



Utilization of flower dyes on silk and cotton using mordant combinations

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ABSTRACT

Natural dyes are biodegradable eco friendly. In the present study an attempt was made to dye silk and cotton with the dyes extracted from the flowers of *Delonix regia*, *Nyctanthes arborescens*, *Tagetes erecta* and *Pterocarpum petiolarum* using two different mordant, copper sulphate and potassium dichromate. The fabrics dyed in *Nyctanthes* have found to be good colour fastness when they subjected to involve in qualitative test.

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Introduction

Natural dyes have been used to colour clothing or other textiles. In ancient India, only a small percentage of textile dyes were extracted. Lately there has been increasing interest in natural dyes, as the public becomes aware of environmental problems related to the use of synthetic dyes (Piccagli and Venturi, 1998).

In India, the use of natural dyes goes back to the prehistoric period, which is abundant by the use of synthetic dyes. In ancient times natural dyes have been used for many purposes. They also served to colour cosmetic products and to produce inks. Synthetic dyes are commercially available because of their fastness, easiness of use and the various colour shades available. Therefore, natural dyes become a better option because they are sustainable in nature and have low toxicity and low allergic reactions. However, now the use of natural dyes became extinct due to popularity of synthetic dyes. So this paper deals with the importance of natural dyes.

Now a days, skin allergies due to clothes are becoming common. One primary reason for this is the use of non-eco-friendly dyes on textiles. Therefore, the European Community has banned few azo dyes that give bright colours on textiles. This has encouraged the revival of natural dyes globally. India, once famous for production of dyed and printed textiles from natural dyes is trying to revive its fast glory (Sharada Devi *et al.*, 2002). Being biodegradable and rightly compatible with environment, the natural dyes are free from the effects associated with synthetic dye synthetic dyes such as harmfulness to human body, Pollution and waste water problems. (Padhy and Rathi, 1990; Garg *et al.*, 1991; Eom *et al.*, 2001).

The synthetic chemical dye causes many adverse effects on the skin and also environmental unfriendly since, natural dying methods used by the people needs revival, therefore this study was undertaken and was focused on dying properties of flowers of *Delonix regia*, *Nyctanthes arborescens*, *Tagetes erecta* and *pterocarpum petiolarum*.

Methodology

For the present study, flowers of four different families were used. *Delonix regia*, Raf. belongs to the family Caesalpinaceae as avenue tree. It cools the atmosphere pollution tolerant climate purifier, wood for cheap items and as fuel. *Nyctanthes arborescens* belongs to the family Oleaceae. The vapours from its fragrant flowers neutralize the odour of ammonia and carbon monoxide from the atmosphere, flowers essential oil as perfume, leaf and bark in tanning. Plant acts as sink for dust particles. *Tagetes erecta*, L. belongs to the family Asteraceae. The plant yields as essential oil, antibacterial and used in cosmetics plant infusion given in rheumatism, cold and bronchitis flowers are used in decoration. *Pterocarpum Pterocarpum*, DC belongs to the family leguminosae. Tree is partial air purifier, bark for tanning, dysentery, mixed in tooth powder, leaves used as cattle feed. The flowers of above mentioned plants were collected, dried and powdered. For the present study silk was obtained from Tamil Nadu Agricultural University, Coimbatore and cotton from textile yarn industry, Tirupur.

The degumming of raw silk is carried out using four to five grams per litre soda ash to boil for 45-60 minutes, maintaining the liquid ratio at 30:1. The treated material is given a hot wash for 10-15 minutes and finally it is washed in cold water. The degumming loss in this process is 20-25%. The bleaching of silk is done in water bath at 90-95°C for 1 hour and finally goods are washed and dried. The dye stuff powder is pasted with cold water and a small amount of soda ash and boiling water should be added to the paste with constant stirring to dissolve it completely. The silk material is then introduced in the dye bath containing dissolved dye solution and required amount of glauber salt (sodium silicate) at room temperature of the dye bath is then gradually raise to 85-90°C and dyeing is continued for 30-45 minutes. Increasing the size of the dye molecule can be achieved by using formaldehyde which will link the dye molecules through air bifunctional aldehyde group. After treatment of this nature improves the washing fastness of the

