Supporting information

**Phenolate platform for anion exchange in ionic liquids**

Kallidanthiyil Chellappan Lethesh, Dries Parmentier, Wim Dehaen, Koen Binnemans*
Tetrabutylphosphonium acetate (1)

To a solution of tetrabutylphosphonium chloride (10 g, 33.91 mmol) in dry toluene (400 mL) was added sodium 4-tert-butylphenolate (5.83 g, 33.91 mmol). The reaction mixture was stirred vigorously for 12 h and afterwards filtered through Celite. An aqueous solution (500 mL) of acetic acid (2.84 g, 47.47 mmol) was added to the reaction mixture and stirred for 30 minutes. The organic phase was separated and washed with 50 mL of H₂O. The water was removed under vacuum to yield the product as a white solid. Yield: 9.07 g (84%). mp: 57 ºC. ¹H NMR (300 MHz, D₂O): δ = 0.82 (t, 12H), 1.37 (m, 16H), 1.84 (s, 3H), 2.06 (m, 8H). ¹³C NMR (100 MHz, D₂O): δ = 12.55, 17.45 (d), 22.71 (d), 22.88, 23.22 (d), 180.71. CHN elemental analysis for C₁₈H₃₉O₂P·2H₂O: calculated (%): C 60.98, H: 12.23, found (%): C: 60.63, H: 12.40.

Tetrabutylphosphonium methanesulfonate (2)

Tetrabutylphosphonium methanesulfonate was prepared by the procedure described for ionic liquid (1) from tetrabutylphosphonium chloride (10 g, 33.91 mmol), sodium 4-tert-butylphenolate (5.83 g, 33.91 mmol) and methanesulfonic acid (2.93 g, 30.51 mmol) to give a colorless solid. Yield: (10.45 g, 87%). mp: 65 ºC (lit: 59-62 ºC). ¹H NMR (300 MHz, D₂O): δ = 0.84 (t, 12H), 1.41 (m, 16H), 2.05 (m, 8H), 2.70 (s, 3H). ¹³C NMR (75 MHz, D₂O): δ = 12.53, 17.95 (d), 22.73 (d), 23.18 (d), 38.44. CHN elemental analysis for C₁₉H₄₁O₂P·1.5H₂O: calculated (%): C: 63.47, H: 12.34 found (%): C: 63.32, H: 15.54.

Tetrabutylphosphonium 4-methylbenzenesulfonate (3)

Tetrabutylphosphonium 4-methylbenzenesulfonate was prepared by the procedure described for ionic liquid (1) from tetrabutylphosphonium chloride (10 g, 33.91 mmol), sodium 4-tert-butylphenolate (5.83 g, 33.91 mmol) and 4-methylbenzenesulfonic acid (5.25 g, 30.51 mmol) to give a colorless solid. Yield: (12.70 g, 87%). mp: 57 ºC (lit: 54-57 ºC). ¹H NMR (300 MHz, D₂O): δ = 0.81 (t, 12H, 7), 1.32 (m, 16H), 2.01 (m, 8H), 2.31 (s, 3H), 7.27 (d, 2H, 8.44 Hz), 7.59 (d, 2H, 8.44 Hz). ¹³C NMR (75 MHz, D₂O): δ = 12.51, 17.28 (d), 20.48, 22.64 (d), 23.15 (d), 125.35, 129.40, 139.58, 142.32. CHN elemental analysis for C₂₃H₄₅O₃PS·2H₂O: calculated (%): C: 59.20, H: 10.15. found (%): C: 59.03, H: 10.61.
Tetrabutylphosphonium isonicotinate (4)

Tetrabutylphosphonium isonicotinate was prepared by the procedure described for ionic liquid (1) from tetrabutylphosphonium chloride (10 g, 33.91 mmol), sodium 4-tert-butylphenolate (5.83 g, 33.91 mmol) and isonicotinic acid (4.17 g, 33.91 mmol) to give a colorless solid. Yield: (11.77 g, 91%). mp: 215 ºC. ¹H NMR (300 MHz, D₂O): δ = 0.83 (t, 12H), 1.40 (m, 16H), 2.06 (m, 8H), 7.87 (d, 2H, 5.2 Hz), 8.61 (d, 2H, 5.0 Hz). ¹³C NMR (100 MHz, D₂O): δ = 12.56, 17.41 (d), 20.45 (d), 23.20 (d), 124.21, 146.48, 148.49, 171.53. CHN elemental analysis for C₂₂H₄₀NO₂P·3H₂O: calculated (%): C: 60.66, H: 10.64, N: 3.22, found (%): C: 60.57, H: 8.81, N: 3.22.

Tetrabutylphosphonium nicotinate (5)

Tetrabutylphosphonium nicotinate was prepared by the procedure described for ionic liquid (1) from tetrabutylphosphonium chloride (10 g, 33.91 mmol), sodium 4-tert-butylphenolate (5.83 g, 33.91 mmol) and nicotinic acid (4.17 g, 33.91 mmol) to give a colorless solid. Yield: (10.86 g, 84%). mp: 186 ºC. ¹H NMR (300 MHz, D₂O): δ = 0.82 (t, 12H), 1.41 (m, 16H), 2.05 (m, 8H), 7.98 (m, 1H), 8.75 (m, 2H), 9.05 (s, 1H). ¹³C NMR (75 MHz, D₂O): δ = 12.59, 17.32 (d), 22.68 (d), 23.20 (d), 120.62, 125.94, 130.03, 142.19, 153.25, 169.06. CHN elemental analysis for C₂₂H₄₀O₂NP·H₂O: calculated (%): C: 66.13, H: 10.60, N: 3.51, found (%): C: 66.07, H: 10.48, N: 3.39.

Tetrabutylphosphonium picolinate (6)

Tetrabutylphosphonium picolinate was prepared by the procedure described for ionic liquid (1) from tetrabutylphosphonium chloride (10 g, 33.91 mmol), sodium 4-tert-butylphenolate (5.83 g, 33.91 mmol) and picolinic acid (3.34 g, 27.12 mmol) to give a colorless solid. Yield:(10.86 g, 84%). mp: 59 ºC. ¹H NMR (300 MHz, D₂O): δ = 0.80 (t, 12H), 1.32 (m, 16H), 2.01 (m, 8H), 7.98 (m, 1H), 8.25 (d, 1H, 8.10 Hz), 8.51 (m, 1H), 8.63 (d, 1H, 5.40 Hz). ¹³C NMR (75 MHz, D₂O): δ = 12.54, 17.32 (d), 22.67 (d), 23.18 (d), 126.25, 128.30, 141.60, 146.30, 146.69, 164.36. CHN elemental analysis for C₂₂H₄₀NO₂P·3H₂O: calculated (%): C: 60.66, H: 10.64, N: 3.22, found (%): C: 60.70, H: 10.92, N: 3.27.
Tetrabutylphosphonium 6-carboxypicolinate (7)

Tetrabutylphosphonium 6-carboxypicolinate was prepared by the procedure described for ionic liquid (1) from tetrabutylphosphonium chloride (10 g, 33.91 mmol), sodium 4-tert-butylphenolate (5.83 g, 33.91 mmol) and pyridine-2,6-dicarboxylic acid (5.10 g, 30.51 mmol) to give a colorless solid. Yield: (11.68 g, 81 %). mp: 205 ºC. \(^1\)H NMR (300 MHz, D\(_2\)O): \(\delta = 0.81\) (t, 12H), 1.32 (m, 16H), 2.02 (m, 8H), 8.33 (m, 3H). \(^13\)C NMR (75 MHz, D\(_2\)O): \(\delta = 12.53, 17.32\) (d), 22.67 (d), 23.18 (d), 128.20, 143.23, 146.37, 165.75. CHN elemental analysis for C\(_{23}\)H\(_{40}\)NO\(_4\)P\(\cdot\)2H\(_2\)O: calculated (%): C: 59.85, H: 9.61, N: 3.03. found (%): C: 59.79, H: 10.32, N: 2.58.

