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Oxidative degradation of *p*-chloroaniline by copper oxidate activated persulfate

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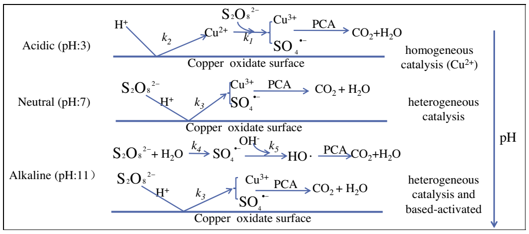
HIGHLIGHTS

- A novel copper oxidate catalyst activated persulfate to generate $SO_4^{\cdot-}$ was investigated.
- Dissolved Cu^{2+} was regarded as the key factor activating the persulfate at pH 3.0.
- Heterogeneous catalysis played the main role in the oxidation of *p*-chloroaniline at pH 5 and 7.
- *p*-Chloroaniline removal would occur on the boundary-layer of solid surface at pH 7.
- Base activation of persulfate and heterogeneous catalysis was occurred at pH 11.

GRAPHICAL ABSTRACT



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ABSTRACT

Oxidation of *p*-chloroaniline (PCA) by persulfate (PS) performed with a novel supported copper oxidate catalyst in an aqueous solution at ambient temperature (i.e. 20 °C) was investigated in this study. This study focused mainly on determining the proportions of heterogeneous catalysis in the copper oxidate/PS combined system. There existed a more remarkable effect on the degradation of PCA in the copper oxidate/PS combined system than in the Cu^{2+}/PS or only PS system. The effects of copper oxidate dosage, persulfate concentration, and initial solution pH on the oxidation of PCA were also evaluated. Higher copper oxidate dosage and persulfate concentration resulted in higher PCA degrading rates, the optimal initial pH was determined as 7.0. Moreover, the change in the degradation of PCA by pH was also investigated in terms of the contribution of dissolved copper ion in leaching solution. We inferred that homogeneous catalysis was of increasing importance and the copper ion dissolved from the copper oxidate was regarded as the key factor activating the persulfate under acidic conditions (pH 3.0), heterogeneous catalysis played the main role in the oxidation of PCA at pH 5–7. However, both heterogeneous catalysis and base-activated persulfate contributed to the degradation of PCA under alkaline conditions (pH 11). In addition, the radical mechanism was studied and three radical scavengers (phenol, methanol (MA) and *Tert*-butanol (TBA)) were used to determine the kind of major active areas taking part in the PCA degradation at pH 7.

1. Introduction

p-Chloroaniline (PCA), known as a chloroaromatics, is widely used as an intermediate during variety of chemical manufacture,

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