

A STUDY ON THE EFFECT OF MARIGOLD FLOWER DYE WITH NATURAL MORDANT ON SELECTED FIBERS

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ABSTRACT

In present study Marigold (*Tagetes erecta*) petals were used for the extraction of the natural dye material. Aloe vera juice was selected as natural mordant to standardize the dyeing effect of Mari gold dye on natural and synthetic fibers. Natural dye was formulated with Marigold dye and natural mordant Aloe vera juice in the ratio 2:10, 5:10 and 10:10 and the effect was compared with synthetic mordant namely copper sulphate, lead acetate and potassium dichromate with Mari gold dye in the ratio 10:1. Natural dye with Aloe vera juice in the ratio 10:10 shows a good dyeing effect on the animal fibers when compared to plant or synthetic fibers. The natural dye with Aloe vera juice in the ratio 10:10 was subjected to skin irritation study and the result showed no skin irritation, erythema or edema.

Key words: *Tagetes erecta*, *Aloe vera*, Synthetic fibers, Natural mordant, Synthetic mordants.

INTRODUCTION

In recent years there has been a revival of the use of dyes and color of natural origin for coloring food, pharmaceutical, cosmetic and textile products. This increasing demand for the material of natural origin is because of the toxic nature of many of the synthetic dyes and the natural dyes are becoming widely recognized throughout the world. Natural dyes are the colors derived from plants or animal or insect matter with out any chemical processing.[1] Many reports related to mordant research were focused on the effect of synthetic mordant (Aluminum sulphate, copper sulphate, lead acetate and potassium dichromate etc..)[2] and no much effort had been made to study the effect of natural mordant in dyeing industry. Considering the important of the natural dyes with natural mordant and the harmful effect of synthetic dyes with synthetic mordant, an effort had been made to formulate an eco-friendly herbal dye with a natural mordant. Effort was also made to standardize the dyeing effect on human and animal hair.

MATERIALS AND METHODS:

a). Selection of dye:-

60 gm freshly collected Mari gold petals were dried in shade and powdered. The powdered Mari gold petals were subjected to aqueous extraction[3].

b). Selection of mordants:-

Synthetic mordants - Copper sulphate, lead acetate and potassium dichromate.

Natural mordant - Dried juice of Aloe vera[4].

c). Selection of fibers:-

Natural fibers (Vegetable origin [5] - Cotton and Jute; Animal origin- Silk [6], Wool and Rabbit hair; Human hair), Synthetic fibers (Nylon and rayon).

d). Selection of synthetic and semi-synthetic hair dye:-

Synthetic hair dye containing para-phenylenediamine (Natural black). Semi-synthetic hair dye containing Amla, Bhrinraj, Methi, Henna, Hibiscus (Indigo herbal hair color).

e). Extraction of marigold flower dye:-

20 gms of the dried Marigold flower powder was extracted with 100 ml of distilled water and heated for 1 hour at 100°C. The extract was filtered to obtain a yellowish brown dye

solution. The optical density was recorded. The extracted dye solution was evaporated to 1/10th volume under controlled temperature.

f). Extraction of Aloe vera juice:-

Fresh leaves of *Aloe vera* were collected and washed thoroughly. The outer green surface was peeled off and the linear white mass was collected. 150 gm of the collected material was crushed to a semi-solid consistency which was subjected to filtration.50 gm of filtrate was subjected to evaporation to 1/10th of its volume under controlled temperature.

g). Formulation of natural dye with mordant:-

Mari gold flower dye in 4 batches of 10ml each was prepared and mixed with Aloe vera juice (2, 5, 10 ml), Copper sulphate (1 ml), Lead acetate (1 ml) and Potassium dichromate (1 ml) respectively.

RESULT:

The natural hair dye containing Mari gold flower dye with various concentration of selected natural and synthetic mordant were subjected to staining process with specific fibers and human hair and the results are tabulated in table no 1 ,2 and 3 .

Table-1 reveals that the coloring effect of the Marigold hair dye with out mordant was poor in natural fibers and synthetic fibers, where as it had a moderate effect on the human and

rabbit hair without any visible physical damage. It can be inferred from Table -2 and figure 1-25; that the natural dye with synthetic mordants caused physical damage to the fibers and the coloring effect was ranging from poor to moderate. The natural dye with natural mordants caused no physical damage to the fibers and the coloring effect was good. Table -3 and figure 26-32 gives comparative evaluation of the formulation with the marketed brands. The penetration efficacy and the coloring effect of the formulation were comparable with that of the marketed brands but the later containing synthetic dye (Paraphenylene diamine) damaged the cortex of the hair.

