Ajay Mandal, Ph.D., CChem, FRSC
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Indian Institute of Technology (Indian School of Mines), Dhanbad, India
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Dr. Ajay Mandal, is presently working as Professor (HAG) in the Department of Petroleum Engineering, Indian Institute of Technology (Indian School of Mines), Dhanbad. Dr Mandal is conducting research in reservoir engineering, enhanced oil recovery, and other areas of petroleum engineering, with over 275 research papers, books, and book chapters, more than 18,300 citations, and a stellar H-Index of over 80. He is an outstanding Academician and Researcher in the field of Petroleum Engineering. His work focuses on the synthesis of a wide variety of surfactants, polymers, and nanoparticles for their application in enhanced oil recovery. He developed innovative formulations of microemulsions, nanoemulsions, nanofluids, Pickering emulsions, and stabilised foams for enhanced oil recovery applications. Prof. Mandal is also working in the fields of carbon dioxide sequestration and gas hydrate recovery. He published several papers on the thermodynamics of gas hydrate formation and dissociation, which significantly contributed to the development of technology for producing gas from gas hydrate reservoirs. As an active member of the "Enhanced Recovery" committee within the Ministry of Oil and Natural Gas, he evaluates various enhanced oil recovery projects in India, considering technical feasibility, economic viability, and environmental impact. Dr Mandal has been awarded 24 sponsored R&D projects, primarily focused on enhanced oil recovery, and 22 consultancy projects from various government funding agencies and the oil & gas sector. Dr. Mandal received a number of awards like DAAD (German Academic Exchange Service Fellowship), two SPE south Asia regional awards (2015 SPE South Asia Regional Distinguished Achievement Award for Petroleum Engineering Faculty and 2019 SPE Reservoir Dynamics and Description Regional Award for South Asia and Pacific region), IIChE (Indian Institute of Chemical Engineers) National Award for the Year 2017, Fellow of RSC, and many more. He is actively associated with several foreign universities for collaborative research worldwide. He guided 30 Doctoral students, and many are working. Dr. Mandal has been ranked within the top 2% of researchers in the field of energy for six consecutive years (2020–2026), according to an independent global study conducted by scientists at Stanford University. He also ranked #1 in Enhanced Oil Recovery and highly-ranked scholar lifetime in Petroleum Engineering globally by ScholarGPS (Powering Scholarly Analytics, 2024-2026). His global rank as a scientist is 108184 in SCIRANK 2026. His world rank in enhanced oil recovery is 6th, according to the Scholarly Index in 2026. Dr. Mandal is on the editorial board of a number of journals in the field of petroleum engineering and is a reviewer of more than 50 journals.

Education:

Ph.D.: Chemical Engineering, Indian Institute of Technology, Kharagpur- 2004.
M. ChE.: Chemical Engineering, Jadavpur University, 1998, 1ST Class 1st
B. Tech.: Chemical Engineering, Calcutta University, 1996. 1st Class
B. Sc.: Chemistry (Hons.), Calcutta University, 1993. 1st Class 3rd

Academic Experience:

July 2026 - Present	Professor (HAG), Department of Petroleum Engineering Petroleum, IIT(ISM), Dhanbad.
Jun 2019 – July 2026	Professor, Department of Petroleum Engineering Petroleum, IIT(ISM), Dhanbad.
Mar 2023-Present	Professor In-charge, Central Library, IIT(ISM), Dhanbad.
May 2019 -April, 2022	Head, Department of Petroleum Engineering Petroleum, IIT(ISM), Dhanbad.
May 2018 - June 2019	Associate Dean (Sponsored Research) IIT(ISM), Dhanbad.
Feb 2010 - June 2019	Associate Professor, Department of Petroleum Engineering Petroleum, IIT(ISM), Dhanbad.
Feb 2007 - Feb 2010	Assistant Professor, Department of Petroleum Engineering Petroleum, IIT(ISM), Dhanbad.
Dec 2004 - Feb 2007	Lecturer, Department of Petroleum Engineering Petroleum, IIT(ISM), Dhanbad.
Aug 2004- Dec 2004	Lecturer, Department of Chemical Engineering, Heritage Institute of Technology, Kolkata
Oct 2003 – Jul 2004	Principal Scientist, DST Project, Department of Chemical Engineering, IIT, Kharagpur

Non-academic Experience:

May 2017 - May 2018	Professional Intern, Institute of Reservoir Studies, ONGC, Ahmedabad.
Jun 1998 - July 1999	Assistant Engineer, ELQUE Polyester Limited, WB
Jun 2015 – July 2015	Professional Intern, MANSAROVAR ENERGY COLOMBIA LTD,

Membership in Professional Organizations:

- Society of Petroleum Engineers: Member ID: 3268367- Professional Member
- Royal Society of Chemistry:662970-Fellow and Professional Member
- American Chemical Society: Membership Number: 30553624
- Foreign Member of the Luxembourg Academy of Sciences and Arts (LASA)
- Editorial Board Members of Petroleum Journal (Elsevier)
- Guest Editor: Petroleum Exploration and Production Technology
- Editorial Board Member: Petroleum Exploration and Development
- Indian Institute of Chemical Engineers- Life Member LM-57511
- Mining Geological and Metallurgical Institute (MGMI), Life Member-LM 10937
- ER Screening committee, Ministry of Petroleum and Natural Gas- Member
- PAC Committee, SERB, DST-Member, Ministry of Education (2021-2025)
- CSIR-FIRST Scheme-PAC member, 2023
- Editorial Board Members of SPE Journals
- Served as Membership Chairperson of Newly formed SPE Kolkata Section,2012
- Served as Member of Jharkhand State Pollution Control Board, to review CTPS- Furnace

Oil discharge into Damodar River, 2020.

