

Supporting Information for

“Porphyrin and phthalocyanine glycodendritic conjugates: synthesis, photophysical and photochemical properties”

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1 Experimental section

1.1 General methods

^1H , ^{13}C , and ^{19}F NMR spectra were recorded on a *Bruker Avance-300* spectrometer at 300.13, 75.47 and 282.38 MHz, respectively. CDCl_3 and DMSO-d_6 were used as solvents and TMS as internal reference; the chemical shifts are expressed in δ (ppm) and the coupling constants (J) in Hertz (Hz). Unequivocal ^1H assignments were made with aid of 2D COSY ($^1\text{H}/^1\text{H}$), while ^{13}C assignments were made on the basis of 2D HSQC ($^1\text{H}/^{13}\text{C}$) spectra. Mass spectra and HRMS were recorded on a APEXQe FT-ICR mass spectrometer (Bruker Daltonics, Billerica, MA). The UV–Vis absorption spectra were recorded using a UV-2501 PC Shimadzu spectrophotometer. Steady-state fluorescence spectra of the investigated compounds were measured in 1 cm x 1 cm quartz optical cells with a computer controlled Jobin-Yvon FluoroMax-3 spectrofluorometer with slits of 2.0 nm. For measurements of fluorescence quantum yields, Φ_{F} , 5,10,15,20-tetraphenylporphyrin (TPP) in DMF ($\Phi_{\text{F}} = 0.11$) was used as reference.¹ Column chromatography was carried out using silica gel (Merck, 35-70 mesh). Reverse phase column chromatography was carried out using Sep-Pak[®] Vac 35 cc (10 g) columns. All chemicals were supplied by Sigma–Aldrich. Solvents were purified or dried according to the literature procedures.²

1.2 Synthesis and characterization of all new compounds

1.2.1 2-Chloro-4,6-bis(1,2:3,4-di-*O*-isopropylidene- α -D-galactopyran-6-yl)-1,3,5-triazine (1)

Under N_2 , 1,2:3,4-di-*O*-isopropylidene- α -D-galactopyranose (4.0 g, 15.4 mmol) was dissolved in dry toluene (40 mL) and a large excess of DIPEA (2.0 mL) was added. The reaction was then cooled at 0 °C and 2,4,6-trichloro-1,3,5-triazine (1.4 g, 7.33 mmol) was joined to the mixture. The reaction mixture was stirred at 60 °C during 48 h. After concentration under vacuum, the residue was purified by column chromatography (PE/AcOEt 8:2 to 2:1) to afford compound **1** (4.28 g, 92%) as a viscous colourless oil. ^1H NMR (CDCl_3): δ 1.27, 1.28, 1.39 and 1.45 (4s, 4 x 6H, CH_3), 4.14 (ddd, $J_{4'-5'} = 1.7$, $J_{5'-6'a} = 6.5$, $J_{5'-6'b} = 7.9$, 2H, H-5'), 4.26-4.29 (m, 4H, H-2', H-4'), 4.48-4.50 (m, 4H, H-6'a, H-6'b), 4.58 (dd, $J_{2'-3'} = 7.9$, $J_{3'-4'} = 2.5$, 2H, H-3'), 5.48 (d, $J_{1'-2'} = 5.0$, 2H, H-1'). ^{13}C NMR (CDCl_3): δ 24.4, 24.9, 25.9, 26.0 (Me-isop), 65.4 (C-5'), 67.4 (C-6'), 70.4 (C-3'), 70.5 (C-2', C-4'), 96.2 (C-1'), 108.8, 109.6 (Cq-isop), 171.9 (C-4, C-6), 172.6 (C-2). HRMS-ESI: calcd. for $\text{C}_{27}\text{H}_{39}\text{ClN}_3\text{O}_{12}$ $[\text{M}+\text{H}]^+$ 632.2222, found 632.2212; calcd for

$C_{27}H_{38}ClN_3O_{12}Na$ $[M+Na]^+$ 654.2042, found 654.2033; calcd for $C_{27}H_{38}ClN_3O_{12}K$ $[M+K]^+$ 670.1781, found 670.1771.

1.2.2 3-[(4,6-bis(1,2:3,4-di-*O*-isopropylidene- α -D-galactopyran-6-yl)-1,3,5-triazin-2-yl)thio]propane-1-thiol (2)

Under N_2 , compound **1** (4.3 g, 6.8 mmol) was dissolved in dry toluene (40 mL). DIPEA (5.9 mL, 34 mmol) and 1,3-dimercaptopropane (2.7 mL, 27.2 mmol) were then added and the mixture stirred at 70 °C during 48 h. After concentration under vacuum, the residue was purified by column chromatography (EP/AcOEt, 8:2 to 2:1) to afford compound **2** (4.2 g, 89%) as a viscous colourless oil. 1H NMR ($CDCl_3$): δ 1.33, 1.34, 1.45, 1.51 and 1.61 (4s, 4 x 6H, CH_3), 1.97-2.09 (m, 2H, $CH_2CH_2CH_2SH$), 2.61-2.69 (m, 2H, $CH_2CH_2CH_2SH$), 2.77-2.81 (m, 1H, SH), 3.21-3.27 (m, 2H, $CH_2CH_2CH_2SH$), 4.19 (ddd, $J_{4'-5'}=1.7$, $J_{5'-6'a}=6.5$, $J_{5'-6'b}=8.2$, 2H, H-5'), 4.32-4.36 (m, 4H, H-2', H-4'), 4.50-4.52 (m, 4H, H-6'a, H-6'b), 4.63 (dd, $J_{2'-3'}=7.9$, $J_{3'-4'}=2.4$, 2H, H-3'), 5.54 (d, $J_{1'-2'}=5.0$, 2H, H-1'). ^{13}C NMR ($CDCl_3$): δ 23.5 ($CH_2CH_2CH_2SH$), 24.6, 25.1, 26.1 and 26.2 (Me-isop), 28.9 ($CH_2CH_2CH_2SH$), 33.3 ($CH_2CH_2CH_2SH$), 65.6 (C-5'), 66.5 (C-6'), 70.7 (C-3', C-2'), 70.8 (C-4'), 96.4 (C-1'), 108.9, 109.7 (Cq-isop), 170.6 (C-4, C-6), 185.0 (C-2). **HRMS-ESI**: calcd. for $C_{30}H_{46}N_3O_{12}S_2$ $[M+H]^+$ 704,2523, found 704.2510; calcd. for $C_{30}H_{45}N_3O_{12}S_2Na$ $[M+Na]^+$ 726.2342, found 726.2333.

1.2.3 Glycoporphyrin conjugate 3

Under N_2 , **TPPF**₂₀ (50.0 mg, 51.3 μ mol) was dissolved in DMF. DIPEA (0.9 mL, 5.13 mmol) and compound **2** (155.0 mg, 0.22 mmol) were added and the mixture stirred at 50 °C during 24 h. After co-evaporation of DMF with toluene, the residue was purified by column chromatography (PE/EtOAc/Acetone, 2:1:0.5). The eluent was evaporated to dryness under reduced pressure and the solid was dissolved in CH_2Cl_2 and precipitated with PE affording compound **3a** (148.4 mg, 78%) as a red solid. 1H NMR ($CDCl_3$): δ -2.88 (brs, 2H, NH), 1.31 and 1.34 (2s, 2 x 24H, CH_3), 1.47 (m, 24H, CH_3), 1.52 (s, 24H, CH_3), 2.30 (q, $J=6.9$, 8H, $SCH_2CH_2CH_2SPor$), 3.40-3.49 (m, 16H, $SCH_2CH_2CH_2SPor$), 4.23 (ddd, $J_{4'-5'}=1.5$, $J_{5'-6'a}=6.4$, $J_{5'-6'b}=8.0$, 8H, H-5'), 4.34 (dd, $J_{1'-2'}=5.0$, $J_{2'-3'}=2.4$, 8H, H-2'), 4.37 (dd, $J_{3'-4'}=7.9$, $J_{4'-5'}=1.5$, 8H, H-4'), 4.56-4.58 (m, 16H, H-6'a, H-6'b), 4.64 (dd, $J_{2'-3'}=2.4$, $J_{3'-4'}=7.9$, 8H, H-3'), 5.55 (d, $J_{1'-2'}=5.0$, 8H, H-1'), 8.94 (brs, 8H, pyrrolic β -H). ^{19}F NMR (282 MHz, $CDCl_3$): δ -160.2 (q, $J_{o-m}=12.5$, 8F, F-ortho), -157.4 (q, $J_{o-m}=12.5$, 8F, F-meta). ^{13}C NMR ($CDCl_3$): δ 24.6, 25.1, 26.1 and 26.2 (Me-isop), 29.0

(SCH₂CH₂CH₂SPor), 29.5 (SCH₂CH₂CH₂SPor), 33.6 (SCH₂CH₂CH₂SPor), 65.6 (C-5'), 66.6 (C-6'), 70.7 (C-3', C-2'), 70.8 (C-4'), 96.4 (C-1'), 108.9, 109.7 (Cq-isop), 119.9, 120.4 and 134.7 (C-Por), 145.4, 148.3, 148.5 and 149.6 (C-Por, C-F), 155.1 (C-Por), 170.7 (C-4, C-6), 184.8 (C-2). **HRMS-ESI**: calcd. for C₁₆₄H₁₈₈F₁₆N₁₆O₄₈S₈ [M+2H]²⁺ 1854.5103, found 1854.5131. **UV-Vis** in DMSO λ_{max} (log ε): 412 (4.31), 508 (3.14), 582 (2.78), 656 (1.12).

1.2.4 Glycoporphyrin conjugate 3a

Porphyrin dendrimer conjugate **3** (35.0 mg, 9.43 μmol) in TFA/water (9:1, 3 mL) was stirred at room temperature during 5 h. The mixture was neutralized with aqueous K₂CO₃ and the product was purified by reverse phase column chromatography using a gradient of water and THF as eluent. Compound **3a** was precipitated with dichloromethane, filtered, washed with acetone and dried under reduced pressure (23.2 mg, 80%). **¹H NMR** (DMSO-d₆): δ -3.20 (brs, 2H, NH), 2.19–2.32 (m, 8H, SCH₂CH₂CH₂SPor), 3.64–3.92 (m, 16H, SCH₂CH₂CH₂SPor), 4.17–4.51 (m, 24H, H-5', H-2', H-4'), 4.61–4.82 (m, 16H, H-6'a, H-6'b), 4.93–4.99 and 5.17 – 5.28 (2m, 8H, H-3'), 6.29–6.36 (m, 4H, H-1'α), 6.65–6.76 (m, 4H, H-1'β), 9.41 (brs, 8H, pyrrolic β-H). **¹⁹F NMR** (DMSO-d₆): δ -162.8 to -162.7 (m, 8F, F-ortho), -158.1 to -158.0 (m, 8F, F-meta). **HRMS**: calcd. for C₁₁₆H₁₂₂F₁₆N₁₆O₄₆S₈ [M+2H-2OH]²⁺ 1517.2605, found 1517.2562; calcd. for C₁₁₆H₁₂₃F₁₆N₁₆O₄₇S₈ [M+2H-OH]²⁺ 1525.7618, found 1525.7622; calcd. for C₁₁₆H₁₂₄F₁₆N₁₆O₄₈S₈ [M+2H]²⁺ 1534.2632, found 1534.7648; calcd for C₁₁₆H₁₂₃F₁₆N₁₆O₄₈S₈Na [M+H+Na]²⁺ 1545.2542, found 1545.2570. **UV-Vis** in DMSO λ_{max} (log ε) 415 (5.15), 505 (3.73), 580 (3.44), 655 (2.60); **UV-Vis** in DMF λ_{max} (log ε): 413 (5.10), 506 (3.46), 581 (3.41), 658 (2.19).

1.2.5 Glycophthalocyanine conjugate 4

Under N₂, **ZnPcF₁₆** (53.0 mg, 61.2 μmol) was dissolved in DMF. DIPEA (1.1 mL, 61.2 μmol) and compound **2** (516.9 mg, 0.73 mmol) were added and the mixture stirred at 50 °C during 24 h. After co-evaporation of DMF with toluene, the residue was purified by column chromatography (EP/DCM/Acetone, 3:3:2). The eluent was evaporated to dryness under reduced pressure and the solid was dissolved in CH₂Cl₂ and precipitated with EP affording compound **4** (313.4 mg, 81%) as a blue-green solid. **¹H NMR** (CDCl₃): δ 1.25, 1.30, 1.40, 1.41 (4s, 4 x 48H, CH₃), 2.25 (q, J= 6.7, 16H, SCH₂CH₂CH₂SPc), 3.41–3.45 (m, 16H, SCH₂CH₂CH₂SPc), 3.53–3.57 (m, 16H, SCH₂CH₂CH₂SPc), 4.07–4.11 (m, 16H, H-5'), 4.25–4.33 (m, 32H, H-2', H-4'),

4.40-4.51 (m, 32H, H-6'a, H-6'b), 4.58 (dd, $J_{2',3'}=8.0$, $J_{3',4'}=2.4$, 2H, H-3'), 5.45 (d, $J_{1',2'}=4.8$, 2H, H-1'). **^{19}F NMR** (CDCl_3): δ -131.5 (s, 8F, F-alfa). **^{13}C NMR** (CDCl_3): δ 24.6, 25.0 and 26.1 (Me-isop), 29.8 ($\text{SCH}_2\text{CH}_2\text{CH}_2\text{SPc}$), 31.5 ($\text{SCH}_2\text{CH}_2\text{CH}_2\text{SPc}$), and 36.6 ($\text{SCH}_2\text{CH}_2\text{CH}_2\text{SPc}$), 65.6 (C-5'), 66.6 (C-6'), 70.7 (C-3'), 70.8 (C-2', C-4'), 96.3 (C-1'), 108.8 and 109.6 (Cq-isop), 113.0, 123.6, 151.9 and 153.1 (Cq-Pc), 170.4 (C-4, C-6), 185.0 (C-2). **HRMS-ESI**: calcd for $\text{C}_{272}\text{H}_{352}\text{F}_8\text{N}_{32}\text{O}_{93}\text{S}_{16}\text{Zn}$ $[\text{M}+3\text{H}-3\text{OH}]^{3+}$ 2093.6667, found 2093.6137; calcd for $\text{C}_{272}\text{H}_{355}\text{F}_8\text{N}_{32}\text{O}_{96}\text{S}_{16}\text{Zn}$ $[\text{M}+3\text{H}]^{3+}$ 2110.9525, found 2110.9520; calcd for $\text{C}_{272}\text{H}_{349}\text{F}_8\text{N}_{32}\text{O}_{93}\text{S}_{16}\text{ZnK}_3$ $[\text{M}+3\text{K}-3\text{OH}]^{3+}$ 2131.9033, found 2131.9258. **UV-Vis** in DMSO λ_{max} (log ϵ): 399 (5.16), 650 (5.26), 723 (5.40); **UV-Vis** in DMF λ_{max} (log ϵ): 391 (5.34), 649 (5.30), 722 (5.45).

