Boosting peroxymonosulfate activation via Co-based LDH-derived magnetic catalysts: a dynamic and static state assessment of efficient radical-assisted electron transfer processes

Wenhan Yang[1], Junmin Xia[2], Fanfan Shang[1], Gege Yang[1], Bin Wang[1], Hairui Cai[1], Lingyun Jing[3], Hao Zhu[4], Shengchun Yang[1], Chao Liang[1], and Guosheng Shao[5]

[1]Xi'an Jiaotong University
[2]Nanjing University of Posts and Telecommunications
[3]Lanzhou University of Technology
[4]Lanzhou University
[5]Zhengzhou University

September 27, 2023

Abstract

Heterogeneous catalysts promoting efficient production of reactive species and dynamically stabilized electron transfer mechanisms for peroxomonosulfates (PMS) still lack systematic investigation. Herein, a more stable magnetic layered double oxides (CFLDO/N-C), was designed using self-polymerization and high temperature carbonization of dopamine. The CFLDO/N-C/PMS system effectively activated PMS to remove 99% (k=0.737 min-1) of tetracycline (TC) within 10 min. The CFLDO/N-C/PMS system exhibited favorable resistance to inorganic anions and natural organics, as well as satisfactory suitability for multiple pollutants. The magnetic properties of the catalyst facilitated the separation of catalysts from the liquid phase, resulting in excellent reproducibility and effectively reducing the leaching of metal ions. An electronic bridge was constructed between cobalt (the active platform of the catalyst) and PMS, inducing PMS to break the O-O bond to generate the active species. The combination of static analysis and dynamic evolution confirmed the effective adsorption of PMS on the catalyst surface as well as the strong radical-assisted electron transfer process. Eventually, we further identified the sites where the reactive species attacked the TC and evaluated the toxicity of the intermediates. These findings offer innovative insights into the rapid degradation of pollutants achieved by transition metals in SR-AOPs and its mechanistic elaboration.

Hosted file

`manuscript.docx` available at https://authorea.com/users/668864/articles/669608-boosting-peroxymonosulfate-activation-via-co-based-ldh-derived-magnetic-catalysts-a-dynamic-and-static-state-assessment-of-efficient-radical-assisted-electron-transfer-processes