# Tris-imidazolium and benzimidazolium ionic liquids: A new class of biodegradable surfactants

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## Supplementary Information

Structural and characterization data

**Tris-((2-chloro-acetayloxy)methyl)ethane (3)**

Colourless crystals; Yield: 27.94 g (96%); m.p 42-44°C. Molecular Formula: $C_{11}H_{15}Cl_3O_6$; Mol. Wt.: 349.59; FTIR ($cm^{-1}$): 2960, 2852 $(C\text{-}H)_{Aliph}$, 1732 (C=O), 1174, 1150 (O-C), 789 (C-Cl); $^1$H-NMR (400 MHz, $CDCl_3$) δ ppm: 4.08 (s, 6H, $CH_2$-Cl), 4.04 (s, 6H, $CH_2$-O), 1.02 (s, 3H, $CH_3$); $^{13}$C-NMR (100 MHz, $CDCl_3$) δ ppm: 167.00 (C=O), 66.98 ($CH_2$-O), 40.73 ($CH_2$-Cl), 38.42 (-C-), 16.92 ($CH_3$); EIMS (m/z): 347.9 (10%)(M), 273.0 (12%), 197.0 (45%), 121.0 (66%), 90.9 (100%).

**1-Hexyl-1H-imidazole (6c)**

This compound was prepared by using 1-bromohexane (10.10 g, 8.60 mL, 61.2 mmole) to give pale yellow oil in 91% yield (8.48 g). Molecular Formula: $C_9H_{16}N_2$; Mol. Wt.: 152.24; FTIR ($cm^{-1}$): 3106 $(C\text{-}H)_{Ar}$, 2955, 2929, 2858 $(C\text{-}H)_{Aliph}$, 1506 (C=N), 1460 $(C{=}C)_{Ar}$; $^1$H-NMR (400 MHz, $CDCl_3$) δ ppm: 7.29 (s, H, $C\text{-}H_{Imidazole}$), 6.88 (s, H, $C\text{-}H_{Imidazole}$), 6.75 (s, H, $C\text{-}H_{Imidazole}$), 3.76 (t, $J$ = 7.02 Hz, 2H, α-$CH_2$), 1.64-1.56 (m, 2H, β-$CH_2$), 1.13 (bs, 6H, bulk-$CH_2$), 0.72 (t, $J$ = 6.71 Hz, 3H, ω-$CH_3$); $^{13}$C-NMR (100 MHz, $CDCl_3$) δ ppm: 136.95 ($CH_{Imidazole}$), 129.19 ($CH_{Imidazole}$), 118.75 ($CH_{Imidazole}$), 46.91 (α-$CH_2$), 31.17 (ω-2), 30.98 (bulk-$CH_2$), 26.02 (β), 22.35 (ω-1), 13.90 (ω); EIMS (m/z): 152.1 (15%)(M), 137.0 (3%), 125.1 (35%), 109.1 (6%), 96.0 (19%), 84.0 (89%), 69.0 (23%), 49.0 (100%).

**1-Octyl-1H-imidazole (6d)**

This compound was prepared by using 1-bromooctane (11.82 g, 10.65 mL, 61.2 mmole) to give pale yellow oil in 94% yield (10.37 g). Molecular Formula: $C_{11}H_{20}N_2$; Mol. Wt.: 180.29; FTIR ($cm^{-1}$): 3108 $(C\text{-}H)_{Ar}$, 2958, 2925, 2855 $(C\text{-}H)_{Aliph}$, 1677 (C=N), 1506, 1461 $(C{=}C)_{Ar}$; $^1$H-NMR (400 MHz, $CDCl_3$) δ ppm: 7.32 (s, H, $C\text{-}H_{Imidazole}$), 6.91 (s, H, $C\text{-}H_{Imidazole}$), 6.77 (s, H, $C\text{-}H_{Imidazole}$), 3.78 (t, $J$ = 7.07 Hz, 2H, α-$CH_2$), 1.66-1.59 (m, 2H, β-$CH_2$), 1.15 (bs, 10H, bulk-$CH_2$), 0.75 (t, $J$ = 7.07 Hz, 3H, ω-$CH_3$); $^{13}$C-NMR (100 MHz, $CDCl_3$) δ ppm: 137.04 ($CH_{Imidazole}$), 129.28 ($CH_{Imidazole}$), 118.77 ($CH_{Imidazole}$), 47.01 (α-$CH_2$), 31.72 (ω-2), 30.89, 29.09, 29.02 (bulk-$CH_2$), 26.52 (β), 22.60 (ω-1), 14.06 (ω); EIMS (m/z): 180.1 (45%)(M), 165.1 (10%), 151.1 (24%), 137.1 (20%), 109.1 (36%), 96.0 (40%), 82.0 (100%), 69.0 (55%), 55.0 (25%), 43.1 (18%).

**1-Decyl-1H-imidazole (6e)**

This compound was prepared by using 1-bromodecane (13.54 g, 12.65 mL, 61.2 mmole) to give pale yellow oil in 93% yield (11.86g). Molecular Formula: $C_{13}H_{24}N_2$; Mol. Wt.: 208.34; FTIR ($cm^{-1}$): 3107 (C-

H)$_{Ar}$, 2956, 2925, 2855 (C-H)$_{Aliph}$, 1678(C=N), 1506, 1461 (C=C)$_{Ar}$; $^{1}$H-NMR (400 MHz, $CDCl_3$) δ ppm: 7.38 (s, H, C-H$_{Imidazole}$), 6.97 (s, H, C-H$_{Imidazole}$), 6.83 (s, H, C-H$_{Imidazole}$), 3.85 (t, *J* = 7.07 Hz, 2H, α-$CH_2$), 1.73-1.66 (m, 2H, β-$CH_2$), 1.19 (bs, 14H, bulk-$CH_2$), 0.81 (t, *J* = 7.07Hz, 3H, ω-$CH_3$); $^{13}$C-NMR (100 MHz, $CDCl_3$) δ ppm: 137.07 (CH$_{Imidazole}$), 129.33 (CH$_{Imidazole}$), 118.79 (CH$_{Imidazole}$), 47.06 (α-$CH_2$), 31.88 (ω-2), 31.11, 29.50, 29.46, 29.28, 29.10 (bulk -$CH_2$), 26.57 (β), 22.69 (ω-1), 14.13(ω); EIMS (m/z): 207.2 (32%)($M^+$), 193.1 (9%), 179.1 (18%), 165.1 (14%), 151.1 (18%), 137.1 (23%), 123.1 (35%), 109.1 (28%), 96.0 (48%), 82.0 (100%), 69.0 (48%), 55.0 (45%), 43.1 (29%).

**1-Dodecyl-1H-imidazole (6f)**

This compound was prepared by using 1-bromododecane (15.25 g, 14.7 mL, 61.2 mmole) to give pale yellow oil in 96% yield (13.88 g). Molecular Formula: $C_{15}H_{28}N_2$; Mol. Wt.: 236.40; FTIR ($cm^{-1}$): 3010 (C-H)$_{Ar}$, 2955, 2924, 2854 (C-H)$_{Aliph}$, 1672 (C=N), 1505, 1495, 1452 (C=C)$_{Ar}$; $^{1}$H-NMR (400 MHz, $CDCl_3$) δ ppm: 7.29 (s, H, C-H$_{Imidazole}$), 6.88 (s, H, C-H$_{Imidazole}$), 6.74 (s, H, C-H$_{Imidazole}$), 3.76 (t, *J* = 7.09 Hz, 2H, α-$CH_2$), 1.64-1.57 (m, 2H, β-$CH_2$), 1.11 (bs, 18H, bulk-$CH_2$), 0.74 (t, *J* = 7.09 Hz, 3H, ω-$CH_3$); $^{13}$C-NMR (100 MHz, $CDCl_3$) δ ppm: 136.26 (CH$_{Imidazole}$), 128.89 (CH$_{Imidazole}$), 118.34 (CH$_{Imidazole}$), 46.60 (α-$CH_2$), 31.52 (ω-2), 30.70, 29.22 (2), 29.13, 29.04, 28.95, 28.68 (bulk-$CH_2$), 26.15 (β), 22.29 (ω-1), 13.71 (ω); EIMS (m/z): 235.2 (40%)($M^+$), 221.2 (32%), 207.2 (38%), 193.1 (22%), 179.1 (28%), 165.1 (14%), 151.1 (25%), 137.1 (18%), 123.1 (35%), 109.1 (30%), 96.0 (48%), 82.0 (100%), 69.0 (35%), 55.0 (45%), 43.1 (35%).

