INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study : Ph.D.

Thesis Title: **Control of Gaseous Volatile Organic Compounds Using a Sponge-medium Based Rotating Biological Contactor**

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Thesis Submitted to the Department/ Center : YES

Date of completion of Thesis Viva-Voce Exam : 17/08/2017

Key words for description of Thesis Work : Rotating biological contactor, BTEX, Mixed culture, Biodegradation, CO_2

SHORT ABSTRACT

Volatile organic compounds (VOCs) containing toxic air pollutants mainly benzene, toluene, ethylbenzene and xylene (BTEX) are generated from paint, chemical, and petrochemical industries, and have a harmful impact on human health and the atmosphere. In this research, rotating biological contactor (RBC) has been designed and developed with sponge as a bio-support medium for the control of benzene and BTEX at different combinations. The performance of RBC at different inlet loading rates (ILR), and its effect on elimination capacity (EC) and removal efficiency (RE) have been studied for benzene and xylene as a single pollutant, a combined toluene and xylene, and BTEX mixture in waste gas streams. Prior to the operation of RBC a batch study was carried out to study the biodegradation of benzene and the kinetics involved in the process for modeling. Haldane model was found to be the best. The central composite design (CCD) was used to determine optimum pH and benzene concentration to enhance the benzene biodegradation. The results showed that at the optimum value of pH (7.05) and benzene concentration (332.82 mg/l), the maximum specific growth rate (μ) and degradation rate (r) obtained were found to be 0.05 1/h and 6.01 mg/l h, respectively. The metabolic intermediates produced during benzene biodegradation were determined, which ensured the biodegradation and justified the pathway of benzene biodegradation. Further, the treatment of benzene using RBC at various loading rates have been performed, which showed that removal was over 92% at an ILR of 8.171 ± 0.162 g/m^3 h and decreased with the further increase in ILR. To enhance the performance of RBC the screening of enriched cultures was done for treating xylene, toluene and xylene, and BTEX at various loading rates. The removal efficiency of BTEX was maximum (82%) at the highest ILR of 50.16 ± 2.418 g/m^3 h, higher than toluene and xylene (79%), and xylene (72%). The toluene removal was more effective than xylene and at high toluene concentration the biodegradation of xylene was inhibited. In the BTEX mixture, the order of removal was toluene > ethylbenzene > benzene > xylene. The higher CO_2 concentration and the RE of VOCs confirmed the better performance of RBC at smaller flow rates. *Enterobacter cloacae* strain SP4001 is identified as a predominant strain in mixed culture responsible for biodegradation of BTEX compounds. The RBC is effective in removing VOCs in waste gas streams along with nutrients in wastewater, which shows its potential use for industrial pollution control application.