

Removal of Tributyltin Chloride (TBT) from TBT-contaminated Natural Water by Adsorption onto nFe₃O₄/Fly ash/Activated Carbon Composite

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Introduction

Tributyltin chloride (TBT) is an organic biocide that has been widely used as wood and stone treatment, textile preservation, water paints, paper/leather preservation and antifouling paints (Fang *et al.*, 2010). TBT is highly toxic and the use of TBT in industries has led to significant concentration of TBT in the environment (Brandli, 2009). Therefore, efforts are being made to reduce the concentration of TBT in wastewaters to the barest minimum before discharge into the environment (Ayanda *et al.*, 2012). In this work, the ability of nFe₃O₄/fly ash/activated carbon composite to remove TBT from simulated contaminated wastewater was scientifically studied. The effect of contact time, initial TBT concentration, composite dosage, stirring speed, and solution pH was investigated on the adsorption rate.

Materials and Methods

nFe₃O₄, fly ash and activated carbon in the ratio 1:1:1 were dispersed in HCl solution to form a slurry. The slurry was dried and washed, filtered, dried again in an oven at 100°C for 24 hours. The equilibrium, kinetics and thermodynamics of adsorption were investigated in a batch adsorption system.

Results and Discussions

Adsorption experiments revealed that the adsorption capacity of TBT increases with increase in the composite amount, contact time, pH, stirring speed and initial TBT concentration. The adsorption process is endothermic, the adsorption fitted well the pseudo-second order kinetic, while the equilibrium study showed that the sorption of TBT on the composite fitted the Freundlich isotherm (Table 1). The scanning electron micrograph (SEM) of the composite after adsorption is shown in Fig. 1.

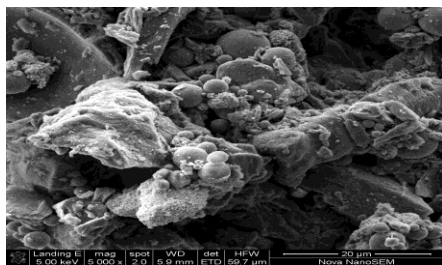


Table 1: Parameters for the Kinetic and Isotherm Models

Pseudo second order kinetic		Freundlich isotherm	
q _e (mg/g)	4.9950	K _F	1426.3
h ₀ (mg/g/min)	312.50	n _F	0.6876
k ₂ (g/mg/min)	12.525	R ²	0.9913
R ²	0.9999		

Fig. 1: SEM of Composite after Adsorption

Approximately 99.98 % of TBT was removed from the initial concentration of 100 mg/L TBT by the composite at a temperature of 80°C, 60 min contact time, pH 8 and a stirring speed of 200 rpm. In conclusion, this study showed that the nFe₃O₄/fly ash/activated carbon composite could be used as effective adsorbent for the removal of TBT from contaminated water and wastewater (Fatoki *et al.*, 2013).

References

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