Comparison of biomineralization process of middle REE (Sm) by different microorganisms: yeast and bacteria

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Microorganism plays a key role in the mineralization process of heavy metals in different environments. Previous studies have reported the interaction process of rare earth elements with different microbes during the mineralization process. However, little is known about the difference of the REE biomineralization process caused by yeast and bacteria. We carried out a series of experiments to compare the sorption process of Sm by *Saccharomyces cerevisiae* (yeast), *Pseudomonas fluorescens* (gram-negative bacteria) and *Bacillus subtilis* (gram-positive bacteria) at initial pH 3, 4, and 5 solutions, respectively. In this study, a middle REE of Sm(III) was chosen as a heavy metal ions and as an homologue for trivalent actinide ions, which was used to investigate and compare the mineralization process by several representative microbes (*S. cerevisiae*, *B. subtilis*, and *P. fluorescens*). The concentrations of Sm in exposure solutions decreased as a function of exposure time in all these three systems, which revealed the accumulation of Sm by cells. In both yeast and bacteria systems, Sm(III) was mineralized to monazite(Sm) phase particles on cells surface at 5 days of exposure after a short-term adsorption process. In these three systems, nano-sized Sm phosphate was formed more quickly on cells surfaces at higher pH exposure solutions. The formation of precipitation on bacterial cells surface seems to have a higher speed than in yeast case, which would be induced by the difference of P releasing speed in different cells.