

LABORATORY REACTOR FOR IRON(II) OXIDATION /PRECIPITATION BY *GALLIONELLA FERRUGINEA*

SØGAARD, E.G. (Aalborg University, Department of Chemistry and Applied Engineering Science, Esbjerg, Denmark)

The bacterium *Gallionella ferruginea* is reported to grow within the limits of a pH range from 6.0 to 7.6 and Eh range of +200 mV to +320 mV, corresponding to rH₂ from 19 to 21. Oxygen content should be in the range 0.1–1 mg/l (HANERT, 1992).

However, in a pilot plant built to investigate the possibility to adsorb the pollutants trichloroethene and several hydrophobic pesticides onto the stalks (exopolymers) of *Gallionella ferruginea*, we observed that at pH of about 5.5 and oxygen contents of about 5.4–7.5 mg/l the bacterium created very big amounts of stalks in the ferrihydrate precipitate (SØGAARD et al., 2000).

A laboratory reactor was built for the purpose of iron(II) oxidation / precipitation in a biological way, based on the results from the pilot plant. The reactor was made of a glass cylinder – top and bottom were sealed with stainless steel covers, each with 5 ports for inlets and outlets. The reactor was filled with silica sand grains of size 1.5–3 mm in diameter, all covered with iron (hydr)oxides precipitated by *Gallionella ferruginea*. Tap water was used with a flow rate of about 215 ml/min. Iron was added as iron(II) sulphate to the reactor in a content of about 3.5 mg/l. To avoid oxidation of iron(II) in its container, oxygen free water was used as solvent. Hydrogen carbonate and phosphate were added in form of their sodium salts. The pH of inlet water was adjusted, regulated and controlled by computer to 5.2–5.8 and was not changed from top to bottom of the filter. Eh was measured between 90 mV and 200 mV in top of the filter – normally an increase of 5–50 mV was observed from top to bottom. Oxygen contents were high. The inlet water to the reactor had oxygen contents of about 6.2–6.3 mg/l, which were only slightly changed during the filtration process.

Visible optical microscopy showed an increasing gradient of stalks in the precipitate of iron (hydr)oxide down through the filter. Kinetic calculations showed an increase in the rate of oxidation / precipitation of about 10000 times as compared to purely physico-chemical oxidation / precipitation.

References

- HANERT, H.H. (1992). The Genus *Gallionella*. 4082–4088. in: BALOWS, A., TRÜPER, H.G., DWORKIN, M., HARDER, W. & SCHLEIFER, K. (eds.) *The Prokaryotes*. Springer Verlag, Berlin. 4126 p.
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