Ionic Liquids - an introduction
Introduction into Ionic Liquids (IL‘s)

What are Ionic Liquids?

- liquid salts
- m.p. < 100°C
- (often: < r.t.)

![Ionic Liquid Structures]

- NaCl: m.p. 803°C
- „imidazolium Cl: m.p. 80°C

- RSO₄⁻
- CH₃SO₃⁻
- R₂PO₄⁻
- SCN⁻
- (F₃CSO₂)₂N⁻

- Literally no vapour pressure
- Non flammable
- High therm. & mechan. stability
- Broad liquid range
- Electric conductivity
- High electrochem. stability
- Exceptional diss. properties
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Overview on Application Segments

- Chemical Processing
- Cellulose Processing
- Engineering Fluids
- Electrolytes
- Functional Liquids
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General Synthesis Concept Imidazolium IL’s

Imidazole Synthesis

BASF: flexible multi product plant

Alkylation

broad range of alkylation agents in existing multi product plants

Anion Exchange

several concepts adapted to customer requirements

1-Methyl-
1-Ethyl-
1,2-Dimethyl-
1-Butyl-
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Synthesis of high purity IL’s

Industrial scale synthesis developed together with pro ionic

Examples:
- RMIM I, RMIM TFSI, RMIM BF4, RMIM SCN

Advantages:
- Very broad applicability (works also with NH₄ salts $\rightarrow$ NH₄ Y)
- Easy access to a broad range of IL’s with high purities

Limitations:
- Availability Brönstedt acids or NH₄ salts

Purity profile:
- In principle halide free synthesis route
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Ionic Liquid manufacturing at BASF

- backward integration in amines, heterocycles esp. imidazoles
- flexible ton scale production by using existing multi product plants
- broad range of analytical methods available
- determination of physical properties (incl. corrosion, solubilities etc.)
- toxicity, ecotoxicity, REACH registration

→ Standard Product Portfolio
→ Customized Product Solutions
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BASIONIC™: Customized Products

- range of products specifically adopted to customer needs
- optimization of performance properties
- material compatibility (e.g. corrosion behaviour)
- environmental aspects (e.g. toxicity, biodegradability)
- ... and others more
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Toxicological Assessment I

LD50 (oral, rat) in mg/kg

EMIM EtOSO₃
> 2000

EMIM OAc
appr. 2000

BMIM CI
> 50 < 300

BMIM MeOSO₃
> 50 < 300

EMIM Cl
> 300 < 2000
toxicity & ecotoxicity increases with the length of the alkyl chains
this is more or less independent from the kind of cation
→ best choice: Ethyl-methyl-imidazolium (EMIM) cation

dermal toxicity of all IL‘s tested so far is considerably low

so far no effects on mutagenicity observed

most IL‘s are not readily biodegradable
unless they contain functional groups (e.g. cholinium)