A fundamental study on microbial removal of hydrogen sulfide from anoxic sea water on sediments by using photosynthetic sulfur bacterium

Yasuhiro Konishi and Satoru Asai
Department of Chemical Engineering, College of Engineering
Osaka Prefecture University

Summary

Because the presence of hydrogen sulfide in sea water on sediments poses serious problem of blue tide (blue colored anoxic sea water, so called Aoshio phenomenone), the removal of dissolved hydrogen sulfide is of importance in control of environmental pollution. Although physical and chemical processes have been extensively developed, another possible process is the removal of microbial means. One of microorganisms responsible for the sulfide removal is the photosynthetic bacterium *Chlorobium limicola*, which is associated with the sulfur cycle of aqueous environments.

In this report, the bioconversion of dissolved hydrogen sulfide to elemental sulfur by *C. limicola* was studied at 23°C and solution pH 6.5 ± 0.3 in a continuous-flow stirred reactor. The specific growth rate μ of *C. limicola* was measured under a wide variety of dilution rates (solution flow rate/reactor volume), liquid-phase sulfide concentrations and light intensities. The measured values of specific growth rate μ were slightly dependent on the light intensities between 2600 and 16000 lx, whereas the measured μ values markedly decreased as the light intensity was decreased from 2600 to 10 lx. For each light intensity, the dependence of the specific growth rate μ on sulfide concentration in the liquid effluent could be modeled by the Monod equation, and the rate data were analyzed to determine the kinetic parameters (maximum specific growth rate and saturation constant) at each light intensity. On the other hand, the stoichiometric data for the microbial growth and sulfide conversion were graphically analyzed to determine the growth yield $Y_{X/S}$. The light intensity had a slight effect on the measured $Y_{X/S}$ values. The conversion rate of dissolved hydrogen sulfide per unit reactor volume was a function of the dilution rate, the sulfide concentration in the feed, and the light intensity. The measured conversion rates were quantitatively described by using the Monod equation and the kinetic and stoichiometric parameters. The rate expression and the estimated parameter values allowed us to simulate quantitatively the microbial conversion rates as a function of the process parameters.