


Brief Biodata

Name: Dr. Shankar G. Aggarwal

Designation:	Professor (in AcSIR), Chief Scientist & Head (Gas Metrology)	
DP No. and Name:	Gas Metrology, 3.02	
DU No. and Name:	Environmental Sciences & Biomedical Metrology Division, 3.0	
Email:	aggarwalsg.nplindia@csir.res.in	
Date of Joining CSIR-NPL:	15.04.2009	
Phone (office)	91 11 4560 8331	
Mobile (optional)		

Research Area/ Interest

Aerosol atmospheric chemistry and physics, gas and particulate metrology, air quality measurements and instrumentation, control technology development and measurement

Educational Qualifications

(Please write latest qualification first)

Degree	Subject	University/ Institute	Year
Ph.D.	Chemistry	Pt. Ravishankar University, Raipur	1999
PGDCA	C, FORTRAN, COBOL,UNIX	Pt. Ravishankar University, Raipur	1994
M.Sc.	Chemistry	Pt. Ravishankar University, Raipur	1992
B.Sc.	Physics, Chemistry, Physics	Pt. Ravishankar University, Raipur	1990

Academic / Research Experience

Grade / Post	Institute	Duration		Research Field
		From	To	
Chief Scientist	CSIR-National Physical Laboratory	April 2022	Till date	Particle and gas metrology, aerosol chemistry and physics, air quality measurement and instrumentation, control technology development and measurement

Senior Principal Scientist	CSIR-National Physical Laboratory	April 2017	April 2022	Particle and gas metrology, aerosol chemistry and physics, air quality measurement and instrumentation, control technology development and measurement
Principal Scientist	CSIR-National Physical Laboratory	April 2013	April 2017	Particle and gas metrology, aerosol chemistry and physics, air quality measurement and instrumentation, control technology development and measurement
Senior Scientist	CSIR-National Physical Laboratory	April 2009	April 2013	Particle and gas metrology, aerosol chemistry and physics, air quality measurement, metrology in chemistry
University post doctoral fellow	Hokkaido University, Japan	May 2007	March 2009	Aerosol Micro-Physical and Molecular Chemical, Isotope Characterization
JSPS fellow	Hokkaido University, Japan	May 2005	April 2007	Aerosol Micro-Physical and Molecular Chemical, Isotope Characterization
Researcher	Industrial Technology Research Institute (DI), Taiwan	December 2002	April 2005	Stake emission measurement, control technology
CSIR-RA	Pt Ravishankar Shukla University, Raipur, India	April 2000	September 2001	Atmospheric chemistry
NSC post doctoral fellow	National ChiaoTung Univeristy, Hsinchu, Taiwan	October 2001	September 2002	Aerosol physics, control technology
CSIR-RA	Pt Ravishankar Shukla University, Raipur, India	April 2000	September 2001	Atmospheric chemistry

No. of Publications

No. of Publications in SCI Journals	No. of Publications in non-SCI Journals	No. of Publications in Conference Proceedings/Reports	Books	Total
>130	>15	>150	5	>300

Selected Publications

• Emission monitoring and control technology

Chuen-Jinn Tsai, Shankar G. Aggarwal, Chung-Tso Chang, I-Fu Hung, Concentration Profiles of Acidic and Basic Air Pollutants Around an Industrial Park of Taiwan, Water, Air, & Soil Pollution, 151, 287-304, 2004.

HungMin Chein, Tzu Ming Chen, Shankar G. Aggarwal, Chuen-Jinn Tsai, Chun-Chao Huang, Inorganic Acids Emission Factors of Semiconductor Manufacturing Processes, Journal of Air & Waste Management Association, 54, 218-228, 2004.

HungMin Chein, Shankar G. Aggarwal, Hsin-Hsien Wu, Efficient Control System for Low-Concentration Inorganic Gases from Process Vent Stream: Application of Surfactants in Spray and Packed Column, Environmental Science & Technology, 38, 5766-5772, 2004.

