Rahul K. Gupta, Ph.D.

Research Professor, Department of Chemical Engineering, Kyung Hee University

103, Engineering Research Facility, Kyung Hee University, Giheung-gu, Yongin-si, Republic of Korea
guptarahul9m@gmail.com | guptarkg.github.io | ORCID 0009-0005-6077-3122 | Google Scholar | LinkedIn

PROFILE

Research Professor in Chemical Engineering with process-development experience in enzyme and whole-cell immobilization, multi-enzyme cascade biocatalysis, and bioreactor operation up to 10 L; 22 peer-reviewed articles (900+ citations; h-index 16, i10-index 20) and five Korean patents.

RESEARCH INTERESTS

Enzyme engineering and catalysis; enzyme and whole-cell immobilization; enzyme–inorganic hybrid nanoflowers; methanotrophic C1 bioconversion (methane to methanol); 3D bioprinting of microbial biocatalysts; fermentation and bioprocess optimization; bioconversion of biowaste; bioremediation of environmental contaminants.

POSITIONS

Research Professor, Department of Chemical Engineering, Kyung Hee University, Korea — May 2026 – present

- Process development for a synthetic-biology platform converting greenhouse gases into plant-growth-promoting biomaterials (with Prof. Eun Yeol Lee)
- Technical evaluation of laboratory automation platforms for enzyme screening and strain engineering, with a procurement recommendation
- Supervision of one Ph.D., three M.Sc., and two B.Sc. students in bioprocess and enzyme engineering

Postdoctoral Researcher, Department of Chemical Engineering, Kyung Hee University, Korea — May 2025 – Apr 2026

- Bioconversion of low-grade CO_2/CH_4 streams, including bioreactor operation up to 10 L for scale-up and validation
- Repeated-batch column biocatalyst (enzyme immobilized on alginate/organic–inorganic hybrid beads) retaining 88.6% activity over ten cycles without enzyme leaching

Ph.D. Researcher, Department of Chemical Engineering, Konkuk University, Seoul, Korea — Mar 2018 – Feb 2025

- Engineering and immobilization of carboxylases, oxidases, and dehydrogenases for C1 gas bioconversion and biomass-to-ethanol processes
- Teaching: Enzyme Engineering and Biotechnology; Biocatalysis and Thermodynamics

Project Fellow, All India Institute of Medical Sciences (AIIMS), New Delhi, India — Sep 2017 – Dec 2017

- Supervisor: Dr. Ashok Sharma, Additional Professor, Department of Biochemistry
- Epigenetic alterations, including DNA and histone modifications and chromatin remodelling

Project Assistant, CSIR-Institute of Genomics and Integrative Biology, New Delhi, India — Aug 2016 – Aug 2017

- Crude glycerol as a bioprocess substrate for hydrogen, propanediols, lipids, and biopolymers

EDUCATION

Ph.D., Chemical Engineering, Konkuk University, Seoul, Korea — Mar 2018 – Feb 2025

- Thesis: “Engineering and Immobilization of Enzymes to Improve their Activity and Stability”
- Supervisor: Prof. Jung-Kul Lee; Brain Korea 21 (BK21) fellowship

M.Sc., Biotechnology, Jamia Hamdard, New Delhi, India — Aug 2014 – Jul 2016

- Thesis: role of ACE, TNF-α, and CTLA4 in rheumatic heart disease

B.Sc., Biotechnology, Chaudhary Charan Singh University, Meerut, India — Aug 2011 – Jun 2014

- Summer trainee, Quality Assurance and Production Department, Parag Dairy Plant

AWARDS AND DISTINCTIONS

Seal of Excellence, Horizon Europe, European Commission — Feb 2026

AMI–Prof. J. V. Bhat Award for the best paper in *Indian Journal of Microbiology*, Association of Microbiologists of India — 2021

FUNDED RESEARCH PROJECTS (PARTICIPATING INVESTIGATOR)

Synthetic-biology-based plant-growth-promoting biomaterial production for greenhouse-gas reduction, National Research Foundation of Korea — Jun 2026 – Dec 2030

Low-grade CO_2/CH_4 bioconversion technology development, National Research Foundation of Korea — May 2025 – Dec 2028

Biological methane mitigation using methanotrophs, National Institute of Biological Resources — May 2025 – Nov 2026

JOURNAL PUBLICATIONS

22 peer-reviewed articles; 900+ citations, h-index 16, i10-index 20 (Google Scholar, November 2026). Profiles: Google Scholar U6SrZPEAAAAJ; Scopus 59031694400; Web of Science AGQ-9997-2022.

