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## Chapter 2 Statement of problem

The main objective of my research work is to contribute towards better understanding of different bioactive glass systems and to explore the new bioactive glass compositions. It was also aimed to study the process of reactivity and assess their physico-chemical, bioactivity, biological, mechanical and thermal behaviors.

The first patented bioactive glass (45S5) contained  $45\text{SiO}_2 - 24.5\text{Na}_2\text{O} - 24.5\text{CaO} - 6\text{P}_2\text{O}_5$  (wt %) has been investigated extensively and being used worldwide in clinical applications. However, addition of certain therapeutic ions in the glass has shown the better osteogenesis and also angiogenesis. A lot of research work has been carried out during past few years on bioactive glasses but the role of the different elements in 45S5 bioactive glass was not fully investigated.

Form the literature survey; it was found that the substitution of MgO and SrO in the bioactive glasses retard the HCA formation in SBF. The formation of HCA is highly dependent on kinetic dissolution and precipitation of calcium and phosphate ions. The MgO and SrO are bone seeking ions which play a vital role in bone remodelling. Mainly, the reactivity of the glass depends on the glass structure and the ions being present in the glass system. Moreover, it was also found from the literature survey that the mechanical behaviour of the glasses has been reported poorly. Hence, it needs to be improved its reactivity and HCA formation in SBF as well as mechanical properties. Therefore, there is need to design the new compositions with the bone forming ions which can enhance their properties.

Further, it was observed from literature that porous scaffold bioactive glasses are showing higher bioactivity than the porous-free bioactive glasses. But, it was also pointed out that as it has low mechanical strengths.

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Furthermore, it was also noticed from the literature survey, the formation of biofilm (bacteria) on the implants surface and its integrity with tissue cells led to failure of implant. The percentage of failure of implants was due to *S. epidermidis* and *S. aureus* bacteria are reported to be about 50% and 23% respectively which need to be addressed.

In order to have better solutions for the problems, the new bioactive glasses were designed in such way that they are more reactive and highly bioactive. The following investigations have been undertaken with ceramic science to biological science to clinical applications. I hope that the research work would contribute to extend the application of different bioactive glasses in the field of biomaterials science and technology.