SUPPRESSION OF SULFATE REDUCING BACTERIA DURING ANAEROBIC TREATMENT

by

SK. ZIAUDDIN AHAMMAD

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Certificate

This is to certify that the thesis entitled "**Suppression of Sulfate Reducing Bacteria during Anaerobic Treatment**" being submitted by Sk. Ziauddin Ahammad is worthy of consideration for the award of the degree of Doctor of Philosophy. The thesis has been prepared under my supervision and guidance in conformity with the rules and regulations of Indian Institute of Technology Delhi and is a record of the original bonafide research work. The results presented in this thesis have not been submitted in part or full to any other universities or institutes for the award of any other degree or diploma.

Dr. T.R. Sreekrishnan
Professor
Department of Biochemical Engineering and Biotechnology
Indian Institute of Technology Delhi

Dr. James Gomes
Associate Professor
School of Biological Sciences
Indian Institute of Technology Delhi

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Sk. Ziauddin Ahammad

(Sk. Ziauddin Ahammad)

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Abstract

In anaerobic wastewater treatment processes, the sulfate-reducing bacteria (SRB), which coexist with methanogens, produces hydrogen sulfide (H_2S). Though several techniques are being used to remove H_2S from biogas to obtain H_2S-free biogas, none of those are cost effective. This study was taken up to attempt the suppression of SRB in anaerobic reactors using modifications in process as well as reactor operating conditions.

The effects of different parameters like temperature, volatile fatty acids (VFA) concentration and reactor dilution rate on the growth of SRB in these reactors were studied. Complete suppression of SRB with H_2S free biogas containing 72 and 76% methane was achieved at 55^0C in batch reactor and in continuous stirred tank reactor (HRT 3.8 d) respectively. The effect of immobilization on the suppression of SRB was also studied with different support materials. Bio-film immobilized on nylon granules produced H_2S free biogas containing 68% methane in an anaerobic fluidized bed reactor (HRT 0.55 d). Anaerobic RBC having acrylic discs favored the methanogens over SRB to form bio-film on the disc resulting in H_2S free biogas containing 53 % methane. SRB suppression was found to be independent of VFA concentration in both batch and continuous processes. A mathematical model has been developed and simulated with the experimental observations to predict the interaction behavior of SRB and methanogens in the mixed culture system.

The results of this research show for the first time that it is possible to eliminate SRB from anaerobic cultures to produce H_2S-free methane by manipulating the operational

parameters. Consequently, the process technology based on these findings will be placed economically at a significantly advantageous position compared to existing technologies for the removal of H_2S from biogas.

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