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Electronic Supporting Information

Biologically active binaphtol-scaffolded imidazolium salts

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1. General information

All chemicals were purchased from Aldrich Chemicals in their highest purity and used without further purification. CD_3OD or $CDCl_3$ were also purchased from Aldrich Chemicals. All solvents and liquid reagents were degassed by bubbling nitrogen for 15 min before each use or by two freeze-pump-thaw cycles before use. NMR experiments were recorded on Avance 300 Bruker, at 300 and 75.5 MHz and Avance 400 Brucker, at 400 and 101 MHz, respectively. All NMR experiments were obtained by the use of the sequence commercially available on Brucker spectrometer. Coupling constants are given in Hertz (Hz) and chemical shifts are given in ppm (δ) measured relative to residual solvent. Data are reported as follows : chemical shift, multiplicity (br = broad, s = singlet, d = doublet, t = triplet, q = quartet, quin = quintuplet, m = multiplet). Mass spectral data were obtained by the Université de Montréal Mass Spectrometry Facility and were recorded on a Mass spectrometer TSQ Quantum Ultra (Thermo Scientific) with accurate mass options instrument. Fluorimetric studies were performed on a Varian Cary Eclipse Fluorescence spectrophotometer equipped with a temperature controller. The antimicrobial assays were performed on a Fluostar Optima plate reader. The *Escherichia coli* (DH5α and SK037) and *Baccilus thuringiensis* (HD73) strains were provided by prof. J. Pelletier, Chemistry Department, Université de Montréal. *Listeria seeligeri* (ATCC 35967) and *Alcaligenes faecalis* (ATCC 8750) were obtained from ATCC. The cytotoxic experiment were performed on a Wallac 1420 Victor^2 plate reader. The HEK203T cells were provided by prof. A. Claing, Pharmacology Department, Université de Montréal. The cells were grown in a Dulbecco's Modified Eagle Medium (DEME) purchased from Wisent (N°319-005-CL) supplemented with 10% Fetal Bovine Serum (FBS) purchased from Wisent (N°080-150).

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2. Synthesis

2,2'-dioctoxy-1,1'-binaphtalene (2). To a solution of 1,1'-binaphtol (5.0 g, 17.5 mMol) in acetone (180 mL) was added potassium carbonate (12 g, 87.3 mMol) and bromooctane (15.2 mL, 87.3 mMol). The mixture was stirred at reflux for 24 h. After evaporation of acetone under reduced pressure, 100 mL of dichloromethane and 100 mL of water were added. Phases were separated and the organic phase was washed twice with 100 mL saturated $NaHCO_3$ solution and once with 100 mL water. The organic phase was dried and evaporated under reduced pressure. Excess of bromooctane was removed by distillation under vacuum. The yellow oil was then submitted to silica chromatography column with hexane/ethyl acetate 99:1 as eluting agent. 8.12 g of a yellow oil are obtained. Yield : 91 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ 0.86 (t, *J*=7.3 Hz, 6H), 0.88 - 0.94 (m, 4H), 0.94 - 1.05 (m, 8H), 1.05 - 1.15 (m, 4H), 1.17 - 1.28 (m, 4H), 1.33 - 1.44 (m, 4H), 3.85 - 4.00 (m, 4H), 7.12 - 7.17 (m, 2H), 7.17 - 7.23 (m, 2H), 7.30 (ddd, *J*=8.1, 6.51, 1.38 Hz, 2H), 7.40 (d, *J*=8.9 Hz, 2H), 7.84 (d, *J*=8.1 Hz, 2H), 7.92 (d, *J*=8.9 Hz, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 14.25, 22.80, 25.75, 29.25, 29.56, 31.84, 69.94, 116.04, 120.89, 123.51, 125.65, 126.13, 127.90, 129.14, 129.40, 154.69. HR-MS : m/z $[M+Na]^+$ ($C_{36}H_{46}NaO_2$) calcd : 533.33900, found : 533.34051. $[M+H]^+$ ($C_{36}H_{47}O_2$) calcd : 511.35706, found : 511.35822.

3,3'-dicarbaldehyde-2,2'-dioctoxy-1,1'-binaphthalene (3). Under nitrogen atmosphere, to a solution of (2) (5.93 g, 11.6 mMol) and TMEDA (8.7 mL, 58 mMol) in dry Et_2O (120 mL) at 0°C was added *n*BuLi (23 mL, 49.9 mMol, 2.0 M in hexane) dropwise. The solution was then heated at reflux for 5 hours and then cooled at 0°C before adding 4 mL of dry DMF dropwise (60.7 mMol). The mixture was stirred for 30 minutes 0°C before being poured into HCl/ice water. The solution was extracted three times with 100 mL of dichloromethane. The combined organic phases were washed once wih 100 mL of saturated $NaHCO_3$ solution and once with 100 mL of water. After removing the solvent *in vacuo*, the obtained oil was purified by silica chromatography column with hexane/ethyl acetate 95:5 as eluting agent to give 4.99 g of an yellow oil. Yield : 76 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ 0.69 - 0.81 (m, 4H), 0.80 - 0.87 (m, 10H), 0.89 - 0.98 (m, 4H), 0.98 - 1.08 (m, 4H), 1.12 - 1.32 (m, 8H), 3.45 (dt, *J*=9.1, 6.5 Hz, 2H), 3.77 (dt, *J*=9.1, 6.2 Hz, 2H), 7.21 (d, *J*=8.4Hz, 2H), 7.38 (ddd, *J*=8.3, 6.8, 1.3 Hz, 2H), 7.47 (td, *J*=7.5, 1.1 Hz, 2H), 8.05 (d, *J*=8.1 Hz, 2H), 8.6 (s, 2H), 10.6 (s, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 14.08, 22.56, 25.44, 28.86, 29.01, 29.73, 31.61, 76.39, 125.45, 125.70, 125.84, 128.95, 129.36, 129.88, 130.43, 131.58, 137.08, 156.31. HR-MS : m/z $[M+Na]^+$ ($C_{38}H_{46}NaO_4$) calcd : 589.32883, found : 589.32915. $[M+H]^+$ ($C_{38}H_{47}O_4$) calcd : 567.34689, found : 567.34644.

3,3'-dihydroxymethyl-2,2'-dioctoxy-1,1'-binaphthalene (4). To a stirred solution of (3) (4.99 g, 8.8 mMol) in 60 mL of THF/MeOH 1:1 at room temperature was added sodium borohydride (1.33 g, 35.3 mMol). After 1 h of stirring, 60 mL of water were added and the mixture was stirred for 30 more

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minutes. The mixture was then extracted twice with 60 mL of dichloromethane and the solvent was removed *in vacuo* to give a pale yellow oil. The oil was purified by silica chromatography column with hexane/ethyl acetate 9:1 as eluting agent to give 4.62 g of pale yellow oil. Yield : 92 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ 0.60 - 0.91 (m, 14H), 0.95 - 1.13 (m, 8H), 1.13 - 1.29 (m, 8H), 2.51 (br. s., 2H), 3.25 (dt, *J*=9.1, 6.8 Hz, 2H), 3.57 (dt, *J*=9.1, 6.4 Hz, 2H), 4.81 - 4.90 (m, 2H), 5.03 (d, *J*=13.2 Hz, 2H), 7.16 - 7.21 (m, 2H), 7.22 - 7.27 (m, 2H), 7.39 (ddd, *J*=8.1, 6.6, 1.4 Hz, 2H), 7.88 (d, *J*=8.1 Hz, 2H), 7.96 (s, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 14.17, 22.67, 25.47, 29.00, 29.13, 30.06, 31.76, 62.46, 73.75, 124.52, 124.91, 125.80, 126.35, 128.04, 128.09, 130.56, 134.00, 134.39, 154.35. HR-MS : m/z $[M+Na]^+$ ($C_{38}H_{50}NaO_4$) calcd : 593.36013, found : 593.35879. $[M+NH_4]^+$ ($C_{38}H_{54}NO_4$) calcd : 588.40474, found : 588.40311.

3,3'-dichloromethyl-2,2'-dioctoxy-1,1'-binaphthalene (5). Under nitrogen atmosphere, a solution of (4) (2.21 g, 3.9 mMol) in thionyl chloride (20 mL) was stirred at 0°C and few drops of dry DMF were added. After 1 hour of stirring at 0°C, thionyl chloride was removed under reduced pressure and the resulting oil was redissolved in 20 mL of dichloromethane. The organic phase was washed with 20 mL of a saturated $NaHCO_3$ solution and with 20 mL water. After removing the solvent *in vacuo* the resulting oil was purified by silica chromatography column with hexane/ethyl acetate 99:1 as eluting agent giving 1.79 g of pale yellow oil. Yield : 76 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ 0.58 - 0.72 (m, 2H), 0.73 - 0.91 (m, 12H), 0.94 - 1.13 (m, 8H), 1.14 - 1.29 (m, 8H), 3.25 (dt, *J*=8.9, 6.7 Hz, 2H), 3.65 (dt, *J*=9.0, 6.4 Hz, 2H), 4.82 - 4.88 (m, 2H), 4.93 - 5.01 (m, 2H), 7.16 - 7.23 (m, 2H), 7.23 - 7.31 (m, 2H), 7.41 (ddd, *J*=8.1, 6.7, 1.2 Hz, 2H), 7.89 (d, *J*=8.2 Hz, 2H), 8.08 (s, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 14.25, 22.76, 25.50, 29.09, 29.21, 29.97, 31.84, 42.27, 74.39, 125.17, 125.91, 127.04, 128.23, 130.46, 130.87, 131.43, 134.55, 154.26. HR-MS : m/z $[M+Ag]^+$ ($C_{38}H_{48}AgCl_2O_2$) calcd : 713.20768, found : 713.21065.

General procedure for compounds 6a-e. 1 mMol of (5) was dissolved in 10 mL of acetonitrile. 5 mMol of corresponding alkylimidazole were added and the resulting mixture was stirred under reflux for 24 h. After cooling to room temperature the solvent was evaporated and the crude product was directly submitted to silica chromatography column using dichloromethane/methanol 95:5 as eluting agent giving yellow to brown oil.

3,3'-di(1,3-dimethylimidazolium)-2,2'-octoxy-1,1'-binaphthalene-dichloride (6a). Yield : 87 %. ^{1}H NMR (400 MHz, CD_3OD) δ 0.54 - 0.65 (m, 4H), 0.66 - 0.76 (m, 4H), 0.84 - 0.89 (m, 6H), 0.89 - 1.11 (m, 12H), 1.14 - 1.26 (m, 4H), 3.25 - 3.31 (m, 2H), 3.50 (dt, *J*=8.9, 6.8 Hz, 2H), 3.98 (s, 6H), 5.68 (s, 4H), 7.15 (d, *J*=8.4 Hz, 2H), 7.36 (ddd, *J*=8.4, 6.9, 1.28 Hz, 2H), 7.50 (ddd, *J*=8.1, 6.9, 1.10 Hz, 2H), 7.67 (d, *J*=1.8 Hz, 2H), 7.71 (d, *J*=2.0 Hz, 2H), 8.02 (d, *J*=8.1 Hz, 2H), 8.17 (s, 2H). ^{13}C NMR (75 MHz, CD_3OD)

δ 14.44, 23.63, 26.31, 29.87, 30.16, 30.81, 32.82, 36.66, 50.70, 74.91, 123.96, 125.19, 126.24, 126.62, 126.92, 128.74, 128.83, 129.72, 131.92, 132.58, 136.06, 154.92. HR-MS : m/z $[M]^{2+}$ ($C_{46}H_{60}N_4O_2$) calcd : 350.73687, found : 350.73773.

3,3'-di(3-butyl-1-methyl-imidazolium)-2,2'-octoxy-1,1'-binaphthalene-dichloride (6 b). Yield : 88 %. ^{1}H NMR (400 MHz, CD_3OD) δ 0.49 - 0.63 (m, 4H), 0.64 - 0.75 (m, 4H), 0.78 - 1.10 (m, 22H), 1.12 - 1.27 (m, 6H), 1.29 - 1.45 (m, 4H), 1.79 - 1.94 (m, 4H), 3.26 - 3.37 (m, 2H), 3.43 - 3.53 (m, 2H), 4.29 (t, *J*=7.2 Hz, 4H), 5.61 - 5.78 (m, 4H), 7.14 (d, *J*=8.6 Hz, 2H), 7.29 - 7.38 (m, 2H), 7.44 - 7.53 (m, 2H), 7.69 - 7.73 (m, 2H), 7.74 - 7.80 (m, 2H), 8.03 (d, *J*=8.1 Hz, 2H), 8.24 (s, 2H), 9.27 (s, 2H). ^{13}C NMR (101 MHz, CD_3OD) δ 13.83, 14.47, 20.46, 23.63, 26.31, 29.88, 30.19, 30.87, 32.81, 33.28, 50.77, 50.90, 74.78, 123.97, 124.01, 126.24, 126.59, 126.87, 128.64, 128.81, 129.74, 131.90, 132.92, 136.06, 137.49, 154.96. HR-MS : m/z $[M]^{2+}$ ($C_{52}H_{72}N_4O_2$) calcd : 392.28222, found : 392.28339.

3,3'-di(1-methyl-3-octylimidazolium)-2,2'-octoxy-1,1'-binaphthalene-dichloride (6c). Yield : 76 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ 0.37 - 0.64 (m, 8 H), 0.67 - 0.86 (m, 18H), 0.87 - 0.98 (m, 4H), 0.99 - 1.35 (m, 26H), 1.78 - 1.92 (m, 4H), 2.99 - 3.09 (m, 2H), 3.18 - 3.29 (m, 2H), 4.28 (t, *J*=7.4 Hz, 4H), 5.6 (d, *J*=14.1 Hz, 2H), 6.03 (d, *J*=14.1 Hz, 2H), 7.1 (d, *J*=8.5 Hz, 2H), 7.20 - 7.28 (m, 2H), 7.31 - 7.38 (m, 2H), 7.54 (br. s., 4H), 7.87 (d, *J*=8.1 Hz, 2H), 8.30 (s, 2H), 10.90 (br. s., 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 14.00, 14.03, 22.49, 22.52, 25.12, 26.31, 28.70, 28.93, 28.96, 29.01, 29.69, 30.41, 31.57, 31.63, 49.21, 50.14, 74.34, 122.19, 124.71, 125.35, 125.70, 126.98, 127.86, 128.74, 130.34, 132.21, 134.54, 137.50, 153.56. HR-MS : m/z $[M]^{2+}$ ($C_{60}H_8N_4O_2$) calcd : 448.34482, found : 448.34522.

3,3'-di(3-dodecyl-1-methyl-imidazolium)-2,2'-octoxy-1,1'-binaphthalene-dichloride (6d). Yield : 89 %. ^{1}H NMR (400 MHz, CD_3OD) δ 0.54 - 0.65 (m, 4H), 0.66 - 0.77 (m, 4H), 0.84 - 0.96 (m, 16H), 0.99 - 1.10 (m, 4H), 1.13 - 1.39 (m, 44H), 1.88 (t, *J*=6.8 Hz, 4H), 3.30 - 3.36 (m, 2H), 3.46 (m, 2H), 4.26 (t, *J*=7.2 Hz, 4H), 5.69 (q, *J*=12.8 Hz, 4H), 7.14 (d, *J*=8.6 Hz, 2H), 7.35 (t, J=7.7 Hz, 2H), 7.49 (t, *J*=8.1 Hz, 2H), 7.71 (d, *J*=2.0 Hz, 2H), 7.75 (d, *J*=1.8 Hz, 2H), 8.02 (d, *J*=8.1 Hz, 2H), 8.19 - 8.22 (m, 2H). ^{13}C NMR (101 MHz, CD_3OD) δ 14.46, 14.49, 23.69, 23.73, 26.38, 27.32, 29.96, 30.17, 30.26, 30.47, 30.57, 30.69, 30.74, 30.76, 30.92, 31.34, 32.88, 33.06, 50.93, 51.02, 74.75, 123.99, 124.01, 126.24, 126.63, 126.94, 128.56, 128.85, 129.74, 131.90, 132.95, 136.10, 154.92. HR-MS : m/z $[M]^{2+}$ ($C_{68}H_{104}N_4O_2$) calcd : 504.40742, found : 504.40895.

3,3'-di(3-hexadecyl-1-methyl-imidazolium)-2,2'-octoxy-1,1'-binaphthalene-dichloride (6e). Yield : 86 %. ^{1}H NMR (400 MHz, CD_3OD) δ 0.54 - 0.65 (m, 4H), 0.66 - 0.77 (m, 4H), 0.83 - 1.00 (m, 16H), 1.00 - 1.11 (m, 4H), 1.14 - 1.38 (m, 60 H), 1.80 - 1.96 (m, 4H), 3.27 - 3.38 (m, 2H), 3.42 - 3.53 (m, 2H),

4.26 (t, *J*=7.2 Hz, 4H), 5.69 (q, *J*=12.3 Hz, 4H), 7.14 (d, *J*=8.3 Hz, 2H), 7.35 (ddd, *J*=8.4, 7.0, 1.3 Hz, 2H), 7.50 (ddd, *J*=8.2, 7.0, 1.0 Hz, 2H), 7.69 - 7.73 (m, 2H), 7.74 - 7.78 (m, 2H), 8.02 (d, *J*=8.1 Hz, 2H), 8.21 (s, 2H), 9.22 (s, 2H). ^{13}C NMR (101 MHz, CD_3OD) δ 14.47, 14.52, 23.69, 23.74, 26.38, 27.32, 29.97, 30.17, 30.26, 30.47, 30.58, 30.70, 30.76, 30.80, 30.92, 31.34, 32.88, 33.08, 50.93, 51.03, 74.77, 123.99, 124.01, 126.25, 126.63, 126.94, 128.56, 128.86, 129.75, 131.91, 132.96, 136.10, 154.93. HR-MS : m/z $[M]^{2+}$ ($C_{76}H_{120}N_4O_2$) calcd : 560.47002, found : 560.4728.

General procedure for the synthesis of compounds 1a-e. Under nitrogen atmosphere, to a solution of **6a-e** (1 mMol) in dry dichloromethane (10 mL) at 0°C was added boron tribromide (3 mMol) dropwise. After 1 hour of stirring at 0°C, excess of boron tribromide was quenched by adding few drops of methanol, then 10 mL of water were added. The organic phase was evaporated and the crude product was redissolved in 10 mL of methanol. After adding an excess of $LiNTf_2$ (5 mMol) the solution was refluxed for 1 h then cooled to room temperature. 10 mL of dichloromethane and 10 mL of deionised water were added and the phases were separated. The aqueous phase was extracted once with 10 mL of dichloromethane and the combined organic phases were washed ten times with 10 mL of deionised water in order to remove any trace of chloride anion. After evaporation of dichloromethane, the product was purified on silica chromatography column with dichloromethane/methanol 95:5 as eluant giving brown amorphous solid.

3,3'-di(1,3-dimethylimidazolium)-1,1'-bi-2-naphthol-di[bis-(trifluoromethanesulfonyl) imide (1a). Yield : 76 %. ^{1}H NMR (400 MHz, CD_3OD) δ 3.90 (s, 6H), 5.62 (s, 4H), 6.92 (d, *J*=8.4 Hz, 2H), 7.23 (ddd, *J*=8.4, 7.0, 1.1 Hz, 2H), 7.30 - 7.37 (m, 2H), 7.51 (t, *J*=1.7 Hz, 2H), 7.66 (t, *J*=1.7 Hz, 2H), 7.95 (d, *J*=8.1 Hz, 2H), 8.17 (s, 2H), 8.91 (s, 2H). 13C NMR (101 MHz, CD_3OD) δ 36.46, 50.96, 114.94, 119.54, 122.73, 123.95, 124.30, 124.65, 125.04, 125.11, 128.61, 129.68, 130.17, 133.20, 136.12, 138.03, 153.09. HR-MS : m/z $[M]^{2+}$ ($C_{30}H_{28}N_4O_2$) calcd : 238.61162, found : 238.61218.

3,3'-di(3-butyl-1-methyl-imidazolium)-1,1'-bi-2-naphthol-di[bis-(trifluoromethanesulfo-nyl)imide (1 b). Yield : 69 %. ^{1}H NMR (400 MHz, CD_3OD) δ 0.91 (t, *J*=7.3 Hz, 6H), 1.31 (d, *J*=7.7 Hz, 4H), 1.83 (s, 4H), 4.19 (t, *J*=7.3 Hz, 4H), 5.57 - 5.69 (m, 4H), 6.89 (d, *J*=8.2 Hz, 2H), 7.20 - 7.26 (m, 2H), 7.32 - 7.38 (m, 2H), 7.61 (t, *J*=1.8 Hz, 2H), 7.7 (t, *J*=1.8 Hz, 2H), 7.96 (d, *J*=7.9 Hz, 2H), 8.16 (s, 2H), 9.01 (s, 2H). ^{13}C NMR (101 MHz, CD_3OD) δ 13.67, 20.34, 33.11, 50.65, 51.20, 115.03, 119.59, 122.78, 123.49, 124.09, 124.38, 125.07, 128.65, 129.71, 130.21, 133.24, 136.19, 137.49, 153.22. HR-MS : m/z $[M]^{2+}$ ($C_{36}H_{40}N_4O_2$) calcd : 280.15701, found : 280.15809. $[M+2Na]^{2+}$ ($C_{36}H_{40}N_4Na_2O_2$) calcd : 303.14678, found : 303.14589.

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3,3'-di(1-methyl-3-octyl-imidazolium)-1,1'-bi-2-naphthol-di[bis-(trifluoromethanesulfonyl) imide (1c). Yield : 61 %. ^{1}H NMR (400 MHz, CD_3OD) δ 0.90 (t, *J*=6.4 Hz, 6H), 1.22 - 1.40 (m, 20H), 1.81 – 1.95 (m, 4H), 4.22 (t, *J*=7.3 Hz, 4H), 5.59 – 5.74 (m, 4H), 6.93 (d, *J*=8.4 Hz, 2H), 7.25 (t, *J*=7.8 Hz, 2H), 7.37 (t, *J*=7.6 Hz, 2H), 7.6 (br. s., 2H), 7.70 (br. s., 2H), 7.97 (d, *J*=8.1 Hz, 2H), 8.19 (br. s., 2H), 9.03 (br. s., 2H). ^{13}C NMR (101 MHz, CD_3OD) δ 23.58, 27.14, 29.94, 30.06, 31.15, 32.81, 50.90, 51.11, 115.02, 119.58, 122.77, 123.47, 124.07, 124.41, 125.04, 125.07, 128.62, 129.70, 130.20, 133.18, 136.13, 137.39, 153.19. HR-MS : m/z $[M]^{2+}$ ($C_{44}H_{56}N_4O_2$) calcd : 336.72122, found : 336.72221.

3,3'-di(3-dodecyl-1-methyl--imidazolium)-1,1'-bi-2-naphthol-di[bis(trifluoromethane-sulfonyl) imide (1d). Yield : 95 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ 0.86 (t, *J*=6.8 Hz, 6H), 1.15 - 1.33 (m, 34H), 1.80 (br. s., 4H), 4.11 (t, *J*=7.4 Hz, 4H), 5.55 (q, *J*=14.3 Hz, 4H), 6.01 (br. s., 2H), 6.97 (d, *J*=8.4 Hz, 2H), 7.22 (s, 2H), 7.26 (t, *J*=7.5 Hz, 2H), 7.35 (t, *J*=7.5 Hz, 2H), 7.55 (s, 2H), 7.91 (d, *J*=8.2 Hz, 2H), 8.13 (s, 2H), 8.86 (s, 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 14.22, 22.78, 26.20, 28.97, 29.41, 29.44, 29.57, 29.68, 29.69, 30.21, 32.00, 50.10, 50.29, 112.27, 118.18, 121.37, 121.78, 122.10, 123.29, 124.06, 124.92, 128.53, 129.02, 129.13, 133.11, 134.30, 135.84, 150.87. HR-MS : m/z $[M]^{2+}$ ($C_{52}H_{72}N_4O_2$) calcd : 392.28222, found : 392.28329.