HungMin Chein, Shankar Gopala Aggarwal, Hsin Hsien Wu, Tzu Ming Chen, Chun-Chao Huang, Field Enhancements of Packed Bed Performance for Low-Concentration Acidic and Basic Waste-Gases from Semiconductor Manufacturing Process, Journal of Air & Waste Management Association, 55, 647-657, 2005.

HungMin Chein, Yu-Du Hsu, Shankar G. Aggarwal, Tzu-Ming Chen, Chun-Chao Huang, Evaluation of arsenical emission from semiconductor and opto-electronics facilities in Hsinchu, Taiwan, Atmospheric Environment, 40(10), 1901-1907, 2006.

P Kumari, G Garg, D Soni, SG Aggarwal, Measurement of benzene and other volatile organic compounds: implications for its inhalation health risk associated with the workers at fuel station in Delhi, Asian Journal of Atmospheric Environment, 17 (1), 7,2023.

P Kumari, D Soni, SG Aggarwal, K Singh, Seasonal and diurnal measurement of ambient benzene at a high traffic inflation site in Delhi: Health risk assessment and its possible role in ozone formation pathways, Environmental Analysis, Health and Toxicology 38,2023.

Komal, D Soni, K Singh, SG Aggarwal, Comparative measurement of CO₂, CH₄ and CO at two traffic inter-junctions having vehicular flow in Delhi, Journal of Environmental Sciences, 141, 314-329,2024.

• Scientific interpretation based on aerosol physical/optical characterization

Chuen-Jinn Tsai, Jyh-Shyan Lin, Shankar G. Aggarwal, Da-Ren Chen, Thermophoretic Deposition of Particles in Laminar and Turbulent Tube Flows, Aerosol Science and Technology, 38, 131-139, 2004.

Shankar Gopala Aggarwal, Michihiro Mochida, Yasuyuki Kitamori, Kimitaka Kawamura, Chemical Closure Study on Hygroscopic Properties of Urban Aerosol Particles in Sapporo,

Japan, Environmental Science & Technology, 41, 6920-6925, 2007.

Mochida, M., C. Nishita-Hara, Y. Kitamori, S. G. Aggarwal, K. Kawamura, K. Miura, A. Takami, Size-segregated measurements of cloud condensation nucleus activity and hygroscopic growth for aerosols at Cape Hedo, Japan in spring 2008, Journal of Geophysical Research, 115, D21207, 2010.

Jinsang Jung, Young J. Kim, Shankar Gopala Aggarwal, Kimitaka Kawamura, Hygroscopic property of water-soluble organic-enriched aerosols in Ulaanbaatar, Mongolia during the cold winter of 2007, Atmospheric Environment, 45, 2722 – 2729, 2011.

P. M. Shamjad, S. N. Tripathi, S. G. Aggarwal, S. K. Mishra, Manish Joshi, Arshad Khan, B. K. Sapra, and Kirpa Ram, Comparison of Experimental and Modeled Absorption Enhancement by Black Carbon (BC) Cored Polydisperse Aerosols under Hygroscopic Conditions, Environ. Sci. Technol., 46 (15), 8082–8089, 2012.

Bighnaraj Sarangi, Shankar G. Aggarwal, Deepak Sinha, and Prabhat K. Gupta, Aerosol effective density measurement using scanning mobility particle sizer and quartz crystal microbalance with the estimation of involved uncertainty, Atmos. Measurement Techniques, 9, 859–875, 2016.

B. Sarangi, S.G. Aggarwal, B. Kunwar, S. Kumar, R. Kaur, D. Sinha, S. Tiwari, K. Kawamura, Nighttime particle growth observed during spring in New Delhi: Evidences for the aqueous phase oxidation of SO₂, Atmos. Environ., 188, 82–96, 2018.

Arpit Malik and Shankar G. Aggarwal, A Review on the Techniques Used and Status of Equivalent Black Carbon Measurement in Two Major Asian Countries, Asian Journal of Atmospheric Environment (AJAE), Volume 15, Issue 3 (2021).

