Dr. Santosh Kumar

National Postdoctoral Fellow, IIT Bombay
IIT Bombay, Powai, Mumbai, Maharashtra 400076
Santoshjnv1391@gmail.com | 20004687@iitb.ac.in | +91-9973688325
Scopus | Google Scholar | ResearchGate | ORCID Link | LinkedIn

Education and Training

Indian Institute of Technology (IIT) Bombay **Powai, Mumbai**

National Postdoctoral Fellow, Environmental Science and Engineering Department ***2025 - Present***
Principal Investigator of ANRF-funded NPDF project, ESED ***2025 - 2027***

Indian Institute of Technology Kharagpur **Kharagpur, WB**

Ph.D. in Bioenergy and Renewables, P K Sinha Center of Bioenergy & Renewables ***2020-2025***
Thesis: Upgrading photosynthetic microbial fuel cells for wastewater treatment with concomitant bioelectricity generation and recovery of value-added biomass
Supervisors: Prof. Makarand M. Ghangrekar & Prof. Gourav Dhar Bhowmick

M.Tech. in Agricultural Biotechnology ***2017-19***
Thesis: Outdoor cultivation of *Tetradesmus lagerheimii* in the mini pond system for biodiesel production
Supervisor: Prof. Nirupama Mallick

Indian Institute of Technology Roorkee **Roorkee, Uttarakhand**

B.Tech. in Biotechnology ***2013-17***
Project: Identification of genes encoding Ap4 complex subunits in Guar
Summer Project: Callus development and secondary metabolite profiling in *Ocimum sanctum*

Research Summary

Innovative researcher with a strong foundation in algal-bioelectrochemical processes, carbon capture, biohydrogen and bioelectricity production, integrated wastewater treatment systems, and dark fermentation of waste biomass for biohydrogen production and resource recovery. Proficiency in developing microbial fuel cells, microbial electrolysis, and sustainable bioenergy solutions. Expertise in genetic and metabolic regulatory mechanisms in plants, with a focus on gene identification, developmental biology, and secondary metabolite profiling to enhance understanding of plant growth and biochemical pathways. Proven track record of interdisciplinary research, peer-reviewed publications, and international conference presentations.

Research Interest

- Algal Bioenergy & Biorefinery

- Microbial electrosynthesis for resource recovery
- Microbial Fuel Cells (MFCs), Photosynthetic MFCs, & Dark Fermentation
- Wastewater Treatment & Resource Recovery
- Microbial Electrolysis & Carbon-Capture Cells
- Biohydrogen & Bioelectricity Production
- Engineered Nanomaterials & Biochar
- Ion exchange membrane & resource recovery
- Molecular biology & genetics

Publications

Peer-Reviewed Journals:

