Arunagirinathan M. Adhimoolam

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- PhD (IIT Bombay) and Postdoc (Stanford University & University of Minnesota).
- Colloid & Interfacial Science, Surfactants, Consumer Care : 10+ years
- Solubilization, Encapsulation driven product development for personal care, home care, and health care using structured mesophases of surfactant, lipid, lipid-inorganic and peptide-inorganic hybrid systems.
- Published peer reviewed articles, patent and presented at international and national conferences.

Ph. D., Colloid & Interfacial Science, Indian Institute of Technology Bombay 2007/2008
"Surfactant Dissolution: Phase Transformations and Microstructure Evolution"
Advisors: Prof. Jayesh R. Bellare, Prof. C. Manohar.

M.Sc., Applied Chemistry**,** 1999**,** C.G.P.A (8.29/10),
Anna University, College of Engineering, Guindy Chennai, India
Master's Thesis: "Evaluation of Detergents' Efficiency and Mesoporous Alumino Silicate Cage for Dirt Entrapment", *Advisor:* Prof. K. Rengaraj.

B.Sc. Chemistry 1997 (I Class)
University of Madras, Pachaiyappa's College, Chennai

RESEARCH EXPERIENCE:

Senior Scientist, Surfactants, 3/2016 - present.
Clariant India Limited, Group Technology and Innovation, Navi Mumbai.

- Physicochemical understanding of interfaces; Solubilisation and encapsulation driven new product development in personal care, home care and paints/coatings.
- Exploring encapsulation, effective deposition and delivery mechanisms for home care and personal care.
- Building innovation pipeline for Home care, Personal care, Paints/Coatings.
- Lead surfactant manufacturing process improvement for cost efficiency.

Scientist, Performance Chemicals**,** 6/2013 – 2/2016.
SABIC Technology Centre, Bengaluru.

- Developed proof of concept formulations for two new products with (1) New surfactant blend and (2) Alternate hydrotrope with enhanced solubilisation for textile scouring.
- Explored foam minimization of surfactant for turbulent scouring.

- Modified existing product for enhanced application performance and competitive price offering.

Post-doctoral Research (2008-2013, 5 years):
Stanford University, 4/2011 – 2/2013; **University of Minnesota,** 3/2008 – 3/2011.

- Explored solubilization phase behavior of polymeric surfactant poly(butadiene-b-ethylene oxide) and identified routes to make stable polymeric pods, interconnected lamellar and bicontinuous structures that can be used as potential encapsulating agents for crop care and personal care applications.
- Unraveled the role of block copolymer surfactant (PEO-*b*-PPO-*b*-PEO) and studied the oriented ordering of silica nanoparticles for potential coating applications.
- Studied the influence of hydrated counterion in shielding the electrostatic repulsion of dodecylsulfate anionic surfactant to understand the extended microstructures for solubilisation.
- Explored clathrin protein epitope recognition in microstructure self-assembly and nanoparticle synthesis for energy application.

Research Associate, 8/2007 – 2/2008.
Department of Chemical Engineering, Indian Institute of Technology Bombay.
"Explored Lipid and Lipid-Inorganic Hybrid Systems for Protein Delivery"

Research Assistant, 7/2000 – 6/2001.
Department of Chemistry, Indian Institute of Technology Madras**.**
"Fullerene Synthesis"

Plant Technical Supervisor, 4/1999- 6/2000.
Madras Rubber Factory (MRF) Limited, Chennai.
Responsibilities: Polymer processing and chemical compounding.

Summer Research Fellow, 5/1998 – 6/1998.
Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore.
"Porphyrin Synthesis"

EXPERTISE:

- Phase equilibria, phase immiscibility of anionic surfactants, nonionic surfactants and phospholipids in water/oil (IIT Bombay, University of Minnesota, SABIC).
- Oil/water/diblock copolymer surfactant system for bicontinuous microemulsion and double emulsion (University of Minnesota).
- Formation of structured soft solids, multilamellar concentric cylinders and giant vesicles (IIT Bombay, Clariant).

