ABSTRACT

Now-a-days natural dyes are commonly used for textile industries, due to their harmless effects and harmful consequences of synthetic dyes. Natural dyes work on cotton, silk and wool etc. Their colours are stable and ecofriendly because of no irritating effects on human skin. Different plant parts are used for colouring methods. Nature has given us a number of plants to use them in dyeing processes for safe life. In these processes different mordants are used in combinations, which can be natural plant products like lemon juice, tamarind pulp, pomegranate and some chemicals like alum, chrome, stannous chloride, copper sulphate, ferrous sulphate etc. are commonly used. Large range of colour shades was obtained from different plant sources which were studied in various research projects. Studies about fastness test of dyed clothes were undertaken by different researchers and fair to excellent result were obtained. In all the reviewed studies three mordanting techniques were commonly used as pre-mordanting, simultaneous and post-mordanting. The results of natural dyeing were found very encouraging, with their non toxic, non allergic and non-carcinogenic soothing harmless effects. Moreover these dyes are cost effective and ecofriendly.

Key Words: Natural dye, Synthetic dye, Fastness property, Mordant, Eco-friendly

INTRODUCTION

India has a rich biodiversity and it is not only one of the world’s twelve mega diversity countries, but also one of the eight major center of origin and diversification of domesticated taxa. It has approximately 490,000 plant species of which about 17,500 are angiosperms more than 400 are domesticated crop species and almost an equal number their wild relatives. Thus, India harbour a wealth of useful germplasm resources and there is no doubt that the plant kingdom is a treasure-house of diverse natural products. One such product from nature is the dye. Dyes are generally used in textile, paper, cosmetic, food, pharmaceutical and leather industries. In 1856, William Perkins accidently synthesized a basic dye, with the advent of synthetic dyes, the use of natural dyes declined tremendously because of existing natural dyes failed to full fill the demand of the market. Presently there is an excessive use of synthetic dyes, estimated at around 10,000,000 tons per annum, the production and application of which release vast amounts of waste and unfixed colorants, causing serious health hazards and disturbing eco-balance of nature. Research has shown that synthetic dyes are suspected to release harmful chemicals that are allergic, carcinogenic and detrimental to human health, some studied are recorded.\textsuperscript{1-4} Germany was the first to take initiative to put ban on numerous specific azo-dyes for their manufacturing and applications. Netherlands, India and some other countries also followed the ban, even then the large number of synthetic dyes are in use. Mordants are metal salts which produce an affinity between the fabric and the dye.\textsuperscript{5} Alum, chrome, stannous chloride, copper sulphate, ferrous sulphate etc. are commonly used mordants. Colouring agent of plants are derived from roots, leaves, barks, trunk and fruits. Henna, madar, pomegranate, turmeric, eucalyptus etc. are well known examples of natural dyes.

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Natural dyes have better biodegradability and are obtained from renewable sources. Efforts are now being made to identify the raw materials from plant sources and to standardise the recipes for their use. Thus, utilizing natural dyes to impart colour on the fabric has a number of advantages over synthetic dyes. These include (i) eco-friendliness, (ii) possibility of premium pricing (iii) variety of colours produced from single dye source (iv) no health hazard to humans.

**DISCUSSION**

Onal et al. studied the total amount of dyeing substances present in *Rubia tinctorum* was found by using the extraction method and then separated in column. All of the dyeing were carried out with red component alizarin (1, 2 – dehydroxyanthraquinone) dyeing condition and other characteristics were determined and in most cases high fast colours were obtained. Mathur et al. carried out wool yarn has been dyed with natural colourant extracted from bark of neem (Azadirachta indica) branchlets under the optimum condition. The soft, lustrous, reddish-brown colour with good fastness properties.

Mahale et al. studied the use of *Acalypha wilkesiana* leaves for silk dyeing. The samples tested with potash alum showed increase in colour when subjected to sunlight test and those treated with potassium dichromate, copper sulphate and ferrous sulphate showed excellent to good washing properties.

Grover et al. studied the dye yielding potential of flowers of *Jatropha intregrimma* was evaluated and results revealed that the dye extracted from these flowers give good shades with satisfactory fastness to light, washing, crocking and perspiration on silk.

