ROSELLE RETTING

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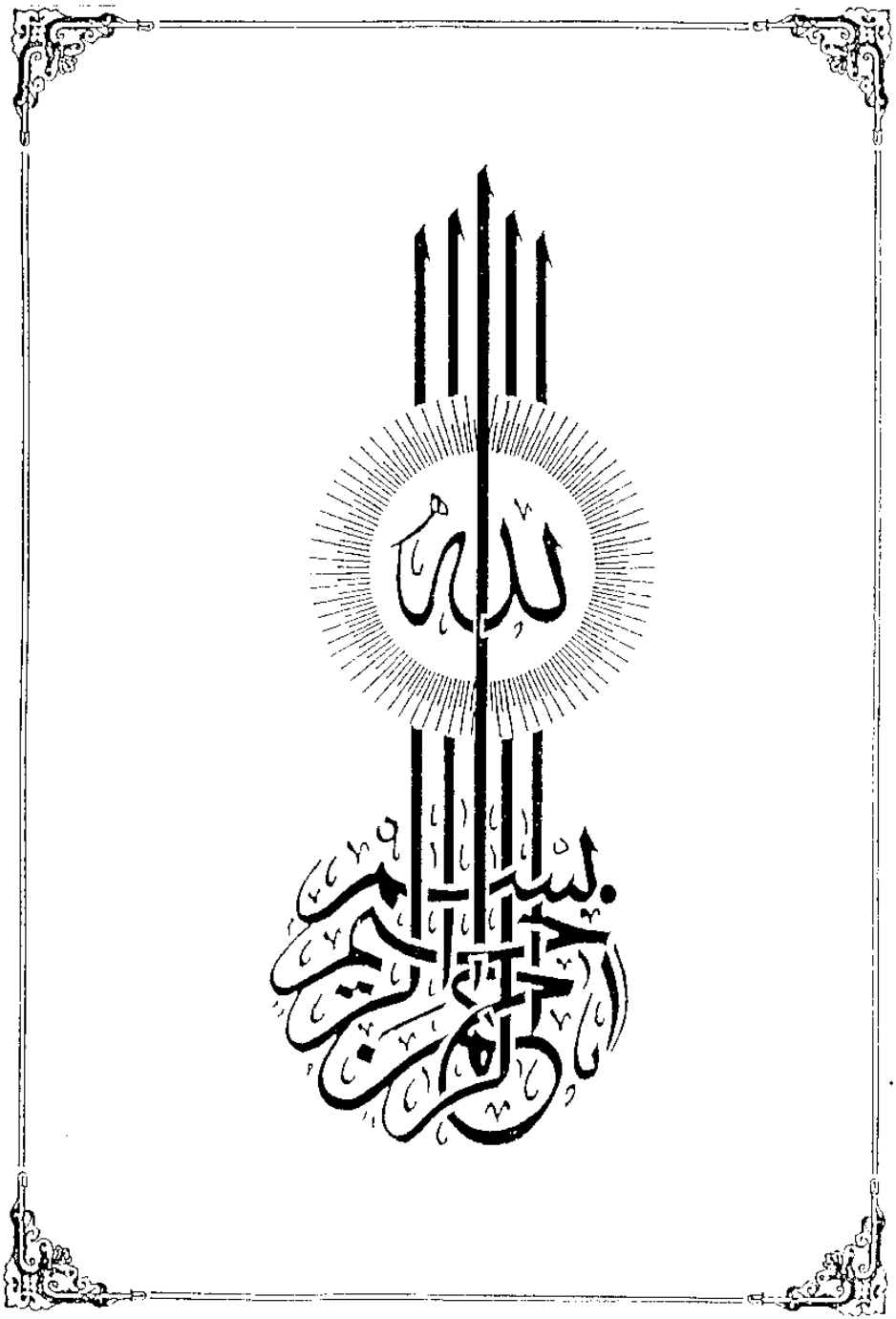

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C O N T E N T S

INTRODUCTION

It is expected that, the progress in the exportable products in Egypt needs large quantities of sacs. To cover the continuous supply of sacs, several trials have been carried out to improve some local substitutes for the expensive important jute fibres.

The microbiology of retting plant fibres has been extensively investigated in flax, hemp, and jute. It would be advisable to study the possibilities to develop a convenient method for retting roselle-stalk fibres.

