Preparation, characterization, and application of sludge with additive scrap iron-based activated carbons

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ABSTRACT

Activated carbons were prepared using sewage sludge with additive scrap iron as precursor and ZnCl₂ as activator by pyrolysis method. By examining the effects of pyrolysis temperature, pyrolysis time, impregnation ratio, and scrap iron dosage on the adsorption performance of the sludge with additive scrap iron-based activated carbon, the optimum preparation conditions were obtained as following: pyrolysis temperature of 550°C, pyrolysis time of 50 min, impregnation ratio of 3:1, and scrap iron dosage of 0.5 wt %. The physical and chemical characteristics of the activated carbons produced from sewage sludge with and without additive scrap iron were determined and compared. The results showed that adding scrap iron into sewage sludge could enhance the pyrolysis of sludge and significantly improve the formation of mesopores in the produced activated carbon. In the adsorption experiments applying the prepared activated carbons to the treatment of azo dye wastewater, the adsorption data fitted the Langmuir model well. The adsorption performance of the activated carbon for the dye was remarkably enhanced after the addition of scrap iron, with the maximum adsorption capacity increasing from 156.25 to 243.31 mg/g.

Keywords: Sewage sludge; Scrap iron; Pyrolysis; Activated carbon; Mesopores; Dye adsorption

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