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Investigating the morphological properties of calcium oxalate monohydrate: crystal formation in systems with different chemical complexity
Istraživanje morfoloških karakteristika kalcijeva oksalata monohidrata: formiranje kristala u sustavima različite kemijske kompleksnosti

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Urolithiasis, the formation of urinary stones in different parts of kidney or bladder, is a specific form of pathological biomineralization [1]. Recently, an increasing prevalence of kidney stones in industrial countries is observed and the interest of scientists to explain their pathogenesis with a special focus on calcium oxalate stones is renewed.
Calcium oxalates crystallize in the form of hydrated salts: thermodynamically stable calcium oxalate monohydrate [2,3] (COM, $CaC_2O_4 \cdot H_2O$), metastable dihydrate [4,5] (COD, $CaC_2O_4 \cdot 2H_2O$) and trihydrate [6,7] (COT, $CaC_2O_4 \cdot 3H_2O$).
The kidney stones formation under biological conditions can be triggered by various metabolic disorders such as: hypercalciuria, hypocitraturia, hyperoxaluria and the change in the urine acidity. The mechanisms and the conditions under which they crystallize are still not completely clarified [1].
In this work, the spontaneous precipitation and characterization of calcium oxalate monohydrate under conditions of hiperoxaluria ($c_i(Ca^{2+}) = 7.5 \cdot 10^{-3}$ mol dm^{-3} and $c_i(C_2O_4^{2-}) = 6.0 \cdot 10^{-3}$ mol dm^{-3}) is reported. The experiments were conducted in a model system (I_c = 0.3 mol dm^{-3} NaCl, which imitates the physiological conditions in the human body) at two initial pH (pH_i = 5.0 and 9.0) and with the addition of amino acids reportedly important for pathologic biomineralization [8,9]. The amino acids selected for the addition are often found in the urine of healthy people and in the organic matrix which is an integral part of kidney stones. The reactant solutions were mixed under controlled hydrodynamic and thermodynamic conditions. Changes in the structure and morphology of precipitated calcium oxalate monohydrate were observed by means of PXRD, SEM, IR and TGA.

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