Preface

The 45S5 bioactive glass have been widely used because of bonding capability with hard & soft tissues. Bioactive glasses have been widely investigated for bone repair because of their outstanding bioactive properties. However, these bioactive materials undergo incomplete conversion into a bone-like material which severely limits their biomedical application. The soft tissue response may be due to their fast dissolution, which is more rapid than that for silica-based glasses. The benefits of phosphate glasses are also likely to be related to their very rapid solubility rather than bioactivity. Specifically for hard-tissue applications, such as the regeneration and repair of bones and teeth, several bioactive or bioinert materials have been used clinically. Silica-based bioglasses constitute the essential part of such bioactive materials, having already been utilized in numerous orthopedic and dental applications.

Chapter 1 consists of literature survey regarding the studies on bioactivity, physical and mechanical properties of biocomposites. It also gives details, description of literature survey about the 45S5 bioglass, hydroxyapatite, TiO_2, ZrO_2, Fe_2O_3, CoO, Nb_2O_5 reinforced bioglass based biocomposite. The most widely researched bioactive material is 45S5 bioactive glass [Composition wt. % 45 SiO_2 - 24.5 Na_2O - 24.5 CaO - 6 P_2O_5], where S denotes the network former SiO_2 in 45% by weight followed by a specific Ca/P molar ratio 5%. The aim of the present investigation is to improve our understanding in vitro bioactivity and physical-mechanical properties of 45S5 bioactive glass based biocomposite.

Chapter 2 presents a brief description about the material synthesis, sample preparation and characterization techniques viz. preparation of bioactive glass by melting route, production of hydroxyapatite, preparation of biocomposite sample by controlling

crystallization, structural analysis by DTA/TGA, XRD, FTIR, SEM, EDS. Evaluation of in-vitro bioactivity in SBF, identification of HCA formation by pH, FTIR, SEM, mechanical properties of biocomposite.

Chapter 3 reports the in-vitro bioactivity and physical-mechanical properties of HA based 45S5 bio-composites in this describe about material synthesis, sample preparation and characterization techniques viz. Preparation of bioactive glass by melting route, production of hydroxyapatite and prepare biocomposite by hydraulic press. The sample were characterized and heat treated by DTA/TGA, XRD, FTIR, SEM, EDS, measurement of physical properties of biocomposite.

Chapter 4 reports study of in-vitro bioactivity, physical and mechanical properties of BG/HA/TiO_2 based biocomposites. The addition of TiO_2 was expected to form $CaTiSiO_3$ in the biocomposite. The Tg of biocomposite were determined by differential thermal analysis. Biocomposite were processed through controlled crystallization. The crystalline phases reinforcement of HA, TiO_2 in 45S5 bioactive glass enhanced its bioactivity and mechanical properties.

Chapter 5 present the preparation, in-vitro bioactivity and mechanical properties of reinforced 45S5 bioglass composite with HA-ZrO_2 Powders. The addition of ZrO_2 was expected to form $CaZrO_3$. This is characterized by XRD, DTA/TGA and also supported by pH and SEM. FTIR results showed the silicate network structure in prepared biocomposite.Increasing the ZrO_2 content in 45S5 bioactive glass increased the density, flexural strength, compressive strength and micro hardness.

Chapter 6 study report the investigating in-vitro bioactivity, magnetic and mechanical properties of iron and cobalt oxide reinforced (45S5-HA) biocomposite. The addition of Fe_2O_3 and CoO in bioglass an increase in bioactivity and mechanical strength upto the

limit. This is also supported by pH and SEM. FTIR results showed the silicate network structure in prepared biocomposite increasing the density, flexural strength, compressive strength and micro hardness.

Chapter 7 study report the physical, mechanical and bioactivity study of bioglass-hydroxyapatite-titania-niobium pentoxide composites for biomedical applications. Addition of TiO_2 and Nb_2O_5 concluded an increase in bioactivity. This is also supported by pH and SEM analysis. FTIR results showed the silicate network structure in prepared bioactive glass composite.

Chapter 8 explain the summary of whole thesis in brief and presents the future work and application of this work in research and development area.

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