dyed material. Cotton fiber was soaked in distilled water and ionic detergent solution containing two grams per litre each of soap in soda ash at 80°C for 1 hour to remove starch. The material to liquor (M:L) ratio was maintained at 1:30, after which fabric was washed with distilled water, dried and iron. Prior to dyeing or mordanting the fiber sample were soaked in water for half an hour. Mordant used are copper sulphate and potassium dichromate. In case of cold water extract, the powder was soaked in water and kept for 48hrs. The resultant liquid was then filtered. The extracted dye solutions were then concentrated and then dried in hot air circulatory oven at 60-70°C dry material is obtained. The solid mass so obtained was then subjected to extraction was then subjected to extraction with 70:30, alcohol: water mixture and then filtered. Then filtrate was evaporated under reduced pressure to get concentrated mass of colour component for dyeing experiment. Cotton fibers were pre-treated with acetic acid at M:L(1:10) at 95°C for 30 minutes. The fiber was then dyed bath containing each of dye extracted from flower. The dyeing was carried out at 97-98°C for 45 minutes in which 2% sodium chloride solution basis of material was added to bath and the system was further heated for 15 minutes. Then the fibers were washed thoroughly and with ionized water and dried at room temperature. Mordanting was carried out for 30 minutes at 97-98°C

After the desired time the cotton and silk fibers are withdrawn from dye extracts, dried in air and thoroughly rinsed with cold water. The P^H of dyeing extracts was recorded by digital P^H meter, while the optical density (OD) of extracts before and after dyeing was also recorded by UV. The percentage of dye uptake of silk and cotton fibers obtained

through measurement of the differences in the absorbance, at the same wavelength of the dye bath concentration before and after dyeing with an ultraviolet visible spectrophotometer. Each sample was tested three times and the average OD was reported.

Results and Discussion

The dye uptake was calculated with the following equation, dye uptake (%) = $(A_b - A_a) / A_b \times 100$, where A_b and A_a were absorbance values measured before and after dyeing respectively (Badoni et al., 2009).

Table 1: Colour obtained after dyeing

Name of the Plants	Parts used	Colour obtained in silk	Colour obtained in cotton
<i>Delonix regia</i>	flowers	red	Dark brown
<i>Nyctanthes arboristis</i>	flowers	yellow	yellow
<i>Peltophorum pterocarpum</i>	flowers	Cream	Light brown
<i>Tagetes erecta</i>	flowers	Light brown	Olive green

It was clear that the four samples had an increase in breaking strength. It was observed that after dyeing, the breaking strength of silk material is increased. (Ahmed et al., 1997). The maximum absorbance of extracted dye was obtained after 60 minutes of extraction in present study. ushpanjali(2006) inferred that this was an optimum extraction time to obtain good results.

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Table 2. Dye absorption in silk and cotton

Type of fabric	Wavelength(nm)	Dye Used	Optical density before dyeing	Optical density after dyeing	Dye absorption (%)
Silk	570	<i>Delonix regia</i>	0.786	0.524	33.33
		<i>Nyctanthes arboristis</i>	0.821	0.424	48.36
		<i>Peltophorum pterocarpum</i>	0.721	0.531	26.35
		<i>Tagetes erecta</i>	0.782	0.646	17.39
Cotton	420	<i>Delonix regia</i>	0.732	0.519	29.09
		<i>Nyctanthes arboristis</i>	0.784	0.412	47.45
		<i>Peltophorum pterocarpum</i>	0.752	0.611	18.72
		<i>Tagetes erecta</i>	0.764	0.623	18.45

Table 3. Fastness Chart

Fabrics used	Washing fastness	Sunlight fastness	Perspiration fastness	Rubbing fastness	
				Wet	Dry
Control (without mordant)	+	+	+	+	+
Silk	+++	++	+	+++	+++
Cotton	+++	+	+	++	++

+ fair, ++ good, +++ excellent

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