1. **Santosh Kumar**, Atul Shinde, and Makarand M. Ghangrekar (2024). "Coal-based material as 3-D electrodes in continuous up-flow constructed wetland-microbial fuel cells." *Sustainable Energy Technologies and Assessments* 69:103913. **IF-7.4**. https://doi.org/10.1016/j.seta.2024.103913
2. **Santosh Kumar**, Akash Tripathi, Gourav Dhar Bhowmick, Makarand M. Ghangrekar (2025). "Activated coke-based cathode to improve the efficiency of continuous up-flow constructed wetland-microbial carbon-capture cell" *Bioresource Technology Reports* 31: 102200. **IF- 5**. https://doi.org/10.1016/j.biteb.2025.102200
3. **Santosh Kumar**, Akash Tripathi, Indrajit Chakraborty, Makarand M Ghangrekar (2023). "Engineered nanomaterials for carbon capture and bioenergy production in microbial electrochemical technologies." *Bioresource technology* 389: 129809. **IF- 8.2**. https://doi.org/10.1016/j.biortech.2023.129809
4. **Santosh Kumar**, Monali Priyadarshini, Azhan Ahmad, Makarand M Ghangrekar (2023). "Advanced biological and non-biological technologies for carbon sequestration, wastewater treatment, and concurrent valuable recovery: A review." *Journal of CO2 Utilization* 68: 102372. **IF- 8.6**. https://doi.org/10.1016/j.jcou.2022.102372
5. **Santosh Kumar**, Rishabh Raj, Akash Tripathi, Swati Das, Gourav Dhar Bhowmick, Makarand M Ghangrekar (2025). "Exploring Innovative Techniques in Algal Lipid Extraction: Pioneering Paths to Sustainable Biofuel Production." *Biocatalysis and Agricultural Biotechnology* 66:103583. **IF-4.6**. https://doi.org/10.1016/j.bcab.2025.103583
6. Das, Swati, **Santosh Kumar**, Arun Kumar Mehta, and Makarand M. Ghangrekar (2024). "Heavy metals removal by algae and usage of activated metal-enriched biomass as cathode catalyst for improving performance of photosynthetic microbial fuel cell." *Bioresource Technology* 406: 131038. **IF- 8.2**. https://doi.org/10.1016/j.biortech.2024.131038
7. Tripathi, Akash, **Santosh Kumar**, G. S. Jadhav, Dipak A. Jadhav, Makarand M. Ghangrekar, and Rao Y. Surampalli (2024). "Electromethanogenic reactor for biogas production using agricultural and livestock waste and its comparative analysis with biogas plant: A mini-review." *Biomass and Bioenergy* 185:107246. **IF- 7**. https://doi.org/10.1016/j.biombioe.2024.107246

8. Tripathi, Akash, **Santosh Kumar**, Makarand M Ghangrekar, Brajesh K Dubey (2025). "Next-Gen bioelectrochemical wetlands for onsite treatment: Compact MFC-embedded baffled wetland supercharged by rGO-emulated metcoke and waste coagulant." *Journal of Environmental Management* 392: 126865. **IF-9.2**. https://doi.org/10.1016/j.jenvman.2025.126865
9. Raj, Rishabh, Anil Dhanda, **Santosh Kumar**, Sovik Das, and Makarand Madhao Ghangrekar (2024). "Repurposing waste-iron electrocoagulated algal biomass as effective heterogenous (bio) electro-fenton catalyst for phthalate removal from wastewater." *Scientific Reports* 14: 23932. **IF- 4.9**. https://doi.org/10.1038/s41598-024-74911-6
10. Akash Tripathi, Rajashri Bhar, **Santosh Kumar**, Makarand M Ghangrekar, Brajesh K Dubey (2025). "A comprehensive investigation of transforming recyclables into resources: electrocoagulation for sulfamethoxazole removal from hospital effluents." *Environmental Science and Pollution Research* 32: 18478-18495. **IF- 8.4**. https://doi.org/10.1007/s11356-25-36763-z
11. Arka Pramanik, Diptesh Goswami, **Santosh Kumar**, Gourav Dhar Bhowmick (2026). "Performance evaluation of aquacultural processing waste-derived biochar as a cathod catalyst in constructed wetland microbial fuel cell." *Discover Electrochemistry* 3: 26. https://doi.org/10.1007/s44373-026-00114-5
12. Swati Das, Gopa Nandikes, **Santosh Kumar**, Doki Manmadha Manikanta, Guido Sonnemann, Booki Min, Makarand M Ghangrekar (2026). "Leveraging different cathodic phototrophs for semi-pilot-scale photosynthetic microbial fuel cells: A comparative study on optimizing performance, cost-efficiency, and environmental impact." *Chemical Engineering Journal* 538: 176727. **IF- 12.2**. https://doi.org/10.1016/j.cej.2026.176727

Book Chapters:

