

C. V of Dr. Lakshminarayana Rao

1. Research and Education Details

Associate Professor, IISc, Bangalore

2022 to date

- Working in the field of cold plasma science and technology in the areas of renewable energy and wastewater treatment and recycling
- Graduated 1 PhD student. Currently supervising 5 PhD students as the main guide and 6 PhD students as Co-Guide
- 35 peer reviewed international journal articles, 28 conference proceedings, 2 book chapters, 6 granted patents and 5 patent applications submitted. One technology transfer ongoing
- Have secured funding of Rs 3.37 Crores (0.45 Million USD) as Principal investigator and Rs 22.5 Crores (3 Million USD) as Co-Principal Investigator
- Societal impact of the research: work has resulted in a large-scale water recycling project for the state which is benefitting 20 Lakh (2 Million) farmers

Assistant Professor, IISc, Bangalore India

2016 to 2022

- Working in the field of cold plasma science and technology in the areas of renewable energy and wastewater treatment and recycling
- Graduated 2 Master's students.

Unilever Research Center, Bangalore India

2014 to 2016

- Research scientist – Strategic Science group working in the area of cold plasma consumer applications in the field of air and water hygiene and water saving programs

Industrial Research, PyroGenesis Canada Inc., Montreal, Canada

2010 to 2014

NSERC Industrial R & D Fellowship, PyroGenesis Canada Inc., Canada

2008 to 2010

- Led a thermal plasma torch developmental program which included physical experiments and 3D steady state mathematical modeling of a thermal plasma torch. Conducted physical experiments on a 150 kW plasma torch system to improve its life. The work resulting in an improved life of the plasma torch from 150 hrs to 1000 hrs.
- Chief scientist for the development of 'Steam Plasma Arc Hydrolysis System' for destruction of Ozone Depleting Substances. Successfully designed, constructed and performed proof of concept testing on a 2 kg/hr system to achieve 99.9999% destruction and removal efficiency, with R-12 as the feed material. Led the scale up effort for a 50 kg/hr commercial system.
- Design and development of high power thermal plasma torches ranging from 30 kW to 750 kW gross power. This work so far has led to two products & three patent applications.

- Development of thermal plasma waste to energy system.
- Led all contract research efforts undertaken by PyroGenesis Canada Inc.

Ph.D. Chemical Engineering

McGill University, Montreal, Canada.

2004-2007

CGPA 4.0 out of 4.0

- Thesis work: Effect of Cathode Microstructure on Erosion of Copper Cathodes - An Experimental Study.
- Plan, produce and characterize nano-structured cathodes in close collaboration with the Industrial Materials Institute, a research lab of the National Research Council of Canada.
- Established qualitative and quantitative relationship between cathode microstructure and arc electrode erosion rate. Established that coatings with smaller grain sizes having 900 to 1500 micron grain size result up to 70% lower erosion rates compared to regular copper having 20 to 23 micron grains.
- Contributed towards fundamental understanding of atmospheric pressure arc movement and existence/movement of cathode spots.
- The work resulted in six journal publications.

M.Sc(Eng). Dept. of Metallurgy

Indian Institute of Science, Bangalore, India.

2002-2004

CGPA 6.2 out of 8.0

- Thesis work: Mathematical and Physical Modeling of Boron Carbide Manufacturing Process.
- Design, development, procurement, installation and troubleshooting of a 80 kilowatt Boron Carbide reactor (100 kg/batch) and its accessories.
- Mathematical modeling and numerical simulation of the process.
- Conducted physical experiments to validate the modeling results and established that the modeling results correlates with the experimental observations.
- Graduated with best outgoing thesis of the year.
- The work resulted in two journal publications.

B.E. Chemical Engineering

Bangalore University, Bangalore, India.

1996-2000

Overall average of 79.8%

- Graduated with distinction. Received University's 10th rank medal out of 500 students graduating for the year 2000.

