**Conductometric and refractometric study of 1-Propyl-3-methylimidazolium bromide ionic liquid in water + ethylene carbonate mixtures at T = (298.2, 308.2 and 318.2) K**

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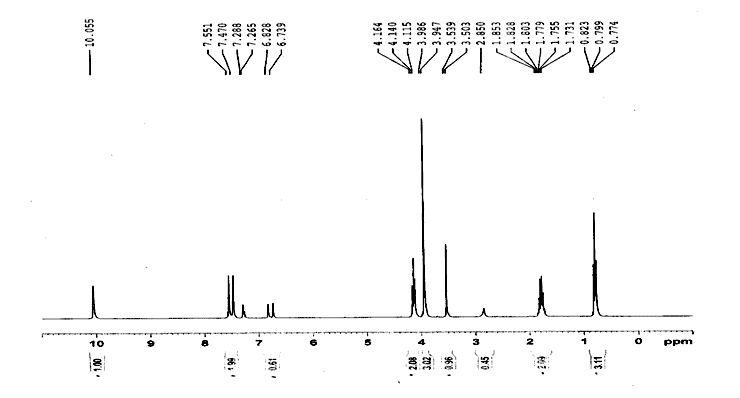
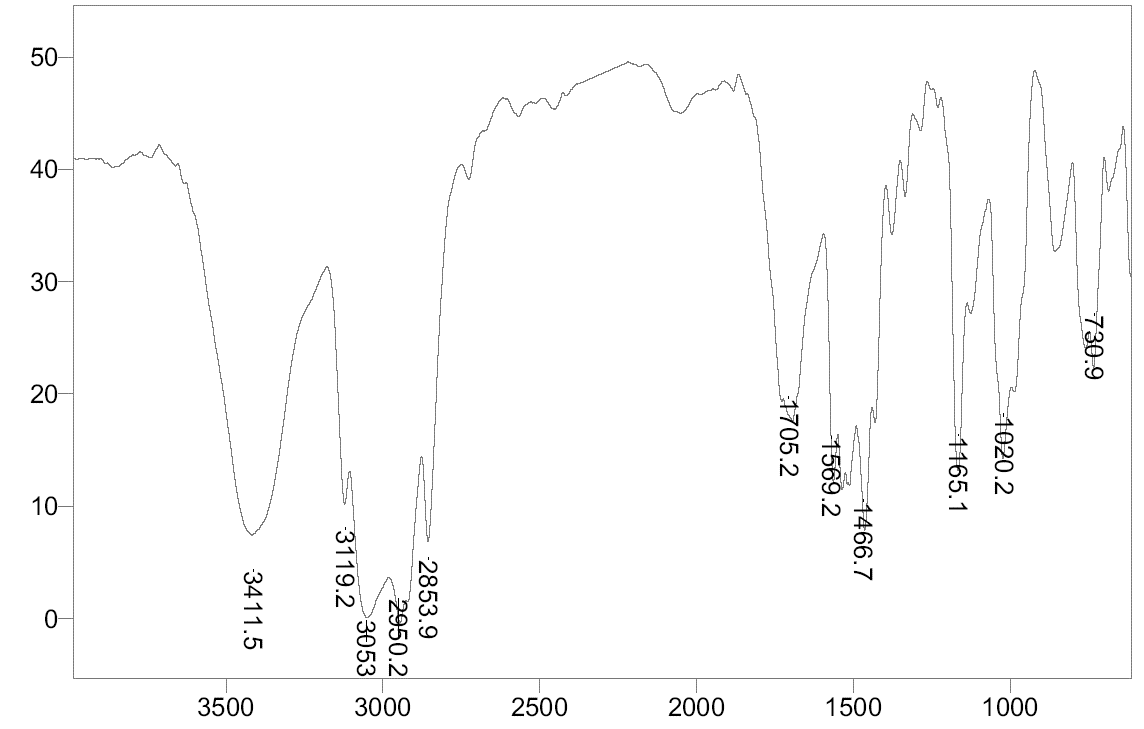


Figure S1. 1H NMR spectrum of 1-ethyl-3-methylimidazolium bromide

Figure S1.1H NMR spectrum of 1-propyl-3-methylimidazolium bromide



Wavenumber (cm-1)

Transmittance (%)

Figure S2. FT-IR spectrum of 1-propyl-3-methylimidazolium bromide

Figure S3. Molar conductivity of [PrMIm]Br against molal concentration (mIL) of ionic liquid in mass fraction 10% (wEC/wmixture).

Figure S4. Molar conductivity of [PrMIm]Br against molal concentration (mIL) of ionic liquid in mass fraction 20% (wEC/wmixture).

