# ANIL KUMAR K

**Assistant Professor, Chemical Engineering | SIT, Tumkur, India**

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## PROFESSIONAL SUMMARY


I hold a PhD in Chemical Engineering and have over five years of research and development experience across academia and industry. My work focuses on water treatment, membrane technology, advanced materials, electrochemical systems, and smart sensor development. I currently serve as an Assistant Professor at SIT, Tumkur, where I lead research and academic activities.


## EDUCATION

**Ph.D., Chemical Engineering** | Birla Institute of Technology and Science, India | Grad. April, 2024)
Thesis title: Sustainable Metal-based Functionalized Nanomaterials and their Immobilized Porous Matrix for the Removal of Hazardous Metal Ions and Dyes from Wastewater

- Focus on biodegradable polymer matrices for immobilizing nanoparticles in environmental remediation.
- Focused on developing advanced functional materials for environmental remediation.
- Conducted adsorption and membrane separation studies for heavy metal ions and dyes.

M.Tech., Chemical Engineering | R. V. College of Engineering, Bangalore, India. | Grad. July 2018 | CGPA: 8.92
B.E., Chemical Engineering | Siddaganga Institute of Technology, Tumakuru, India | Grad. August 2016 | CGPA: 7.98

## TECHNICAL EXPERTISE & APPLIED R&D FOCUS

### Water Treatment & Filtration

- GO-based, polymeric, and mixed-matrix membranes (TFC, MMM, dip-coated, IP)
- Whole-home & point-of-use filtration systems
- Media evaluation, regeneration, and lifecycle assessment
- Chlorine, chloramine, heavy metal, and organic contaminant removal

### Adsorption & Process Engineering

- Batch and continuous adsorption systems
- Packed-bed column design, modeling, and scale-up
- Kinetics, isotherms, breakthrough modeling
- Design of Experiments (DoE) and predictive equation development

### Sensors & Electrochemical Systems

- Colorimetric, electrochemical, and potnetiometric sensor development
- Electrochemical system design, calibration, and validation
- Sensor modeling, data fitting, and response optimization
- Real-water condition testing

### Electrochemical Energy & Devices

- Sensor Design & Developemnt
- Chlor-alkali electrolyzer design for pool-water conditions
- PEM fuel cell materials, MEA fabrication, and diagnostics
- Electrocatalyst development

### Functional Materials

- MOFs, COFs, metal oxides, GO, CNTs, activated carbon, polymers
- Nanocomposite design for membranes, sensors, and media
- Sustainable and biodegradable material systems

## INDUSTRY EXPERIENCE

**Associate Specialist (R&D), Water Chemical** | Pentair, Noida, India | *June 2025 – September 2026*
Leading applied R&D projects across five parallel workstreams in water treatment, sensing, and electrochemical systems, with an emphasis on delivering validated, application-ready outputs.

### Electrochlorination Disinfection System

- Leading supplier engagement and qualification for alternate chlorine electrode vendors — managing RFI/RFQ cycles, NDA initiation, and sample procurement.
- Coordinating cross-functional technical benchmarking of electrode samples against performance specifications with stakeholders (electrochemistry, product, and supply chain teams).

- ***Deliverables:*** *Vendor Scouting, Vendor qualification matrix, technical benchmarking, sample test data, and supplier scorecards.*

**Sustainable Pool Dosing Chemistry**

- Developed sustainable pool dosing chemistry to improve disinfection efficiency while reducing overall chemical consumption.
- Designed and evaluated a chlor-alkali electrolyzer-based dosing approach, validated under pool-water conditions.
  - ***Deliverables:*** *New Ideation, US provisional patent submitted, Sustainable approach, PoC Development, Dosing chemistry protocol.*

**Carbon-Based Filtration Media & Whole-Home Filtration**

- Designed and evaluated carbon-based filtration media for chlorine/chloramine removal.
- Led media performance evaluation and regeneration studies under application-relevant conditions.
- Supported whole-home filtration system development, including performance evaluation and professional dashboards.
  - ***Deliverables:*** *Media performance dataset, Invention disclosure, regeneration protocol, and benchmarking report.*

