Effect of Cellulase Adsorption on the Surface and Interfacial Properties of Cellulose

Dourado, F; Gama, F.M.; Mota, M.
Centro de Engenharia Biológica - IBQF, Universidade do Minho, 4700 Braga, Portugal

In the last 10 years, the paper industries have been increasing the amount of used paper, for the manufacture of new paper products. However, use after use, undesirable changes in the pulps furnish [1] tend to occur, affecting mainly the pulps ability to release water [2]. The enzymatic treatment of wastepaper pulps [2-6] could improve the pulps drainability. Although the hydrolytic capability of the enzymes may be important in this improvement, the effect of the adsorbed protein (enzymes) on the surface properties of the fibers, should also be pondered. This work is an attempt to understand the effect of cellulase adsorption on the fibers surface and interfacial properties, and to relate these effects with the drainability improvement. Purified celluloses were used instead of lignocellulosic materials, because cellulose fibers are complex and heterogeneous materials, which would make their characterisation difficult, with the techniques applied.
The surface properties of purified cellulosic materials was characterised, before and after protein adsorption by thin-layer wicking. The celluloses interaction with water was also analysed by thermogravimetry (amount of adsorbed water) and differential scanning calorimetry (specific heat of dehydration), before and following protein adsorption. It was concluded that celluloses have a strong electron donor component, regardless of their cristallinity. The more crystalline are slightly hydrophobic. Both the heat of dehydration and the amount of adsorbed water are higher in the less crystalline celluloses. After protein adsorption, the cellulose surface become hydrophilic, and can adsorb a higher amount of water; this water is also more tightly bound to their surface [7].
The results obtained from this work were discussed on the perspective of possible mechanisms of the enzymatic drainability improvements: regardless of the preferential type of activity for this application, cellulases and xylanases have been proven to be effective in the improvement of the pulps drainage ability. However, the adsorption of the enzymes, which stabilises the fibers, probably increases the porosity of the pulps slurry, therefore increasing the velocity of water drainage.

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