Supplemental Information

Preparation and characterization of ionic liquids

The *N*-alkylpyridinium ($C_n pyr^+$, with n = 4, 6, 7, 8, 10, 12, and 14) and 1-alkyl-3-methylimidazolium ($C_n mim^+$, with n = 12 and 14) ionic liquids used in this study were synthesized by a two-step process. In the first step, the bromide form of each IL was prepared by microwave irradiation of a mixture of an appropriate alkyl bromide and either pyridine (for $C_n pyr^+$ ILs) or 1-methylimidazole ($C_n mim^+$ ILs) according to established methods.[40] For the quaternary ammonium ILs ($N_{n,111}^+$, where n = 10, 12 and 14), whose halide forms are readily available commercially, this step was unnecessary. The bromide form of each IL was then converted to the corresponding *bis*[(trifluoromethyl)sulfonylimide] (Tf_2N^-) IL *via* an anion metathesis reaction with $LiTf_2N$ (TCI America), again following established procedures.[41] The purity of the final product was confirmed by ^{1}H-NMR, and for those compounds observed to form micelles, by elemental (CHN) analysis.

^{1}H-NMR

N-alkylpyridinium ionic liquids:

$C_4pyr^+Tf_2N^-$:
^{1}H NMR (300 MHz, $CDCl_3$): δ 8.82 (d, 2H), 8.50 (t, 1H), 8.08 (t, 2H), 4.61 (t, 2H), 2.00 (quin, 2H), 1.36-1.46 (m, 2H), 0.98 (t, 3H)

$C_6pyr^+Tf_2N^-$:
^{1}H NMR (300 MHz, $CDCl_3$): δ 8.83 (d, 2H), 8.49 (t, 1H), 8.07 (t, 2H), 4.61 (t, 2H), 2.00 (quin, 2H), 1.30-1.39 (m, 6H), 0.88 (t, 3H)

$C_7pyr^+Tf_2N^-$:
^{1}H NMR (300 MHz, $CDCl_3$): δ 8.83 (d, 2H), 8.50 (t, 1H), 8.08 (t, 2H), 4.62 (t, 2H), 2.02 (quin, 2H), 1.28-1.36 (m, 8H), 0.89 (t, 3H)

$C_8pyr^+Tf_2N^-$:
^{1}H NMR (300 MHz, $CDCl_3$): δ 8.83 (d, 2H), 8.50 (t, 1H), 8.08 (t, 2H), 4.62 (t, 2H), 2.02 (quin, 2H), 1.27-1.36 (m, 10H), 0.88 (t, 3H)

$C_{10}pyr^+Tf_2N^-$:
^{1}H NMR (300 MHz, $CDCl_3$): δ 8.83 (d, 2H), 8.50 (t, 1H), 8.09 (t, 2H), 4.63 (t, 2H), 2.03 (quin, 2H), 1.27-1.36 (m, 14H), 0.89 (t, 3H)

$C_{12}pyr^+Tf_2N^-$:
^1H NMR (300 MHz, $CDCl_3$): δ 8.82 (d, 2H), 8.50 (t, 1H), 8.08 (t, 2H), 4.63 (t, 2H), 2.03 (quin, 2H), 1.27-1.37 (m, 18H), 0.90 (t, 3H)

$C_{14}pyr^+Tf_2N^-$:
^1H NMR (300 MHz, $CDCl_3$): δ 8.81 (d, 2H), 8.50 (t, 1H), 8.09 (t, 2H), 4.65 (t, 2H), 2.04 (quin, 2H), 1.27-1.37 (m, 18H), 0.90 (t, 3H)

N,N-dialkylimidazolium ionic liquids:

$C_{12}mim^+Tf_2N^-$:
^1H NMR (300 MHz, $CDCl_3$): δ 8.79 (s, 1H), 7.29 (m, 2H), 4.18 (t, 2H), 3.96 (s, 3H), 1.88 (quin, 2H), 1.27-1.33 (m, 18H), 0.89 (t, 3H)

$C_{14}mim^+Tf_2N^-$:
^1H NMR (300 MHz, $CDCl_3$): δ 8.81 (s, 1H), 7.28 (m, 2H), 4.18 (t, 2H), 3.97 (s, 3H), 1.88 (quin, 2H), 1.27-1.34 (m, 22H), 0.90 (t, 3H)

Quaternary ammonium ionic liquids:

$N_{10,111}^+Tf_2N^-$:
^1H NMR (300 MHz, $CDCl_3$): δ 3.29 (m, 2H), 3.14 (s, 9H), 1.75 (broad peak, 2H), 1.28-1.36 (m, 14H), 0.89 (t, 3H)

$N_{12,111}^+Tf_2N^-$:
^1H NMR (300 MHz, $CDCl_3$): δ 3.28 (m, 2H), 3.14 (s, 9H), 1.74 (broad peak, 2H), 1.27-1.36 (m, 18H), 0.89 (t, 3H)

$N_{14,111}^+Tf_2N^-$:
^1H NMR (300 MHz, $CDCl_3$): δ 3.31 (m, 2H), 3.19 (s, 9H), 1.58 (broad peak, 2H), 1.28-1.37 (m, 22H), 0.90 (t, 3H)

Elemental (CHN) analysis:

$C_{12}pyr^+Tf_2N^-$:

Theoretical: %C: 43.2; %H: 5.72; %N: 5.30.

Actual: %C: 43.4; %H: 5.80; %N: 5.32.

$C_{14}pyr^+Tf_2N^-$:

Theoretical: %C: 45.3; %H: 6.16; %N: 5.03.

Actual: %C: 45.5; %H: 6.17; %N: 5.03.

Water solubility of ionic liquids

Ionic liquid	Water solubility
C10mimTf2N	794 uM
C12mimTf2N	564 uM
C14mimTf2N	340 uM
N10,111Tf2N	693 uM
N12,111Tf2N	276 uM
N14,111Tf2N	230 uM
C10pyrTf2N	560 uM
C12pyrTf2N	132 uM
C14pyrTf2N	305 uM