1. **Santosh Kumar**, Akash Tripathi, Shraddha Yadhav, Srishti Mishra, Makarand M. Ghangrekar, (2025). Interactions of Microplastics with Microbial Communities and the Food Web/Plants. Microplastics in the Environment: Fate, Impacts, Removal, and Management (283-310), John Wiley & Sons, Ltd. https://doi.org/10.1002/9781394251100.ch11
2. **Santosh Kumar**, Shraddha Yadav, Makarand M Ghangrekar, (2025). Wastewater treatment employing microbial carbon-capture cells with concomitant bioenergy production and valuable product recovery. Algal Biorefinery (263-271) Elsevier. https://doi.org/10.1016/B978-0-443-23967-0.00022-X
3. **Santosh Kumar,** & Makarand M Ghangrekar, (2024). Algae-Based Bioenergy Production as a Carbon Mitigation Technology. Algae as a Natural Solution for Challenges in Water-Food-Energy Nexus, 833. https://doi.org/10.1007/978-981-97-2371-3_29
4. **Santosh Kumar**, Akash Tripathi, Swati Das, & Makarand M Ghangrekar. (2023). Biochemical Approach for Transformation of Agricultural Waste to Bioenergy and Other Value-Added Products Through the Bioelectrochemical System. In Agricultural Waste to Value-Added Products: Technical, Economic and Sustainable Aspects (pp. 69-94). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-99-4472-9_4

5. **Santosh Kumar,** Debkumar Chakraborty, Akash Tripathi, Makarand M Ghangrekar, (2025). Prospect and challenges of production of high value-added products using purple bacteria in integration with wastewater treatment. In Microbial Biotechnology: Integrated Microbial Engineering for B3–Bioenergy, Bioremediation, and Bioproducts, pp. 307-333. Elsevier, 2025. https://doi.org/10.1016/B978-0-443-23796-6.00013-4
6. Makarand M Ghangrekar, **Santosh Kumar,** and Indrajit Chakraborty, 2022. Environmental Impacts and Necessity of Removal of Emerging Contaminants to Facilitate Safe Reuse of Treated Municipal Wastewaters. Environmental Degradation: Challenges and Strategies for Mitigation, 104, p.95. https://doi.org/10.1007/978-3-030-95542-7_5
7. Makarand M Ghangrekar, **Santosh Kumar,** Azhan Ahmad, and Sovik Das, 2022. Concomitant bioenergy production and wastewater treatment employing microbial electrochemical technologies, p.359-385. https://doi.org/10.1016/B978-0-323-85269-2.00015-0
8. Akash Tripathi, Shraddha Yadav, **Santosh Kumar**, & Makarand M Ghangrekar. (2024). Application of microbial electrolysis cells for the production of biogas and other valuables from industrial wastewater and sludge. https://doi.org/10.2166/9781789063813_0175

Conferences, Workshops, Awards & Recognition

- 19th IWA Leading Edge Conference (Germany, 2024)
- IISc Sustainability Summit (2024)
- 3rd International Scientific Conference on Environmental Research (India, 2023)
- Indo-Belgium Workshop on Bioelectrochemical Systems (IIT KGP)
- ICC Water and Wastewater Innovation Workshop (IIT KGP)
- Best Paper Presentation Award, 3rd Intl. Scientific Conference, 2023
- 3rd Place Poster, ICC Workshop on Water and Wastewater Innovation, 2023
- MNRE Renewable Energy Fellowship, Govt. of India (2019–2024)

Mentorship

Mentored M.Tech. thesis: "Biohydrogen production from sewage sludge using integrated dark fermentation-MEC."

Technical Skills

- Experience with CV, EIS, LSV, XRD, SEM, FTIR, RAMAN spectroscopy, BET, PCR, IC, TOC, COD, GC-MS, etc.
- Software: OriginPro, CasaXPS, X'Pert HighScore Plus, Mendeley, EndNote, MS Office, etc.

Extracurricular Activities

- Gardening Club Coordinator, IIT Roorkee: Led green initiatives, awarded for innovation
- NSS IIT Roorkee: Active volunteer in education outreach

Languages

English, Hindi, Oriya

References

Prof. Makarand M. Ghangrekar
Professor, Dept. of Civil Engineering, IIT Kharagpur; Director, NIT Puducherry
Email: ghangrekar@civil.iitkgp.ac.in | Phone: +91-3222283440

Prof. Gourav Dhar Bhowmick
Assistant Professor, Agricultural & Food Engineering Dept., IIT Kharagpur
Email: gourav@agfe.iitkgp.ac.in | Phone: +91-3222281950

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