DR. NITIN KHANDELWAL

Assistant Professor, Department of Hydrology
Indian Institute of Technology (IIT) Roorkee
nitin.khandelwal@hy.iitr.ac.in

PROFESSIONAL EXPERIENCE

IIT Roorkee, Uttarakhand, India *(July 2023- Present)*
Assistant Professor
Department of Hydrology

Imperial College London, UK *(Mar 2023- July 2023)*
Royal Society Newton International Fellow
Department of Materials
Project: *"Nucleating redox-active iron-based nanostructures on porous substrates for developing next generation water-warriors"*

McGill University, Montreal, Canada *(Oct 2022- Feb 2023)*
Postdoctoral Researcher
Environmental Engineering Laboratory, Department of Civil Engineering
Project: *"Redox-active nanocomposites for the degradation of halogenated organic compounds"*

EDUCATION

IISER Kolkata, India
Ph.D. Earth Sciences (Jul 2022)
M.S. Earth Sciences (May 2020)
Dissertation: *"Eco-friendly Geo-nanocomposites for Achieving Aqueous Sustainability"*
Research areas: *Aqueous geochemistry, Materials nanoscience, Environmental engineering*

University of Delhi, India
B.Sc. (Hons), Geology (May 2017)
Selected coursework:

- Geochemistry
- Environmental geoscience
- Sedimentology
- Hydrogeology
- Mineralogy and Crystallography
- Isotope geology

RESEARCH PROPOSAL BASED AWARDS

1. **Newton International Fellowship 2022** (Funding awarded £1,31,250) for the project "Nucleating redox-active iron-based nanostructures on porous substrates for developing next generation water-warriors (Nano-aquacleaners)" to work with Prof. Mary Ryan, Department of Materials, Imperial College London, UK.
2. **Los Alamos National Laboratory Postdoctoral Associate** ($92000 per annum) for the project "Bentonite Erosion Under Simulated Waste Repository Geochemical Conditions: Probing Towards the Fate of Radionuclides in Deep Repositories"
3. **JSPS Postdoctoral Fellowship 2022** for the project "Mobility of radionuclides and their sequestration by nano particles under high soil-CO_2 condition (RadMobRem)" to work with Prof. Yoshio Takahashi, Department of Earth and Planetary Environmental Science, University of Tokyo
4. **Indo-US Water Advance Research and Innovation (WARI) Fellowship (2020)** for the project "Reactive transport modelling of toxic metals- iron nanocomposites interaction and application in low cost water purification" to work with Prof. Daniel Snow and Prof. Xu Li at University of Nebraska Lincoln, USA.
5. **VISION 2019 Student project grant** (Funding awarded ₹3,00,000) for the project "Modified Hydroxyapatite based adsorbents for permanent removal of Cr(VI) and other toxic metals from contaminated groundwater samples: Illustration using designed prototype barrier unit", Physical Research Laboratory (PRL), Ahmedabad, India

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OTHER RECOGNITIONS

1. Leon Peters Early Career Researcher Award #EnvChem2023
2. Prof. Sabu Thomas Best PhD thesis award 2022 (*Nanoscience and Technology*)
3. SERB-International Travel Award (2022)
4. RSC Researcher Development Grant (2021, 2022)
5. Early-career Goldschmidt conference grant (2020, 2021, 2022)
6. IPh.D. Scholar, Junior Research Fellowship, IISER Kolkata (2019-2024)
7. IPh.D. Scholar, MS Research Scholarship, IISER Kolkata (2017-2019)
8. Academic Excellence Award, RLA College, University of Delhi (2017)
9. Gold medalist (1st rank holder), University of Delhi (2017)
10. SHE INSPIRE Scholarship (2014-2019)

COMPLETED RESEARCH PROJECTS

- **"**Designing Geo-Nanocomposites for toxic pollutants remediation from natural water matrices.**"** (2017- 22)
  Advisor: Dr. Gopala Krishna Darbha, Environmental Nanoscience Laboratory, IISER Kolkata, India
- "Modified Hydroxyapatite based adsorbents for permanent removal of Cr(VI) and other toxic metals from contaminated groundwater samples: Illustration using designed prototype barrier unit." (2019-20),
  Role- Principal investigator, VISION 2019, Physical Research Laboratory (PRL), Ahmedabad
- "Geochemical speciation calculations- modelling of Adsorbate-Adsorbent interaction using PHREEQC." (2020)
  Advisor: Dr. Remi Marsac, University of Rennes-1, France
- "EXAFS study on permanent binding and crystal incorporation of toxic metal ions in novel synthesized eco-friendly phosphate minerals." (2019)
  Role- Principal investigator, Raja Raman Centre for Advanced Technology (RRCAT), Indore, India
- **"**Synthesis and characterization of Nano- hydroxyapatite powders of varying Ca/P ratio and their application in removal of Uranium from aqueous solutions." (2018)
  Advisor: Dr. Sabyasachi Rout & Dr. R.M. Tripathi, Bhabha Atomic Research Centre (BARC) Bombay, India

