

Supplementary Information

(A) Spectral characterization data for catalysts and Mannich reaction products

N,N'-Dibutyl-*N,N'*-dimethylethylenediamine: Yield 54%; Colorless liquid; ^1H -NMR (400 MHz, CDCl_3 , TMS): δ 0.91 (t, 6H, $2\text{CH}_3\text{CH}_2$), 1.28–1.33 (m, 4H, $2\text{CH}_3\text{CH}_2\text{CH}_2$), 1.41–1.47 (m, 4H, $2\text{-CH}_2\text{CH}_2\text{NCH}_3(\text{CH}_2)$), 2.23 (s, 6H, $2\text{-CH}_2\text{NCH}_2(\text{CH}_3)$), 2.30–2.34 (t, 4H, $2\text{-CH}_2\text{CH}_2\text{CH}_2\text{NCH}_3(\text{CH}_2)$), 2.47 (t, 4H, $\text{CH}_2\text{N}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{N}(\text{CH}_3)\text{CH}_2$); ^{13}C -NMR (100 MHz, CDCl_3): 14.11, 20.74, 29.46, 42.79, 55.62, 58.18.

N,N'-Dimethyl-*N,N'*-dioctylethylenediamine: Yield 60%; Colorless liquid; ^1H -NMR (400 MHz, CDCl_3 , TMS): δ 0.87 (t, 6H, $2\text{CH}_3\text{CH}_2$), 1.27–1.31 (m, 20H, $2\text{CH}_3(\text{CH}_2)_5\text{CH}_2$), 1.45 (m, 4H, $2\text{-CH}_2\text{CH}_2\text{NCH}_3(\text{CH}_2)$), 2.23 (s, 6H, $2\text{-CH}_2\text{NCH}_2(\text{CH}_3)$), 2.31–2.35 (t, 4H, $2\text{-CH}_2\text{CH}_2\text{CH}_2\text{NCH}_3(\text{CH}_2)$), 2.46 (t, 4H, $\text{CH}_2\text{N}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{N}(\text{CH}_3)\text{CH}_2$); ^{13}C -NMR (100 MHz, CDCl_3): 14.11, 22.68, 27.29, 27.61, 27.50, 29.30, 29.60, 31.87, 42.78, 55.57, 58.48.

N,N'-Didecyl-*N,N'*-dimethylethylenediamine: Yield 63%; Colorless liquid; ^1H -NMR (400 MHz, CDCl_3 , TMS): δ 0.87 (t, 6H, $2\text{CH}_3\text{CH}_2$), 1.26–1.31 (m, 28H, $2\text{CH}_3(\text{CH}_2)_7\text{CH}_2$), 1.45 (m, 4H, $2\text{-CH}_2\text{CH}_2\text{NCH}_3(\text{CH}_2)$), 2.23 (s, 6H, $2\text{-CH}_2\text{NCH}_2(\text{CH}_3)$), 2.31–2.35 (t, 4H, $2\text{-CH}_2\text{CH}_2\text{CH}_2\text{NCH}_3(\text{CH}_2)$), 2.47 (t, 4H, $\text{CH}_2\text{N}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{N}(\text{CH}_3)\text{CH}_2$); ^{13}C -NMR (100 MHz, CDCl_3): 14.07, 26.25, 27.25, 27.57, 29.31, 29.57, 29.60, 31.88, 42.72, 55.53, 58.43.

N,N'-Didodecyl-*N,N'*-dimethylethylenediamine: Yield 69%; Colorless liquid; ^1H -NMR (400 MHz, CDCl_3 , TMS): δ 0.88 (t, 6H, $2\text{CH}_3\text{CH}_2$), 1.25–1.31 (m, 36H, $2\text{CH}_3(\text{CH}_2)_9\text{CH}_2$), 1.45 (m, 4H, $2\text{-CH}_2\text{CH}_2\text{NCH}_3(\text{CH}_2)$), 2.23 (s, 6H, $2\text{-CH}_2\text{NCH}_2(\text{CH}_3)$), 2.31–2.35 (t, 4H, $2\text{-CH}_2\text{CH}_2\text{CH}_2\text{NCH}_3(\text{CH}_2)$), 2.46 (t, 4H, $\text{CH}_2\text{N}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{N}(\text{CH}_3)\text{CH}_2$); ^{13}C -NMR (100 MHz, CDCl_3): 14.09, 22.67, 27.28, 27.59, 29.35, 29.63, 29.67, 31.91, 42.75, 55.56, 56.46.

N,N'-Dimethyl-*N,N'*-ditetradecylethylenediamine: Yield 74%; White solid; m.p. 36–37 °C ^1H -NMR (400 MHz, CDCl_3 , TMS): δ 0.88 (t, 6H, $2\text{CH}_3\text{CH}_2$), 1.25–1.27 (m, 44H, $2\text{CH}_3(\text{CH}_2)_{11}\text{CH}_2$), 1.49 (m, 4H, $2\text{-CH}_2\text{CH}_2\text{NCH}_3(\text{CH}_2)$), 2.29 (s, 6H, $2\text{-CH}_2\text{NCH}_2(\text{CH}_3)$), 2.39–2.43 (t, 4H, $2\text{-CH}_2\text{CH}_2\text{CH}_2\text{NCH}_3(\text{CH}_2)$), 2.57 (t, 4H, $\text{CH}_2\text{N}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{N}(\text{CH}_3)\text{CH}_2$); ^{13}C -NMR (100 MHz, CDCl_3): 14.12, 22.70, 26.88, 27.50, 29.37, 29.57, 29.62, 29.63, 29.67, 29.69, 31.93, 42.42, 54.92, 58.19; FT-IR (KBr pellet, 4000–400 cm^{-1}) 718, 1032, 1381, 1470, 2453, 2852, 2921.

N,N'-Dihexadecyl-*N,N'*-dimethylethylenediamine: Yield 79%; White solid; m.p. 42–44 °C ^1H -NMR (400 MHz, CDCl_3 , TMS): δ 0.88 (t, 6H, $2\text{CH}_3\text{CH}_2$), 1.25–1.29 (m, 52H, $2\text{CH}_3(\text{CH}_2)_{13}\text{CH}_2$), 1.46 (m, 4H, $2\text{-CH}_2\text{CH}_2\text{NCH}_3(\text{CH}_2)$), 2.24 (s, 6H, $2\text{-CH}_2\text{NCH}_2(\text{CH}_3)$), 2.33–2.37 (t, 4H, $2\text{-CH}_2\text{CH}_2\text{CH}_2\text{NCH}_3(\text{CH}_2)$), 2.49 (t, 4H, $\text{CH}_2\text{N}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{N}(\text{CH}_3)\text{CH}_2$); FT-IR (KBr pellet, 4000–400 cm^{-1}) 718, 1032, 1381, 1470, 2453, 2852, 2921; ^{13}C -NMR (100 MHz, CDCl_3): 14.13, 22.70, 27.19, 27.59, 29.37, 29.64, 29.67, 29.71, 31.94, 42.70, 54.41, 58.40; FT-IR (KBr pellet, 4000–400 cm^{-1}) 718, 1046, 1381, 1469, 2451, 2850, 2919.

N,N'-Dimethyl-*N,N'*-distearylethylenediamine: Yield 83%; White solid; m.p. 50–52 °C ^1H -NMR (400 MHz, CDCl_3 , TMS): δ 0.88 (t, 6H, $2\text{CH}_3\text{CH}_2$), 1.25–1.29 (m, 60H, $2\text{CH}_3(\text{CH}_2)_{15}\text{CH}_2$),

1.46 (m, 4H, 2-CH₂CH₂NCH₃(CH₂)), 2.24 (s, 6H, 2-CH₂NCH₂(CH₃)), 2.33–2.36 (t, 4H, 2-CH₂CH₂CH₂NCH₃(CH₂)), 2.48 (t, 4H, CH₂N(CH₃)CH₂CH₂N(CH₃)CH₂); ¹³C-NMR (100 MHz, CDCl₃): 14.11, 22.69, 27.21, 27.58, 29.36, 29.63, 29.66, 29.70, 31.93, 42.71, 55.45, 58.41; FT-IR (KBr pellet, 4000–400 cm⁻¹) 718, 1028, 1381, 1470, 2452, 2850, 2916.

1,2-bis(N-Methyl-N-(3-sulfopropyl)-butylammonium)ethane: Yield 89%; White solid; ¹H-NMR (D₂O, TMS) 0.81 (t, 6H, 2CH₃CH₂), 1.20–1.24 (m, 4H, 2CH₃CH₂CH₂), 1.60 (m, 4H, 2-CH₂CH₂N⁺CH₃(CH₂)), 2.09 (m, 4H, 2-N⁺CH₂CH₂CH₂SO₃⁻), 2.81 (t, 4H, 2-N⁺CH₂CH₂CH₂SO₃⁻), 2.86 (s, 6H, 2-CH₂N⁺CH₂(CH₂)(CH₃)), 3.11 (t, 4H, 2-CH₂CH₂CH₂ N⁺CH₂(CH₂)(CH₃)), 3.26–3.28 (t, 4H, 2-N⁺CH₂CH₂CH₂SO₃⁻), 3.53 (t, 4H, N⁺CH₂CH₂N⁺); ¹³C-NMR (100 MHz, D₂O): 12.68, 17.73, 18.95, 23.52, 25.37, 26.85, 40.09, 49.46, 60.14; FT-IR (KBr pellet, 4000–400 cm⁻¹) 529, 606, 734, 1042, 1201, 1474, 1644, 2960.

1,2-bis(N-Methyl-N-(3-sulfopropyl)-octylammonium)ethane: Yield 84%; White solid; ¹H-NMR (D₂O, TMS) 0.76 (t, 6H, 2CH₃CH₂), 1.18–1.28 (m, 20H, 2CH₃(CH₂)₅CH₂), 1.69 (m, 4H, 2-CH₂CH₂N⁺CH₃(CH₂)), 2.14 (m, 4H, 2-N⁺CH₂CH₂CH₂SO₃⁻), 2.90 (t, 4H, 2-N⁺CH₂CH₂CH₂SO₃⁻), 3.11 (s, 6H, 2-CH₂N⁺CH₂(CH₂)(CH₃)), 3.35 (t, 4H, 2-CH₂CH₂CH₂ N⁺CH₂(CH₂)(CH₃)), 3.48–3.52 (t, 4H, 2-N⁺CH₂CH₂CH₂SO₃⁻), 3.81 (t, 4H, N⁺CH₂CH₂N⁺); ¹³C-NMR (100 MHz, D₂O): 13.35, 17.90, 21.66, 21.95, 25.27, 28.14, 28.15, 30.92, 46.74, 48.65, 53.06, 60.41, 60.52, 62.81, 62.89; FT-IR (KBr pellet, 4000–400 cm⁻¹) 529, 608, 732, 1042, 1200, 1470, 1642, 2927.

1,2-bis(N-Methyl-N-(3-sulfopropyl)-decylammonium)ethane: Yield 87%; White solid; ¹H-NMR (DMSO, TMS) 0.86 (t, 6H, 2CH₃CH₂), 1.26–1.30 (m, 28H, 2CH₃(CH₂)₇CH₂), 1.73 (m, 4H, 2-CH₂CH₂N⁺CH₃(CH₂)), 2.02 (m, 4H, 2-N⁺CH₂CH₂CH₂SO₃⁻), 3.09 (t, 4H, 2-N⁺CH₂CH₂CH₂SO₃⁻), 3.30 (s, 6H, 2-CH₂N⁺CH₂(CH₂)(CH₃)), 3.40 (t, 4H, 2-CH₂CH₂CH₂ N⁺CH₂(CH₂)(CH₃)), 3.46–3.50 (t, 4H, 2-N⁺CH₂CH₂CH₂SO₃⁻), 3.91 (t, 4H, N⁺CH₂CH₂N⁺); ¹³C-NMR (100 MHz, DMSO): 13.92, 18.39, 21.35, 22.06, 25.81, 28.51, 28.65, 28.91, 31.26, 46.78, 48.13, 59.68, 62.35.

