# Supporting Information

## Molecular interactions between surface-active ionic liquids based on 2-hydroxyethylammonium laurate with gabapentin: electrical conductivity and surface tension studies

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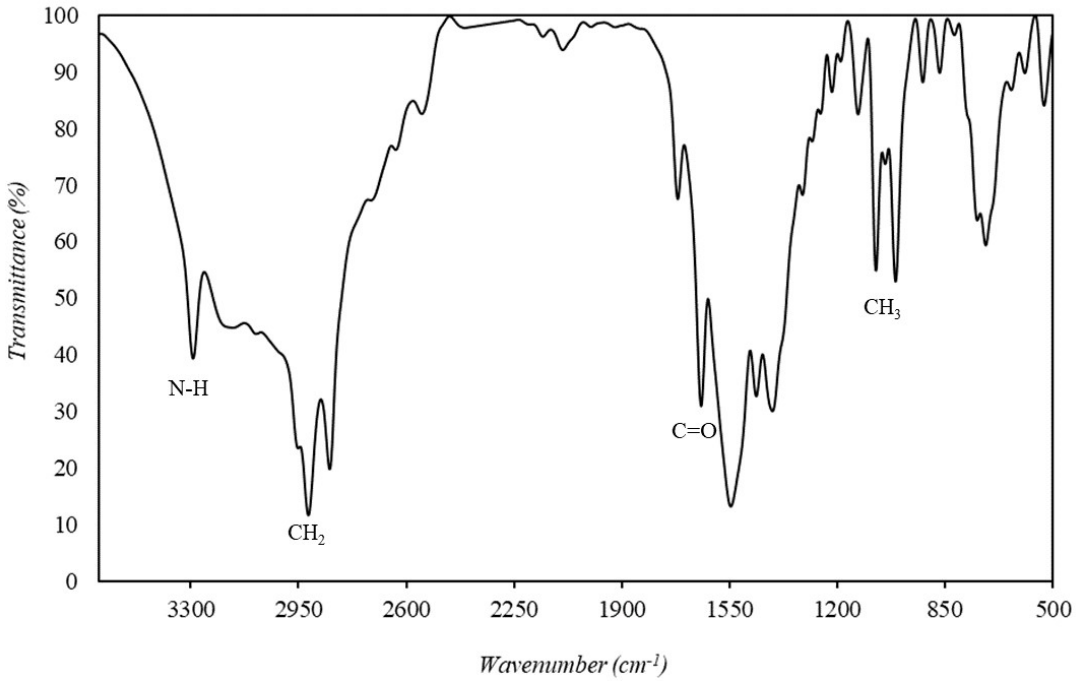


**Fig S1.** The FT-IR spectrum of [2-HEA]Lau.

For 2-hydroxyethylammonium Laurate [2-HEA][Lau], the FT-IR peaks (KBr, cm-1) are observed at: 530.81, 593.21, 720.25, 869.95, 924.69, 1013.10, 1047.01, 1077.01, 1135.19, 1315.58, 1413.11, 1465.85, 1548.57, 1644.86, 1720.87, 2851.75, 2921.02, and 3295.55.

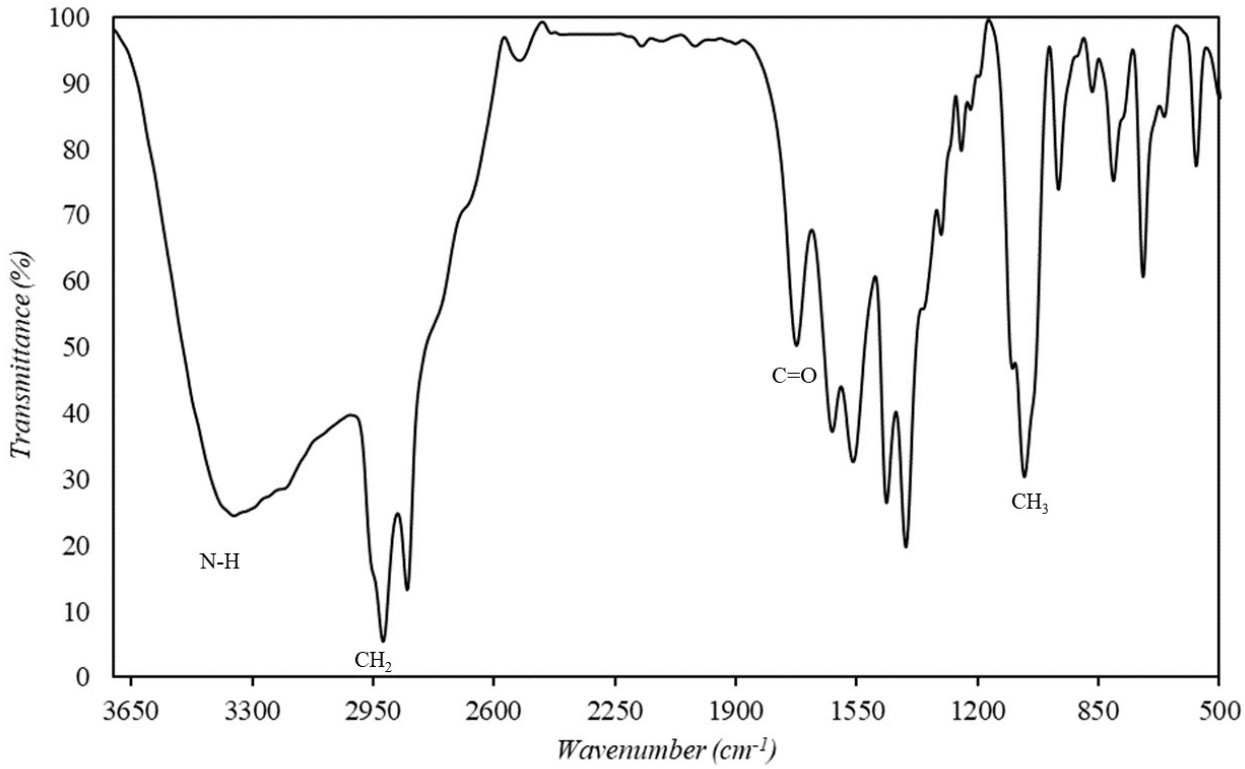


**Fig S2.** The FT-IR spectrum of the [bis-2-HEA]Lau.

For bis-2-hydroxyethylammonium Laurate [bis-2-HEA][Lau], the FT-IR peaks (KBr, cm-1) occur at: 566.69, 720.48, 806.46, 965.67, 1013.10, 1047.01, 1064.36, 1407.65, 1463.61, 1560.29, 1620.98, 1724.41, 2851.72, 2921.58, and 3353.54.

