

Curriculum vitae

Position Title: Research scientist

Name: Dr. Krishnaiah Damarla

Ph. D. (Chemical Science), Title of Ph. D. Thesis: "Ionic liquid based colloidal formulations and their applications"

Academy of Scientific and Innovative Research (AcSIR), CSIR-Central Salt and Marine Chemicals Research Institute. Bhavnagar-364002, Gujarat, India



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DATE OF BIRTH & PERMANENT ADDRESS:

DOB: 01/03/1988; **H.No:** 16-23, Hanuman nagar, Kalwakurthy, Telangana, Pin: 509324, INDIA.

Languages Known (both oral and written): English, Hindi and Telugu.

Marital Status: Married

Research Profile and Publications: <https://scholar.google.co.in/citations?user=iOYS-UAAAAJ&hl=en>

<http://orcid.org/0000-0002-4205-8214>

EDUCATIONAL QUALIFICATION

S. No.	Name of Degree	Institution/Board /University	Marks (%)	Years	From	To
1	Ph.D. (Physical Chemistry)	Academy of Scientific and Innovative Research - CSMCRI	85.8	5	2014	2019
2	M.Sc. (Chemical science)	Pondicherry University	67.4	2	2010	2012
3	B.Sc. (Maths, Physics, Chemistry)	Osmania University	66.8	3	2006	2009

PROFESSIONAL EXPERIENCE SUMMARY

S.No	Organization	Position	Duration	From (DD/MM/YYYY)	TO (DD/MM/YYYY)
1	CSIR-Central Salt and Marine Chemicals Research Institute	Junior research fellow	2 years	10/03/2014	09/03/2016
2	CSIR-Central Salt and Marine Chemicals Research Institute	Senior research fellow	3year 2 months	10/03/2016	06/12/2019

OBJECTIVES & RESEARCH INTERESTS

- Preparation of novel colloidal formulations such as emulsions, nanoemulsions and microemulsions.
- Enhancing and developing the stability of sustainable colloidal systems using suitable materials.
- Preparation of shiny and cost-effective inks/paints using greener solvents and advanced materials.
- Synthesis of novel bio-friendly Ionic Liquid (IL) / deep eutectic solvents (DES) and their interaction studies with proteins and biopolymers.
- Explore research in the field of sustainable synthesis of advanced materials (Perovskites, QDs, CDs and nanoclusters) using ILs/DES and their applications in energy conversion and storage.

AWARDS:

Name of Award	Year	Agency
NET	2013	CSIR-UGC India
Junior Research Fellow	2014-2016	DST, Govt. of India
Senior Research Fellow	2016-2018	DST, Govt. of India
Senior Research Fellow	2018-2019	CSIR, Govt. of India
Young Scientist (for best poster presentation)	2019	ICEFN&SEM-2019 International conference

WORK EXPERIENCE & ACHIEVEMENTS

Work Experience: More than 5 years of research experience in colloidal science at CSIR-CSMCRI as a research scholar (DST and CSIR). During that, I enrolled for Doctoral studies (PhD) under AcSIR-CSMCRI. I assisted and guided M.S. dissertation trainee students during my PhD. Apart from that, I have experience as a guest lecture in chemical science at Girraj Govt. College (Telangana University) for M.Sc. students.

Achievements: I have synthesized various bio-friendly ILs, and studied the properties of ILs based colloidal formulations (emulsions, nanoemulsions and microemulsions) for synthesis of advanced materials. Studied optical properties and gas adsorption properties of the materials. I also published various peer reviewed international articles.

RESEARCH EXPERIENCE AND KNOWLEDGE:

- Synthesis and characterization of Ionic liquids and their physicochemical properties.
- Studied the aggregation behavior of ILs based surfactants in aqueous/non-aqueous and preparation of thermally stable IL based emulsions.
- Synthesis and stabilization of Nanoparticles, Quantum Dots, Nano clusters using IL based microemulsions / reverse micelles and their applications in light harvesting.
- Optoelectronic properties of colloidal semiconducting materials and synthesis of nano-porous materials in microemulsions/micelles and their applications for gas storage/adsorption.
- Preparation of "ionogels" using ILs and their applications in supercapacitors.
- I can independently handle Isothermal Titration Calorimeter (ITC), Tensiometer, Rheometer (Rheology), Dynamic light scattering (DLS), UV-Vis spectrophotometer, Fluorescence (Emission) spectrophotometer, Time resolved Photoluminescence spectroscopy (TrPL), Circular Dichroism (CD), Optical and Fluorescence Microscope, Densitometer, Ultrasonic Analyser, Viscometer, Digital Conductivity meter, pH meter, Osmometer, Refractometer with details analysis using their respective software.