PUBLICATIONS *(Google Scholar)*

Patents

N. Khandelwal, N. Singh, E. Tiwari, G.K. Darbha, "Preparation of iron and zinc rich redox-active Dittmarite nanosheets- applications in simultaneous water purification and mineralizatison, and agricultural soil fertilization", *Indian Patent- 400319* (Granted).

Research Articles

Engineered Geo-nanocomposites for Environmental Applications

1. **N. Khandelwal**, N. Singh, E. Tiwari, R. Marsac, D. Schild, T. Schäfer, G. Krishna Darbha, "Varying growth behavior of redox-sensitive nanoparticles on 1:1 and 2:1 clay surfaces: Mechanistic insights on preferential toxic ions removal in mono, co, and multi-metal contaminated waters" *Chem Eng J* (2023), 461, 141883. https://doi.org/10.1016/j.cej.2023.141883
2. **N. Khandelwal**, N. Singh, E. Tiwari, G.K. Darbha, "Achieving strong Pb-Cr complexation in Mg/Al LDHs for ultrafast chromate ions separation and chrome recovery from complex water matrices" *Environmental Nanotechnology, Monitoring & Management* (2022) 18, 100754. https://doi.org/10.1016/j.enmm.2022.100754.

3. **N. Khandelwal**, J.K. Rajak, N. Singh, E. Tiwari, Z.A. Ganie, A. Choudhary, G.K. Darbha, "Continuous Filtration of Multimetal-Contaminated River Water and Groundwater Using Antioxidants Preserved Redox-Sensitive Nanocomposites: Ultrahigh Reactivity and Self-Sedimentation Possibility." *ACS Es&T Water* 2(6) (2022) 1073-1086. https://doi.org/10.1021/acsestwater.2c00046.

4. **N. Khandelwal**, G.K. Darbha, "Sorption and continuous filtration of heavy metals and radionuclides using novel nano-Farringtonite: Mechanisms delineation using EXAFS." *Chemosphere* (2022) 136376. https://doi.org/10.1016/j.chemosphere.2022.136376.

5. S. Rout, **N. Khandelwal**, A.K. Poswal, V. Pulhani, A.V. Kumar, "Inducing non-stoichiometry in nano-hydroxyapatite for ultra-fast sequestration of uranyl ions in water: mechanism delineation using XAS." *Environ Sci-Nano* 8(5) (2021) 1256-1268. https://doi.org/10.1039/d0en01246g. [Cover article]

6. J.K. Rajak, **N. Khandelwal**, M.P. Behera, E. Tiwari, N. Singh, Z.A. Ganie, G.K. Darbha, F.A. Monikh, T. Schafer, "Removal of chromate ions from leachate-contaminated groundwater samples of Khan Chandpur, India, using chitin modified iron-enriched hydroxyapatite nanocomposite." *Environ Sci Pollut R* 28(31) (2021) 41760-41771. https://doi.org/10.1007/s11356-021-13549-7.

7. **N. Khandelwal**, E. Tiwari, N. Singh, R. Marsac, T. Schafer, F.A. Monikh, G.K. Darbha, "Impact of long-term storage of various redox-sensitive supported nanocomposites on their application in removal of dyes from wastewater: Mechanisms delineation through spectroscopic investigations." *J Hazard Mater* 401 (2021). https://doi.org/10.1016/j.jhazmat.2020.123375.

8. **N. Khandelwal**, E. Tiwari, N. Singh, G.K. Darbha, "Heterogeneously Porous Multiadsorbent Clay-Biochar Surface to Support Redox-Sensitive Nanoparticles: Applications of Novel Clay-Biochar-Nanoscale Zerovalent Iron Nanotrident (C-BC-nZVI) in Continuous Water Filtration." *ACS Es&T Water* 1(3) (2021) 641-652. https://doi.org/10.1021/acsestwater.0c00147. [Cover article]

9. **N. Khandelwal**, G.K. Darbha, "A decade of exploring MXenes as aquatic cleaners: Covering a broad range of contaminants, current challenges and future trends." *Chemosphere* 279 (2021). https://doi.org/10.1016/j.chemosphere.2021.130587.