Tetrabutylphosphonium nitrate (8)

Tetrabutylphosphonium nitrate was prepared by the procedure described for ionic liquid (1) from tetrabutylphosphonium chloride (10 g, 33.91 mmol), sodium 4-tert-butylphenolate (5.83 g, 33.91 mmol) and nitric acid (65 % solution, 3.29 mL, 2.14 g, 33.91 mmol) to give a colorless solid. Yield: (9.81 g, 90 %). mp: 70 ºC (lit: 70-73 ºC). \(^1\)H NMR (300 MHz, D\(_2\)O): \(\delta = 0.80\) (t, 12H), 1.32 (m, 16H), 2.01 (m, 8H). \(^13\)C NMR (75 MHz, D\(_2\)O): \(\delta = 12.51, 17.30\) (d), 22.66 (d), 23.18 (d). CHN elemental analysis for C\(_{16}\)H\(_{36}\)NO\(_3\)P\(\cdot\)2H\(_2\)O: calculated (%): C: 56.61, H: 11.28, N: 4.13. found (%): C: 56.87, H: 11.61, N: 4.11.

Tetrabutylphosphonium hydrogen sulfate (9)

Tetrabutylphosphonium hydrogen sulfate was prepared by the procedure described for ionic liquid (1) from tetrabutylphosphonium chloride (10 g, 33.91 mmol), sodium 4-tert-butylphenolate (5.83 g, 33.91 mmol) and sulfuric acid (95 % solution, 3.49 mL, 3.32 g, 33.91 mmol) to give a colorless solid. Yield: (10.75 g, 90 %). mp: 124 ºC (lit: 122 ºC). \(^1\)H NMR (300 MHz, D\(_2\)O): \(\delta = 0.80\) (t, 12H), 1.32 (m, 16H), 2.01 (m, 8H). \(^13\)C NMR (75 MHz, D\(_2\)O): \(\delta = 12.51, 17.28\) (d), 22.64 (d), 23.15(d). CHN elemental analysis for C\(_{16}\)H\(_{37}\)O\(_4\)P\(_3\)\(\cdot\)5H\(_2\)O: calculated (%): C: 45.80, H: 10.57 found (%): C: 45.84, H: 10.08.
**Tetrabutylphosphonium dihydrogen phosphate (10)**

Tetrabutylphosphonium dihydrogen phosphate was prepared by the procedure described for ionic liquid (1) from tetrabutylphosphonium chloride (10 g, 33.91 mmol), sodium 4-tert-butylphenolate (5.83 g, 33.91 mmol) and phosphoric acid (85% solution, 3.90 mL, 3.32 g, 33.91 mmol) to give a colorless solid. Yield: (10.27 g, 85%). mp: 149 ºC (lit: 148-151 ºC). $^1$H NMR (300 MHz, D$_2$O): $\delta = 0.79$ (t, 12H), 1.31 (m, 16H), 2.00 (m, 8H). $^{13}$C NMR (75 MHz, D$_2$O): $\delta = 12.51, 17.29$ (d), 22.65 (d), 23.39 (d). CHN elemental analysis for C$_{16}$H$_{38}$O$_4$P$_2$·2H$_2$O: calculated (%): C: 48.97, H: 10.79 found (%): C: 49.11, H: 11.08.

**Tetrabutylphosphonium formate (11)**

Tetrabutylphosphonium formate was prepared by the procedure described for ionic liquid (1) from tetrabutylphosphonium chloride (10 g, 33.91 mmol), sodium 4-tert-butylphenolate (5.83 g, 33.91 mmol) and formic acid (7.80 g, 169.55 mmol) to give a colorless solid. Yield: (8.46 g, 82%). mp: 41 ºC. $^1$H NMR (300 MHz, D$_2$O): $\delta = 0.83$ (t, 12H), 1.35 (m, 16H), 2.04 (m, 8H), 8.17 (s, 1H). $^{13}$C NMR (75 MHz, D$_2$O): $\delta = 12.54, 17.32$ (d), 22.67 (d), 23.39 (d), 166.07. CHN elemental analysis for C$_{17}$H$_{37}$O$_2$P·3H$_2$O: calculated (%): C: 56.96, H: 12.09 found (%): C: 57.13, H: 12.30.

**Tetrabutylphosphonium trifluoroacetate (12)**

Tetrabutylphosphonium trifluoroacetate was prepared by the procedure described for ionic liquid (1) from tetrabutylphosphonium chloride (10 g, 33.91 mmol), sodium 4-tert-butylphenolate (5.83 g, 33.91 mmol) and trifluoroacetic acid (3.86 g, 33.91 mmol) to give a colorless liquid. Yield: (10.23 g, 81%). $^1$H NMR (300 MHz, D$_2$O): $\delta = 0.83$ (t, 12H), 1.35 (m, 16H), 2.04 (m, 8H). $^{13}$C NMR (75 MHz, D$_2$O): $\delta = 12.51, 17.29$ (d), 22.65 (d), 23.16 (d), 114.27 (q), 162.44 (q). CHN elemental analysis for C$_{18}$H$_{36}$F$_3$O$_2$P·H$_2$O calculated (%): C: 55.37, H: 9.81 found (%): C: 56.00, H: 10.08.

**Tetrabutylammonium acetate (13)**
To a solution of tetrabutylammonium bromide (10 g, 31.02 mmol) in dry toluene (400 mL) was added sodium 4-tert-butyl phenolate (5.34 g, 31.02 mmol). The reaction mixture was stirred vigorously for 12 h and afterwards filtered through Celite. An aqueous solution (500 mL) of acetic acid (2.84 g, 47.47 mmol) was added to the reaction mixture and stirred for half an hours. The organic phase was separated and washed with 50 mL of H$_2$O. The solvent was removed under vacuum to yield the product as a white solid. Yield: 8.41 g (90 %). mp: 90 ºC (lit: 95-98 ºC). $^1$H NMR (300 MHz, D$_2$O): δ = 0. 85 (t, 12H), 1.25 (m, 8H), 1.55 (m, 8H), 2.01 (s, 3H), 3.09 (m, 8H). $^{13}$C NMR (75 MHz, D$_2$O): δ = 12.82, 19.13, 20.98, 23.13, 58.08, 177.62. CHN elemental analysis for C$_{18}$H$_{39}$O$_2$N: calculated (%): C: 67.66, H:12.93, N:4.38 found (%): C: 67.61, H: 12.89, N:4.41.