1.2.6 Glycophthalocyanine conjugate 4a

Phthalocyanine dendrimer conjugate **4** (25.0 mg, 3.95 μmol) in TFA/water (9:1, 3 mL) was stirred at room temperature during 5 h. The mixture was neutralized with aqueous K_2CO_3 and the product was purified by reverse phase column chromatography using a gradient of water and THF as eluent. Compound **4a** was precipitated with acetone, filtered, washed with acetone and dried under diminished pressure (15.6 mg, 78%). **^1H NMR** (DMSO-d_6): 4.20-4.45 (m, 48H, $\text{SCH}_2\text{CH}_2\text{CH}_2\text{SPc}$), 4.46-4.80 (m, 80H, H-5', H-4', H-2', H-6'a, H-6'b), 4.81-5.04 (m, 16H, H-3'), 6.17-6.34 (m, 8H, H-1' α), 6.56-6.74 (m, 8H, H-1' β). **^{19}F NMR** (DMSO-d_6) -134.4 (s, 8F, F-alfa). **ESIMS**: calcd for $\text{C}_{176}\text{H}_{232}\text{F}_8\text{N}_{34}\text{O}_{96}\text{S}_{16}\text{Zn}$ $[\text{M}+2\text{NH}_4]^{2+}$ 2545.42, found 2545.41, calcd for $\text{C}_{158}\text{H}_{196}\text{F}_8\text{KN}_{29}\text{NaO}_{84}\text{S}_{14}\text{Zn}$ $[\text{M}+\text{Na}+\text{K}]^{2+}$ 2284.73, found 2284.85. **UV-Vis** in DMSO λ_{max} (log ϵ): 379 (4.90), 652 (4.51), 724 (5.50); **UV-Vis** in DMF λ_{max} (log ϵ): 389 (5.18), 650 (5.15), 722 (5.18).

1.3 Aggregation behaviour of porphyrin **3a** and phthalocyanine **4a** in DMSO and PBS

Absorption spectra of Por **3a** and Pc **4a** were recorded on a UV-2501 PC Shimadzu spectrophotometer.

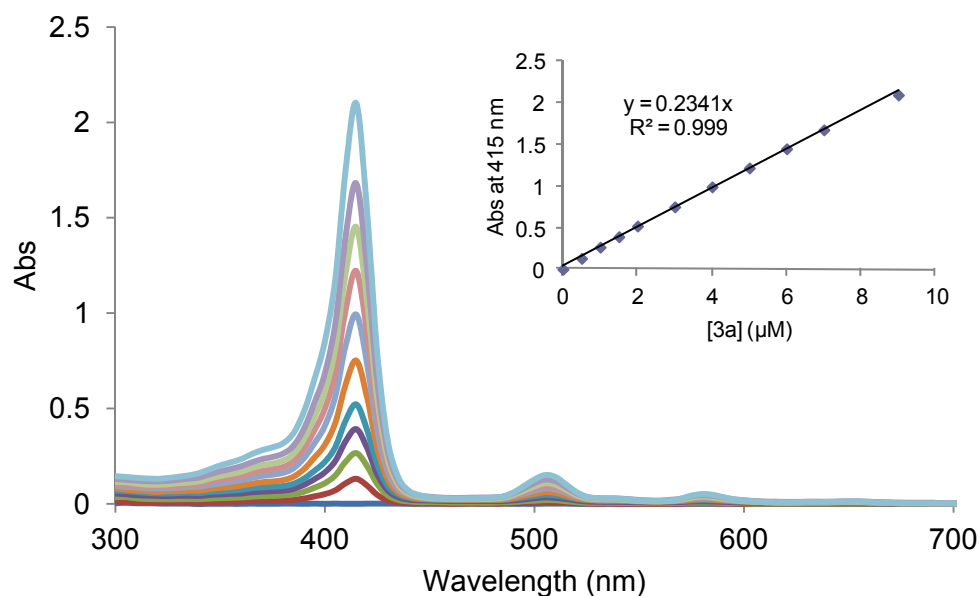


Figure S11 - UV-Vis spectra of porphyrin derivative **3a** in DMSO at different concentrations. The inset plots the *Soret*-band absorbance at 415 nm *versus* concentration of **3a** in DMSO.

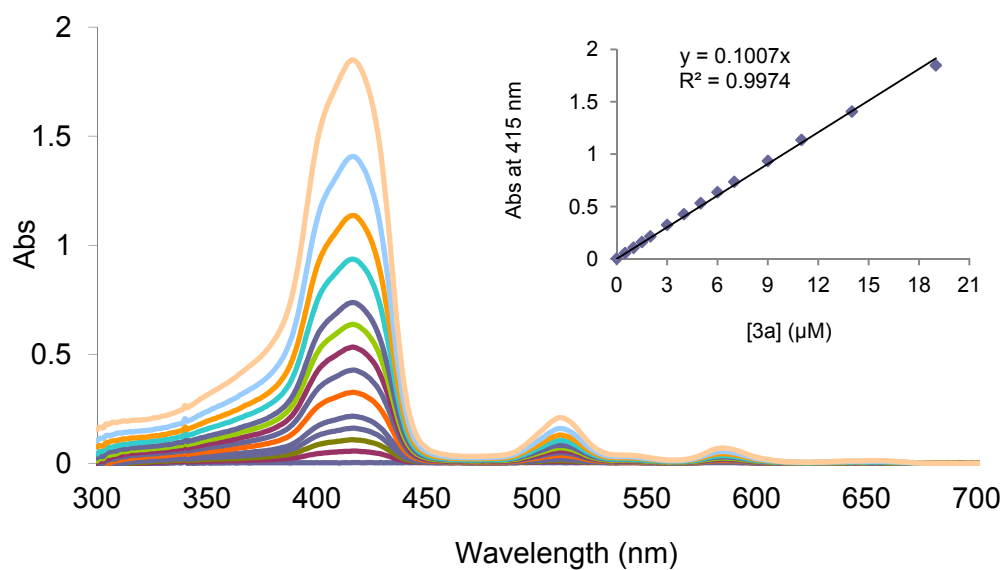


Figure S12 - UV-Vis spectra of porphyrin derivative **3a** in PBS at different concentrations. The inset plots the *Soret* band absorbance at 415 nm *versus* concentration of **3a** in PBS.

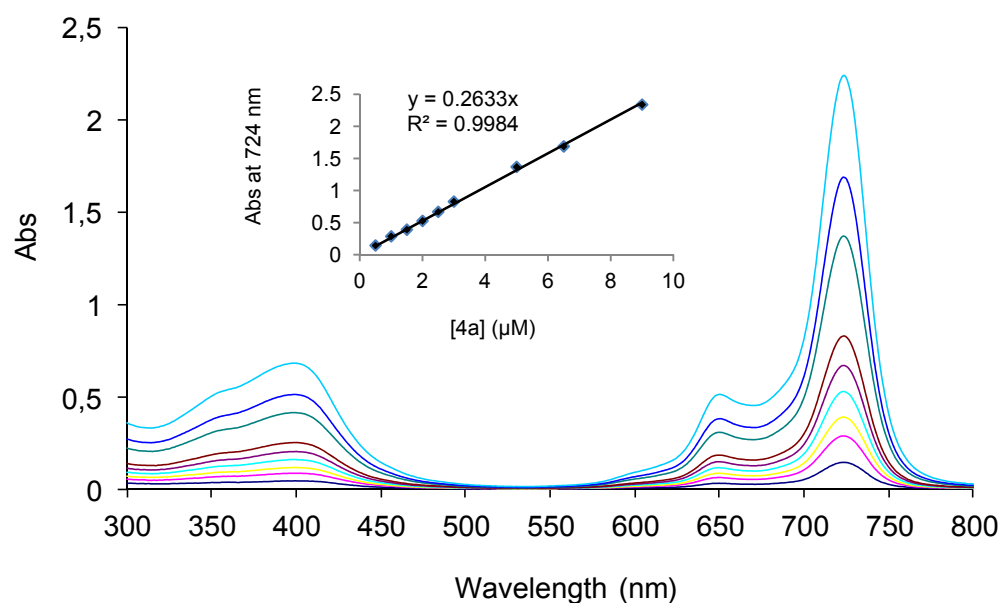


Figure SI3. UV-Vis spectra of phthalocyanine derivative 4a in DMSO at different concentrations. The inset plots the Q-band absorbance at 724 nm *versus* concentration of 4a in DMSO.

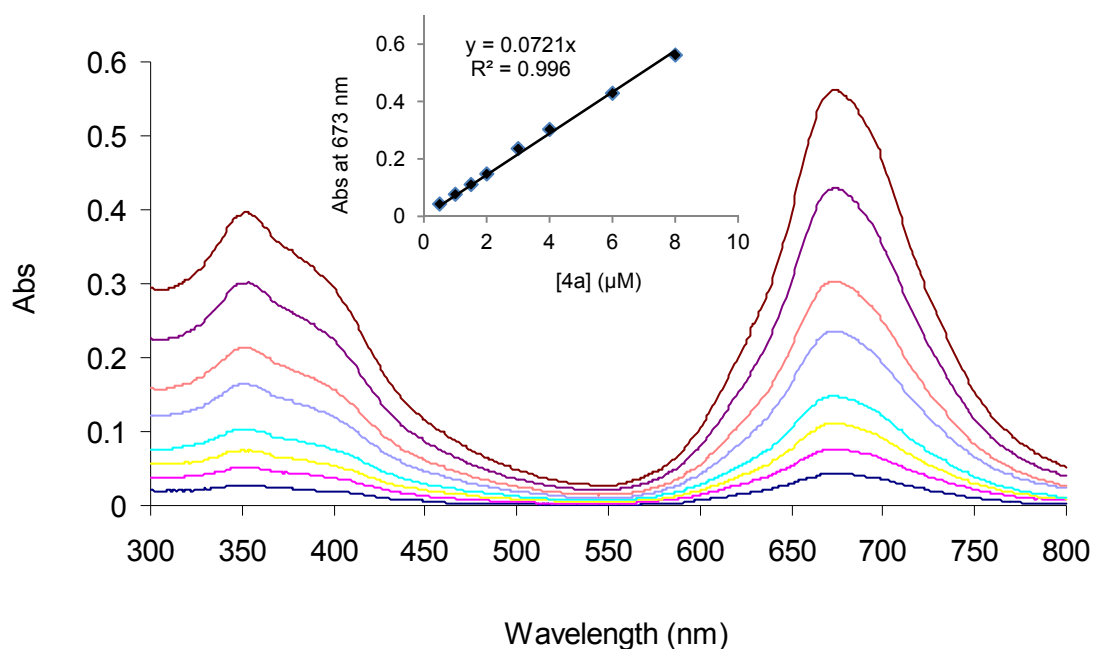


Figure SI4. UV-Vis spectra of phthalocyanine derivative 4a in PBS at different concentrations. The inset plots the Q-band absorbance at 673 nm *versus* concentration of 4a in PBS.

1.4 Fluorescence quantum yields

The fluorescence emission spectra of derivatives **3a** and **4a** were measured in DMF, at 20 °C, in 1 cm x 1 cm quartz optical cells under normal air conditions on a computer controlled Horiba Jobin Yvon FluoroMax-3 spectrofluorimeter. The widths of both excitation slit and emission slit were set at 2.0 nm. The fluorescence quantum yields (Φ_F) of the derivatives were calculated by comparison of the area below the corrected emission spectrum (620-850 nm) with that of 5,10,15,20-tetraphenylporphyrin (TPP). TPP was used as fluorescence standard ($\lambda_{exc} = 601$ nm) with $\Phi_F = 0.11$ in DMF.¹ In all cases, the absorbance of the sample and reference solutions was kept at 0.03 at 601 nm, the excitation wavelength. Fluorescence quantum yield was calculated according equation (Eq. 1):

$$\Phi_F^{sample} = \Phi_F^{ref} \frac{AUC^{sample} (1 - 10^{-Abs_{ref}})}{AUC^{ref} (1 - 10^{-Abs_{sample}})} \quad (1)$$

where AUC is the integrated area under the fluorescence curves of each derivative and the standard and Abs is the absorbance of the samples and the standard at the excitation wavelength, respectively.^{3,4}

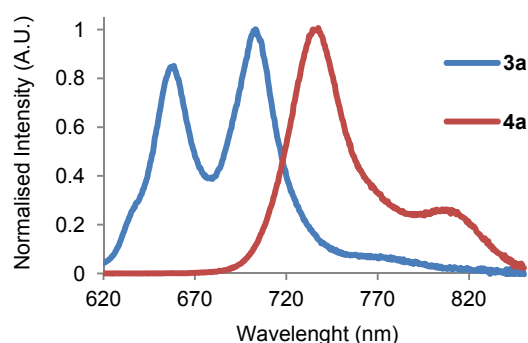


Figure SI5 - Normalised fluorescence spectra of **3a** and **4a** in DMF ($\lambda_{exc} = 601$ nm).

1.5 Photostability studies

The photobleaching studies of **3a** and **4a** were determined in PBS solutions, by monitoring respectively the decrease of the Soret and Q bands intensities, at different irradiation times with white (400-800 nm) and red light (620-750 nm) delivered by an illumination system (LC-122 LumaCare, London) equipped with a halogen/quartz 250 W lamp coupled to two different interchangeable optic fiber probes (400–800 nm and 620-750 nm). The lights were delivered at a fluence rate of 150 mW cm⁻², measured with an energy meter Coherent FieldMaxII-Top combined with a Coherent PowerSens PS19Q energy sensor. During irradiation the diluted

solutions (~2 mL) of each derivative in PBS were magnetically stirred and kept at room temperature. The results presented in Table 1 are expressed as I_t/I_0 (%) (I_t = intensity of the band at given time of irradiation, I_0 = intensity of the band before irradiation).

Table S11 - Photostability of **3a** and **4a** in PBS, after irradiation with white (400-800 nm) and red light (620-750 nm) at fluence rate of 150 mW cm⁻² for different periods of time.

PS	light	Irradiation time (min)									
		0	1	3	4	5	10	15	20	25	30
3a	white	100	99	99	99	99	99	98	98	97	97
	red	100	100	100	100	99	99	99	99	99	99
4a	white	100	100	100	99	99	98	98	98	98	97
	red	100	99	98	98	98	97	97	96	96	95

1.6 Singlet oxygen production

Solutions containing 1,3-diphenylisobenzofuran (DPBF) (16.15 μM) and **3a** (0.67 μM) or **4a** (0.1615 μM) in DMF:H₂O (9:1) were prepared in the dark, and then irradiated in a quartz cuvette cell of 1 cm at room temperature and under gentle magnetic stirring, with white light filtered through a cut-off filter for wavelengths <550 nm, at a fluence rate of 14.0 mW cm⁻² or 4.5 mW cm⁻² for **3a** and **4a**, respectively. The generation of singlet oxygen was followed by its reaction with DPBF. The breakdown of DPBF was monitored by measuring the decreasing of the absorbance at 415 nm at pre-established irradiation intervals.

