Chapter-3

Objective of the work

With the advancement of technology and increased mechanization, there is an increase in the number of trauma cases throughout the world. Annually, millions of people have been observed to suffer from fractured bones from a road accident, sports, or an accident occurring in the industry. To cure bone injury, the traditional method is use of permanent load-bearing implants, but it has disadvantages such as post-surgery grievances and secondary surgeries are required to remove implants. Also, there are chances of some bacterial infections at the implant site. To overcome the disadvantages associated with permanent implants, research has shifted towards developing biodegradable implants which degrade with time after providing the sufficient strength to the fractured bones. Magnesium-based alloys and composites have emerged as the most suitable biodegradable material with the only problem being their high corrosion rate and low mechanical strength. Magnesium is also a micronutrient required in human body for various metabolic processes.

Thus, based on previous studies made by different scientists, the present work focus on synthesizing a magnesium-based composite material with enhanced mechanical characteristics and improved corrosion resistance. To achieve this feat, magnesium-based alloy was reinforced with hydroxyapatite, borate bioactive glass S45P7 BAG and 1393 bioactive glasses in different proportions and analyzed for their mechanical corrosion and biological properties along with various characterizations.

The objectives of the present work are as follows:

1. **Synthesis of different alloy and composite specimens**

- To prepare the metal alloy composite, magnesium alloy of Mg20Zn2Mn was reinforced with varying amounts of hydroxyapatite and S45P7 BAG. Processing was done by powder blending route at a sintering temperature of 630 °C in an inert gas atmosphere.
- To prepare the Mg3Al2Zn0.6Ca alloy composite added with 1393 BAG in a different composition.
- To synthesize hydroxyapatite by co-precipitation method
- To synthesize bio glasses 1393 and S45P7 by melting and quenching method.

2. **Physical and structural characterization**

- To determine the density of the sintered alloy and composite specimens and to study their densification behavior.
- To identify the phase formation in different specimens using X-Ray diffraction and investigate the effect of composition and processing parameters on the development of phases during sintering.
- To determine the microstructure of as prepared, and corroded surfaces using Scanning Electron Microscope and FTIR analysis and study the effect of composition and processing parameters on the development of microstructure of the composites along with the effect of corrosion.

3. **Mechanical and Electrochemical characterization**

- To study the effect of composition and processing parameters on the mechanical characteristics of the composites.

- To measure the hardness, flexural strength, compressive strength and young's modulus of the specimens using different instruments.
- To study the Electrochemical behavior of specimens in simulated body fluid and to determine the corrosion rate of the specimens.

4. Biological characterization

- To study the biological properties of the composites viz. cell viability, growth inhibition & cytotoxicity assay on K562 cells lines.
- A Hemolysis assay was done on Red Blood Cells to analyze the effect of 1393 BAG on the composites.