List of publications: Thesis Work

[1] Kashyap, N., Das, S., and Borah, R. Solvent responsive self-separation behaviour of Brønsted acidic ionic liquid-polyoxometalate hybrid catalysts on H_2O_2 mediated oxidation of alcohols. *Polyhedron*, 196:114993, 2021.

[2] Kashyap, N., Paul, S., Bora, D.B., Kalita, S., and Borah, R. Dual functional behaviour of dicationic ionic liquid as extractant and hydrophobic biphasic solvent for extraction of Pb (II) in water. *Journal of Molecular Liquids*, 392:123521, 2023.

[3] Kashyap, N., Kalita, S., Bora, D. B., Das, S., Yashmin, F., Guha, A.K., and Borah, R. A mechanistic study on solar energized degradation of herbicide into value-added product using -SO_3H functionalized ionic liquid-polyoxometalate based heterogeneous catalyst in aqueous medium. *Journal of Molecular Structure,* 138372, 2024.

[4] Kashyap, N., Das, S., Paul, S., Purkayastha, S.K., Guha, A. K., and Borah, R. Study of the catalytic activity of methylene-bridged dicationic – SO_3H-functionalized imidazolium phosphomolybdate hybrids for the one-pot sequential synthesis of 3-substituted indoles. *New Journal of Chemistry*, 2024.

List of Publications: Other Publications

[1] Das, S., Kashyap, N., Kalita, S., Bora, D. B., and Borah, R. Comparative study on the physicochemical properties of N-SO_3H functionalized ammonium and imidazolium ionic liquids. *Journal of Molecular Liquids,* 390: 123041, 2023.

[2] Kalita, S., Kashyap, N., Bora, D.B., Das, S., and Borah, R. Investigation of N, N′-disulfopiperazinium chlorometallates of Fe (III), Ni (II) and Co (II) as hybrid catalysts for the synthesis of 1, 2-dihydroquinazoline derivatives. *ChemistrySelect*, 8: e202204533, 2023.

[3] Baruah, K., Kalita, S., Kashyap, N., Bora, D.B., Paul, S., and Borah, R. Study of multicomponent synthesis of 7-alkyl or aryl-6H, 7H-benzo [f] chromeno [4, 3-b] chromen-6-ones involving N, N-disulfopiperidiniumbisulfate [DSPP][HSO_4] as efficient recyclable homogeneous Brönsted acidic catalyst. *Molecular Diversity,* 28(1): 159-169, 2024.

[4] Das, S., Paul, S., Kashyap, N., Saikia, P., and Borah, R. N−SO_3H Functionalised Brønsted Acidic Ionic Liquid Catalysed Sequential One-Pot Synthesis of 2-Amino-3-

Cyanopyridines via Claisen-Schmidt Condensation Under Solvent-free Condition. *ChemistrySelect*, *9(*11):e 202304103, 2024.

[5] Bora, D.B., Bora, B.R., Paul, S., Kalita, S., Kashyap, N., and Borah, R. Variation of micellization, thermodynamic, and surface properties of sodium dodecyl sulfate in aqueous media using 1, 3-disulfo-2-alkyl imidazolium chloride ionic liquids. *Colloid and Polymer Science*, *302*(6):979-999, 2024.

List of Publications: Book Chapters

[1] Das, S., Kashyap, N., Kalita, S., Bora, D. B., and Borah, R. A brief insight into the physicochemical properties of room-temperature acidic ionic liquids and their catalytic applications in C-C bond formation reactions. *In Advances in Physical Organic Chemistry*, volume 54, pages 1-98, ISBN: 978-0-12-821820-4. Elsevier, 2020.

[2] Kashyap, N., Das, S., and Borah, R. A brief insight into the polyoxometalate based organic-inorganic hybrid systems and their catalytic uses in oxidation and acid catalyzed organic reactions. In *Research Trends in Chemical Sciences*, volume 10, pages 167-192, ISBN: 978-93-90420-17-9. AkiNik Publications, 2020.

