ANODIC OXIDATION OF PHENOL IN CONTAMINATED WATER ON DIMENSIONALLY STABLE ANODE

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Phenol and substituted phenol compounds in water have been recognized as some of the major organic pollutants. These compounds have potential to act as human carcinogens, even at low concentrations, due to their high toxicity, high oxygen demand and low bio-degradability. Therefore, recent attention has been paid on contamination of water by phenolic compounds. Hence, phenol is extensively studied for both fundamental and practical interests as a model organic pollutant compound.

Among the water treatment techniques, electrochemical methods have received more attention due to facts, such as in-situ chemical generation, ease in process control and high efficiency. Higher energy consumption is the major drawback in electrochemical methods. In order to minimize this drawback, different anode materials were developed and tested for the potential for oxidizing pollutants. However, limited studies are reported in literature for probing mechanism of degradation on specific anodes. In addition, little attention has been paid towards the development and optimization of anode materials for specific contaminant, phenol. Therefore, this project addresses the above limitations by developing optimized anode material and probing mechanisms of electrochemical degradation of phenol as a model system. Anode development and preliminary studies were based on different anode materials, such as steel, steel/IrO_2, steel/IrO_2-Sb_2O_3, Ti, Ti/IrO_2 and Ti/IrO_2-Sb_2O_3. Both the experimental and theoretical mechanistic studies confirm that catechol is the major byproduct, formed on steel/IrO_2-Sb_2O_3 anode. Further study revealed that Ti/IrO_2-Sb_2O_3 anode is one of the most suitable anode materials for phenol removal. Therefore, anode optimization studies were conducted on Ti/IrO_2-Sb_2O_3 anode, in order to find out the best Ir and Sb amount for anodes' optimum stability, high electrochemical activity and higher COD removal. It was found that 0.089 g/L of Ir and 0.924 g/L of Sb are the optimum concentrations.