Title: A STUDY OF RADIOPACITY FOR MAKING BIORESORBABLE METAL/ POLYMER STENTS VISIBLE IN MRI/CT SCAN

Abstract

All bioresorbable polymeric implants are radiolucent, making them undetectable under the X-rays. The high atomic number (at. no.) elements such as Pt, Au, Ta, Ba, or its alloy are attached to a body of bioresorbable polymeric implant to improve their X-ray visibility. However, during the *In Vivo* degradation, these bioinert heavy metals can either detach or leach out from the lesion site and can get accumulated into a vital organ, leading to severe health complications. A novel biodegradable and radiopaque Mg alloy was produced in this research to impart radiopacity to a known biopolymer. Here, Mg metal was alloyed with an optimized ratio of high atomic number elements of Zn and Y, to achieve enough radiographic visibility. The biodegradable radiopaque Mg-Zn-Y alloy contains three phases α-Mg, binary phase Mg_7Zn_3 and Icosahedral (I-phase) Mg_3Zn_6Y precipitated in the inter-dendritic region of α-Mg. The thermally stable intermetallic I-phase particles reinforce the Mg alloy to form in-situ composites.

Mg alloy was powdered and blended in different ratios with bioresorbable Poly-L-lactic acid (PLLA) by using a solvent casting method. The studies were carried out to evaluate the optimum quantity of Mg alloy required in PLLA to achieve not only desirable physicomechanical properties but also radiopacity. The X-ray linear attenuation coefficient (μ) and optical density (OD) were measured from the bio-composite radiographs. Thermal analysis revealed that Mg alloy microparticles acted as a nucleating site and further enhanced the crystallinity of the polymer.

The Mg alloy was further blended in a twin extruder with radiolucent PLLA and Polycaprolactone (PCL) polymer for a comparative study. The bi-axially expanded (BAE)

tubes of PLLA/PCL and PLLA/PCL/Mg alloy were extruded for fabricating cardiovascular stents. The potential of 5% Mg alloy microparticles was found to be reinforcing as well as acting as a radiopaque agent. *In Vitro* cell adhesion and blood compatibility studies were assessed by evaluating the proliferation of L929 fibroblasts and platelets, respectively on the developed blends to ensure complete cytocompatibility.

Furthermore, PLLA/PCL and PLLA/PCL/Mg alloy tubes were smoothly cut to stents. The crimping load, recoil, foreshortening, cyclic loading and unloading were estimated for comparative studies. The proposed biocomposite material thus can improve radiocontrast with enhanced mechanical properties as required for future BVS.