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Adhesion to sulfur & metal sulfide surfaces by leaching bacteria

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Attachment of various strains of *Acidithiobacillus ferrooxidans*, *Acidithiobacillus thiooxidans* or *Leptospirillum ferrooxidans* to the minerals pyrite, chalcopyrite, galena, sphalerite, sulfur or quartz was tested and, in case of most strains, found to be mineral-selective. The extracellular polymeric substances (EPS) of the bacteria were responsible for mediating attachment. Cells of *Acidithiobacillus ferrooxidans* cover mineral surfaces with a dense biofilm after four days of cultivation, as visualized by fluorescence microscopy and AFM. Primary attachment (first 12 hours) however, was restricted to surface sites with visible defects. If the same cells (in parallel experiments) were stripped off of their EPS, they did not attach to a mineral surface anymore.

Chemical analyses of the EPS of the strains of all three species indicated neutral sugars, fatty acids, uronic acids, and, when grown with iron(II)sulfate or pyrite, complexed iron(III) ions. The composition of these compounds differed according to the strain and the growth substrate. Especially remarkable was the finding that sulfur-grown cells contained almost no complexed iron(III) ions in their EPS and exhibited the highest content of fatty acids.

Pyrite oxidation rates were correlated with the amount of complexed iron(III)ions within the EPS. Sulfur oxidation rates were not affected by the composition of the EPS. In case of *Leptospirillum ferrooxidans* the oxidation rates were clearly correlated wih the genetic affiliation of the strains, i.e. the classification into five genospecies.

The data for *Acidithiobacillus ferrooxidans* seem to indicate a similar correlation with the genetic affiliation, however the results were not as clear-cut as those obtained for *Leptospirillum ferooxidans*.