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Dyeing of mulberry silk with natural dye extract from Rosa Centifolia

MANPREET KALSY AND SANGITA SRIVASTAVA*
Department of Home Science, University of Allahabad, Allahabad (U.P.) India
(Email : kalsy.freesoul.manpreet@gmail.com; sangitasrivastava22@yahoo.co.in)

ABSTRACT

Dyes derived from various natural sources are known as natural dyes. Natural dyes are eco-friendly in nature. Synthetic dyes are more susceptible to release harmful chemicals that are cyctotoxic and carcinogenic in nature. Due to harmful effects of synthetic dyes, interest has been growing rapidly towards eco-friendly dyes. Nature has blessed us with many esteem 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. This uncontrolled release of floral waste affects our aquatic eco-system. The present study deals with the extraction and application of natural dye from Rosa Centifolia. The dyeing was carried out on pre-mordanted 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.

Key Words : Natural dye, Mordant

INTRODUCTION

India harbours a wealth of natural resources; natural dye is one of them. Natural colourants are obtained from plants, invertebrates and mineral sources. Majority of them are obtained from other sources: roots, berries, barks, leaves, flowers, wood and other organic sources such as fungi and lichens. They are organic compounds having a hydroxyl group in their nucleus and are sparingly soluble in water (Sinha *et al.*, 2012).

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, 2011). Dyeing with mordant can give excellent fastness properties and gives a range of different colours and shades with the same natural dyestuff.

Interest in the use of natural dyes has been growing rapidly. Synthetic dyes are extensively used in the textile industry. Research has shown that synthetic dyes are more susceptible to release harmful chemicals that are cyctotoxic and carcinogenic in nature. Due to toxic and harmful effects of these dyes, today many craftsmen have shifted towards using these eco-friendly dyes.

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

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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 and Patni, 2011).

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.

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. The researcher observed that such a valuable flower was being immersed in the river after being offered to the deity. This uncontrolled release of floral waste affects our aquatic eco-system. The flowers were collected from the temple caretakers. A natural dye was extracted using the petals of these roses. And also optimum conditions for dyeing were evaluated (Gogoi and Baruah, 2015).

METHODOLOGY

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

Extraction of natural dye:

Source: used rose petals

Ingredients:

Rose petals: 12 g

HCl : 2mL

Distill water: 200mL

Alum (mordant): 20g

Fresh 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 (12g) were immersed in the solution. The solution was kept for half an hour. Further the extraction process was carried out at the temperature of 80^0C for 60 mins. Mean while 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 (20 g) was used as a mordant. Chemically alum is known as Aluminium potassium sulphate dodecahydrate $KAI(SO_4)2.12(H_2O)$, 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 wash 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:

Silk varies from 5 to 23 microns in diameter. Length of a filament if taken unbroken from the cocoon varies from 400 to 1300 yards. Silk is a light weight fiber with a specific gravity of 1.25 to 1.33. It has hygroscopicity about equal to that of wool. It resembles wool in absorbency and electrical properties. Silk reacts well to acidic and basic dyes. It has affinity to metallic salts. Silk is readily dyeable with a variety of dyes. The uncluttered structure enables tighter packing in the molecule and a relatively straight chain. Silk is smooth and continuous filament fibre. The fibre and the gum (sericin) are composed of amino acids. Thus silk is the simplest protein fibre. Both silk and wool have an intensive property of holding odours and fragrance for a long time.

Silk is formed in two glands one on each side of the caterpillar's body, which come together in one exit tube in the head called a spinneret. Where a silk glue, sericin, from another pair of glands is also secreted. As the two tiny filaments of silk fibrion are extruded in a liquid form and begin to 'set' after being extruded. Each raw silk fibre, than consists of two fine filaments of silk coated and glued together with sericin.

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. Before dyeing the samples were subjected to pre-treatment's. The samples were degummed. For this, samples were boil at 30-40^{0}C for 20 mins in a mild detergent (Ezee). After that the samples were washed in cold water and dried in shade.

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 40^0, 50^0, 60^0, 70^0 and 80^0 C. The temperature giving maximum dye absorption was taken as the optimum dyeing temperature.

RESULTS AND DISCUSSION

A dark pink dye was obtained from the petals of rose. A very soft pink dyed mulberry silk fabric with fastness to light, 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 40^0, 50^0, 60^0, 70^0 and 80^0 C. The per cent dye absorption at different

Table 1 : Optimization dyeing temperature on the basis of dye absorption through Spectrophotometry

Temperature	Time	Absorption (%)
40^0 C	60mins	0.245
50^0 C	60mins	0.283
60^0 C	60mins	0.411
70^0 C	60mins	0.283
80^0 C	60mins	0.261

temperatures is shown in Table 1.

On the basis of results it can be concluded that the maximum absorption (0.411) was observed at temperature of 60^0 C for one hour.

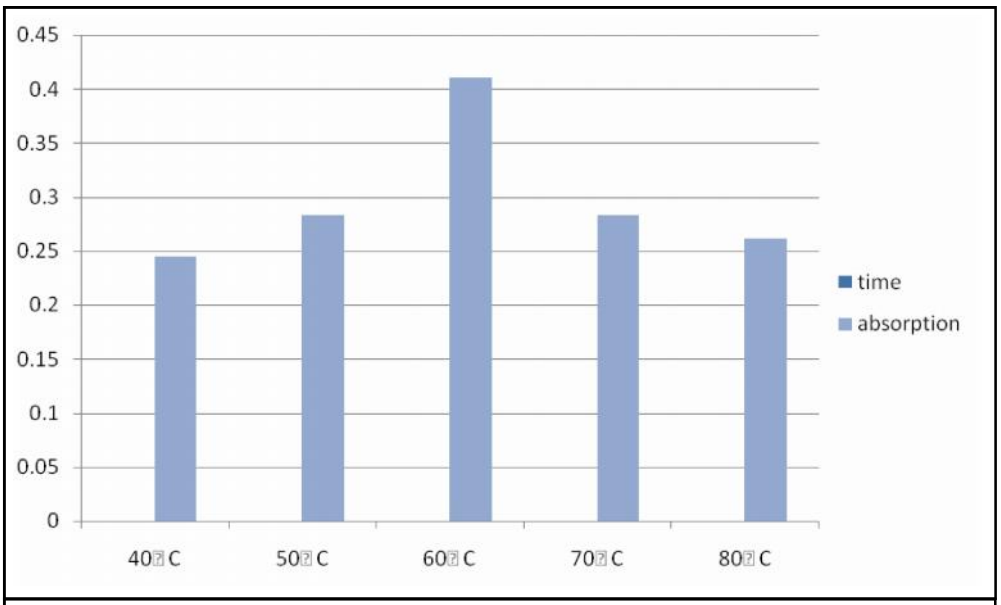

Fig. 1 : Optimization dyeing temperature on the basis of dye absorption through Spectrophotometry

Conclusion :

The present research work showed that natural dye can be successfully extracted from petals of Rose. Maximum absorption of dye was observed at 60^0 C. Different temperature range of dyeing markedly influenced the absorption percent of dye.

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