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# Electrocatalytic cogeneration of reactive oxygen species for synergistic water treatment

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## Abstract

This study examines the co-generation effect of hydroxyl radicals ( $\text{OH}^\bullet$ ) via water oxidation and  $\text{H}_2\text{O}_2$  via  $\text{O}_2$  reduction in electrocatalytic processes with Sb-doped  $\text{SnO}_2$  (SS) anode and carbon nanotube (CNT) cathode pairs facing each other as a function of applied SS/CNT cell voltage and purging gas ( $\text{O}_2$  vs.  $\text{N}_2$ ). 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 ( $E_{\text{SS}}$  or  $E_{\text{CNT}}$ ) and the purging gas. Regardless of the purging gas, a stepwise increase in  $E_{\text{SS}}$  enhances the  $\text{OH}^\bullet$  generation and phenol decomposition, yet inversely decreases the current efficiency of  $\text{OH}^\bullet$  (max. ~30%), owing to competitive  $\text{O}_2$  evolution. Similar to this, the current efficiency of  $\text{H}_2\text{O}_2$  is high at a less

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