1,2-bis(N-Methyl-N-(3-sulfopropyl)-dodecylammonium)ethane: Yield 76%; White solid; ¹H-NMR (DMSO, TMS) 0.85 (t, 6H, 2CH₃CH₂), 1.25 (m, 36H, 2CH₃(CH₂)₉CH₂), 1.72 (m, 4H, 2-CH₂CH₂N⁺CH₃(CH₂)), 2.00 (m, 4H, 2-N⁺CH₂CH₂CH₂SO₃⁻), 3.09 (t, 4H, 2-N⁺CH₂CH₂CH₂SO₃⁻), 3.30 (s, 6H, 2-CH₂N⁺CH₂(CH₂)(CH₃)), 3.33 (t, 4H, 2-CH₂CH₂CH₂ N⁺CH₂(CH₂)(CH₃)), 3.49 (t, 4H, 2-N⁺CH₂CH₂CH₂SO₃⁻), 3.86 (t, 4H, N⁺CH₂CH₂N⁺); ¹³C-NMR (100 MHz, CDCl₃): 14.15, 15.26, 22.71, 23.62, 26.20, 26.46, 28.61, 29.35, 29.42, 29.52, 29.61, 29.73, 29.81, 31.93, 32.59, 44.03, 66.05; FT-IR (KBr pellet, 4000–400 cm⁻¹) 529, 604, 732, 1040, 1199, 1469, 1645, 2925.

1,2-bis(N-Methyl-N-(3-sulfopropyl)-tetradecylammonium)ethane: Yield 89%; White solid; ¹H-NMR (CDCl₃, TMS) 0.89 (t, 6H, 2CH₃CH₂), 1.18–1.25 (m, 44H, 2CH₃(CH₂)₁₁CH₂), 1.73 (m, 4H, 2-CH₂CH₂N⁺CH₃(CH₂)), 2.18 (m, 4H, 2-N⁺CH₂CH₂CH₂SO₃⁻), 2.91 (t, 4H, 2-N⁺CH₂CH₂CH₂SO₃⁻), 2.96 (s, 6H, 2-CH₂N⁺CH₂(CH₂)(CH₃)), 3.26 (t, 4H, 2-CH₂CH₂CH₂ N⁺CH₂(CH₂)(CH₃)), 3.40–3.47 (t, 4H, 2-N⁺CH₂CH₂CH₂SO₃⁻), 3.59 (t, 4H, N⁺CH₂CH₂N⁺); ¹³C-NMR (100 MHz, CDCl₃): 14.14, 15.25, 19.75, 22.70, 23.61, 26.19, 26.73, 28.28, 29.36, 29.52, 29.61, 29.66, 29.80, 31.92, 32.43, 44.01, 47.74, 48.54, 66.06.

1,2-bis(N-Methyl-N-(3-sulfopropyl)-hexadecylammonium)ethane: Yield 90%; White solid; $^1\text{H-NMR}$ (CDCl_3 , TMS) 0.88 (t, 6H, $2\text{CH}_3\text{CH}_2$), 1.25–1.31 (m, 52H, $2\text{CH}_3(\text{CH}_2)_{13}\text{CH}_2$), 1.74 (m, 4H, $2\text{-CH}_2\text{CH}_2\text{N}^+\text{CH}_3(\text{CH}_2)$), 2.21 (m, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 2.92 (t, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 3.01 (s, 6H, $2\text{-CH}_2\text{N}^+\text{CH}_2(\text{CH}_2)(\text{CH}_3)$), 3.31 (t, 4H, $2\text{-CH}_2\text{CH}_2\text{CH}_2\text{N}^+\text{CH}_2(\text{CH}_2)(\text{CH}_3)$), 3.40–3.47 (t, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 3.68 (t, 4H, $\text{N}^+\text{CH}_2\text{CH}_2\text{N}^+$); $^{13}\text{C-NMR}$ (100 MHz, CDCl_3): 14.15, 18.79, 22.53, 22.71, 23.62, 24.17, 26.20, 26.61, 28.65, 29.16, 29.41, 29.47, 29.53, 29.72, 29.79, 31.95, 32.57, 44.03, 47.57, 48.58, 66.05; FT-IR (KBr pellet, $4000\text{--}400\text{ cm}^{-1}$) 529, 606, 730, 1042, 1198, 1469, 1643, 2853, 2920.

1,2-bis(N-Methyl-N-(3-sulfopropyl)-steraylammonium)ethane: Yield 92%; White solid; $^1\text{H-NMR}$ (CDCl_3 , TMS) 0.88 (t, 6H, $2\text{CH}_3\text{CH}_2$), 1.25–1.31 (m, 60H, $2\text{CH}_3(\text{CH}_2)_{15}\text{CH}_2$), 1.74 (m, 4H, $2\text{-CH}_2\text{CH}_2\text{N}^+\text{CH}_3(\text{CH}_2)$), 2.27 (m, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 2.96 (t, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 3.31 (s, 6H, $2\text{-CH}_2\text{N}^+\text{CH}_2(\text{CH}_2)(\text{CH}_3)$), 3.26 (t, 4H, $2\text{-CH}_2\text{CH}_2\text{CH}_2\text{N}^+\text{CH}_2(\text{CH}_2)(\text{CH}_3)$), 3.40–3.45 (t, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 3.68 (t, 4H, $\text{N}^+\text{CH}_2\text{CH}_2\text{N}^+$); FT-IR (KBr pellet, $4000\text{--}400\text{ cm}^{-1}$) 529, 607, 726, 1038, 1207, 1469, 1648, 2851, 2920.

GBAIL-C₄: $^1\text{H-NMR}$ (D_2O , TMS) 0.75 (t, 6H, $2\text{CH}_3\text{CH}_2$), 1.12–1.16 (m, 4H, $2\text{CH}_3\text{CH}_2\text{CH}_2$), 1.52 (m, 4H, $2\text{-CH}_2\text{CH}_2\text{N}^+\text{CH}_3(\text{CH}_2)$), 2.03 (m, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 2.14 (s, 3H, Ar- CH_3), 2.72 (t, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 2.76 (s, 6H, $2\text{-CH}_2\text{N}^+\text{CH}_2(\text{CH}_2)(\text{CH}_3)$), 2.97 (t, 4H, $2\text{-CH}_2\text{CH}_2\text{CH}_2\text{N}^+\text{CH}_2(\text{CH}_2)(\text{CH}_3)$), 3.18–3.20 (t, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 3.35 (t, 4H, $\text{N}^+\text{CH}_2\text{CH}_2\text{N}^+$), 7.13 (d, 2H, Ar- H), 7.44 (d, 2H, Ar- H); $^{13}\text{C-NMR}$ (100 MHz, CDCl_3): 12.62, 17.17, 19.32, 20.43, 39.85, 46.61, 48.45, 60.58, 62.51, 125.29, 129.42, 139.23, 142.43.

GBAIL-C₈: $^1\text{H-NMR}$ (D_2O , TMS) 0.75 (t, 6H, $2\text{CH}_3\text{CH}_2$), 1.02–1.15 (m, 20H, $2\text{CH}_3(\text{CH}_2)_5\text{CH}_2$), 1.50 (m, 4H, $2\text{-CH}_2\text{CH}_2\text{N}^+\text{CH}_3(\text{CH}_2)$), 2.10 (m, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 2.22 (s, 3H, Ar- CH_3), 2.85 (t, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 3.07 (s, 6H, $2\text{-CH}_2\text{N}^+\text{CH}_2(\text{CH}_2)(\text{CH}_3)$), 3.26 (t, 4H, $2\text{-CH}_2\text{CH}_2\text{CH}_2\text{N}^+\text{CH}_2(\text{CH}_2)(\text{CH}_3)$), 3.45 (t, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 3.49 (t, 4H, $\text{N}^+\text{CH}_2\text{CH}_2\text{N}^+$), 7.17 (d, 2H, Ar- H), 7.56 (d, 2H, Ar- H); $^{13}\text{C-NMR}$ (100 MHz, D_2O): 13.78, 16.74, 19.96, 20.54, 22.12, 22.50, 25.68, 28.97, 29.01, 31.70, 46.94, 46.98, 48.69, 52.32, 57.38, 61.49, 61.97, 125.42, 129.22, 140.32, 141.53.

GBAIL-C₁₀: $^1\text{H-NMR}$ (D_2O , TMS) 0.78 (t, 6H, $2\text{CH}_3\text{CH}_2$), 1.02–1.13 (m, 28H, $2\text{CH}_3(\text{CH}_2)_7\text{CH}_2$), 2.11 (m, 4H, $2\text{-CH}_2\text{CH}_2\text{N}^+\text{CH}_3(\text{CH}_2)$), 2.04 (m, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 2.30 (s, 3H, Ar- CH_3), 2.85 (t, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 3.08 (s, 6H, $2\text{-CH}_2\text{N}^+\text{CH}_2(\text{CH}_2)(\text{CH}_3)$), 3.47 (t, 4H, $2\text{-CH}_2\text{CH}_2\text{CH}_2\text{N}^+\text{CH}_2(\text{CH}_2)(\text{CH}_3)$), 3.41–3.44 (t, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 3.50 (t, 4H, $\text{N}^+\text{CH}_2\text{CH}_2\text{N}^+$), 7.16 (d, 2H, Ar- H), 7.56 (d, 2H, Ar- H); $^{13}\text{C-NMR}$ (100 MHz, D_2O): 13.83, 18.03, 20.60, 22.28, 22.77, 25.87, 29.40–29.97, 32.21, 47.05, 48.75–48.89, 61.09, 61.93, 125.47, 129.18, 140.90.

GBAIL-C₁₂: $^1\text{H-NMR}$ (CDCl_3 , TMS) 0.89 (t, 6H, $2\text{CH}_3\text{CH}_2$), 1.08–1.27 (m, 36H, $2\text{CH}_3(\text{CH}_2)_9\text{CH}_2$), 1.60 (m, 4H, $2\text{-CH}_2\text{CH}_2\text{N}^+\text{CH}_3(\text{CH}_2)$), 2.31 (m, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 2.31 (s, 3H, Ar- CH_3), 3.17 (t, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 3.27 (s, 6H, $2\text{-CH}_2\text{N}^+\text{CH}_2(\text{CH}_2)(\text{CH}_3)$), (t, 3.37(4H, $2\text{-CH}_2\text{CH}_2\text{CH}_2\text{N}^+\text{CH}_2(\text{CH}_2)(\text{CH}_3)$), 3.64 (t, 4H, $2\text{-N}^+\text{CH}_2\text{CH}_2\text{CH}_2\text{SO}_3^-$), 4.00 (t, 4H, $\text{N}^+\text{CH}_2\text{CH}_2\text{N}^+$), 7.14 (d, 2H, Ar- H), 7.66 (d, 2H, Ar- H), 12.34 (m 1H, SO_3H); $^{13}\text{C-NMR}$ (100 MHz, CDCl_3): 14.15,

21.38, 22.71, 23.60, 26.09, 26.22, 27.55, 29.15, 29.27, 29.44, 29.62, 29.71, 29.80, 31.65, 31.93, 44.56, 49.95, 126.11, 129.33, 138.92, 142.00.

