

Kinetic studies on the biosorption of the brominated flame retardant 4-dibromodiphenyl ether (BDE-3) using coconut palm leaf powders

ABSTRACT

Methods such as membrane isolation, ion replacements, precipitation, transformation and biosorption are proven approaches to contaminant control. Biosorption has all of these technological features including low operating costs, very efficient detoxifying of toxicities at low volumes, minimal amounts of removal components and nutrient requirement, as well as bacterial remediation, which are limited to the presence of heavy metals and other toxicants. The biosorption of BDE-3 on coconut leaves powder on the biosorption of BDE-3 from coconut leaves powder were analyzed using three models—pseudo-1st, pseudo-2nd and Elovich, and fitted using non-linear regression. Statistical analysis based on root-mean-square error (RMSE), adjusted coefficient of determination ($adjR^2$), bias factor (BF), accuracy factor (AF), corrected AICc (Akaike Information Criterion), Bayesian Information Criterion (BIC) and Hannan–Quinn information criterion (HQC) showed that the Pseudo-2nd order model is the best model. Kinetic analysis using the Pseudo-2nd order model gave a value of equilibrium sorption capacity q_e for 0.01 g per L adsorbent of 488.16 mg g⁻¹ (95% confidence interval from 463.68 to 512.64) and a value of the Pseudo-2nd-order rate constant, k_2 of 0.00019 (95% confidence interval from 0.00010 to 0.00027) while the equilibrium sorption capacity q_e for 0.002 g per L adsorbent of 2403.61 mg g⁻¹ (95% confidence interval from 2313.99 to 2493.22) and a value of the Pseudo-2nd-order rate constant, k_2 of 0.000043 (95% confidence interval from 0.000027 to 0.000059). These calculated values will be very useful in designing effective sorption experiment and understanding the limitations of the system developed.

Keyword: Biosorption; Polybrominated Diphenyl Ether; Kinetics; coconut leaves powder; Pseudo-2nd order