Roselle or Karkada (Hibiscus subdariffa L.) is a multipurpose plant. It is cultivated for its stem, seeds and the acid fleshy calyx which is important in preparing some pharmaceutical products and a local soft drink. The climate in Upper Egypt is favourable for growing roselle , especially in Aswan. In the present investigation, trials were made to ret roselle stalk fibres in a short period, taking into consideration the quality of the produced fibres. Pacticular attention had been paid to determine the effect of nitrogen application on the progress of the retting process.

Bacteriological changes in the retting liquor and the chemical composition of the retted material were followed throughout the whole process in all treatments under investigation. The active retting microorganisms were isolated, identified and used as starters.

REVIEW OF LITERATURE

Retting is the process which allows the separation of fibres from cortex and wood that contain them and affects at least partial digestion of the cementing materials - mainly of pectic nature - between fibre bundles (Ruschmann, 1924; Lanigan, 1951).

Workers in the field of fibre retting, divide the process into two phases, i.e., preliminary and principal stages. Stutzer (1927), Allen (1946), Lanigan (1959), Fudl-Allah (1962) and Vardhanabhut et al. (1968) claimed that subsidary flora convert soluble carbohydrates in the preliminary phase to organic acids, alcohols and gases. The deplition of these materials with the consumption of dissolved oxygen pave the way for the proliferation of pectinolytic flora to attack pectic substances of the middle lammella. This constitutes the principal stage of retting.

Lanigan (1951) and Fudl-Allah (1962) recorded that the presence of high densities of active fermentors of carbohydrates and related substances at early stages of retting were of great importance. As a result of their activities, pectinolytic flora were compelled to utilize pectic substances as carbon and energy source at relatively

earlier period. Therefore, the shorter the period of carbohydrate utilization, the shorter would be the retting period.

Retting of local fibre plants in Egypt:

Some Egyptian workers tried to follow the bacteriological and chemical changes occurring during retting of some local fibre plants in Egypt and to improve retting process.

Fudl Allah (1962) reported that in kenaf retting, counts of total flora, saccharolytic organisms and pectinolytic flora attained their maxima on the 5th day, then counts declined. Most acidity produced were identified as acetic acid. No acetones, alcohols or formic acid were detected in the liquor.

Ghazi (1967) made a survey of retting flora of kenaf retting by flowing method. Total and pectinolytic flora were higher in summer than in winter. At the middle stage of retting, pectinolytic flora reached their highest level, while total flora, G- and sporeforming bacteria showed their lowest counts. However, cellulose decomposers were found in low densities during the whole retting process.

Zaki (1969) found that the time needed for kenaf retting was greatly reduced by nitrogen addition. Nitrogen treatments enhanced different microbial groups during retting liquor and the pH shifted to the alkaline side at the end of retting.

Mahmoud et al. (1972a) recorded that cotton-stalk ribbons could not be retted by ordinary method. They obtained well retted fibres by adding ammonium nitrate to the retting process. Nitrogen applied enhanced the proliferation of different microbial groups of retting.

Eweida and Rizk (1973) stated that retting of cotton stems in the presence of ammonium phosphate was accelerated at 30-35°C.

Eweida et al. (1974) recorded that the best temperature of roselle retting ranged between 30-33°C. They also concluded that warm water retting produced longer and higher quality fibres than chemical retting.

Zaki et al. (1975) followed bacteriological and chemical changes during roselle retting. Well retted fibres were produced after 20 days.

Pectinolytic flora of retting:

Active retting organisms are usually capable of decomposing pectic substances of the middle lammella with the resultant separation of fibre bundles. (Lanigan, 1959; Fudl-Allah, 1962; Ghazi, 1967; Zaki, 1969, Ishac *et al.* 1971; De Medeiros *et al.* 1973; Zaki *et al.* 1975).

Different retting organisms of jute and jute substitute plants were isolated by various workers. In jute retting *Bacillus corchorus* was isolated by Katagiri and Nakahama (1940), *B. mesentericus* and *B. macerans* by Debsarma (1946); *Pseudomonas acruginosa* by Ahmed (1951); *B. polymyxa* by Ali (1958); *B. brevis*, *Micrococcus corchorus*, *M. Luteus* and *M. variens* by Ahmed (1963), *B. macerans*, *B. subtilis*, *B. cereus*, *B. megatherium* and *M. cascolyticus* by Jalaluddin (1965); *B. coagulans*, *B. circulans*, *B. polymyxa* and *B. megatherium* by Alam (1970).