- Served as member of the Regional Scholarship & Student Retention Committee of SPE Middle East, North Africa and India Region during 2010-11.
- Faculty Sponsor of SPE IIT(ISM) Student Chapter, 2008-2016.

Honors and Awards:

	Year	Name of Award/Honor	Name of Organization
1.	1993	1st class 3rd rank in B.Sc. (Chemistry Hons.)-Bronz Medal	Calcutta University
2.	1998	1st class 1st rank in M.ChE. -Gold Medal	Jadavpur University
3.	2008	Research on DAAD Fellowship	DAAD, New Delhi
4.	2010	SPE Outstanding Chapter Award in my convenorship	SPE, USA
5.	2011	SPE faculty Travel Grant for participation in SPE Conference, 2011	SPE, USA
6.	2012	SPE faculty Travel Grant for participation in SPE Conference, 2012	SPE, USA
7.	2014	IIT(ISM) Best research Award	CANARA BANK
8.	2015	2015 SPE South Asia Regional Distinguished Achievement Award for Petroleum Engineering Faculty	SPE, South Asia and Pacific region
9.	2015	IIT(ISM) Best research Award	CANARA BANK
10.	2015	SPE outstanding Chapter Award in my convenorship	SPE, USA
11.	2011-16	SPE Gold Standard Chapter Award in my convenorship in year 2011, 2012, 2013, 2014, 2015.	SPE, USA
12.	2016	IIT(ISM) Best research Award	CANARA BANK
13.	2016-17	"The Inder Mohan Thapar Foundation (IMTF)" Research Award from IIT(ISM) for the (Jointly with PhD Student)	(IMTF)
14.	2017	IIChE (Indian Institute of Chemical Engineers) National Award for the Year 2017: ONGC Award for Excellence in Design and Development of Oil/Gas Related Process Plant and/or Chemicals.	IIChE (Indian Institute of Chemical Engineers)
15.	2017-18	"The Inder Mohan Thapar Foundation (IMTF)" Research Award from IIT(ISM) for the (Jointly with PhD Student)	IMTF
16.	2017	IIT(ISM) Best research Award	CANARA BANK

17.	2018	IIT(ISM) Best research Award	CANARA BANK
18.	2019	2019 SPE Reservoir Dynamics and Description Regional Award for South Asia and Pacific region	SPE, South Asia and Pacific region
19.	2018-19	"The Inder Mohan Thapar Foundation (IMTF)" Research Award from IIT(ISM) for the (Jointly with PhD Student)	IMTF
20.	2019	Publons Top reviewers in Cross-Field – September 2019 Publons Top reviewers in Chemistry – September 2019	Publons
21.	2020-25 (Continuous)	Ranked within top 2% in the field of energy by an independent study done by Stanford University scientists.	Stanford University
22.	2020	Admitted as a Fellow of Royal Society of Chemistry	RSC, London
23.	2022	Highly Ranked Scholar-Lifetime in the speciality of Enhanced Oil recovery.	ScholarGPS
24.	2023	"The Inder Mohan Thapar Foundation (IMTF)" Research Award from IIT(ISM) for the (Jointly with PhD Student), IMTF	IMTF
25.	2023	Ranked#21 in Engineering and Technology within India and ranked # 1539 worldwide as per Research.com Ranking 2023.	Research.com
26.	2024	Ranked#1 Researcher within IIT(ISM) and 134 within India as per World Scientist and University Ranking 2024.	AD Scientific Index
27.	2024	Ranked#1 in Petroleum Engineering and Enhanced Oil Recovery by ScholarGPS (Powering Scholarly Analytics, 2024.	ScholarGPS
28.	2024	2024 - Research.com Chemistry in India Leader Award	Research.com
29.	Till date	Around 1000 Reviewer Certificate Award (with some outstanding) from more than 50 international journals	ACS, Elsevier, Springer, Willey, RSC, MDPI, etc.
30.	2024	"The Inder Mohan Thapar Foundation (IMTF)" Research Award from IIT(ISM) for the (Jointly with PhD Student), IMTF	IMTF
31.	2024	IOGCA 2024 Awards in "Excellence in Chemistry and Chemical Engineering in Oil & Gas Industry and Petrochemical" in 7th International Oil & Gas Chemistry, Chemicals and Additives Conference & Exhibition (IOGCA 2024)" on 26th & 27th September, 2024 at Hotel Radisson Blu, Dwarka, New Delhi	MatCorr Delhi
32.	2023-24	Energy & Fuels 2024 Excellence in Review Awards	Energy & Fuels Journal, ACS

33.	2024	Distinguished Alumnus Award from the Department of Chemical Engineering, Calcutta University, Raja Bazar Science College	Department of Chemical Engineering, Calcutta University
34.	2025	2025 - Research.com Chemistry in India Leader Award Rank in Engineering and Technology in India: 16 Rank in Engineering and Technology in the World: 885	Research.com
35.	2025	Energy & Fuels 2025 Excellence in Review Awards	Energy & Fuels Journal, ACS
36.	2025	Highly Ranked Scholar-Lifetime in the speciality of Enhanced Oil Recovery-2025	ScholarGPS
39.	2025	Highly Ranked Scholar in Petroleum Engineering-2025	ScholarGPS
40	2025	2024 "The Inder Mohan Thapar Foundation (IMTF)" Best Researcher Award from IIT(ISM) for the (Jointly with PhD Student), IMTF	IMTF
41	2025	India ranking based on H-Index is 207	AD Scientific Index-2025
42	2025	Ranked within top 2% in the field of energy by an independent study done by Stanford University scientists. World rank in the subfield of Energy: 199	Stanford University
43	2026	Chartered Chemist, RSC	RSC, London
44	2026	Ranked within top 2% in the field of energy by an independent study done by Stanford University scientists. World rank in the subfield of Energy: 455	Stanford University
45	2026	Highly Ranked Scholar-Lifetime in the speciality of Enhanced Oil Recovery-2025	ScholarGPS
46	2026	Highly Ranked Scholar in Petroleum Engineering-2025	ScholarGPS
47	2026	Ranked 6th globally in enhanced oil recovery in 2026.	Scholarly Index

