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Extraction of natural dye from different flowers for dyeing cotton fabrics

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ABSTRACT

Cotton fabric used as a substrate was dyed from fresh natural resources. Fresh flowers of Red Rose (*Rosa L.*), Hibiscus (*Hibiscus rosa-sinensis*) and Marigold (*Tagetus erecta*) were used for the extraction of natural dyes. In this study, the dying pigments present in flowers were extracted by using three different extraction methods. Ferrous Sulphate ($FeSO_4$) and Copper Sulphate ($CuSO_4$) were two different mordants used to set extracted dye on the 100% cotton fabric. The results revealed different shades from Red Rose, Hibiscus and Marigold flowers. These findings can be useful for coloration of 100% natural fabrics. This article deals with the application of natural dyes in the textile industry.

Keywords – Natural dye, Red Rose, Hibiscus, Marigold, Mordant, Cotton fabrics.

1. INTRODUCTION:

Natural dyes have been used as a colouring agent in textiles, foods, and paints since the beginning of time. However, synthetic dyes are eliminating colour in the process, and the use of natural dyes has decreased since roughly a century ago.Dyeing is an ancient practice which mainly involved coloring textiles then. Later it was used in the food and pharmaceutical industry as well. After the production of synthetic dyes which were easily accessible and gave superior results, natural dyes were taken a step back. However synthetic dyes possess many side effects and allergic reactions making it harmful for humans. Also, they do not degrade and get accumulated in the environment making it destructive for the environment as well. It has been estimated that nearly 10,00,000 tonnes of synthetic dye were used per annum [(1)]. The synthetic dye may cause pollution, skin diseases, health hazards to humans and other important organisms [(2)].

Therefore, consumers are concerned about health as well as ecological safety. This is creating a need for regaining popularity of natural dyes which are basically biodegradable, eco-friendly, and harmless in the long run. Natural dyes obtained from different sources such as plants, animals, and minerals, are renewable and sustainable bio-resource products with minimum environmental impact and known since antiquity for their use, not only in coloration of textiles but also as food ingredients and cosmetics [(3-5)].

Natural dyes may have a wide range of shades, and can be obtained from various parts of plants and synthesis dyes are fully chemical components. Since the advent of widely available and cheaper synthetic dyes in 1856 having moderate to excellent colour fastness properties is polluted eco system so natural dye was used for dyeing on cotton fabric[12].In, recently there has been revival of the growing interest on the application of natural dyes on natural fibers due to all over worldwide environmental consciousness[13].In many of the world's developing countries, natural dyes can offer not only rich and varied source of dye stuff, it used income and through sustainable harvest and sale of these plants[14].Today due to global environmental awareness trend of using natural colours is drawing production and application of synthetic dyes release large amount of waste and unwanted colour and causing health hazards environmental pollution and disturb eco – balance. The most alarming and affect to health due to the presence of toxic chemicals in the finished textiles especially which are coming in contact with the skin has opened new challenges for the persons working in the field of textiles industry[15].

Natural dyes are more eco friendly because they degrade faster. They are non-toxic,non- skin-allergenic, non-carcinogenic, readily available, and renewable. Colour fastness refers to a material's resistance to changing any of its colour characteristics, as well as the extent to which its colourants are transferred to adjacent materials when they come into contact with them. While light fastness, wash fastness, and rub fastness are all important for textile fibres, synthesis is not biodegradable and can cause environmental allergies.In India, more than 500 plants are a source of natural dye. In the existing study, alternative dye yielding plants were studied for their ability to obtain natural dye.

2. EXPERIMENTAL

2.1. Materials:

Source: Fresh flowers of Red Rose, Red Hibiscus, Orange Marigold were collected from nearby local market from Goregaon- (W), Mumbai, Maharashtra, India.

Substrate: 100 % soft cotton fabric was used as substrate.

Chemicals: Different chemicals such as Ferrous Sulphate ($FeSO_4$), Copper Sulphate ($CuSO_4$), 50 % Chloroform, 1% & 10% NaOH were used.

2.2. Method:

Dyeing of 100% cotton fabric with flowers is carried out at five stages: Extraction of dyes from flower, Scouring, Mordanting (fixing dye with fibre), Dyeing and Drying. Extracted dyes were also subjected to analysis.

2.2.1. Extraction of Dye from Petals-

Extraction of colour dye was carried out by three different methods.

Aqueous extraction method - 10 gm fresh petals were boiled in 100 ml distilled water at 100^0 C for more than 60 minutes. Later the decolorized petals were taken out from extraction solvent. Filter the solution for further study.

Alkaline extraction method - In alkaline extraction method, 10 gm fresh petals were boiled in 1 % Sodium hydroxide for more than 60 minutes at 100^0 C. The decolorized petals were taken out from extraction solvent. Finally, filter the solution and used for further study.

Chloroform Extraction method - In alcoholic extraction method, 10 gm fresh petals were boiled in 50 % chloroform for more than 60 min. Filtrate was used for further study.

2.2.2. Scouring of Cotton Cloth -

Cotton cloths used for dyeing were boiled in 10 % NaOH solution for 15 min. To remove starch and other impurities from the cloth. The NaOH treated cotton cloths were then thoroughly washed with cold distilled water [(5)].

2.2.3. Mordanting -

Those dyes which do not bind directly but require a mordant which act as the binding agent between the fibre and the dye [(16)].

The clean scouring cotton cloths were individually soaked with different Mordent such as Ferrous Sulphate ($FeSO_4$) and Copper Sulphate ($CuSO_4$) and then brought to heating by dye bath for about 30 minutes.

Temperature of the dye bath was raised to 80ºC over a period of half an hour and left at that temperature for another 30 minutes. Mordanted cotton needs to be used immediately for dyeing because some mordants are very sensitive to light.

