Development of functional coatings for the controlled degradation and corrosion protection of biocompatible Mg alloys

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The advantage of using magnesium alloys over traditional metals, biodegradable polymer and ceramics lies on their superior mechanical properties and their biocompatibility and biodegradability [1]. This advantage makes them suitable for biomedical applications [2] but prone to corrosion, therefore their biggest advantage is simultaneously a challenge [1]. Magnesium alloys degradation, by corrosion, is fast, localized, inhomogeneous and uncontrolled [2, 3]. In addition, it is usually accompanied by hydrogen formation which lead to complications when used in biomedical applications [4].

In this work we propose the development of a functional coating where gelatin-based capsules are incorporated for the controlled release of relevant active species. It aims at controlling and delaying Mg alloy degradation. To achieve this a multistep approach is tackled: (1) Application of appropriate surface treatments, (2) synthesis of gelatin-based capsules with biocompatible corrosion inhibitors, (3) selection of a coating or combination of coating formulations that will delay Mg degradation, (4) Biocompatibility of all the materials in a biological environment (4) corrosion degradation studies of selected coatings containing capsules.

Gelatin capsules containing Ca^{2+}were incorporated in different coating formulations and applied on different Mg Alloys (Mg1Ca, Mg10Gd). Their behavior in corrosion prone environment was tested by different electrochemical techniques (DC polarization, electrochemical impedance spectroscopy). In addition, the different coating formulations were tested in relevant biological environments to access their biocompatibility and toxicity.

References:

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