

Microstructural, mechanical, and physicochemical behaviours of alkali pre-treated oil palm stalk fibres

ABSTRACT

The effect of alkali pre-treatment (sodium hydroxide, NaOH) on the microstructural, mechanical, and chemical composition of oil palm stalk fibres (OPSF) is reported for future bioconversion processes. The OPSF was pre-treated with various concentrations of NaOH (5, 10, 20, 30, and 40% w/v). Scanning electron microscopy analysis revealed that 5% w/v alkali concentration caused complete removal of silica bodies and waxy layers, whereas pronounced degradation of the fibres occurred at 40% w/v NaOH concentration. Mechanical test results showed that the maximum elastic modulus of untreated OPSF was 2.5 GPa and the modulus was not sensitive to alkali concentration. Permanent set (plastic strain) and viscoelastic behaviours of OPSF were observed from the loading-unloading and stress relaxation test results, respectively. Agreement was observed between the Prony series viscoelastic model and test results, which provided further evidence of the viscoelastic behaviour of OPSF.

Keyword: Oil palm stalk fibres (OPSF); Pre-treatment; Sodium hydroxide (NaOH); Mechanical behaviours; Morphology; Lignocellulosic composition