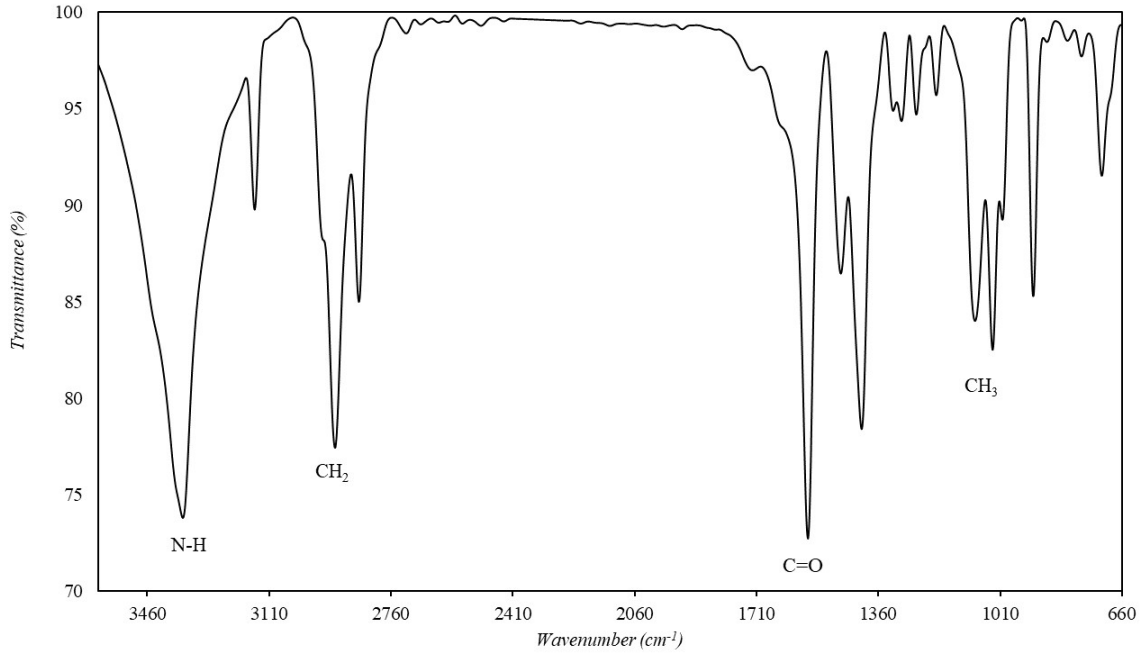


**Fig S3.** The FT-IR spectrum of [tris-2-HEA]Lau.

For tris-2-hydroxyethylammonium Laurate [tris-2-HEA][Lau], the FT-IR peaks (KBr, cm-1) are observed at: 531.04, 566.69, 718.37, 915.24, 1031.92, 1082.54, 1408.08, 1468.05, 1562.47, 2852.12, 2920.76, 3151.51, and 3357.97.

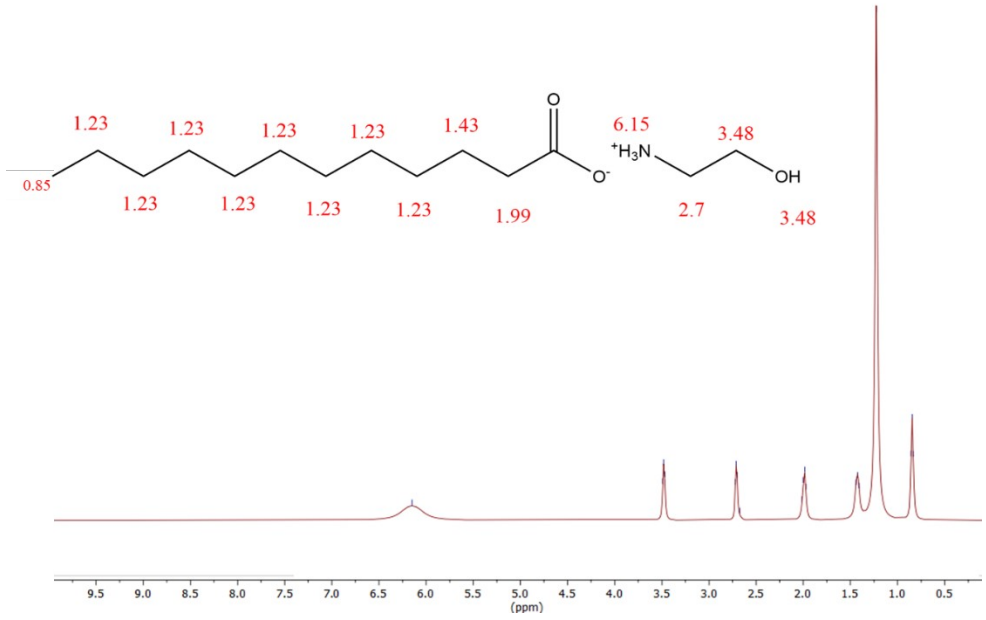


**Fig S4.** $^{1}$H NMR of [2-HEA]Lau.

For 2-hydroxyethylammonium Laurate [2-HEA][Lau], the H-NMR peaks are observed at (500 MHz, DMSO) δ 6.15 (s, 3H), 3.51 – 3.45 (m, 2H), 2.74 – 2.66 (m, 2H), 1.99 (q, J = 7.4 Hz, 2H), 1.46 – 1.39 (m, 2H), 1.23 (s, 16H), 0.85 (t, J = 6.5 Hz, 3H).

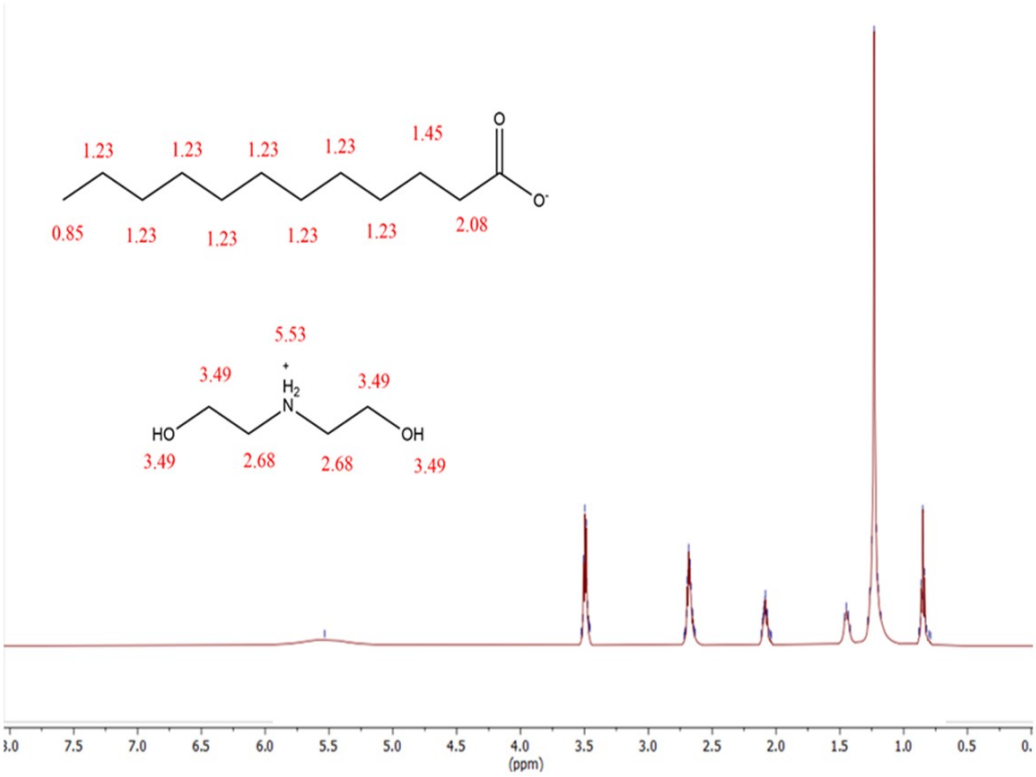


**Fig S5.** $^{1}$H NMR of [bis-2-HEA]Lau.

For [bis-2-HEA]Lau, the H-NMR peaks are observed at (500 MHz, DMSO) δ 5.53 (s, 1H), 3.49 (ddt, J = 8.6, 5.5, 3.0 Hz, 6H), 2.68 (dt, J = 5.7, 2.9 Hz, 4H), 2.08 (ddd, J = 7.5, 4.7, 2.9 Hz, 2H), 1.45 (t, J = 7.2 Hz, 2H), 1.23 (s, 16H), 0.86 – 0.84 (m, 3H).

