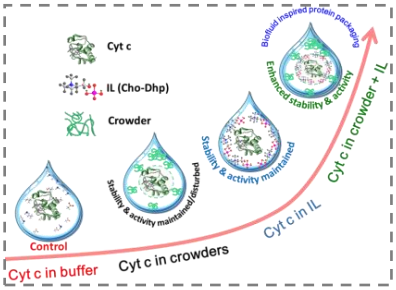
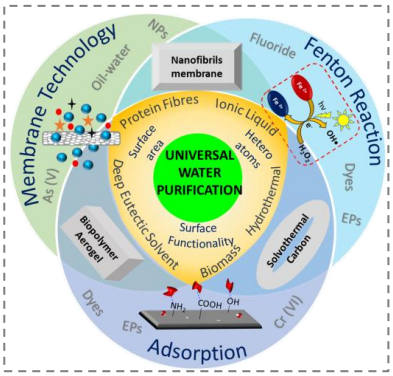
Neoteric Solvents Assisted Sustainable Strategies for Enhanced Protein Packaging and Universal Water Purification

Dr. Dibyendu Mondal

Abstract: This talk will be focused on two different topics which are (i) strategies for improving the stability and activity of enzymes for facile biocatalysis and (2) devising protocol for sustainable and universal water purification. Enzymatic biocatalysis has been recognized as key process applied in diverse fields of applications including synthesis of valuable pharmaceutical intermediates and biofuels from renewable resources.[1] However, the fact that enzymes have evolved to work in cellular environments and are therefore usually unstable to harsh process conditions such as temperature, pressure, use of organic solvents and etc.—the major barrier to the use of the enzyme in industrial biotechnology.[2] Consequently, there is a clash between low-temperature aqueous processing (optimal conditions for enzyme stability and selectivity), and organic solvent or high-temperature processing (which favor high substrate solubility and immensely improved reaction kinetics, respectively). First part of the talk majorly will focus fundamentals of protein packaging and some of the interesting results that we developed in our laboratory. We developed a facile protocol for sustainable protein packaging platform using biomass derived functional carbon materials as host and also via manipulation of solvent environment using molecularly crowded ionic liquids.[3]



Even with advancement in the water treatment technologies, sustainable and scalable methods of removing toxic substances and emerging pollutants from water has become increasingly challenging and thus have scope for materials which removes contaminants affordably and robustly. In the second part of the talk will cover a holistic approach to deliver sustainable, efficient and point-of-use materials such as multifunctional carbonaceous materials, task-specific functional aerogel membrane, and the robust silk based self-cleaning membrane for Universal water purification.[4] In the process of preparing sustainable materials, we established many 'first time' in research, such as demonstrating deep eutectic system based solvothermal synthesis, functionalizing aerogel membrane for the separation of arsenic and fluoride both, along with conventional and emerging organic pollutants, and functionalizing proteinaceous fibrils with task specific nanocomposites and exploring their self-cleaning property.



References

(1) Damborsky and co-workers, *ACS Catal*., 2013, 3, 2823. (2) Ferna´ndez-Lafuente and co-workers, *Chem. Soc. Rev*., 2013, 42, 6290. (3) Mondal and co-workers, *Green Chemistry* 2017, 19, 4900-4911; Mondal and co-workers, *Green Chemistry* 2018, 20, 3711-3716; Mondal and co-workers, *Chemical Communication*, 2019, 55, 5747-5750; Mondal and co-workers, *Adv. Optical Mater*., 2020, 1902022; Mondal and co-workers, *Chem. Commun*., 2020, 56, 9659-9662. (4) Mondal and co-workers, *Journal of Material Chemistry A,* 2019, 7, 4988-4997; Mondal and co-workers, *ACS Sustainable Chemistry and Engineering* 2019, 7, 10143−10153; Mondal and co-workers, *ACS Appl. Bio Mater.* 2020, 3, 8, 5233–5243.