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Abul Hussam

PUBLICATIONS AND PRESENTATIONS

RESEARCH

M. Sc Thesis

Multielement Trace Analysis by Proton Induced X-Ray Emission Spectroscopy. December 1976, Dhaka University, Bangladesh. Advisor: Professor Amir. H. Khan, Atomic Energy Centre, Dhaka, Bangladesh.

Ph. D. Dissertation

I. Potentiometric Stripping Analysis of Electropositive Elements by Solvent Optimization. II. Speciation of Water at Low Concentrations in Hydrogen Bond Acceptor Solvents. December 1982, University of Pittsburgh, USA. Advisor: Professor J. F. Coetzee, Department of Chemistry, University of Pittsburgh, PA, USA.

PATENTS (first name inventor)

Arsenic Water Filter, US Provisional Patent Application Numbers: 60/886,989 and 60/913,120. Filed by George Mason Intellectual Properties Inc., January 2007.

Removing Viruses from Drinking Water, US Provisional Patent Application No.: 61089143; Filed by George Mason Intellectual Properties Inc., August 15, 2008.

Composite Iron Matrix Embedded Fabrics - A Prototype, GMU-10-024, US Provisional Patent Application No.: 61/285,635, filed 12/11/2009.

PUBLICATIONS (Reviewed Journals, Book Section and Proceedings)

1. Hong Zhang, Abul Hussam, and Stephen G. Weber*. *Properties and Transport Behavior of Perfluorotriptylamine (FC-70)-Doped Amorphous Teflon AF 2400 Films*. *J. Am. Chem. Soc.* **132 (50)**, 17867–17879 (2010).
2. Abul Hussam, *Contending with a Development Disaster: SONO Filters Remove Arsenic*. *Innovations: Technology, Governance, and Globalization*. **4(3)**, 103–106, (2009).
3. Abul Hussam, *Clean Drinking Water: Solving the Arsenic Crisis in Bangladesh through a Sustainable Local Filtration Technology*. IOM (Institute of Medicine) 2009. pp. 24-29. *Global Environmental Health: Research Gaps and Barriers for Providing Sustainable Water, Sanitation, and Hygiene Services*. Washington, D.C.: The National Academic Press.
4. Doug Mays and Abul Hussam*. *Voltammetric Measurement of Arsenic in the Environment - A Review*. *Analytica Chimica Acta*. **646**, 6-16 (2009).
5. Sad Ahamed, Abul K. M. Munir, and Abul Hussam. *Groundwater Arsenic Removal Technologies Based on Sorbents: Field Applications and Sustainability*, in *Handbook of Water Quality and Water Purity*, pp 379-417, S. Ahuja (Editor), Elsevier Inc., 2009.
6. Abul Hussam*, Sad Ahamed, and Abul K. M. Munir. *Arsenic Filters for Bangladesh: Toward a Sustainable Solution*. The Bridge- Linking Engineering and Society, National Academy of Engineering, **38(3)**, 14-23 (2008).
7. Abul Hussam* and Abul K. M. Munir. *Development of a simple arsenic filter for groundwater of Bangladesh based on composite iron matrix* in *Arsenic Contamination of Groundwater: Mechanism, Analysis, and Remediation*. pp 278 – 289, S. Ahuja (Editor). Wiley Interscience. 2008.
8. Abul Hussam* and Abul K. M. Munir. *A simple and effective arsenic filter based on composite iron matrix: development and deployment studies for ground water of Bangladesh*. *J. Environ. Sci. and Health. Part A. Toxic/Hazardous Substances & Environmental Engineering*. **42**, 1869-1878, 2007.
9. A. Hussam, and M. Alauddin. *Foreword: Special Issue on Arsenic*. *J. Environ. Sci. and Health, Part A. Toxic/Hazardous Substances & Environmental Engineering*. **42**, 1693-1694, 2007.
10. A. Hussam*, *Voltammetry: Dynamic Electrochemical Techniques* in *Comprehensive Analytical Chemistry*. Volume 47. pp 663-692, S. Ahuja and N. Jespersen (Eds). Elsevier B.V., 2007.
11. K. P. Bloschock, T.W. Schneider, A. Hussam, E.R. Van Keuren*. *Development of a MEMS-fabricated SU-8 device for 2D separations* in *Smart Medical and Biomedical Sensor Technology IV*, Brian M. Cullum; J. Chance Carter, Editors, Proceedings Vol. 6380. Oct 23, 2006.
12. M Giasuddin Ahmed*, Syed M Iqbal Moeiz, S Asghari Ahmed, and Abul Hussam. *Mass spectral fragmentation of substituted adamantane-2,4-diones*. *Indian J. Chem.*, Vol 45B (5), 1234 (2006).

