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Research Paper

DYEING OF SILK WITH ECO-FRIENDLY NATURAL DYES OBTAINED FROM FLOWER OF *Syzygium cumini* (SC) PLANT USING DIFFERENT MORDANTS

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Abstract

Introduction and application of eco-friendly natural dyes on textile coloration have significant importance on the reduction of environmental pollution. Natural dyes are obtained from natural sources such as plants, insects and minerals. Among all the plant based dye sources i.e. bark, flowers, seeds etc. floral dye sources are more important for textile dyeing as it provides both dye as well as fragrance. In this study, the *Syzygium cumini* (SC) plant extract is dyed with Silk fabrics by different mordanting techniques with different mordant. After dyeing, the dyed Silk is subjected to different fastness tests. This study will help in improving the natural dye resources and replace them with synthetic dyes, consequently leading to a safe environment.

Key words: *Syzygium cumini* (SC), Colour fastness, extraction of natural dyes.

INTRODUCTION

People have added color to cloth for thousands of years [1]. Coloration is value-added treatments for most textile materials which includes dyeing and printing processes [2]. The aspect of producing textile products without impacting on the ecological balance, affecting both human and environmental health, is an important focal point to be pursued [3]. Due to increasing awareness of environmental issues and also pollution produced by synthetic dyes, wide spread interest has emerged in the dyeing of textile fibres using natural colorants on account of their better biodegradability and higher compatibility[4]. Natural dyes are believed that, they have better biodegradability, have wide variety non-toxic, non-carcinogenic, easily available and renewable, eco-friend and

generally higher compatibility with the environment; provide a wide range of beautiful shades with acceptable levels of color fastness [5-7]. Natural dyes are known for their use in colouring of food substrate, leather, wood as well as natural fibers like wool, silk, cotton and flax as major areas of application since ancient times. Natural dyes may have a wide range of shades, and can be obtained from various parts of plants including roots, bark, leaves, flowers, and fruit [8]. This trend is aimed at safeguarding human health as well as protecting and prolonging life on earth. Therefore, to address some of these issues this study was aimed to dye silk fabric with eco-friendly natural dye and different mordant extracted from the flower of *Syzygium cumini* (SC) plant.

MATERIAL AND METHODS

Collection of Sources

Flowers of *Syzygium cumini* (SC) are collected from Avalpoondurai, Erode District, Tamil Nadu, India. The plant sample was authenticated by a botanist of TNAU, Coimbatore. The flower are weighed accurately and then dried at room temperature. After drying, the dry leaves were powdered for extraction.

Dye extraction

The Petals of the flowers of *Syzygium cumini* (SC) are plucked early in the morning. These petals are cut into small pieces and placed in a vessel containing ethanol and allowed to simmer for about an hour. The collected extract (dye) is evaporated to remove the Solvent. The Plant extract of SC is shown in figure 1.



Figure 1. Plant Extraction of SC

In each case the extracted dye was used for various dyeing operations

PREPARATION OF MATERIALS

Silk

The Silk fabric in grey from was desized, scored and bleached well. It was cut into small pieces for dyeing with the dye extracts.

Chemicals Used

Alkali Used: Glauber's Salt

Exhausting Agent: Sodium Chloride

Metal Salts:

- ❖ Ferrous Sulphate
- ❖ Copper Sulphate + Potassium Dichromate
- ❖ Ferrous Sulphate + Magnesium Carbonate
- ❖ Potassium Dichromate + Potassium Permanganate
- ❖ Ferrous Sulphate + Copper Sulphate
- ❖ Aluminium Sulphate + Potassium Dichromate
- ❖ Potassium Permanganate
- ❖ Potassium Permanganate + Magnesium Carbonate
- ❖ Magnesium Carbonate + Potassium Dichromate
- ❖ Potassium Dichromate

Dyeing procedure: The cotton samples were dyed with dye extract keeping M: L ratio such 1:20. Dyeing was carried out different temperatures such as 40°C, 60°C and 80°C and continued for 1 hour.

Mordanting: The Silk fabrics were treated with different chemical and natural mordants [9].

Pre- mordanting method: In this method, dyed Silk fabrics were treated with solution of different chemical and natural mordants.

Colour fastness: The colour fastness of the dyed fabrics was tested according to IS standards. Colour fastness to washing, light and rubbing were determined from standard test methods IS-687-79, IS-2454-85 and IS-766-88 respectively [10].

RESULTS AND DISCUSSION

The dye extract from the plant sources *Syzigium Cumini* (SC) and its dyeing properties with Silk research have yielded certain exciting insights.

QUANTUM YIELD OF DYE EXTRACT

The quantum yield of the colouring matter from *Syzigium Cumini* (SC) has been found to be 4%. The colour of the dye extract of the flowers of *Syzigium Cumini* (SC) is Brown.

DYEING PROPERTIES

The natural dyes from the flower of *Syzigium Cumini* (SC) is found to be suitable for dyeing of Silk. These fabrics are dyed with metallic salts and organic molecules are created to be mordant with metal ions to yield not the same ensign on thread and fabrics.