GBAIL-C₁₄: ¹H-NMR (CDCl₃, TMS) 0.86 (t, 6H, 2CH₃CH₂), 1.06–1.09 (m, 44H, 2CH₃(CH₂)₁₁CH₂), 1.55 (m, 4H, 2-CH₂CH₂N⁺CH₃(CH₂)), 2.25 (m, 4H, 2-N⁺CH₂CH₂CH₂SO₃[−]), 2.32 (s, 3H, Ar-CH₃), 2.84 (t, 4H, 2-N⁺CH₂CH₂CH₂SO₃[−]), 2.95 (s, 6H, 2-CH₂N⁺CH₂(CH₂)(CH₃)), 3.18 (t, 4H, 2-CH₂CH₂CH₂N⁺CH₂(CH₂)(CH₃)), 3.41–3.42 (t, 4H, 2-N⁺CH₂CH₂CH₂SO₃[−]), 3.50 (t, 4H, N⁺CH₂CH₂N⁺), 7.15 (d, 2H, Ar-H), 7.67 (d, 2H, Ar-H), 12.48 (m 1H, SO₃H); ¹³C-NMR (100 MHz, CDCl₃): 13.92, 18.81, 20.75, 22.05, 28.68, 28.99, 29.04, 31.26, 38.82, 40.08, 55.98, 125.45, 128.11, 137.85, 145.25.

GBAIL-C₁₆: ¹H-NMR (CDCl₃, TMS) 0.88 (t, 6H, 2CH₃CH₂), 1.20–1.29 (m, 52H, 2CH₃(CH₂)₁₃CH₂), 1.58 (m, 4H, 2-CH₂CH₂N⁺CH₃(CH₂)), 2.26 (m, 4H, 2-N⁺CH₂CH₂CH₂SO₃[−]), 2.41 (s, 3H, Ar-CH₃), 2.93 (t, 4H, 2-N⁺CH₂CH₂CH₂SO₃[−]), 3.01 (s, 6H, 2-CH₂N⁺CH₂(CH₂)(CH₃)), 3.31 (t, 4H, 2-CH₂CH₂CH₂N⁺CH₂(CH₂)(CH₃)), 3.40–3.47 (t, 4H, 2-N⁺CH₂CH₂CH₂SO₃[−]), 3.68 (t, 4H, N⁺CH₂CH₂N⁺), 7.17 (d, 2H, Ar-H), 7.70 (d, 2H, Ar-H), 12.85 (m 1H, SO₃H); ¹³C-NMR (100 MHz, CDCl₃): 14.13, 21.33, 22.70, 26.36, 29.24, 29.40, 29.57, 29.71, 29.81, 29.84, 31.95, 125.91, 129.12, 140.90; ¹³C-NMR (100 MHz, CDCl₃): 14.13, 21.35, 22.70, 29.24, 29.39, 29.58, 29.69, 29.76, 29.78, 29.18, 31.94, 125.92, 129.11, 140.89, 140.99.

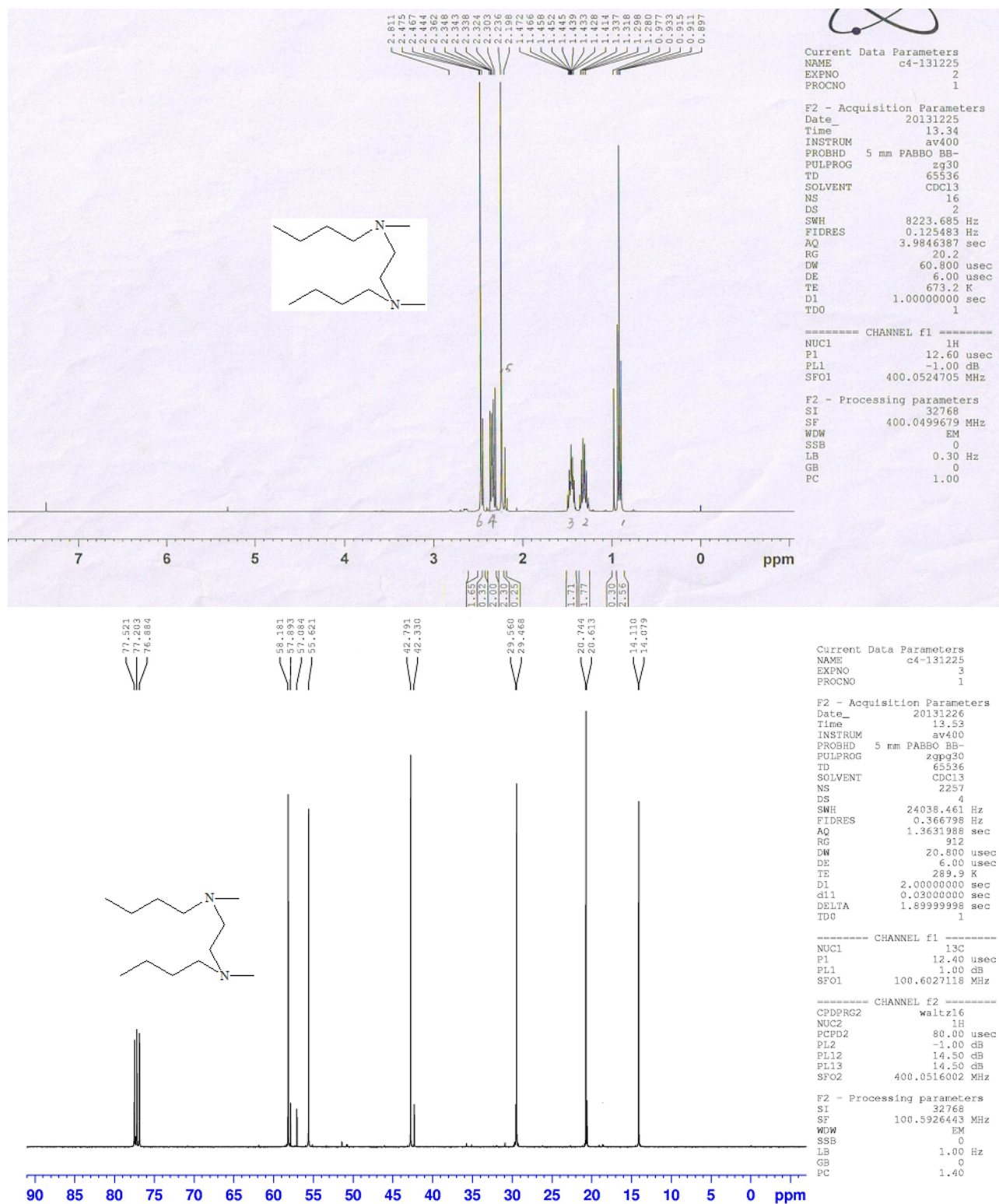
2-(Phenyl(phenylamino) methyl) cyclohexanone (Table 3, entry 1): ¹H-NMR (CDCl₃), 1.65–1.71 (m, 2H), 1.79–1.92 (m, 4H), 2.31–2.40 (m, 1H), 2.42–2.43 (m, 1H), 2.74–2.76 (m, 1H), 4.60 (d, 1H), 4.62 (s, br, 1H), 6.52–6.54 (m, 2H), 6.59–6.63 (m, 1H), 7.03–7.07 (m, 2H), 7.18–7.23 (m, 1H), 7.26–7.30 (m, 2H), 7.35–7.37 (m, 2H); ¹³C-NMR (100 MHz, CDCl₃): 23.67, 27.91, 31.92, 41.80, 57.45, 58.08, 113.70, 117.61, 127.20, 127.30, 128.49, 141.64, 147.13, 212.90.

2-(Phenyl(4-chlorophenylamino)methyl) cyclohexanone (Table 3, entry 2): ¹H-NMR (CDCl₃), 1.63–1.69 (m, 2H), 1.79–1.96 (m, H), 2.33–2.45 (m, 2H), 2.83–2.84 (m, 1H), 4.53 (d, 1H), 6.45–6.49 (m, 2H), 6.99–7.02 (m, 2H), 7.20–7.27 (m, 7H); ¹³C-NMR (100 MHz, CDCl₃): 23.86, 23.89, 24.85, 41.99, 56.39, 57.14, 115.27, 122.21, 127.30, 128.34–128.91, 129.24, 144.35, 150.48.

2-(4-Nitrophenyl(phenylamino)methyl) cyclohexanone (Table 3, entry 6): ¹H-NMR (CDCl₃), 1.72–1.79 (m, 2H), 1.92–2.06 (m, 4H), 2.32–2.42 (m, 2H), 2.83–2.86 (m, 1H), 4.70 (d, 1H), 4.86 (s, br, 1H), 6.48–6.51 (m, 2H), 6.53–6.69 (m, 1H), 7.06–7.10 (m, 2H), 7.52–7.58 (m, 2H), 8.13–8.15 (m, 2H); ¹³C-NMR (100 MHz, CDCl₃): 23.90, 28.09, 33.80, 40.61, 41.98, 55.37, 55.99, 113.96, 118.33, 127.97, 128.92, 129.29, 138.77, 146.70.

2-(2-Chlorophenyl(phenylamino)methyl) cyclohexanone (Table 3, entry 7): ¹H-NMR (CDCl₃), 1.73–1.79 (m, 2H), 1.94–2.08 (m, 4H), 2.29–2.38 (m, 2H), 2.91–2.95 (m, 1H), 4.90 (d, 1H), 5.41 (s, br, 1H), 6.51–6.53 (m, 2H), 6.61–6.64 (m, 1H), 7.05–7.19 (m, 4H), 7.24–7.33 (m, 1H), 7.55–7.57 (m, 1H); ¹³C-NMR (100 MHz, CDCl₃): 24.80, 28.09, 32.66, 42.83, 55.48, 113.48, 117.71, 127.07, 128.26, 129.00, 129.17, 129.28, 133.33, 139.02, 146.71, 213.19.

(B) Copies of NMR spectra for intermediate materials and GBaILs

Figure S1. Copies of NMR spectra for *N,N'*-dimethyl-*N,N'*-dialkylethylenediamine.

Chemical Structure:

CN(CCCCCCCC)CCN(CCCCCCCC)C

¹H NMR Spectrum (CDCl₃):

Peak list (ppm): 7.267, 2.467, 2.395, 2.385, 2.335, 2.315, 2.234, 2.199, 1.494, 1.475, 1.458, 1.400, 1.311, 1.274, 0.895, 0.879, 0.861, 0.000.

Integration values: 2.03, 2.04, 2.92, 2.06, 10.10, 3.09.

¹³C NMR Spectrum (CDCl₃):

Peak list (ppm): 77.367, 77.049, 76.732, 58.482, 55.572, 42.783, 31.870, 29.602, 29.502, 27.618, 27.291, 22.680, 14.112.

Current Data Parameters:

NAME: San-140122
EXPNO: 1
PROCNO: 1

F2 - Acquisition Parameters:

Date_: 20140122
Time: 8.46
INSTRUM: av400
PROBHD: 5 mm PABBO BB-
PULPROG: zg30
TD: 65536
SOLVENT: CDCl3
NS: 16
DS: 2
SWH: 8223.685 Hz
FIDRES: 0.125483 Hz
AQ: 3.9846387 sec
RG: 64
DM: 60.800 usec
DE: 6.00 usec
TE: 673.2 K
D1: 1.00000000 sec
TDO: 1

Channel f1:

NUC1: 1H
P1: 12.60 usec
PL1: -1.00 dB
SF01: 400.0524705 MHz

F2 - Processing parameters:

SI: 32768
SF: 400.0500011 MHz
WDW: EM
SSB: 0
LB: 0.30 Hz
GB: 0
PC: 1.00

Current Data Parameters:

NAME: San-13C-140122
EXPNO: 1
PROCNO: 1

F2 - Acquisition Parameters:

Date_: 20140127
Time: 11.30
INSTRUM: av400
PROBHD: 5 mm PABBO BB-
PULPROG: zgpg30
TD: 65536
SOLVENT: CDCl3
NS: 2285
DS: 4
SWH: 24038.461 Hz
FIDRES: 0.366798 Hz
AQ: 1.3631988 sec
RG: 912
DM: 20.800 usec
DE: 6.00 usec
TE: 673.2 K
D1: 2.00000000 sec
d11: 0.03000000 sec
DELTA: 1.89999998 sec
TDO: 1

Channel f1:

NUC1: 13C
P1: 12.40 usec
PL1: 1.00 dB
SF01: 100.6027118 MHz

Channel f2:

CPDPRG2: waltz16
NUC2: 1H
PCPD2: 80.00 usec
PL2: -1.00 dB
PL12: 14.50 dB
PL13: 14.50 dB
SF02: 400.0516002 MHz

F2 - Processing parameters:

SI: 32768
SF: 100.5926504 MHz
WDW: EM
SSB: 0
LB: 1.00 Hz
GB: 0
PC: 1.40

Figure S1. Cont.

