## Nanochemistry and biotechnology

# Amino acids as growth modifiers of calcium oxalate monohydrate crystals

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The study of crystallization processes that occur in biological media and lead to the formation of pathogenic formations are particularly relevant to date. The deposition of kidney stones, the main component of which is calcium oxalate monohydrate (COM) is one of the results of such processes. The matrix of kidney stones also contains various amino acids and proteins, which make a significantly contribution to the processes of COM crystallization [1].

The aim was to study the features of crystallization COM in the presence of amino acid of different nature – L-aspartic acid (L-asp), L-arginine (L-arg) and L-threonine (L-thr). The model system was close to physiological conditions [2]: 37°C, ionic strength of 0.15 M, pH 5.8, $[Ca^{2+}] / [C_2O_4^{2-}]$=20:1. The concentration of amino acids was 2–20 mM. Powders of COM was investigated by X-ray diffraction, IR-spectroscopy and scanning electron microscopy.

It has been found that the molecules of amino acids (L-asp, L-arg and L-thr), having different charge state in the investigated COM solution, exhibit an inhibitory effect on growth processes of COM crystals. The addition of amino acids L-asp (anionic form at pH 5.8) and L-arg (cationic form) leads to a decrease of crystal size in comparison with the pure crystals COM, the crystal size is reduced proportionally to increase the concentration of additives. This allows amino acids to be adsorbed on the growing crystal faces COM due to two types of interactions: electrostatic interaction and formation of hydrogen bonds. The size of the COM crystals also decreases with the introduction of small quantities of L-thr (zwitterionic form at pH 5.8) in the solution, but further addition of L-thr does not lead to a decrease in the size crystals. Probably, the neutral charge of L-thr prevents the appearance of electrostatic interaction of its molecules with the charged faces of COM crystals, therefore, only the formation of hydrogen bonds with the faces takes place.

1. *He J., Lin R., Long H., Liang Y., Chen Y.* Adsorption characteristics of amino acids on to calcium oxalate // J. Colloid Interface Sci.-2015.-**454**.-P. 144-151.
2. *Ogawa Y., Miyazato T., Hatano T.* Oxalate and Urinary Stones // World J. Surg.-2000. - **24**.-P. 1154-1159.