

Clean Synthesis in Ionic Liquids

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When carrying out reactions in ionic liquids, the methods and chemistry employed should have some clear advantage over reactions in conventional solvents. Some of the desirable characteristics of such reactions are as follows:

1. Better yields / selectivity
2. Produce less noxious by-products
3. Allow catalyst recycling
4. Simplify a separation process
5. Allow reactions on poorly soluble compounds
6. The ionic liquid should not be lost in the synthesis

Ionic liquids can be used for clean synthesis in a variety of reactions. Here, we present a number of reaction classes in ionic liquids that meet many of the above criteria. These include:

1. Synthesis in ionic liquids¹
2. Cracking reactions²
3. Diels-Alder reactions³
4. The Heck reaction⁴
5. Sulfonation reactions⁵
6. Nitration reactions⁶
7. Halogenation reactions⁷
8. Oxidation reactions⁸

The ways in which these industrially important reactions can be designed to be cleaner than current processes is described, and is exemplified by the first total synthesis of a pharmaceutical (Pravadoline) carried out entirely in ionic liquids, with potassium chloride as the only by-product.

To date most chemical reactions have been carried out in molecular solvents. When carrying out chemical reactions in ionic solvents, unexpected chemical reactions can occur, and hence lead to new chemical reactions. Examples of an "almost forgotten"⁷ and a new chemical reaction⁸ are presented.

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 - 4 Carmichael, A. J.; Earle, M. J.; Holbrey, J. D.; McCormac, P. B.; Seddon, K. R. *Org. Lett.* **1999**, *1*, 997-1000.
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 - 6 PCT (British Patent) 0024744.5
 - 7 PCT (British Patent) 0024752.8
 - 8 PCT (British Patent) 0024745.2