Skin irritation study

Draize modified scoring technique ⁷ was used to perform the skin irritation study at 24hrs for seven days on healthy rabbits, (average weight: 1.5-2.25.Kg). The dorsal surface (50Cm²) of the rabbits was cleared by shaving. Natural dye was applied over the skin and was observed for skin irritation, erythema and edema formation.

CONCLUSION

Marigold dye with natural mordant Aloe vera juice in the ratio 10:10 produced significant dying effect when compared to synthetic hair dye. The natural dye was considered to be a better dying agent for human grey hair since the dye did not cause any physical damage to the hair. The present study had laid a foundation for the development of a natural dye which is eco-friendly, biodegradable and with no toxic effect on

Table 1: Coloring Effect Mari Gold Dye With Out Mordant

Name of fiber	Duration of exposure	Physical appearance of the fiber after applying the Mari gold dye	Coloring effect of Mari gold hair dye	
			Before washing	Afterwashing
Cotton	1 hour	Good	Moderate	Poor
Jute	1 hour	Good	Moderate	Poor
Silk	1 hour	Good	Moderate	Poor
Wool	1 hour	Good	Moderate	Poor
Nylon	1 hour	Good	Poor	Poor
Rayon	1 hour	Good	Poor	Poor
Human hair	1 hour	Good	Moderate	Moderate
Rabbit hair	1 hour	Good	Moderate	Moderate

human and animal. This natural dye can be used in Textile industry, Cosmetics industry (Hair dye) and Handy craft – small scale industry (Soft toys made with animal fur and synthetic fiber).

Table 2: Study on the coloring effect of natural dye with mordants on the selected fibers.

Name of Fiber	Name of Mordent	Coloring effect		Physical appearance	Duration of Treatment
		Before Wash	After Wash		
Cotton	1. <i>Aloe vera</i>	Good	Moderate	Good	30 minutes
	2. Copper sulphate	Good	Moderate	Good	30 minutes
	3. Lead acetate	Good	Good	Damaged	30 minutes
	4. Pot. dichromate	Good	Good	Damaged	30 minutes
Jute	1. <i>Aloe vera</i>	Good	Moderate	Good	30 minutes
	2. Copper sulphate	Good	Moderate	Good	30 minutes
	3. Lead acetate	Good	Good	Good	30 minutes
	4. Pot. dichromate	Good	Good	Damaged	30 minutes
Silk	1. <i>Aloe vera</i>	Very Good	Good	Good	30 minutes
	2. Copper sulphate	Moderate	Poor	Damaged	30 minutes
	3. Lead acetate	Good	Moderate	Damaged	30 minutes
	4. Pot. dichromate	Moderate	Poor	Damaged	30 minutes
Wool	1. <i>Aloe vera</i>	Very good	Good	Good	30 minutes
	2. Copper sulphate	Moderate	Poor	Damaged	30 minutes
	3. Lead acetate	Moderate	Moderate	Good	30 minutes
	4. Pot. dichromate	Moderate	Poor	Damaged	30 minutes
Nylon	1. <i>Aloe vera</i>	Dissolved	-	Damaged	30 minutes
	2. Copper sulphate	Good	Moderate	Good	30 minutes
	3. Lead acetate	Moderate	Poor	Good	30 minutes
	4. Pot. dichromate	Moderate	Poor	Good	30 minutes
Rayon	1. <i>Aloe vera</i>	Good	Good	Good	30 minutes
	2. Copper sulphate	Moderate	Moderate	Good	30 minutes
	3. Lead acetate	Moderate	Poor	Good	30 minutes
	4. Pot. dichromate	Poor	Poor	Damaged	30 minutes
Rabbit hair	1. <i>Aloe vera</i>	Good	Very good	Good	30 minutes
	2. Copper sulphate	Good	Good	Good	30 minutes
	3. Lead acetate	Good	Good	Good	30 minutes
	4. Pot. dichromate	Good	Good	Damaged	30 minutes

Table 3: Comparison of coloring effect of natural dye with marketed brands on human hair.