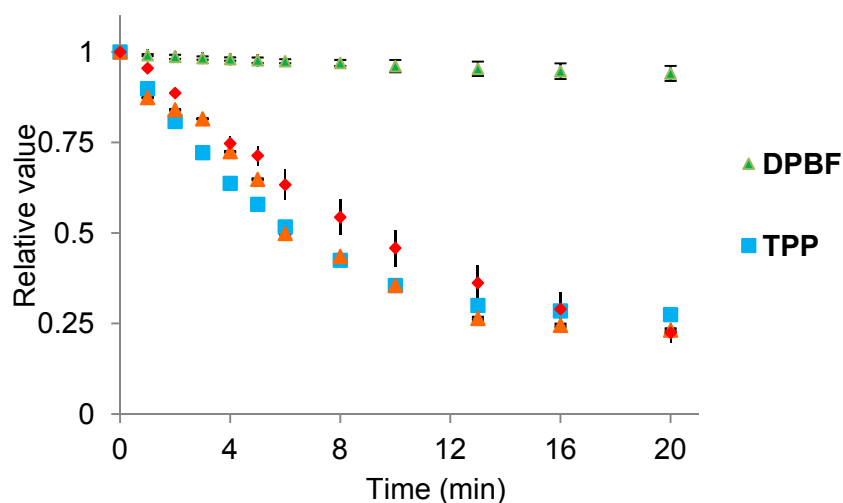


Figure SI6 – Photooxidation of DPBF in DMF:H₂O (9:1) by singlet oxygen generated by the porphyrin derivatives after irradiation with white light filtered through a cut-off filter for wavelengths <550 nm (14 mW cm⁻²).

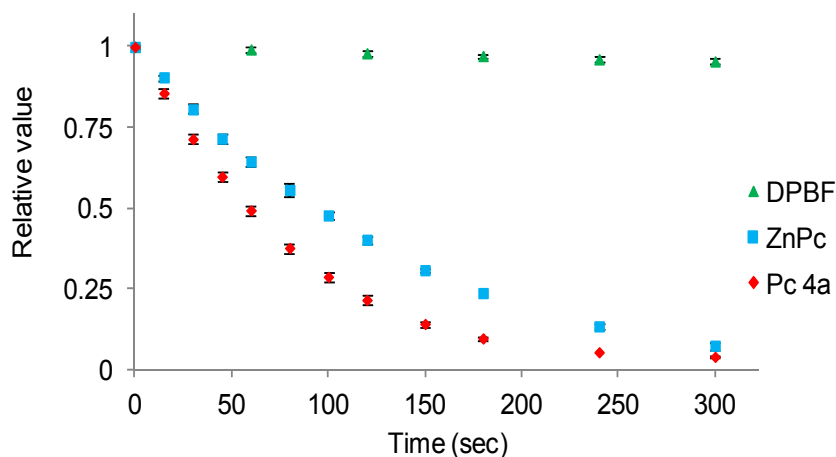


Figure S17 - Photooxidation of DPBF (16.15 μM) in DMF:H₂O (9:1) by singlet oxygen generated by the phthalocyanine derivatives after irradiation with white light filtered through a cut-off filter for wavelengths <550 nm (4.5 mW cm⁻²).

1.7 Compounds affinity to Human Serum Albumin

The emission spectra of HSA were recorded in the wavelength range of 300 – 450 nm upon excitation at 280 nm. HSA samples (2.0 μM) were titrated with the derivatives **3a** and **4a** by using trace syringes with the final concentration of PSs in the range of 0–30.0 μM . The stock solutions of **3a** and **4a** were prepared in DMSO. At this way we tested the effects of DMSO on HSA fluorescence quenching. Over a concentration range of 0–30% v/v, DMSO did not quench HSA fluorescence (data not shown).

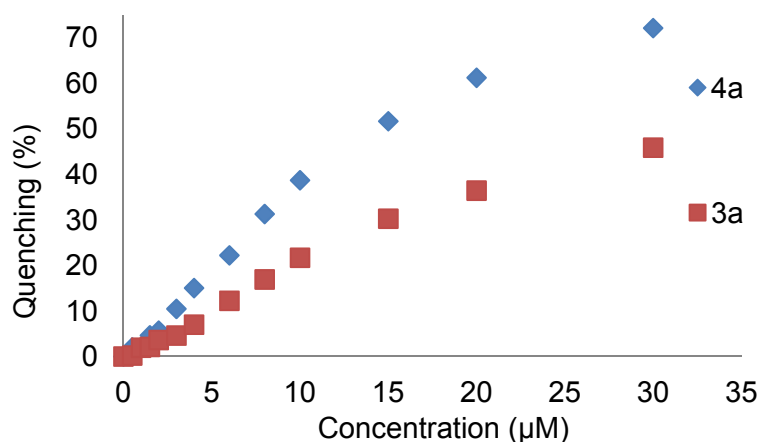


Figure S18 - Quenching curves of HSA for **3a** and **4a**. Quenching (%) = $(F_0 - F)/F_0$, where F_0 and F are the HSA fluorescence intensities in the absence and presence of a quencher (Por **3a** or Pc **4a**).

When molecules are bound independently to a set of equivalent sites on a macromolecule, the binding constant (K_a) and the numbers of binding sites (n) can be determined by the following equation:⁵

$$\log \frac{F_0 - F}{F} = \log K_a + n \log [Q] \quad \text{Equation 2,}$$

where F_0 and F are the fluorescence intensities in the absence and presence of a quencher (Por **3a** or Pc **4a**). This equation was applied to fit the spectral data, yielding a linear plot of $\log[(F_0 - F)/F] = 4.1887 + 1.1883 \log[\text{Por } \mathbf{3a}]$ ($R^2 = 0.9909$). Therefore, the values of K_a and n for **3a** were $1.544 \times 10^4 \text{ M}^{-1}$ and 1.189, respectively. For **4a** was obtained a linear plot of $\log[(F_0 - F)/F] = 5.3713 + 1.3979 \log[\text{Pc } \mathbf{4a}]$ ($R^2 = 0.9974$). Therefore, the values of K_a and n , for **4a**, were $2.351 \times 10^5 \text{ M}^{-1}$ and 1.398, respectively.

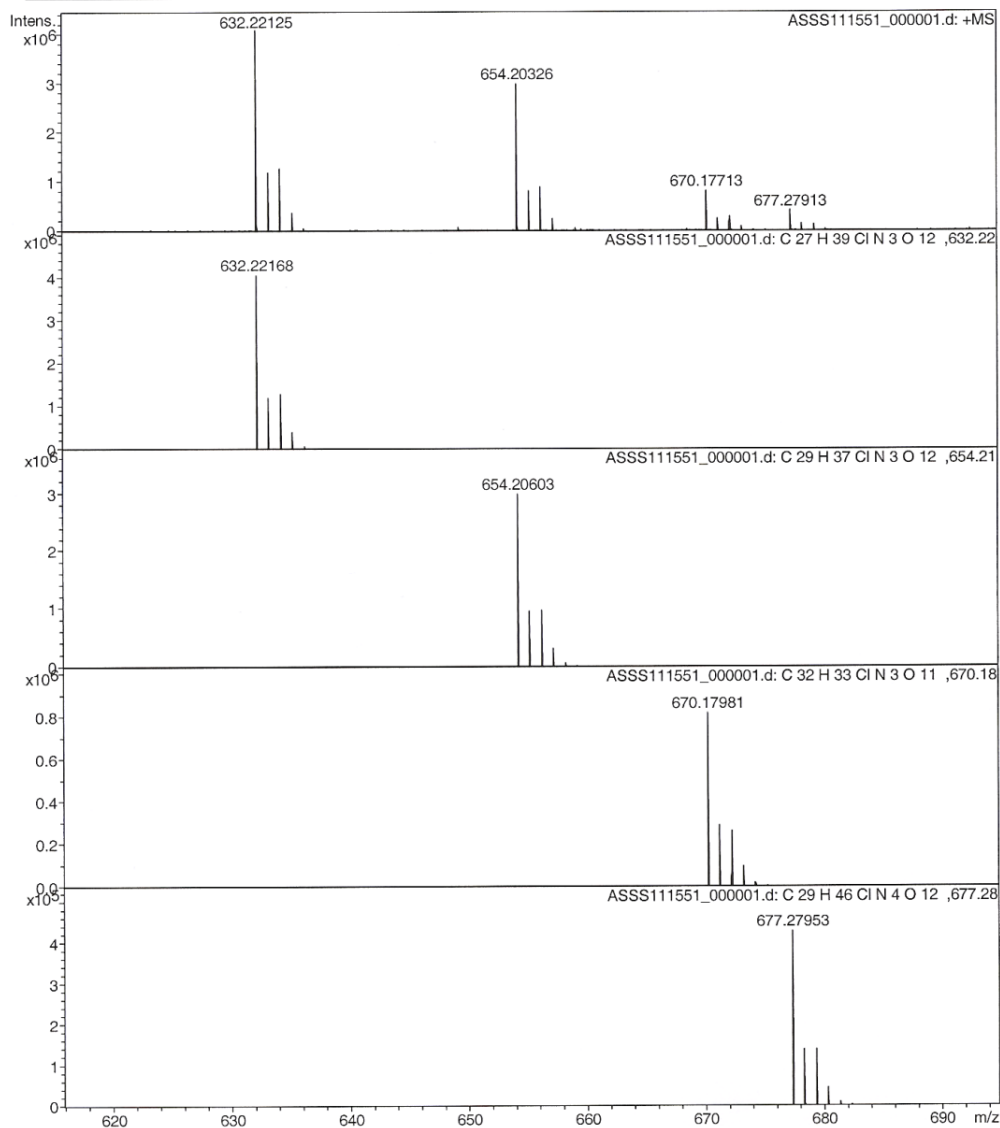
1.8 Optical and Scanning Electron Microscopy images of Pc 4

Scanning Electron Microscopy (SEM) images were collected using a high-resolution scanning electron microscope Hitachi SU-70 working at 4 kV. EDS (Energy Dispersive X-ray Spectroscopy) data and SEM mapping images were recorded in the same SU-70 instrument working at 15 kV and using a Bruker QUANTAX 400. Samples were prepared by deposition on aluminium sample holders followed by carbon coating using an Emitech K950X carbon evaporator.

Acquisition Parameter

Capillary Exit 300.0 V

Skimmer 1 15.0 V



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Mass Spectrum Molecular Formula Report

Meas. m/z	#	Formula	Score	m/z	err [mDa]	err [ppm]	mSigma	rdb	e ⁻ Conf	N-Rule
632.22125	1	C 27 H 39 Cl N 3 O 12	100.00	632.22168	0.4	0.7	40.0	9.5	even	ok
654.20326	1	C 29 H 37 Cl N 3 O 12	100.00	654.20603	2.8	4.2	54.1	12.5	even	ok
670.17713	1	C 32 H 32 N O 15	100.00	670.17665	-0.5	-0.7	51.3	17.5	even	ok
	2	C 32 H 33 Cl N 3 O 11	13.69	670.17981	2.7	4.0	65.8	17.5	even	ok
677.27913	1	C 29 H 46 Cl N 4 O 12	100.00	677.27953	0.4	0.6	64.8	8.5	even	ok

Figure SI11 - HRMS of compound 1.

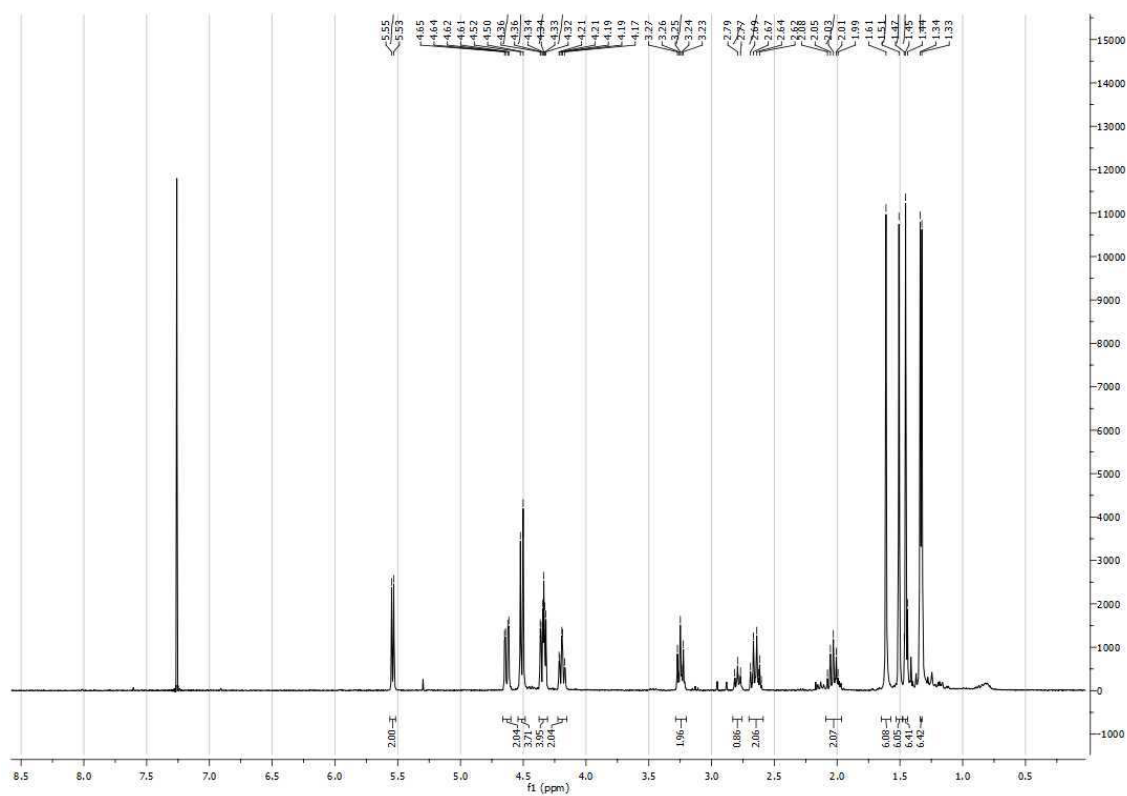


Figure SI12 - ^1H NMR spectrum of compound 2.

