

Family of Novel Silicon-Containing Imidazolium Ionic Liquids: Toxicity Study and Prospects for Reversible Ethylene Absorption

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Ionic liquids (ILs) have shown promise for various applications, including gas purification, catalysis, and energy applications. However, whatever the application may be, understanding of the IL environmental fate is necessary to assess the future process sustainability and life cycle.

In this study, we assessed structure–toxicity and structure–biodegradability relationships for a novel silicon-containing IL family (**Figure 1**). Additionally, we report physical properties for the latest members of this IL family.

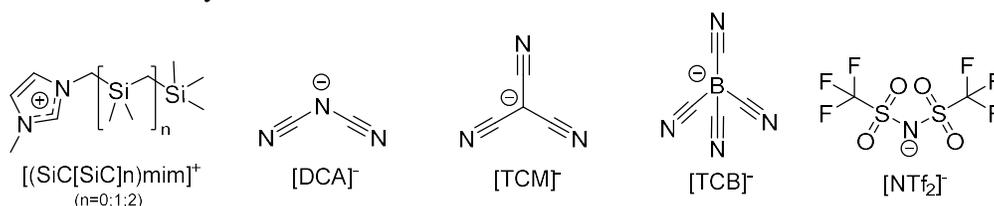


Figure 1 – Ionic liquid ion structures studied in this work

The toxicity evaluation was conducted using five microbial strains – *Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Saccharomyces cerevisiae*, and *Yarrowia lipolytica* – across the IL concentration range of 1 nM to 100 mM in water. Microbial growth curves were recorded for IL cations (as Cl⁻ salts) and anions (as K⁺ salts). Additionally, an NMR-based method was used to determine *K_{ow}* partition coefficients and IL biodegradability assessed in a closed reactor setting.

Results of the toxicity study indicated that some ILs display a lower toxicity compared to the archetypal [C₈C₁im]⁺ ILs. Anion screening showed they exhibit generally low toxicity, and point towards cations as the primary cause for toxicity.

These results, in addition to the valuable physical properties determined previously (low viscosities, high ethylene solubilities and conductivity),¹ demonstrate the potential of these ILs for reversible ethylene absorption in, e.g., reversible ethylene scrubbers for fruit supply chains.

References

1. Bakis, E.; Costa Gomes, M. F.; Padua, A. A. H. *Chem. Sci.* **2022**, *13* (31), 9062-9073.



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