Name of the hair dye with constituent	Coloring effect		Duration of exposure	Physical appearance
	Before washing	After washing		
1. Natural hair dyed marigold flower dye + <i>Aloe vera</i> juice	Good	Good	30 minutes	Good
2. Semi synthetic hair dye Indigo herbal hair color. (Henna, Amla, Bringraj, Methi, Hibiscus, resorcinol, Paraphenylene diamine and H ₂ O ₂)	Good	Good	15 minutes	Cortex damaged
3. Synthetic hair dye Godrej permanent hair dye (Paraphenylene diamine)	Very good	Very good		Cortex damaged

I. Study on the coloring effect of natural dye with mordants on the plant fibers



Fig-1 : Absorbent cotton- no dye



fig-2 : Absorbent cotton- natural mordant-*aloe vera*



fig-3 : Absorbent cotton- synthetic mordant - copper sulphate:



fig-4 : Absorbent cotton- synthetic mordant lead acetate



fig-5 : Jute -no dye

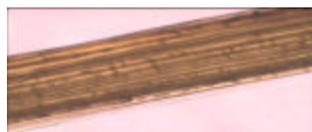


fig-6 :Jute -natural dye mordant-*aloe vera*



fig-7 :Jute- natural dye synthetic mordant copper sulphate

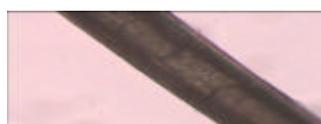


Fig-8 : Jute- natural dye synthetic mordant lead acetate.

II. Study on the coloring effect of natural dye with mordants on the animal fibers



fig-9 : Silk-no dye



fig-10 : Silk-natural dye natural mordant- *Aloe vera*

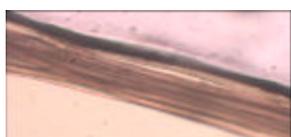


fig-11 : Silk-natural dye synthetic mordant lead acetate

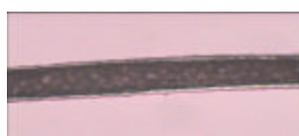


fig-12 : Wool-no dye



fig-13 : Wool-natural dye natural mordant- *Aloe vera*

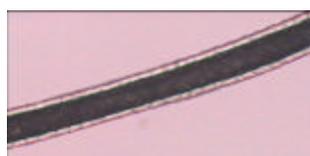


fig-14 : Wool -natural dye synthetic mordant lead acetate

III. Study on the coloring effect of natural dye with mordants on the synthetic fibers



fig-15 : Nylon-no dye



fig-16 :Nylon -natural dye natural mordant- *Aloe vera*



fig-17 : Nylon-natural dye synthetic mordant copper sulphate



fig-18 : Rayon-no dye



fig-19 : Rayon- natural dye natural mordant- *Aloe vera*

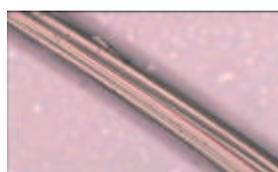


fig-20 : Rayon- synthetic mordant copper sulphate

IV. Study on the coloring effect of natural dye with mordants on the animal hair (RABBIT HAIR)



Fig-21: No dye

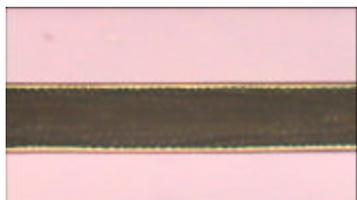


fig-22: Natural dye natural mordant-*Aloe vera*

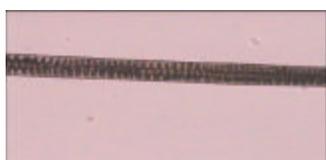


fig-23: Natural dye synthetic mordant copper sulphate

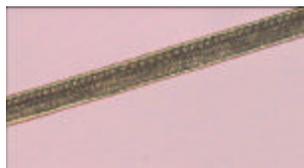


fig-24: Natural dye synthetic mordant lead acetate



fig-25: Natural dye synthetic mordant potassium dichromate

V. Comparison of coloring effect of natural dye with synthetic and semi-synthetic hair dye and human hair.



Fig-26: Human grey hair

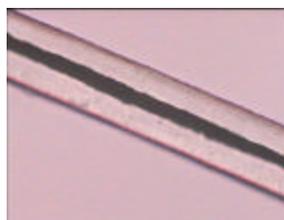


fig-27: Human grey hair-*Aloe vera* gel alone

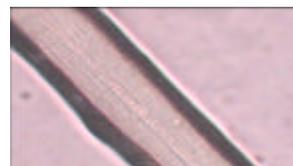


fig-28: Human grey hair-marigold dye alone.

VI. Comparison of coloring effect of natural dye with synthetic and semi-synthetic hair dye on human grey hair



Fig-29: Natural dye after washing



fig-30: Synthetic dye after washing



fig-31: Synthetic dye (after washing) showing damaged cortex potassium dichromate



fig 32: Marketed herbal dye (after washing) showing damaged cortex.

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