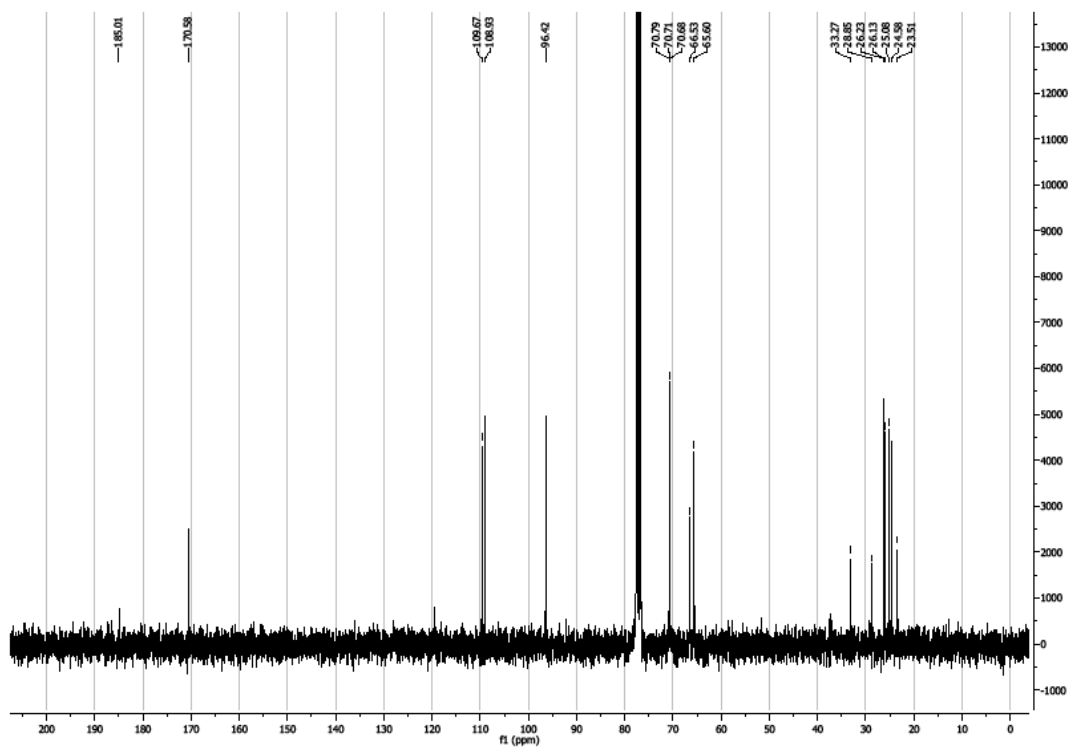
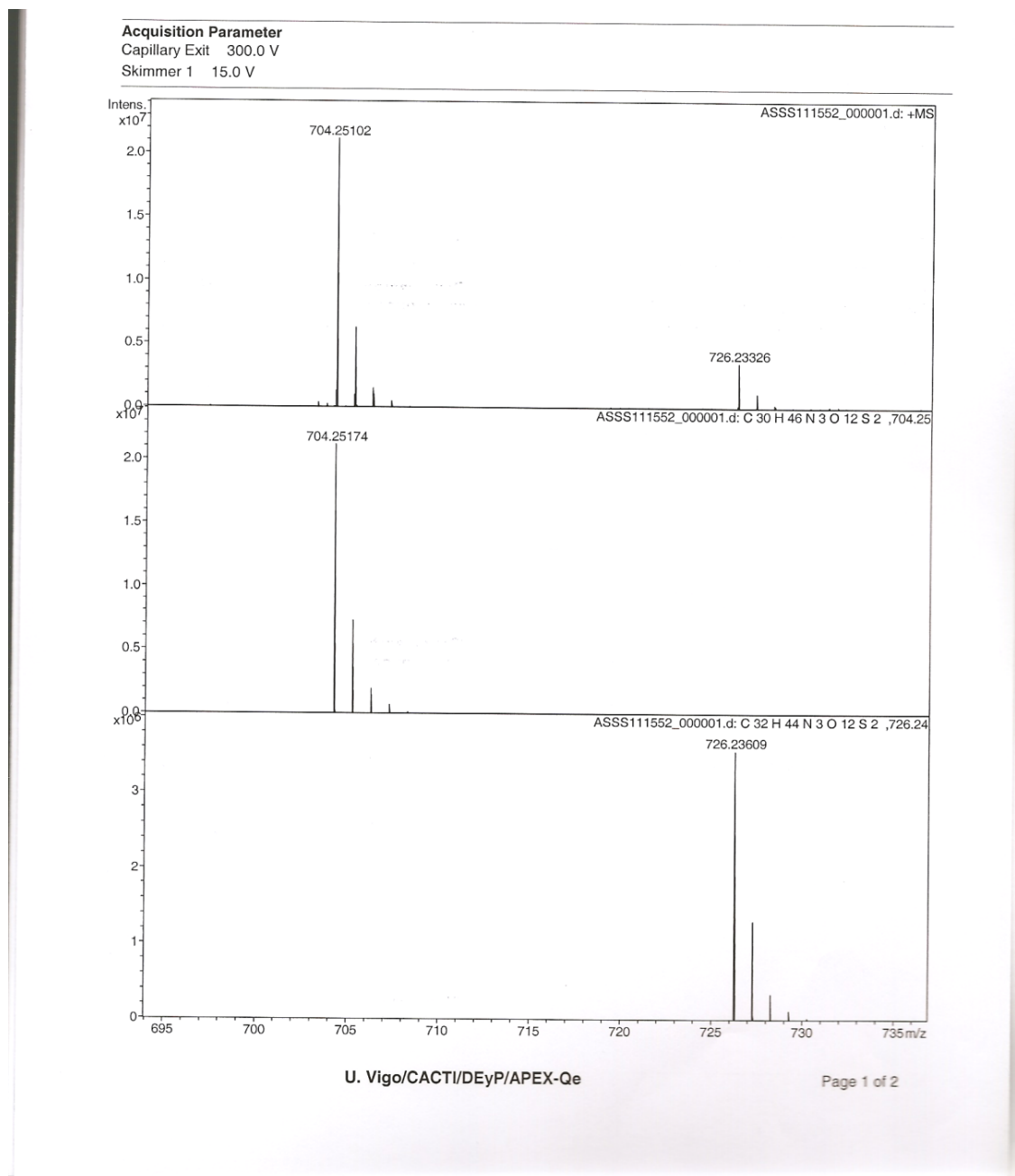


Figure SI13 - ^{13}C NMR spectrum of compound 2.



Mass Spectrum Molecular Formula Report

Meas. m/z	#	Formula	Score	m/z	err [mDa]	err [ppm]	mSigma	rdb	e ⁻ Conf	N-Rule
704.25102	1	C 30 H 46 N 3 O 12 S 2	100.00	704.25174	0.7	1.0	58.9	9.5	even	ok
726.23326	1	C 32 H 44 N 3 O 12 S 2	100.00	726.23609	2.8	3.9	91.2	12.5	even	ok

Figure SI14 - HRMS of compound 2.

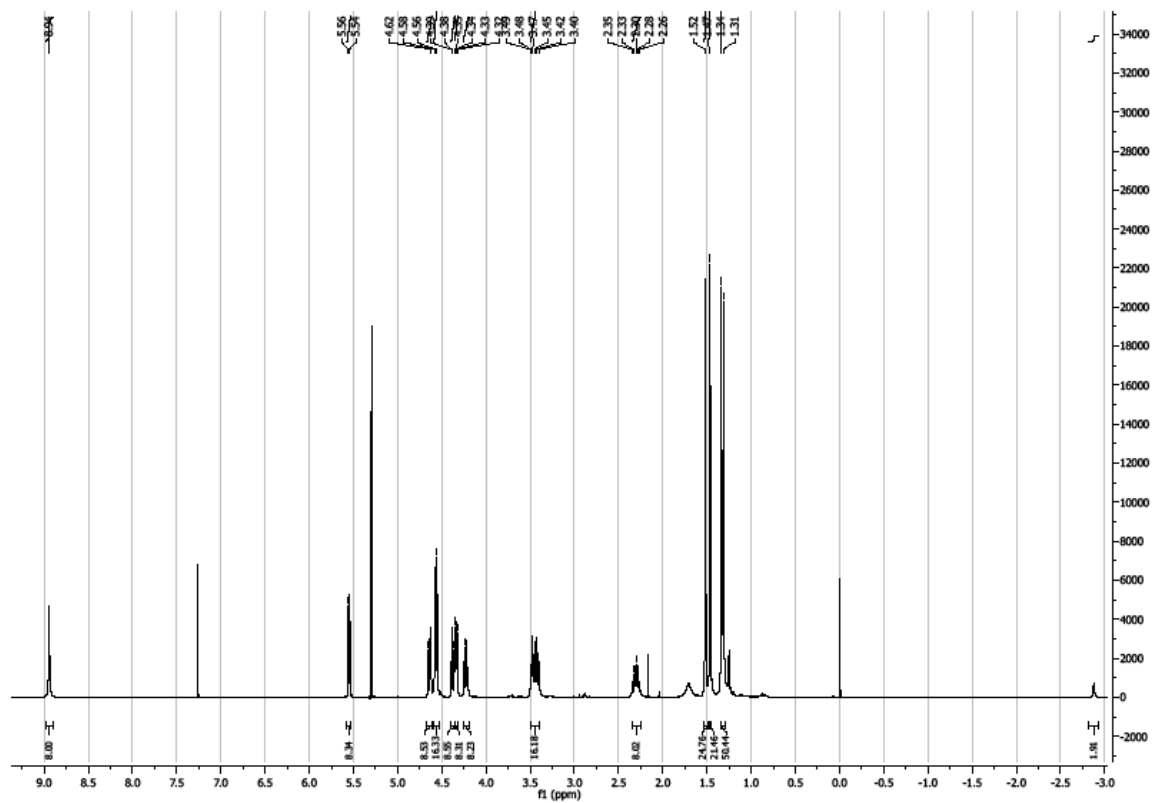


Figure SI15 - ^1H NMR spectrum of compound 3.

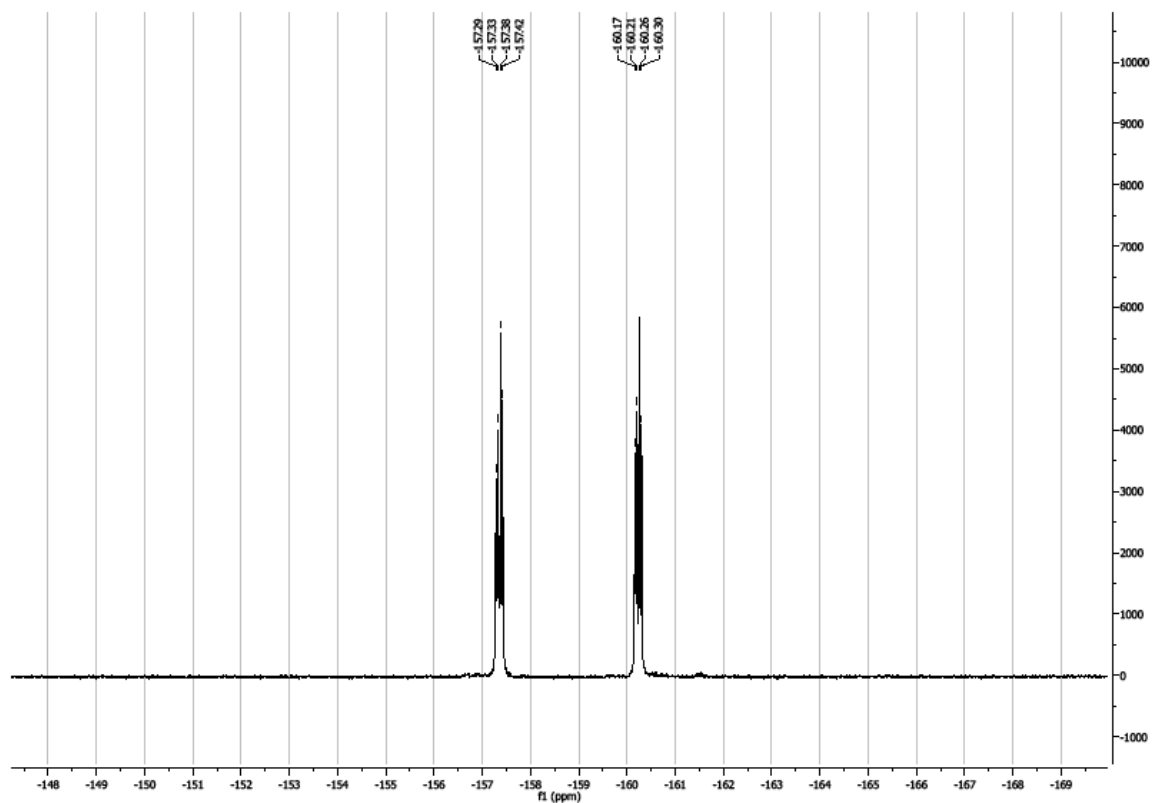


Figure SI16 - ^{19}F NMR spectrum of compound 3.

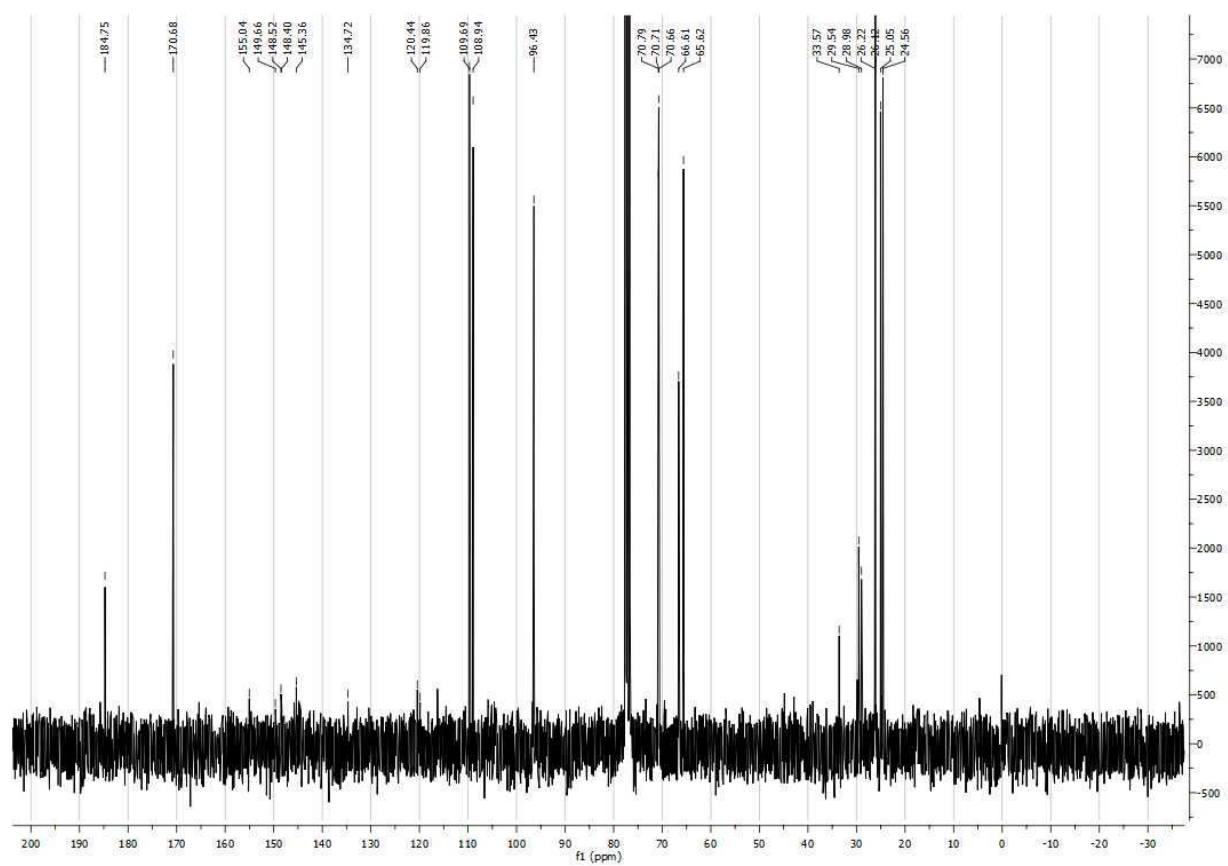
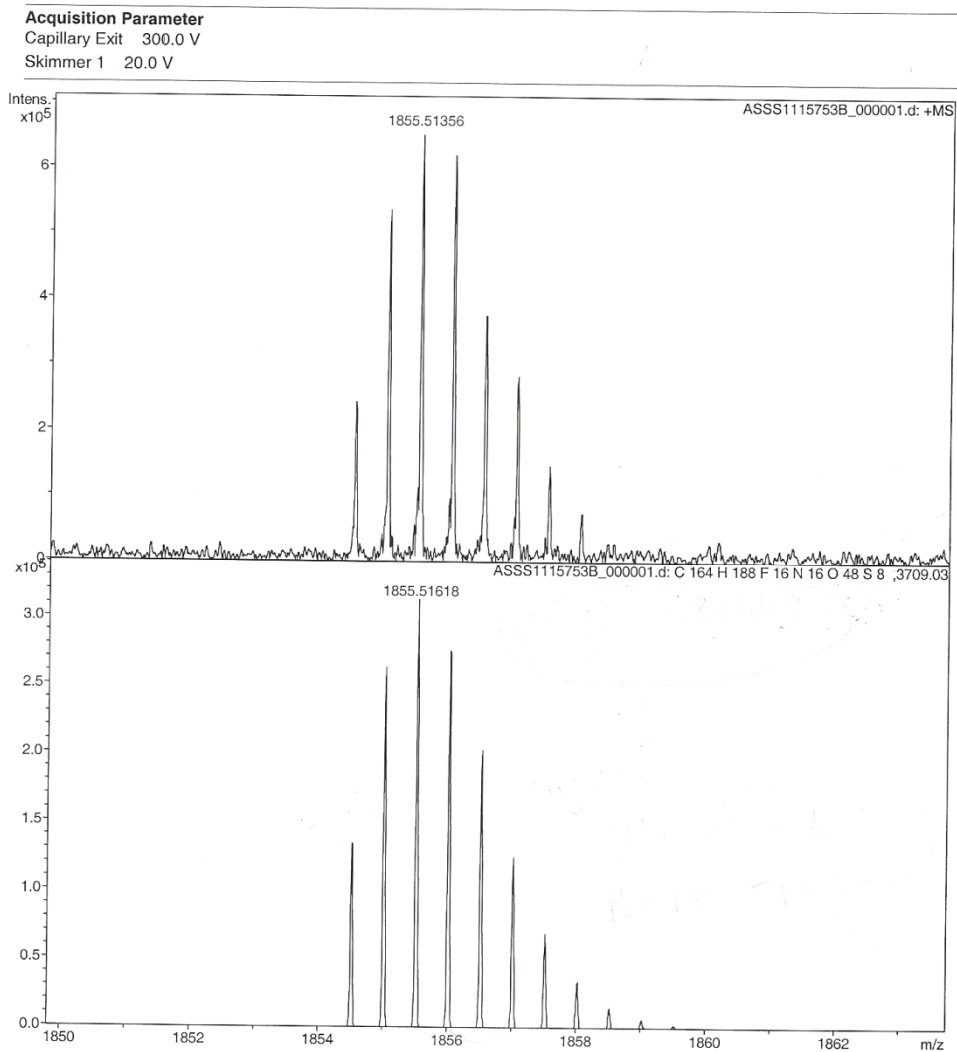


