COMPARISON OF HEMP PRETREATMENT METHODS FOR SUGARS PRODUCTION

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ABSTRACT

Non-wood lignocellulosic residuals are promising raw materials for production of sugars for bioethanol and value-added products. Among them, industrial hemp has great potential with its high biomass yield per hectare. At present from hemp plants, mainly the long fibers are separated from the stems. This remains a residue of hemp particles, which are characterized by a hardwood-like content of cellulose, hemicellulose and lignin, but with a very low bulk density of the material.

The aim of the present study is to compare pretreatment methods of industrial hemp biomass in order to achieve the highest total sugars yield after enzymatic hydrolysis. Hemp residue after mechanical separation of long fibers from hemp stalks was used. The chemical composition of the hemp raw material has been determined. Diluted sulfuric acid hydrolysis and steam pretreatment with and witout CO_2 impregnation were performed under different temperatures and durations. The efficiency of the pretreatment was evaluated after cellulase hydrolysis.

The diluted acid hydrolysis method provides the highest total glucose yield, but also significant furfural formation. The classic steam explosion method leads to the same glucose yield after enzymatic treatment as after acid pretreatment, but with practically no formation of glucose and furfural during pretreatmentstage. The CO_2 steam explosion method provides the highest xylose yield in the pretreatment stage. Dueto the mild acid conditions, that pretreatment can be carried out at a lower temperature, increasing the energy efficiency of the process. In conclusion, the potential of hemp residues is similar to that of straw stalks as a raw material and the most suitable method of pretreatment of industrial hemp for enzymatic hydrolysis to glucose for bioethanol is diluted acid hydrolysis, while the xylose yield is a higher after CO_2 steam explosion method.

Keywords: hemp biomass, pretreatment, enzymatic hydrolysis, sugars.

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