2.2.4. Dyeing -

Transfer the treated cloth with mordant in the dyeing solution. Keep the dyeing solution containing cloth pieces for more than 60 minutes in boiling water bath.

2.2.5. Drying -

The dyed material was washed with cold water and dried at room temperature in the open air.

2.3. Analysis of Color Pigments from The Extraction-

When the color strength of the extracted dye was determined in spectrometer at 400nm and 660nm it was found to have broad spectrum (Table 1).

Table.1. Absorbance readings at 400nm and 660nm

Absorbance (nm)	Solutions	Red Rose & Hibiscus	Orange Marigold
400	Aqueous	0.30	0.36
	Alkaline	0.34	0.43
	Chloroform	0.25	0.25
660	Aqueous	0.13	0.42
	Alkaline	0.49	0.25
	Chloroform	0.06	0.05

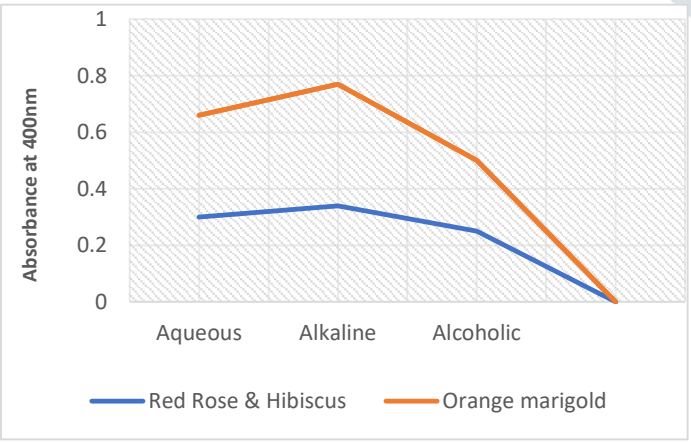


Fig.1. Absorbance at 400nm

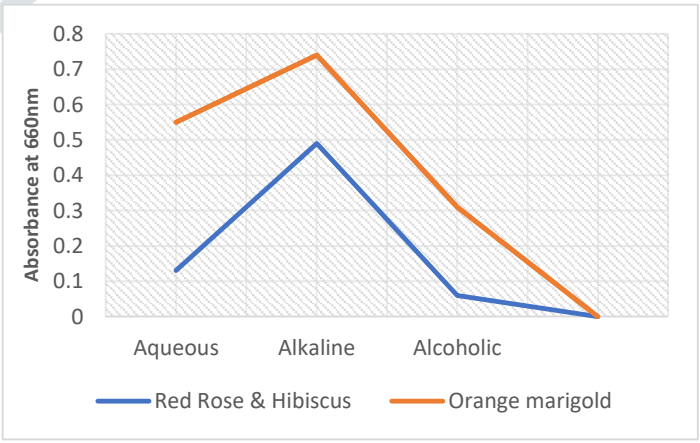


Fig.2. Absorbance at 660nm

RESULT AND DISCUSSION:

The different colour shades were obtained from various extracts of red Rose and Hibiscus together and Orange Marigold. These extracts show variation in colour which mainly depends upon the nature of extraction solvents. (Figure 3 & 4).

Rose & Hibiscus in $FeSO_4$		
		
Aqueous	**Alkaline**	**Chloroform**

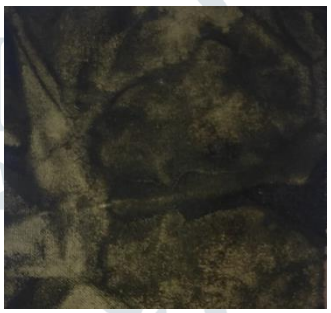
Orange Marigold in $FeSO_4$		
		
Aqueous	**Alkaline**	**Chloroform**

Fig.3.Application of $FeSO_4$ with different extracts on cotton fabric

Rose & Hibiscus in $CuSO_4$		
		
Aqueous	**Alkaline**	**Chloroform**

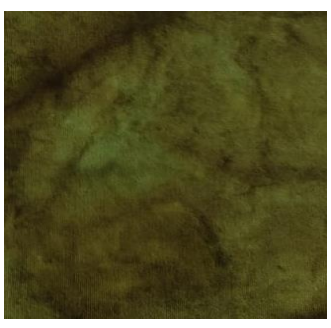
Orange Marigold in $CuSO_4$		
		
Aqueous	**Alkaline**	**Chloroform**

Fig.4.Application of $CuSO_4$ with different

FASTNESS TESTING –

The colour strength also depends upon use of Mordent [7]. Mordents are the metals salts having tendency to co-ordinate with dye and fibres [8]. These studies have revealed different colour shades which are stated in the following table 2.

Table 2 Fastness testing for colour strength

Mordant	Solutions	Red Rose & Hibiscus	Orange Marigold
$FeSO_4$	**Aqueous**	Bluish grey	Brownish yellow
	Alkaline	Brownish	Brownish yellow
	Chloroform	Bluish grey	Black
$CuSO_4$	**Aqueous**	Bluish grey	Brown
	Alkaline	Beige	Beige
	Chloroform	Blue	Olive

CONCLUSION-

Global awareness is already amongst people which favors the use of natural resources for protecting the environment. Therefore utilization of natural resources in food, pharmaceutical, textile, cosmetic and leather industry is gaining popularity in order to maintain health of a well-being and environment.

The present study suggests that the natural resources could be of a great value in the textile coloration market.Natural dyes have been subjected to extensive scientific testing, which has proven that their qualities are comparable to those of synthetic dyes. If natural dyes should be commercialized, modern practices should be substituted for traditional methods and more scientific approach to overcome few disadvantages of natural dyes.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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