**1-Benzyl-1H-imidazole (6g)**

This compound was prepared by using benzyl bromide (10.47 g, 7.28 mL, 61.2 mmole) to give brown viscous syrup crystallized after 5-7 days. Re-crystallization from hexane gave off-white crystals in 86% yield (7.75 g); m.p 70-72°C. Molecular Formula: $C_{10}H_{10}N_2$; Mol. Wt.: 158.20; FTIR ($cm^{-1}$): 3113, 3028 (C-H)$_{Ar}$, 2942 (C-H)$_{Aliph}$, 1664, 1603, 1585 (C=N), 1505, 1495, 1449 (C=C)$_{Ar}$; $^{1}$H-NMR (400 MHz, DMSO-$d_6$) δ ppm: 7.74 (s, H, C-H$_{Imidazole}$), 7.46-7.17 (m, 6H, 5H$_{Ar}$, C-H$_{Imidazole}$), 6.90 (s, H, C-H$_{Imidazole}$), 5.18 (s, 2H, Ar-C$\underline{H}_2$-N); $^{13}$C-NMR (100 MHz, DMSO-$d_6$) δ ppm: 137.91 (-$\underline{C}_{Ar}$-$CH_2$-), 137.80 (CH$_{Imidazole}$), 129.22 (2CH$_{Ar}$), 128.89 (CH$_{Imidazole}$), 128.35 (CH$_{Ar}$), 128.05 (2CH$_{Ar}$), 120.19 (CH$_{Imidazole}$), 50.13 (Ar-$\underline{C}H_2$-); EIMS (m/z): 158.0 (15%)(M), 131.0 (10%), 118.0 (15%), 104.0 (11%), 91.0 (100%), 77.0 (7.5%), 65.0 (14%).

**1-Butyl-1H-benzimidazole (7b)**

This compound was prepared by using 1-bromobutane (8.38 g, 6.57 mL, 61.2 mmole) to give yellow oil in 83% yield (8.84 g). Molecular Formula: $C_{11}H_{14}N_2$; Mol. Wt.: 174.24; FTIR ($cm^{-1}$): 3055 (C-H)$_{Ar}$, 2955, 2930, 2855 (C-H)$_{Aliph}$, 1612 (C=N), 1494, 1450 (C=C)$_{Ar}$; $^{1}$H-NMR (400 MHz, DMSO-$d_6$) δ ppm: 8.21 (s, H, C-H$_{BImidazole}$), 7.64 (d, *J*= 8.05 Hz, H, C-H$_{Ar}$), 7.58 (d, *J*= 8.05 Hz, H, C-H$_{Ar}$), 7.26-7.16 (m, 2H, CH$_{Ar}$), 4.23 (t, *J*= 7.07 Hz, 2H, α-$CH_2$), 1.72-1.79 (m, 2H, β-$CH_2$), 1.28-1.18 (m, 2H, (ω-1)), 0.87 (t, *J* =7.23 Hz, 3H, ω-$CH_3$); $^{13}$C-NMR (100 MHz, DMSO-$d_6$) δ ppm: 144.49 (CH$_{BImidazole}$), 144.07 (C$_{Ar}$), 134.35 (C$_{Ar}$), 122.68 (CH$_{Ar}$), 121.85 (CH$_{Ar}$), 119.97 (CH$_{Ar}$), 110.82 (CH$_{Ar}$), 44.30 (α-$CH_2$), 31.98 (ω-2), 19.87 (ω-1),

13.86 (ω); EIMS (m/z): 174.1 (50%)(M), 159.0 (12%), 145.0 (18%), 131.0 (100%), 118.0 (30%), 104.0 (12%), 90.0 (10%) 77.0 (25%).

**1-Hexyl-1H-benzimidazole (7c)**

This compound was prepared by using 1-bromohexane (10.10 g, 8.63 mL, 61.2 mmole) to give yellow oil in 88% yield (10.90 g). Molecular Formula: $C_{13}H_{18}N_2$; Mol. Wt.: 202.30; FTIR ($cm^{-1}$): 3058 $(C\text{-}H)_{Ar}$, 2954, 2928, 2857 $(C\text{-}H)_{Aliph}$, 1615 (C=N), 1494, 1457 $(C{=}C)_{Ar}$; $^1$H-NMR (400 MHz, DMSO-$d_6$) δ ppm: 8.23 (s, H, $C\text{-}H_{BImidazole}$), 7.69 (d, *J*= 7.56 Hz, H, $C\text{-}H_{Ar}$), 7.54 (d, *J*= 7.56 Hz, H, $C\text{-}H_{Ar}$), 7.25-7.17 (m, 2H, $CH_{Ar}$), 4.18 (t, *J*= 7.07 Hz, 2H, α-$CH_2$), 1.76-1.69 (m, β-$CH_2$), 1.18 (bs, 6H, bulk-$CH_2$), 0.78 (t, *J* = 6.34 Hz, 3H, ω-$CH_3$); $^{13}$C-NMR (100 MHz, DMSO-$d_6$) δ ppm: 143.86 ($CH_{BImidazole}$), 143.55 ($C_{Ar}$), 133.77 ($C_{Ar}$), 122.05 ($CH_{Ar}$), 121.22 ($CH_{Ar}$), 119.40 ($CH_{Ar}$), 110.17 ($CH_{Ar}$), 44.02 (α-$CH_2$), 30.67 (ω-2), 29.32 (bulk-$CH_2$), 25.73 (β), 21.93 (ω-1), 13.78 (ω); EIMS (m/z): 202.1 (43%)(M), 187.1 (5%), 173.1 (18%), 159.0 (15%), 145.0 (15%), 131.0 (100%), 118.0 (19%), 104.0 (12%), 90.0 (7%) 77.0 (17%).

**1-Octyl-1H-benzimidazole (7d)**

This compound was prepared by using 1-bromooctane (11.82 g, 10.65 mL, 61.2 mmole) to give yellow oil in 90% yield (12.69 g). Molecular Formula: $C_{15}H_{22}N_2$; Mol. Wt.: 230.35; FTIR ($cm^{-1}$): 3058$(C\text{-}H)_{Ar}$, 2955, 2925, 2854 $(C\text{-}H)_{Aliph}$, 1615 (C=N), 1494, 1458 $(C{=}C)_{Ar}$; $^1$H-NMR (400 MHz, DMSO-$d_6$) δ ppm: 8.21 (s, H, $C\text{-}H_{BImidazole}$), 7.64 (d, *J*= 7.07 Hz, H, $C\text{-}H_{Ar}$), 7.56 (d, *J*= 7.07 Hz, H, $C\text{-}H_{Ar}$), 7.25-7.16 (m, 2H, $CH_{Ar}$), 4.20 (t, *J*= 7.07 Hz, 2H, α-$CH_2$), 1.79-1.72 (m, β-$CH_2$), 1.17 (bs, 10H, bulk-$CH_2$), 0.80 (t, *J* = 7.07 Hz, 3H, ω-$CH_3$); $^{13}$C-NMR (100 MHz, DMSO-$d_6$) δ ppm: 144.39 ($CH_{BImidazole}$), 144.06 ($C_{Ar}$), 134.29 ($C_{Ar}$), 122.60 ($CH_{Ar}$), 121.77 ($CH_{Ar}$), 119.94 ($CH_{Ar}$), 110.69 ($CH_{Ar}$), 44.58 (α-$CH_2$), 31.72 (ω-2), 29.92, 29.14, 29.05 (bulk-$CH_2$), 26.66 (β), 22.59 (ω-1), 14.32 (ω); EIMS (m/z): 230.1 (40%)(M), 215.1 (9%), 201.1 (12%), 187.1 (24%), 173.1 (39%), 159.0 (25%), 145.0 (39%), 131.0 (100%), 118.0 (47%), 104.0 (17%), 90.0 (9%), 77.0 (22%).

