Thesis Title	Biorector Design for Removal Hydrogen Sulfide from Biogas by *Thiobacillus ferrooxidans*
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Abstract

In this work, hydrogen sulfide gas contained in biogas was removed by the system comprised of the combination of chemical and biological reactions. In the packed tower, hydrogen sulfides react chemically with ferric ions and generate sulfur and ferrous ions. Then these ferrous ions are oxidized to ferric by the biological reaction of *Thiobacillus ferrooxidans*, an iron oxidizing bacterium, in the bioreactor. The objective of this work is to investigate the optimal volumetric ratio of the bioreactor to the packed tower.

First, we studied the solubility of hydrogen sulfide gas in ferric sulfate solution (from the acidic medium broth of *T. ferrooxidans*) to determine the solubility constant. The input gas containing 0.01% hydrogen sulfide was fed into the packed tower with flow rate of 100 l/h. The ratio of molar flows of liquid and gas was 0 – 400 in counter current. The study showed that the Henry's constant of hydrogen sulfide in acidic medium broth was ca. 5400 (0.097 atm–m^3/mol) .

Second, we investigated the growth kinetic parameters of *T. ferrooxidans* in the continuous process comprised of a packed tower and a bioreactor of which volume was varied to 4.5 , 9.0 and 18.0 l. In the experiments, we used sodium sulfide in stead of hydrogen sulfide to avoid the toxicity of hydrogen sulfide gas. The experimental results showed that the maximum specific growth Rate (μ_m) was 0.079 h^{-1} and Monod all growth saturation coefficient (k_s) was 0.006 M.

Third, with the accquired experimental results, we predicted the volumetric ratio of the bioreactor and packed by running a simulation program under the following conditions: the concentration of hydrogen sulfide in the input gas flow was 1 – 3 %, gas flow rate was 100 l/h, the ratio of molar flows of liquid and gas (L_S/G_S) were 613, 679, 786 and 813, and cell density was controlled constant at 10^8 Cell/ml (or 43.5 mg Protein/l). We found that the efficiency of hydrogen sulfide gas removal decreased with the increasing dilution rate. The optimal volumetric ratio of bioreactor and packed tower was 3 - 25 and the ratio of dilution rate and maximum growth rate (D_1/μ_{max}) was 0.1-0.7.

Keywords : *Thiobacillus ferrooxidans* / Ratio / Bioreactor/ Packed Column Tower / Hydrogen Sulfide / Biogas