CHAPTER I

INTRODUCTION

I. INTRODUCTION

Together with food and shelter, clothing is one of the three basic needs of human beings. 'Textiles' is not just pertinent to clothing, their performance and functional properties but means much more by way of their aesthetic, decorative and functional attributes. Textiles play multifaceted roles like being used as clothing, as part of covering material for equipment used in war, in space research equipment, roof material, choke an oil spill, replace an artery, hold one safely in car seat, become tea bags, support tyres used in vehicles, line roads, wrap wounds and so on and so forth (Rakshit and Hira, 2003).

Thus textiles has become a part of every walk of life and occupies a premier position in the industrial economy of India in respect to employment, capital employed and foreign exchange earned (Dudeja, 2002). Shukla et al. (2005) point out that textile industry has been one of the oldest and the most important sectors in the Indian economy. It is the second largest employment provider in the country, next to agriculture and also mentioned that textile industry involves more than 35 million people directly contributing to almost one third of foreign exchange earning.

Cotton is the backbone of the world's textile trade. Cotton the natural vegetable fibre is the oldest textile fibre and has great economic importance as a raw material for textile cloth. Cotton is the fabric for every home and is one of the most widely produced textile fabric. India was the first country to use cotton, inform Deshwal and Khambra (2006). In a tropical country like India, cotton is the most desirable for making apparels because of its easy availability, comfort, excellent heat conductivity and hygroscopic nature (Samantha et al. 2003 and Moses, 2003) also reiterate that cotton's strength, absorbency and capacity to be washed and dyed makes it adaptable to considerable variety of textile products.

Nature is full of colours without which life would be dull and monotonous. The application of colour to the textile material is to give aesthetic value and improve the value of the products. Colour is extremely important in the modern world. In most cases, colour is an important factor in the production of the material and it is often vital to the commercial success of the product, says Becerir (2006).

The purpose of applying colour to a textile is to produce a visually enhanced appearance. Colour also adds value to the material, energizes the imagination and continues to fascinate mankind with its vibrancy and vividity. Sudhakar et al. (2006) stress that colouring fabric is a creative and lucrative art nurtured and patronized through centuries. Indian textiles are greatly valued and sought after for their colour and enduring qualities since olden days. Throughout history, dyes and pigments have been the major articles of commerce (Britannica, 2006).

In every civilization from the very early time to the present day, the art of applying colour through dyeing has played an important role. Dyeing of textile material not only changes colour but helps to retain the dye effectively (Paul et al., 2003). In ancient times most of these colours were obtained from natural sources such as flowers, fruits, leaves, seeds, barks, roots of plants, certain insects and even few animal sources (Agarwal and Gupta, 2003). The use of natural dyestuffs dates back to remote antiquity. Archaeological evidence shows dyeing was a wide spread industrial enterprise in Egypt, India and Mesopotamia round about Third millennium BC (Sharma et al., 2007). India had a virtual monopoly in the production of dyed, printed and painted textiles with natural colour (Gill and Singh, 2005).

A solid evidence of dyed fabrics found in Egyptian tombs 4000 years ago speak about the dyeing methods. The formation of different colours by mixing red, blue and yellow dyes was well known during ancient times, as was the use of metal salts to aid the retention of dyes on the desired material with

the varying resultant colours. Highly skilled craftsmen with closely guarded secret formulas rendered dyeing a well protected trade (Britannica, 2006).

The natural dyes obtained from natural resources are non-pollutant, non-allergic, eco-friendly, shade rich and warm. They are soft in colour, cool to eyes and good to skin (Kale et al., 2005). Virtually all dyes were obtained from natural sources, mainly vegetables until 1856 when the first commercially successful synthetic dye, mauve was serendipitously discovered in England by William, H. Perkin. The introduction of mauve in 1857 by setting up a factory for manufacturing it, triggered a decline in the dominance of natural dyes in the world markets (Gill and Singh, 2005).

The success of mauve led to demand among English textile manufacturers for other new dyes. By trial and error, reactions of coal tar compounds were found to yield useful synthetic dyes (Britannica, 2006). With the passage of time, synthetic dyes came into scene with direct dyes as its first component which reigned the world of coloration of textiles for a very long time (Nagpal, 2007). Thus natural dyes lost out to synthetic dyes owing to lack of standardization, uniformity and consistency from one batch to another. Hence, the interest in natural dyes drastically reduced since more and more, synthetic dyes were invented (Singh and Bains, 2003 and Patil and Shukla, 2006).

