

Uptake of Indosol Dark-blue GL dye from aqueous solution by water hyacinth roots powder: adsorption and desorption study

Md. M. R. Khan · M. Z. B. Mukhlis ·
M. S. I. Mazumder · K. Ferdous · D. M. R. Prasad ·
Z. Hassan

Abstract Adsorption characteristics of water hyacinth roots powder for the removal of Indosol Dark-blue GL dye were investigated in batch mode. Operating variables, such as initial solution pH, presence of detergent, adsorbent dosage, initial concentration and contact time, were studied. The results showed that the adsorption of dye increased with increasing the initial concentration and contact time. The adsorption is highly pH dependent and adsorption capacity increased with decrease in pH. Kinetic study revealed that the uptake of Indosol Dark-blue GL was very rapid within the first 15 min and equilibrium time was independent of initial concentration. Batch equilibrium experiments were carried out at different pH and found that equilibrium data fitted well to Langmuir isotherm model. The maximum sorption capacity of the adsorbent was found as 86 mg g^{-1} at pH 3 which reduced to 64 mg g^{-1} at pH 5. The presence of detergent reduced the sorption capacity of the adsorbent significantly. Using equilibrium and kinetic data, the forward and backward rate constants

were determined from the unified approach model. Desorption study revealed that the dye can be recovered by swing the pH from low to high.

Keywords Water hyacinth roots powder · Langmuir model · Unified approach model · Detergent · Indosol Dark-blue GL

Md. M. R. Khan (✉) · M. Z. B. Mukhlis · M. S. I. Mazumder
Department of Chemical Engineering and Polymer Science,
Shahjalal University of Science and Technology,
Sylhet 3114, Bangladesh
e-mail: mrkhancep@yahoo.com

K. Ferdous
Centre for Environmental Process Engineering, Shahjalal
University of Science and Technology, Sylhet 3114, Bangladesh

D. M. R. Prasad
Faculty of Chemical and Natural Resources Engineering,
Universiti Malaysia Pahang, Gambang, 26300 Kuantan, Pahang,
Malaysia

Z. Hassan
Faculty of Chemical Engineering, Universiti Teknologi MARA,
40450 Shah Alam, Selangor, Malaysia