Corrosion degradation of Mg1Ca1Si alloy in Ringer solution

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Mg alloys exhibit attractive mechanical properties, low density and high strength-to-weight ratio. Therefore they are widely used as structural materials in the automotive and aerospace sectors. In recent years, Mg alloys are considered as a new class of biodegradable implant materials. It has been revealed that magnesium alloys exhibit very good biocompatibility and their density is close to that of natural bones (1.8 - 2.1 g cm^3). In vitro and in vivo studies have shown that magnesium alloys easily undergo resorption and do not cause allergic reactions. Magnesium alloys exhibit very low corrosion resistance in physiological solutions.

The corrosion mechanism of Mg1Ca1Si magnesium alloys in the Ringer solution was investigated by means of electrochemical techniques like: Linear Sweep Voltamperommetry (LSV), Electrochemical Impedance Spectroscopy (EIS), chronoamperometry were performed. All electrochemical measurements have been performed in the Ringer solution at 37°C and pH = 7.2. The surface analysis after corrosion tests were performed by using FE-SEM. Moreover, the chemical analysis of the solution after corrosion tests were investigated by ICP-MS and UV-vis spectroscopy.

It has been revealed that the corrosion of Mg1Ca1Si alloys starts at the interface matrix / precipitates and the eutectic (mixture of a and Mg_2Ca phases) is a week place where the corrosion starts. After corrosion tests the magnesium and calcium species were detected in the solution. In order to improve the corrosion resistance the chitosan coatings were deposited on the surface of Mg1Ca1Si alloy. The electrochemical tests have been shown that such coatings enhance the corrosion resistance of Mg alloy in the Ringer solution.

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