Srivastava et al. studied on optimization of dye from Khakra gum (*Butea monosperma*) and effect of mordant combination on fastness properties of silk yarn. The results concluded that the effect of mordant combination on the fastness properties of silk yarns dyed with khakra ka gond showed remarkable improvement in the colourfastness properties in all the six mordant combination especially towards sunlight and washing.

Sood et al. revealed that combination of litchi and apricot dye combination exhibit excellent colour fastness to washing, crocking and light and good perspiration fastness.

Dixit et al. studied the colourfastness properties of the dye obtained from *Euphorbia cotinifolia* leaves on silk fabric resulting to different shades of grey, chamois, sandstone and sandalwood. Colourfastness of the dyed samples was successfully improved with the use of mordants. Sudhakar et al. evaluated the performance of the *Spathodea campanulata* flower extract as dye on silk fabric. Silk fabric was dyed with flower extract along with varying concentrations of different mordant.

Patel and Patel et al. polyurethane fibre has been dyed with a methanolic extract from the leaves of *Ocimum sanctum* containing ursolic acid as the major colorant with or without various metallic salts and different mordanting techniques. The dyeing show moderate to good fastness to washing, light and rubbing.

Agarwal et al. studied the use of Marigold (*Tagetes erecta*) petals to standardize the printing paste for cotton. The use of mordants produced various colours with marigold flower dye. Beige colour was obtained when dye was used without any mordant whereas it was mustard with chrome and olive green with copper sulphate.

Sankat and Siddique et al. studied dyeing of cotton fabric with the natural dye obtained from cultivated Poppy petals (*Papaver orientale* L.). Three different eco-friendly metallic mordants; alum[Al₂(SO₄)₃],CuSO₄ and FeSO₄ are used. The results for dyeing were very encouraging. Jothi et al. studied the use of an extract isolated from marigold (*Tagetes erecta*), as a natural dye it can be used for coloration of 100% cotton, silk and wood fabrics. Pruthi et al. barberry bark dye was used for dyeing of degummed pure silk yarn using four selected mordants alum, chrome, copper sulphate and ferrous sulphate in different ratio i.e. 1:1, 1:3 and 3:1. The dyed sample possess very good to excellent fastness and large range of shades were obtained. The mordant which was in high proportion dominated the shade. Win and Swe et al. studied the purification of natural dyestuff extracted from mango bark for the application on protein fibres. Colour fastness properties of crude dyes extracted from mango bark are good in light fastness.
According to Adeet et al. 20 the natural dye extracted from pomegranate rind might be used as a possible substitute of synthetic dyes having banned aryl-amine moieties.

Kamel et al. 21 studied the colour strength of cotton fabrics dyed with natural colouring matter extracted from Crocus sativus (Saffron) by the ultrasonic method is better than the colour strength for cotton fabric dyed by the traditional method.

Vanker et al. 22 carried out aqueous extract of pericarp of Garcinia was prepared by sonicator for quick extraction of the colorant and has been used for dyeing cotton, silk, and wool yarn. The hue colour ranged from camel brown to dark chocolate brown. The colour strength K/S has been found to be very good in dyed samples.

Goodarzian and Ekrami et al. 23 studied the dyeing substances present in madder plant were extracted by using the solvent extraction method. It was found that the colour strength of extracted madder dye is more than raw madder.

Haji Aminoddin et al. 24 studied a functional colorant, Berberine extracted from Berberis vulgaris wood was applied onto wool fibre using extract of root Rumex hymenosepolus as biomordant. The extract of the Berberis vulgaris can be considered as a natural dye of acceptable fastness together with excellent antibacterial activity for woolen textile.

Grover and Patni et al. 9 studied the extraction of natural dye from Woodfordia fruticosa and their application on textiles. Three different types of fabrics and three different types of yarns were used in the experiment to observe the strength of dye. Cotton Jute mix sample showed dark yellowish brown colour with Myrobalan, dark blackish brown colour with ferrous sulphate, camel colour with stannous chloride and yellowish brown with potassium dichromate.

