

Advances in **Green and Sustainable Chemistry**



# **Ionic Liquids and Their Application in Green Chemistry**



Edited by  
Jamal Akhter Siddique, Akil Ahmad,  
and Mohammad Jawaid

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### 3. Chemistry of ionic liquid with its classification and applications

*Arif Ali, Saima Kamaal, Mohd Muslim, Musheer Ahmad, Mohd Afzal, Saleem Javed, and Qazi Inamur Rahman*

1. Introduction	27
2. Chemistry of ionic liquids (synthesis)	30
3. Classification of ionic liquids	31
3.1 Neutral ionic liquids	31
3.2 Protic and aprotic ionic liquids	32
3.3 Chiral ionic liquids	32
3.4 Polymeric ionic liquids	34
3.5 Metallic ionic liquids	35
3.6 Bio-ionic liquids	35
4. Applications of ionic liquids	36
4.1 Water splitting	36
4.2 Electrochemical industry and energy production by biofuels	37
4.3 Catalysis	38
4.4 Bio-medical	38
4.5 Energy production (solar photo conversion, solar thermal conversion)	41
4.6 Engineering	43
5. Conclusion	44
Acknowledgment	44
References	44

### 4. Ionic liquids: A novel solvents in nanotechnology applications

*Tuerxun Duolikun, Chin Wei Lai, Leo Bey Fen, and Mohd Rafie Bin Johan*

1. Introduction	49
2. Applications	49
2.1 ILs for CO <sub>2</sub> capture	49
2.2 ILs for thin-layer chromatography	50
2.3 ILs for biomedicine	51
2.4 ILs for chemistry	51
3. Toxicity of ILs	54
Acknowledgments	56
References	56

### 5. Functionalization of carbon-based nanomaterials with ionic liquids

*Sahita Karmakar, Parveen Begum, Kaizar Hossain, Akil Ahmad, K Suresh Kumar, and Rameeja Shaik*

1. Introduction	59
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## Chapter 3

# Chemistry of ionic liquid with its classification and applications

Arif Ali<sup>a</sup>, Saima Kamaal<sup>a</sup>, Mohd Muslim<sup>a</sup>, Musheer Ahmad<sup>a</sup>, Mohd Afzal<sup>b</sup>, Saleem Javed<sup>c</sup>, and Qazi Inamur Rahman<sup>d</sup>

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### 1 Introduction

In last years, ionic liquids (ILs) mainly consist of essential ions (cation and anion) with melting points below 100 °C temperature and some ionic compounds are liquid below ambient temperature, e.g. has ionic liquid [EMIM] [N(CN)<sub>2</sub>]<sup>−</sup> (1-ethyl-3-methylimidazolium dicyanamide) have melted at −6 °F (−21 °C) [1–3]. Firstly, ionic liquid was introduced by Paul Walden in 1914 who reported the 12 °C melting point of ethyl ammonium nitrate (EAN), which exists in an ionic liquid state below room temperature, while EAN is acquired at the melting point of 52–55 °C [4–6]. Who never realized that ILs have become much more interesting for researcher? After the passing of one century, researcher have focused on this topic because it has a broad potential for the outcomes of multidisciplinary environmental aspects. In another way, ILs are well known as salts which also exhibit under 100 °C or even at ambient temperature. Most of ILs are usually fascinated by cations like organic compounds (substitutes of *N,N'*-substituted imidazolium, tetra-alkylated, tetra-alkylated ammonium, phosphonium, N-substituted pyridinium etc.), and inorganic or organic anions (trifluoromethylsulfonate [CF<sub>3</sub>SO<sub>3</sub>]<sup>−</sup>, bis [(trifluoromethyl)sulfonyl]imide [(CF<sub>3</sub>SO<sub>2</sub>)<sub>2</sub>N]<sup>−</sup> (i.e., NTF<sub>2</sub>), trifluoroethanoate [CF<sub>3</sub>CO<sub>2</sub>]<sup>−</sup>, BF<sub>4</sub><sup>−</sup>, HSO<sub>4</sub><sup>−</sup>, Cl<sup>−</sup>, PF<sub>6</sub><sup>−</sup> etc.) (Fig. 1) [7]. ILs were developed by organ-aluminates, which are used on the basis of electron donor and electron acceptor potential and their ionic (like acidic and alkaline) character that could be achieved by modifying in aluminum composition. Dissimilar to acidic organoaluminates, the solvation and solvolysis of metallic ions are inhibited by basic haloaluminates; chloro, bromo and iodo-based ILs provide a large