Photo-Degradation of a bio polyester blend under UV-C rays

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Abstract.

The use of biomedical equipment and components in the biomedical field, considering the related use of germicidal and antibacterial equipment that accompany the life of these materials, has brought attention to the analysis of the degradation processes resulting from this application.

In this research work a polymeric blend of polycaprolactone (PCL) and polylactic acid (PLA) with ethyl ester l-lysine triisocyanate (LTI) used as a compatibilizer was made. The PLA/PCL blend (50/50 wt.%/wt.%-1phr of LTI) was melted in a Brabender Plasticorder twin screw. The torque analysis indicated that the LTI compatibilizer increases the compatibility of the two base polymers by improving the interaction between them. Pure PLA, pure PCL and their 50/50 blend, have been exposed under UV-C lamp irradiations for 4, 8, 16 and 32 hours, according to ASTM 638 standard. To check the degrading effect during the UV-C rays exposure of the materials, mechanical uniaxial tensile tests, and thermal Differential Scanning Calorimeter tests have been performed. Contact angle measurements with a distilled water and human blood related to the material's surface roughness also have been investigated. Results highlighted as both PLA and PCL suffers the UV-C photodegradation although in a different way. Blend's resistance to the UV-C rays depends to its structure in which chemical bonds occurs between the compatibilizer and the two bio-polyesters during the reactive blending. The general effect is the stiffness improvement and the deformability decreasing, due to a change in bulk structural order and in surface water/blood wettability, during the UV-C rays exposition.