Effects of the high –energy grinding of bi-phase calcium phosphates on their cell biocompatibility

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Synthetic bi-phase calcium phosphate ceramics are highly investigated in a view of materials for bone defect repairing. Thus the results of their cell biocompatibility are of a crucial importance. Studies are focused also on the elucidation of the relationships between bone-related cells (osteoblasts and osteoclasts) important for the formation of calcified tissues and nanosized calcium orthophosphates.

In the present study the effect of high-energy grinding of sintered bi-phased calcium phosphates consisting of HAP (hydroxyapatite) and β- TCP (tricalcium phosphate), on the phase modification and crystal size as well as on their biocompatibility was studied.

Chemical analysis, X-Ray, SEM and BET analysis were performed for product characterization.

It was found that the grinding (agate mill, 600 rpm, 20 hours) of sintered at 1100°C samples with about 70-80 nm crystal size of the particles leads to different decreasing of the crystal size of the both phases. The particles of the β-TCP phase were transformed into amorphous phase, while the crystal size of HAP was reduced from 2 to 3 times.

The specific area was increased about 10 times (from 2,5 to 28 m^2/g).

The biocompatibility of the samples was investigated using in-vitro test with SBF (simulated body fluid). and cell-culture test. No cytopathological changes were observed using double staining with acridin orange and propidium iodide.

The kinetic studies on maturation of the grinding and non-grinding samples in SBF reveal an increased ability for crystals growth of the grinding material in comparison with non–grinding material. This activity was bigger during the 1h and the equilibrium was reached for about 5- 7 days. No changes were found with the non-grinding materials.

The applied mechanochemical methods for phase and crystal size modification of bi-phased ceramics is an useful for preparation of materials prospective for biological application as the geometric characteristics of particles are important for contact osteointegration.

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