Foreign Visit & Collaboration:

i. Collaborative SPARC Project: Development of Polymer augmented surfactant-based microemulsion systems for enhanced oil recovery; Collaborators: Prof. Lau Hon Chung, Rice University, USA; Prof. Ofer Manor of TECHNION, Israel; 2023-25.

ii. Collaborative Project with Kuwait University on the Synthesis of tailor-made polymer for high-salinity and high-temperature reservoirs, 2024.

iii. Invited talk and research collaboration King Abdullah University of Science and Technology Thuwal 23955-6900, Kingdom of Saudi Arabia with full sponsorship during 17-21 April 2023.

iv. Research Visit: National University Singapore (15-18th October, 2018).

v. Collaborative Research Program: University Technology of Petronas, Malaysia (30 September-15 October, 2018)

vi. Collaborative research work in Fuels and Energy Technology Institute of Curtin University of Technology under the Australia-India Joint Research Centre for Coal and Energy Technology from 20 September 2016 to 30 September 2016.

vii. Internship program in the petroleum fields of MANSAROVAR ENERGY COLOMBIA LTD, Colombia (25th June-24th July, 2015).

viii. Participated SPE conference at Kuwait under SPE faculty support program for the Middle East Region in December, 2012.

ix. Presented a paper entitled "Physicochemical Properties of Microemulsions and their uses in Enhanced Oil Recovery", in International Conference on *Nanoscience* and Nanotechnology, 5-6 July, 2012, Zurich, Switzerland, 2012.

x. Participated SPE conference at Muscat under SPE faculty support program for the Middle East Region in February, 2011.

xi. Visited Japan for presenting a paper on "Role of Oil-Water Emulsion in Enhanced Oil Recovery" in International Conference on Chemistry and Chemical Engineering (ICCCE 2010) at Kyoto, Japan during 1st to 3rd August, 2010.

xii. Visited Germany as a Fellow of the German Academic Exchange Service (DAAD) on a research project entitled "Gas absorption into oil-water emulsion" for two months from May 15 to July 13, 2008, in Technische Universitat Braunschweig, Braunschweig, Germany.

PhDs Guided:

1. **Abhijit Samanta** on "Studies on Characterization of Alkali-Surfactant-Polymer System and its use in Enhanced Oil Recovery", (2011).
2. **Achinta Bera** on "Studies on Enhanced Oil Recovery by Means of Microemulsions, Interfacial Tension Reduction and Wettability Alteration", (2014).
3. **Shashikant Kumar** on "Development of Advanced Membrane Filtration for Separation of Oil from Oil-in-Water Emulsion", (2016).
4. **Keshak Babu** on "Synthesis and Characterization of New Surfactant and Polymeric Surfactant from Castor Oil for Chemical Enhanced Oil Recovery" (2016).
5. **Himangshu Kakati** on "Studies of hydrate formation and dissociation in mixture of gases in presence of promoters and inhibitors" (2017).
6. **Ravindra Kumar** on "Studies on improvement in transportation of heavy crude oil using natural and commercial surfactants" (2017).
7. **Sunil Kumar** on "Studies on Surface and Interfacial Properties of Cationic, Anionic and Nonionic Surfactants for their Application in Enhanced Oil Recovery" (2017).
8. **Vinay Kumar Rajak**, "Optimization of Process Parameters for Separation of Oil from Oil-In-Water Emulsion" (2017).

9. **Shirsendu Banerjee**, "Experimental and Modeling Studies of Flow of Paraffinic Crude Oil through Horizontal Pipes" (2017).
10. **Sudhir Kumar,** "Synthesis and Characterization of Surfactant and Polymeric Surfactant from Jatropha Oil for their Application in Enhanced Oil Recovery"- (2018).
11. **Neetish Kumar Maurya**, "Formulation and Characterization of Nanoparticle based Chemical slugs for their potential application in Enhanced Oil Recovery"-2018.
12. **Manojkumar Gudala**, "Studies on Hydrodynamics of Multiphase Crude Oil Flow in a Pipeline"-2019.
13. **Neha Saxena, "**Synthesis of Surfactants from Natural Resources and Their Characterization for Application in Enhanced Oil Recovery"-2020.
14. **Amit Kumar,** "Synthesis and Characterization of Zwitterionic Surfactant for Application in Enhanced Oil Recovery"-2020.
15. **Nilanjan Pal,** "Gemini Surfactant assisted Enhanced Oil Recovery: Synthesis, Formulation Design and Performance Assessment" -2020.
16. **Md. Tausif Ahmad**, "Oily Wastewater Treatment Using Polymeric Membranes: Synthesis, Characterization, Deliverability and Modeling of Phase Inversion Membranes"-2020
17. **Narendra Kumar Rawat,** "Formulation and Characterization of Nanoemulsion for Application in Enhanced Oil Recovery"-2021.
18. **Aditi Agarwal**, Separation of Oil from Oil-In-Water Emulsion by Microfiltration Using Ceramic Membranes-2022.
19. **Ekta Chaturvedi,** Comprehensive Studies on Reservoir Aspects of Gas Hydrates and Thermodynamics & Kinetics of Hydrate Formation and Dissociation in the Presence of Different Additives, 2022.
20. **Prathibha Pillai,** Synthesis and Characterization of Ionic Liquids for Application in Enhanced Oil Recovery, 2022.
21. **Mohammad Yunus Khan:** Mathematical and Numerical Investigations of Gas and WAG displacement Processes in Stratified Porous Media, 2022.
22. **Suresh Kumar Yatirajula**, Studies on Structural Properties and Rheology of Polymer Solutions for Enhanced Oil Recovery, 2022.
23. **Moumita Maiti,** Geological Characterization of Gas Hydrate-Bearing Sediments and Development of Drilling Fluids with Efficient Hydrate Inhibition Properties, 2023.
24. **Rohit Kumar Saw**, Investigation of Mechanisms and Performance Evaluation of Oil Recovery by Low Salinity Water Flooding in Carbonate Reservoirs, 2023.
25. **Dinesh Joshi:** Synthesis and Characterization of Nanoparticles and their effects on Surfactant based Enhanced oil Recovery, 2024.
26. **Ranjit Dutta:** Simulation Study of CO2 Enhanced Oil Recovery and CO2 Sequestration for a Mature Oilfield of Upper Assam Basin, India, 2025.

