



## Simultaneous sorption of 4-nitrophenol and 2-nitrophenol on a hybrid geocomposite based on surfactant-modified pillared-clay and activated carbon



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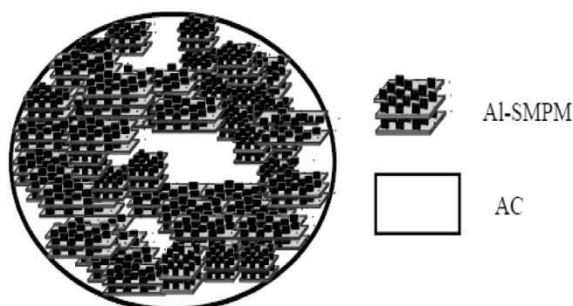
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### HIGHLIGHTS

- Solids are produced from surfactant-modified pillared clay and activated carbon.
- These mesoporous sorbents prove to be efficient for both 2- and 4-nitrophenol.
- According to the Freundlich model, sorption capacities increase as pH decreases.
- Binary mixture sorption is modeled using an extended Freundlich model.
- Competing sorption effects are displayed in binary mixtures of 2NP and 4NP.

### GRAPHICAL ABSTRACT

These mesoporous hybrid sorbents prove to be efficient for both 2- and 4-nitrophenol; competing sorption effects are displayed in binary mixtures, they are modeled using an extended Freundlich model.



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### ABSTRACT

New generations of hydrophobic composite geomaterials intended to sorb certain hazardous wastes are assembled by mixing surfactant-modified aluminum-pillared montmorillonite (Al-SMPM) with activated carbon (AC). The sorption of 4-nitrophenol (4NP) and 2-nitrophenol (2NP) on these sorbents was studied in both single and binary component systems from aqueous solutions using batch tests. Results showed the efficiency of these composite sorbents relative to the two phenolic compounds, with a dominant contribution from Al-SMPM. In single-component systems, sorption isotherms of 4NP and 2NP as a function of pH were analyzed with the Freundlich equation, whose statistical interpretation was also developed. Sorption capacities sharply decreased when the solution pH value was raised from 3 to 9. In binary-component systems, the fit between measured and predicted simultaneous sorption capacities of both 4NP and 2NP indicated that the Sheindorf–Rebhun–Sheintuch model, an extended Freundlich model, is fully applicable. The 2NP favorably influences the sorption of 4NP. The synergistic effect between these two nitrophenol compounds has been confirmed by the higher competition coefficients, which increase with increasing pH. A number of hypotheses, based on the Abraham's solvation parameters model, have been advanced to discuss this mechanism.

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