AK Alang, SG Aggarwal, K Singh, D Soni, P Hegde, Light-absorbing properties of polar and non-polar brown carbon fractions of aerosol in Delhi, Atmospheric Research, 296, 107073, 2023.

AK Alang, SG Aggarwal, K Singh, P Johri, R Agarwal, K Kawamura, Hygroscopic properties of water-soluble counterpart of ultrafine particles from agriculture crop-residue burning in Patiala, Northwestern India, Atmosphere, 15 (7), 835, 2024.

A Malik, SG Aggarwal, Y Kondo, B Kumar, P Patel, PR Sinha, N Oshima, Source contribution of black carbon aerosol during 2020-2022 at urban site in Indo- Gangetic Plain, Science of The Total Environment, 934, 173039, 2024.

Arpit Malik, Shankar G. Aggarwal, Sho Ohata, Tatsuhiro Mori, Yutaka Kondo, Puna Ram Sinha, Prashant Patel, Baban Kumar, Khem Singh, Daya Soni and Makoto Koike, Measurement of Black Carbon in Delhi: Evidence of Regional Transport, Meteorology and Local Sources for Pollution Episodes. Aerosol and Air Quality Research, Volume 22, Issue 8 (2022): 220128.

- **Scientific implementation based on aerosol chemical and isotope analysis**

Shankar G. Aggarwal, Kimitaka Kawamura, Molecular distributions and stable carbon isotopic compositions of dicarboxylic acids and related compounds in aerosols from Sapporo, Japan: Implications for photochemical aging during long-range atmospheric transport, Journal of Geophysical Research, 113, D14301, 2008.

Shankar G. Aggarwal, Kimitaka Kawamura, Carbonaceous and inorganic composition in long-range transported aerosols over northern Japan: Implication for aging of water-soluble organic fraction, Atmospheric Environment, 43, 2532-2540, 2009.

Yuzo Miyazaki, Shankar G. Aggarwal, Khem Singh, Prabhat K. Gupta, Kimitaka Kawamura,

Dicarboxylic acids and water-soluble organic carbon in aerosols in New Delhi, India in winter: Characteristics and formation processes, *Journal of Geophysical Research*, 114 (D19). 1984–2012, 2009.

S. Agarwal, S. G. Aggarwal, K. Okuzawa, K. Kawamura, Size distributions of dicarboxylic acids, ketoacids, α -dicarbonyls, sugars, WSOC, OC, EC and inorganic ions in atmospheric particles over Northern Japan: Implication for long-range transport of Siberian biomass burning and Asian polluted aerosols, *Atmospheric Chemistry and Physics*, 10, 5839-5858, 2010.

Sudhanshu Kumar, Shankar G. Aggarwal, Prabhat K. Gupta, Kimitaka Kawamura, Investigation of the tracers for plastic-enriched waste burning aerosols, *Atmospheric Environment* 108,49-58, 2015.

S. Kumar, S.G. Aggarwal, J. Malherbe, J.P.G. Barre, S. Berail, P.K. Gupta, O.F.X. Donard, Tracing dust transport from Middle-East over Delhi in March 2012 using metal and lead isotope composition, *Atmospheric Environment* 132, 179-187, 2016.

Pingqing Fu, Shankar G. Aggarwal, Jing Chen, Jie Li, Yele Sun, Zifa Wang, Huansheng Chen, Hong Liao, Aijun Ding, G. S. Umarji, R. S. Patil, Qi Chen, and Kimitaka Kawamura, Molecular Markers of Secondary Organic Aerosol in Mumbai, India, *Environmental Science and Technology*, 50, 9, 4659–4667, 2016.

Rishu Agarwal, Kritika Shukla, Sudhanshu Kumar, Shankar G. Aggarwal and Kimitaka Kawamura, Chemical composition of waste burning organic aerosols at landfill and urban sites in Delhi, *Atmospheric Pollution Research*, Volume 11, Issue 3 (2020): Pages 554–565.

