Rapid synthesis of multifunction composite adsorbent by microwave and evaluate with multiple value integration


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ABSTRACT

This work focuses on the synthesis of microwave absorbing-catalytic multifunction novel adsorbent. During adsorbent design secondary pollution produced by adsorbent regeneration is continuously neglected, which motivates the author to load catalyst on adsorbent to enhance the mineralization of adsorbed organic compounds during thermal regeneration. Microwave absorption fuels the synthesis and regeneration of adsorbent. The morphology and structure of composite adsorbent are analyzed by X-ray diffraction, scanning electron microscope-energy dispersive spectrometer, transmission electron microscope, and Brunauer–Emmett–Teller–Barrett–Joyner–Halenda method. The results show that the synthesized composite adsorbent is mesoporous with wide pore diameter distribution and 252 m$^2$/g specific surface area. The host of composite adsorbent is $\gamma$-Al$_2$O$_3$ and the loaded catalyst is amorphous manganese oxides. The synthesis process of composite adsorbent is designed and evaluated by the response surface methodology using a Box–Behnken design method. After optimization, the optimal adsorption capacity of composite adsorbent can reach up to 135 mg/g, and more than 47% tetracycline can be mineralized into H$_2$O and CO$_2$ during 5 min regeneration. The properties of the composite material can be changed by adjusting synthesis condition. These designed functions of material will make adsorbent more adaptable to meet the growing demand of the environmental standard.

Keywords: Adsorbent; Microwave; Catalytic; Regeneration; Mineralization

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