13. M. G. Ahmed*, S. A. Ahmed, S. M. Ahmed, M. M. Hossain, and A. Hussam. *Synthesis of 7,11-diaryl-3-oxo (or thioxo)-2,4-diazaspiro[5.5]undecane-1,5,9-triones, Part I*. J. Chemical Research, 622-625, October (2005).
14. A. Hussam*, Z. Ahmed, and G. Mushrush. *Solute-Solute Interactions in Jet Fuel by Ultralow Conductance Measurement*. J. Petroleum Sci. and Technol. 23, 1129-1138 (2005).
15. A. A. Shaikh, M. Q. Ehsan, S. A. Ahmed, M. G. Ahmed, A. Hussam, and A. H. Khan*. *Electrochemical Studies on Redox reactions of Oximes at Carbon Paste and Glassy Carbon Electrodes*. Oriental J. Chem. 20(3), 421-428 (2004).
16. K. P. Bloschock*, J. N. Flyer, T.W. Schneider, A. Hussam, E.R. Van Keuren, *Development of a MEMS 2D separations device*. Proceedings of the International Society for Optical Engineering, Vol. 5591, Paper 12. 2004.
17. A. Hussam*. *Book Review: Environmental Chemistry of Arsenic, Ed. W. T. Frankenberger, Jr. Marcel Dekker, Inc. NY. J. Environ. Sci. and Health, A39(6), 1643-1644 (2004)*.
18. D. Chakraborti, A. Hussam, and M. Alauddin. *Foreword: Special Issue on Arsenic: Environmental and Health Aspects with Special Reference to Groundwater in South Asia*. J. Environ. Sci. and Health, A38(1), pp xi-xv, (2003).
19. A. Hussam*, M. Habibuddowla, M. Alauddin, Z. A. Hossain, A. K. M. Munir, and A. H. Khan, *Chemical Fate of Arsenic and Other Metals in Groundwater of Bangladesh: Experimental Measurement and Chemical Equilibrium Model*, J. Environ. Sci. and Health, A38(1), 71-86, (2003).
20. A. Hussam*, M. Alauddin, A. H. Khan, D. Chowdhury, H. Bibi, M. Bhattacharjee, and S. Sultana. *Solid Phase Microextraction: Measurement of Volatile Organic Compounds (VOCs) in Dhaka City Air Pollution*. J. Environ. Sci. Health, A37(7), 1223-1239 (2002).
21. Rasul, S. B.; Hossain, Z.; Munir, A. K. M.; Alauddin, M.; Khan, A. H.; Hussam*, A. *Electrochemical Measurement and Speciation of Inorganic Arsenic in Groundwater of Bangladesh*. Talanta, 58(1), 33-43 (2002).
22. M. Alauddin, A. Hussam*, A. H. Khan, M. Habibuddowla, S. B. Rasul, and A. K.M. Munir; *Critical Evaluation of a Simple Arsenic Removal Method for Groundwater of Bangladesh*. in 'Arsenic Exposure and Health Effects', W. R. Chappell, C. O. Abernathy, and R. L. Calderon (Editors), Elsevier Science, B. V. 2001. pp. 439-449.
23. A.K.M. Munir*; S. B. Rasul, M. Habibuddowla, M Alauddin, A. Hussam, and A. H. Khan, *Evaluation of the Performance of the Sono3-Kolshi Filter for Arsenic Removal from Groundwater Using Zero Valent Iron Through Laboratory and Field Studies*. Proceedings International Workshop on Technology for Arsenic Removal from Drinking Water, Bangladesh University of Engineering and Technology and United Nations University, Japan, May 5, 2001. pp. 171-189.
24. A. H. Khan, S. B. Rasul, A. K. M. Munir, M. Habibuddowla, M. Alauddin, and A. Hussam*. *On Two Simple Arsenic Removal Methods for Groundwater of Bangladesh*. Proceedings Bangladesh Environmental Network Conference, Dhaka, Bangladesh, Jan 14, 2000. pp 12.
25. A. H. Khan, S. B. Rasul, A. K. M. Munir, M. Habibuddowla, M. Alauddin, S. S. Newaz, A. Hussam*; *Appraisal of a Simple Arsenic Removal Method for Groundwater of Bangladesh*; J. Environ. Sci. and Health, A35(7), 1021-1041 (2000).
26. A. Hussam*, M. Alauddin, A. H. Khan, S. B. Rasul, and A. K. M. Munir.; *Evaluation of Arsine Generation in Arsenic Field Kit*.; Environ. Sci. and Technol.; 33, 3686-3688 (1999).
27. Dilip M. Shah, Keith M. Davies*, Abul Hussam; *Electrochemical Investigation of Amphiphilic Cobalt Complexes and Ferrocene Derivatives in Sodium Dodecyl Sulfate Microemulsions*; Langmuir, 13, 4729-4736 (1997).
28. Wei Zhang, Robert V. Honeychuck, and Abul Hussam*; *Buckminsterfullerene-containing Microemulsions*.; Langmuir, 12, 1402-1403, (1996).
29. A. Hussam*, S. C. Basu, M. Hixon, and Z. Olumee; *A Precise General Method for the Study of Solute-Surfactant Association Equilibria of Volatile Solutes by Headspace Gas Chromatography*.; Anal. Chem., 67, 1459-1464, (1995).
30. K. M. Davies*, A. Hussam*, B. R. Rector, Jr., I. M. Owens, and P. King; *Redox Reactions of Lipophilic Cobalt Complexes in Aqueous Surfactant Media. Correlation of Rate and Electrochemical Behavior*. Inorg. Chem., 33, 1741-1747, (1994).
31. Keith Davies* and Abul Hussam*; *Electrochemical Studies of Metal Complexes in Micellar Solution*. Langmuir, 9, 3270-3276, (1993).
32. D. E. Martire*, R. L. Reister, T. J. Bruno, A. Hussam, and D. P. Poe; *Generalized Treatment of Spatial and Temporal Column Parameters, Applicable to Gas, Liquid and Supercritical Fluid Chromatography. II. Application to Supercritical CO₂*; J. Chromatogr. 545, 135-147, (1991).
33. J. M. Zytow*, J. Zhu, and A. Hussam; *Determining Repeatability and Error in Experimental Results by a Discovery System; Methodologies for Intelligent Systems*, Volume 5, 1990, Ed. Ras. Z.; Elsevier, New York.
34. J. M. Zytow*, J. Zhu, and A. Hussam; *Automated Discovery in Chemistry Laboratory*; Proceedings of the Eighth National Conference on Artificial Intelligence (AAAI-90), AAAI Press, Massachusetts Institute of Technology, USA, 1990, pg. 889-894.
35. E. Dayalan, S. Qutubuddin*, and A. Hussam; *Electrochemical Investigations in Microemulsion Media. 1. Methylviologen Reduction*; Langmuir, 6, 715-721 (1990).
36. K. R. Choksi, S. Qutubuddin*, and A. Hussam; *Electrochemical Investigation of Microemulsions*; J. Colloid and Interfac. Sci., 129(2), 315-326 (1989).
37. A. Hussam*; *Fast Step-Potential Pulse Chronopotentiometry*; Anal. Chem., 60, 2776-2781 (1988).
38. A. Hussam* and G. Gunaratna; *Chronopotentiometry by Measuring Current Transients*; Anal. Chem., 60, 503-507 (1988).
39. L. Meites* and A. Hussam; *Optimization of Data Acquisition Schedule in Physicochemical Experiments. I. Principle of the Method and Application to the First-Order Decay of an Absorbing Species*; Anal. Chim. Acta., 204, 295-309 (1988).
40. J. H. Park, A. Hussam, P. Cousnon, and P. W. Carr*; *The Precision of Area and Height Measurement with Flame Ionization Detector in Temperature Programmed Capillary Gas Chromatography*; Microchemical Journal, 35, 232-239 (1987).
41. Hussam, J. H. Park, and P. W. Carr*; *Use of Homologous Series of Liquids for the Study of the Linearity and Relative Response Factors for Methyl and Methylene Groups in Flame Ionization Detectors by Headspace Gas Chromatography*; Microchemical Journal, 36, 107-111 (1987).
42. J. H. Park, A. Hussam, P. Couasnon, D. Fritz, and P. W. Carr*; *Experimental Reexamination of Selected Partition Coefficients from Rohrschneider's Data Set*; Anal. Chem., 59, 1970-1976, (1987).
43. Hussam and Peter W. Carr*; *A Study of Rapid and Precise Methodology for the Measurement of Vapor/Liquid Equilibria by Headspace Gas Chromatography*; Anal. Chem., 57, 793-801 (1985).

