Photoelectrocatalytic removal of bisphenol A using $[\text{Ru}(\text{bpy})_2(\text{tatp})]^{2+}$ modified TiO_2 electrode

Qian Li*, Tong Li, Qingqing Wang

School of Material and Chemical Engineering, Bengbu University, Bengbu 233030, PR China

*E-mail: liqian10000@126.com

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A novel photoelectrocatalytic method is applied to the oxidative removal of bisphenol A (BPA) that is regarded as a representative endocrine disrupting chemical. The result from electrocatalysis of $[\text{Ru}(\text{bpy})_2(\text{tatp})]^{2+}$ (bpy = 2,2'-bipyridine, tatp = 1,4,8,9-tetra-aza-triphenylene) present in solution or assembled electrochemically on the nano- TiO_2 electrode shows high removal efficiency for BPA by a Ru(III)-based coupled chemical reaction. The evidence from photocatalysis of $[\text{Ru}(\text{bpy})_2(\text{tatp})]^{2+}$ modified TiO_2 nanoparticles reveals a $[\text{Ru}(\text{bpy})_2(\text{tatp})]^{2+}$ -controlled BPA removal sensitive to the irradiation of ultraviolet (UV) and visible light via an $^1\text{O}_2$ and $\bullet\text{OH}$ -based coupled chemical reaction, showing more than 97.3% removal efficiency within 30 min. The result from photoelectrocatalysis of $[\text{Ru}(\text{bpy})_2(\text{tatp})]^{2+}/\text{TiO}_2$ photoanode suggests a bifunctionalized BPA removal based on a BPA/ H_2O_2 photoactivated fuel cell, showing more than 41.3% removal efficiency as well as good preliminary cell performance, which opens a way to search for diverse applications. It becomes evident that the photoelectrocatalytic removal of BPA depends on the coupled chemical reactions between BPA and intermediate species generating from excited states and electro-oxidation of Ru(II) complexes.

Keywords: Bisphenol A; Removal; Polypyridyl ruthenium(II) complex; TiO_2 nanoparticles; Photoelectrocatalysis

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