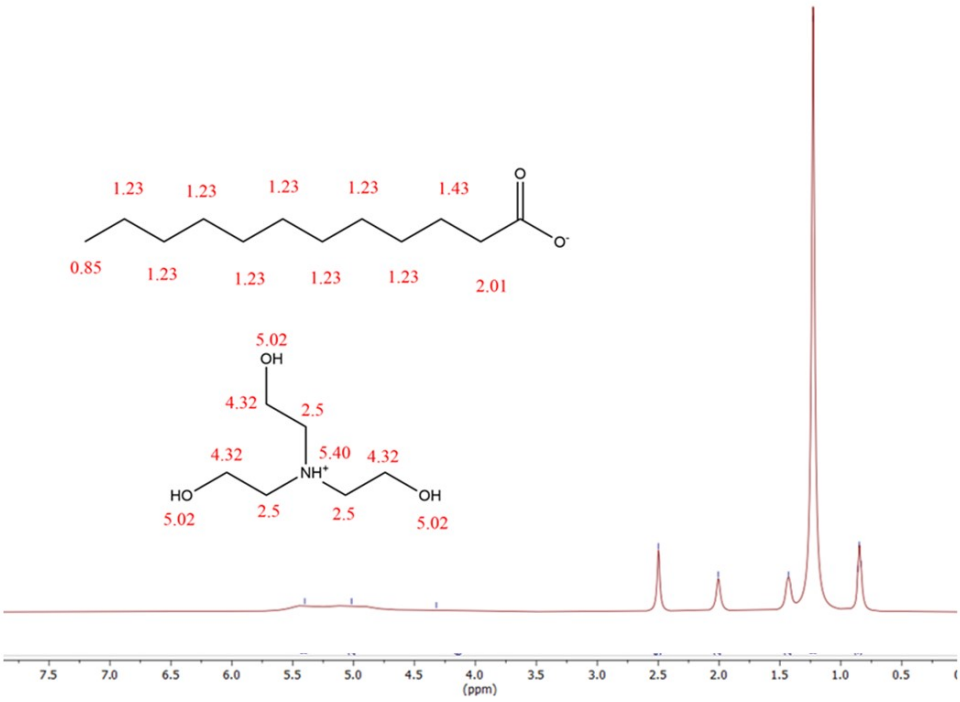


**Fig S6.** $^{1}$H NMR of [tris-2-HEA]Lau.

For [tris-2HEA][Lau], the H-NMR peaks are observed at (500 MHz, DMSO) δ 5.40 (s, 1H), 5.02 (s, 3H), 4.32 (s, 6H), 2.50 (s, 6H), 2.01 (s, 2H), 1.43 (s, 2H), 1.23 (s, 16H), 0.85 (s, 3H).

**Table S1.** Surface tension of [EA]Lau SAILs in various aqueous gabapentin solutions (from 0.0000 to 0.0500 $mol \cdot kg^{-1}$) at 298.15 K.

| $m_{GPT}(mol \cdot kg^{-1})$ | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.0000 | | 0.0100 | | 0.0300 | | 0.0500 | |
| $C(mol \cdot m^{-3})$ | $\sigma(mN \cdot m^{-1})$ | $C(mol \cdot m^{-3})$ | $\sigma(mN \cdot m^{-1})$ | $C(mol \cdot m^{-3})$ | $\sigma(mN \cdot m^{-1})$ | $C(mol \cdot m^{-3})$ | $\sigma(mN \cdot m^{-1})$ |
| [2-HEA]Lau | | | | | | | |
| 0.0000 | 72.6 | 0.0000 | 54.0 | 0.0000 | 49.5 | 0.0000 | 46.0 |
| 0.1994 | 54.0 | 0.1994 | 50.5 | 0.1994 | 46.8 | 0.2193 | 42.3 |
| 0.4985 | 53.0 | 0.4387 | 49.5 | 0.6182 | 45.7 | 0.7179 | 41.2 |
| 0.9970 | 51.5 | 1.2962 | 47.3 | 1.0967 | 44.0 | 1.5953 | 38.5 |
| 2.3929 | 48.0 | 2.3929 | 44.5 | 2.5923 | 39.8 | 2.3929 | 35.3 |
| 4.3870 | 43.5 | 4.3870 | 39.5 | 4.2873 | 35.2 | 4.2873 | 30.5 |
| 6.3811 | 39.7 | 6.2814 | 36.1 | 6.1817 | 31.5 | 6.2814 | 26.3 |
| 8.2754 | 37.4 | 8.4749 | 32.8 | 8.1757 | 28.2 | 8.4749 | 22.8 |
| 10.2695 | 35.2 | 10.3692 | 30.7 | 10.3692 | 25.6 | 10.1698 | 20.7 |
| 12.1639 | 33.6 | 12.0642 | 28.6 | 12.1639 | 23.6 | 12.3633 | 18.2 |
| 14.5568 | 32.1 | 14.1580 | 27.4 | 14.4571 | 21.8 | 14.1580 | 16.8 |
| 16.2518 | 30.7 | 16.2518 | 26.1 | 16.4512 | 21.3 | 16.3515 | 15.4 |
| 18.4453 | 29.0 | 17.9468 | 25.2 | 18.3456 | 20.2 | 18.4453 | 14.5 |
| [bis-2-HEA]Lau | | | | | | | |
| 0.0000 | 72.6 | 0.0000 | 54.0 | 0.0000 | 49.5 | 0.0000 | 46.0 |
| 0.1695 | 50.1 | 0.2293 | 47.5 | 0.1795 | 44.0 | 0.1795 | 39.2 |
| 0.6580 | 49.0 | 0.4586 | 46.4 | 0.5484 | 42.8 | 0.4586 | 38.1 |
| 1.3959 | 47.3 | 1.1965 | 44.8 | 0.9771 | 41.3 | 1.2962 | 36.4 |
| 2.7917 | 43.6 | 2.4926 | 40.2 | 2.4926 | 36.5 | 2.3929 | 32.0 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4.2873 | 38.8 | 4.1876 | 35.5 | 4.3870 | 31.2 | 4.4867 | 26.3 |
| 6.3811 | 34.5 | 6.1817 | 31.2 | 6.3811 | 27.2 | 6.2814 | 22.3 |
| 8.3752 | 31.4 | 8.3752 | 27.5 | 8.2754 | 24.1 | 8.3752 | 18.5 |
| 10.3692 | 28.7 | 10.3692 | 24.8 | 10.4689 | 21.5 | 10.3692 | 16.0 |
| 12.2636 | 26.6 | 12.2636 | 23.0 | 12.4630 | 19.6 | 12.4630 | 13.5 |
| 14.2577 | 24.8 | 14.2577 | 21.5 | 14.2577 | 18.4 | 14.2577 | 12.4 |
| 16.3515 | 23.3 | 16.4512 | 20.0 | 16.1521 | 17.5 | 16.3515 | 11.2 |
| 18.1462 | 22.1 | 18.2459 | 19.0 | 18.1462 | 16.8 | 18.2459 | 10.3 |

[tris-2-HEA]Lau

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.0000 | 72.6 | 0.0000 | 54.0 | 0.0000 | 49.5 | 0.0000 | 46.0 |
| 0.1496 | 46.5 | 0.1994 | 43.6 | 0.1994 | 41.3 | 0.2293 | 36.0 |
| 0.5384 | 45.5 | 0.4985 | 42.4 | 0.4985 | 40.2 | 0.4985 | 34.8 |
| 1.1965 | 43.6 | 0.9970 | 40.0 | 0.9970 | 38.5 | 0.9970 | 33.2 |
| 2.3929 | 39.5 | 2.3929 | 33.5 | 2.2932 | 34.0 | 2.3929 | 28.4 |
| 3.9882 | 34.6 | 3.9882 | 29.1 | 4.3870 | 27.6 | 4.3870 | 22.3 |
| 6.3811 | 30.4 | 6.3811 | 24.0 | 6.1817 | 23.4 | 6.6802 | 17.5 |
| 8.3752 | 26.7 | 8.3752 | 20.3 | 8.1757 | 20.0 | 7.9763 | 13.6 |
| 10.3692 | 23.6 | 10.3692 | 17.5 | 10.3692 | 17.5 | 10.4689 | 10.5 |
| 12.3633 | 20.7 | 12.3633 | 15.3 | 12.3633 | 15.8 | 12.0642 | 8.3 |
| 14.3574 | 19.4 | 14.3574 | 13.9 | 14.4571 | 14.2 | 14.0583 | 6.2 |
| 16.3515 | 16.8 | 16.3515 | 12.8 | 16.2518 | 13.2 | 15.9527 | 4.8 |
| 17.8471 | 15.3 | 17.8471 | 12.0 | 18.3456 | 12.4 | 18.7444 | 4.0 |