3,3'-di(3-hexadecyl-1-methyl--imidazolium)-1,1'-bi-2-naphthol-di[bis(trifluoromethane-sulfonyl) imide (1e). Yield : 63 %. ^{1}H NMR (400 MHz, $CDCl_3$) δ 0.81 - 0.91 (m, 6H), 1.14 - 1.34 (m, 52H), 1.70 - 1.89 (m, 4H), 4.11 (t, *J*=7.1 Hz, 4H), 5.55 (q, *J*=14.1 Hz, 4H), 5.88 - 6.17 (br. s., 2H), 6.97 (d, *J*=8.4 Hz, 2H), 7.22 (s, 2H), 7.24 - 7.29 (m, 2H), 7.32 - 7.40 (m, 2H), 7.55 (s, 2H), 7.91 (d, *J*=8.1 Hz, 2H), 8.14 (s, 2H), 8.86 (br. s., 2H). ^{13}C NMR (101 MHz, $CDCl_3$) δ 14.24, 22.81, 26.22, 29.00, 29.44, 29.48, 29.61, 29.72, 29.78, 29.82, 30.23, 32.04, 50.10, 50.31, 112.30, 118.19, 121.38, 121.81, 122.12, 123.31, 124.06, 124.92, 128.54, 129.03, 129.15, 133.11, 134.31, 135.87, 150.88. HR-MS : m/z $[M]^{2+}$ ($C_{60}H_{88}N_4O_2$) calcd : 448.34482, found : 448.34674.

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3. Ion transport

3.1 Preparation of EYPC large unilamellar vesicles (LUVs) for lucigenin based assays

A lipid film was formed by evaporating a chloroform solution containing 50 mg of EYPC under reduced pressure at 25°C. The lipid film was then dried under vacuum at room temperature for at least 2 hours. The lipid film was then hydrated with 1 mL of a 2 mM lucigenin solution containing NaCl (100 mM), and sodium phosophate salt (10 mM, pH = 6.4). The obtained suspension was subjected to 8 freeze/thaw cycles (1 cycle = 1 minute at -78°C followed by 1 minute at 35°C). The mixture was vortexed for 1 minute after every cycle to help the hydration. The solution was then extruded through a 100 nm polycarbonate membrane 21 times until the solution was transparent and passed down a Sephadex G-25 column to remove extravesicular lucigenin dye. The eluant was a solution containing 100 mM of NaCl and 10 mM of sodium phosphate salt. 10.4 mL of liposome solution were isolated after gel filtration. The stock solution was 6.25 mM in lipid, assuming all EYPC was incorporated into the liposomes.

3.2 Chloride transport assays with EYPC LUVs

A 20 µL aliquot of the stock solution of EYPC LUVs were added to a 2.5 mL gently stirred thermostated buffer solution containing 10 mM sodium phosphate salt (pH = 6.4), and 100 mM MX (MX = $NaNO_3$, $NaHCO_3$, Na_2SO_4). The lucigenin fluorescence was monitored by excitation at λ_{ex} = 372 nm and the emission was recorded at λ_{em} = 503 nm. At t = 50 s, 100 µL of solution of transporter at different concentrations in MeOH were added, and at t = 300 s, 100 µL of a Triton-X 20% solution were added in order to lyse the liposomes and the maximum chloride efflux was recorded at t = 350 s. The temperature was set to 37°C. Experiments were repeated in triplicate and all traces reported are the average of the three trials.

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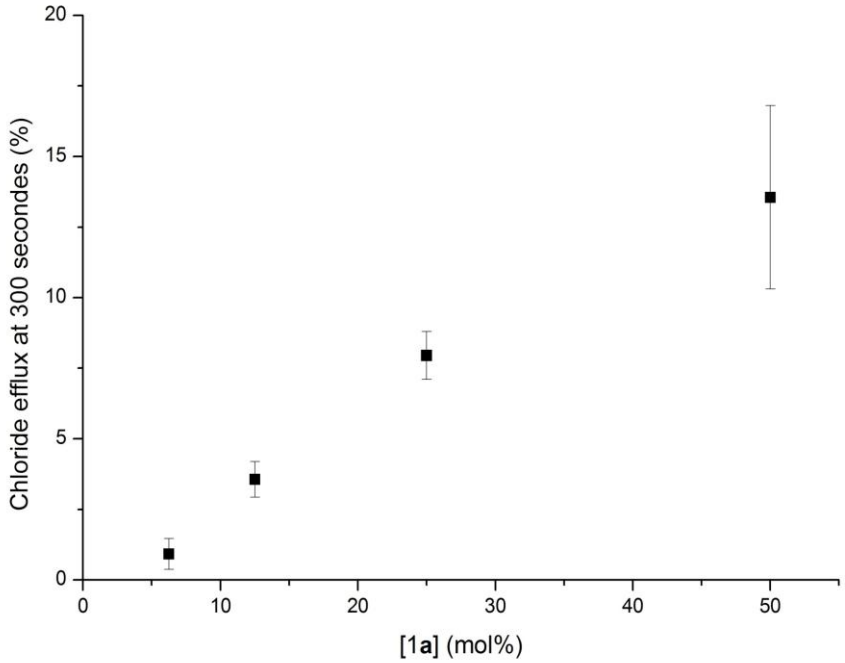

Figure S1. Dose response relationship after addition of several concentrations of **1a** to mixture containing EYPC LUVs containing lucigénine.

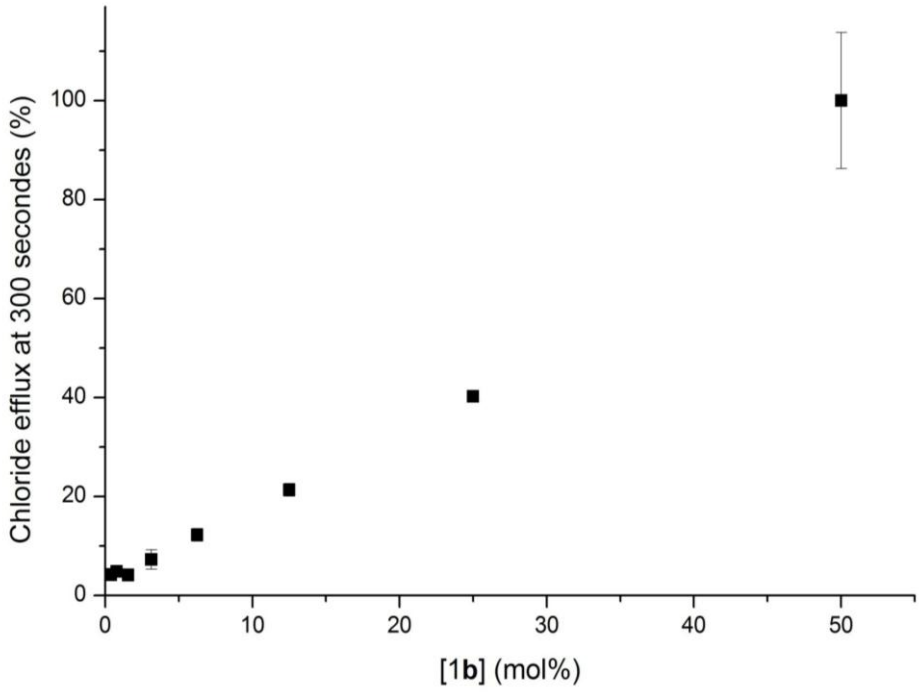

Figure S2. Dose response relationship after addition of several concentrations of **1b** to mixture containing EYPC LUVs containing lucigénine.

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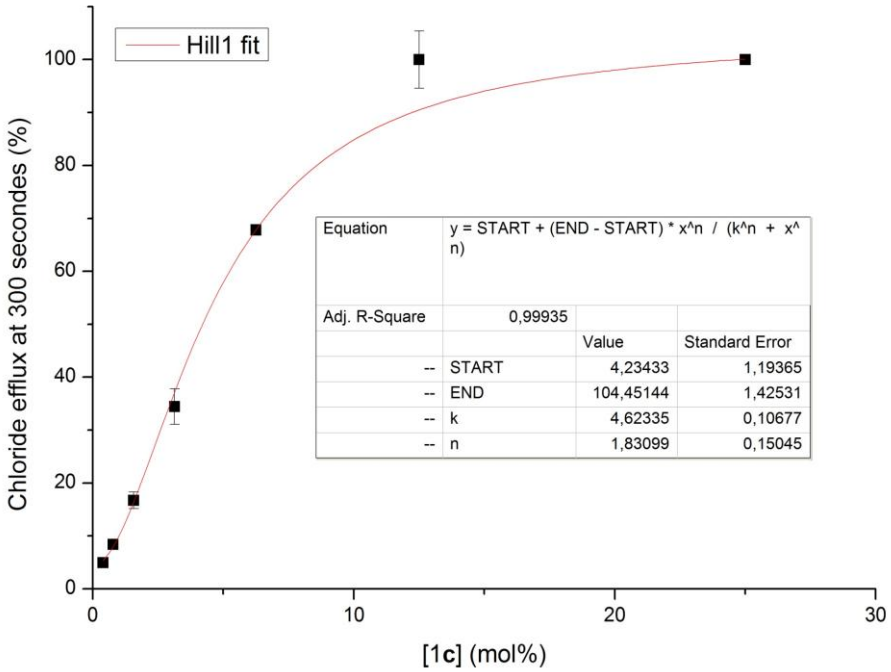

Figure S3. Dose response relationship after addition of several concentrations of **1c** to mixture containing EYPC LUVs containing lucigénine.

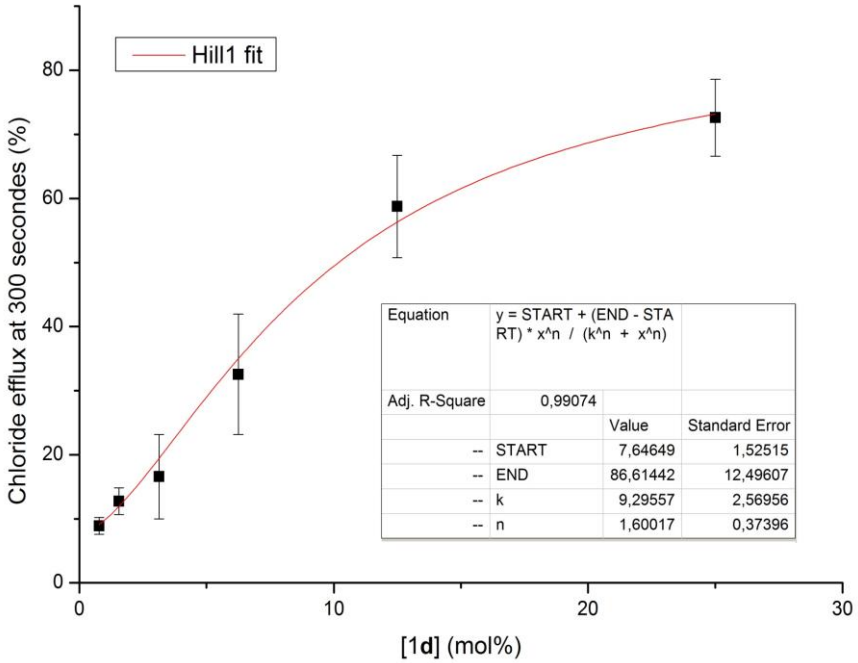

Figure S4. Dose response relationship after addition of several concentrations of **1d** to mixture containing EYPC LUVs containing lucigénine.

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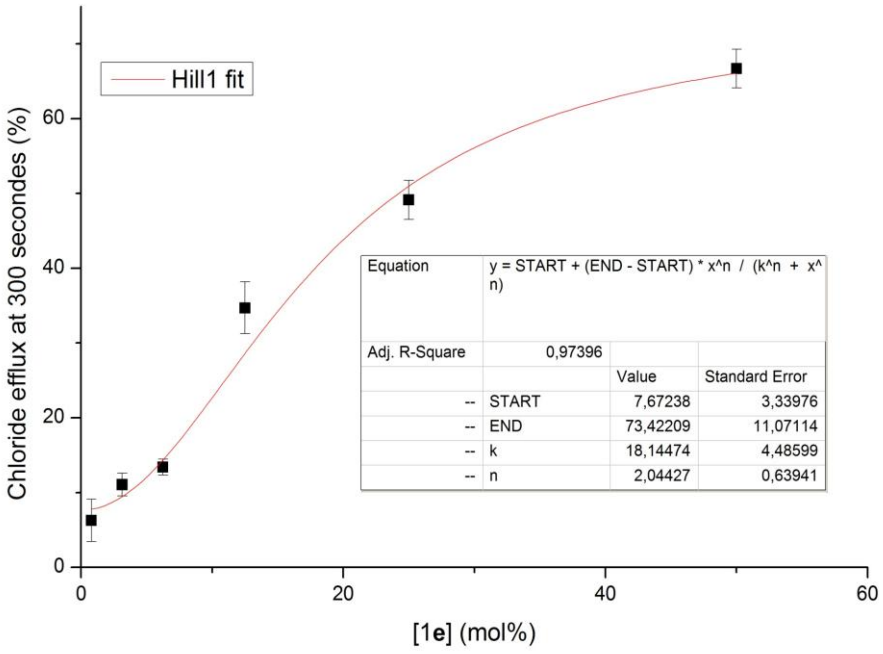

Figure S5. Dose response relationship after addition of several concentrations of **1e** to mixture containing EYPC LUVs containing lucigénine.

3.3 Minimal inhibitory concentration (MIC) determination

5 mL of lysogeny broth (LB) medium were inoculated with *Escheria coli* (DH5α and SK037 strains), *Bacillus thuringiensis* (HD73 strain), *Listeria seeligeri* (ATCC 35967) or *Alcaligenes faecalis* (ATCC 8750). The precultures were grown overnight at 37°C under stirring, and resuspended in 75 mL of a fresh LB medium. The cultures were grown at 37°C until the OD_{600} = 0.4-0.5 and then rediluted in fresh LB medium until OD_{600} = 0.1-0.2. Assays were performed in 96-well culture plates. Each well was filled with 190 µL bacterial culture and 10 µL MiliQ water, MeOH or compounds in methanol solution, as the final volume in each well was 200 µL and the concentration in methanol max 5%. The plates were stirred in an thermostated incubator at 37°C and the OD_{600} was monitored at t = 0 h, 2 h, 4 h, 8 h and 24 h. Every experiment in triplicates on independent bacterial cultures. The MICs were determined as the minimal concentration at which no bacterial growth was detected.

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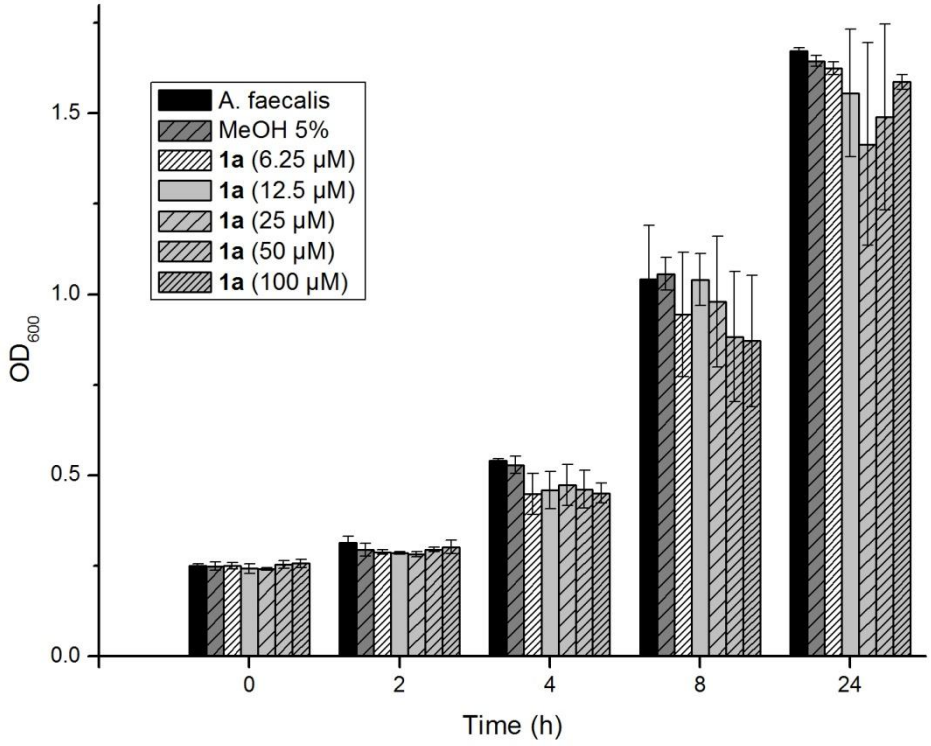

Figure S6. Dose-dependent growth inhibition of *Alcaligenes faecalis* by **1a**.

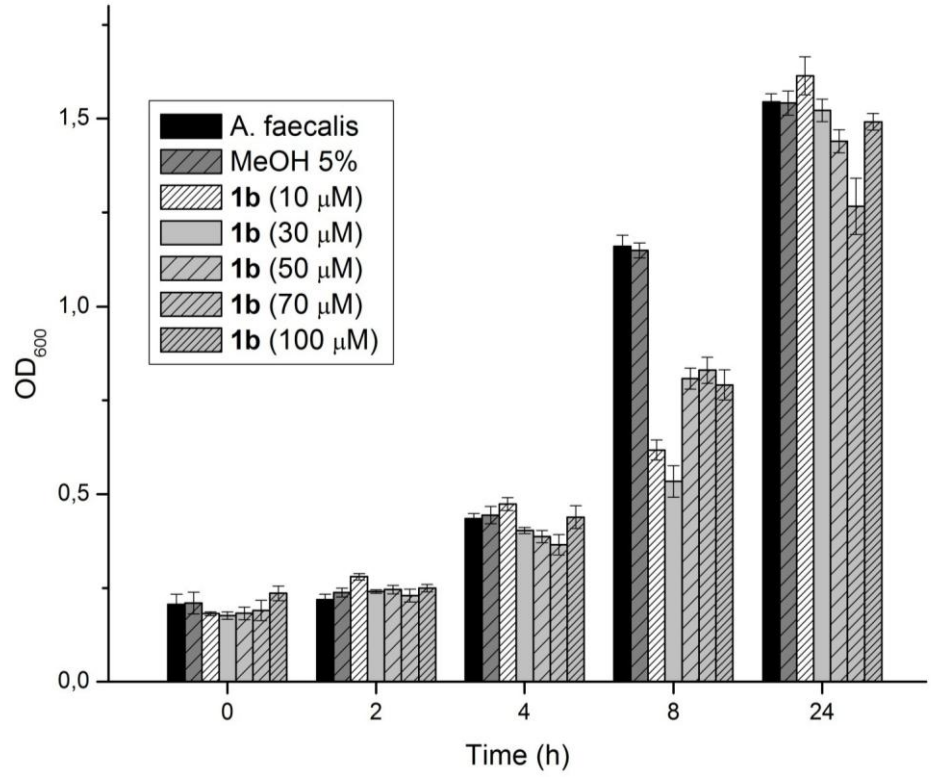

Figure S7. Dose-dependent growth inhibition of *Alcaligenes faecalis* by **1b**.

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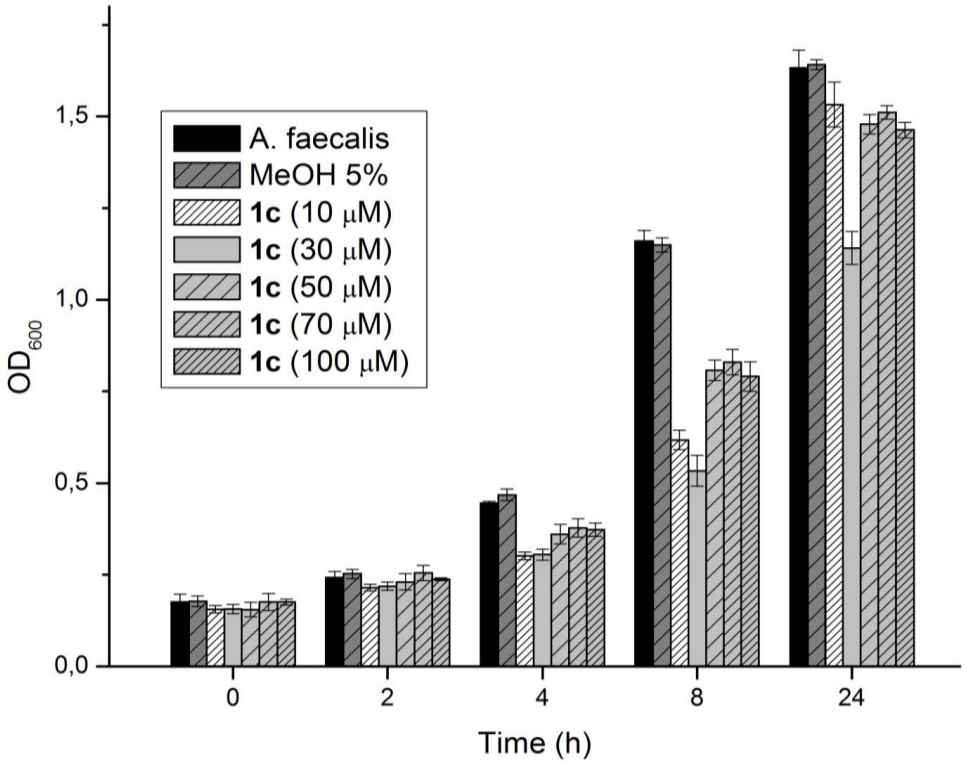

Figure S8. Dose-dependent growth inhibition of *Alcaligenes faecalis* by **1c**.

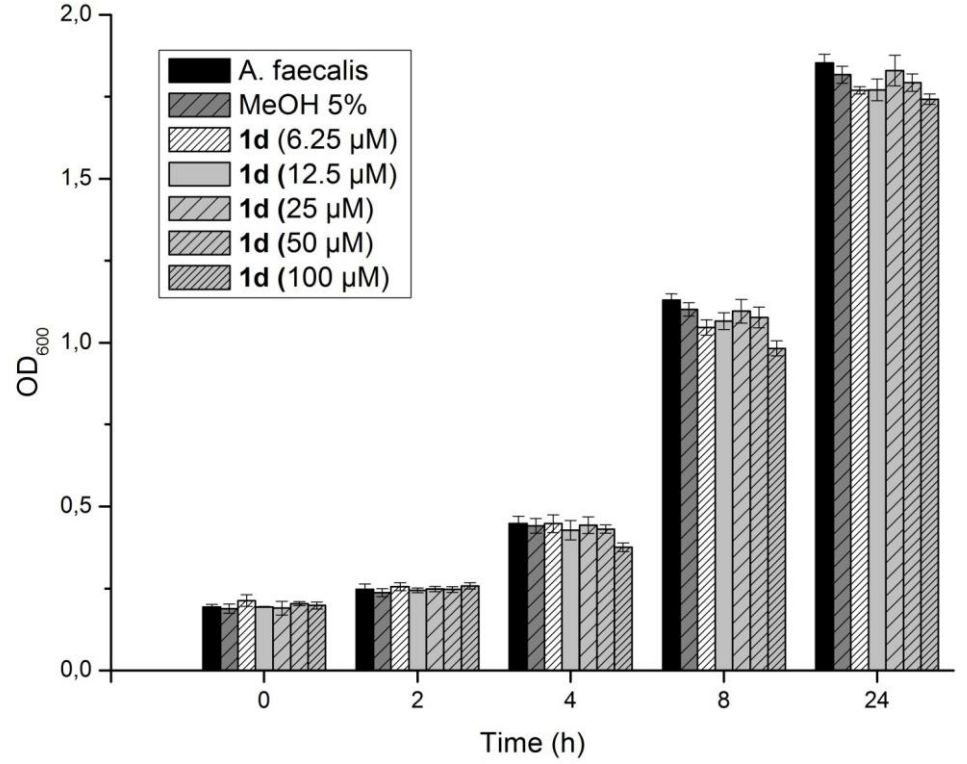

Figure S9. Dose-dependent growth inhibition of *Alcaligenes faecalis* by **1d**.

