# Rajnish KUMAR, Ph.D, FRSC

Professor, Department of Chemical Engineering
Indian Institute of Technology - Madras, Chennai, India
Contact: (+91) 44 2257 4180
Email: rajnish@iitm.ac.in
Website: https://rrg-iitm.com/


## Qualification

**Ph.D., Chemical & Biological Engineering** **2004 -2009**
The University of British Columbia (UBC), Vancouver, BC, Canada
Thesis: Separation of carbon dioxide from fuel gas via hydrate crystallization
Supervisor: Prof. Peter Englezos

**M.S., Chemical Engineering** **2001 - 2003**
Indian Institute of Science (IISc), Bangalore, India
Thesis: Enzymatic synthesis in supercritical fluids
Supervisors: Prof. Giridhar Madras & Prof. Jayant Modak

**Bachelor of Chemical Engineering** **1997 - 2001**
Pt. Ravishankar Shukla Univ., Raipur, India
First Class with Distinction

## Work Experience

June 2021 – Current : **Professor,** Chemical Engineering, Indian Institute of Technology – Madras, Chennai.

Dec 2016 – June 2021 : **Associate Professor**, Chemical Engineering, Indian Institute of Technology – Madras, Chennai.

Aug 2010 – Dec 2016 : **Senior Scientist,** Chemical Engineering & Process Development, National Chemical Laboratory, Pune, INDIA

March 2009 – Aug 2010 : **Research Associate,** Steacie Institute for Molecular Sciences - National Research Council Canada

Sep 2003 – June 2004 : **Postgraduate Engineer Trainee,** Hindustan Zinc Limited, Udaipur, Sterlite Industries (India) Limited

## Teaching

1. Advanced Chemical Engineering Thermodynamics (PG Core course, IIT – Madras)
2. Advanced Chemical Engineering Thermodynamics (PG China Univ. of Petroleum., Beijing)
3. Chemical Engineering Thermodynamics (PG Core course, NCL – Pune)
4. Unconventional Energy Resources (PG Elective – IIT Madras)
5. Seminar (PG Core course – IIT Madras)
6. Heat and Mass Transfer Laboratory (UG Lab course – IIT Madras)
7. Thermodynamics Laboratory (UG Lab course – IIT Madras)
8. Chemical Engineering Thermodynamics (UG Core course, IIT – Madras)

## Research Areas

- Gas hydrates and its applications in innovative energy solutions
- Energy recovery from unconventional resources
- Carbon dioxide capture, storage & utilization
- Water treatment, purification, desalination
- Hydrothermal Liquefaction Processes

## Fellowships, Awards & Recognition

- 2024 MRSI Medal
- 2022 Shanti Swarup Bhatnagar Award – Engineering
- 2021 Energy & Fuels Rising Star – ACS (2021)
- Celebrating Authors of our Top 1% Most Cited Papers, I&ECR, (2021)
- Professor Dr. YBG Varma Award for teaching Excellence in Chemical Engineering, (2020)
- Fellow of Royal Society of Chemistry, FRSC (2020)
- Highly Cited Researcher in Engineering, Clarivate Analytics (2018)
- 2017 Class of Influential Researchers, Invited by I&EC Research Journal, (2017)

- NASI – SCOPUS Young Scientist Award, (2016)
- Most Cited Paper award, *Energy* Journal (2018, 2017)
- Most Cited Paper award, *International Journal of Greenhouse Gas Control* (2018, 2017)
- Most Cited Paper award, *Energy* Journal (2018)
- Best Paper Award, Applied Energy (2016)
- Most Cited Paper award, *International Journal of Greenhouse Gas Control* (2015)
- Most Cited Paper award, *Chemical Engineering Science* Journal (2012)

## Research in the News

IITM professor bags national award for research on carbon sequestration, Nov 19, 2023 The Hindu

How to sequester carbon dioxide and produce natural gas, Dec 5, 2021 Business Line

Indian scientists discover chemicals to help make gas hydrates faster, October 22, 2020 Business Line

Pushing Innovation, One Citation at a Time, February 7, 2019 Times of India

Methane in interstellar atmosphere can exist, say IIT Madras researchers, January 9, 2019 Zee News.com

Only 10 Indians on list of world's 4,000 top scientists, January 5, 2019 Times of India

