A REVIEW ON APPLICATION OF RETTING TECHNIQUES FOR NATURAL FIBER EXTRACTION

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ABSTRACT: In recent years, the amount of research focused on retting techniques for natural fiber extraction. Retting is the major problem in extracting natural fibers. The traditional methods of retting such as water retting, dew retting and chemical retting are used to natural fibers but recently enzymes have been evaluated to replace currently used methods. In this paper reviews different types of retting process used for natural fibers, recent retting techniques and microbial enzymes for retting of fibers provides an environmentally friendly and enhance the quality of fiber.

Keywords; Natural fibers, retting, spray retting, Bio-innovative retting.

INTRODUCTION

Natural fibers have begun to pace towards becoming the main alternative source in the modern world industry. It is used various applications from composite reinforcement, textile and even medical. Recently in 'environmental-friendly-era' natural fibers has definitely gain its place in the heart of most industries as it is biodegradable and most crucially, renewable (Yusri yuso et al., 2013). There are plenty of sources which can be extracted into natural fibers such as flax,kenaf, jute, sisal, pineapple leaf, banana and others.

Retting is a microbial process, sometimes termed degumming to release separate the fibre from the non-fibre stem tissues (woody part), and removal of non cellulosic components like pectin, hemicelluloses, lignin, waxes and fats. The individual fibers are cleaned of nonfibre materials by mechanical processing. Insufficient retting, or under-retting, results in poor separation of the non-fiber materials (i.e., shive) from the fibers which reduce fibre yield, processing efficiency, and ultimate fiber quality. On the other hand, over-retting can occur resulting in poor fiber quality. Retting is very importance in fiber yield and quality (Ruzica Brunsek et al, 2015).

RETTING

Retting is a natural microbial process and it is also involves the degradation of non-fibrous matter which acts as glue between the fibers in woody plant parts and fibers without damaging the fiber cellulose. This process allows easy separation of individual fiber strands and the woody core. Since retting is a biological process, it requires both moisture and a warm temperature for microbial action to occur (Ashish Hulle et al 2015)

NATURAL RETTING

Natural retting is a preferential retting process to separate the fiber from lignocellulosic biomass without damaging the fiber cellulose. Retting is the microbial freeing of plant fibers from their surroundings (Mignoni 1999). The process takes up to three weeks. Retting microbes consume the non-fibrous cementing materials mainly pectin and hemicellulose. Its increase softens the leaves by the destruction of the less resisting intercellular adhesive substances. When fermentation has reached the appropriate stage, the fibers can be separated quite easily from the leaves. If retting process is allowed beyond this point, fibers decline in quality.

Under-retting causes incomplete removal of gummy materials such as pectin substances, and extraction of fiber becomes difficult. Therefore, the progress of retting must be observed carefully at intervals to avoid fiber damage. Though the natural retting takes more time, the process is economical. There are two traditional types of retting include water retting and field or dew retting. In water retting, plant leaves are immersed in water (river, pond or tanks). In field or dew retting, the crop is spread in the field where rain or dew provides moisture for retting. Water retting produces fibers of greater uniformity and higher quality than fibers extracted by field retting (Steyn,2006).

APPLICATION OF RETTING TECHNIQUES FOR NATURAL FIBER EXTRACTION

Water Retting:

Acacia leucophloea Bark

New Natural Cellulosic Fiber from Acacia leucophloea Bark extracted by retting processes, also called degumming processes. Acacia leucophloea Bark plant was soaked in water for a maximum period of 15 days to permit microbial degradation. During this period, the pectinous substances that bind the fibers with other plant tissues are softened and degraded by micro-organisms. Then the bark was removed and thoroughly washed with running fresh water and allowed to dry in the open air for about a week. The inner layers were preserved for a combing operation by fine long metal teeth to extract the ALFs (V. P. Arthanarieswaran et al.2015).

Lygeumspartum L.

New natural cellulosic fiber from Lygeumspartum stems was cut to the length of 50 to 60 cm approximately, and they were washed with distilled water to remove the contaminants and adhering dirt. After that,stems were completely immersed into the container filled with fresh water and covered for a period of 15 days at room temperature to undergo microbial degradation. Once this period is past, LS stems were brushed manually using a comb with the metal teeth. Then, the obtained fibers were washed several times in distilled water to remove any remaining unwanted materials from the fiber surface. Finally, fiber bundles were dried in the oven at 70◦C during6 h to remove moisture (Z. Belouadah et al. 2015)

Kusha grass

The Kusha grass have immersed in water for about four weeks (Retting process). By using the manual extraction process, the fibers were separated from the wet grass after retting process. The extracted fibers were cleaned thoroughly and dried in at ambient conditions for a week before using for analysis (A. N. Balaji, et al., 2016).