**Table S1.** The values of coefficients in Eq (16) A0, A1 and A2 at different solvent compositions

|  |  |  |  |
| --- | --- | --- | --- |
| w% | A0 (kJ.mol-1) | A1 (kJ.mol-1.K-1) | A2 (kJ.mol-1.K-2) |
| 10 | -1.7426 | 0.1756 | 0.0013 |
| 20 | -1.1769 | 0.2600 | 0.0046 |
| 30 | -0.6335 | 0.2388 | 0.0029 |

**Table S2.** Coefficients of Redlich-Kister equation (Ai) and standard deviations (σ) for binary mixtures at 298.2, 308.2 and 318.2 K

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | A0 | A1 | A2 | A3 | σ |
| T/K = 298.2 | | | | | |
| Water + EC | 0.1072 | 0.0654 | 0.0635 | 0.0469 | 0.0005 |
| Water + [PrMIm]Br | 0.3145 | 0.2103 | 0.2166 | 0.1500 | 0.0029 |
| EC + [PrMIm]Br | 0.0966 | 0.0346 | 0.0296 | 0.0187 | 0.0005 |
|  |  |  |  |  |  |
| T/K = 308.2 | | | | | |
| Water + EC | 0.1039 | 0.0504 | 0.0592 | 0.0669 | 0.0008 |
| Water + [PrMIm]Br | 0.2982 | 0.2108 | 0.2148 | 0.1593 | 0.0023 |
| EC + [PrMIm]Br | 0.0992 | 0.0350 | 0.0217 | 0.0248 | 0.0003 |
|  |  |  |  |  |  |
| T/K=318.2 | | | | | |
| Water + EC | 0.1022 | 0.0503 | 0.0632 | 0.0699 | 0.0010 |
| Water + [PrMIm]Br | 0.2923 | 0.2185 | 0.2065 | 0.1611 | 0.0023 |
| EC + [PrMIm]Br | 0.0100 | 0.0413 | 0.0117 | 0.0250 | 0.0007 |

**Table S3.** Adjustable coefficients of Cibulka equation (Bi) and standard deviations (σ) for water + EC + ionic liquid mixtures at T = 298.2, 308.2 and 318.2 K

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| T/K | B0 | B1 | B2 | σ |
| 298.2 | 0.1270 | -0.0305 | -0.0117 | 0.0010 |
| 308.2 | 0.2461 | -0.1206 | -0.2294 | 0.0010 |
| 318.2 | 0.2645 | -0.1295 | -0.3330 | 0.0009 |

**Table S4.** Average percentage deviation (APD) in Lorentz–Lorenz (L–L), Gladstone–Dale (G–D), Eykman (EK), Newton (N), Heller (H) and Edwards relations in binary and ternary investigated mixtures of this work

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| T/K | L-L | G-D | EK | N | H | Ed |
| Water + EC | | | | | | |
| 298.2 | 0.1449 | 0.1109 | 0.1938 | 0.0799 | 0.1614 | 0.1828 |
| 308.2 | 0.0996 | 0.0752 | 0.1454 | 0.0584 | 0.1163 | 0.1348 |
| 318.2 | 0.1127 | 0.0831 | 0.1594 | 0.0687 | 0.1289 | 0.1490 |
| <APD> | 0.12 | 0.09 | 0.17 | 0.07 | 0.14 | 0.16 |
|  |  |  |  |  |  |  |
| Water + [PrMIm]Br | | | | | | |
| 298.2 | 0.4501 | 0.5707 | 0.2989 | 0.6810 | 0.4341 | 0.3411 |
| 308.2 | 0.5788 | 0.7040 | 0.4140 | 0.8172 | 0.4710 | 0.4602 |
| 318.2 | 0.7167 | 0.8440 | 0.5485 | 0.9593 | 0.5401 | 0.5954 |
| <APD> | 0.58 | 0.71 | 0.42 | 0.82 | 0.48 | 0.47 |
|  |  |  |  |  |  |  |
| EC + [PrMIm]Br | | | | | | |
| 298.2 | 0.0469 | 0.0475 | 0.1202 | 0.0840 | 0.0645 | 0.0974 |
| 308.2 | 0.0643 | 0.0250 | 0.1383 | 0.0668 | 0.0797 | 0.1162 |
| 318.2 | 0.0508 | 0.0875 | 0.0835 | 0.1445 | 0.0337 | 0.0651 |
| <APD> | 0.05 | 0.05 | 0.11 | 0.10 | 0.06 | 0.10 |
|  |  |  |  |  |  |  |
| Water + EC + [PrMIm]Br | | | | | | |
| 298.2 | 0.0905 | 0.1140 | 0.2091 | 0.2353 | 0.1614 | 0.1601 |
| 308.2 | 0.0831 | 0.1627 | 0.1559 | 0.2945 | 0.1393 | 0.1205 |
| 318.2 | 0.1187 | 0.2646 | 0.0863 | 0.4009 | 0.1116 | 0.0696 |
| <APD> | 0.10 | 0.18 | 0.15 | 0.31 | 0.14 | 0.12 |