

Interpenetrating polymer network (IPN) with epoxidized and acrylated bioresins and their composites with glass and jute fibres

ABSTRACT

Epoxidized (EHO) and acrylated (AEHO) bio-resins from hemp oil were synthesized, and their interpenetrating networks (IPNs) were investigated in reinforced bio-composites with natural jute fibres and glass fibres. The mechanical properties (tensile, flexural, Charpy impact, and inter-laminar shear) and viscoelastic properties (glass transition temperature, storage modulus, and crosslink density) of the bio-resins and their hybrid IPNs EHO/AEHO system were investigated as a function of the level of bio-resin hybridization. The hybrid bio-resins exhibited interpenetrating network (IPN) behaviour. Composites prepared with the synthetic vinyl ester (VE) and epoxy resins showed superior mechanical and viscoelastic properties compared with their bio-resins and IPNs-based counterparts. With glass fibre (GF) reinforcement, increases in the EHO content of the IPNs resulted in increased stiffness of the composites, while the strength, inter-laminar shear strength (ILSS), and impact resistance decreased. However, in the jute fibre reinforced bio-composites, increases in AEHO content generated increased tensile modulus, ILSS, and mechanical strength of the bio-materials. Crosslink density and glass transition temperature (T_g) were also higher for the synthetic resins than for the bio-resins. Increased AEHO content of the IPNs resulted in improved viscoelastic properties.

Keyword: Bio-resins; Epoxy; Vinyl ester; EHO; AEHO; IPN; Impact strength; DMA; FTIR