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# Optimized adsorption of 4-chlorophenol onto activated carbon derived from milk vetch utilizing response surface methodology

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ABSTRACT

In the present study, the adsorption of 4-chlrorophenol (4-CP) from aqueous solutions was investigated using activated carbon prepared from milk vetch. Scanning electron microscopy, Brunauer–Emmett–Teller, and Fourier transform infrared were carried out to characterize as-prepared activated carbon. The adsorption process was optimized by response surface methodology based on central composite design. Accordingly, a 4-CP removal of 89.52% was obtained with a reaction time of 49 min, initial 4-CP concentration of 56 mg/L, adsorbent dosage of 1 g/L, and initial pH of 7. Among various operational parameters, the adsorbent dosage ($F$-value = 139.5) produced the largest effect on 4-CP removal (%), while initial pH ($F$-value = 0.620) presented the lowest effect. The pseudo-second-order kinetic equation described the process reasonably well ($R^2$ = 0.9996). The process followed Langmuir isotherm ($R^2$ = 0.9969) with a maximum adsorption capacity of about 87 mg/g. For chemical regeneration, during three-stage regeneration runs, the removal efficiency (%) of 4-CP decreased from 87.45 to 61.15%, while, in the case of thermal regeneration, it decreased from 87.45 to 77.68%, respectively. Overall, activated carbon derived from milk vetch can be applied as an efficient adsorbent for sequestering 4-CP from aqueous phase with relatively high reusability potential.

*Keywords:* Adsorption; Phenolic compounds; Precursor; Activated carbon; Experimental design

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