

Effect of physical, chemical and thermal pretreatments on the enzymatic hydrolysis of oil palm empty fruit bunch (OPEFB)

ABSTRACT

The effect of physical, chemical and thermal pretreatments on the chemical composition (cellulose, hemicellulose and lignin) and the physical structure of oil palm empty fruit bunch (OPEFB) fibres for subsequent use in reducing sugar production were investigated. Physical pretreatment was done to reduce the size of OPEFB by grinding the OPEFB to 1.62 cm followed by hammer-milling to an average size of 62 mm. Chemical pretreatment was done by soaking the OPEFB fibres in 0.1 M and 0.5 M NaOH. Thermal pretreatment was done by two methods: (i) heating at 21 °C, 5 psi for 5 min and (ii) heating at 240 °C, 40 psi for h and 50 min. The effect of combined pretreatments (chemical, physical and thermal) was also studied. From the results, it was evident that the cellulose, hemicellulose and lignin composition in the OPEFB were affected. Higher cellulose content was found in treated OPEFB as compared to untreated OPEFB due to the removal of lignin. The scanning electron microscope (SEM) micrograph showed a marked change in the physical appearance of treated OPEFB as compared to the untreated OPEFB, especially OPEFB treated with combined pretreatments. Enzymatic saccharification of OPEFB treated with various pretreatments was conducted for reducing sugar production using Celluclast .5 litres (Novozyme A/S, Denmark). Saccharification was conducted in shaker incubator at 37 °C, 80 rpm. Hammer-milled OPEFB fibres soaked in 0.5 M NaOH and heated at 21 °C, 5 psi gave the highest conversion yield in this study with 0.53 g sugars/g OPEFB being produced. This was nine-fold higher as compared to chemically and thermally untreated OPEFB fibres (62 cm) where only 0.06 g sugars/g OPEFB was produced.

Keyword: Oil palm empty fruit bunch (OPEFB); Pretreatment; Hydrolysis; Reducing sugars