**1-Decyl-1H-benzimidazole (7e)**

This compound was prepared by using 1-bromodecane (13.53 g, 12.65 mL, 61.2 mmole) to give a yellow semi-solid in 91% yield (14.38 g). Molecular Formula: $C_{17}H_{26}N_2$; Mol. Wt.: 258.40; FTIR ($cm^{-1}$): 3057 $(C\text{-}H)_{Ar}$, 2954, 2923, 2853 $(C\text{-}H)_{Aliph}$, 1615 (C=N), 1494,1458 $(C{=}C)_{Ar}$; $^1$H-NMR (400 MHz, DMSO-$d_6$) δ ppm: 8.20 (s, H, $C\text{-}H_{BImidazole}$), 7.64 (d, *J*= 7.32 Hz, H, $C\text{-}H_{Ar}$), 7.56 (d, *J*= 7.32 Hz, H, $C\text{-}H_{Ar}$), 7.25-7.16 (m, 2H, $CH_{Ar}$), 4.21 (t, *J*= 7.16 Hz, 2H, α-$CH_2$), 1.79- 1.72 (m, 2H, β-$CH_2$), 1.18 (bs, 14H, bulk-$CH_2$), 0.82 (t, *J* = 7.07 Hz, 3H, ω-$CH_3$); $^{13}$C-NMR (100 MHz, DMSO-$d_6$) δ ppm: 144.34 ($CH_{BImidazole}$), 143.40 ($C_{Ar}$), 134.05 ($C_{Ar}$), 122.93 ($CH_{Ar}$), 122.13 ($CH_{Ar}$), 119.73 ($CH_{Ar}$), 110.82 ($CH_{Ar}$), 44.63 (α-$CH_2$), 31.65 (ω-2), 29.69, 29.56, 29.24, 29.02, 28.88 (bulk-$CH_2$), 26.43 (β), 22.48 (ω-1), 14.30 (ω); EIMS (m/z): 258.2 (60%)(M), 243.2 (16%), 229.1 (32%), 215.1 (27%), 201.1 (30%), 187.1 (36%), 173.1 (53%), 159.1 (39%), 145.0 (50%), 131.0 (100%), 118.0 (70%), 104.0 (21%), 90.0 (10%), 77.0 (25%).

**1-Dodecyl-1H-benzimidazole (7f)**

This compound was prepared by using 1-bromododecane (15.25 g, 14.70 mL, 61.2 mmole) to give yellow semi-solid in 94% yield (16.48 g). Molecular Formula: $C_{19}H_{30}N_2$; Mol. Wt.: 286.45; FTIR ($cm^{-1}$): 3055 $(C\text{-}H)_{Ar}$, 2958, 2924, 2857 $(C\text{-}H)_{Aliph}$, 1612 (C=N), 1496, 1458 $(C{=}C)_{Ar}$; $^1$H-NMR (400 MHz, $CDCl_3$) δ ppm: 7.84 (s, H, $C\text{-}H_{BImidazole}$), 7.82-7.77 (m, H, $C\text{-}H_{Ar}$), 7.37-7.34 (m, H, $C\text{-}H_{Ar}$), 7.29-7.23 (m, 2H, $CH_{Ar}$), 4.09 (t, *J*= 7.09 Hz, 2H, α-$CH_2$), 1.87-1.80 (m, 2H, β-$CH_2$), 1.23 (bs, 18H, (bulk-$CH_2$)), 0.87 (t, *J* = 7.09 Hz, 3H, ω-$CH_3$). $^{13}$C-NMR (100 MHz, $CDCl_3$) δ ppm: 143.75 ($C_{Ar}$), 142.74 ($CH_{BImidazole}$), 133.68 ($C_{Ar}$), 122.57 ($CH_{Ar}$), 121.78 ($CH_{Ar}$), 120.17 ($CH_{Ar}$), 109.49 ($CH_{Ar}$), 44.89 (α-$CH_2$), 31.74 (ω-2), 29.62, 29.42 (2), 29.43, 29.25, 29.16, 28.91 (bulk-$CH_2$), 26.63 (β), 22.51 (ω-1), 13.94 (ω). EIMS (m/z): 286.2 (62%)(M), 271.2 (18%), 257.2 (30%), 243.2 (32%), 229.1 (30%), 215.1 (32%), 201.1 (57%), 187.1 (40%), 173.1 (50%), 159.1 (40%), 145.0 (55%), 131.0 (100%), 118.0 (60%), 104.0 (21%), 90.0 (10%), 77.0 (20%).

**1-Benzyl-1H-benzimidazole (7g)**

This compound was prepared by using benzyl bromide (10.47 g, 7.28 mL, 61.2 mmole) to give a brown solid re-crystallized from hexane gave off-white crystals in 90% yield (11.47 g); m.p 108-110°C. Molecular Formula: $C_{14}H_{12}N_2$; Mol. Wt.: 208.26; FTIR ($cm^{-1}$): 3081, 3032 $(C\text{-}H)_{Ar}$, 2944 $(C\text{-}H)_{Aliph}$, 1666, 1613 (C=N), 1493, 1451, 1442 $(C{=}C)_{Ar}$; $^1$H-NMR (400 MHz, DMSO-$d_6$) δ ppm: 8.41 (s, H, $C\text{-}H_{BImidazole}$), 7.67-7.64 (m, H, $C\text{-}H_{Ar}$), 7.51-7.49 (m, H, $C\text{-}H_{Ar}$), 7.34-7.14 (m, 7H, $C\text{-}H_{Ar}$), 5.49 (s, 2H, Ar-C$\underline{H}_2$-N); $^{13}$C-NMR (100 MHz, DMSO-$d_6$) δ ppm: 144.21 ($CH_{BImidazole}$), 143.57 ($C_{BImidazole}$), 136.93 (-$\underline{C}_{Ar}$-$CH_2$-), 133.65 ($C_{BImidazole}$), 128.67 ($2CH_{Ar}$), 127.70 ($CH_{Ar}$), 127.35 ($2CH_{Ar}$), 122.37 ($CH_{BImidazole}$), 121.56 ($CH_{BImidazole}$), 119.48 ($CH_{BImidazole}$), 110.67 ($CH_{BImidazole}$), 47.60 (Ar-$\underline{C}H_2$-); EIMS (m/z): 208.1 (58%)(M), 103.0 (3%), 91.1 (100%), 77.0 (3%), 65.0 (13%).

## Tris-((*N*-butyl-imidazoliumyl-acetayloxy)methyl)ethane chloride (8b)

This compound was prepared analogously to **8a** using tris-((2-chloro-acetayloxy)methyl)ethane (compound **3**) (1.9 g, 5.43 mmol) and 1-butylimidazole (2.02 g, 2.14 mL, 16.3 mmol) to provide a viscous hygroscopic syrup in 98% yield (3.85 g). Molecular Formula: $C_{32}H_{51}Cl_3N_6O_6$; Mol. Wt.: 722.14; FTIR ($cm^{-1}$): 3058 $(C\text{-}H)_{Ar}$, 2959, 2933, 2873 $(C\text{-}H)_{Aliph}$, 1748 (C=O), 1632 (C=N), 1564, 1464 $(C{=}C)_{Ar}$, 1199, 1165 (C-O); $^1$H-NMR (400 MHz, DMSO-$d_6$) δ ppm: 9.56 (bt~s, 3H, $C\text{-}H_{Imidazole}$, major), 9.51 (bt~s, 3H, $C\text{-}H_{Imidazole}$, minor), 9.46 (bt~s, 3H, $C\text{-}H_{Imidazole}$, minor), 7.89 (dt, *J* =6.83, 1.71 Hz, 6H, $C\text{-}H_{Imidazole}$, major), 7.85 (dt, *J* =6.83, 1.71 Hz, 6H, $C\text{-}H_{Imidazole}$, minor), 5.45 (s, 6H, O-$CH_2$, major), 5.40 (s, 6H, O-$CH_2$, minor), 4.25 (t, *J*= 7.07 Hz, 6H, α-$CH_2$, major), 4.04 (s, 6H, N-$CH_2$) 3.95 (t, J= 7.07 Hz, 6H, α-$CH_2$, minor), 1.80-1.73 (m, 6H, β-$CH_2$, major), 1.69-1.62 (m, 6H, β-$CH_2$, minor), 1.28-1.14 (m, 6H, (ω-1)), 0.93 (s, 3H, $CH_3$), 0.88 (t, J =7.32 Hz, 9H, ω-$CH_3$); $^{13}$C-NMR (100 MHz, DMSO-$d_6$) δ ppm: 166.72 (C=O), 137.44 ($CH_{Imidazole}$, major), 137.06 ($CH_{Imidazole}$, minor), 123.95 ($CH_{Imidazole}$), 122.14 ($CH_{Imidazole}$), 66.54 ($CH_2$-O), 49.60 ($CH_2$-N), 48.78 (α-$CH_2$), 38.16 (-C-), 32.56 ((ω-2), minor), 31.40 ((ω-2), major), 19.14 ((ω-1), minor), 18.79 ((ω-1), major), 16.38 ($CH_3$), 13.42 ((ω), minor), 13.32 ((ω), major); HRMS: m/z, $[M^{+3}–2H]–3Cl^–$ calcd. for $C_{32}H_{49}N_6O_6^{5+}$ : 613.3714, found: 613.3748.