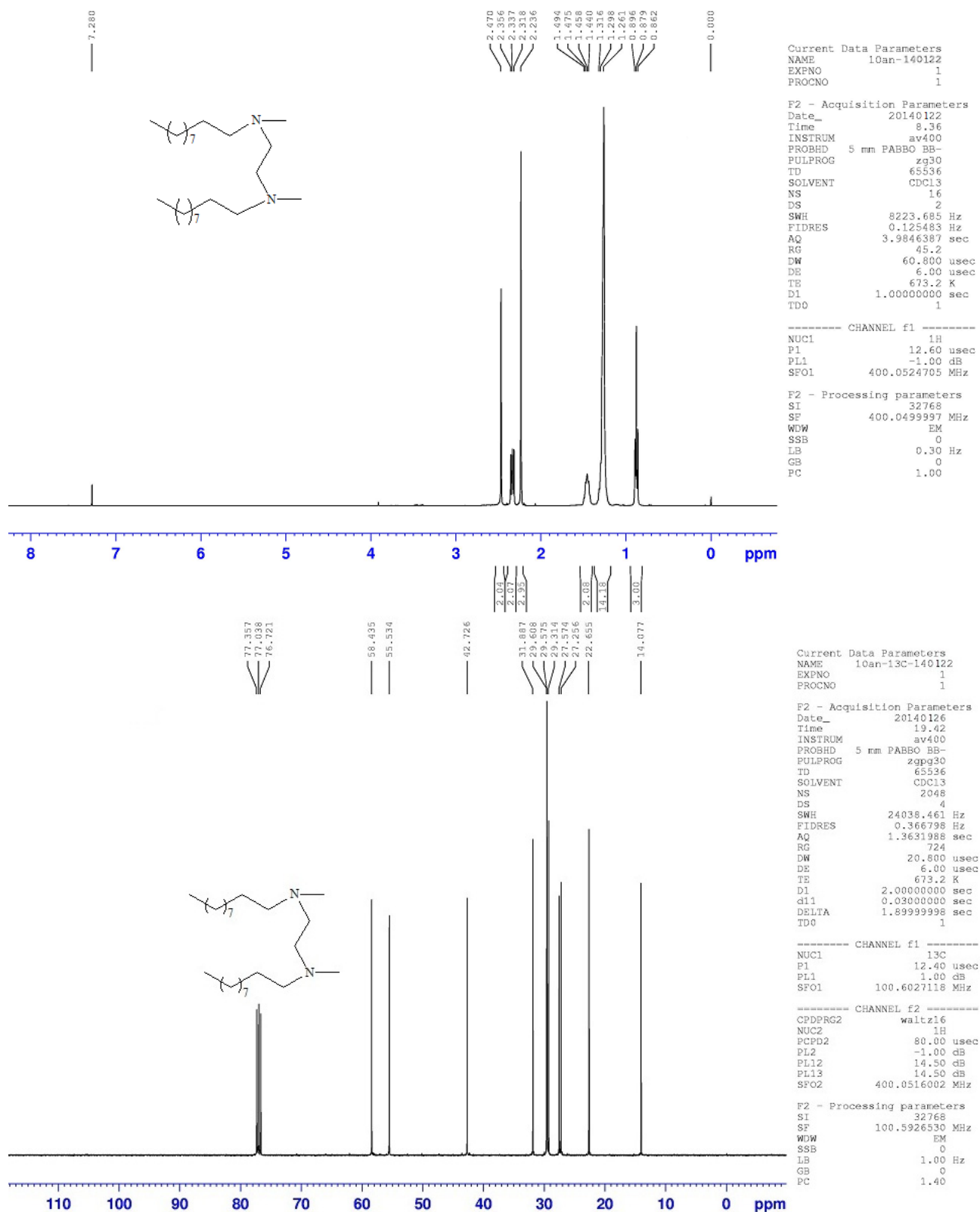


Figure S1. Cont.

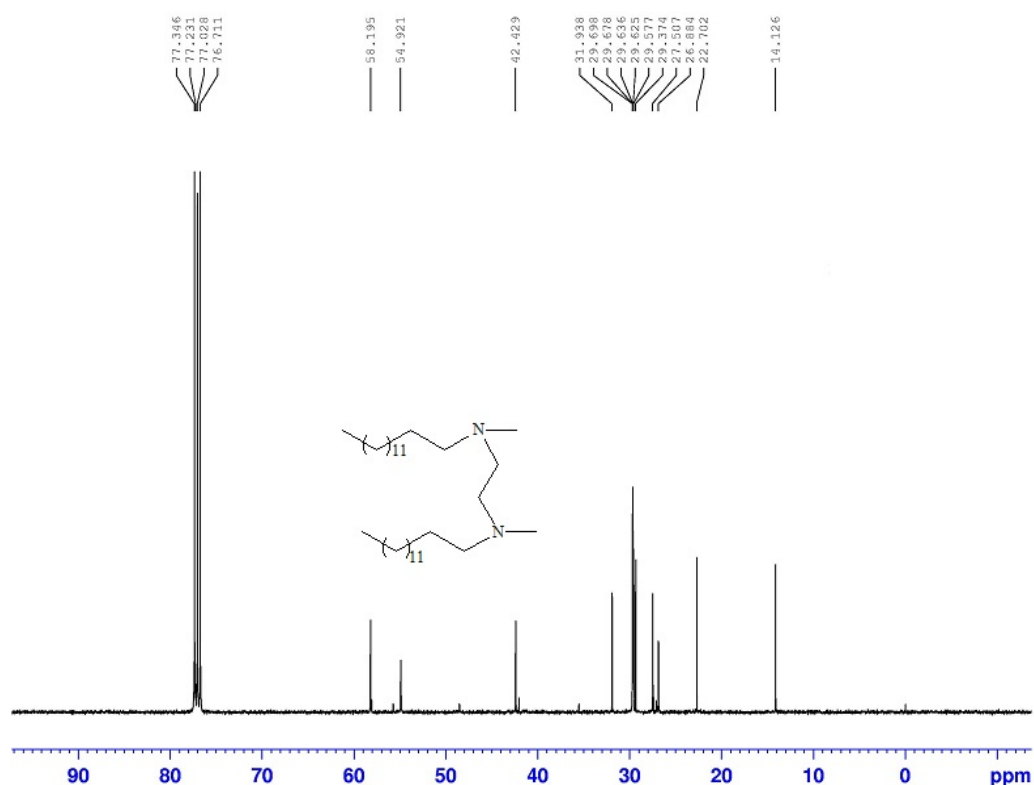
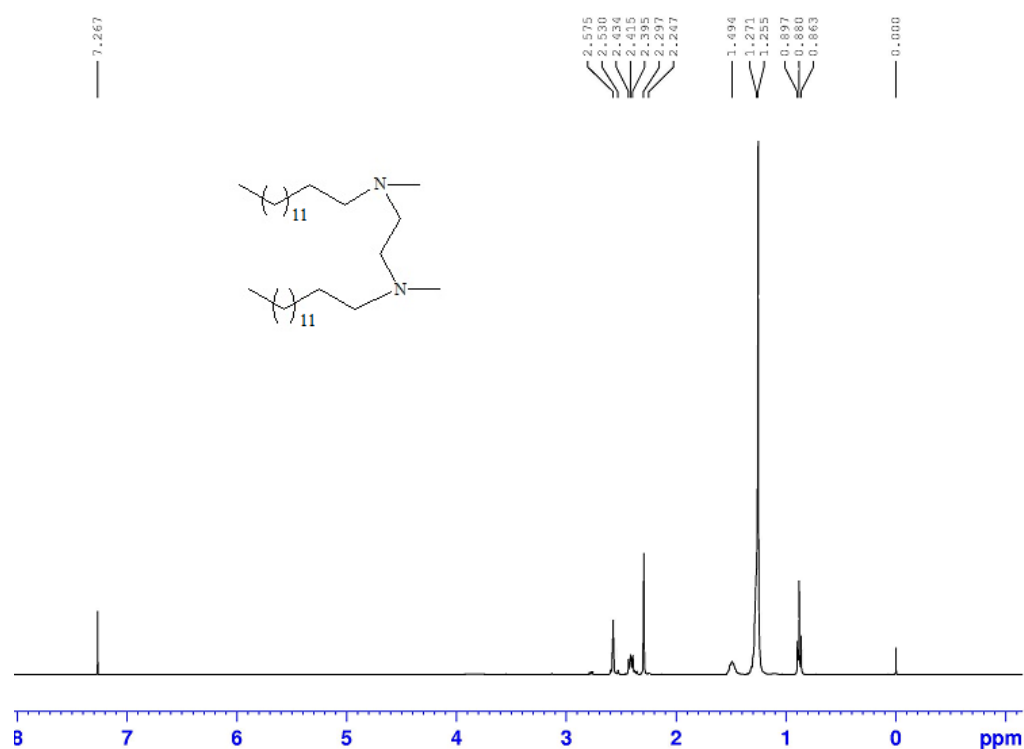
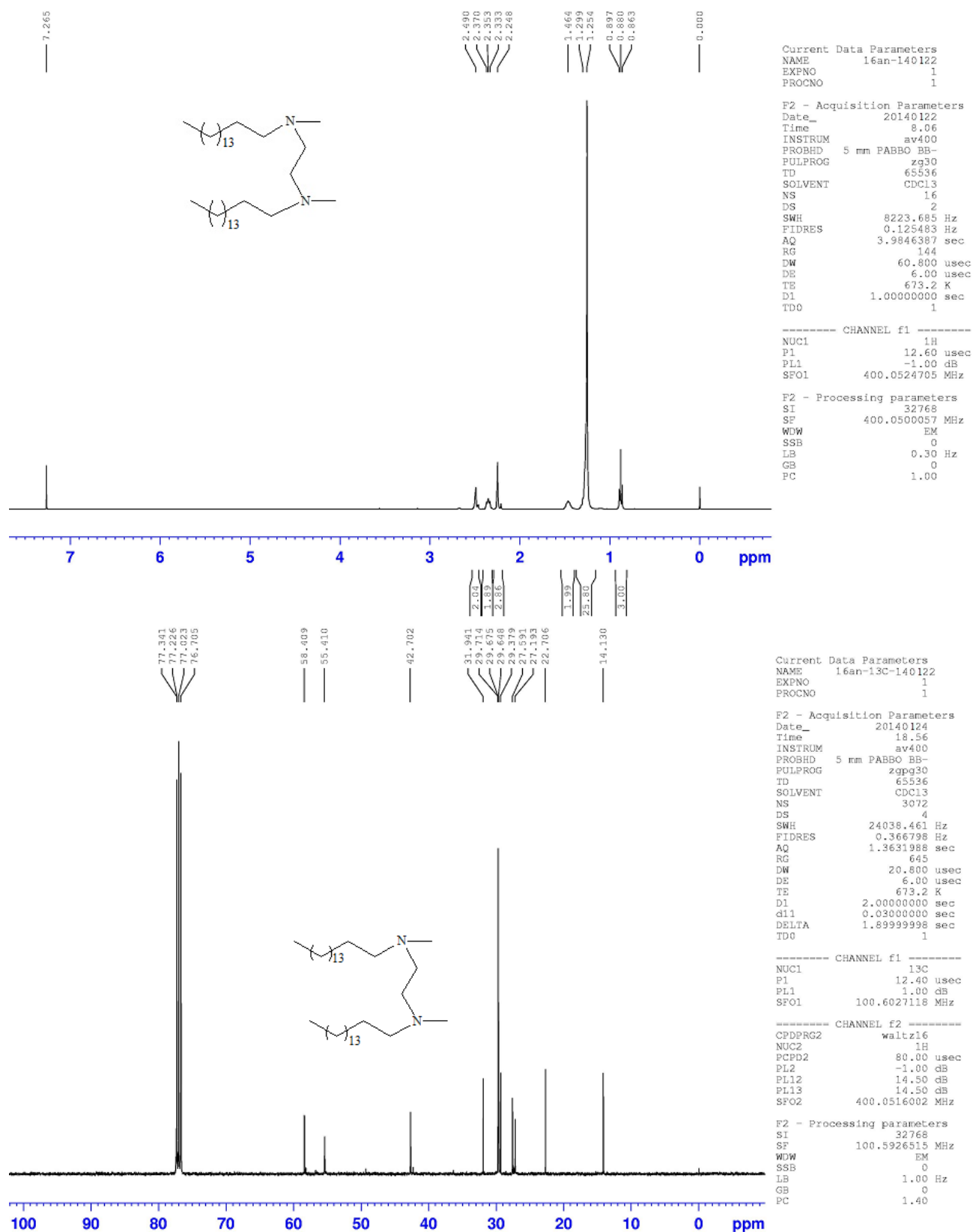


