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Dyeing of Silk with Rosa Centifolia: An Eco-Friendly Approach

Manpreet Kalsy[1], Sangita Srivastava[2]
[1, 2]Department of Home Science, University of Allahabad, India

Abstract: *Natural dyes are one of the most important sources derived from plants, invertebrates or minerals. These dyes are eco-friendly in nature. Research has shown that synthetic dyes are more suspected to release harmful chemicals that are allergenic and carcinogenic in nature and also effects human health. Nature has blessed us with many valuable varieties of dye yielding plants. Rosa Centifolia is one of them. It was found that after being offering flowers to the deity, the valuable flower was being immersed in the river or dumped at the available place which creates an ecological imbalance and other health hazards. Hence the present research work was undertaken to extract natural colour from the floral waste (Rosa Centifolia). The dyeing was carried out on pre-mordant mulberry silk fabric. Further optimum conditions for dyeing were evaluated. On the basis of result it was found that temperature also significantly influence the dyeing process.*

Keywords*:* Natural dye, mordant, silk.

INTRODUCTION

India has a rich biodiversity natural resources; natural dye is one of them. Natural colorants are dyes and pigmentary molecules that are obtained from plant, animal or mineral sources with or without chemical treatments. They are organic compounds, having hydroxyl group in their nucleus and are sparingly soluble in water (Sinha. K, Saha.D.P , Datta. S,2012).

Recently, organic awareness and environmental conscious of consumers have revived the interest of natural dyed textiles. The impact of the textile industry on the environment and the consumption of raw materials and natural resources are becoming prime concern. Research has shown that synthetic dyes are more suspected to release harmful chemicals that are allergitic and carcinogenic in nature and also effects human health.

Interest in the use of natural dyes has been growing rapidly. Dyes obtained from various natural sources have emerged as an important alternative against synthetic dyes. Natural dyes are eco-friendly in nature. The primary advantage of these dyes is that they are renewable, non- carcinogenic, non-toxic and easily disposable. Natural dyes are antioxidant and antimicrobial in nature; hence play an important role in neutralizing free radicals. Its antimicrobial properties also prevent skin inflammation, toxicity and other fungal infections. Even some of them have therapeutic values for which the raw material finds use in medicinal field (Grover. N and Patni.V).

Mostly natural dyes are non-substantive in nature. Hence require mordant's in order to bind the dye with the textile fibres. The term mordant is derived from the Latin word mordeo which means to bite or take hold of (Gohl and Vilensky). Dyeing with mordant can give excellent fastness properties and gives a range of different colours and shades with the same natural dyestuff.

A naturally dyed product is environmentally friendly and gives added value to fabric. Fabric dyed with natural dyes not only gives a cooling sensation but also revitalizes our body, mind and soul.

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The art of dyeing was as old as human civilization. Our Vedas, the Atharveda carries description of natural dyes. Natural dyes have been used for colouring and printing fabrics. Most of these dyes were derived from plants or animal sources by long and elaborate processes. Among these were Indigo, Tyrian Purple, Ali Zarin, Cochineal and Logwood dyes.

Nature has blessed us with many varieties of dye yielding plants. The researcher has used petals of Rose flower. It's the most used flower in temples. A rose is a woody perennial of the genus Rosa. Botanical or scientific name is Rosa Centifolia and belongs to the family of Rosaceae. The Red Indian rose is sweet, cool, pungent and slightly bitter.

In the local language it is called 'Desi Gulab'. The flower is extensively cultivated in Northern India. The flowers have a mild fragrance. Lots of this flower is used in deity worship and also for decoration in marriages. Essential oil of rose is extracted for the cosmetic industry and also attar. The rose petals are also used in the manufacture of gulukand and rose water. Apart from its aphrodisiac fragrance it has medicinal value also.

India is a country of commercial and cultural wealth.Religion in India is characterized by a diversity of religious beliefs and practices. Offering flowers to Deities are an important part of Hindu worship. The researcher observed that daily huge amount of flowers are offered in the temple and further these offered flowers are released in the rivers or dumped at the available places which creates an ecological imbalance and other health hazards. Hence the present research work was undertaken to extract natural colour from the floral waste. The flowers were collected from the temple caretakers. A natural dye was extracted using the petals of rose. And also optimum conditions for dyeing were evaluated.

Materials and Methods

The dye was extracted from the used petals of Rose flower.

Extraction of natural dye:

Source: used rose petals
Ingredients:
Rose petals: 12gms
HCL: 2mL
Distill water: 200mL
Alum (mordant): 20gms

Rose petals were used for extraction process. The dye was extracted in acidic bath. The dye was extracted in the presence of acidic medium. For this 2mL HCL was poured in 200mL of double distill water. Then fresh petals of Rose (12gms) were immersed in the solution. The solution was kept for half an hour. Further the extraction process was carried out at the temperature of 80^{o}c for 60 mins. Meanwhile the solution was stirred continuously. After completion, liquor was left in the dye bath till it cools down. The extract was filtered and used for dyeing process.

