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# Cr (VI) Adsorption on Ce0.25Zr0.75O2.nH2O-Kinetics and Thermodynamics

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**Abstract :** Hexavalent chromium, Cr (VI) is present in the effluents from different industries such as electroplating, mining, leather tanning, etc. This compound is of great academic and industrial concern because of its toxic and carcinogenic behavior. Its dumping to both environmental and public health for animals and humans causes serious problems in water sources. The amount of Cr (VI) in industrial wastewaters ranges from 0.5 to 270,000 mgL-1. According to the Colombian standard for water quality (NTC-813-2010), the maximum allowed concentration for the Cr (VI) in drinking water is 0.05 mg L-1. To comply with this limit, it is essential that industries treat their effluent to reduce the Cr (VI) to acceptable levels. Numerous methods have been reported for the treatment removing metal ions from aqueous solutions such as: reduction, ion exchange, electrodialysis, etc. Adsorption has become a promising method for the purification of metal ions in water, since its application corresponds with an economic and efficient technology. The absorbent selection and the kinetic and thermodynamic study of the adsorption conditions are key to the development of a suitable adsorption technology. The Ce0.25Zr0.75O2.nH2O presents higher adsorption capacity between a series of hydrated mixed oxides Ce1-xZrxO2 (x = 0, 0.25, 0.5, 0.75, 1). This work presents the kinetic and thermodynamic study of Cr (VI) adsorption on Ce0.25Zr0.75O2.nH2O. Experiments were performed under the following experimental conditions: initial Cr (VI) concentration = 25, 50 and 100 mgL-1, pH = 2, adsorbent charge = 4 gL-1, stirring time = 60 min, temperature=20, 28 and 40 °C. The Cr (VI) concentration was spectrophotometrically estimated by the method of difenilcarbazide with monitoring the absorbance at 540 nm. The Cr (VI) adsorption over hydrated Ce0.25Zr0.75O2.nH2O models was analyzed using pseudo-first and pseudo-second order kinetics. The Langmuir and Freundlich models were used to model the experimental data. The convergence between the experimental values and those predicted by the model, is expressed as a linear regression correlation coefficient (R2) and was employed as the model selection criterion. The adsorption process followed the pseudo-second order kinetic model and obeyed the Langmuir isotherm model. The thermodynamic parameters were calculated as: ΔH°=9.04 kJmol-1,ΔS°=0.03 kJmol-1 K-1, ΔG°=-0.35 kJmol-1 and indicated the endothermic and spontaneous nature of the adsorption process, governed by physisorption interactions.

**Keywords :** adsorption, hexavalent chromium, kinetics, thermodynamics
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