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Studies of lignin and polysaccharides recovery from kraft liquor for biotechnological applications

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Abstract

According to the biorefinery concept, this study has the objective of evaluating alternatives for the valorization of all the kraft liquor fractions. This liquor consists mainly in lignin, cellulose and hemicellulose. Currently, cellulose pulp industries recover the cooking chemicals by burning and energy is introduced into the process. Sustainable development guidelines, regarding the costs and wastes reduction and biotechnology principles may present new solutions for the production of valuable products.

In this study, two methods for the polysaccharides extraction, in three different pH conditions, are presented. The only difference between these methods is the solvent applied: ethanol and 1,4-dioxane. All the samples were maintained 24 h at 298 K. After a filtration step, the solid fraction resultant from the ethanol treatment had a carbohydrate content of 40.51%, 44.64% and 49.53%, for pH values of 3, 4 and 6, respectively. The treatment with 1,4-dioxane, reached the following values: 21.17%, 18.41% and 29.73% for the same pH values. These results were obtained with HPLC analysis after polysaccharides hydrolysis. Three unknown peaks were detected that we considered to be sugar derivative compounds. Thus, the polysaccharides contents, for both treatments, might actually be superior.

Concerning to the product purity, the ethanol extraction revealed to be the less efficient. The lignin content in the solid fraction, ranged between 28% and 31%, with 1,4-dioxane extraction, and between 40% and 50%, with ethanol.

The lignin molecular weight was determined with GPC, after and before liquor pH lowering. Thereby, for pH 6, pH 4 and pH 3 the obtained MWs were: 2376 Da, 1477 Da and 3705 Da, respectively. The molecular weight increase may be due to the lignin repolymerization. These results suggest that the polysaccharides recovery and lignin molecular weight may be related. As the molecular weight increases or decreases, the polysaccharides percentage presents the same behavior, regardless of the product purity. The data obtained after FT-IR analysis suggested that there was no significant modifications on lignin structure.

Summarizing, these preliminary results indicate that there is a possibility of recovering the kraft liquor´s polysaccharide while the residual lignin can still be used for burning to energy recovery.

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