Modelling the Kinetics of Tartrazine Sorption by Bottom Ash

ABSTRACT

Bottom ash is the solid residue left over from municipal waste combustion or incineration in a Municipal Waste Incineration Furnace. Its use as a sorption agent, particularly for dye sorption, is a new and important application. Linearized adsorption kinetics has drawbacks such as inaccurate representation of the parameters' 95 percent confidence interval output, unbalanced attention to potential outliers, and magnification of errors may result in inaccurate parameter values. In this study, we used nonlinear regression to investigate 16 adsorption kinetics models of tartrazine by bottom ash. The pseudo-second order was the best model based on the Bias and Accuracy factor near unity, but based on other error function analysis, this model performs equally well with the exponential and fractal-like pseudo-second order based other error functions such as Root-Mean-Square Error (RMSE), adjusted coefficient of determination (adjR2), Marquardt's percent standard deviation (MPSD), Bayesian Information Criterion (BIC), HannanQuinn Information Criterion (HQC), and especially the corrected Akaike Information Criterion (AICc) function as the absolute difference is 5 absolute unit making discriminatory activity difficult. Furthermore, because the pseudo-second order and exponential models have only two parameters, they are less complicated according to Occam's razor. Because the pseudo-second order model is more popular and has more applications than the less well-known exponential model, we chose it as the best model for tartrazine sorption to bottom ash. Kinetic analysis using the PSO model gave a value of equilibrium adsorption capacity, qe of 21.88 mg g-1 (95% confidence interval (C.I.), 20.93 to 22.84) and k2 (g/(mg.sec)) of 0.00002 (95%, C.I., 0.00001 to 0.00002)