The standard uncertainties for molality, temperature and pressure were $u$ ($C$) = 0.001 mol $m^{-3}$ , $u$ ($T$) = 0.5 K, and u($P$) = 0.01 MPa respectively with level of confidence 0.95. The standard combined uncertainty for surface tension were about, $uc$ ($\sigma$) = 0.01 $mN \cdot m^{-1}$ (level of confidence 0.68), respectively.

Table S2. Special conductivities, $\kappa$, of [2-HEA]Lau, [bis-2-HEA]Lau, [tris-2-HEA]Lau in Binary aqueous solutions as a function of SAIL molarity (c) at 298.15-318.15 K

| *T (K)* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 298.15 | | 303.15 | | 308.15 | | 313.15 | | 318.15 | |
| *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) | *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) | *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) | *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) | *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) |
| [2-HEA]Lau + water | | | | | | | | | |
| 0.593 | 32.1 | 0.119 | 10.5 | 0.303 | 28.7 | 0.739 | 59.7 | 0.2130 | 35.1 |
| 0.772 | 38.5 | 0.353 | 26.4 | 0.438 | 34.7 | 0.935 | 68.5 | 0.3590 | 45.3 |
| 0.988 | 46.0 | 0.468 | 31.3 | 0.64 | 43.7 | 1.201 | 80.2 | 0.5900 | 58.4 |
| 1.253 | 54.4 | 0.814 | 45.4 | 0.821 | 51.6 | 1.588 | 96.6 | 0.6650 | 62.5 |
| 1.414 | 59.1 | 1.148 | 57.8 | 1.026 | 60.5 | 1.952 | 111.9 | 0.8960 | 74.6 |
| 1.764 | 69.5 | 1.455 | 69.4 | 1.244 | 70.1 | 2.228 | 123.8 | 1.1680 | 88.0 |
| 2.247 | 84.2 | 1.795 | 82.5 | 1.544 | 83.2 | 2.593 | 139.2 | 1.4220 | 100.1 |
| 2.796 | 99.0 | 2.47 | 107.5 | 1.771 | 93.1 | 3.104 | 161.2 | 1.7500 | 115.8 |
| 3.245 | 113.1 | 2.885 | 122.5 | 2.037 | 104.5 | | | 1.9870 | 125.3 |
| | | 3.169 | 132.5 | 2.36 | 118.4 | | | 2.2570 | 138.5 |
| | | | | 2.707 | 133.3 | | | 2.5930 | 153.3 |
| | | | | 3.036 | 147.4 | | | 3.0510 | 175.2 |
| [bis-2-HEA]Lau + water | | | | | | | | | |
| 0.218 | 11.4 | 0.059 | 2.6 | 0.102 | 7.2 | 0.149 | 13.2 | 0.087 | 12.1 |
| 0.283 | 13.6 | 0.164 | 7.2 | 0.203 | 13.6 | 0.341 | 26.3 | 0.233 | 25.8 |
| 0.371 | 16.6 | 0.273 | 11.6 | 0.31 | 19.5 | 0.449 | 33.5 | 0.486 | 42.5 |
| 0.439 | 18.9 | 0.402 | 16.7 | 0.514 | 30.1 | 0.736 | 48.6 | 0.711 | 55.6 |
| 0.571 | 23.1 | 0.616 | 25.1 | 0.655 | 36.3 | 0.906 | 57.1 | 1.117 | 77.5 |
| 0.718 | 27.7 | 0.856 | 34.4 | 0.832 | 43.4 | 1.21 | 72.9 | 1.262 | 85.7 |
| 0.964 | 35.1 | 1.182 | 46.8 | 0.998 | 50.0 | 1.591 | 89.2 | 1.441 | 93.0 |
| 1.241 | 42.8 | 1.596 | 62.7 | 1.265 | 60.6 | 1.816 | 98.4 | 1.614 | 103.4 |
| 1.629 | 53.6 | 2.152 | 83.5 | 1.5 | 69.8 | 2.126 | 111.5 | 1.985 | 120.6 |
| 1.944 | 62.4 | 2.612 | 99.8 | 1.698 | 77.6 | 2.491 | 125.7 | 2.238 | 133.1 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2.473 | 76.0 | 3.068 | 116.6 | 1.998 | 89.4 | 2.915 | 141.3 | 2.539 | 145.5 |
| 2.891 | 87.4 | | | 2.323 | 102.0 | | | 2.911 | 160.2 |
| | | | | 2.644 | 114.5 | | | 3.329 | 180.9 |
| | | | | 3.018 | 128.9 | | | | |
| [tris-2-HEA]Lau + water | | | | | | | | | |
| 0.0455 | 2 | 0.114 | 4.6 | 0.209 | 9.9 | 0.277 | 15.2 | 0.09 | 4.3 |
| 0.0965 | 4 | 0.29 | 11.2 | 0.327 | 15.1 | 0.5 | 26.0 | 0.187 | 8.9 |
| 0.1637 | 6 | 0.556 | 19.8 | 0.448 | 20.2 | 0.678 | 34.1 | 0.439 | 20.7 |
| 0.2049 | 7 | 0.728 | 25.0 | 0.58 | 25.5 | 0.869 | 42.0 | 0.603 | 28.2 |
| 0.2591 | 8 | 0.861 | 29.4 | 0.759 | 32.2 | 1.133 | 52.2 | 0.901 | 41.7 |
| 0.3968 | 11 | 1.112 | 36.8 | 0.859 | 35.7 | 1.4 | 61.6 | 1.156 | 53.0 |
| 0.4965 | 13 | 1.307 | 41.1 | 1.081 | 43.0 | 1.906 | 76.2 | 1.445 | 65.5 |
| 0.6363 | 15 | 1.582 | 48.5 | 1.262 | 48.5 | 1.986 | 78.0 | 1.928 | 85.9 |
| 0.7859 | 18.5 | 2.013 | 57.8 | 1.503 | 55.5 | 2.2415 | 85.1 | 2.228 | 98.1 |
| 0.9637 | 22 | 2.345 | 64.3 | 1.685 | 60.5 | 2.4966 | 92.9 | 2.505 | 109.1 |
| 1.1328 | 26 | 2.68 | 70.4 | 1.92 | 66.5 | 2.7516 | 98.7 | 2.857 | 122.9 |
| 1.3507 | 30 | 3.259 | 80.1 | 2.064 | 70.2 | 3.0067 | 105.6 | 3.513 | 148.9 |
| 1.5783 | 34 | | | 2.449 | 79.6 | | | | |
| 1.9166 | 40 | | | 2.803 | 86.7 | | | | |
| 2.1095 | 44 | | | 3.197 | 93.1 | | | | |
| 2.5247 | 51 | | | | | | | | |
| 2.7426 | 55 | | | | | | | | |
| 2.9843 | 60 | | | | | | | | |

[a] The standard uncertainties for molality and temperature were $u(C) = 0.001$ mol m$^{-3}$ and $u(T) = 0.5$ K, respectively with level of confidence 0.95. The standard combined uncertainty for conductance and molar conductivity were about, $uc(\kappa) = 0.5$ μS.cm$^{-1}$ (level of confidence 0.68), respectively.