Rishu Agarwal and Shankar G. Aggarwal, A year-round study of ambient gaseous pollutants, their atmospheric chemistry and role in secondary particle formation at an urban site in Delhi, *Atmospheric Environment* 295 (2023): 119557.

A Malik, SG Aggarwal, B Kunwar, DK Deshmukh, K Shukla, R Agarwal, Physical and Chemical properties of PM₁ in Delhi: comparison between clean and polluted days, *Science of the Total Environment* 892, 164266,2023.

AK Alang, SG Aggarwal, K Singh, D Soni, K Kawamura, Water -soluble dicarboxylic acids, oxoacids and α -dicarbonyls in tropical aerosols in coastal megacity Mumbai: molecular characteristics and formation processes, *Journal of Atmospheric Chemistry*, 80 (2), 137-155, 2023.

R Agarwal, SG Aggarwal, B Kunwar, DK Deshmukh, K Singh, D Soni, Stable isotopic, bulk and molecular composition of post-monsoon biomass-burning aerosol in Delhi suggest photochemical ageing during regional transport is more pronounced, *Journal of Atmospheric Chemistry*, 81 (1), 9, 2024.

AK Alang, SG Aggarwal, P Johri, P Hegde, Characterization, sources and formation process of dicarboxylic acids and α -dicarbonyls in PM_{2.5} aerosol in New Delhi, *Atmospheric Environment*, 336, 120759,2024.

- **Studies on bioaerosol and related compounds**

Agarwal S., Mandal P., Majumdar D., Aggarwal S.G., Srivastava A., Characterization of Bioaerosols and their Relation with OC, EC and Carbonyl VOCs at a Busy Roadside Restaurants-Cluster in New Delhi, *Aerosol and Air Quality Research*, 16, 3198–3211, 2016.

Kumar S., Aggarwal S.G., Fu P.Q. Kang M., Sarangi B., Sinha D., Kotnala R.K. Size-segregated sugar composition of transported dust aerosols from Middle-East over Delhi during March 2012, *Atmos. Research*, 189, 24–32, 2017.

Kumar S., Patel P., Aggarwal S.G., Design Validation of a Developed Six-Stage Cascade Impactor Sampler, Air Quality, Atmosphere and Health, AIRQ-D-25-00432

- **Air monitoring technology development and instrumentation**

Chuen-Jinn Tsai, Kai-Chung Cheng, Shankar G. Aggarwal, Tung-Sheng Shih, I.-Fu Hung, Simultaneous Sampling of Gaseous- and Aerosol-Phase TDI with a Triple Filter System, Journal of Air & Waste Management Association, 53, 1265-1272, 2003.

Prashant Patel, Shankar G. Aggarwal, Chuen-Jinn Tsai, Tomoaki Okuda, Theoretical and field evaluation of a PM_{2.5} high-volume impactor inlet design, Atmospheric Environment 244, 117811, 2021.

Prashant Patel and Shankar G. Aggarwal, Theoretical and Experimental Evaluation of a Compact Aerosol Wind-tunnel and its Application for Performance Investigation of Particulate Matter Instruments, Aerosol and Air Quality Research, Volume 21, Issue 7 (2021): 210006.

Thi-Cuc Le, Manisha Mishra, Thi-Thuy-Nghiem Nguyen, David Y. H. Pui, Shankar G. Aggarwal, Chao-Ting Hsu, Ssu-Ying Lai and Chuen-Jinn Tsai, PPWD-SDEP-IC monitoring system for atmospheric precursor inorganic gases and PM_{2.5} water-soluble ions, Journal of Aerosol Science, Volume 170 (2023): 106160.

P Patel, SG Aggarwal, TC Le, K Singh, D Soni, CJ Tsai, Design and development of a Pm₁₀ multi-inlet cyclone and comparison with references cyclones, Air Quality, Atmosphere & Health 16 (10), 1955-1968, 2023.

