Supporting Information

Negatively Charged Red-Emitting Acridine Dyes for Facile Reductive Amination, Separation and Fluorescent Detection of Glycans

Maksim A. Fomin,[1] Jan Seikowski,[2] Vladimir N. Belov,[1,*] and Stefan W. Hell[1]

[1]Department of NanoBiophotonics, Max Planck Institute for Biophysical Chemistry (MPIBPC), Am Fassberg 11, 37077 Göttingen, Germany

[2]Facility for Synthetic Chemistry, MPIBPC, Am Fassberg 11, 37077 Göttingen, Germany

Email: vladimir.belov@mpibpc.mpg.de

Table of Contents:

1. Additional Experimental Procedures

GENERAL METHODS

All the reagents were purchased from commercial suppliers (Merck, TCI, abcr, Carbosynth), stored according to published protocols, and used as received unless indicated otherwise. Solvents were obtained from Merck (EMSURE® ACS, ISO, Reag. Ph Eur). For photophysical measurements, solvents of spectrophotometric grade were used. Anhydrous solvents were stored over molecular sieves. Deuterated solvents were purchased from Deutero GmbH ($CDCl_3$, CD_3OD, D_2O, DMF-d_7, DMSO-d_6, TFA-d). Reactions at "0 °C" were carried out using external cooling with an ice-bath. For reduction reactions with hydrogen, 10% Pd/C (oxidized form, VWR International) was used. Oligosaccharides were purchased from Carbosynth (6'-sialyllactose sodium salt, 3'-sialyllactose sodium salt, maltodextrin oligosaccharides DP2 to DP15, Fuc(α1–3)GlcNAc, Fuc(α1–6)GlcNAc) and Sigma Aldrich (glucose, maltotriose, maltoheptaose, *N*-acetylglucosamine and *N*-acetylgalactosamine, Lewis-Y tetrasaccharide).

Normal phase TLC was performed on silica gel 60 F_{254} (Merck Millipore). Compounds were detected by exposing TLC plates to UV-light (254 or 365 nm).

Analytical HPLC was performed on a Knauer Azura liquid chromatography system with a binary P 6.1L pump, dynamic mixing chamber V7119-1, UV diode array detector DAD 6.1L working in the range of 200–800 nm, an injection valve with a 20 µL loop and two electrical switching valves V 2.1S with 6-port multiposition valve head. The UV detection wavelengths were set at 254 and 350 nm. The column temperature was not standardized, but remained at ambient temperature. Data acquisition was carried out by ClarityChrom (V6.2.0.208) software. Figures were prepared using ACD Labs Spectrus Processor 2019.

Analytical columns: Knauer Eurospher II 100-5 C18, 5 µm, 150×4 mm (if not stated otherwise); Knauer Eurospher II 100-5 C18A, 5 µm, 150×4 mm; Knauer Eurospher II 100-10 C18A, 10 µm, 150×4 mm; Interchim Uptisphere Strategy C18-HQ, 10 µm, 250×4.6 mm; Interchim Puriflash C18-AQ, 5 µm, 150×4.6 mm.

Flow rate: 1.2 mL/min.

Phase A: water + 0.1% v/v trifluoroacetic acid (TFA).

Phase B: MeCN + 0.1% v/v TFA.

Gradient 20–100: 20% B (0–3 min); 20–100% B (3–15 min).

Gradient 5–50: 5% B (0–3 min); 5–50% B (3–15 min); 50–100% B (15–18 min).

For isolation and purification of phosphorylated dyes, acetonitrile (phase B) – aqueous systems containing 0.05 M of TEAB buffer (phase A, pH = 8; self-prepared from 1 M aq. Et_3N and CO_2 gas obtained by evaporation of solid CO_2).

Gradient TEAB-1–20: 1% B (0–3 min); 1–20% B (3–20 min).

Gradient TEAB-1–25: 1% B (0–3 min); 1–25% B (3–20 min).

Gradient TEAB-1–25-AQ: 1% B (0–2 min); 1–25% B (2–15 min).

Gradient TEAB-0–25: 0% B (0–2 min); 0–25% B (2–15 min); 25–100% B (15–18 min).

Gradient TEAB-0–40: 0% B (0–2 min); 0–40% B (2–15 min); 40–100% B (15–18 min).

Flash chromatography was performed on an automated Biotage Isolera One or Interchim puriFlash™ flash purification system using the cartridges and solvent gradients indicated in the text.

Mass spectra with ESI ion source were using a *Varian 500 MS* spectrometer (Agilent). High resolution mass spectra were obtained on a *Bruker maXis* (ESI-QTOF-HRMS) or *Bruker Autoflex Speed* (MALDI-TOF HRMS) spectrometer (Institut für Organische und Biomolekulare Chemie, Georg-August-Universität Göttingen).

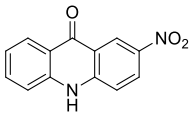
Nuclear magnetic resonance (NMR) spectra were recorded on an *Agilent 400MR DD2* spectrometer. All spectra are referenced to tetrametylsilane as an internal standard (δ = 0.00 ppm) using the signals of the residual protons of $CHCl_3$ (7.26 ppm) in $CDCl_3$, CHD_2OD (3.31 ppm) in CD_3OD or DMSO-d_5 in DMSO-d_6 (2.5 ppm). Multiplicities of the signals

are described as follows: s = singlet, br. s = broad singlet, d = doublet, t = triplet, q = quartet, m = multiplet. Coupling constants *J* are given in Hz. For ^{13}C-signals revealed by indirect detection by HSQC, only resonances of the carbon atoms linked to H-atoms were recorded.

UV–vis and fluorescence. Absorption spectra was recorded on a double-beam UV–vis spectrophotometer (Varian 4000). Measurements were performed in 1 cm quartz- or UV–vis disposable cuvettes (BRAND semi-micro), without exclusion of air oxygen at ambient temperature. Emission spectra and absolute fluorescence quantum yields were obtained on a Cary Eclipse fluorescence spectrometer (Varian) and a Quantaurus-QY Absolute PL quantum yield spectrometer C11347 (Hamamatsu). Emission and UV–vis scan spectra were recorded using following parameters: average time 0.1 s; data interval 1 nm; scan rate 600 nm/min; with base line correction.

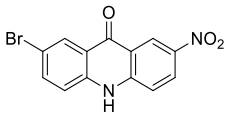
SYNTHESIS OF MODEL COMPOUNDS

2-Nitroacridone (9)



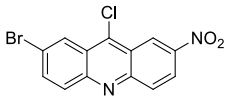
A modified procedure was used.[1] *N*-Phenyl-5-nitroanthranilic acid (1.97 g, 7.63 mmol) and $POCl_3$ (20 mL) were heated to reflux for 4 h. The reaction mixture was cooled on ice. Small pieces of ice and cold water (20 mL) were added. The resulting mixture was refluxed for 1 h, and the precipitate was observed. The mixture was allowed to reach rt. The precipitate was collected by filtration, washed with water, cold methanol and diethyl ether, and dried *in vacuo* to give a light yellow-green solid (1.76 g, 96%). ^{1}H NMR (400 MHz, DMSO-d_6): δ = 12.33 (s, 1H), 8.95 (d, *J* = 2.7 Hz, 1H), 8.45 (dd, *J* = 9.4, 2.7 Hz, 1H), 8.22 (dd, *J* = 8.2, 1.2 Hz, 1H), 7.80 (ddd, *J* = 8.2, 7.0, 1.6 Hz, 1H), 7.65 (d, *J* = 9.4 Hz, 1H), 7.58 (d, *J* = 8.2 Hz, 1H), 7.36 (ddd, *J* = 8.2, 7.0, 0.8 Hz, 1H) ppm.

2-Bromo-7-nitroacridone (10)



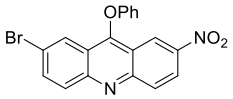
A modified procedure was used.[2] 2-Nitroacridone (407 mg, 1.69 mmol) was suspended in nitrobenzene (15 mL). Bromine (542 mg, 3.39 mmol, 2 eq.) in nitrobenzene (1 mL) was added. The reaction mixture was stirred at 120 °C for 18 h in a closed vessel. The reaction mixture was allowed to cool down to rt, ether was added, the precipitate was collected by filtration, washed with ether, MeOH and ether, and then dried *in vacuo* to give a yellow solid (500 mg, 93%). ^{1}H NMR (400 MHz, DMSO-d_6): δ = 12.47 (s, 1H), 8.92 (d, *J* = 2.7 Hz, 1H), 8.46 (dd, *J* = 9.2, 2.7 Hz, 1H), 8.27 (d, *J* = 2.3 Hz, 1H), 7.93 (dd, *J* = 8.6, 2.3 Hz, 1H), 7.65 (d, *J* = 9.2 Hz, 1H), 7.54 (d, *J* = 8.6 Hz, 1H) ppm.

2-Bromo-9-chloro-7-nitroacridine (11)



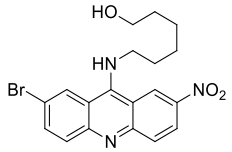
A modified procedure was used.[3] 7-Bromo-2-nitroacridone (100 mg, 313 µmol) was suspended in $POCl_3$ (2 mL) and heated at 105 °C in a closed vessel overnight. The reaction mixture was allowed to cool down to rt, diluted with DCM, transferred to a round bottom flask and concentrated *in vacuo*. The residue was dissolved in DCM (10 mL) and poured into a vigorously stirred mixture of crushed ice and aqueous ammonia solution (25%, 10 mL). The organic layer was separated, and the aqueous layer was washed with DCM (3 × 25 mL). The organic solutions were pooled, washed with brine (until pH became neutral), dried (Na_2SO_4), and the solvent was removed *in vacuo* to give a yellow powder (100 mg, 95%). TLC (SiO_2): R_f = 0.4 (DCM/MeOH 20:0.05). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 9.41 (d, *J* = 2.7 Hz, 1H), 8.64 (d, *J* = 2.0 Hz, 1H), 8.53 (dd, *J* = 9.4, 2.7 Hz, 1H), 8.33 (d, *J* = 9.4 Hz, 1H), 8.13 (d, *J* = 9.0 Hz, 1H), 7.96 (dd, *J* = 9.0, 2.0 Hz, 1H) ppm.

2-Bromo-7-nitro-9-phenoxyacridine (12)



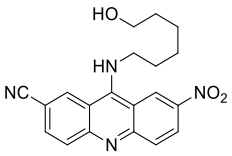
The synthesis is based on the general method for the preparation of 9-phenoxyacridines.[4] A mixture of 2-bromo-9-chloro-7-nitroacridine (76 mg, 225 µmol) and phenol (1 g) was stirred at 100 °C for 1.5 h under Ar. The reaction mixture was allowed to cool down to rt, diluted with DCM and washed with 0.1 M NaOH to remove phenol. The organic phase was further washed with brine (until pH became neutral), dried (Na_2SO_4), and the solvent was removed *in vacuo* to give a yellow solid (85 mg, 95%). TLC (SiO_2): R_f = 0.35 (DCM/MeOH 20:0.05). HRMS: *m/z* 395.0022 ([M + H]$^+$) calculated for $C_{19}H_{12}BrN_2O_3^+$: 395.0026 (Δ 1.0 ppm). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 9.05 (d, *J* = 2.0 Hz, 1H), 8.50 (dd, *J* = 9.4, 2.3 Hz, 1H), 8.34 (dd, *J* = 9.4, 0.8 Hz, 1H), 8.27 (d, *J* = 1.6 Hz, 1H), 8.15 (d, *J* = 9.4 Hz, 1H), 7.92 (dd, *J* = 9.4, 2.3 Hz, 1H), 7.32–7.38 (m, 2H), 7.12–7.19 (m, 1H), 6.86–6.91 (m, 2H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$): δ = 159.2, 157.3, 151.0, 150.9, 145.2, 136.3, 131.9, 131.7, 130.4, 124.9, 123.8, 123.7, 121.6, 121.6, 120.8, 118.9, 115.7 ppm.

Compound 13[5]



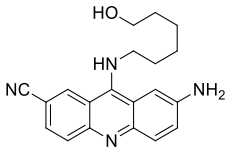
The synthesis is based on the general method for the preparation of 9-aminoacridines.[4] A mixture of 2-bromo-7-nitro-9-phenoxyacridine (85 mg, 215 µmol) and 6-amino-1-hexanol (50 mg, 430 µmol) in dry DMF (5 mL) was stirred at rt for 1 h under Ar. The reaction mixture was diluted with DCM (50 mL) and washed with 0.1 M NaOH to remove phenol. The organic phase was further washed with brine (until pH became neutral), dried (Na_2SO_4), and the solvent was removed *in vacuo* to give a red-orange powder (85 mg, 95%). TLC (SiO_2): R_f = 0.19 (DCM/MeOH 20:1), R_f = 0.39 (DCM/MeOH 20:2). HPLC (gradient 20–100, Knauer Eurospher II 100-10 C18A): t_R = 8.7 min; λ_{max} = 442, 423, 362, 314, 271, 251 nm. ESI-MS: *m/z* 418.2 [M + H]$^+$. HRMS: *m/z* 418.075 ([M + H]$^+$) calculated for $C_{19}H_{21}BrN_3O_3^+$: 418.0761 (Δ 2.6 ppm). ^{1}H NMR (400 MHz, MeOD-d_3 with TFA-d): δ = 9.22–9.72 (m, 1H), 8.60–8.84 (m, 1H), 8.71 (dd, *J* = 9.4, 2.3 Hz, 1H), 8.15 (dd, *J* = 9.0, 2.0 Hz, 1H), 7.91 (d, *J* = 9.4 Hz, 1H), 7.77 (d, *J* = 9.0 Hz, 1H), 4.14–4.20 (m, 2H), 3.56–3.61 (m, 2H), 1.99–2.18 (m, 2H), 1.57–1.67 (m, 4H), 1.47–1.57 (m, 2H) ppm.

Compound 14[5]



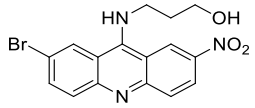
Compound **13** (127 mg, 304 µmol), $Zn(CN)_2$ (71 mg, 608 µmol) and $Pd(PPh_3)_4$ (35 mg, 30 µmol) were placed into a hot and dry Schlenk tube filled with Ar, which was evacuated and backfilled with Ar (3 times). DMF (2.5 mL) was added, and the reaction mixture placed into a hot bath (100 °C). After 30 min of stirring at 100°C, the reaction mixture was allowed to cool down to rt, diluted with DCM, washed with brine, dried (Na_2SO_4) and concentrated *in vacuo*. The residue was purified by FC (SiO_2, RediSep Rf 24 g cartridge, dry-load, DCM/MeOH with 0.5–5% MeOH gradient) to give a red solid (96 mg, 87%). TLC (SiO_2): R_f = 0.42 (DCM/MeOH 10:1). HPLC (gradient 20–100, Knauer Eurospher II 100-10 C18A): t_R = 7.0 min; λ_{max} = 430, 413, 361, 307, 266 nm. ESI-MS: *m/z* 365.2 [M + H]$^+$. HRMS: *m/z* 365.1606 ([M + H]$^+$) calculated for $C_{20}H_{21}N_4O_3^+$: 365.1608 (Δ 0.5 ppm). ^{1}H NMR (400 MHz, MeOD-d_3 with TFA-d): δ = 9.26–9.72 (m, 1H), 8.81–9.08 (m, 1H), 8.75 (dd, *J* = 9.4, 2.0 Hz, 1H), 8.23 (dd, *J* = 9.0, 1.6 Hz, 1H), 7.85–7.98 (m, 2H), 4.16–4.26 (m, 2H), 3.54–3.63 (m, 2H), 1.98–2.22 (m, 2H), 1.57–1.72 (m, 4H), 1.48–1.56 (m, 2H) ppm. Compound **13** is slowly hydrolyzed into acridone (within hours) in MeOD-d_3 with TFA-d (by HPLC).

Nitrile 3[5]



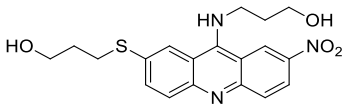
The synthesis is based on the published procedure for the selective reduction of aromatic nitro compounds with stannous chloride.[6] Compound **14** (64 mg, 176 µmol) and $SnCl_2 \times 2H_2O$ (199 mg, 880 µmol) were placed into a Schlenk flask, which was evacuated and backfilled with Ar. Absolute EtOH (0.5 mL) was added, and the reaction mixture was placed into an oil bath heated up to 70 °C. After 15 min of stirring at 70 °C, the reaction mixture was allowed to cool down to rt, diluted with 18 mL of 0.1% aq. TFA and purified by FC (C18 silica gel, 30C18AQ-F0025 cartridge, H_2O/ACN (with 0.1% TFA) with 0–50% ACN gradient). The appropriate fractions were pooled, concentrated *in vacuo*, and the excess of TFA was removed by filtration through a C18 column using a step-wise H_2O/ACN elution. The resulting orange filtrate was diluted with H_2O and lyophilized to give red-orange powder (48 mg, 48%, TFA salt). HPLC: t_R = 11.3 min (gradient 5–50). HPLC (Knauer Eurospher II 100-10 C18A): t_R = 4.8 min (gradient 20–100); t_R = 10.7 min (gradient 5–50); λ_{max} = 433, 412, 308, 285, 269 nm. HPLC (Interchim Uptisphere Strategy C18-HQ, 10 µm, 250×4.6 mm): t_R = 7.7 min (gradient 20–100). ESI-MS: *m/z* 335.4 $[M + H]^+$. HRMS: *m/z* 335.1867 ($[M + H]^+$) calculated for $C_{20}H_{23}N_4O^+$: 335.1866 (Δ 0.3 ppm). ^{1}H NMR (400 MHz, D_2O): δ = 8.29 (s, 1H), 7.82 (br d, *J* = 8.6 Hz, 1H), 7.47 (d, *J* = 9.0 Hz, 1H), 7.32–7.42 (m, 2H), 7.10 (s, 1H), 3.81 (br dd, *J* = 7.4, 7.0 Hz, 2H), 3.56 (dd, *J* = 6.7, 6.3 Hz, 2H), 1.69–1.89 (m, 2H), 1.46–1.60 (m, 2H), 1.28–1.45 (m, 4H) ppm. The following signals were visible in ^{13}C NMR (100 MHz, D_2O/ACN-d_3, HSQC): δ = 134.3 (CH), 124.8, 120.1 (CH), 119.7 (CH), 118.7, 61.6 (CH_2), 48.9 (CH_2), 31.3 (CH_2), 29.0 (CH_2), 25.8 (CH_2), 24.8 (CH_2) ppm. ^{19}F NMR (376 MHz, D_2O): δ = −75.5 (CF_3COOH) ppm.

Compound 15[5]



The synthesis is based on the general procedure for the preparation of 9-aminoacridines.[4] A mixture of 2-bromo-7-nitro-9-phenoxyacridine (500 mg, 1.27 mmol) and 3-amino-1-propanol (191 mg, 2.54 mmol) in dry DMF (15 mL) was stirred at rt for 1 h under Ar. The reaction mixture was diluted with DCM-MeOH (10:1, 500 mL) and washed with 0.1 M NaOH to remove phenol. MeOH was added to the organic phase whenever precipitates were formed. The organic phase was further washed with brine (until pH became neutral), dried (Na_2SO_4), and the solvent was removed *in vacuo* to give a red powder (440 mg, 92%). This procedure was repeated four times on various scales and reliably gave yields above 85%. TLC (SiO_2): R_f = 0.18 (DCM/MeOH 20:1); R_f = 0.46 (DCM/MeOH 10:1); R_f = 0.55 (DCM/MeOH/H_2O 90:10:1). HPLC (gradient 20–100): t_R = 7.2 min; λ_{max} = 442, 423, 363, 313, 271, 251 nm. ESI-MS: *m/z* 376.0 $[M + H]^+$. HRMS: *m/z* 376.0291 ($[M + H]^+$) calculated for $C_{16}H_{15}BrN_3O_3^+$: 376.0291 (Δ 0.0 ppm). ^{1}H NMR (400 MHz, MeOD-d_3 with TFA-d): δ = 9.45 (d, *J* = 2.0 Hz, 1H), 8.64–8.75 (m, 2H), 8.13 (dd, *J* = 9.0, 2.0 Hz, 1H), 7.92 (d, *J* = 9.0 Hz, 1H), 7.78 (d, *J* = 9.0 Hz, 1H), 4.39 (t, *J* = 6.6 Hz, 2H), 3.91 (t, *J* = 5.9, 5.5 Hz, 2H), 2.23 (quin., *J* = 6.6, 5.9, 5.5 Hz, 2H) ppm. The following signals were visible in ^{13}C NMR (100 MHz, MeOD-d_3 with TFA-d): δ = 159.7, 140.3, 130.1, 122.0, 121.2, 61.3, 49.9, 32.1 ppm.

