**Assessing uranium contamination in groundwater of North-East Punjab: Spatial and vertical distribution and extraction using NdFeO3**

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**Abstract**

High prevalence of uranium in groundwater and corresponded potential health hazards to human population of north-east Punjab, India is presently a matter of great concern, as the groundwater is a major source of drinking water for human consumption as well as irrigation. So, the current integrated study was carried out to understand the spatial and vertical distribution of uranium and its remediation using NdFeO3. In this study, in comparison to the samples from deeper aquifers, high prevalence (surpassing WHO limit 30 µg/L in drinking water) of uranium was observed in groundwater samples collected from shallow depth (< 200 ft) and mean uranium concentration has been observed is 33.98 µg/L. Approximately 13% of groundwater samples had uranium concentrations above the WHO (2011) recommendation of 30 µg/L. For the remediation of U(VI), NdFeO3 was synthesized using sol gel method and shown optimal performance under the following adsorption parameters: pH (7), adsorbent dosage (0.4 g/L), and contact period (30 min). The maximum Langmuir adsorption capacity of NdFeO3 was 56.68 mg/g observed and primarily accomplished through monolayer chemisorption and electrostatic interactions. The potential of NdFeO3 as a key filling component in columns used in water filtration systems was explored for practical application and successfully utilized for treatment of high prevalent groundwater samples from north-east Punjab, India.