PREPARATION AND CHARACTERIZATION OF POROUS COMPOSITES BASED ON POLYURETHANES AND BIOCERAMICS

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[Engineering of Biomaterials 138 (2016) 85]

Introduction

One of many challenges in modern materials science is to find new solutions for implantology, which would efficiently facilitate and accelerate bone regeneration. Biomimetics is common approach, which takes into account composite structure of bone tissue. In the process of designing bone implants, materials with similar chemical composition and mechanical properties as these of a bone, are used. Such materials are biocompatible ceramics (hydroxyapatite and TCP) and polyurethane, and both of them were used in experimental stage of this paper [1,2].

Materials and Methods

The objective of work was to develop synthesis method and to characterize selected properties of polyurethanes modified with bioactive ceramics (TCP, HAp), and to perform preliminary assessment of the possibility of their use in orthopaedics [3,4].

Two series of polyurethane/ceramics (β-TCP or HAp) composites were synthesized by one stage bulk polymerization method. Next, FTIR and DSC analyses were performed, as well as mechanical properties, porosity, surface analysis after incubation in SBF and chemical stability in water environment were investigated.

Results and Discussion

Spectroscopic analysis confirmed the lack of linkages between the polyurethane matrix and ceramic additives and complete conversion of reactants. DSC analysis showed the presence of a glass transition of soft segments - glass transition temperature shifted to higher temperatures with the addition of hydroxyapatite. Mechanical tests have shown that both additives result in improved mechanical properties. Porosity test results showed that the best distribution of pores occur in PU composites modified by hydroxyapatite. Preliminary assessment of bioactivity showed that only the addition of 20% β-TCP allowed the accretion of apatite on the material. In the case of additive which is hydroxyapatite, bioactive properties occur in the PU materials containing 2.5%, 5% and 10% Hap.

Conclusions

In this work porous polyurethane based materials modified with bioactive ceramics were obtained. Based on preliminary results it can be concluded that the presented materials have potential for the regeneration of bone tissue.

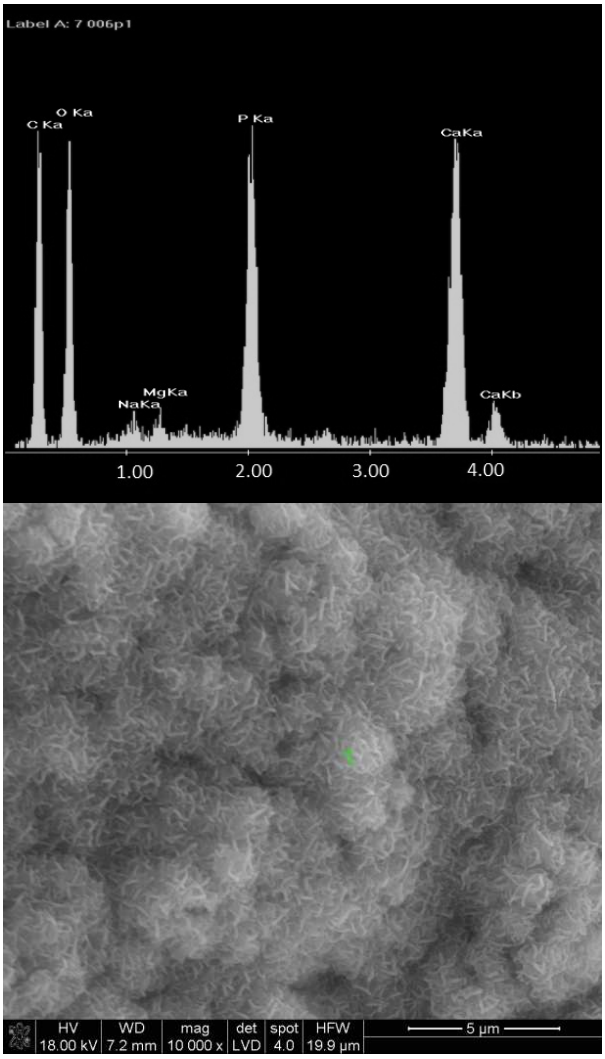

FIG. 1. SEM microphotographs and EDS results for PU composite with 5% HAp after incubation in SBF.

Acknowledgments

This work was financed by statute fund of Faculty of Materials Science and Ceramics AGH-UST under contract No. 11.11.160.616.

References

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