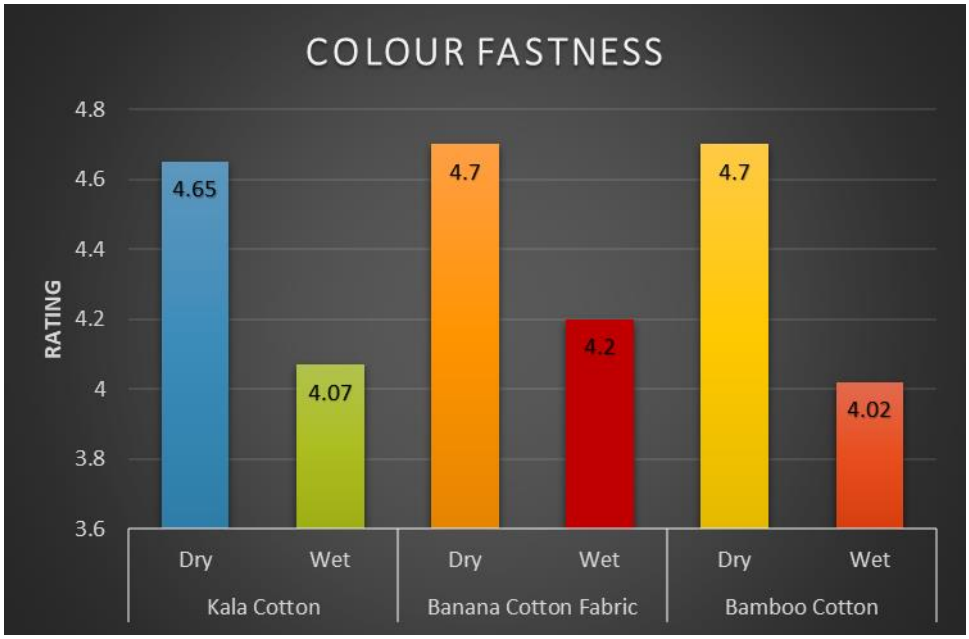

Figure 02: Comparison of Colourfastness

Thus from the above table its shown that Banana Cotton and Bamboo cotton has same rating when the fabrics was treated to dry crocking whereas in the case of wet crocking Banana Cotton fabric has good colourfastness.

Conclusion

Analyses of Colourfastness by *Punica granatum* on Kala Cotton, Banana Cotton and Bamboo Cotton has been carried out using two different methods i.e., Dry crocking and Wet crocking in which dry crocking is made using the dry dyed fabric intended to crocked against white fabric which helps to find out change in colour and colour stained. Wet crocking is made by wetting the dyed fabrics and made to crock against white fabric to find out the same. As the result of dry crocking Banana Cotton and Bamboo Cotton has shown the same rating and in wet crocking Banana Cotton has good colourfastness than the other two fabrics.

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