44. Hussam and J. F. Coetzee*; *Potentiometric Stripping Analysis: Theory, Experimental Verification, and Generation of Stripping Polarograms*; Anal. Chem. 57, 581-585 (1985).
45. S. Qutubuddin, G. C. Berry, C.A. Miller, T. Fort, Jr., and A. Hussam; *An Investigation of Microemulsions Using Electrophoretic Laser Light Scattering*, "Surfactants in Solutions", Volume 3, pp. 1693-1708; Mittal, K. L. and B. Lindman, Eds., Plenum Press, 1985.
46. J. F. Coetzee*, A. Hussam, and T. R. Petrick; *Extensions of Potentiometric Stripping Analysis to Electropositive Elements by Solvent Optimization*; Anal. Chem., 55, 120-122 (1982).
47. J. F. Coetzee* and A. Hussam; *Speciation of Water at Low Concentration in Hydrogen Bond Acceptor Solvents by Proton Magnetic Resonance Spectroscopy*; J. Soln. Chem., 11, 395-407 (1982).
48. M. A. Kalam, A. Hussam, M. Khaliquzzaman, A. H. Khan*, M. M. Islam, M. B. Zaman, and M. Husain; *Elemental Analysis in Solutions by Radioisotope Excited X-Ray Fluorescence Spectroscopy*; J. Radioanal. Chem. 46, 285-297 (1978).

PROFESSIONAL PRESENTATIONS (Conference Papers and Abstracts)

1. Abul Hussam, *Provisioning of arsenic-free drinking water in Bangladesh: Sustainable Technologies and Social Implications*. Clifford Symposium: Beyond Rx: Global Health. Middlebury College, Vermont, USA. September 24, 2010.
2. Abul Hussam*, Abul K. M. Munir, and Sad Ahmed, *Arsenic sorption dynamics on composite iron matrix for efficient arsenic water filter design*, ENVRO12a Sustaining Water Quality, Document ID 11741, 240th American Chemical Society National Meeting, Boston MA. August 23, 2010.
3. Abul Hussam* and Sad Ahmed, *Fast evaluation of arsenic sorption dynamics on iron based sorbents by continuous flow hydride generation atomic fluorescence spectrometry*. Advances in Analytical Chemistry for Environmental Applications, Paper 20, 238th American Chemical Society National Meeting, Washington D.C. August 23, 2010.
4. Purnendu Dasgupta*, Mrinal K. Sengupta, and Abul Hussam., *Electroreduction based gas-phase chemiluminescence: Green analyzer for arsenic*. Paper 175, 239th American Chemical Society National Conference, San Francisco, CA, USA. March 21-25. 2010.
5. Kirubel Assegid* and Abul Hussam, *Development of a gas phase chemiluminescence system for the measurement of arsenic in environmental samples*. Abstract #970-IP, Fluorescence and Luminescence Applications, Pittsburgh Conference (PITTCON), Orlando, Florida, March 01, 2010.
6. Abul Hussam* and Sad Ahmed, *Fast evaluation of arsenic sorption dynamics on iron based sorbents by continuous flow hydride generation atomic fluorescence spectrometry*. Advances in Analytical Chemistry for Environmental Applications, Paper 20, 238th American Chemical Society National Meeting, Washington D.C. August 17, 2009.
7. Kirubel Assegid* and Abul Hussam, *Development of a gas phase chemiluminescence detection system for the measurement of arsenic in environmental samples*. General poster # 59, 238th American Chemical Society National Meeting, Washington D.C. August 16 and 17, 2009.
8. Doug E. Mays* and Abul Hussam, *Voltammetric speciation of arsenic in groundwater: Problems and prospects*. General poster # 198, 238th American Chemical Society National Meeting, Washington D.C. August 16, 2009.
9. Sad Ahamed*, Abul K. M. Munir, and Abul Hussam, *Novel arsenic filters based on composite iron matrix: Fundamental studies, production, and large scale deployment*. General poster # 188, 238th American Chemical Society National Meeting, Washington D.C. August 19, 2009.
10. Abul Hussam. *Chemistry for Clean Water*. Keynote and theme paper presented and published by Bangladesh Chemical Congress 2008, Dhaka Bangladesh. Jan 30, 2009. (invited keynote speaker)
11. Abul Hussam*, Abul K. M. Munir, and Sad Ahamed. *Arsenic Filter based on Composite Iron Matrix*. Paper presented at International Conference on Water Scarcity, Global Changes, and Groundwater Management Responses, UC Irvine, United Nations Educational, Scientific and Cultural Organization (UNESCO) and U.S. Geological Survey (USGS), University of California, Irvine. Dec. 1-5, 2008 (invited)
12. Abul Barkat* and Abul Hussam*. *Provisioning of Arsenic-free Water in Bangladesh: A Human Rights Challenge*. Keynote Paper presented at Engineering, Social Justice, and Sustainable Community Development Workshop, The National Academy of Engineering (NAE) Centre for Engineering, Ethics, and Society and the National Science Foundation, Washington, D.C. October 2-3, 2008. (invited)
13. Abul Hussam*, Amir H. Khan, and Abul K. M. Munir. *Measurement of Arsenic in Groundwater of Bangladesh: Kit vs. Instrumental Techniques and Inter-laboratory Comparison Studies*. Pittsburgh Conference 2007, Arsenic: Transformation, Speciation and Toxicity, Feb 28, 2007. Chicago, USA. Invited Speaker.
14. Abul Hussam*, Mohammad Alauddin, Amir H. Khan, and Abul K. M. Munir., *Measurement of arsenic in groundwater of Bangladesh: Technical overview and interlaboratory comparison studies*. Paper ANYL 351, [The 231st ACS National Meeting, Atlanta, GA, March 26-30, 2006](#). Invited Speaker
15. Mohammad Alauddin*, Margaret Fiasconaro, Sarah Alauddin, Abul Hussam, Maya Bhattacharjee, Shamima Sultana, and Mohammad Jakariya. *Fate of arsenic and other trace metals in deep aquifer water of Bangladesh*. Paper ANYL 381, [The 231st ACS National Meeting, Atlanta, GA, March 26-30, 2006](#)
16. Abul Hussam* and Amir H. Khan. *Groundwater arsenic filters: A critical look at two environmental technology verification projects for arsenic mitigation (ETVAM) in Bangladesh*. Paper 353, [The 231st ACS National Meeting, Atlanta, GA, March 26-30, 2006](#). Invited Speaker.
17. Abul K. M. Munir* and Abul Hussam. *Composite iron matrix based arsenic filter for groundwater of Bangladesh: A large scale deployment studies*. Paper ENVR 150, [The 231st ACS National Meeting, Atlanta, GA, March 26-30, 2006](#).
18. Jie Zhang*, Hong Zhao, Abul Hussam, and Stephen G. Weber., *Selective Transport of Organic Solutes through Teflon AF Films*, Paper No 1110-7, Pittsburgh Conference, March 14, 2006
19. Hussam, A*., Munir, A. K. M. *Groundwater Arsenic Filter based on Composite Iron Matrix: Performance and Large Scale Deployment Studies*. 6th International Conference on "Safe Water and Safe Food Options in Arsenic Mitigation: Lessons Learned", Dhaka Community Hospital, Dhaka, Bangladesh. Jan 4, 2006. Invited Speaker.