Kritika Shukla and Shankar G. Aggarwal, Particulate Matter Measurement Techniques, In Handbook of Metrology and Applications, pp. 1-29. Singapore: Springer Nature Singapore, 2022.

Kritika Shukla and S. G. Aggarwal, A technical overview on beta-attenuation method for the monitoring of particulate matter in ambient air. Aerosol Air Qual. Res. 22, 220195, 2022.

- **Air quality metrology (standards and calibration)**

Shankar G. Aggarwal, Recent Developments in Aerosol Measurement Techniques and the Metrological Issues, MAPAN Journal of Metrology Society of India, 25 (3), 165-189, 2010.

Shankar G. Aggarwal, Sudhanshu Kumar, Papiya Mandal, Bighnaraj Sarangi, et al., Traceability issue in PM_{2.5} and PM₁₀ measurements, MAPAN- Journal of Metrology Society of India, 28(3), 153-166, 2013.

Bighnaraj Sarangi, Shankar G. Aggarwal, Prabhat K. Gupta, Performance Check of Particle Size Standards within and after Shelf-life using Differential Mobility Analyzer, Journal of Aerosol Science, 103, 24–37, 2017.

Kritika Shukla and Shankar G. Aggarwal, Performance check of beta gauge method under high PM_{2.5} mass loading and varying meteorological conditions in an urban atmosphere, Atmospheric Pollution Research, Volume 12, Issue 11 (2021): 101215.

Rishu Agarwal and Shankar G. Aggarwal, Absorption Efficiency Assessment and Uncertainty Measurement of the Sodium Arsenite Method for Ambient NO₂ Determination, Aerosol and Air Quality Research 21, no.3 (2021): 200583.

Prashant Patel and Shankar G. Aggarwal, On the techniques and standards of particulate

matter sampling, Journal of the Air & Waste Management Association, Volume 72, Issue 8 (2022): Pages 791–814.

Bhagawati Kunwar, Kazuhiro Torii, Shankar G. Aggarwal, Akinori Takami, and Kimitaka Kawamura, Comparisons of GC-Measured Carboxylic Acids and AMS m/z 44 Signals: Contributions of Organic Acids to m/z 44 Signals in Remote Aerosols from Okinawa Island, Applied Sciences 12, no. 16 (2022): 8017.

Komal, Daya Soni, Poonam Kumari, Gazal, Khem Singh, and S. G. Aggarwal. A practical approach of measurement uncertainty evaluation for gravimetrically prepared binary component calibration gas mixture, MAPAN-JMSI, 37, no. 3 (2022): 653-664.

Ashmeet Kaur Alang, and Shankar G. Aggarwal, Five-year Ground-based Observation Trend of PM_{2.5} and PM₁₀, and Comparison with MERRA-2 Data over India, Asian Journal of Atmospheric Environment 16, no. 3 (2022): 2022039.

Komal, Daya Soni, and Shankar G. Aggarwal, A case study for in-house method validation of gas chromatography technique using class-1 calibration gas mixtures for greenhouse gases monitoring, Accreditation and Quality Assurance 28, no. 5 (2023): 209-220.

Poonam Kumari, Daya Soni, Khem Singh, and Shankar G. Aggarwal, Preparation, Verification and Stability of Calibration Gas Mixture of Benzene in Nitrogen, MAPAN-JMSI, 38 no. 3, 2023: 707-713.

Arpit Malik and Shankar G. Aggarwal. Status of Traceability in BC Measurements: Need of an Agreed Method. No. EGU24-9997. Copernicus Meetings, 2024.