Figure S1. Cont.



7.265

2.488
2.369
2.360
2.330
2.247

1.462
1.299
1.254
0.896
0.880
0.862

0.000

Current Data Parameters
NAME 18an-140122
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20140122
Time 7.55
INSTRUM av400
PROBHD 5 mm PABBO BB-
PULPROG zg30
TD 65536
SOLVENT CDCl3
NS 16
DS 2
SWH 8223.685 Hz
FIDRES 0.125483 Hz
AQ 3.9846387 sec
RG 128
DW 60.800 usec
DE 6.00 usec
TE 673.2 K
D1 1.00000000 sec
TD0 1

----- CHANNEL f1 -----
NUC1 1H
P1 12.60 usec
PL1 -1.00 dB
SFO1 400.0524705 MHz

F2 - Processing parameters
SI 32768
SF 400.0500055 MHz
WDW EM
SSB 0
LB 0.30 Hz
GB 0
PC 1.00

7 6 5 4 3 2 1 0 ppm

77.328
77.010
76.693

58.419
55.451

42.719

31.930
29.705
29.664
29.635
29.385
27.298
22.692
29.935

14.116

Current Data Parameters
NAME 18an-13C-140122
EXPNO 1
PROCNO 1

F2 - Acquisition Parameters
Date_ 20140123
Time 7.55
INSTRUM av400
PROBHD 5 mm PABBO BB-
PULPROG zgpg30
TD 65536
SOLVENT CDCl3
NS 2549
DS 4
SWH 24038.461 Hz
FIDRES 0.366798 Hz
AQ 1.3631988 sec
RG 812
DW 20.800 usec
DE 6.00 usec
TE 673.2 K
D1 2.00000000 sec
d11 0.03000000 sec
DELTA 1.89999998 sec
TD0 1

----- CHANNEL f1 -----
NUC1 13C
P1 12.40 usec
PL1 -1.00 dB
SFO1 100.6027118 MHz

----- CHANNEL f2 -----
CPDPRG2 waltz16
NUC2 1H
PCPD2 80.00 usec
PL2 -1.00 dB
PL12 14.50 dB
PL13 14.50 dB
SFO2 400.0516002 MHz

F2 - Processing parameters
SI 32768
SF 100.5926330 MHz
WDW EM
SSB 0
LB 1.00 Hz
GB 0
PC 1.40

110 100 90 80 70 60 50 40 30 20 10 0 ppm

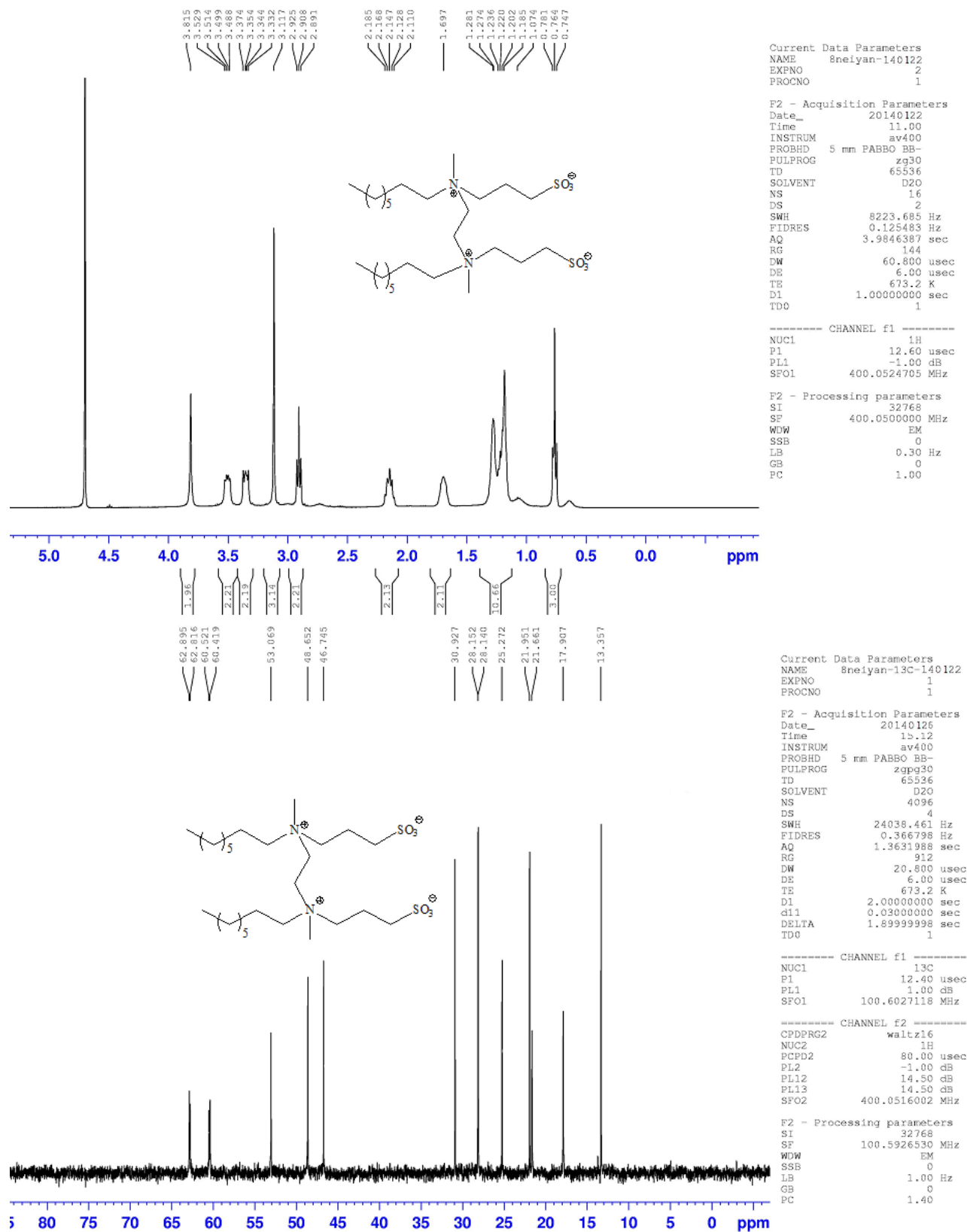
Figure S2. Copies of NMR spectra for 1,2-bis(*N*-methyl-*N*-(3-sulfopropyl)-alkyl ammonium)ethane.

Figure S2. Cont.

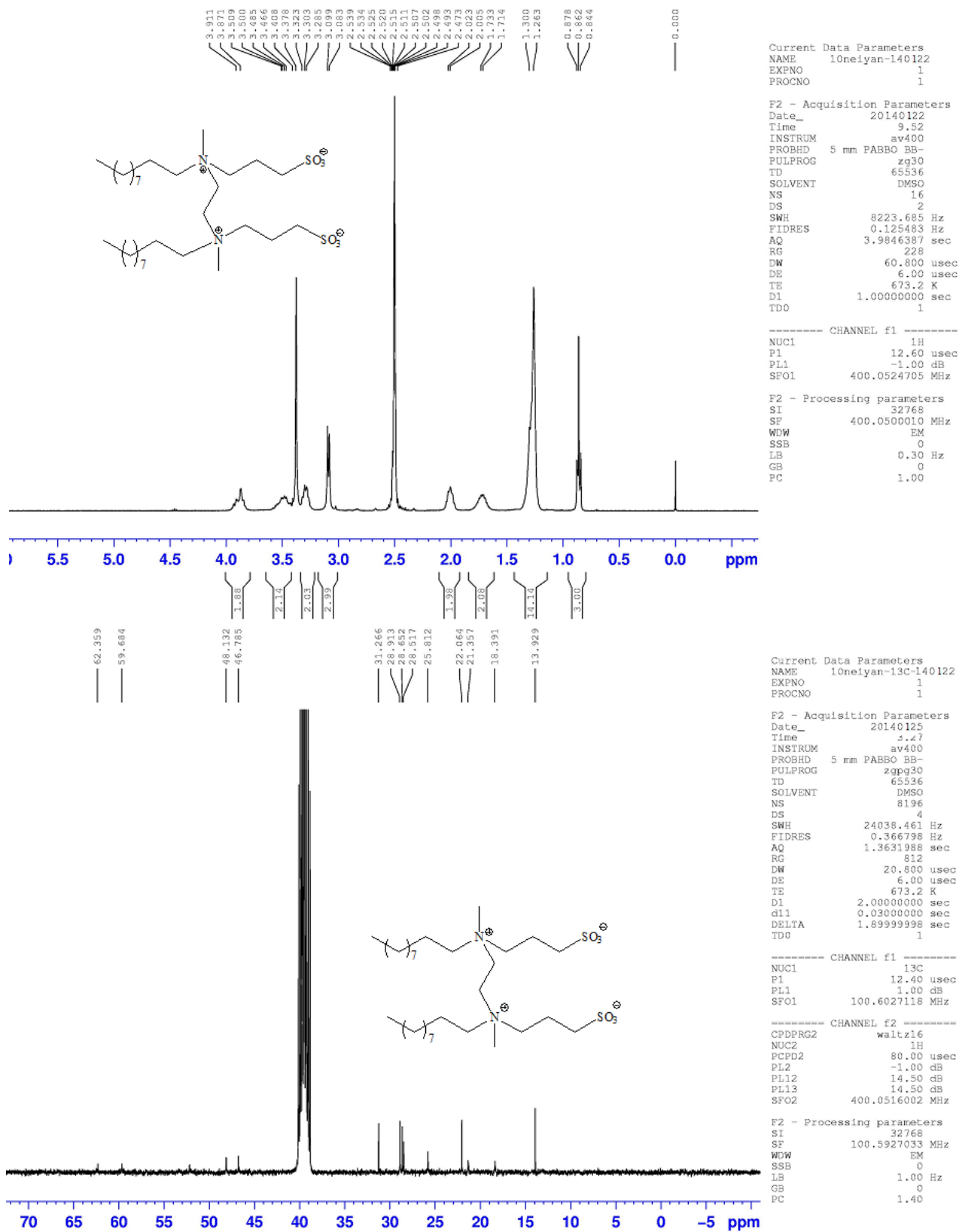


Figure S2. Cont.