Figure SI17 - ^{13}C NMR spectrum of compound 3.



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Mass Spectrum Molecular Formula Report

Meas. m/z	#	Formula	Score	m/z	err [mDa]	err [ppm]	mSigma	rdb	e ⁻ Conf	N-Rule
1854.51035	1	C 164 H 188 F 16 N 16 O 48 S 8	100.00	1854.51306	2.7	1.5	35.9	71.0	even	ok
	2	C 165 H 186 F 16 N 16 O 49 S 7	0.00	1851.51665	10.6	5.7	581.1	73.0	even	ok
	3	C 165 H 188 F 16 N 16 O 49 S 7	0.00	1852.52448	17.6	9.5	581.1	72.0	even	ok
	4	C 164 H 182 F 16 N 16 O 48 S 8	0.00	1851.48958	-16.9	-9.1	588.6	74.0	even	ok
	5	C 164 H 184 F 16 N 16 O 48 S 8	0.00	1852.49741	-9.7	-5.3	588.6	73.0	even	ok
	6	C 164 H 186 F 16 N 16 O 48 S 8	0.00	1853.50523	-2.9	-1.6	588.6	72.0	even	ok
	7	C 164 H 183 F 16 N 15 O 49 S 8	0.00	1852.98941	-18.1	-9.8	588.6	73.0	even	ok
	8	C 164 H 185 F 16 N 15 O 49 S 8	0.00	1853.99724	-11.6	-6.2	588.6	72.0	even	ok
	9	C 164 H 185 F 15 N 16 O 49 S 8	0.00	1851.49957	-6.9	-3.7	589.0	73.0	even	ok
	10	C 164 H 187 F 15 N 16 O 49 S 8	0.00	1852.50740	0.3	0.1	589.0	72.0	even	ok
	11	C 164 H 189 F 15 N 16 O 49 S 8	0.00	1853.51522	7.1	3.8	589.1	71.0	even	ok
	12	C 165 H 186 F 16 N 16 O 47 S 8	0.00	1851.50777	1.3	0.7	589.3	73.0	even	ok
	13	C 165 H 183 F 16 N 15 O 48 S 8	0.00	1850.99196	-14.2	-7.7	589.4	74.0	even	ok
	14	C 165 H 188 F 16 N 16 O 47 S 8	0.00	1852.51560	8.5	4.6	589.4	72.0	even	ok
	15	C 165 H 185 F 16 N 15 O 48 S 8	0.00	1851.99978	-7.0	-3.8	589.4	73.0	even	ok
	16	C 165 H 190 F 16 N 16 O 47 S 8	0.00	1853.52342	15.3	8.3	589.4	71.0	even	ok
	17	C 165 H 187 F 16 N 15 O 48 S 8	0.00	1853.00761	0.1	0.0	589.4	72.0	even	ok
	18	C 165 H 189 F 16 N 15 O 48 S 8	0.00	1854.01543	6.6	3.6	589.4	71.0	even	ok
	19	C 165 H 189 F 15 N 16 O 48 S 8	0.00	1851.51777	11.3	6.1	589.8	72.0	even	ok
	20	C 165 H 186 F 15 N 15 O 49 S 8	0.00	1851.00195	-4.2	-2.3	589.8	73.0	even	ok
	21	C 165 H 188 F 15 N 15 O 49 S 8	0.00	1852.00977	3.0	1.6	589.8	72.0	even	ok
	22	C 165 H 190 F 15 N 15 O 49 S 8	0.00	1853.01760	10.1	5.4	589.9	71.0	even	ok

Figure SI18 - HRMS of compound 3.

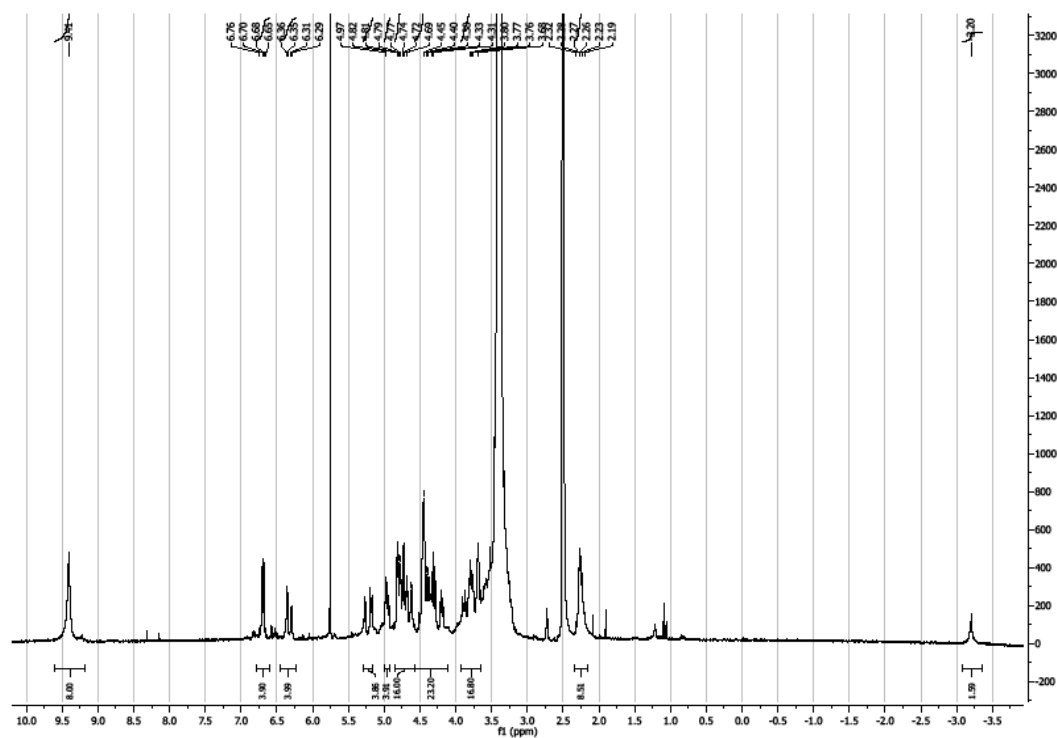


Figure SI19 - ^1H NMR spectrum of compound **3a**.

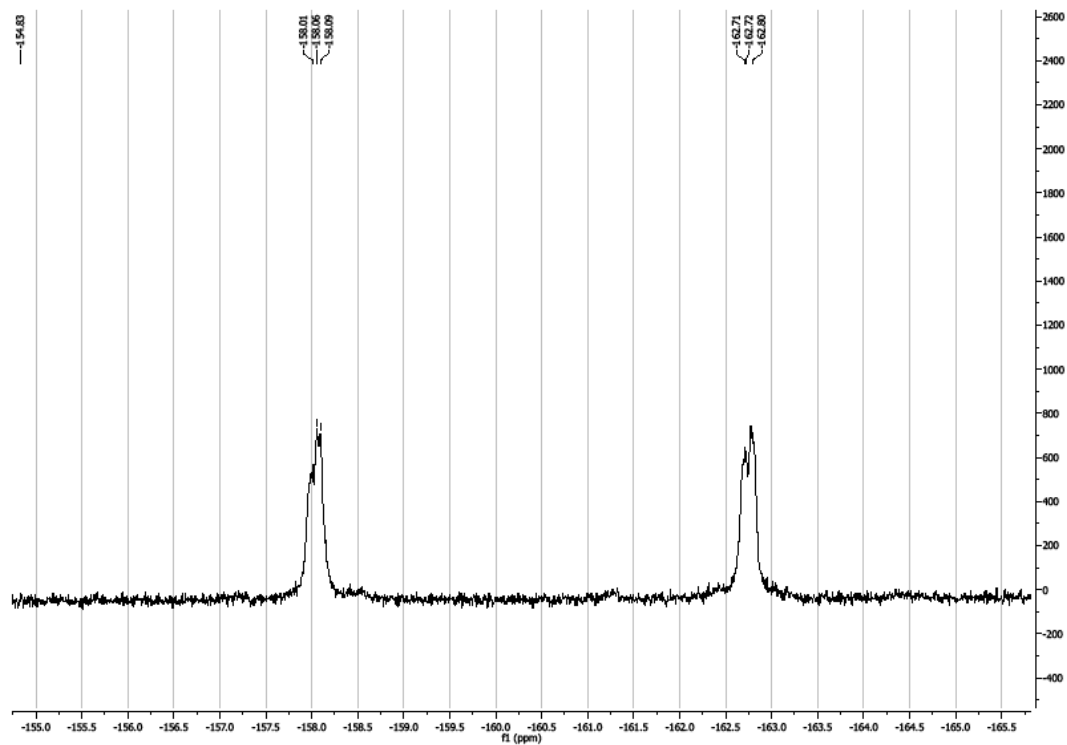


Figure SI20 - ^{19}F NMR spectrum of compound **3a**.

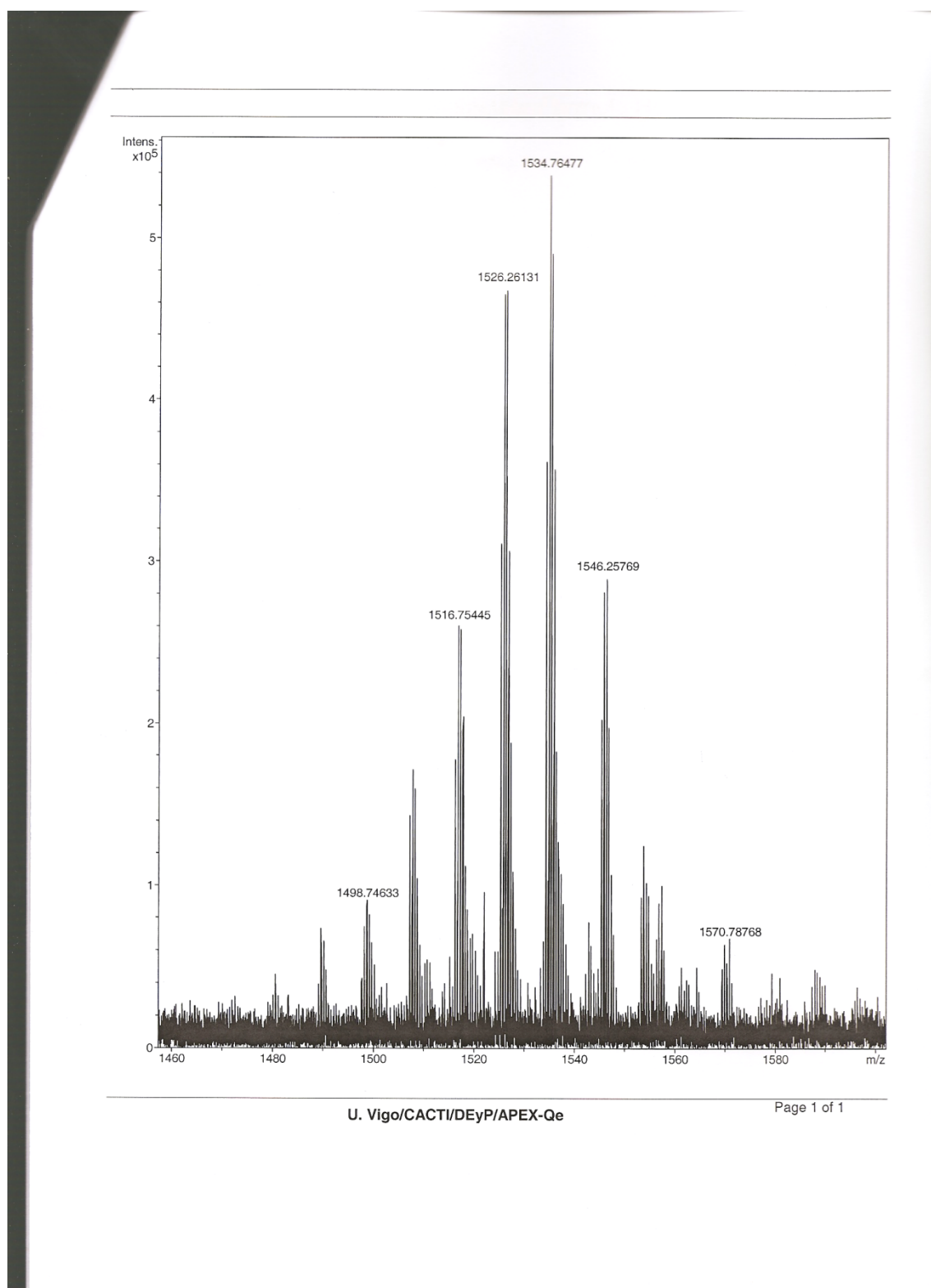


Figure SI21a - HRMS of compound 3a.

