

Accepted Manuscript

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PII: S0014-3057(16)31730-X
DOI: <http://dx.doi.org/10.1016/j.eurpolymj.2017.02.028>
Reference: EPJ 7730

To appear in: *European Polymer Journal*

Received Date: 21 December 2016
Revised Date: 14 February 2017
Accepted Date: 15 February 2017

Please cite this article as: Arrieta, M.P., Peponi, L., Polyurethane based on PLA and PCL incorporated with catechin: structural, thermal and mechanical characterization, *European Polymer Journal* (2017), doi: <http://dx.doi.org/10.1016/j.eurpolymj.2017.02.028>

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Polyurethane based on PLA and PCL incorporated with catechin: structural, thermal and mechanical characterization

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Abstract

Catechin (Cat) was added into polyurethane (PU) based on a tri-block copolymer of poly(L-lactic acid) and poly(ϵ -caprolactone) (PLLA-*b*-PCL-*b*-PLLA) to improve the thermal stability of the final PU composite materials. The morphological, structural, mechanical and thermal properties of PU-Cat composites loaded with 1 wt%, 3 wt% and 5 wt% of Cat were investigated and designed as PU-Cat1, PU-Cat3 and PU-Cat5, respectively. Homogeneous films were obtained after the solvent casting process, but the higher amount of 5 wt% used in this work could not be successfully dispersed and produced some structural defects as were observed by scanning electron microscopy. Well dispersed Cat in PU-Cat1 and PU-Cat3 not only substantially improved the thermal stability due to the Cat antioxidant effect, but also allowed the crystallization of PCL and PLLA blocks in the final PU-Cat composites. Additionally, PU-Cat composite materials showed excellent stretchability for film production.

Key words: PLA; PCL; polyurethane, catechin; film; antioxidant.

1. Introduction

Due to the awareness of environmental issues there is an increasing demand for sustainable plastic products, made from renewable resources as well as with biodegradable character, as potential replacement of petrochemical polymers [1, 2] towards the reduction of the environmental impact produced by the consumption of residual fossil feedstock and the accumulation of short term plastic wastes, such as the case of food packaging, agricultural mulch films, etc. [2, 3]. Among others, poly(lactic acid) (PLA) which can be produced from annually renewable resources, like sugar beet or corn starch, is currently the most used biodegradable polymer for short term

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