- Experience and expertise with NMR (^1H , ^{13}C , 2D-NOESY), FT-IR, Raman Spectrometer, LC-MS, GC, GC-MS, DSC, CHNS elemental analysis, TGA, ICP, P-XRD, BET Surface area, FE-SEM, TEM and AFM techniques with details analysis using their respective software.
- I also have knowledge and experience on Small Angle X-ray Scattering (SAXS) and Small Angle Neutron Scattering techniques (SANS).
- Having knowledge on computer programs. Independently I can handle analytical software such as Chem Draw, ORIGIN, Mercury, MatLab, Adobe Illustrator, MestReNova etc.

IMPORTANT CONFERENCES:

- Given poster presentation on “All Ionic Liquid based Colloidal Formulations as Recyclable Nanoreactors” at International Conference on “Energy, functional materials and nanotechnology & sustainable environment management”- ICEFN & SEM -2019, at Kumaun University, Nainital-263002 Uttarakhand, India.
- Selected and Participated in “XVIII-School on Neutrons as Probes of Condensed Matter” at BARC, Mumbai, India., 28th October – 1st November, 2018”
- Given Oral presentation on, “Ionic Liquid based Colloidal formulations and their applications in material synthesis towards light harvesting and energy storage materials” at International Conference on Nanomaterials for Energy conversion and Storage Applications, held at Pandit Deendayal Petroleum University, Gandhinagar, India during 29th - 31st January’ 2018.
- Oral Presentation in “National Symposium on Electrochemistry, Energy and Environment” at Department of Chemistry Jai Narain Vyas University Jodhpur December 16-18, 2016.

SUMMARY OR RESEARCH EXPERIENCE AND ACHIEVEMENTS:

March 10th 2014 to 6th December 2019, Doctoral student at CSIR-Central Salt and Marine Chemicals Research Institute, Bhavnagar, Gujarat, India.

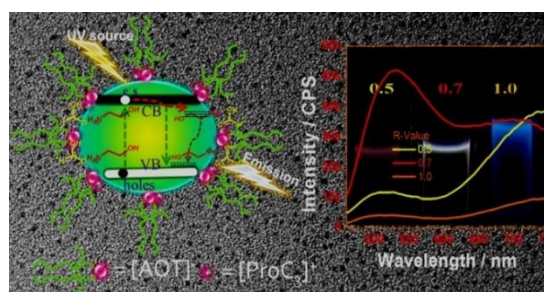
Supervisors: Dr. Arvind Kumar (Principal scientist)

Research Field: Ionic Liquid surfactant based colloidal formulations and their applications in material synthesis for light harvesting and gas storage.

Major Research Achievements:

1) Illuminating microemulsions: ionic liquid–CdS quantum dots hybrid materials as light harvesting systems.

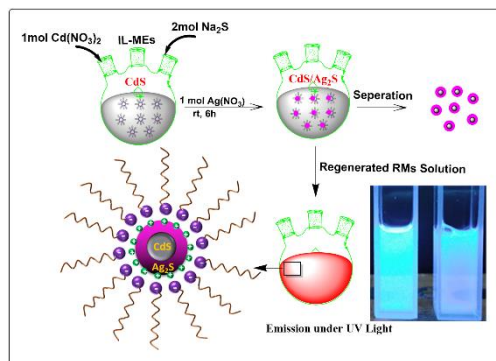
Publication: *Chem. Commun.*, 2016, 52, 6320-6323.
Microemulsions (MEs) comprising of 2-hydroxyethylammonium formate, (HO-EAF), isoctane and dioctylsulfosuccinate proliniumisopropylester ([ProC₃]AOT) have been constructed and used to prepare and stabilize CdS Quantum Dots (QDs) at room temperature. Such hybrid materials exhibited tunable light emission wherein the photoluminescence chromaticity could be precisely adjusted to pure white with a quantum efficiency (QE) of 43%, by adjusting the droplet size of MEs.



