



Performance and mechanism of removal of atrazine pesticide from aqueous media utilizing pumpkin seeds shell powder

Atta ul Haq*, Muhammad Saeed, Muhammad Usman, Majid Muneer, Tahir Maqbool, Muhammad Kaleem Khan Khosa, Nasir Abbas

Department of Chemistry, Government College University Faisalabad, Pakistan, email: attaulhaq@gcuf.edu.pk (A.U. Haq), msaeed@gcuf.edu.pk (M. Saeed), musman@gcuf.edu.pk (M. Usman), majid.chemist@yahoo.com (M. Muneer), drtahirmaqbool@gcuf.edu.pk (T. Maqbool), mkaleemkhosa@gcuf.edu.pk (M.K.K. Khosa), nasirmalhi38.na@gmail.com (N. Abbas)

Received 20 November 2018; Accepted 27 March 2019

ABSTRACT

The present study was focused on the removal of atrazine pesticide from aqueous media employing pumpkin seeds shell powder (PSSP) in batch mode of experiments. This removal study was performed considering the effect of pH, time of contact, dosage of sorbent, initial pesticide concentration and temperature. Characterizations of PSSP were performed before and after removal study using SEM, EDX, FTIR and surface area analyzer. The pH study indicates that optimum pH for the removal of atrazine from aqueous media was 3.0. The best fit kinetic model among pseudo first order, pseudo second order, Elovich, intra particle and liquid film diffusion was pseudo second order due to the highest R^2 and the proximity between the values of experimental and calculated sorption capacity of this model. The adsorptive characteristic of atrazine onto PSSP was evaluated using Freundlich, Langmuir, Temkin and Dubinin–Radushkevich isotherms and demonstrates that the data fitted excellently into Langmuir isotherm due to high R^2 value. Langmuir isotherm was also used to find out the maximum sorption capacity of PSSP for atrazine and was found to be 74.62 mg g^{-1} . Thermodynamic study of the removal of atrazine implies that atrazine removal onto PSSP was spontaneous and exothermic process. It may be deduced from these findings that pumpkin seeds shell is an inexpensive, eco-friendly and promising biosorbent for the removal of pollutants from wastewater.

Keywords: Atrazine; Pumpkin seeds shell powder; Kinetics; Equilibrium; Thermodynamics

*Corresponding author.