

Cotton and silk dyeing with Natural dye extracted from floral parts of African marigold (*Tagetes erecta*)

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ABSTRACT-The chemicals used to produce dyes today are often highly toxic and carcinogenic. Thus, use of natural dyes has increased several folds in the past few years. This paper concerns with extraction of natural dye from African Marigold and used to dye cotton and silk. Different colors were obtained from the dark yellow colored African Marigold using ferrous sulphate and alum as mordant. Variations in colors were also observed in the presence of acid and alkali. Dyeing of 100% cotton and silk along with mordanting techniques which included scouring, mordanting and post mordanting was carried out. The fastness properties for dye on cotton and silk were studied. The dye is found to have good light, rub and wash (with detergent) fastness. The dye showed deterioration of color from cloth in presence of alkali. Dyeing of silk was excellent.

Index Terms- marigold, cotton, silk, mordant, acid, alkali.

1. INTRODUCTION

Dyeing has been an ancient art which predates written records. It was practiced since Bronze Age. The widely and commercially used synthetic dyes impart strong colors but causes carcinogenicity and inhibition of benthic photosynthesis (Adeel *et al.*, 2009). A renewed international interest has arisen in natural dyes due to increased awareness of environmental and health hazards associated with the synthesis, processing and use of synthetic dyes. (Tanveer Hussain, 2008;Kulkarni *et al.* 2011). Certain problems with the use of natural dyes in textile dyeing are color yield, complexibility of dyeing process and its reproducible results, limited shades, blending problems and inadequate fastness properties (Sachan and Kapoor,2005; Siva,2007;). But these problems can always be overcome by using the chemicals called as mordants. Mordants are metallic salts which produce an affinity between the fabric and the dye (Vankar *et al.*; Samanta and Agarwal, 2009).

In Ethiopia for example, there is a wealth of marigold flowers available for producing natural dyes, but very little is known about the processes involved in harvesting and processing the plants, little use is made of this natural resource. Presently there is an excessive usage of synthetic dyes, estimated at around 10,000,000 tons per annum (D. Jothi, 2008;Kulkarni *et al.* 2011).

Metallic ions of mordants act as electron acceptors for electron donors to form co-ordinate bonds with

the dye molecule, making them insoluble in water (Mongkhorrattanasit *et al.*, 2011). Alum, chrome, stannous chloride, copper sulphate, ferrous sulphate etc. are the commonly used mordants. (Siva, 2007; Mahangade *et al.*, 2009; Samanta and Agarwal,2009). Generally light, wash and rub fastness are considered for textile fibers.

2. MATERIALS AND METHODS

2.1 Source : A dark yellow variety of marigold flowers were purchased from local market, Pune.



2.2 Extraction of dye:

20% of marigold petals were crushed and added in distilled water and extraction was carried out by boiling at 85°C for 2 hour with regular stirring. The extract was filtered using muslin cloth and the

biomass was re-heated for next half hour and kept in hot air oven at 60 °C overnight and extract was collected using muslin cloth.

2.3. Scouring of cotton and silk cloth:

Scouring of 10cm x10cm cotton and silk cloth was done by washing it in a solution containing 0.5g/lit sodium carbonate and 2g/lit detergent (Tween 80) at 50°C for 30 min, keeping the material to liquor ratio at 1:40.(D. Jothi,2008).The scoured cloth was thoroughly washed with tap water and dried at room temperature. The scoured material was soaked in distilled water for 30 mins prior to mordanting (Jothi 2008;Kulkrani.S.S et al, 2011)

2.4 Mordanting :

Silk and cotton cloth were treated with ferrous sulphate and alum individually (2% mordant was made in distilled water). The cloth were brought to boil at 80°C for 30min and left for another 30min in the mordant solution. This mordanted material was then rinsed, squeezed and dried at room temperature. Mordanted cloth was immediately used for dyeing since the mordants are light sensitive (D. Jothi,2008)

2.5 Dyeing

The dried mordanted material was then dyed in 10 ml dye extract and kept for 1 day. The dyed material was then dried in room temperature

2.6 Fastness Tests:

The dyed material was tested for light , wash and rub fastness. The color fastness is usually tested by either by loss of depth of color in original sample or is expressed by staining scale (Samanta and Agarwal, 2009).

Light fastness was analyzed by exposing the dyed materials to direct sunlight for 1 day. (Kulkarni S.S et.al 2011).

The wash fastness was carried out by washing the dyed fiber with tween 80 (1g/lit).The rub fastness of the dyed fiber was carried out by rubbing the fiber and checking for fading of color (Adeel *et al.*, 2009; Raja, 2010; Mishra and Patni, 2011).

Acid and alkali fastness was also studied. The cotton and silk cloth were allowed to soak in the solution of acid and alkali.

