EFFECT OF CELLULOSE BINDING DOMAINS ON THE CELLULOSE SURFACE ENERGY AND PAPER TECHNICAL PROPERTIES

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Native cellulose is a high high–molecular-weight linear polymer composed of D-glucano-pyranose units joined by β-1,4-linkages in a long chain molecule. Adjacent molecules are stabilized laterally by hydrogen bonding between hydroxyl groups, resulting in three-dimensional structures called fibrils. The purified cellulose materials consist of amorphous cellulose areas, in addition to well-ordered crystalline regions. The surface free energy plays an important and determining role in the behavior of cellulose materials in liquid media, for instance in what concerns solubility, aggregation and enzyme adsorption. Also, it may be rather important regarding the properties of materials such as paper and fabrics. The application of enzymes in both pulp and paper and textile industries is a fast developing field, and therefore the study of the effect of protein adsorption on the fibers surface and technical properties is of great importance.

In previous work, a calorimetric technique and the Thin-Layer Wicking technique to characterize the surface properties of several pure celluloses were used [1]. Due to limitations of the referred techniques, we decided to use another experimental approach: the Inverse Gas Chromatography technique. The dispersive and polar surface energy of Whatman CF-11 was measured. Cellulose Binding Domains (CBD) were purified by limited proteolysis and ultrafiltration [2]. The effect of the peptides adsorption on the cellulose surface energy was analyzed.

CBDs were also used in the treatment of paper pulps. It was verified that drainability improvement, as measured by the Shopper-Riegler method, is comparable with the one normally obtained with glycanases; however, better paper mechanical properties were obtained in this case, which is generally not the case with glycanases [3]. As CBDs are non-hydrolitic peptides, it seems that the modification of the fibres surface energy, or the solvation and steric effects induced by the proteins adsorption, are responsible for dramatic modification of the technical characteristics of pulp and paper.

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