**Tetrabutylammonium methanesulfonate (14)**

Tetrabutylammonium methanesulfonate was prepared by the procedure described for ionic liquid (13) from tetrabutylammonium bromide (10 g, 31.02 mmol), sodium 4-tert-butylphenolate (5.34 g, 31.02 mmol) and methanesulfonic acid (2.68 g, 27.91 mmol) to give a colorless solid. Yield: (8.46 g, 82 %). mp: 78 ºC (lit.: 78-80 ºC). $^1$H NMR (300 MHz, D$_2$O): δ = 0. 81 (t, 12H), 1.22 (m, 8H), 1.52 (m, 8H), 2.69 (s, 3H), 3.06 (m, 8H). $^{13}$C NMR (75 MHz, D$_2$O): δ = 12.82, 19.12, 23.12, 38.43, 58.07. CHN elemental analysis for C$_{17}$H$_{39}$NO$_3$S: calculated (%): C: 52.14, H: 11.58, N: 3.58, found (%): C: 51.71, H: 11.26, N: 3.20.

**Tetrabutylammonium 4-methylbenzenesulfonate (15)**

Tetrabutylammonium 4-methylbenzenesulfonate was prepared by the procedure described for ionic liquid (13) from tetrabutylammonium bromide (10 g, 31.02 mmol), sodium 4-tert-butylphenolate (5.34 g, 31.02 mmol) and 4-methylbenzenesulfonic acid (4.80 g, 27.90 mmol) to give a colorless solid. Yield: (11.29 g, 88 %). mp: 75 ºC (lit: 70-72 ºC). $^1$H NMR (300 MHz, D$_2$O): δ = 0. 83 (t, 12H), 1.22 (m, 8H), 1.52 (m, 8H), 2.31(s, 3H), 3.05(m, 8H), 7.27(d, 2H, 8.1 Hz), 7.61(d, 2H, 8.1 Hz). $^{13}$C NMR (75 MHz, D$_2$O): δ= 12.84, 19.11, 20.49, 23.09, 58.01, 125.37, 129.41, 139.63, 142.30. CHN elemental analysis for C$_{23}$H$_{43}$O$_3$N: calculated (%):C:63.99, H:10.51, N:3.24. found (%): C: 64.05, H: 10.59, N: 3.31.
Tetrabutylammonium isonicotinate (16)

Tetrabutylammonium isonicotinate was prepared by the procedure described for ionic liquid (13) from tetrabutylammonium bromide (10 g, 31.02 mmol), sodium 4-tert-butylphenolate (5.34 g, 31.02 mmol) and isonicotinic acid (3.81 g, 31.02 mmol) to give a colorless solid. Yield: (9.72 g, 86 %). mp: 240 ºC. $^1$H NMR (300 MHz, D$_2$O): $\delta = 0.82$ (t, 12H), $1.19$ (m, 8H), $1.52$ (m, 8H), $3.04$ (m, 8H), $8.10$ (d, 2H, 6.33 Hz), $8.69$ (d, 2H, 6.33 Hz). $^{13}$C NMR (75 MHz, D$_2$O): $\delta = 12.83$, $19.13$, $23.13$, $58.08$, $125.66$, $142.71$, $152.87$, $169.72$. CHN elemental analysis for C$_{22}$H$_{40}$O$_2$N$_2$$\cdot$H$_2$O: calculated (%): C: 69.07, H: 11.07, N: 7.32, found (%): C: 69.02, H: 11.10, N: 7.37.

Tetrabutylammonium nicotinate (17)

Tetrabutylammonium nicotinate was prepared by the procedure described for ionic liquid (13) from tetrabutylammonium bromide (10 g, 31.02 mmol), sodium 4-tert-butylphenolate (5.34 g, 31.02 mmol) and nicotinic acid (4.20 g, 34.12 mmol) to give a colorless solid. Yield: (9.95 g, 88 %). mp: 163 ºC. $^1$H NMR (300 MHz, D$_2$O): $\delta = 0.83$ (t, 12H), $1.23$ (m, 8H), $1.54$ (m, 8H), $3.08$ (m, 8H), $7.86$ (t, 1H, 6.53 Hz), $8.66$ (m, 2H), $8.97$ (s, 1H). $^{13}$C NMR (75 MHz, D$_2$O): $\delta = 12.80$, $19.13$, $23.11$, $58.14$, $126.33$, $135.04$, $143.65$, $144.30$, $144.32$, $169.26$. CHN elemental analysis for C$_{22}$H$_{40}$N$_2$O$_2$$\cdot$H$_2$O: calculated (%): C: 69.07, H: 11.07, N: 7.32 found (%): C: 69.13, H: 11.05, N: 7.40.

Tetrabutylammonium picolinate (18)

Tetrabutylammonium picolinate was prepared by the procedure described for ionic liquid (13) from tetrabutylammonium bromide (10 g, 31.02 mmol), sodium 4-tert-butylphenolate (5.34 g, 31.02 mmol) and picolinic acid (3.05 g, 24.81 mmol) to give a colorless solid. Yield: (10.06 g, 89 %). mp: 62 ºC. $^1$H NMR (300 MHz, D$_2$O): $\delta = 0.82$ (t, 12H), $1.22$ (m, 8H), $1.49$ (m, 8H), $3.07$ (m, 8H), $8.26$ (m, 1H), $8.29$ (d, 1H, 7.8 Hz), $8.50$ (m, 1H), $8.63$ (d, 1H, 5.4 Hz). $^{13}$C NMR (75 MHz, D$_2$O): $\delta = 12.84$, $19.14$, $23.14$, $58.09$, $126.28$, $128.34$, $141.53$, $146.23$, $146.79$, $164.27$. CHN elemental analysis for C$_{22}$H$_{40}$N$_2$O$_2$$\cdot$2H$_2$O: C: 65.96, H: 11.07, N: 6.99, found (%) C: 66.18, H: 10.98, N: 6.83.
Tetrabutylammonium 6-carboxypicolinate (19)

Tetrabutylammonium 6-carboxypicolinate was prepared by the procedure described for ionic liquid (13) from tetrabutylammonium bromide (10 g, 31.02 mmol), sodium 4-tert-butylphenolate (5.34 g, 31.02 mmol) and pyridine-2,6-dicarboxylic acid (4.14 g, 24.81 mmol) to give a colorless solid (10.26 g, 81 %). mp: 219 °C. ¹H NMR (300 MHz, D₂O): δ = 0.82 (t, 12H), 1.22 (m, 8H), 1.49 (m, 8H), 3.07 (m, 8H), 8.26 (m, 1H), 8.29 (d, 1H, 7.8 Hz), 8.50 (m, 1H), 8.63 (d, 1H, 5.4 Hz). ¹³C NMR (75 MHz, D₂O): δ = 12.84, 19.14, 23.14, 58.09, 126.28, 128.34, 141.53, 146.23, 146.79, 164.27. CHN elemental analysis for C₂₃H₄₀O₄N₂·H₂O: calculated (%): C: 64.76, H: 9.92, N: 6.57 found (%): C: 64.85, H: 9.79, N: 6.53.

