

Characterization of EPS fractions before and after adsorption to goethite

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Extracellular polymeric substances (EPS) are produced by many different microorganisms and are crucial for their initial attachment to solid surfaces. They consist of a mixture of polysaccharides, proteins, lipids and nucleic acids, i.e. of compounds, which are known to be easily degradable. In soils however, microbial-derived polysaccharides seem to be effectively stabilized against degradation when adsorbed to minerals. We therefore assume that EPS may be a long-term stable and significant component of organic coatings on soil minerals. This is of environmental concern as the coverage of mineral surfaces by EPS will completely change interface properties such as solubility, charge, and hydrophobicity.

We performed batch adsorption experiments using EPS extracted from liquid cultures of *Bacillus subtilis* and goethite. The pure EPS and the EPS covered goethites were characterized by atomic force microscopy (AFM), Fourier-transform infrared spectroscopy (FTIR), scanning transmission X-ray microscopy (STXM) and high-lateral-resolution secondary ion mass spectrometry (NanoSIMS). The original EPS was found to be spatially separated into three fractions which differ in their content of polysaccharides, proteins and aromatic groups. During reaction with goethite, we observed the formation of an additional fraction, rich in lipids and proteins, which is preferentially adsorbed. Polysaccharides, in contrast, remained in solution. NanoSIMS allowed to map the spatial distribution of C, P, N, and S. Phosphorus was homogeneously distributed throughout the whole EPS, whereas N was only found where EPS was in close association with goethite. Sulfur was enriched in some patches (~500 nm in diameter) of the goethite associated EPS.

We conclude, that mainly proteins and lipids, i.e., the EPS components which preferentially adsorb to goethite will be stabilized against biodegradation. Likewise, mainly these components, will change the surface properties and hence the reactivity of goethite.

Acidophilic Population Succession in Pilot Uranium Bioleaching Process

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Microorganisms community changes and develops with its environment. In uranium bioleaching, acidophiles especially some chemolithotrophic play an important role as well as some heterotrophic and mixotrophic acidophiles[1]. This paper investigated the acidophilic community successions by double layer solid plate and molecular methods such as t-RFLP, RFLP and Gene Clone Library methods.

Two different type minerals for bioleaching were set up as a 5000-ton heap and a 3-ton column, respectively. The main uranium mineral was pitchblende and the average uranium content was 0.021% and 0.290%, respectively. 9 mineral samples were taken from the bioleaching heap or column sites during the process of bioleaching, meanwhile, the chemical parameters such as pH value, Eh value, Ferric ion, total iron and uranium IV concentration of PLS before and after the samples were analysis. After 120 days and 116 days, the uranium extraction rate were reached to 55.92% and 90.20%, respectively. Results showed that the predominant bacteria of the 5000-ton heap were *At. thiooxidans*, *L. ferriphilum*, *Sulfobacillus thermotolerans*, *L. Ferrodiazotrophum*, *At. caldus* and *Acidocella sp.* and of the 3-ton column were *At. thiooxidans*, *L. ferriphilum*, *L. Ferrodiazotrophum*. It confirmed that *L. ferriphilum* always an active and predominant species in our laboratory and so did in the column, but not in the waste rock heap. It concluded that the bacterial population of the column bio-leaching was less influenced by the natural acidophilic bacteria, while in the 5000-ton heap, the bacterial population was highly influenced by the natural ones. More over, the population succession was evident with the temperature and bioprocessing.

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