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Facial Design of Combined Photoelectrocehmcial-Fenton Coupling Nanocomposites for Antibiotic Eliminations

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Abstract : A new coupling system was constructed by combining photo-electrochemical cell with eletro-fenton cell (PEC-EF). The electrode material in this system was derived from MnyFe1–yCo Prussian-Blue-Analog (PBA). $Mn_{0.4}Fe_{0.6}Co_{0.67}$-N@C spin-coated on carbon paper behaved as the gas diffusion cathode and $Mn_{0.4}Fe_{0.6}Co_{0.67}O_{2.2}$ spin-coated on fluorine-tin oxide glass (FTO) as anode. The two separated cells could degrade Sulfamethoxazole (SMX) simultaneously and some coupling mechanisms by PEC and EF enhancing the degradation efficiency were investigated. The continuous on-site generation of H_2O_2 at cathode through an oxygen reduction reaction (ORR) was realized over rotating ring-disk electrode (RRDE). The electron transfer number (n) of the ORR with $Mn_{0.4}Fe_{0.6}Co_{0.67}$-N@C was 2.5 in the selected potential and pH range. The photo-electrochemical properties of $Mn_{0.4}Fe_{0.6}Co_{0.67}O_{2.2}$ were systematically studied, which displayed good response towards visible light. The photo-induced electrons at anode can transfer to cathode for further use. Efficient photo-electro-catalytic performance was observed in degrading SMX. Almost 100% SMX removal was achieved in 120 min. This work not only provided a highly effective technique for antibiotic treatment but also revealed the synergic effect between PEC and EF.

Keywords : Electro-Fenton, photo-electrochemical, synergic effect, sulfamethoxazole
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