2. Awards and Prizes

1. Industrial Research and Development Fellowship (30,000 \$/yr), NSERC 2008-2010
2. W.H. Gauvin Graduate Fellowship (15,000 \$/yr), McGill University 2004-2005
3. McGill Graduate Studies Fellowship (19,000 \$/yr), McGill University 2005-2006

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| 4. McGill Graduate Studies Fellowship (24,000 \$/yr), McGill University | 2006-2007 |
| 5. McGill Graduate Award (5,000 \$), McGill University | 2006 |
| 6. Graduate Student Research Scholarship (72,000 Rs./yr), IISc | 2002-2004 |
| 7. Medal for the best outgoing thesis of the year 2004-2005, IISc | 2005 |

Research Guidance

1. Graduated 2 Master's and 1 PhD. Currently supervising 5 PhD students as a main guide and 6 PhD students as Co-Guide
2. At PyroGenesis Canada Inc, I have lead an active research team of five people comprising of two process technicians, one post doctoral student completing his post doctoral fellowship, one chemical engineer with Masters Degree and one automation engineer with a bachelor's degree.

3. Research Expertise and Technical Skills

- Expertise in plasma reformers
- Expertise in design of ozonators
- Expertise in modelling of sewage treatment plants
- Expertise on design of plasma torches and plasma systems
- Expertise on design of refractory lined reactors
- Expertise on working with high power transformers and rectifiers
- Experience in installation and aligning of industrial CO₂ pulsed laser system.
- Proficient with characterization of plasma sprayed and HVOF sprayed coatings.
- Experience in design and development of data acquisition systems using NI Lab view.
- Adept in various material characterization tools : FESEM, EDS, AFM, XRD, Optical microscopy, high speed CCD camera imaging, Particle size distribution analysis and Two color pyrometer.
- Fluent with programming languages such as Matlab, Visual Fortran and Fluent.
- Teaching experience in Mathematical Analysis of Experimental Data and Design Principles in Environmental Engineering Courses.

3.1 Personal Details

Date of Birth	:	28 th of November 1978
Marital Status	:	Married
Nationality	:	Indian

Dr. Lakshminarayana Rao - List of Publications
Journal Publications- Accepted/Published

1. Anbarasan Rajan, Bhavadharini Boopathy, Mahendran Radhakrishnan, **Lakshminarayana Rao**, Oliver K. Schlüter, and Brijesh K. Tiwari, Plasma processing: a sustainable technology in agri-food processing, *Sustainable Food Technology*, Minor Revision
2. Manjari M, Kavita V, Ramesh N, Anirudha TP, Santrupt RM, Reshmi Das, Mohan Kumar M S, Chanakya H N and **Lakshminarayana Rao**, Socio-Economic Impact Assessment of Large-Scale Recycling of Treated Municipal Wastewater for Indirect Groundwater Recharge, *Science of Total Environment*, Accepted
3. Rucha Vaidya, K R Sheetal Kumar, M S Mohan Kumar and **Lakshminarayana Rao**, Chlorine Attenuation in Continuous and Intermittent Drinking Water Supply Networks, *Urban Water Journal*, <https://doi.org/10.1080/1573062X.2022.2139275>
4. Punith N., Ashish K. Singh, Ananthanarasimhan J., Bhavadharini Boopathy, Ritika Chatterjee, Hemanth M., Dipshikha Chakravorty, **Lakshminarayana Rao**, Generation of neutral pH high-strength plasma-activated water from a pin to water discharge and its bactericidal activity on multidrug-resistant pathogens, *Plasma Process Polym.* 2022, e2200133. <https://doi.org/10.1002/ppap.202200133>
5. Reshma Mohan, Mohan Kumar M S, and **Lakshminarayana Rao**, Biofouling of hollow fiber ultrafiltration membranes: A novel multiphase CFD – porous - CES model and experimental study, *Journal of Membrane Science*, 2022, pp, 121034, <https://doi.org/10.1016/j.memsci.2022.121034>
6. Reshma Mohan, Mohan Kumar M S, and **Lakshminarayana Rao**, An integrated hydrodynamic-biokinetic model to optimize the treatment processes in a laboratory-scale, pilot-scale, and full-scale bioreactor, *Journal of Water Process Engineering*, 2022, 49, pp.103108, <https://doi.org/10.1016/j.jwpe.2022.103108>
7. Reshmi Das, H.N. Chanakya, and Lakshminarayana Rao. Study towards understanding foaming and foam stability in urban lakes. *Journal of environmental management* 322, 2022, pp. 116111. <https://doi.org/10.1016/j.jenvman.2022.116111>
8. Ram Mohan Pathak, Ananthanarasimhan N J and **Lakshminarayana Rao** Chemical Kinetics Simulation of Hydrogen Generation in Rotating Gliding Arc Plasma, *IEEE Trans. Plasma Science*, vol. 50, no. 8, Aug. 2022, pp. 2482-2488, <https://doi.org/10.1109/TPS.2022.3188338>
9. Ananthanarasimhan N J and **Lakshminarayana Rao**, Influence of flow regime on the decomposition of diluted methane in a nitrogen rotating gliding arc, *Sci Rep* 12, 2022, 11700, <https://doi.org/10.1038/s41598-022-14435-z>

