EVALUATION OF THE POTENTIAL OF SOME MICROBIAL STRAINS ON BIOPULPING AND BIOBLEACHING

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ABSTRACT

Enas Ali Hassan. "Evaluation of the potential of some microbial strains on biopulping and biobleaching". Unpublished Doctor of Philosophy Dissertation, University of Ain Shams, Faculty of Agriculture, Department of Agricultural Microbiology, ٢٠٠٧.

It is known that biopulping and biobleaching are experimental processes that use fungal treatment of lignocellulosic materials for lignin degradation and the use of fungal enzymes to treat pulps prior to pulping and bleaching processes. Fungi pretreatment might reduce the refining energy and chemicals consumption of pulping processes to improve pulps properties. Therefore this investigation was designed to study the effect of chemical, physical, and biological pretreatments on the improving bagasse biopulping properties as well as the use of fungal xylanses and lignin peroxidase to treat biopulps prior to bleaching in order to improve the paper sheets properties.

The best favorable conditions for bagasse chemical pulping were ٩٠ % propylene glycol at ١٥٠ °C for ٢ hours, which gave higher pulp yield, no rejects and lower kappa number. Using bagasse at ١٠ mesh-size treated with steam for one hour was the best physical pretreatment to remove the extractives before fungal biodegradation. The biological pretreatment gave the best paper sheets properties than biopulping of steam extraction and chemical pulping. Using both *Ophiostoma piliferum* and *Ceriporiopsis subvermispora* SS- ٣٣ as mixed culture for bagasse degradation in one stage was the best biological pretreatment led to increase the percentage of brightness, breaking length, and tear factor by

about ٥,٦ %, ٠.٨١ %, and ٣,٧٨ % respectively as compared to biopulping of two-stage degradation.

The biological bleaching of bagasse biopulp was carried out by crude fungal xylanase (١٠,٣٠ IUg $^{-١}$) for ٤ hours at ٥٠°C and crude fungal lignin peroxidase (١,٥٤ IUg $^{-١}$) for ٨ hours at ٣٧°C which improved the bleachability of bagasse biopulp and increased the brightness about ٦.٧ and ٨,٩٤ %, respectively.

Scanning electron microscopy (SEM) of unbleached bagasse pulp influenced by fungal pretreatment exhibit a cleaner surface and an apparent high flexibility and conformability, which would contribute to good binding, were more visible in the mixed fungal culture in one stage cultivation. Whereas, the morphological change of the fiber surfaces for enzyme pretreated and untreated bleached bagasse pulp clearly showed that the application of xylanase or lignin peroxidase caused change in the surface of the fiber. Fibers without enzyme treatment had smooth, sleek and uniform surfaces.

X – ray diffraction (XRD) technique provide an increase in the crystallinty percent by ١١,٢٩ and ٨,٣ % of the pulp prebleached with xylanase or lignin peroxidase respectively.

Keywords: Biopulping, Biobleaching, Organosolv pulping, *Ophiostoma piliferum*, *Ceriporiopsis subvermispora*, *X* – ray diffraction (XRD) and Scanning electron microscopy (SEM)

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