Junior Science Communications
Faculty of Applied Sciences, UiTM Shah Alam
https://journal.uitm.edu.my/ojs/index.php/JSC

E-ISSN 2637-0689
Vol. 33

Colloquium on Applied Sciences 2024
19-21 January 2024, Faculty of Applied Sciences, UiTM Shah Alam, Malaysia

Understanding the Micro-viscosity of Deep Eutectic Solvents and Ionic Liquids using Fluorescent Molecular Rotor as a Probe

Iffah Fasihah Athirah Laznan[a], Mohd Azizi Nawawi[a*]

Structured Abstract

Background: Traditional organic molecular solvent are harmful due to their volatility. Green solvents like deep eutectic solvents (DESs) and ionic liquids (ILs) has emerged as alternatives as they are non-volatile but highly viscous. Hence, this has aroused the need for an extensive comprehension of the green solvent characterization specifically on their viscosity at molecular level.

Methods: In this study, four DESs of different viscosities was synthesized by mixing choline chloride (hydrogen bond acceptor) with different hydrogen bond donor (ethylene glycol (1:2 and 1:3), glycerol (1:3) and urea (1:2)) according to their molar ratio. The physical and chemical properties of synthesized samples and ILs were characterized by FTIR spectrophotometer, rheometer and UV-Vis spectrometer. Then, fluorescence emission intensity of Cy3 in DESs and ILs were measured and the correlation between emission intensity and of the samples was studied using Förster-Hoffmann equation ($\log I = C + x \log \eta$).

Results: The results showed that the emission intensity of Cy3 increased with the theoretical viscosity of DESs. Based on maximum emission intensity, Cy3 can be used as fluorescent probe for estimating micro-viscosity in DESs however, the measured viscosity from DES ChCl/Urea was too low than theoretical value with R^2=0.0326 compared to R^2=0.8907. ChCl/Urea was expected to produce the highest viscosity compared to all DESs. Meanwhile, the emission intensity of Cy3 increased with increasing the viscosity of ILs except for $[C_4C_1pyrr][NTf_2]$. This indicates that Cy3 can be used as molecular rotor to estimate micro-viscosity in ionic liquids (R^2=0.6535). The intensity of λ_{max} emission does not solely depend on the viscosity of the solvents, it could also be affected by the polarity effect.

Conclusion: Measurements of photo-physical properties of Cy3 in deep eutectic solvents and ionic liquids revealed that the rotor may has great potential to be used as a probe to determine local viscosities as it was sensitive to viscosity. The fluorescence emission intensity of Cy3 showed a good correlation to the theoretical viscosity of DESs and measured viscosity of ILs solvents.

Keywords: Fluorescent molecular rotor, viscosity, deep eutectic solvents, ionic liquids, Förster-Hoffmann

*Correspondence: azizi_nawawi@uitm.edu.my

[a] School of Chemistry & Environment, Faculty of Applied Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia