Original Article

Anthocyanin from red tamarind, *Tamarindus indica* vs rhodocarpa as a potential natural pigment for use in textile industry

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Abstract

Tamarindus indica var. rhodocarpa (red tamarind) is one of the fruits rich in anthocyanins and these pigments can be used as natural dye for dying fabrics instead of synthetic dyes which are harmful. This study has been carried out to utilise the natural pigment of this fruit as a colourant in the textile industry. The dying ability of the fruit is obtained by dying it on a bleached cotton fabric with and without the use of mordant. The colour absorption values (K/S) were calculated using the Kubelka–Munk equation from reflectance values. Tannic acid and ferrous sulphate were used as pre and post mordants respectively. On spectrophotometrical analysis, increased colour intensity was observed on the fabric which has been treated with mordant. The mordanting process resulted into varied values of (% STR-WSUM) colour strength, red/green value (a*), yellow/blue value (b*) chroma (C*) and hues (H*) with significant changes in lightness values (L*).

Key words: Anthocyanin, mordant, natural dye, Spectrophotometrical analysis, *Tamarindus indica* var. rhodocarpa

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INTRODUCTION

Plants, animals and minerals serve to be the source of natural dyes, these dyes are not readily available and they require an extraction process. The colours of the plants are mostly due to the presence of aromatic oxygen containing pigments called flavonoids found in the epidermal region of plants. These naturally occurring pigments are used as colourants in food, cosmetics and textile. They produce uncommon and soft shades compared to synthetic dyes. Some fabrics can be coloured simply by being dipped in the dye, others such as cotton require a mordant ensuring reasonable fastness to sunlight and washing. With the knowledge of the public towards eco-safety and health concerns, interest on natural dyes has been increased and hence eco-friendly products are gaining popularity. Recently commercial dyers and small textile exporters are finding ways to make use of these natural dyes for printing and dyeing of textiles to eliminate harmful effects on environment. The advantage of these natural colourants revolves around the fact that they are usually agro renewable, biodegradable, non-toxic, employment generating and utilisation of wasteland.

Collection of the plant sample and extraction of the dye material

Tamarindus indica var. rhodocarpa unripe fruits were collected from Pollachi, Coimbatore, Tamilnadu, India, situated between 10°39'12.0" N longitude and 077°02'03.6" E latitude. The unripe fruits were brought to the Bioprospecting laboratory at Institute of Forest Genetics and Tree Breeding, Coimbatore for extraction of pigments. Extraction process involves maceration and

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soaking of the unripe fruit in acidified methanol (0.01% HCl in methanol) overnight under refridgerated condition. Extraction was repeated until faint coloured extract was obtained and the filtrates were pooled. Solvent was removed by rotary evaporator at 40°c under vacuum.

Dying of the bleached cotton fabric with natural colour:

The fabrics were dyed using the natural colour obtained from this unripe fruit. One fabric was dyed with the colour without any treatment while the other was premordanted with 10% tanic acid then dyed using natural dye which then was treated with 1% ferrous sulphate as a post mordant. The samples were then washed and dried.

Measurement of colour strength and colour hue changes:

The dyed samples were measured for their colour difference by using (CCM) Macbeth 7000A spectrophotometer. The colour strength was determined by K/S values which is calculated by Kubelka-Munk equation [K/S= (1-R) 2 /2R] Where, R is the decimal fraction of the light reflectance of dyed fabric at λmax. K is the absorption coefficient and S is scattering coefficient and the weighted strength is calculated by the formula % Strength WSUM = Color Value WSUM SAM / Color Value WSUM STD x 100. The total color difference ΔE* was calculated, the value that is taken into account to obtain differences between L*, a*, b* of the sample ΔE = (ΔL 2 + Δa*2 +Δb*2)1/2

