Optimization of activated carbon preparation conditions from *Prosopis africana* seed hulls for the removal of 2,4,6-Trichlorophenol from aqueous solution

Zaharaddeen N. Garba\textsuperscript{a,b}, Afidah Abdul Rahim\textsuperscript{a,*}

\textsuperscript{a}School of Chemical Sciences, Universiti Sains Malaysia, 11800 Penang, Malaysia, email: dinigetso2000@gmail.com (Z.N. Garba), Tel. +60 46533888; Fax: +60 46574854; email: afidah@usm.my (A.A. Rahim)

\textsuperscript{b}Department of Chemistry, Ahmadu Bello University, P.M.B. 1044, Zaria, Nigeria

Received 31 December 2013; Accepted 2 September 2014

\textbf{ABSTRACT}

Optimum conditions for activated carbon preparation from *Prosopis africana* seed hulls (PASH) were investigated for the removal of 2,4,6-Trichlorophenol (2,4,6-TCP) by employing central composite design (CCD) to study the effects of three preparation variables which were activation temperature, activation time, and impregnation ratio (IR) on 2,4,6-TCP percentage removal and PASH-derived activated carbon yield (PASH-AC yield). Based on the CCD, a quadratic model and a two-factor interaction model were developed for 2,4,6-TCP removal and PASH-AC yield, respectively. The optimum conditions for preparing activated carbon from PASH for the removal of 2,4,6-TCP were found as follows: activation temperature of 800 disorder C, activation time of 58 min, and IR of 2.70, which resulted into 93.64\% of 2,4,6-TCP removal and 22.13\% of PASH-AC yield. The experimental results obtained agreed satisfactorily with the model predictions. The optimum activated carbon was mesoporous with BET surface area, micropore volume, total pore volume and average size of 1,071.89 m\(^2\)/g, 0.35 cm\(^3\)/g, 0.46 cm\(^3\)/g, and 3.19 nm, respectively. The surface morphology and elemental composition of the activated carbon were determined by scanning electron microscopy and electron dispersive X-ray, respectively.

\textit{Keywords}: *Prosopis africana* seed hulls; Activated carbon; Response surface methodology; 2,4,6-Trichlorophenol; Adsorption