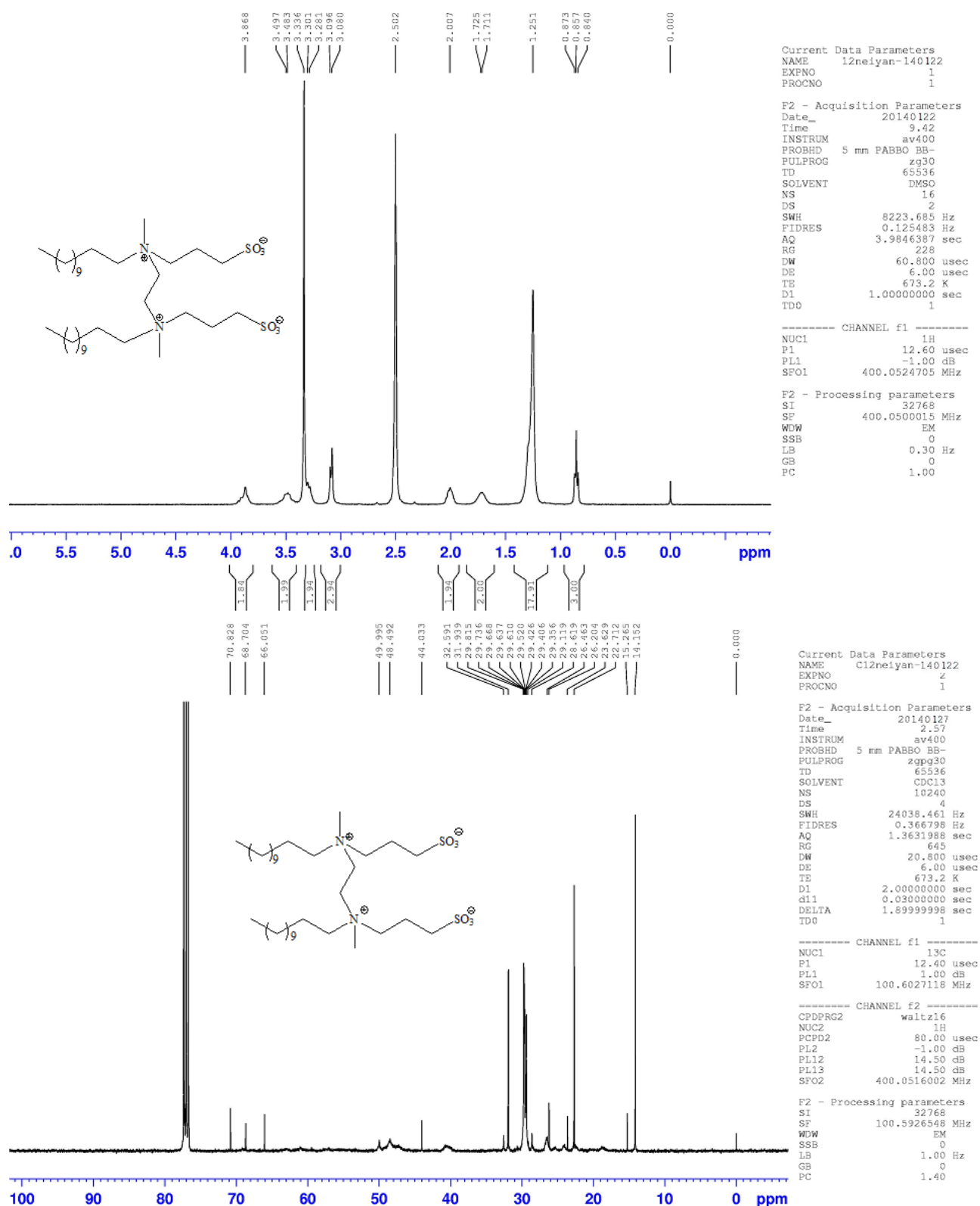


Figure S2. Cont.

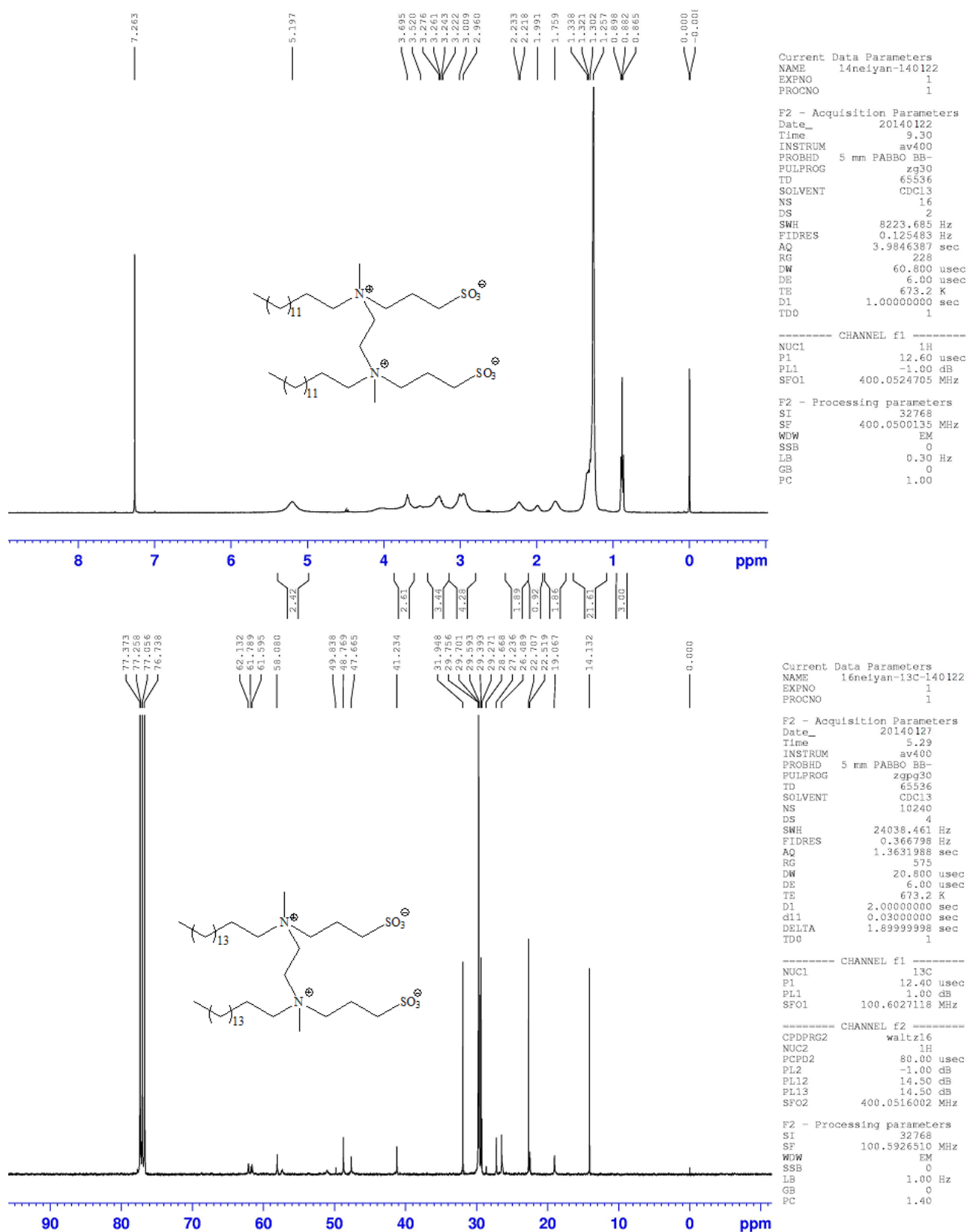


Figure S3. Copies of NMR spectra for GBAILs.

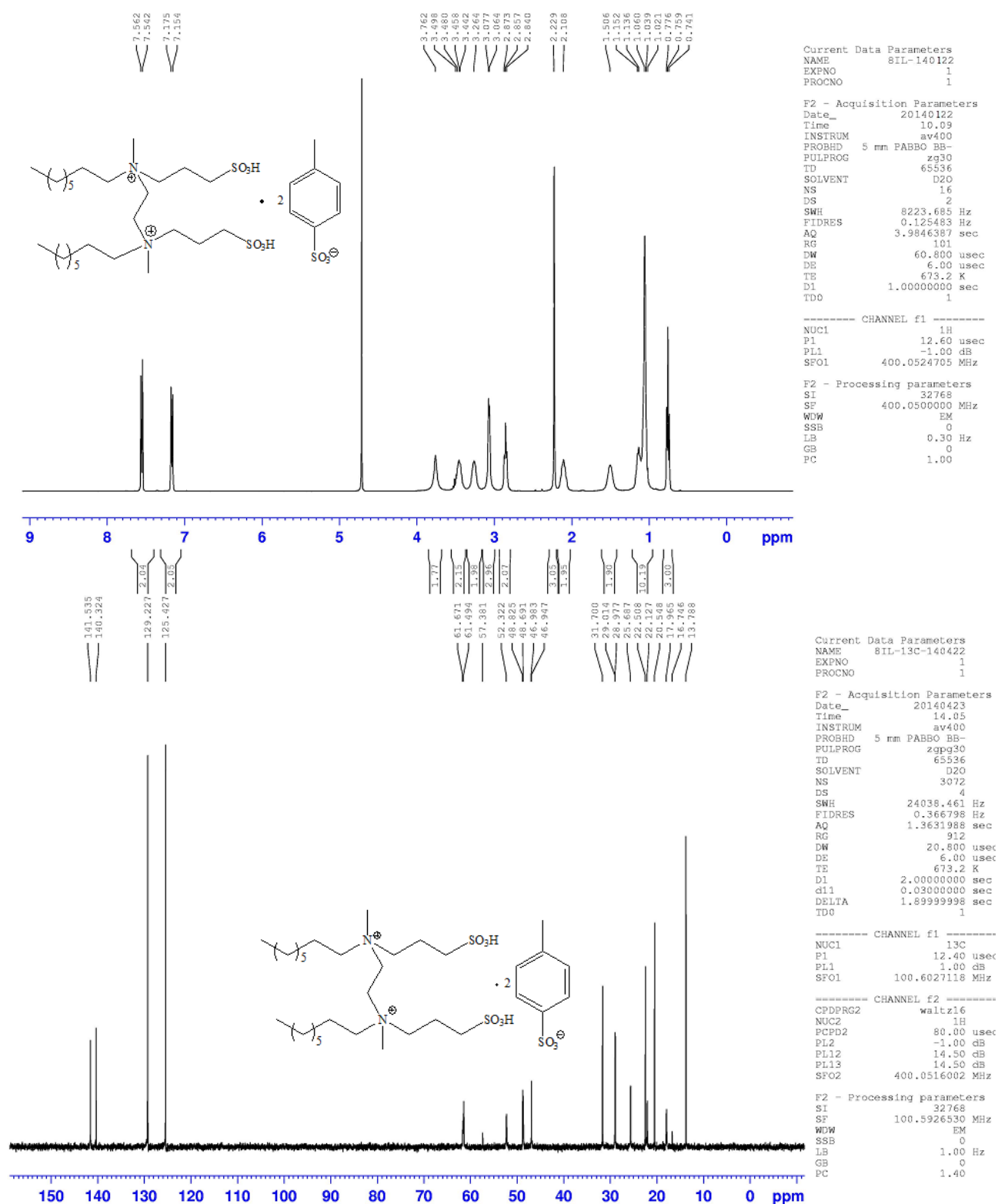


Figure S3. Cont.