Tetrabutylammonium nitrate (20)

Tetrabutylammonium nitrate was prepared by the procedure described for ionic liquid (13) from tetrabutylammonium bromide (10 g, 31.02 mmol), sodium 4-tert-butylphenolate (5.34 g, 31.02 mmol) and nitric acid (65 % solution, 3 mL, 1.95 g, 31.02 mmol) to give a colorless solid. Yield: (8.5 g, 90 %). mp: 114 °C (lit: 116-118 °C). ¹H NMR (300 MHz, D₂O): δ = 0.83 (t, 12H), 1.23 (m, 8H), 1.53 (m, 8H), 3.08 (m, 8H). ¹³C NMR (75 MHz, D₂O): δ = 12.80, 19.12, 23.12, 58.07. CHN elemental analysis for C₁₆H₃₆N₂O₃·2H₂O: calculated (%): C: 56.44, H: 11.84, N: 8.23. found (%): C: 56.42, H: 11.44, 8.33.

Tetrabutylammonium hydrogen sulfate (21)

Tetrabutylammonium hydrogen sulfate was prepared by the procedure described for ionic liquid (13) from tetrabutylammonium bromide (10 g, 31.02 mmol), sodium 4-tert-butylphenolate (5.34 g, 31.02 mmol) and sulfuric acid (95 % solution, 2.88 mL, 3.03 g, 31.02 mmol) to give a colorless solid. Yield: (9.37 g, 89 %). mp: 168 °C (lit: 169-171°C). ¹H NMR (300 MHz, D₂O): δ = 0.82 (t, 12H), 1.21 (m, 8H), 1.50 (m, 8H), 3.05 (m, 8H). ¹³C NMR (75 MHz, D₂O): δ = 12.80, 19.11, 23.11, 58.06. CHN elemental analysis for C₁₆H₃₇O₄N·H₂O: calculated (%): C: 53.75, H: 10.99, N: 3.92. found (%): C: 53.67, H: 10.79, N: 4.03.

Tetrabutylammonium dihydrogen phosphate (22)
Tetrabutylammonium dihydrogen phosphate was prepared by the procedure described for ionic liquid (13) from tetrabutylammonium bromide (10 g, 31.02 mmol), sodium 4-tert-butylphenolate (5.34 g, 31.02 mmol) and phosphoric acid (85 % solution, 3.03 g, 3.57 mL) to give a colorless solid. Yield (9.05 g, 86 %). mp: 154 ºC (lit: 151-154 º C). ¹H NMR (300 MHz, D₂O): δ = 0. 81 (t, 12H), 1.23 (m, 8H), 1,53 (m, 8H), 3.08 (m, 8H). ¹³C NMR (75 MHz, D₂O): δ = 12.80, 19.12, 23.12, 58.06. CHN elemental analysis for C₁₆H₃₈ NO₄P·2H₂O: calculated (%): C: 51.18, H: 11.27, N: 3.73. found (%): C: 51.31, H: 11.25, N:3.67.

**Tetrabutylammonium formate (23)**

Tetrabutylammonium formate was prepared by the procedure described for ionic liquid (13) from tetrabutylammonium bromide (10 g, 31.02 mmol), sodium 4-tert-butylphenolate (5.34 g, 31.02 mmol) and formic acid (7.13 g, 155.10 mmol) to give a colorless solid. Yield: (7.40 g, 83 %). mp: 69 ºC. ¹H NMR (300 MHz, D₂O): δ = 0. 68 (t, 12H), 1.07 (m, 8H), 1.36 (m, 8H), 2.91 (m, 8H), 8.07 (s, 1H). ¹³C NMR (75 MHz, D₂O): δ = 12.81, 19.12, 23.11, 58.13, 169.07. CHN elemental analysis for C₁₇H₃₇ NO₂P·2H₂O: calculated (%): C: 63.11, H: 12.77, N: 4.33, found (%): C: 63.05, H: 13.06, N: 4.24.

**Tetrabutylammonium trifluoroacetate (24)**

Tetrabutylammonium trifluoroacetate was prepared by the procedure described for ionic liquid (13) from tetrabutylammonium bromide (10 g, 31.02 mmol), sodium 4-tert-butylphenolate (5.34 g, 31.02 mmol) and trifluoroacetic acid (3.53 g, 31.02 mmol) to give a colorless solid. Yield: (9.37 g, 85 %). mp: 74 ºC. ¹H NMR (300 MHz, D₂O): δ = 0. 89 (t, 12H), 1.29 (m, 8H), 1.62 (m, 8H), 3.14 (m, 8H). ¹³C NMR (75 MHz, D₂O): δ = 12.80, 19.12, 23.12, 58.06, 117.81 (q), 178.20 (q). CHN elemental analysis for C₁₈H₃₆ F₃ NO₃ ·2H₂O: calculated (%): C: 53.05, H: 9.89, N: 3.44, found (%): C: 53.34, H: 9.28, N: 3.61.

**1-Butyl-3-methylimidazolium acetate (25)**

To a solution of 1-butyl-3-methylimidazolium chloride (10g, 57.25 mmol) in dry 2-butanone (500 mL) was added sodium 4-tert-butylphenolate (9.85 g, 57.25 mmol). The reaction
mixture was stirred vigorously for 12 h and afterwards filtered through Celite. An aqueous solution (500 mL) of acetic acid (5.15 g, 85.87 mmol) was added to the reaction mixture and stirred for half an hours. The organic phase was separated and washed with 50 mL of H2O. The water was removed under vacuum to yield the product as a colorless liquid. Yield: 9.08 g (80 %). 1H NMR (300 MHz, D2O): δ = 0.80 (t, 3H; 7.37 Hz), 1.21 (m, 2H), 1.75 (m, 2H), 1.93 (s, 3H), 3.79 (s, 3H), 4.09 (m, 2H), 7.32 (m, 2H), 8.61 (s, 1H). 13C NMR (75 MHz, D2O): δ = 12.59, 18.70, 23.09, 31.21, 35.56, 49.21, 122.17, 123.43, 135.79, 180.75. CHN elemental analysis for C10H18 N2O2: calculated (%): C: 51.26, H: 9.46, N: 11.96, found (%): C: 51.20, H: 9.51, N: 12.03.

1-Butyl-3-methylimidazolium methanesulfonate (26)

1-Butyl-3-methylimidazolium methanesulfonate was prepared by the procedure described for ionic liquid (25) from 1-butyl-3-methylimidazolium chloride (10 g, 57.25 mmol) sodium 4-tert-butylphenolate (9.85 g, 57.25 mmol) and methanesulfonic acid (4.95g, 51.25 mmol) to give a colorless solid. Yield: (11.40 g, 85 %). mp: 76 ºC (lit: 74 º). 1H NMR (300 MHz, D2O): δ = 0.81 (t, 3H; 7.35 Hz), 1.17 (m, 2H), 1.71 (m, 2H), 2.70 (s, 3H), 3.78 (s, 3H), 4.06 (m, 2H), 7.31 (m, 2H), 8.59 (s, 1H). 13C NMR (75 MHz, D2O): δ = 12.62, 18.70, 31.22, 35.59, 38.48, 49.22, 122.18, 123.44, 135.79. CHN elemental analysis for C9H18 N2O3S·H2O: calculated (%): C: 42.84, H: 7.99, N: 11.10 found (%): C: 42.81, H: 9.77, N: 11.22.

