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Physico-chemical Behavior and Microstructural Manipulation of Nanocomposites Containing Hydroxyapatite, Alumina, and Graphene Oxide

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Abstract : Ternary nanocomposites based on hydroxyapatite (HAP) and alumina (Al2O3) were embedded through graphene oxide (GO) nanosheets to be investigated for medical applications. The composition of the preparations has been confirmed by X-ray photoelectron spectroscopy, energy-dispersive X-ray analysis, and Fourier-Transform infrared spectroscopy. Scanning and transmission electron microscopy have shown the typical morphologies of the components of the nanocomposites with hydroxyapatite nanorods reaching an average diameter of 22.26±2 nm and an average length of 69.56±19.25 nm in the ternary nanocomposites. The ternary nanocomposite has a microhardness of 5.8±0.1 GPa and a higher average roughness of 6.5 nm compared to pure HAP preparation with an average roughness of 2.7 nm. All preparations have shown an acceptable cytotoxicity profile with a percent osteoblasts cell viability of 98.6±1.3% after culturing with the ternary nanocomposite. The TNC has also shown the highest antibacterial activity compared to preparations of each of its constituents and their nanocomposites, with a zone of inhibition's diameter of 14.1±0.8 mm and 13.6±0.6 mm against Staphylococcus aureus and Escherichia coli, respectively, compared to no zone of inhibition for the pure hydroxyapatite preparation.

Keywords : hydroxypatite, cytotoxicity, nanocomposites, X-ray analysis
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