### Tris-((*N*-octyl-imidazoliumyl-acetayloxy)methyl)ethane chloride (8d)

This compound was prepared analogously to **8a** using tris-((2-chloro-acetayloxy)methyl)ethane (compound **3**) (1.9 g, 5.43 mmol) and 1-octylimidazole (**6d**) (2.94 g, 16.3 mmol) to provide a viscous hygroscopic syrup in 97% yield (4.70 g). Molecular Formula: $C_{44}H_{75}Cl_3N_6O_6$; Mol. Wt.: 890.46; FTIR ($cm^{-1}$): 3058 $(C\text{-}H)_{Ar}$, 2955, 2925, 2855 $(C\text{-}H)_{Aliph}$, 1749 (C=O), 1668 (C=N), 1564, 1464 $(C{=}C)_{Ar}$, 1199, 1167 (C-O); $^1$H-NMR (400 MHz, DMSO-$d_6$) δ ppm: 9.55 (bt~s, 3H, $C\text{-}H_{Imidazole}$, major), 9.48 (bt~s, 3H, $C\text{-}H_{Imidazole}$, minor), 9.41 (bt~s, 3H, $C\text{-}H_{Imidazole}$, minor), 7.89 (dt, 6H, $J$ =8.86, 1.72 Hz, $C\text{-}H_{Imidazole}$, major), 7.85 (dt , 6H, $J$ =8.86, 1.72 Hz, $C\text{-}H_{Imidazole}$, minor), 5.45 (s, 6H, $O\text{-}CH_2$, major), 5.39 (s, 6H, $O\text{-}CH_2$, minor), 5.37 (s, 6H, $O\text{-}CH_2$, minor), 4.24 (t, $J$= 7.15 Hz, 6H, α-$CH_2$), 4.06 (bs, 6H, $N\text{-}CH_2$), 1.82-1.74 (m, 6H, β-$CH_2$), 1.24 (bs, 30H, bulk-$CH_2$), 0.95 (s, 3H, $CH_3$), 0.85 (t, $J$ =6.98 Hz, 9H, ω-$CH_3$); $^{13}$C-NMR (100 MHz, DMSO-$d_6$) δ ppm: 167.99 (C=O, major), 166.85 (C=O, minor), 137.31 ($CH_{Imidazole}$, minor), 137.21 ($CH_{Imidazole}$, major), 123.87 ($CH_{Imidazole}$), 122.05 ($CH_{Imidazole}$, minor), 121.91 ($CH_{Imidazole}$, major), 63.92 ($CH_2$-O, major), 63.05 ($CH_2$-O, minor), 49.75 ($CH_2$-N, major), 49.63 ($CH_2$-N, minor), 48.94 (α-$CH_2$, minor), 48.87 (α-$CH_2$, major), 40.62 (-C-), 31.10 (ω-2), 29.34, 28.44, 28.26 ( (bulk-$CH_2$), 25.39 (β), 22.01 (ω-1), 16.57 ($CH_3$, major), 16.42 ($CH_3$, minor), 13.89 (ω); HRMS: m/z, $[M^{+3}–2H]-3Cl^-$ calcd. for $C_{44}H_{73}N_6O_6^{5+}$: 781.5592, found: 781.5608.

### Tris-((*N*-decyl-imidazoliumyl-acetayloxy)methyl)ethane chloride (8e)

This compound was prepared analogously to **8a** using tris-((2-chloro-acetayloxy)methyl)ethane (compound **3**) (1.9 g, 5.43 mmol) and 1-decylimidazole (**6e**) (3.39 g, 16.3 mmol) to provide a viscous hygroscopic syrup in 99% yield (5.24 g).Molecular Formula: $C_{50}H_{87}Cl_3N_6O_6$; Mol. Wt.: 974.62; FTIR ($cm^{-1}$): 3058 $(C\text{-}H)_{Ar}$, 2955, 2929, 2857 $(C\text{-}H)_{Aliph}$, 1749 (C=O), 1666 (C=N), 1564, 1462 $(C{=}C)_{Ar}$, 1199, 1165 (C-O); $^1$H-NMR (400 MHz, DMSO-$d_6$) δ ppm: 9.64 (bt~s, 3H, $C\text{-}H_{Imidazole}$, major), 9.57 (bt~s, 3H, $C\text{-}H_{Imidazole}$, minor), 9.51 (bt~s, 3H, $C\text{-}H_{Imidazole}$, minor), 7.94 (t, $J$ =1.81 Hz, 6H, $C\text{-}H_{Imidazole}$, major), 7.89 (t, $J$ =1.81 Hz, 6H, $C\text{-}H_{Imidazole}$, major), 7.84 (t, $J$ =1.81 Hz, 6H, $C\text{-}H_{Imidazole}$, minor), 7.81 (t, $J$ =1.81 Hz, 6H, $C\text{-}H_{Imidazole}$, minor), 5.49 (s, 6H, $O\text{-}CH_2$, major), 5.45 (s, 6H, $O\text{-}CH_2$, minor), 5.40 (s, 6H, $O\text{-}CH_2$, minor), 4.25 (t, $J$= 7.25 Hz, 6H, α-$CH_2$, major), 4.05 (s, 6H, $N\text{-}CH_2$), 4.01 (t, 6H, $J$= 7.25 Hz, α-$CH_2$, minor), 1.82-1.75 (m, 6H, β-$CH_2$, major), 1.73-1.67 (m, 6H, β-$CH_2$, minor), 1.24 (bs, 42H, bulk-$CH_2$), 0.95 (s, 3H, $CH_3$), 0.84 (t, 9H, $J$ =6.80 Hz, ω-$CH_3$); $^{13}$C-NMR (100 MHz, DMSO-$d_6$) δ ppm: 166.72 (C=O), 137.41 ($CH_{Imidazole}$, major), 136.42 ($CH_{Imidazole}$, minor), 123.91 ($CH_{Imidazole}$), 122.04($CH_{Imidazole}$), 66.48 ($CH_2$-O), 49.52 ($CH_2$-N), 48.92 (α-$CH_2$), 38.08 (-C-), 31.15 (ω-2), 30.16 (minor), 29.40 (major), 28.53, 28.49, 28.37, 28.31 (bulk-$CH_2$), 25.76 (β, minor), 25.47 (β, major), 22.05 (ω-1), 16.39 ($CH_3$), 13.93 (ω); HRMS: m/z, $[M^{+3}–2H]-3Cl^-$ calcd. for $C_{50}H_{85}N_6O_6^{5+}$: 865.6531, found: 865.6518.

