European Mineralogical Conference
Vol. 1, EMC2012-435, 2012
European Mineralogical Conference 2012

To the question about the role of bacteria, viruses and micromycetes in the formation of human kidney stones

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In recent years an interest in studies of pathogenic biomineral structures, in particular, the stones of the urinary system increases. Up to date, all proposed mechanisms of their formation associated with the complex interaction between mineral and organic components. The role of the protein nature substances and especially of bacteria, viruses, and micromycetes in this process is still not clear. The purpose of this study is to determine the role of bacteria, viruses and micromycetes in human urinary system stone formation based on the study of kidney stones material, and the results of model experiments. To determine the presence of bacterial and fungal colonies in samples of kidney stones the screening of crumbs and small pieces of kidney stones data samples on agar nutrient medium was carried out. The physiological solution (urine) was simulated for all the inorganic components to study the conditions of mineralization. Simulation experiments were performed in the presence of nutrient medium, and without it. Klebsiella pneumoniae 4140, Staphylococcus aureus 474-field surgery, Pseudomonas aeruginosa ATCC 27853, Escherichia coli K-12 were used as bacterial and viral pathogens because their presence is possible in the kidney during inflammatory processes. The results of screening showed the presence of microscopic fungi and bacteria in samples of kidney stones. The quantitative content of micromycetes in some samples was quite high (up to 5000 cfu per 1 gram of substrate). The observed colonies of fungi and micromycetes depend on the phase composition of the stone. For example, in the samples of calcium oxalate and urate stones there is a small number of bacterial and fungal colonies. Apparently, for calcium oxalate stones micromycetes selection is random and not related to their genesis. In contrast to calcium oxalate stones, a heavy growth of colonies of micromycetes and bacteria in a nutrient medium was found for the phosphate stones.
Addition of bacteria in the model solution leads to changes in pH and precipitation of phosphates. Thermodynamic calculations show that concentration of the components that corresponds to the composition of the physiological solution, allow the formation of apatite whereas calcium oxalate formation is thermodynamically impossible. At the same time, it is well known that the amount of calcium oxalate stones is up to 70% of all kidney stones. In model experiments simulating the composition of physiological solution (urine) on inorganic components the calcium oxalates was obtained only by increasing the concentration of oxalate ions to a value typical for oxalatourea disease. Addition of the bacterial-viral associates to this solution leads to increase the amount of the precipitating oxalates (up to a ratio of 1:4 for phosphate). At the same time, the study of crystallization in the presence of bacteria in the nutrient medium leads to preferential formation of calcium oxalates.
This work was supported by RFBR (grants 10-05-00881-a and 11-05-90425-Ukr_f_a)