20. M. Alauddin*, M. Fiasconaro, S. Alauddin, A. Hussam, M. Bhattacharjee, S. Sultana, and M. Jakariya. *Fate of arsenic and other trace elements in deep aquifer water of Bangladesh*. 6th International Conference on "Safe Water and Safe Food Options in Arsenic Mitigation: Lessons Learned", Dhaka Community Hospital, Dhaka, Bangladesh. Jan 4, 2006.
21. Stephen G. Weber*, Jie Zhang, Hong Zhao, Kristi O'Neal, Max Osipov, Alex Harmatuck, Abul Hussam, *New Observations on Partitioning, Transport, and Molecular Recognition in Fluorinated Media*, International Conference on Electrochemical Sensors, Matrafured, Hungary, November 13-18, 2005.
22. Abul Hussam* and A.K.M. Munir, *Development and Deployment of an Arsenic Filter for Groundwater of Bangladesh*. American Chemical Society, 37th Middle Atlantic Regional Meeting, Session: Assuring Water Purity, May 23, 2005. Abstract # 252. Invited Speaker.
23. K. P. Bloschock*, J. N. Flyer, T.W. Schneider, A. Hussam, E.R. Van Keuren, *Development of a MEMS 2D Separations Device*. International Conference on MEMS and Optics, International Society for Optical Engineering (SPIE), October 23, 2004.
24. Hussam*, A., Munir, A. K. M., Hossain, Z. A., Alauddin, M., Khan, A. H., Chusuei, C. C. *Chemistry of a Simple and Effective Groundwater Arsenic Filter Based on Iron Composites: A Large Scale Bangladesh Experiment*. Advances in Arsenic Research: Integration of Experimental and Observational Studies and Implications for Mitigation. 226th American Chemical Society National Meeting, New York, NY, September 8, 2003. Abstract 676068. Invited Speaker.
25. M. Bhattacharjee, S. Sultana, A. Hasneen, M. S. Islam, M. Alauddin*, M. Fiasconaro, S. Alauddin, A. Hussam, and A.M. Sikder. *Speciation of arsenic in bore-hole sediment leachate and groundwater of Bangladesh*. 7th International Conference on the Biogeochemistry of Trace Elements (7th ICBTE), Special Symposium, Arsenic in Soil and Groundwater Environments: Biogeochemical Interactions, Uppsala, Sweden, June 15-19, 2003.
26. M. Bhattacharjee, M. Alauddin, A. Hussam, U. Ali, S. Sultana, S. Islam, and K. Sarkar. *Status of Volatile Organic Compounds (VOC), Suspended Particulate Matters and Lead in Ambient Air and Indoor Environments in Dhaka City*. Better Air Quality 2002, Regional Workshop on Better Air Quality in Asia and Pacific Rim Cities, Hong Kong. 16-18 December 2002.
27. Abul Hussam*, Abul Kalam M. Munir, Zafreen A. Hossain, Mohammad Alauddin, and Amir H. Khan. *A Simple and Effective Groundwater Arsenic Filter Based on Iron and Iron Composites: Bangladesh Experience.*, American Association of Bangladeshi Engineers and Architects, Fourth Biennial Convention, Laurel, Maryland, USA, October 12, 2002. Invited Speaker.
28. M. Alauddin* and A. Hussam. *Indoor Air Pollution, Household Exposure to Suspended Particulate Matters and Volatile Organic Compounds in Rural Bangladesh*. Fourth Biennial Convention, American Association of Bangladeshi Engineers and Architects, Laurel, Maryland, USA, October 12, 2002.
29. D. Chowdhury, M. Bhattacharya, H. Bibi, S. Begum, M. S. Islam, M. Alauddin*, D. M. Fiasconaro, A. Hussam, and A. M. Sikdar, *Speciation of arsenic in sediment leachate by chromatographic separation and flow injection hydride generation atomic absorption spectrometry*, International Conference on Arsenic, Dhaka, Bangladesh, January 11-12, 2002.
30. A. K.M. Munir*; S. B. Rasul, M. Habibuddowla, M Alauddin, A. Hussam, and A. H. Khan, *Evaluation of the Performance of the Sono3-Kolshi Filter for Arsenic Removal from Groundwater Using Zero Valent iron Through Laboratory and Field Studies*. International Workshop on Technology for Arsenic Removal from Drinking Water, Bangladesh University of Engineering and Technology and United Nations University, May 5, 2001.
31. M. Alauddin*, A. Hussam, A. H. Khan, M. Habibuddowla, S. B. Rasul, and A. K.M. Munir; *Critical Evaluation of a Simple Arsenic Removal Method for Groundwater of Bangladesh*. Fourth International Conference on Arsenic Exposure and Health Hazard, SanDiego, California, June 2000.
32. A. H. Khan*, S. B. Rasul, A. K. M. Munir, M. Habibuddowla, M. Alauddin, and A. Hussam. *On Two Simple Arsenic Removal Methods for Groundwater of Bangladesh*. International Conference on Bangladesh Environment, Dhaka, Bangladesh, Jan 14, 2000.
33. A. H. Khan*, A. Hussam, M. Alauddin, S. B. Rasul, and A. K. M. Munir. *Evaluation of Arsenic Kit*. International Conference on Bangladesh Environment, Dhaka, Bangladesh, Jan 14, 2000.
34. M. Alauddin*, A. H. Khan, and Abul Hussam, *Volatile Organic Compounds in Urban Air*. International Conference on Bangladesh Environment. Dhaka, Bangladesh. January 14-15, 2000.
35. A. Hussam*, M. Alauddin, A. H. Khan, S. B. Rasul, and A. K. M. Munir.; *Arsine Generation in Arsenic Field Kit. A Health Hazard*. International Conference on Arsenic in Bangladesh Ground Water.; Wagner College, New York, February 27-28, 1999.
36. M. Alauddin, Y. Islam, M. Habibuddowla, and A. Hussam*; *Arsenic Measurement: The Right Approach for Bangladesh!*. International Conference on Arsenic in Bangladesh Ground Water.; Wagner College, New York, February 27-28, 1999.
37. S. B. Rasul, N. Ahmed, A. K. M. Munir, S. Washe, M. Khaliqzaman, and A. H. Khan, and A. Hussam*; *Speciation of Arsenic in Ground Water of Bangladesh.*, International Conference on Arsenic in Bangladesh Ground Water.; Wagner College, New York, February 27-28, 1999.
38. A. H. Khan*, A. Hussam, and M. Alauddin.; *Ground Water Chemistry and Arsenic Distribution in Ground Water of Bangladesh*. International Conference on Arsenic in Bangladesh Ground Water.; Wagner College, New York, February 27-28, 1999.
39. M. Alauddin*, A. Hussam, and A. H. Khan.; *Levels of Arsenic in Some Specific Areas of the Dhaka City and Sitakundu.*, International Conference on Arsenic in Bangladesh Ground Water.; Wagner College, New York, February 27-28, 1999.
40. A. H. Khan*, M. Khaliqzaman, M. Alauddin, A. Hussam, A. K. M. Munir, A. I. Kazi, and M. Aftabuddin.; *Analytical Science of Arsenic: Problems and Practice in Arsenic Analysis in the Bangladesh Laboratories.* ; International Conference on Arsenic in Bangladesh Ground Water.; Wagner College, New York, February 27-28, 1999.
41. K. M. Munir, S. B. Rasul, N. Ahmed, S. Washe, M. Khaliqzaman, A. Hussam and A. H. Khan*.; *On Analytical Aspects of Arsenic in Groundwater: An Electrochemical Approach*. International Conference on Arsenic Pollution of Ground Water in Bangladesh: Causes, Effects and Remedies.; 8-12 February, 1998.
42. A. Hussam; *A Precise Method for the Study of Solute-Surfactant Association Equilibria by Headspace Gas Chromatography*, Middle Atlantic Regional Conference for Analytical Chemists, Towson, Maryland, April, 1996.