With regard to hemp retting, active retting organisms were found to be *B. comesii* (Rossi, 1916), *M. cannabis* (Katagiri and Nakahama 1940), *B. mesentericus* (Asia and Nakanishi,1944), *B. subtilis* - *Licheniforms* group and *B. polymyxa* (Fudl-Allah .1962).

In kenaf retting, Ghazi (1967) and Ishac *et al.* (1971) found that active retting organisms in flowing water method were *B. subtilis*, *B. pumilus*, *B. megatherium*, *B. macerans*,

B. licheniforms, B. cereus, B. polymyxa and B. circulans In stagnant method of retting Zaki (1969) recorded that active retters in kenaf retting were Micrococcus urea, M. candidus and M. freundenreichii.

In cotton-stalks retting, Mahmoud et al. (1972a) identified active retting organisms as B. subtilis, B. megatherium and B. licheniforms.

The use of pure cultures of active retting organisms as starters were recorded to accelerate the retting process (Carbone, 1917; Markova, 1940; Ruschmann and Bartram, 1942; Jalaluddin, 1970; Ishac et al. 1971, Woo, JiHyoung 1973)and to improve the quality of fibres produced (Makrinov, 1928; Markova and Dudarav, 1958).

Chemical composition of fibre plants and changes during retting process:

This aspect of retting had received little attention of bacteriologists. Couchman (1939), Zamyslov (1940) and Hessler (1945) found a decrease in pectic substances content of hemp and flax fibres as compared with the starting materials.

Urquhart and Howitt (1953) recorded that ramie, hemp and jute fibres contained 68.6, 67.0 and 64.4% cellulose

respectively. Pectin content was 0.2 and 1.9% of jute and ramie fibres respectively.

Centola (1954) recorded that fibre bundles contained small quantities of pectin at periodic points along the fibres. However, pectins remained after retting had undergone a change in properties.

Lanigan (1959) found that pectinolytic organisms vary greatly in their activities as retting agents of different plants. This is probably due to the differences in the physico-chemical properties of pectic substances in different plants.

Fieser (1961) found that Legnin represented 3.9-5.0%, 15.4-15.9% and 16.1-16.8% in hemp, jute and ramie fibres respectively.

Kundu (1964) indicated that free sugers were decomposed in early stage of retting. Pectin disappeared during the middle stage of retting, while hemicelluloses decreased at the end of the retting period.

Mironov and Rostovtsera (1967) found a considerable decrease in organic substances of the retting liquor especially volatile acids. Ammoniacal nitrogen increased as a result of protein degradation. Retting liquor contained more K,P and

monosaccharides owing to more extensive degradation of polysaccharides.

Attia et al. (1968) found that water used in flax retting extracts 12% of plant weight which consisted of sugars, glucosides, tannis, soluble nitrogenous compounds and colouring matter.

Khan et al. (1969) recorded that the values of cellulose content in some fibre plants ranged from 69.119 to 86.651%. The lowest value was found by kenaf and the highest value by cotton. Cellulose content have direct relation with the quality characters, length of individual cell, strength maturity and fineness, i.e. the higher the value of cellulose content, the best fibres.

Eweida et al. (1969) reported that percentages of pectins and legnins in kenaf fibres were 9.6% and 5.9% respectively.

Nishikawa et al. (1972) recorded that the decrease in N-content of the pith during water retting was fast during the first 15 days.

Eweida et al. (1974) pointed out that cellulose content of roselle fibres depend on the method of retting. They also found a positive correlation between fibre strength, cellulose and pectin contents. On the contrary,

a negative correlation was found between these characters and fibre fineness.

Rodionova et al. (1975) recorded that the middle lammella of potato tuber tissues and cortical parenchyma of flax contain an appreciable content of pectates or low methoxylated pectin.

Zaki et al. (1975) noted a continuous loss in ash, resins and pectic substances of roselle ribbons during retting. Cellulose and legnin contents were not affected. Well retted fibres contained 65.66, 13.50, 3.97, 1.14 and 1.96% cellulose, legnin, resins, pectic substances and ash respectively.

Favourable action of nitrogen on retting:

The favourable effect of added nitrogen source to the retting process was recorded by some investigators.

Flieg (1924) reported that the addition of urea accelerated the retting process and eliminated foul smell.

Asia and Imamure (1943) obtained well retted ramie fibres in three days when soybean residues were added together with controlling pH 5.5-5.6 and temperature at 35-40°C.