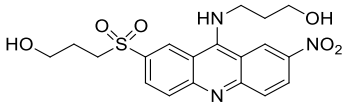
Compound 16[5]



The synthesis is based on the general procedure for the palladium-catalyzed coupling of aryl bromides and thiols.[7] Compound **15** (50 mg, 133 µmol), $Pd_2(dba)_3$ (7.4 mg, 8.0 µmol) and Xantphos (8.9 mg, 15 µmol) were placed into a hot and dry Schlenk tube filled with Ar, which was evacuated and backfilled with Ar (3×). DMF (1.3 mL), DIPEA (46 µL, 266 µmol) and 3-mercapto-1-propanol (15 mg, 160 µmol) were added, and the reaction mixture was placed into a hot bath (100 °C). After stirring for 1 h at 100 °C, the reaction mixture was allowed to cool down to rt, diluted with DCM-MeOH

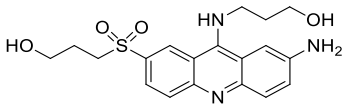
(10:1), washed with 10% aq. Na_2SO_3 – aq. sat. $NaHCO_3$ (1:1) and brine, dried (Na_2SO_4) and concentrated *in vacuo*. The residue was purified by FC (SiO_2, RediSep Rf 24 g cartridge, dry-load, DCM/MeOH with 0–15% MeOH gradient) to give a dark-red solid (46 mg, 89%). This procedure was repeated four times on various scales and gave 60–90% yields. TLC (SiO_2): R_f = 0.24 (DCM/MeOH 10:1); R_f = 0.3 (DCM/MeOH/H_2O 90:10:1). HPLC: t_R = 7.0 min (gradient 20–100); t_R = 12.1 min (gradient 5–50); λ_{max} = 442, 345, 273 nm. ESI-MS: *m/z* 388.0 $[M + H]^+$. HRMS: *m/z* 388.1327 ($[M + H]^+$) calculated for $C_{19}H_{22}N_3O_4S^+$: 388.1326 (Δ 0.3 ppm). ^{1}H NMR (400 MHz, $CDCl_3$/MeOD-d_3 7:3): δ = 9.29 (d, *J* = 2.3 Hz, 1H), 8.26 (dd, *J* = 9.4, 2.3 Hz, 1H), 7.99 (d, *J* = 2.0 Hz, 1H), 7.80 (d, *J* = 9.4 Hz, 1H), 7.76 (d, *J* = 9.0 Hz, 1H), 7.61 (dd, *J* = 9.0, 2.0 Hz, 1H), 4.19 (t, *J* = 6.3, 5.9 Hz, 2H), 3.93 (t, *J* = 5.5, 5.1 Hz, 2H), 3.69 (t, *J* = 5.9 Hz, 2H), 3.10 (t, *J* = 7.4, 7.0 Hz, 2H), 2.04–2.11 (m, 2H), 1.82–1.97 (m, 2H) ppm.

Compound 17[5]



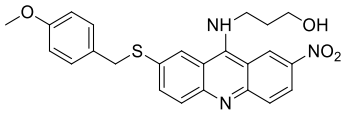
The synthesis is based on the general procedure for the selective oxidation of organic sulfides with Oxone™.[8] Compound **16** (110 mg, 284 µmol) was suspended in H_2O (6 mL). Oxone™ (166 mg, 270 µmol) was added in small portions. The red suspension became yellow. After 30 min of stirring at rt, the reaction mixture was diluted with 10% aq. Na_2SO_3 – aq. sat. $NaHCO_3$ (1:1), and the product was extracted into EtOAc (containing small amounts of MeOH). The organic phase was washed with brine, dried (Na_2SO_4) and concentrated *in vacuo*. The residue was purified by FC (SiO_2, RediSep Rf 24 g cartridge, DCM/MeOH/H_2O 90:10:1) to give a light-orange solid (60 mg, 50%). This procedure was repeated three times on various scales and gave 50–74% yields. TLC (SiO_2): R_f = 0.3 (DCM/MeOH/H_2O 90:10:1); R_f = 0.1 (DCM/MeOH 20:1). HPLC: t_R = 10.3 min (gradient 5–50); λ_{max} = 426, 408, 357, 303, 266 nm. ESI-MS: *m/z* 420.2 $[M + H]^+$. HRMS: *m/z* 420.1227 ($[M + H]^+$) calculated for $C_{19}H_{22}N_3O_6S^+$: 420.1224 (Δ 0.7 ppm). ^{1}H NMR (400 MHz, MeOD-d_3 with TFA-d): δ = 9.39–9.57 (m, 1H), 9.04 (d, *J* = 1.6 Hz, 1H), 8.76 (dd, *J* = 9.4, 1.6 Hz, 1H), 8.43 (dd, *J* = 9.0, 1.6 Hz, 1H), 7.99 (d, *J* = 9.0 Hz, 1H), 7.95 (d, *J* = 9.4 Hz, 1H), 4.33–4.53 (m, 2H), 3.86–3.99 (m, 2H), 3.63 (t, *J* = 6.3 Hz, 2H), 3.39–3.47 (m, 2H), 2.26 (quin., *J* = 6.7, 6.3, 5.9, 5.5 Hz, 2H), 1.88–1.98 (m, 2H) ppm. Compound **17** is slowly hydrolyzed into acridone (within hours) in MeOD-d_3 with TFA-d (by HPLC).

Sulfone 4[5]



Aminoacridine **4** (3.4 mg, 22%, acetate salt) was obtained as a red solid according to GP2, from the mixture of nitroacridine **17** (15 mg, 36 µmol), MeOH (10 mL), AcOH (10 µL) and 10% Pd/C (7 mg) under hydrogen atmosphere. The product appeared to be unstable in the presence of TFA (HPLC control). The crude product was re-purified by FC (C18 silica gel, 30C18AQ-F0025 cartridge, ACN/10 mM triethylammonium acetate pH 7.0). HPLC: t_R = 9.0 min (gradient 5–50); λ_{max} = 428, 408, 301, 273, 227 nm. HRMS: *m/z* 390.1488 ($[M + H]^+$) calculated for $C_{19}H_{24}N_3O_4S^+$: 390.1482 (Δ 1.5 ppm). ^{1}H NMR (400 MHz, D_2O/MeCN-d_3 6:1): δ = 8.69 (d, *J* = 2.0 Hz, 1H), 8.07 (dd, *J* = 9.0, 1.6 Hz, 1H), 7.78 (d, *J* = 9.0 Hz, 1H), 7.56 (d, *J* = 9.0 Hz, 1H), 7.45 (dd, *J* = 9.0, 2.0 Hz, 1H), 7.24 (d, *J* = 1.6 Hz, 1H), 4.09 (t, *J* = 7.0 Hz, 2H), 3.91 (t, *J* = 5.9 Hz, 2H), 3.73 (t, *J* = 6.3 Hz, 2H), 3.51–3.63 (m, 2H), 2.17 (quin, *J* = 6.3 Hz, 2H), 2.00–2.07 (m, 2H), 1.99 (s, AcOH) ppm. The following ^{13}C signals were visible in ^{1}H-^{13}C HSQC NMR (400/100 MHz, D_2O/ACN-d_3 6:1): δ = 129.7 (CH), 129.4 (CH), 128.8 (CH), 124.1 (CH), 123.6 (CH), 104.7 (CH), 60.6 (CH_2), 60.3 (CH_2), 53.5 (CH_2), 48.2 (CH_2), 32.3 (CH_2), 26.1 (CH_2), 24.3 (CH_3, acetate) ppm.

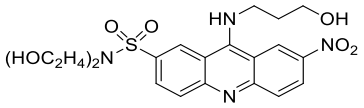
Compound 18[5]



The synthesis is based on palladium-catalyzed coupling of aryl bromides and thiols.[7] Compound **15** (290 mg, 0.77 mmol), $Pd_2(dba)_3$ (37 mg, 0.04 mmol) and Xantphos (46 mg, 0.08 mmol) were placed in a heat dried Schlenk tube filled with Ar,

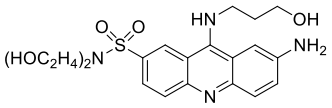
which was evacuated and backfilled with Ar (3×). DMF (7.7 mL), DIPEA (268 µL, 1.54 mmol) and 4-methoxybenzyl mercaptan (142 µg, 0.92 mmol) were added, and the reaction mixture was placed into an oil bath preheated to 100 °C. After stirring for 2 h at 100 °C, the reaction mixture was allowed to cool down to rt, diluted with DCM-MeOH (10:1), washed with 10% aq. Na_2SO_3 – aq. sat. $NaHCO_3$ (1:1) and brine, dried (Na_2SO_4) and concentrated *in vacuo*. The residue was purified by FC (SiO_2, RediSep Rf 24 g cartridge, dry-load, DCM – DCM/MeOH/H_2O 90:10:1) to give a red solid (325 mg, 94%). TLC (SiO_2): R_f = 0.35 (DCM/MeOH/H_2O 90:10:1). HPLC: t_R = 9.6 min (gradient 20–100); λ_{max} = 441, 348, 274 nm. ESI-MS: *m/z* 450.3 $[M + H]^+$. HRMS: *m/z* 450.1491 ($[M + H]^+$) calculated for $C_{24}H_{24}N_3O_4S^+$: 450.1482 (Δ 2.0 ppm). ^{1}H NMR (400 MHz, MeOD-d_3 with TFA-d): δ = 9.43 (d, *J* = 2.0 Hz, 1H), 8.67 (dd, *J* = 9.4, 2.3 Hz, 1H), 8.24 (br s, 1H), 7.92–8.05 (m, 1H), 7.88 (d, *J* = 9.4 Hz, 1H), 7.75 (d, *J* = 9.0 Hz, 1H), 7.26 (d, *J* = 8.6 Hz, 2H), 6.76–6.88 (m, 2H), 4.28 (s, 2H), 4.00–4.63 (m, 2H), 3.82–3.99 (m, 2H), 3.74 (s, 3H), 1.93–2.31 (m, 2H) ppm.

Compound 20[5]



Compound **20** was synthesized from sulfide **18** *via* a sulfonyl chloride intermediate **19** generated as described in.[9] Compound **18** (61 mg, 136 µmol) was suspended in 3 mL of MeCN/AcOH/H_2O (20:0.75:0.5) at 0 °C. 1,3-Dichloro-5,5-dimethylhydantoin (DCDMH, 75 mg, 381 µmol) was added portionwise. The suspension turned yellow. The reaction mixture was stirred at 0 °C for 30 min, then 30 min at rt. The formation of the sulfonyl chloride intermediate **19** was detected by HPLC (t_R = 7.7 min, λ_{max} = 423, 406, 360, 302, 265 nm, gradient 20–100), the educt was fully converted. The solvent was removed *in vacuo* (35 °C, <20 mbar). Diethanolamine (75 mg) in ACN (15 mL) was added. The color changed immediately to orange-brown. After 1 h of stirring at rt, the reaction mixture was diluted with EtOAc-MeOH (10:1), washed with sat. $NaHCO_3$ and brine, dried (Na_2SO_4) and concentrated *in vacuo*. The residue was purified by FC (SiO_2, RediSep Rf 24 g cartridge, dry-load, DCM – DCM/MeOH/H_2O 90:10:1) to give a light orange solid (52 mg, 82%). This procedure was repeated three times on various scales affording 67–82% yields. TLC (SiO_2): R_f = 0.2 (DCM/MeOH/H_2O 90:10:1). HPLC: t_R = 10.5 min (gradient 5–50); λ_{max} = 428, 410, 360, 307, 267 nm. HRMS: *m/z* 465.1441 ($[M + H]^+$) calculated for $C_{20}H_{25}N_4O_7S^+$: 465.1438 (Δ 0.6 ppm). ^{1}H NMR (400 MHz, MeOD-d_3 with TFA-d): δ = 9.33–9.63 (m, 1H), 8.95 (s, 1H), 8.73 (br dd, *J* = 9.0, 0.8 Hz, 1H), 8.35 (br d, *J* = 9.0 Hz, 1H), 7.95 (d, *J* = 9.0 Hz, 2H), 4.31–4.55 (m, 2H), 3.83–4.04 (m, 2H), 3.74 (t, *J* = 5.9, 5.5 Hz, 4H), 3.42 (t, *J* = 5.5 Hz, 4H), 2.25 (quin, *J* = 6.7, 6.3, 5.9, 5.5 Hz, 2H) ppm. The following signals were visible in ^{13}C NMR (100 MHz, MeOD-d_3 with TFA-d): δ = 119.8, 119.7, 60.1, 50.9 ppm. Compound **20** is slowly hydrolyzed into acridone (within hours) in MeOD-d_3 with TFA-d.

Sulfonamide 5[5]

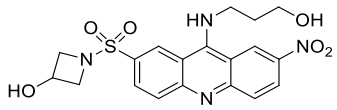


Aminoacridine **5** (4.94 mg, 84%, TFA salt) was obtained as a red powder according to GP2, from the mixture of nitroacridine **20** (5 mg, 11 µmol), MeOH (10 mL), AcOH (10 µL) and 10% Pd/C (1 mg) under hydrogen atmosphere. HPLC: t_R = 9.0 min (gradient 5–50); λ_{max} = 430, 410, 272 nm. HRMS: *m/z* 435.1693 ($[M + H]^+$) calculated for $C_{20}H_{27}N_4O_5S^+$: 435.1697 (Δ 0.9 ppm). ^{1}H NMR (400 MHz, D_2O): δ = 8.35 (d, *J* = 2.0 Hz, 1H), 7.95 (dd, *J* = 9.0, 2.0 Hz, 1H), 7.48 (d, *J* = 9.0 Hz, 1H), 7.25–7.38 (m, 2H), 7.07 (br s, 1H), 3.97 (t, *J* = 7.0, 6.7 Hz, 2H), 3.81 (t, *J* = 5.9, 5.5 Hz, 2H), 3.70 (t, *J* = 5.9, 5.5 Hz, 4H), 3.37 (t, *J* = 5.9, 5.5 Hz, 4H), 2.04 (quin, *J* = 6.7, 6.3, 5.9 Hz, 2H) ppm. The following signals were visible in ^{13}C NMR (100 MHz, D_2O, HSQC): δ = 155.2, 144.8, 139.6, 132.3, 131.7, 130.1 (CH), 127.7 (CH), 126.5 (CH), 119.9 (CH), 119.9 (CH), 114.3, 59.8 (CH_2), 59.3 (2×CH_2), 50.4 (2×CH_2), 47.5 (CH_2), 30.9 (CH_2) ppm. ^{19}F NMR (376 MHz, D_2O): δ = −75.5 (CF_3COOH) ppm.

Reaction of sulfide 18 with 3-hydroxyazetidine *via* a sulfonyl chloride intermediate. Compound **18** (22 mg, 50 µmol) was suspended in 1 mL of MeCN/AcOH/H_2O (20:0.75:0.5) at 0 °C. DCDMH (25 mg, 125 µmol) was added portionwise. The suspension turned yellow. The reaction mixture was stirred at 0 °C for 30 min, then 30 min at rt. The formation of the sulfonyl chloride intermediate **19** was observed by HPLC (t_R = 7.5 min, λ_{max} = 423, 406, 360, 302, 265 nm, gradient 20–

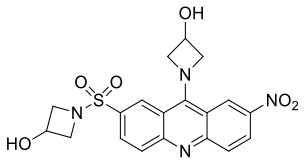
100), the starting material was fully consumed. The solvent was removed *in vacuo* (35 °C, <20 mbar). MeCN (10 mL), 3-hydroxyazetidine hydrochloride (50 mg, 456 µmol) and DIPEA (15 mL) were added. The color changed immediately to orange-brown. After stirring for 1 h at rt, the reaction mixture was stored at −20 °C overnight, diluted with EtOAc-MeOH (10:1), washed with sat. $NaHCO_3$ and brine, dried (Na_2SO_4) and concentrated *in vacuo*. The residue was purified by FC (SiO_2, SNAP Ultra 10 g cartridge, dry-load, DCM – DCM/MeOH/H_2O 90:10:1) to give the desired product **21** (3 mg, 14%) as a brown solid and side-product **22** (6 mg, 28%) as a light orange solid.

Compound 21[5]



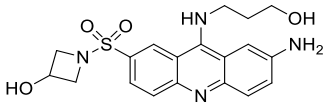
HPLC: t_R = 11.0 min (gradient 5–50); λ_{max} = 428, 410, 359, 305, 267 nm. ESI-MS: *m/z* 433.2 $[M + H]^+$. HRMS: *m/z* 433.1177 ($[M + H]^+$) calculated for $C_{19}H_{21}N_4O_6S^+$: 433.1176 (*Δ* 0.2 ppm). ^{1}H NMR (400 MHz, MeOD-d_3 with TFA-d): δ = 9.48 (br s, 1H), 8.94 (d, *J* = 1.6 Hz, 1H), 8.76 (dd, *J* = 9.4, 2.0 Hz, 1H), 8.35 (dd, *J* = 9.0, 1.6 Hz, 1H), 8.02 (d, *J* = 9.0 Hz, 1H), 7.96 (d, *J* = 9.4 Hz, 1H), 4.43 (quin, *J* = 6.3, 5.9, 5.5 Hz, 1H), 4.31 – 4.55 (m, 2H), 4.02–4.15 (m, 2H), 3.82–4.01 (m, 2H), 3.59 (dd, *J* = 8.6, 5.5 Hz, 2H), 2.26 (quin, *J* = 6.3, 5.9, 5.5 Hz, 2H) ppm. The following ^{13}C signals were visible in ^{1}H-^{13}C HSQC NMR (400/100 MHz, MeOD-d_3 with TFA-d): δ = 134.6 (CH), 129.9 (CH), 120.8 (CH), 120.6 (CH), 61.3 (2×CH_2), 60.7 (CH_2), 60.3 (CH), 49.7 (CH_2), 31.2 (CH_2) ppm.

Compound 22[5]



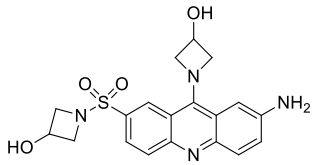
HPLC: t_R = 10.5 min (gradient 5–50); λ_{max} = 425, 410, 361, 305, 269 nm. ESI-MS: *m/z* 431.3 $[M + H]^+$. HRMS: *m/z* 431.1022 ($[M + H]^+$) calculated for $C_{19}H_{19}N_4O_6S^+$: 431.1020 (*Δ* 0.5 ppm). ^{1}H NMR (400 MHz, MeOD-d_3/$CDCl_3$ 1:1 with TFA-d): δ = 9.00 (d, *J* = 2.3 Hz, 1H), 8.68 (dd, *J* = 9.4, 2.3 Hz, 1H), 8.51 (d, *J* = 2.0 Hz, 1H), 8.25 (dd, *J* = 9.0, 2.0 Hz, 1H), 7.95 (d, *J* = 9.0 Hz, 1H), 7.91 (d, *J* = 9.4 Hz, 1H), 5.27–5.38 (m, 2H), 5.15–5.26 (m, 2H), 4.88 (dd, *J* = 6.6, 4.4 Hz, 1H), 4.45 (dd, *J* = 6.6, 5.5 Hz, 1H), 4.02–4.12 (m, 2H), 3.54–3.63 (m, 2H) ppm.

Sulfonamide 6[5]



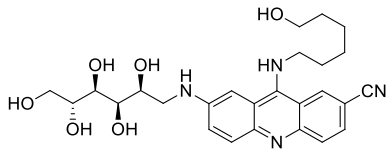
Aminoacridine **6** (2.3 mg, 63%, TFA salt) was obtained as a red powder according to GP2, from the mixture of nitroacridine **21** (3 mg, 7 µmol), MeOH (10 mL), AcOH (10 µL) and 10% Pd/C (1 mg) under hydrogen atmosphere. HPLC: t_R = 9.7 min (gradient 5–50); λ_{max} = 431, 410, 303, 273 nm. HRMS: *m/z* 403.1439 ($[M + H]^+$) calculated for $C_{19}H_{23}N_4O_4S^+$: 403.1435 (*Δ* 1.0 ppm). ^{1}H NMR (400 MHz, D_2O): δ = 8.45 (d, *J* = 1.6 Hz, 1H), 8.00 (dd, *J* = 9.0, 1.6 Hz, 1H), 7.64 (d, *J* = 9.4 Hz, 1H), 7.37–7.48 (m, 2H), 7.25 (br s, 1H), 4.45 (quin, *J* = 6.7, 6.3, 5.5, 5.1 Hz, 1H), 4.01–4.13 (m, 4H), 3.82 (t, *J* = 5.9, 5.5 Hz, 2H), 3.60 (d, *J* = 5.1 Hz, 1H), 3.57 (d, *J* = 5.1 Hz, 1H), 2.07 (quin, *J* = 6.7, 6.3, 5.9 Hz, 2H) ppm. The following signals were visible in ^{13}C NMR (100 MHz, D_2O, HSQC): δ = 130.9 (CH), 128.0 (CH), 120.1 (CH), 120.0 (CH), 110.0, 60.1 (2×CH_2), 59.8 (CH_2), 59.5 (CH), 47.5 (CH_2), 30.8 (CH_2) ppm. ^{19}F NMR (376 MHz, D_2O): δ = −75.5 (CF_3COOH) ppm.