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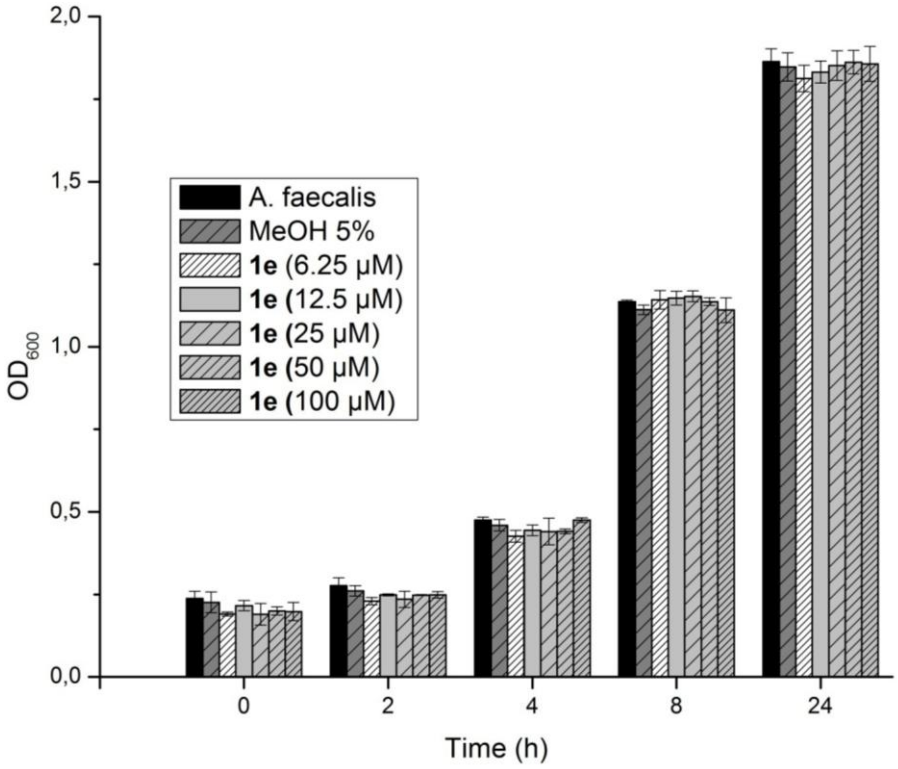

Figure S10. Dose-dependent growth inhibition of *Alcaligenes faecalis* by **1e**.

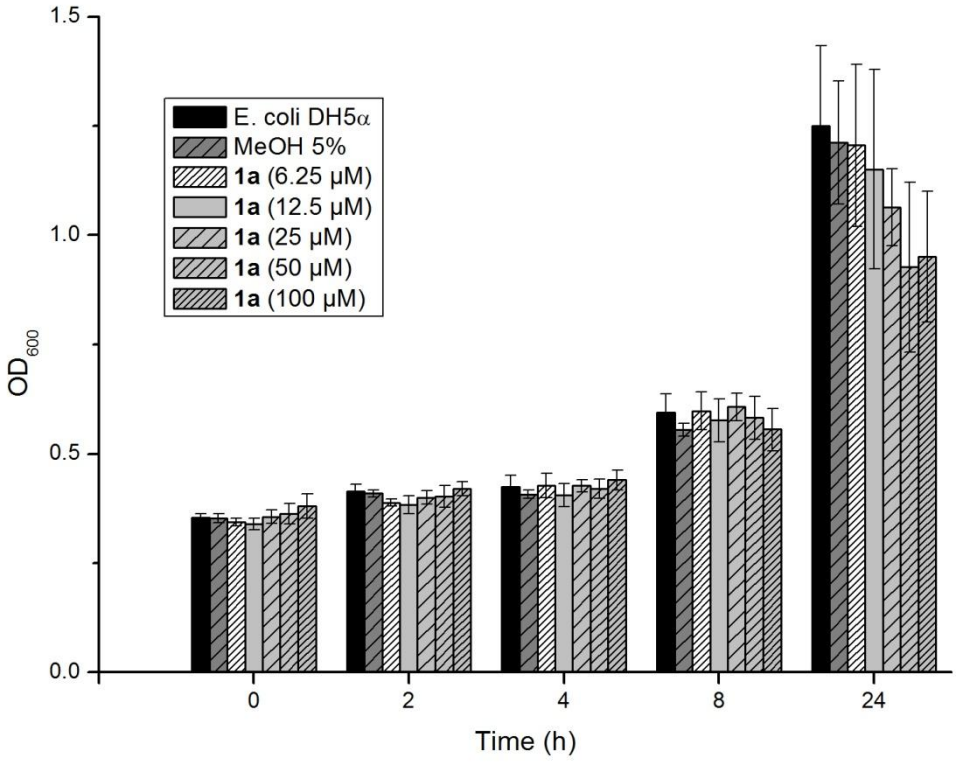

Figure S11. Dose-dependent growth inhibition of *Escherichia coli* by **1a**.

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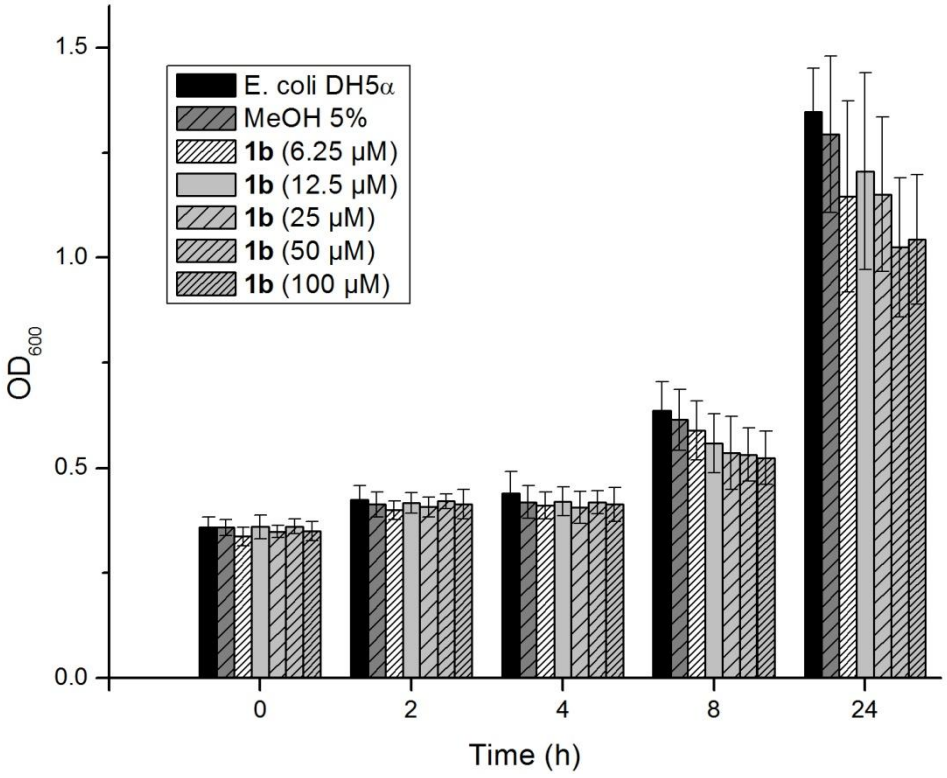

Figure S12. Dose-dependent growth inhibition of *Escherichia coli* by **1b**.

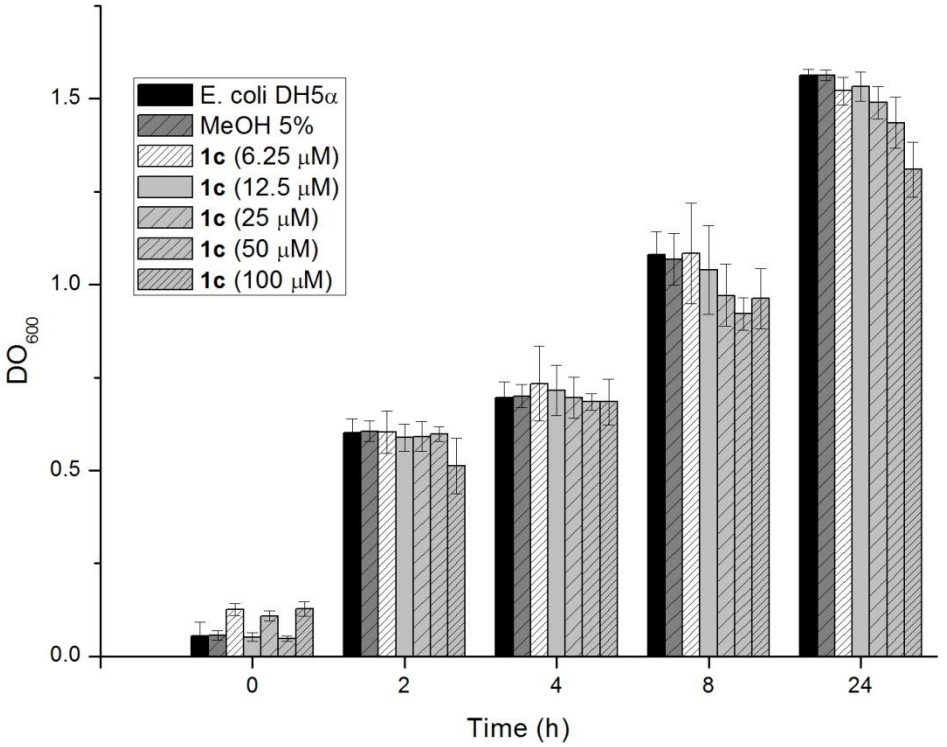

Figure S13. Dose-dependent growth inhibition of *Escherichia coli* by **1c**.

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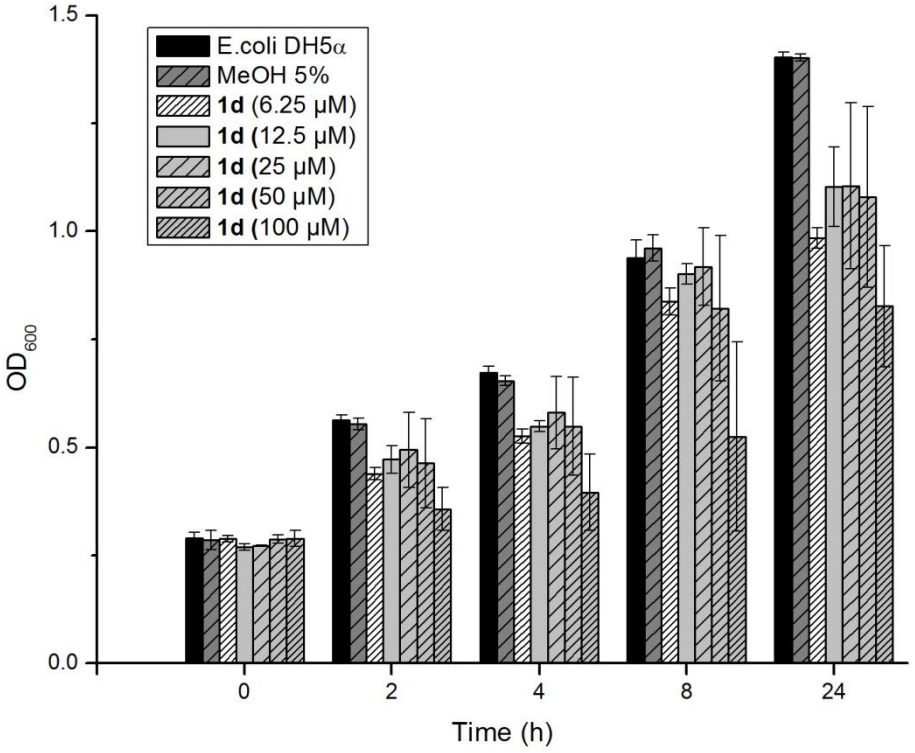

Figure S14. Dose-dependent growth inhibition of *Escherichia coli* by **1d**.

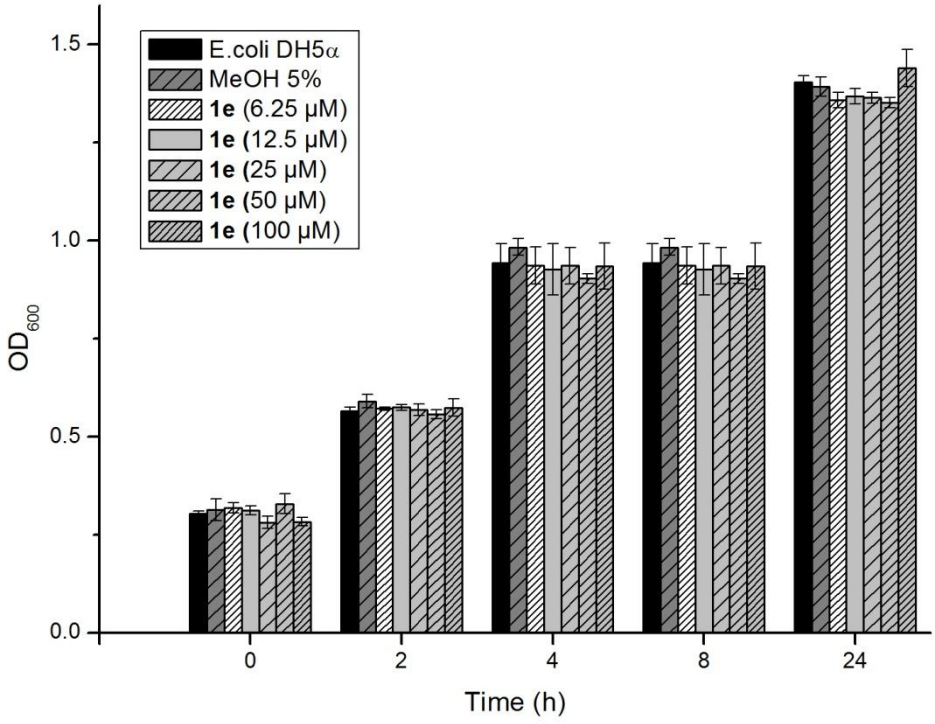

Figure S15. Dose-dependent growth inhibition of *Escherichia coli* by **1e**.

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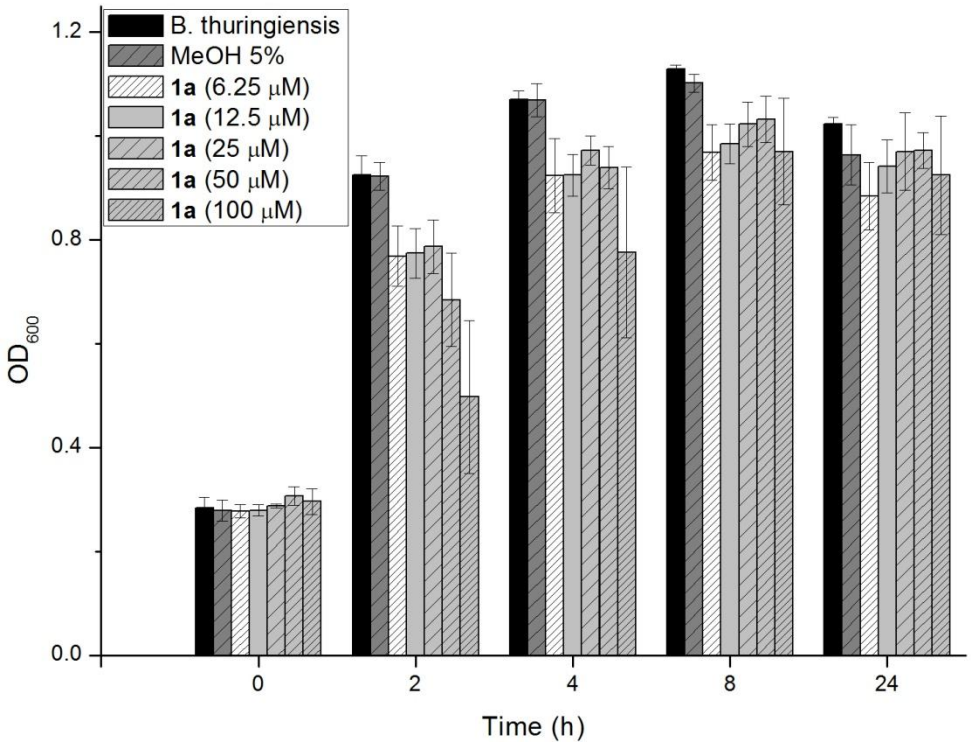

Figure S16. Dose-dependent growth inhibition of *Bacillus thuringiensis* by **1a**.

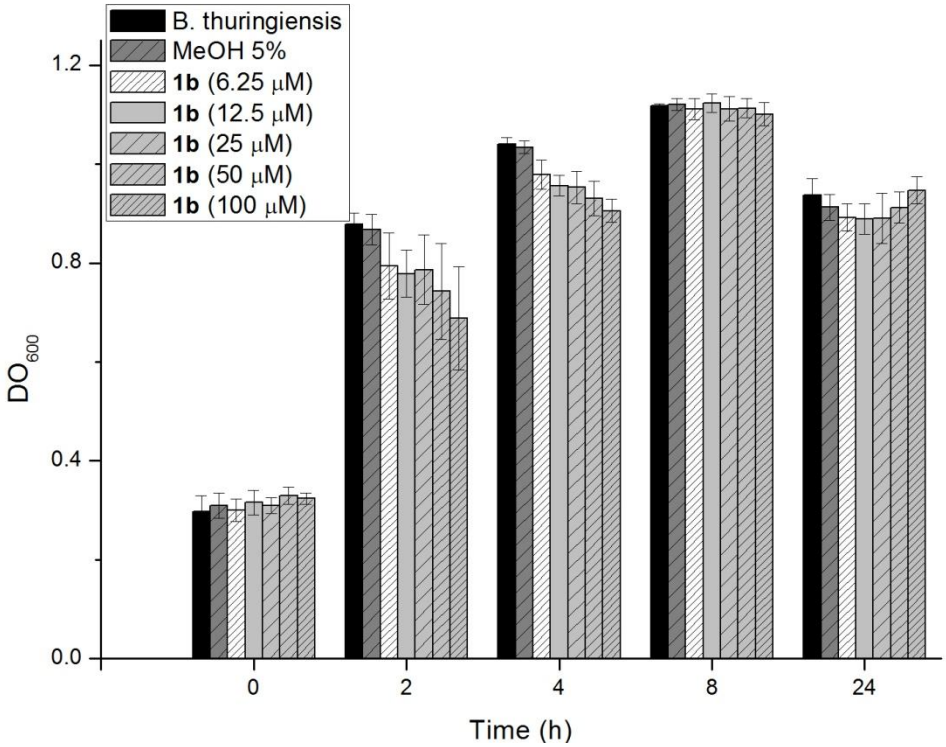

Figure S17. Dose-dependent growth inhibition of *Bacillus thuringiensis* by **1b**.

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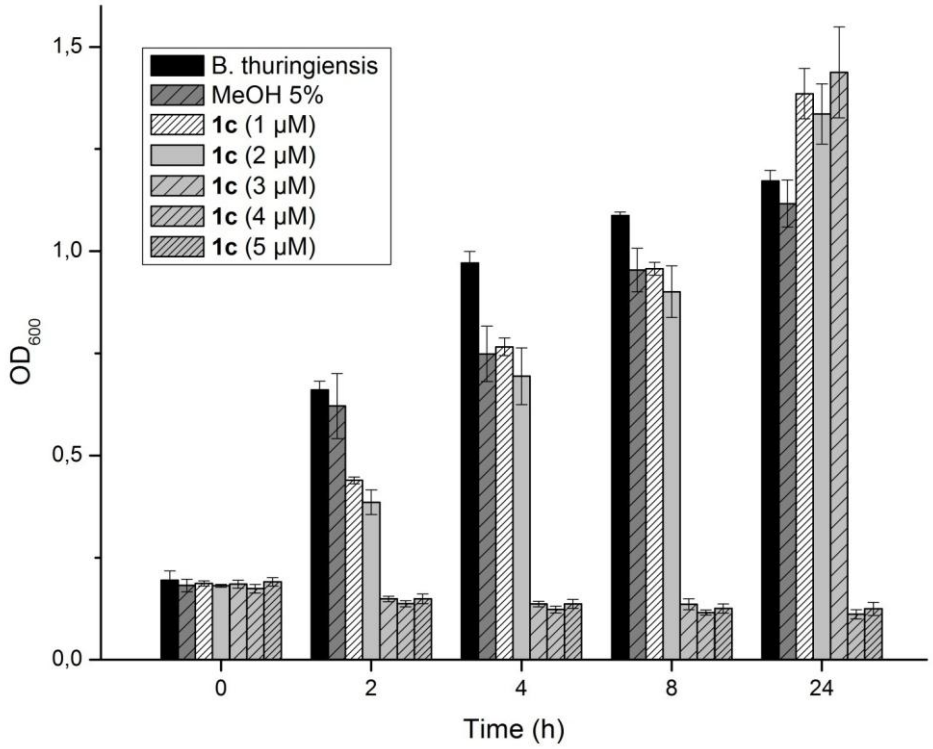

Figure S18. Dose-dependent growth inhibition of *Bacillus thuringiensis* by **1c**.

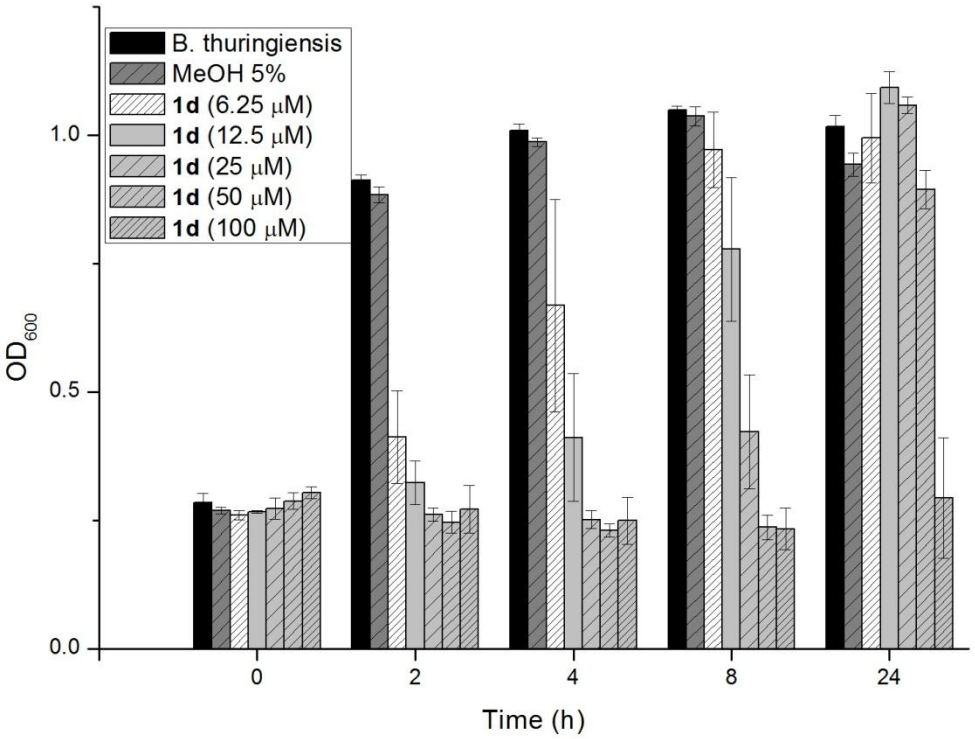

Figure S19. Dose-dependent growth inhibition of *Bacillus thuringiensis* by **1d**.

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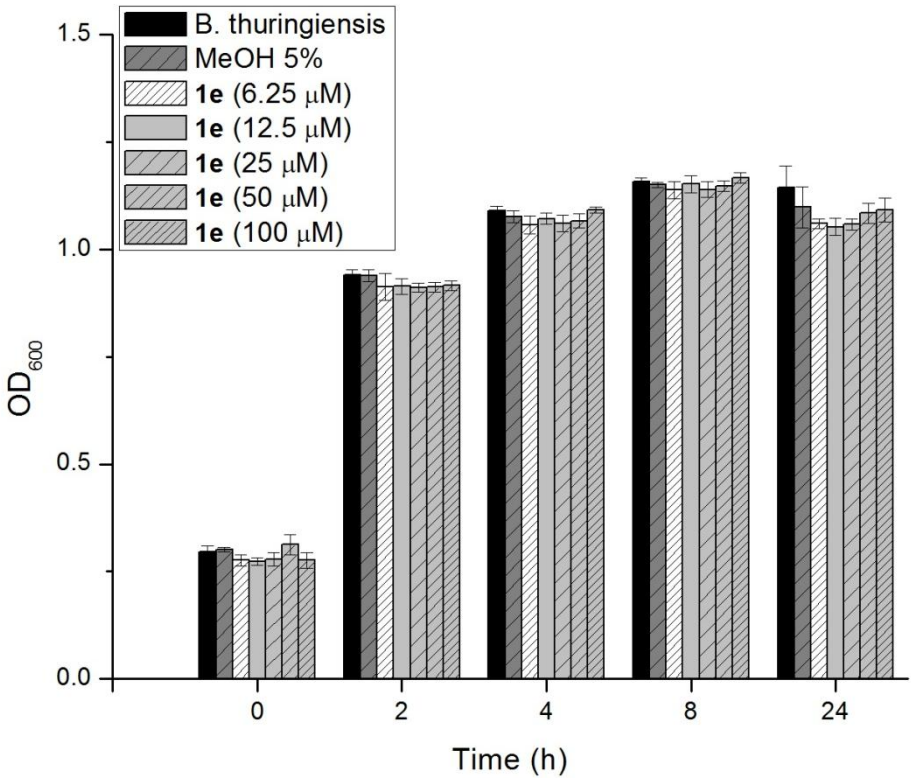

Figure S20. Dose-dependent growth inhibition of *Bacillus thuringiensis* by **1e**.