- Protein phase behavior (University of Minnesota, Stanford University) and biotemplate engineering through epitope recognition for nanoparticle synthesis (Stanford University).
- Microencapsulation and delivery systems (IIT Bombay, University of Minnesota, Clariant).
- Solution phase behavior of silica nanoparticles influenced by electrostatic and steric interactions (University of Minnesota).
- Hydrothermal synthesis of mesoporous aluminosilicate (Anna University); Solvothermal synthesis of ferrite nanoparticles (IIT Bombay); Porphyrin synthesis (IISc Bangalore);
- **Spectroscopy, Scattering:** Confocal MicroRaman Spectroscopy (IIT Bombay); Small Angle X-ray Scattering (IIT Bombay, University of Minnesota).
- **Microscopy:**
    - Cryo-Transmission Electron Microscopy (cryo-TEM), Cryo Electron Tomography (cryo-ET) (University of Minnesota, Stanford University, University of California San Francisco); Freeze-Fracture TEM (IIT Bombay, University of Minnesota).Cryo Scanning Electron Microscopy (cryo-SEM) (IIT Bombay, University of Minnesota).
    - *In situ* Liquid Environment TEM (Stanford University).

PUBLICATIONS:

1. Bellare, J., Dwivedi, N., **Arunagirinathan, M. A,** Sharma, S., "Orally Administrable Pharmaceutical Preparation containing Protein", IPA No. 201621005792.
2. Lee, H. S., **Arunagirinathan, M.A**., Vagias, A., Lee, S., Bellare, J.R., TedDavis, H., Kaler, E. W., McCormick, A.V. and Bates, F.S., "Almost Fooled Again: New Insights into Cesium Dodecyl Sulfate Micelle Structures", Langmuir, 2014, 30 (43), 12743-12747.
3. Huggins, K.N.L., Schoen, A.P., **Arunagirinathan, M.A.** and Heilshorn, S.C., "Multi-site Functionalization of Protein Scaffolds for Bimetallic Nanoparticle Templating", Advanced Functional Materials, 2014, 24 (48), 7737-7744.
4. Schoen, A.P., Cordella, N., Mehraeen, S., **Arunagirinathan, M.A.,** Spakowitz, A.J. and Heilshorn, S.C., "Dynamic Remodeling of Disordered Aggregates is an Alternative Pathway to Achieve Robust Self-Assembly of Nanostructures", **Soft Matter**, 2013, 9 (38), 9137-9145.
5. Schoen, A.P., Schoen, D.T., Huggins, K.N.L., **Arunagirinathan, M.A.** and Heilshorn, S.C., "Template Engineering Through Epitope Recognition: A Modular, Biomimetic Strategy for Inorganic Nanomaterial Synthesis", **Journal of the American Chemical Society,** 2011, 133 (45), 18202-18207.
6. Atchinson, N., Fan, W., Brewer, D.D., **Arunagirinathan, M.A.,** Hering, B.J., Kumar, S., Papas, K.K., Kokkoli, E. and Tsapatsis, M., "Silica Nanoparticle

Coatings by Adsorption from Lys-Sil Sols on Inorganic and Biological Surfaces" **Angewandte Chemie International Edition,** 2011, 50, 1617-1621.

