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H₂O₂-mediated electrocatalytic degradation of Amoxicillin by Fe₃VO₄/Printex L6 carbon-based gas diffusion electrode (Oral)

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Electrochemical technologies are emerging as promising alternatives to conventional methods for removing persistent organic contaminants (Trench et al., 2024). Electrochemical advanced oxidation processes (EAOP), which use hydrogen peroxide (H₂O₂) as a precursor to generate of highly reactive hydroxyl radicals (•OH), represent a particularly approach (Ismail et al., 2021). In this sense, this work focuses on developing a novel electrocatalyst based on vanadium-doped iron oxide nanoparticles (Fe₃VO₄ NPs) to modify the Printex L6 carbon (PL6C) for efficient H₂O₂ electrogeneration. The synergistic effect between Fe₃VO₄ and PL6C was investigated using a rotating ring-disk electrode (RRDE) and other electrochemical techniques. These analyses revealed a significant enhancement in electrocatalytic activity towards the two-electron oxygen reduction reaction (2e⁻ ORR) and consequently, H₂O₂ production compared to unmodified PL6C. Furthermore, gas diffusion electrode (GDE) constructed from carbon cloth and the Fe₃VO₄/PL6C catalyst were integrated into EAOP system for the amoxicillin (AMX) degradation using the electrogenerated H₂O₂. The system used for the experiments consisted of a 250 mL electrochemical reactor, with the GDE as the working electrode, an Ag/AgCl reference electrode and a dimensionally stable anode (DSA) as the counter electrode, with potassium sulphate (K₂SO₄) as the supporting electrolyte, at pH 3.0 and 9.0. AMX removal and mineralization rate were monitored using high-performance liquid chromatography (HPLC) and total organic carbon (TOC) analysis, respectively. The results demonstrated a substantial improvement in H₂O₂ production (~ 750 mg L⁻¹) in alkaline media when applied 1.5 V. Specifically, H₂O₂ accumulation increased by 50 and 33% at pH 3.0 and 9.0, respectively, within 60 minutes of electrolysis at different potentials (0.5 to 2.5 V). In addition, the effective activation of H₂O₂ into •OH and/or others radical species, led to higher AMX removal efficiency when used the Fe₃VO₄/PL6C-GDE. The integration of UV-C irradiation significantly enhanced AMX removal, achieving greater than 95% removal within 60 minutes, accompanied by significant mineralization at both pH values. These results emphasize the potential of this composite material as an effective bifunctional electrocatalyst for environmental remediation applications. Additionally, the Fe₃VO₄/PL6C demonstrates the ability to simultaneously electrogenerate H₂O₂ combining with the generation of •OH.

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References

- Ismail, A. S. et al., Journal of Water Process Engineering, 40 (2021) 101952.
Trench, A. B. et al., Chemosphere, 352 (2024) 141456.