Table S3. Special conductivities, $\kappa$, of [2-HEA]Lau in Ternary aqueous Gabapentin solutions as a function of SAIL molarity (c) at 298.15 K.

| *M (mol·kg$^{-1}$)* | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.0000 | | 0.0100 | | 0.0300 | | 0.0500 | |
| *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) | *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) | *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) | *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) |
| 0.593 | 32.1 | 0.06 | 2.9 | 0.183 | 7.8 | 0.153 | 4.7 |
| 0.772 | 38.5 | 0.133 | 6.2 | 0.283 | 11.6 | 0.247 | 7.4 |
| 0.988 | 46.0 | 0.178 | 8.3 | 0.459 | 18.0 | 0.328 | 9.7 |
| 1.253 | 54.4 | 0.239 | 11.1 | 0.59 | 22.3 | 0.379 | 11.1 |
| 1.414 | 59.1 | 0.301 | 13.8 | 0.746 | 27.3 | 0.443 | 12.8 |
| 1.764 | 69.5 | 0.337 | 15.4 | 0.931 | 32.8 | 0.552 | 15.8 |
| 2.247 | 84.1 | 0.499 | 22.3 | 1.195 | 40.3 | 0.718 | 20.0 |
| 2.796 | 99.0 | 0.653 | 28.6 | 1.45 | 47.6 | 0.906 | 24.5 |
| 3.245 | 113.1 | 0.869 | 36.1 | 1.758 | 55.8 | 1.132 | 29.6 |
| 3.687 | 125.4 | 0.991 | 40.3 | 2.037 | 62.4 | 1.428 | 35.1 |
| 4.251 | 142.1 | 1.226 | 47.5 | 2.297 | 68.1 | 1.78 | 42.9 |
| 4.774 | 157.4 | 1.498 | 55.7 | | | 2.103 | 49.4 |
| 5.792 | 187.2 | 1.754 | 62.6 | | | 2.557 | 57.2 |
| 6.839 | 217.9 | 2.017 | 69.1 | | | | |
| 6.683 | 289.5 | 2.369 | 78.4 | | | | |

[a] The standard uncertainties for molality and temperature were $u$ ($C$) = 0.001 mol m$^{-3}$ and $u$ ($T$) = 0.5 K, respectively with level of confidence 0.95. The standard combined uncertainty for conductance and molar conductivity were about, $uc$ ($\kappa$) = 0.5 μS.cm$^{-1}$ (level of confidence 0.68), respectively.

Table S4. Special conductivities, $\kappa$ , of [bis-2-HEA]Laurate in Ternary aqueous Gabapentin solutions as a function of SAIL molarity (c) at 298.15 K.

| *m (mol·kg$^{-1}$)* | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.0000 | | 0.0100 | | 0.0300 | | 0.0500 | |
| *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) | *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) | *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) | *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) |
| 0.2180 | 11.4 | 0.1280 | 5.7 | 0.1330 | 5.4 | 0.1130 | 3.3 |
| 0.2830 | 13.6 | 0.1590 | 6.7 | 0.1740 | 6.3 | 0.1510 | 4.2 |
| 0.3710 | 16.6 | 0.2060 | 8.3 | 0.2140 | 7.1 | 0.1890 | 5.0 |
| 0.4390 | 18.8 | 0.2550 | 10.1 | 0.2770 | 8.9 | 0.2500 | 6.2 |
| 0.5710 | 23.1 | 0.3080 | 11.8 | 0.3230 | 9.8 | 0.3000 | 7.0 |
| 0.7180 | 27.7 | 0.3690 | 13.4 | 0.3780 | 10.9 | 0.3470 | 8.1 |
| 0.9640 | 35.0 | 0.4760 | 16.6 | 0.5260 | 14.2 | 0.3920 | 9.1 |
| 1.2410 | 42.8 | 0.5750 | 19.4 | 0.6790 | 17.4 | 0.5280 | 12.2 |
| 1.6290 | 53.5 | 0.7120 | 23.6 | 0.8440 | 21.3 | 0.6250 | 14.5 |
| 1.9440 | 62.4 | 0.8380 | 27.3 | 1.2330 | 29.8 | 0.7470 | 16.4 |
| 2.4730 | 76.0 | 1.0750 | 33.7 | 1.5050 | 35.3 | 0.8790 | 18.6 |
| 2.8910 | 87.3 | 1.3320 | 40.4 | 2.2190 | 48.4 | 1.1330 | 22.9 |
| | | 1.7000 | 49.9 | 2.7600 | 57.9 | 1.3800 | 25.3 |
| | | 2.1180 | 60.8 | | | 1.6790 | 29.1 |
| | | 2.5270 | 70.7 | | | 2.0730 | 34.0 |
| | | | | | | 2.4190 | 38.2 |

[a] The standard uncertainties for molality and temperature were $u(C) = 0.001$ mol m$^{-3}$ and $u(T) = 0.5$ K, respectively with level of confidence 0.95. The standard combined uncertainty for conductance and molar conductivity were about, $uc(\kappa) = 0.5$ μS.cm$^{-1}$ (level of confidence 0.68), respectively.

Table S5. Special conductivities, $\kappa$ , of [tris-2-HEA]Laurate in Ternary aqueous Gabapentin solutions as a function of SAIL molarity (C) at 298.15 K.

| *m (mol·kg$^{-1}$)* | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.0000 | | 0.0100 | | 0.0300 | | 0.0500 | |
| *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) | *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) | *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) | *c* (mol.m$^3$) | $\kappa$ (μS.cm$^{-1}$) |
| 0.0455 | 2.0 | 0.1070 | 3.8 | 0.0866 | 2.0 | 0.038 | 1.0 |
| 0.0965 | 4.0 | 0.1588 | 5.4 | 0.1267 | 2.4 | 0.075 | 1.7 |
| 0.1637 | 6.0 | 0.1934 | 6.3 | 0.1549 | 3.1 | 0.104 | 2.1 |
| 0.2049 | 7.1 | 0.2409 | 7.4 | 0.1787 | 3.6 | 0.16 | 2.8 |
| 0.2591 | 8.0 | 0.2809 | 8.2 | 0.2177 | 4.2 | 0.246 | 3.7 |
| 0.3968 | 11.3 | 0.3360 | 8.9 | 0.2621 | 4.6 | 0.309 | 4.2 |
| 0.4965 | 13.2 | 0.4159 | 10.4 | 0.3076 | 5.1 | 0.393 | 4.9 |
| 0.6363 | 15.0 | 0.5326 | 12.5 | 0.3379 | 5.6 | 0.479 | 6.0 |
| 0.7859 | 18.5 | 0.6255 | 14.2 | 0.4246 | 7.0 | 0.572 | 7.0 |
| 0.9637 | 22.7 | 0.7519 | 15.9 | 0.4582 | 7.5 | 0.655 | 8.5 |
| 1.1328 | 26.0 | 0.8988 | 18.9 | 0.5156 | 8.5 | 0.768 | 9.0 |
| 1.3507 | 30.5 | 1.0533 | 22.0 | 0.5903 | 9.5 | 0.958 | 11.2 |
| 1.5783 | 34.1 | 1.2164 | 25.1 | 0.6336 | 10.1 | 1.185 | 13.1 |
| 1.9166 | 40.8 | 1.6097 | 31.9 | 0.7094 | 11.2 | 1.437 | 15.0 |
| 2.1095 | 44.4 | 1.9921 | 38.9 | 0.8600 | 13.5 | 1.739 | 18.1 |
| 2.5247 | 51.3 | 2.3972 | 44.9 | 0.9607 | 15.2 | 1.982 | 20.2 |
| 2.7426 | 55.2 | 2.8218 | 48.9 | 1.1557 | 17.8 | 2.249 | 21.8 |
| 2.9843 | 60.0 | | | 1.3528 | 20.9 | 2.785 | 27.1 |
| | | | | 1.6106 | 25.2 | 3.068 | 29.0 |
| | | | | 1.8153 | 28.1 | 3.653 | 32.1 |
| | | | | 2.0167 | 30.8 | | |
| | | | | 2.2799 | 33.9 | | |
| | | | | 2.6774 | 38.3 | | |

[a] The standard uncertainties for molality and temperature were $u$ ($C$) = 0.001 mol m$^{-3}$ and $u$ ($T$) = 0.5 K, respectively with level of confidence 0.95. The standard combined uncertainty for conductance and molar conductivity were about, $uc$ ($\kappa$) = 0.5 μS.cm$^{-1}$ (level of confidence 0.68), respectively.