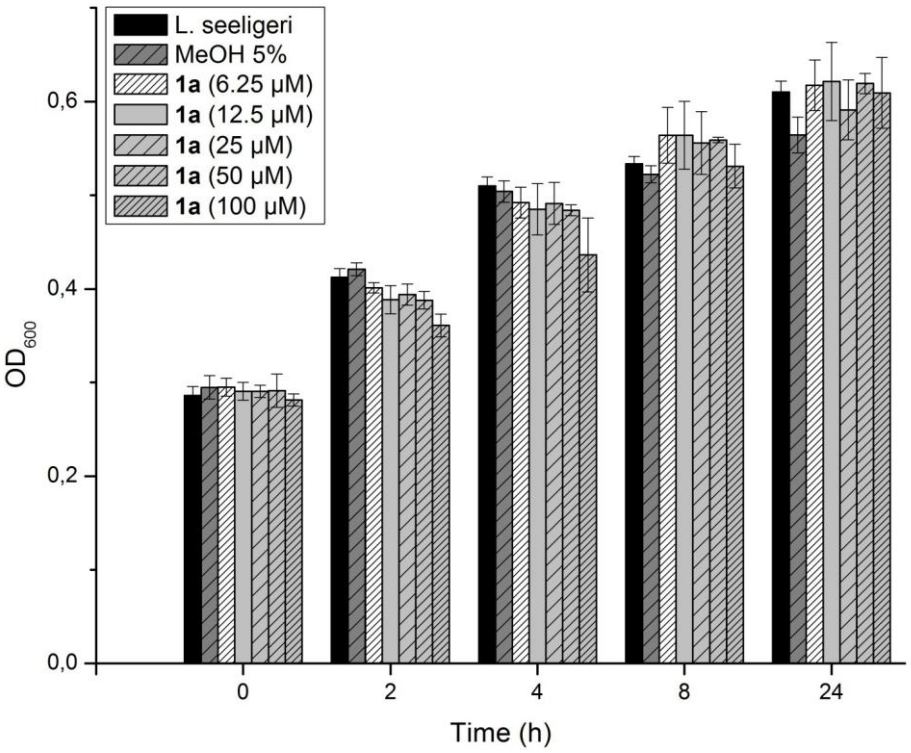

Figure S21. Dose-dependent growth inhibition of *Listeria seeligeri* by **1a**.

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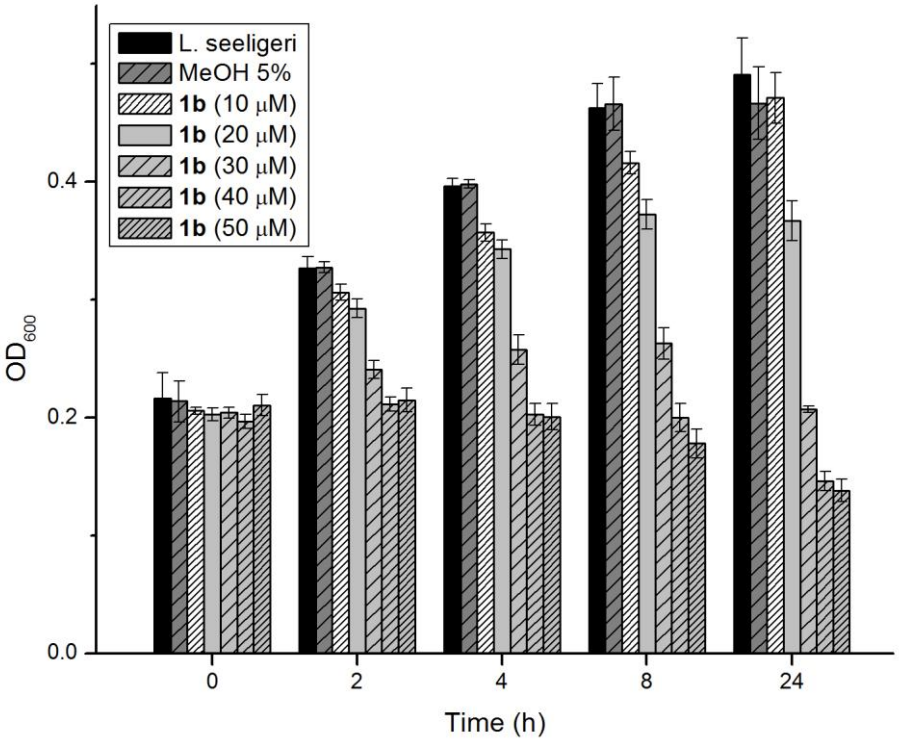

Figure S22. Dose-dependent growth inhibition of *Listeria seeligeri* by **1b**.

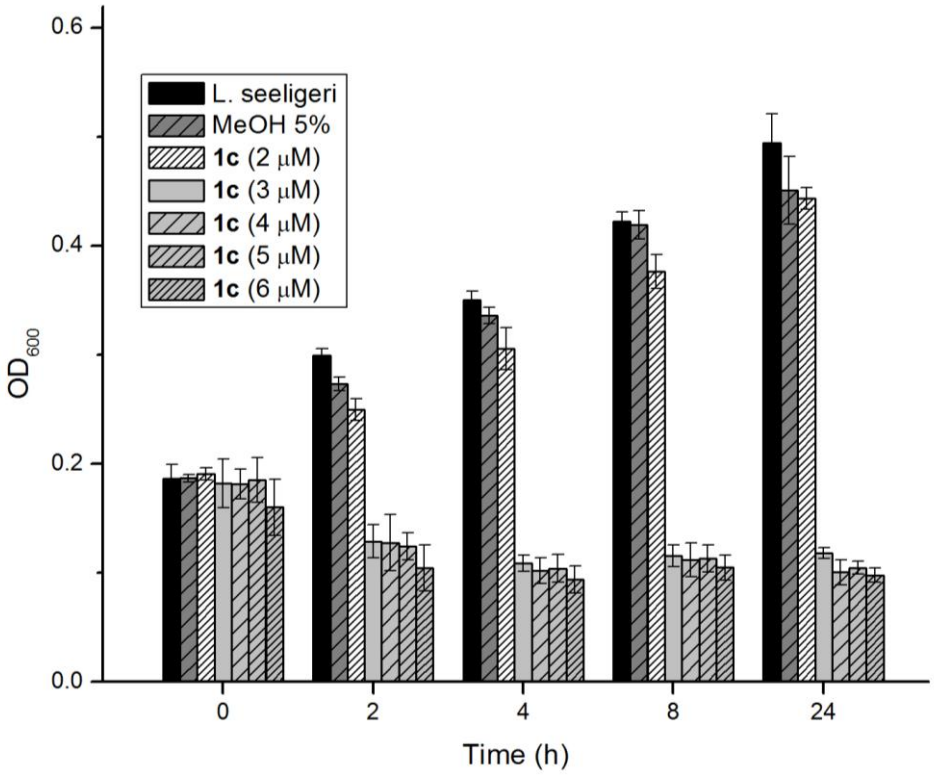

Figure S23. Dose-dependent growth inhibition of *Listeria seeligeri* by **1c**.

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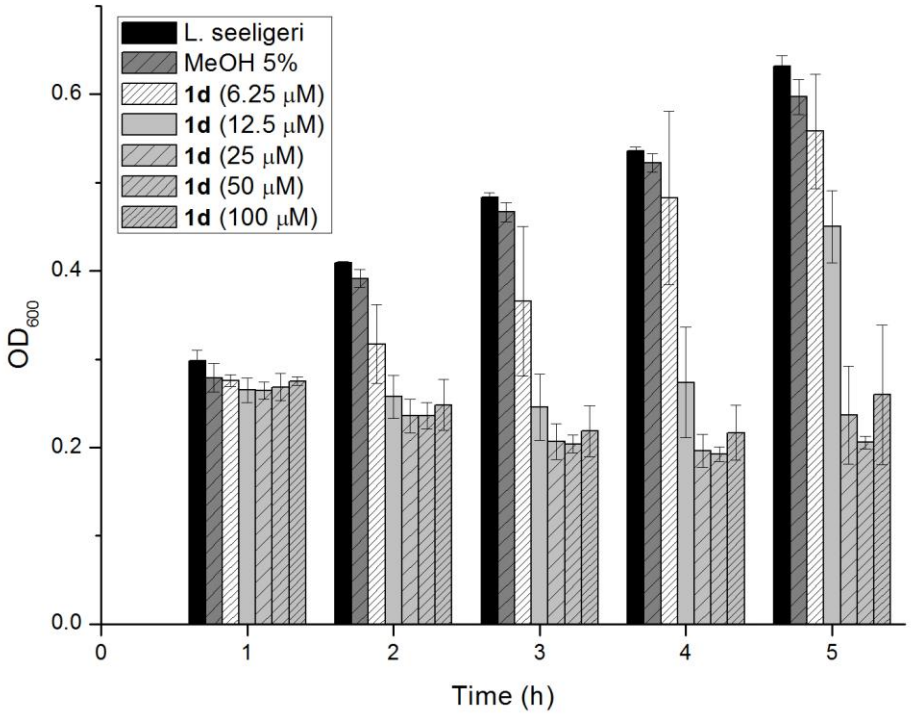

Figure S24. Dose-dependent growth inhibition of *Listeria seeligeri* by **1c**.

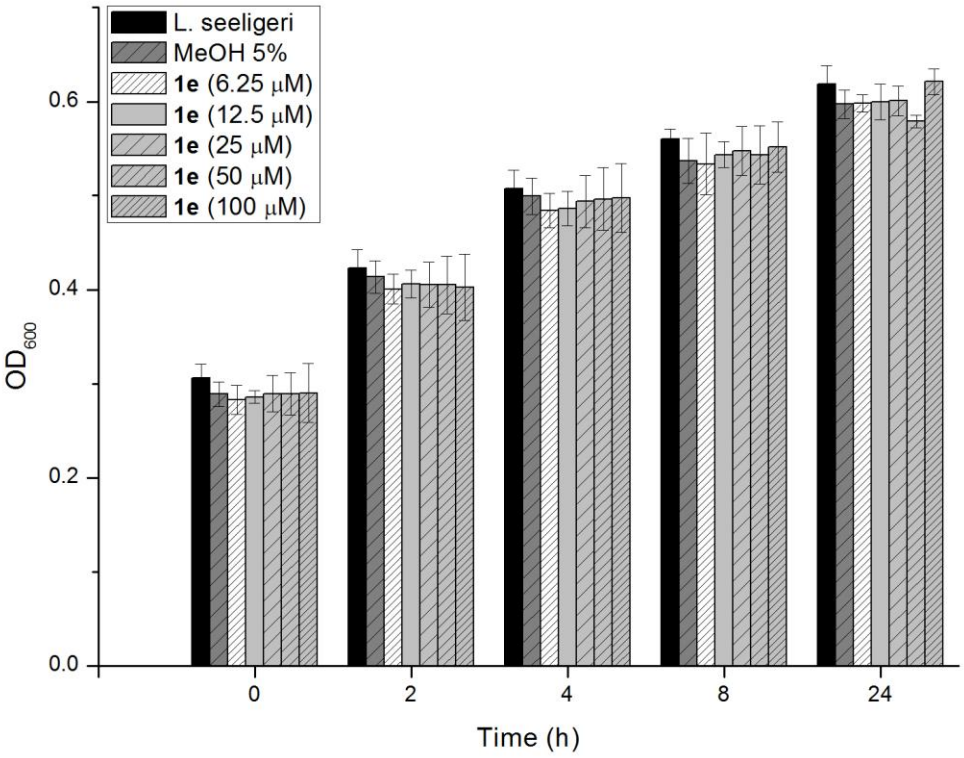

Figure S25. Dose-dependent growth inhibition of *Listeria seeligeri* by **1e**.

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3.4 Cytotoxicity

Every experiment was repeated at least three times. Assays were performed in 96-well culture plates. Each well was filled with 100 µL of DMEM growth media containing ten thousands cells (HEK293T). Cells were allowed to adhere during one hour in the incubator at 37°C with 5% CO_2 after which 50 µL of culture media containing 0.3% MeOH and the compounds at different concentrations were added and the plates were incubated for 24 hours (the final MeOH concentration in the wells was 0.1%). Three wells were prepared for the negative control (0% activity) by adding 50 µL of growth media containing 0.3% MeOH, and three wells containing only 150 µL of growth medium were prepared for the 100% activity control. After 24h of incubation at 37°C with 5% CO_2, 15 µL of a 5 mg/mL MTT solution was added to each well and the plates were incubated for an additional 4 h. 100 µL of DMSO were added to dissolve the purple MTT formazan precipitate and the absorbance at 530 nm was measured with a plate reader. The percentage of cell viability was calculated as $[(At-A_0)/(Ac-A_0)]x100\%$ where At is the mean absorbance of wells treated with compounds **1b-d**, Ac is the mean absorbance of untreated cells and A_0 is the mean absorbance of wells containing only the growth medium. IC_{50} values were calculated using the software Origin 8.0.

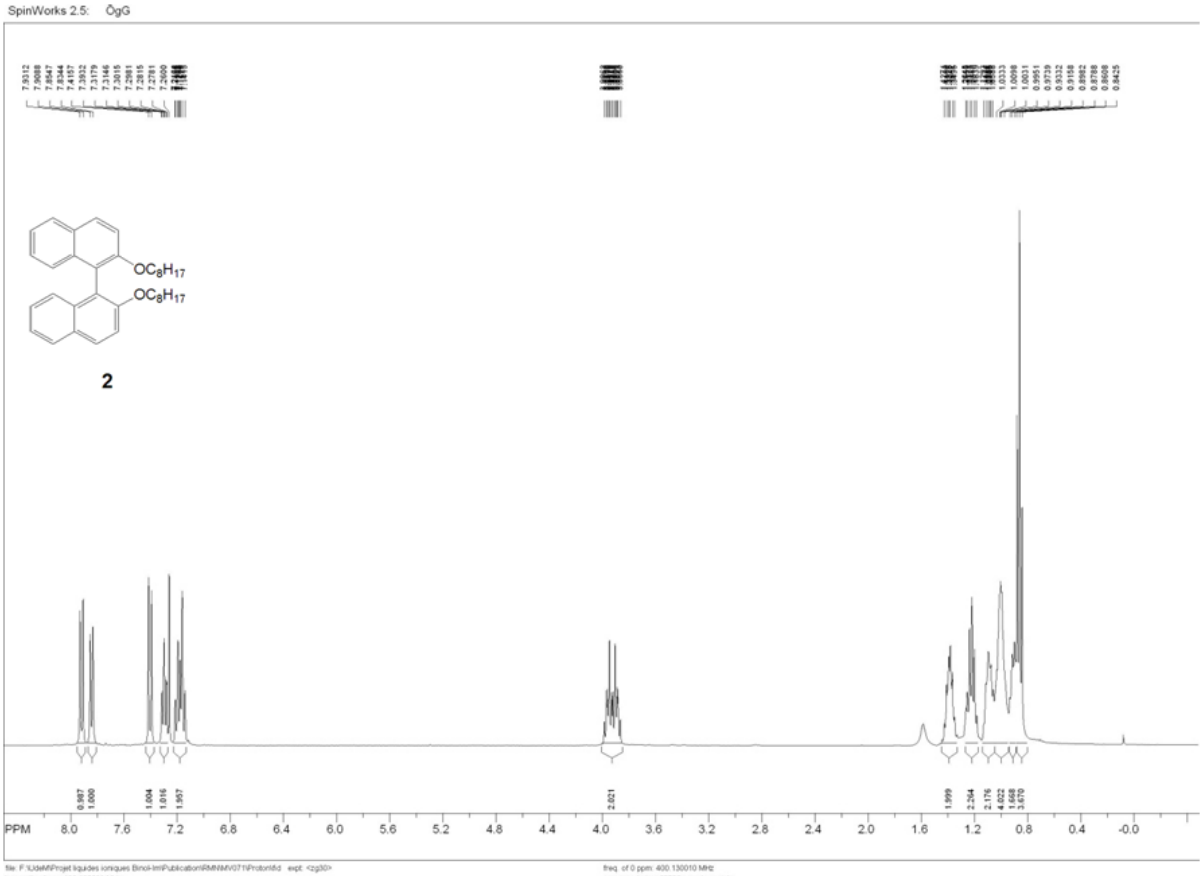
3.5 Measurement of haemolytic activity.

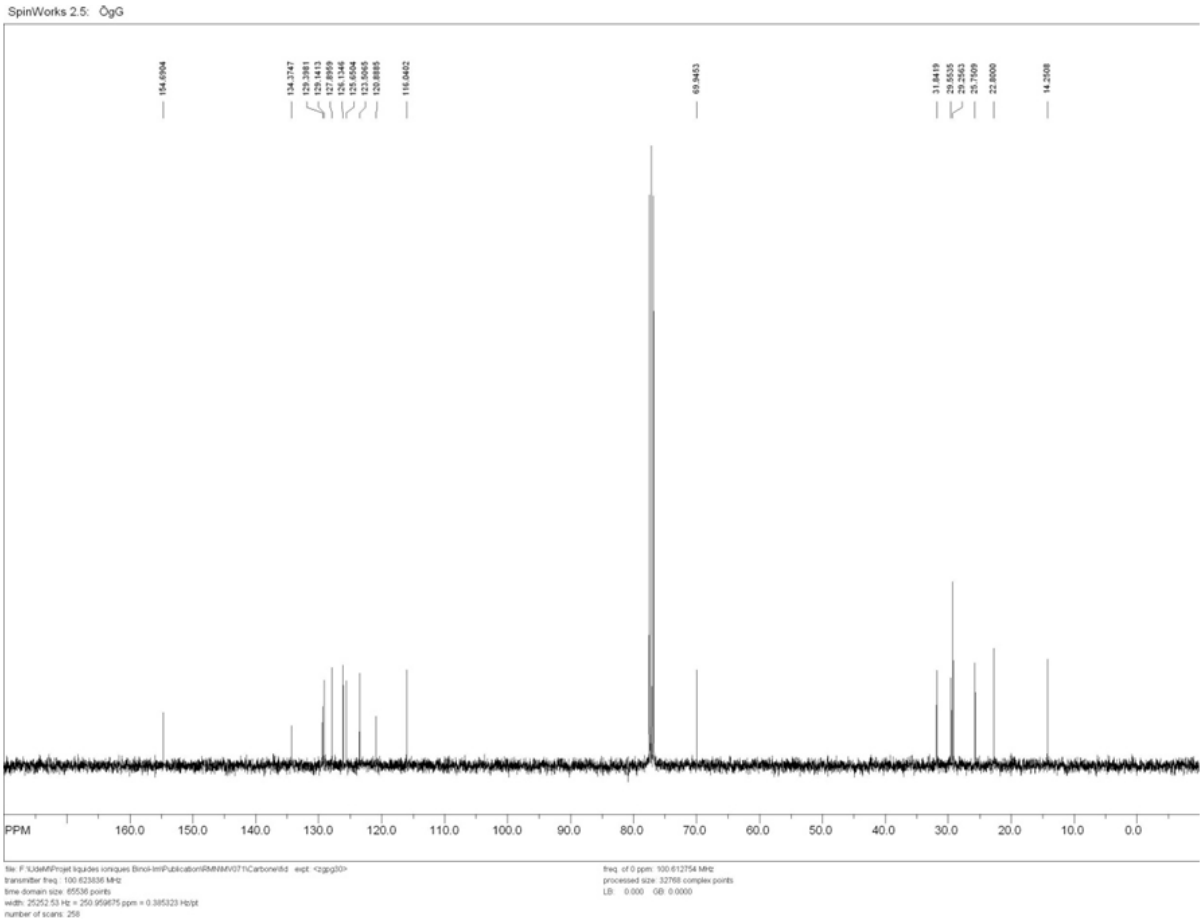
Haemolytic activity was tested against erythrocytes from human blood. Fresh human red blood cells (blood type O) were centrifuged for 10 minutes at 2000g, then washed with PBS buffer until supernatant was clear and diluted to a concentration of 2% (v/v) in PBS buffer. 10 µL of two-fold serial dilutions of compounds **1b-d** in methanol were added to 96-well plates, after which 190 µL of erythrocyte suspension were added. After 1 or 24 h of incubation at 37°C with gentle shaking, the plates were centrifuged for 10 minutes at 2000g. 50 µL of supernatant of each well were transferred to a fresh plate and the release of hemoglobin was monitored by measuring the absorbance at 405 nm. The values for 0% and 100% hemolysis were determined by incubating erythrocytes with PBS or with 0.5% (v/v) Triton X-100. The hemolysis percentage is calculated using the following equation :

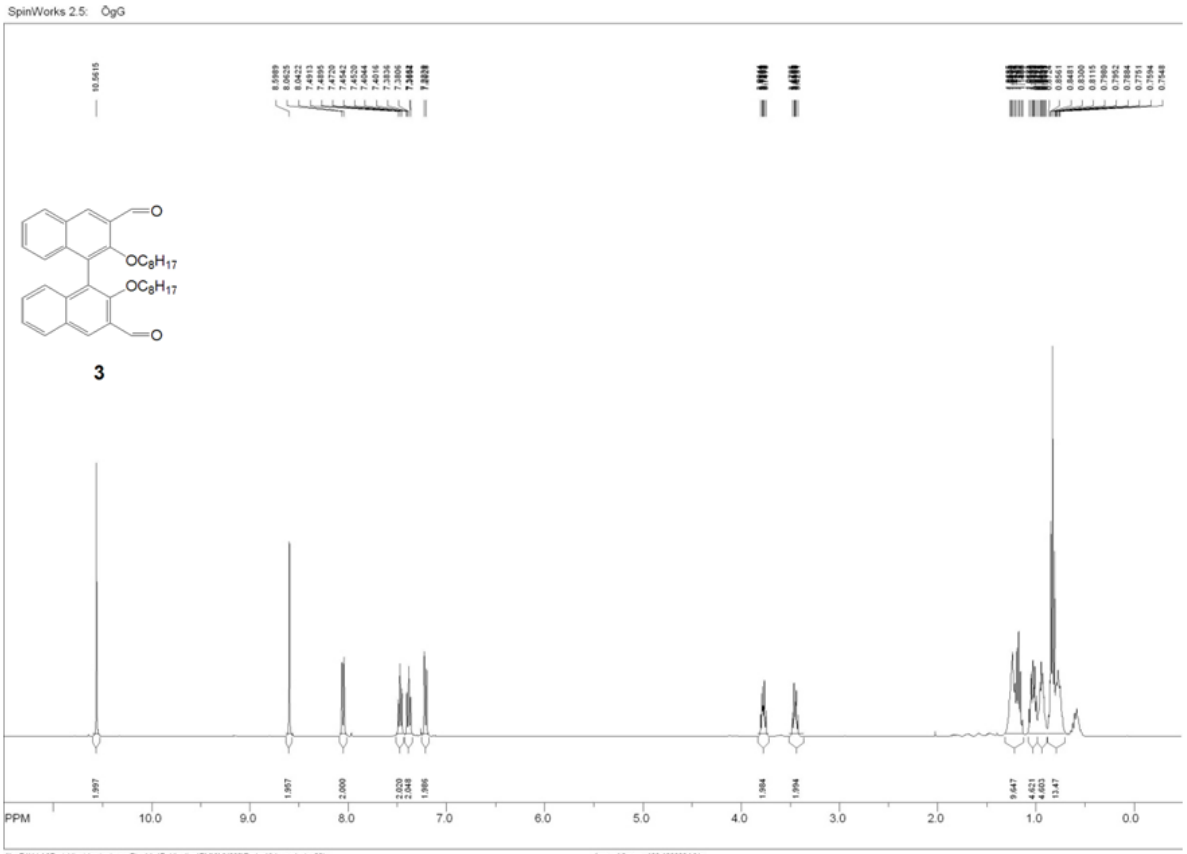
$$\text{Hemolysis (\%)} = \frac{A - A_0}{A_{100} - A_0} \times 100$$

where A is the absorbance of supernatant **1b-d** solutions, A_0 is the absorbance of supernatant with PBS and A_{100} is the absorbance of supernatant with 0.5% Triton X-100. Data are the mean of three separate experiments.