EFFECTS ON METAL SALTS

Nine metal salts were used to apply the extracts of *Syzigium Cumini* (SC) to silk fabrics individually. The colour of silk yarn treated with dye extract and nine metal salts was compared and the results are shown in Table No.1. It is carried out the well known process of premordanting. Colours are created by combining different metal salts with dye extracts. Shade cards which are available on the market are used to distinguish the colours.

EFFECT OF EXHAUSTING AGENT

Sodium chloride has been used as an exhausting agent. It has been observed that it has no effect on dye uptake. But the levelness of dyeing is found to be good.

Table -1 Colors Obtained On Silk with Different Metal Salts Using *Syzigium Cumini* (SC) Extract (Brown Portion)

Metal Salts	Pre – Mordanting	
	Shades / colors	Fabrics (Silk)
Ferrous Sulphate	SULTRY (AP)	
Potassium Dichromate	MID CREAM (AP)	
Potassium Permanganate	NUT BROWN (DU)	
Copper Sulphate + Potassium Dichromate	LIMON (APC)	
Ferrous Sulphate + Magnesium Carbonate	SLEIGH BELLS (N)	
Potassium Dichromate + Potassium Permanganate	TEAK BROWN (APC)	
Ferrous Sulphate + Copper Sulphate	STEEL GREY DU)	
Aluminum Sulphate + Potassium Dichromate	CASHMERE-N (AP)	
Potassium Permanganate + Magnesium Carbonate	TIMBER GOLDEN BROWN (NP)	
Magnesium Carbonate + Potassium Dichromate	HONEY MUSTARD (APC)	

EFFECT OF TEMPERATURE:

It has been practical that more intense temperature shrinks the dye uptake whereas the dyeing of samples at 50° C yields enhanced consequences more readily than at scope temperature.

FASTNESS PROPERTIES

The soft and the abrasion refuge properties of these dyed fabrics were studied [11].

Rubbing Fastness

The resistance fastness of the dyed samples was assessed by a crock gauge by filament resistance fabrics and wet and dry rubbing fastness is associated anyhow under illegal conditions. The evaluation of the grade of castle is completed visually by means of grey scale. The results are presented in tables (Table 2).

Light Fastness

The light fastness of the dyed samples were assessed by exposing the dyed samples to the sunlight for 8, 12 and 16 hours and then the extend of fading was assessed and grading was given. The results are presented in tables.(Table 2)

It is seen that all properties can't be maintained practically on entire samples. The values became low when fabrics were dyed using pre mordanting methods with metal salts potassium permanganate, potassium dichromate + potassium permanganate & Ferrous sulphate + copper sulphate.

The same level of light and rubbing fastness properties were followed in both case of dye extracts from Syzigum Cumini (SC) and Sesbania Grandi Flora (SGF) sources.

It is inferred that the metal ions have a direct influence on the light and rubbing fastness properties of dyed Silk fabrics the hexavalent aluminium [Al(VI)] and Magnesium Ion [Mg(II)] have shown greater impact on the fiber dye bond which in turn leads to poor fastness property.

Table-2: FASTNESS PROPERTIES OF SILK DYED BY PRE-MORDANTING METHOD WITH SYZIGUM CUMINI (SC) (BROWN PORTION)

Methods	Metal salts	Rubbing Fastness		Light Fastness		
		Dry	Wet	8 hrs	12 hrs	16 hrs
	Dyed fabric	4-5	4-5	7	6	6
Pre-Mordanting Method	Ferrous Sulphate	4-5	3-4	6	5	4
	Potassium Dichromate	4-5	3-4	6	5	5
	Potassium Permanganate	3-4	2-3	6	5	4
	Copper Sulphate + Potassium Dichromate	4-5	4-5	7	6	5
	Ferrous Sulphate + Magnesium Carbonate	4-5	4-5	6	6	5
	Potassium Dichromate + Potassium Permanganate	3-4	2-3	6	5	4
	Ferrous Sulphate + Copper Sulphate	3-4	2-3	5	4	3
	Aluminum Sulphate + Potassium Dichromate	4-5	4-5	6	5	5
	Potassium Permanganate + Magnesium Carbonate	4-5	3-4	7	6	5
	Magnesium Carbonate + Potassium Dichromate	4-5	3-4	6	5	5

CONCLUSION

The study shows that natural dye can be efficiently extracted from the flower of *Syzygium cumini* (SC). The quantum yield of the colouring matter from *Syzygium Cumini* (SC) has been found to be 4% gives better results. Mordant treatment not only improves the

color strength and fastness properties of this natural dye but also results in numerous shades; therefore, this natural dye colourant source can be a promising alternative to synthetic dyes. As the flower of *Syzygium cumini* (SC) are from a renewable source and are abundantly available, the natural dye colorant obtained may be considered a potential source of eco- friendly natural dye for textiles.

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