



## Adsorptive removal of phenol from coke-oven wastewater using Gondwana shale, India: experiment, modeling and optimization

Koushik Sadhu<sup>a</sup>, Ankita Mukherjee<sup>a</sup>, Surya Kumar Shukla<sup>b</sup>, Kalyan Adhikari<sup>a</sup>,  
Susmita Dutta<sup>b,\*</sup>

<sup>a</sup>Department of Earth and Environmental Studies, National Institute of Technology, Durgapur 713209, India

<sup>b</sup>Department of Chemical Engineering, National Institute of Technology, Durgapur 713209, India

Tel. +91 9434788120; Fax: +91 343 2547375; email: susmita\_che@yahoo.com

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### ABSTRACT

The aim of this study is to explore the effectiveness of Gondwana shale for the removal of phenol from coke-oven wastewater. The phenol concentration in coke-oven plant effluent varies from 2 mg/L to 10 mg/L depending on the extent of final treatment in the effluent treatment plant. Kinetics of the removal of phenol from industrial effluent having different initial phenol concentration using Gondwana shale has been studied in a batch contactor by varying different parameters. Morris Webber model has been found to fit the kinetic data. Langmuir isotherm model has been found to fit the equilibrium data with  $R^2$  value of 0.986 and adsorption capacity  $q^0$  of  $0.0334 \text{ mg g}^{-1}$ . Response surface methodology has been employed to optimize the removal condition of phenol using shale. The spent shale obtained by removing phenol at optimum condition is used for recovery study. Finally, to see whether the shale is efficient with much higher concentration of phenol, it is contacted with untreated industrial wastewater coming directly from coke-oven battery in a batch contactor. 74.11% removal has been obtained after 24 h when 100 ml of industrial wastewater having phenol concentration of 476.24 mg/L was contacted with 50 g shale at pH 9.3.

*Keywords:* Adsorption; Response surface methodology; Coke-oven wastewater; Phenol; Gondwana shale

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\*Corresponding author.