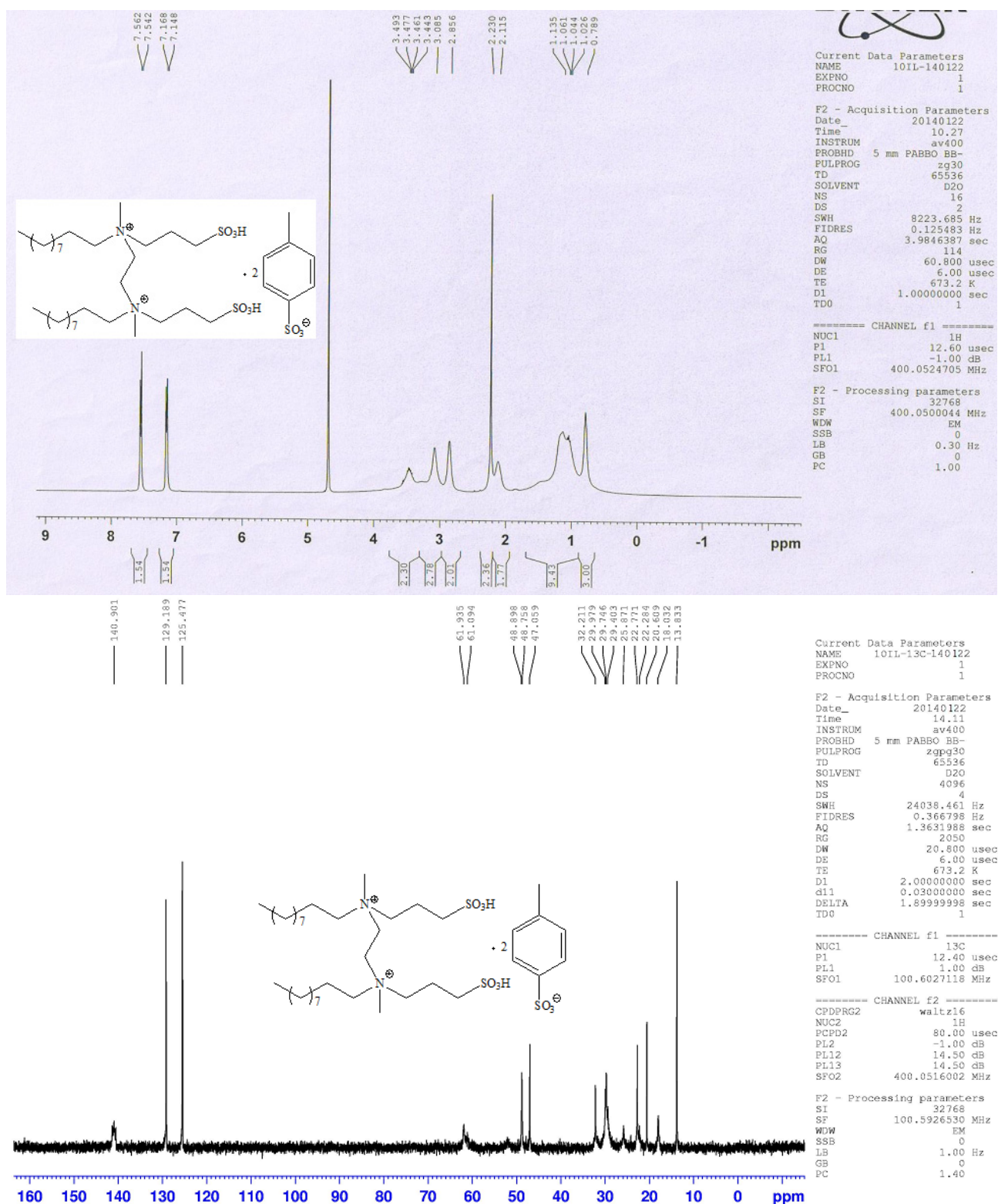


Figure S3. Cont.

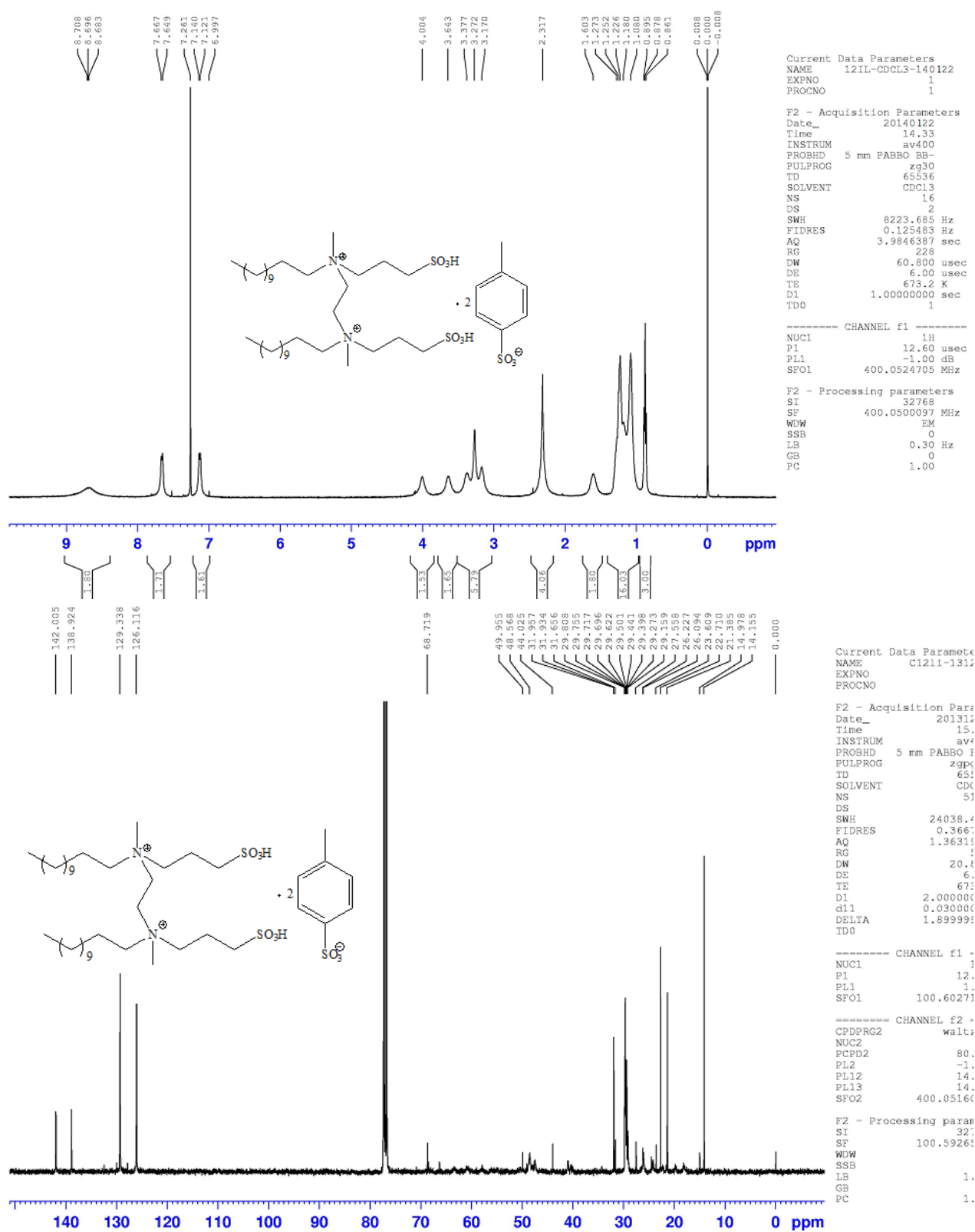


Figure S3. Cont.

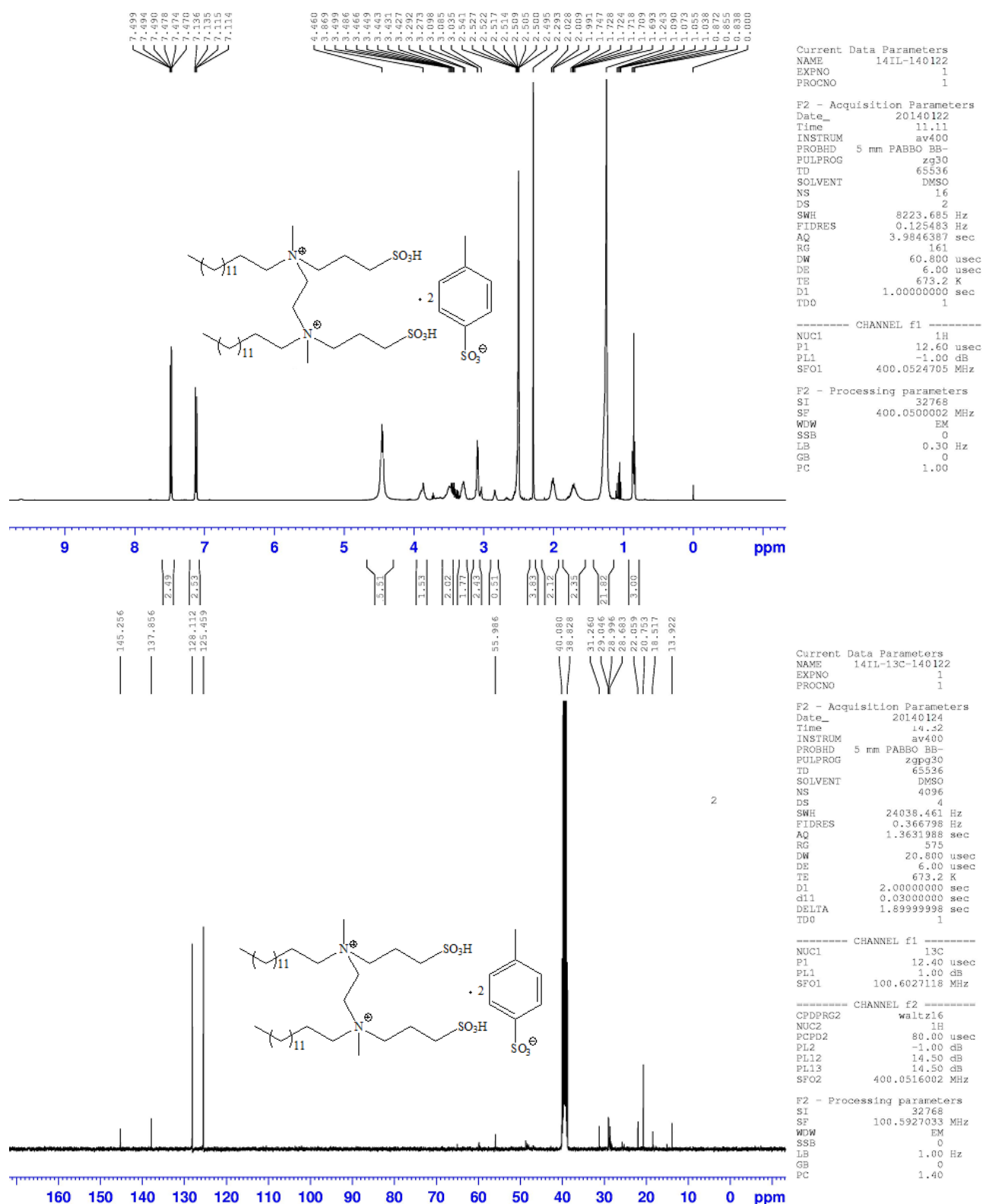


Figure S3. Cont.

