

Bougainvillea Extract As Sustainable Natural Dye For Textile Dyeing

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Abstract:

The challenges in environment are occurs due to harmful synthetic dyes. The use of these toxic and harmful synthetic dye shows great interest in the use of natural and sustainable Colorants as alternatives for synthetic dyes. The Synthetic dyes, are always associated with toxic and hazardous effects in environment. They are water and air pollutants, and also have harmful effects to the human health. On the other hand the Natural dyes, are eco-friendly, biodegradable and they are derived from renewable natural sources. This study of sustainable colors will explores the potential of selected Bougainvillea plant bracts for dyeing. This plant is an ornamental plant which can grow in the tropical as well as in subtropical region. The selected bracts of Bougainvillea plants are rich in the pigments such as betalain pigments. These pigments have ability to impart wide range of colour shades by using different mordants and dyeing methods. The eco-friendly fabric such as Cotton and silk fabric was taken as sample and dyed by the Bougainvillea ruby red dye extracts. The mordants such as potash Alum, FeSO₄, Banana stem sap and Myrobalan were used for fixation of this colour and to enhance bonding towards substrate. This dyeing of fabrics gives variety of colour shades in presence of these mordants. The fastness properties of these dyeing process, suggesting that the Bougainvillea dye can be developed as economical natural dye source. The natural components are used for this dyeing work.

Key words: Bougainvillea natural dye, Extraction, Fabrics, Mordants, Fastness properties.

INTRODUCTION:

The synthetic dyes was trying to replace the use of traditional natural dyes, due to availability of dye and less expensive products. However, these synthetic dyeing industries are contributing global pollution in environment due to toxic and nonbiodegradable characters of synthetic dyes. The presence of these synthetic dyes in environment are showing serious effects such as water and air contamination and shows health hazards to the consumers. Natural dyes are believed as safer and nontoxic products. This natural dyes have great demand in different types of manufacturing industries. India is rich in the biodiversity. The natural source of dyeing is easily available in Indian biodiversity [1]. Industries and researchers are also focused back towards the natural dyeing sources and natural dyeing process by utilizing the awareness as tool of eco-friendly and sustainable environment. The natural dye can be used on textile material to draw designs and to print cloth [2]. Natural dye can be obtained through plant part such as seed, leaves, flower, etc. The natural dyes are always gives richness to the products. These Natural dyes are obtained from mineral, plant and also from animal sources. The Plants are used in the preparation of ayurvedic and harmless medicinal products. The use of different types of mordants in during dyeing can provide different colour shades to the textile material and also give different fastness properties to the fabric [3]. These natural dyes are non-toxic for ecosystem and also biodegradable. These natural dyes can have some poor fastness properties. These fastness properties should improve by developing the dyeing techniques [4]. The development in the dye extraction methods and in the natural dyeing process is important maintain quality of textile products. The limited availability of these natural dyes and comparatively lower fastness properties have been interfering the commercial use of these natural dyes. The bougainvillea ruby red plant can be used as source of natural dyes. This research work includes the use of dye in textile dyeing from bougainvillea source.

MATERIALS:

Bougainvillea bracts, textile such as Cotton and silk, Beakers, Mordants, Filter paper, dye bath, etc. were used in this research work. The coloured bracts of bougainvillea ruby red plant were carefully collected from local gardens. The contamination of bracts due to unwanted parts of plant such as dry leaves was avoided. The source of collected bracts was washed under the clean water to remove impurities and dust.

These bracts also washed under distilled water. Then these washed and cleaned bracts of bougainvillea were dried for 2 days under normal sunlight to minimize the surface moisture. The fabric material such a cotton and silk of 130 GSM and were taken for this research work. The scouring process was performed to remove the components or impurities such as wax and oil on these fabric material. The fabric material was added in 5% solution of sodium carbonate and boiled for 40 min. to perform this scouring process. This fabric then washed under distilled water. Then this fabric is dried in air medium. The 2 x 2 cm sized pieces these cotton and silk fabrics were used for mordanting process.



Fig.1 Bougainvillea ruby red dye source.

