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Functionalization of Polypropylene Films with Glycidyl Methacrylate by Gamma Radiation

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Background

Polymeric materials with biologically active components immobilized onto surfaces are very important for biotechnological and biomedical applications. However, conventional polymers have no appropriate functional groups (amine, imine, carboxyl, hydroxyl, etc.) to immobilize biomolecules. Indeed the polymeric surfaces should be modified to introduce such functional groups; although there are many possible routes to functionalize surfaces, radiation grafting has advantages such as facility in synthesis process and purification of products, initiators or additives are not necessary, etc. Therefore, a possible alternative to obtain surfaces rich in amines is carry out the surface modification by gamma radiation, grafting monomers with functional groups such as primary amino (allylamine), secondary (acrylamides) and derivatives, which can react with diamines such as hydrazine or ethylenediamine to obtain free amino groups.

Methodology

Glycidyl metahcrylate (GMA) was grafted onto polypropylene films (PP) using gamma radiation. Direct and oxidative pre-irradiation methods were studied. The evaluated parameters were solvent, monomer concentration, doses, time and temperature. Subsequently, PP-g-GMA films were reacted with amines (ethylenediamine and hydrazine) to obtain functionalized films (amines rich surfaces). Different reaction conditions were tested and optimized. The grafted (PP-g-GMA) and functionalized films were characterized by FTIR, DSC, TGA, angle contact and swelling behavior.

Results and Conclusions

GMA was successfully grafted onto PP films using oxidative pre-irradiation and direct method. In both procedures were easy to control the graft percentages (10-200%) varying any parameter such as solvent or dose. The PP-g-GMA was reacted with diamines to obtain aminated films; the introduction of amine groups was confirmed by monitoring the disappearance of epoxy group band at 906 cm-1 in FTIR spectra. The radiation grafting technique can be an easy and quick alternative way to functionalize polymeric materials.

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