Agave Americana leaves

The Agave Amerciana leaves contain a single bundle of fibres along the leaf length supporting the cellular tissue, which constitute also the vascular system of the leaf. The fibres were obtained from leaves buried under a layer of soil between 30 cm and 40 cm deep for three months (first method). The second extraction method consisted in immersing the leaves in a barrel for a period of 10–13 days (Fig. 1e and f). The use of a closed barrel accelerates the biodegradation process of the leaves matrix due to the rapid development of the bacteria in a closed environment with reduced water vaporisation. The washed A. americana have been dried for 72 h in sunlight, and then stored inside vacuum-proofed plastic containers before testing. (A. Bezazi et al.2014)

Chemical Retting

Cornhusk

The experiments were carried out for 60 min at four different temperature levels viz. 100, 120, 140, and 160 oC by using 10 % w/w concentrations of sodium hydroxide (as an alkali material for degumming and releasing the fibers from cornhusks) 5 g/l with the material:liquor ratio of 1:20. The extracted fibers were washed thoroughly in tap water to remove the dissolved substances. The extracted fibers were then neutralized with dilute acetic acid 0.1 % (w/v), rinsed with water and in finally dried under ambient condition.
(Nishant Kambli et al.2016)

SPRAY ENZYME RETTING

FLAX

The spray enzyme retting method (*11*) was used for retting 50 g and larger samples. Briefly, stems were crimped with fluted rollers at _80 N and sprayed (or in some cases soaked for 2 min) to completely saturate stems with enzyme formulation containing (unless otherwise noted) 0.05%Viscozyme (v/v as supplied by Novozymes, Franklinton, NC) or a similar pectinase-rich enzyme mixture plus 25 or 50 mm EDTA at pH 5.0 for 24 h at 40 °C. The Fried test, an in vitro method for evaluating separation of fiber from shive by enzyme retting, was also employed (*10, 14*). Briefly, sections usually from the middle of the stem 10 cm in length from 12 plants were placed in tubes with enzyme solution as above for retting on a rotary device. After retting, liquid was decanted, boiling water was added, and the stems were shaken in precise movements. The fibers were scored independently from 0 (no fiber separation from stems) to 3 (fibers separated from stems) using standard images.

Enzymatic dew-retting process of Flax

Enzyme is enhancement of the dew-retting process by use of development range of INOTEX tailor made enzymatic blends sprayed on the field before pull out or within first the 3 days of dew-retting period.

Procedures:

Field area 0, 50 ha, ie. Approx. 2, 5 tons of stems

Spray consumption 320 l/ha, enzymatic product dilution 1:20

Followed by common dew-retting, turbine scutching.

Best results used Texazym SER-3conc spray with a measured increase in long fibre yield (about

+ 43%)The results of repeated seasonal trials confirmed the possibility of shortening retting time as all enzymatically sprayed flax stem batches reached the scutching quality after 11-14 days of dew retting(Marek et al,2008).

BIO-INNOVATIVE RETTING

FLAX

Pectin splitting enzyme Beisol PRO (CHT/Bezema), applicable for discontinuous, semi-continuous and continuous processes, was used for the bio-innovative flax retting. It is capable product for individual application as well as for integration within a process of enzymatic desizing or enzymatic scouring of cotton. It does not require the presence of a sequestering agent, is efficient within a wide temperature range from 20 to 98 °C, and pH of 6.0-9.0 as well. In this research it was applied by exhaustion method in Polycolor turbomat

(Mathis) in three concentrations: 0.1 %, 0.2 % and 0.5 % owf (over weight of fibre), in buffered solution at 55 °C for 60 min. The Fluka buffer solutions were used for varying pH: Buffer solution pH 5.0 (citric acid/ sodium hydroxide solution), pH 7.00 (potassium dihydrogen phosphate/ sodium hydroxide); and pH 9.0 (borax/ hydrochloric acid).

CONCLUSION

As for the conclusion, the retting technique is the predimonal challenge in the application of retting techniques for natural fiber extraction and selection of retting method is very important is by combing chemical,enzymatic,etc., The natural fiber extracted from the plants can be used in a limited number of applications in textiles.Hopefully,this review benefits the new retting techniques for natural fiber extraction methods.

REFERENCES

- V. P. Arthanarieswaran, A. Kumaravel & S. S. Saravanakumar (2015) Characterization of New Natural Cellulosic Fiber from *Acacia leucophloea* Bark, International Journal of Polymer Analysis and Characterization, 20:4, 367-376.
- Ashish Hulle, Pradyumkumar Kadole and Pooja Katkar, Review *Agave Americana* Leaf Fibers,Fibers, 2015, 3, 64-75; ISSN 2079-6439.
- Abderrezak Bezazi,Ahmed Belaadi, Mostefa Bourchak, Fabrizio Scarpa, Katarzyna Boba, Novel extraction techniques, chemical and mechanical characterization of Agave americana L. natural fibres,Composites: Part B 66 (2014) 194–203.
- Z. Belouadah et al.Characterization of new natural cellulosic fiber from *Lygeumspartum L.* Carbohydrate Polymers 134 (2015) 429–437
- A. N. Balaji, M. K. V. Karthikeyan & V. Vignesh (2016): Characterization of New Natural Cellulosic Fiber from *Kusha Grass*, International Journal of Polymer Analysis and Characterization.
- Steyn, H.J.H. The Evaluation of Conventional Retting versus Solar Baking of *Agave Americana* Fibres in Terms of Textile Properties. Master's Thesis, University of Free State, Bloemfontein, South Africa, 2006.
- Mignoni, G. Cannabis as a Licit Crop: Recent Developments in Europe; Kenaf Ecofibre: Rome, Italy, 1999.
- Nishant Kambli, Shantanu Basak, Kartick K. Samanta, and Rajendra R. Deshmukh, Extraction of Natural Cellulosic Fibers from *Cornhusk* and Its Physico-Chemical Properties, Fibers and Polymers 2016, Vol.17, No.5, 687-694.

- Yusri yusof, Anbia dam', Review on PALF Extraction Machines for Natural Fibers,Advanced Materials Research Vols. 781-784 (2013) pp 2699-2703.