43. A. Hussam*, S. H. Siddiqui, and S. Qutubuddin; *Electrochemical Behavior of Synthetic-Lipid Modified Carbon Fiber Electrodes: Amperometric Detection of Ca(II)*; 204th American Chemical Society National Meeting, August 23, 1992.
44. M. Davies* and A. Hussam; *Redox Behavior of Cobalt Phenanthroline and Terpyridine Complexes in Micellar Solutions*; 204th American Chemical Society National Meeting, August 23, 1992. INORG 87
45. M. Alauddin, R. Gowran, A. Hussam*, and O. Lofthus; *Fabrication and Performance of a Glucose Microsensor Inside a Capillary Tube*; 204th American Chemical Society National Meeting, August 23, 1992.
46. A Hussam* and M. Hixon; *Vapor/Liquid Equilibria of Microemulsions*; Virginia Academy of Science Conference, George Mason University, Fairfax, VA, May 29 1990.
47. M. Zytkow*, J. Zhu, and A. Hussam; *Automated Discovery in Chemistry Laboratory*; Eighth National Conference on Artificial Intelligence (AAAI-90), July 29 - Aug 3, 1990. Boston, MA.
48. Peter W. Carr*, Won Jo Cheong, and Abul Hussam; *Infinite Dilution Activity Coefficients in Exploring the Mechanism of Reversed Phase Liquid Chromatography*; 28th Eastern Analytical Symposium, New York, September 25, 1989.
49. Qutubuddin*, S. Dayalan, K. R. Choksi, and A. Hussam; *Electrochemical Characterization of Microemulsions*; Paper presented at the 6th International Conference on Surface and Colloid Science, Hakone, Japan, June 1988.
50. Dayalan, S. Qutubuddin*, and A. Hussam; *Electrochemistry in Microemulsions*; Paper presented at the 62nd ACS Symposium on Colloid and Surface Science, Pennsylvania State University, June 1988.
51. S. Qutubuddin*, A. Hussam, and K. R. Choksi; *Electrochemical Characterization of Microemulsions*; Gordon Conference on Chemistry at Interfaces, July, 1986.
52. A. Hussam*; *Computer Aided Chronopotentiometry by Current Transient Measurement*, Middle Atlantic Analytical Chemistry Conference, Pittsburgh, Oct 18, 1986.
53. F. Coetzee, A. Hussam, and M. Ecoff; *Advantages of Fiber Electrodes in Potentiometric Stripping Analysis*; Pittsburgh Analytical Conference, February 25, 1985.
54. S. Qutubuddin*, K. R. Choksi, A. Bhatia, and A. Hussam; *An Electrochemical Investigation of Oil-in-Water Microemulsions*; Symposium on Microemulsions; AIChE Annual Meeting, Chicago, November 1985.
55. A. Hussam; *Rapid Measurement of Vapor/Liquid Equilibria by Headspace Gas Chromatography*; Minnesota Chromatography Forum, Minneapolis, June 1985.
56. P. W. Carr*, A. Hussam, J. H. Park, and P. Couasnon; *Microchemical Methods Based Upon Capillary Gas Chromatography for the Study of Vapor/Liquid Equilibria*; Silver Jubilee Eastern Analytical Symposium, New York, Oct 20, 1985.
57. S. Qutubuddin*, A. Hussam, and K. R. Choksi; *Electrochemical Investigation in Microemulsions*; Annual Symposium of Electrochemistry at Case Center for Electrochemical Studies, Cleveland, November, 1983.
58. J. F. Coetzee* and A. Hussam; *Speciation of Water at Low Concentrations in Organic Solvents*; International Conference. on Nonaqueous Solvents; France, 1982.
59. J. F. Coetzee*, A. Hussam, and T. Petrick; *Extension of Potentiometric Stripping Analysis to Electropositive Elements by Optimization of Solvents*; Pittsburgh Conference., Atlantic City, NJ, 1981.