Sulfonamide 7



Aminoacridine **7** (6 mg, 86%, TFA salt) was obtained as a red powder according to GP2, from the mixture of nitroacridine **22** (6 mg, 14 µmol), MeOH (10 mL), AcOH (10 µL) and 10% Pd/C (1 mg) under hydrogen atmosphere. HPLC: t_R = 8.6 min (gradient 5–50); λ_{max} = 430, 410, 277 nm. HRMS: *m/z* 401.1281 ([M + H]$^+$) calculated for $C_{19}H_{21}N_4O_4S^+$: 401.1278 (Δ 0.7 ppm). ^{1}H NMR (400 MHz, MeOD-d$_3$): δ = 8.47 (d, *J* = 1.6 Hz, 1H), 8.08 (dd, *J* = 9.0, 1.6 Hz, 1H), 7.85 (d, *J* = 9.0 Hz, 1H), 7.64 (d, *J* = 9.0 Hz, 1H), 7.47 (dd, *J* = 9.0, 2.0 Hz, 1H), 7.32 (d, *J* = 2.0 Hz, 1H), 5.17–5.43 (m, 2H), 4.98–5.16 (m, 2H), 4.83–4.91 (m, 1H), 4.45 (dq, *J* = 6.3, 5.9 Hz, 1H), 4.06 (t, *J* = 7.8 Hz, 2H), 3.57 (dd, *J* = 8.6, 5.5 Hz, 2H) ppm. ^{13}C NMR (100 MHz, MeOD-d$_3$, HSQC): δ = 158.4, 146.0, 142.4, 134.5, 132.4 (CH), 129.7 (CH), 127.9 (CH), 127.8, 120.5 (2×CH), 115.5, 111.3, 107.3 (CH), 72.6 (2×CH$_2$), 63.4 (CH), 61.6 (2×CH$_2$), 60.8 (CH) ppm. ^{19}F NMR (376 MHz, MeOD-d$_3$): δ = −76.71 (CF$_3$COOH) ppm.

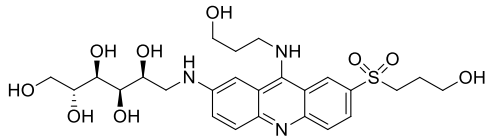
Conjugate 3-G[5]



Compound **3** (20 mg, 36 µmol), glucose (32 mg, 178 µmol) and AcOH (4 mg, 71 µmol) were mixed in 1 mL of water. NaBH$_3$CN (22 mg, 356 µmol) in 0.5 mL of MeOH was added. The reaction mixture was heated to 60 °C. The progress of the reaction was monitored by HPLC. After stirring for 5 h at 60 °C, the reaction mixture was cooled to rt, diluted with 10 mL of 0.1% aq. TFA and purified by FC (C18 silica gel, 30C18AQ-F0025 cartridge, ACN – 0.1% aq. TFA). The appropriate fractions were pooled and lyophilized to give a red-purple solid (10 mg, TFA salt). HPLC (Knauer Eurospher II 100-10 C18A): t_R = 10.9 min (gradient 5–50). HPLC (Interchim Uptisphere Strategy C18-HQ, 10 µm, 250×4.6 mm): t_R = 7.5 min (gradient 20–100); λ_{max} = 486, 324, 276, 262, 236 nm. ESI-MS: *m/z* 499.4 [M + H]$^+$. HRMS: *m/z* 499.2553 ([M + H]$^+$) calculated for $C_{26}H_{34}N_4O_6^+$: 499.2551 (Δ 0.4 ppm). ^{1}H NMR (400 MHz, D$_2$O): δ = 8.12 (s, 1H), 7.76 (dd, *J* = 9.0, 1.6 Hz, 1H), 7.39 (d, *J* = 9.0 Hz, 1H), 7.30 (dd, *J* = 9.0, 2.0 Hz, 1H), 7.25 (d, *J* = 9.0 Hz, 1H), 6.62 (d, *J* = 2.0 Hz, 1H), 4.06 (ddtd, *J* = 5.1, 4.3, 3.9, 0.9 Hz, 1H), 3.91 (dd, *J* = 5.3, 2.2 Hz, 1H), 3.86 (dd, *J* = 15.7, 2.7 Hz, 1H), 3.80–3.89 (m, 1H), 3.66–3.78 (m, 4H), 3.57 (t, *J* = 6.7 Hz, 2H), 3.33 (dd, *J* = 13.3, 3.9 Hz, 1H), 3.18 (dd, *J* = 13.3, 8.2 Hz, 1H), 1.76 (quin, *J* = 7.0 Hz, 2H), 1.54 (quin, *J* = 6.7 Hz, 2H), 1.30–1.45 (m, 4H) ppm. The following signals were visible in ^{13}C NMR (100 MHz, D$_2$O, HSQC): δ = 153.9, 133.7 (CH), 132.3 (CH), 127.3 (CH), 119.7 (CH), 119.5 (CH), 118.4, 71.6 (CH), 71.04 (CH), 71.0 (CH), 70.7 (CH), 62.9 (CH$_2$), 61.6 (CH$_2$), 48.5 (CH$_2$), 45.7 (CH$_2$), 31.2 (CH$_2$), 29.3 (CH$_2$), 25.8 (CH$_2$), 24.8 (CH$_2$) ppm. ^{19}F NMR (376 MHz, D$_2$O): δ = −75.5 (CF$_3$COOH) ppm.

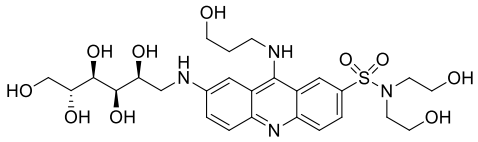
General procedure 5 (GP5) for labeling of glucose with model compounds (4–7). A 1.5 mL micro tube with screw cap was charged with dye (1 equiv., 0.1 M aq. solution), glucose (1 equiv., 0.1 M aq. solution), malonic acid (10 equiv., 1 M solution in DMSO) and 2-picoline-borane complex (10 equiv., 1 M solution in DMSO). After vortexing for 10 s, the reaction mixture was incubated with shaking (400–600 rpm) at 40 °C for 18 h. The reaction mixture was cooled to rt, diluted with 10 mL of 0.1% aq. TFA and purified by FC (C18 silica gel, 15C18HP-F0012 cartridge, ACN – 0.1% aq. TFA). The fractions with product were pooled and lyophilized.

Conjugate 4-G



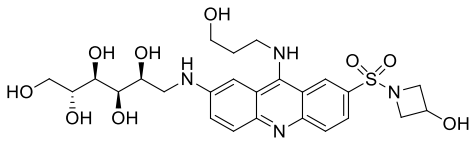
Glycoconjugate **4**-G (0.8 µmol, TFA salt) was obtained as an orange-red solid from the amino dye **4** (1.3 µmol) according to GP5. HPLC: t_R = 9.1 min (gradient 5–50); λ_{max} = 482, 319, 275 nm. ESI-MS: *m/z* 554.3 [M + H]$^+$. HRMS: *m/z* 554.2160 ([M + H]$^+$) calculated for $C_{25}H_{36}N_3O_9S^+$: 554.2167 (*Δ* 1.3 ppm). ^{1}H NMR (400 MHz, D_2O): δ = 8.63 (d, *J* = 1.0 Hz, 1H), 8.06 (d, *J* = 9.0 Hz, 1H), 7.69 (dd, *J* = 9.0, 0.4 Hz, 1H), 7.46 (d, *J* = 9.0 Hz, 1H), 7.38–7.44 (m, 1H), 6.91 (s, 1H), 4.03–4.20 (m, 3H), 3.91 (dd, *J* = 5.5, 2.2 Hz, 1H), 3.78–3.88 (m, 4H), 3.75 (dd, *J* = 8.2, 2.2 Hz, 1H), 3.64–3.71 (m, 1H), 3.62 (t, *J* = 6.3 Hz, 2H), 3.46–3.53 (m, 2H), 3.43 (dd, *J* = 13.3, 3.5 Hz, 1H), 3.26 (dd, *J* = 13.3, 8.2 Hz, 1H), 2.04–2.17 (m, 2H), 1.85–1.97 (m, 2H) ppm. ^{19}F NMR (376 MHz, D_2O): δ = −75.5 (CF_3COOH) ppm.

Conjugate 5-G



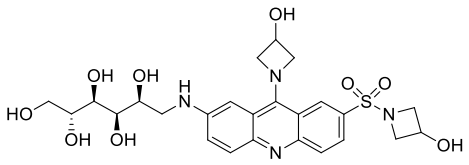
Glycoconjugate **5**-G (0.7 µmol, TFA salt) was obtained as an orange-red solid from the amino dye **5** (1.6 µmol) according to GP5. HPLC: t_R = 9.1 min (gradient 5–50); λ_{max} = 480, 319, 276 nm. ESI-MS: *m/z* 599.3 [M + H]$^+$. HRMS: *m/z* 599.2381 ([M + H]$^+$) calculated for $C_{26}H_{39}N_4O_{10}S^+$: 599.2381 (*Δ* 0.0 ppm). ^{1}H NMR (400 MHz, D_2O): δ = 8.53 (s, 1H), 8.01 (dd, *J* = 9.0, 1.0 Hz, 1H), 7.61 (d, *J* = 9.0 Hz, 1H), 7.36–7.47 (m, 2H), 6.88 (s, 1H), 4.01–4.17 (m, 3H), 3.93 (dd, *J* = 5.5, 2.0 Hz, 1H), 3.80–3.89 (m, 4H), 3.75–3.80 (m, 1H), 3.62–3.75 (m, 5H), 3.33–3.48 (m, 5H), 3.27 (dd, *J* = 13.1, 8.4 Hz, 1H), 2.04–2.17 (m, 2H) ppm. ^{19}F NMR (376 MHz, D_2O): δ = −75.52 (CF_3COOH) ppm.

Conjugate 6-G



Glycoconjugate **6**-G (0.6 µmol, TFA salt) was obtained as an orange-red solid from the amino dye **6** (1.5 µmol) according to GP5. HPLC: t_R = 9.6 min (gradient 5–50); λ_{max} = 482, 320, 276 nm. ESI-MS: *m/z* 567.3 [M + H]$^+$. HRMS: *m/z* 567.2120 ([M + H]$^+$) calculated for $C_{25}H_{35}N_4O_9S^+$: 567.2119 (*Δ* 0.2 ppm). ^{1}H NMR (400 MHz, D_2O): δ = 8.53 (s, 1H), 7.95–8.12 (m, 1H), 7.60–7.82 (m, 1H), 7.33–7.57 (m, 2H), 6.82–7.00 (m, 1H), 4.39–4.56 (m, 1H), 4.00–4.25 (m, 5H), 3.90–3.97 (m, 1H), 3.80–3.89 (m, 4H), 3.74–3.80 (m, 1H), 3.66–3.74 (m, 1H), 3.56–3.65 (m, 2H), 3.37–3.51 (m, 1H), 3.20–3.32 (m, 1H), 2.07–2.18 (m, 2H) ppm. ^{19}F NMR (376 MHz, D_2O): δ = −75.5 (CF_3COOH) ppm.

Conjugate 7-G



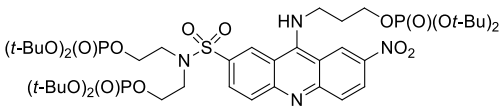
Glycoconjugate **7**-G (1.3 µmol, AcOH salt) was obtained as a red solid from the amino dye **7** (5.1 µmol) according to GP5. The material was further purified by FC (C18 silica gel, 15C18HP-F0012 cartridge, ACN – 0.1% aq. AcOH). The product appeared to be unstable in the presence of TFA (by HPLC). HPLC: t_R = 8.8 min (gradient 5–50); λ_{max} = 485, 431, 320, 277 nm. HRMS: *m/z* 565.1959 ([M + H]$^+$) calculated for $C_{25}H_{33}N_4O_9S^+$: 565.1963 (*Δ* 0.7 ppm). ^{1}H NMR (400 MHz, D_2O): δ = 8.12 (d, *J* = 1.2 Hz, 1H), 7.96 (dd, *J* = 9.0, 1.2 Hz, 1H), 7.54 (br d, *J* = 9.0 Hz, 1H), 7.37–7.48 (m, 2H), 6.87 (s, 1H), 5.04–5.25 (m, 2H), 4.87–5.01 (m, 2H), 4.78–4.82 (m, 1H), 4.47 (dt, *J* = 11.7, 5.9 Hz, 1H), 4.00–4.16 (m, 3H), 3.91 (dd, *J*

= 5.5, 2.3 Hz, 1H), 3.78–3.86 (m, 2H), 3.75 (dd, *J* = 8.0, 2.2 Hz, 1H), 3.64–3.71 (m, 1H), 3.61 (dd, *J* = 9.2, 5.3 Hz, 2H), 3.47 (dd, *J* = 13.5, 4.1 Hz, 1H), 3.29 (dd, *J* = 13.5, 8.0 Hz, 1H), 1.88 (s, 2H, AcOH) ppm.

SYNTHESIS OF PHOSPHORYLATED ACRIDINE 2 AND ACRIDONE 29

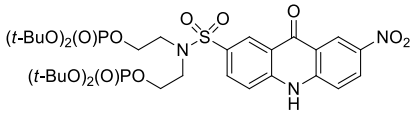
Reaction of 20 with di-*tert*-butyl *N,N*-diisopropylphosphoramidite followed by oxidation with H_2O_2. Compound **20** (57 mg, 0.12 mmol) and 1*H*-tetrazole (78 mg, 1.11 mmol) were placed in an argon-filled flask, which was evacuated and backfilled with Ar (3 times). DMF (1.25 mL) and $(t\text{-BuO})_2\text{PN}i\text{-Pr}_2$ (233 µL, 0.74 mmol) were added, and the reaction mixture was stirred for 1 h at rt. Formation of the phosphite intermediate was monitored by HPLC (t_R = 9.2 min, gradient 20–100). Then 50% aq. H_2O_2 (278 µL, 4.9 mmol) was added in one portion. After stirring for 30 min at rt, the reaction mixture was diluted with DCM (200 mL), washed with 10% aq. Na_2SO_3 – aq. sat. $NaHCO_3$ (100 mL, 1:1), brine, dried (Na_2SO_4) and concentrated *in vacuo*. The residue was purified by FC (SiO_2, 30SIHP-F0025 cartridge, DCM/MeOH with 1–5% MeOH gradient) to give compound **25** (58 mg, 47%) as an orange oil, and a by-product **26** (12 mg, 13%) as a yellow powder.

Compound 25[5]



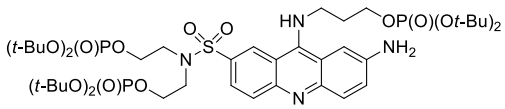
HPLC: t_R = 12.3 min (gradient 20–100); λ_{max} = 429, 412, 358, 307, 268 nm. HRMS: *m/z* 1041.4168 ([M + H]$^+$) calculated for $C_{44}H_{76}N_4O_{16}P_3S^+$: 1041.4184 (*Δ* 1.5 ppm). ^{1}H NMR (400 MHz, MeOD-d$_3$ with TFA-d): δ = 9.29–9.80 (m, 1H), 8.83–9.23 (m, 1H), 8.76 (dd, *J* = 9.4, 2.3 Hz, 1H), 8.40 (dd, *J* = 9.0, 2.0 Hz, 1H), 7.97 (d, *J* = 9.0 Hz, 1H), 7.96 (d, *J* = 9.4 Hz, 1H), 4.37 (t, *J* = 7.0, 6.7 Hz, 2H), 4.21 (q, *J* = 6.7, 5.9 Hz, 2H), 4.13 (q, *J* = 6.3, 5.9, 5.5 Hz, 4H), 3.66 (t, *J* = 5.5 Hz, 4H), 2.47 (quin, *J* = 6.3, 5.9 Hz, 2H), 1.46 (s, 36H), 1.45 (s, 18H) ppm. Compound **25** is slowly hydrolyzed into acridone (within hours) in MeOD-d$_3$ with TFA-d. ^{31}P NMR (162 MHz, MeOD-d$_3$ with TFA-d): δ = −10.2 (s, 1P), −10.9 (s, 2P) ppm.

Compound 26



HPLC: t_R = 12.6 min (gradient 20–100); λ_{max} = 354, 298, 249 nm. ESI-MS: *m/z* 790.4 [M − H]$^-$. HRMS: *m/z* 814.2515 ([M + Na]$^+$) calculated for $C_{33}H_{51}N_3NaO_{13}P_2S^+$: 814.2510 (*Δ* 0.6 ppm). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 12.05 (s, 1H), 9.08 (d, *J* = 2.3 Hz, 1H), 8.82 (d, *J* = 2.3 Hz, 1H), 8.29 (dd, *J* = 9.0, 2.7 Hz, 1H), 7.98 (dd, *J* = 8.6, 2.3 Hz, 1H), 7.57 (d, *J* = 9.0 Hz, 1H), 7.43 (d, *J* = 9.0 Hz, 1H), 4.19 (q, *J* = 7.4, 6.3, 5.9 Hz, 4H), 3.64 (t, *J* = 6.3, 5.9 Hz, 4H), 1.51 (s, 36H) ppm. ^{13}C NMR (100 MHz, $CDCl_3$, HSQC): δ = 176.6, 144.4, 143.2, 142.0, 133.2, 131.3 (CH), 127.6 (CH), 127.2 (CH), 123.9 (CH), 120.8, 120.4, 119.0 (CH), 118.4 (CH), 83.4 (d, 4×C, J_{CP} = 7.6 Hz), 65.3 (d, 2×CH_2, J_{CP} = 6.9 Hz), 48.9 (d, CH_2, J_{CP} = 8.4 Hz), 29.9 (d, 12×CH_3, J_{CP} = 3.8 Hz) ppm. ^{31}P NMR (162 MHz, $CDCl_3$): δ = −11.2 (s) ppm.

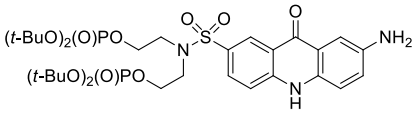
Compound 27[5]



Aminoacridine **27** (27 mg, 43%, TFA salt) was obtained as a red powder according to GP2, from the mixture of nitroacridine **25** (58 mg, 56 µmol), MeOH (5 mL), AcOH (100 µL) and 10% Pd/C (5 mg) under hydrogen atmosphere. HPLC: t_R = 11.8 min (gradient 20–100); λ_{max} = 475, 312, 275 nm. HRMS: *m/z* 1011.4449 ([M + H]$^+$) calculated for $C_{44}H_{78}N_4O_{14}P_3S^+$: 1011.4443 (Δ 0.6 ppm). ^{1}H NMR (400 MHz, MeOD-d$_3$): δ = 8.95 (d, *J* = 2.0 Hz, 1H), 8.17 (dd, *J* = 9.0, 2.0 Hz, 1H), 7.86 (d, *J* = 9.0 Hz, 1H), 7.66 (dd, *J* = 8.2, 1.6 Hz, 1H), 7.51 (s, 1H), 7.49 (dd, *J* = 9.0, 2.3 Hz, 1H), 4.30 (t, *J* = 7.0, 6.7 Hz, 2H), 4.18 (q, *J* = 6.3, 5.9 Hz, 2H), 4.10 (q, *J* = 6.7, 5.9 Hz, 4H), 3.62 (t, *J* = 5.9 Hz, 4H), 2.35 (quin, *J* = 6.3, 5.9 Hz, 2H), 1.44 (s, 36H), 1.42 (s, 18H) ppm. The following signals were visible in ^{13}C NMR (100 MHz, MeOD-d$_3$, HSQC): δ = 156.5, 146.7, 140.0, 133.6, 130.1 (CH), 127.3 (CH), 126.5 (CH), 120.1 (CH), 119.7 (CH), 102.4 (CH), 83.33 (d, 2×C, J_{CP} = 7.6

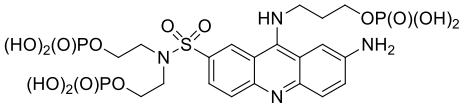
Hz), 83.29 (d, 4×C, J_{CP} = 7.6 Hz), 65.1 (d, 2×CH_2, J_{CP} = 6.9 Hz), 64.5 (d, CH_2, J_{CP} = 6.9 Hz), 48.4 (d, 2×CH_2, J_{CP} = 8.4 Hz), 46.0 (CH_2), 29.8 (d, CH_2, J_{CP} = 7.6 Hz), 28.7 (m, 18×CH_3) ppm. ^{31}P NMR (162 MHz, $CDCl_3$): δ = −10.0 (s, 2P), −10.9 (s, 1P) ppm.

