Treatment of the Mixture of Heavy Metal and Organic Wastewaters by Cementation and Fenton-like Processes

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ABSTRACT

The treatment for copper ions and/or organic compounds (dye and isopropanol) from aqueous solutions by iron powder cementation and Fenton-like processes was studied as a function of solution pH, temperature, amount of iron, concentration of pollutants and H2O2. Cementation of copper and dye (Acid Orange 10, Acid Red 4, and Acid Red 27) wastewaters was shown to be a feasible treatment process to achieve a high degree of removal within a fairly reasonable contact time, but not for isopropanol (IPA) which possesses a relatively slow reaction rate. The chemical kinetics and reaction rate equations for the removal of pollutants (copper ions, Orange 10, and IPA) by cementation and Fenton-like processes were explored and developed based on experimental results. The deposition of copper ions and consumption of iron are highly dependent on solution pH conditions and is most practically operated at weak acidic conditions of pH 3 to 4. The reaction rate is approximately first order with respect to both the amount of iron and the concentration of copper ion. The decomposition rates of Orange 10 and IPA in aqueous solutions by Fenton-like process increase with increasing the amount of iron powder and H2O2, rotation speed, concentration of dissolved oxygen, and with decreasing the initial concentration. The solution pH and the amount of iron powder and H2O2 are found to be the dominant factors on the removal of organic pollutants by Fenton-like process. The individual contribution for the decomposition of Orange 10 and IPA in aqueous solutions by OH. oxidation and by e- reduction in the Fenton-like reaction system was differentiated based on the assumption the linear addition of the rate constants of pollutants by cementation and Fenton-like processes. In the Fenton-like reaction system, the main contribution to the decomposition of IPA in aqueous solutions was determined to be OH. destruction, while the main contribution to the decoloration of Orange 10 solution was found to be e- reduction.

Keywords : Fenton-like

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