**Table S6.** Critical micelle concentration, Thermodynamic parameters of micellization of [2-HEA]Lau, [bis-2-HEA]Lau, [tris-2-HEA]Lau in aqueous systems using conductometric method at $T$ = 298.15-318.15 K.

| material | $CMC$ (mol·m$^{-3}$) | $\Delta G_{mic}$ (kJ·mol$^{-1}$) | $\Delta H_{mic}$ (kJ·mol$^{-1}$) |
|---|---|---|---|
| [2-HEA]Lau + water 298.15 K | 1.5700 | -18.267 | -36.534 |
| [2-HEA]Lau + water 303.15 K | 1.3258 | -18.928 | -37.543 |
| [2-HEA]Lau + water 308.15 K | 1.2367 | -19.059 | -37.500 |
| [2-HEA]Lau + water 313.15 K | 1.0643 | -20.015 | -39.071 |
| [2-HEA]Lau + water 318.15 K | 1.14553 | -20.513 | -39.737 |
| [bis-2-HEA]Lau+ water 298.15 K | 1.1407 | -19.775 | -39.549 |
| [bis-2-HEA]Lau + water 303.15 K | 1.0669 | -18.802 | -37.293 |
| [bis-2-HEA]Lau + water 308.15 K | 0.9340 | -19.562 | -38.488 |
| [bis-2-HEA]Lau + water 313.15 K | 1.0019 | -20.050 | -39.139 |
| [bis-2-HEA]Lau + water 318.15 K | 1.1277 | -19.650 | -38.065 |
| [tris-2-HEA]Lau + water 298.15 K | 1.1044 | -19.350 | -38.699 |
| [tris-2-HEA]Lau + water 303.15 K | 0.9985 | -19.498 | -38.673 |
| [tris-2-HEA]Lau + water 308.15 K | 0.8822 | -20.506 | -40.347 |
| [tris-2-HEA]Lau + water 313.15 K | 0.9180 | -20.278 | -39.585 |
| [tris-2-HEA]Lau + water 318.15 K | 1.0591 | -20.197 | -39.124 |

[a] The standard uncertainties for molality and temperature were $u$ ($C$) = 0.001 mol m$^{-3}$ and $u$ ($T$) = 0.5 K, respectively with level of confidence 0.95. The standard combined uncertainty for conductance were about, $uc$ ($\kappa$) = 0.5 μS.cm$^{-1}$ (level of confidence 0.68), respectively.

**Table S7.** Critical micelle concentration and Thermodynamic parameters of micellization of [2-HEA]Lau, [bis-2-HEA]Lau, [tris-2-HEA]Lau in binary and ternary systems using conductometric method at T = 298.15 K.

| material | *CMC* (mol·m$^{-3}$) | $\Delta H_{mic}$ (kJ·mol$^{-1}$) |
|---|---|---|
| [2-HEA]Lau + water | 1.5100 | -36.5336 |
| [2-HEA]Lau in aqueous gabapentin solutions (0.01 mol·kg$^{-1}$) | 1.1000 | -39.3504 |
| [2-HEA]Lau in aqueous gabapentin solutions (0.03 mol·kg$^{-1}$) | 0.9153 | -39.7198 |
| [2-HEA]Lau in aqueous gabapentin solutions (0.05 mol·kg$^{-1}$) | 0.8144 | -40.9114 |
| | | |
| [bis-2-HEA]Lau + water | 1.1407 | -39.5494 |
| [bis-2-HEA]Lau in aqueous gabapentin solutions (0.01 mol·kg$^{-1}$) | 1.0380 | -38.8341 |
| [bis-2-HEA]Lau in aqueous gabapentin solutions (0.03 mol·kg$^{-1}$) | 0.8975 | -40.1889 |
| [bis-2-HEA]Lau in aqueous gabapentin solutions (0.05 mol·kg$^{-1}$) | 0.7800 | -39.9286 |
| | | |
| [tris-2-HEA]Lau + water | 1.1044 | -38.6992 |
| [tris-2-HEA]Lau in aqueous gabapentin solutions (0.01 mol·kg$^{-1}$) | 0.9498 | -39.0225 |
| [tris-2-HEA]Lau in aqueous gabapentin solutions (0.03 mol·kg$^{-1}$) | 0.8673 | -40.056 |
| [tris-2-HEA]Lau in aqueous gabapentin solutions (0.05 mol·kg$^{-1}$) | 0.7528 | -40.7154 |

[a] The standard uncertainties for molality and temperature were $u$ ($C$) = 0.001 mol m$^{-3}$ and $u$ ($T$) = 0.5 K, respectively with level of confidence 0.95. The standard combined uncertainty for conductance were about, $uc$ ($\kappa$) = 0.5 μS.cm$^{-1}$ (level of confidence 0.68), respectively.

**Table S8.** Molar conductivities of [2-HEA]Lau, [bis-2-HEA]Lau, [tris-2-HEA]Lau in binary aqueous solutions as a function of SAIL molarity (*c*) at 298.15-318.15 K.