4. NMR Spectra



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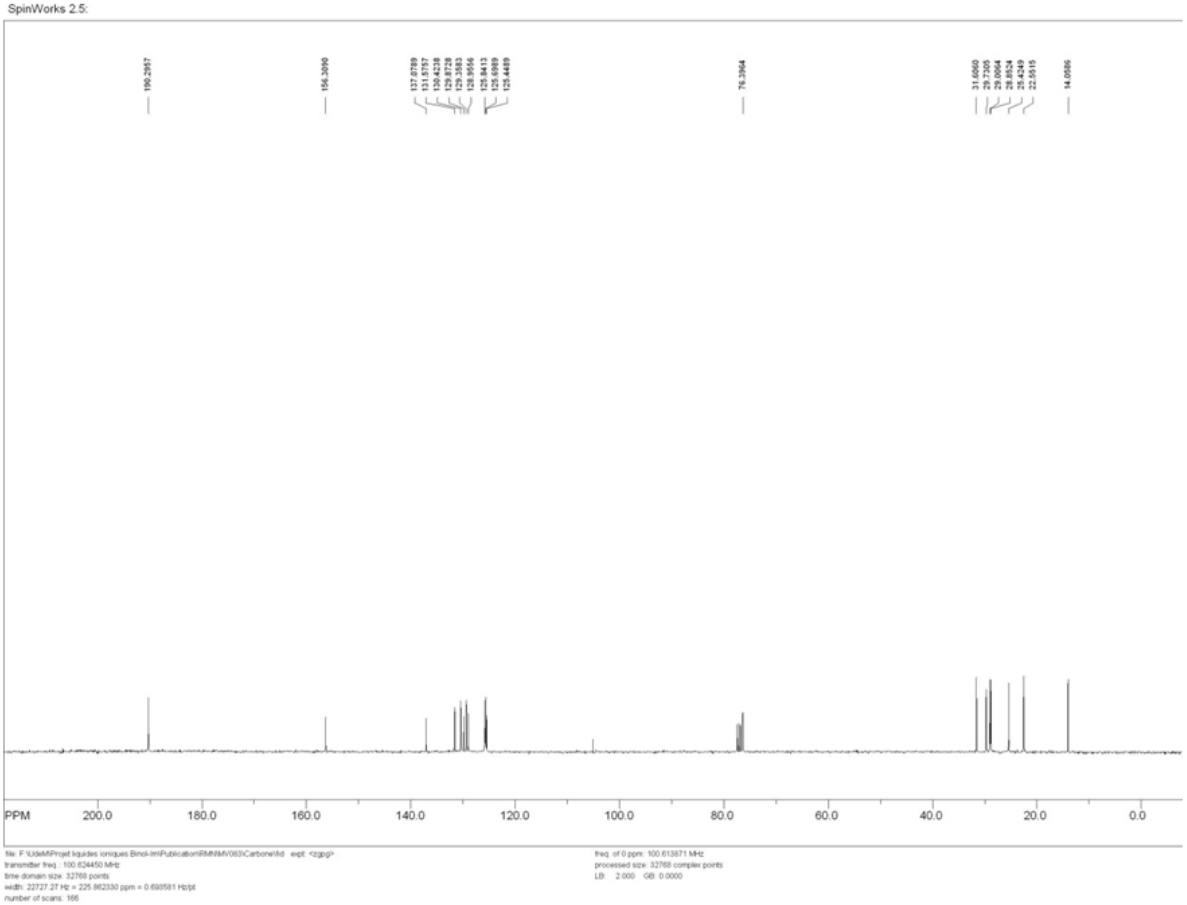
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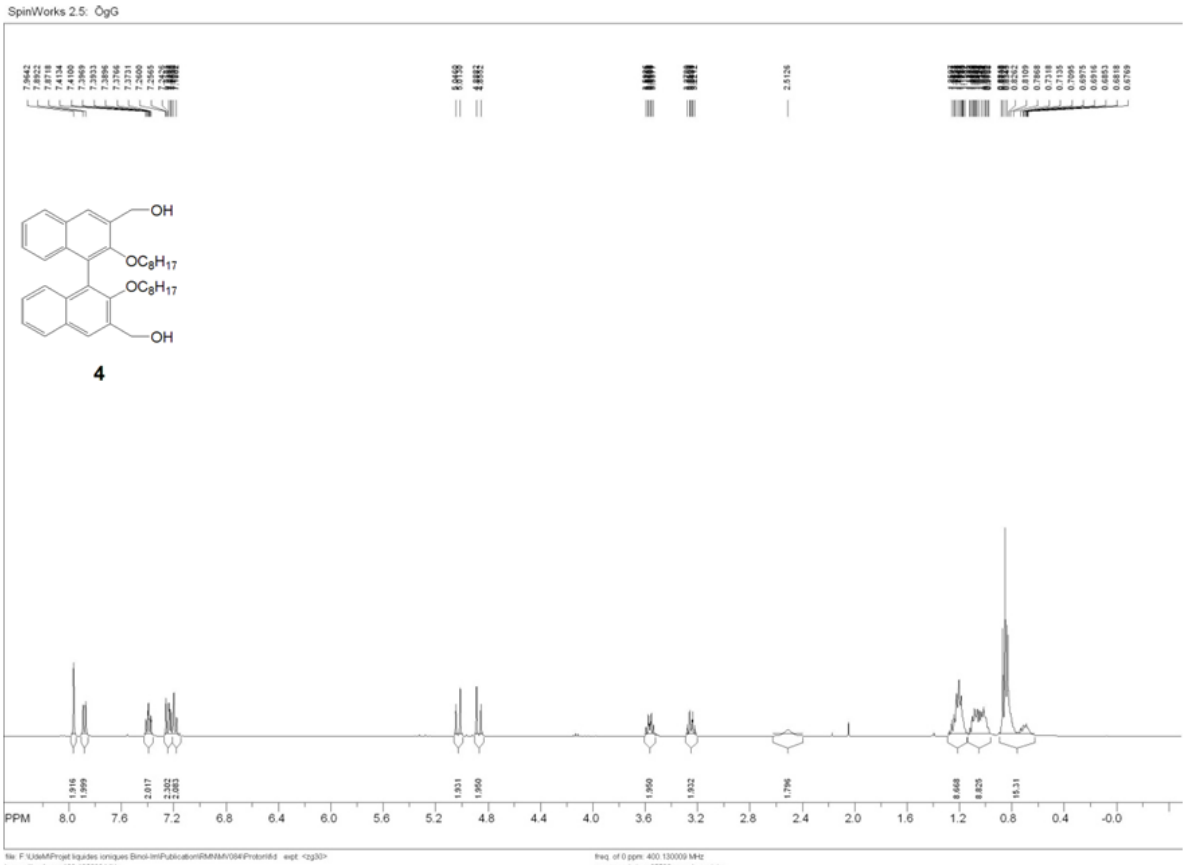
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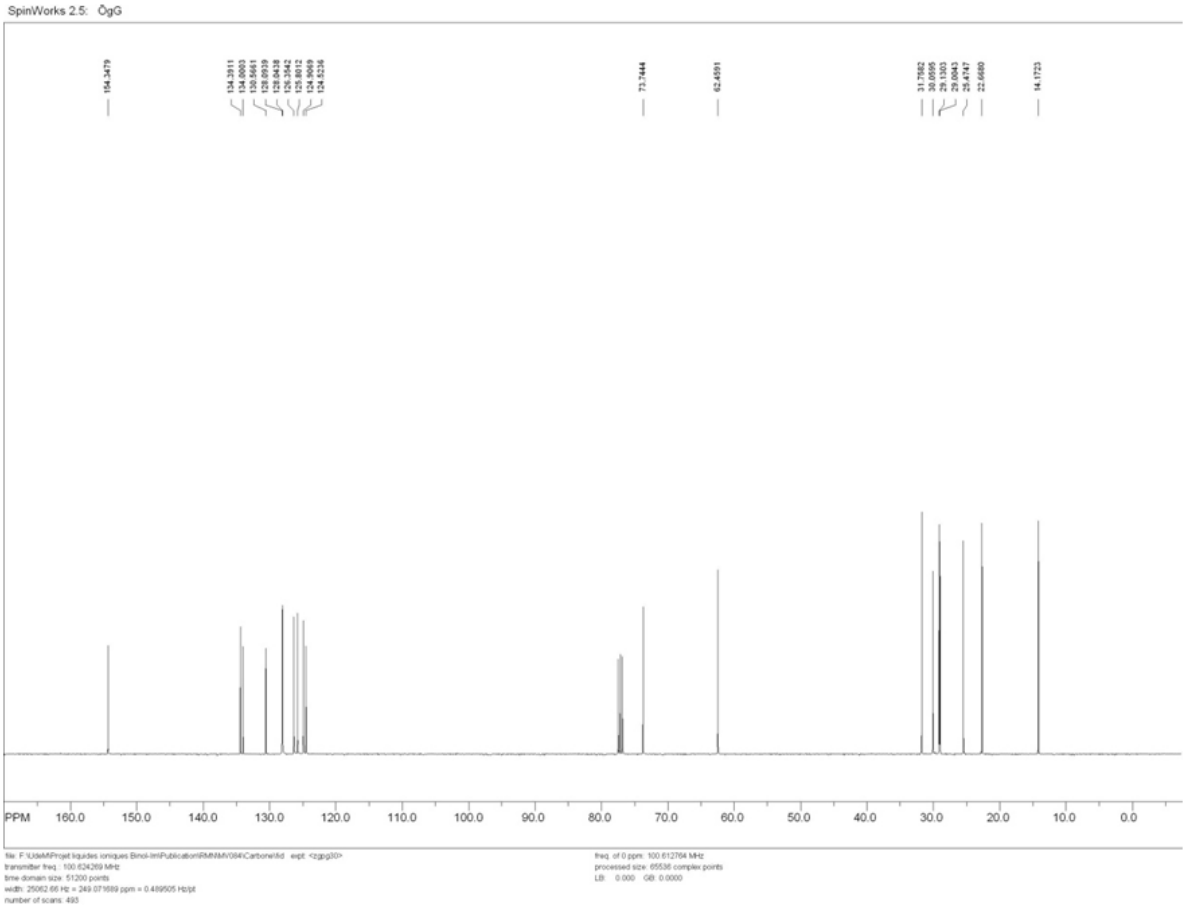
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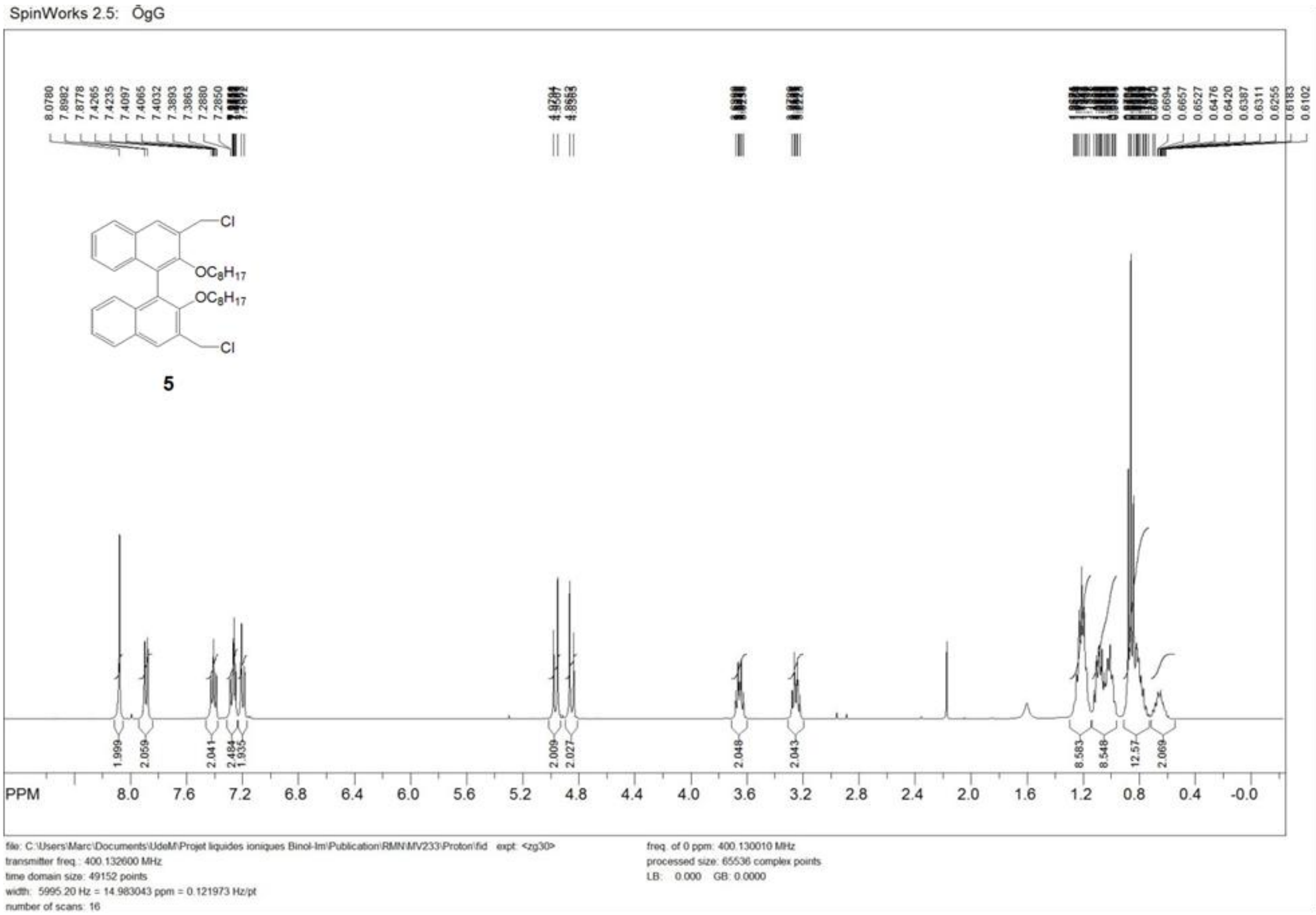
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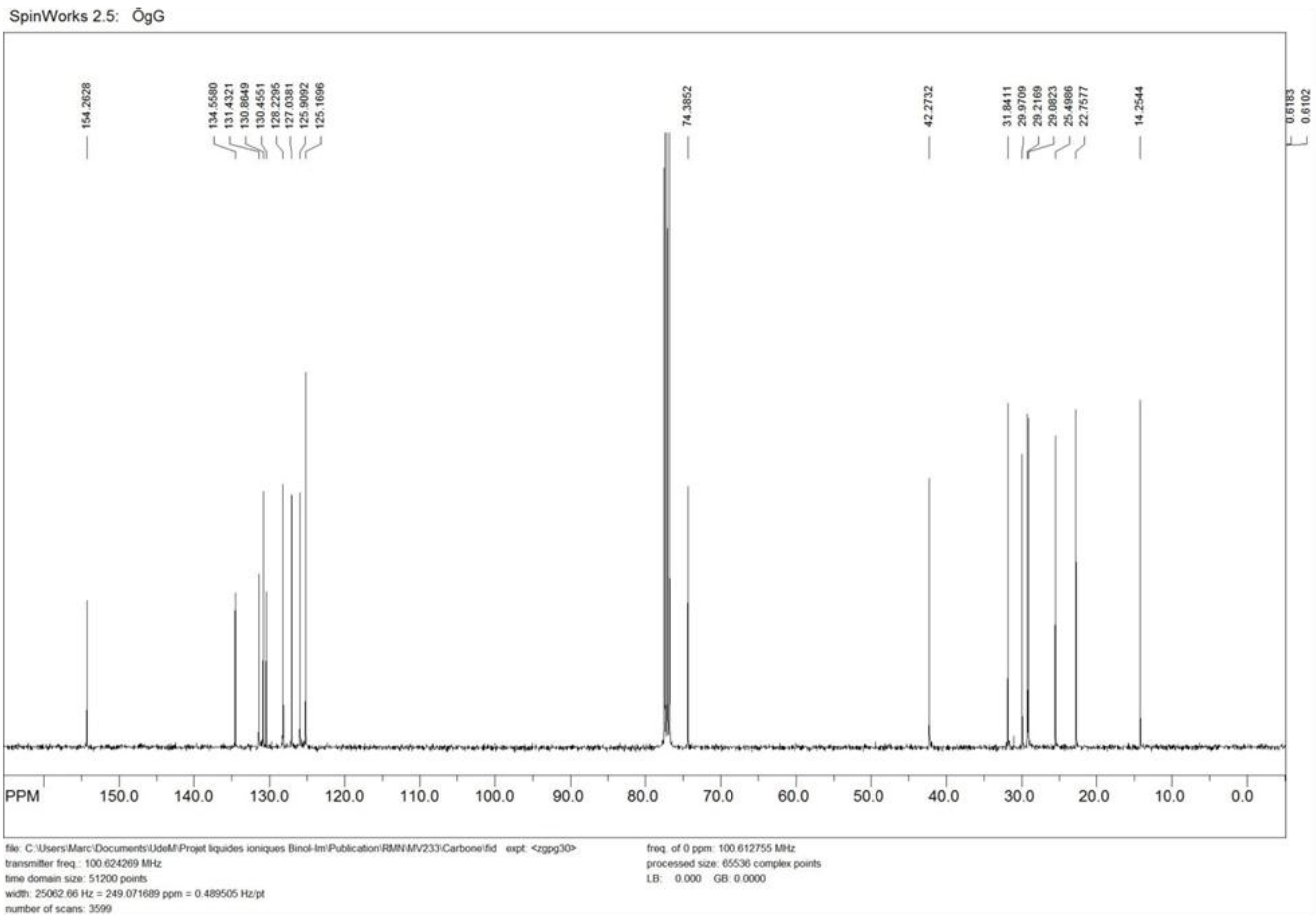
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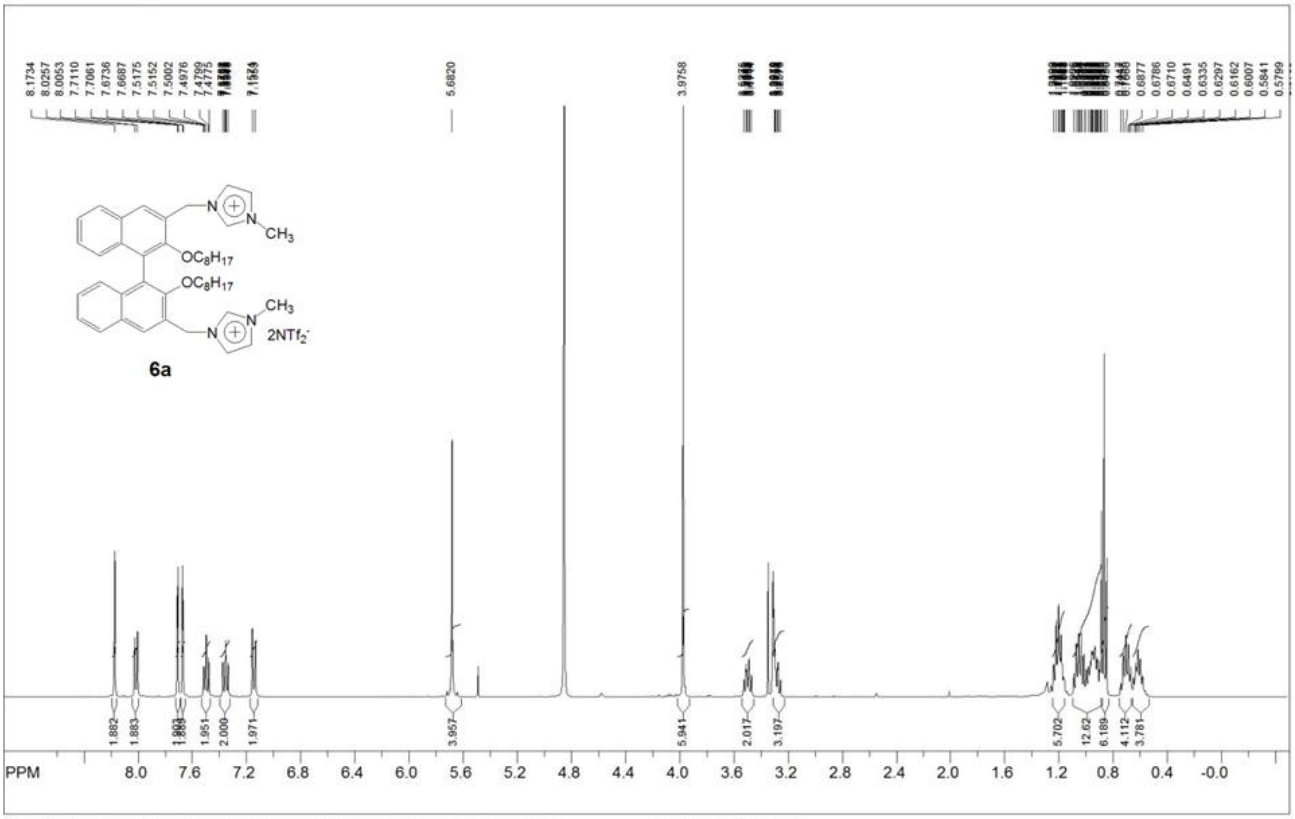

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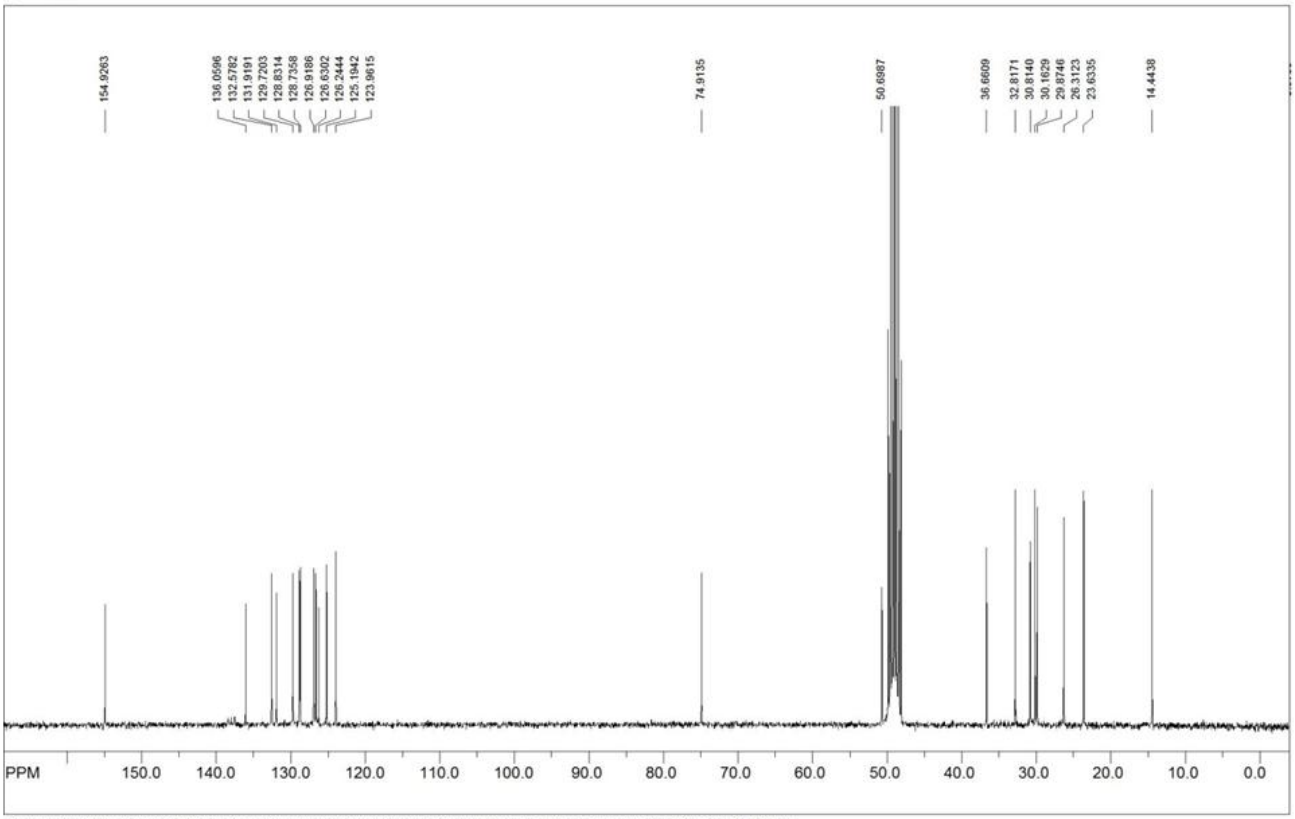

