1-Butyl-3-methylimidazolium
Tetrafluoroborate as a Green Reaction Medium

Compiled by Yogesh R. Jorapur

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Introduction

Ionic liquids1 as green high tech reaction media of the future are considered as environmentally friendly substitutes for volatile organic solvents, because of their low vapor pressures and their ability to act as catalysts. They also possess several other attractive properties,2–4 including chemical and thermal stability, non-flammability, high ionic conductivity, a wide electrochemical potential window, and are 100% recyclable solvent media for synthesis and catalytic processes.

Ionic liquids first described in 1914,5 consist of inorganic anions and nitrogen containing organic cations whose chemical and physical properties can be finely tuned for a range of applications by varying the cations or anions.4

Abstracts

(A) Dupont and co-workers8 carried out ruthenium-catalyzed enantioselective hydrogenations in ionic liquids. The chiral [RuCl2(S)-BINAP]2NEt3 complex was shown to catalyze the asymmetric hydrogenation of 2-(6-methoxy-2-naphthyl)acrylic acid in 1 and i-PrOH, which afforded the anti-inflammatory drug, (S)-naproxen in 80% ee.

(B) To overcome the drawbacks such as incorporation of the catalyst, and/or poor reagent solubility, Welton and co-workers9 carried out Suzuki cross-coupling in 1, which showed significant increase in catalyst reactivity without loss of yield or degradation of catalyst.

The toxicological and/or eco-toxicological effects12 of 1 in comparison with volatile organic solvents is uncertain.
(C) Enhancement in the solubility and nucleophilicity of KF was achieved in I. Kim and co-workers\(^\text{10}\) reported nucleophilic substitution reactions such as halogenations, acetoxylation, nitrilation, and alkoxylation of mesyloxyalkane in I; significant reactivity and improved selectivity were observed.

(D) Monteiro and co-workers\(^\text{10}\) reported palladium-catalyzed alkoxylation of styrene in hydrocarbons. Using (+)-neomethyl diphenylphosphine [(+)-NMDPP] as a ligand, the product was obtained in 89% yield and 99.5% regioselectivity.

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\text{alkoxycarbonylation of styrene in hydrocarbons.}
\]

\[
\text{C7H15CO3HC} \rightarrow \text{C7H15CO2H}
\]

(E) As an environmentally friendly alternative, I was used as reaction media for butylbutyrate synthesis\(^\text{14}\) catalyzed by free \textit{Candida antarctica} lipase (CAL) B with 2% water content at 50 °C and showed enhanced synthetic activity.

(F) Several two-phase bio-catalytic transformations have been reported in ionic liquids. The epoxidation\(^\text{15}\) of cyclohexene by peroxyoctanoic acid, generated in situ by Novozyme 435-catalyzed reaction of octanoic acid with 60% aqueous H\(_2\)O\(_2\), proceeded smoothly in I.

(G) The cycloaddition\(^\text{11}\) of propylene oxide and carbon dioxide (2.5 MPa) has been conducted in ionic liquids. Optimal results were obtained with 1 as catalyst.

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\text{CO} + \text{CO}_2 \rightarrow \text{less than 90%}
\]

\[
\text{80-90%}
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References


(7) Acros Organics (Cat. No. 35421-0050); Future-Chem(Cat. No. IIIO4C http://www.futurechem.co.kr/); Sigma-Aldrich (Cat. No. 91508).


