Sodium hydroxide pretreatment of sunflower stalks for enzymatic hydrolysis

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Monomeric sugars are generally produced by enzymatic hydrolysis. However, the presence of lignin makes the access of enzymes to cellulose or hemicellulose difficult, thus reducing the efficiency of the hydrolysis. An effective pretreatment method is required to increase accessibility of cellulose and xylan and to remove lignin from biomass. The main purpose of sodium hydroxide pretreatment on lignocellulosic biomass is removal of lignin. Sodium hydroxide pretreatment increases the porosity of biomass by breaking the ester bonds cross-linking lignin and hemicellulose, hence lignin is removed from lignocellulosic biomass [1].

Sunflower is the largest oil seed source for Turkey, with more than one million ton annual production [2]. After seed harvesting, sunflower stalks can be considered as readily available raw material for C-5, C-6 sugars [2].

In this study, dried and milled sunflower stalks were pretreated with NaOH (0.5, 2.0, 4.0% w/v) at different temperatures (60, 90 and 120°C), and pretreatment times (15, 30, and 60 min). Enzymatic hydrolysis was carried out using a mixture of cellulase (60 FPU/g dry biomass) and β-Glucosidase (40 CBU/g dry biomass) at 50°C for 48 h. Glucose and xylose contents in the solutions were analyzed by HPLC [3].

Raw sunflower stalks were contained 16% lignin, 32% cellulose, and 19% hemicellulose. After pretreatment, cellulose recovery ranged between 77% and 94%, and maximized with 2%NaOH, at 60°C for 60 min. 52% of lignin was removed at 120°C. While temperature increased from 60 to 120°C, glucose recovery slightly increased up to 72% of glucose/unpretreated biomass.

References

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Acknowledgement: This study was supported by Anadolu University Scientific Research Projects Commission under the grant no: 1205F081