1-Butyl-3-methylimidazolium 4-methylbenzenesulfonate (27)

1-Butyl-3-methylimidazolium 4-methylbenzenesulfonate was prepared by the procedure described for ionic liquid (25) from 1-butyl-3-methylimidazolium chloride (10 g, 57.25 mmol) sodium 4-tert-butylphenolate (9.85 g, 57.25 mmol) and 4-methylbenzenesulfonic acid (8.87 g, 51.52 mmol) to give a colorless solid. Yield: (14.57 g, 82 %). mp: 67 ºC (lit: 67 º). 1H NMR (300 MHz, D2O): δ = 0.87 (t, 3H; 7.36 Hz), 1.21 (m, 2H), 1.69 (m, 2H.), 2.35 (s, 3H), 3.82 (s, 3H), 4.08 (m, 2H), 7.34 (m, 4H), 7.63 (d, 2H), 8.7 (s, 1H). 13C NMR (75 MHz, D2O): δ = 12.54, 18.67, 20.43, 31.18, 35.52, 49.20, 122.13, 123.38, 125.30, 129.39, 135.74, 139.40, 142.41. CHN elemental analysis for C15H22 N2O3.S·H2O: calculated (%): C: 54.86, H: 7.37,N 8.53, found (%): C: 54.95, H: 7.21, N: 8.63.
1-Butyl-3-methylimidazolium isonicotinate (28)

1-Butyl-3-methylimidazolium isonicotinate was prepared by the procedure described for ionic liquid (25) from 1-butyl-3-methylimidazolium chloride (10 g, 57.25 mmol) sodium 4-tert-butyl phenolate (9.85 g, 57.25 mmol) and isonicotinic acid (7.04 g, 57.25 mmol) to give a colorless solid. Yield: (12.41 g, 83 %). mp: 269 ºC. ¹H NMR (300 MHz, D₂O): δ = 0.80 (t, 3H; 7.35 Hz), 1.16 (m, 2H), 1.72 (m, 2H), 3.77(s, 3H), 4.06 (t, 2H, 7.13 Hz), 7.30 (m, 2H), 7.79 (d, 2H, 6.35 Hz), 8.58 (m, 3H). ¹³C NMR (75 MHz, D₂O): δ = 12.52, 18.65, 31.16, 35.50, 49.17, 122.11, 123.37, 123.89, 135.70, 146.86, 147.77, 171.89. CHN elemental analysis for C₁₄H₁₉N₃O₂P·H₂O: calculated (%): C: 60.20, H: 7.58, N: 15.04, found (%): C: 60.23, H: 7.61, N: 15.10.

1-Butyl-3-methylimidazolium nicotinate (29)

1-Butyl-3-methylimidazolium nicotinate was prepared by the procedure described for ionic liquid (25) from 1-butyl-3-methylimidazolium chloride (10 g, 57.25 mmol) sodium 4-tert-butyl phenolate (9.85 g, 57.25 mmol) and nicotinic acid (7.04 g, 57.25 mmol) to give a colorless solid. Yield: (12.86 g, 86 %). mp: 195 ºC. ¹H NMR (300 MHz, D₂O): δ = 0.87 (t, 3H; 7.32 Hz), 1.28 (m, 2H), 1.81 (m, 2H), 4.06 (s, 3H), 4.25 (t, 2H, 7.15 Hz), 7.20 (m, 3H), 8.32 (m, 2H), 8.62 (m, 1H), 9.19 (s, 1H). ¹³C NMR (75 MHz, D₂O): δ = 12.54, 18.67, 31.19, 35.53, 49.21, 122.14, 123.40, 134.89, 135.77, 143.86, 144.58, 169.36. CHN elemental analysis for C₁₄H₁₉N₃O₂·H₂O: calculated (%): C: 60.20, H: 7.58, N: 15.04, found (%): C: 60.13, H: 7.39, N: 15.01.

1-Butyl-3-methylimidazolium picolinate (30)

1-Butyl-3-methylimidazolium picolinate was prepared by the procedure described for ionic liquid (25) from 1-butyl-3-methylimidazolium chloride (10 g, 57.25 mmol) sodium 4-tert-butyl phenolate (9.85 g, 57.25 mmol) and picolinic acid (5.63 g, 45.73 mmol) to give a colorless liquid. Yield: (11.96 g, 80 %). ¹H NMR (300 MHz, D₂O): δ = 0.87 (t, 3H; 7.32 Hz), 1.17 (m, 2H), 1.71 (m, 2H), 3.78 (s, 3H), 4.06 (t, 2H, 7.15 Hz), 7.32 (m, 2H), 7.91 (t, 1H, 6.62 Hz), 8.19 (d, 1H, 7.78 Hz), 8.42 (m, 1H), 8.63 (m, 2H). ¹³C NMR (75 MHz, D₂O): δ = 12.56,
18.68, 31.20, 35.55, 49.22, 122.15, 123.41, 125.88, 127.93, 135.79, 142.46, 145.52, 147.18, 165.56. CHN elemental analysis for C\textsubscript{14}H\textsubscript{19}N\textsubscript{3}O\textsubscript{2}·2H\textsubscript{2}O: calculated (%): C: 56.55, H: 7.80, N: 14.13, found (%): C: 56.52, H: 7.73, N: 14.19.

1-Butyl-3-methylimidazolium nitrate (31)

1-Butyl-3-methylimidazolium nitrate was prepared by the procedure described for ionic liquid (25) from 1-butyl-3-methylimidazolium chloride (10 g, 57.25 mmol) sodium 4-tert-butyl phenolate (9.85 g, 57.25 mmol) and nitric acid (65 % solution, 5.55 mL, 3.60 g, 57.25 mmol) to give a pale yellow liquid. Yield: (9.56 g, 83 %). \(^1\)H NMR (300 MHz, D\textsubscript{2}O): \(\delta = 0.79\) (t, 3H; 7.39 Hz), 1.23 (m, 2H), 1.72 (m, 2H), 3.78 (s, 3H), 4.09 (t, 2H, 7.13 Hz), 7.36 (m, 2H), 8.75 (s, 1H). \(^1\)C NMR (75 MHz, D\textsubscript{2}O): \(\delta = 12.54, 18.68, 31.20, 35.52, 49.21, 122.12, 123.38, 135.77\). CHN elemental analysis for C\textsubscript{8}H\textsubscript{15}N\textsubscript{3}O\textsubscript{3}·H\textsubscript{2}O: calculated (%): C: 43.83, H: 7.82, N: 19.17, found (%): C: 43.50, H: 7.80, N: 19.31.

