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Effects of adsorption properties of particle electrodes on the degradation of acid red 14 using three-dimensional electrode system

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ABSTRACT

Four types of granular activated carbon (GAC), i.e., two coal-based activated carbon (ϕ = 4 mm, CBAC-4; ϕ = 1.5 mm, CBAC-1.5), coconut shell activated carbon (CSAC), and nut shell activated carbon (NSAC), were selected to investigate the effects of their adsorption properties on the degradation of acid red 14 (AR-14) by using three-dimensional electrode system. The results of Brunauer–Emmett–Teller surface area analysis, scanning electron microscopy, and Fourier transform infrared spectroscopy indicated that obvious differences in the surface morphologies, textural properties, and surface functional groups among them were not observed. Based on the pseudo-second-order and Freundlich model, the adsorption velocity and capacity followed the order: NSAC > CSAC ≈ CBAC-4 > CBAC-1.5. According to the variation of AR-14, chemical oxygen demand, and total organic carbon concentrations in the electro-oxidation processes, the order of the four GACs on AR-14 degradation and removal was approximately NSAC > CSAC > CBAC-4 ≈ CBAC-1.5. The increase in hydraulic retention time was more beneficial to GACs with higher adsorption property. The GACs with lower adsorption property required higher current and energy consumption to obtain the similar efficiency for AR-14 removal. Thus, the particle electrodes should be the material with good adsorption capacity toward the target pollutants.

Keywords: Adsorption property; Particle electrode; Granular activated carbon; Electro-chemical oxidation; Acid red 14

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