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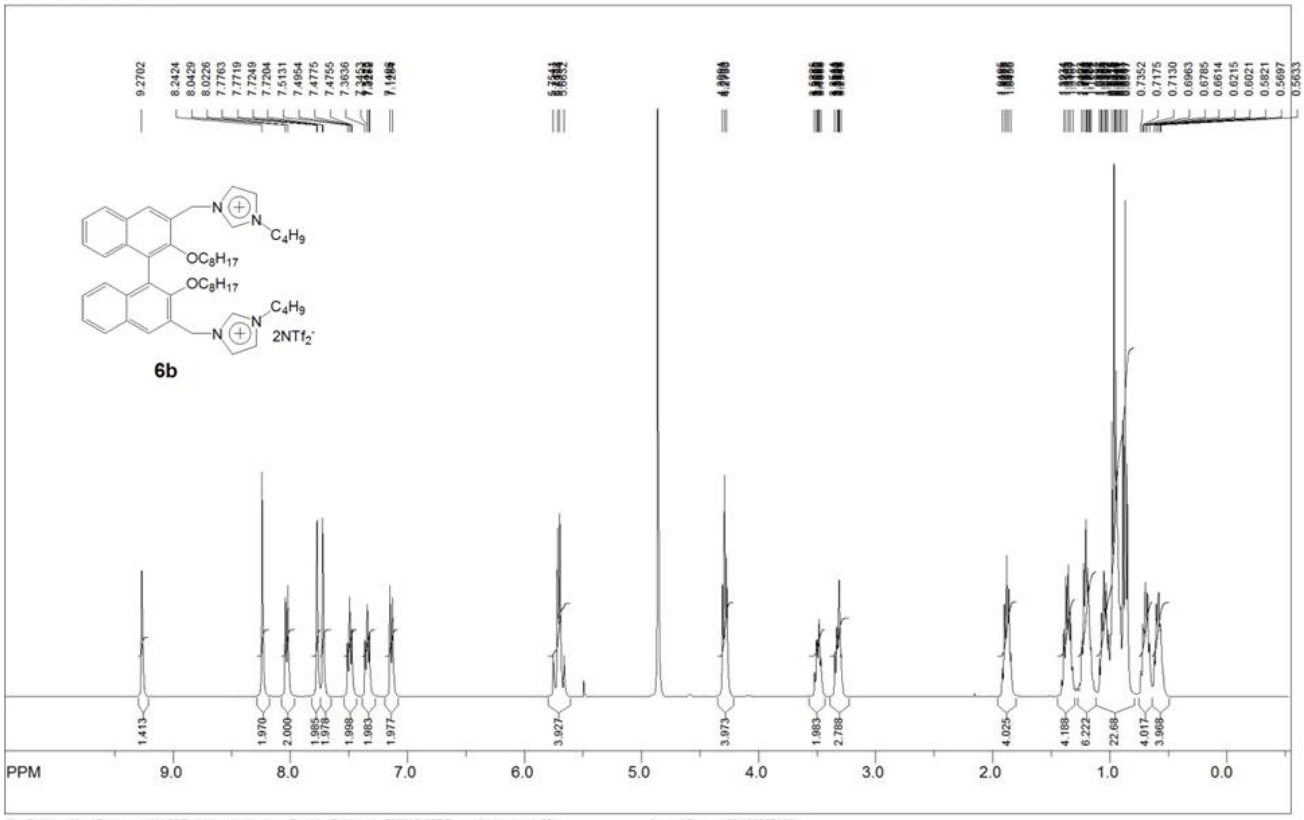

6b

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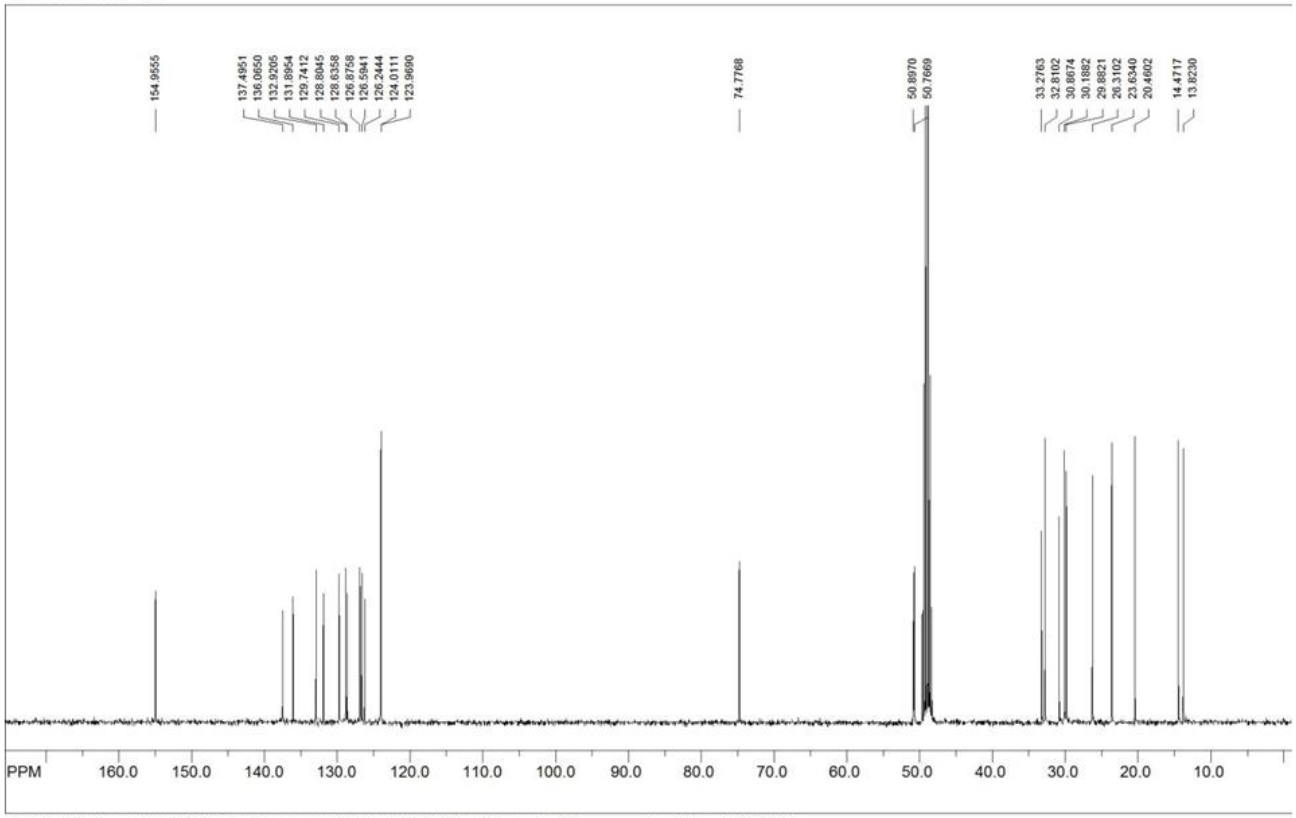
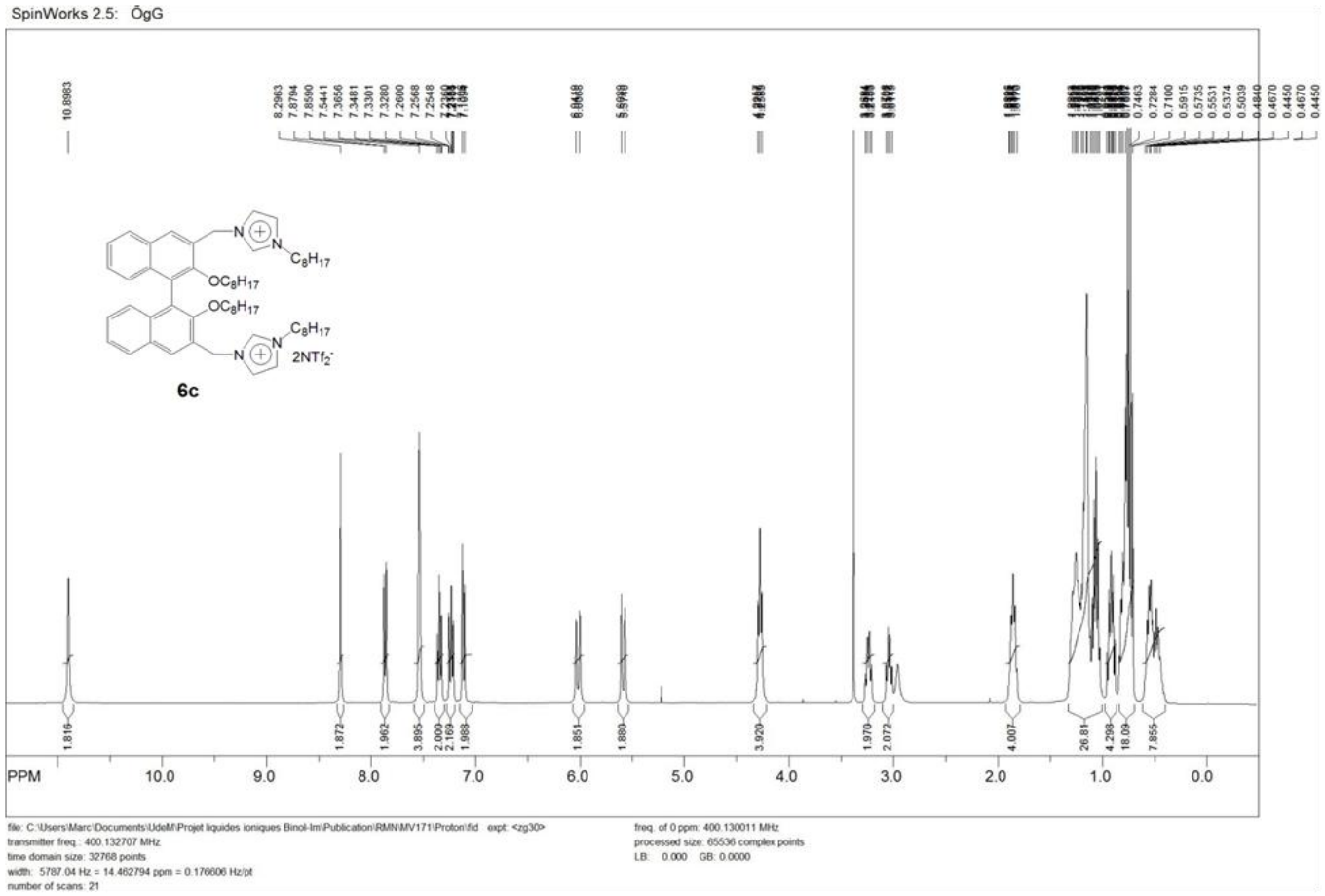
LB: 0.000 GB: 0.0000

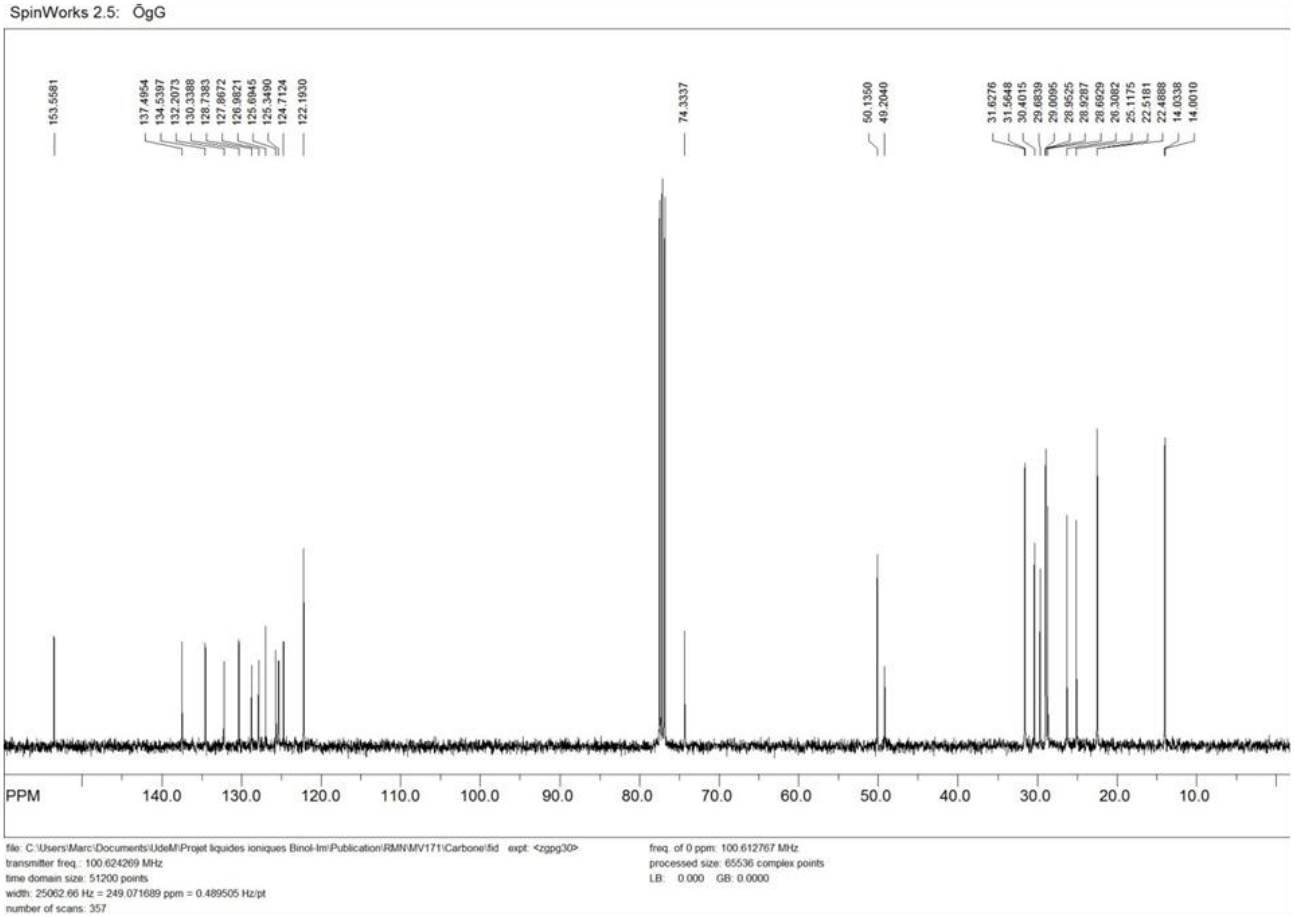
SpinWorks 2.5: ÔgG

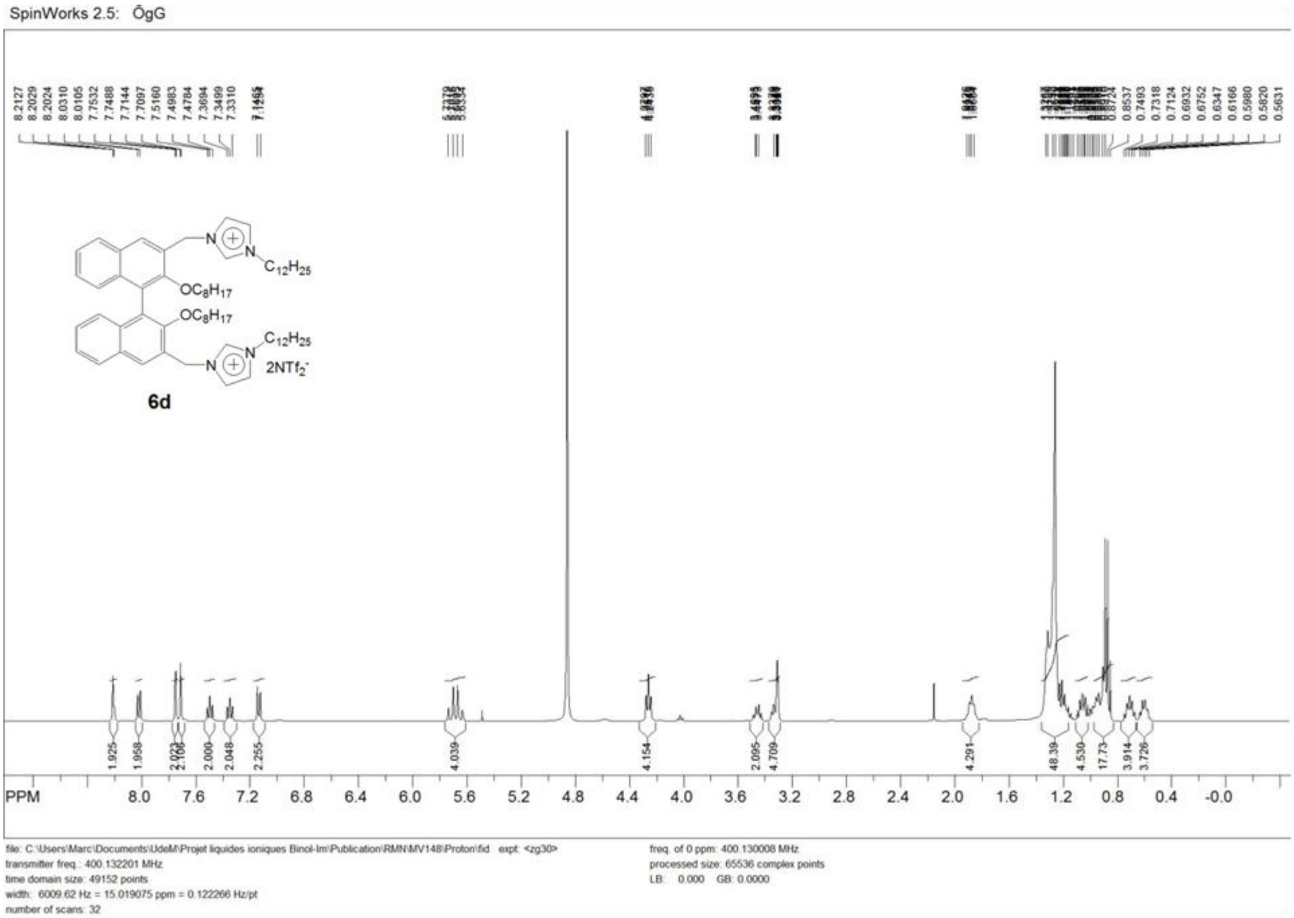


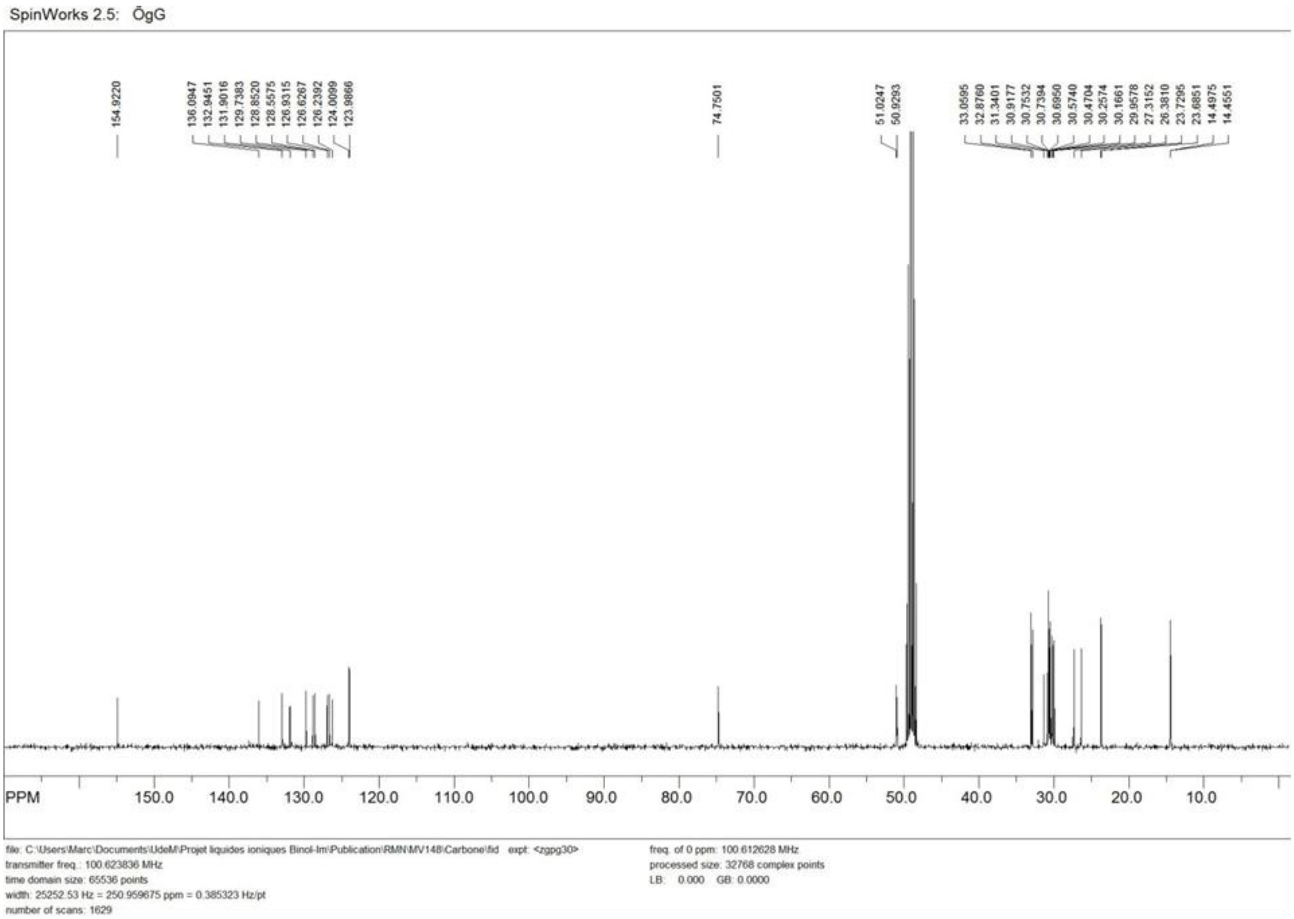
file: C:\Users\Marc\Documents\UdeM\Projet liquides ioniques Binol-Im\Publication\RMN\MV157\Carbone\fid expt: <zgpg30>
transmitter freq.: 100.624269 MHz
time domain size: 51200 points
width: 25062.66 Hz = 249.071689 ppm = 0.489505 Hz/pt
number of scans: 722

freq. of 0 ppm: 100.612631 MHz
processed size: 65536 complex points
LB: 0.000 GB: 0.0000

