

Isothermal modelling of the adsorption of glyphosate onto palm oil fronds activated carbon

ABSTRACT

Glyphosate is a heavily usage herbicide in Malaysia. It inhibits amino acids synthesis in plants and microorganisms with the latter inhibition makes it difficult to find biodegradation microorganism as a bioremediation agent for this pesticide. One candidate for bioremediation is biosorption that has several positive aspects which include low operating expenses, very efficient detoxification of toxicants at low concentrations, low amount of disposal materials and does not need nutrient requirements as in bacterial-based remediation, the latter of which is limited by the presence of heavy metals and other toxicants. The biosorption of glyphosate on palm oil fronds activated carbon can be an efficient and low-cost tool for remediation of glyphosate. The absorption kinetics data of biosorption isotherm on the biosorption of glyphosate on oil palm fronds activated carbon were analyzed using modelled according to various models ranging from one to five parameters models such as Henry, Langmuir, Dubinin-Radushkevich, Freundlich, BET, Toth, Sips, Fritz-Schlunder IV, Baudu and Fritz-Schlunder V, and fitted using non-linear regression. Only the Henry, Langmuir, Freundlich, BET and Toth models can fit the data. Statistical analysis based on root-mean-square error (RMSE), adjusted coefficient of determination ($\text{adj}R^2$), bias factor (BF), accuracy factor (AF), corrected AICc (Akaike Information Criterion) showed that the Langmuir model is the best model. The calculated Langmuir parameters b_L value of 0.002 L/mg (95% confidence interval from 0.001 to 0.004) and q_{mL} value of 255.5 mg/g (95% confidence interval from 160.90 to 350.11).

Keyword: Biosorption; Glyphosate; Isotherm; Langmuir; Palm oil fronds activated carbon