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## Cobalt-Modified NiFe Layered Double Hydroxides for Catalytic Reduction of 4-Nitrophenol

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### Highlights

Layered double hydroxides containing different amounts of cobalt were synthesized. LDH was employed in the catalytic reduction of 4-nitrophenol. Increased cobalt content enhanced the catalytic performance.

### Resumo/Abstract

One of the current environmental pollution problems is the wastewater contamination by toxic organic compounds, among which nitrobenzene derivatives are of special concern<sup>1</sup>. Therefore, it is necessary to develop technologies capable of degrading these persistent contaminants, since conventional treatments are often ineffective. One approach for degrading these compounds is catalytic reduction using sodium borohydride to produce anilines, which are less toxic and widely used in industry, particularly in the pharmaceutical sector. However, such catalysts are typically based on noble metals. Thus, synthesizing catalysts based on more readily available metals is particularly interesting. Among these, layered double hydroxides (LDHs) have shown significant potential and have been widely explored by researchers. These materials consist of layers containing two cations and intercalated hydrated anions<sup>2</sup>. Thus, in this work NiFe LDHs with different amounts of cobalt (Co), NiFeCo<sub>1</sub> LDH, and NiFeCo<sub>2</sub> LDH, were synthesized using a hydrothermal methodology<sup>3</sup>. The materials were applied in the reduction of 4-nitrophenol to 4-aminophenol, using sodium borohydride (NaBH<sub>4</sub>) as the reducing agent. Kinetic studies were conducted to evaluate the reaction rates, indicating that NiFeCo<sub>2</sub> exhibited a higher rate constant,  $k$ , ( $k = 1.05904 \pm 0.03646 \text{ min}^{-1}$ ) than NiFeCo<sub>1</sub> LDH ( $k = 0.61004 \pm 0.0198 \text{ min}^{-1}$ ), suggesting that the higher the cobalt content, the higher the reaction rate. Additionally, the resulting materials exhibited magnetic properties, facilitating their separation and reuse. Overall, the materials showed good performance in the catalytic reduction of 4-nitrophenol, indicating potential to be used in the degradation of nitroarenes.

#### References

<sup>1</sup>CAVALOTTI, L. F. R. *et al.* **Química Nova**, v. 32, p. 1504-1508, 2009.<sup>2</sup>VELÁZQUEZ-HERRERA, F. D. *et al.* **MethodsX**, v. 13, 2024.<sup>3</sup>SUN, Z. *et al.* **Journal of the American Chemical Society**, v. 144, p. 8204-8213, 2022.

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