1-Butyl-3-methylimidazolium hydrogen sulfate (32)

1-Butyl-3-methylimidazolium hydrogen sulfate was prepared by the procedure described for ionic liquid (25) from 1-butyl-3-methylimidazolium chloride (10 g, 57.25 mmol) sodium 4-tert-butyl phenolate (9.85 g, 57.25 mmol) and sulfuric acid (95 % solution, 5.90 mL, 5.60 g, 57.25 mmol) to give a colorless solid. Yield: (10.82 g, 80 %), mp: 30 °C (lit: 29-32 °C). \(^1\)H NMR (300 MHz, D\textsubscript{2}O): \(\delta = 0.78\) (t, 3H; 7.39 Hz), 1.18 (m, 2H), 1.70 (m, 2H), 3.77 (s, 3H), 4.05 (t, 2H, 7.13 Hz), 7.30 (m, 2H), 8.59 (s, 1H). \(^1\)C NMR (75 MHz, D\textsubscript{2}O): \(\delta = 12.55, 18.66, 31.18, 35.54, 49.19, 122.13, 123.39, 135.76\). CHN elemental analysis for C\textsubscript{8}H\textsubscript{16}N\textsubscript{2}O\textsubscript{4}S·2H\textsubscript{2}O: Calculated (%): C: 35.28, H: 7.40, N: 10.29, found (%): C: 35.29, H: 7.51, N: 10.30.

1-Butyl-3-methylimidazolium dihydrogen phosphate (33)

1-Butyl-3-methylimidazolium dihydrogen phosphate was prepared by the procedure described for ionic liquid (25) from 1-butyl-3-methylimidazolium chloride (10 g, 57.25 mmol) sodium 4-tert-butylphenolate (9.85 g, 57.25 mmol) and phosphoric acid (85 % solution, 6.59 mL,
5.60 g, 57.25 mmol) to give a colorless solid. Yield: (11.49 g, 85 %). mp: 165 ºC (lit: 167 ºC).

\[ ^1H \text{ NMR (300 MHz, D}_2\text{O): } \delta = 0.80 \text{ (t, 3H; 7.39 Hz), 1.21 \text{ (m, 2H), 1.73 \text{ (m, 2H), 3.97 \text{ (s, 3H), 4.12 \text{ (t, 2H, 7.13 Hz), 7.33 \text{ (m, 2H), 8.7 \text{ (s, 1H).} } } ^{13}C \text{ NMR (75 MHz, D}_2\text{O): } \delta = 12.53, 18.66, 31.19, 35.52, 49.20, 122.12, 123.38, 135.76. } \]

CHN elemental analysis for C\textsubscript{8}H\textsubscript{17}N\textsubscript{2}O\textsubscript{4}P\cdot 2H\textsubscript{2}O: calculated (%): C: 35.29, H: 7.7 8, N: 10.29, found (%): C: 35.33, H: 7.91, N: 10.40.

**1-Butyl-3-methylimidazolium formate (34)**

1-Butyl-3-methylimidazolium formate was prepared by the procedure described for ionic liquid (25) from 1-butyl-3-methylimidazolium chloride (10 g, 57.25 mmol) sodium 4-tert-butyl phenolate (9.85 g, 57.25 mmol) and formic acid (13.17 g, 286.25 mmol) to give a colorless liquid. Yield: (11.49 g, 85 %). \[ ^1H \text{ NMR (300 MHz, D}_2\text{O): } \delta = 0.82 \text{ (t, 3H; 7.30 Hz), 1.28 \text{ (m, 2H), 1.74 \text{ (m, 2H), 3.78 \text{ (s, 3H), 4.09 \text{ (t, 2H, 7.15 Hz), 7.32 \text{ (m, 2H), 8.71 \text{ (m, 1H), 9.60 \text{ (s, 1H).} } } ^{13}C \text{ NMR (75 MHz, D}_2\text{O): } \delta = 12.58, 18.70, 31.22, 35.58, 49.23, 122.17, 123.42, 123.89, 135.79, 167.33 } \]

CHN elemental analysis for C\textsubscript{9}H\textsubscript{16}N\textsubscript{2}O\textsubscript{2}\cdot 2H\textsubscript{2}O: calculated (%): C: 49.08, H: 9.15, N: 12.72 found (%): C: 48.95, H: 9.20, N: 12.89.

**1-Butyl-3-methylimidazolium trifluoroacetate (35)**

1-Butyl-3-methylimidazolium trifluoroacetate was prepared by the procedure described for ionic liquid (25) from 1-butyl-3-methylimidazolium chloride (10 g, 57.25 mmol) sodium 4-tert-butylphenolate (9.85 g, 57.25 mmol) and trifluoroacetic acid (6.52 g, 57.25 mmol) to give a colorless liquid. Yield: (11.23 g, 86 %). \[ ^1H \text{ NMR (300 MHz, D}_2\text{O): } \delta = 0.75 \text{ (t, 3H; 7.35 Hz), 1.16 \text{ (m, 2H), 1.68 \text{ (m, 2H), 3.75 \text{ (s, 3H), 4.03 \text{ (t, 2H, 7.17 Hz), 7.28 \text{ (m, 3H), 8.57 \text{ (m, 2H).} } } ^{13}C \text{ NMR (75 MHz, D}_2\text{O): } \delta = 12.55, 18.68, 31.19, 35.56, 49.22, 118.08(q), 122.15, 123.40, 135.75, 162.18 } \]

CHN elemental analysis for C\textsubscript{10}H\textsubscript{15}F\textsubscript{3}N\textsubscript{2}O\textsubscript{2}\cdot H\textsubscript{2}O: calculated (%): C: 44.44, H: 6.34, N: 10.37, found (%): C: 44.62, H: 6.29, N: 10.24.
1-Butyl-3-methylimidazolium trifluoromethanesulfonate was prepared by the procedure described for ionic liquid (25) from 1-butyl-3-methylimidazolium chloride (10 g, 57.25 mmol) sodium 4-tert-butylphenolate (9.85 g, 57.25 mmol) and trifluoromethanesulfonic acid (8.59 g, 57.25 mmol) to give a colorless liquid. Yield: (13.20 g, 80 %). 1H NMR (300 MHz, D$_2$O): $\delta = 0.78$ (t, 3H; 7.35 Hz), 1.19 (m, 2H), 1.71 (m, 2H), 3.77 (s, 3H), 4.05 (t, 2H, 7.17 Hz), 7.35 (m, 3H), 8.57 (m, 2H). 13C NMR (75 MHz, D$_2$O): $\delta = 12.56$, 18.70, 31.21, 35.54, 49.24, 117.53(q), 122.17, 123.43, 135.74. CHN elemental analysis for C$_9$H$_{15}$F$_3$N$_2$O$_3$S$\cdot$2H$_2$O: calculated (%): C: 33.33, H: 5.90, N: 8.64, found (%): C: 33.32, H: 5.79, N: 8.71.