Singh and Agarwal (2003) inform that the introduction of synthetic dyes in the middle of 19^{th} century pushed back the art of dyeing with natural dyes. The synthetic dyes thus became more prevalent due to easy availability and cheapness of the raw material (Agarwal and Gupta, 2003). Today practically all dyes are synthetic. They are prepared from aromatic compounds for which the only available source is coal tar.

Singh et al. (2006) reveal that reactive dyes are very popular and important class of dyes for cellulosic fibres and are well known for their

brilliancy of shades and excellent colour fastness. Use of synthetic dyes involves release of enormous amount of hazardous chemicals in the environment during their production and use. Synthetic dyes are carcinogenic in nature, environmentally unfriendly and create havoc in life system (Kale et al., 2005). Shukla (2005) points out that many chemicals used have been black listed as toxic, carcinogenic to human beings. Hence, if it is not possible to eliminate them for want of a particular effect, they need to be substituted with non-polluting or less polluting ones.

Textile industry is one of the largest uses of water and huge quantities of complex chemicals at different processing stages. Dyeing, especially is a water intensive process which consumes 16 per cent of the total water. It contains three major pollutants - the dye that is unabsorbed, heavy metals incorporated in the dye and large amounts of salts that are often used to improve the dye fixation. Apart from these, colour effluents are aesthetically objectionable. The dye effluents are high suspended and soluble organic impurities in Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), temperature, pH and aquatic toxicity. The direct discharge of the wastewater into water bodies like stream and river, pollute the water and affect the flora and fauna. Besides, in India, the capacity and the technology of wastewater treatment plants are poor (Jajpura et al., 2004 and Storti et al., 2005).

These drawbacks of synthetic dyes prompted the environmentalists to look back again for eco-friendly products and technologies. In this context, Singh and Bhattacharya (2005) opine that environmental considerations are now becoming additionally important for both developed and developing countries. Shukla (2005) stress that the word “environment” today has become almost inseperable with the terms “environmental pollution”, “environmental damage”, and “environmentally friendly”.

The protection of environment has become a challenge all over the world and environmental regulations are becoming stricter and are forcing the shift of technology towards protecting the environment. Hence there is an urgent need today to realize the importance of natural dyes and to explore newer technologies which will be as good as synthetic dyes.

With the world becoming more conscious towards ecology and environment, there is a greater need to revive the heritage and tradition of natural dyeing of the most widely used fabric namely cotton (Sudhakar et al., 2006). The only possible approach to overcome the pollution abatement is to destroy or degrade the dyes and chemicals in an eco-friendly manner. If it is not possible to eliminate them, they should be substituted with non-polluting or less polluting dyes. Pollution control can be achieved through sensible approaches like using minimum of the dyes, changing life styles and using substitutes. Since, many of the synthesized products are toxic and non-biodegradable, the toxic material should be substituted by less harmful and non-toxic material (Shukla, 2006).

Teli et al. (2004) criticize the role of the chemical industry in introducing contaminants in the environment have suggested returning to a traditional or "more natural" way of life. Rani and Singh (2003) point out that gradual awareness about the hazardous effects of synthetic dyes on human health and environment has revived the interest in the eco-friendly natural dyes. Dayal and Dobhal (1999) were also of the opinion that the dye industry has turned its attention to newer products, which cater to fashion trends, as well as to environmental specifications.

The application of natural dyes, which has once again caught the attention of the world, offers itself as an effective eco-option to the use of synthetic dyes on textiles. The growing interest in natural dyes is already reflected in the demand for textiles dyed with natural dyes from western countries (Iyer and Saxena, 1999). Today in the world of growing

environmental consciousness, natural colourants have attracted the attention of everyone. The art of dyeing with vegetable dyes have gained momentum not only from the point of view of safety of health and environment but also for their beauty and novelty.

Dayal and Dobhal (1999) express that India is in an advantageous position since the country holds a rich reservoir of natural resources with potential produce. Singh and Agarwal (2003) view that attention should be paid to explore the forest wealth of India, which can be the source of various colours for textiles. With increased public awareness about environmental issues over the past decade, most people have started exploring the use of natural colourants as possible means of producing an ecologically sound product and appealing to the green-minded consumers (Sood and Bansal, 2002).