10. **N. Khandelwal**, G.K. Darbha, Combined antioxidant capped and surface supported redox-sensitive nanoparticles for continuous elimination of multi-metallic species." *Chem Commun* 57(59) (2021) 7280-7283. https://doi.org/10.1039/d1cc02972j.

11. **N. Khandelwal**, M.P. Behera, J.K. Rajak, G.K. Darbha, "Biochar-nZVI nanocomposite: optimization of grain size and Fe-0 loading, application and removal mechanism of anionic metal species from soft water, hard water and groundwater." *Clean Technol Envir* 22(5) (2020) 1015-1024. https://doi.org/10.1007/s10098-020-01846-7.

12. K. Gupta, **N. Khandelwal**, G.K. Darbha, "Removal and recovery of toxic nanosized Cerium Oxide using eco-friendly Iron Oxide Nanoparticles." *Front Env Sci Eng* 14(1) (2020). https://doi.org/10.1007/s11783-019-1194-4.

13. **N. Khandelwal**, N. Singh, E. Tiwari, G.K. Darbha, "Novel synthesis of a clay supported amorphous aluminum nanocomposite and its application in removal of hexavalent chromium from aqueous solutions." *Rsc Adv* 9(20) (2019) 11160-11169. https://doi.org/10.1039/c9ra00742c.

Micro-Nanoplastics: Environmental distribution, interaction and remediation

14. A. Choudhary, **N. Khandelwal**, N. Singh, E. Tiwari, Z.A. Ganie, G.K. Darbha, "Nanoplastics interaction with feldspar and weathering originated secondary minerals (kaolinite and gibbsite) in the riverine environment." *Science of the Total Environment* 818 (2022). https://doi.org/10.1016/j.scitotenv.2021.151831.

15. N. Singh, A. Mondal, A. Bagri, E. Tiwari, **N. Khandelwal**, F.A. Monikh, G.K. Darbha, "Characteristics and spatial distribution of microplastics in the lower Ganga River water and sediment." *Mar Pollut Bull* 163 (2021). https://doi.org/10.1016/j.marpolbul.2020.111960.

16. N. Singh, **N. Khandelwal**, E. Tiwari, N. Naskar, S. Lahiri, J. Lutzenkirchen, G.K. Darbha, "Interaction of metal oxide nanoparticles with microplastics: Impact of weathering under riverine conditions." *Water Res* 189 (2021). https://doi.org/10.1016/j.watres.2020.116622.

17. N. Singh, **N. Khandelwal**, Z.A. Ganie, E. Tiwari, G.K. Darbha, "Eco-friendly magnetic biochar: An effective trap for nanoplastics of varying surface functionality and size in the aqueous environment." *Chem Eng J* 418 (2021). https://doi.org/10.1016/j.cej.2021.129405.

18. N. Singh, J. Bhagat, E. Tiwari, **N. Khandelwal**, G.K. Darbha, S.K. Shyama, "Metal oxide nanoparticles and polycyclic aromatic hydrocarbons alter nanoplastic's stability and toxicity to zebrafish." *J Hazard Mater* 407 (2021). https://doi.org/10.1016/j.jhazmat.2020.124382.

19. Z.A. Ganie, **N. Khandelwal**, E. Tiwari, N. Singh, G.K. Darbha, "Biochar-facilitated remediation of nanoplastic contaminated water: Effect of pyrolysis temperature induced surface modifications." *J Hazard Mater* 417 (2021). https://doi.org/10.1016/j.jhazmat.2021.126096.

20. N. Singh, E. Tiwari, **N. Khandelwal**, G.K. Darbha, "Understanding the stability of nanoplastics in aqueous environments: effect of ionic strength, temperature, dissolved organic matter, clay, and heavy metals." *Environ Sci-Nano* 6(10) (2019) 2968-2976. https://doi.org/10.1039/c9en00557a. [Cover article]

21. E. Tiwari, N. Singh, **N. Khandelwal**, F.A. Monikh, G.K. Darbha, "Application of Zn/Al layered double hydroxides for the removal of nanoscale plastic debris from aqueous systems." *J Hazard Mater* 397 (2020). https://doi.org/10.1016/j.jhazmat.2020.122769.

Fate and transport of engineered nanomaterials in soils and water bodies

22. E. Tiwari, N. Singh, **N. Khandelwal**, Z.A. Ganie, A. Choudhary, F.A. Monikh, G.K. Darbha, "Impact of nanoplastic debris on the stability and transport of metal oxide nanoparticles: role of varying soil solution chemistry." *Chemosphere* 308(Pt 1) (2022) 136091. https://doi.org/10.1016/j.chemosphere.2022.136091.