List of Conferences and Symposiums Attended

Title of Conference	Year	Institution	Mode of Presentation
International Conference on “Emerging Trends in Chemical Sciences” (ETCS-2020)	2020	Guwahati University	Poster
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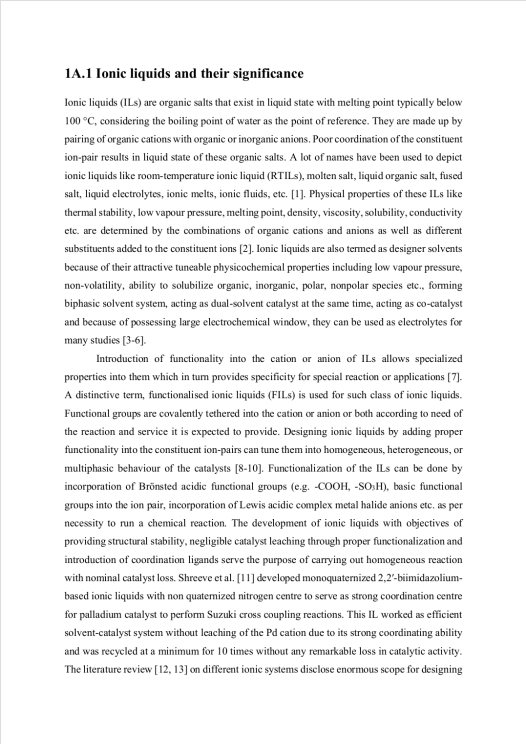

1A.1 Ionic liquids and their significance

Ionic liquids (ILs) are organic salts that exist in liquid state with melting point typically below 100 °C, considering the boiling point of water as the point of reference. They are made up by pairing of organic cations with organic or inorganic anions. Poor coordination of the constituent ion-pair results in liquid state of these organic salts. A lot of names have been used to depict ionic liquids like room-temperature ionic liquid (RTILs), molten salt, liquid organic salt, fused salt, liquid electrolytes, ionic melts, ionic fluids, etc. [1]. Physical properties of these ILs like thermal stability, low vapour pressure, melting point, density, viscosity, solubility, conductivity etc. are determined by the combinations of organic cations and anions as well as different substituents added to the constituent ions [2]. Ionic liquids are also termed as designer solvents because of their attractive tuneable physicochemical properties including low vapour pressure, non-volatility, ability to solubilize organic, inorganic, polar, nonpolar species etc., forming biphasic solvent system, acting as dual-solvent catalyst at the same time, acting as co-catalyst and because of possessing large electrochemical window, they can be used as electrolytes for many studies [3-6].

Introduction of functionality into the cation or anion of ILs allows specialized properties into them which in turn provides specificity for special reaction or applications [7]. A distinctive term, functionalised ionic liquids (FILs) is used for such class of ionic liquids. Functional groups are covalently tethered into the cation or anion or both according to need of the reaction and service it is expected to provide. Designing ionic liquids by adding proper functionality into the constituent ion-pairs can tune them into homogeneous, heterogeneous, or multiphasic behaviour of the catalysts [8-10]. Functionalization of the ILs can be done by incorporation of Brönsted acidic functional groups (e.g. -COOH, -SO_3H), basic functional groups into the ion pair, incorporation of Lewis acidic complex metal halide anions etc. as per necessity to run a chemical reaction. The development of ionic liquids with objectives of providing structural stability, negligible catalyst leaching through proper functionalization and introduction of coordination ligands serve the purpose of carrying out homogeneous reaction with nominal catalyst loss. Shreeve et al. [11] developed monoquaternized 2,2'-biimidazolium-based ionic liquids with non quaternized nitrogen centre to serve as strong coordination centre for palladium catalyst to perform Suzuki cross coupling reactions. This IL worked as efficient solvent-catalyst system without leaching of the Pd cation due to its strong coordinating ability and was recycled at a minimum for 10 times without any remarkable loss in catalytic activity. The literature review [12, 13] on different ionic systems disclose enormous scope for designing

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