Extraction method:

The source of dried bracts of Bougainvillea ruby red plant converted into small pieces and then prepared fine powder by using blender machine. 20g red bracts of Bougainvillea and 100 ml of distilled water were boiled in beaker at 60°C to produce aqueous extract of dye source. Then this extract was carefully filtered through the filter paper to get dye solution. The acidic, neutral and basic pH of dye solutions were prepared. The acidic pH was maintained by using acetic acid solution .The alkaline pH was maintained by using the basic solution of sodium carbonate. And also neutral condition was maintained. The selected dye extracted solution was carefully stored in cold condition.

Mordanting and Dyeing method of fabrics:

Mordants such as Alum, FeSO₄, Banana stem sap, Myrobalan were used on the surface of selected fabric material to increase dye attachment and to get different shade of colours on given fabric by red bracts dye source. The mordants are applied to the selected cotton and silk fabric material by using pre mordanting method. The fabric material separately put into mordant solution and kept for 25 min. at 40°C. then this fabric was washed in water and dried. The pieces of pre mordanted fabric material were added slowly and separately into the dye bath. The material to liquor ratio for this dyeing process was kept as 1:20. The dyeing of these fabric was performed at 40°C for 1 hr. Then this fabric was rinsed by cold water after dyeing process and dried in room temperature.

RESULTS AND DISCUSSION:

The strength of coloured shade on the given cotton and silk dyed fabric material is determined by the K/S values obtained after dyeing the fabric through acidic, alkaline and neutral pH range of dye solution. The fastness properties such as washing, rubbing and light fastness of dyed fabric were determined. The ISO 105-CO3 was used for washing fastness determination. The ISO105-BO2 was used for light fastness and ISO105-AO3 was used for rubbing fastness determination. The scale 1 to 5 was used for washing and rubbing fastness to represent poor to excellent scale. The scale 1 to 8 was used for light fastness determination. This data gives the strength of dye component towards the fabric. The colour shade given by fabric in presence of mordant material was observed. The table1 represents colour shades of fabric in presence of different eco-friendly mordants. The K/S values obtained for dyed cotton and silk fabric material by spectrometric data is given in table2.

mordants	Colour shade on fabric
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	Acidic pH	Basic pH	Neutral pH
Alum	Dark red	Pale green	Reddish pink
FeSO ₄	Brownish green	Greyish brown	Dark brown
Myrobalan	Reddish brown	Brownish yellow	Brownish green
Banana stem sap	Dark red	Brownish red	Brownish yellow

Table1. The colour shade given by fabric in presence of mordants.

Mordants	k/s values for Cotton fabric			k/s values for silk fabric		
	Acidic dye bath	Alkaline dye bath	Neutral dye bath	Acidic dye bath	Alkaline dye bath	Neutral dye bath
Alum	5.7	5.2	5.4	4.8	4.1	4.5
FeSO ₄	5.1	4.7	4.9	4.3	3.6	3.7
Banana stem sap	3.8	3.2	3.7	3.7	3.1	3.4
Myrobalan	4.3	3.8	4.1	3.4	2.7	2.9

Table 2. The k/s values for fabric.

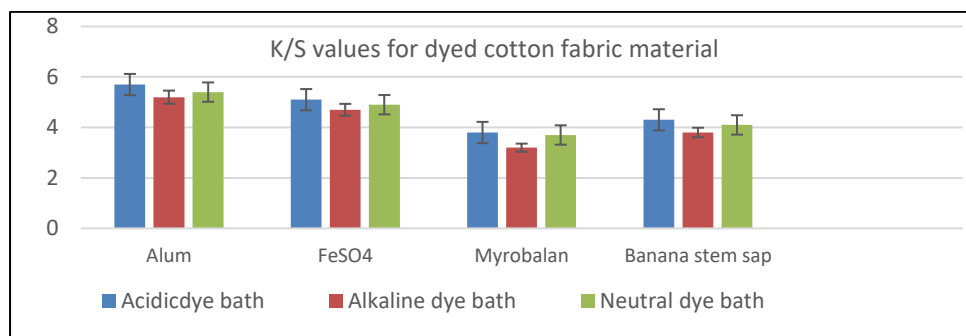


Fig.a K/S values for dyed cotton fabric material.