Natural dyes are associated with ancient culture and heritage. Clothes are designed to give an aesthetic appeal and traditional look, as well as to venture into the latest life styles, natural dyes are required. Most of the natural dyes based on vegetable origin are renewable, biodegradable and eco-friendly. They also produce rare and uncommon shades which are soft, lustrous and in some cases the shades are enhanced with age during use. Srivatsava et al. (2006) inform that the natural dyes obtained from plants are safer and can be extracted from all parts of plant.

However, Singh et al. (2003) reveal that the dye fastness properties of most of the natural dyes range between lower and medium levels only and the number of shades obtained from dyes are limited. Phukan and Phukan (2004) also establish the fact that use of natural colour is still very limited due to non-availability of precise and specific ways of application and standard norms. Shukla (2005) also notes that natural dyes are known for pastel shades but not definitely for the bright deep colours. Although the durability of

some natural dyes is well established, colour fastness properties do not generally meet today's requirements.

The main problems with natural dyeing are the dye uptake is not good and variety and intensity in the colour are not adequate. Natural dyes were famous for creating variety of shades with the help of bio and metallic mordants informed by Sharma et al. (2007). Deo and Paul (2003) revealed that majority of the natural dyes need a mordant in the form of a metallic salt to create affinity between the fibre and the pigment. While the natural dyes are themselves harmless, the mordants are generally not eco-friendly.

To develop a totally eco-friendly natural dyeing process it is necessary to modify or replace the metallic mordants with processed form of mordants or with the eco-friendly mordants. Bio mordants may be of use in this regard. The idea of using bio mordants is to reduce the usage of chemicals and to find out the effect of dye uptake in the case of bio mordants as well as for the reconstruction and revival of traditional dyeing technique.

There is an urgent need to explore natural sources of dyes, identify new and rediscover traditional dyeing methods, and find out more precise and specific ways of applying natural dyes to get the required shades of colour, and ensure colour fastness and examine the processes that have a potential for making natural dyes more eco-friendly and commercially important again. Kumar et al. (2002) view that inspite of few drawbacks of natural dyes the awareness and demand for natural dyes are increasing.

Dyeing is not merely applying colour to a textile fabric, it must stay on it successfully during the lifetime of the fabric. Various natural fibres vary in their ability to take up dyes because of their different physical and chemical composition. However, special procedures need to be created for applying different types of dyes on textile fibres and fabrics.

Though India is rich in plant materials that could be explored for production of natural dyes and pigments, information on such botanical species is scattered and not easily accessible. The method of extraction of dyes and creation of different shades with appropriate natural auxiliaries such as mordants have also vanished as they were not documented.

In the light of knowledge gained in recent times on the chemistry of colours and the various factors responsible for the fastness characteristics of these colours on cotton material, investigation on promising natural dyes and methods of extraction and use of mordants has been attempted in the present study. Since not much work has been done to study the effect of mordants and mordanting techniques on absorption of natural dyes, a trial has been made in this direction also.

The effluent water obtained from the dyeing process should be safe for disposal and safe for reuse. Hence the feasibility of reusing the treated water should be given a serious thought in order to minimize fresh water consumption and also to mitigate the problem of water shortages thereby exercising a control over the water pollution to a certain extent at least.

Having these facts and needs in mind, the present study was designed to find out the ability of selected natural dyes using metallic, processed and bio mordants following pre, simultaneous and post mordanting techniques in increasing the dye uptake, colour fastness, colour intensity and eco-friendly nature. Since cotton fibre, which is the purest form of natural cellulose, is bestowed with the versatile properties like its ability to take up a wide range of dyestuff, low cost of production and comfort during wear for a wide range of ever changing, textile fashions and needs, cotton was selected for dyeing.

The major objectives of the study are as follows :

1. conduct surveys for finding out the availability and purchase patterns of natural dyes and fabrics dyed with natural dyes.

2. explore the possibilities of improving the dye uptake, colour intensity and colour fastness of selected natural dyes on cotton material and

3. study the pollution load of the effluent produced while using natural and synthetic dyes and the effect of the natural dye effluent on the growth of selected leguminous plants.