10. Indumathy. B, Ananthanarasimhan N. J, **Lakshminarayana Rao**, Yugeswaran. S and P.V. Ananthapadmanabhan, Catalyst free production of green ammonia from the interaction of gliding arc plasma and water surface. *Journal of Physics D: Applied Physics* 55, no. 39 2022, 39550 <https://doi.org/10.1088/1361-6463/ac7b52>
11. Ananthanarasimhan N J and **Lakshminarayana Rao**, Influence of transitional and turbulent flow on electrical, optical, morphological and chemical characteristics of a nitrogen rotating gliding arc, *Journal of Physics D: Applied Physics*, 55, 2022, 245202-245219. <https://doi.org/10.1088/1361-6463/ac5bcc>
12. Anam Adil, Anand M Shivapuji and **Lakshminarayana Rao**, Thermodynamic analysis for methanol synthesis using biomass-derived syngas, *Biomass Conv. Bioref.* 12, 2022, 1819–1834. <https://doi.org/10.1007/s13399-022-02338-y>
13. Ananthanarasimhan N J Adarsh R and **Lakshminarayana Rao**, Arc diameter estimation of a rotating gliding arc using a simple high-speed camera and “Gaussian fit” function, *IEEE Transactions on Plasma Science*. 50, 6, 2022, 1401, <https://doi.org/10.1109/TPS.2022.3145497>
14. Adil, Anam, and **Lakshminarayana Rao**. Methanol production from biomass: Analysis and optimization. *Materials Today: Proceedings* 57 (2022): 1770-1775. <https://doi.org/10.1016/j.matpr.2021.12.450>
15. Reshma Mohan, Mohan Kumar M S, Chanakya H N and **Lakshminarayana Rao**, Optimization of Biological Nutrient Removal in a Sewage Treatment Plant through Process Modelling and Simulation, *Journal of Water Process Engineering*, 45, 2022, 102461, <https://doi.org/10.1016/j.jwpe.2021.102461>
16. Anand M S, Dasappa S and **Lakshminarayana Rao**, Assessment of planar laminar flame speed of Hythane generated in-situ from non-thermal plasma reforming of Methane: Flame tube-based experiments and thermo-chemical analysis, *Thermal Science and Engineering Progress*, 29 (2022) 10117 <https://doi.org/10.1016/j.tsep.2021.101179>
17. Priyanka Jamwal, Anjali V Raj, Anusree K Anju, Praveen Kumar, Durba Biswas, **Lakshminarayana Rao**, Rachel Helliwell, Samia Richards, Rowan Ellis, Nazli Koseoglu, Jagadeesh Yeluripati and Stephanie Connelly, A novel approach to baseline water quality assessment at local and catchment scale: A case study from southern region, India, *Environ Monit Assess* 193, 837 (2021). <https://doi.org/10.1007/s10661-021-09617-7>
18. Priyanka Tripathi, and **Lakshminarayana Rao**, Single particle and Packed bed studies of High Ash and High Plastic Content Refused Derived Fuel, *Fuel*, 308, 2022, 121983-121995. <https://doi.org/10.1016/j.fuel.2021.121983>
19. Harsha Rao, **Lakshminarayana Rao** and H N Chanakya, Fate of Heavy Metals in Sewage Systems, *Current Science*, 121, 2021, [154.pdf \(currentscience.ac.in\)](https://www.currentscience.ac.in/pdf/cs/121/154/2021154.pdf)

