

## Adsorptive removal of methyl orange from aqueous solution by hydrotalcite derived catalysts

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### ABSTRACT

The objective of our work is to study the adsorption of methyl orange dye over  $\text{ZnAl}_2\text{O}_4$  and  $\text{ZnO-ZnAl}_2\text{O}_4$  derived from hydrotalcite in order to highlight their potential as low-cost adsorbents for the treatment of water. The materials  $\text{ZnAl}_2$ ,  $\text{Zn}_2\text{Al}$  were synthesized *via* co-precipitation method and were characterized using various characterization techniques, which showed that the obtained materials corresponds to the compounds of hydrotalcite. Different parameters were studied to optimize the process of methyl orange removal on samples derived from hydrotalcite, including the mass of the adsorbent, the contact time, the concentration, and pH. On the other hand, adsorption isotherms were studied using Langmuir and Freundlich models, as well as the effect of these solids on thermodynamic quantities. According to the results obtained, the  $\text{ZnO-ZnAl}_2\text{O}_4$  has the greatest adsorption capacity compared to the  $\text{ZnAl}_2\text{O}_4$ . The interaction of these materials with the dye shows that the adsorption kinetics are fast and follows a second-order adsorption rate expression. The maximum adsorption capacity determined by the Langmuir mathematical model is about 62.85 mg/g for  $\text{ZnO-ZnAl}_2\text{O}_4$  and 46.24 mg/g for  $\text{ZnAl}_2\text{O}_4$  and the thermodynamic study led to the conclusion that the adsorption is endothermic and that the adsorption process is spontaneous.

*Keywords:* Adsorption isotherms;  $\text{ZnO-ZnAl}_2\text{O}_4$ ; Hydrotalcite; Methyl orange; Co-precipitation

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