ABSTRACT

Over the past years, R&D on advanced oxidation processes (AOPs) has been of immense importance. AOPs involve diversity of technologies and many areas of potential application in wastewater treatment methods. Removal of hazardous industrial organic pollutants from water is a well known global issue that is being addressed by the environmental applications of AOPs. Fenton's process is a prominent AOP usable for destroying organic compounds in wastewater. Particular focus of this research has been on Fenton and related processes for treatment of some specific pollutants of concern and industrial wastewater streams.

The first investigation includes application of *Fenton's process* for degradation of 1,4-dioxane. Treatment of a local petrochemical industry wastewater primarily contaminated with 1.4-dioxane and ethylene glycol by Fenton process was also investigated. The kinetics of contamination reduction was developed through a COD degradation model. Two lumps of pollutants with different degradation kinetics were considered.

Option of using *electro-Fenton* process to treat a rayon industry effluent was investigated and the process parameters were optimized to meet COD discharge limit. Investigations on optimizing treatment parameters for electro-Fenton process to degrade the dyes - methylene blue and titan yellow were also carried out.

Tannery wastewater treatment using *photo-Fenton* process was investigated for COD reduction. Optimized process parameters led to achieving the required COD limit (250 mg/L) for discharge.

A catalyst with Fe^{3+} immobilized on alumina matrix was prepared for heterogeneous Fenton like process and was used for 2.4-dinitrophenol degradation in batch experiments. The catalyst performance was observed for 4 cycles with the 3^{rd} and the 4^{th} cycle having almost the same activity (~80% of original).

The results of investigations point to feasibility of using of some specific Fenton and Fenton related processes for specific pollutants like 1,4-dioxane, 2,4-dinitrophenol, methylene blue dye and titan yellow dye. It also finds electro-Fenton to be suitable for treatment of rayon industry wastewater and photo-Fenton suitable for tannery wastewater samples. The immobilized Fe^{3+} catalyst developed shows potential of use due to its reasonably high efficiency and stability.

Keywords: Advanced oxidation processes, Hydroxyl radicals, Environmental pollution control, Organic pollutant removal, COD reduction, Kinetic modeling, Heterogeneous catalyst