Mass Spectrum Molecular Formula Report

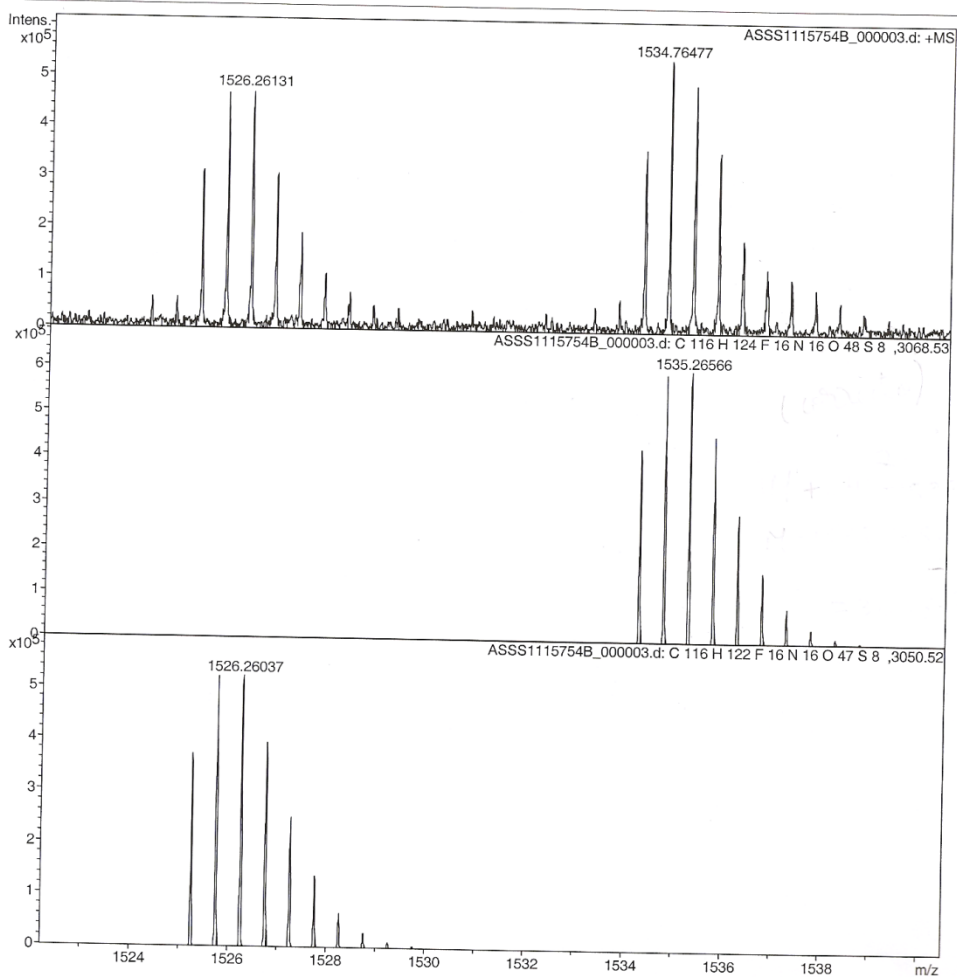
Analysis Info Electropray (ESI)

Analysis Name D:\Data\AUAVEIRO\ASSS1115754B_000003.d
Sample Name SS4
Comment

Acquisition Date 6/17/2011 2:42:53 PM
Instrument apex-Qe

Acquisition Parameter

Capillary Exit 300.0 V
Skimmer 1 120.0 V



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Figure SI21b - HRMS of compound 3a.

Mass Spectrum Molecular Formula Report

Meas. m/z	#	Formula	Score	m/z	err [mDa]	err [ppm]	mSigma	rdb	e ⁻ Conf	N-Rule
1526.26131	1	C ₁₁₆ H ₁₂₂ F ₁₆ N ₁₆ O ₄₉ S ₇	1.56	1525.26625	6.7	-4.4	43.7	56.0	even	ok
	2	C ₁₁₆ H ₁₂₂ F ₁₆ N ₁₆ O ₄₇ S ₈	100.00	1525.25737	-2.3	-1.5	51.4	56.0	even	ok
	3	C ₁₁₆ H ₁₂₅ F ₁₅ N ₁₆ O ₄₈ S ₈	0.16	1525.26737	7.7	5.0	51.9	55.0	even	ok
	4	C ₁₁₅ H ₁₂₁ F ₁₅ N ₁₆ O ₄₉ S ₈	0.00	1525.24917	-10.5	-6.9	65.8	56.0	even	ok
	5	C ₁₁₆ H ₁₂₁ F ₁₆ N ₁₅ O ₄₈ S ₈	0.00	1525.74938	-10.4	-6.8	218.1	56.0	even	ok
	6	C ₁₁₆ H ₁₂₄ F ₁₅ N ₁₅ O ₄₉ S ₈	0.00	1525.75937	-0.5	-0.3	218.8	55.0	even	ok
	7	C ₁₁₇ H ₁₂₅ F ₁₆ N ₁₅ O ₄₇ S ₈	0.00	1525.76757	7.7	5.1	219.8	55.0	even	ok
	8	C ₁₁₇ H ₁₂₃ F ₁₆ N ₁₅ O ₄₇ S ₈	0.00	1524.75975	0.5	0.3	244.1	56.0	even	ok
	9	C ₁₁₆ H ₁₂₂ F ₁₅ N ₁₅ O ₄₉ S ₈	0.00	1524.75155	-7.7	-5.1	245.4	56.0	even	ok
	10	C ₁₁₇ H ₁₂₃ F ₁₆ N ₁₅ O ₄₉ S ₇	0.00	1524.76863	9.5	6.2	261.0	56.0	even	ok
	11	C ₁₁₅ H ₁₂₃ F ₁₅ N ₁₆ O ₄₉ S ₈	0.00	1526.25700	-4.3	-2.8	337.7	55.0	even	ok
	12	C ₁₁₆ H ₁₂₄ F ₁₆ N ₁₆ O ₄₇ S ₈	0.00	1526.26520	3.9	2.5	338.3	55.0	even	ok
	13	C ₁₁₇ H ₁₂₄ F ₁₆ N ₁₆ O ₄₆ S ₈	0.00	1524.26774	8.6	5.6	439.5	56.0	even	ok
	14	C ₁₁₆ H ₁₂₃ F ₁₅ N ₁₆ O ₄₈ S ₈	0.00	1524.25954	0.4	0.2	440.3	56.0	even	ok
	15	C ₁₁₆ H ₁₂₀ F ₁₆ N ₁₆ O ₄₇ S ₈	0.00	1524.24955	-9.6	-6.3	441.3	57.0	even	ok
	16	C ₁₁₆ H ₁₂₀ F ₁₆ N ₁₆ O ₄₉ S ₇	0.00	1524.25843	-0.5	-0.3	483.6	57.0	even	ok
	17	C ₁₁₇ H ₁₂₄ F ₁₅ N ₁₅ O ₄₈ S ₈	0.00	1523.76192	2.9	1.9	595.4	56.0	even	ok
	18	C ₁₁₇ H ₁₂₁ F ₁₆ N ₁₅ O ₄₇ S ₈	0.00	1523.75192	-7.1	-4.6	596.2	57.0	even	ok
	19	C ₁₁₄ H ₁₂₅ F ₁₆ N ₁₅ O ₄₉ S ₈	0.00	1523.76249	3.4	2.2	601.4	52.0	even	ok
	20	C ₁₁₇ H ₁₂₁ F ₁₆ N ₁₅ O ₄₉ S ₇	0.00	1523.76080	2.1	1.4	610.2	57.0	even	ok
	21	C ₁₁₇ H ₁₂₅ F ₁₅ N ₁₆ O ₄₇ S ₈	0.00	1523.26991	11.0	7.2	718.0	56.0	even	ok
	22	C ₁₁₇ H ₁₂₂ F ₁₆ N ₁₆ O ₄₆ S ₈	0.00	1523.25992	1.0	0.6	718.6	57.0	even	ok
	23	C ₁₁₆ H ₁₂₁ F ₁₅ N ₁₆ O ₄₈ S ₈	0.00	1523.25172	-7.2	-4.7	719.0	57.0	even	ok
	24	C ₁₁₇ H ₁₂₂ F ₁₆ N ₁₆ O ₄₈ S ₇	0.00	1523.26879	10.3	6.7	728.0	57.0	even	ok
	25	C ₁₁₇ H ₁₂₂ F ₁₅ N ₁₅ O ₄₈ S ₈	0.00	1522.75409	-4.7	-3.1	756.1	57.0	even	ok
	26	C ₁₁₇ H ₁₁₉ F ₁₆ N ₁₅ O ₄₇ S ₈	0.00	1522.74410	-14.7	-9.6	756.5	58.0	even	ok
	27	C ₁₁₄ H ₁₂₃ F ₁₆ N ₁₅ O ₄₉ S ₈	0.00	1522.75466	-4.2	-2.8	759.8	53.0	even	ok
	28	C ₁₁₆ H ₁₁₈ F ₁₆ N ₁₆ O ₄₉ S ₇	0.00	1523.25060	-7.9	-5.2	760.5	58.0	even	ok
	29	C ₁₁₇ H ₁₁₉ F ₁₆ N ₁₅ O ₄₉ S ₇	0.00	1522.75298	-5.3	-3.5	762.6	58.0	even	ok
1534.76477	1	C ₁₁₆ H ₁₂₄ F ₁₆ N ₁₆ O ₄₈ S ₈	100.00	1534.26265	-0.6	-0.4	83.8	55.0	even	ok
	2	C ₁₁₇ H ₁₂₅ F ₁₆ N ₁₅ O ₄₈ S ₈	0.00	1533.76503	1.9	1.2	230.0	55.0	even	ok
	3	C ₁₁₆ H ₁₂₂ F ₁₆ N ₁₆ O ₄₈ S ₈	0.00	1533.25483	-7.9	-5.2	455.1	56.0	even	ok
	4	C ₁₁₆ H ₁₂₅ F ₁₅ N ₁₆ O ₄₉ S ₈	0.00	1533.26482	2.1	1.3	456.3	55.0	even	ok
	5	C ₁₁₇ H ₁₂₃ F ₁₆ N ₁₅ O ₄₈ S ₈	0.00	1532.75721	-5.4	-3.5	605.8	56.0	even	ok
	6	C ₁₁₇ H ₁₂₄ F ₁₆ N ₁₆ O ₄₇ S ₈	0.00	1532.26520	2.7	1.8	684.9	56.0	even	ok
	7	C ₁₁₆ H ₁₂₃ F ₁₅ N ₁₆ O ₄₉ S ₈	0.00	1532.25700	-5.5	-3.6	685.3	56.0	even	ok
	8	C ₁₁₇ H ₁₂₄ F ₁₆ N ₁₆ O ₄₉ S ₇	0.00	1532.27408	11.9	7.8	695.0	56.0	even	ok
	9	C ₁₁₇ H ₁₂₄ F ₁₅ N ₁₅ O ₄₉ S ₈	0.00	1531.75937	-3.0	-1.9	748.3	56.0	even	ok
	10	C ₁₁₇ H ₁₂₁ F ₁₆ N ₁₅ O ₄₈ S ₈	0.00	1531.74938	-13.0	-8.4	748.7	57.0	even	ok
	11	C ₁₁₇ H ₁₂₅ F ₁₅ N ₁₆ O ₄₈ S ₈	0.00	1531.26737	5.1	3.3	750.8	56.0	even	ok
	12	C ₁₁₇ H ₁₂₂ F ₁₆ N ₁₆ O ₄₇ S ₈	0.00	1531.25737	-4.9	-3.2	751.1	57.0	even	ok
	13	C ₁₁₆ H ₁₂₁ F ₁₅ N ₁₆ O ₄₉ S ₈	0.00	1531.24917	-13.1	-8.5	751.4	57.0	even	ok
	14	C ₁₁₇ H ₁₂₂ F ₁₆ N ₁₆ O ₄₉ S ₇	0.00	1531.26625	4.5	2.9	754.0	57.0	even	ok

Figure SI21c - HRMS of compound 3a.

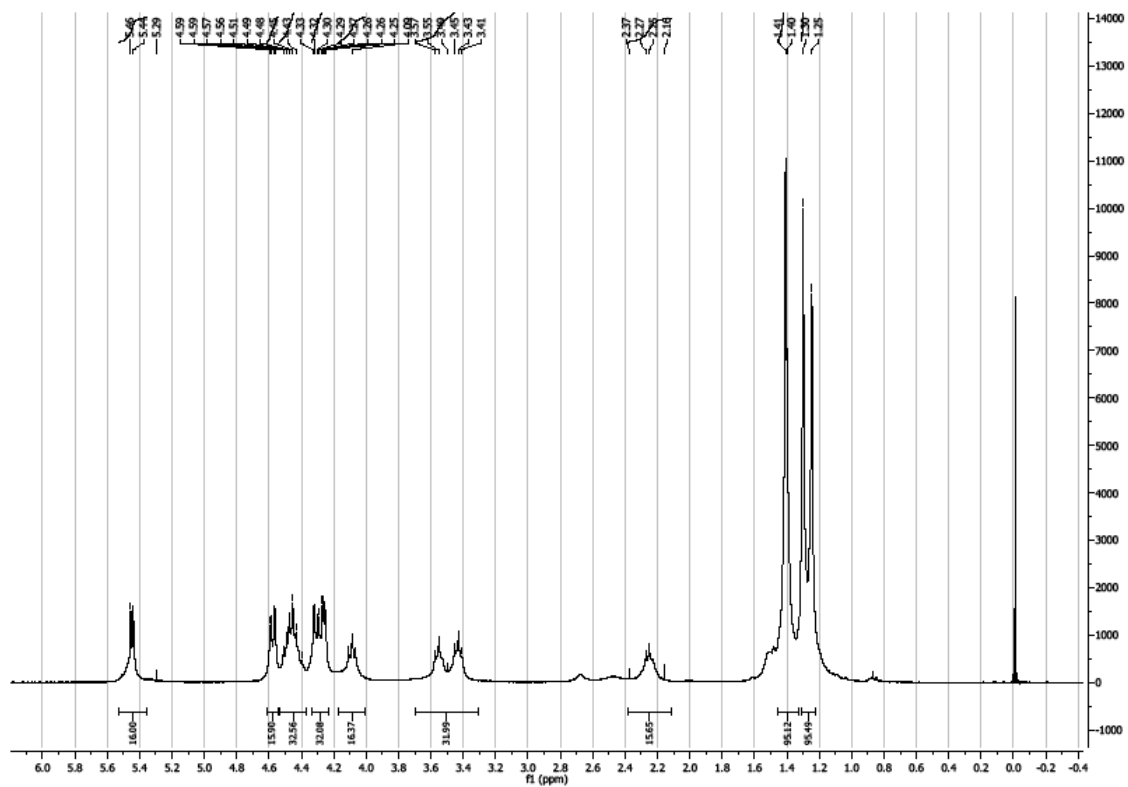


Figure SI22 - ¹H NMR of compound 4.

