

Combined pretreatment with hot compressed water and wet disk milling opened up oil palm biomass structure resulting in enhanced enzymatic digestibility

ABSTRACT

Combined pretreatment with hot compressed water and wet disk milling was performed with the aim to reduce the natural recalcitrance of oil palm biomass by opening its structure and provide maximal access to cellulase attack. Oil palm empty fruit bunch and oil palm frond fiber were first hydrothermally pretreated at 150-190° C and 10-240 min. Further treatment with wet disk milling resulted in nanofibrillation of fiber which caused the loosening of the tight biomass structure, thus increasing the subsequent enzymatic conversion of cellulose to glucose. The effectiveness of the combined pretreatments was evaluated by chemical composition changes, power consumption, morphological alterations by SEM and the enzymatic digestibility of treated samples. At optimal pretreatment process, approximately 88.5% and 100.0% of total sugar yields were obtained from oil palm empty fruit bunch and oil palm frond fiber samples, which only consumed about 15.1 and 23.5 MJ/kg of biomass, respectively.

Keyword: Combined pretreatment; Hot compressed water; Oil palm empty fruit bunch; Oil palm frond fiber; Wet disk milling