Tensile, flexural and fracture morphological properties of recycled polypropylene (*rPP*) filled dried banana leaves fibre (DBLF) composites : effects of DBLF loadings

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ABSTRACT

Global interest to reduce the use and disposal of non-degradable plastic based product, has enticed the initiative to develop eco-friendly plastic based composites. Green product require degradability attribute while maintaining superior mechanical and physical properties, especially for packaging application. For such reason, some portion of thermoplastic was substituted with some portion of plant based natural fibre, for composite production. In this study, recycled waste polypropylene (*rPP*) was filled with dried banana leaves fibre (DBLF), for *rPP*/DBLF composites fabrication. The effects of DBLF fibre loadings (0, 10, 20, 30 and 40 wt%) towards the resulted mechanical, physical and fracture morphological properties of *rPP*/DBLF composites were studied. Local supply of dried banana leaves was grinded into 60 *µm* of fibre length, and *rPP* was obtained from waste injection moulding scrapped and crushed beforehand into finer *rPP* particles. The *rPP*/DBLF composites were prepared through double steps compounding method using melting device (180 °C, 80 rpm, 30 min) followed by an injection moulding process (185 °C, 5 min of residence time). Later, produced *rPP/*DBLF composites were tested for their tensile strength (ASTM D638) and flexural strength (ASTM D790) performances. The relationships between the fracture morphology and composite strength was established through the observation of tensile fracture surfaces of the selected samples, under the Scanning Electron Microscope (SEM) observation. From the experimental work, interestingly it was found that, the tensile strength (TS) of *rPP*/DBLF composite has improved about +37.70% with 30 wt% of DBLF higher loading, while oppositely the maximum flexural strength (FS) had attained by 10 wt% of DBLF lower loadings, with only +22.60% of positive improvement, in comparison to unfilled *rPP* sample. Addition of DBLF into *rPP* prone to establish the strengthening outcome, but less stiffening effects. This could be explained by coarse DBLF particle morphology as observed by SEM, which encourage for mechanical interlocking with *rPP* for good matrix-filler interaction, that increased the TS, while better filler-filler segregation avoiding the filler domination which lowering the stiffness or FS. In overall, this study has successfully highlighted the potential of DBLF filler to enhance the properties of *rPP*, as another alternative of degradable plastic based composite for various promising applications.

KEYWORDS
rPP; DBLF; Degradable plastics; Flexural; Fracture surfaces; Tensile

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