### Tris-((*N*-hexyl-benzimidazoliumyl-acetayloxy)methyl)ethane chloride (9c)

This compound was prepared analogously to **9b** using tris-((2-chloro-acetayloxy)methyl)ethane (compound **3**) (1.9 g, 5.43 mmol) and 1-hexyl-benzimidazole (**7c**) (3.30 g, 16.3 mmol) to provide a viscous hygroscopic syrup in 99% yield (5.15 g). Molecular Formula: $C_{50}H_{69}Cl_3N_6O_6$; Mol. Wt.: 956.48; FTIR ($cm^{-1}$): 3020 $(C\text{-}H)_{Ar}$, 2954, 2929, 2859 $(C\text{-}H)_{Aliph}$, 1748 (C=O), 1617(C=N), 1563, 1486, 1464 $(C{=}C)_{Ar}$, 1196, 1160 (C-O); $^1$H-NMR (400 MHz, DMSO-$d_6$) δ ppm: 10.39 (s, 3H, $C\text{-}H_{BImidazole}$, major),

10.32 (s, 3H, C-$H_{BImidazole}$, minor), 10.26 (s, 3H, C-$H_{BImidazole}$, minor), 8.15-8.09 (m, 6H, $CH_{Ar}$), 7.70-7.61 (m, 6H, $CH_{Ar}$, major), 7.31-7.24 (m, 6H, $CH_{Ar}$, minor), 5.85 (s, 6H, O-$CH_2$, major), 5.80 (s, 6H, O-$CH_2$, minor), 4.57 (t, *J*=7.07, 6H, α-$CH_2$, major), 4.29 (t, *J*=7.07, 6H, α-$CH_2$, minor), 4.03 (s, 6H, N-$CH_2$, minor), 3.99 (s, 6H, N-$CH_2$, major), 1.92-1.84 (m, 6H, β-$CH_2$), 1.26 (bs, 18H, bulk-$CH_2$), 0.86 (s, 3H, $CH_3$), 0.82 (t, 9H, overlap, ω-$CH_3$); $^{13}$C-NMR (100 MHz, DMSO-$d_6$) δ ppm: 167.13 (C=O, minor), 166.41 (C=O, major), 143.37 ($CH_{BImidazole}$), 131.50 ($C_{Ar}$), 130.61 ($C_{Ar}$), 126.74 ($CH_{Ar}$), 126.66 ($CH_{Ar}$), 114.10 ($CH_{Ar}$), 113.75 ($CH_{Ar}$), 66.29 ($CH_2$-O), 47.55 ($CH_2$-N), 46.80 (α-$CH_2$), 38.13 (-C-), 30.56 (ω-2), 28.49 (bulk-$CH_2$), 25.64 (β, minor), 25.32 (β, major), 21.87 (ω-1), 16.16 ($CH_3$, major), 16.09 ($CH_3$, minor), 13.79 (ω); HRMS: m/z, $[M^{+3}–2H]-3Cl^-$ calcd. for $C_{50}H_{67}N_6O_6^{5+}$: 847.5122, found: 847.5162.

## Tris-((*N*-octyl-benzimidazoliumyl-acetayloxy)methyl)ethane chloride (9d)

This compound was prepared analogously to **9b** using tris-((2-chloro-acetayloxy)methyl)ethane (compound **3**) (1.9 g, 5.43 mmol) and 1-octyl-benzimidazole (**7d**) (3.75 g, 16.3 mmol) to provide a viscous hygroscopic syrup in 98% yield (5.54g). Molecular Formula: $C_{56}H_{81}Cl_3N_6O_6$; Mol. Wt.: 1040.64; FTIR ($cm^{-1}$): 3134 (C-H)$_{Ar}$, 2955, 2925, 2855 (C-H)$_{Aliph}$, 1749 (C=O), 1618 (C=N), 1562, 1486 1462 (C=C)$_{Ar}$, 1199 (C-O); $^1$H-NMR (400 MHz, DMSO-$d_6$) δ ppm: 10.39 (s, 3H, C-$H_{BImidazole}$, major), 10.32 (s, 3H, C-$H_{BImidazole}$, minor), 10.26 (s, 3H, C-$H_{BImidazole}$, minor), 8.16-8.10 (m, 6H, $CH_{Ar}$), 7.70-7.61 (m, 6H, $CH_{Ar}$, major), 7.29-7.19 (m, 6H, $CH_{Ar}$, minor), 5.85 (s, 6H, O-$CH_2$, major), 5.80 (s, 6H, O-$CH_2$, minor), 4.57 (t, *J*=7.07, 6H, α-$CH_2$, major), 4.25 (t, *J*=7.07, 6H, α-$CH_2$, minor), 4.04 (s, 6H, N-$CH_2$, minor), 3.99 (s, 6H, N-$CH_2$, major), 1.92- 1.85 (m, 6H, β-$CH_2$), 1.20 (bs, 30H, bulk-$CH_2$), 0.86 (s, 3H, $CH_3$), 0.82 (t, 9H, *J*=6.80, ω-$CH_3$); $^{13}$C-NMR (100 MHz, DMSO-$d_6$) δ ppm: 167.83 (C=O, major), 166.51 (C=O, minor), 143.22 ($CH_{BImidazole}$), 131.56 ($C_{Ar}$), 130.62 ($C_{Ar}$), 126.79 ($CH_{Ar}$), 126.57 ($CH_{Ar}$), 113.86 ($CH_{Ar}$), 113.71 ($CH_{Ar}$), 64.02 ($CH_2$-O, major), 63.13 ($CH_2$-O, minor), 47.54 ($CH_2$-N), 46.77 (α-$CH_2$), 40.58 (-C-), 31.08 (ω-2), 28.42 (2), 28.31 (bulk-$CH_2$), 25.61 (β), 21.98 (ω-1), 16.55 ($CH_3$, major), 16.32 ($CH_3$, minor), 13.88 (ω); HRMS: m/z, $[M^{+3}–2H]-3Cl^-$ calcd. for $C_{56}H_{79}N_6O_6^{5+}$: 931.6061, found: 931.6144.

## Tris-((*N*-benzyl-benzimidazoliumyl-acetayloxy)methyl)ethane chloride (9g)

This compound was prepared analogously to **9b** using tris-((2-chloro-acetayloxy)methyl)ethane (compound **3**) (1.9 g, 5.43 mmol) and 1-benzyl-benzimidazole (**7g**) (3.39 g, 16.3 mmol) to provide a pale yellow hygroscopic semi-solid in 96% yield (5.08g). Molecular Formula: $C_{53}H_{51}Cl_3N_6O_6$; Mol. Wt.: 974.37 ; FTIR ($cm^{-1}$): 3120 (C-H)$_{Ar}$, 2974 (C-H)$_{Aliph}$, 1750 (C=O), 1615 (C=N), 1562, 1486, 1455 (C=C)$_{Ar}$, 1190, 1165 (C-O); $^1$H-NMR (400 MHz, DMSO-$d_6$) δ ppm: 10.30 (s, 3H, C-$H_{BImidazole}$, major), 10.23 (s, 3H, C-$H_{BImidazole}$, minor), 10.17 (s, 3H, C-$H_{BImidazole}$, minor), 8.05 (d, *J* =8.31 Hz, 3H, C-$H_{Ar}$), 7.99 (d, *J* =8.31 Hz, 3H, C-$H_{Ar}$), 7.63-7.51 (m, 12H, C-$H_{Ar}$), 7.41-7.31 (m, 9H, C-$H_{Ar}$), 5.89 (s, 6H, $CH_2$-Ar), 5.78 (s, 6H, O-$CH_2$, major), 5.74 (s, 6H, O-$CH_2$, minor), 5.67 (s, 6H, O-$CH_2$, minor), 4.03 (s, 6H, N-$CH_2$, major), 3.97 (s, 6H, N-$CH_2$, minor), 0.88 (s, 3H, $CH_3$, minor), 0.85 (s, 3H, minor), 0.81 (s, 3H, $CH_3$, major); $^{13}$C-NMR (100 MHz, DMSO-$d_6$) δ ppm: 167.19 (C=O, minor), 166.45 (C=O, major), 143.97 ($CH_{BImidazole}$, minor), 143.66 ($CH_{BImidazole}$, major), 133.93 (-$\underline{C}_{Ar}$-$CH_2$-), 131.65 ($C_{BImidazole}$), 130.34 ($C_{BImidazole}$), 129.00 (2×$CH_{Ar}$), 128.77 ($CH_{Ar}$, major), 128.70 ($CH_{Ar}$, minor), 128.35 (2×$CH_{Ar}$), 126.90 ($CH_{BImidazole}$), 126.84 ($CH_{BImidazole}$), 114.20 ($CH_{BImidazole}$), 113.96 ($CH_{BImidazole}$), 66.36 ($CH_2$-O, major),

66.19 ($CH_2$-O, minor), 49.93 ($CH_2$-N), 47.84 (Ar-$CH_2$-, minor), 47.20 (Ar-$CH_2$-, major), 38.30 (-C-), 16.21 ($CH_3$, minor), 16.13 ($CH_3$, major); HRMS: m/z, $[M^{+3}–2H]-3Cl^-$ calcd. for $C_{53}H_{49}N_6O_6^{5+}$ :865.3714, found: 865.3746.