NCL scientist receives prestigious award, October 13, 2016, Sakaal Times (India)

## Selected Journal Publications (Peer Reviewed)

**https://orcid.org/0000-0002-4172-2638**
**https://scholar.google.co.in/citations?user=P21tbTMAAAAJ&hl=en&oi=ao**

Kavya Mrudula Tadepalli; Rajnish Kumar, 2022. Can Ammonia Be Used To Enhance the $CO_2$ Sequestration in Methane Hydrates: A Molecular Dynamics Perspective. *Energy & Fuels*. 2023. DOI: 10.1021/acs.energyfuels.2c01721

C Sahu, A Sircar, JS Sangwai, R Kumar. Effect of sodium tripolyphosphate (STPP) and tetrasodium pyrophosphate (TSPP) on the formation kinetics of CO2 hydrate in bulk and porous media in the presence of pure water and seawater relevant for CO2 sequestration. *International Journal of Greenhouse Gas Control*, **2022** 114, 103564. DOI: 10.1016/j.ijggc.2021.103564

Pragati Sharma, Suman Chakrabarty, Sudip Roy, Rajnish Kumar: A Molecular View of CO2 Capture by Polyethyleneimine: Role of Structural and Dynamical Heterogeneity. *Langmuir* **2018**; 34(17)., DOI:10.1021/acs.langmuir.8b00204

Asheesh Kumar, Tushar Sakpal, Gaurav Bhattacharjee, Anupam Kumar, Rajnish Kumar: Impact of H2S Impurity on Carbon Dioxide Hydrate Formation Kinetics in Fixed Bed Arrangements. *Industrial & Engineering Chemistry Research* **2016**; 55(29)., DOI:10.1021/acs.iecr.5b04079

Gaurav Bhattacharjee, Asheesh Kumar, Tushar Sakpal, Rajnish Kumar: CO2 sequestration: Influence of Porous Media on Hydrate Formation Kinetics. *ACS Sustainable Chemistry & Engineering* **2015**; 3(6), 1205-1214, DOI:10.1021/acssuschemeng.5b00171

Asheesh Kumar, Tushar Sakpal, Praveen Linga, Rajnish Kumar: Impact of Fly Ash Impurity on the Hydrate Based Gas Separation Process for Carbon Dioxide Capture from a Flue Gas Mixture. *Industrial & Engineering Chemistry Research* **2014**; 53(23):9849-9859., DOI:10.1021/ie5001955

**Research Project as Principal Investigator:**

1. Rajnish Kumar (PI), Center of Carbon Capture Utilization and Sequestration at IIT Madras, 2023-2024 (INR 55000000.00)

2. Rajnish Kumar (PI), Development of CO2 scrubbing system, L&T Infra, 2023-2024 (INR 5250000.00)

3. Rajnish Kumar (PI), Synthesis of Substituted benzene via Cyclotrimerization Reaction, Shell India, 2023 - 2025 (INR 8700000.00)

4. Rajnish Kumar (PI), Porous Organic Ligands Based Solid Heterogeneous Catalyst for Hydroformylation, Shell India, 2023-2025 (INR 8800000.00)

5. Rajnish Kumar (PI), Continuous Process for Waste Water Purification and Recycle by Gas Hydrate Process (Bench scale study-phase-II) RB/2022-2024/GAIL008836 (INR 9500000.00)

6. Rajnish Kumar (PI), Niket Kaisare (co-PI) R&D Project on waste water purifications and recycle by GAS Hydrate process. RB/2021-2022/0947/CH/GAII/008836 (INR 4560000 +Taxes)

7. Rajnish Kumar (PI) CO2 capture in glass waste. RB/2021-2022/0489/CH/SAIN/008836 (INR 10 Lakhs + taxes)

8. Rajnish Kumar (Principle investigator), Hadas Mamane (Principle investigator) Next generation multifunctional aerogels for treating soluble microplastics, pesticides and drugs in water, and recovery. SPARC/2018-2019/P765/SL (INR 78,47,624.00)

9. Rajnish Kumar (Principle investigator), “Bench Scale Studies For Gas Hydrate Based Continuous Gas Separation Process: Separation of industrially relevant binary and ternary gas mixture” EMR/2017/000810 (INR 45,74,880.00)

