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NOVEL BIOACTIVE AND BIODEGRADABLE MATERIALS FOR MEDICAL APPLICATIONS

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Abstract

Poly(vinyl chloride) (PVC) is the most widely used material for the production of medical devices such as intravenous fluid bags and tubing, enteral feeding, dialysis equipment and catheters. Despite of their numerous advantages, the plastic medical devices are non biodegradable and prone to microbial colonization causing biofilm associated infections which are difficult to treat and tend to chronicisation. A possible solution to surpass these limitations could be the fabrication of new biodegradable polymeric materials with optimized biocompatibility and antimicrobial properties. In this regard, biodegradable polymeric materials, such as poly(ε-caprolactone) (PCL), poly(DL-lactic acid) (PLA) etc. have been considered the most desirable solution from the environment management point of view. In this paper, Alg(1%)Zn, Alg(2%)Zn, Alg(3%)Zn compounds were obtained from sodium alginate (AlgNa) crosslinked with $ZnCl_2$. Antimicrobial activity of the AlgZn compounds was assessed by the microdilutions and the diffusion methods, towards Gram-positive and Gram-negative bacterial strains (reference and clinical isolates). The Alg(3%)Zn compound was selected as antimicrobial agent to obtain the biocomposites encoded: PLA/PCL/AlgZn0.1 and PLA/PCL/AlgZn0.3. The PLA/PCL sample was used as control. Antibiofilm activity against *Staphylococcus xylosus*, cytotoxic effect on mammalian cells and thermal analysis by DSC were investigated for the obtained biocomposites. The obtained results show that the addition of the Alg(3%)Zn compound in the biocomposites decreased the glass transition temperature as well as the degree of crystallinity both of the PCL and PLA components in samples. Although the results suggest that the biocomposites containing Alg(3%)Zn did not inhibit the staphylococcal colonization and mature biofilm formation, the high degree of biocompatibility of blends leads to conclusion that these materials could be used for the development of novel bioactive and biodegradable polymeric materials with medical applications.

Key words: biocompatibility, biofilm, blend, medical device, thermal analysis

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