Compound 28



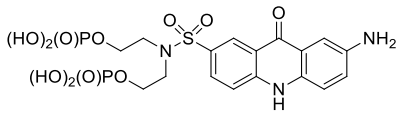
Aminoacridone **28** (6.3 mg, 77%, TFA salt) was obtained as a light yellow powder according to GP2, from the mixture of nitroacridone **26** (12 mg, 15 µmol), MeOH (1 mL), AcOH (25 µL) and 10% Pd/C (1 mg) under hydrogen atmosphere. HPLC: t_R = 9.6 min (gradient 20–100); λ_{max} = 397, 380, 318, 306, 280, 256 nm. ESI-MS: *m/z* 762.4 [M + H]$^+$. HRMS: *m/z* 762.2945 ([M + H]$^+$) calculated for $C_{33}H_{54}N_3O_{11}P_2S^+$: 762.2949 (*Δ* 0.5 ppm). ^{1}H NMR (400 MHz, MeOD-d_3): δ = 8.78 (d, *J* = 2.0 Hz, 1H), 8.07–8.13 (m, 2H), 7.66 (d, *J* = 8.6 Hz, 1H), 7.62 (d, *J* = 1.6 Hz, 2H), 4.09 (q, *J* = 7.0, 6.3, 5.9 Hz, 4H), 3.56 (t, *J* = 5.9 Hz, 4H), 1.45 (s, 36H) ppm. ^{13}C NMR (100 MHz, MeOD-d_3, HSQC): δ = 177.2, 143.1, 138.6, 132.1, 131.2, 130.9 (CH), 127.5 (CH), 126.8 (CH), 121.6, 119.3 (CH), 119.2, 118.8 (CH), 116.2 (CH), 83.3 (d, 2×C, J_{CP} = 7.6 Hz), 65.3 (d, 2×CH_2, J_{CP} = 6.9 Hz), 48.7 (d, 2×CH_2, J_{CP} = 8.4 Hz), 28.7 (d, 12×CH_3, J_{CP} = 3.8 Hz) ppm. ^{31}P NMR (162 MHz, MeOD-d_3): δ = −10.8 (s) ppm.

Acridine-triphosphate 2[5]



Triphosphate **2** (8 mg, 72%, TEA salt) was obtained as a dark red solid according to GP3, from the mixture of compound **27** (11 mg, 10 µmol) and 5% TFA in DCM (0.75 mL). HPLC (Knauer Eurospher II 100-5 C18A): t_R = 8.7 min (gradient TEAB-0–25); t_R = 7.0 min (gradient TEAB-0–40); λ_{max} = 458, 305, 273 nm. ESI-MS: *m/z* 673.2 [M − H]$^-$. HRMS: *m/z* 673.0532 ([M − H]$^-$) calculated for $C_{20}H_{28}N_4O_{14}P_3S^-$: 673.0541 (*Δ* 1.3 ppm). ^{1}H NMR (400 MHz, D_2O): δ = 8.46 (s, 1H), 8.05 (d, *J* = 9.0 Hz, 1H), 7.63 (d, *J* = 9.4 Hz, 1H), 7.30 (d, *J* = 8.6 Hz, 1H), 7.25 (d, *J* = 9.0 Hz, 1H), 7.16 (s, 1H), 4.08–4.20 (m, 2H), 4.04 (t, *J* = 6.3, 5.9 Hz, 2H), 3.98 (q, *J* = 5.9, 5.5, 5.1 Hz, 4H), 3.58 (t, *J* = 5.5, 5.1 Hz, 4H), 3.19 (q, *J* = 7.4 Hz, 26H, TEA), 2.12–2.26 (m, 2H), 1.26 (t, *J* = 7.4 Hz, 38H, TEA) ppm. The following signals were visible in ^{13}C NMR (100 MHz, D_2O, HSQC): δ = 181.4 (acetate), 154.8, 145.0, 140.0, 131.5, 130.1 (CH), 127.3 (CH), 126.8 (CH), 120.4 (CH), 119.9 (CH), 114.3, 109.3, 103.7 (CH), 63.6 (d, CH_2, J_{CP} = 4.6 Hz), 63.0 (d, 2×CH_2, J_{CP} = 4.6 Hz), 48.7 (d, 2×CH_2, J_{CP} = 7.6 Hz), 47.0 (CH_2), 46.7 (CH_2, TEA), 29.8 (d, CH_2, J_{CP} = 6.7 Hz), 23.2 (CH_3, acetate), 8.3 (CH_3, TEA) ppm. ^{31}P NMR (162 MHz, D_2O): δ = 1.32 (s, 1P), 0.72 (s, 2P) ppm.

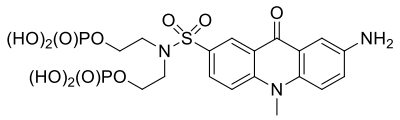
Acridone-diphosphate 29



Diphosphate **29** (4 mg, 79%, TEA salt) was obtained as a yellow-brown solid according to GP3, from the mixture of compound **28** (6.3 mg, 7 µmol) and 5% TFA in DCM (0.75 mL). HPLC (Knauer Eurospher II 100-5 C18A): t_R = 8.6 min (gradient TEAB-0–40); λ_{max} = 425, 297, 260 nm. ESI-MS: *m/z* 536.1 [M − H]$^-$. HRMS: *m/z* 536.0298 ([M − H]$^-$) calculated for $C_{17}H_{20}N_3O_{11}P_2S^-$: 536.0299 (*Δ* 0.2 ppm). ^{1}H NMR (400 MHz, D_2O): δ = 8.32 (d, *J* = 2.0 Hz, 1H), 7.84 (dd, *J* = 9.0, 1.2 Hz, 1H), 7.27 (d, *J* = 9.0 Hz, 1H), 7.23 (s, 1H), 7.18 (dd, *J* = 8.6, 0.8 Hz, 1H), 7.06 (d, *J* = 9.0 Hz, 1H), 4.00 (q, *J* = 5.9, 5.5 Hz, 4H), 3.51 (t, *J* = 5.5, 5.1 Hz, 4H), 3.17 (q, *J* = 7.4 Hz, TEA), 1.25 (t, *J* = 7.4 Hz, TEA) ppm. ^{13}C NMR (100 MHz, D_2O, HSQC): δ = 177.5, 141.7, 139.1, 135.2, 130.0 (CH), 129.6, 126.8 (CH), 126.6 (CH), 120.6, 119.1 (CH), 119.0 (CH), 117.4, 110.1 (CH), 63.5 (d, 2×CH_2, J_{CP} = 4.6 Hz), 49.1 (d, 2×CH_2, J_{CP} = 6.9 Hz), 46.7 (CH_2, TEA), 8.3 (CH_3, TEA) ppm. ^{31}P NMR (162 MHz, D_2O): δ = 0.3 (s) ppm.

REFERENCE COMPOUND

***N*-Methyl-acridone-diphosphate (ASA)**



HPLC (Knauer Eurospher II 100-5 C18A): t_R = 11.2 min (gradient TEAB-0–25). ESI-MS: *m/z* 550.2 [M − H]$^-$. HRMS: *m/z* 550.0441 ([M − H]$^-$) calculated for $C_{18}H_{22}N_3O_{11}P_2S^-$: 550.0456 (*Δ* 2.7 ppm). ^{1}H NMR (400 MHz, D_2O): δ = 8.37 (d, *J* = 2.3 Hz, 1H), 7.92 (dd, *J* = 9.4, 2.3 Hz, 1H), 7.49 (d, *J* = 9.4 Hz, 1H), 7.18 (d, *J* = 9.4 Hz, 1H), 7.09 (d, *J* = 2.7 Hz, 1H), 7.05 (dd, *J* = 9.0, 2.7 Hz, 1H), 3.98 (q, *J* = 6.3, 5.9 Hz, 4H), 3.55 (s, 3H), 3.50 (t, *J* = 5.9 Hz, 4H), 3.16 (q, *J* = 7.4 Hz, 12H, TEA), 1.24 (t, *J* = 7.2 Hz, 18H, TEA) ppm. ^{13}C NMR (100 MHz, D_2O): δ = 177.0, 142.8, 142.0, 135.5, 130.3 (CH), 129.1, 126.8 (CH), 125.9 (CH), 121.7, 118.4, 117.6 (CH), 117.4 (CH), 108.7 (CH), 63.4 (d, 2×CH_2, J_{CP} = 4.6 Hz), 49.5 (d, 2×CH_2, J_{CP} = 8.4 Hz), 46.7 (CH_2, TEA), 33.8 (CH_3), 8.3 (CH_3, TEA) ppm. ^{31}P NMR (162 MHz, D_2O): δ = 0.8 (s) ppm.

REDUCTIVE AMINATION OF CARBOHYDRATES WITH NEGATIVELY CHARGED AMINO-DYES

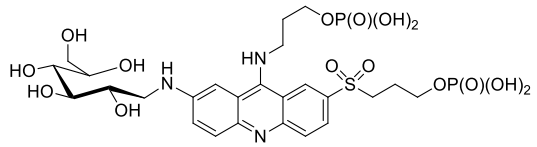
Labeling of maltoheptaose with acridine 1 in standard (GP4) or evaporative conditions. A stock solution of maltoheptaose (100 mM) was prepared in water containing 25 mM of 8-hydroxy-1,3,6-pyrenetrisulfonate (HPTS) as internal standard. The stock was aliquoted to 50, 75, 100 mM maltoheptaose concentrations. The reactions were performed either in standard (GP4) or evaporative conditions described below. The reaction time was 6 h.

1.5 mL micro tube with a screw cap was charged with acridine **1** (2 µL, 0.1 M solution in water), maltoheptaose (2 µL, 0.05–0.1 M) and malonic acid (2 µL, 1 M solution in DMSO). The solvents were removed in a freeze-dryer (pressure <0.2 mbar, temp. of the cooling coil –80°C). A solution of 2-picoline-borane complex (4 µL, 0.5 M solution in DMSO) was added, and the samples were incubated with shaking (400–600 rpm) at 40 °C for 6 h.

The reaction progress was monitored by HPLC. The product peak was detected by UV–vis spectrum (red shift). The conversion degrees were determined by measuring peak areas of the residual dye **1** and product **1**-G_7 at isosbestic point (309 nm) and by calibration curve method with HPTS as an internal standard. Labeling yields are summarized in Figure S10.

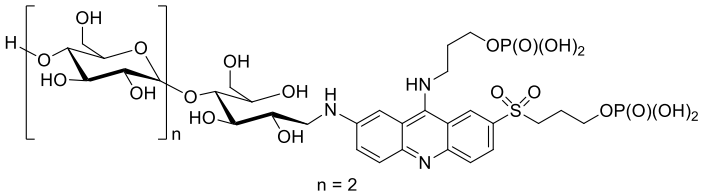
Labeling of dextran ladder with acridine 2 for electrophoresis. Maltooligosaccharide ladder labeled with acridine-triphosphate **2** was obtained as an orange-red solution (55 µL, 4.2 mM) from aminoacridine **2** (4 µmol) and a dextran ladder (1.9 mg, maltodextrin oligosaccharides DP2 to DP15, Carbosynth) according to GP4.

Conjugate 1-G^5



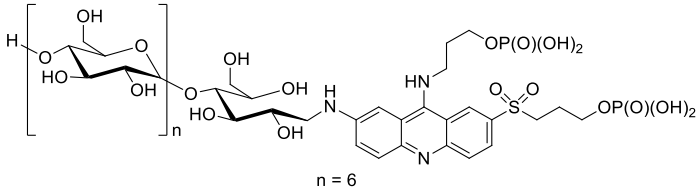
Glycoconjugate **1**-G (1.4 µmol, TEA salt) was obtained as a red solid from the amino dye **1** (3 µmol) and glucose (3 µmol) according to GP4. HPLC (Knauer Eurospher II 100-5 C18A): t_R = 9.5 min (gradient TEAB-0–25); λ_{max} = 469, 317, 276 nm. ESI-MS: *m/z* 712.4 [M − H]$^-$. HRMS: *m/z* 712.1339 ([M − H]$^-$) calculated for $C_{25}H_{36}N_3O_{15}P_2S^-$: 712.1348 (*Δ* 1.3 ppm). ^{1}H NMR (400 MHz, D_2O): δ = 8.60 (s, 1H), 8.04 (d, *J* = 8.6 Hz, 1H), 7.69 (d, *J* = 9.4 Hz, 1H), 7.39 (d, *J* = 9.0 Hz, 1H), 7.16–7.35 (m, 1H), 6.91 (s, 1H), 4.06–4.17 (m, 4H), 4.04 (quin, *J* = 5.5, 4.3, 3.5 Hz, 1H), 3.86–3.96 (m, 3H), 3.78–3.86 (m, 2H), 3.74–3.79 (m, 1H), 3.64–3.73 (m, 1H), 3.49–3.61 (m, 2H), 3.40 (dd, *J* = 13.5, 3.7 Hz, 1H), 3.23 (dd, *J* = 13.7, 8.2 Hz, 1H), 3.18 (q, *J* = 7.4 Hz, TEA), 2.17–2.29 (m, 2H), 1.97–2.08 (m, 2H), 1.25 (t, *J* = 7.4 Hz, TEA) ppm. The following ^{13}C signals were visible in ^{1}H-^{13}C HSQC NMR (400/100 MHz, D_2O): δ = 63.9 (CH_2), 63.6 (CH_2), 53.0 (CH_2), 47.1 (CH_2), 47.1 (CH_2, TEA), 30.5 (CH_2), 24.1 (CH_2), 8.7 (CH_3, TEA) ppm. ^{31}P NMR (162 MHz, D_2O): δ = 0.7 (s, 1P), 0.3 (s, 1P) ppm.

Conjugate 1-G$_3$



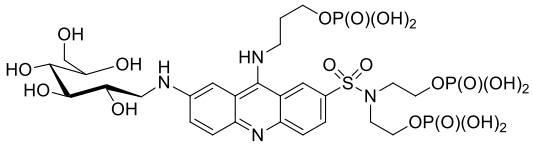
Glycoconjugate **1**-G$_3$ (0.6 µmol) was obtained as an orange-red solution (3 mM) from the amino dye **1** (1 µmol) and maltotriose (1 µmol) according to GP4. HPLC (Knauer Eurospher II 100-5 C18A): t_R = 9.5 min (gradient TEAB-0–25); λ_{max} = 469, 317, 276 nm. ESI-MS: *m/z* 1036.6 [M − H]$^-$.

Conjugate 1-G$_7$



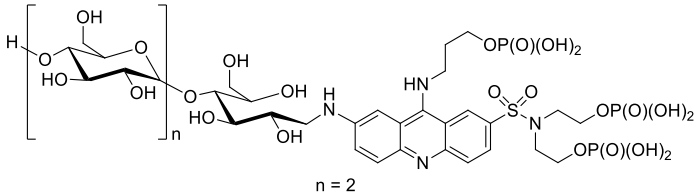
Glycoconjugate **1**-G$_7$ (0.6 µmol) was obtained as an orange-red solution (3 mM) from the amino dye **1** (1 µmol) and maltoheptaose (1 µmol) according to GP4. HPLC (Knauer Eurospher II 100-5 C18A): t_R = 9.5 min (gradient TEAB-0–25); λ_{max} = 469, 317, 276 nm. ESI-MS: *m/z* 1685.6 [M − H]$^-$.

Conjugate 2-G



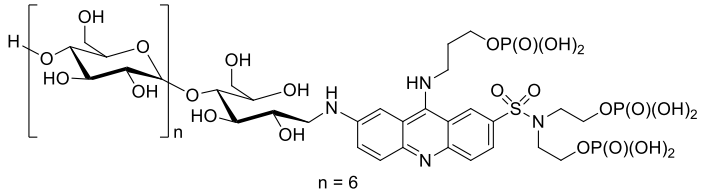
Glycoconjugate **2**-G (0.45 µmol) was obtained as an orange-red solution (1.8 mM) from the amino dye **2** (1.5 µmol) and glucose (1.5 µmol) according to GP4. HPLC (Knauer Eurospher II 100-5 C18A): t_R = 8.8 min (gradient TEAB-0–25); λ_{max} = 473, 318, 276 nm. ESI-MS: *m/z* 836.9 [M − H]$^-$. HRMS: *m/z* 418.0568 ([M − 2H]$^{2-}$) calculated for $C_{26}H_{39}N_4O_{19}P_3S^{2-}$: 418.0577 ($\Delta$ 2.2 ppm).

Conjugate 2-G$_3$



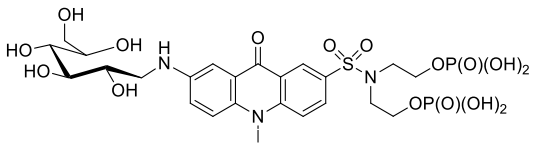
Glycoconjugate **2**-G$_3$ (0.38 µmol) was obtained as an orange-red solution (1.5 mM) from the amino dye **2** (1 µmol) and maltotriose (1 µmol) according to GP4. HPLC (Knauer Eurospher II 100-5 C18A): t_R = 9.0 min (gradient TEAB-0–25); λ_{max} = 473, 318, 276 nm. ESI-MS: *m/z* 1161.1 [M − H]$^-$.

Conjugate 2-G$_7$



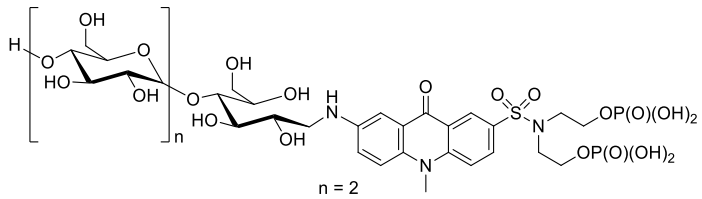
Glycoconjugate **2**-G$_7$ (0.3 µmol) was obtained as an orange-red solution (1.2 mM) from the amino dye **2** (1 µmol) and maltoheptaose (1 µmol) according to GP4. HPLC (Knauer Eurospher II 100-5 C18A): t_R = 8.8 min (gradient TEAB-0–25). ESI-MS: *m/z* 904.1 $[M - 2H]^{2-}$.

Conjugate ASA-G



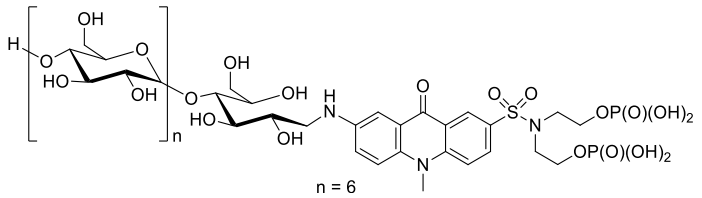
Glycoconjugate **ASA**-G (0.26 µmol) was obtained as an yellow-orange solution (1.3 mM) from the amino dye **ASA** (2 µmol) and glucose (2 µmol) according to GP4. HPLC (Knauer Eurospher II 100-5 C18A): t_R = 10.6 min (gradient TEAB-0–25); λ_{max} = 439, 306, 254 nm. ESI-MS: *m/z* 714.2 $[M - H]^-$. HRMS: *m/z* 356.5533 ($[M - 2H]^{2-}$) calculated for $C_{24}H_{33}N_3O_{16}P_2S^{2-}$: 356.5534 ($\Delta$ 0.3 ppm).

Conjugate ASA-G$_3$



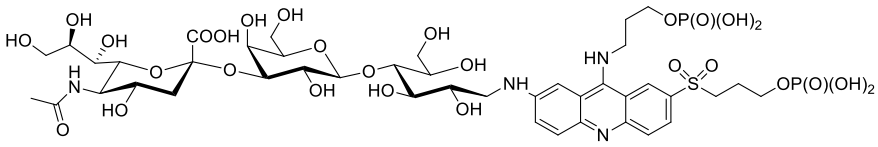
Glycoconjugate **ASA**-G$_3$ (0.27 µmol) was obtained as an yellow-orange solution (2.7 mM) from the amino dye **ASA** (1 µmol) and maltotriose (1 µmol) according to GP4. HPLC (Knauer Eurospher II 100-5 C18A): t_R = 10.2 min (gradient TEAB-0–25); λ_{max} = 439, 306, 254 nm. ESI-MS: *m/z* 1038.4 $[M - H]^-$.

Conjugate ASA-G$_7$



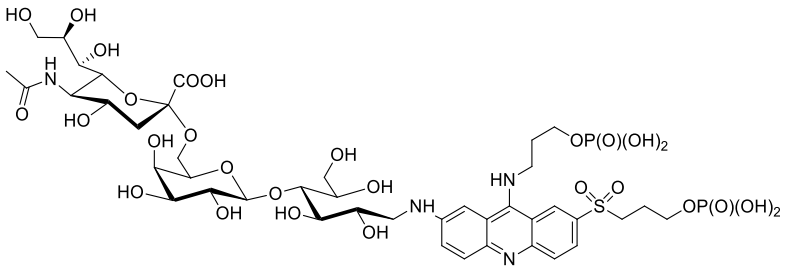
Glycoconjugate **ASA**-G$_7$ (0.23 µmol) was obtained as an yellow-orange solution (2.3 mM) from the amino dye **ASA** (1 µmol) and maltoheptaose (1 µmol) according to GP4. HPLC (Knauer Eurospher II 100-5 C18A): t_R = 10.3 min (gradient TEAB-0–25); λ_{max} = 439, 306, 254 nm. ESI-MS: *m/z* 1686.6 $[M - H]^-$.

