Final Year Project Showcase Batch-2019
Year 2023

	Department: Materials Engineering Programme: BE Materials Engineering
1	**Project Idea** Bio active antibacterial coating on biomedical implants is the need of hour. Currently available metals for implants do not own bioactivity hence; do not form bonds readily inside the human. This lead to implants loosening and failure. Mesoporous Bioglass particles MBG can help in the development of bioactive layers and wound healing when coated on the metal substrate. Developing 58S Mesoporous Bioactive Glass Particle as a coating material which can help in tissue regeneration and increase biocompatibility of the substrate. The project goal is to "Synthesis and Characterization of 58S Mesoporous Bioactive Glass Particle"
2	**Process** Among different process method,the sol-gel approach stands out due to its inherent simplicity, cost-effectiveness, and capacity to generate various high-purity materials with different configurations from a single composition directly from solutions. By modulating synthesis parameters, the sol-gel method facilitates the creation of homogeneous materials endowed with desired attributes, such as robust chemical and thermal stability, strength, controlled porosity, and excellent optical transparency. Sol-gel derived Bioactive Glasses (MBGs) are fashioned from a colloidal silica solution, a result of alkoxide precursor hydrolysis, yielding a sol. Tetraethyl orthosilicate (TEOS) frequently serves as a silica precursor, while triethyl phosphate (TEP), Calcium Nitrate served as phosphate, calcium. Pluromic 123 served as surface directing agent and play important role in mesoporosity. Followed by drying, aging and calcination to achived amorphose MBG particle.
3	**Outcome** The biocompatibility and bioactivity of 58S MBG used as a coating material on implant devices in the human body which helps in the regeneration of soft and hard tissues (bone regeneration) and healing wounds as well. In this project we synthesis and 58S MBG and achived mesoporosity in nanometer what particle size in few microns because of the study that mesoporosity helps in good coating adhesion on the implant devices.
4	**Evidence (Theoretical Basis):** 58S MBG of compostion 58%SiO_2–33%CaO–9%P_2O_5 has been synthesized by solgel method using tetra Ethyl OrhoSilicate TEOS, Tetra Ethyl Phosphate TEP and Calcium Nitrate has precursors. Pluronic P123 has been selected as surface directing agent which is responsible for porous surface. Developed 58SMBG characterized by XRD which confirm its amorphous behaviour. SEM EDX analysis has been performed which confirm the presence of SiO_2 , CaO, P_2O_5 . results also shows the spherical segregated particles having size in the range of 7µm to 10µm, with porosity in range of 8nm to 31nm which is much better than other grades of MBG,s. Electrophoresis Deposition of 58S MBG on Mg alloy Az314 has been also performed in which rough surface coated has been achived and SEM analysis confirmed the presence of MBGs particle on the Mg surface.
5	**Competitive Advantage or Unique Selling Proposition:**
a	**Attainment of any SDG;** **<u>SDG#03: Good Health and Well being:</u>** **Is to** Ensure healthy lives and promote well-being for all at all ages This project is based on biomedical applications by developing biomaterial nanoparticle which is mesoporous bioactive glasses nanoparticles. It helps in hard and soft tissue regeneration due to its property of controlled degradability and compatibility to stimulate new tissue formation. It will contribute to a healthy and

	sustainable environment and it can overall contribute to preventing needless suffering to help bone growth and wound healing. **SDG#09: Industry Inovation and Infrastrecutre:** Is to Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.This project will contribute in foster innovation as it provides the solution of bioactive and biocompatible coating of implant metals use in bone surgery and dental application. Also, MBGN reduces the corrosion and failure of implant metals.
c	**Cost Reduction of Existing Product:** Conventional Bioactive glass which processed by melt quench and Sol-gel methd is available in the market. Sol-gel method is a low cost method for forming MBG. MBG as compare to BG contain better properties and coating adhesion which can contribute to sutable implants devices.
d	**Process Improvement which Leads to Superior Product or Cost Reduction, Efficiency Improvement of the Whole Process:** Using Sol-gel method to process MBG is much cost reductive and time efficient but however it can only develop limited amount of MBG. Further improvement on the process of selecting green method approach to obtain the precursors is suggested.
e	**Expanding of Market share:** Current market of MBG has a market share of 990million $usd. But due to limited awerness about advantages of MBG and its coating on implant devices and high cost methods and chemicals creating difficulty in publicizing MBG. R&D to develop new formulation with enhanced properties and product diversification can contribute in expendaing market share of Mesoporous Bioglass Particles.
f	**Capture New Market:** Implant Devices, Biomaterials, Dental implants market are some markets to capture.
6	**Target Market:** BioMaterials Industries which are manufacturing implant devices for Human Body and Dental application are the target market. These industries can use MBG coated implant devices which can contribute in Health care sector by providing degradable implant device which can help in regeneration of tissues and wound healing.
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10	**Pictures (If any)**