

## Preparation of controlled porosity activated carbon from walnut shell for phenol adsorption

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### ABSTRACT

Phenol and its derivatives constitute widespread water pollutants. They have been found to accelerate tumor formation, cancer, and mutation. In this paper, walnut shell residue has been used as a raw material in preparation of powder activated carbon by the method of chemical activation with zinc chloride for the adsorption of phenol from dilute aqueous solutions. The influence of the mass impregnation ratio ( $R = \text{ZnCl}_2/\text{walnut shell}$ ) and physical activation by the  $\text{CO}_2$  stream on the physical and chemical properties of the prepared carbons was examined. The effects of main parameters such as contact time ( $t$ ), initial phenol concentration ( $C_0$ ), and solution's pH were studied on phenol adsorption. The maximum uptake of phenol at  $25^\circ\text{C}$  was  $214 \text{ mg g}^{-1}$  at pH near phenol  $\text{p}K_a$  and  $C_0 = 1,000 \text{ mg L}^{-1}$ . All data were fitted well with Langmuir isotherm, but after  $\text{CO}_2$  modification, deviation from Langmuir shows that both physical and chemical adsorption occurred during adsorption. The kinetic data were fitted to different models such as pseudo-first-order, pseudo-second-order, and diffusion model. Pseudo-second-order model has been chosen as the best model. In overall, walnut shell shows excellent adaptive characteristics for the removal of phenol and appears as a very promising sorbent due to its high uptake capacity and to its low cost.

*Keywords:* Adsorption; Activated carbon; Walnut shell; Phenol

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