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Rheological analysis of micro-structured adhesives derived from castor oil conjugates

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In this work, we studied the effect of chemical modification of castor oil (CO) based polyurethane (PU) adhesives, once included bio and synthetic polymer on the adhesiveness. In detail, two different adhesives were prepared by chemical functionalization of castor oil by adding gelatin (0.5-1.5 wt%) and poly(ethylene oxide-*b*-propylene oxide-*b*-ethylene oxide) (PEPE) (5 and 10 wt%) using hexamenthylene diisocyanate (HMDI) as a crosslinker. These adhesives were cured at room temperature and the curing process was followed by using ATR-FT IR spectroscopy to check the presence of –NCO groups during the curing. In addition, the mechanical properties were anlalyzed by performing rheological measurements before and after curing of these adhesives. The adhesiveness of the system was measured by performing tack tests by using smooth plate-plate geometries with different initial gap (0.1 and 0.5 mm) and by applying different debonding velocities (1 to 5 mm/sec) and then the adhesion energies were calculated. The chemical functionalization of CO-based adhesives by gelatin and PEPE has induced a dramatic enhancement in adhesivesness. Moreover, the gelatin based CO adhesives have shown highest adhesiveness due to the ability of gelatin to form triple helices, which can also contribute to enhance the adhesiveness. However, an excessive increase in the amount of geltin (>1.5 wt%) and PEPE (>10 wt%) in the composition, yields a decrease in adhesiveness. Thus, the adhesiveness of the system was tunable by varying the amount of gelatin and PEPE in the composition. Moreover, these adhesives were found to be degradable in presence of emzyme.

Biography

Harshal D Santan completed his PhD in 2014 from a joint program of Berlin Brandenburg School of Regenerative Therapies and Institute of Biomaterial Science (HZG) Berlin. The work of PhD was mainly related to the functionalization of biopolymers, preparation of thermosensitive hydrogels and 3D-scaffolds, and investigation of effect of hydrogel network structure on the mechanical properties and degradation. From November 2014, he is working as a Marie Curie Postdoc at the University of Huelva, Spain, (ISSFLOW project) on synthesis and characterization of adhesives based on renewable sources and preparation of hydrophobic rheology modifiers for industrial applications.

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