

Electrosorption of paraquat pesticide on activated carbon modified by aluminium oxide (Al₂O₃) with capacitive deionization

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Abstract

Composite electrode materials for removing paraquat from contaminated water were synthesized by loading [aluminium oxide](#) (Al₂O₃) onto activated carbon (AC) via co-precipitation method. The composite properties were investigated by X-ray diffraction, scanning electron microscopy, [Fourier transform](#) infrared spectroscopy, and energy-dispersive X-ray spectroscopy. [Capacitive deionization](#) batch experiments compared the electrosorption of paraquat herbicide by the composite electrode and the pristine activated carbon. The performance of the composite electrodes showed that the removal efficiency and [adsorption capacity](#) depend on the [aluminium oxide](#) loading, applied potential, flow rate, and charging time. At 1.2 V, a flow rate of 15 mL/min, a charging time of 3 h and 20 mg/L PQ initial concentration, the composite electrode (AC/Al₂O₃-1:1) demonstrated a removal efficiency, electrosorption capacity, and energy consumption of 95.5 %, 1.27 mg/g, and 0.055 kWh/m³, respectively, compared to 62 %, 0.83 mg/g, and 0.11 kWh/m³ for the unmodified AC. The presences of other ions/pollutants were found to have negligible interference on PQ pesticide removal as the removal efficiency and electrosorption capacity of the AC/Al₂O₃-1:1 composite in both artificial (95.5 %, 1.27 mg/g) and natural water (87.5 % 1.17 mg/g). The study confirmed that composite electrode can reused several times, as there was no significant decrease in its regeneration efficiency even after multiple cycles.