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PII: S1385-8947(18)31910-7
DOI: https://doi.org/10.1016/j.cej.2018.09.192
Reference: CEJ 20031

To appear in: *Chemical Engineering Journal*

Received Date: 13 July 2018
Revised Date: 22 September 2018
Accepted Date: 24 September 2018

Please cite this article as: S.Y. Yang, H.W. Jeong, B-j. Kim, D.S. Han, W. Choi, H. Park, Electrocatalytic cogeneration of reactive oxygen species for synergistic water treatment, *Chemical Engineering Journal* (2018), doi: https://doi.org/10.1016/j.cej.2018.09.192

Electrocatalytic cogeneration of reactive oxygen species for synergistic water treatment

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***Keywords*:** Reactive oxygen species, Electrocatalysts, Hydroxyl radicals, Hydrogen peroxide, Synergy

Abstract

This study examines the co-generation effect of hydroxyl radicals ($OH^{\bullet}$) via water oxidation and H_2O_2 via O_2 reduction in electrocatalytic processes with Sb-doped SnO_2 (SS) anode and carbon nanotube (CNT) cathode pairs facing each other as a function of applied SS/CNT cell voltage and purging gas (O_2 vs. N_2). Prior to coupling the electrodes, both electrodes are examined for the generation kinetics and current efficiency of reactive oxygen species as well as the decomposition kinetics and total organic carbon (TOC) removal of phenol, as a function of applied half-potential (E_{SS} or E_{CNT}) and the purging gas. Regardless of the purging gas, a stepwise increase in E_{SS} enhances the $OH^{\bullet}$ generation and phenol decomposition, yet inversely decreases the current efficiency of $OH^{\bullet}$ (max. ~30%), owing to competitive O_2 evolution. Similar to this, the current efficiency of H_2O_2 is high at a less