Conjugate 1-3SL



Glycoconjugate **1**-3SL (0.21 µmol) was obtained as an orange-red solution (3.9 mM) from the amino dye **1** (0.5 µmol) and 3'-sialyllactose (2.5 µmol) according to GP4. HPLC (Interchim Uptisphere Strategy C18-HQ, 10 µm, 250×4.6 mm): t_R = 12.3 min (gradient TEAB-1–20); λ_{max} = 469, 317, 276 nm. ESI-MS: *m/z* 582 $[M - 2H]^{2-}$.

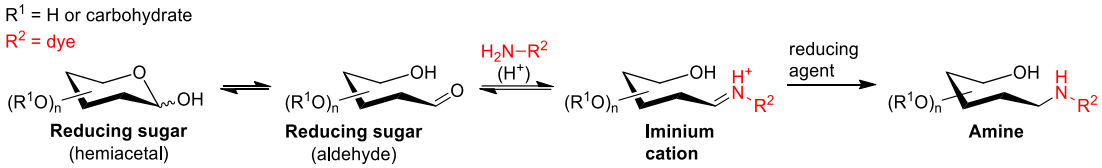
Conjugate 1-6SL



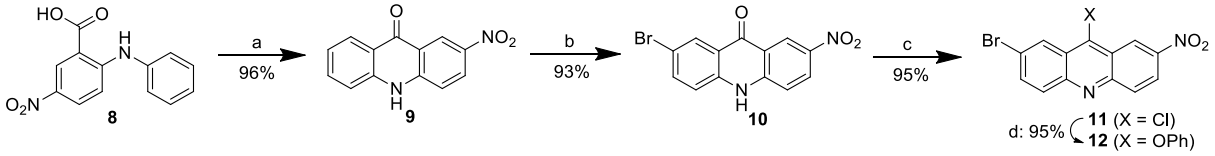
Glycoconjugate **1**-6SL (0.18 µmol) was obtained as an orange-red solution (3.2 mM) from the amino dye **1** (0.5 µmol) and 6'-sialyllactose (2.5 µmol) according to GP4. HPLC (Interchim Uptisphere Strategy C18-HQ, 10 µm, 250×4.6 mm): t_R = 12.3 min (gradient TEAB-1–20); λ_{max} = 469, 317, 276 nm. ESI-MS: *m/z* 581.9 $[M - 2H]^{2-}$.

2. Supplementary Schemes

Scheme S1. Labeling by reductive amination of mono and oligosaccharides

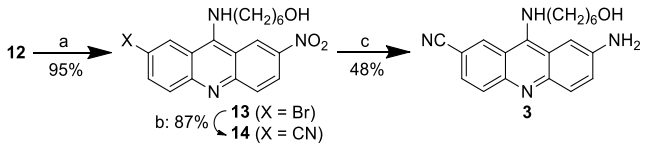


Scheme S2. Synthesis of acridine precursor 12[a]



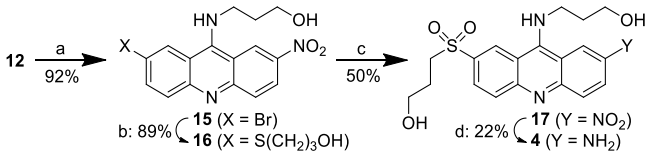
[a]Reagents and conditions: (a) 1. $POCl_3$, reflux. 2. H_3O^+, reflux. (b) Br_2, $PhNO_2$, 120 °C. (c) 1. $POCl_3$, 105 °C. 2. Aq. NH_3. (d) PhOH, 100 °C.

Scheme S3. Synthesis of nitrile 3[a]



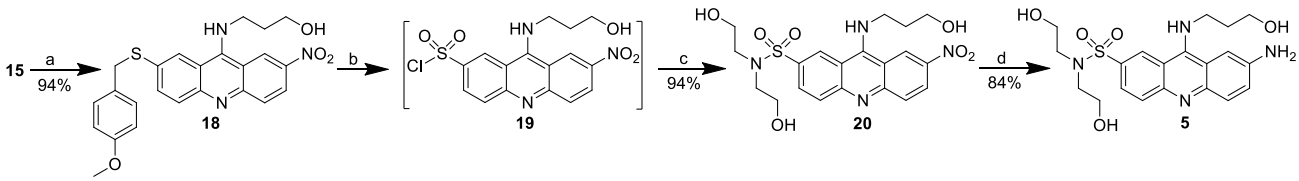
[a]Reagents and conditions: (a) 6-Amino-1-hexanol, DMF. (b) $Zn(CN)_2$, $Pd(PPh_3)_4$, DMF, 100 °C, 30 min, Ar. (c) $SnCl_2 \times 2H_2O$, EtOH, 70 °C, 10 min, Ar.

Scheme S4. Synthesis of sulfone 4[a]



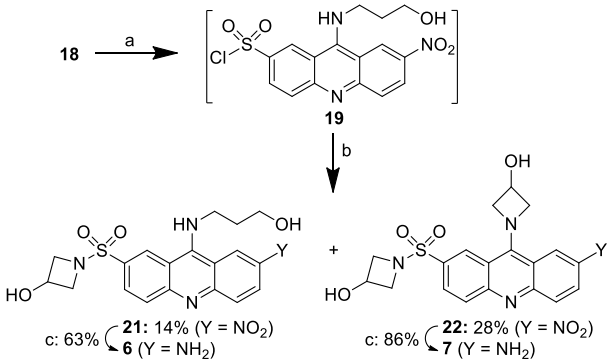
[a]Reagents and conditions: (a) 3-Amino-1-propanol, DMF. (b) 3-Mercapto-1-propanol, $Pd_2(dba)_3$, Xantphos, DIPEA, DMF, 100 °C, Ar. (c) Oxone™, H_2O. (d) H_2, 10% Pd/C, MeOH-AcOH.

Scheme S5. Synthesis of sulfonamide 5[a]



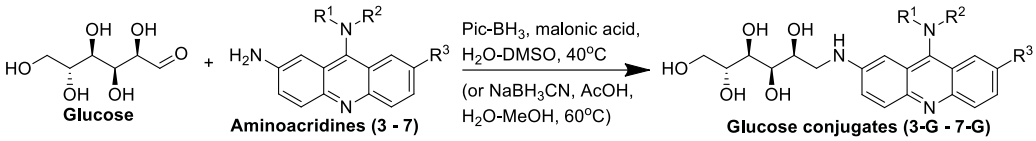
[a]Reagents and conditions: (a) 4-Methoxybenzyl mercaptan, $Pd_2(dba)_3$, Xantphos, DIPEA, DMF, 100 °C, Ar. (b) DCDMH, MeCN-AcOH-H2O, 0 °C. (c) DEA, MeCN. (d) H_2, 10% Pd/C, MeOH-AcOH.

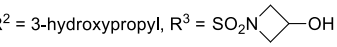
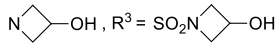
Scheme S6. Synthesis of sulfonamides 6 and 7[a]



[a]Reagents and conditions: (a) 1,3-Dichloro-5,5-dimethylhydantoin, MeCN-AcOH-H2O, 0 °C. (b) 3-Hydroxyazetidine, DIPEA, MeCN. (c) H_2, 10% Pd/C, MeOH-AcOH.

Scheme S7. Glucose conjugates prepared from dyes 3–7 *via* reductive amination



3: R^1= H, R^2 = 6-hydroxyhexyl, R^3 = CN
4: R^1= H, R^2 = 3-hydroxypropyl, R^3 = $SO_2(CH_2)_3OH$
5: R^1= H, R^2 = 3-hydroxypropyl, R^3 = $SO_2N(C_2H_4OH)_2$
6: R^1= H, R^2 = 3-hydroxypropyl, R^3 = SO_2N  OH
7: R^1R^2N = N  OH , R^3 = SO_2N OH

3. Supplementary Tables

Table S1. *Hammett* constants for donor and acceptor groups in *meta* (σ_m) and *para* (σ_p) positions. The positive values correspond to electron-acceptors; negative values – to electron-donor groups. For hydrogen, $\sigma_m \equiv \sigma_m \equiv 0$.[10]

Name	Substituent	σ_m	σ_p
Amino	$-NH_2$	−0.16	−0.66
Methylamino	-NHMe	−0.21	−0.70
Dimethylamino	$-NMe_2$	−0.16	−0.83
Methylthio	-SMe	0.15	0.00
Methyl sulfonyl	$-SO_2Me$	0.60	0.72
Methylsulfoxide	-SOMe	0.52	0.49
Sulfonamide	$-SO_2NH_2$	0.53	0.60
Nitrile	-CN	0.56	0.66

Table S2. Photophysical properties of the model compounds and their conjugates with glucose.

Com-pound	Solvent	Absorbance λ_{max}, nm (ε, $M^{-1}cm^{-1}$)	Emission λ_{max}, nm (Φ_{fl}, %)[c]	$\Delta\nu_{St}$, nm (cm^{-1})
3-G	H_2O[a]	471 (5000), 317 (31100), 277 (26100)	611 (3)	140 (4865)
	MeOH[b]	480 (4700), 363 (8800), 326 (38100), 283 (29400)	586 (20)	106 (3768)
4	H_2O[a]	455 (4700), 300 (27300), 272 (27400)	611 (3)	156 (5611)
	MeOH[b]	462 (4100), 352 (5500), 310 (27000), 274 (28100)	584 (17)	122 (4522)
4-G	H_2O[a]	473, 314, 276	623 (3)	150 (5090)
	MeOH[b]	481, 360, 324, 280	590 (26)	109 (3841)
5	H_2O[a]	455 (5500), 303 (31900), 273 (28700)	612 (2)	157 (5638)
	MeOH[b]	459 (5200), 355 (5900), 310 (35500), 275 (31800)	579 (22)	120 (4515)
5-G	H_2O[a]	466, 314, 276	612 (4)	146 (5119)
	MeOH[b]	467, 358, 320, 280	580 (24)	113 (4172)
6	H_2O[a]	457 (4700), 303 (27300), 273 (25000)	615 (2)	158 (5622)
	MeOH[b]	463 (4700), 354 (5800), 310 (30700), 275 (30100)	582 (19)	119 (4416)
6-G	H_2O[a]	470, 315, 276	615 (3)	145 (5016)
	MeOH[b]	471, 358, 321, 280	585 (22)	114 (4137)
7	H_2O[a]	460 (6400), 303 (33700), 275 (30000)	626 (3)	166 (5765)
	MeOH[b]	476 (5800), 356 (5800), 313 (35000), 275 (30800)	587 (25)	111 (3973)
7-G	H_2O[a]	473, 314, 276	627 (3)	154 (5193)
	MeOH[b]	482, 361, 324, 279	589 (25)	107 (3769)

[a]25 mM HEPES pH 8.0; [b]MeOH with 0.1% TEA; [c]absolute values of the fluorescence quantum yields.

Table S3. Photophysical properties of the negatively charged dyes and their conjugates with glucose.

Com-pound	Solvent	Absorbance λ_{max}, nm (ε, $M^{-1}cm^{-1}$)	Emission λ_{max}, nm (Φ_{fl}, %)[c]	$\Delta\nu_{St}$, nm (cm^{-1})
1	H_2O[a]	455 (5100), 301 (27400), 272 (24800)	629 (1)	174 (6080)
	MeOH[b]	468 (4300), 352 (5500), 312 (26400), 275 (25900)	590 (15)	122 (4418)
1-G	H_2O[a]	469, 314, 274	627 (2)	158 (5373)
	MeOH[b]	483, 323, 279	589 (15)	106 (3726)
2	H_2O[a]	455 (5500), 303 (30400), 273 (25800)	625 (2)	170 (5978)
	MeOH[b]	470 (4800), 352 (5400), 312 (30300), 276 (26000)	586 (11)	116 (4212)
2-G	H_2O[a]	466, 313, 275	626 (2)	160 (5485)
	MeOH[b]	480, 322, 279	583 (14)	103 (3681)
29	H_2O[a]	422 (3900), 295 (29900), 261 (26200)	583 (7)	161 (6544)
	MeOH[b]	428 (3500), 298 (27000)	562 (20)	134 (5571)
ASA	H_2O[a]	431 (5200), 299 (32900), 263 (32900)	593 (4)	162 (6338)
	MeOH[b]	435 (4900), 302 (29200)	575 (15)	140 (5597)
ASA-G	H_2O[a]	439, 306	597 (4)	158 (6029)
	MeOH[b]	448, 310	583 (12)	135 (5169)

[a]25 mM HEPES pH 8.0; [b]MeOH with 0.1% TEA; [c]absolute values of the fluorescence quantum yields.

Table S4. Gel electrophoresis results from Figure 4A reported as relative mobility units (RMU).

Entry	Name (charge)	Mol. mass	*m/z*	RMU[a]
1	**APTS** (−3)	457	152	1.00
2	-glucose	621	207	0.80
3	-maltotriose	945	315	0.67
4	-maltoheptaose	1593	531	0.47
5	**ASA** (−4)	551	138	0.94
6	-glucose	715	179	0.76
7	-maltotriose	1039	260	0.66
8	-maltoheptaose	1687	422	0.48
9	**Dye 1** (−3)[b]	549	183	0.83
10	-glucose	713	238	0.71
11	-maltotriose	1037	346	0.62
12	-maltoheptaose	1685	562	0.45
13	**Dye 2** (−5)[b]	674	135	0.92
14	-glucose	838	168	0.78
15	-maltotriose	1162	232	0.68
16	-maltoheptaose	1810	362	0.51

[a]Relative mobility units (RMU) were calculated from the cathodal edge of **APTS** band in the gel. [b]Assuming protonation of acridine moiety at pH 8.3.

4. Supplementary Figures

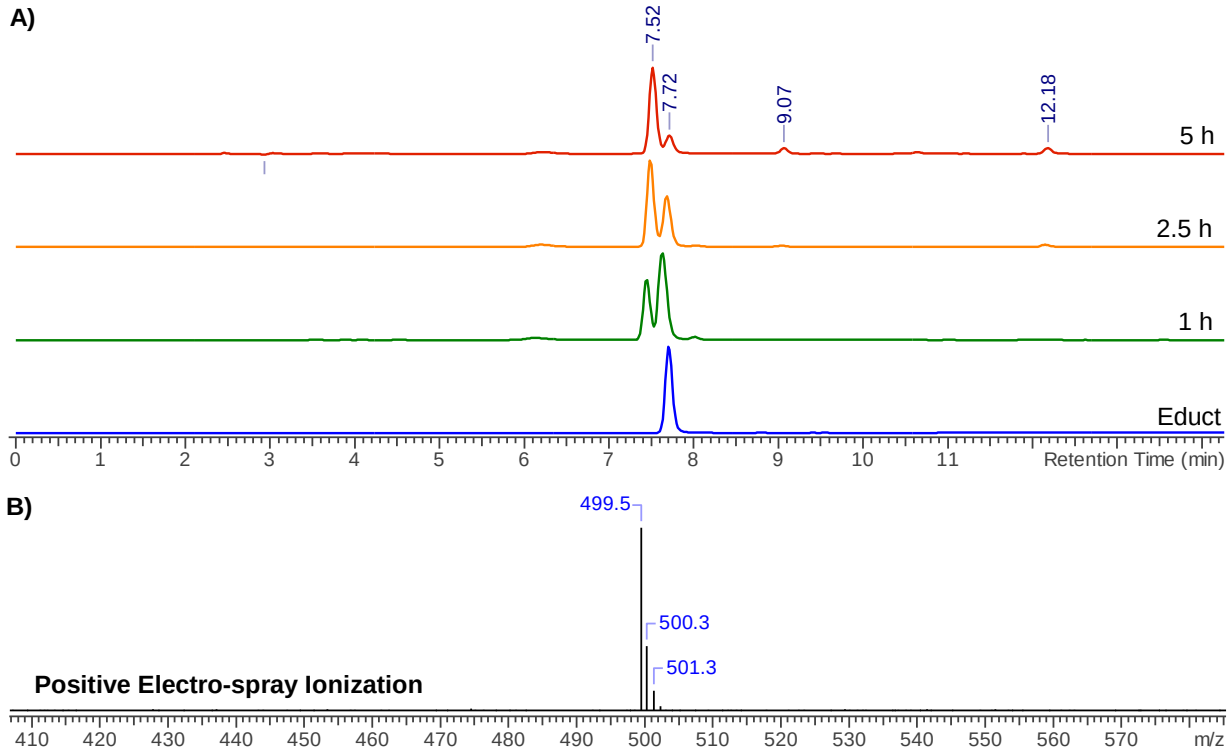


Figure S1. (A) HPLC analysis (Interchim Uptisphere Strategy C18-HQ, gradient 20–100) of the reaction progress for the reductive amination of nitrile **3** (retention time 7.7 min) with glucose showed nearly complete conversion to product **3**-G (retention time 7.5 min) within 5 h (detection at λ 295 nm). (B) ESI-MS spectrum of conjugate **3**-G.

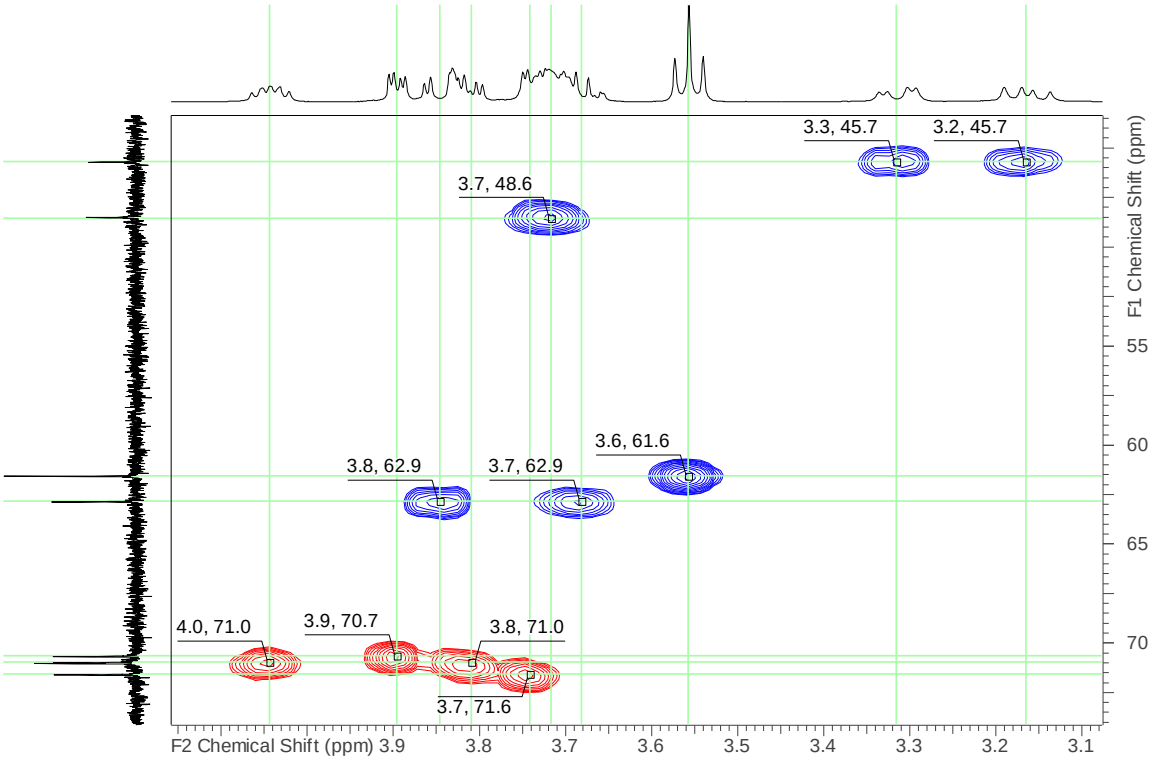


Figure S2. A zoomed region of the ^{1}H-^{13}C HSQC NMR spectrum (D_2O) of **3**-G (blue: CH_2, red: CH).

