




# BG-58S microspheres produced using BG powder synthesized by alkali-mediated sol–gel process and different phosphorus precursor

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## Abstract

**Purpose** Bioactive glass (BG) spheres with uniform shape and specific size variation are allowed to be packed into a 3D arrangement, which results in an open porosity that improves bone growth.

**Methods** BG-58S microspheres were produced using BG powder synthesized by alkali-mediated sol–gel process and different phosphorus precursors (TEP or phosphoric acid-AF). Microspheres (MAF-1 M, MAF-2 M, MTEP-1 M, and MTEP-2 M) were characterized as to surface morphology and size, theoretical density, and specific surface area/pore size distribution. In vitro bioactivity was evaluated in simulated body fluid (SBF). In vitro tests were conducted (for MAF-2 M and MTEP-2 M) as cell viability, total protein content, determination of alkaline phosphatase, cell adhesion by means of SEM, and mineralization nodules formation compared to commercial product (BG-45S5). Biological performance was verified through histological and histomorphometric analyses around the samples: BG-45S5, MTEP-2 M, and control (clot).

**Results** All physicochemical characterizations demonstrated favorable microspheres for application in bone grafting. MTEP-2 M and MAF-2 M showed higher cell viability and total protein content when compared to BG-45S5 with a statistical difference ( $p < 0.05$ ); however, no statistical difference was detected among the groups regarding the determination of alkaline phosphatase ( $p > 0.05$ ). Cells adhered to the surface were observed for all samples as well as nodules of mineralization. The results referring to in vivo biological assays showed no statistical difference between the experimental groups MTEP-2 M, BV45S5, and clot control in the two periods evaluated ( $p > 0.05$ ).

**Conclusion** The method used in this study was able to prepare microsphere bioglass, and this material seems to be a promising biomaterial to improve bone tissue regeneration.

**Keywords** BG-58S microspheres · Phosphorus precursor · Alkali-mediated sol–gel · Osteoblast · Bone repair

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