Catalytic wet peroxide oxidation of phenol using nanoscale zero-valent iron supported on activated carbon

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ABSTRACT

The main objective of the work is to prepare catalysts based on nanoscale zero-valent iron supported on activated carbon (nZVI/AC) and to test their activity for catalytic wet peroxide oxidation of phenol. The catalysts were characterized by X-ray diffraction (XRD), scanning electron microscope (SEM), ICP, and N₂ adsorption-desorption, and their performance was evaluated in terms of phenol and TOC removal. The effect of the initial phenol concentration and initial pH on the oxidation process was investigated. Possible leaching of iron from the catalyst into the aqueous solution was also examined. The experimental results indicate that the catalytic activity toward phenol degradation was found to be enhanced by nZVI/AC catalysts compared to that of Fe/AC. In the range 150–1,000 mg/L, phenol conversion above 90% can be reached using these catalysts after only 15 min of the reaction, and using the stoichiometric hydrogen peroxide for complete mineralization. The leaching observed is less than 4% of the total initial iron in the catalyst even after 120 min of the reaction. It was also observed that the stability or reutilization of the catalyst was fairly good.

Keywords: Phenol; Activated carbon; Zero-valent iron; Catalytic wet peroxide oxidation