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QAIHER(Urtica dioica} DECORTICATION, EXTRACTION, BLEACHING, SOFTENING AND DYEING

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Studies were carried out around Murree near Islamabad about decortication, extraction, bleaching, softening and dyeing of fibre from *Urtica dioica* sp. of Nettle plant, while running retting process in such a manner that sustained yields are obtained without disturbing fibre quality. Three different types of treatments viz. snow, tap water and effective microorganisms (EM) were used for retting. Selected shoots were processed for decortication followed by retting. The snow-treated samples took 40 days, the tap water samples10 days and the microbially treated 8 days to be retted. For chemical extraction, boiling in 5% caustic soda solution for 6 hours yielded satisfactory results. On bleaching the fibre, maximum weight loss was observed in snow-retted (9.44%) followed by EM (9.28%) and tap water (8.80%) treatment.

Key words: bleaching, decortication, dyeing, extraction, retting, softening, *Urtica dioica*

INTRODUCTION

The fibre locally known as "Qaiher" in the northern mountains of Murree near Islamabad, Pakistan, is obtained from a *Urtica dioica* sp. of Nettle (Uricacae family), which grows at an altitude range of 1,500-3,000 meters. It is spread over an area of 6.5 million acres. It is important that the bast fibres should be harvested at the right time if best fibre is to be obtained, for if the stems are allowed to become mature, saponification takes place, Since the bast fibres are present in the outer portion of the stem near the bark, the inner wooden portion has to be separated before boiling for the extraction purpose. This operation of separating the fibrous material from the wooden stalk is termed as decortication.

The vegetable fibres lie just under the bark of the stalk. Retting is the most important process by which these stalks are prepared for the extraction of fibres. If the process of retting is not carried out properly, the quality of the fibre is deteriorated.

Retting is the process by which the fibres in the 'bark' ribbons are separated from the woody stem, and from the extraneous green matter by the removal of pectins and other gummy substances in the stem. This process is completed under the joint action and effect of water, microorganisms and enzymes. In retting, disintegration of the tissue starts from the cambium and proceeds to the ray cells, phloem and cortex, so that the fibre bundles are finally separated from the woody pith or core of the stem cortex. During rotting the organisms feed on pectic substances, proteins of the cell protoplasm, sugars, starch, fats, waxes, tannin and mineral substances.

The most important types of bacteria involved in retting process are spore forming bacilli, penicillium sp. etc. The enzymes which are produced by the bacteria, are able to act best at a pH of 6.8 (Zahid,1973). Retting process is followed by chemical extraction of fibre. The next step is bleaching. The degree of bleaching is usually determined according to the nature of the desired product, for example table-cloths and similar other uses. A hard hand is desired for table-cloths and similar products while for apparel products a soft hand is needed, thus a strong alkaline extraction is carried out. To soften the bleached fibre different softeners are used. The traditional method is the use of ash or talc. Investigations were made of locally,available dyes used by the weavers. Dyestuffs are divided into a number of classes. The ability of the fibres to accept each of these dye classes depends upon several factors. Dyes must be applied in an alkaline medium because dye baths that are strongly acidic may be harmful to cellulose fibres (Phyllis,1982). Therefore this study was conducted to explore various aspects starting from harvest of Nettle stems up to dyeing of fibre in such a manner that sustained yields are obtained without. disturbing fibre quality.

MATERIALS AND METHODS

The samples of Nettle plant shoots were collected from different places around Murree. At the time of harvest, the Nettle plant stalk should have lost its green colour, shiny appearance and the lowest tines of the stalk should have shed their leaves. The shoots were cut 15 cm from the ground. Gloves were worn while cutting the shoots. The steps for fibre extraction were carried out in the following sequence:

i) Decortication, ii) Retting (snow-retting, tapwater retting and microbial retting) iii) Chemical extraction; and iv) Cleaning of fibres.

