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Research paper

Response surface methodology and artificial neural network for prediction and validation of bisphenol a adsorption onto zeolite imidazole framework

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Highlights

- ZIF-8 for bisphenol A adsorption from wastewater
- RSM optimization for bisphenol A adsorption
- ANN validation for the bisphenol adsorption
- ZIF-8 is possible for regeneration and reusability.

Abstract

Zeolite imidazole frameworks (ZIFs) have demonstrated good capacity in the adsorption of molecules. This work reported the highly porous ZIF-8 with a specific Bruner–Emmett–Teller (BET) area and pore volume of 1299m²/g and 0.60m³/g, respectively, for the effective removal of bisphenol A (BPA) from the aqueous medium. The experiments were designed using response surface methodology (RSM), according to Box–Behnken design (BBD), comprising four factors; BPA concentrations, ZIF-8 dosages, pH, and contact time. The model fitting was justified by the analysis of variance with the statistical model F and p-values of 6.360 and 0.0007, respectively, thus, achieving the highest removal efficiency of 99.93%. The artificial neural network (ANN) was employed for the experimental validation, and the optimum topography was obtained at node 10. Thermodynamically, the process was described as exothermic and spontaneous, with overall changes of enthalpy (ΔH°) and entropy (ΔS°) of 9.557 kJ/mol and 0.0142 J/mol/K, respectively. The ZIF-8 has demonstrated good reusability for several adsorption cycles. Thus, ZIF-8 could be adopted as potential material for BPA removal from the environmental waters.

Graphical abstract