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Functionalized Spherical Aluminosilicates in Biomedically Grade Composites

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Abstract : The main aim of the research was to functionalize the surface of spherical aluminum silicates in the form of so-called cenospheres. Cenospheres are light ceramic particles with a density between 0.45 and 0.85 kgm-3 hat can be obtained as a result of separation from fly ash from coal combustion. However, their occurrence is limited to about 1% by weight of dry ash mainly derived from anthracite. Hence they are very rare and desirable material. Cenospheres are characterized by complete chemical inertness. Mohs hardness in range of 6 and completely smooth surface. Main idea was to prepare the surface by chemical etching, among others hydrofluoric acid (HF) and hydrogen peroxide, caro acid, silanization using (3-aminopropyl) triethoxysilane (APTES) and tetraethyl orthosilicate (TEOS) to obtain the maximum development and functionalization of the surface to improve chemical and mechanical connection with biomedically used polymers, i.e., polyacrylic methacrylate (PMMA) and polyetheretherketone (PEEK). These polymers are used medically mainly as a material for fixed and removable dental prostheses and PEEK spinal implants. The problem with their use is the decrease in mechanical properties over time and bacterial infections fungal during implantation and use of dentures. Hence, the use of a ceramic filler that will significantly improve the mechanical properties, improve the fluidity of the polymer during shape formation, and in the future, will be able to support bacteriostatic substances such as silver and zinc ions seem promising. In order to evaluate our laboratory work, several instrumental studies were performed: chemical composition and morphology with scanning electron microscopy with Energy-Dispersive X-Ray Probe (SEM/EDX), determination of characteristic functional groups of Fourier Transform Infrared Spectroscopy (FTIR), phase composition of X-ray Diffraction (XRD) and thermal analysis of Thermo Gravimetric Analysis/differentia thermal analysis (TGA/DTA), as well as assessment of isotherm of adsorption with Brunauer-Emmett-Teller (BET) surface development. The surface was evaluated for the future application of additional bacteria and static fungus layers. Based on the experimental work, it was found that orated methods can be suitable for the functionalization of the surface of cenosphere ceramics, and in the future it can be suitable as a bacteriostatic filler for biomedical polymers, i.e., PEEK or PMMA.

Keywords : bioceramics, composites, functionalization, surface development
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