Tatsuhiro Mori, Sho Ohata, Yutaka Kondo, Naga Oshima, Nobuhiro Moteki, Yohei Hayakawa, Yutaka Tobo, Puna Ram Sinha, Shankar G. Aggarwal, Arpit Malik & Makoto Koike, Derivation of the correction factors needed for COSMOS observations at high mass concentrations of black carbon, Aerosol Science and Technology, May 2025, DOI: 10.1080/02786826.2025.2499690

Patents (Filed/ Published/ Granted)

Method and apparatus for analysing multiple species, Taiwan Patent, No. 093141381, Date: 30.12.2004

Method and apparatus for treating waste gas containing acid and/or base, US Patent, No. US 2005/0053536 A1, Date 10.03.2005

A method for number count efficiency checks of particular counter based on corresponding particle mass collected in parallel, Indian Patent, No. 2336DEL2015, Date: 03.02.2017

Particulate matter sampler, US Patent, No. US 10782212 B2, Date: 22.09.2020

Tangential six-inlet co-cylindrical cyclone for PM₁₀ sampling, Indian Patent, No. 202111014940, Date: 31.03.2021

A mask testing setup, Indian Patent, No. 202111045226, Date: 05.10.2021

UVC based air microbial disinfection unit, Indian Patent, No. 46NF2021, Date: 03.03.2021

Design and development of a high volume PM_{2.5} impactor, Indian Patent, No 464709, Date: 01.11.2023

Current Activities

(Not more than 100 words)

Dr. Shankar's current research focus is "**metrology for national ambient air quality standards (NAAQS)**" in which he involves in preparation of gas standards, PM sampler development and its calibration work, performance evaluation of air monitoring instruments, sensors, etc. Also, they have designed and developed an aerosol wind tunnel facility at CSIR-NPL for cutoff size calibration of aerosol samplers. About 10 Ph.D. thesis have been done so far on above subject area:

"Physico-Chemical Characterization of Urban Aerosols", Bighnaraj Sarangi, Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, 2016

"Understanding Aerosol Sources and Chemistry Using Selective Markers and Stable Isotopes Analyses", Sudhanshu Kumar, Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, 2016

"A Study on Online and Offline Measurements of PM₁₀ and PM_{2.5} in an Urban City, Raipur", Jaya Dammani, Pt. Ravishankar Shukla University, Raipur, 2019

"Uncertainty Calculation in Aerosol Measurements", Jyoti Pokhariyal, Delhi Technological University, Delhi, 2020

"Designing and Development of PM_{2.5} Impactor and PM₁₀ Cyclone Samplers, and Study on their Cutoff Size Performances", Prashant Patel, Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, 2023

"Study on the Measurement and Chemistry of Gaseous and Particulate Pollutant in an Urban Atmosphere", Rishu Agarwal, Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, 2023.

"Gravimetric Preparation of Benzene Gas Standards for Emission and Ambient Monitoring Applications", Poonam Kumari, Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, 2023.

"Performance Study of Beta Attenuation Method for PM_{2.5} Measurement Under India Conditions and its Suggested Design and Development", Kritika Shukla, Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, 2023.

"Black Carbon Measurements in Urban Air", Arpit Malik, Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, 2024.

"Study on Brown Carbon and Secondary Organic Aerosol in Urban Atmosphere", Ashmeet Kaur Alang, Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, 2024

"Development and design validations of particle filtration, control and sampling devices", Baban Kumar, Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, 2025 (Submitted)

Honour(s)/ Award(s)/ Fellowship(s)

S. No.	Name of the award/recognition	Year	Awarding Org./ Inst. CSIR, India	Brief citation of the award work/remarks
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1	RA award	2000	CSIR, New Delhi	Detected As contamination in ground water and acidification of surface water in central India
2	PDF award	2001	NSC, Taiwan	Studied thermophoretic deposition technique for particle deposition from industrial waste gas
3	Best research team member award, ITRI, Taiwan	2004	ITRI, Taiwan	Developed waste gas treatment technology for TSMC, Taiwan
4	JSPS award	2005	JSPS, Japan	Studied/development of HTDMA for hygroscopicity measurement of aerosol particles, studied CCN activity of particles
5	Best paper award in AAC2011, Xi'an, China	2011	Asian Aerosol Research Assembly	Isotopic changes in aged atmospheric aerosols as indicator for their photochemical aging
6	Associate Editor of MAPAN	2014	Publisher: Springer	Journal theme is "Metrology"
7	CITAC best paper award -2013, France	2015	Cooperation on International Traceability in Analytical Chemistry	Traceability Issue in PM2.5 and PM10 Measurements
8	Technology Licensed Award	2017	CSIR-National Physical Laboratory	High-Volume PM2.5 Impactor Sampler
9	Associate Editor of Asian Journal of Atmospheric Environment	2022	Publisher: Springer	Journal theme is "Atmospheric Monitoring and Measurements, Instrumentation, Chemistry, Physics, etc."
10	Technology Transfer Award	2025	CSIR-National Physical Laboratory	High-Volume PM10 Sampler