1-Butyl-1-methylpyrrolidinium 4-tert-butylphenolate (37)

To a solution of 1-butyl-1-methylpyrrolidinium bromide (10 g, 45.01 mmol) in dry DCM (500 mL), sodium 4-tert-butylphenolate (7.75 g, 45.01 mmol) was added and stirred for 12 hours. The reaction mixture was filtered through Celite to remove the precipitated sodium bromide. The solvent was removed under vacuum. 1-butyl-1-methylpyrrolidinium 4-tert-butylphenolate was obtained as a white solid. Yield (12.85 g, 98 %). 1H NMR (300 MHz, CDCl$_3$): $\delta = 0.82$ (t, 3H, 7.32 Hz), 1.25 (m, 11H), 1.62 (m, 2H), 2.54 (m, 4H), 2.92 (s, 3H), 3.55 (m, 2H), 3.68 (m, 4H), 6.87 (d, 2H), 7.13 (d, 2H). 13C NMR (75 MHz, CDCl$_3$): $\delta = 13.64$, 19.63, 21.52, 25.80, 29.15, 31.71, 33.84, 49.51, 64.11, 64.39, 115.51, 126.04, 140.85, 156.20. CHN elemental analysis for C$_{19}$H$_{33}$NO: Calculated (%) C: 78.29, H: 11.41, N: 4.81, found (%) C: 78.18, H: 11.53, N: 4.80

1-Butyl-1-methylpyrrolidinium acetate (38)

To a solution of 1-butyl-1-methylpyrrolidinium 4-tert-butylphenolate (10 g, 34.30 mmol) in toluene (250 mL), an aqueous solution (500 mL) of acetic acid (3.08 g, 51.45 mmol) was added and stirred for 30 minutes. The organic layer was separated and washed with water (50 mL). The combined aqueous layer was concentrated under vacuum to give 1-butyl-1-methylpyrrolidinium acetate as a colorless solid. Yield (5.66 g, 82 %). mp: 78 ºC (lit: 81 ºC). 1H NMR (300 MHz, D$_2$O): $\delta = 0.88$ (t, 3H, 7.32 Hz), 1.25 (m, 2H), 1.62 (m, 2H), 1.98 (s, 3H), 2.10 (m, 4H), 2.94 (s, 3H), 3.19 (m, 2H), 3.40 (m, 4H). 13C NMR (75 MHz, D$_2$O): $\delta = 12.86$, 19.27, 20.75, 21.33, 25.12, 48.05, 64.11, 64.30, 177.08. CHN elemental analysis for
C_{11}H_{23}NO_2\cdot2H_2O: calculated (%): C: 55.67, H: 11.47, N: 5.90 found (%): C: 45.59, H: 11.37, N: 5.83.

1-Butyl-1-methylpyrrolidinium methanesulfonate (39)

1-Butyl-1-methylpyrrolidinium methanesulfonate was prepared by the procedure described for ionic liquid (38) from 1-butyl-1-methylpyrrolidinium 4-tert-butylphenolate (10 g, 34.30 mmol) and methanesulfonic acid (2.96 g, 30.87 mmol) to give a colorless solid. Yield (6.51 g, 80 %). mp: 65 °C (lit: 63 °C). $^1$H NMR (300 MHz, D$_2$O): $\delta = 0.82$ (t, 3H, 7.32 Hz), 1.28 (m, 2H), 1.65 (m, 2H), 2.10 (m, 4H), 2.70 (s, 3H), 2.93 (s, 3H), 3.19 (m, 2H), 3.39 (m, 4H). $^{13}$C NMR (75 MHz, D$_2$O): $\delta = 12.75, 14.80, 19.19, 21.24, 25.04, 38.40, 49.90, 64.09, 64.15$ CHN elemental analysis for C$_{10}$H$_{23}$NO$_3$S $\cdot$H$_2$O: calculated (%): C: 47.03, H: 9.87, N: 5.48 found (%): C: 47.10, H: 8.28, N: 5.30.

1-Butyl-1-methylpyrrolidinium 4-methylbenzenesulfonate (40)

1-Butyl-1-methylpyrrolidinium 4-methylbenzenesulfonate was prepared by the procedure described for ionic liquid (38) from 1-butyl-1-methylpyrrolidinium 4-tert-butylphenolate (10 g, 34.30 mmol) and 4-methylbenzenesulfonic acid (5.31 g, 30.87 mmol) to give a colorless solid. Yield (8.81 g, 82 %). mp: 114 °C (lit: 115 °C). $^1$H NMR (300 MHz, D$_2$O): $\delta = 0.83$ (t, 2H, 7.34 Hz), 12.27 (m, 2H), 1.67 (m, 2H), 2.13 (m, 4H), 2.30 (s, 3H), 2.92 (s, 3H), 3.19 (m, 2H), 3.38 (m, 4H), 7.29 (d, 2H, 8.16Hz), 7.61 (d, 2H, 8.16Hz). $^{13}$C NMR (75 MHz, D$_2$O): $\delta = 15.26, 21.71, 22.96, 23.75, 27.52, 50.52, 64.05, 64.18, 127.85, 131.94, 141.95, 144.96$. CHN elemental analysis for C$_{16}$H$_{27}$NO$_3$S $\cdot$2H$_2$O: calculated (%): C: 54.99 H: 8.94, N: 4.01 found (%): C: 55.02, H: 8.60, N: 4.01.

1-Butyl-1-methylpyrrolidinium isonicotinate (41)

1-Butyl-1-methylpyrrolidinium isonicotinate was prepared by the procedure described for ionic liquid (38) from 1-butyl-1-methylpyrrolidinium 4-tert-butylphenolate (10 g, 34.30 mmol) and isonicotinic acid (4.22 g, 34.30 mmol) to give a colorless solid. Yield: (8.07 g, 89 %). mp: 227 °C. $^1$H NMR (300 MHz, D$_2$O): $\delta = 0.83$ (t, 3H, 7.40 Hz), 1.27 (m, 2H), 1.68 (m,
1-Butyl-1-methylpyrrolidinium nicotinate (42)

1-Butyl-1-methylpyrrolidinium nicotinate was prepared by the procedure described for ionic liquid (38) from 1-butyl-1-methylpyrrolidinium 4-tert-butylphenolate (10 g, 34.30 mmol) and nicotinic acid (4.22 g, 37.30 mmol) to give a colorless solid. Yield: (7.70 g, 85 %). mp: 174 ºC. 1H NMR (300 MHz, D2O): δ = 0.82 (t, 3H, 7.45 Hz), 1.25 (m, 2H), 1.65 (m, 2H), 2.10 (m, 4H), 2.93 (s, 3H), 3.19 (m, 2H), 3.39 (m, 4H), 7.48 (m, 1H), 8.68 (d, 2H, 6.35), 8.99 (s, 1H). 13C NMR (75 MHz, D2O): δ = 12.73, 19.18, 21.26, 25.05, 47.97, 64.06, 64.23, 126.47, 128.54, 140.98, 146.88, 147.48, 163.58. CHN elemental analysis for C15H24N2O2·3H2O: calculated (%): C: 63.80, H: 9.28, N: 9.92 found (%): C: 63.78, H: 9.39, N: 9.83.

1-Butyl-1-methylpyrrolidinium picolinate (43)

1-Butyl-1-methylpyrrolidinium picolinate was prepared by the procedure described for ionic liquid (38) from 1-butyl-1-methylpyrrolidinium 4-tert-butylphenolate (10 g, 34.30 mmol) and picolinic acid (3.37 g, 27.44 mmol) to give a colorless solid. Yield (7.52 g, 83 %). mp: 78 ºC. 1H NMR (300 MHz, D2O): δ = 1.28 (t, 3H, 7.35 Hz), 1.29 (m, 2H), 1.30 (m, 2H), 2.11 (m, 4H), 2.94 (s, 3H), 3.23 (m, 2H), 3.40 (m, 4H), 8.04 (m, 1H), 8.33 (t, 1H), 8.67 (m, 2H). 13C NMR (75 MHz, D2O): δ = 12.77, 19.21, 21.26, 25.05, 47.97, 64.06, 64.23, 126.47, 128.54, 140.98, 146.88, 147.48, 163.58. CHN elemental analysis for C15H24N2O2·H2O: calculated (%): C: 63.80, H: 9.28, 9.92, found (%): C: 63.69, H: 9.39, N: 9.87.

