# Biomineralization Behaviour of 58S, 70S and 82S Mesoporous Bioactive Glasses stabilized through ethanol extraction process.

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# Requirement for Bioactive Glasses

## Hypothesis of Bioglass by L L Hench: 1967

*"The human body rejects metallic and synthetic polymeric materials by forming scar tissue because living tissues are not composed of such materials. Bone contains a hydrated calcium phosphate component, hydroxyapatite [HA] and therefore if a material is able to form a HA layer in vivo it may not be rejected by the body."*

### Selection Criteria for Bioactive Glasses

**Biocompatibility**
Biomaterials shall be non-toxic and promote cell proliferation in addition to cell adhesion.

**Mechanical Properties**
Biomaterials shall posses superior mechanical properties to prevent structural failure during the patients normal routine activity.

**Bioactivity**
Upon contact with biological fluid biomaterials shall form apatite like layer on their surface.

**Fabrication**
Biomaterials shall be easy to fabricate and economical.

**Biodegradable**
With course of time biomaterials shall degrade completely without any toxic effects.

# Motivation of Work

**58S MBG**

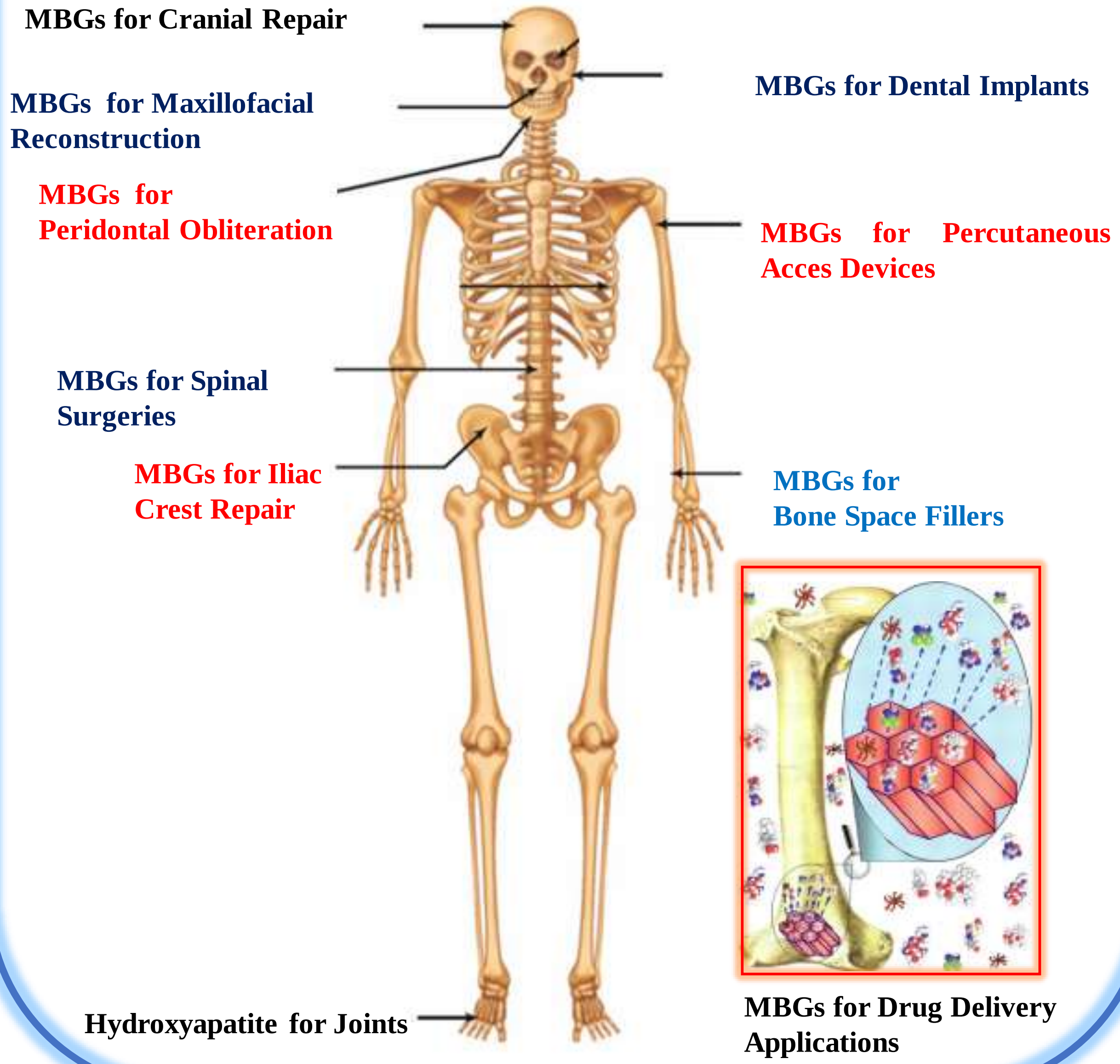
58 $SiO_2$ – 36 CaO – 6 $P_2O_5$ (in mol %)

