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Synthesis and characterization of waterborne polyurethane dispersion from glycolyzed products of waste polyethylene terephthalate used as soft and hard segment

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Abstract

Waste polyethylene terephthalate (PET) bottles were collected, cleaned and then depolymerized by glycolysis with neopentyl glycol (NPG) and dipropylene glycol (DPG), in the presence of N-butyl titanate catalyst. The product, named glycolyzed oligoesters, obtained through the depolymerization, were employed respectively in hard segment and soft segment in the synthesis of novel waterborne polyurethane dispersions (PUDs) via a simple and environmentally benign process. In addition, a polyurethane dispersion without glycolyzed oligoesters was synthesized as a comparison. The bulk structure of PET glycolyzed oligoesters and PUDs films were characterized by Fourier transform infrared spectroscopy (FT-IR), H-nuclear magnetic resonance (^{1}H NMR) and Gel permeation chromatography (GPC). The results illustrated that glycolyzed oligoesters were successfully introduced into the hard and soft segment of the polyurethanes. Furthermore, differential scanning