International Journal of Agricultural Research and Food Production
ISSN: 2536-7331 (Print): 2536-734x (Online)
Volume 5, Number 1, March 2020
http://www.casirmediapublishing.com

FASTNESS AND FADING CHARACTERISTICS OF MANGO LEAVES EXTRACTED DYE ON FABRICS EXPOSED TO SUNLIGHT IN A DESIGNED AND CONSTRUCTED FRAME

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ABSTRACT
In this study, a dye was extracted from mango leaves and the solution obtained was deep yellow but turned light brown when a mordant (alum) was added to it. The two solutions – one containing alum and the other without alum were each tested on their ability to imprint colour on the cotton and wool fabrics. The cotton dyed fabrics (one without alum and the other with alum) were thereafter exposed to sunlight using the exposure frame (designed and constructed sensor instrument) for 40 hours to detect and evaluate the fastness and fading capacity of the dyes. The result revealed that the solution of the dyes without alum (deep yellow) turned the cotton fabric creamy with no significant change in colour after 40 hours of exposure in the designed and constructed exposure frame. This instrument confirmed that the creamy colour on the fabric was indication of its fastness to sunlight and suitability as dye for cotton fabric. The solution with Alum (light brown) turned the cotton fabric lemon green but after exposure to sunlight in an exposure frame there was a significant change and the colour was lost. This indicated fading and the inability of the dye to be applied on cotton favric when alum is usd as a mordant. In dyed wool fabric exposed for 40 hours to sunlight, all lost their colours indicating the unsuitability of the mango dye on wool with or without mordant. The exposure frame was able to determine the suitability of mango dyes for cotton fabric without mordant and unsuitability of the dye for wool fabrics

INTRODUCTION
Dyeing fabric is an ancient art which predates written records (Jothi, 2008). Primitive dyeing techniques required rubbing crushed coloured pigments from plant sources on fabric. The pigments become associated with the fabric and the imparted colours are attractive to influence the interest of the user. However, when exposed to sunlight and rinsed in water, the dye dissociates resulting in fading. The synthetic dyes hardly dissociate but however contain carcinogenic amines (Hunger, 2003). Therefore the application of synthetic dyes causes serious health hazards and influences negatively the eco-balance of nature (Bruna and Maria, 2013). Considering the consequences of using synthetic dyes, natural dyes from plant sources are preferable for use (Ammayappan et al, 2014). Plant leaves are potential sources of natural dyes

because of their abundant availability. Whenever mordant (double salts) are added to plant dyes, a wide range of colours are produced (Win and Swe, 2005). Mango Bark extract (dye) has been reported to be used on silk and cotton materials as a source of natural dyes (Bains et al, 2003). On the other hand, mango leaves were used to produce extract that could be used as mango dye.

Statement of the Problem

A lot of work has been done on the production of dyes from plant sources. However, a little has been done on instrumental method using an exposure frame for evaluating the fastness and fading characteristics of dye from plant sources when exposed to sunlight and when rinsed in either cold or hot water. Work on specific amount of sunlight to be exposed to fabric already dyed before evaluating fastness and fading characteristics is lacking

Material and Methods

Dye extraction

The mango leaves used for this study were collected from mango trees grown within the college of food technology complex, university of agriculture, Makurdi, Benue State. The leaves were washed to remove dust and other foreign particles and dried in sunlight under controlled conditions for 4 days. The leaves were milled into powder using the attrition miller. The powder was dissolved in hot water and the dye solution extracted by filtration with cheese cloth.