SEMINAR PRESENTATIONS (Invited Speaker)

1. *Potable water - A cost-effective and environmentally sustainable solution using a simple filtration technology*. Seminar organized by AASHA, University of North Carolina, Chapel Hill, USA. April 8, 2010.
2. *Clean drinking water - A cost-effective and environmentally sustainable solution using a simple filtration technology*. Department of Civil, Environmental, and Infrastructure Engineering, Thursday, March 18, 2010.
3. *Our Water: Preventable water related illnesses: Problems*, United Press International, Washington, D. C., September 23, 2009. <http://www.upi.com/Special-Reports/>
4. *Potable water for Bangladesh - A cost-effective and environmentally sustainable solution to addressing a critical need*. Asian Connection for Excellence Week at Exxon-Mobil Research and Engineering, Fairfax, Virginia, USA. May 13, 2009.
5. *Arsenic in Ground Water: Aquatic Chemistry and Mitigation through a Sustainable Filtration Technology*. The Annual Joseph Henry Lecture. The Philosophical Society of Washington, Washington DC, May 16, 2008. <http://www.philsoc.org>
6. *Appropriate Technology: Making a Difference in People's Lives*. Global Lecture Series, Haworth College of Business, Western Michigan University, Kalamazoo, MI. March 13, 2008.
7. *The SONO Filter: Making a Difference with Safe Drinking Water*, Distinguish Speaker Series, Kalamazoo Math and Science Center, Kalamazoo, MI., March 12, 2008. <http://www.kamsconline.com>
8. *Arsenic in Drinking Water: Worldwide Crisis and Mitigation through Simple and Effective Filtration Technologies*, Seminar and Reception by Bangla Patriots, George Mason University, Fairfax, VA, Nov 15, 2007.
9. Abul Hussam* and Abul K. M. Munir. *Arsenic in Groundwater: Aquatic Chemistry and Development of a Sustainable Filtration Technology*, Swiss Institute of Technology, Department of Water Resources and Drinking Water- Eawg, Duebendorf, Switzerland, Nov 6, 2007.
10. *Development of a Novel Water Filtration System for Removing Poisonous Arsenic from Drinking Water*, Science Showcase for High End High School Students, George Mason University, October 19, 2007.
11. *Clean Drinking Water: Solving Arsenic Crisis through a Simple Filtration Technology*, Roundtable on EHSRM, Inst of Medicine of National Academies, Washington, DC., Oct 17, 2007
12. *Arsenic in Ground Water: Aquatic Chemistry and Development of a Sustainable Filtration Technology*, Department of Chemistry, University of Maryland, October 11, 2007. (Also lectured in honors class the same day)
13. *Arsenic Poison in Drinking Water: Aquatic Chemistry and Development of a Sustainable Filtration Technology*, Engineers without Borders Conference, Rowan University, NJ, October 5, 2007. (Keynote Speaker)
14. *The SONO Filter Household Water Treatment System*, Engineering Forum on Sustainability, National Academy of Engineering, Washington DC, USA. September 21, 2007.
15. *Arsenic in Drinking Water: Aquatic Chemistry and Mitigation through a Sustainable Filtration Technology*. National Institutes of Standard and Technology Sigma Xi Colloquium, Maryland, USA. September 13, 2007.

