Preparation and antibacterial properties of silver doped hydroxyapatite scaffolds

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Silver doped calcium phosphate biomaterials, such as silver doped hydroxyapatite (Hap/Ag) offer a great potential in the biomedical applications, due to their osteoconductivity, bioactivity and antibacterial properties. Silver ions shows antibacterial properties against 12 species of bacteria and hydroxyapatite is widely used for reconstruction and regeneration of bone tissue [1,2]. The aim of this work was to synthesize Hap/Ag composites containing up to 3% of silver, using slightly modified wet precipitation method. The intensity of *Staphylococcus epidermidis* and *Pseudomonas aeruginosa* adhesion and colonization on prepared Hap/Ag composite surfaces was investigated.

The chemical synthesis of Hap/Ag with various silver amounts was carried out by wet precipitation method. CaO was used as starting material and precipitation form an aqueous medium by slow addition of silver nitrate and ortophosphoric acid was performed. The dried precipitate was milled to obtain fine powder which was uniaxially pressed and sintered at 1000^{o}C and 1150^{o}C. The adhesion and colonization of *Staphylococcus epidermidis* strain ATCC 12228 and *Pseudomonas aeruginosa* strain ATCC 27853 was investigated. HAp/Ag complexes were evaluated using X-Ray diffraction (XRD) and X-Ray fluorescence spectrometry (XRF) methods. Scanning electron microscopy (SEM) was used to evaluate the surface morphology, inner structure of prepared samples and distribution of bacteria.

The adhesion and colonization of bacteria on the HAp/Ag surfaces is dependent on the chemical and structural composition of the samples as well as on the included silver amount. From the obtained results it can be concluded that the adhesion and colonization intensity of both bacteria is decreasing for samples with higher silver amount (Fig. 1.) and for samples which are sintered in 1150^{o}C temperature. It was found that the colonization intensity in the 10^3 CFU/mm^2 bacterial suspension for the HAp/Ag samples with no silver and 0,2% silver sintered in 1150^{o}C for *P. Aeruginosa* was 50 to 100 times higher than for *S. Epidermidis*.

Obtained results indicate that the use of silver doped hydroxyapatite bioceramic as implant materials can cause less inflammatory risks compare to the pure hydroxyapatite. The preparation method and sintering temperature influence colonization intensity of bacteria on the surface of implant material.

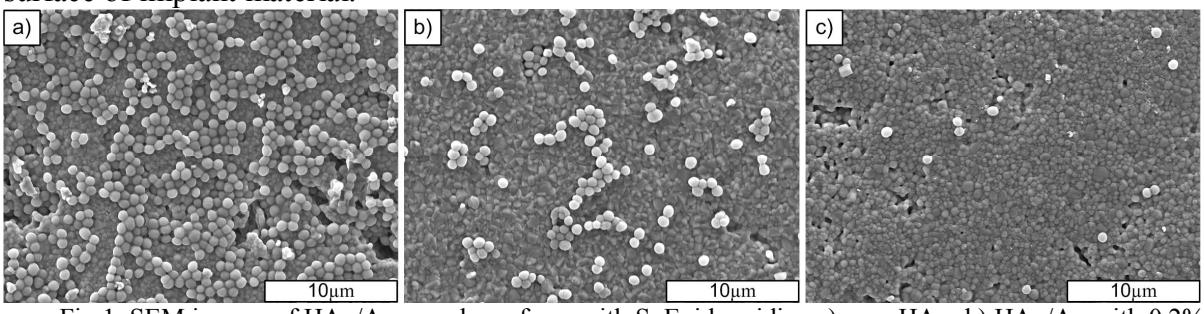

Fig.1. SEM images of HAp/Ag sample surfaces with S. Epidermidis : a) pure HAp; b) HAp/Ag with 0,2% Ag; c)HAp/Ag with 1,2% Ag

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References

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