**Membrane Fabrication & CIP System**

- Developed graphene oxide membranes for water treatment applications.
- Designed a membrane cleaning-in-place (CIP) system and protocol to extend membrane operational life for residential and commercial systems.
  - ***Deliverables:*** *New Ideation,Invention disclosure, advance membranes, CIP systems.*

**Smart Sensor Systems for Water Quality Monitoring**

- Designed colorimetric, potentiometric, and chemiresistive sensor prototypes
- Applied Design of Experiments (DoE) for sensor calibration modeling and predictive equation development.
  - ***Deliverables:*** *Functional sensor prototypes, calibration models/equations, and sensor prototypes.*

**Project & Program Management**

- Track project milestones using Gantt charts and prepare periodic project status updates for management review.
- Prepare structured project reports, technical documentation, and executive-level presentation decks for R&D projects.
- Collaborate with cross-functional teams on product-focused R&D and validation.

## POSTDOCTORAL AND INDUSTRIAL R&D EXPERIENCE

**Postdoctoral Fellow —** Indian Institute of Technology (IIT) Bombay, India
*Oct 2024 – May 2025*

- Developed optical and electrochemical sensors for Hg detection in water.
- Designed functionalized carbon-based nanocomposites for sensing and remediation.
- Developed MOF-based TFC membranes for pharmaceutical pollutant removal.
- Validated sensor and membrane performance under realistic water matrices.
- Design of scaled-up synthesis of GO using batch reactor

**Research Associate —** Aatral Innovations Pvt. Ltd., Chennai, India
*Jan 2024 – March 2024*

- Developed non-noble and ultra-low Pt electrocatalysts for ORR and HOR.
- Fabricated and tested MEA assemblies for PEM fuel cells.
- Designed self-humidifying catalyst layers to enhance fuel cell durability.
- Conducted single-cell fuel cell performance diagnostics.

Expertise: PEMFC catalyst development, MEA fabrication, single-cell fuel cell performance analysis.

## DOCTORAL RESEARCH EXPERIENCE

**Doctoral Research – Chemical Engineering,** *Birla Institute of Technology and Science* (BITS Pilani)

- Designed biodegradable polymer matrices and hydrogels for immobilizing functional nanomaterials
- Conducted batch and continuous adsorption studies with full kinetic, isotherm, and thermodynamic analysis
- Developed mathematical models for packed-bed column adsorption and scale-up
- Fabricated mixed-matrix membranes for $CO_2$ separation and water remediation
- Mentored graduate students and led collaborative research projects
- Extensive experience with material synthesis, characterization, and performance validation

## AWARDS & ACHIEVEMENTS

- Birla Institute of Technology and Science Institute fellowship for PhD. (15th Jan 2019-31st Dec 2023).
- Awarded 2nd place for the best oral presentation at the International Conference on Technological Interventions for Sustainability (Chem-Conflux22) held from 14th to 16th April 2022 at MNNIT Allahabad, Prayagraj.