23. E. Tiwari, **N. Khandelwal**, N. Singh, G.K. Darbha, "Influence of natural soil colloid's stability on transport of copper-based nanoparticles in saturated porous media." *Environmental Nanotechnology, Monitoring & Management* 17 (2022) 100633. https://doi.org/10.1016/j.enmm.2021.100633.

24. E. Tiwari, **N. Khandelwal**, N. Singh, S. Biswas, G.K. Darbha, "Effect of clay colloid - CuO nanoparticles interaction on retention of nanoparticles in different types of soils: role of clay fraction and environmental parameters." *Environ Res* 203 (2022). https://doi.org/10.1016/j.envres.2021.111885.

25. E. Tiwari, M. Mondal, N. Singh, **N. Khandelwal**, F.A. Monikh, G.K. Darbha, "Effect of the irrigation water type and other environmental parameters on CeO2 nanopesticide-clay colloid interactions." *Environ Sci-Proc Imp* 22(1) (2020) 84-94. https://doi.org/10.1039/c9em00428a. [Cover article]

SELECTED PRESENTATIONS

1. "Redox-active nanocomposites: mechanistic insights on surface-controlled water remediation" Goldschmidt2023 geochemistry conference, Lyon, France ***(Oral)***
2. "Engineered iron nanostructures on different surfaces for continuous water purification" #EnvChem2023, University of Glasgow, UK ***(Best Oral)***
3. "Nanoscale water-warriors for achieving aqueous sustainability" ICNP-2023, MG University Kottayam, India ***(Invited talk)***

4. "Antioxidants from fruits waste, innovative way to preserve redox-active nano-adsorbents for co-contaminants removal and continuous water filtration." #EnvChem2022 conference, University of York, UK ***(Oral)***
5. "Environmental Nanoscience Laboratory: at a glance." DCS day- 2022, IISER Kolkata, India ***(Invited Flash talk)***
6. "Fighting water pollution in the interdisciplinary space of geochemistry and material science." Convergence-2022, IISER Kolkata, India ***(Invited talk)***
7. "Antioxidants from fruits waste to generate super reactive redox-active nano-adsorbents: continuous filtration of polluted surface and groundwaters." Goldschmidt 2022 geochemistry conference, Hawaii ***(Oral)***
8. "Towards Sustainable Solutions for Legacy of Chromite Ore Processing Industries: An Unfortunate Global Inheritance of Polluted Soils and Groundwater Aquifers." SETAC Young Environmental Scientists (YES) meeting 2022 ***(Oral)***
9. "Antioxidant capping, a new strategy to preserve redox-sensitive nanoparticles for continuous water filtration." 2nd Commonwealth Chemistry Posters – Building Networks to Address the Goals' virtual poster event, 2021 ***(Poster)***
10. "Comparative evaluation of different remediation strategies to clean chromite ore processing residue leachate contaminated groundwaters: novel materials for aqueous sustainability." AGU Fall meeting-2021, New Orleans, LA ***(eLightning presentation)***
11. "Geo-nanocomposites for the Treatment of Chromite Ore Processing Residue Contaminated Groundwater of Khan-Chandpur Region, UP, India." International Conference on Ground Water (ICGW)-2021, India ***(Best Oral)***
12. "Fruit waste is a new warrior of water pollution: Antioxidant capping to preserve redox-active nanocomposites for continuous water filtration." #LatinXChem Twitter Conference 2021 ***(Poster)***
13. "Designing armor of water warriors using fruit waste." Nature Index paper seminar series, DES, IISER-K 2021 ***(Invited talk)***
14. "Impact of long-term open-air exposure on the reactivity of redox-sensitive nanocomposites." 15th International Conference on Materials chemistry- 2021, RSC ***(Poster)***
15. "Geochemical understanding of metallic species in the environmental matrices and strategic modifications of natural surfaces for aqueous sustainability." Goldschmidt-2021, International Geochemistry conference ***(Oral)***
16. "Combining geochemistry and material science: targeting aqueous sustainability via strategic modifications of geo-adsorbents." Geoscience research advances in India, National Seminar- 2021, University of Delhi, India ***(Oral)***
17. "Geochemical understanding of adsorbate-adsorbent interactions: implications in designing PRB materials for remediation." Contased-2021, International conference ***(Poster)***
18. "Redox-sensitive nanotridents: eco-friendly warriors for aqueous sustainability." 2nd International symposium, FNMLA-2020, UCLAN, UK ***(Oral)***
19. "Deciding geochemical factor for incorporation of metal ions in vacant sites of non-stoichiometric hydroxyapatite." Goldschmidt-2020, International Geochemistry conference ***(Oral)***
20. "Fundamental and applied geochemical aspects of various novel Nano based ecofriendly materials for environmental applications." Geoscience Rennes, University of Rennes-1, France, 2020 ***(Visiting Seminar)***
21. "Kinetics and isotherm studies for the removal of Cr(VI) from synthetic hard water using Fe^0 -Biochar composite." 9th IconSWM-CE 2019, KIIT Bhubaneswar, India ***(Oral)***
22. "Modified clay particles for the remediation of toxic metals ions in the environment." Convergence-2019, IISER Kolkata, India ***(Best Poster)***