20. Samia Richards, **Lakshminarayana Rao**, Stephanie Connelly, Anjali Raj, Lakshmi Raveendran, Shahana Shirin, Priyanka Jamwal and Rachel Helliwell, Sustainable water resources through harvesting rainwater and the effectiveness of a low-cost water treatment, *Journal of Environmental Management*, 286, 2021, 112223-112231
<https://doi.org/10.1016/j.jenvman.2021.112223>.
21. Ananthanarasimhan N J, Reetesh G, Leelesh. P, Srikar P S, Anand M Shivapuji and **Lakshminarayana Rao**, Estimation of electron temperature and density of argon rotating gliding arc discharge using spectroscopic, and physical–electrical measurements, *Journal of Applied Physics*, 129, 223301-223317, 2021
<https://doi.org/10.1063/5.0044014>
22. Ananthanarasimhan N J, Anand M Shivapuji and **Lakshminarayana Rao**, Simulation of Velocity Evolution of a Cold Collision-less Non-Magnetised Plasma by Particle-in-Cell Method, *Front Adv Mat Res*, 2, 2, 2020,18-25.
<https://doi.org/10.34256/famr2023>
23. P S Ganesh Subramanian, Leelesh P, Anand M Shivapuji, Pierre-Luc G, and **Lakshminarayana Rao**, Plasma Activated Water from DBD as a source of Nitrogen for Agriculture: Specific Energy and Stability Studies, *Journal of Applied Physics*, 129, 2021, 093303-093314
<https://doi.org/10.1063/5.0039253>
24. Priyanka Jamwal, Anjali V Raj, Stephanie Connelly, Jagadeesh Yeluripati, Samia Richards, **Lakshminarayana Rao** and Matteo Tamburini, Evaluating the performance of planted and unplanted HSSF-constructed wetlands: A case study from southern India, *Ecological Engineering*, 162, 2021,106170-106181
<https://doi.org/10.1016/j.ecoleng.2021.106170>
25. Reshma Mohan, Mohan Kumar and **Lakshminarayana Rao**, CFD Multiphase Simulation of Oxygen Transfer from Diffused Aeration System in Synthetic Wastewater, *Journal of Water Process Engineering*, 40, 2021,101920 <https://doi.org/10.1016/j.jwpe.2021.101920>
26. P. S. Ganesh Subramanian, Anjali V Raj, Priyanka Jamwal, Stephanie Connelly, Jagadeesh Yeluripati, Samia Richards, Rowan Ellis and **Lakshminarayana Rao**, Decentralized Treatment and Recycling of Greywater from a School in Rural India, *Journal of Water Process Engineering*, 38, 2020, 101695
<https://doi.org/10.1016/j.jwpe.2020.101695>
27. Amit Kumar, Ananthanarasimhan J, Anand M S, Dasappa S and **Lakshminarayana Rao**, Experimental Investigations of Non catalytic Cold Plasma Water Gas Shift Reaction, *Journal of Physics D: Applied Physics*,53, 2020, 465205
<https://doi.org/10.1088/1361-6463/aba92d>
28. P S Ganesh Subramanian, Aditi Jain, Anand M Shivapuji, Nagalingam R Sundaresan, S Dasappa, and **Lakshminarayana Rao**, Plasma activated water from a dielectric barrier

discharge plasma source for the selective treatment of cancer cells, *Plasma Processes and Polymers*, 17, 8, 1900260-1900273, 2020.
<https://doi.org/10.1002/ppap.201900260>

