Factors that affect carbothermal synthesis of nanoscale zero-valent iron supported activated carbon and its use as dechlorination agent of hexachlorobenzene

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ABSTRACT

Starting with sucrose and ferrous chloride, nanoparticles of iron encapsulated in carbon structure were synthesized using a carbothermal method. The effects of carbothermal temperature, treatment time, Fe:sucrose mass ratio on the properties of the nanoscale zero-valent iron supported activated carbon were investigated. Temperatures ranged from 500°C to 1,100°C and treatment time used was 0.5, 1 and 3 h. Mass ratios of Fe and sucrose were 1:2, 1:4 and 1:8, respectively. Materials thus obtained were mostly powdered. X-ray diffraction patterns indicate that zero-valent iron was successfully produced from reduction of iron oxides. Iron was incorporated into the carbon structure. Hexachlorobenzene was employed as the target substance to test the material’s application. The optimum synthesis condition which resulted in a more than 95% HCB removal was carbothermal temperature of 700°C, treatment time of 1 h and mass ratio of Fe:sucrose of 1:4.

Keywords: Carbothermal synthesis; Nano zero-valent iron; Synthesis conditions; HCB dechlorination