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Highly efficient removal of trimethoprim based on peroxymonosulfate activation by carbonized resin with Co doping: performance, mechanism and degradation pathway

Yang Liu[a], Hongguang Guo[a, b,]*, Yongli Zhang[a], Xin Cheng[a], Peng Zhou[a], Jing Deng[c], Jingquan Wang[a], Wei Li[a]

[a] *College of Architecture and Environment, Sichuan University, Chengdu 610065, China*

[b] *Department of Civil & Environmental Engineering, University of Washington, Box 352700, Seattle, WA 98195-2700, United States*

[c] *College of Civil Engineering and Architecture, Zhejiang University of Technology, Hangzhou 310014, China*

*Corresponding author. Tel: +86-028-85408889; fax: +86-028-85405534

Email: hgguo@scu.edu.cn

Abstract: We first report the syntheses of carbon-supported Co (CS-Co) composite via a carbonization process from a saturated resin. CS-Co exhibited favorable catalysis activities in activation of peroxymonosulfate (PMS) to generate $\cdot SO_4^-$ and ·OH for trimethoprim (TMP) degradation. The performance of composites were studied with respect to diverse pHs (3.0-9.0), catalyst dosages (0.05-0.5 g/L), PMS dosages (0.05-1.0 mM), TMP concentration (5-20 mg/L) and temperature (15-30℃). Water matrix concerning various levels of humic acid (HA) showed negative effect for TMP removal due to the intrinsic competition between HA. Scavenging test indicated that $\cdot SO_4^-$ and ·OH were the dominant reactive radicals, and an uncomplicated method to calculate the normalized steady-state concentration of radicals in CS-Co/PMS process was established. The electron transfer concerning PMS, carbon surface and Co^{2+} was attributed as the main activation mechanism. The main intermediate products of TMP were identified by LC/MS/MS technology with four degradation pathways proposed, including hydroxylation, electron transfer mechanism, demethylation and ring-cleavage.

Keywords: cationic resin, carbonation, peroxymonosulfate, mechanism, degradation pathway