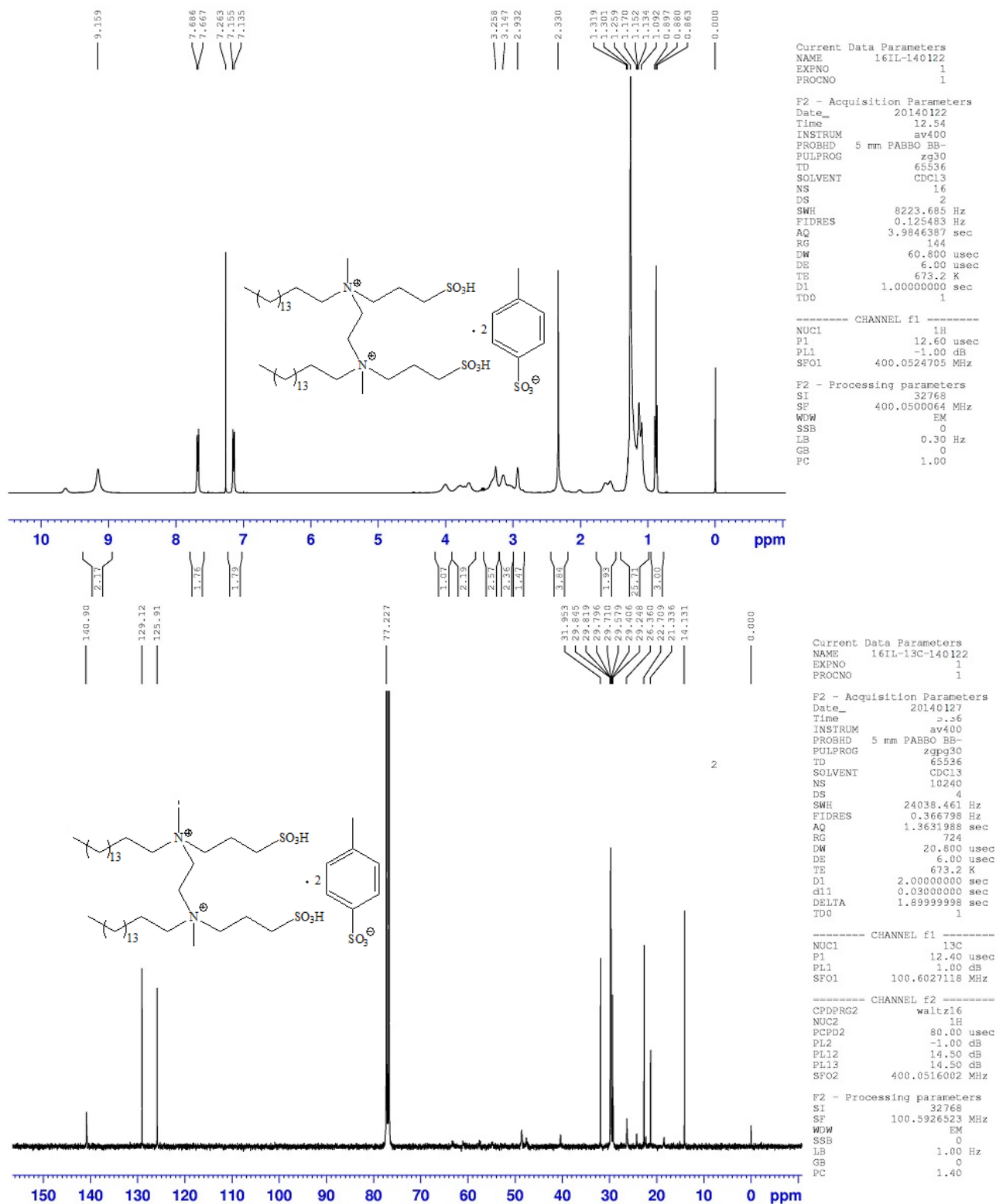
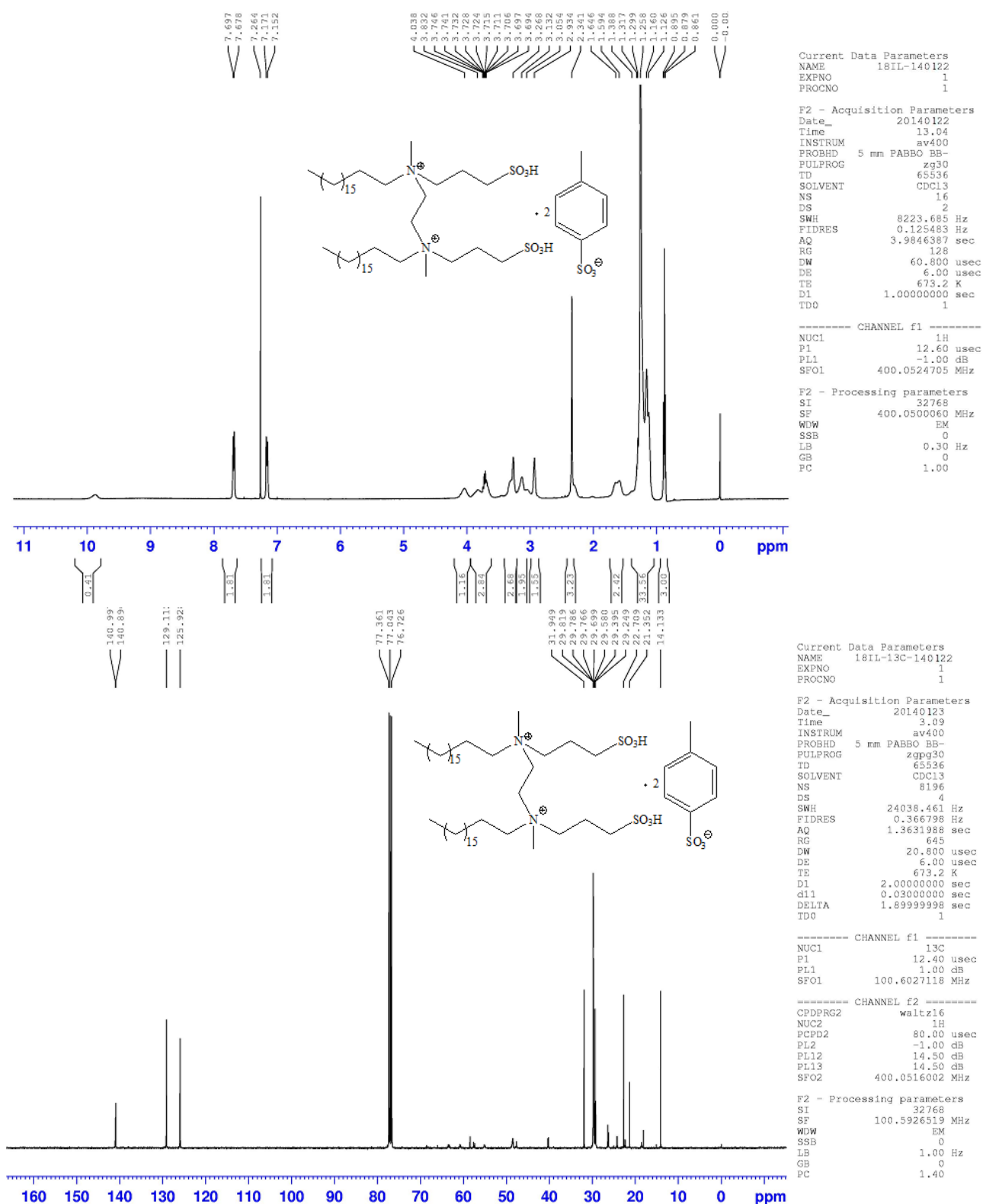


Figure S3. Cont.



(C) Copies of NMR spectra for the Mannich reaction products

Figure S4. Copies of NMR spectra for the Mannich reaction products.

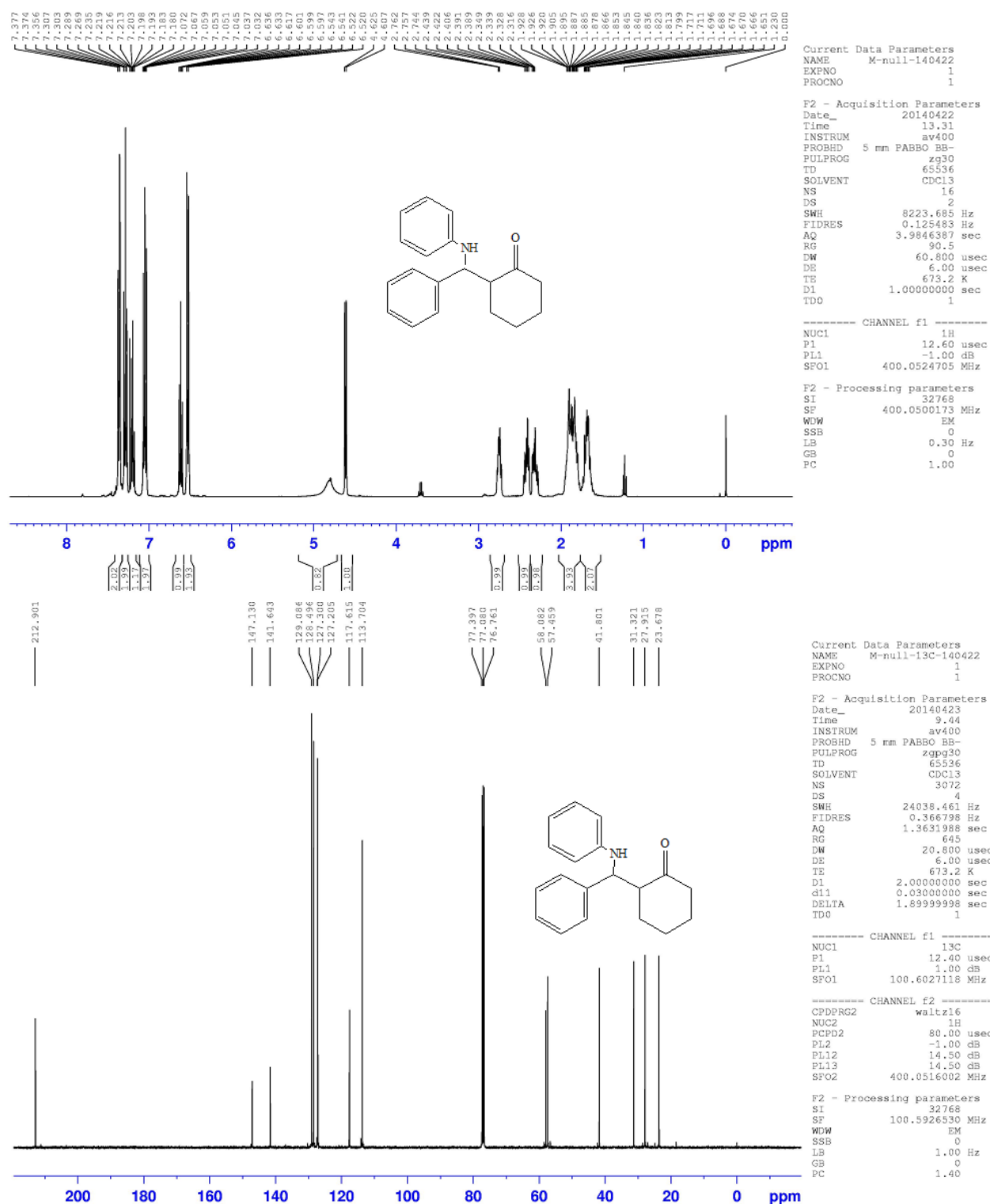


Figure S4. Cont.

