

TITLE: STUDY OF SULFATE REDUCTION WITH LOW RETENTION TIME IN AN ANAEROBIC HORIZONTAL FIXED-BED BIORREACTOR PACKED WITH MINERAL COAL

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ABSTRACT:

Sulfate rich industrial wastewater may cause imbalances in the natural sulfur cycle and induce several environmental problems. For that reason, the interest in solutions and treatments of this contaminant has been increasing in the last years. An alternative for the chemical treatments is the anaerobic bioprocess that use sulfate reducing bacteria (SRB) which converts sulfate in sulfide that can be used for other purposes like metal precipitation or elemental sulfur production. This study presents the results obtained during 66 days of operation of a horizontal-flow immobilized biomass (HAIB) reactor with mineral coal (inert support - 5 mm side) to the treatment of sulfate rich wastewater from a chemical industry from Brazil in which the sulfonation of vegetable oils (rice, soy and corn) is one of the most important wastewater-producing process. The HAIB reactor consisted of a tube (PVC) of 1.5 m length and 0.10 m diameter and length-to-diameter ratio (L/D) of 15 with useful volume of 6 L (bed porosity: 50%) and retention time of 9 h. After inoculation, the reactor was operated for 66 days under sulfate-reducing conditions characterized by different influent sulfate concentrations. Initially, the reactor was fed (11 days) with a solution of ethanol and tap water containing 500 mgCOD.L⁻¹ for biomass adaptation in mineral coal. After 11 days, the reactor was supplied with 500 mgSO₄²⁻.L⁻¹ and 1000 mgCOD.L⁻¹ (COD/sufate=2). The sulfate reduction efficiencies reached 98%. The increase in sulfate concentration occurred after 37 days of operation (1000 mgSO₄²⁻.L⁻¹ and 2000 mgCOD.L⁻¹) with average sulfate removal of 61.1 ± 1.6 %. Another increase occurred after 55 days (2000 mgSO₄²⁻.L⁻¹ and 4000 mgCOD.L⁻¹) with sulfate removal of 35.3 ± 2.9 %. Based on the responses of the HAIB reactor, it can be concluded that this reactor configuration can be used for sulfate removal at sulfate influent concentrations below 2000 mgSO₄²⁻.L⁻¹ if ethanol is used as electron donor. Our study has demonstrated that the HAIB reactor is a novel option for sulfate removal, particularly in Brazil, where calcium salts (Ca(OH)₂ and CaCl₂) are employed in sulfate removal process.

Keywords: sulfate reduction, anaerobic reactor, sulfate removal, treatment

Development Agency: Fundação de Amparo à Pesquisa do Estado de São Paulo