## Tris-((*N*-butyl-imidazoliumyl-acetayloxy)methyl)ethane bis(trifluoromethylsulfonyl)amide (10b)

This compound was prepared analogously to **10a** using tris-((*N*-butyl-imidazoliumyl-acetayloxy)methyl)-ethane chloride **8b** (0.72 g, 1.0 mmole) and Lithium bis-(trifluoromethanesulphonyl)imide $LiNTf_2$ (1.0 g, 3.5 mmol) to provide a clear viscous hygroscopic liquid at room temperature in 84% yield (1.22 g). Molecular Formula: $C_{38}H_{51}F_{18}N_9O_{18}S_6$; Mol. Wt.: 1456.22; FTIR ($cm^{-1}$): 3055 $(C-H)_{Ar}$, 2960, 2935, 2872 $(C-H)_{Aliph}$, 1743 (C=O), 1642 (C=N), 1560, 1466 $(C=C)_{Ar}$, 1351, 1223 (C-F), 1360, 1152 (O=S=O), 1195, 1163 (C-O); $^1$H-NMR (400 MHz, $CD_3OD$) δ ppm: 8.97 (s, 3H, C-$H_{Imidazole}$, minor), 8.94 (s, 3H, C-$H_{Imidazole}$, major), 8.80 (s, 3H, C-$H_{Imidazole}$, minor), 7.70 (s, 3H, C-$H_{Imidazole}$), 7.60 (s, 3H, C-$H_{Imidazole}$, major), 7.50 (s, 3H, C-$H_{Imidazole}$, minor), 5.20 (s, 6H, O-$CH_2$, major), 5.19 (s, 6H, O-$CH_2$, minor), 4.26 (t, *J*= 7.28 Hz, 6H, α-$CH_2$), 4.19 (s, 6H, N-$CH_2$, major), 4.16 (s, 6H, N-$CH_2$, minor), 4.15 (s, 6H, N-$CH_2$, minor), 1.80-1.73 (m, 6H, β-$CH_2$, major), 1.92-1.83 (m, 6H, β-$CH_2$), 1.42-1.33 (m, 6H, (ω-1), 1.08 (s, 3H, $CH_3$), 0.98 (t, *J* =7.28 Hz, 9H, ω-$CH_3$); $^{13}$C-NMR (100 MHz, $CD_3OD$) δ ppm: 167.90 (C=O, minor), 167.77 (C=O, major), 138.67 ($CH_{Imidazole}$), 126.10, 122.91, 119.72, 116.54 (q, *J*=320, $CF_3$), 125.37 ($CH_{Imidazole}$), 123.69 ($CH_{Imidazole}$), 68.83 ($CH_2$-O, minor), 68.30 ($CH_2$-O, minor), 68.10 ($CH_2$-O, major), 51.03 ($CH_2$-N), 50.87 (α-$CH_2$), 40.10 (-C-), 33.39 ((ω-2), minor), 33.15 ((ω-2), major), 20.61 ((ω-1), minor), 20.52 ((ω-1), major), 17.04 ($CH_3$, major), 17.00 ($CH_3$, minor),13.83 (ω). $^{19}$F (336, MHz) δ ppm: –80.02; HRMS: m/z, $[M^{+3}–2H]-3NTF_2$ calcd. for $C_{32}H_{49}N_6O_6^{5+}$: 613.3714, found: 613.3692; m/z, $[NTF_2]$ calcd. for $C_2F_6NO_4S_2^-$: 279.9173, found: 279.9175.

## Tris-((*N*-hexyl-imidazoliumyl-acetayloxy)methyl)ethane bis(trifluoromethylsulfonyl)amide (10c)

This compound was prepared analogously to **10a** using tris-((*N*-hexyl-imidazoliumyl-acetayloxy)methyl)-ethane chloride **8c** (0.81 g, 1.0 mmole) and Lithium bis-(trifluoromethanesulphonyl)imide $LiNTf_2$ (1.0 g, 3.5 mmol) to provide a clear viscous hygroscopic liquid at room temperature in 85% yield (1.32 g). Molecular Formula: $C_{44}H_{63}F_{18}N_9O_{18}S_6$; Mol. Wt.: 1540.38; FTIR ($cm^{-1}$): 3062 $(C-H)_{Ar}$, 2950, 2931, 2845 $(C-H)_{Aliph}$, 1749 (C=O), 1644 (C=N), 1564, 1460$(C=C)_{Ar}$, 1347, 1220 (C-F), 1366, 1153 (O=S=O), 1185, 1185 (C-O);$^1$H-NMR (400 MHz, $CD_3OD$) δ ppm: 8.98 (bt~s, 3H, C-$H_{Imidazole}$, minor), 8.96 (bt~s, 3H, C-$H_{Imidazole}$, minor), 8.93 (bt~s, 3H, C-$H_{Imidazole}$, major), 7.69 (t, *J* =1.81 Hz, 3H, C-$H_{Imidazole}$, major), 7.63 (t, *J* =1.81 Hz, 3H, C-$H_{Imidazole}$, minor), 7.61 (t, 3H, *J* =1.81 Hz, C-$H_{Imidazole}$, minor), 7.59 (t, *J* =1.81 Hz, 3H,C-$H_{Imidazole}$, major), 5.19 (s, 6H, O-$CH_2$), 4.24 (t, *J*= 7.25 Hz, 6H, α-$CH_2$), 4.19 (s, 6H, N-$CH_2$, major), 4.14 (s, 6H, N-$CH_2$, minor), 1.93-1.86 (m, 6H, β-$CH_2$), 1.34 (bs, 18H, bulk-$CH_2$), 1.08 (s, 3H, $CH_3$), 0.90 (t, *J* =6.34 Hz, 9H, ω-$CH_3$); $^{13}$C-NMR (100 MHz, $CD_3OD$) δ ppm: 167.77 (C=O), 138.65 ($CH_{Imidazole}$), 126.15, 122.93, 119,71, 116.49 (q, *J*=320, $CF_3$), 125.37 ($CH_{Imidazole}$), 123.69 ($CH_{Imidazole}$), 68.23 ($CH_2$-O, minor), 68.15 ($CH_2$-O, major), 51.31 ($CH_2$-N), 50.89 (α-$CH_2$), 40.11(-C-), 32.35 (ω-2), 31.14 (bulk-$CH_2$), 26.99 (β-$CH_2$), 23.58 (ω-1), 17.11 ($CH_3$, minor), 17.07 ($CH_3$, major), 14.38 (ω). $^{19}$F (336, MHz) δ ppm: –80.22;

HRMS: m/z, $[M^{+3}–2H]–3NTF_2$ calcd. for $C_{38}H_{61}N_6O_6^{5+}$ : 697.4653, found: 697.4623; m/z, $[NTF_2]$ calcd. for $C_2F_6NO_4S_2^–$: 279.9173, found: 279.9177.

