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Chemical and biochemical transformations in ionic liquids

Nidhi Jain, Anil Kumar, Sushma Chauhan and S. M. S. Chauhan*

Bioorganic Laboratory, Department of Chemistry, University of Delhi, Delhi, India

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Abbreviations: Hacac, Acetylacetone; [R(Rf)taz][Y], 1,4-Alkyl(polyfluoroalkyl)-1,2,4-triazolium ionic liquids; [taz][X], 1-Alkyl-4-polyfluoroalkyl-1,2,4-triazolium halides; $(DHQ)_2$PHAL, 1,4-Bis(9-*O*-dihydroquininyl)phthalazine; $(DHQD)_2$PHAL, 1,4-Bis(9-*O*-dihydroquinidinyl)phthalazine; $(DHQD)_2$PYR, 1,4-Bis(9-*O*-dihydroquinidinyl)biphenyl-pyrimidine; $(QN)_2$PHAL, 1,4-Bis(9-*O*-quininyl)phthalazine; [tfsa], Bis(trifluoromethanesulphonyl)amide; TFSI, $N(Tf)_2$, Bis(trifluoromethanesulphonyl)imide; bm_2im, 1-Butyl-2,3-dimethylimidazolium; [bdmim][BF_4], 1-Butyl-2,3-dimethylimidazolium tetrafluoroborate; [bhim][BF_4], 1-Butyl-3-hexylimidazolium tetrafluoroborate; bmim, 1-Butyl-3-methylimidazolium; [bmim][$(CF_3SO_2)_2N$], 1-Butyl-3-methylimidazolium bis(trifluoromethyl)sulphonamide; [bmim][BF_4], 1-Butyl-3-methylimidazolium tetrafluoroborate; [bmim][Tf_2N], 1-Butyl-3-methylimidazolium bis-triflimide; [bmim]Cl·$AlCl_3$, 1-Butyl-3-methylimidazolium chloroaluminate; bmpy, 1-Butyl-1-methylpyrrolidinium; BPC, 1-Butylpyridinium chloride; [bpy][BF_4], *N*-Butylpyridinium tetrafluoroborate; [bpy]Cl·$AlCl_3$, 1-Butylpyridinium chloroaluminate; CAL B, *Candida antarctica* lipase type B; CRL, *Candida rugosa* lipase; Selectfluor™, 1-Chloromethyl-4-fluoro-1,4-diazoniabicyclo[2.2.2]octane bis(tetrafluoroborate); cyt-c, Cytochrome-c; DABCO, 1,4-Diazabicyclo[2.2.2]octane; dba, Dibenzylidineacetone; dca, Dicyanamide anion; DHP, 3,4-Dihydro-2*H*-pyran; DMAP, 4-Dimethylaminopyridine; DMSO, Dimethylsulphoxide; dppe, Diphenylphosphinoethane; EMIC, 1-Ethyl-3-methylimidazolium chloride; [emim][BF_4], 1-Ethyl-3-methylimidazolium tetrafluoroborate; [emim][Tf_2N], 1-Ethyl-3-methylimidazolium bis-triflimide; [EtDBU][OTf], 8-Ethyl-1,8-diazabicyclo[5.4.0]-7-undecenium trifluoromethanesulphonate; Accufluor®, 1-Fluoro-4-hydroxy-1,4-diazoniabicyclo[2.2.2]octane bis(tetrafluoroborate); [6-mim]PF_6], 1-Hexyl-3-methyl imidazolium hexafluorophosphate; [HexPy][PF_6], *N*-Hexylpyridinium hexafluorophosphate; ILCE, Ionic liquid-coated-enzyme; MALDI, Matrix-assisted laser desorption/ionisation; MA, Methyl acrylate; [MeDBU][OTf], 8-Methyl-1,8-diazabicyclo[5.4.0]-7-undecenium trifluoromethanesulphonate; dpRe, Methyldiperoxorhenium; NMO, 4-Methylmorpholine-*N*-oxide; MTBE, Methyl *t*-butyl ether; MTO, Methyltrioxorhenium; [moemim][OMs], 1-Methoxyethyl-3-methylimidazolium methanesulphonate; mpRe, Monoperoxorhenium; NMDPP, Neomenthyldiphenylphosphine; [omim][PF_6], 1-Octyl-3-methylimidazolium hexafluorophosphate; [ppmim], 1-(3′-Phenylpropyl)-methylimidazolium; PDI, Polydispersity index; PEG, Poly(ethylene glycol); PEO, Polyethylene oxide; PCL, *Pseudomonas cepacia* lipase; PsL, *Pseudomonas lipase*; RCM, Ring-closing metathesis; TBAA, Tetrabutylammonium acetate; TBAB, Tetrabutylammonium bromide; NHB_3-CHCA, Tributylammonium α-cyano-4-hydroxycinnamate; NHB_3-SA, Tributylammonium sinapinate acid; TPPTS, Triphenylphosphine trisulphonate, sodium salt; TRIPHOS, 1,1,1-Tris(diphenylphosphonium-ethyl)ethane; TSAC, 2,2,2-Trifluoro-*N*-(trifluoromethylsulphonyl)acetamide; TsOH, *p*-Toluenesulphonic acid; TON, Turnover number; sEH, Soluble epoxide hydrolase; UHP, Urea hydrogen peroxide.

* Corresponding author. Tel.: +91 11 276 66845; e-mail: smschauhan@chemistry.du.ac.in

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1. Introduction

Ionic liquids have gained wide popularity in recent years[1–8] for their increasing use in the two important fields of chemistry—synthetic and biochemical—and their concept and history has been well documented.[9–17] Ionic liquids were primarily explored for their applications in electrochemical technologies and as solvents in electronic