
Talk

Microbial Populations in Ferrous Iron Oxidation Bioreactors



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ABSTRACT

Motivación: ferrous iron oxidation can take place in partly controlled biological reactors inoculated with mixed cultures of acidophilic microorganisms. In these bioreactors, liquor pH can affect productivity. We aimed at determining whether productivity changes are directly due to the chemistry of iron precipitation or due to microbial population changes.

Methods: flooded (with 9K standard medium) packed-bed (randomly packed with siliceous stone particles between 6 and 8 mm in size; 0.42 porosity) bioreactors (cylinders 4.32 cm in diameter and 10 cm in height) were operated in continuous mode, with controlled temperature (310C), fed at constant liquid flow rate (100 mL/h), and constantly aerated with two different air-flow rates (250 and 500 mL/min). Liquor inlet pH in bioreactors was change in the range 1.9-0.8. Outlet pH was measured with a standard pH-meter and ferric iron productivities (g/h) were measured in an automatic titrator using the standard potassium dichromate method. Microbial identification was done by phylogenetic analyses of 16S rRNA sequences obtained after PCR, cloning, transformation, and sequencing.

Results and conclusions: Operation pH does not affect bioreactor productivity in the range from 1 to 2.3. Falls in productivity are essentially due to ferric iron precipitation chemistry. If upper pH limit is exceed, productivity can be recovered lowering pH; conversely, if lower pH limit is exceed, productivity never recovers though pH is increased. The microbial population of the bioreactor changes with changes in pH, being 1.3 the pH transition value. Above pH 1.3 acidithiobacilli are the dominant microorganisms, while below pH 1.3 leptospirilli are the dominant ones. Thus, we conclude that the microbial population inside the bioreactor behave in a highly versatile manner, allowing productivity to remains virtually unchanging. The versatility turns this kind of bioreactor into a highly flexible platform for ferrous iron oxidation; stepwise pH changes can result into perfectly adapted microbial populations, the basis to treat industrial influent liquor at different pHs. This kind of bioreactor and operation mode has been successfully applied at semi-industrial scale.

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