7. Shroff, K., Rexeisen, E.L., **Arunagirinathan, M.A.** and Kokkoli, E., "Fibronectin-mimetic Peptide-Amphiphile Nanofiber Gels Support Increased Cell Adhesion and Promote ECM Production", **Soft Matter**, 2010, 6, 5064-5072.
8. Dwivedi, N., **Arunagirinathan, M.A,** Sharma, S. and Bellare, J.R., "Silica-Coated Liposomes for Insulin Delivery" **Journal of Nanomaterials,** 2010, Article ID 652048, 8pp.
9. Lee, S., **Arunagirinathan, M.A.** and Bates, F.S., Path Dependent Morphologies in Oil/water/Diblock Copolymer Mixtures, **Langmuir,** 2010, 26 (3), 1707-1715.
10. Dwivedi, N., **Arunagirinathan, M.A.,** Sharma, S. and Bellare, J.R., "Ferrite-Silica-Insulin Nanocomposites (FeSINC) for Glucose Reduction", **Langmuir,** 2010, 26 (1), 357-361.
11. Fukao, M., Sugawara, A., Shimojima, A., Fan, W., **Arunagirinathan, M.A.,** Tsapatsis, M. and Okubo, T., One-Dimensional Assembly of Silica Nanospheres Mediated by Block Copolymer in Liquid Phase. **Journal of American Chemical Society,** 2009, 131 (45), 16344-16345**.**
12. Harikrishnan, G., Lindsay, C.I., **Arunagirinathan, M.A.** and Macosko, C.W., "Probing Nanodispersions of Clay for Reactive Foaming", **ACS Applied Materials & Interfaces,** 2009, 1 (9), 1913-1918.
13. Dwivedi, N., **Arunagirinathan, M.A.,** Sharma, S., and Bellare, J.R., "Nanoferrite Embedded Magnetocochleate Microstructures to Encapsulate Insulin Macromolecule", **Journal of Physical Chemistry B,** 2009, 113 (42), 13782-13787.
14. Dubois, M., Carriere, D., Iyer, R., **Arunagirinathan, M.A.,** Bellare, J., Verbavatz, J.-M. and Zemb, Th., "From Dispersed Nanodiscs to Thin Films of Layered Organic Material via Reversible Swelling", **Colloids and Surfaces A: Physicochemical and Engineering Aspects**, 2008, 319 (1-3), 90-97.
15. Giddi, H., **Arunagirinathan, M.A** and Bellare, J.R., "Self-assembled surfactant nanostructures important in drug delivery: a review", Ind. J. Exp. Bio, 2007, 45 (2), 133-159.
16. Taribagil, R., **Arunagirinathan, M.A.,** Manohar, C. and Bellare, J.R., "Extended Time Range Modeling of Myelin Growth", **Journal of Colloid and Interface Science**, 2005, 289 (1), 242-248.
17. Iyer, R., **Arunagirinathan, M. A.,** Prabhu, C. S. and Bellare, J.R., "An Improved Specimen Loader for Cryo-SEM", **Scanning**, 2005, 27 (3), 141-146.
18. **Arunagirinathan, M. A.,** Manohar, C. and Bellare, J.R., "Eroded Myelin Figures", **Langmuir**, 2004, 20, 4318-4321.
19. **Arunagirinathan, M. A.,** Roy, M., Dua, A. K., Manohar, C. and Bellare, J.R., "Micro-Raman Investigations of Myelin in Aerosol-OT/Water System", **Langmuir**, 2004, 20, 4816-4822.

INVITED TALKS:

1. Arunagirinathan, M.A., Understanding surfactant phase behavior for consumer care applications, 2017, 2nd National Conference on Surfactants and Colloids, Society for Industrial Chemistry, Mumbai, Feb 10-11, 2017.
2. Dynamic Interfaces and Colloidal Nano/Micro Structures, June 05, 2013, Department of Metallurgical and Materials Science, Indian Institute of Technology Bombay.
3. Non-Equilibrium Phase Behavior in Soft Materials, April 17, 2012, Chalmers University of Technology, Goteborg, Sweden.
4. Clathrin Protein Template for Nanoparticle Nucleation, November 11, 2011, University of California San Francisco, Prof. Yifan Cheng's group.
5. Phase Transformation and Microstructure Evolution in Soft Materials, January 27, 2011, Stanford University, Prof. Sarah Heilshorn's group.
6. Cryo-Electron Tomography & Reconstruction for Cryo Electron Microscopy Short Course-2010, July 29-30, 2010, University of Minnesota, Minneapolis, USA.

FELLOWSHIPS AND AWARDS:

1. Visiting Fellow, Chalmers University of Technology, Department of Chemical and Biological Engineering, Applied Surface Chemistry Division, Goteborg, Sweden, April 2012.

2. Hindustan Unilever Fellowship for doctoral studies, Department of Chemical Engineering, IIT Bombay, 2001-2004.

3. Summer Research Fellow, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India, 1998.

CONFERENCES:

1. Arunagirinathan, M.A., Understanding surfactant phase behavior for consumer care applications, 2017, **2nd National Conference on Surfactants and Colloids**, Society for Industrial Chemistry, Mumbai, Feb 10-11, 2017.