## PUBLICATIONS

- Mahadevaprasad, K.N., Santhosh, K.N., **Anil Kumar K**. and Nataraj, S.K., 2025. Mn-aminoclay induced biopolymer interfacial TFC membrane for emerging pollutants separation and effective heavy metal sequestration. *Chemical Engineering Journal*, *504*, p.158717. https://doi.org/10.1016/j.cej.2024.158717.
- **Anil Kumar K.,** Bisoi, A., Yeshwanth, M., Jujaru, M., Panwar, J. and Gupta, S., 2024. Unveiling dye adsorption capability of *Moringa oleifera* functionalized hybrid porous MOF-GO composites: In vitro and in silico ecotoxicity assessment via antibacterial and molecular docking studies. *Environmental Science: Water Research & Technology*. https://doi.org/10.1039/D4EW00185K.
- **Anil Kumar K.,** Jujaru, M., Panwar, J. and Gupta, S., 2024. Non-derivatizing solvent assisted waste-derived cellulose/ MOF composite porous matrix for efficient metal ion removal: comprehensive analysis of batch and continuous packed-bed column sorption studies. *RSC Advances,* 14, pp.20254. https://doi.org/ 10.1039/d4ra02566k.
- **Anil Kumar K.,** Mahesh, Y., Panwar, J. and Gupta, S., 2024. Remediation of multifarious metal ions and molecular docking assessment for pathogenic microbe disinfection in aqueous solution by waste-derived Ca-MOF. *Environmental Science and Pollution Research*, 31(14), pp.21545-21567. https://doi.org/10.1007/s11356-024-32311-3
- **Anil Kumar K.,** Yeshwanth, M., Kusum Kumar, Jitendra Panwar. and Suresh Gupta, 2022. Functionalized Cu-based metal oxide nanoparticles with enhanced $Cd^{+2}$ adsorption capacity and their ecotoxicity assessment by molecular docking. *Journal of Environmental Management*, 307, p.114523. https://doi.org/10.1016/j.jenvman.2022.114523.
- **Anil Kumar K.,** Shobham, Jitendra Panwar. and Suresh Gupta, 2022. One-pot synthesis of metal oxide-clay composite for the evaluation of dye removal studies: Taguchi optimization of parameters and environmental toxicity studies. *Environmental Science and Pollution Research*, 30(22), pp.61541-61561. https://doi.org/10.1007/s11356-022-23752-9.
- Pradhan, S.K., Pareek, V., **Anil Kumar K**., Maheshwari, U., Panwar, J. and Gupta, S., 2024. Sustainable Development of Functionalized Cobalt Oxide Nanoparticles with Effective Cu (II) Sorbent Properties. *Water, Air, & Soil Pollution*, *235*(9), p.595. https://doi.org/10.1007/s11270-024-07388-8.
- Lashmi, P.G, Balaji, N, **Anil Kumar K**, Ananthapadmanabhan, P.V., Unnikrishnan, G., Kumar, S.S. and Aruna, S.T., 2019. Solution combustion synthesis of calcia-magnesia-aluminosilicate powder and its interaction with yttria-stabilized zirconia and co-doped yttria-stabilized zirconia. *Ceramics International*, 45(15), pp.18255-18264. https://doi.org/10.1016/j.ceramint.2019.06.036.

## BOOK CHAPTERS

- **Anil Kumar K,** Garima Verma, Smita Raghuvanshi, Suresh Gupta, "Defluoridation studies using graphene oxide based nano adsorbents", Green Chemistry and Water Remediation: research and applications, Elsevier, pp 35-56, Oct 2020. https://doi.org/10.1016/B978-0-12-817742-6.00002-5.
- **Anil Kumar K**, Jitendra Panwar. and Suresh Gupta, "Metal-based Nanoparticles Synthesis and Modifications Techniques for the Efficient Removal of Heavy Metal Ions and Dyes from Wastewater", Current Trends in Nanoremediation for Water and Wastewater Treatment, Elsevier, June 2024 (Accepted).

## CONFERENCE ABSTRACTS

- **Anil Kumar K**, Kusum Kumar B, Suresh Gupta, Jitendra Panwar, "Investigation on Cu(I&II)- based metal oxides as an adsorbent for the removal of heavy metal ions from an industrial wastewater", International Conference on Energy and Environmental Technologies for Sustainable Development (Chem-Conflux[20]), 14th - 16th Feb 2020, MNNIT Allahabad, Prayagraj.
- **Anil Kumar K**, Shobham, Suresh Gupta, Jitendra Panwar, "One-pot synthesis of metal oxide-clay composite for the evaluation of dye degradation studies: Taguchi optimization of parameters and antibacterial studies", International Conference on Technological Interventions for Sustainability (Chem-Conflux[22]) 14th - 16th April, 2022, MNNIT Allahabad, Prayagraj.
- **Anil Kumar K**, Arpit Bisoi, Suresh Gupta, Jitendra Panwar, "Cost-effective Synthesis of GO-MOF Composites for the Removal of Dyes from Wastewater: A Taguchi Optimization of Factors", 2nd International conference on water technologies for developing Nano materials for water purification/desalination (ICWT-2022 AUA Academic Conference), 1st - 2nd Dec 2022, IIT Bombay

## TOOLS & TECHNIQUES

- Characterization: SEM, XRD, BET, FTIR, UV–Vis, XPS, ICP-OES, AAS, PL, TGA, DSC
- Electrochemical workstations, fuel cell test stations
- Statistical modeling, DoE, data fitting
- Membrane fabrication and module testing
- Sensor circuit design and microcontroller interfacing
- GROMACS: Molecular Dynamics Simulation

## LANGUAGES KNOWN

English, Kannada, and Hindi.