3D printable bio-based nanocomposites filaments containing nanocellulose derived from forestry waste residues: Production and analysis

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At present, the most widely used 3D-printing technique is the fused deposition modelling (FDM) [1]. This technique mostly utilizes thermoplastic based monofilament as printing material. The 3D-printable monofilaments are a form of continuous fibre with diameters ranging from 1.75 – 3 mm [1]. Currently, both petroleum and bio-based thermoplastic filaments are available. Although, monofilaments of Poly (lactic acid) (PLA) are the most widely used bioplastic in the FDM technique [1]. Nevertheless, issues like slow crystallization, poor melt strength, low hit distortion temperature and brittleness affect both PLA processing and final material property.

However, these issues can be circumvented via the incorporation of plasticizers and reinforcing fillers into PLA to make bionanocomposites. For instance, PLA bionanocomposites containing nanocellulose reinforcing fillers such as cellulose nanocrystals (CNC) and cellulose nanofibers (CNF) have been shown to possess superior properties [2].

The superior mechanical property and low environmental impact of PLA bionanocomposites filaments presents a huge potential [3]. Therefore, this study is aimed to demonstrates the applicability of PLA/nanocellulose bionanocomposites in the production of filament suitable for 3D printing. The nanocellulose used in this study was extracted from waste saw dust of *Eucalyptus grandis*. In addition, the addition of a biobased plasticizer (glycerol tricacetate) improved the brittle nature of the bionanocomposite filaments. Finally, the effect of nanocellulose loadings on the thermal, physical and mechanical properties of these PLA bionanocomposite fibres have been elucidated.

List of Bibliographies

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