

RENUKA VERMA

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ACADEMIC DETAILS

Indian Institute of Technology Roorkee, Roorkee, India

Ph.D. in Civil Engineering (Environmental Engineering), 2022

Dissertation: Investigation & Synthesis of High Capacity Adsorbents for Trace Removal of Cr(VI) from Water

Supervisor: Dr. Sudipta Sarkar

This work investigated the mechanism of highly efficient removal of trace Cr(VI) by a weak base anion exchanger called Duolite A7. The results revealed that in addition to ion exchange, redox reactions were also taking place inside the resin, where Cr(VI) oxidized the amine functional groups as well as the phenol-formaldehyde matrix, while itself getting reduced to Cr(III). Cr(III) formed was either precipitated inside the resin as Cr(OH)₃ or formed complexes with carboxylic acid groups which were formed as a result of oxidation inside the resin. By-product analysis showed that formaldehyde, a human carcinogen, is released in the effluent due to oxidative attack of Cr(VI) on the resin. An attempt was also made to have a more insightful investigation of the adsorption-coupled redox reaction mechanism of Cr(VI) with a lignocellulosic material, coconut husk, since elucidation of the mechanism would help open up a new paradigm for the design of a special class of redox-active sorbents with high Cr(VI) removal capacity for effective remediation of Cr(VI) contaminated water. Motivated by the impressive Cr(VI) removal performance of Duolite A7 resin which was achieved due to the phenomenon of redox-active ion exchange, a redox-active adsorbent called PS-7 was synthesized by immobilizing polyethylenimine (PEI) polymer on the surface of a hydrophobic substrate. The composite material was validated through a series of batch and fixed-bed column studies, and the removal mechanism was established through extensive characterization.

Indian Institute of Technology Roorkee, Roorkee, India

M.Tech. in Civil Engineering (Environmental Engineering), 2015

Thesis: Preparation of Solid Fertilizers from Secondary Treated Wastewater

G.P.A.: 8.015

Jamia Millia Islamia, Delhi, India

B.Tech. in Civil Engineering, 2013

G.P.A.: 9.43

PROFESSIONAL APPOINTMENTS

- 1) Guest Faculty (on contract), Civil Engineering Department, **Dr B R Ambedkar National Institute of Technology Jalandhar**
 - **Teaching:** 03 Aug 2022 – 20 Jan 2023
 - **Courses engaged:** Smart Cities (BTech IV year)
 - Environmental Risk Assessment (MTech I year)
 - Advanced Water & Wastewater Laboratory (MTech I year)
- 2) Assistant Professor (Full time), Department of Civil & Infrastructure Engineering, **Indian Institute of Technology Jodhpur:** 10 April 2023 – 07 July 2023
- 3) Assistant Professor (Full time), Department of Environmental Science & Engineering, **Indian Institute of Technology Bombay:** 10 July 2023 – Present

RESEARCH INTERESTS

- Water and Wastewater Treatment
- Nutrient recovery from Wastewater
- Ion Exchange, Adsorption, and Reactive Sorption processes
- Material synthesis for Water/Wastewater remediation

RESEARCH CONTRIBUTION

LIST OF JOURNAL PUBLICATIONS

1. Verma, R., Sarkar, S., 2020. Trace Cr(VI) Removal: Evidence of redox-active ion exchange by a weak base anion exchanger. *Ind. Eng. Chem. Res.* 59, 21187-21195.
2. Verma, R., Maji, P.K., Sarkar, S., 2021. Comprehensive investigation of the mechanism for Cr(VI) removal from contaminated water using coconut husk as a biosorbent, *J. Clean. Prod.* 314, 128117.
3. Verma, R., Maji, P.K., Sarkar, S., 2021. Synthesis and validation of polystyrene-based polyethylenimine composite for Cr(VI) removal from aqueous solution: Performance and mechanism, *J. Environ. Chem. Eng.* 10, 107119.
4. Verma, R., Maji, P.K., Sarkar, S., 2022. Detailed Investigation of Effective Trace Cr(VI) Removal Mechanism by Anion Exchange Resin with Phenol-Formaldehyde Matrix, *J. Ind. Eng. Chem.* 111, 147-154.
5. Verma, R., Maji, P.K., Sarkar, S. Removal of hexavalent chromium from impaired water: Polyethylenimine-based adsorbents - A review, *J. Environ. Chem. Eng.* 11, 109598.

LIST OF PLATFORM PRESENTATIONS AT CONFERENCES

1. **Sarkar, S.,** Verma, R. “Redox-active Ion Exchange Process for Enhanced Cr(VI) Removal”, ACS Spring 2022, San Diego, California.
2. **Verma, R.,** Sarkar, S. “Reaction Mechanism for High Capacity Redox-Active Adsorbents for Selective Removal of Trace Hexavalent Chromium from Drinking Water”, Second ASCE India Conference on Challenges of Resilient and Sustainable Infrastructure Development in Emerging Economies (CRSIDE 2020), Kolkata, India. (ISBN: 978-93-5396-500-6)
3. **Verma, R.,** Sarkar, S. “Investigation of Cr(VI) Removal Mechanism by Coconut Husk”, IWA Water and Development Congress & Exhibition 2019, Colombo, Sri Lanka.
4. **Verma, R.,** Sarkar, S. “Selective Removal of Trace Hexavalent Chromium by New Class of Redox-Active Adsorbents from Drinking Water”, IWA Water and Development Congress & Exhibition 2019, Colombo, Sri Lanka.
5. **Verma, R.,** Sarkar, S. “Selective Removal of Trace Hexavalent Chromium by New Class of Redox-Active Adsorbents”, International Conference on “Innovative Trends in Civil Engineering for Sustainable Development (ITCSD-2019), NIT Warangal, India.
6. **Verma, R.,** Sarkar, S. “High capacity adsorbents for trace Cr(VI) removal from drinking water”, IWA Regional Conference on Opportunities for Water Reuse in Southeast Asia (Water Reuse 2018), Phuket, Thailand.
7. **Verma, R.,** Sarkar, S. “Investigation of Cr(VI) removal mechanism by different ion exchange resins”, International Conference on Waste Management “RECYCLE 2018”, IIT Guwahati, India. **(Received Best Paper Award)**
8. **Verma, R.,** Sarkar, S. “Reductive removal of Cr(VI) from drinking water”, International Conference on Sustainable Technologies for Intelligent Water Management 2018, organized by IWRS and IIT Roorkee, India.
9. **Verma, R.,** Sarkar, S. “Novel ion exchange assisted redox process for trace Cr(VI) removal”, XI World Aqua Congress (International Conference) 2017, New Delhi, India.
10. **Verma, R.,** Sarkar, S. “Preparation of solid fertilizer from secondary treated wastewater”, International Conference on Waste Management “RECYCLE 2016”, IIT Guwahati, India.

LIST OF POSTER PRESENTATIONS AT CONFERENCES

1. **Verma, R.,** Sarkar, S. “Comparative study of different resins for trace Cr(VI) removal from drinking water”, ACS on Campus 2018, IIT Roorkee, India.

HONORS AND AWARDS

- **Best Paper Award** in the “Reduce, Recycle, Remediation Concepts & Implementation Strategies” category at “**Recycle 2018**”, 2nd International Conference on Waste Management, held in IIT Guwahati, India.