Research Proposal Seminar

Design and Synthesis of Ionic liquids for Augmenting their Role in Sensing and Biomedical Applications

Name: Bhaswati Sarkar
Roll No: CY16D040

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Ionic liquids (ILs) consist of bulky organic cations and inorganic/organic anions, which are bound by electrostatic interaction. ILsarewell recognized as designer solvents due to their tunable physicochemical properties which can be adjusted by judicious selection of the cation and/or anion for a particular application. ILs have gained considerable attraction due to their significant role in areas such as sensing, organic synthesis, catalysis, pharmaceutics and medicine, nanotechnology, and solar cells.[1]

Though ILs have been widely explored as sensors, there are number of concerns yet to be addressed in this field. For example, most of the ion sensing experiments involve electrochemical methods, which require sophisticated instruments. Further, metal/non-biodegradable polymer doping is currently being used in IL based sensing, which causes environmental toxicity. It has also been observed that solution-based sensors have disadvantages over gel-based sensors where a potential possibility for device fabrication exists in the latter case.[2] Keeping these aspects in mind, we have designed and synthesized a few pyridinium ions appended poly (alkyl ether) based ionic liquid based gels for anion sensing.The presence of poly (alkyl ether) part can impart gelation without any external polymer or gelating agents such as metal ions. Similarly, the ionic part in the IL is expected to provide sufficient water solubility, which assists detection of water-soluble toxic analytes. Further, acylhydrazone linker is expected to strengthen the gelation as well as act as an ion binding unit by proton abstraction. Among various ion sensing, cyanide ion (CN^-) sensing is extremely important due to its lethal toxicity. We hypothesized that the proposed ionogels will act as CN^- sensor under aqueous conditions. The important initial findings of cyanide sensing using the IL will be presented during the seminar.

Besides acting as sensors, ILs can also perform as antibacterial, antifungal, antiproliferative, and anticancerous agents.[3] However, the applications are seriously affected due to toxicity and limited solubility of several ILs. For example, ILs having dialkylimidazolium, alkylpyridinium, ammonium, and phosphonium parts as cations and halides, tetrafluoroborate, and hexafluorophosphate parts as anions are reported to be highly toxic.[3] However, when IL is encapsulated in cyclodextrins, the biological activity of the IL is preserved, and also gradual delivery of the complexed IL, reduced toxicity and enhanced aqueous solubility can be achieved. We plan to design and synthesize inclusion complexes between novel ILs and cyclodextrin for various biomedical applications. The initial results and future perspectives will be presented during the seminar.

References:

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Research Supervisors

Prof. Ramesh L. Gardas 07/11/19

Prof. Edamana Prasad 07/11/19

Signature of Coordinator

Prof. B. Rajakumar 07.11.2019

Signature of H.O.D

Prof. R. Mangala Sunder

HEAD OF THE DEPARTMENT
विभागाध्यक्ष
DEPT OF CHEMISTRY
रसायन विभाग
INDIAN INSTITUTE OF TECHNOLOGY, MADRAS
भारतीय प्रौद्योगिकी संस्थान, मद्रास
CHENNAI - 600 036.
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