INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

Name of the Student : **Abdisa Jabesa**

Roll Number : **136107035**

Programme of Study : **Ph.D.**

Thesis Title: **Removal of Dimethyl Phthalate, Diethyl Phthalate, Bisphenol-A, and Dimethyl Sulfoxide from Water by Ozone Microbubbles**

Name of Thesis Supervisor(s) : **Prof. Pallab Ghosh**

Thesis Submitted to the Department/ Center : **Chemical Engineering**

Date of completion of Thesis Viva-Voce Exam : **21 April 2021**

Key words for description of Thesis Work : **Bisphenol-A; Diethyl and dimethyl phthalates; Dimethyl sulfoxide; hydroxyl radical; kinetics; microbubbles; mineralization; ozonation**

SHORT ABSTRACT

Ozone microbubbles (OMBs) have been used widely nowadays for water/wastewater treatment. Properties of ozone, its applications in water/wastewater treatment, and the properties of the OMBs and their applications in water/wastewater treatment have been discussed in this thesis. The removal of dimethyl phthalate (DMP), diethyl phthalate (DEP), bisphenol-A (BPA), and dimethyl sulfoxide (DMSO) from water using OMBs were studied in an experimental setup with a reactor of 20 dm^3 capacity. Experiments were performed under various reaction conditions to examine the effects of the initial concentration of the pollutants, pH of the medium, and ozone generation rate. The extent of mineralization of the target pollutants was studied from the TOC measurements. The stoichiometric ratio of ozone consumed to the pollutant removed, and the ozone utilization efficiency of the OMB-system were computed from the experimental results. The enhancement factor, Hatta number, volumetric mass transfer coefficient, and the rate constant of the reaction between the pollutants and ozone were determined. The potential of the OMBs for the oxidation of DMSO was investigated in detail, and the results were compared with those of the conventional ozonation using the ozone millibubbles (OMLBs).

DMP, DEP, BPA, and DMSO present in water were effectively removed by the OMBs. The OMB-system needed a shorter ozonation time for the complete removal of the target pollutant. Lower values of the stoichiometric ratio were obtained in the OMB-system, possibly due to the high rate of mass transfer of ozone into the aqueous phase. A considerably high range of ozone utilization efficiency was achieved for the complete removal of the pollutants. The optimal addition of H_2O_2 increased the rate of removal of the pollutants by augmenting the generation of the hydroxyl radicals. A better TOC removal efficiency was observed in the OMB system as compared to the conventional ozonation. In terms of the TOC removal efficiency, the effectiveness was in the following order: OMLBs < OMLBs/ H_2O_2 < OMBs < OMBs/ H_2O_2. Very low values of the Hatta number were obtained, which prove that the mass transfer resistance was negligible, implying that the rate of mass transfer was enhanced by the OMBs. Higher ozone volumetric mass transfer coefficient, enhancement factor, and volumetric ozone transfer rate were obtained for the OMBs as compared to the OMLBs.