1. Jabeen, A., **Gupta, R. K.**, Sharma, R., Pham, K. N., Viet, D. T., & Lee, E. Y. (2026). Systems-guided glycerol valorization reveals an NADPH-driven metabolic route switch for high-titer auxin production in Pseudomonas sp. KHU-1. *Journal of Biological Engineering*. doi:10.1186/s13036-026-00775-1.
2. **Gupta, R. K.**, & Lee, E. Y. (2026). Harnessing Sustainable Biopolymers: Engineered Alginate-Based Materials for Whole-Cell Environmental Remediation. *ChemSusChem*, 19(1), e202501882. doi:10.1002/cssc.202501882. Front Cover.
3. Patel, S. K. S., **Gupta, R. K.**, & Lee, J.-K. (2025). Immobilization of Pleurotus eryngii Laccase via a Protein–Inorganic Hybrid for Efficient Degradation of Bisphenol A as a Potent Xenobiotic. *Journal of Xenobiotics*, 15(4), 108. doi:10.3390/jox15040108.
4. Patel, S. K. S., Singh, D., Pant, D., **Gupta, R. K.**, Busi, S., Singh, R. V., & Lee, J.-K. (2024). Polyhydroxyalkanoate Production by Methanotrophs: Recent Updates and Perspectives. *Polymers*, 16(18), 2570. doi:10.3390/polym16182570.
5. Patel, S. K. S., **Gupta, R. K.**, Karuppanan, K. K., Padhi, D. K., Ranganathan, S., Paramanantham, P., & Lee, J.-K. (2024). Nonsterile Process for Biohydrogen Production: Recent Updates, Challenges, and Opportunities. *Indian Journal of Microbiology*, 64(2), 445–456. doi:10.1007/s12088-024-01319-1.
6. **Gupta, R. K.**, Patel, S. K. S., & Lee, J.-K. (2024). Novel cofactor regeneration-based magnetic metal–organic framework for cascade enzymatic conversion of biomass-derived bioethanol to acetoin. *Bioresource Technology*, 408, 131175. doi:10.1016/j.biortech.2024.131175.
7. Patel, S. K. S., **Gupta, R. K.**, Rohit, M. V., & Lee, J.-K. (2024). Recent Developments in Hydrogen Production, Storage, and Transportation: Challenges, Opportunities, and Perspectives. *Fire*, 7(7), 233. doi:10.3390/fire7070233.
8. Patel, S. K. S., **Gupta, R. K.**, Karuppanan, K. K., Kim, I.-W., & Lee, J.-K. (2024). Sequential Co-Immobilization of Enzymes on Magnetic Nanoparticles for Efficient L-Xylulose Production. *International Journal of Molecular Sciences*, 25(5), 2746. doi:10.3390/ijms25052746.
9. Patel, S. K. S., **Gupta, R. K.**, Karuppanan, K. K., Padhi, D. K., Ranganathan, S., Paramanantham, P., & Lee, J.-K. (2024). Trametes versicolor Laccase-Based Magnetic Inorganic-Protein Hybrid Nanobiocatalyst for Efficient Decolorization of Dyes in the Presence of Inhibitors. *Materials*, 17(8), 1790. doi:10.3390/ma17081790.
10. Patel, S. K. S., **Gupta, R. K.**, Kim, I.-W., & Lee, J.-K. (2023). Coriolus versicolor laccase-based inorganic protein hybrid synthesis for application in biomass saccharification to enhance biological production of hydrogen and ethanol. *Enzyme and Microbial Technology*, 170, 110301. doi:10.1016/j.enzmictec.2023.110301.
11. Patel, S. K. S., **Gupta, R. K.**, Kim, I.-W., & Lee, J.-K. (2023). Encapsulation of Methanotrophs within a Polymeric Matrix Containing Copper- and Iron-Based Nanoparticles to Enhance Methanol Production from a Simulated Biogas. *Polymers*, 15(18), 3667. doi:10.3390/polym15183667.
12. Zhu, C.-Y., Li, F.-L., Zhang, Y.-W., **Gupta, R. K.**, Patel, S. K. S., & Lee, J.-K. (2022). Recent Strategies for the Immobilization of Therapeutic Enzymes. *Polymers*, 14(7), 1409. doi:10.3390/polym14071409.
13. Patel, S. K. S., **Gupta, R. K.**, Kalia, V. C., & Lee, J.-K. (2022). Synthetic design of methanotroph co-cultures and their immobilization within polymers containing magnetic nanoparticles to enhance methanol production from wheat straw-based biogas. *Bioresource Technology*, 364, 128032. doi:10.1016/j.biortech.2022.128032.
14. Patel, S. K. S., **Gupta, R. K.**, Das, D., Lee, J.-K., & Kalia, V. C. (2021). Continuous biohydrogen production from poplar biomass hydrolysate by a defined bacterial mixture immobilized on lignocellulosic materials under non-sterile

conditions. *Journal of Cleaner Production*, 287, 125037. doi:10.1016/j.jclepro.2020.125037.