29. Ananthanarasimhan J, **Lakshminarayana Rao**, Anand M Shivapuji and Dasappa S, Influence of gas dynamics on arc dynamics and discharge power of rotating gliding arc, *Plasma Sources Sci. Technol*, 28, 2019, 085012.
<https://doi.org/10.1088/1361-6595/ab2169>
30. Seema Sukhani, Punith N, Atharva Ekatpure, Gautami Salunke, Manjari M, Harsha Rao, H N Chanakya and **Lakshminarayana Rao**. Understanding potential of using plasma activated water as nitrogen source for algal growth: A Microcosm study, *IEEE Transactions on Plasma Science*, 49,2, 551-556, 2021
31. Ananthanarasimhan J, Anand M Shivapuji, Leelesh P and **Lakshminarayana Rao**, Effect of Gas Dynamics on Discharge Modes and Plasma Chemistry in Rotating Gliding Arc Reactor, *IEEE Transactions on Plasma Science*, 49, 2, 502-506, 2021.
<https://doi.org/10.1109/TPS.2020.2994580>
32. Ganesh Subramanian P S, Harsha R, Manju D. K., Hemanth M, **Lakshminarayana R**, Anand M S and Dasappa S, Characterization of Plasma Activated Water for Medical Applications, *Advanced Materials Letter*, 10, 12, 919-923, 2019
<https://doi.org/10.5185/amlett.2019.0041> ;
33. Punith N, Harsha R, **Lakshminarayana R**, Hemanth M, Anand M S and Dasappa S, Plasma activated water generation and its application in agriculture, *Advanced Materials Letter*, 10, 10, 700-704. 2019
<https://doi.org/10.5185/amlett.2019.0042> ;
34. Seema Sukhani, Punith N, **Lakshminarayana R** and Chanakya H N., Plasma activated water as a source of nitrogen for algae growth, *Advanced Materials Letter*, 10, 11, 797-801, 2019
<https://doi.org/10.5185/amlett.2019.0043> ;
35. Ananthanarasimhan N J, **Lakshminarayana R**, Anand M Shivapuji and Dasappa S, Characterization and Applications of Non-Magnetic Rotating Gliding Arc Reactors - A Brief Review, *Front Adv Mat Res*, 1, 1, 31-38, 2018,
<https://doi.org/10.34256/famr1916> ;
36. Ananthanarasimhan J, Leelesh P, Anand M Shivapuji, and **Lakshminarayana Rao**, Validation of Projected Length of the Rotating Gliding Arc Measured using Regionprops function, *Plasma Research Express*, 2, 035008, 2020.
<https://doi.org/10.1088/2516-1067/abae49> ;
37. J. Tavares, **L. Rao**, C. Derboghossian, P. Carabin, A. Kaldas, P. Chevalier, and G. Holcroft, Large-Scale Plasma Waste Gasification, *IEEE Transactions on Plasma Science*: 39 (11), 2908-2909, 2011.