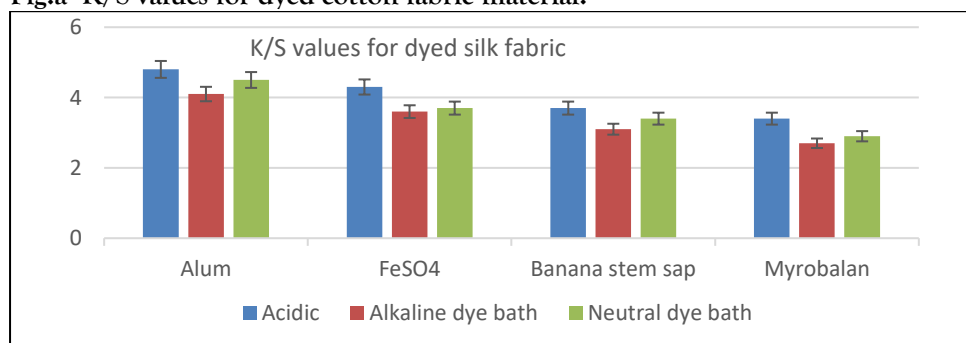


Fig.b K/S values for dyed silk fabric material.

The pH of the dyeing solution also shows variation in experimental values. The use of mordants were giving different colour shade to the fabric. The fastness properties such as washing, light and rubbing fastness for dyed cotton and silk fabric through bougainvillea dye solution of natural pH range is represented in table3.

Mordants	fastness values for Cotton fabric			fastness values for silk fabric		
	washing	light	rubbing	washing	light	rubbing
Alum	3	6	4	3	5	3
FeSO ₄	2	7	3	2	4	3

Banana stem sap	4	5	4	3	4	4
Myrobalan	2	4	3	3	5	3

Table 3. Fastness properties of dyed fabrics.

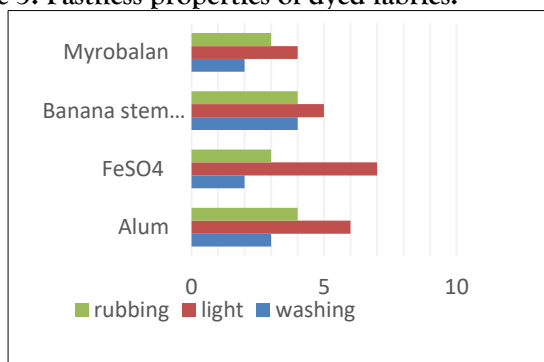


Fig.c fastness values for Cotton fabric

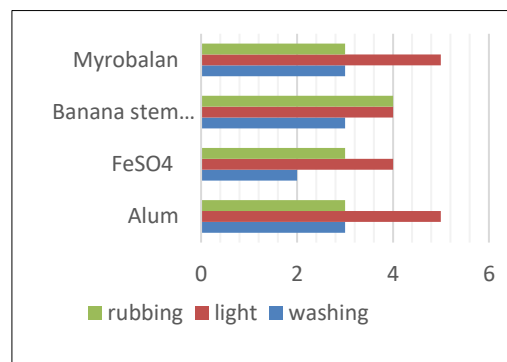


Fig.d fastness values for silk fabric

The given fabric material in presence of eco-friendly mordants and bougainvillea plant dye shows different colour shades. The mordants such as Alum, FeSO₄, Myrobalan and Banana stem sap, are used in acidic, alkaline and neutral pH range of solution to obtain these coloured shades.

CONCLUSION

The acidic, alkaline and neutral pH range dye solution gives different colour shade to the selected fabric material. The determination of K/S values of dyed cotton and silk fabric are showing the different values in acidic, alkaline and neutral pH range of dye solution. The alum shows good K/S values for both cotton and silk dyed fabric in these acidic, alkaline and neutral pH medium. The washing fastness properties is good for dyed cotton fabric through banana stem mordant. The washing fastness properties is not good for dyed silk fabric through FeSO₄ mordant. The light fastness is good for dyed cotton fabric through Alum and FeSO₄ mordants. The light fastness is good for dyed silk fabric through Myrobalan and Alum mordants. The rubbing fastness properties is good for dyed cotton fabric through banana stem and Alum mordants. The rubbing fastness is good for dyed silk fabric through banana stem mordants.

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