1-Butyl-1-methylpyrrolidinium nitrate (44)

1-Butyl-1-methylpyrrolidinium nitrate was prepared by the procedure described for ionic liquid (38) from 1-butyl-1-methylpyrrolidinium 4-tert-butylphenolate (10 g, 34.30 mmol) and nitric acid (65 % solution, 3.32 mL, 2.15 g, 34.30 mmol) to give a colorless liquid. Yield:
1-Butyl-1-methylpyrrolidinium hydrogen sulfate (45)

1-Butyl-1-methylpyrrolidinium hydrogen sulfate was prepared by the procedure described for ionic liquid (38) from 1-butyl-1-methylpyrrolidinium 4-tert-butylphenolate (10 g, 34.30 mmol) and sulfuric acid (95 % solution, 3.53 mL, 3.36 g, 34.30 mmol) to give a colorless liquid. Yield (6.97 g, 85 %). ¹H NMR (300 MHz, D₂O): δ = 0.85 (t, 3H, 7.38 Hz), 1.28 (m, 2H), 1.67 (m, 2H), 2.10 (m, 4H), 2.93 (s, 3H), 3.20 (m, 2H), 3.39 (m, 4H). ¹³C NMR (75 MHz, D₂O): δ = 12.72, 19.17, 21.22, 25.02, 47.95, 64.05, 64.20. CHN elemental analysis for C₉H₂₁O₄NS·3H₂O: calculated (%): C: 36.85, H: 9.28, N: 4.77, found (%): C: 36.20, H: 8.27, N: 4.34.

1-Butyl-1-methylpyrrolidinium dihydrogen phosphate (46)

1-Butyl-1-methylpyrrolidinium dihydrogen phosphate was prepared by the procedure described for ionic liquid (38) from 1-butyl-1-methylpyrrolidinium 4-tert-butylphenolate (10 g, 34.30 mmol) and phosphoric acid (85 % solution, 3.95 mL, 3.36 g, 34.30 mmol) to give a colorless liquid. Yield (6.81 g, 83 %). ¹H NMR (300 MHz, D₂O): δ = 0.81 (t, 3H, 7.31 Hz), 1.24 (m, 2H), 1.64 (m, 2H), 2.09 (m, 4H), 2.92 (s, 3H), 3.19 (m, 2H), 3.40 (m, 4H). ¹³C NMR (75 MHz, D₂O): δ = 12.77, 19.22, 21.27, 25.06, 47.96, 64.11, 64.24. CHN elemental analysis for C₉H₂₂O₄NP·H₂O: calculated (%): C: 42.02, H: 9.40, N: 5.44 found (%): C: 42.12, H: 9.50, N: 5.40.

1-Butyl-1-methylpyrrolidinium formate (47)

1-Butyl-1-methylpyrrolidinium formate was prepared by the procedure described for ionic liquid (38) from 1-butyl-1-methylpyrrolidinium 4-tert-butylphenolate (10 g, 34.30 mmol) and formic acid (7.89 g, 171.5 mmol) to give a colorless liquid. Yield (5.2 g, 81 %). ¹H NMR (300 MHz, D₂O): δ = 0.82 (t, 3H, 7.45 Hz), 1.25 (m, 2H), 1.65 (m, 2H), 2.10 (m, 4H), 2.93 (s, 3H), 3.19 (m, 2H), 3.39 (m, 4H). ¹³C NMR (75 MHz, D₂O): δ = 12.73, 19.18, 21.22, 25.02, 47.95, 64.05, 64.19. CHN elemental analysis for C₉H₂₀N₂O₃·2H₂O: calculated (%): C: 44.98, H: 10.07, N: 11.66, found (%): C: 44.87, H: 10.21, N: 11.59.
MHz, D$_2$O): δ = 0.81 (t, 3H, 7.31 Hz), 1.24 (m, 2H), 1.64 (m, 2H), 2.09 (m, 4H), 2.92 (s, 3H), 3.19 (m, 2H), 3.40 (m, 4H), 8.21 (s, 1H). $^{13}$C NMR (75 MHz, D$_2$O): δ = 12.77, 19.22, 21.27, 25.06, 47.96, 64.11, 64.24, 167.29. CHN elemental analysis for C$_{10}$H$_{21}$NO$_2$·2H$_2$O: calculated (%): C: 53.78, H:11.28, N:6.27, found (%): C: 53.91, H: 11.43, N:6.36.

1-Butyl-1-methylpyrrolidinium trifluoroacetate (48)

1-Butyl-1-methylpyrrolidinium trifluoroacetate was prepared by the procedure described for ionic liquid (38) from 1-butyl-1-methylpyrrolidinium 4-tert-butylphenolate (10 g, 34.30 mmol) and trifluoroacetic acid (3.91 g, 34.3 mmol) to give a colorless liquid. Yield (7 g, 80 %). $^1$H NMR (300 MHz, D$_2$O): δ = 0.81 (t, 3H, 7.31 Hz), 1.24 (m, 2H), 1.64 (m, 2H), 2.09 (m, 4H), 2.92 (s, 3H), 3.19 (m, 2H), 3.40 (m, 4H). $^{13}$C NMR (75 MHz, D$_2$O ): δ = 12.77, 19.18, 21.24, 21.95, 25.04, 47.98, 64.11, 64.23, 117.98(q), 162.55(q). CHN elemental analysis for C$_{11}$H$_{20}$F$_3$NO$_2$·H$_2$O: calculated (%): C: 45.35, H: 8.30, N: 4.81. found (%): C: 45.45, H: 8.04, N: 5.49.

1-Butyl-1-methylpyrrolidinium trifluoromethanesulfonate (49)

1-Butyl-1-methylpyrrolidinium trifluoromethanesulfonate was prepared by the procedure described for ionic liquid (38) from 1-butyl-1-methylpyrrolidinium 4-tert-butylphenolate (10 g, 34.30 mmol) and trifluoromethanesulfonic acid (5.14 g, 34.3 mmol) to give a colorless liquid. Yield: (8.19 g, 82 %). $^1$H NMR (300 MHz, D$_2$O): δ = 0.81 (t, 3H, 7.31 Hz), 1.24 (m, 2H), 1.64 (m, 2H), 2.09 (m, 4H), 2.92 (s, 3H), 3.19 (m, 2H), 3.40 (m, 4H), 8.21 (s, 1H). $^{13}$C NMR (75 MHz, D$_2$O): δ = 12.66, 19.11, 21.16,21.87, 24.97, 47.88, 64.11, 64.04, 117.47(q). CHN elemental analysis for C$_{10}$H$_{20}$F$_3$NO$_3$S·2H$_2$O: calculated (%): C: 36.69, 7.39,N: 4.28 found (%): C: 37.01, H: 7.61, N:4.50.