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Radiation Tailored Polymers for Detectors, Adhesive-Coatings and Other Industrial Uses

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The ever growing importance of humans to depend on renewable resources has shifted the focus of consumers, producers, and even politicians to more sustainable answers. Furthermore, pressure on the oil and natural gas industry has elevated the status of biopolymers in this regard. Polylactic acid (PLA) is unique polymer that offers unique abilities for tailored property derivation; thereby, enabling one to replace many engineered polymers and provide a sustainable solution as a nontoxic renewable resource. As a bioplastic, the tailoring of PLA under various conditions is important to the application and integration into current industry uses. After irradiating high molecular weight PLA in increments of 10 kGy to 100 kGy, the molecule changes can be evaluated through viscometry and friability testing to optimize material properties. The change in molecular weight of irradiated samples was evaluated through dilute solution viscometry, and friability was evaluated based upon generation of fine particulates under fixed milling conditions. As the high molecular weight PLA was irradiated from 0 kGy to 100 kGy the relative viscosity (RV) decreased with increasing dose. The initial RV of 3.52 for 0 kGy conditions dropped to 1.62 after a dose of 100 kGy. The decrease in relative viscosity correlated directly with increasing friability and generation of fine powders. Such controlled tailoring of PLA should permit the user to derive a suitable formulation pertaining to its durability in different operational conditions. Food packaging and medical applications are the most likely industries to benefit from this approach.

Keywords

Polylactic acid, ionizing radiation, dosimetry, polymer degradation.