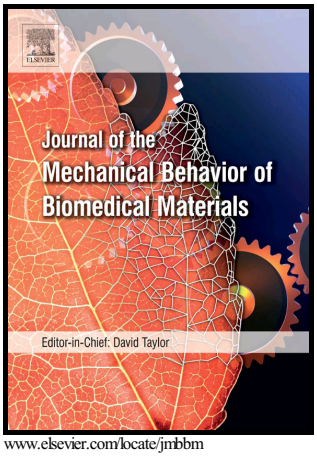

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Micromechanical modelling of oil palm empty fruit bunch fibres containing silica bodies

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Abstract

Experimental and numerical investigation was conducted to study the micromechanics of oil palm empty fruit bunch fibres containing silica bodies. The finite viscoelastic-plastic material model called Parallel Rheological Network model was proposed, that fitted well with cyclic and stress relaxation tensile tests of the fibres. Representative volume element and microstructure models were developed using finite element method, where the models information was obtained from microscopy and x-ray micro-tomography analyses. Simulation results showed that difference of the fibres model with silica bodies and those without ones is larger under shear than compression and tension. However, in comparison to geometrical effect (i.e. silica bodies), it is suggested that ultrastructure components of the fibres (modelled using finite viscoelastic-plastic model) is responsible for the complex mechanical behaviour of oil palm fibres. This can be due to cellulose, hemicellulose and lignin components and the interface behaviour, as reported on other lignocellulosic materials.

Keywords: finite-element-micromechanics, silica-body-fibre-interface, x-ray-micro-tomography

Abbreviations: ADF: Acid detergent fibre, ADL: Acid detergent liquid, ATR: Attenuated total reflectance, CZM: Cohesive zone model, CW: Cell wall, FTIR: Fourier Transform infrared, NDF: Neutral detergent fibre, OPEFB: Oil palm empty fruit bunch, PRN: Parallel