27. **Rajib Chakraborty:** Laboratory and Simulation Study of Chemical Enhanced Oil Recovery Involving Alkali-Surfactant-Polymer/Alkali-Surfactant Flooding for Parametric Evaluation, 2025.
28. **Lavisha Jangid:** Synthesis and Characterization of Gemini Surfactants Derived from Vegetable Oil and Their Application in Enhanced Oil Recovery, 2026.
29. **Shubham Prakash:** Evaluation of Enhanced Oil Recovery Potential of CO2 and Hybrid CO2 Flooding: Experimental and Modelling Approach, 2026
30. **Goru Lakshmi Papa Rao:** Design and Evaluation of Nanofluid Formulations and Deep Eutectic Solvent-Integrated Surfactant Systems for Enhanced Oil Recovery,2026.

PhD Ongoing:

1. **Soumyadip Dey:** Synthesis of Tailor-made Polymers and their Application in Enhanced Oil Recovery.
2. **Venkata Vijay Shankar Anuprakash Muthayala:** Application of AI and ML in Enhanced Oil Recovery
3. **Raj Nigam:** Synergistic Effects of CO_2 Injection and Low-Salinity Water Flooding on Oil Displacement and Reservoir Wettability
4. **Jayanta Rakhsit:** Functional Polymeric Surfactants: Interfacial Activity, Thermal Stability, and EOR Application

M.Tech. Dissertation supervised: More than 40

B.Tech. Dissertation supervised: More than 150

- **Reviewer**: He is the reviewer of more than 40 International Journals like SPE Journals, Journal of Petroleum Science and Engineering, Fuel, Fuel Processing Technology, Chemical Engineering Science, Chemical Engineering Journal, Chemical Engineering Research and Design, Chemical Engineering Data, Chemical Engineering Communication, Energy & Fuel, International Journal of Petroleum Engineering, Petroleum Exploration and Development, ACS Omega, Geosystem Engineering, Journal of Molecular Liquid, SPE Polymers, RSC Advances, Molecules, Polymer Engineering & Science, Surfaces and Interfaces, Journal of Industrial and Engineering Chemistry, The Canadian Journal of Chemical Engineering, Physics of Fluids, Applied Sciences, Petroleum Science, Journal of CO2 Utilization, Colloids and Surfaces A: Physicochemical and Engineering Aspects, Polymers, Energy & Fuels, Journal of the Taiwan Institute of Chemical Engineers, RSC Sustainability, Australian Journal of Chemistry, etc. with more than 1000 reviews.

- **Evaluation of International Projects for funding:**

  - Mitacs Accelerate research proposal GMS-100311 entitled "Development of Improved-Performance Emulsifier Systems for Oil-Based Drilling Fluids Using Waste Canola Cooking Oil". 2nd July 2026.
  - ACS Petroleum Research Fund "Experimental and simulation studies of enhanced oil recovery in porous media using viscoelastic fluorescent polymer microspheres, 2023.

- Micro Gas Turbine Modelling and Performance Assessment for Distributed Power Generation in Kuwait, Kuwait Foundation for The Advancement of Sciences (KFAS), 2023, Kuwait University.
- Novel mathematical methods with applications in oil production and refining, Kuwait Foundation for The Advancement of Sciences (KFAS), 2023, Kuwait University.
- Polymer beads for ammonia removal and bacteria control in marine water for sustainable intensive aquaculture; Science & Engineering Research Council (SERC), which is part of the Agency for Science, Technology and Research (A*STAR) in Singapore; March 2022.
- ACS PRF Project proposal "Interfacial thermodynamics and dynamics of imidazolium-based ionic liquid on calcite surface: Optimizing the adsorption and wettability alteration using large-scale molecular dynamics simulations". 2021.
- Assessment of Pore Volume Interpretations in Polymer Flooding- Research Sector Kuwait University; 2/08/2021
- Grant/Funding Program: Czech Science Foundation Grant Reviews 2021, Funder: Czech Science Foundation
- Machine Learning Based Adsorption Study for CO2:CH4 mixtures in ultra-tight Shale Reservoirs; YAYASAN UNIVERSITI TEKNOLOGI PETRONAS, Malaysia, June, 2020.
- Design of ecological, biodegradable surfactants based on renewable raw materials, 2017; National Science Centre (Narodowe Centrum Nauki), ul. Królewska 57, 30-081 Kraków.
- Proposal for the National Science Center, Poland, 2018.
- DPI Polymer Research Platform, Poland Project Evaluation Proposal Title: New Polymeric Surfactants for Enhanced Oil Recovery; 2018
- DPI Polymer Research Platform, Poland Project Evaluation Proposal Title: Well-defined Polymeric Surfactants by Group Transfer Polymerization for Enhanced Oil Recovery; 2018.

