

Properties of Bio-Composite Packaging Materials Developed Using Cowpea Lignocellulosic Sidestream as a Filler

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Abstract

Bio-composite packaging materials have gained substantial attention in replacing petroleum-based non-biodegradable plastics. Interest in the latter has been motivated by stringent regulations, which promote the development of sustainable, environmentally friendly packaging materials. Bio-composite packaging materials are attractive as they can be made up of biodegradable polymers and agricultural residues. The Agricultural sidestream of cowpea (*Vigna unguiculata* (L.) Walp) is considered as waste, not traded as a commodity, and thus does not have economic value. In this study, bio-composite materials made up of polymer blend as a matrix reinforced with 0, 10, 20 and 30 % cowpea sidestream were compounded by extrusion, followed by injection moulding and film extrusion for the development of rigid and flexible packaging, respectively. The tensile stress at maximum force and Young's modulus increased with the addition of the cowpea sidestream, while decreasing the strain in relation to the neat blend. The bio-composites had a shear thinning behaviour in which the complex viscosity decreased with an increase in angular frequency as revealed by rheology. Furthermore, the viscosity of the complex increased with an increase in fibre loading. The DMA results showed that the storage modulus increased with an increase in fibre loading in the temperature range of -80 to 70 °C. Degradation of bio-composite films increased with fibre loading after 60 days of soil burial compared to the neat blend. In this study, we have demonstrated that locally available sidestream of cowpea can be used to produce bio-composite films for flexible packaging and injection mould specimens for rigid packaging with balanced material properties.

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Mondli Masanabo is a PhD candidate at the University of Pretoria. His research focuses on the development of biodegradable packaging materials using agricultural biomass waste of climate-smart African crops.