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FASTNESS PROPERTIES OF COTTON FABRICS DYED WITH THE DYES OBTAINED FROM ACHRAS ZAPOTA, PHYLLANTHUS EMBLICA AND GREWIA ASIATICA

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ABSTRACT

The herbal dye was extracted from bark of achras zapata (chico), phylanthus emblica (amla) and grewia asiatica (falsa) by boiling in aqueous medium. The cotton fabric was dyed with the aqueous solution of these plant materials by using mordant. This fabric was studied its fastness properties such a wash fastness, sunlight fastness and rubbing fastness over a period of thirty days by grey scale. After ten days all properties sere same as original 5/5, after twenty days these were 4/5 and after thirty days these parameters were 3/5 on grey scale.

KEYWORDS: Bark, Plant materials, Dyes, Color fastness, Grey scale.

INTRODUCTION

Environmental pollution due to the discharge of dyeing industry effluents is the matter of major concern now-a-days. Upto the end of 19th century natural dyes were the main colourants for textiles.[1] Nature has gifted about 500 species of plants from which colorants can be extracted[2] from their barks, roots, leaves, trunks and fruits.[3]

Recently, interest in the use of natural dyes has been growing rapidly due to the result of stringent environmental standards imposed by many countries in response to toxic and allergic reactions associated with synthetic dyes.[4] Until about 150 years ago all dyes were natural substances, derived mainly from plants and animals. The natural dyes present in plants and animals are pigmentary molecules[5] which impart colour to the materials. Natural colorants are non-allergic to skin, non-toxic and easily accessible. Furthermore, these

colorants have better biodegradability and better suitability with the environment.[6] With the world becoming more conscious towards ecology and environment, there is greater need today to revive the tradition of natural dye and dyeing techniques as an alternative of hazardous synthetic dyes is an extremely crude. There are several plants/plant parts that provide natural dyes which are used in the textile industry. However, the common drawbacks of natural dyes are their non-reproducible and non-uniform shades, poor to moderate colour fastness and lack of scientific information on the chemistry of dyeing and standardized dyeing methods.[3,4] The synthetic dyestuffs produce hazardous by-products, some of which possess carcinogenic intermediates and hence a ban has been imposed by Germany and some other European countries on the use of benzidine dyes in textile garments exported into their countries.[2] Hence, due to the current eco-consciousness, the researcher's attention has been shifted to the use of natural dyes for dyeing textile materials. Many reports are available on application of natural dyes on silk[5,6] and cotton.[7,8] Synthetic dyes being less expensive that natural ones experiences great progress in short time and have gained huge market but at the same time these have created health hazard and related problems. These dyes induce dermatitis, skin irritation, erythema, and skin cancer.[9] Disadvantage of synthetic dyes can only be overcome by nontoxic ingredients derived from herbal or natural sources. Composition of plant materials is well suitable and compatible with the human need to deliver variety of shades. However substantial efforts and improvement s are required to develop stable and consist shades and fastness characteristics. The present investigation deals with the extraction of natural dyes from the locally available of bark of the plants materials from achras zapata (chico), phylanthus emblica (amla) and grewia asiatica (falsa) in aqueous medium. The extracted dyes will be used for dyeing cotton fabric and then their fastness characteristics will be studied.

MATERIALS AND METHODS

The bark of three plants achras zapota, vernacular chico, phyllanthus emblica vernacular amala and grewia asiatica vernacular falsa barks were collected from the local areas. It was dried under shade for ten days to reduce the moisture content. Dried barks were ground to a fine powder and stored separately in the desiccator. These powders were used for extraction of dyes and further processing.

Extraction of dyes

Dyes from the bark powder of three plants achras zapota, phyllanthus emblica and grewia asiatica were extracted through aqueous medium. 100 g of each plant material was soaked separately in water keeping the material to liquor ratio (MLR) 1:20 and heated on water bath for 1.5 hours. These materials were filtered hot and cooled to room temperature then stored in a fridge for further processing.

Mordanting and dyeing of cotton fabrics

As preparatory processes for dyeing of the cotton fabrics, the desized cotton fabrics samples were washed in a solution containing 0.5g/l of sodium carbonate and 2g/l of detergent at 50°C for 25minutes. The scoured material was thoroughly rinsed with water and dried at room temperature. Aluminium sulfate 1g was dissolved in 100 ml of distilled water and scoured cotton samples were heated for 30 minutes at a temperature of 100°C in the mordant solution. The fabrics were dried without washing. Dyeing of cotton fabric was carried out by following the method of Zubairu and Mshelia, 2015.[10]

Color fastness studies

Color fastness properties of the dyed cotton fabrics were studied by following the standard procedures like, light fastness was studied by following BS EN ISO 105-B02, 1999, wash fastness was studied by following the method of Brtiish standard BS EN 201(03:1995)/ ISO 105-(03:1999), heat fastness was studied by BS 1006:1999, other fastness properties were studied by following the method applied by Samanta et al., 2010[11]

RESULTS AND DISCUSSION

Natural dyes from the dry powdered bark of three plant achras zapata (chico), phylanthus emblica (amla) and grewia asiatica (falsa) were extracted in aqueous medium. The scoured cotton fabric samples were dyed with these dyes by following standard procedure. The results are shown in the table 1-3.

