

Features of Structure and Phase Composition of Calcium Phosphates Synthesized From Eggshell

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Hydroxyapatite (HA) is a main mineral component in hard tissues of human and animals. It is widely used in medical practice as implant. There are several methods of HA production. Nowadays the synthesis of HA from biological waste product is becoming more and more popular due to environmental protection. In this connection use of eggshell as a calcium source is promising because of simplicity and efficiency. However, due to the HA synthesis depends on the several factors, the obtained product has often variable phase composition and the structure. The aim of this work was to synthesize HA from eggshell and study its structure and phase composition.

Eggshell was collected from 10 eggs. It was treated during 2 hour in boiled water in order to remove the organic substances. Then the shell was dried at 60°C for 3 days. The dry shell was milled in mixer to obtain the fine powder, which was used as a source of calcium in the synthesis. The XRD of the powder have shown, that it contain one phase – CaCO₃. HA was synthesized by reaction between CaCO₃ and H₃PO₄ [1]. The ratio of reagent was chosen in order to get the stoichiometric HA (Ca/P=1.67) [2]. The synthesis was performed at 25°C for 24 h. The synthesized product was filtered at Buchner funnel and dried at 60°C for 3 days. The powder was pressed into cylindrical pellets, which then fired from room temperature to 1250°C for 1 h. The samples were examined by XRD and X-ray qualitative phase analysis.

The XRD of the samples have shown that the samples fired at low temperatures have the structure of calcium-deficient hydroxyapatite (CdHA), which then transform to tricalcium phosphate (TCP) at higher temperatures. Heating of the samples at 950°C led to the formation of CaO and β-Ca₃(PO₄)₂. The quantity of CaO in the samples is tend to decreasing when the temperature rise up to 1250°C. This route of the synthesis opens ways for production of new calcium phosphate biomaterials based on HA.

1. M. Jarcho, C.H. Bolen, J. Mater. Sci., 11, 2027 (1976).
2. Narasaraju T. S. B., Phebe D. E., J. Mater. Sci., 31 (1996), 1-21.