38. **M.P.L.N. Rao**, Gupta, G.S., Manjunatha, P., Kumara, S., Surib, A.K., Krishnamurthy, N., Subramanian, C. Core temperature measurement in carbothermal reduction processes. *Thermochimica Acta*, 482: 66 (7 pages), 2009.
39. **M.P.L.N. Rao**, Gupta, G.S., Manjunatha, P., Kumara, S., Surib, A.K., Krishnamurthy, N., Subramanian, C. Temperature measurements in the boron carbide manufacturing process- A hot model study. *Int. Journal of Refractory Metals & Hard Materials*, 27 (3), 621–628, 2009.
40. D'Sa K., **Lakshminarayana Rao**, and Munz, R. J. Effect of cathode microstructure on arc velocity and erosion rate of cold-sprayed copper cathodes in a magnetically rotated atmospheric pressure arc. *Journal of Thermal Spray Technology*, 17 (4): 574-582, 2008.
41. **Lakshminarayana Rao**, and Munz, R. J. E Effect of cathode microstructure on arc velocity and erosion rate of cold cathodes in magnetically rotated atmospheric pressure arcs. *Journal of Physics D: Applied Physics*, 41: 165201 (11 pages), 2008.
42. **Lakshminarayana Rao**, Munz, R. J. and Meunier, J-L. Vacuum arc velocity and erosion rate measurements on nanostructured plasma and HVOF spray coatings. *Journal of Physics D: Applied Physics*, 40 (14): 4192-4201, 2007.
43. **Lakshminarayana Rao**, and Munz R. J. Effect of surface roughness on erosion rates of pure copper coupons in pulsed vacuum arc system. *Journal of Physics D: Applied Physics*, 40 (24): 7753-7760, 2007.
44. **Lakshminarayana Rao**, Munz, R. J. and Coulombe, S. Observation of atmospheric pressure arc on a cold cathode. *Applied Physics Letters*, 91: 141502-4, 2007.
45. **Lakshminarayana Rao**, Reddy N.K., Coulombe, S., Meunier, J-L., and Munz, R. J. Carbon nanotubes as nanoparticles collector. *Journal of Nanoparticle Research*, 9 (4): 689-695, 2007.

Journal Publications- Submitted

1. Chakraborty, A., Muddu, S., Bhanja. S. and **Rao, L.**, Assessment of the Role of Seasonal Cycle-Water Table Depth Interplay on the Water and Carbon Fluxes of India's Terrestrial Ecosystems Corresponding, *Journal of Agricultural and Forest Meteorology*, Submitted
2. Ram Mohan Pathak, Ananthanarasimhan N J and **Lakshminarayana Rao**, Validation of Electrical Characteristics in a Dielectric Barrier Discharge Simulated using Equivalent Circuit Model and Simulink, *IEEE Trans. Plasma Science*

Journal articles under preparation

1. Reshmi Das, P. S. Ganesh Subramanian, Anjali V Raj, Priyanka Jamwal, Stephanie Connelly, Jagadeesh Yeluripati, Samia Richards, Rowan Ellis and **Lakshminarayana Rao**, Design of decentralized wastewater treatment system for a School in Rural India, *Journal of water resources management*
2. Ananthanarasimhan N J, Anand M S and Lakshminarayana Rao, A review of tar decomposition using cold plasma, *Chemical Engineering Journal*
3. P S Ganesh Subramanian, Leelesh P, Anand M Shivapuji, Naveen Reddy and Lakshminarayana Rao, Nitrogen supplements via plasma activated water: Energy analysis, *Plasma Chemistry Plasma Processing*.

Abstracts/papers submitted to International Conferences

1. Chakraborty, A., Muddu, S., **Rao, L.** (2022), "Assessment of the Response of Carbon Use Efficiency of Indian Ecosystems to Climate Extremes and Aridity Gradients". 19th Annual Meeting, Asia Oceania Geosciences Society (AOGS2022) Virtual, 01-05 August, 2022.
2. Anam A and **Rao, L.**, Methanol Synthesis from Biomass Gasification., International Conference on Engineering for Waste and Biomass Valorisation, Copenhagen, Denmark, June 27-30, 2022, Submitted
3. Priyanka T and **Rao, L.**, Effect of Plastic Content And Pelletisation Method On Physical, Chemical, And Thermal Properties Of Refuse Derived Fuel., International Conference on Engineering for Waste and Biomass Valorisation, Copenhagen, Denmark, June 27-30, 2022, Submitted
4. Chakraborty, A., Muddu, S., **Rao, L.** (2021), "Assessment of the Impacts of Climate and Land Use Change and Uncertainty Quantification of the Global Gross Primary Productivity: A Performance Weightage Ensemble Approach". 2021 Fall Meeting, AGU, New Orleans, LA, 13-17 December.
5. Chakraborty, A., Muddu, S., **Rao, L.**, Assessment of the Carbonate Weathering Carbon Sink Potential of Indian Ecosystems for the 21st Century, Goldschmidt2021 Virtual - 5584, 4-9 July, 2021.Submitted
6. Chakraborty, A., Muddu, S., and **Rao, L.**, Assessment of Impact of Hydroclimatic Disturbances on Terrestrial GPP Extremes of India Under Land Use and Climate Change,