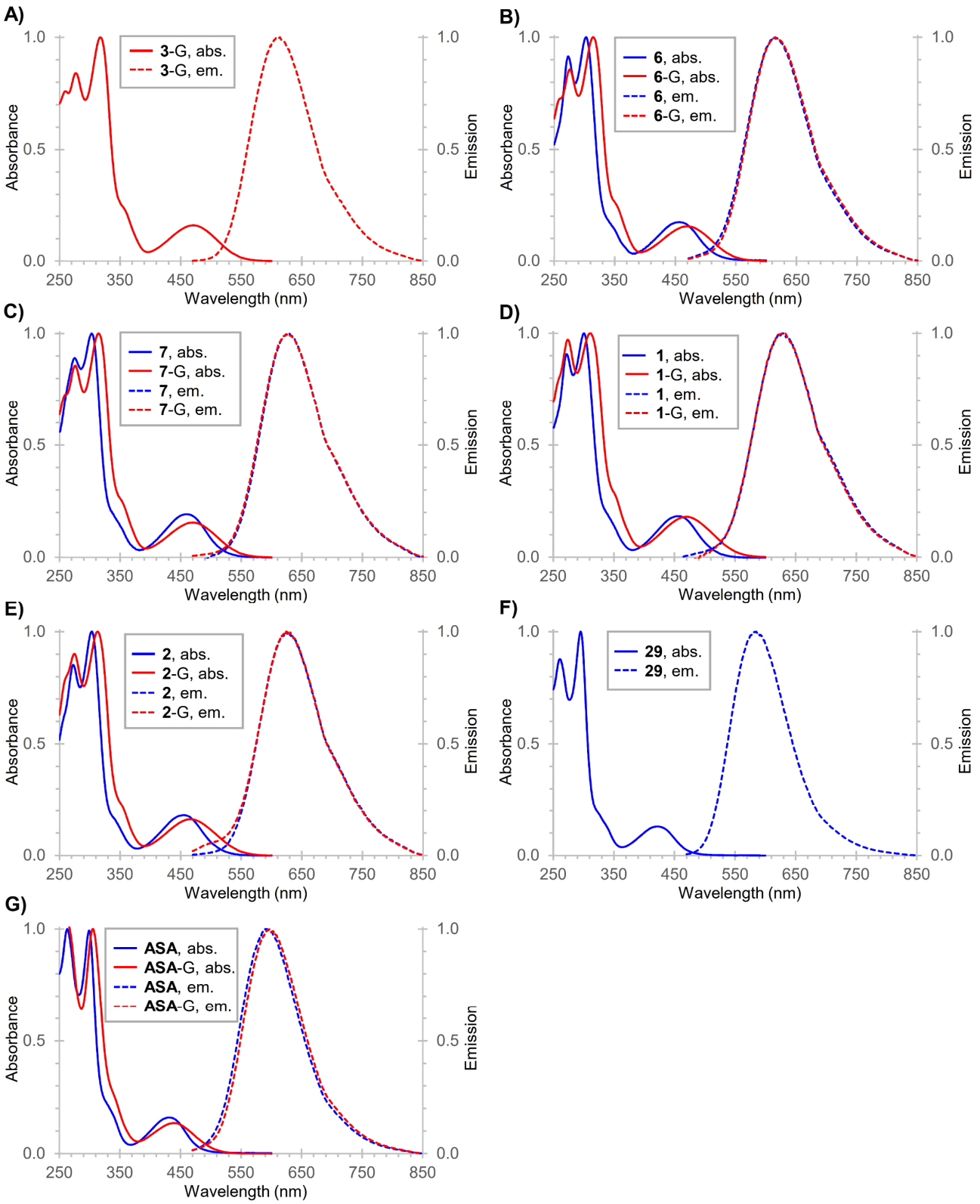


Figure S3. Normalized absorption (solid lines) and emission (dashed lines, λ_{exc} 450 nm) spectra in aqueous buffer (25 mM HEPES, pH 8): (A) glucose conjugate of nitrile **3**-G; (B, C) sulfonamides (**6**, **7**) and their conjugates (**6**-G, **7**-G); (D, E) acridine-phosphates (**1**, **2**) and their conjugates (**1**-G, **2**-G); (F) acridone-diphosphate (**29**); (G) *N*-methyl-acridone-diphosphate (**ASA**) and its conjugate (**ASA**-G).

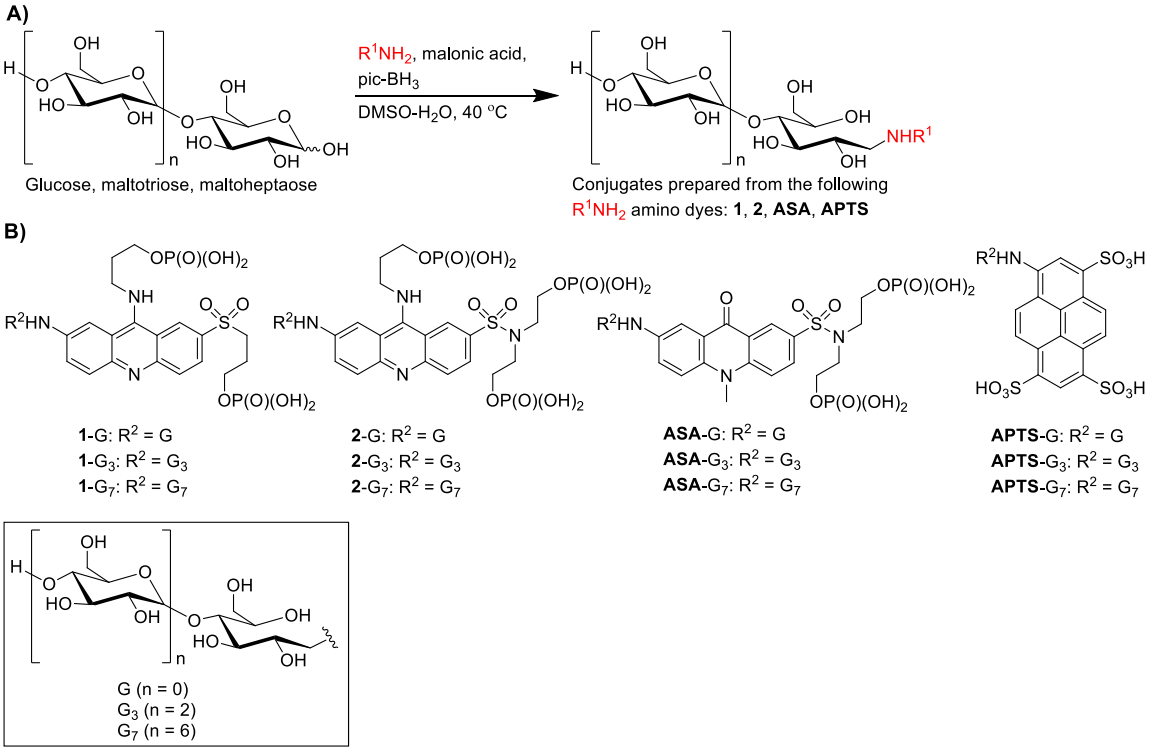


Figure S4. (A) Labeling procedure and (B) glycoconjugates prepared *via* reductive amination from the negatively charged amino-dyes and glucose oligomers.

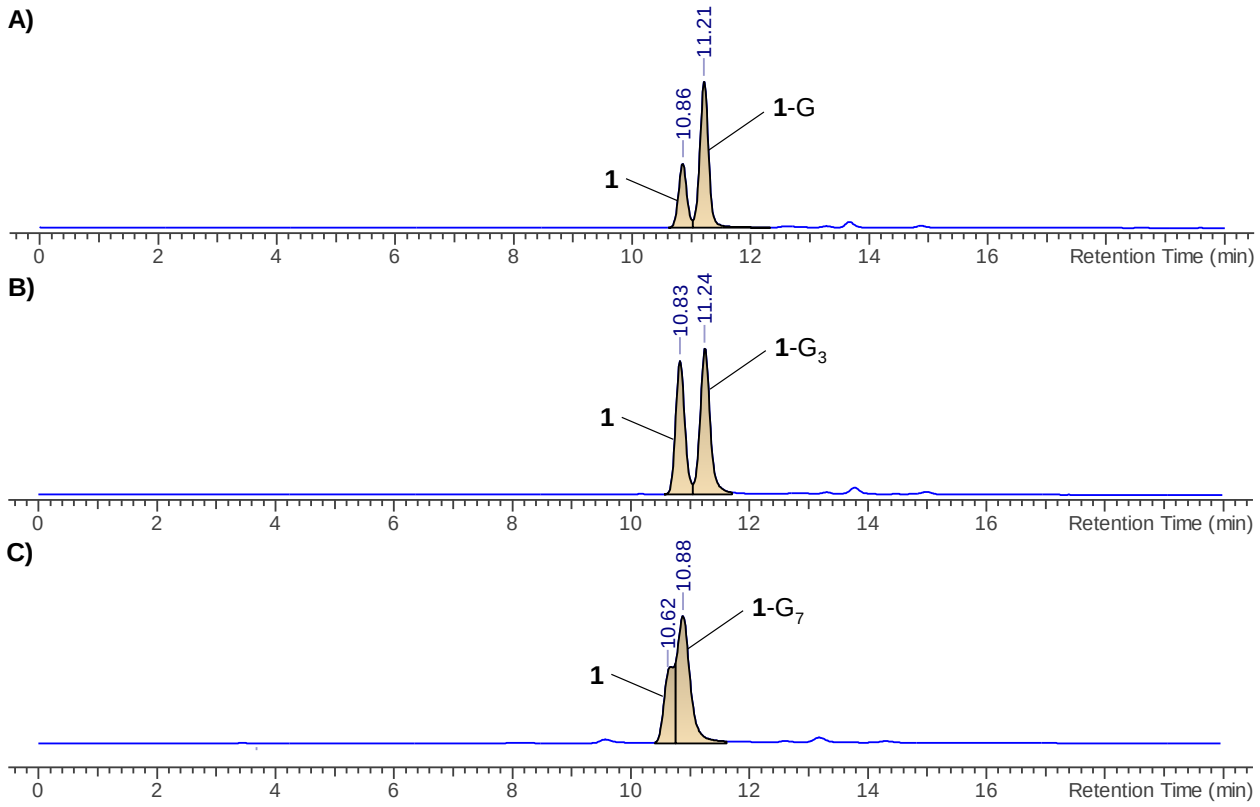


Figure S5. HPLC analysis (Interchim Uptisphere Strategy C18-HQ, gradient TEAB-1–20, dynamic mixing chamber disabled) of reaction progress for the reductive amination of acridine **1** (left peak) with glucose (A), maltotriose (B), maltoheptaose (C) showed clean conversion to glycoconjugates (right peak) after 6 h (the traces were recorded at λ 309 nm).

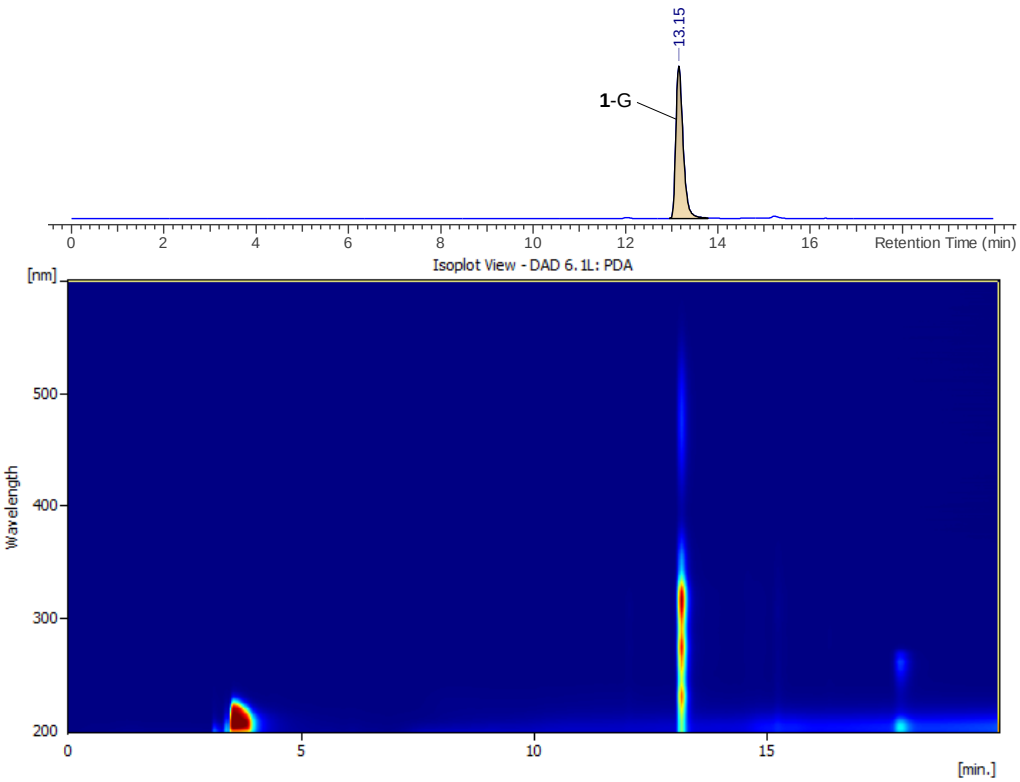


Figure S6. HPLC analysis (Interchim Uptisphere Strategy C18-HQ, gradient TEAB-1–25) of the reductive amination of acridine **1** with an excess of glucose after 3 h (the upper trace was recorded at λ 309 nm).

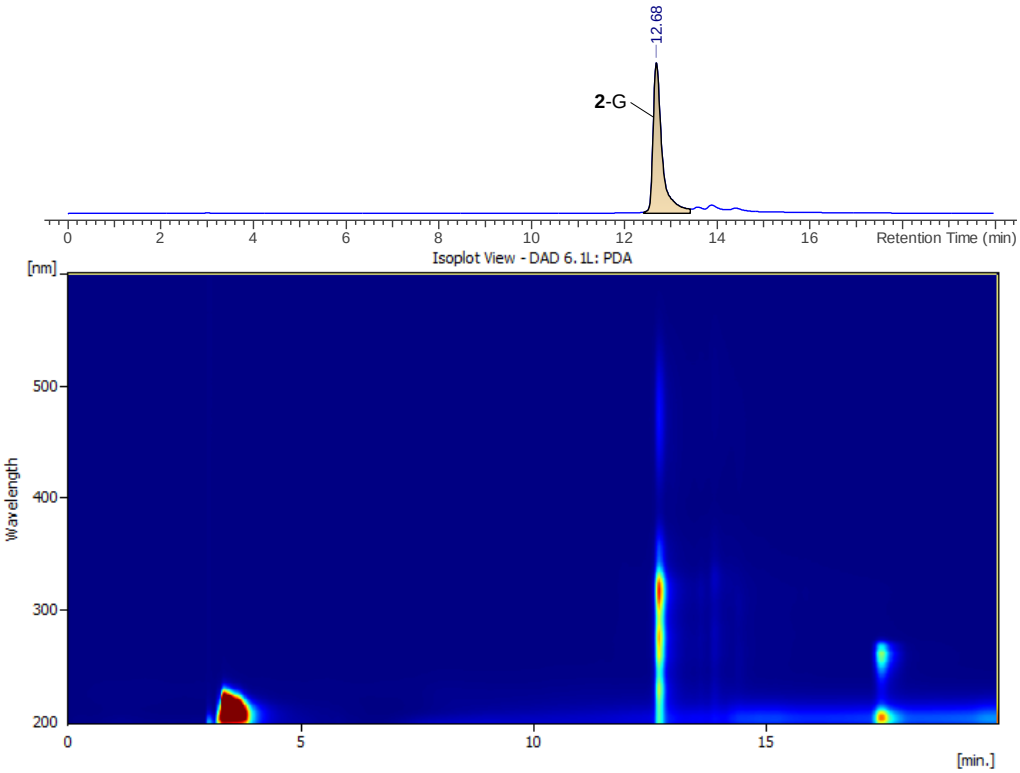


Figure S7. HPLC analysis (Interchim Uptisphere Strategy C18-HQ, gradient TEAB-1–25) of the reductive amination of acridine **2** with an excess of glucose after 3 h (the upper trace was recorded at λ 309 nm).

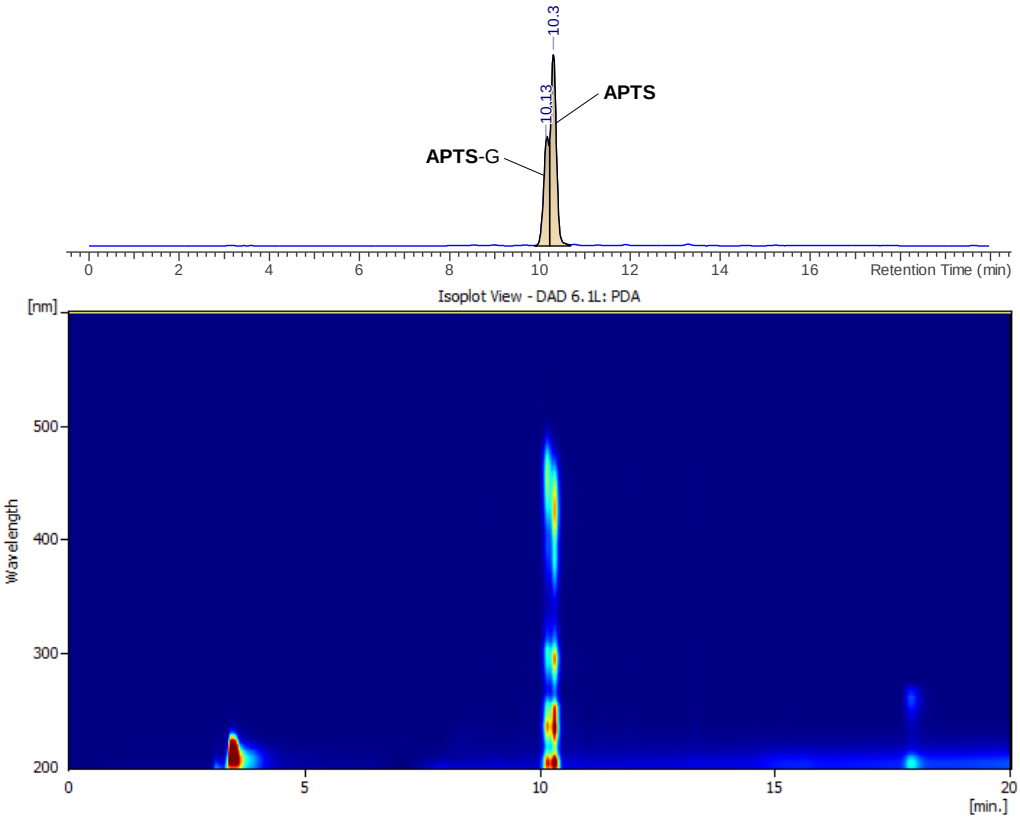


Figure S8. HPLC analysis (Interchim Uptisphere Strategy C18-HQ, gradient TEAB-1–25) of the reductive amination of **APTS** with an excess of glucose after 3 h (the upper trace was recorded at λ 299 nm).

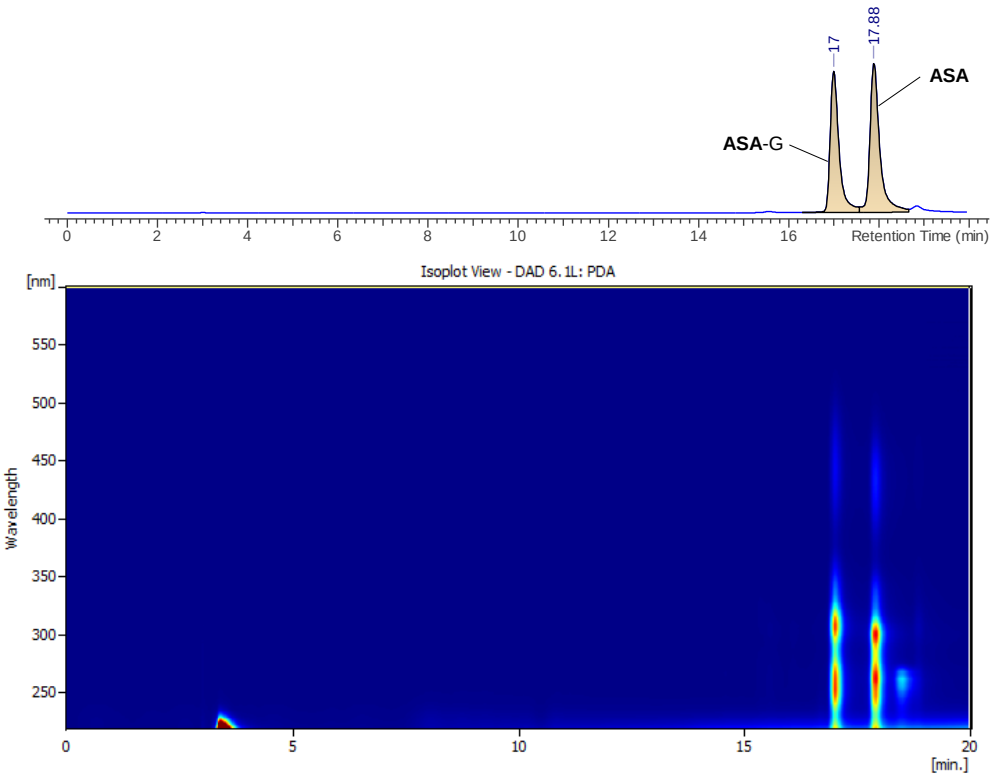


Figure S9. HPLC analysis (Interchim Uptisphere Strategy C18-HQ, gradient TEAB-1–25) of the reductive amination of acridone **ASA** with an excess of glucose after 3 h (the upper trace was recorded at λ 304 nm).