16. *Measurement and Environmental Technology Verification for Arsenic Mitigation in Bangladesh*, Federations of Bangladesh America National Association Seminar and Forum, Atlanta, Georgia, September 2, 2006.
17. Abul Hussam* and Abul K. M. Munir, *Arsenic in Groundwater: Aquatic Chemistry and Development of a Novel Filtration Technology*. Department of Chemistry, Dhaka University, Bangladesh. July 1, 2007.
18. Abul Hussam* and Abul K. M. Munir, *Arsenic Free Clean Water and Sustainable Local Technology*, FINAS Foundation Lecture 2007. Asiatic Society of Bangladesh. July 2, 2007.
19. *Measurement and Environmental Technology Verification for Arsenic Mitigation in Bangladesh*, The Bangladeshi-American Foundation Inc., Biennial Bangladeshi-American Convention, July 6, 2007.
20. *Measurement and Environmental Technology Verification for Arsenic Mitigation in Bangladesh*, Bangladesh Medical Association of North America, July 28, 2007.
21. Abul Hussam* and Abul K. M. Munir. *Clean Drinking Water: Solving Arsenic Crisis through a Sustainable Local Filtration Technology*, North South University, Dhaka, Bangladesh, June 28, 2007.
22. *Arsenic in Drinking Water: Aquatic Chemistry and Mitigation through Filtration Technologies*, Institute of Food Science and Technology. Dhaka, Bangladesh Chemical Society, June 26, 2007.
23. Abul Hussam* and Abul K. M. Munir, *A simple and effective arsenic filter based on composite iron matrix: development and deployment studies for groundwater of Bangladesh*. Engineers Institute of Bangladesh, Institute Auditorium, Dhaka, Bangladesh, June 27, 2007.
24. *A Novel Arsenic Filter for Drinking Water Purification*. Prince William County Department of Economic Development Technovation Forum, Virginia, USA, May 17, 2007
25. *Arsenic in Drinking Water: Worldwide Crisis and Mitigation through Simple and Effective Filtration Technologies*. Muslim Community Center, Maryland, USA, May 20, 2007.
26. *Arsenic Poison in Drinking Water: Solving a Health Crisis through a Simple and Effective Filtration Technology*, Asian American Heritage Month Celebration of the Maryland-National Capital Park and Planning Commission (M-NCPPC), May 25, 2007. USA.
27. *Arsenic in Drinking Water: Aquatic Chemistry and Mitigation through Filtration*, Department of Civil and Environmental Engineering, Massachusetts Institute of Technology, Boston, USA. April 26, 2007.
28. *Arsenic in Drinking Water: Chemistry and Mitigation through SONO Filters*. American Association of Bangladeshi Engineers and Architects Seminar, March 31, 2007, Maryland, USA.
29. *Arsenic in Drinking Water: Aquatic Chemistry and Mitigation through Filtration Technologies*, College of Science Seminar, George Mason University, VA, March 22, 2007.
30. *Groundwater Arsenic Mitigation SONO vs. Other Technologies in Bangladesh*, US EPA, Arlington VA, March 8, 2007.
31. *Arsenic Filter Development and Deployment in Bangladesh*, ArcTech Inc, Chantilly, Virginia, July 15, 2005.
32. *Arsenic in Groundwater: Aquatic Chemistry and Fate*, Department of Chemistry and Biochemistry, George Mason University, Fairfax, Virginia. February 10, 2005.
33. *Solving Arsenic Crisis: Chemistry and Mitigation*, North South University, Dhaka, Bangladesh. August 3, 2004.
34. *Arsenic in Groundwater: Mitigation through Sono Filter*. Training on Integrated National Program on Arsenic Mitigation and Promotion of public Health, Organized by Manob Shakti Unnayan Kendro, Kushtia, Bangladesh. August 1, 2004.
35. *Arsenic in Groundwater Aquatic Chemistry and Mitigation*, Chemistry Department, Rajshahi University, Rajshahi, Bangladesh. July 25, 2004.
36. Abul Hussam* and A.K.M. Munir, *Arsenic Disaster: Chemistry and Mitigation*, Fourth Annual Workshop-2004 on Social Education with Training and Skill Development: A Means Toward Transforming Human Deprivation into Human Development, Dhaka, Jan 16, 2004.
37. *Dynamic Electrochemistry and Sensors*. Proposed Ph.D. in Physical Sciences at GMU: Sample project in Physical Chemistry/Chemical Physics, Jan 30, 2004. (Teaching and curriculum development related).
38. *Computer Applications for Chemistry*, Department of Chemistry, Jahangirnagar University, Dhaka, Bangladesh, August 21, 2001.
39. *Aquatic Chemistry of Arsenic in Groundwater of Bangladesh*, Department of Chemistry and Chemical Technology, Islamic University, Kushtia, Bangladesh, August 14, 2001.
40. *Aquatic Chemistry of Arsenic Removal from Groundwater of Bangladesh*, Department of Environmental Engineering, Johns Hopkins University, Maryland. October 27, 2000.
41. *A Simple Method for the Removal of Arsenic from Groundwater*. A Public Awareness Conference in Kushtia, Bangladesh, July 26, 2000.
42. *Understanding Simple Arsenic Removal Methods by Computational Chemical Equilibria*. Institute of Public Health and NIPSOM Joint Seminar, Dhaka, Bangladesh, August 3, 2000.
43. *Aquatic Chemistry of Arsenic Removal from Groundwater of Bangladesh*. Department of Chemistry, University of Dhaka, Dhaka, Bangladesh. August 8, 2000.
44. *Measurement of Volatile Organic Compounds by Solid Phase Microextraction*. Department of Chemistry, Jahangirnagar University, Dhaka, Bangladesh, August 12, 2000.
45. *Simple Methods for Removal of Arsenic from Groundwater of Bangladesh*, Community Development Library- a Non Governmental Organization, Dhaka, Bangladesh, August 13, 2000.
46. *Measurement and Speciation of Arsenic in Groundwater of Bangladesh*, Department of Chemistry and Institute of Environmental Science, University of Maryland, College Park, Maryland, March 2000.
47. *Applications of Solid Phase Microextractions in VOC Analysis in the Environment*, Chemistry Department, George Mason University, November, 1999.
48. *Aspects of Volatile Organic Compounds Pollution in Dhaka City.*, Atomic Energy Center Dhaka, Bangladesh., August 25, 1998.
49. *Understanding Solute-Surfactant Association Equilibria: Application of Headspace Gas Chromatography.*; Department of Chemistry, Dhaka University, Dhaka, Bangladesh., August 26, 1998.

50. *Electroanalytical Aspects of Arsenic Measurement in the Environment*, Chemistry Department, George Mason University, October 2, 1997.
51. *Measurement of Arsenic in the Environment by Computerized Electrochemical Technique*, ADAB, Dhaka, Bangladesh, August 18, 1997.
52. *Electroanalytical Aspects of Arsenic Measurement in the Environment*, Atomic Energy Centre, Dhaka, Bangladesh. August 17, 1997.
53. *Development of Fast Electroanalytical Method for the Measurement of Arsenic in the Environment, The Report of the Arsenic Test by Local Government Engineering Department (LGED)*, LGED, Dhaka, Bangladesh. August 14, 1997. ([First report on our arsenic measurement](#))
54. *Method Development for the Study of Solute-Surfactant Interactions by Headspace Gas Chromatography*, Chemistry Department, University of Minnesota, June, 1996.
55. *Measurement of Interaction Parameters of Solute-Surfactant Associations by Headspace Gas Chromatography*, Chemistry Department, George Mason University, 1995.
56. *Electrochemistry in Organized Media*, Chemistry Department, Dhaka University, Dhaka, Bangladesh, July 14, 1993.
57. *Development of a Computerized Electrochemical System and its Applications*; Atomic Energy Centre, Dhaka, Bangladesh, August 18, 1993.
58. *Applications of Headspace Gas Chromatography to Fluid Phase Equilibria of Reversed Phase Liquid Chromatography*; George Mason University, December 5, 1991.
59. *Electrochemical Instrumentation: Evolution of New Voltammetric Techniques*; Atomic Energy Center, Dhaka, Bangladesh, July 13, 1989.
60. *Computerized Electrochemistry: Development of Some New Voltammetric Techniques*; George Mason University, May 4, 1989.
61. S. L. Davis, E. D. Johnson, and A. Hussam; *Computers in Undergraduate Chemistry at GMU*; George Mason University, April 30, 1986.
62. *Pulse Chronopotentiometry*, George Mason University, December 8, 1986.
63. *Potentiometric Stripping Analysis*; George Mason University, December 2, 1985.
64. *Precise Measurements of Fluid-Phase Equilibria by Headspace Gas Chromatography*; Eastern Illinois State University, March 4, 1985.
65. *Measurements of Fluid Phase Equilibria by Headspace Gas Chromatography*; George Mason University, March 12, 1985.
66. *Applications of Headspace Gas Chromatography in the Study of Vapor/Liquid Equilibria*; University of Louisville, March 25, 1985.
67. *Rapid Measurement of Vapor/Liquid Equilibria by Headspace Gas Chromatography*; San Diego State University, February 4, 1985.
68. *Speciation of Water at Low Concentrations in Hydrogen Bond Acceptor Solvents*; University of Pittsburgh, December 8, 1982.
69. *Differential Constant Potential Anodic Pulse Polarography*; University of Pittsburgh, August 11, 1982.