Kulkarni et al. 25 studied cotton dyeing with natural dye extracted from Pomegranate (Punica granatum) peel the main colouring agent is granatamine which present in the alkaloid form N-methyl granatamine. The fabrics dyed with pomegranate peel gave different shade of yellow, brown and black. Kulkarni et al. 26 carried out to extract natural dye from green chilli (Capsicum annum) the main colouring component in chilli is oleoresin. Different shades of yellow were obtained from the dye extracted from chilli skin.

Kumaresan et al. 27 studied that flower of Cordia sebestena gives dye which was successfully used for dyeing of silk and cotton to obtain a wide range of soft, pastel and light colours by using combination of mordants.

Kumaresan et al. 28 studied dye obtained from flower of Spathodia campanulata was successfully used for dyeing of silk to have a wide range of soft and light colours by using combination of mordants.

Mongkolrattanasit et al. 29 studied dye extraction from the leaves of eucalyptus and application of this on wool fabric. Dyeing was done by the exhaust process. The results confirmed that natural dye from eucalyptus leaves extract have potential application for fabric dyeing and producing ultraviolet (UV) protect silk and wool fabrics.

Saravanan and Chandramohan et al. 30 studied dyeing with natural dye obtained from barks of Ficus religiosa L. belong to family Moraceae. The dyed silk sample have shown good washing, light and rubbing fastness properties.

Sharma and Grover et al. 9 an attempt has been made to dye cotton yarns with walnut bark dye and it has been found that walnut dye can be successfully used for dyeing of cotton.

Sundarajan et al. 31 were used marigold and turmeric for the extraction of natural dye material tannin acid. Cow dung, pomegranate rind and lemon juice were selected as natural mordant to standardized the dyeing effect of marigold and turmeric dyes on silk and knitted cotton fabric. All the mordanted fabric showed good dye uptake.

Bose and Nag et al. 32 attempt to isolate natural dyes from the flowers of Hibiscus rosasinensis. In the result, three different colours like blue, purple and green were prepared from the flowers and they are well stable on cloths after washing by hot water and soap too. The intensity of the three colours are also high, they are bright and really eco-friendly to human skin.
Charu Swami et al. 33 studied ethanolic extract of Sesbania aculeata to dye cotton fabric using five different mordants with three different mordanting techniques. The fastness properties of dyed samples were quite good. Deshpande and chaturvedi et al. 34 extracted a natural dye from different parts of Ricinus plant. Aerial parts of plant (fruit coat, leaf) were found to be good source of natural dye for cotton as well as silk cloth with different mordants. Green, brown and yellow shades were obtained on cloth. Excellent fastness property of dye was also observed. Mishra performance 35 of ultrasound assisted extraction (UAE) technique for the extraction of colourant from Dahlia variabilis has been compared with conventional solvent extraction method. The extracted dye is also used for dyeing of wool yarns, generally used in carpet industries for eco-dyeing.

Singh and Purohit36 the colour fastness properties of the flowers of Erythrina suberosa dyed on wool were studied using combination of mordants such as lemon juice: copper sulphate, lemon juice: potassium dichromate, lemon juice: ferrous sulphate and lemon juice: stannous chloride in the ratio of 1:3, 1:2 and 3:1. Large range of shades was obtained because of varying mordant ratios and combinations.

In natural dyeing process mordants are used in combinations. In above research works fabrics commonly used, such as cotton, silk and wool etc. but cotton is used mostly. Parts of these plants are used - *Papaver orientale*, Punica granatum, Sesbania aculeata, Tagetes erecta, Capsicum annum, Spathodea campanulata, Allium cepa, Crocus sativus, Molus sikkimensis, Garcinia, Hibiscus rosa sinensis, Ricinus, Walnut etc. These plants can be used successfully for dyeing of cotton to obtain a wide range of soft, pastel and light colours with natural and metallic mordants.

Dye extracted from Woodfordia fruticosa, Cordia sebestena, Tagetes erecta, Spathodea campanulata, Ficus religiosa, Allium cepa, Bark of Neem, Bixa orellana, Rheum emodi, Garcinia, Molus sikkimensis, Berberis vulgaris, leaves of Eucalyptus, outer green Almond, Dahlia variabilis, Erythrina suberosa, Rubia

REFERENCES


Environment should be put in the category of our national security. Defence of our resources is just as important as defence abroad. Otherwise what will remain there to defend?

Robert Redford