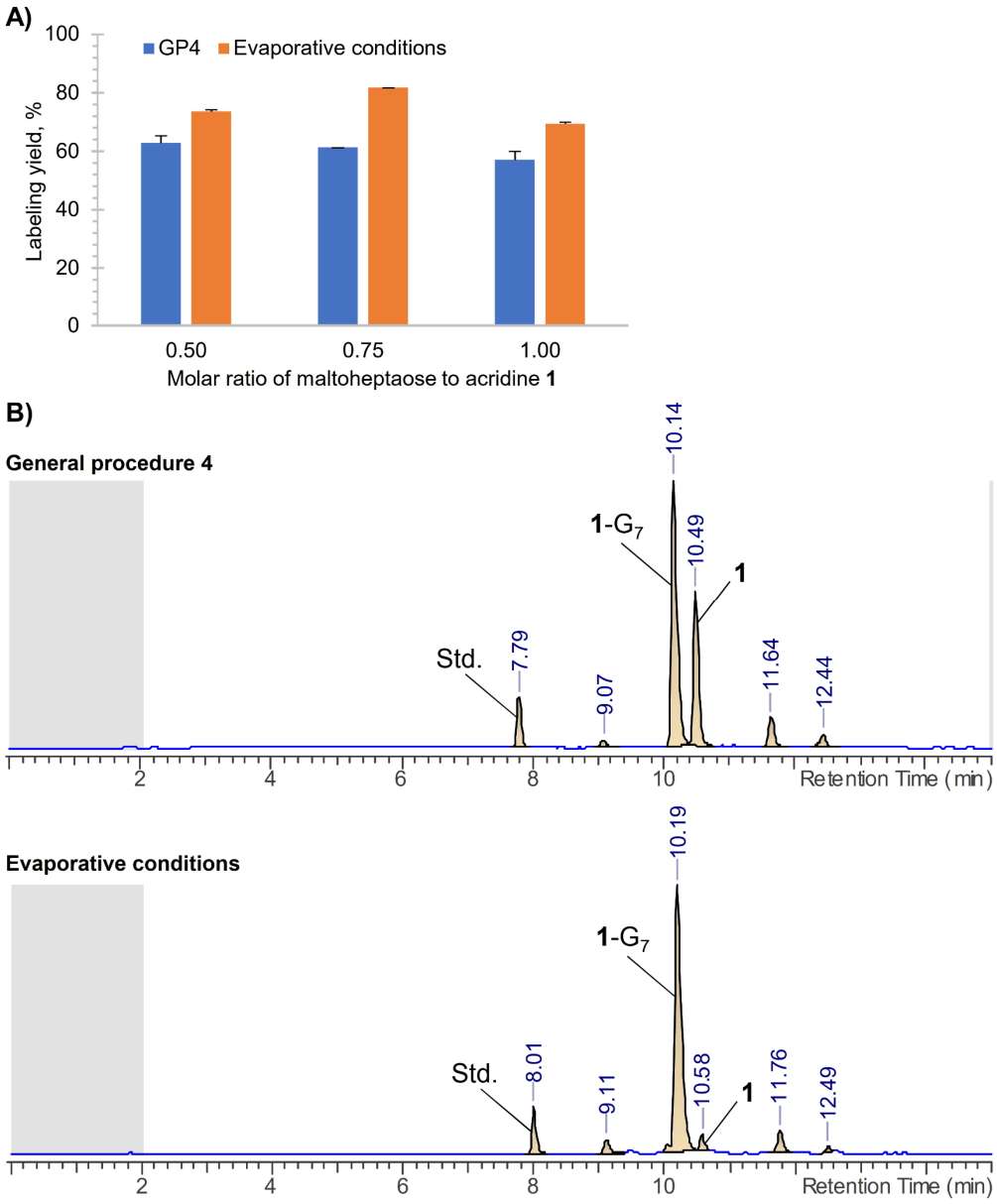


Figure S10. (A) Yields of maltoheptaose derivatization with acridine **1** under various conditions. Reaction mixture: acridine **1** (2 µL, 0.1 M solution in water), maltoheptaose (2 µL, 0.05–0.1 M solution in water), malonic acid (2 µL, 1 M solution in DMSO) and 2-picoline-borane complex (2 µl, 1 M solution in DMSO). The reactions were made in triplicate. (B) HPLC analysis (Interchim Puriflash C18-AQ, gradient TEAB-1–25-AQ) of the reductive amination of acridine **1** with maltoheptaose (1 equiv.) after 6 h (the traces were recorded at λ 309 nm). "Std." indicates the 8-hydroxy-1,3,6-pyrenetrisulfonate internal standard.

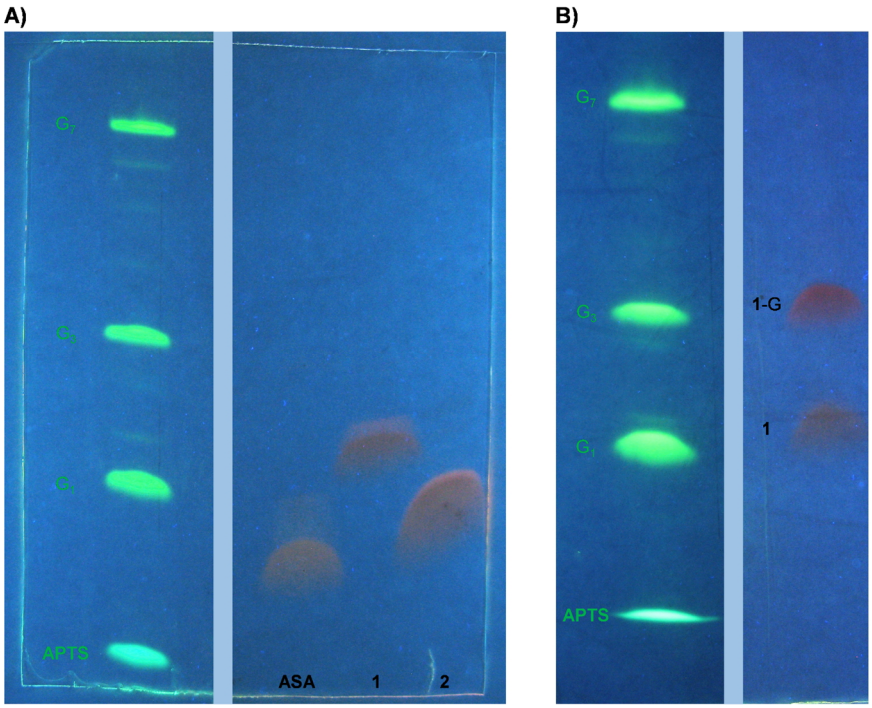


Figure S11. Representative electrophoresis gels from stability tests. (A) Left, **APTS** reference lane, sample: 5 nmol; right, dyes **ASA**, **1**, **2**, sample: 50 nmol. (B) Left, **APTS** reference lane, sample: 5 nmol; right, acridine-diphosphate **1** and its glucose conjugate **1**-G, sample: 50 nmol. Bands were detected by emission (excitation at 365 nm). The gels were of the 8-well format (width 20 cm). Note that the spot of glucose conjugate **1**-G is more intense than that of free dye **1**.

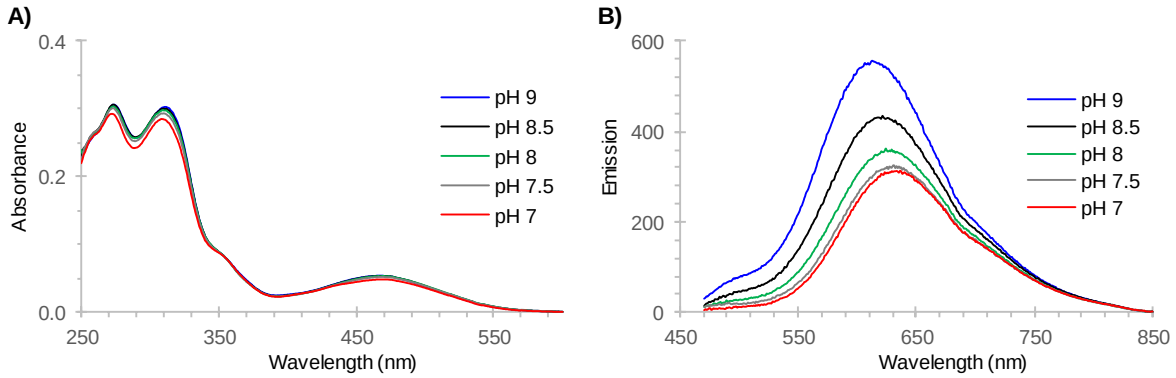


Figure S12. pH titration of **1**-G in TRIS buffer (25 mM): (A) absorption and (B) emission (λ_{exc} 450 nm) spectra.

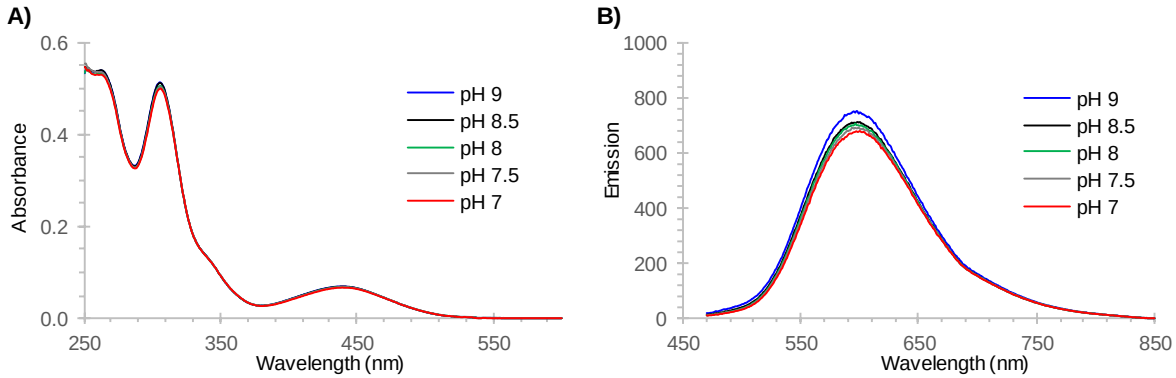


Figure S13. pH titration of **ASA**-G in TRIS buffer (25 mM): (A) absorption and (B) emission (λ_{exc} 450 nm) spectra.

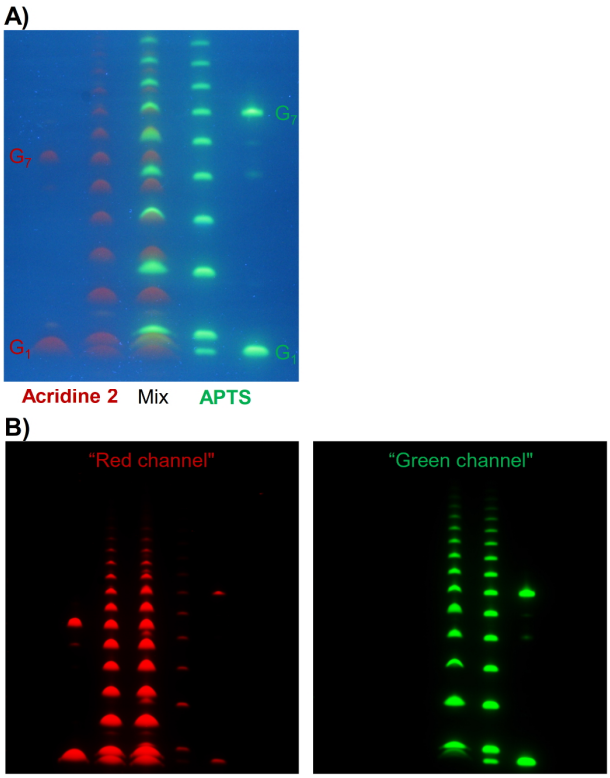


Figure S14. (A) The gel visualized using a UV transilluminator and digital camera (excitation at 365 nm). (B) Signals obtained from individual channels on an Amersham Imager 600 RGB. "Red" channel: excitation 520 nm, emission collected: 585–625 nm, exposure 3.7 s; "green" channel: excitation 460 nm, emission collected: 515–535 nm, exposure 0.1 s. The gel was of the 17-well format (width 20 cm).

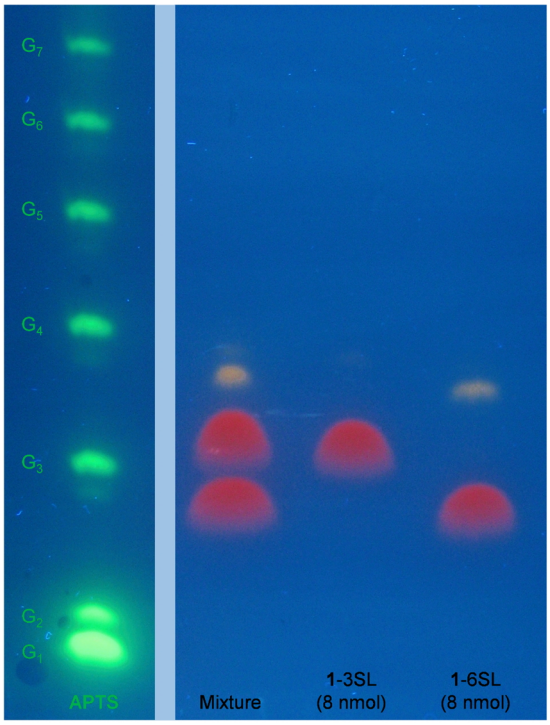


Figure S15. Electrophoresis gel related to separation of two glycan isomers, 2,3-sialyllactose (3SL) and 2,6-sialyllactose (6SL). Left, **APTS** reference lane; right, isomers of sialyllactose derivatized with acridine-diphosphate **1**. Bands were detected by emission (excitation at 365 nm). An acridone by-product gives additional light orange bands. The gel was of the 17-well format (width 20 cm).

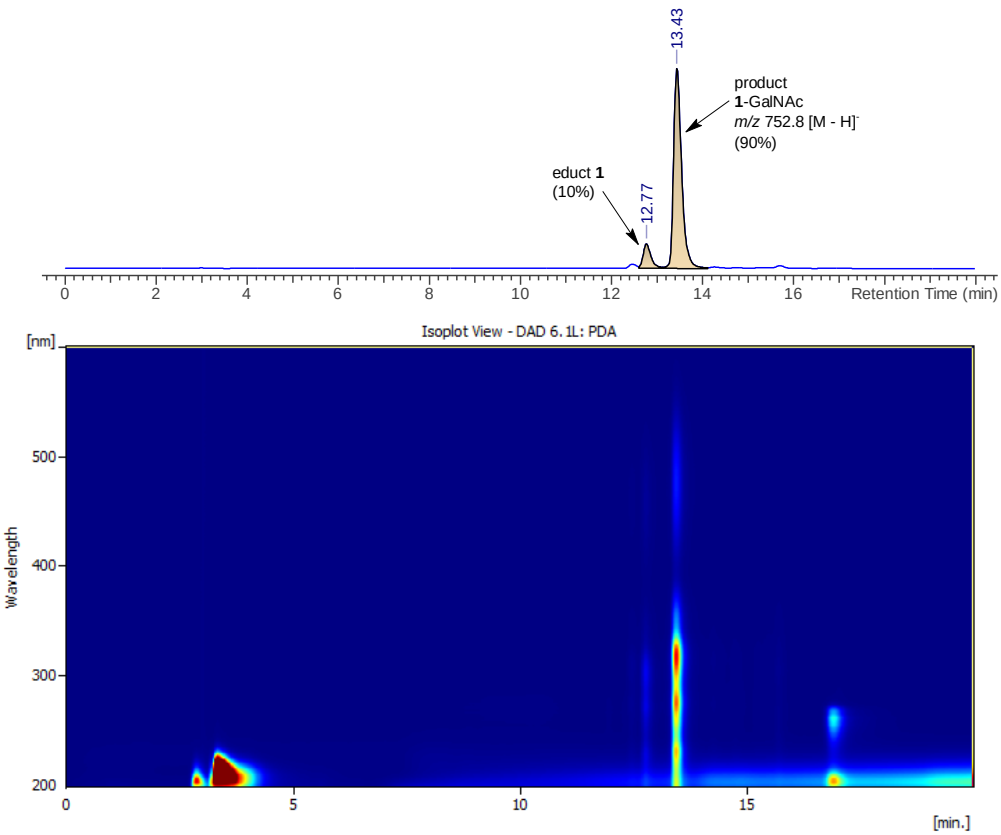


Figure S16. HPLC analysis (Interchim Uptisphere Strategy C18-HQ, gradient TEAB-1–25) of the reductive amination of acridine **1** with an excess of *N*-acetyl-D-galactosamine after 3 h (the upper trace was recorded at λ 309 nm).

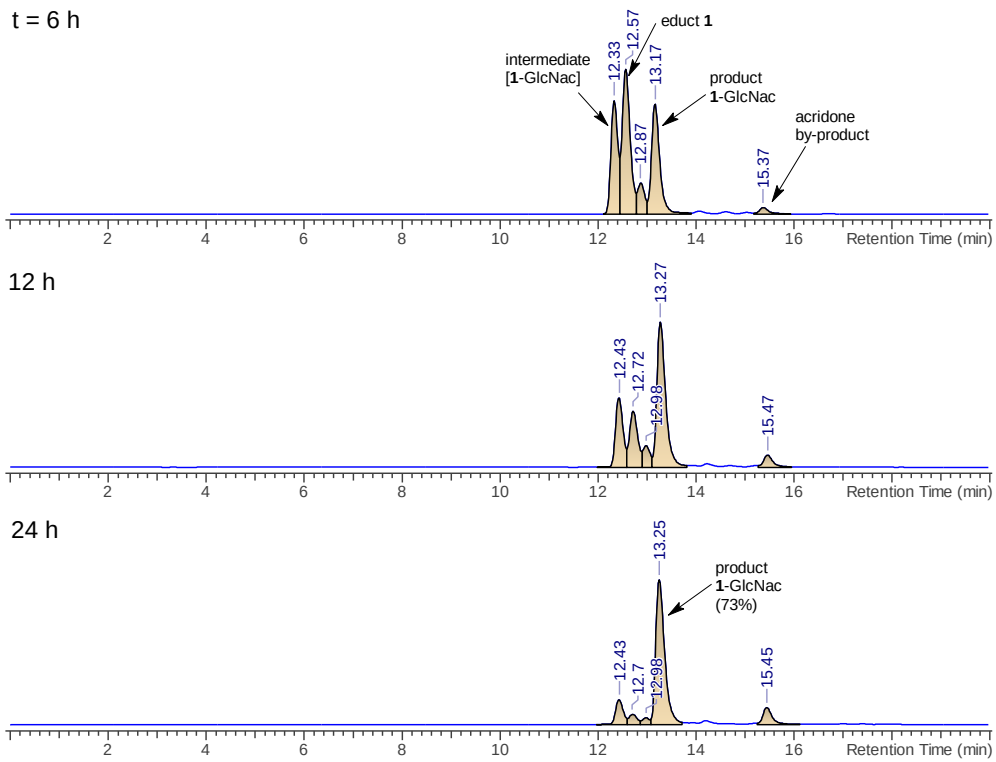


Figure S17. HPLC analysis (Interchim Uptisphere Strategy C18-HQ, gradient TEAB-1–25) of reaction progress for the reductive amination of acridine **1** with an excess of *N*-acetyl-D-glucosamine (the traces were recorded at λ 309 nm).

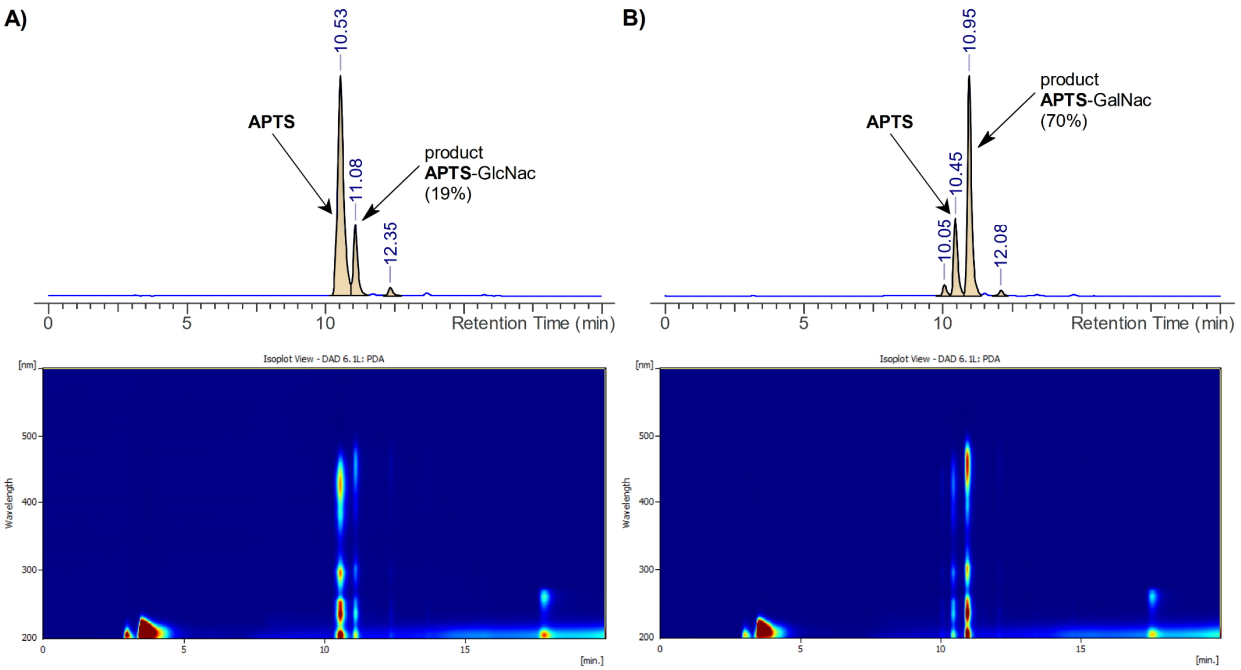


Figure S18. HPLC analysis (Interchim Uptisphere Strategy C18-HQ, gradient TEAB-1–25) of the reductive amination of **APTS** with an excess of (A) *N*-acetyl-D-glucosamine and (B) *N*-acetyl-D-galactosamine after 24 h (the traces were recorded at λ 299 nm).