Table: 1 Fastness properties of Groviva asiatica

Botanical Name	Dye used	Original color	Washing	Sunlight	Rubbing	Heating	Remarks
Grewia asiatica Falsa	After 10 days	5/5	5/5	5/5	5/5	5/5	Excellent
	After 20 days	4/5	4/5	4/5	4/5	4/5	Good
	After 30 days	3/5	3/5	3/5	3/5	3/5	Fair

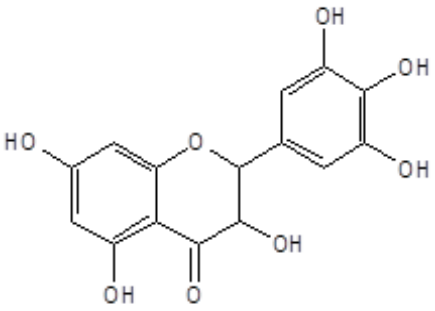
Table: 2 Fastness properties of phylanthus embalica

Botanical Name	Dye used	Original color	Washing	Sunlight	Rubbing	Heating	Remarks
Embalica phylanthus (Amala)	After 10 days	5/5	5/5	5/5	5/5	5/5	Excellent
	After 20 days	4/5	4/5	4/5	4/5	4/5	Good
	After 30 days	3/5	3/5	3/5	3/5	3/5	Fair

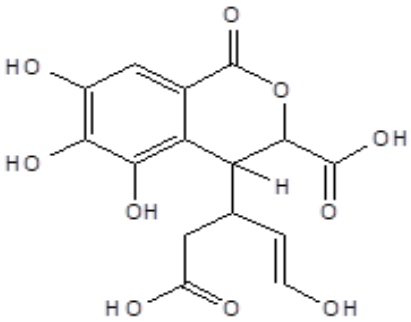
Table: 3 Fastness properties of Achras Zapota

Botanical Name	Dye used	Original color	Washing	Sunlight	Rubbing	Heating	Remarks
Achras Zapota (Chico)	After 10 days	5/5	5/5	5/5	5/5	5/5	Excellent
	After 20 days	4/5	4/5	4/5	4/5	4/5	Good
	After 30 days	3/5	3/5	3/5	3/5	3/5	Fair

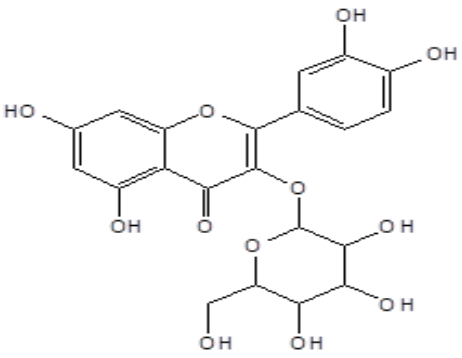
A mordant was used for dyeing purpose because the barks on plant materials contain tannins having phonolics functional groups that can be bridged between dye and cotton fabric. So mordant play a vital role. As all the plant materials contain tannins in their mass[18-20] so their fastness properties were also similar on grey scale. Grewia asiatica contain 20-28% tannin like catechin[12], phylanthus emblica contain about 28% tannin like chebulic acid[13] while achras zapata contain about 22-25% like dihydromyrecetin.[14]



Dihydromyrecetin



Chebulic acid



Catechin

After ten days all properties sere same as original 5/5, after twenty days these were 4/5 and after thirty days these parameters were 3/5 on grey scale. These are fairly good results and further improvement in the dye extraction and dyeing cotton fabrics is in progress.

CONCLUSION

Three natural dyes from the bark of achras zapata (chico), phylanthus emblica (amla) and grewia asiatica (falsa) were extract in aqueous medium and then cotton fabric was dyed by using aluminum sulfate as mordant. The fastness properties like, color, light, heat, washing, rubbing were measured on grey scale. After ten days the results were same but after 20 and 30 days these properties declined. Natural dyes being less toxic, less polluting, and less health hazard are more attractive to the humanity. But for commercialization appropriate scientific technique are need in order to obtain newer color shades with acceptable fastness behavior.

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