Invited Talk (Selected):

1. Delivered a lecture on “Exploring Carbon Capture and Storage: Insights into CO2 EOR and Carbonated water injection” 12th May, 2025, Monash University, Malaysia.
2. Delivered a lecture on: Low salinity water flooding for potential enhanced oil recovery in SPE Petro Fest, Dibrugarh University on 21.03.2025.
3. Invited talk in “ACS Energy Letters, and Energy & Fuels-Scholarly Publishing in Energy Research: Perspectives from Authors & Editor” June 27-28, 2024
4. Invited talk on “CO2 EOR & its application in CCUS; SPE Dibrugarh University Students’ Chapter; 17th July, 2024.
5. Delivered an invited talk on “CO_2 Sequestration and Utilization for Oil Recovery: A Pathway to Pollution Control” under National Pollution Control Day 2024; Department of Chemical Engineering; Heritage Institute of Technology Kolkata, 02.12.2024.
6. Invited talk on “Estimation of Oil Recovery and CO2 Storage Capacity in CO2 and Hybrid CO2 EOR: Experimental and Simulation Studies’ Cairn Oil & Gas, Gurugram; 13 August, 2024
7. Invited talk on “Nanoparticle-Enhanced Surfactant-Stabilized Nanoemulsions for Enhanced Oil Recovery” International Conference on Petroleum, Hydrogen& Decarbonization (ICPHD 2023), 03-05 Nov, 2023. IIT Guwahati and IIT Guwahati Society of Petroleum Engineers (SPE) Student Chapter.
8. Invited Talk on “Fundamentals and recent advances in enhanced oil recovery”, Presidency University, Bangalore, September 2020.

9. Invited talk on “Enhanced Oil Recovery” at Director General of Hydrocarbon (DGH) Office on 14th March, 2019.
10. Invited talk on “Enhanced Recovery: A Policy toward a paradigm shift”, Centre of Excellence for Energy Studies (CoEES), Guwahati, Oil India Ltd., 28th September, 2019.
11. Invited talk on “Chemical Enhanced Oil recovery” Cairn India Ltd. Office, Gurugram, on 13th March, 2019.
12. Invited talk on “Enhanced Oil Recovery- Policy to Implementation” Industry-Academia Meet Centre of Excellence for Energy Studies (CoEES), Guwahati, Oil India Ltd., 13th March 2018.
13. Delivered lectures to the Specialized training of 2 GT batches, ONGC Ahmedabad, 2018.
14. Invited talk on “Advanced Technology in Enhanced Oil Recovery”, Jadavpur University, Kolkata, 2015.

PATENT Granted: (201831026697 of 17.07.2018)

Title of Invention: Non-ionic Gemini surfactants derived from sunflower oil and compositions thereof for oil mobility control in enhanced oil recovery application

Patent No.: 433978

Application No.: 201831026697

Inventor(s): Dr. AJAY MANDAL
Shri NILANJAN PAL

Assignee: Indian Institute of Technology (Indian School of Mines) Dhanbad, Dhanbad, Jharkhand, India (IN)

Date of Grant: 07/06/2023

Patent Granted: Surfactant Stabilized Green Nano Emulsion and Method of Preparation thereof for Application in Petroleum Industries; **Patent Number 580561**

Inventor(s): Dr. AJAY MANDAL
Dr. Rohit Saw

Date of Grant: 12/02/2026; Application Number:202531001027

Patent Published: An Acid-Based Chemical Slug for Enhanced Oil Recovery; Application no. filed 202531079561 on 21.08.2025. Inventors: Prof. Ajay Mandal, Prof. Keka Ojha; Pasivedala Raj Kumar

Swayam NPTEL Course: An initiative by the Ministry of Education (Govt. of India): Enhanced Oil Recovery Techniques

TEXT BOOK Authored:

- ***Mandal, A. and Ojha, K., 2023. Enhanced Oil Recovery: Mechanisms, Technologies and Feasibility Analyses. CRC Press. ISBN 9780367566678; 346 Pages.***
- ***Saxena, N., Kumar, A. and Mandal, A., 2022. Nano Emulsions in Enhanced Oil Recovery. Germany: Springer.***
- ***Saxena, N. and Mandal, A., 2021. Natural Surfactants: Application in Enhanced Oil Recovery ISBN 978-3-030-78547-5 Book © 2022 Cham: Springer International Publishing.***

- ***Ajay Mandal, Nilanjan Pal: Emulsions in Oilfield Operations: Fundamentals to Applications in the Petroleum Industry; Springer Nature (Under submission stage).***

Contribution to the Petroleum Industry:

Dr. Mandal's profound impact on the petroleum industry is exemplified through his pioneering research in reservoir engineering and enhanced oil recovery. His groundbreaking work in surface and interface chemistry has not only advanced the scientific understanding but has yielded practical applications that hold immense promise for transforming oil and gas extraction. The innovative formulations he has developed, spanning surfactants, polymers, and nanoparticles for enhanced oil recovery, mark a paradigm shift in the industry's approach to matured reservoirs. Noteworthy formulations include microemulsions, nanoemulsions, nanofluids, Pickering emulsions, and stabilized foams. Dr. Mandal's commitment to sustainability is evident in his research on carbon dioxide sequestration, aligning with global goals. Actively collaborating with foreign universities, Dr. Mandal fosters a dynamic global exchange of knowledge. As a key member of the "Enhanced Recovery" committee within the Ministry of Oil and Natural Gas, he guides the industry toward adopting advanced technologies. Given India's dependence on imported crude oil and natural gas and the maturity of domestic reservoirs, Dr. Mandal's contributions are pivotal in shaping the future of enhanced oil recovery, ensuring a sustainable and efficient trajectory for the petroleum sector.