POPULAR PRESS AND APPEARANCES (Limited list)

1. Voice of America. *Extensive arsenic contamination in Bangladesh*, Interview by Sarkar Kabiruddin, Sept 05, 2010. <http://www.voanews.com/bangla/news/abul-hussam-interview-102256549.html>
2. US Citizenship and Immigration Services, Keynote Speaker at the Naturalization Ceremony at Fairfax County Government Center, Fairfax, Virginia, May 14, 2010.
3. Voice of America. [VOA News - Dr. Abul Hussam Explains Nature Geoscience Article on Arsenic Contamination in Bangladesh's Groundwater](#), 22-November-2009.
4. Voice of America., US Citizenship and Immigration Services Honor Scientist A. Hussam, by Shameem Chowdhury, Oct 23, 2008. <http://www.voanews.com/bangla/2008-10-23-voa6.cfm>
5. TIME Magazine, Global Heroes of the Environment 2007. *Scientists and Innovators- Abul Hussam* by Madhur Singh. Special issue of TIME Magazine, Oct 19, 2007.
6. World wide news release by National Academy of Engineering 2007 Grainger Challenge Prize Gold Award. Feb 2, 2007. This award led to local, national, and worldwide news in popular and professional media including local, national, and international radio and TV interviews in several languages. Examples are listed below.
7. Radio interviews: Public Radio- Washington DC, Massachusetts, Seattle Washington, North Carolina, Voice of America Radio- English, Bangla, Hindi, Urdu; Radio Bangladesh.
8. Television interviews: Voice of America TV- Bangla (2) and Urdu, Fox Ch 5, CNN, Washington Ch 56 Darshan, Washington Ch 56 Bangla Vhalobashi; Bangladesh satellite TV channels: Ekushey-ETV, National- NTV, Stamford- STV.
9. *GMU Teacher's Ingenuity Nets \$1 Million Prize*, Rick Weiss, Washington Post, Metro Section B3, February 2, 2007.
10. *News of chemistry professor's water filter is spreading the world: fighting the hidden poison*, Shamim Ashraf, Pittsburgh Post-Gazette, Health and Science, Section F, August 8, 2007.
11. *Making Drinking Water Safe: award winning chemist eliminates arsenic in water one village at a time*. Tara Laskowski, MFA 06, The Mason Spirit, Spring 2007, pg 14-15.
12. Invited Speaker, *Panel Discussions on Arsenic Crisis*, Satellite TV Broadcasting, Recorded July 15, 2006, 7:30 PM, STV New York, Broadcasted on July 29, 2006 on STV Satellite Channel.
13. Speaker for Bangladesh: *Answer to Questions on Aquatic Chemistry of Arsenic in Bangladesh*, BCBSNA Newsletter, USA. November 2001.
14. Press Conference, *A Simple Arsenic Removal Method for Groundwater of Bangladesh*, National Press Club, Dhaka, Bangladesh, August 5, 2000. Press report was published in the following national newspaper: The Independent, Daily Star, Financial Times, The New Nation, Vhorer Kagaz, Dainik Inquiliab, Dainik Dinkal, Mahanagor, Ajker Kagaz, Matribhumi, and Dainik Arthaniti.

15. Interview published by W. Lepkowski, *Millennium Special Report: Science Meets Policy in Shaping Water's Future*, Chemical Engineering and News, American Chemical Society, 77(49), 127-134 (1999).
16. Interview published by Mason Gazette, George Mason University, pg. 11, September 1999.
17. Arsenic- The International Conference. Protidhoni, 1999.
18. Letter to the Editor: Arsenic Crisis, Chemical Engineering and News (published by American Chemical Society), 1998.
19. *Autos fouling Dhaka air with cancer-causing compounds*, The Independent, Dhaka, Bangladesh., August 27, 1998.
20. *Arsenic Pollution in Bangladesh: An Analytical Perspective*, BCBSNA Newsletter, USA., March 1998.
21. *Chemistry of Arsenic Removal from Water*, BCBSNA Newsletter, USA., March 1997.
22. *Kushtia district exposed to arsenic contamination*, The Bangladesh Observer, Dhaka, Bangladesh., August 18, 1997.
23. *Science, Technology and National Crisis*, Protidhoni, USA., June 1995.
24. *'Environmental Radiation and Health (Paribesh Tejoshkriota and Sashtho)*, Biggyan Samoiki (Science Monthly), 10(6), pg. 3-8, August 1973. Bangladesh.
25. *Hydroponics: Farm of the Future (Hydroponics: Vobishoter Khamar)*, Biggyan Samoiki (Science Monthly), 10(4), pg. 9-10, June 1973. Bangladesh.
26. *Sixty Years of Science in India by Vhagabontom (Vharote Bigganer Shat Bochor: Translation into Bangla)*, Biggyan Samoiki (Science Monthly), 10(7), pg. 7-16, September 1973. Bangladesh.
27. *The Source of Proteins (Protener Utsha)*, Biggyan Samoiki (Science Monthly), 10(10), pg. 9-11, November 1973. Bangladesh.

TECHNICAL REVIEWER (Journals, Funding Agencies, and Institutions)

Environmental Science and Technology, Journal of Environmental Science and Health- Part A (Special Issue Editor) and Member, Editorial Board Part A and B., Analyst, Analytical Chemistry, Journal of Chromatographic Science, Analytica Chimica Acta., Talanta, Journal of Physical Chemistry, Langmuir, Electrochimica Acta, Journal of Solid State Electrochemistry, Journal of Environmental Management, Journal of Environmental Pollution, Journal of Hazardous Materials,

American Chemical Society- Petroleum Research Fund, National Science Foundation (NSF), NSF SBIR Panel, Cottrell Foundation, Marine Science Research: King Abdul Aziz University, Saudi Arabia, International Science Foundation (George Soros Fund), USA., Center for Border Health Research, Texas, USA, International Union of Pure and Applied Chemistry (IUPAC), Jadavpur University, Kolkata, India, Islamic University, Kushtia, Bangladesh, Yarmouk University, Irbid, Jordan, Qatar National Research Fund (QNRF).