Mathematical Model of the First Stage of Adaptation of *Acidithiobacillus ferrooxidans* JCM 3863 to High Substrate Concentrations in Batch

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Acidithiobacillus ferrooxidans oxidizes ferrous ions and are used for waste water and tail gas treatment. The application of bacteria in environmentally friendly technologies may fall in surroundings with high concentrations of iron and lead, because these conditions are toxic for the strain. In order to avoid inhibition of the bacterial action, it is necessary to adapt *Acidithiobacillus ferrooxidans* to high initial concentrations of iron ions.

There is scarce literature data for mathematical models of periodic cultivation of this strain. The mathematical model would give a better idea about the processes that take place during adaptation of the strain to higher initial concentrations of substrate.,The purpose of this work is to present the mathematical model describing the first two phases of the batch. Mathematical modeling was based on Haldane model that takes into account sigmoid nature of the dependence of the specific growth rate of the biomass on substrate oxidation. It describes the inhibitory effect of the substrate on the specific growth rate of the biomass adapted to high concentrations of feerrous ions.

The system of three ordinary differential equations was determined by the method of Runge-Kutta. A gradient method for minimization of the criterion of errors was used. In optimization criterion does not include substrate S, because the amount of substrate in liquid culture medium is directly calculated from the amount of product R, which recognizes. The similarity between model values and experimental data was calculated as $R = 100\% - \varepsilon\%$. The economic coefficient begins to grow from the beginning of the adaptation process. The formulated mathematical model gives a good idea on the initial process of adaptation to high initial concentrations of substrate.