## Tris-((*N*-decyl-imidazoliumyl-acetayloxy)methyl)ethane bis(trifluoromethylsulfonyl)amide (10e)

This compound was prepared analogously to **10a** using tris-((*N*-decyl-imidazoliumyl-acetayloxy)methyl)-ethane chloride **8e** (0.97 g, 1.0 mmole) and Lithium bis-(trifluoromethanesulphonyl)imide $LiNTf_2$ (1.0 g, 3.5 mmol) to provide a clear viscous hygroscopic liquid at room temperature in 94% yield (1.6 g). Molecular Formula: $C_{56}H_{87}F_{18}N_9O_{18}S_6$; Mol. Wt.: 1708.70; FTIR ($cm^{-1}$): 3058 $(C-H)_{Ar}$, 2955, 2929, 2857 $(C-H)_{Aliph}$, 1749 (C=O), 1666 (C=N), 1564, 1462 $(C=C)_{Ar}$, 1340, 1210 (C-F), 1360, 1123 (O=S=O), 1199, 1165 (C-O); $^1$H-NMR (400 MHz, $CD_3OD$) δ ppm: 9.00 (bt~s, 3H, $C-H_{Imidazole}$, minor), 8.98 (bt~s, 3H, $C-H_{Imidazole}$, minor), 8.95 (bt~s, 3H, $C-H_{Imidazole}$, major), 7.70 (t, *J*=1.81, 3H, $C-H_{Imidazole}$, major), 7.65 (t, 3H, $C-H_{Imidazole}$, minor), 7.61 (t, *J*=1.81, 3H, $C-H_{Imidazole}$, major), 7.56 (t, 3H, *J*=1.81, $C-H_{Imidazole}$, minor), 5.31 (s, 6H, $O-CH_2$, minor), 5.21 (s, 6H, $O-CH_2$, major), 4.25 (t, *J*= 7.25 Hz, 6H, α-$CH_2$), 4.21 (s, 6H, $N-CH_2$), 4.19 (s, 6H, $N-CH_2$), 1.94-1.87 (m, 6H, β-$CH_2$), 1.33 (bs, 42H, bulk-$CH_2$), 1.09 (s, 3H, $CH_3$, major), 1.07 (s, 3H, $CH_3$, minor), 0.90 (t, 9H, *J* =6.80 Hz, ω-$CH_3$); $^{13}$C-NMR (100 MHz, $CD_3OD$) δ ppm: 167.80 (C=O), 138.67 ($CH_{Imidazole}$), 126.17, 122.94, 119.71, 116.49 (q, *J*=321, $CF_3$), 125.38 ($CH_{Imidazole}$), 123.70 ($CH_{Imidazole}$), 68.17 ($CH_2-O$), 51.32 ($CH_2-N$), 50.88 (α-$CH_2$), 40.12 (-C-), 33.00 (ω-2), 31.20, 30.30 (2), 30.15 (2) (bulk-$CH_2$), 27.33 (β), 23.80 (ω-1), 17.07 ($CH_3$), 14.53 (ω). $^{19}$F (336, MHz) δ ppm: –80.52; HRMS: m/z, $[M^{+3}–2H]–3NTF_2$ calcd. for $C_{50}H_{85}N_6O_6^{5+}$ 865.6531 found: 865.6512; m/z, $[NTF_2]$ calcd. for $C_2F_6NO_4S_2^–$: 279.9173, found: 279.9148.

## Tris-((*N*-butyl-benzimidazoliumyl-acetayloxy)methyl)ethane bis(trifluoromethylsulfonyl)-amide (11b)

This compound was prepared analogously to **10a** using tris-((*N*-butyl-benzimidazoliumyl-acetayloxy)-methyl) ethane chloride **9b** (0.87 g, 1.0 mmole) and Lithium bis-(trifluoromethanesulphonyl)imide $LiNTf_2$ (1.0 g, 3.5 mmol) to provide a clear viscous hygroscopic liquid at room temperature in 84% yield (1.35 g). Molecular Formula: $C_{50}H_{57}F_{18}N_9O_{18}S_6$; Mol. Wt.: 1606.39; FTIR ($cm^{-1}$): 3022 $(C-H)_{Ar}$, 2950, 2942, 2863 $(C-H)_{Aliph}$, 1755(C=O), 1618(C=N), 1564, 1485, 1469 $(C=C)_{Ar}$, 1374, 1233 (C-F), 1354, 1169 (O=S=O), 1187, 1160 (C-O); $^1$H-NMR (400 MHz, DMSO-$d_6$) δ ppm: 9.94 (s, 3H, $C-H_{BImidazole}$, minor), 9.89 (s, 3H, $C-H_{BImidazole}$, minor), 9.82 (s, 3H, $C-H_{BImidazole}$), 8.10-8.04 (m, 6H, $CH_{Ar}$), 7.68-7.59 (m, 6H, $CH_{Ar}$, major), 7.27-7.22 (m, 6H, $CH_{Ar}$, minor), 5.65 (s, 6H, $O-CH_2$, minor), 5.60 (s, 6H, $O-CH_2$, major), 4.47 (t, *J*=7.07, 6H, α-$CH_2$, major), 4.27 (t, *J*=7.07, 6H, α-$CH_2$, minor), 4.01 (s, 6H, $N-CH_2$, major), 3.98 (s, 6H, $N-CH_2$, minor), 1.87-1.79 (m, 6H, β-$CH_2$, major), 1.66-1.59 (m, 6H, β-$CH_2$, minor), 1.28-1.18 (m, 6H, (ω-1)), 0.93 (s, 3H, $CH_3$), 0.87 (t, 9H, *J* =7.21 Hz, ω-$CH_3$); $^{13}$C-NMR (100 MHz, DMSO-$d_6$) δ ppm: 166.76 (C=O), 144.03 ($CH_{BImidazole}$, major), 143.867 ($CH_{BImidazole}$, minor), 132.45 ($C_{Ar}$), 128.90 ($C_{Ar}$), 125.30, 122.09, 118.88, 115.67 (q, *J*=321, $CF_3$), 125.02 ($CH_{Ar}$), 124.14 ($CH_{Ar}$), 112.85 ($CH_{Ar}$), 110.17 ($CH_{Ar}$), 68.03 ($CH_2-O$), 46.55 ($CH_2-N$), 44.03 (α-$CH_2$, minor), 43.78 (α-$CH_2$, major), 38.31 (-C-), 32.17 ((ω-2), minor), 31.90 ((ω-2), major), 18.55 ((ω-1), major), 17.95 ((ω-1), minor), 15.74 ($CH_3$), 13.23 ((ω), minor), 13.12 ((ω), major). $^{19}$F (336, MHz) δ ppm: –80.12; HRMS: m/z, $[M^{+3}–2H]–3NTF_2$ calcd. for

$C_{44}H_{55}N_6O_6^{5+}$: 763.4183, found: 763.4202; m/z, [$NTF_2$] calcd. for $C_2F_6NO_4S_2^-$: 279.9173, found: 279.9209.

## Tris-((*N*-decyl-benzimidazoliumyl-acetayloxy)methyl)ethane bis(trifluoromethylsulfonyl)-amide (11e)

This compound was prepared analogously to **10a** using tris-((*N*-decyl-benzimidazoliumyl-acetayloxy)-methyl) ethane chloride **9e** (1.12 g, 1.0 mmole) and Lithium bis-(trifluoromethanesulphonyl)imide $LiNTf_2$ (1.0 g, 3.5 mmol) to provide a clear viscous hygroscopic liquid at room temperature in 90% yield (1.67 g). Molecular Formula: $C_{68}H_{93}F_{18}N_9O_{18}S_6$; Mol. Wt.: 1858.88; FTIR ($cm^{-1}$): 3130 $(C\text{-}H)_{Ar}$, 2949, 2924, 2848 $(C\text{-}H)_{Aliph}$, 1749 (C=O), 1620 (C=N), 1566 1485, 1457 $(C{=}C)_{Ar}$, 1367, 1223 (C-F), 1360, 1165 (O=S=O), 1218, 1199 (C-O); $^1$H-NMR (400 MHz, $CD_3OD$) δ ppm: 9.54 (s, 3H, $C\text{-}H_{BImidazole}$, minor), 9.48 (s, 3H, $C\text{-}H_{BImidazole}$, minor), 9.42 (s, 3H, $C\text{-}H_{BImidazole}$, major), 8.02-7.82 (m, 6H, $CH_{Ar}$), 7.73-7.55 (m, 6H, $CH_{Ar}$), 5.51 (s, 6H, O-$CH_2$, minor), 5.50 (s, 6H, O-$CH_2$, minor), 5.48 (s, 6H, O-$CH_2$, major), 4.57 (t, *J*=7.20, 6H, α-$CH_2$, major), 4.50 (t, *J*=7.20, 6H, α-$CH_2$, minor), 4.21 (s, 6H, N-$CH_2$, major), 4.19 (s, 6H, N-$CH_2$, minor), 4.17 (s, 6H, N-$CH_2$, minor), 2.04- 1.94 (m, 6H, β-$CH_2$), 1.27 (bs, 42H, bulk-$CH_2$), 1.04 (s, 3H, $CH_3$, major), 1.02 (s, 3H, $CH_3$, minor), 0.88 (t, 9H, *J*=6.78, ω-$CH_3$); $^{13}$C-NMR (100 MHz, $CD_3OD$) δ ppm: 167.66 (C=O, major), 167.57 (C=O, minor), 144.05 ($CH_{BImidazole}$), 133.31 ($C_{Ar}$), 132.57 ($C_{Ar}$), 128.78 ($CH_{Ar}$), 128.60 ($CH_{Ar}$), 126.17, 122.95, 119.73, 116.51 (q, *J*=320, $CF_3$), 114.79 (2) ($CH_{Ar}$), 68.07 ($CH_2$-O, minor), 67.85 ($CH_2$-O, major), 46.69 ($CH_2$-N), 41.89 (α-$CH_2$, minor), 41.70 (α-$CH_2$, major), 40.50 (-C-), 33.17 (ω-2), 30.72, 30.65, 30.54, 30.25 (2) (bulk-$CH_2$), 27.58 (β), 23.85 (ω-1), 17.07 ($CH_3$, minor), 16.97 ($CH_3$, major), 14.58 (ω). $^{19}$F (336, MHz) δ ppm: –80.06; HRMS: m/z, $[M^{+3}–2H]-3NTF_2$ calcd. for $C_{62}H_{91}N_6O_6^{5+}$ : 1015.7000, found: 1015.6977; m/z, [$NTF_2$] calcd. for $C_2F_6NO_4S_2^-$: 279.9173, found: 279.9175.