2. Arunagirinathan, M.A., Gibbons, B., Schoen, A., Spakowitz, A.J., and Heilshorn, S.C., Self-Assembly of Clathrin Protein 3D Structures, **2012 AIChE Anuual Meeting**, Pittsburgh, PA, Oct 28 - Nov 2, 2012.

3. Arunagirinathan, M.A., Schoen, A.P, Huggins, K.N.L., and Heilshorn, S.C., Clathrin Self-Assembly Templates for Gold Nanoparticle Nucleation, **Microscopy & Microanalysis 2012 Meeting**, Phoenix, July 29 - Aug 2, 2012.

4. Arunagirinathan, M.A., Gibbons, B., Schoen, A., Spakowitz, A.J., and Heilshorn, S.C., Self-Assembly of Clathrin Protein 3D Structures, **Gordon Research Conference: Bioinspired Materials**, Davidson, June 24-29, 2012.

5. Arunagirinathan, M.A., Huggins, K.N.L., Schoen, A.P., and Heilshorn, S.C., Three Dimensional Clathrin Protein Template for Nanoparticle Nucleation, Center for Probing the Nanoscale - 8th Annual Nanoprobes Workshop, Stanford, May 18, 2012.

6. Arunagirinathan, M.A., Gibbons, B., Schoen, A., Huggins, K.N.L., and Heilshorn, S.C., Self-assembly of Clathrin protein nanostructures, **243rd ACS National Meeting**, San Diego, March 25-29, 2012.
7. Lee,S., Arunagirinathan, M.A., and Bates, F.S., Process dependent microstructures in nonionic block copolymer/water/oil/mixtures, Industrial Partnership for Research in Interfacial and Materials Engineering-Annual Meeting, Minneapolis, **IPrime,** June 1-4, 2010.
8. Arunagirinathan, M. A., Dwivedi, N., and Bellare, J.R., Multilamellar Stacks of Phospholipid Bilayers: Phase Transformation and Microstructure Evolution, **NSTI NanoTech,** The Nanotechnology Conference and Trade Show, **Nanotech 2008,** June 1-5, 2008.
9. Rajkumar, S., Arunagirinathan, M. A., Agarwal, K. and Bahadur, D., Shape Controlled Synthesis of Ni Nano particles through Surfactant Assisted Soft Template Process, International Conference on Nanoscience and Technology, **ICONSAT**-**2008,** Feb 27-29, 2008.
10. Bellare, J.R.., Arunagirinathan, M. A., and Giddi, H., Nano and Microstructures In Dynamical Surfactant Systems, International Congress on Nanobiotechnology and Nanomedicine, **NanoBio-2006,** June19-26, 2006.
11. Arunagirinathan, M. A., Manohar, C. and Bellare, J.R., Nanostructures in transient surfactant systems, International Symposium on Macro- and Supramolecular Architectures and Materials, **MAM-06,** May 28-June 1, 2006.
12. Arunagirinathan, M. A., Manohar, C. and Bellare, J.R., Dissolution Characteristics of a Catanionic Surfactant in Water, Indian Chemical Engineering Congress, **CHEMCON-2004**, Dec 27-30, 2004.
13. Arunagirinathan, M. A., Manohar, C. and Bellare, J.R., Cryo-Electron Microscopic Studies of Pentaethoxy Nonylphenyl Ether/Water surfactant System, Electron Microscopy and Allied Fields**, EMSI-2004,** April 1-3, 2004.
14. Arunagirinathan, M. A., Manohar, C. and Bellare, J.R., Non-Equilibrium Microstructures of Polyoxyethylene Sorbitan Trioleate, National Conference on Surfactants, Emulsions and Biocolloids, **NATCOSEB-2003**, Dec 11-13, 2003.
15. Arunagirinathan, M. A., Vijaykumar, B., Malladeb, S., Hota, G., Manohar, C. and Bellare, J.R., Particle formation in Dynamic Myelin Phases of Surfactants, International Symposium on Recent Advances in Inorganic Materials, **RAIMS-2002**, Dec 11-13, 2002.