| *T (K)* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 298.15 | | 303.15 | | 308.15 | | 313.15 | | 318.15 | |
| *c* (mol.m$^3$) | Λ (S.m$^2$.mol$^{-1}$) | *c* (mol.m$^3$) | Λ (S.m$^2$.mol$^{-1}$) | *c* (mol.m$^3$) | Λ (S.m$^2$.mol$^{-1}$) | *c* (mol.m$^3$) | Λ (S.m$^2$.mol$^{-1}$) | *c* (mol.m$^3$) | Λ (S.m$^2$.mol$^{-1}$) |
| [2-HEA]Lau+ water | | | | | | | | | |
| 0.593 | 54.138 | 0.119 | 47.755 | 0.303 | 94.746 | 0.739 | 80.822 | 0.213 | 35 |
| 0.772 | 49.898 | 0.353 | 46.461 | 0.438 | 79.341 | 0.935 | 73.226 | 0.359 | 45 |
| 0.988 | 46.578 | 0.468 | 45.588 | 0.64 | 68.244 | 1.201 | 66.85 | 0.59 | 58 |
| 1.253 | 43.396 | 0.814 | 43.517 | 0.821 | 62.873 | 1.588 | 60.831 | 0.665 | 62 |
| 1.414 | 41.789 | 1.148 | 41.631 | 1.026 | 59.03 | 1.952 | 57.355 | 0.896 | 74 |
| 1.764 | 39.386 | 1.455 | 40.836 | 1.244 | 56.34 | 2.228 | 55.555 | 1.168 | 88 |
| 2.247 | 37.448 | 1.795 | 40.374 | 1.544 | 53.867 | 2.593 | 53.679 | 1.422 | 100 |
| 2.796 | 35.419 | 2.47 | 39.502 | 1.771 | 52.525 | 3.104 | 51.938 | 1.75 | 115 |
| 3.245 | 34.857 | 2.885 | 39.016 | 2.037 | 51.317 | | | 1.987 | 125 |
| | | 3.169 | 38.67 | 2.36 | 50.196 | | | 2.257 | 138 |
| | | | | 2.707 | 49.261 | | | 2.593 | 153.304 |
| | | | | 3.036 | 48.548 | | | 3.051 | 175 |
| [bis-2-HEA]Lau+ water | | | | | | | | | |
| 0.218 | 52.51 | 0.059 | 45.066 | 0.102 | 71.232 | 0.149 | 87.365 | 0.087 | 137.946 |
| 0.283 | 48.066 | 0.164 | 43.84 | 0.203 | 66.893 | 0.341 | 76.297 | 0.233 | 107.2 |
| 0.371 | 44.813 | 0.273 | 42.674 | 0.31 | 63.086 | 0.449 | 73.47 | 0.486 | 87.475 |
| 0.439 | 43.027 | 0.402 | 41.657 | 0.514 | 58.469 | 0.736 | 65.24 | 0.711 | 77.385 |
| 0.571 | 40.589 | 0.616 | 40.772 | 0.655 | 55.473 | 0.906 | 62.937 | 1.117 | 69.396 |
| 0.718 | 38.636 | 0.856 | 40.232 | 0.832 | 52.161 | 1.21 | 59.519 | 1.262 | 67.338 |
| 0.964 | 36.363 | 1.182 | 39.619 | 0.998 | 50.096 | 1.591 | 55.943 | 1.441 | 64.543 |
| 1.241 | 34.492 | 1.596 | 39.279 | 1.265 | 47.861 | 1.816 | 53.967 | 1.614 | 63.818 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1.629 | 32.901 | 2.152 | 38.807 | 1.5 | 46.549 | 2.126 | 52.201 | 1.985 | 60.452 |
| 1.944 | 32.128 | 2.612 | 38.209 | 1.698 | 45.72 | 2.491 | 50.18 | 2.238 | 59.436 |
| 2.473 | 30.749 | 3.068 | 37.999 | 1.998 | 44.746 | 2.915 | 48.535 | 2.539 | 57.297 |
| 2.891 | 30.217 | | 36.719 | 2.323 | 43.919 | | | 2.911 | 54.956 |
| | | | | 2.644 | 43.287 | | | 3.329 | 54.074 |
| | | | | 3.018 | 42.703 | | | | |
| [tris-2-HEA]Lau+ water | | | | | | | | | |
| 0.0455 | 43.928 | 0.114 | 40.912 | 0.209 | 47.557 | 0.277 | 54.823 | 0.09 | 47.708 |
| 0.0965 | 41.46 | 0.29 | 38.523 | 0.327 | 46.356 | 0.5 | 52.092 | 0.187 | 47.52 |
| 0.1637 | 36.655 | 0.556 | 35.707 | 0.448 | 45.188 | 0.678 | 50.245 | 0.439 | 46.834 |
| 0.2049 | 34.166 | 0.728 | 34.556 | 0.58 | 43.926 | 0.869 | 48.335 | 0.603 | 46.3 |
| 0.2591 | 30.878 | 0.861 | 33.864 | 0.759 | 42.419 | 1.133 | 46.123 | 0.901 | 45.527 |
| 0.3968 | 27.725 | 1.112 | 32.489 | 0.859 | 41.605 | 1.4 | 43.951 | 1.156 | 44.875 |
| 0.4965 | 26.184 | 1.307 | 31.478 | 1.081 | 39.763 | 1.906 | 39.973 | 1.445 | 43.885 |
| 0.6363 | 23.573 | 1.582 | 30.438 | 1.262 | 38.426 | 1.986 | 38.655 | 1.928 | 42.287 |
| 0.7859 | 23.539 | 2.013 | 28.387 | 1.503 | 36.931 | 2.2415 | 36.336 | 2.228 | 41.733 |
| 0.9637 | 22.829 | 2.345 | 27.354 | 1.685 | 35.89 | 2.4966 | 34.015 | 2.505 | 40.946 |
| 1.1328 | 22.952 | 2.68 | 26.173 | 1.92 | 34.639 | 2.7516 | 31.696 | 2.857 | 40.067 |
| 1.3507 | 22.211 | 3.259 | 24.588 | 2.064 | 33.904 | 3.0067 | 29.376 | 3.513 | 39.731 |
| 1.5783 | 21.542 | | | 2.449 | 32.258 | | | | |
| 1.9166 | 20.871 | | | 2.803 | 30.683 | | | | |
| 2.1095 | 20.858 | | | 3.197 | 29.089 | | | | |
| 2.5247 | 20.2 | | | | | | | | |
| 2.7426 | 20.054 | | | | | | | | |
| 2.9843 | 20.105 | | | | | | | | |

[a] The standard uncertainties for molality and temperature were $u(C) = 0.001$ mol m$^{-3}$ and $u(T) = 0.5$ K, respectively with level of confidence 0.95. The standard combined uncertainty for conductance and molar conductivity were about, $uc(\kappa) = 0.5$ μS.cm$^{-1}$ and $uc(\Lambda) = 0.7$ S.m$^2$.mol$^{-1}$ (level of confidence 0.68), respectively.

**Table S9.** Molar conductivities of [2-HEA]Lau in ternary aqueous gabapentin solutions as a function of SAIL molarity ($c$) at 298.15 K.

| *m* (mol·kg$^{-1}$) | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.0000 | | 0.0100 | | 0.0300 | | 0.0500 | |
| $c$ (mol.m$^3$) | $\Lambda$ (S.m$^2$.mol$^{-1}$) | $c$ (mol.m$^3$) | $\Lambda$ (S.m$^2$.mol$^{-1}$) | $c$ (mol.m$^3$) | $\Lambda$ (S.m$^2$.mol$^{-1}$) | $c$ (mol.m$^3$) | $\Lambda$ (S.m$^2$.mol$^{-1}$) |
| 0.084 | 95.329 | 0.06 | 48.233 | 0.09 | 47.684 | 0.153 | 30.642 |
| 0.186 | 79.253 | 0.133 | 47.196 | 0.183 | 42.649 | 0.247 | 30.112 |
| 0.326 | 66.038 | 0.178 | 46.706 | 0.283 | 41.044 | 0.328 | 29.671 |
| 0.593 | 54.138 | 0.239 | 46.48 | 0.459 | 39.282 | 0.379 | 29.427 |
| 0.772 | 49.898 | 0.301 | 46.18 | 0.59 | 37.809 | 0.443 | 29.119 |
| 0.988 | 46.578 | 0.337 | 45.914 | 0.746 | 36.541 | 0.552 | 28.616 |
| 1.253 | 43.396 | 0.499 | 44.658 | 0.931 | 35.186 | 0.718 | 27.863 |
| 1.414 | 41.789 | 0.653 | 43.944 | 1.195 | 33.698 | 0.906 | 27.059 |
| 1.764 | 39.386 | 0.869 | 42.312 | 1.45 | 32.606 | 1.132 | 26.166 |
| 2.247 | 37.448 | 0.991 | 41.154 | 1.758 | 31.436 | 1.428 | 25.157 |
| 2.796 | 35.419 | 1.226 | 39.126 | 2.037 | 30.573 | 1.78 | 24.113 |
| 3.245 | 34.857 | 1.498 | 37.23 | 2.297 | 29.716 | 2.103 | 23.411 |
| 3.687 | 34.047 | 1.754 | 35.804 | | | 2.557 | 22.378 |
| 4.251 | 33.529 | 2.017 | 34.604 | | | | |
| 4.774 | 32.996 | 2.369 | 33.26 | | | | |
| 5.792 | 32.375 | | | | | | |
| 6.839 | 31.803 | | | | | | |

[a] The standard uncertainties for molality and temperature were $u$ ($C$) = 0.001 mol m$^{-3}$ and $u$ ($T$) = 0.5 K, respectively with level of confidence 0.95. The standard combined uncertainty for conductance and molar conductivity were about, $uc$ ($\kappa$) = 0.5 μS.cm$^{-1}$ and $uc$($\Lambda$) = 0.7 S.m$^2$.mol$^{-1}$ (level of confidence 0.68), respectively.