- ✓ Great effect on the cell attachment and proliferation
- ✓ Antibacterial and have fungicidal effect
- ✓ Widely used in tissues engineering

MBG: Pure amorphous form with superior textural characteristics

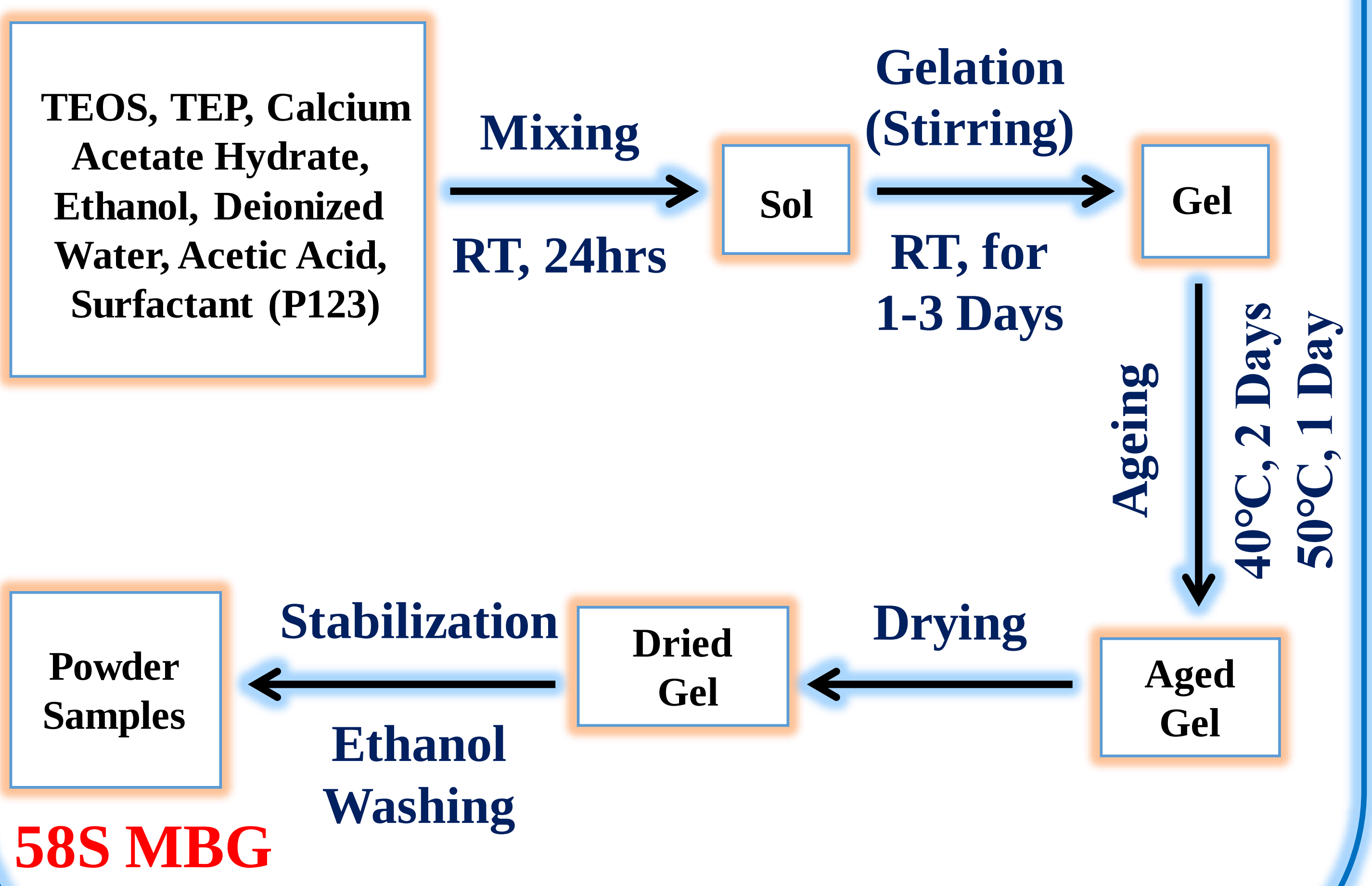
Modified Sol-Gel route : Conventional Sol-Gel technique + Supramoleculare chemistry approach

