SONOCHEMICAL SYNTHESIS OF HYDROXYAPATITE USING HOMOGENIOUS PRECIPITATIO ENT- UREA

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Introduction

Synthetic hydroxyapatite- HAp is biomaterial with excellent biocompatibility, bioactivity and similarity to live bond. Its mechanical properties allow using this biomaterial for medical and dental applications [1-4].

Ultrasonic irradiation is a novel precipitation method for nanocrystalline HAp preparation [5]. The chemical effects of ultrasound derive primarily from acoustic cavitations (the formation, growth and collapse of bubbles) [6] . Synthesis of HAp nanoparticles in ultrasonic precipitation and influence of temperature, [Ca^{2+}], Ca/P ratio and ultrasonic power on its morphology and crystalline has been recently reported by Li-yun, Chuan-bo Zhang and Jian-feng Huang Cao [5,7].

In this work we analyzed ability for HAp sinthesing using homogenious precipitation method in the field of ultrasonic irradiation. We researched ability of using urea for precipitation agent. We defined basic synthetic parameters: temperature, concentration, power of ultrasound field, time and dynamics of ultrasound field effect.

Materials and methods

In the first step, $Ca(NO_3)_2$ and $NH_4H_2PO_4$ were dissolved in distilled water, by stirring on stirrer, to make homogeneous solutions with Ca/P ratio at 2 and [Ca^{2+}] at 0.02M. Solutions were pounded into reaction vessel and heated at 88°C.

Next, different volumes of 12% urea were added to regulate pH value and to allow homogeneous precipitation (Table 1). Parameters of ultrasonic liquid processor were set (Table 2). The sonic horn, made of Ti, was dipped into solution and ultrasonic irradiating started.

Precipitates were aged for 15 h,separated from the mother liquid and washed with distilled water by centrifugal processing method. Sludges were dried in dryer for 5h at 80ºC.

Results and disscusion

Figure 1 shows XRD of powders synthesized with different amount of precipitation agent. Samples A, B and C consist two phases- HAp and OCP (octa calcium phosphate). OCP is intermediate for HAp synthesis. Sample D is monophase HAp which indicate that reaction is finished. Graph 1 shows increasing of HAp content with increasing of urea amount i.e. concentration of OH^- ions according figure 1.

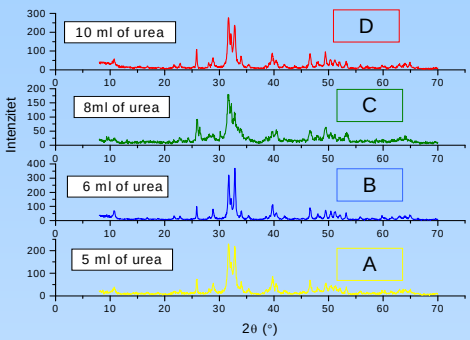


Figure 1: XRD spectra of samples

Figure 2 represents IR spectrum of sample D. The characteristic bands of HAp are exhibited: 632.42 cm^{-1}, 601. 88 cm^{-1} and 563.88 cm^{-1} for PO_4^{3-} bending, 961.76 cm^{-1}, 1108.1 cm^{-1} and 1032.5 cm^{-1} for PO_4^{3-} stretching, 3568.8 cm^{-1} and 632.43 cm^{-1} for OH^- vibrations. The broad band at 2500-3600 cm^{-1} and band at 1642.5 cm^{-1} are reflection of absorbed and associated water in HAp powder. Bands at 874.93 cm^{-1} and 1455.1 cm^{-1} are vibrations of CO_3^{2-} group which presence is normal concerned with organic precipitation agent. The band at 2359.2 is air CO_2 vibration.

There are no bands in IR spectrum or peaks in XRD patterns belong to urea or any urea composition. That indicates that urea is totally decomposed.

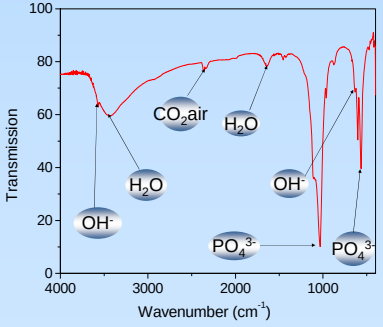
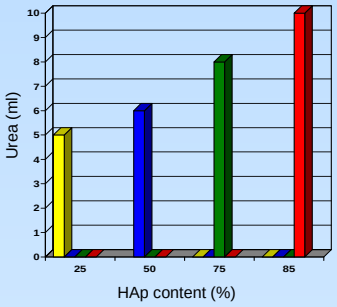


Figure 2: IR spectra of HAp monophase



Graph 1: Relationship between urea and HAp content

Table 1: **Parameters of ultrasonic liquid processor**

T(°C)	t (min)	amp.(%)
60-80	2	80
80-90	3	80
80-90	3	80
82-90	3	80
80-90	3	85

Table 2: **Volume of 12% urea in different samples**

sample	urea (ml)
1	100
2	15
3	10
4	8
5	6
6	5

lusion

In this wo ynthesized Hap using sonochemi thod. As starting component d $Ca(NO_3)_2$, $NH_4H_2PO_4$ (Ca/P rat 2) and homogeneous agent was NH_2CONH_2). With following p s: T= (80-90)°C, P= 600W, E= nd ratio Ca:P:Urea = 2:1:9 we ob Ap and OCP mixture. With incre urea content, HAp percentage ed, too. In the final product w ed HAp monophase. Optimal pa were: T= (80-90)°C, P= 640W, E and ratio Ca:P:Urea = 2:1:10. Hon s precipitation method in the field onic irradiation is very effective fo ase HAp synthesis.

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