10. Rajnish Kumar (Principle Investigator), “Sustainable production of methane from marine gas hydrate” Centre For IC & SR, IIT Madras” RB/17-18/CHE/006/GAIM/RAJN, 2018-2020 (INR 185, 00,000.00)

11. Rajnish Kumar (Principle Investigator), “Bench Scale Process Demostration for Hydrate based Gas Separation Process” Centre For IC & SR, IIT Madras” 682/NFSC/RAJN, 2017-2020 (INR 35, 00,000.00)

12. Rajnish Kumar (P.I.) & Prashant Barve (Co.PI) Supercritical Fluid Extraction and Equipment Design, Consultancy Project, CNP 278026, Jan 2015 – June 2015 (INR 5,00,000.00)

13. Rajnish Kumar (P.I) & Sudip Roy (Co.PI) Bench Scale Studies for Methane Recovery from Natural Gas Hydrate, Industrial Project, SSP 294626, 2014 – 2016 (INR 95,00,000.00)

14. Rajnish Kumar (Principle Investigator). Development Studies for Kinetics of Methane recovery from Natural Gas Hydrate, Industrial Project, SSP 292526, 2012 – 2014 (INR 55,00,000.00)

15. Rajnish Kumar (Principle Investigator). Detailed Evaluation of Renewable Substrates available in India for use in the preparation of bio-fuels and chemicals, Department of Bio Technology, GAP 303826, 2013 – 2015 (INR 25,00,000.00)

16. Rajnish Kumar (Principle Investigator), Process development for CO2 capture from flue and fuel gas mixture, Department of Science and Technology, GAP 294026, 2011-2014 (INR 35, 00,000.00)

17. Rajnish Kumar (Principle Investigator). Feasibility study of methane replacement from natural gas hydrates in presence of carbon dioxide, Council of Scientific and Industrial Research, MLP020926, 2010 – 2012 (INR 12, 00,000.00)

**Graduate Students Supervised**

*(Graduated 8 PhD Students & 8 Masters Students)*

Ravinder Reddy Palle (Joint M.Tech student, 2017 – 2019, Project Assistant in IITM)
Danam Mahesh (joint M.Tech student, 2017-2019, Gulf Oil)
Chandaram Sai Kishore (M.Tech, 2017-2019, Vedanta)
Seshan B Meshram (M.Tech, 2017- 2019, Exxon Mobil)
Salim Kumar (M.Tech, 2016 – 2018, self-employed)
Vikesh Singh Baghel (M.E, 2012-2014, now with Halliburton India, Pune)
Asheesh Kumar (PhD, 2012 – 2016, now with NUS, Singapore)

Subhadip Das (PhD, 2010 – 2016, now faculty at LPU, India)
Nilesh Choudhary (PhD Student, 2013 – 2017, now postdoc at KAUST)
Gaurav Bhattacharya (PhD Student, 2013 – 2017, now postdoc at NUS)
Pragati Sharma (PhD Student, 2014 -2018, now with JK Tyres, Mysore)
Amit Arora (PhD at IIT – Roorkee, 2012 – 2016, QIP student, co-supervised be me)
Namrata Gaikwad (PhD at IIT Madras, 2017-2022)
Chandan Sahu (PhD at IIT Madras, 2018-2022)

**Graduate Students Currently Under Supervision**

*(6 PhD students & 2 Masters Student)*

Kavya M Tadepalli (PhD student, 2018 – 2022)
Subhash K Sharma (PhD Student, 2019 – 2023)
Anshu Bhaduria (PhD Student, 2019 – 2023)
Bhavik Kumar B Mahant (PhD Student, 2019 – 2023)
Lagnajita Paul (PhD Student, 2019 – 2023)
Rahul Sarkhel (PhD Student, 2020 – 2023)
Abhishek Bhadani (MS Student, 2021-2023)
Dhaval Patel (M.Tech Student, 2021-2023)

**Research Associate/ Research Engineer/Project Assistant**

Asheesh Kumar (Project Assistant, 2011 – 2012)
Tushar Sakpal (Project Assistant, 2011 – 2013)
Dr. Omkar Singh Kushwaha (Research Associate, 2017-2020)
Dr. Sujoy Chattraj (Post-doc, 2022 – 2023)