Major R&D Projects:

(i) Completed:

Sl. N.	Title of Project	Sponsoring Agency	Amount (Rs.)	Duration/Role
1.	Development of a CFD model for predicting axial dispersion and mass transfer characteristics in an ejector induced downflow bubble column	DST, Govt of India, New Delhi	30 Lakhs	2004-05 (*Principal Investigator*)
2.	Optimization of Alkaline-Surfactant-Polymer (ASP) Flooding for Enhanced Oil Recovery	CSIR, Govt New Delhi	9.06 lakh	2007-2010 (*Principal Investigator*)
3.	Studies on improved recovery of oil by surfactant induced wettability alteration and interfacial tension (IFT) reduction	UGC, Govt. Of India, New Delhi	7.5 lakh	2009-2012 (*Principal Investigator*)
4.	Separation of oil from oil-water emulsion by membrane filtration	IIT(ISM), Dhanbad	8.40 lakh	2010-2012 (*Principal Investigator*)
5.	Characterization of Nanoparticle Stabilized Emulsions and its use in Enhanced Oil Recovery	Oil India Ltd., India	24.34 lakh	2012-2014 (*Principal Investigator*)
6.	Development and Optimization of Coal Bed Methane Recovery Process by CO_2 Sequestration	Ministry of Coal, Govt. Of India	26.98 lakh	2007-2009 (*Co-Principal Investigator*)
7.	Synthesis of surfactant-based hydro-fracturing gel	CSIR, Govt. Of India, New Delhi	8.63 lakh	2007-2010 (*Co-Principal Investigator*)

8.	Experimental and modelling studies of flow of paraffinic crude oil through a complex flow loop	UGC, Govt. Of India, New Delhi	13.79 lakh	2013-2016 (*Co-Principal Investigator*)
9.	Experimental and Modeling Studies of Chemically Enhanced Water Alternating Gas (CEWAG) Injection for Enhanced Oil Recovery	CSIR, Govt New Delhi	17.97 lakh	2014-2017 (*Principal Investigator*)
10.	Synthesis and extraction of surfactants from natural resources and their characterization for application in enhanced oil recovery	Oil India Ltd., India	22.62 lakh	2015-2018 (*Principal Investigator*)
11.	Studies on Characteristics and Dissociation behaviour of Natural Gas Hydrate in Sediments under Subsurface Mimic Conditions.	DST, Govt of India, New Delhi	44.18 lakh	2015-2018 (*Principal Investigator*)
12.	Development of Reservoir Engineering Laboratory	FIST, DST	160 lakhs	Co-Coordinator
13.	Development and characterization of efficient drilling fluid systems to explore huge natural gas hydrate resource in the offshore of India.	Ministry of Earth Science, Govt of India, New Delhi	42.77 lakh	(2017-2020) (Principal Investigator)
14	Feasibility of using Nanoparticles for Enhanced Oil Recovery in fields of ONGC	ONGC	39.35 lakh	PI (2018-20220) (Principal Investigator)
15	Synergistic Effects of Nanoparticle and Surfactant in Formation of Nanoemulsion for Application in Enhanced Oil Recovery: Experimental and Molecular Dynamic Simulation Studies	CSIR, Govt New Delhi	22.00 lakh	2020-2023 (*Principal Investigator*)
16	Microbial Simulation and Augmentation of Gas Content of Coal Seam	Essar Oil and Gas Exploration and Production Limited	Rs. 18.54 lakhs	(2021-2022) (Co-*Principal Investigator*)
17	Foam Assisted Oil-Water Nanoemulsion for Enhanced Oil Recovery: Experimental and Molecular Dynamic Simulation Studies	OIDB	70.00 lakhs	(2020-2023) (Principal Investigator)
18	Use of natural extracts as pour point depressants for waxy crude oil"	OIDB	54 lakhs	(2020-2023) (Co-*Principal Investigator*)
19	Micro-scale investigation of miscibility behaviour of CO_2 with crude oil for enhanced oil recovery and its geological sequestration potential in Cambay Basin	DST, SERB	45 lakhs	2021-2024 (Principal Investigator)

(ii) Ongoing:

S. N.	Title	Sponsoring Agency	Amount (Rs.)	Duration
20	SPARC Project: Development of Polymer augmented surfactant-based microemulsion systems for enhanced oil recovery	MHRD, Government of India	75.00 lakhs	2023-2025 (Principal Investigator)
21	Synthesis of Bio-Based Zwitterionic surfactant for use in Enhanced Oil recovery (EOR) at High Reservoir Temperature Conditions	SERB, DST	27.00 lakhs	2024-2027 (Co-Principal Investigator)
22	Developments Tailor-made Surfactants for application in enhanced oil recovery	Syntron Industries Private Limited, Ahmedabad	8.32 lakhs	2024-26 (Principal Investigator)
23	Hot Nanofluid for Enhanced Oil Recovery: Design and Mechanism Development	HOEC	12.30 lakhs	2024-26 (Principal Investigator)
24	Development and Optimization of Eco-Friendly Surfactant/Polymer Dust Suppressants for Coal Mines Areas of Jharkhand	JSPCB	31.90 lakhs	2025-26 (Principal Investigator)
25	Study of the Impact of Injection Fluids on the Performance of a Producing Coal Bed Methane (CBM) Reservoir in the Ranigaunj East Block	Essar Oil and Gas Limited	16.44	2026-28 (Co-Principal Investigator)

