Nanochemistry and biotechnology

Influence of synthesis conditions on structural properties of HA

V.N. Kuznetsov[1], L.B. Sukhodub[1], L.F. Sukhodub[1]

[1] Sumy State University, Ministry of Education and Science of Ukraine, Rymskogo-Korsakova St., 2, Sumy-40007, Ukraine.
E-mail: vldnik84@gmail.com.

In the last decade the creation of calcium phosphate biomaterials was focused on the substitution of such material by the newly formed bone. The synthetic part of the material is used as the source of the necessary elements for the creation of the bone tissue. In this case, the disadvantages of hydroxyapatite (HA) based materials are their low mechanical hardness, insufficient osteoinduction, low resorption rate *in vivo*. The polymer-apatite composites draw special attention advancing material structure close to the native bone tissue.

The paper studies the influence of various synthesis conditions on structural characteristics of the formed HA. Generally, an acetic acid is used for the chitosan dissolution obtaining chitosan-HA composites. Instead, the usage of an aqueous solution of calcium acetate was proposed to avoid the inclusion of additional ions. Such solution is simultaneously the source of calcium ions during HA synthesis. In this case, the side products of the reaction have a lower toxicity level as compared to the usage of calcium nitrate or chloride. The obtained powder product have a lower hardness and is easily washed.

It was shown that the obtained product is a low crystallinity amorphous HA. The decrease of initial Ca/P values in the solution as compared to the stoichiometric value of 1.67 leads to the increase of the microstrains due to the deficiency of Ca, which is in good correlation with the results obtained after the heat treatment at 900 °C for 1 hour. The phase composition of the non-stoichiometric heat-treated samples consists of HA and tricalcium phosphate (TCP) whose concentration increasing with the decrease of the initial Ca/P ratio (see Table 1). This indicates that HA, as a part of the polymer-apatite material, will have improved resorption *in vivo* with better perspectives for medical applications.

Table 1. Structural parameters and phase composition of the samples.

Ca/ P	L (Scherrer), nm		Willamson-Hall		C (HA), %	C (TCP), %
	(0 0 2)	(0 0 4)	L, nm	ε, $\cdot 10^3$		
1,11	40	29	62	1.528	27	73
1,25	49	29	>120	2.334	32	68
1,67	46	38	60	0.851	100	0