Chapter-8

Conclusion

The present chapter outlines the conclusion extracted from the research work. From the research work conducted, the following conclusion can be drawn:

1. It can be concluded that magnesium alloy-based composite Mg20Zn2Mn based composite reinforced with HAp and S45P7 BAG has better bioactivity in the corrosive media and the corrosion product developed on the surface prevents the degradation of the composites.
2. It can be concluded that for the composite Mg20Zn2Mn reinforced with HAp and S45P7 BAG, the mechanical properties initially increases up to 10 % addition of the reinforcement, but at higher concentration of the reinforcements due to less densification, higher porosity and due to agglomeration of reinforcement particle, the strength decreases.
3. It can be concluded that for another composite added with 1393 BAG and base alloy having magnesium, zinc, aluminum and calcium, the composite Mg3Al2Zn0.6Ca10BAG have optimized mechanical strength and corrosion resistance. The strength of the composite was observed to increase by the dispersion hardening mechanism and densification. At higher concentration of 1393 BAG, the properties deteriorate mainly due to porosity effect and less densification. For the magnesium alloy Mg3Al2Zn0.6Ca when added with 10% 1393 BAG exhibit maximum mechanical properties, above which the composite loses its strength.
4. The corrosion studies of Mg3Al2Zn0.6Ca10BAG has revealed that the corrosion rate of the composite specimen were very high on the first day of immersion in the SBF, but as the time duration increased the formation of protective layers of $Mg(OH)_2$ and hydroxyapatite $[Ca_{10}(PO_4)_6(OH)_2]$ act as an agent to control the degradation and hence

maintain mechanical integrity of the composites prepared. The composite Mg3Al2Zn0.6Ca10BAG was observed to have corrosion rates between 0.058 mm/year on first day of immersion to 0.005mm/year after 28 days of immersion in the corrosive media. The study of corrosion surfaces were confirmed by both SEM and XRD data. It has also been found that with the increase in 1393 BAG content in the matrix, the corrosion rate were comparatively higher than the composite without 1393 BAG particle reinforcement, but at higher concentration the integrity of the composite was compromised due to less strengthening and hence corrosion rate increased at higher concentration.

5. The AAS experiments suggest that the metal ions dissolve in the range of 10.642 ppm to 12.5452 ppm, which is well below the daily limit for human bodies. It has been observed that magnesium has a significant effect on osteoblastic cell differentiation.
6. The biological testing shown that the 1393 bioactive glass with increasing content has significant role in providing biocompatibility and hemocompatibility for the materials and they could be used for the implant applications. The addition of 1393 BAG appears to have protective functions from potential toxic effects of 0 BAG materials. Proliferation of K562 (human immortalized myelogenous leukemia) and DL (Dalton's lymphoma) cells was not significantly affected by the increasing amount of 1393 BAG in a concentration dependent manner as judged by 48 hours MTT assay. Similar to dividing tumor cells, the compounds were tolerant to blood lymphocytes and monocytes with minimum or no effect on viability and cytotoxicity. At higher concentrations of 1393 BAG, the cell proliferation increased considerably, but the decrease in mechanical strength and corrosion resistance makes this composite less suitable.

Hence it can be concluded that the composite Mg3Al2Zn0.6Ca10BAG can be considered as a best among the different compositions in terms of mechanical, corrosion and biological characteristics and it can be used as a load bearing implant material subjected to clinical trials.

Scope of future work

On the basis of results obtained from the present work the scope of future work is as mentioned below:

1. More compositions can be prepared and the processing route of powder metallurgy can be replaced with melt-cast route for synthesizing the composites.
2. Further testing can be done for the prepared composite on animals (rat/rabbit) and results can be obtained by in-vivo testing in animals.
3. If the in-vivo result comes positive, then the prepared composite can be recommended for clinical trials on human.