COMPARATIVE CALORIMETRIC MEASUREMENTS OF TWO LEACHING-ACTIVE BACTERIAL STRAINS

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The application of microorganisms for the extraction of valuable metals from mineral concentrates and low-grade ores is called bioleaching or biomining at an industrial scale [1, 2]. Microorganisms involved in the leaching of metal sulfides are mainly extremely acidophilic archaea and bacteria, which are able to oxidize iron(II) ions and/or reduced inorganic sulfur compounds [3].

Calorimetric measurements were carried out in order to study the different leaching strategies of the two leaching-active strains *Acidithiobacillus ferrooxidans* and *Sulfobacillus thermosulfidooxidans*. These two strains differ in their leaching strategies. As known from the literature, cells of *A. ferrooxidans* attach very quickly to a large percentage to the substrate [4], whereas a large part of the cells of *S. thermosulfidooxidans* remain in the planktonic state [5]. The comparison of metabolic heat rate and planktonic cell concentration should help to elucidate to which extent the difference in adsorption behavior reflects the different leaching strategies of both types of cells.

The leaching experiments were carried out in shaking flasks filled with medium (pH 1.8) and 2 wt% of pyrite (grain size 63-100 µm). Each pyrite slurry was inoculated with a defined cell number ($5 \cdot 10^7$ cells mL^{-1}). In order to identify the influence of the microorganisms on the leaching, a negative control was set up in parallel with each experiment, using a non-inoculated pyrite slurry. Samples for the analyses were taken daily to monitor the leaching over time. The heat output was determined using a chip calorimeter. In addition, the iron (II) and iron (III) concentrations in the supernatant as well as the pH and the planktonic cell number were determined.

The course of metabolic heat production and planktonic cell concentration were found to be different for the two strains. In the case of *A. ferrooxidans*, the heat output increased before the cell number started to increase, which indicates that the measured heat signal was caused rather by the attached cells than by the planktonic ones, at least in the beginning of the leaching process. In contrast, the heat output and the number of planktonic cells were strongly correlated in the case of *S. thermosulfidooxidans*. This means that the heat signal was almost exclusively caused by the planktonic cells. In summary, the combination of chip calorimetry and cell counting was demonstrated to be an efficient method for the qualitative differentiation of adsorption and non-adsorption based leaching processes.

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