EGU General Assembly 2021, online, 19–30 Apr 2021, EGU21-4195,
<https://doi.org/10.5194/egusphere-egu21-4195>, 2021

7. Chakraborty, A., Muddu, S., **Rao, L.**, Assessment of Spatial Variations and the Interaction of Climate-Soil-Human Drivers of India's Terrestrial Carbon Use Efficiency. [Paper number: B108-0012], 2020 Fall Meeting, AGU, San Francisco, CA, 1-17 December.
8. Chakraborty, A., Muddu, S., **Rao, L.**, Assessment of Carbon Storage of India's Terrestrial Ecosystems and Important Drivers: A Remote Sensing Approach. In National Symposium on Remote Sensing for Environment Modelling & Climate Change Assessment: Opportunities and Challenges, Space Applications Centre (ISRO), Ahmedabad, Page 132 – 133, 18-19 December, 2020.
https://isrsns2020.in/img/ISRSNS_2020_Abstract_Volume.pdf
9. Kapudeep K, Punith N, P S Ganesh Subramanian, Manju D K, Dipshikha Chakravortty, and **Lakshminarayana Rao**, Antimicrobial Study Of The Plasma Activated Water Using E. coli, 8th International Conference on Plasma Medicine, August 01~06, 2021 / Songdo Convensia, Incheon, Korea. *Accepted*.
10. Reshma Mohan T, Seetha Lakshmi, **Lakshminarayana Rao** and M.S. Mohan Kumar, Numerical Simulation of Hydrodynamics and Bio-Chemical Membrane Fouling in Porous Media, AGU Fall Meeting, San Francisco, 7 – 11 December 2020,
11. Reshma Mohan T, **Lakshminarayana Rao** and M.S. Mohan Kumar, Oxygen Transfer Predictions for Diffused Aeration System in Wastewater Treatment Plants: A Numerical Approach, AGU Fall Meeting, San Francisco, 9 – 13 December 2019.
12. Ananthanarasimhan N J, **Lakshminarayana R**, Anand M Shivapuji and Dasappa S, Observation of Arc Rotation and Voltage characteristics in Rotating Gliding Arc, Proceeding of the 24th International Symposium on Plasma Chemistry, Naples, Italy, June 9th –14th, 2019
13. Harsha Rao, Punith Narayanappa, **Lakshminarayana Rao**, Anand M Shivapuji, and Dasappa, S, Plasma activated water generation, characterization and application for seed germination and plant growth, Proceeding of the 24th International Symposium on Plasma Chemistry, Naples, Italy, June 9th –14th, 2019
14. Sharath Chandra, Niveditha, Chanakya H N, Puttanna C and **Lakshminarayana Rao**, Wastewater treatment and recycling in a bus depot-a case study from Bangalore, Proceedings of ICONSWM 2019, Bhubaneshwar, India
15. Priyanka Tripathi, **Lakshminarayana Rao**, Anand Shivapuji and S. Dasappa, Status of Municipal Solid Waste generation in the world and in India with emphasis on refused derived fuel production and its utilization, Proceedings of ICONSWM 2019, Bhubaneshwar, India

