

## Facile synthesis and characterization of $\beta$ -Cd (OH)<sub>2</sub> nanostructures for adsorptive removal of Cr (VI) ions from wastewater: a statistical approach for multivariate sorption optimization

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### Abstract

In the present study, nanostructured  $\beta$ -Cd(OH)<sub>2</sub> adsorbent was synthesized, characterized by Fourier-transform infrared spectroscopy, X-ray diffraction and scanning electron microscopy analysis, and applied for Cr (VI) ions capturing (adsorption) from environmental aqueous samples. The central composite design of 18 adsorption experiments was employed for multivariate sorption optimization. Maximum adsorption (%) of Cr (VI) ions was calculated and found to be 98.5% with relative standard deviation (RSD)  $\leq$  3.5 at optimum concentration 15 mg L<sup>-1</sup>, pH 4.0, adsorbent dosage 50 mg, shaking time 20 min and shaking speed 120 rpm at 25°C. Langmuir, Freundlich and Dubinin–Radushkevich isotherms fitted well to adsorption data with correlation coefficient (R<sup>2</sup>) of 0.993, 0.982 and 0.994, respectively. Monolayered (Q<sub>m</sub>) and multi-layered (K<sub>f</sub>) capacities of  $\beta$ -Cd (OH)<sub>2</sub> adsorbent for Cr(VI) ions retention were calculated and found to be 202.02  $\pm$  2.0 and 4.95  $\pm$  2.5 mg g<sup>-1</sup>, respectively. Sorption energy was calculated and found to be 8.45  $\pm$  2.0 kJ mol<sup>-1</sup>, indicated chemisorption or ion exchange mechanism for Cr (VI) ions adsorption onto  $\beta$ -Cd (OH)<sub>2</sub> adsorbent.

Keywords:  $\beta$ -Cd (OH)<sub>2</sub> nanostructures; Adsorption; Cr (VI) ions; Equilibrium; Analysis of variance.

### Biography

Abdeen Ali Nawaz Siyal is assistant professor of chemistry at University of Sindh, Pakistan. He completed his Ph.D in 2014.



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