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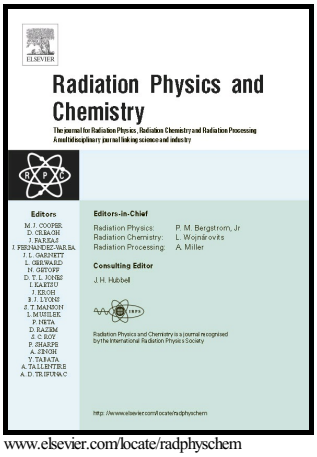

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Optimization of acrylic acid grafting onto polypropylene using response surface methodology and its biodegradability

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Abstract

Simultaneous radiation grafting was optimized to graft acrylic acid monomer on the polypropylene (PP) films to make them hydrophilic and enhance their biodegradability. Experiments were designed based on full factorial central composite design (response surface methodology) and influence of monomer concentration, radiation dose, inhibitor concentration, solvent concentration on degree of grafting was investigated. The extent of grafting was found to increase with increasing monomer concentration, inhibitor concentration and radiation dose. The targeted 35% grafting could be achieved at optimum condition viz. monomer concentration 12.09 wt%, radiation dose 12.40 kGy, inhibitor concentration 0.07 M and solvent concentration 0.12 M. The grafted PP films at different degrees of grafting were tested for tensile properties and characterized by swelling studies, fourier transform infrared spectroscopy (FTIR), thermogravimetric analysis (TGA), differential scanning calorimetry (DSC) and scanning electron microscopy (SEM). Successful grafting of acrylic acid onto polypropylene films was indicated by FTIR and confirmed quantitatively by determination of carboxylic groups on the film surface. Tensile strength of grafted PP films decreased with increase in degree of grafting. The crystallinity of the grafted PP films was lower than that of PP film as indicated by DSC studies. Grafting of acrylic acid increased the roughness on the surface of PP films indicated by SEM studies. The maximum biodegradability of the 34.55% grafed film was 5.5%.

Keywords: Acrylic acid; Biodegradability; Design of experiments; Polypropylene films; Radiation grafting; Response surface methodology;

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