PROBLEM BASED LEARNING, POLYMER MEMBRANES, AND IONIC LIQUIDS

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Introduction

- Renewable energy has many challenges
  - Solar – only during daylight hours
  - Wind – only when the wind blows
  - Electric Cars – batteries can be dangerous
  - Storage is a necessity - batteries need to be safer

Lithium Ion Batteries

- Dendrite growth can cause shorts / fires
- Organic solvents are flammable

Problem

Wetting membranes with ionic liquids cause swelling

Possible Solutions

- Batteries need to be safer
- Renewable energy has many challenges

Materials and Methods

- To calculate Kamlet-Taft Values
  - Dilute dye in ionic liquids
  - Reichardt’s Dye (30)
  - 4-nitroaniline
  - π (π) (normal) and π* (π*) values
  - β (β) – Hydrogen Bond Donor
  - α (α) – Hydrogen Bond Acceptor
  - n (n) – Dipolarity / Polarity Ratio

- Screens and Kamlet-Taft values published

Results

UV-Vis Scan confirmed published Kamlet-Taft values for Emim[Tf2N] and Hmim[Tf2N]

- Differences in membrane diameters as well:

Conclusions

Hydrogen Bonding or Dipolarity / Polarity Ratio may actually determine the swelling effects of ionic liquids.

However, more data is needed. One could try wetting the polymer membranes with Hmim[Br] or Hmim[Cl] to determine if either or α* have a greater correlation.

Lastly, this research can be used to model real-world challenges, and strategies to solve them. In an effort to prepare students for college and / or career, Tom Adams will present these results to his high school students. Students will follow this curriculum unit outline.

Literature Cited


