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(57) Abstract :
The present invention discloses a CeO2-doped bioactive glass composition for enhanced bone healing and regeneration. The composition comprises SiO2 (45-50%), CaO (20-25%), Na2O (5-10%), K2O (3-7%), P2O5 (3-7%), MgO (3-7%), and CeO2 (1-5%), ensuring superior bioactivity, osteogenesis, mechanical strength, and antibacterial properties. The bioactive glass is synthesized using the melt-quenching technique, followed by controlled annealing. The CeO2 doping modulates oxidative stress, promotes hydroxyapatite formation, and enhances osteogenic differentiation. In vitro and in vivo studies confirm improved cytocompatibility, antibacterial efficacy, and accelerated bone integration. The invention is applicable in orthopedic and dental implants, bone scaffolds, and metallic implant coatings, offering an advanced, biodegradable material for regenerative medicine.

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