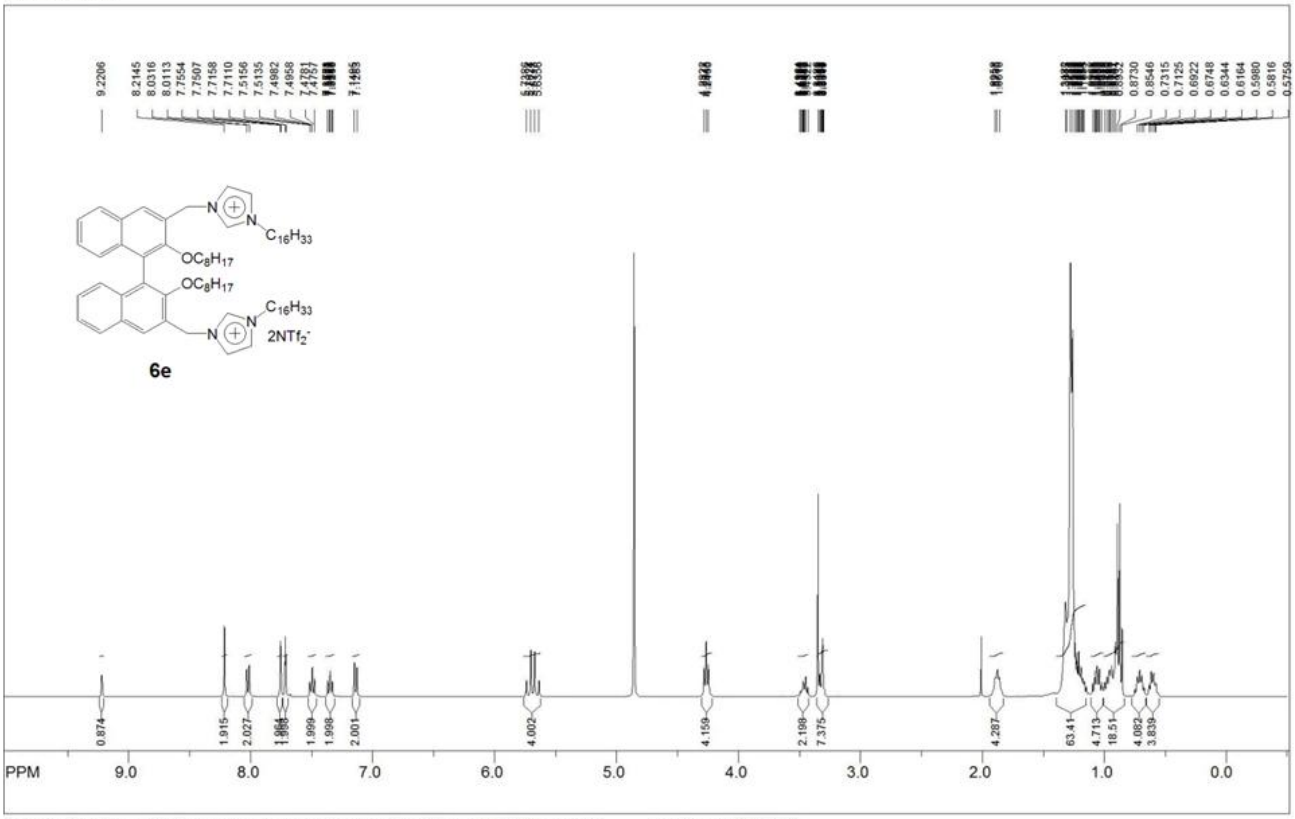

SpinWorks 2.5: ÕgG
10.8983
8.2963
7.8794
7.8590
7.5441
7.3656
7.3461
7.3301
7.3280
7.2600
7.2568
7.2548
6.8448
5.6988
4.2284
1.8993
0.7463
0.7294
0.7100
0.5915
0.5735
0.5531
0.5374
0.5039
0.4840
0.4670
0.4450
0.4670
0.4450
N
N
C8H17
OC8H17
OC8H17
C8H17
N
N
2NTf2-
6c
1.816
1.872
1.962
3.895
2.000
2.169
1.988
1.851
1.880
3.920
1.970
2.072
4.007
26.81
4.298
18.09
7.855
PPM
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
file: C:\Users\Marc\Documents\UdeM\Projet liquides ioniques Binol-Im\Publication\RMN\MV171\Proton\fid expt: <zg30>
transmitter freq.: 400.132707 MHz
time domain size: 32768 points
width: 5787.04 Hz = 14.462794 ppm = 0.176606 Hz/pt
number of scans: 21
freq. of 0 ppm: 400.130011 MHz
processed size: 65536 complex points
LB: 0.000 GB: 0.0000


SpinWorks 2.5: ÕgG
153.5581
137.4954
134.5397
132.2073
130.3388
128.7383
127.8672
126.9821
125.6945
125.3490
124.7124
122.1930
74.3337
50.1350
49.2040
31.6276
31.5648
30.4015
29.6839
29.0095
28.9525
28.9287
28.6929
26.3082
25.1175
22.5181
22.4888
14.0338
14.0010
PPM
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
file: C:\Users\Marc\Documents\UdeM\Projet liquides ioniques Binol-Im\Publication\RMN\MV171\Carbone\fid expt: <zgpg30>
transmitter freq.: 100.624269 MHz
time domain size: 51200 points
width: 25062.66 Hz = 249.071689 ppm = 0.489505 Hz/pt
number of scans: 357
freq. of 0 ppm: 100.612767 MHz
processed size: 65536 complex points
LB: 0.000 GB: 0.0000


SpinWorks 2.5: ÕgG
6d
2NTf2-
PPM
freq. of 0 ppm: 400.130008 MHz
number of scans: 32


SpinWorks 2.5: ÕgG
PPM
freq. of 0 ppm: 100.612628 MHz
number of scans: 1629

SpinWorks 2.5:

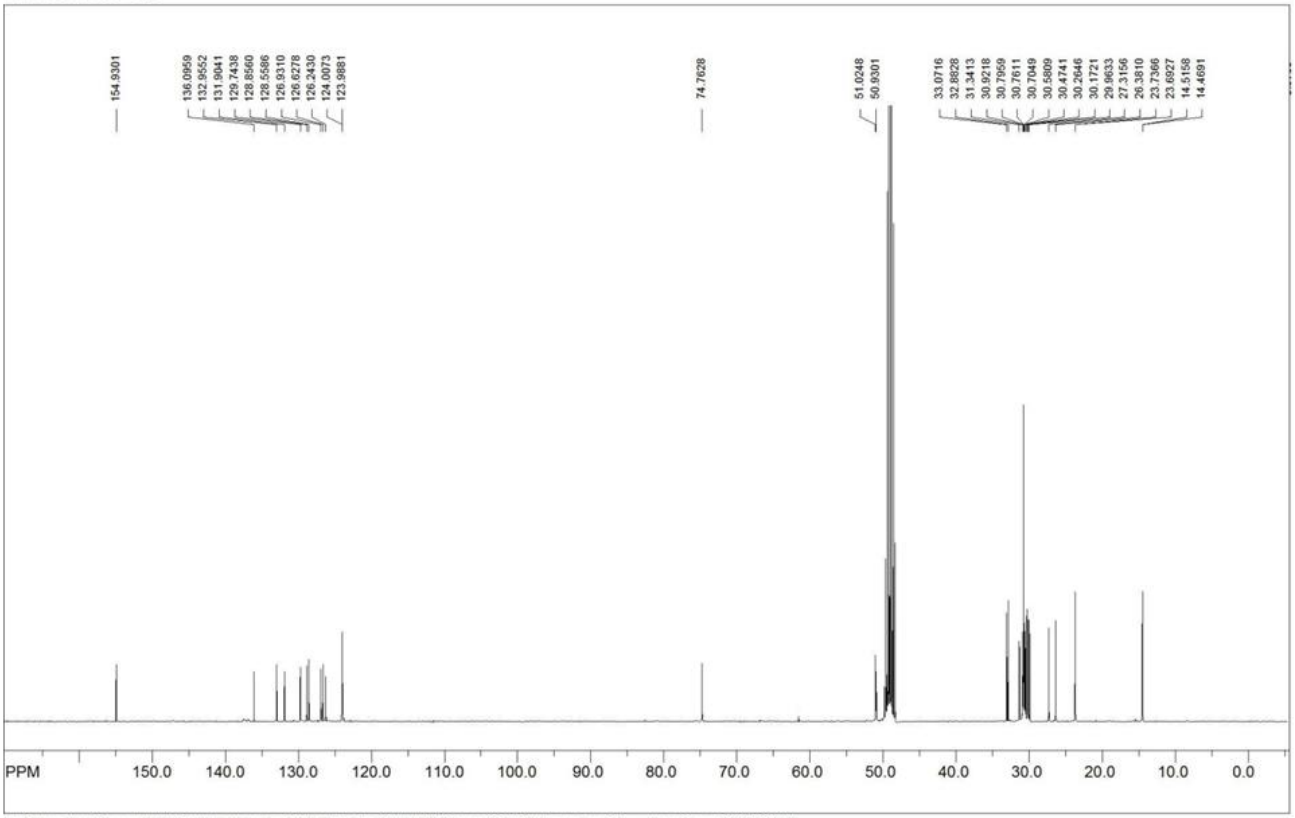


6e

file: C:\Users\Marc\Documents\UdeM\Projet liquides ioniques Binol-Im\Publication\RMN\MV149\Proton (CD3OD)\fid expt: <zg30>
transmitter freq.: 400.132201 MHz
time domain size: 49152 points
width: 6009.62 Hz = 15.019075 ppm = 0.122266 Hz/pt
number of scans: 16

freq. of 0 ppm: 400.130008 MHz
processed size: 65536 complex points
LB: 0.000 GB: 0.0000

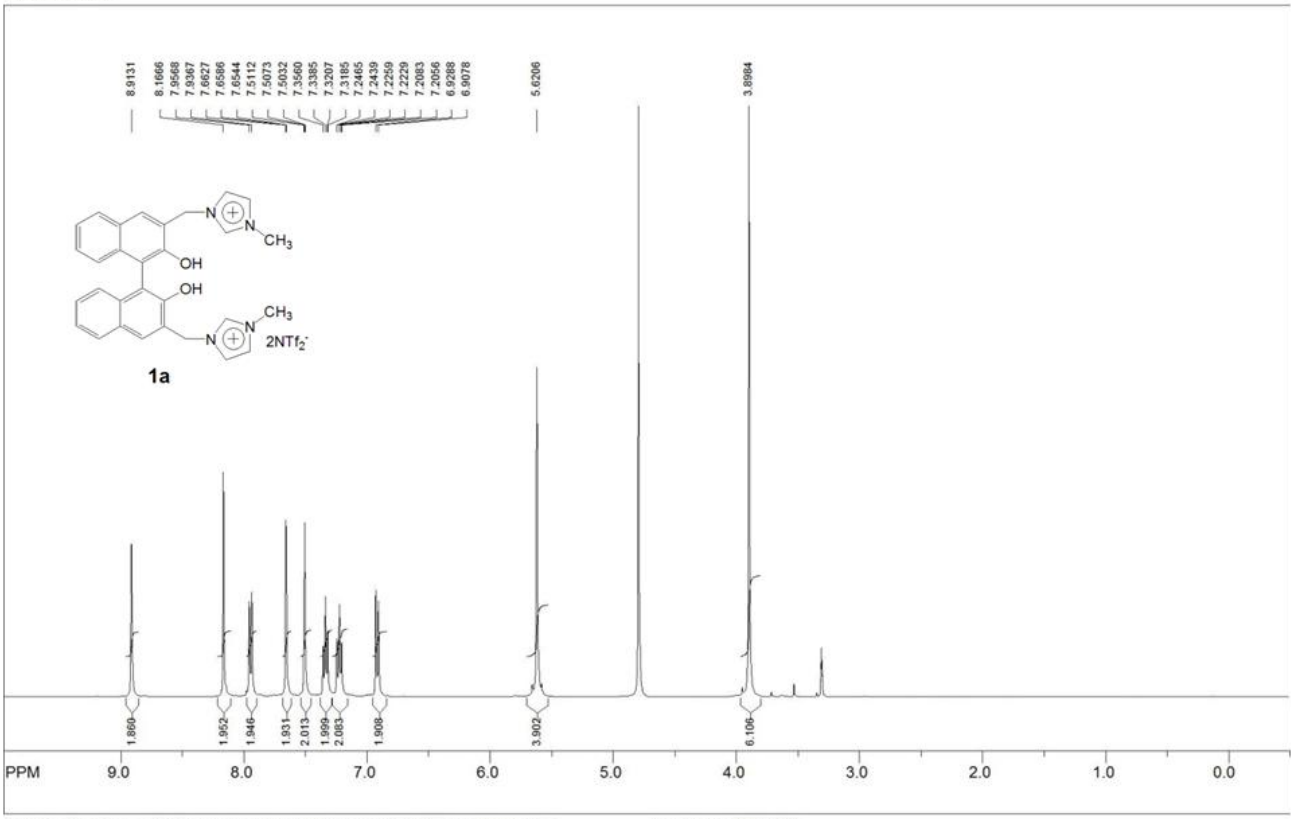
SpinWorks 2.5: ŌgG



file: C:\Users\Marc\Documents\UdeM\Projet liquides ioniques Binol-Im\Publication\RMN\MV149\Carbone (CD3OD)\fid expt: <zgpg30>
transmitter freq.: 100.623836 MHz
time domain size: 65536 points
width: 25252.53 Hz = 250.959675 ppm = 0.385323 Hz/pt
number of scans: 13978

freq. of 0 ppm: 100.612628 MHz
processed size: 32768 complex points
LB: 0.000 GB: 0.0000

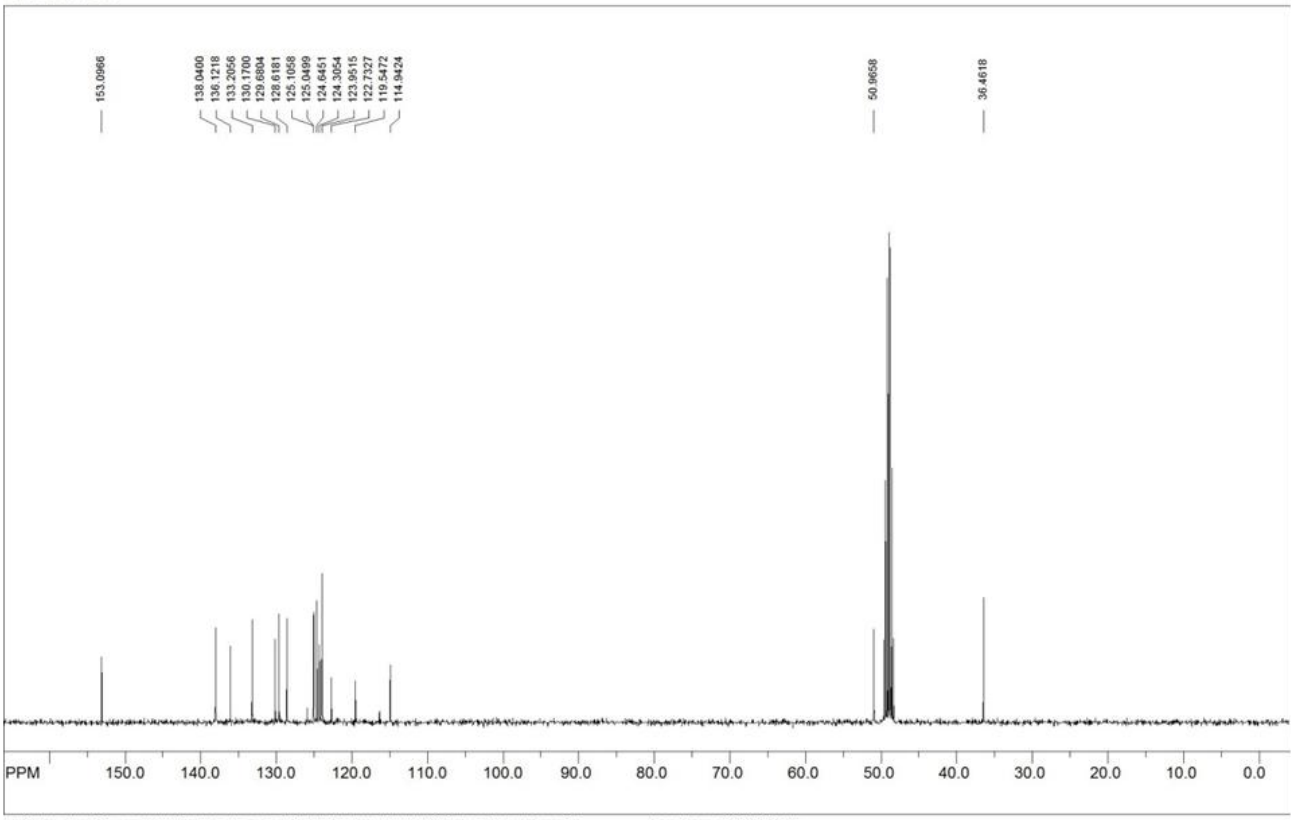
SpinWorks 2.5:



file: C:\Users\Marc\Documents\UdeM\Projet liquides ioniques Binol-Im\Publication\RMN\MV162\Proton\fid expt: <zg30>
transmitter freq.: 400.132201 MHz
time domain size: 49152 points
width: 6009.62 Hz = 15.019075 ppm = 0.122266 Hz/pt
number of scans: 13

freq. of 0 ppm: 400.130008 MHz
processed size: 65536 complex points
LB: 0.000 GB: 0.0000

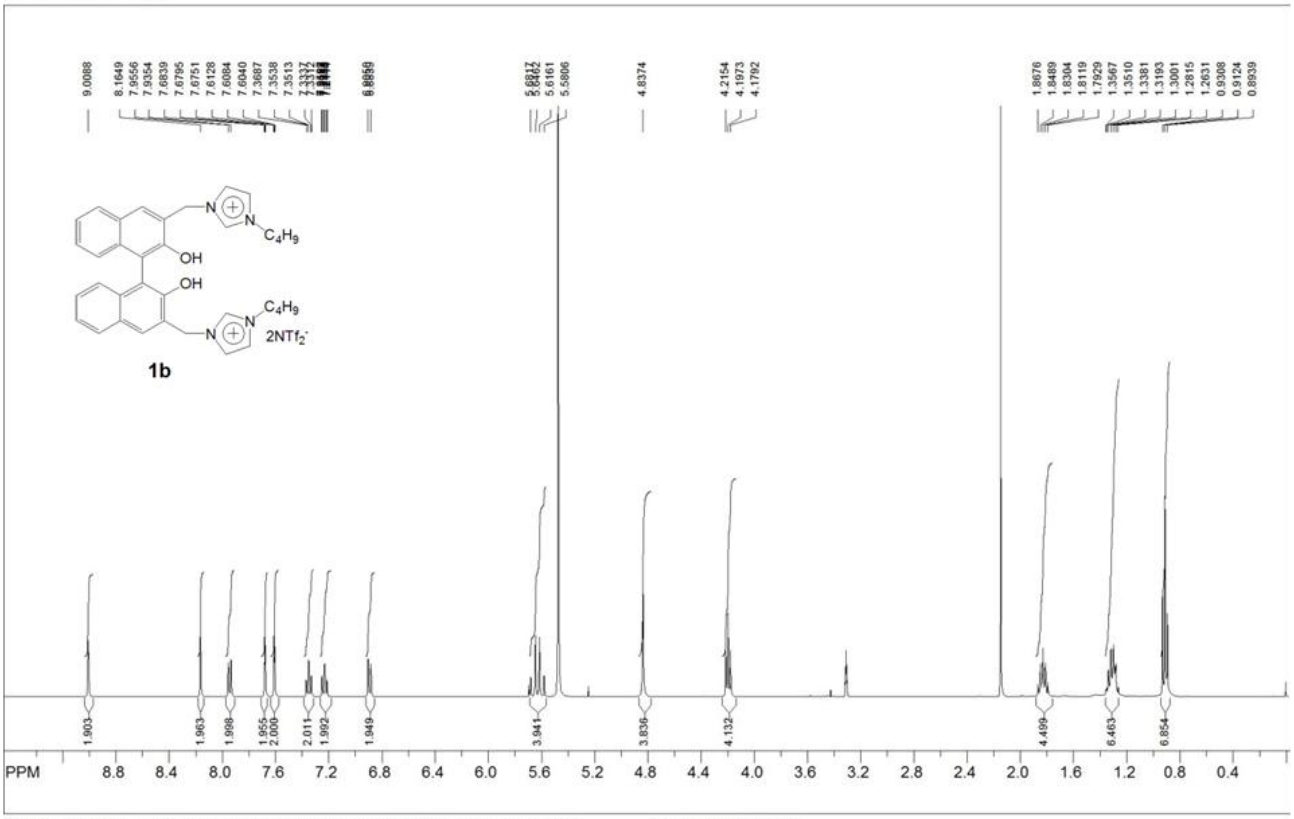
SpinWorks 2.5:



file: C:\Users\Marc\Documents\UdeM\Projet liquides ioniques Binol-Im\Publication\RMN\MV162\Carbone\fid expt: <zgpg30>
transmitter freq.: 100.623836 MHz
time domain size: 65536 points
width: 25252.53 Hz = 250.959675 ppm = 0.385323 Hz/pt
number of scans: 320

freq. of 0 ppm: 100.612635 MHz
processed size: 32768 complex points
LB: 0.000 GB: 0.0000

SpinWorks 2.5: ÖgG

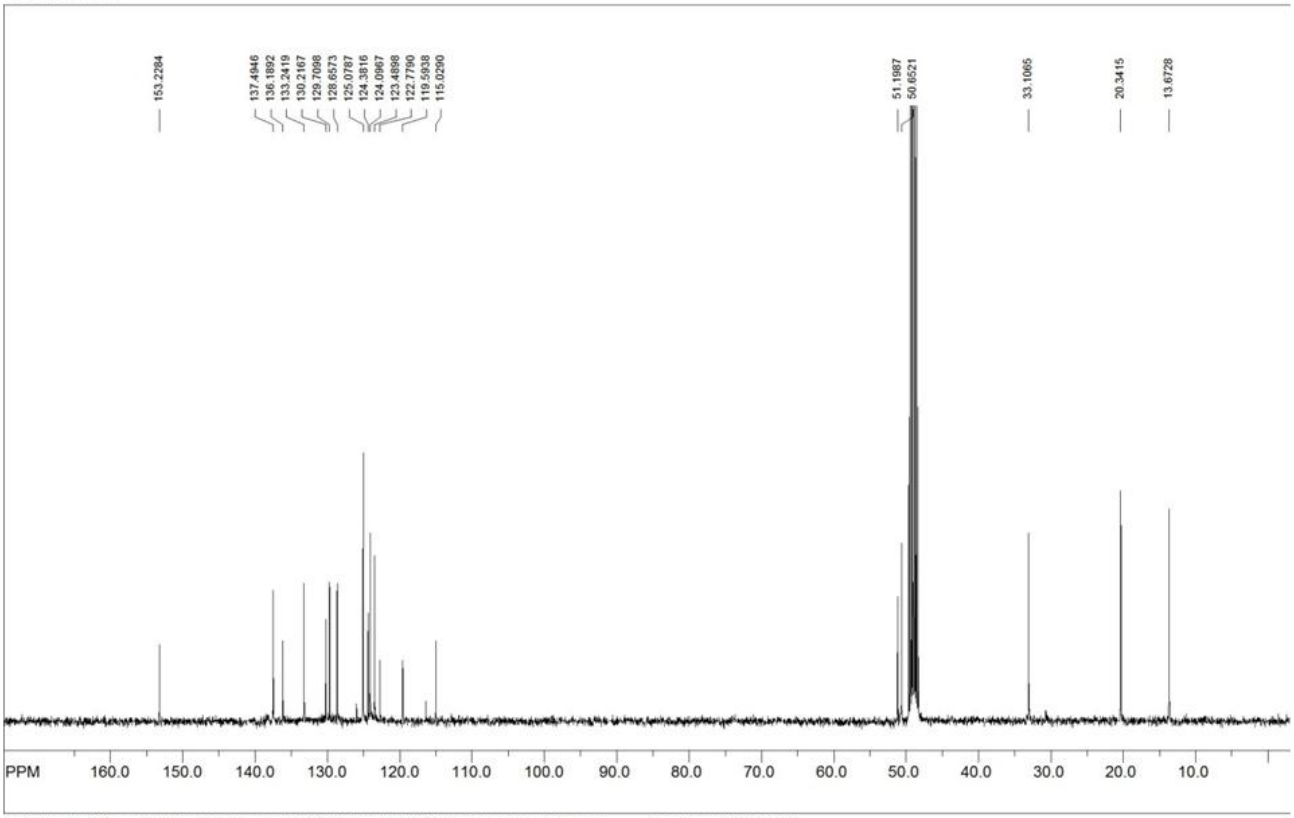


1b

file: C:\Users\Marc\Documents\UdeM\Projet liquides ioniques Binol-Im\Publication\RMN\MV159NTf2\Proton\fid expt: <zg30>
transmitter freq.: 400.132600 MHz
time domain size: 49152 points
width: 5995.20 Hz = 14.983043 ppm = 0.121973 Hz/pt
number of scans: 12

freq. of 0 ppm: 400.130008 MHz
processed size: 65536 complex points
LB: 0.000 GB: 0.0000

