Effect of Co and B co-doped mesoporous bioactive glass nanoparticles on various cell lines.

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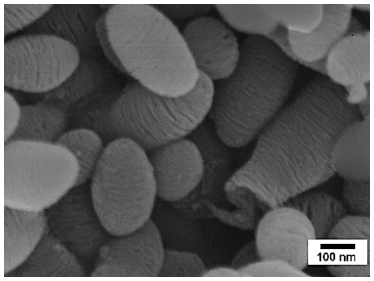
To enhance the multifaceted utility of bioactive glasses in biomedical materials, this study presents a novel approach by co-doping mesoporous bioactive glasses with cobalt (Co) and boron (B) ions. This research aims to engineer a highly versatile biomaterial that combines mesoporous bioactive glasses' inherent biocompatibility and osteoinductive properties with the therapeutic potential offered by Co and B ions.

Co and B co-doped mesoporous bioactive glasses were synthesized through a sol-gel method, allowing precise control over composition and structural characteristics [1]. Comprehensive material characterization techniques, including X-ray diffraction (XRD), scanning electron microscopy (SEM), transmission electron microscopy (TEM), and Fourier-transform infrared spectroscopy (FTIR), were employed to evaluate the physicochemical properties of the synthesized materials. Accordingly, the bioactivity assessment in simulated body fluid (SBF) for up to 14 days under physiological conditions confirmed the creation of hydroxyapatite-like crystals.

A) 

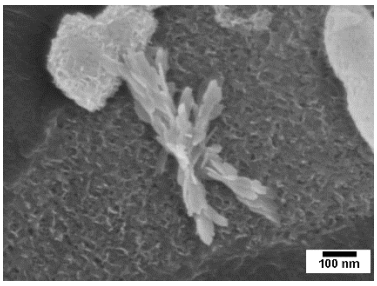
B) 

Figure: a) SEM micrograph of a representative sample, b) SEM micrograph of a representative sample after bioactivity testing with creating of hydroxyapatite-like crystals.

Both cobalt and boron are essential in trace amounts for various biochemical processes and can induce a multitarget effect, especially on angiogenesis, by activating mRNA expression of pro-angiogenic proteins like vascular endothelial growth factor (VEGF). The controlled and sustained release of these ions from the bioactive biomaterials is essential to ensure therapeutic benefits without toxicity [2], [3].

To assess the potential of nanoparticles as targeted therapeutic agents, we conducted in vitro testing on different cell lines. This provides a deeper understanding of how these nanoparticles interact with various cellular environments, which can aid in their more precise utilization. The cell viability tests were conducted using the following cell lines: MG63 (osteosarcoma cell line), ST-2 (mouse bone marrow stromal cell line), T98G (human glioblastoma cell line), SHSY-5Y (human neuroblastoma cell line), A549 (human lung carcinoma cell line), HT-29 (human colorectal adenocarcinoma cell line) and BxPC-3 (human pancreatic adenocarcinoma cell line).

The dual dopants also contributed to enhancing the antimicrobial properties, further broadening the scope of their potential biomedical applications.

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