The Summer Undergraduate Research Fellowship (SURF) Symposium
7 August 2014
Purdue University, West Lafayette, Indiana, USA

Comparison of Thermal and γ-photon Induced Degradation in Polylactic Acid for Potential as a Solid-State Radiation Detector

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ABSTRACT

Degradation of the biopolymer Polylactic Acid, both thermally and through irradiation will cause physical changes in the material [1,2]. These changes can be used in applications such as adhesives and sealants or in the medical industry, but the primary focus of this study is for potential use as a solid-state radiation detector [3]. A literature review shows that current research has been focused on thermal and γ-photon degradation in PLA but the physical characteristics such as melting temperature, latent heat of fusion, and composition of molecular bonds have not been compared in the same study. This study focuses on how thermal properties of PLA change in relation to the irradiation counterpart. The major findings of this study are that the melting temperature for thermally degraded samples decreases in a predictable manner with increasing exposure time, but the melting temperature does not majorly vary with increasing doses up to 110 kGy. The composition of bonds in thermally degraded and irradiated samples experience a change due to the degradation. The latent heat of fusion for thermally degraded and irradiated samples decreases over time, or dose respectively. These characteristics can now be used to further investigate the use of PLA as a solid-state radiation detector, and provide alternative methods in processing PLA to achieve specified physical characteristics.

KEYWORDS

Polylactic Acid, Thermal Degradation, γ-Photon Irradiation

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