RESULT AND DISCUSSION

Red coloured extract was obtained after extraction with acidified methanol. 10 gms of flesh were taken for extraction and after extraction the solvent was removed by oven drying and 900mg of extract was obtained. The extract was subjected to dying and the colour changes between the samples dyed with and without mordanting were studied spectrophotometrically. The values were tabulated in table 1. from which it is determined that the colour intensity increased in the sample treated with mordants (Figure 1). It gave a grey hue compared to the sample dyed without using mordants (Figure 2). For the measurement of %STR-WSUM, l*, a *, b*, c* and h° three illuminating sources were used such as D65-10, A-10 and F02-10 (CWF). These values give the difference between the shades. The sample treated with mordants showed the higher colour depth of DE*=18.79 compared to the other. Similarly many other floras have been experimented as a natural colourants for textile industry. *Tagetes erecta* L. extract gave different shades on cotton fabrics.

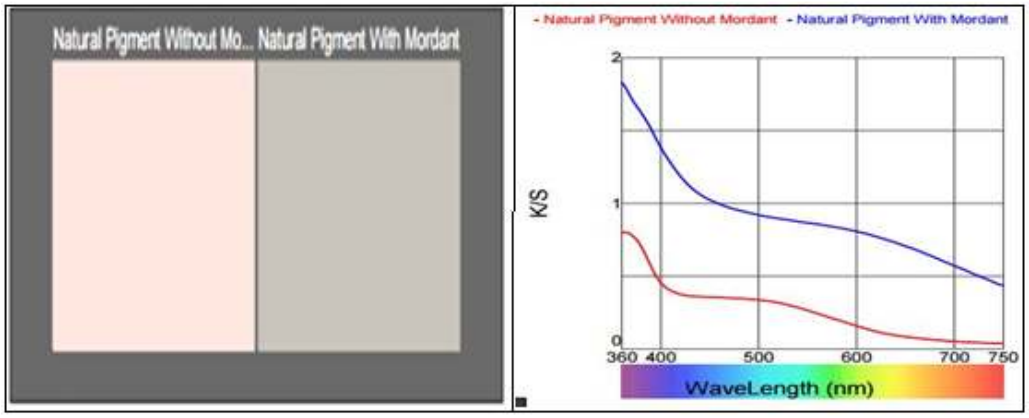

Figure 1 shows the colour of the fabrics after dying; **Figure 2** shows the λmax of the dyed fabrics

Table 1

Sample	Illuminants	DE*	%STR-WSUM	l*	a *	b*	c*	h°
Fabric dyed without mordant	D65-10	0.00	100.00	76.49	7.71	7.40	10.68	43.82
	A -10	0.00	100.00	77.89	9.56	9.65	13.58	45.25
	F02-10 (CWF)	0.00	100.00	77.12	5.30	8.51	10.03	58.09
Fabric dyed with mordant	D65-10	17.30	332.31	60.90	0.79	4.45	4.52	79.92
	A -10	18.79	388.81	61.31	2.23	4.73	5.23	64.79
	F02-10 (CWF)	17.12	352.28	61.08	0.48	5.01	5.03	84.58

Table 1. In this table ΔE* = total color difference value, %STR-WSUM denotes the weighed strength, l* defines lightness, a* denotes the red/green value, b* denotes the yellow/blue value, C* specifies chroma and h° denotes hue angle, an angular measurement. Yarns of wool and cotton on treatment with the dye without and with the use

of different mordants[1]. *Ficus cunia* locally known as *Khaina* is unexplored in terms of dye, the leaves of this plant gave wide range of color/ shades using different synthetic and natural mordants. The colorant produced from the leaves of this plant was found to be very stable on Polyester Cotton and Wool Fabric[2]. Mango leaves dye extract gave different fashion hues on silk fabric using mordants and their combinations[3]. The applications of these dyes are aimed at safeguarding human health as well as protecting and prolonging life on earth.

CONCLUSION

The use of synthetic colours has harmful effects over the society and hence the view of the public has turned towards ecofriendly products. These natural colourants provide different hue compared to the synthetic ones and as an added advantage they possess numerous biological properties. These dyes are cost efficient as the yield of the fruits is higher and hence cultivation of these kinds of economical agro forestry species may support rural livelihood.

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