Effect on Zn Addition on the Corrosion Resistance of Mg in Physiological Conditions

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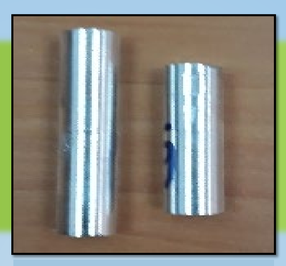
Introduction

Magnesium-based alloys are biodegradable and possess mechanical properties similar to bone, making them promising for orthopedic implants. Their controlled degradation eliminates the need for implant removal, reducing patient risk and healthcare costs. However, rapid biodegradation remains a challenge. Zinc, a biocompatible element, enhances osteogenesis, angiogenesis, and cellular adhesion, improving implant integration. This study aims to investigate the electrochemical behavior and corrosion resistance of three newly developed Mg-xZn alloys (x = 1.4, 4.1, and 6.1) when exposed to simulated body fluid, providing insights into their suitability for biomedical applications.

Fabrication

Levitation induction melting

Mini-ingots



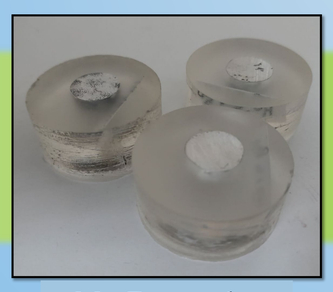
Machined samples

Precision cutting machine for sampled the alloy disc

Mg-Zn discs

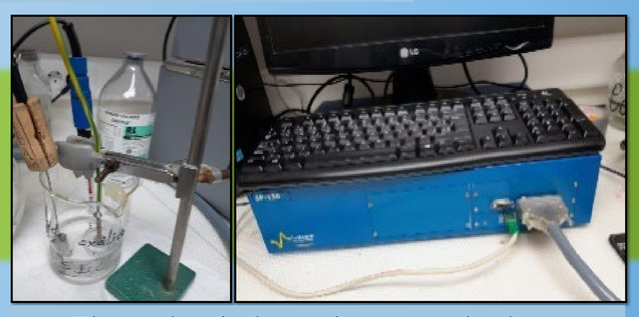
Methodology

Embedded discs



Mg-Zn samples

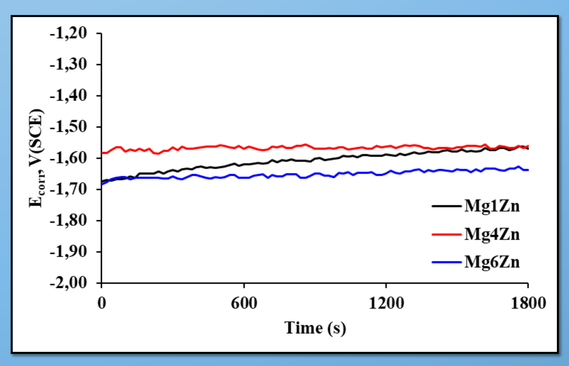
Grinding process with abrasive sheets

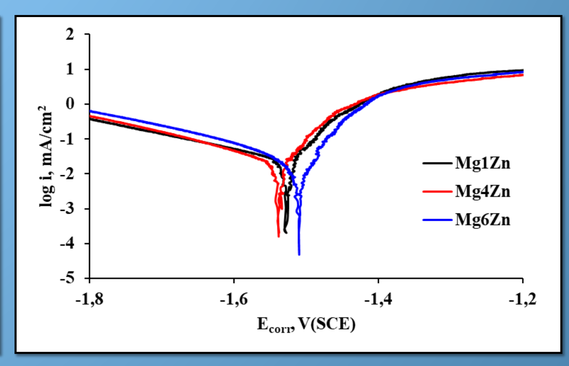


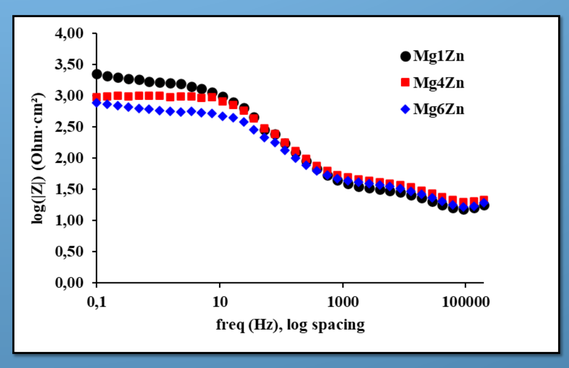
Electrochemical experiments used a three-electrode system

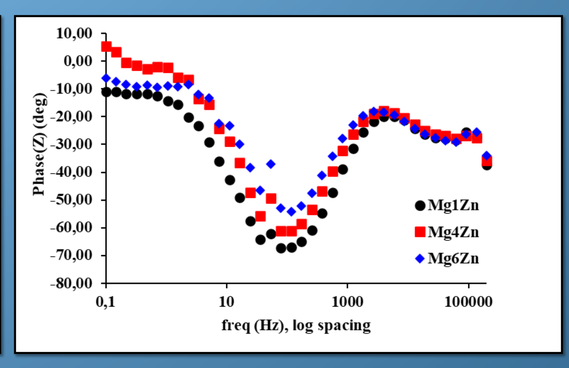
Finding

The Mg6Zn exhibits the best corrosion resistance among magnesium alloys proposed for medical applications. The biocompatibility of Mg-Zn alloys, due to the presence of biogenic Zn in the human body, is a key advantage. Discrepancies between linear polarization and electrochemical impedance spectroscopy results stem from initial current spikes affecting polarization curves and shifting the equilibrium potential. EIS curve-fitting analysis confirms strong agreement between experimental and simulated data.









Conclusions

The magnesium alloy Mg6Zn has superior corrosion resistance and anti-inflammatory characteristics. The Mg6Zn alloy shows potential in mitigating problems related to post-secondary procedures in biomedical applications.