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Removal of fluoride from water using composite of GO: Optimization of process variables through RSM

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Although, the presence of fluoride in the drinking water under a certain limit (<1 mg/L) is beneficial for normal human health, fluoride concentration above 1 mg/L in drinking water can cause deleterious effects leading to dental and skeletal fluorosis, brittle bones, osteoporosis and arthritis. Therefore the removal of excess fluoride from drinking water is a matter of scientific concern. In connection to this, the potential use of rGO/ZrO_2 nanocomposite for the removal of fluoride from water was investigated. The rGO/ZrO_2 nanocomposite was prepared by hydrothermal method and characterized by various instrumental techniques such as FT-IR, XRD, SEM, EDX, TGA, XPS, Raman spectroscopy and BET surface area measurement. Then rGO/ZrO_2 was used as an adsorbent for the removal of fluoride from water. The process variables viz. rGO/ZrO_2 dose, initial fluoride concentration, temperature and pH were optimized using response surface methodology (RSM) in which the multiple regression analysis was conducted with the help of central composite design. The regression analysis showed good agreement with the experimental data having $R^2=0.94$. Maximum percentage removal of fluoride was found to be 97% at predicted optimum values of process variables viz, rGO/ZrO_2 dose 0.63 g/L, initial fluoride concentration 37.6 mg/L, temperature 33°C and pH 5.8. The Langmuir isotherm was found suitable which predicted the uptake capacity to be 59.62 mg/g. The experimental data followed the pseudo-second-order kinetic model and the process was found thermodynamically spontaneous and endothermic in nature.

Biography

Syed Hadi Hasan is a full time Professor in the Department of Chemistry, Indian Institute of Technology (BHU), Varanasi, India. He has guided 6 PhDs and 20 MTech dissertations and published approximately 100 papers in international journals. He has also published several book chapters and monographs and delivered talks in many national and international conferences. He has expertise in the field of removal of heavy metals from water, Nanotechnology, Enzyme technology, colorimetric sensing of heavy metals.

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