Proceedings International
Platinum Open Access Journal (ISSN 2668-6384)

Proceedings, Abstract
Volume 3, Issue 3, 2021, 21 - 22
https://doi.org/10.33263/Proceedings33.021022

Synthesis and Characterization of Nanocomposite Materials Based on the Bio-based Poly(lactic acid), PLA with Ag, TiO_2 or ZnO Nanoparticles †

Elektra Mavromatidou [1], Ioannis Tsagkalias [1], Dimitris S. Achilias [1,*]

[1] Laboratory of Polymer and Colours Chemistry and Technology, Department of Chemistry, Aristotle University of Thessaloniki, 54124 Thessaloniki, Greece; axilias@chem.auth.gr (D.S.A.);
* Correspondence: axilias@chem.auth.gr (D.S.A.);
† Presented at 4th Chemistry Conference of Graduate, Postgraduate students and Ph.D. candidates of the Aristotle University of Thessaloniki (20-21 March 2021)

Received: 10.03.2021; Revised: 12.03.2021; Accepted: 15.03.2021; Published: 19.03.2021

Abstract: Poly(lactic acid), PLA, is a widely used bio-based polymeric material due to its compostability and superior physical, chemical, and mechanical properties. In the present research, the synthesis of nanocomposite films based on PLA, with nanoparticles of Ag, TiO_2, and ZnO, was performed by the solution casting technique. The aim was to investigate the possible antioxidant and/or antimicrobial properties these nanoparticles could provide to the polymer. Tetrahydrofuran (THF) was used as the solvent, and two concentrations, i.e., 0.1 and 0.2% w/w, of the nano-additive in PLA were prepared. Synthesis of silver nanoparticles took place via appropriate reduction of Ag^+ from $AgNO_3$ solution. The presence of the nanoparticles seems to affect the physical and chemical properties of pure PLA slightly. According to ATR-FTIR spectroscopy scans, the incorporation of nanoparticles in the polymer matrix uniformly was confirmed. Using DSC measurements, it was observed that the polymer's glass-transition temperature, Tg, was increased as long as the concentration of the additive in the film was increased. Furthermore, Tg of the composite materials was lower than that of the neat polymer. The antioxidant properties of the materials were evaluated using the DPPH technique and UV-Vis Spectroscopy measurements. It was observed that higher concentrations of the nanoparticles in the PLA matrix cause a more intense reduction of the DPPH, and thus nanocomposites prepared exhibit improved antioxidant capacity compared to pure PLA. TiO_2 was found to have the highest antioxidant capacity.

Keywords: poly(lactic acid); PLA; Ag; nanoparticles; ZnO; TiO_2; nanocomposites.

Funding

This research received no external funding.

Acknowledgments

E. M. wants to thank all the members of the lab of Polymer Chemistry and Technology at the Department of Chemistry, AUTh, for their excellent cooperation and the pleasant atmosphere they always created.

Conflicts of Interest

The authors declare no conflict of interest.