The use of mordant, especially metal ions, is found to produce the harmful effects on environment as well as living organisms. This awareness was also probably in the mind of ancient workers as they used natural mordants in the form of albumen from egg, ox-blood, urea, cowdung and rotten mud. Recently, interest in natural mordants is further arisen, due to their eco-friendly and non-carcinogenic nature. The natural mordants such as myrobalan (Terminalia chebula Retz.), pomegranate rinds (Punica granatum Linn.), tannin, tannic acid, tartaric acid, guava and banana leaves ash, are being utilized for mordanting purpose.

Researchers of Divisions of Textile Manufacture & Textile Chemistry, Central Sheep and Wool Research Institute, Avikanagar studied the use of petaloids of banana flower as a natural mordant in place of chromium, which is non-ecofriendly and non-biodegradable for dyeing of wool yarn using turmeric (Curcuma domestica Valet. syn. C. longa Linn.) as colourant. Natural mordant was obtained by concentrating aqueous extract of banana flower petaloids under reduced pressure and evaporating it to dryness. Bharat Merino sheep wool yarn dyed with turmeric was subjected to mordanting separately with natural mordant and chromium under the identical conditions. It was observed that the dried aqueous extract of petaloids of banana flower can be used as mordant; and 3.5% (on the weight of yarn) concentration of natural mordant provides just similar results to that of 1.5% (on the weight of yarn) chromium in terms of colour fastness, colour shade/tone and K/ S values. The natural mordant does not cause damage to wool. Since the nature of turmeric colourant and banana petaloids is eco-friendly, their use in dyeing and mordanting will not cause any harm to the environment (Mathur & Gupta, Indian J Fibre Text Res, 2003, 28, 90-93).

Annatto seed of the tropical bush Bixa orellana Linn. and its products bixin and norbixin are excellent source of natural edible colours. Annatto products, bixin and norbixin are basically carotenoids having colour shades of yellow, yellow-orange and orange. Process optimization of extraction of crude bixin from annatto seeds by purification to obtain bixin by solvent extraction has been achieved by scientists working at Chemical Engineering & Design Division, Regional Research Laboratory, Jammu. The various process parameters optimized are: temperature, water/seed ratio, solvent/crude ratio, number of extraction and time of each extraction. The optimization was carried out by performing different sets of experiments and varying only one parameter, at a time, in each set of experiments. In case of extraction, four extractions of one hour each at room temperature with 1:3 seed/water ratio was found to be optimum as this produced 6.8% of crude bixin (maximum yield). Similarly in case of purification, ten extractions of one hour each and refluxing in 1:20 crude bixin/solvent ratio, yielded maximum percentage of pure bixin with carotenoid percentage of 18.6% [Koul et al, Indian J Chem Technol, 2003, 10(5), 545-547].
Neem bark as wool colourant

The natural dyes, especially vegetable colourants, have aroused considerable interest in dyeing of textiles due to their eco-friendly nature and harmful effect of synthetic dyes. Flowers of *Gulmoher* and *Tesu*, leaves of Teak and Henna, bark of Chir, Oak, Wattle, *Madder* (*Manjeet*) and Ain trees, Berberine, Annatto, Ratanjot, Lac, etc. are used for dyeing of wool, cotton, silk and synthetic fibres. Scientists of Division of Textile Manufacture & Textile Chemistry, Central Sheep and Wool Research Institute, Avikanagar and Department of Chemistry, University of Rajasthan, Jaipur carried out experiments to find the possible use of neem bark as wool colourant. Wool yarn has been dyed with natural colourant extracted from the bark of neem (*Azadirachta indica A. Juss.*) branchlets under the optimum conditions. The extraction of neem bark colourant from tree branchlets takes 120 min for its optimum extraction. The soft, lustrous, reddish-brown colour with good fastness on wool without deterioration in physico-chemical properties of yarn can be obtained on dyeing at 97.5°C (boiling aqueous solution) under the optimum conditions [pH 4.5 (acetic acid), neem bark colourant conc., 5% (on the weight of the yarn), and treatment time, 60 min]. Further, the discharge of effluent will not harm the environment since it does not contain any polluting ingredients (Mathur *et al*, *Indian J Fibre Text Res*, 2003, 28, 94-99).

Acalypha leaves for silk dyeing

Sericulture has tremendous potentiality in helping the rural people to make their economy viable, especially in developing countries and so has the natural dyeing of raw silk. Researchers at Department of Textiles and Clothing, College of Rural Home Science, University of Agricultural Sciences, Dharwad studied the use of *Acalypha wilkesiana* Muell.-Arg. leaves for silk dyeing. The plant, commonly known as Copper Leaf is a shrub of 3-5 m in height with bronzy leaves often variegated or margined with red, purple or copper. Silk skeins were dyed with leaves extract using different concentrations of various mordants and then tested for fastness properties. Mordanting was done before, during and after dyeing. Irrespective of mordanting methods, the samples tested with potash alum showed increase in colour when subjected to sunlight test and those treated with potassium dichromate, copper sulphate and ferrous sulphate showed excellent to good fastness properties (Mahale *et al*, *Indian J Fibre Text Res*, 2003, 28, 86-89).

Natural bacteria-resist finish for cotton fabrics

Various types of bacteria, fungi and viruses are present in the environment of our everyday life. Under the suitable conditions, these micro-organisms deposit themselves and multiply on our bodies and on the textile materials in contact with our skin. Almost all of these organisms are non-pathogenic. The bacteria, which are always present on our skin, have few significant adverse effects on our health. The products such as starch, protein derivatives, fats and oils, used in the finishing or in the sizing bath can also promote microbial growth. There are few anti-bacterial fibres and various anti-bacterial chemicals available in the international market. But these are all synthetic based, not from the natural sources. There are many natural plant products, which show anti-bacterial properties.

Researchers at the Synthetic & Art Silk Mills Research Association, Mumbai studied the bacteria-resist properties of various natural anti-bacterial products like neem oil, clove oil, tulsi oil and karanja oil. Among these products, the clove and neem oil show good anti-bacterial property on cotton fabric. The wash fastness of finish cotton fabric can be improved by using KVI (Dimethylol dihydroxyethylene urea based inbuilt catalyst) as cross-linking agent. The effect of anti-bacterial finish on other functional fabric properties has also been studied and it was observed that 1% clove oil + KVI treatment gives the optimum results [Sarkar *et al*, *Indian J Fibre Text Res*, 2003, 28(3), 322-331].