S. No.	Professional development/Place of Training	Duration	Year	Brief description
1	Lucknow	11-15 January	2010	Metrology in Chemistry (MiC) organized by Indo-German technical cooperation in the field of Metrology in Chemistry
2	New Delhi	01-04 February	2011	CRM Production & Certification Workshop organized by Indo-German technical cooperation in the field of Metrology in Chemistry
3	PTB, Berlin, Germany	09-13 May	2011	Training on Isotope Dilution Mass Spectrometry technique
4	Imperial College, London, UK	16-20 May	2011	Training on Inductive Coupled Plasma-Mass Spectrometry technique
5	Nu Instruments Ltd., UK	23-27 May	2011	Hands on training on Nu Instruments ATTOM ICP-HRMS
6	CSIR-NPL, New Delhi	22-24 August	2012	Quality System – Laboratory Management, Need for Calibration/Accreditation as per IS/ISO/IEC – 17025:2005
7	Mumbai	6-10 July	2015	Reference Material Producer Assessor Course As per ISO Guide 34:2009
8	New Delhi	24-28 August	2015	Laboratory Assessor Course as per ISO/IEC 17025:2005
9	New Delhi	23-26 October	2018	General Requirements for Proficiency Testing as per ISO/IEC 17043:2010
10	New Delhi	28-29 January	2025	Workshop on Green Hydrogen (Organized by BSI & BIS)

Contributions to AcSIR

Professor in AcSIR since 2017. Course coordinator of Ph.D. credit course “Air Quality Measurement Science and Technology” for AcSIR. Also he is the faculty member of other 3 courses of AcSIR.

Membership of Professional Societies/ Institutions

He is the member of gas and air pollution related committees of BIS, NABL, CPCB, CAQM. He is the Associate Editor of 2 international journals. He is a life member of several scientific societies including: MSI, IASTA, ISAS, IAAPC, etc.

Any other Information

(Not more than 100 words)

He is the PI /Co-PI of several national and international scientific projects/industrial projects. He also serves his duties as assessor (ISO 17034: 2016 and ISO/IEC 17025:2017) for National Accreditation Board for Testing and Calibration Laboratories (NABL). As PI, three technologies which have been developed in last few years are transferred to the Indian manufacturer and commercialized successfully:

“High-volume PM2.5 impactor sampler”: Ideal for source apportionment study and under Indian conditions (all weather conditions with low to very high particulate matter mass loading)

M/s Environmental Solutions, Noida (UP), <https://envsolutions.in/>

“Six-stage bioaerosol sampler”: Ideal for indoor and outdoor sampling for both particle mass and colony counting simultaneously. Designed specifically for uniform particle distribution on collection surface and sharp cutoff size of the stages.

M/s Envirotech Instrumrnts Pvt. Ltd., New Delhi, <https://envirotechindia.com/>

“High-volume PM10 cyclone sampler”: Ideal for source apportionment study and under Indian conditions (all weather conditions with low to very high particulate matter mass loading). Importantly, it has cutoff size of 10 micrometre (not like respiratory dust sampler PM10 which has cutoff size of 4 micrometre).

M/s Biom Tech Pvt. Ltd., Delhi, <https://biomtech.in/>