2) Versatile Surface-Active Ionic Liquid: Construction of Microemulsions and their Applications in Light Harvesting

Publication: *Phys. Chem. Chem. Phys.*, 2020, 22, 8157--8163

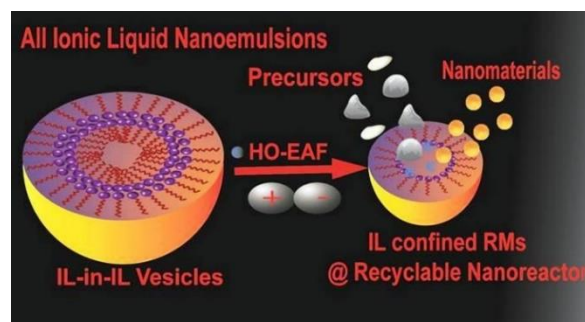
The article outlines towards the sustainable way to the synthesis of advanced materials such as core/shell Quantum Dots (QDs) and their in-situ stabilization using microemulsions (MEs). QDs are the versatile materials which show unusual optical properties. We have constructed MEs consisting of an Ionic Liquid (IL) based surfactant i.e. choline dioctylsulfosuccinate, [Cho][AOT] as an emulsifier, toluene as nonpolar phase and water as polar phase. The system forms a large single-phase region in phase diagram without any co-surfactant. Spontaneous formation of micelles has been observed and studied through tensiometer, fluorescence and isothermal titration calorimetry (ITC). Exceptional swelling behaviour of MEs was studied using Dynamic Light Scattering (DLS) and small angle neutron scattering (SANS). In MEs droplets i.e. Reverse Micelles (RMs), we successfully synthesized spherical core/shell QDs (size ~ 3 to ~ 6 nm) with a precise control over size and morphology. The QDs have been characterized using Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM) and Powder X-ray Diffraction (PXRD). QDs stabilized in MEs exhibited excellent optical properties and can be suitably used as light harvesting material for diverse applications.



3) Nanoemulsions with All Ionic Liquid Components as “Recyclable Nanoreactors”.

Publication: *Langmuir*, 2018, 34, 10081–10091

Nanoemulsions (NEs) comprising of ionic liquids (ILs); ethanolammonium formate (HO-EOAF), proliniumisopropylester dioctylsulfosuccinate ([ProC₃][AOT]) and 1-butyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide, ([Bmim][NTf₂]) as insoluble hydrophilic, surface active and hydrophobic components have been constructed. This novel class of colloidal formulation exhibited several contrasting properties vis-à-vis conventional water-in-oil (W/O) or water-in-ionic liquid (W/IL) or non-aqueous NEs such as (i) spontaneous formation (ii) thermodynamic stability and isotropic nature (iii) decrease of droplet size with increase in polar medium concentration, and (iv) high thermal and kinetic stability. Mechanisms and characteristics for such anomalies have been investigated by physical, spectroscopic and imaging techniques. NEs have been demonstrated as versatile recyclable nanoreactors for user-friendly synthesis of materials such as metal-organic frameworks (MOFs) / light harvesting hybrid systems. We anticipate that this development will lead to the construction of several other need-based “All Ionic Liquid Nanoemulsions” in view of flexibility provided by tailoring nature of ILs. Illuminating microemulsions: ionic liquid–CdS quantum dots hybrid materials as light harvesting systems.



4) Ionic Liquid based Colloidal formulations for the synthesis of nano-MOFs and Applications in gas adsorption and Desalination of Water using Nanofiltration Composite Membranes.

Publication: *Under revision*.

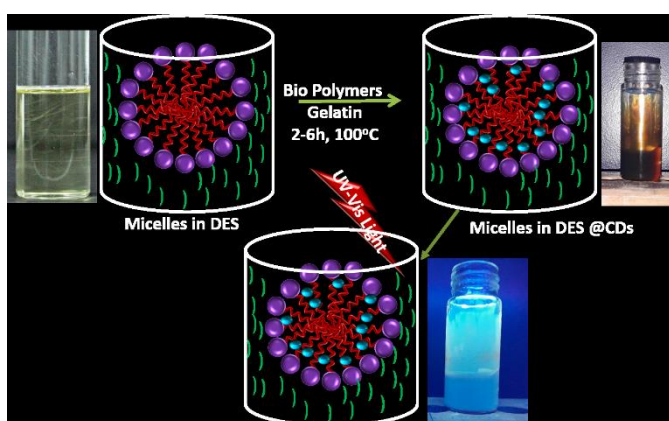
Microemulsions (MEs) consisting of choline dioctylsulfosuccinate, [Cho][AOT], a bio-based ionic liquid surfactant as an emulsifier, (R)-(+)-limonene (RL), ethanolammonium formate (EOAF) as nonpolar and polar phase have been constructed. Isothermal titration calorimetry (ITC) and surface tension measurements indicated the spontaneous aggregation of [Cho][AOT] molecules in RL and EOAF forming reverse micelles