**Table S10.** Molar conductivities of [bis-2-HEA]Lau in ternary aqueous gabapentin solutions as a function of SAIL molarity ($c$) at 298.15 K.

| *m (mol·kg$^{-1}$)* | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.0000 | | 0.0100 | | 0.0300 | | 0.0500 | |
| $c$ (mol.m$^3$) | $\Lambda$ (S.m$^2$.mol$^{-1}$) | $c$ (mol.m$^3$) | $\Lambda$ (S.m$^2$.mol$^{-1}$) | $c$ (mol.m$^3$) | $\Lambda$ (S.m$^2$.mol$^{-1}$) | $c$ (mol.m$^3$) | $\Lambda$ (S.m$^2$.mol$^{-1}$) |
| 0.041 | 69.762 | 0.128 | 44.736 | 0.045 | 48.209 | 0.040 | 33.429 |
| 0.106 | 66.533 | 0.159 | 41.863 | 0.085 | 43.116 | 0.074 | 31.694 |
| 0.158 | 61.808 | 0.206 | 40.431 | 0.133 | 38.872 | 0.113 | 29.307 |
| 0.218 | 52.510 | 0.255 | 39.403 | 0.174 | 36.237 | 0.151 | 27.805 |
| 0.283 | 48.066 | 0.308 | 38.208 | 0.214 | 33.461 | 0.189 | 26.395 |
| 0.371 | 44.813 | 0.369 | 36.412 | 0.277 | 32.314 | 0.250 | 24.754 |
| 0.439 | 43.027 | 0.476 | 34.952 | 0.323 | 30.582 | 0.300 | 23.653 |
| 0.571 | 40.589 | 0.575 | 33.803 | 0.378 | 29.004 | 0.347 | 23.339 |
| 0.718 | 38.636 | 0.712 | 33.242 | 0.526 | 27.193 | 0.392 | 23.210 |
| 0.964 | 36.363 | 0.838 | 32.630 | 0.679 | 25.634 | 0.528 | 22.729 |
| 1.241 | 34.492 | 1.075 | 31.338 | 0.844 | 25.288 | 0.625 | 22.382 |
| 1.629 | 32.901 | 1.332 | 30.354 | 1.233 | 24.224 | 0.747 | 21.407 |
| 1.944 | 32.128 | 1.700 | 29.384 | 1.505 | 23.491 | 0.879 | 20.485 |
| 2.473 | 30.749 | 2.118 | 28.728 | 2.219 | 21.816 | 1.133 | 19.420 |
| 2.891 | 30.217 | 2.527 | 27.993 | 2.760 | 21.006 | 1.380 | 18.111 |
| | | | | | | 1.679 | 17.335 |
| | | | | | | 2.073 | 16.398 |
| | | | | | | 2.419 | 15.712 |

[a] The standard uncertainties for molality and temperature were $u$ ($C$) = 0.001 mol m$^{-3}$ and $u$ ($T$) = 0.5 K, respectively with level of confidence 0.95. The standard combined uncertainty for conductance and molar conductivity were about, $uc$ ($\kappa$) = 0.5 μS.cm$^{-1}$ and $uc$($\Lambda$) = 0.7 S.m$^2$.mol$^{-1}$ (level of confidence 0.68), respectively.

**Table S11.** Molar conductivities of [tris-2-HEA]Lau in ternary aqueous gabapentin solutions as a function of SAIL molarity ($c$) at 298.15 K.

| *M (mol·kg$^{-1}$)* | | | | | | | |
|---|---|---|---|---|---|---|---|
| 0.0000 | | 0.0100 | | 0.0300 | | 0.0500 | |
| $c$ (mol.m$^3$) | $\Lambda$ (S.m$^2$.mol$^{-1}$) | $c$ (mol.m$^3$) | $\Lambda$ (S.m$^2$.mol$^{-1}$) | $c$ (mol.m$^3$) | $\Lambda$ (S.m$^2$.mol$^{-1}$) | $c$ (mol.m$^3$) | $\Lambda$ (S.m$^2$.mol$^{-1}$) |
| 0.0455 | 43.928 | 0.1070 | 35.736 | 0.0370 | 27.155 | 0.038 | 26.228 |
| 0.0965 | 41.460 | 0.1588 | 34.142 | 0.0650 | 23.082 | 0.075 | 23.461 |
| 0.1637 | 36.655 | 0.1934 | 32.693 | 0.0870 | 23.082 | 0.104 | 20.727 |
| 0.2049 | 34.166 | 0.2409 | 30.808 | 0.1270 | 19.728 | 0.160 | 17.545 |
| 0.2591 | 30.878 | 0.2809 | 29.094 | 0.1550 | 19.369 | 0.246 | 15.058 |
| 0.3968 | 27.725 | 0.3360 | 26.555 | 0.1790 | 19.585 | 0.309 | 13.577 |
| 0.4965 | 26.184 | 0.4159 | 25.058 | 0.2180 | 18.374 | 0.393 | 12.477 |
| 0.6363 | 23.573 | 0.5326 | 23.324 | 0.2620 | 17.168 | 0.479 | 12.516 |
| 0.7859 | 23.539 | 0.6255 | 22.657 | 0.3080 | 16.255 | 0.572 | 12.248 |
| 0.9637 | 22.829 | 0.7519 | 21.176 | 0.3380 | 16.276 | 0.655 | 12.216 |
| 1.1328 | 22.952 | 0.8988 | 21.052 | 0.4250 | 16.487 | 0.768 | 11.721 |
| 1.3507 | 22.211 | 1.0533 | 20.813 | 0.4580 | 16.370 | 0.958 | 11.487 |
| 1.5783 | 21.542 | 1.2164 | 20.488 | 0.5160 | 16.487 | 1.185 | 10.973 |
| 1.9166 | 20.871 | 1.6097 | 19.831 | 0.5900 | 16.094 | 1.437 | 10.438 |
| 2.1095 | 20.858 | 1.9921 | 19.538 | 0.6340 | 16.000 | 1.739 | 10.353 |
| 2.5247 | 20.200 | 2.3972 | 18.739 | 0.7090 | 15.841 | 1.982 | 10.090 |
| 2.7426 | 20.054 | 2.8218 | 17.337 | 0.8600 | 15.698 | 2.249 | 9.7830 |
| 2.9843 | 20.105 | | | 0.9610 | 15.613 | 2.785 | 9.6940 |
| | | | | 1.1560 | 15.575 | 3.068 | 9.4520 |
| | | | | 1.3530 | 15.523 | 3.653 | 8.7600 |
| | | | | 1.6110 | 15.522 | | |
| | | | | 1.8150 | 15.425 | | |
| | | | | 2.0170 | 15.371 | | |
| | | | | 2.2800 | 14.886 | | |

| | | |
|---|---|---|
| | 2.6770 | 14.193 |

[a] The standard uncertainties for molality and temperature were $u$ ($C$) = 0.001 mol $m^{-3}$ and $u$ ($T$) = 0.5 K, respectively with level of confidence 0.95. The standard combined uncertainty for conductance and molar conductivity were about, $uc$ ($\kappa$) = 0.5 μS.$cm^{-1}$ and $uc(\Lambda)$ = 0.7 S.$m^2$.$mol^{-1}$ (level of confidence 0.68), respectively.