16. Details of Consultancy Projects:

S. N.	Title	Sponsoring Agency	Amount (Rs.)	Duration
1.	Technical opinion on discovery in FAN-A-Well with respect to non-associated natural gas	Hardy Exploration & Production (India) Inc.	3.5 lakhs	(2009-2010) Co-Consultant In-charge
2.	Technical opinion relating to the Contract with M/S Aban Offshore Limited relating to the provision of "Floating Production System"	Hardy Exploration & Production (India) Inc.	3.86 lakhs	(2011) Co-Consultant In-charge
3.	One-week short-term course on Reservoir Engineering for Executives of Oil India Ltd.	Oil India Ltd.	7.0 lakhs	August 27-31, 2012 Consultant In-Charge
4.	One-week short-term course on Gas Hydrates	UPES, Dehradun	3.0 lakhs	2012-13 Co-Consultant In-Charge
5.	Preliminary screening of EOR for SELAN's Bakrol and Lohar oil and gas fields of Cambay basin- Cons/86-	SELAN	6.0 Lakhs	2019; Co-Consultant In-Charge

6.	Preliminary screening of EOR for SELAN's Bakrol and Lohar oil and gas fields of Cambay basin-Phase II Cons/100-2019-2020	SELAN	12.0 Lakhs	2019, Co-Consultant In-Charge
7.	Design work for oil removal system for equalization tank with 2 options: Still central concentric tube system and gun-barrel tank system along with full details, isometric & feasibility system/2019-2020	Mahima Udyog	4.13 Lakhs	2019-2020, Consultant In-Charge
8.	Core flooding studies and interpretation for Microbial Oil Recovery	TERI	3.0 Lakhs	2019-2020, Consultant In-Charge
9.	Adsorption Isotherm Analysis & Lab Studies of Coal & Shale Samples for CBM & Shale Gas, 2024	M/s Essar Oil and Gas Exploration and Production Limited, Durgapur	41.77 lakhs	2024, Co-Consultant In-Charge
10	Compatibility Study of Fresh Water with Formation Rock & Fluid of Sun Petro.	M/s Sun Petrochemicals Pvt. Ltd. Mumbai	34.0 lakhs	Consultant In-Charge
11	Evaluation of Diesel Samples of Heavy Machineries	M/s Devprabha Construction Pvt. Ltd.	11.0 lakhs	2024, Co-Consultant In-Charge
12	Performance Of Synthesized Surfactants for Enhanced Oil Recovery and Interpretation of Results with Detailed Mechanisms	Shah-Schulman Centre for Surface Science & Nanotechnology	2.95 lakhs	2024-25 Consultant In-Charge
13	Technical Assessment of Diesel Samples of Heavy-Duty Machines used by Devprabha Construction Pvt. Ltd.	M/s Devprabha Construction Pvt. Ltd.	118.0 lakhs	2024-27, Co-Consultant In-Charge
14	Studies On the Analysis and Optimization of Drilling Fluids	Sunita Hydrocolloids Inc; Houston Texas 77041 USA	US$ 1900.00	2024-25 Consultant In-Charge
15	Analysis of the corrosion rate of different corrosion inhibitors and dosage optimization at different temperatures	Sunita Hydrocolloids Inc; Houston Texas 77041 USA	4.04 lakhs	2025-25 Consultant In-Charge
16	Establishment Of Mechanisms of Low-Salinity Water Flooding (LSWF) For Improving Oil Recovery from Sandstone Reservoirs a with Moderate Salinity	Oil India Ltd.	19.80 lakhs	2025-26 Consultant In-Charge
17	Tailor-Made Polymer/Polymer Composite for High-Temperature, High-Salinity Reservoirs	Kuwait University, Kuwait	60 lakhs	2025-26 Consultant In-Charge

18	Technical Evaluation of Chemical Compatibility in Drilling and Production of CBM Wells in EOGEPL Fields.(CONS/9/14/26-27)	M/s. Essar Oil and Gas Exploration and Production Limited, Durgapur	13.10 lakhs	2026-27 Co-Consultant In-Charge

OUTREACH ACTIVITIES/ Short-Term Courses:

1	Three months Competency Development of Reservoirs for ONGC Executives-EDP/4093/2018-2019	ONGC	1.3 Crores	2018-2019, Co-Consultant In-Charge
2	Three months Competency Development of Reservoirs for ONGC Executives-EDP/5031/2019-2020	ONGC	1.3 Crores	2019-2020, Co-Consultant In-Charge
3	CMB –Gas conditioning & Processing" Course for RIL Executives Project No: EDP/6040/2020-21	RIL	6.0 Lakhs	2020-21, Consultant In-Charge
4	"Reservoir Engineering & Fundamentals of Enhanced Oil Recovery" for Executives of Oil India Ltd.: EDP/7085/2023-24	Oil India Ltd.	10.62 lakhs	2023-24, Consultant In-Charge
5	Course: 2514001- Advances in enhanced oil recovery in shale and Tight Reservoirs: Opportunities and Challenges. Foreign Faculty Name: Prof JAMES J. SHENG	Funds for the implementation of Global Initiative on Academic Network (GIAN) programme	2.905 Lakhs	2025-25 (Principal Investigator)
6	Swayam NPTEL Course: Enhanced Oil Recovery Techniques	MHRD, An initiative by the Ministry of Education (Govt. of India):	-	2024 Rerun:2025

Society of Petroleum Engineers (SPE) Activities:

- **Faculty Sponsor of SPE IIT(ISM) STUDENT Chapter (2008-2016)**
  Dr. Ajay Mandal served the SPE IITISM, Dhanbad Student Chapter from 2008 to 2016. The Chapter achievement during his period:
  Outstanding Student Chapter Award in 2010, 2015
  Gold Standard Award in 2011, 2012, 2013, 2014, 2016

- Dr. Ajay Mandal, Dept. of Petroleum Engineering, worked as member of the Regional Scholarship & Student Retention Committee of SPE Middle East, North Africa and India Region

- Worked as a member of South Asia Regional Award evaluation committee in 2016.