Dyeing

1 litre of dye solution was measured into a pot and heated to reach 60°C. A piece of 100% cotton fabric measuring 50cm by 60cm and weighing 24gm was soaked in cold water, squeezed out and immersed in the dye solution and allowed to stay for 30minutes. This was removed, rinsed in cold water and dried.The wool as also dyed in a similar fashion

Method for Exposure of Fabrics to Exposure Frame Analysis

Sample Preparation

From the dyed fabric, a sample measuring 5cm by 20cm was cut and fastened to the free cardboard in the exposure frame. The same was done to the wool fabric. Half of it was covered with aluminium foil while the top part was exposed. The cardboard carrying the sample was put back in the exposure

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frame, the frame was closed and taken outside and placed at an angle of 45° to face the sunlight for 40 hours

Figure 1: A Designed and Constructed Exposure Frame

RESULT AND DISCUSSION

Table 1: Inferences (Results) Drawn from Test and Observations of Fabrics Exposed to Sunlight inExposure Frame for 40 Hours

	Test	Observations	Inference (Results)
1	Creamy coloured dye cotton fabric without alum (mordant) and exposed to light for 40 hours	No significant change of the creamy colour after 40 hours	Mango dye can form a fast colour on cotton fabric without any added fixative
2	Lemon green coloured dye cotton fabric with alum (mordant) exposed for 40 hours	The green colour virtually disappeared during the exposure.	The exposure frame detected the inability of the alum as a mordant to play the role of a fixative in the case of cotton fabric and mango leaf dye
3	Lemon green coloured dyed wool fabric without alum and exposed to sunlight for 40 hours in the exposure frame	There was significant loss of colour on wool fabric during exposure to sunlight – this indicated fading	Mango leaf dye is not suitable for wool fabric without the addition of mordant
4	Lemon green dyed wool fabric with	Total of colour as in the other	The exposure frame

alum exposed to sunlight for 40 hours in the exposure frame	case above	detected that there is no affinity between mango leaf dye and wool fabric even when mordant is added

DISCUSSION

The findings in this experiment has shown that colour of varying degree or shades can be obtained from one dye yielding plant through the use of mordant as was reported by Vanker et al, 2009 that mordant are metal salts which produce an affinity between the fabric and the dye. Based on the discovery in this experiment, it has been found that cotton fabric ordinarily absorb dye more than wool fabric. This was shown in the intensity of the colour obtained after the dyeing and therefore mango dye cannot be used in dyeing wool fabric. Also, when cotton fabric without mordant as shown in sample A was exposed to sunlight for 40hrs (8 hours daily for 5 days) using the exposure frame, there was no significant change in colour. It maintained cream colour. Therefore mango leaf dye can be used. Also from the findings, I observed that the dye sample of cotton fabric with Alum as a mordant that had a lemon green colour before exposure to sunlight using the exposure frame lost some of the colour after being exposed for 40 hours (8 hours daily for 5 days). This means that the lemon green colour obtained was not light fast

Both samples B (wool with mordant and wool without mordant) lost most of its colour immediately after rinsing with water without soap. Therefore mango leaf dye cannot be used in dyeing wool and alum is a good fixer or mordant for wool. In this research, mango leave with alum produced a very nice shade of lemon green but was not colour fast to sunlight as reported by Umbreen (2008). The fastness properties obtained by natural dyes are inferior to those obtained by synthetic dyes.

CONCLUSION

Despite the use of acid activated mango leaf powder (MLP) for the removal of Rhodamine B (RB) dye from aqueous solution (Khan et al, 2011), the result of this study has revealed that natural mango extracted dye is used to impart colours to textile especially cotton Fabrics using Alum as can be seen in plate 2. In this research, mango leave with alum produces nice shades of lemon green but was not colour fast to sunlight as reported by Umbreen (2008). The

fastness properties obtained by natural dyes are inferior to those obtained by synthetic dyes. This can be seen in plate 5 that the lemon green colour acquired by cotton fabric almost lost the colour after 40hours to sunlight using exposure frame. This research also proved that different fibres have different affinity to different dyes. As can be seen in plate 3, mango leaf dye is not good for woollen fabrics as the colour washed off after rinsing in cold water. This is to say that despite the addition of alum to the dye bath, the woollen fibre showed lesser affinity to the dye. Conclusively when cream colour is needed for a cotton fabric, mango leaf dye is suitable for such colour and in a situation where lemon green colour for household apparels, mango leaf dye with alum as a fixative is also the answer provided the apparel used will not be subjected to excessive sunlight.

Recommendation

Studies should be done on natural dyes to identify more dye yielding plants and vegetables. These dyes should also be tested for fastness and fading characteristics using the designed and constructed exposure frame

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