(RMs) and micelles respectively. MEs have been characterized from ternary phase diagram, dynamic light scattering (DLS) and small angle X-ray scattering (SAXS) techniques. Reverse micelles (RMs) have been used as reactors to synthesize various MOFs such as ZIF-8, HKUST-1, UIO-66-NH₂ and MIL-53-Al-NH₂ with desired size and morphology in a greener way and are characterized using scanning electron microscope (SEM), transmission electron microscope (TEM) and powder x-ray diffraction (P-XRD). The nano-MOFs with high BET surface area and better CO₂ adsorption, are fabricated in nanofiltration membranes which shows remarkable properties for the desalination of water. The membranes show excellent flux and selectivity (~99.8%) of divalent salts.

5) Self-assembled Systems of Surface-Active Ionic Liquids in Deep Eutectic Solvents for Sustainable Preparation of Carbon Dots as light harvesting systems.

Publication: *Under revision*.

The utility of deep eutectic solvents (DESs) for self-assembly of amphiphiles, especially surface-active ionic liquids (SAILs), is at a budding stage and offers opportunities to develop new colloidal systems for different applications owing to their physicochemical merits *vis a vis* ionic liquids. One such property of immense interest is biomass dissolution for preparation and stabilization of carbon-based nanomaterials. Following this, herein, we have investigated the self-assembly behavior of



different anionic SAILs, some of which are based on biological components, in a DES composed of choline chloride and ethylene glycol in 1:2 mole ratio and compared the behaviour to that observed in aqueous medium. Thus, obtained micellar systems of bio-based SAILs in DES are exploited as suitable medium for dissolution of easily available and a cheap biopolymer, Gelatin (G), and subsequent preparation and stabilization of Carbon Dots (CDs). The prepared colloidal CDs has been characterized for optical (UV-Vis and fluorescence), structural (X-ray diffraction) and morphological (transmission electron microscopy) properties. In this way, a new and sustainable method for preparation of CDs is presented. It is expected that the present work would open up a new avenue for utilization of DESs based colloidal systems for preparation and stabilization of other carbon-based nanomaterials for diverse applications.

LIST OF PUBLICATIONS:

1. **Krishnaiah Damarla**, Sanjay Mehra, Pratap Bahadur, Debes Ray, Vinod Kumar Aswal and Arvind Kumar, Versatile Surface-Active Ionic Liquid: Construction of Microemulsions and their Applications in Light Harvesting. *Phys. Chem. Chem. Phys.*, **2020**, *22*, 8157--8163.
2. **Krishnaiah Damarla**, Yadagiri Rachuri, Eringathodi Suresh, and Arvind Kumar*. Nanoemulsions with All Ionic Liquid Components as Recyclable Nanoreactors. *Langmuir*, **2018**, *34* (34), pp 10081–10091.
3. **Krishnaiah Damarla**, Pankaj Bharmoria, K. Srinivasa Rao, Praveen Singh Gehlot and Arvind Kumar, Illuminating microemulsions: ionic liquid–CdS quantum dots hybrid materials as potential white light harvesting systems. *Chem. Commun.*, **2016**, *52*, 6320-6323.
4. Manvir Kaur, Gagandeep Singh, **Krishnaiah Damarla**, Gurbir Singh, Huiyong Wang, Jianji Wang, Vinod Kumar Aswal, Arvind Kumar, Tejwant Singh Kang. Aqueous Systems of Surface Active Ionic Liquid

Having Aromatic Anion: Phase Behavior, Exfoliation of Graphene Flakes and Its Hydrogelation. *Phys. Chem. Chem. Phys.*, **2019**, DOI:10.1039/C9CP04449C.

