Treatment of Chelated-Metals Containing Wastewaters by Fenton-like Process

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ABSTRACT

The major purpose of this study was that, through advanced oxidation process with Fenton-like process as the main body, combined with cementation, the wastewater with both different heavy metals (Cu2+) and chelating agents (EDTA, NTA, Oxalic Acid) was treated, to discuss the impact on reaction behaviors and removal efficiency of pollutants from each operation factor in reaction system(the pH value of the solution, the adding amount of sacrificial metal, the initial concentration of pollutant, the adding amount of oxidant H2O2 etc). Through the calculation of pollutant and oxidant based on the mass balance, the usage efficiencies of sacrificial metal and oxidant were assessed, and the kinetic equation of chemical reactions was built, which was the basis of deciding the processing efficiency and the optimal operating conditions for the combination between advanced oxidation process and cementation. According to the experimental results, when Fenton-like process was used to treat the wastewater with all types of chelating heavy metal ions, as the adding amount of iron powder was decreased, as well as the H2O2 amount, initial concentration of pollutants and solution ’ s pH value were increased, the removal efficiency of pollutants decreased. Hereinto, the iron powder adding amount, H2O2 amount and pH value were the main factors, which affected the oxidation-reduction reaction rate of pollutant. As to the adding amount of iron powder, the optimal amount was 2 g; as the amount of Fe2+ and H2O2 was the factor promoting the Fenton reaction, when the amount of iron powder was 2 g, the optimal amount of H2O2 was 2.5 mM. Tool Cu-EDTA as an example, the removal efficiency was up to 100 % or more. Based on the results of EDS analysis, after reaction, there were different deposit types and pore sizes on the sacrificial metal surface in different reaction solution system, it was speculated as one of the main causes affecting the cementation rate. Additionally, the experiment found that, the chelating heavy metal and the oxide-reduced copper would be absorbed on the sacrificial metal surface, which could slow down the erosion effect on metal surface from hydrogen ions, reducing the dissolution of sacrificial metal. However, it would also cover the active sites on the surface of iron powder, reducing the overall utilization rate of iron powder. In this study, the non-toxic iron powder was used as the sacrificial metal, combined with a cheap oxidant H2O2 with rapid reaction to get a good removal efficiency for copper ions, in comparison to treat heavy metal with traditional chemical precipitation, as well as treat organic matter in water solution through Fenton process, it could not only improve the bottleneck about bad utilization rate of iron powder, but could also treat wastewater mixed with chelating agents and heavy metal effectively at the same time, moreover, the sludge from Fenton process was decreased, thus increased the practicality of Fenton-like process.

Keywords : Fenton-like, Cementation, Heavy metal, Chelating agent

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