23. "Synthesis and characterization of Clay-Carbon-nZVI trident nanocomposite for the removal of toxic metal ions from aqueous solutions." National Environmental Conference (NEC-2019), IIT Bombay, India ***(Best Oral)***

RESEARCH COURSES AND WORKSHOPS

1. **Introduction to Management,** Imperial Business School and The Royal Society, UK (2023)
2. **Leadership Effectiveness,** Imperial Business School and The Royal Society, UK (2023)
3. **XPS training**, The Henry Royce Institute, University of Manchester, UK (2022)
4. **X-Ray Absorption Fine Structure (XAFS 2021)** Short Course, Brookhaven National Laboratory, USA
5. **Fundamentals of analytical chemistry**, GSITI, Hyderabad, India (2021)
6. **Five-day innovation series on patent search and filing**, Andhra university, India (2021)
7. **Modelling of geochemical equilibria and speciation calculations** (University of Rennes-1, France- 2020)
8. **Biological treatment of metals and metalloids laden wastewater: Microbiology, Process technology and Resource recovery** (GIAN, IIT Indore- 2018)
9. **WRCS 2018**, International Symposium on Water Resources Challenges and Sustainability, IIT Indore, India
10. **Introduction to Research** (NPTEL, IIT Madras- 2016)
11. **Microscopy and Fluid Inclusion Studies**, Workshop in Protolith '15 at IIT-Bombay (2015)

TEACHING, OUTREACH, AND LEADERSHIP ACTIVITIES

Session Convenor and Chair
Goldschmidt 2023 Geochemistry conference "Anthropogenic contaminants in the environment: geochemical fate, transport and remediation", Lyon, France (July 2023)

Teaching Assistant

ES4103 Geochemistry, IISER-K (Graduate- Level Course)
ES4104 Geochemistry Laboratory, IISER-K (Graduate- Level Course)
ES4106 Environmental Geosciences, IISER-K (Graduate- Level Course)

Journal Reviewer: Environmental Pollution, Environmental Research, Journal of Environmental Radioactivity, Journal of Hazardous Materials Advances (Nov 21- Present)

Involvement in Green Revolution Global Certification Program: An initiative by International Center for Culture and Education to educate, inspire and act against climate change.
Role: generated environmental awareness in people of metro city New Delhi through various activities

Participated in 22nd National Science Exhibition at Milan Samity Maidan, Nimta, Kolkata, organized by the Central Calcutta Science & Culture Organization for Youth, Kolkata.
Role: made young school students and parents aware of research in the field of earth and environmental sciences, latest developments with fascinating laboratory experiments and field collected mineral and fossil samples.

MEMBERSHIPS

Newton International Alumni of the Royal Society (July 2023- present)
Life member, Society for materials chemistry, BARC, India (2019- present)
Affiliate member, European Association of Geochemistry (2021- present)
Affiliate member, Royal Society of chemistry (RSC), UK (2021- present)
Student member, Society of Environmental Toxicology and Chemistry (SETAC), Asia-Pacific (2021- 22)
Student member, American Geophysical Union (AGU), USA (2020-21)

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SKILLS

Material characterization techniques: *XAS, XPS, Electron Microscopy (FESEM, TEM), FT-IR, X-Ray Diffraction (pXRD), Colloidal properties (Zeta Sizer, Particle size analyser)*

Analytical techniques: *UV-Vis spectroscopy, XRF (pellets and fusion bead technique), ICP-MS/OES, Ion Chromatography (IC), High Performance Liquid Chromatography (HPLC), Uranium analyser, Fluorescence spectroscopy, Gas Chromatography (GC-FID, GC-TCD)*

Modelling techniques and software: *PHREEQC for speciation, JFEFF10, Artemis and Athena for EXAFS fitting, KasaXPS and Thermo Avantage for fitting, Origin and Excel, Adobe Illustrator, Endnote citation manager*

Language: *Hindi (native), English (advanced), Sanskrit (intermediate)*