# Application of Mesoporous Bioactive Glasses in Human Body

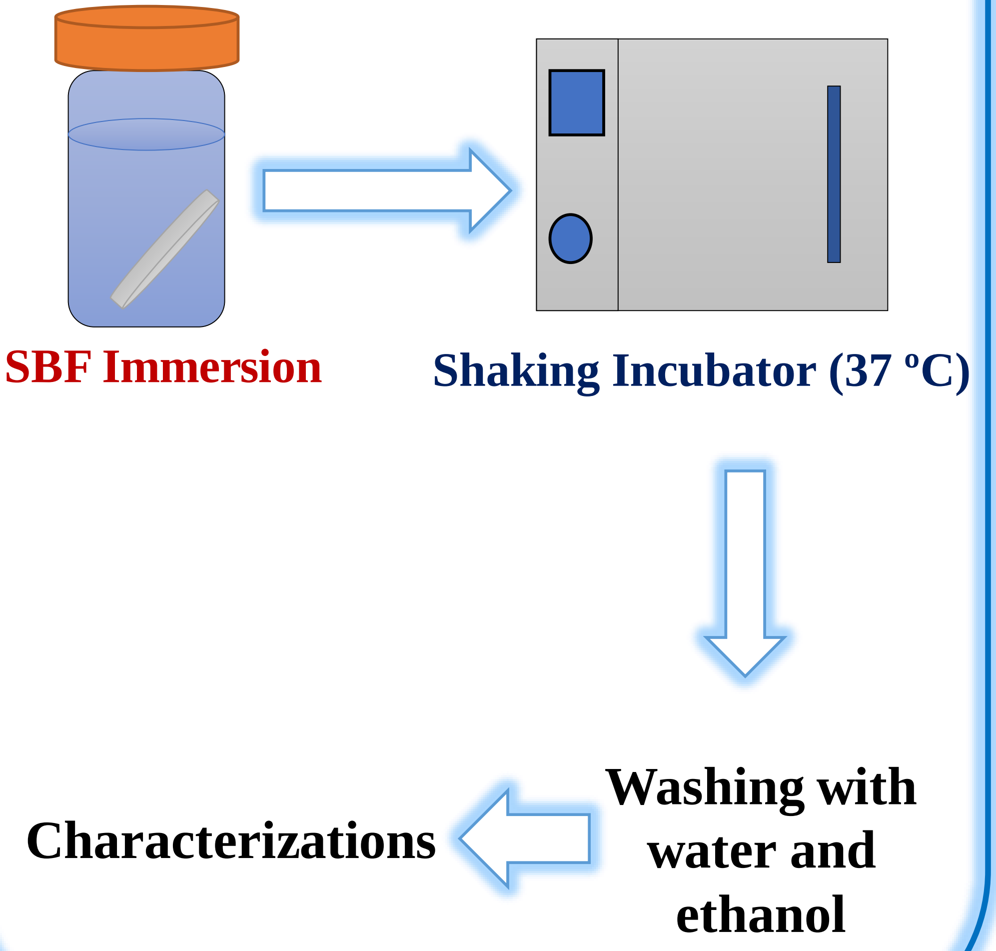



[Gurbinder Kaur, Bioactive Glasses, Series in Bioengineering (2017)]

