Optimization of adsorption conditions using response surface methodology for glyphosate removal from river water matrices by granular activated carbon

ABSTRACT

Granular activated carbon (GAC) was investigated as an effective adsorbent for the adsorption of glyphosate herbicide from the river water matrix. Six physiochemical factors were screened using a Plackett-Burman fractional factorial design to identify the most important variables in the glyphosate adsorption process.Subsequently, the synergistic effects between the four independent variables studied including the pH of glyphosate solution (4.0 –8.0), adsorbent dose (0.1–0.5 $g.L^{-1}$), initial glyphosate concentration (30 –150 mg L^{-1}) and agitation speed (0-100 rpm) on the glyphosate removal efficiency (%) were statistically optimized according to the Box-Behnken approach. Quadratic model was considered to be the best fit with a maximum R2 value of 0.9650 and provides an ideal relationship between the variables and response. An analysis of variance (ANOVA) further confirms the validity of the suggested model. The optimal factors for 95.11 ± 0.77% glyphosate removal were predicted to be a pH solution of 4.00, glyphosate initial concentration of 48.47 $mg.L^{-1}$, 0.1$g.L^{-1}$ GAC and without agitation. The findings showed that the Box-Behnken-based optimization using response surface methodology is a helpful tool for determining the best adsorption conditions and the method can also be customised for glyphosate treatment in natural water or actual wastewater.