

Evaluation of Electro/Fenton Process Using Iron Electrode on Phenol Removal from Aqueous Solution

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Abstract: This study examines phenol removal from aqueous solutions through electro-Fenton (EF) process using iron electrode. The effect of operational parameters such as initial pH, current density, initial concentration of phenol, hydrogen peroxide dosage on the removal of phenol was investigated. The results showed that the efficiency of phenol removal had a direct relationship with initial concentration of hydrogen peroxide, and was inversely correlated with the highly alkaline pH and elevated concentration of phenol. The removal efficiency of phenol was significantly increased with increasing H₂O₂ concentration from 0.1 mM to 0.4 mM, but there was little influence on the removal efficiency in greater quantities of H₂O₂. Ultimately, phenol was almost completely removed after 45 min in this process.

Keywords: Electro Fenton, Phenol removal, Oxidation process, Iron electrode.

1. Introduction

One of the greatest concerns of the 21st century is water shortage. The shortage of the fresh water affects more than 25% of the world population. Consequently, 2.2 million people die every year as reported by the World Health Organization. On the other hand, a large amount of water is contaminated by domestic and industrial activities in developing countries. Therefore, evaluation of waste water quality is essential to avoid further contamination of the environment. The need for reuse of water resources is important in order to reduce fresh water consumption [1]. Overpopulation and the consequent increase of industrial activities generate high concentrations of pollutants leading to aquatic environment contamination. For example, phenol and its derivatives can be found in waste disposal of various industries including resins, plastics, paper-making and coal conversion factories. Although the toxicity and environmental impact of phenolic compounds depend on the number, type and the position of substitution groups of aromatic compounds, these chemicals is found to be toxic for various organisms, including humans, animals and plants. Hence, the removal of phenolic compounds is regarded as one of the greatest concerns in the world [3, 2]. There are several methods of treating wastewater containing phenol and the most important of these are advanced oxidation, chemical oxidation, adsorption, biological, filtration and a combination of these procedures [4]. High cost, long retention time and generation of toxic by-products are drawbacks to the widespread use of some of these elimination strategies [5, 6]. Advanced oxidation processes have attracted much attention today due to their ease of use, being economical and high efficiency [7-9]. Among the advanced oxidation processes, Electro/Fenton process can be noted. Fenton process is a process which Fe²⁺ ions and hydrogen peroxide are concurrently used to decompose and eliminate pollutants. This process is possible in the presence of Fe²⁺ ions, hydrogen peroxide and radical hydroxyl for oxidation to take place. H₂O₂ can be activated by Fe²⁺ to produce hydroxyl radical via Eq. (1).