For decortication, the stalk is first broken from the middle, or the hand-operated bast fibre ribbon is used. The ribbons are given three different treatments for example these were either snow-retted, or tapwater-retted or were subjected to microbial (EM) retting. Retting of the ribbons was done in small retting tanks by using dried ribbons. With biological methods, the ribbons are softened within a week in treated water at 34"C. Light beating and rinsing was done to clean the fibre. The electrical conductivity and pR of the soaking water was monitored. To culture the microorganisms employed in retting, a special nutrient broth medium was used. After retting the fibre was removed from the stalks. By stripping method, the stems of the retted fibres are beaten to loosen the fibre. When the fibres around the stems have been loosened sufficiently, the fibres are gently pulled apart from the stems. The fibre is then squeezed to remove excess water and hung on a frame to dry. After the ribbons have been stripped from the stalks, it is necessary to remove the gums that bind the individual fibres together. The ribbon can be treated with chemicals, such as an alkali which will generate a gas within the material itself on boiling and thus liberate the fibre by mechanical disintegration produced by the action of gas. The fibrous materials are directly boiled in 2.5% sodium hydroxide for 1 hour, washed thoroughly and dried. The ratio of H_2O to fibrous material was 1:2 in all the experiments. The fibre is then thoroughly washed, to eliminate its grayish colour, and bleached to bring out its whiteness and luster.

A major objective of bleaching the bast and leaf fibres is to remove the lignin, with which most of the colouring matter is associated. The bleaching processes used for bast fibres are usually milder, with longer treatment times than those used for cotton in order to preserve the strand structure as much as possible (Subhash,1975).

After bleaching the fibre is harsh and quite wiry. To overcome this, fibres are treated with emulsions, which produce soft, pliable and more lustrous fibre. The process is called softening in which the strength of the fibre is not really impaired (Cartel and Horten, 1936). Linseed was used as a softening agent during the present study, while among the commonly used softeners, talc, curcas oil, soya oil, mustard oil, paraffin oil are preferred. The time period of soaking the fibre in a softener varied from 7-72 hours.

Different types of retting processes produce difference in fibre colour. Fibre colour was studied on UV meter and luster on UV fluorescence apparatus i.e. Fibrograph 180 (1984 model).

The most appropriate dyes for Nettle fibre are Procion MX Dyes (lCI Ltd.).

The following Procion MX dyes were used:

i) Procion blue MX-3G (lCl reactive blue), ii) Procion orange MX-5G (lCI Cl reactive orange), iii) Procion red MX-5G (ICI Cl reactive red), iv) Procion yellow MX-G (lCI Cl reactive yellow), and v) Procion green MX-G (lCI Cl reactive green).

The dyes are applied at room temperature.

RESULTS AND DISCUSSION

Nettle harvesting takes place towards the end of the monsoon season in August! September and continues till December when the plants begin to flower. A man can harvest about 375 kg in one day consisting of more than 370 stems. Due to the stinging hair of the plant the researcher had to wear gloves. During decortication, it was much easier to ribbon the dried stems than the fresh ones. Machine-decorticated fibre is reported to sustain processing damage that reduces its strength. In the traditional method of fibre extraction, stems are cut from plant, dried, stripped with teeth, tied in bundles, soaked, boiled in wood ash, beaten and washed, softened by the use of clay, dried and then spun into yarn. The present method used suggests that retting of barks be done in NaOH solution, then beaten, washed, fibres bleached in sodium hydrochloride solution followed by a wash, softened with cationic softening agent, again washed, carded and finally spun into yarn.

During retting, the pH of the retting water was 5.88. The present results agree with those of Kirby (1963). The microorganisms involved in retting belong to photosynthetic bacteria (Rhodopseudomonas sp.), lactic acid bacteria (Lactobacillus sp.), and yeast (Saccharomyces sp.), Electrical conductivity of the soaking water was. 2.02 dSm^{-1} at 25°C. The snow-treated samples took 40 days, the tapwater 10 days and those subjected to microbial treatment took 8 days only to be retted. It was indicated that for chemical extraction, boiling in 5% caustic soda solution for 6 hours yielded satisfactory results. The use of chemicals speeds up the extraction process.

On bleaching the fibre the weight loss in the snow-retted samples was 9.44%, in microbe-retted was 9.26%'and with tapwater the weight loss was 8.80%. The high percentage of weight loss in the snow-retted samples might be due to the mode of retting, in which the samples remained under snow for 40 days. It was observed during the bleaching process that more severe the conditions used during bleaching, the higher was the degree of whiteness obtained, but greater the loss in weight.