3. RESULT AND DISCUSSION

Shades of yellow color dye were obtained from marigold flowers. Mordant play very important role in imparting color to the fabric. With the use of ferrous sulphate the brown colored shade was obtained for cotton cloth while silk gave black color. Strong co-ordination tendency of Fe enhances the interaction between the fiber and the dye, resulting in high dye uptake (D.Jothi, 2008).Mordant Alum gave golden color to silk while yellow color was retained on cotton cloth.The mordanted cotton and silk cloth was immediately used for dyeing because some mordants are light sensitive. The chromophore in the dye makes the resistant to photochemical attack, but the auxochrome from dye may alter the fastness (Jothi, 2008). Silk cloth showed excellent dyeing.



Fig 1: Cotton and silk cloth after dyeing in presence of mordant FeSO₄ and alum.

Good light fastness was observed in fabrics dyed with the dye extracted from marigold flower. This is due to the formation of complex with the metal which protects the chromophore from photolytic degradation. Wash fastness of the dye is influenced by the rate of diffusion of the dye and state of the dye inside the fiber (Jothi, 2008). Both silk and cotton cloth showed good wash fastness in presence of detergent tween80.

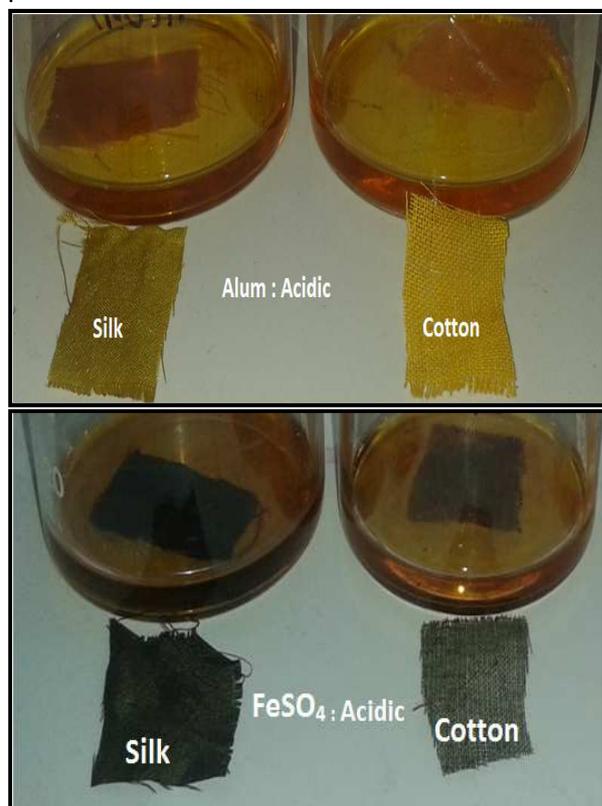


Fig 2: Cotton and silk dye color enhanced after treatment with acid

Good rub fastness was also shown by cotton and silk cloth. The intensity of colorblack color incase of silk increased and became dark in presence of acid. (Fig.2), while change in color was observed in alkali (Fig.3). The color faded in presence of an alkali
The natural dye extracted from marigold might be used as a possible substitute for the synthetic dyes to color cotton and silk cloth

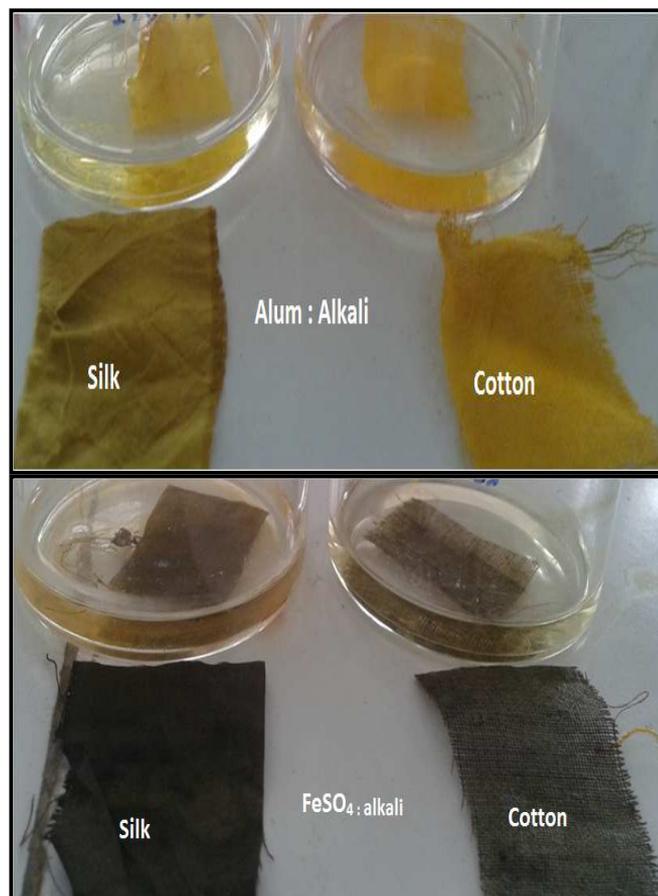


Fig 3: Cotton and Silk dye color faded in presence of alkali.

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