- **Worked as Convener of "SPE Sub-Regional Paper Meet" held at Indian School of Mines, Dhanbad in 2012 and 2009, 2016.**
- Technical Editorial member of SPE Journals.
- He worked as Membership Chairperson of SPE Kolkata Section.
- Dr. Mandal participated SPE conference at Muscat under SPE faculty support program for the Middle East Region in February, 2011.
- He participated SPE conference at Kuwait under SPE faculty support program for the Middle East Region in December, 2012.
- Organization of visit and address of **Dr. Ganesh Chandra Thakur, 2012 SPE President** on 25th Feb, 2012. And Dr. **D Nathan Meehan-SPE President 2016** on 2016 at IITISM Dhanbad, India
- He successfully worked as member of the Regional Scholarship & Student Retention Committee of SPE Middle East, North Africa and India Region during 2010-11.
- Dr. Dinesh Joshi, PhD Student of won the 1st prize in PG category in SPE Regional paper meet in 2023.
- Dr. Mandal actively involved with the SPE as volunteer and organizing different lectures of petroleum Industry experts, which are reflected in the SPE Presidential Award of the Students Chapter in 2024.

Service in Professional Organizations

- Member of Faculty selection Committee, IIT Kharagpur, 2023
- Faculty Performance Evaluation of Presidency University, 2025
- Member of Faculty selection Committee, RGIPT, Jais, Uttar Pradesh 2020
- Attended many meetings as Member of BOCS, UPES, Dehradun
- Attended many meetings as Member of BOCS, JNTU Kakinada
- Attended many meetings as Member of BOCS, Aditya Engineering College, Kakinada
- PhD Thesis Examiner of Foreign Universities: Anastasia Ivanova, Dynamic modelling and experimental evaluation of nanoparticles application in surfactant enhanced oil recovery, Skolkovo Institute of Science and Technology.
- PhD Thesis Examiner of Foreign Universities: Lezorgia Nekabari Nwidee, Nanoparticles for Enhanced Oil Recovery Processes' Curtin University, Australia, 2017.
- PhD Thesis Examiner of Foreign Universities: Syed Ali Qasim Zohair, Performance Evaluation of Quaternary Ammonium Salts as Thermodynamic Gas Hydrate and Corrosion Inhibitors, Universiti Teknologi PETRONAS, 2021.
- PhD Thesis Examiner of Foreign Universities: Najeebullah, Development of Polymeric Nano Composite as a Potential Hybrid Fluid for Enhanced Oil Recovery Process in Sandstone Reservoirs, Universiti Teknologi PETRONAS, 2022.
- PhD Thesis Examiner of Foreign Universities: Daniel Asante Otchere, Development of a new Model for Determination of Water-Wet Sandstone Wettability Using Experimental Work and Machine Learning, Universiti Teknologi PETRONAS, 2022.
- PhD Thesis Examiner of Foreign Universities Nallakukkala Sirisha, Performance Evaluation

and Kinetic Study of CO2-Rich Natural Gas Hydrate Formation for Produced Water Treatment, Universiti Teknologi PETRONAS, 2023.

- PhD Thesis Examiner of Foreign Universities: Khor Siak Foo, Investigation of Interfacial Interaction of Span and Tween Surfactants on Hydrate Crystallization, Universiti Teknologi PETRONAS, 2022.
- PhD Thesis Examiner of Indian Universities: More than 20, mostly from IITs.
- M.S. Thesis examiner of Kuvonchbek Abdirakhmonov on Core-Scale Study of Miscible CO2 Foam–Oil Interactions UAE University, Abu Dhabi.

Institutional Responsibility (Selected)

1. **Professor-In-Charge (Library) -March 2023 onwards**
2. **Head, Department of Petroleum Engineering, May 2019-March 2022**
3. **Associate Dean (Sponsored Project), May 2018 - June 2019**
4. Signed MoU with The GUJARAT ENERGY RESEARCH AND MANAGEMENT INSTITUTE, Gandhinagar, 2019.
5. Signed MoU with ASN Innovative Private Limited (ASN), 2021.
6. Signed MoU with Wesmarty Infotech Pvt. Ltd.,2019.
7. Member of Improvement Group: 2015-2017
8. Member of the Research Council
9. Member Annual Rate Contract
10. Member of HAC
11. Member, Senate
12. Faculty Sponsor of SPE ISM Student Chapter since 2008-2016

Departmental responsibility

1. Head, Department of Petroleum Engineering, May 2019-March 2022
2. Served the Department as M.Tech Coordinator: 2008-2012.
3. Convenor, DUGC
4. Member, DPAC
5. Member, DAC
6. Member, DFSC
7. Developed more than 3 Courses (for both UG/PG/PhD)

Laboratory In-charge

- Process Engineering Lab
- Gas hydrate laboratory

Lab developments:

- Developed State-of-the-Art Enhanced Oil Recovery Lab
- Developed State-of-the-Art Gas Hydrate Lab

I. Publications:

List of Publications: More than 260	
Total Google Scholar Citations:**18,300 (Approx)**	
h-index	**80**

i10-index	**208**

Scopus
Citations: ~ 13,572 ; *documents*: 248; *h*-index: 69
Web of Science:
Citations: 9650; documents: 214; h-index: 63