INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

Increasing demand of metals in industrial sectors has led to the depletion of metal and mineral resources. To compensate for this loss, metals need to be recovered from wastewater discharged from industries, particularly mining and metallurgy, which usually contains a high concentration of heavy metals. Biological sulfate reduction and heavy metal removal process is an emerging technique to recover heavy metals from wastewater. The current thesis demonstrated successful removal and recovery of different heavy metals in the form of nanoparticles from simulated wastewater by anaerobic biomass containing sulfate reducing bacteria (SRB). Initially, anaerobic biomass from three different sources were screened on the basis of their metal removal and sulfate reduction efficiencies. At low metal loading conditions, the biomass obtained from a laboratory scale anaerobic rotating biological contactor (An-RBC) reactor treating metallic wastewater showed a maximum metal removal (95 %), sulfate reduction (90 %) and COD removal (80 %). Further, metal removal and recovery from synthetic wastewater was investigated using two continuously operated sulfidogenic anaerobic inverse fluidized bed reactors (referred as R1 and R2) supplied with influent of pH 7.0 and 3.0, respectively. IFBR with influent pH 7.0 (R1) performed better than R2 in terms of metal recovery and overall order of the metal recovery was Cu > Pb > Cd > Zn > Ni > Fe. In order to purify the copper sulfide nanoparticles (CuS NPs) an indigenous low-cost ceramic membrane was used. Microfiltration using the ceramic membrane showed 92% purification efficiency of the CuS NPs with a flux of 77×10^{-4} m^3/m^2s. Further, the application potential of recovered metal sulfide nanoparticles was successfully tested on azo dye removal and 1,2,3 triazole production. The toxicity analysis as induced oxidative stress in *R. opacus* PD 630 showed both biogenic and chemical metal sulfide nanoparticles exert almost similar effect on the industrially relevant bacteria and need to be recover and reused.