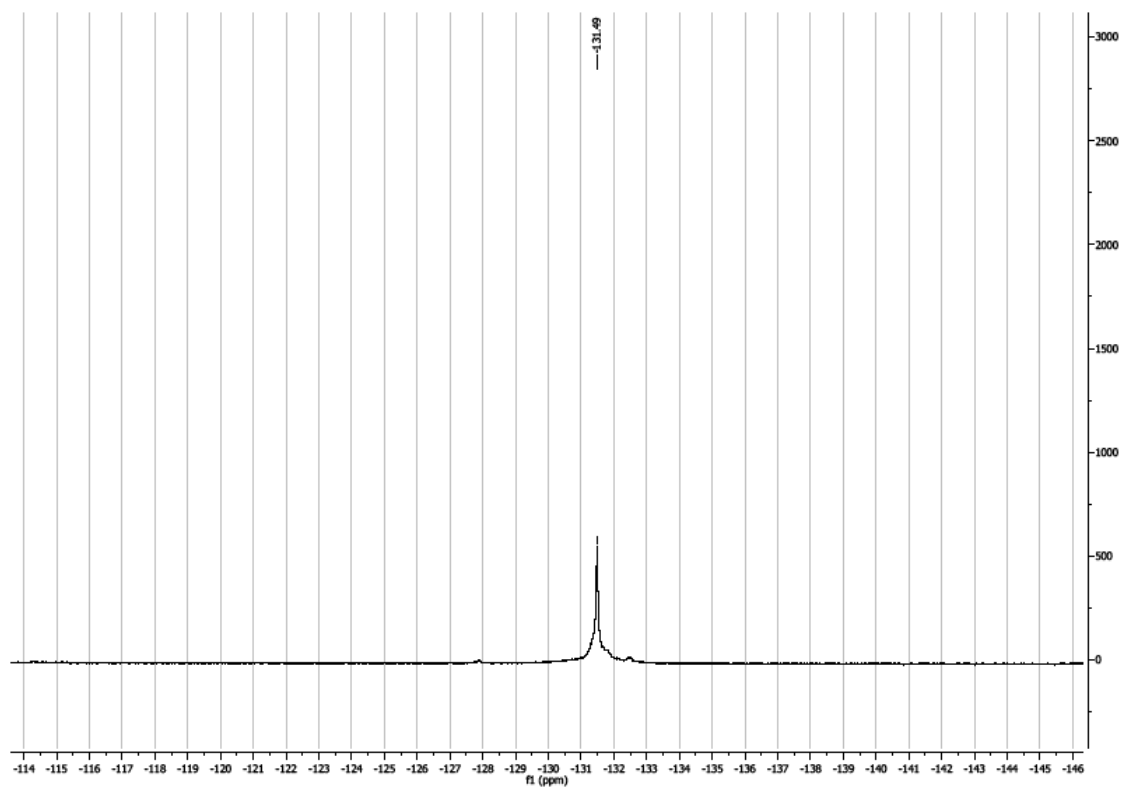


Figure SI23 - ¹⁹F NMR of compound 4.

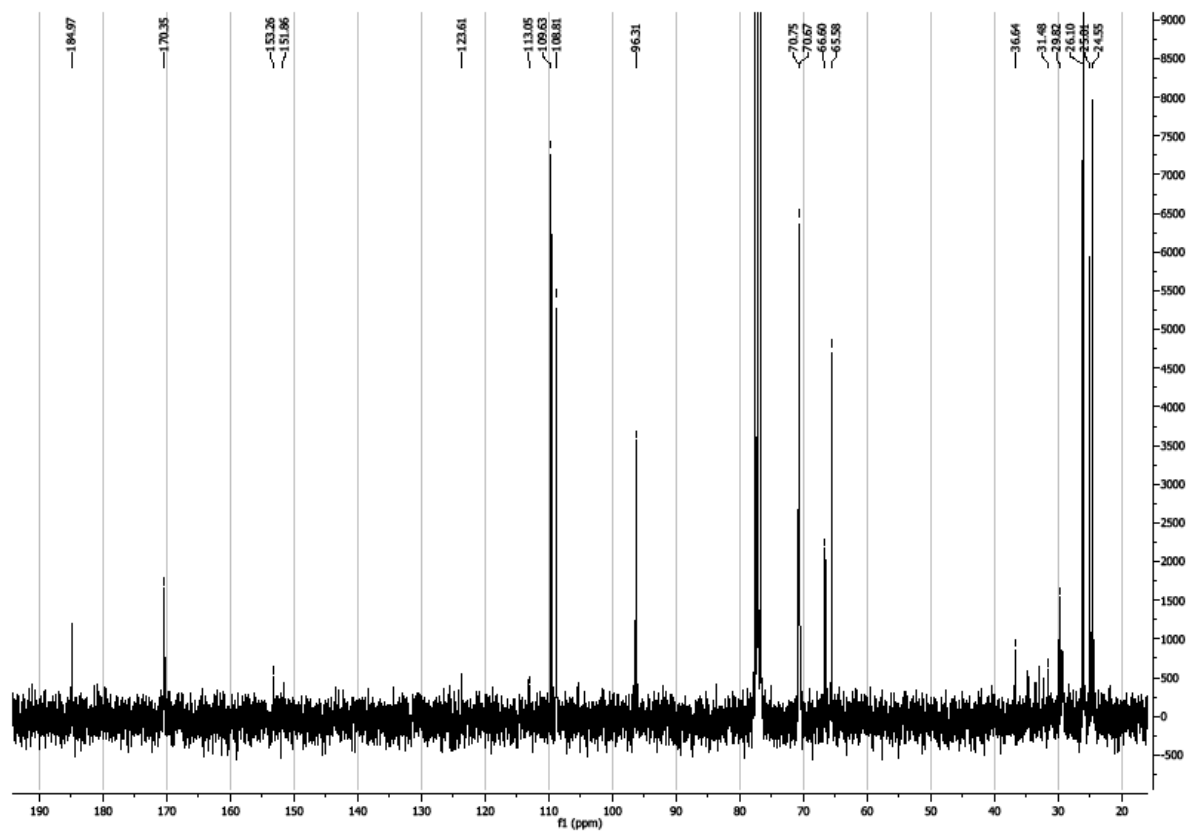


Figure SI24 - ^{13}C NMR of compound 4.

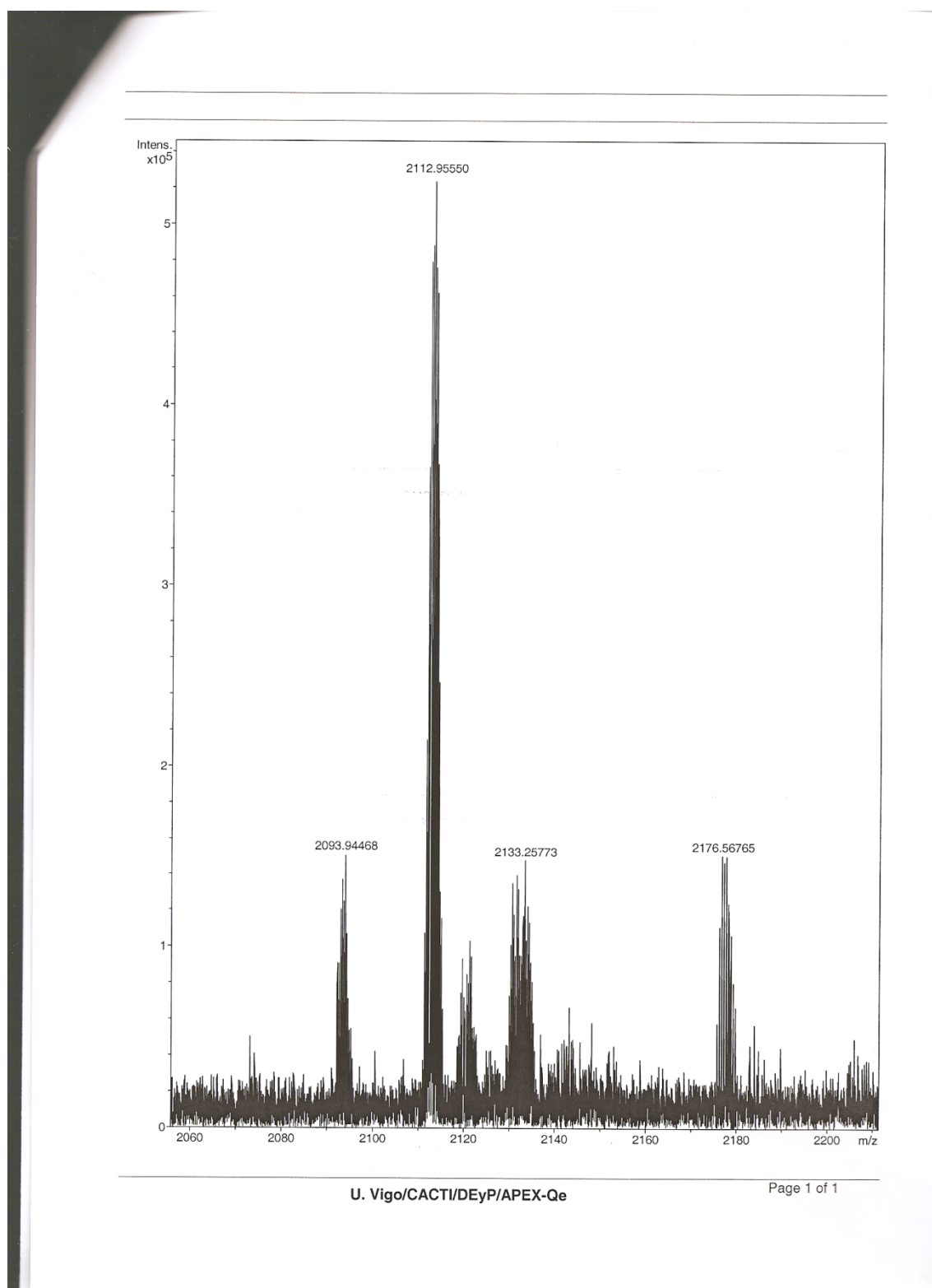


Figure SI25a - HRMS of compound 4.

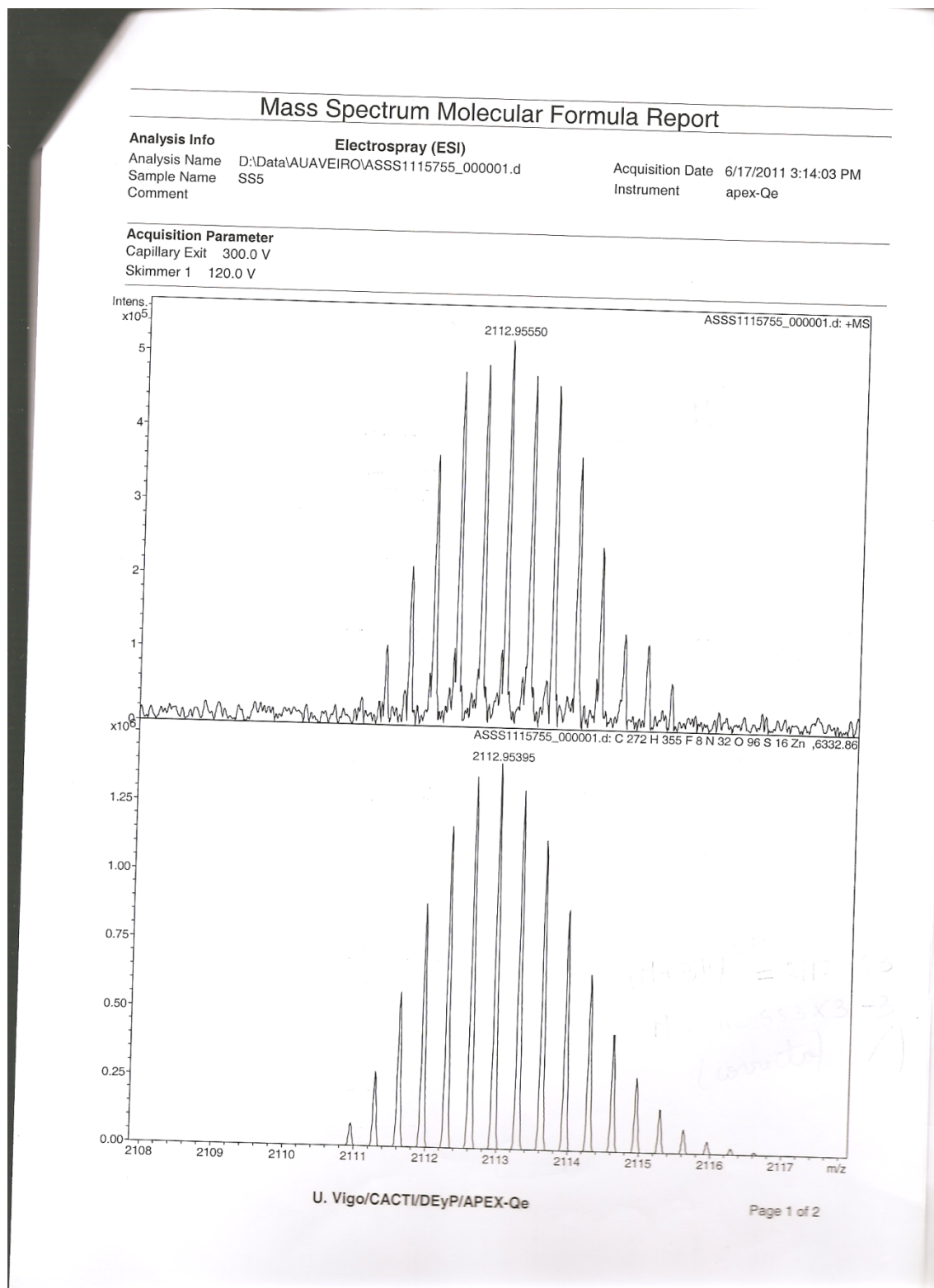


Figure SI25b - HRMS of compound 4.