## Tris-((*N*-dodecyl-benzimidazoliumyl-acetayloxy)methyl)ethane bis(trifluoromethylsulfonyl )amide (11f)

This compound was prepared analogously to **10a** using tris-((*N*-dodecyl-benzimidazoliumyl-acetayloxy)-methyl) ethane chloride **9f** (1.21 g, 1.0 mmole) and Lithium bis-(trifluoromethanesulphonyl)imide $LiNTf_2$ (1.0 g, 3.5 mmol) to provide a clear viscous hygroscopic liquid at room temperature in 96% yield (1.87 g). Molecular Formula: $C_{74}H_{105}F_{18}N_9O_{18}S_6$; Mol. Wt.: 1943.04 ; FTIR ($cm^{-1}$): 3127 $(C\text{-}H)_{Ar}$, 2965 $(C\text{-}H)_{Aliph}$, 1750 (C=O), 1622 (C=N), 1565, 1485, 1448 $(C{=}C)_{Ar}$, 1362, 1222 (C-F), 1358, 1167 (O=S=O), 1210, 1170 (C-O); $^1$H-NMR (400 MHz, $CD_3OD$) δ ppm: 9.72 (s, 3H, $C\text{-}H_{BImidazole}$, minor), 9.69 (s, 3H, $C\text{-}H_{BImidazole}$, minor), 9.65 (s, 3H, $C\text{-}H_{BImidazole}$, major), 8.00-7.91 (m, 6H, $C\text{-}H_{BImidazole}$), 7.71-7.54 (m, 6H, $C\text{-}H_{Ar}$, major), 7.40-7.31 (m, 6H, $C\text{-}H_{Ar}$, minor), 5.60 (s, 6H, O-$CH_2$, major), 5.57 (s, 6H, O-$CH_2$, minor), 4.53 (t, *J*=7.07, 6H, α-$CH_2$, major), 4.34 (t, *J*=7.07, 6H, α-$CH_2$, minor), 4.19 (s, 6H, N-$CH_2$, major), 4.16 (s, 6H, N-$CH_2$, minor), 1.98-1.92 (m, 6H, β-$CH_2$), 1.24 (bs, 54H, bulk-$CH_2$), 1.03 (s, 3H, $CH_3$, minor), 1.00 (s, 3H, $CH_3$, minor), 0.97 (s, 3H, $CH_3$, major), 0.86 (t, *J*=7.25, 9H, ω-$CH_3$); $^{13}$C-NMR (100 MHz, $CD_3OD$) δ ppm: 166.89 (C=O), 143.75 ($CH_{BImidazole}$, major), 143.51($CH_{BImidazole}$, minor), 133.10 ($C_{BImidazole}$), 130.92 ($C_{BImidazole}$), 128.08 ($CH_{Ar}$), 127.12 ($CH_{Ar}$), 126.36, 123.14, 119.92, 116.71 (q, *J*=320, $CF_3$), 114.81 ($CH_{Ar}$), 114.76 ($CH_{Ar}$), 68.37 ($CH_2$-O, minor), 68.24 ($CH_2$-O, major), 45.70 ($CH_2$-N), 40.18 (α-$CH_2$), 39.34 (-C-), 31.65 (ω-2), 29.66 (2), 29.32, 29.22, 29.03, 28.93, 28.86 (bulk-$CH_2$), 25.82 (β),

22.53 (ω-1), 16.23 ($CH_3$, minor), 16.03 ($CH_3$, major), 14.19 (ω). $^{19}F$ (336, MHz) δ ppm: –80.20; HRMS: m/z, $[M^{+3}–2H]-3NTF_2$ calcd. for $C_{68}H_{103}N_6O_6^{5+}$ : 1099.7939, found: 1099.7977; m/z, $[NTF_2]$ calcd. for $C_2F_6NO_4S_2^-$: 279.9173, found: 279.9225.

## Tris-((*N*-benzyl-benzimidazoliumyl-acetayloxy)methyl)ethane bis(trifluoromethylsulfonyl)-amide (11g)

This compound was prepared analogously to **10a** using tris-((*N*-benzyl-benzimidazoliumyl-acetayloxy)-methyl)ethane chloride **9g** (0.97 g, 1.0 mmole) and Lithium bis-(trifluoromethanesulphonyl)imide $LiNTf_2$ (1.0 g, 3.5 mmol) to provide a clear viscous hygroscopic liquid at room temperature in 96% yield (1.63 g). Molecular Formula: $C_{59}H_{51}F_{18}N_9O_{18}S_6$; Mol. Wt.: 1708.45; FTIR ($cm^{-1}$): 3127 $(C-H)_{Ar}$, 2965 $(C-H)_{Aliph}$, 1750 (C=O), 1622 (C=N), 1565, 1485, 1448 $(C=C)_{Ar}$, 1362, 1222 (C-F), 1358, 1167 (O=S=O), 1210, 1170 (C-O); $^1H$-NMR (400 MHz, DMSO-$d_6$) δ ppm: 10.44 (s, 3H, $C-H_{BImidazole}$, major), 10.30 (s, 3H, $C-H_{BImidazole}$, minor), 10.13 (s, 3H, $C-H_{BImidazole}$, minor), 8.12-8.00 (m, 6H, $C-H_{Ar}$), 7.61-7.53 (m, 12H, $C-H_{Ar}$), 7.39-7.22 (m, 9H, $C-H_{Ar}$), 5.92 (s, 6H, $CH_2$-Ar), 5.84 (s, 6H, O-$CH_2$, major), 5.79 (s, 6H, O-$CH_2$, minor), 4.04 (s, 6H, N-$CH_2$, major), 3.99 (s, 6H, N-$CH_2$, minor), 0.91 (s, 3H, $CH_3$, minor), 0.86 (s, 3H, $CH_3$, minor), 0.82 (s, 3H, $CH_3$, major); $^{13}C$-NMR (100 MHz, DMSO-$d_6$) δ ppm: 168.01 (C=O, major), 166.57 (C=O, minor), 143.48 ($CH_{BImidazole}$, major), 142.82 ($CH_{BImidazole}$, minor), 133.82 (-$\underline{C}_{Ar}$-$CH_2$-), 131.79 ($C_{BImidazole}$), 130.48 ($C_{BImidazole}$), 129.10 (2×$CH_{Ar}$), 128.87 ($CH_{Ar}$), 128.31 (2×$CH_{Ar}$), 126.98 ($CH_{BImidazole}$), 126.81 ($CH_{BImidazole}$), 124.37, 121.13, 117.90, 114.66 (q, *J*=322, $CF_3$), 114.06 ($CH_{BImidazole}$), 113.89 ($CH_{BImidazole}$), 63.33 ($CH_2$-O, major), 62.67 ($CH_2$-O, minor), 50.00 ($CH_2$-N), 47.72 (Ar-$CH_2$-, major), 47.61 (Ar-$CH_2$-, minor), 40.63 (-C-), 16.33 ($CH_3$, major), 16.08 ($CH_3$, minor). $^{19}F$ (336, MHz) δ ppm: –79.95; HRMS: m/z, $[M^{+3}–2H]-3NTF_2$ calcd. for $C_{53}H_{49}N_6O_6^{5+}$ :865.3714, found: 865.3750; m/z, $[NTF_2]$ calcd. for $C_2F_6NO_4S_2^-$: 279.9173, found: 279.9214.