

# Mechanical and thermal properties of chitosan-filled polypropylene composites: The effect of acrylic acid

## Abstract

The mechanical properties, morphology, and thermal properties of chitosan-filled polypropylene (PP) composites have been studied. The effect of the chemical modification of chitosan by acrylic acid treatment was also investigated. Results showed that the tensile strength and elongation at break decreased but that the Young's modulus of the composites increased with increasing filler loading. Chemical modification of chitosan with acrylic acid improved the tensile strength and Young's modulus of the composites but reduced the elongation at break. Thermogravimetric analysis showed that the addition of chitosan improved the thermal stability of the PP/chitosan composites as compared to that of neat PP. Chemical modification of chitosan had a positive effect on the thermal stability of the composites. This change was attributed to improvement of the interfacial adhesion between the chitosan and PP matrix due to formation of a covalent bond between chitosan and acrylic acid. Meanwhile, differential scanning calorimetric analysis showed that the addition of filler did not significantly change the melting temperature ( $T_m$ ) of the PP/chitosan composites. The degree of crystallinity of the composites decreased with the addition of chitosan. At a similar chitosan loading, the chemically treated PP/chitosan composites exhibited higher crystallinity than the untreated composites and exhibited slightly increased  $T_m$ . A scanning electron microscopy study of the tensile fracture surface of chemically treated PP/chitosan composites indicated that the presence of acrylic acid increased the interfacial interaction between chitosan and the polypropylene matrix.