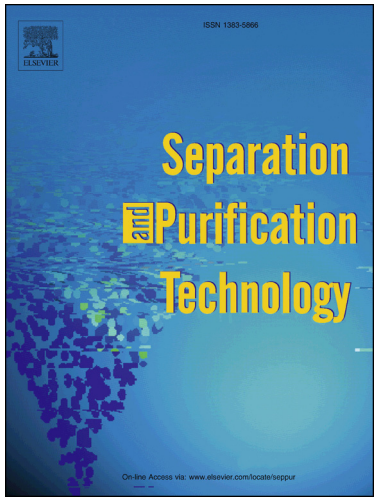

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Catalytic oxidation of 4-chlorophenol on in-situ sulfur-doped activated carbon with sulfate radicals

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Abstract

In-situ S-doped activated carbon (ACS) was prepared and used as a heterogeneous catalyst to activate persulfate (PS) for 4-chlorophenol (4CP) oxidation. The effects of several operation parameters, including PS concentration, initial pH, ACS dosage, and reaction temperature, on 4CP degradation were investigated in detail via batch experiments. Results show that ACS exhibited excellent catalytic activity for PS activation and a complete 4CP degradation as well as 65.3% COD removal can be achieved in 170 min at 25 °C with ACS dosage of 0.1 g/L, PS/4CP molar ratio of 24/1 and initial pH of 4.4. The biodegradability was greatly improved after a 170 min reaction. Quenching tests reveal that SO_4^{-}• was the dominant active species taking part in the degradation of 4CP. Based on the stability tests and the corresponding characterizations of ACS before and after use, it was speculated that the loss of the specific surface area and the change of the surface chemistry led to the significant deactivation of ACS. Meanwhile, a possible mechanism of PS activation on ACS was proposed.

Keywords

Sulfur doping, Activated carbon, Persulfate oxidation, 4-chlorophenol degradation, Advanced oxidation process

1. Introduction

Chlorophenols (CPs) are important intermediates and raw materials for chemical industries, such as in the production of pharmaceuticals, pesticides, herbicides and dyes [1, 2]. Owing to the versatile application of CPs, wastewater discharged from industries inevitably contains high contents of CPs, which have been widely detected