Before dyeing the samples were treated with mordant. For mordanting pre-mordanting method was selected. Alum (20gms) was used as a mordant.Chemically alum is known as Aluminium potassium sulphate dodecahydrate KAI (SO4)2.12(H2O), other names are potassium alum, potash alum. Used in medicine as an astringent and styptic, in dyeing and tanning and in many other technical processes. Most of alums have an astringent and acid taste. They are colourless, odourless and exist as a white crystalline powder. Alums are generally soluble in hot water and they can be readily be precipitated from aqueous solution to form large octahedral crystals.

When used as a mordant (binder) it acts as chemical link that fixes the dye to a substrate by combining with the dye pigment to form an insoluble compound. Majority of natural dyes need a mordanting agent which may be a metallic salt or a suitable coordinating complex forming agents in order to build affinity between the fibre and dye molecules. Further these metallic salts (mordant) form metal complexes with the fibres and the dye.
Alum improves light and washes fastness properties of all natural dyes and keeps the colour clean. It is inexpensive and safe to use. Mordanting can be done in three different ways.
Pre-mordanting: where the mordant is applied first, followed by dyeing.
Post-mordanting: where the dyeing is done first and then mordanting is carried out.
Simultaneous-mordanting: where mordant and dye are mixed together and applied.

Preparation and dyeing of fabric

Mulberry silk fabric was selected for the purpose of this study. Silk is a natural protein fabric which is available in wide variety. The isoelectric point of silk is around pH 5. Silk reacts well to acidic and basic dyes. It has affinity to metallic salts. Silk is readily dyeable with a variety of dyes. Apart from dyeing it has an intensive property of holding odours and fragrance for a long time. Before dyeing the samples were subjected to pre-treatment. The samples were degummed. For this, samples were boil at 30-40^{o}c for 20 mins in a mild detergent (Ezee). After that the samples were washed in cold water and dried in shade.

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Analytical method

The optical density was determined with help of Spectrophotometer. The dye solution was diluted with distill water. Further experiments were carried out to optimize dyeing temperature.

Optimization of dyeing temperature

The present work involves the optimization of different temperature governing the dyeing of sample. To optimize dyeing temperature, dyeing was carried out using optimum concentration of dye at five different temperatures that is 40°, 50°, 60°, 70° and 80° C. The temperature giving maximum dye absorption was taken as the optimum dyeing temperature.

Results and Discussions

A dark pink dye was obtained from the petals of rose. A very soft pink dyed mulberry silk fabric with fastness tolight, washing, perspiration and rubbing properties which was obtained at optimum temperature. The dyed silk fabric retained the aphrodisiac fragrance of rose.Dyeing temperature is the temperature that is suitable for dye absorption and fixation of dye on the sample. Temperature also significantly influenced the dyeing process. For optimization dyeing temperature, dyeing was carried out at five different temperatures 40°, 50°, 60°, 70° and 80° C. The percent dye absorption at different temperatures is shown in Table no.1

Table no.1 Optimization dyeing temperature on the basis of dye absorption through Spectrophotometry.

Temperature	Time	Absorption (%)
40° C	60mins	0.245
50° C	60mins	0.283
60° C	60mins	0.411
70° C	60mins	0.283
80° C	60mins	0.261

On the basis of results it can be concluded that the maximum absorption (0.411) was observed at temperature of 60° C for one hour.

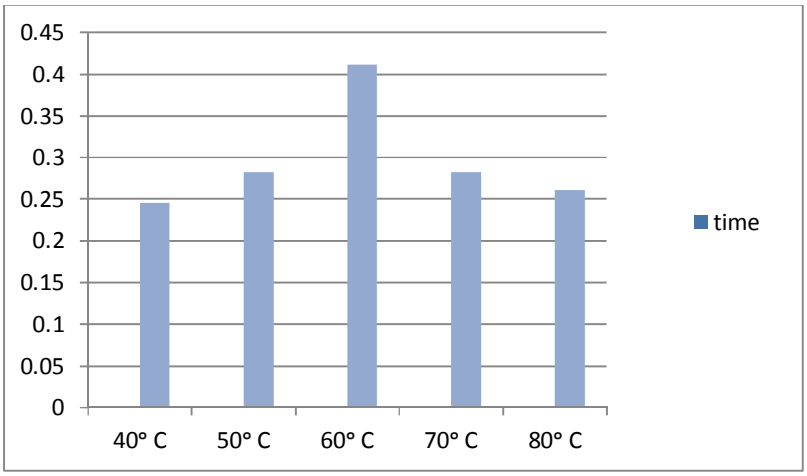

Table no.1 Optimization dyeing temperature on the basis of dye absorption through Spectrophotometry.

Conclusion

In the present scenario, global awareness is of prime concern. The study focussed towards utilization of floral waste for extraction of natural dye. The aim of the study was an eco-friendly approach towards safeguarding human health as well as protecting our environment from pollution. The present research work showed that natural dye can be successfully extracted from petals of Rose. Maximum absorption of dye was observed at 60° C. Different temperature range of dyeing markedly influenced the absorption percent of dye.

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