Corrosion study of Mg-Ca and Mg-Zn biomedical alloys in the Hanks solution

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In recent years, much attention has been devoted to the study of corrosion of magnesium alloys, which can be used as implants. Magnesium alloys exhibit good biocompatibility and the density close to that of natural bones (1.8 - 2.1 g cm^3). The corrosion resistance of Mg alloys depend on their chemical composition and casting technology.

In this work, the corrosion rate of Mg1Ca and Mg20Zn alloys in the Hanks solution was investigated. In order to study the corrosion degradation of Mg alloys the following electrochemical techniques were used: Linear Sweep Voltamperommetry (LSV), Electrochemical Impedance Spectroscopy (EIS), chronoamperometry. The corrosion test were performed in the Hanks solution at 37°C and pH = 7.2. The microstructure of both alloys has been investigated by means of XRD and FE-SEM/EDS measurements. Surface analysis techniques like XPS and FT-IR were used to study the chemical composition corrosion products. To slow down the corrosion of Mg alloys, the chitosan coatings were deposited on the surface of MgCa and MgZn alloys.

Magnesium alloys undergo the active corrosion in the Hanks solution. In the case of Mg1Ca alloy, the corrosion starts at the grain boundaries where Mg_2Ca precipitates are located. In the case of Mg20Zn alloy, the matrix a-Mg is more prone to corrosion than the precipitate $MgZn_2$. The Mg20Zn exhibits higher corrosion resistance than Mg1Ca alloy in the Hanks solution. The chitosan coatings deposited on the surface of both Mg alloys significantly reduce their corrosion rate. Chitosan layer is adsorbed at the surface of Mg alloys and blocked their anodic dissolution. The structure of the chitosan coatings have been studied by FT-IR spectroscopy.

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