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Removal of potassium permanganate from water by modified carbonaceous materials

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ABSTRACT

Potassium permanganate is commonly used in multidiscipline processes as a strong oxidizing agent for oxidative treatment of a great number of organic and inorganic compounds. In this work, a method is proposed for removal of $KMnO_4$ from aqueous solutions and real water samples using treated and activated carbon (AC) sorbents with sulfuric acid. The potential applications of five modified AC sorbents for removal of $KMnO_4$ were explored under different experimental controlling factors including pH, contact time, initial concentration of $KMnO_4$, sorbent dosage, and competing ions by the batch equilibrium technique. The removal values of $KMnO_4$ were found to be ≥99.56% in the examined solutions (pH 1.0–7.0). In pH 1.0–2.0, $KMnO_4$ removal from aqueous solutions was found to proceed by an anion exchange and ion pair interaction mechanisms, while in pH ≥ 3.0–7.0, the uptake of $KMnO_4$ was identified to take place by an initial surface reduction step for the formation of Mn(II) ion and followed by adsorption via a direct complex formation with the AC surface functional groups. The proposed method confirmed an efficient removal of ≥99% of residual $KMnO_4$ from industrial wastewater, seawater, and drinking water in laboratory trials.

Keywords: Potassium permanganate; Carbonaceous materials; Removal

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