15. Patel, S. K. S., **Gupta, R. K.**, Kalia, V. C., & Lee, J.-K. (2021). Integrating anaerobic digestion of potato peels to methanol production by methanotrophs immobilized on banana leaves. *Bioresource Technology*, 323, 124550. doi:10.1016/j.biortech.2020.124550.
16. Patel, S. K. S., **Gupta, R. K.**, Kim, S.-Y., Kim, I.-W., Kalia, V. C., & Lee, J.-K. (2021). Rhus vernicifera Laccase Immobilization on Magnetic Nanoparticles to Improve Stability and Its Potential Application in Bisphenol A Degradation. *Indian Journal of Microbiology*, 61(1), 45–54. doi:10.1007/s12088-020-00912-4. AMI–Prof. J. V. Bhat Award (2021).
17. Patel, S. K. S., **Gupta, R. K.**, Kumar, V., Kondaveeti, S., Kumar, A., Das, D., Kalia, V. C., & Lee, J.-K. (2020). Biomethanol Production from Methane by Immobilized Co-cultures of Methanotrophs. *Indian Journal of Microbiology*, 60(3), 318–324. doi:10.1007/s12088-020-00883-6.
18. Patel, S. K. S., **Gupta, R. K.**, Kondaveeti, S., Otari, S. V., Kumar, A., Kalia, V. C., & Lee, J.-K. (2020). Conversion of biogas to methanol by methanotrophs immobilized on chemically modified chitosan. *Bioresource Technology*, 315, 123791. doi:10.1016/j.biortech.2020.123791.
19. Kumar, V., Patel, S. K. S., **Gupta, R. K.**, Otari, S. V., Gao, H., Lee, J.-K., & Zhang, L. (2019). Enhanced Saccharification and Fermentation of Rice Straw by Reducing the Concentration of Phenolic Compounds Using an Immobilized Enzyme Cocktail. *Biotechnology Journal*, 14(6), 1800468. doi:10.1002/biot.201800468.
20. Patel, S. K. S., Jeon, M. S., **Gupta, R. K.**, Jeon, Y., Kalia, V. C., Kim, S. C., Cho, B. K., Kim, D. R., & Lee, J.-K. (2019). Hierarchical Macroporous Particles for Efficient Whole-Cell Immobilization: Application in Bioconversion of Greenhouse Gases to Methanol. *ACS Applied Materials & Interfaces*, 11(21), 18968–18977. doi:10.1021/acsami.9b03420.
21. Patel, S. K. S., **Gupta, R. K.**, Kumar, V., Mardina, P., Lestari, R., Kalia, V. C., Choi, M.-S., & Lee, J.-K. (2019). Influence of Metal Ions on the Immobilization of β-Glucosidase Through Protein-Inorganic Hybrids. *Indian Journal of Microbiology*, 59(3), 370–374. doi:10.1007/s12088-019-00796-z.
22. Prakash, J., **Gupta, R. K.**, Priyanka, & Kalia, V. C. (2018). Bioprocessing of Biodiesel Industry Effluent by Immobilized Bacteria to Produce Value-Added Products. *Applied Biochemistry and Biotechnology*, 185(1), 179–190. doi:10.1007/s12010-017-2637-7.

PATENTS AND MANUSCRIPTS UNDER REVIEW

- **Gupta, R. K.**, & Lee, E. Y. Multiscale engineering of immobilized methanotrophs: a nano-to-macro framework for methane bioconversion. *Renewable and Sustainable Energy Reviews* (submitted, 2026).
- **Gupta, R. K.** Modelled structure of acetyl-CoA carboxylase from *Ustilago maydis*. (Under communication; underlies the ACC-variant patent below.)
- Acetyl-coenzyme A carboxylase variants with enhanced activity (KIPO, filed).
- Four further Korean patents (KIPO) covering cofactor-regenerating metal–organic frameworks and methanotroph immobilization for methanol production.

TEACHING, SUPERVISION, AND SERVICE

- **Teaching:** Enzyme Engineering and Biotechnology; Biocatalysis and Thermodynamics.
- **Supervision:** one Ph.D., three M.Sc., and two B.Sc. students at Kyung Hee University.
- **Presentations:** six invited departmental seminars on enzyme immobilization and bioconversion; two conference contributions.
- **Peer review:** 162 reviews for 43 journals and grant bodies (verified on ORCID).
- **Membership:** Life member, Association of Microbiologists of India (since 2025).

TECHNICAL SKILLS AND LANGUAGES

- **Bioprocess and analytical:** enzyme production, purification, and characterization; enzyme kinetics; enzyme and whole-cell immobilization; fermentation and bioreactor operation (up to 10 L); GC, HPLC, UV/Vis spectrophotometry, FTIR, PXRD.
- **Molecular biology:** plasmid isolation, transformation, PCR, molecular cloning, site-directed mutagenesis, SDS-PAGE and native PAGE, ELISA, BLAST sequence analysis.
- **Materials:** hybrid nanoflowers, magnetic MOFs and nanoparticles, alginate and biopolymer matrices, bioinks for 3D bioprinting.
- **Languages:** Hindi (native), English (fluent), Korean (beginner).

INTERESTS

Distance running (half marathon and 10 km events, 2022–2023), long-distance cycling on Korea's certified national routes, and hiking (Bukhansan National Park).