5. Manashjyoti Konwar, Parmita Phukan, Amrita K. Chaliha, Alak K. Buragohain, **Krishnaiah Damarla**, Dipshikha Gogoi, Arvind Kumar, Diganta Sarma. An Unexplored Lewis Acidic Catalytic System for Synthesis of Pyrazole and its Biaryls Derivatives with Antimicrobial Activities through Cycloaddition-Iodination-Suzuki Reaction. *ChemistrySelect*, **2019**, *4* (35), 10236-10245.
6. Apurba Dutta, **Krishnaiah Damarla**, Ankur Bordoloi, Arvind Kumar, Diganta Sarma KOH/DMSO: A Basic Suspension for Transition Metal-Free Tandem Synthesis of 2, 3-Dihydroquinazolin-4 (1H)-ones. *Tetrahedron Lett.* **2019**, *60* (24), 1614-1619.
7. Roktopol Hazarika, Manashjyoti Konwar, **Krishnaiah Damarla**, Arvind Kumar and Diganta Sarma, HBF₄/ACN: A simple and efficient protocol for the synthesis of pyrazoles under ambient reaction conditions, *Synth. Commun* **2019**, <https://doi.org/10.1080/00397911.2019.1692869>.
8. Apurba Dutta, Krishnaiah Damarla, Arvind Kumar, Prakash J. Saikia and Diganta Sarma, Gemini basic ionic liquid as bi-functional catalyst for the synthesis of 2,3-dihydroquinazolin-4(1H)-ones at room temperature, *Tetrahedron Lett.* **2019**, 151587.
9. Anirban Garg, Abdul Aziz Ali, **Krishnaiah Damarla**, Arvind Kumar, Diganta Sarma, Aqueous bile salt accelerated cascade synthesis of 1,2,3-triazoles from arylboronic acids. *Tetrahedron Lett.* **2018**, *59* (45), 4031-4035.
10. Arvind Kumar, Praveen Singh Gehlot, **Krishnaiah Damarla**, Mohit J. Mehta and Akshay Kulshrestha. Metal-based ionic liquids: Their properties, applications and future prospects. *J. Indian Chem. Soc.*, **2017**, *94*, 1-20.
11. Praveen Singh Gehlot, Akshay Kulshrestha, Pankaj Bharmoria, **Krishnaiah Damarla**, Kaumeel Chokshi, and Arvind Kumar Surface-Active Ionic Liquid Cholinium Dodecylbenzenesulfonate: Self-Assembling Behavior and Interaction with Cellulase. *ACS Omega*, **2017**, *2* (10), pp 7451–7460.
12. Gagandeep Singh, Gurbir Singh, **Krishnaiah Damarla**, Pushpender K. Sharma, Arvind Kumar, and Tejwant S. Kang. Gelatin-Based Highly Stretchable, Self-Healing, Conducting, Multiadhesive, and Antimicrobial Ionogels Embedded with Ag₂O Nanoparticles. *ACS Sustainable Chem. Eng.*, **2017**, *5* (8), 6568–6577.
13. Pankaj Bharmoria, **Krishnaiah Damarla**, Tushar J. Trivedi, Naved I Malek and Arvind Kumar* Reciprocal Binary Mixture of Protic/Aprotic Ionic Liquids as Deep Eutectic Solvent: Physicochemical Behaviour and Application towards Agarose Processing, *RSC Adv.*, **2015**, *5*, 99245-99252.
14. Praveen Singh Gehlot, K. Srinivasa Rao, Pankaj Bharmoria, **Krishnaiah Damarla**, Hariom Gupta, Markus Drechsler, and Arvind Kumar, Spontaneous Formation of Multi- Architecture Vesicles of [C₈mim]Br + [Na]DBS in Aqueous Medium: Synergic Interplay of Electrostatic, Hydrophobic and pi-pi Stacking Interactions, *Phys. Chem. B*, **2015**, *119* (49), 15300–15309.
15. **Krishnaiah Damarla**, and Arvind Kumar*. Non-aqueous-microemulsions based on green solvents: room temperature synthesis of nanoscale metal–organic frameworks and CO₂ fixation therein. *Manuscript submitted*.

16. **Krishnaiah Damarla**, Sanjay Mehra, Tejwant Singh Kang and Arvind Kumar*. Studies on Aggregation Behaviour of Biobased Surface-Active Ionic Liquids in Aqueous and Non-Aqueous Medium. *Manuscript submitted*.
17. **Krishnaiah Damarla**, and Arvind Kumar*. Is Nanoemulsions are stable for longer period? An experimental and theoretical studies. *Manuscript under preparation*.

References:

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Declaration: *I understand and hereby declare that all the information is true and correct to the best of my knowledge and in case of any discrepancy in information / certificates, my candidature shall stand cancelled.*

Signature

