Properties and morphology of poly(vinyl alcohol) blends with sago pith bio-filler as biodegradable composites

Abstract

The effects of sago pith as a bio-filler (SPB) on the mechanical and thermal properties of poly(vinyl alcohol) (PVA) were studied. The SPB was obtained from sago pith waste after starch extraction from sago palm. Sago pith waste was dried and ground to produce SPB. The SPB was blended with PVA in a twin-screw co-rotating extruder in order to produce PVA-SPB composites for mechanical, morphology, and thermal analyses. Blending of SPB and PVA improved the tensile modulus, whereas the tensile strength was reduced. This result occurred because SPB increased the rigidity of PVA. However, lack of interfacial adhesion between PVA and SPB caused the loss of reinforcing effects. The morphology analysis showed that a high loading of SPB (>70 wt%) tended to form clusters, as implied by the presence of elongated cavities due to droplet coalescence restricting chain mobility. Besides that, the enthalpy of melting (Delta H(m)) for 50 wt% of SPB was higher than that of PVA. This observation means that the molecular interaction forces between PVA and SPB were so great as to overtake those of the PVA itself. Thus it was concluded that 40-50 wt% of SPB was preferably blended with PVA to form a biodegradable composite in order to reduce the overall materials cost, rather than to act as a strong reinforcing filler.