PLA-BIOAlSr GLASS COMPOSITE AS A CANDIDATE FOR BONE AND TENDINOUS REGENERATION APPLICATIONS

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Keywords: biomaterials; tissue engineering; poly(lactic acid); bioactive glasses

Introduction and objective: Poly(lactic acid) (PLA) is currently one of the most promising biodegradable and biocompatible materials once it can be produced from renewable resources and used in packaging, biomedical and tissue engineering applications. In the past decade, composite materials combining biodegradable polymers with inorganic materials such as bioactive glasses are being studied showing remarkable improvements mostly in mechanical and thermal properties. Previous studies conducted by our research group proposed a bioactive glass composition containing strontium and alumina, BioAlSr, ensuring osteointegration and superior mechanical properties [1]. Here, a composite film of PLA and BioAlSr was proposed for bone tissue regeneration.

Methodology: To produce the composite films chloroform was used as cast solvent. The PLA was dissolved in chloroform at 3,3g/ml and the BioAlSr particles was added in ratios of 15, 30, 50 and 70 wt%. The glass particles were submitted to ultrasonic treatment to permit more efficient dispersion in the PLA matrix. The obtained films were analysed for their microstructure with X-ray diffraction and Fourier transform infrared analysis, homogeneity by polarized light microscopy and and in vitro cytotoxicity by NCTC clone 929 cell line.

Results and discussion: All XRD spectra showed predominantly amorphous state of the composite films. To examine the existence and type of interfacial interaction in the composites, FT-IR experiments were performed and compared with pure PLA and BioAlSr. The regions of interest were 1780 and 1680 cm^{-1} for the C=O stretch, and 3600–3000 cm^{-1} for the O–H stretch from PLA known bands [2] and the region of 800-1300 cm^{-1} corresponded to the stretching vibrations of the silica of the bioactive glass was analysed [1]. PLA characteristic bands were predominant even in samples containing 50 and 70 wt% of BioAlSr. The dispersive effect of the glass particles in the PLA matrix was also evaluated by polarized light microscopy and the results demonstrated an adequate homogenization. Also, cytotoxicity and cell viability obtained by using the NCTC clone 929 cell line did not show any significant loss of cell viability or cytotoxicity.

Conclusions: Preliminary results of the proposed study indicate the obtention of a homogeneous composite film with adequate interaction between the matrix and the dispersed material, preserving the microstructure of both materials. Furthermore, the material obtained did not show cytotoxicity, indicating that it is a promising alternative for the application of bone and tendinous regeneration.

References

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Acknowledgments

We would like to thank the funding agency, CAPES from Brazilian government for supporting the research carried out.