16. Reshmi Das, Chanakya H N and **Lakshminarayana Rao**, Water Quality assessment of Bellandur lake, Bangalore Karnataka, Proceedings of ICONSWM 2019, Bhubaneshwar, India
17. P. Narayanappa, A. Singh, **L. Rao** and S. Dasappa, Decentralized Grey Water Recovery System Using Cold Plasma for Rural India, Proceeding of the 23rd International Symposium on Plasma Chemistry, Montreal, Canada, July 30th –August 4th, 2017
18. Amit Kumar., Anand M.S., **Rao L.** and Dasappa S., Cold Plasma Methane Reforming, Proceedings of the 11th Asia-Pacific Conference on Combustion, The University of Sydney, NSW Australia, 10th -14th December 2017. Volume 1, Page # 686-689; ISBN # 9781510856462
19. A. Carkner, **L. Rao**, A. Kaldas, P. Carabin, A. Ross, “Destruction of Ozone Depleting Substances using Steam Plasma”, 31st International Conference on Incineration and Thermal Treatment Technologies, New Orleans, LA, October 22-24, 2012.
20. **L. Rao** and P. Carabin, Thermal Plasma Torches for Metallurgical Applications, COM 2012 Conference of Metallurgists held in conjunction with Pressure Hydrometallurgy, Niagara Falls, Canada, Sept 30 to Oct 3 2012, accepted for Publication. 2012.
21. P. Carabin, **L. Rao** and A. Ross, « Destruction de SACO par plasma de vapeur », Salon des Technologies Environnementales du Québec – STEQ 2012, Québec (Québec), Canada, 14 March 2012.
22. **L. Rao**, P. Carabin, and G. Holcroft, Plasma Waste Gasification: Decentralized Approach to Production of Energy From Waste, 2nd International Conference on Hazardous and Industrial Waste Management, Chania, Crete, Greece, 5-8 October, 2010.
23. **L. Rao**, Plasma Technology Mini-course, 8th World Congress of Chemical Engineering, Montreal, QC, Canada, August 23-27, 2009.
24. N.Y. Mendoza Gonzalez, **L. Rao**, P. Carabin, A. Kaldas, J.L. Meunier, A Three-Dimensional Model of a DC Thermal Plasma Torch for Waste Treatment Applications, Proceeding of the 19th International Symposium on Plasma Chemistry, Bochum, Germany, July 27-31, 2009.
25. **L. Rao**, C. Guédéhoussou, C. Derboghossian, A. Kaldas, A., and P. Carabin, Validation of the Plasma Resource Recovery System (PRRS) Simulations, 28th International Conference on Incineration and Thermal Treatment Technologies, Cincinnati, OH, May 18-21, 2009.
26. **Lakshminarayana Rao** and Richard J. Munz Effect of Microstructure of Cathodes on Arc Erosion and Arc Velocity of Cold Cathodes, Proceedings of International Symposium on Plasma Chemistry-18, Paper No. 111, Kyoto, Japan, 2007.

27. **M. P. L. N. Rao**, G. S. Gupta and A. K. Suri, Modeling of boron carbide manufacturing process. Proceedings of EMC 2003, European Metallurgical Conference. Hanover, Germany, 2003.

Book Chapter

1. Rao Harsha., **Rao L.**, Haridas H., Manju D.K., Swetha S., Chanakya H. (2020) Design and Characterization of Cold Plasma Ozonator for Wastewater Treatment. In: Ghosh S., Saha P., Francesco Di M. (eds) Recent Trends in Wastewater Treatment and Water Resource Management. Springer, Singapore. https://doi.org/10.1007/978-981-15-0706-9_16
2. Gupta G.S. and **M.P.L. Rao** Scale up of Carbide Production. A book chapter in a titled book 'Scale-up in Metallurgy'. Published by ProcessEng Engineering GmbH (2010). ISBN: 3902655100. (All copyright reserved to the publisher).

Patents Granted/Filed

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