Mass Spectrum Molecular Formula Report										
Meas. m/z	#	Formula	Score	m/z	err [mDa]	err [ppm]	mSigma	rdb	e ⁻ Conf	N-Rule
1526.26131	1	C 116 H 122 F 16 N 16 O 49 S 7	1.56	1525.26625	6.7	-4.4	43.7	56.0	even	ok
	2	C 116 H 122 F 16 N 16 O 47 S 8	100.00	1525.25737	-2.3	-1.5	51.4	56.0	even	ok
	3	C 116 H 125 F 15 N 16 O 48 S 8	0.16	1525.26737	7.7	5.0	51.9	55.0	even	ok
	4	C 115 H 121 F 15 N 16 O 49 S 8	0.00	1525.24917	-10.5	-6.9	65.8	56.0	even	ok
	5	C 116 H 121 F 16 N 15 O 48 S 8	0.00	1525.74938	-10.4	-6.8	218.1	56.0	even	ok
	6	C 116 H 124 F 15 N 15 O 49 S 8	0.00	1525.75937	-0.5	-0.3	218.8	55.0	even	ok
	7	C 117 H 125 F 16 N 15 O 47 S 8	0.00	1525.76757	7.7	5.1	219.8	55.0	even	ok
	8	C 117 H 123 F 16 N 15 O 47 S 8	0.00	1524.75975	0.5	0.3	244.1	56.0	even	ok
	9	C 116 H 122 F 15 N 15 O 49 S 8	0.00	1524.75155	-7.7	-5.1	245.4	56.0	even	ok
	10	C 117 H 123 F 16 N 15 O 49 S 7	0.00	1524.76863	9.5	6.2	261.0	56.0	even	ok
	11	C 115 H 123 F 15 N 16 O 49 S 8	0.00	1526.25700	-4.3	-2.8	337.7	55.0	even	ok
	12	C 116 H 124 F 16 N 16 O 47 S 8	0.00	1526.26520	3.9	2.5	338.3	55.0	even	ok
	13	C 117 H 124 F 16 N 16 O 46 S 8	0.00	1524.26774	8.6	5.6	439.5	56.0	even	ok
	14	C 116 H 123 F 15 N 16 O 48 S 8	0.00	1524.25954	0.4	0.2	440.3	56.0	even	ok
	15	C 116 H 120 F 16 N 16 O 47 S 8	0.00	1524.24955	-9.6	-6.3	441.3	57.0	even	ok
	16	C 116 H 120 F 16 N 16 O 49 S 7	0.00	1524.25843	-0.5	-0.3	483.6	57.0	even	ok
	17	C 117 H 124 F 15 N 15 O 48 S 8	0.00	1523.76192	2.9	1.9	595.4	56.0	even	ok
	18	C 117 H 121 F 16 N 15 O 47 S 8	0.00	1523.75192	-7.1	-4.6	596.2	57.0	even	ok
	19	C 114 H 125 F 16 N 15 O 49 S 8	0.00	1523.76249	3.4	2.2	601.4	52.0	even	ok
	20	C 117 H 121 F 16 N 15 O 49 S 7	0.00	1523.76080	2.1	1.4	610.2	57.0	even	ok
	21	C 117 H 125 F 15 N 16 O 47 S 8	0.00	1523.26991	11.0	7.2	718.0	56.0	even	ok
	22	C 117 H 122 F 16 N 16 O 46 S 8	0.00	1523.25992	1.0	0.6	718.6	57.0	even	ok
	23	C 116 H 121 F 15 N 16 O 48 S 8	0.00	1523.25172	-7.2	-4.7	719.0	57.0	even	ok
	24	C 117 H 122 F 16 N 16 O 48 S 7	0.00	1523.26879	10.3	6.7	728.0	57.0	even	ok
	25	C 117 H 122 F 15 N 15 O 48 S 8	0.00	1522.75409	-4.7	-3.1	756.1	57.0	even	ok
	26	C 117 H 119 F 16 N 15 O 47 S 8	0.00	1522.74410	-14.7	-9.6	756.5	58.0	even	ok
	27	C 114 H 123 F 16 N 15 O 49 S 8	0.00	1522.75466	-4.2	-2.8	759.8	53.0	even	ok
	28	C 116 H 118 F 16 N 16 O 49 S 7	0.00	1523.25060	-7.9	-5.2	760.5	58.0	even	ok
	29	C 117 H 119 F 16 N 15 O 49 S 7	0.00	1522.75298	-5.3	-3.5	762.6	58.0	even	ok
1534.76477	1	C 116 H 124 F 16 N 16 O 48 S 8	100.00	1534.26265	-0.6	-0.4	83.8	55.0	even	ok
	2	C 117 H 125 F 16 N 15 O 48 S 8	0.00	1533.76503	1.9	1.2	230.0	55.0	even	ok
	3	C 116 H 122 F 16 N 16 O 48 S 8	0.00	1533.25483	-7.9	-5.2	455.1	56.0	even	ok
	4	C 116 H 125 F 15 N 16 O 49 S 8	0.00	1533.26482	2.1	1.3	456.3	55.0	even	ok
	5	C 117 H 123 F 16 N 15 O 48 S 8	0.00	1532.75721	-5.4	-3.5	605.8	56.0	even	ok
	6	C 117 H 124 F 16 N 16 O 47 S 8	0.00	1532.26520	2.7	1.8	684.9	56.0	even	ok
	7	C 116 H 123 F 15 N 16 O 49 S 8	0.00	1532.25700	-5.5	-3.6	685.3	56.0	even	ok
	8	C 117 H 124 F 16 N 16 O 49 S 7	0.00	1532.27408	11.9	7.8	695.0	56.0	even	ok
	9	C 117 H 124 F 15 N 15 O 49 S 8	0.00	1531.75937	-3.0	-1.9	748.3	56.0	even	ok
	10	C 117 H 121 F 16 N 15 O 48 S 8	0.00	1531.74938	-13.0	-8.4	748.7	57.0	even	ok
	11	C 117 H 125 F 15 N 16 O 48 S 8	0.00	1531.26737	5.1	3.3	750.8	56.0	even	ok
	12	C 117 H 122 F 16 N 16 O 47 S 8	0.00	1531.25737	-4.9	-3.2	751.1	57.0	even	ok
	13	C 116 H 121 F 15 N 16 O 49 S 8	0.00	1531.24917	-13.1	-8.5	751.4	57.0	even	ok
	14	C 117 H 122 F 16 N 16 O 49 S 7	0.00	1531.26625	4.5	2.9	754.0	57.0	even	ok

Figure SI25c - HRMS of compound 4.

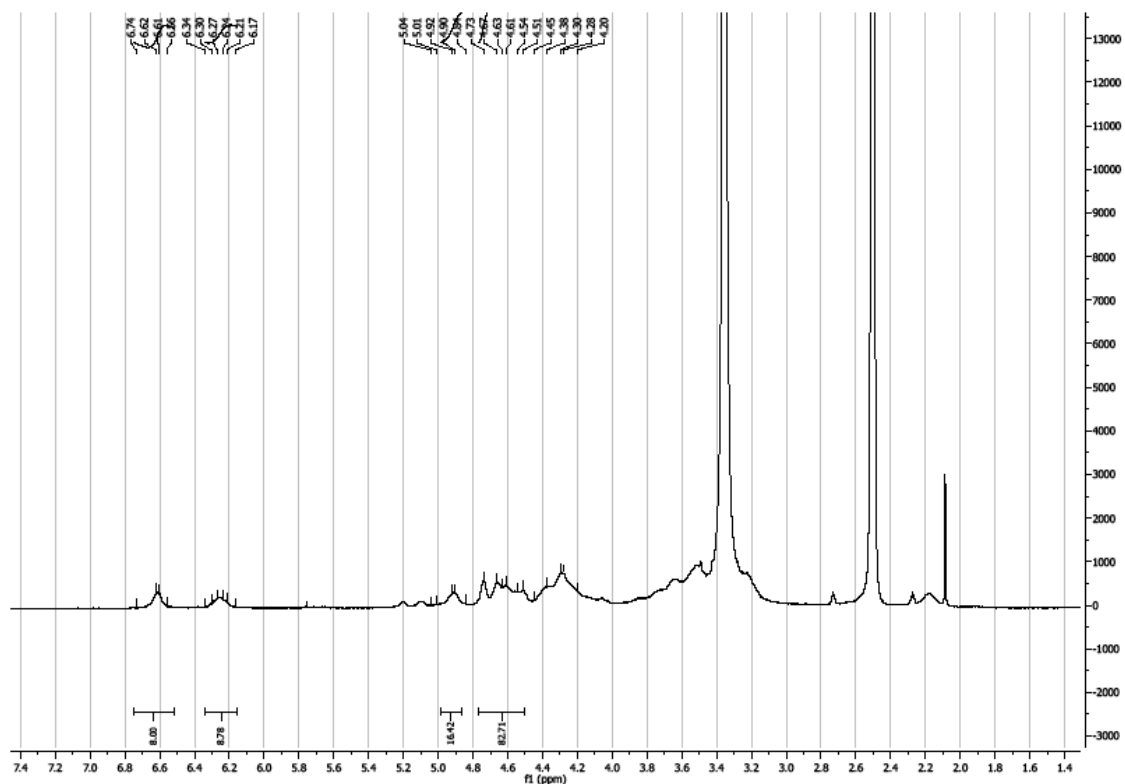


Figure SI26 - ¹H NMR of compound 4a.

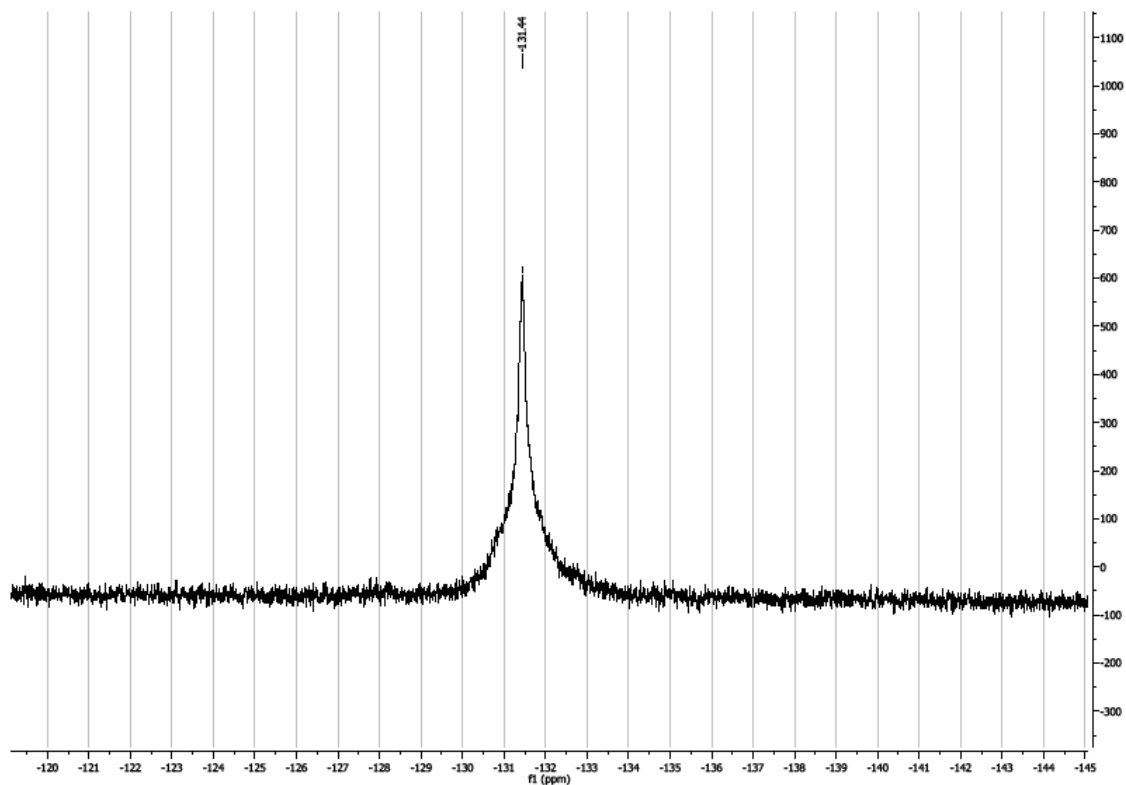


Figure SI27 - ¹⁹F NMR of compound 4a.

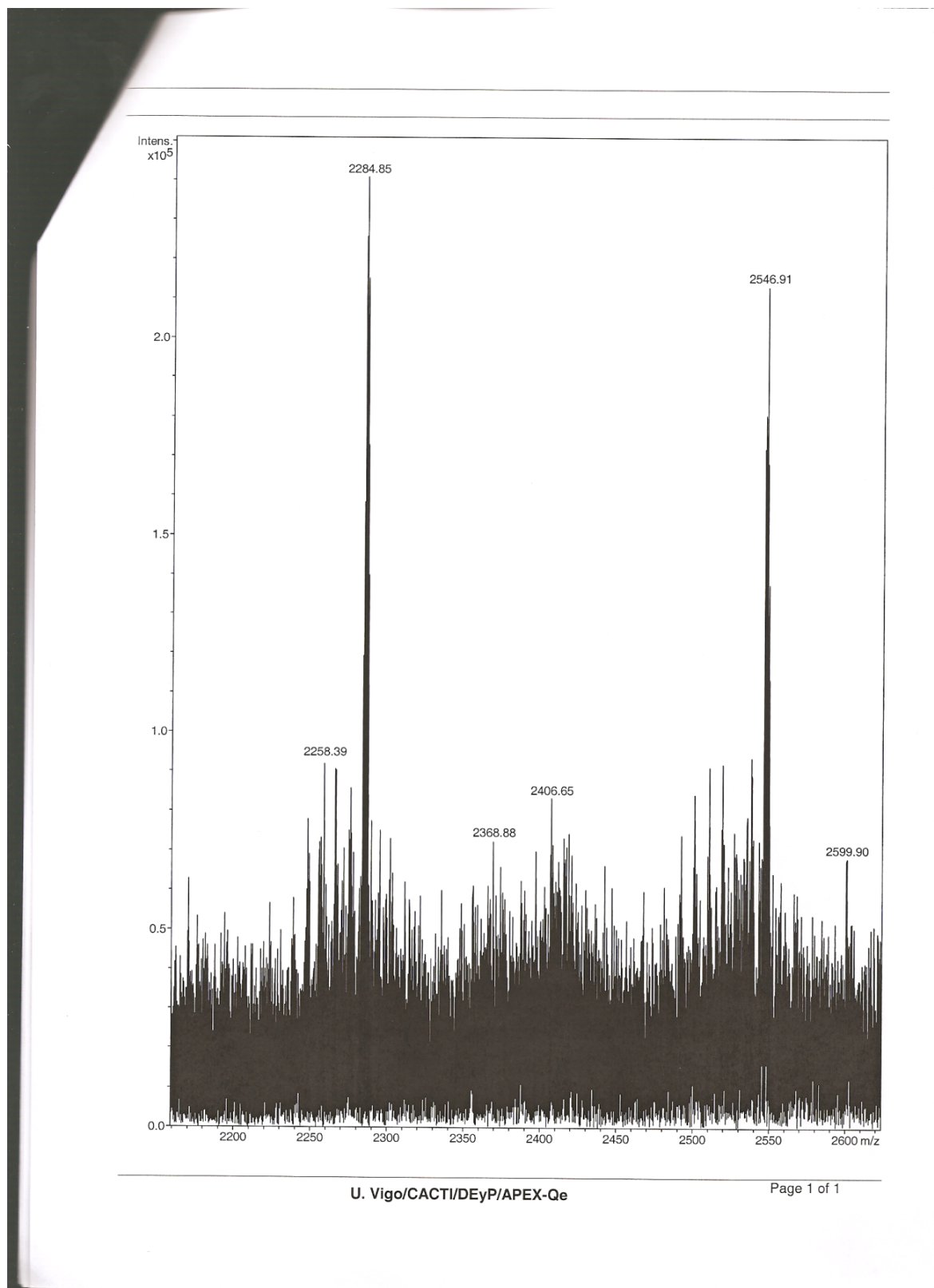


Figure SI28 - HRMS of compound 4a.

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