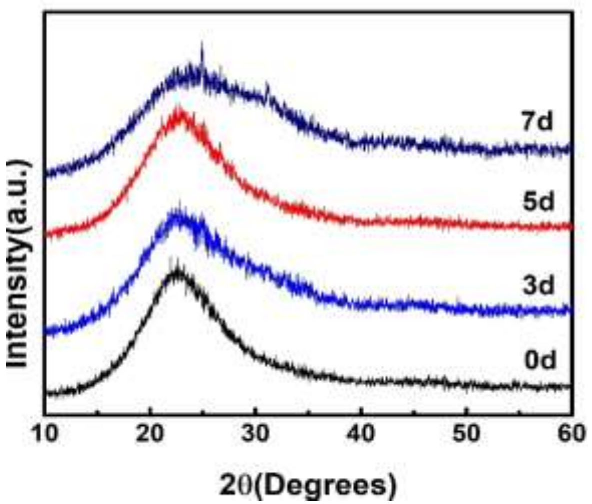
# Schematic Representations of Synthesis Method



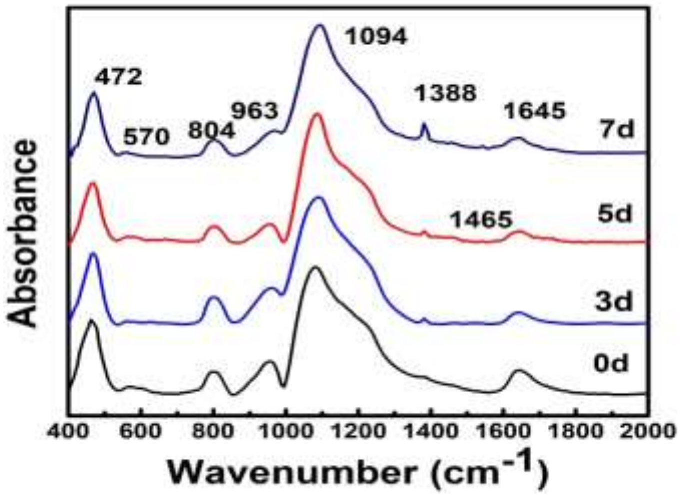

# *In-vitro* Bioactivity Test



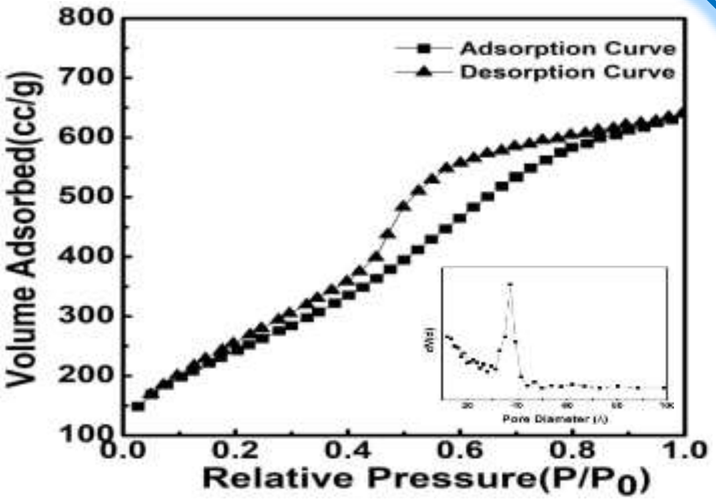
# RESULTS



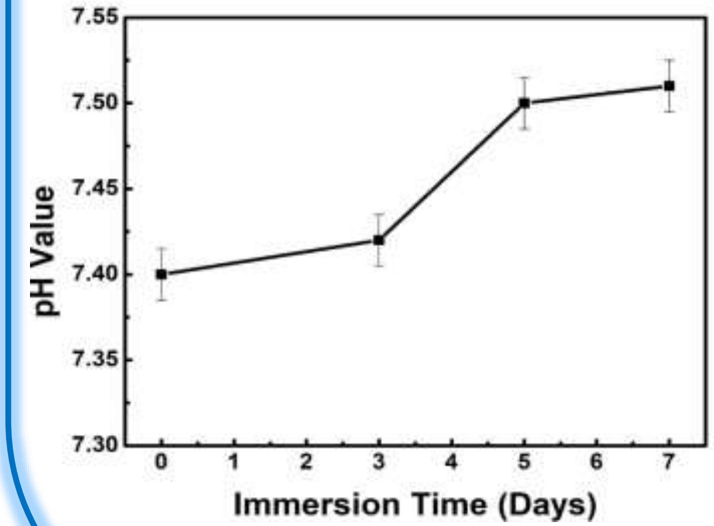

XRD pattern of 58S Mesoporous Bioactive Glass sample before and after SBF immersion for different time-intervals.



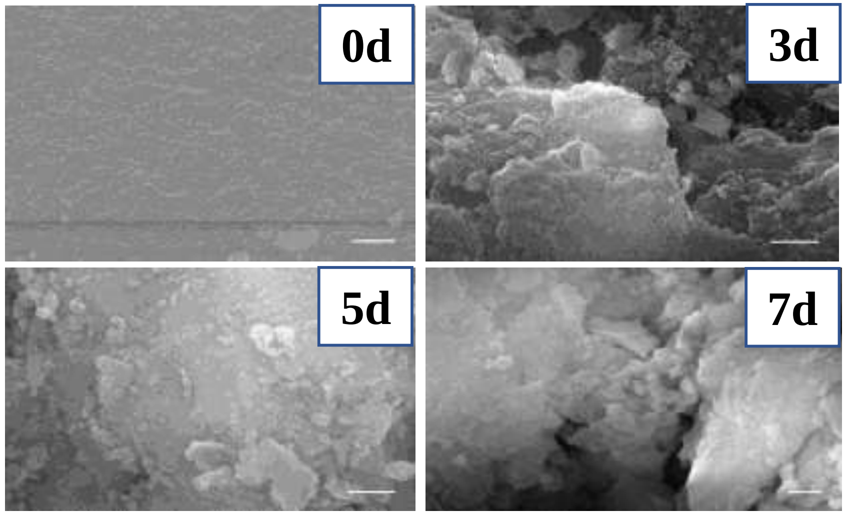

FTIR Spectra of 58S Mesoporous Bioactive Glass sample before and after SBF soaked for 3d, 5d, and 7d time intervals.




Nitrogen Adsorption–Desorption Isotherm and inset corresponds to Pore Size-Distribution of 58S pristine Mesoporous Bioactive Glass sample.




The variation of pH value of SBF solution as a function of soaking time.




SEM micrographs of 58S MB Glass sample before and after soaking for 3d, 5d, and 7d time intervals.

| Sample | Surface Area ($m^2/g$) | Pore Volume ($cm^3/g$) | Pore Diameter (nm) |
|---|---|---|---|
| 58S | 903 | 0.9034 | 4.3 |

Textural parameters for 58S Mesoporous Bioactive Glass.

# CONCLUSION

- The bioactive glass stabilized by ethanol washing shows the superior textural characteristics including the surface area, pore size and pore volume as confirmed by BET study.
- The obtained powder diffraction pattern on SBF soaked samples reveals that the formed HCA layer co-exists in amorphous and crystalline states.
- *In-vitro* study reveals the formation of amorphous HCA layer and has been confirmed with FTIR by presence of various vibrational bands at 1388, 1465 $cm^{-1}$ which correspond to carbonate group.
- *In-vitro* bioactivity study shows a rapid HCA formation on the surface of MBG sample with distinct bio-mineralization behavior.
- SEM images also shows the HCA growth with increasing the immersion time.

Thank you