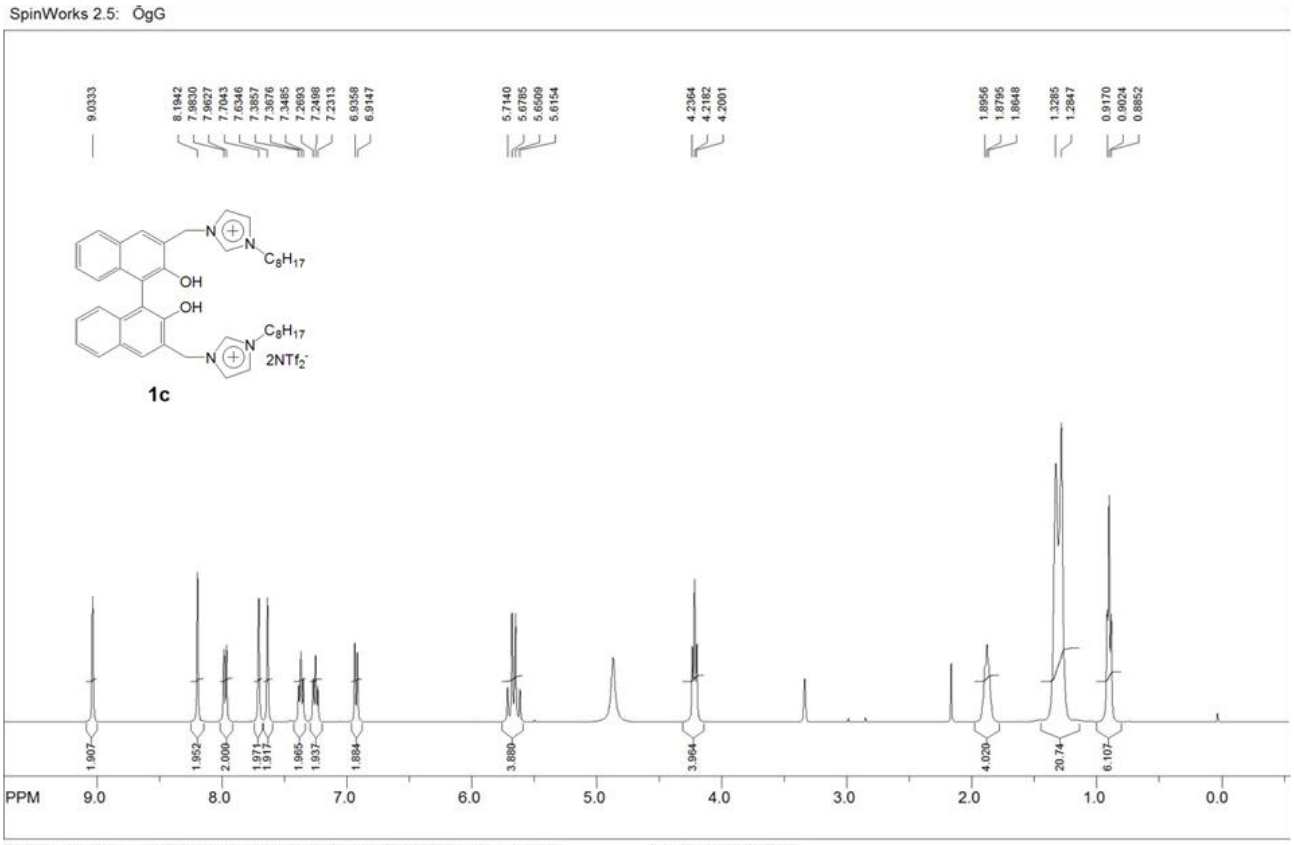
SpinWorks 2.5:



file: C:\Users\Marc\Documents\UdeM\Projet liquides ioniques Binol-Im\Publication\RMN\MV159NTf2\Carbone\fid expt: <zgpg30>
transmitter freq.: 100.623836 MHz
time domain size: 65536 points
width: 25252.53 Hz = 250.959675 ppm = 0.385323 Hz/pt
number of scans: 3198

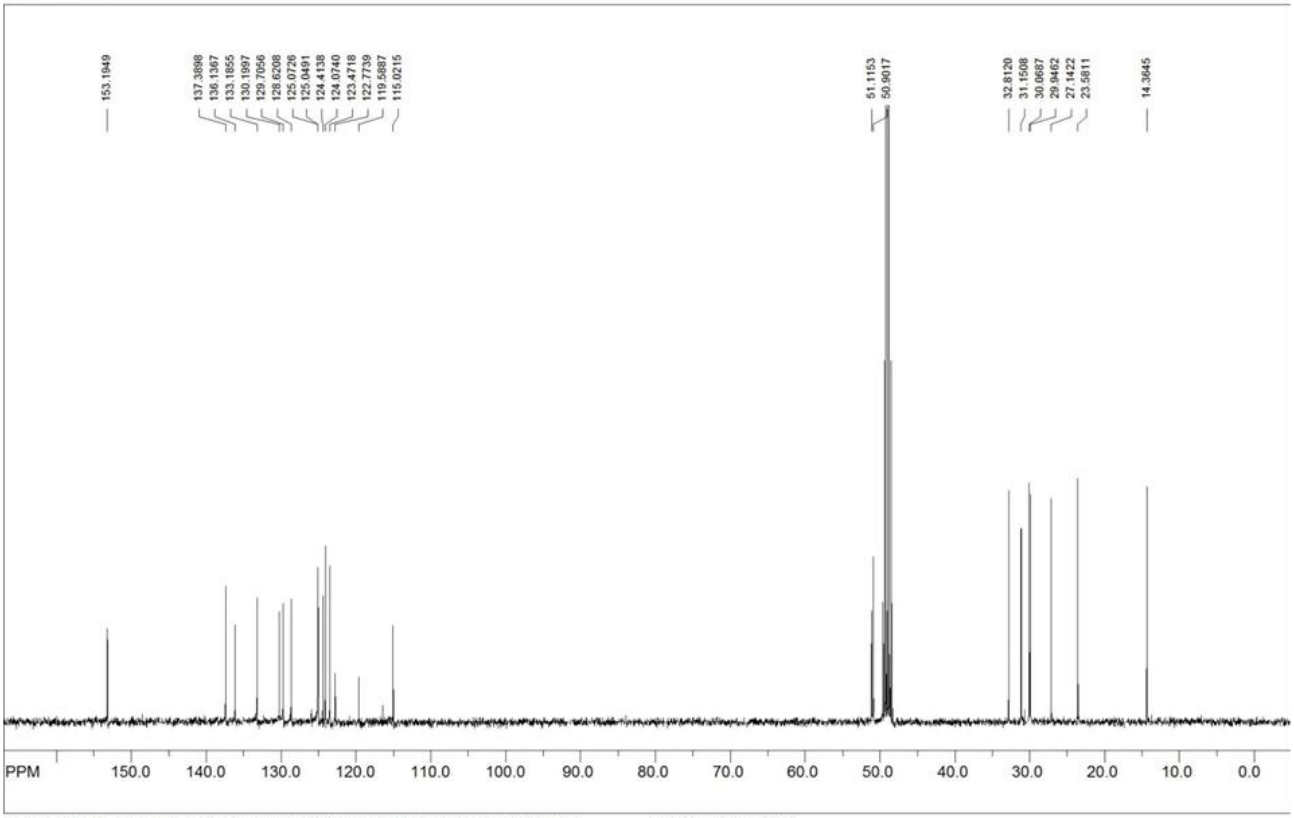
freq. of 0 ppm: 100.612629 MHz
processed size: 32768 complex points
LB: 1.000 GB: 0.0000

SpinWorks 2.5: ÕgG



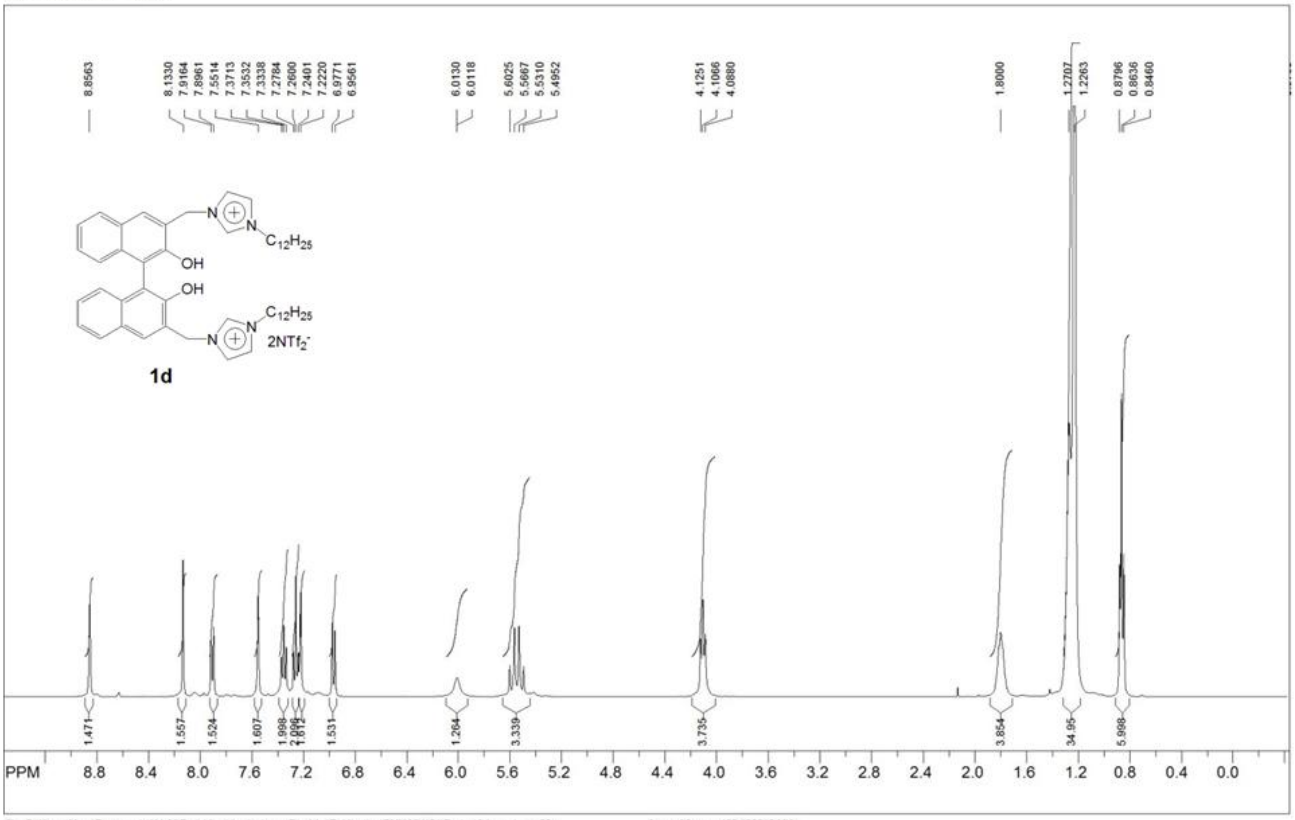
file: C:\Users\Marc\Documents\UdeM\Projet liquides ioniques Binol-Im\Publication\RMN\MV172\Proton\fid expt: <zg30>
transmitter freq.: 400.132600 MHz
time domain size: 49152 points
width: 5995.20 Hz = 14.983043 ppm = 0.121973 Hz/pt
number of scans: 13
freq. of 0 ppm: 400.129997 MHz
processed size: 65536 complex points
LB: 0.000 GB: 0.0000

SpinWorks 2.5:



file: C:\Users\Marc\Documents\UdeM\Projet liquides ioniques Binol-Im\Publication\RMN\MV172\Carbone\fid expt: <zgpg30>
transmitter freq.: 100.624269 MHz
time domain size: 51200 points
width: 25062.66 Hz = 249.071689 ppm = 0.489505 Hz/pt
number of scans: 303
freq. of 0 ppm: 100.612633 MHz
processed size: 65536 complex points
LB: 0.000 GB: 0.0000

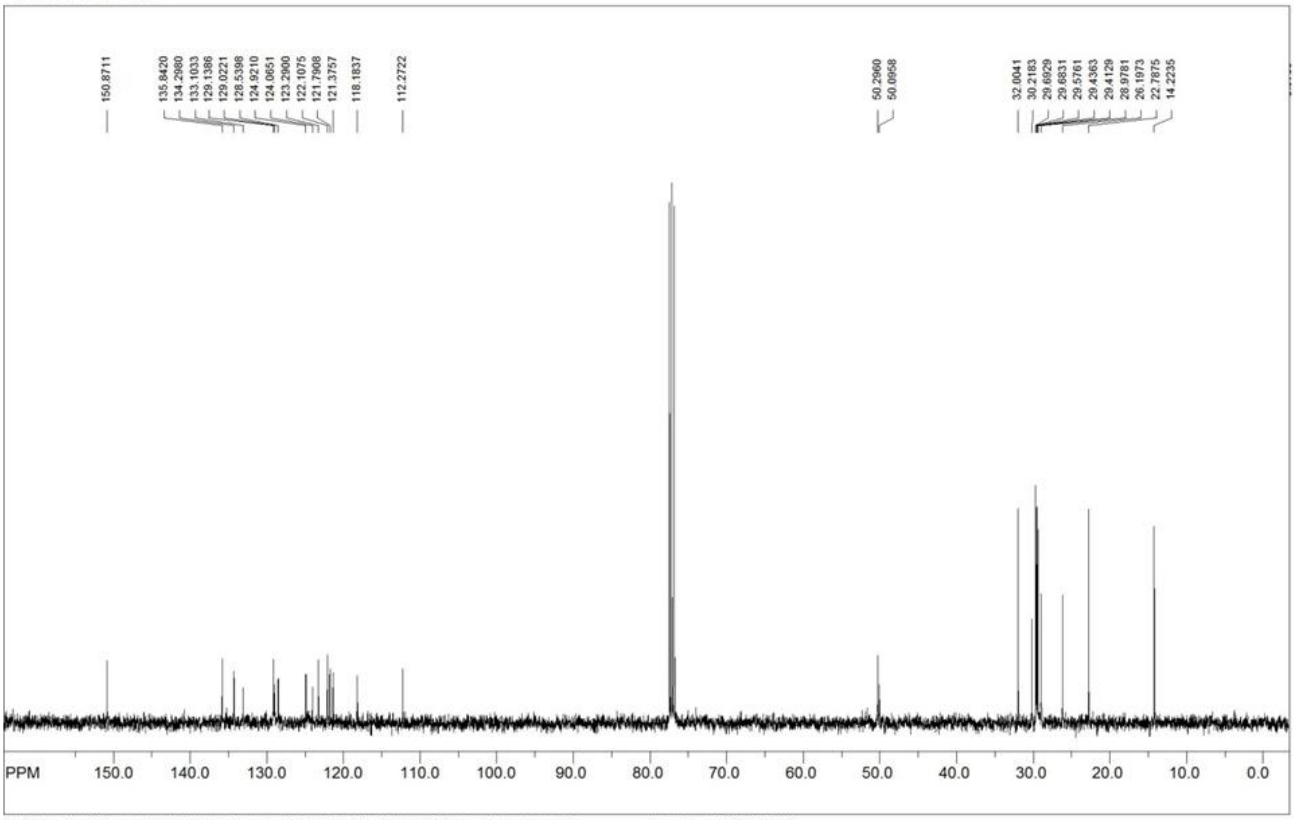
SpinWorks 2.5: ÖgG



file: C:\Users\Marc\Documents\UdeM\Projet liquides ioniques Binol-Im\Publication\RMN\MV151\Proton\fid expt: <zg30>
transmitter freq.: 400.132600 MHz
time domain size: 49152 points
width: 5995.20 Hz = 14.983043 ppm = 0.121973 Hz/pt
number of scans: 16

freq. of 0 ppm: 400.130010 MHz
processed size: 65536 complex points
LB: 0.000 GB: 0.0000

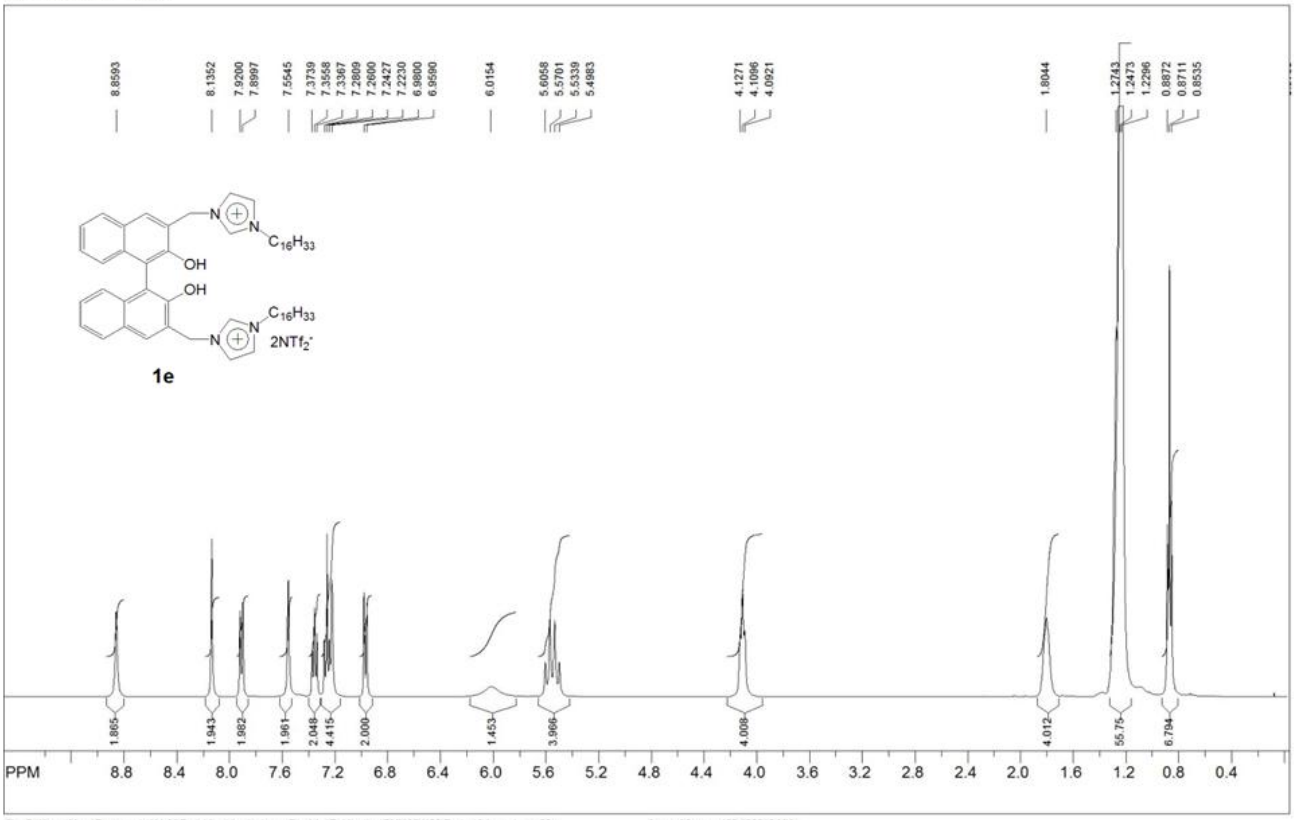
SpinWorks 2.5: ÖgG



file: C:\Users\Marc\Documents\UdeM\Projet liquides ioniques Binol-Im\Publication\RMN\MV151\Carbone\fid expt: <zgpg30>
transmitter freq.: 100.624269 MHz
time domain size: 51200 points
width: 25062.66 Hz = 249.071689 ppm = 0.489505 Hz/pt
number of scans: 178

freq. of 0 ppm: 100.612757 MHz
processed size: 65536 complex points
LB: 0.000 GB: 0.0000

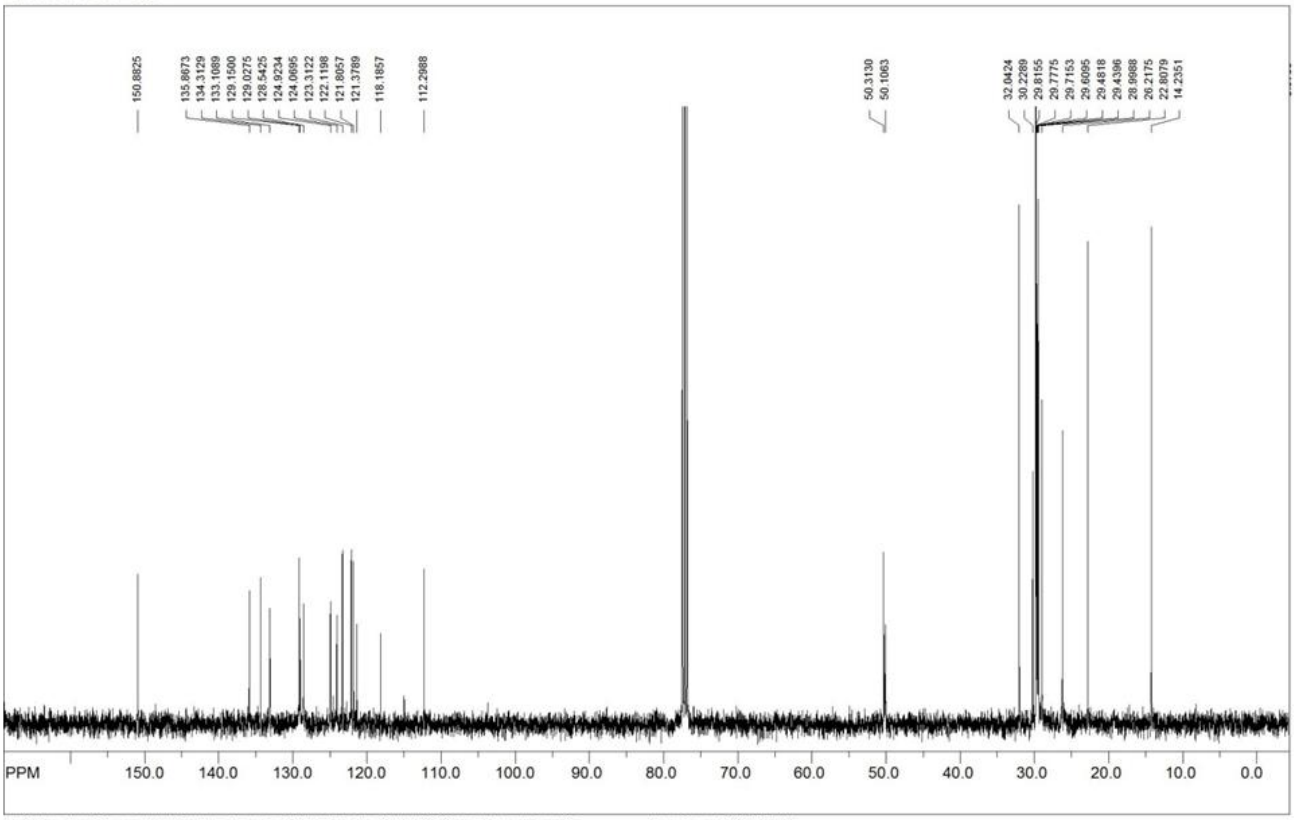
SpinWorks 2.5: ÖgG



file: C:\Users\Marc\Documents\UdeM\Projet liquides ioniques Binol-Im\Publication\RMN\MV150\Proton\fid expt: <zg30>
transmitter freq.: 400.132600 MHz
time domain size: 49152 points
width: 5995.20 Hz = 14.983043 ppm = 0.121973 Hz/pt
number of scans: 12

freq. of 0 ppm: 400.130010 MHz
processed size: 65536 complex points
LB: 0.000 GB: 0.0000

SpinWorks 2.5: ÖgG



file: C:\Users\Marc\Documents\UdeM\Projet liquides ioniques Binol-Im\Publication\RMN\MV150\Carbone\fid expt: <zgpg30>
transmitter freq.: 100.624269 MHz
time domain size: 51200 points
width: 25062.66 Hz = 249.071689 ppm = 0.489505 Hz/pt
number of scans: 392

freq. of 0 ppm: 100.612757 MHz
processed size: 65536 complex points
LB: 0.000 GB: 0.0000