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INVESTIGATION OF THE EFFECT OF OPTICALLY ACTIVE AMINO ACIDS ON THE FORMATION OF SYNTHETIC HYDROXYAPATITE

Currently, there are materials for replacing or repairing damaged bones and joints, the introduction of which into the body does not cause rejection. One of these materials is hydroxyapatite (HA), which does not cause undesirable consequences when it is introduced into the body. Moreover, it can actively bind to bone tissue. Besides, HA can be easily loaded with various substances, such as amino acids, vitamins, hormones and enzymes, which contribute to the healing of bone damage. The α-amino acids are known to play an important role in the formation of natural objects. In a living organism, calcium phosphates form the skeleton of vertebrates in the presence of various optically active α-amino acids, enzymes, hormones and vitamins, which in turn affect the course of reactions and the final product [1,2].

In this regard, the aim of the research is an investigation of the fundamental processes of calcium phosphate formation to understand the nature of bone diseases. The co-precipitation of calcium phosphates and amino acids does not only affect the structure of the product, but also further stabilizes the structure of phosphates involved in the biomineralization process. The study of bone formation in the presence of these substances is of great fundamental and practical importance from the point of view of understanding the processes of regeneration of bone tissue and formation of functional materials that contribute to osteogenesis [3].

The process of formation of periodic precipitation of calcium phosphates in the volume of agar solution was chosen as the object of the research. The necessary amount of active substance solution, agar and sodium hydrophosphate were added to the prepared distilled water. The solution was heated in a water bath. The hot solution was poured into measuring tubes. After solidification of the agar, a concentrated solution of calcium chloride 1 mol l/L was added dropwise on the top. The test tubes were placed in a tripod to document the kinetics of the formation of Liesegang rings.

The formation of Liesegang rings accompanied by a number of laws. In this work, we analyze the influence of various parameters on p-factor. At the first stage, the effect of amino acids (L-glutamic acid, L - ascorbic acid, and D-and L-tyrosine) of different concentration ranging from 10 nmol to 10 mmol was studied. It was found that with an increase in the concentration, the value of the p-factor decreased. At the second stage, we investigated how the density of the agar medium affects the value of the p-factor. The agar concentration was varied in the range from 0.2 wt.% to 1 wt.%. At the third stage, we studied how temperature affects the value of the p-factor. It was found that with an increase in the agar concentration, the value of the p-factor decreases. The research was carried out at +4°C,+25°C and +37°C. Figure 1 shows the change in the p-factor as a function of temperature. It was found that the rate of ring formation increases on increasing the temperature.

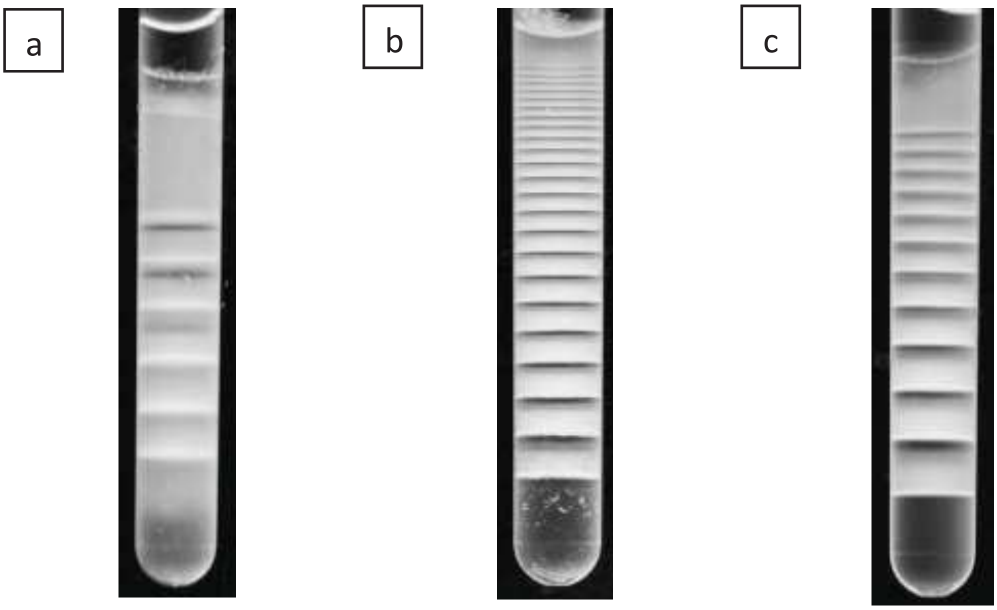

Figure 1 – Photos of the calcium phosphate patterns showing the p-factor dependence on temperature at 4°C (a), 25°C (b) and 37°C (c).

Thus, the calcium periodic patterns obtained under various experimental conditions, starting from the reagents and its concentrations, media density, as well as the temperature, demonstrate all the variety of regularities of the system. Consequently, they are characterized by different mechanisms of reactions.

In the future, it is planned to study the physicochemical properties of the resulting system for the formation of calcium phosphates in the presence of α-amino acids.

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