MECHANICALLY ACTIVATED CALCIUM PHOSPHATE CEMENTS

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Calcium phosphate bone cements are fine calcium phosphate powders that recrystallize upon mixing with liquid phase. The liquid phase consists of water or water solutions. The recrystallized phase can be either hydroxyapatite or brushite depending on Ca/P ratio of the cement and the Ph of the liquid phase.

In this work mechanically activated β-tricalcium phosphate is used as a starting material for the cement. Conventional β-tricalcium phosphate is highly crystalline and therefore the dissolution in water is slow. Mechanically activated β-tricalcium phosphate has small particle size and low crystalinity; the dissolution rate in water is faster and the dissoluted ions can recrystallize in sufficiently short time for cement to harden. B-tricalcium phosphate used in this work was mechanically actived by milling in isopropanol using a planetary mill (speed – 300 rpm).

Several possible compositions of the calcium phosphate cement were tested – β-tricalcium phosphate, dicalcium phosphate and calcium carbonate (calcium hydroxide) – with different Ca/P ratios (1,7 to 1,2). The liquid phase used in the experiments was a water solution of sodium hydrogenphosphate salts. Several compositions of the liquid phase with different salt concentrations and Ph were considered. The data obtained in the experiments agrees with the data obtained previously in other works [1, 2] – the higher phosphate ion concentration in the liquid phase, the faster the hardening rate of cement. The following properties of the obtained cements were examined: hardening time, mechanical strenghth, morphology and phase composition of the hardened cement. The phase composition of the materials used was determined using X-ray diffraction and Fourier transform infrared spectroscopy. Influence of Ca/P ratio of the starting materials on the final phase composition of the hardened cement was evaluated.

References:

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