CHARACERIZATION OF CELLULOSE MICROFIBRILS OBTAINED FROM HEMP

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ABSTRACT

In this work microfibrilled cellulose was extracted from hemp fibers using steam explosion pre-treatment and high intensity ultrasonic treatment.
The acquired results after steam explosion treatment and water and alkali treatment are discussed and interpreted by Fourier transform infrared spectroscopy (FTIR). Scanning electron microscopy (SEM) was used to examine the microstructure of hemp fibres before and after each treatment. X-ray was used to characterise changes to cellulose crystallinity resulting from the approaches used for preparing microfibrills. A fiber size analyser was used to analyse the dimensions of the untreated and treated cellulose fibrils.

Keywords: hemp, steam explosion, microfibrilled cellulose, ultrasonic treatment

INTRODUCTION

Hemp fibres have high strength, low density, and high sustainability; therefore they are used as reinforcement in composite materials. This usefulness of cellulose fibrils is because small fibrils have better mechanical properties than the individual macro fibers. Within their structure, small fibrils include more cellulose crystals, having a higher elastic modulus than fibers, which contribute to their increased strengths [1].

The steam explosion (SE) auto-hydrolysis is currently comprehensively studied as a promising green pre-treatment technology [2] to obtain micro-fibrils of cellulose and also to remove non-celluloses constitutes - lignin, hemicelluloses, pectins, waxes.

The high-intensity ultrasonication technique is an environmentally benign method and a simplified process that conducts fiber isolation and chemical modification simultaneously and helps significantly reduce the production cost of cellulose nanofibers and their composites [3]

RESULTS AND CONCLUSIONS

This study shows that there are substantial differences on the isolation of hemp microfibrills after various treatments (alkali treatment, steam explosion, ultrasonic treatment), surface morphology, physical properties and chemical composition of microfibrills.

Figure 1 shows SEM micrographs of untreated, steam exploded and ultrasonic treated hemp fibres. From micrographs can see differences of surface morphologies and fibril sizes.

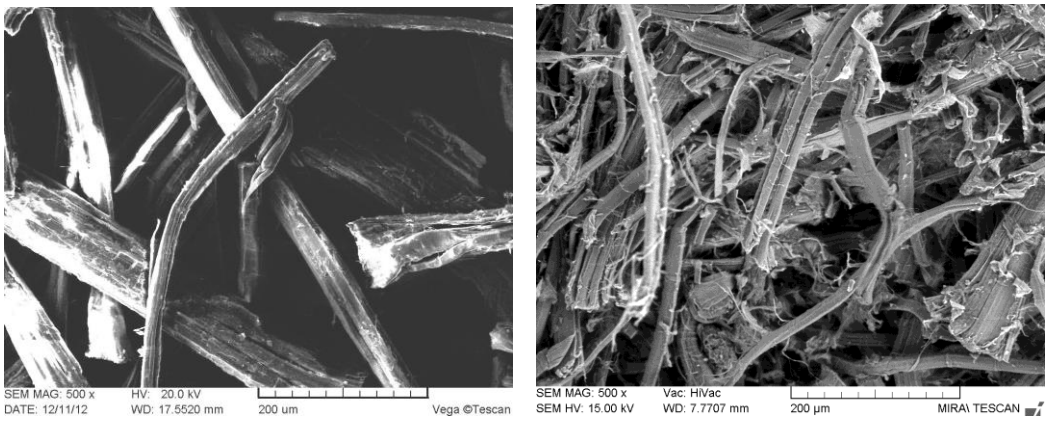

Fig. 1. Untreated, steam exploded and ultrasonic treated hemp fibres

Further work should be performed in order to avoid agglomeration of microfibrils due and after ultrasonic treatment.

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