



## Kinetics, isotherm and thermodynamics of tributyltin removal by adsorption onto activated carbon, silica and composite material of silica and activated carbon

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### ABSTRACT

Activated carbon, silica, and composite material of silica and activated carbon were used as adsorbents to remove tributyltin (TBT) from artificial seawater, and the adsorption efficiencies for the precursors and the composite were compared. The composite presented higher TBT adsorption efficiency than the precursors. The adsorption of TBT onto these materials as a function of adsorbent amount, contact time, pH, stirring speed, initial adsorbate concentration, and temperature was investigated. Maximum TBT adsorption was recorded within the pH range of normal saline water (pH 8). The adsorption kinetics of TBT onto the adsorbents followed a pseudo-second-order kinetic model and the equilibrium adsorption data of TBT onto the precursors and composite were well represented by the Freundlich models. The calculated thermodynamic parameters indicated that TBT adsorption onto the precursor and the composite was spontaneous and endothermic. Optimal conditions for the adsorption of TBT from artificial seawater were applied to TBT removal from natural seawater and the result showed that 99.7, 82.9, and 99.8% TBT was removed by the activated carbon, silica, and composite material, respectively.

**Keywords:** Organotin compounds; Tributyltin; Activated carbon; Silica; Composite material; Adsorption isotherm; Adsorption kinetics

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