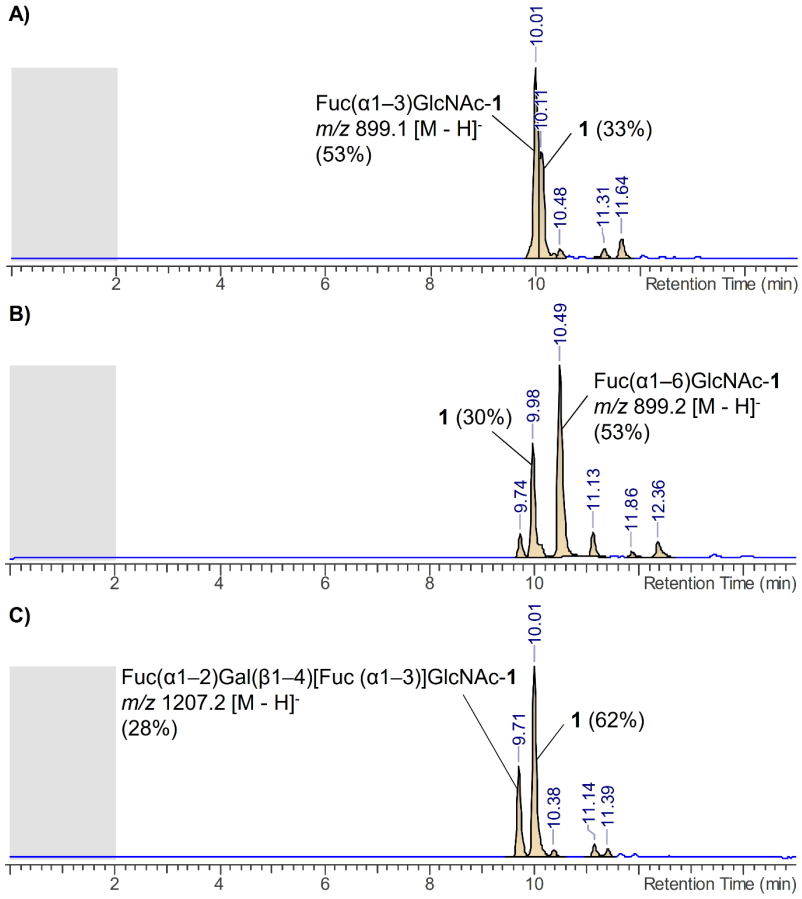


Figure S19. HPLC analysis (Interchim Puriflash C18-AQ, gradient TEAB-1–25-AQ) of the reductive amination of acridine **1** with 5 equiv. of (A) Fuc(α1–3)GlcNAc, (B) Fuc(α1–6)GlcNAc, and (C) Fuc(α1–2)Gal(β1–4)[Fuc (α1–3)]GlcNAc after 24 h (the traces were recorded at λ 309 nm).

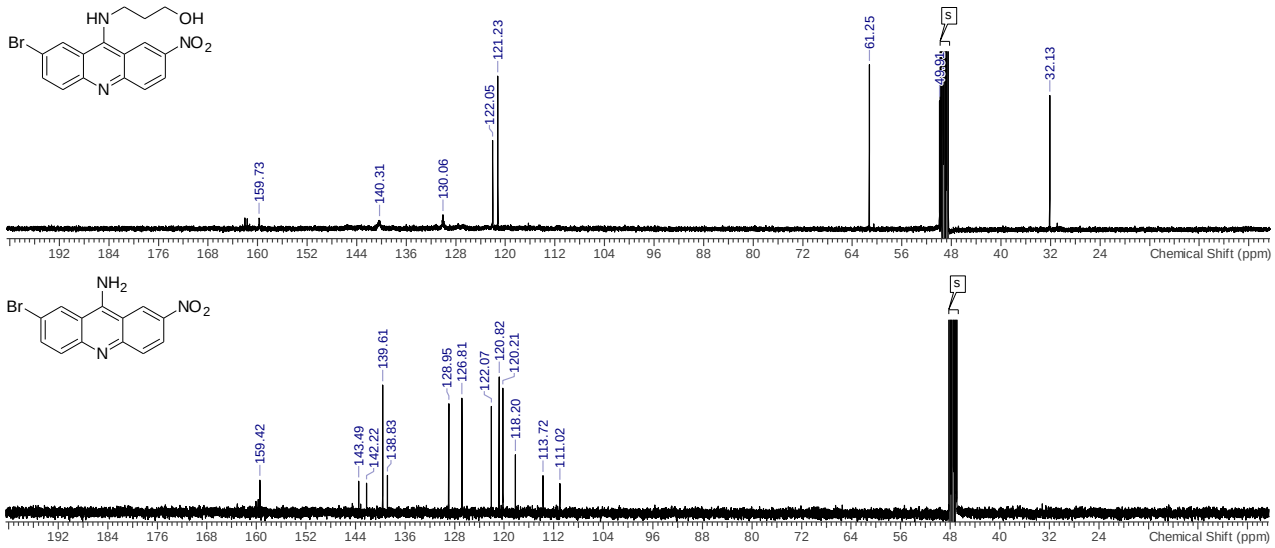
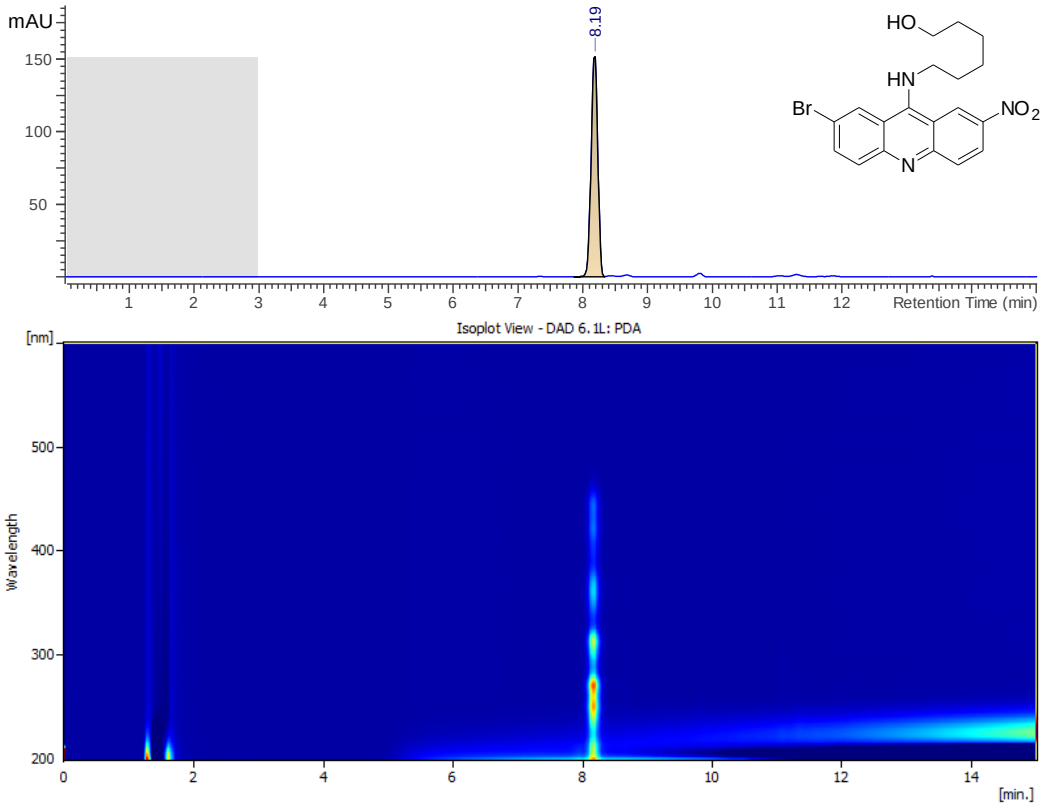


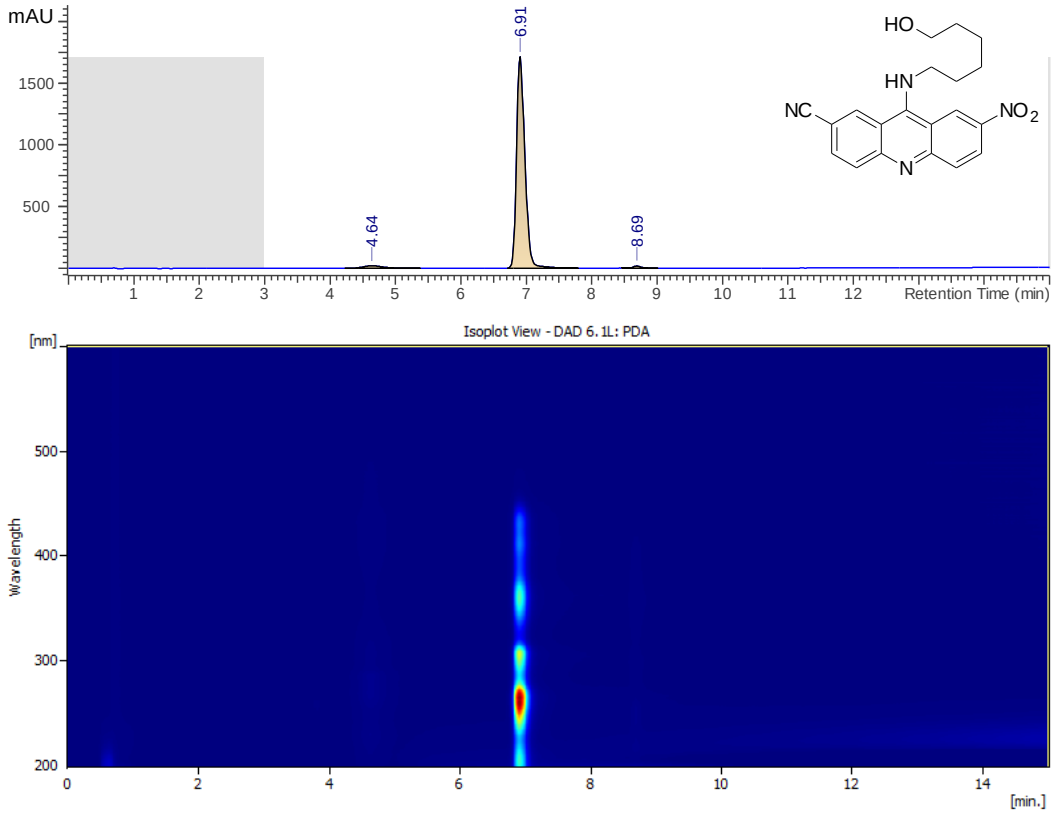
Figure S20. ^{13}C NMR (100 MHz, MeOD-d_3 with TFA-d) spectra for 9-hydroxyalkylaminoacridine **15** *vs.* 2-bromo-7-nitroacridin-9-amine (10 mg of sample, 5000 scans); s: solvent.

5. HPLC Traces

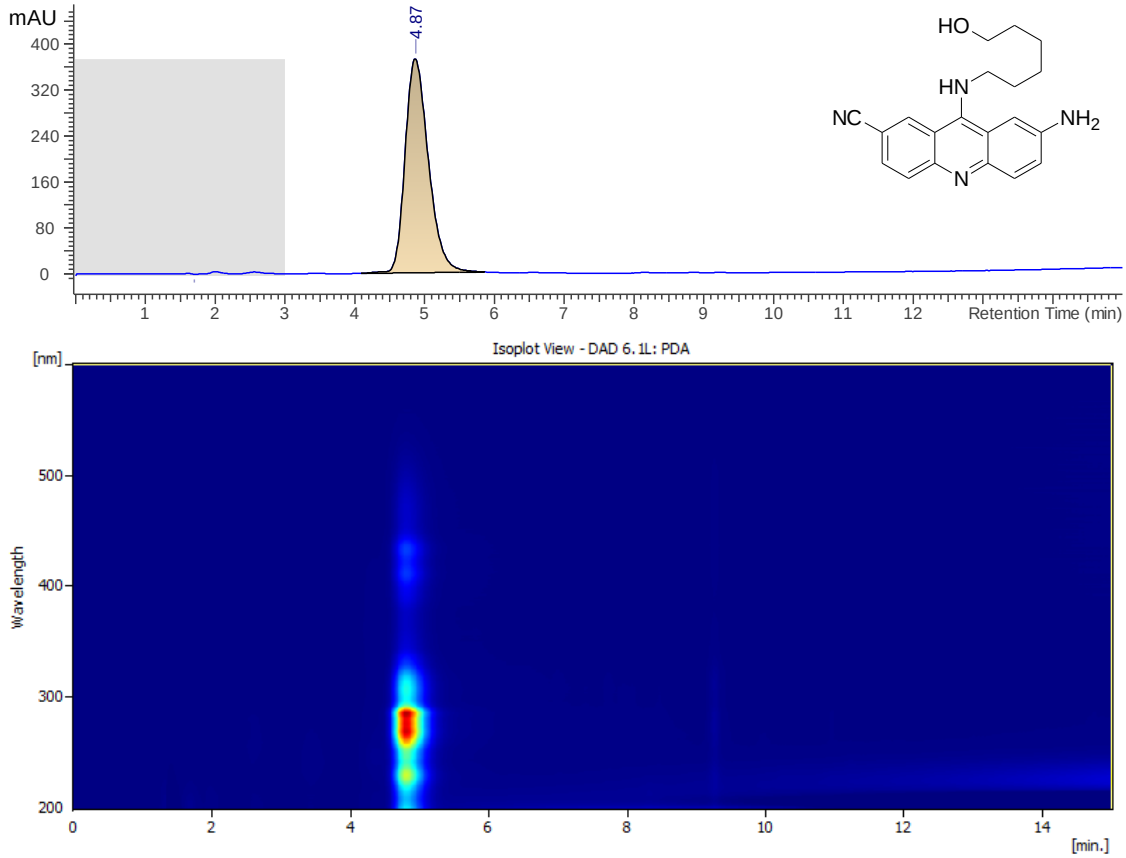
HPLC (gradient 20–100, Knauer Eurospher II 100-10 C18A) of **13** (upper trace 254 nm)



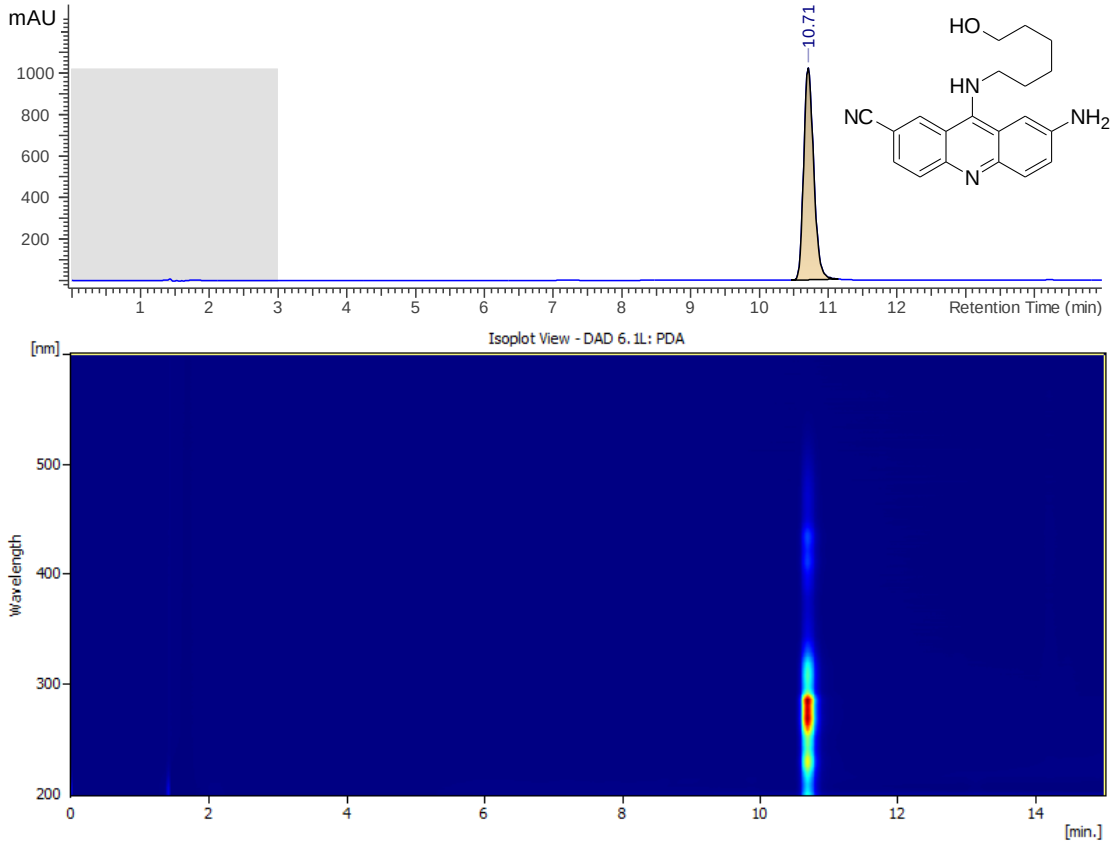
HPLC (gradient 20–100, Knauer Eurospher II 100-10 C18A) of **14** (upper trace 254 nm)



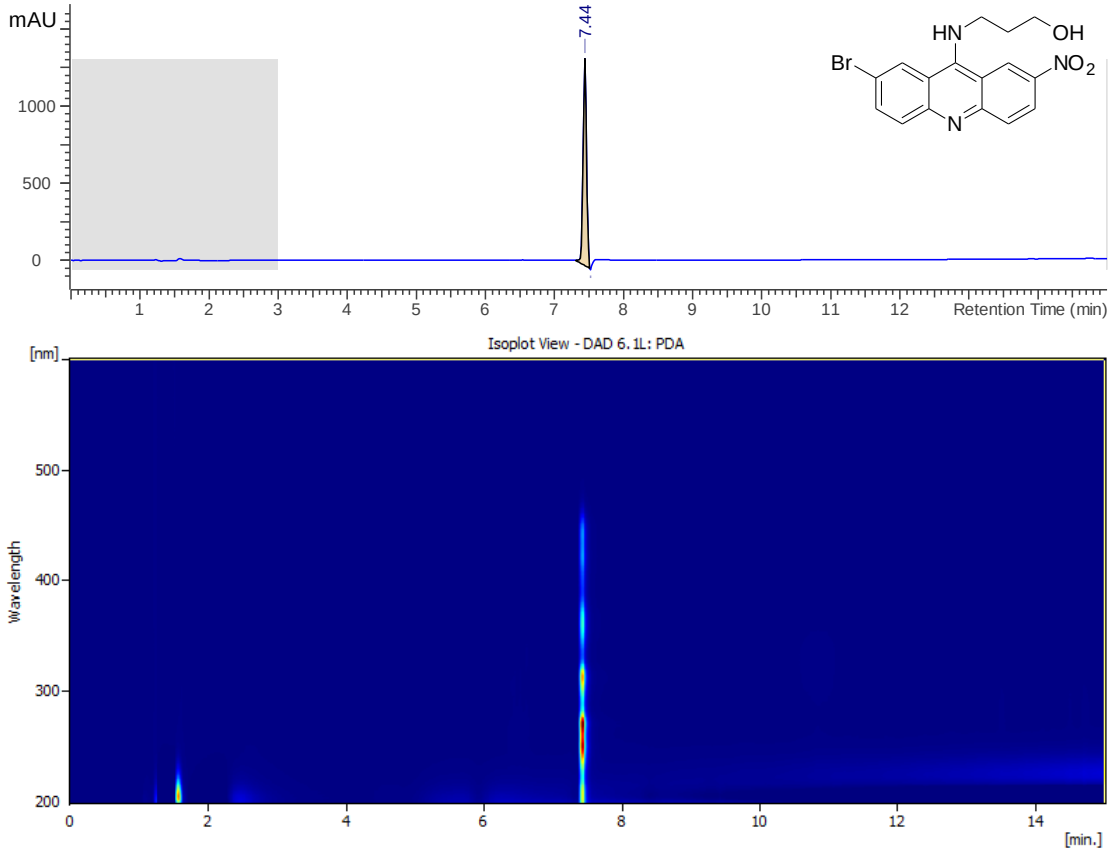
HPLC (gradient 20–100, Knauer Eurospher II 100-10 C18A) of **3** (upper trace 254 nm)



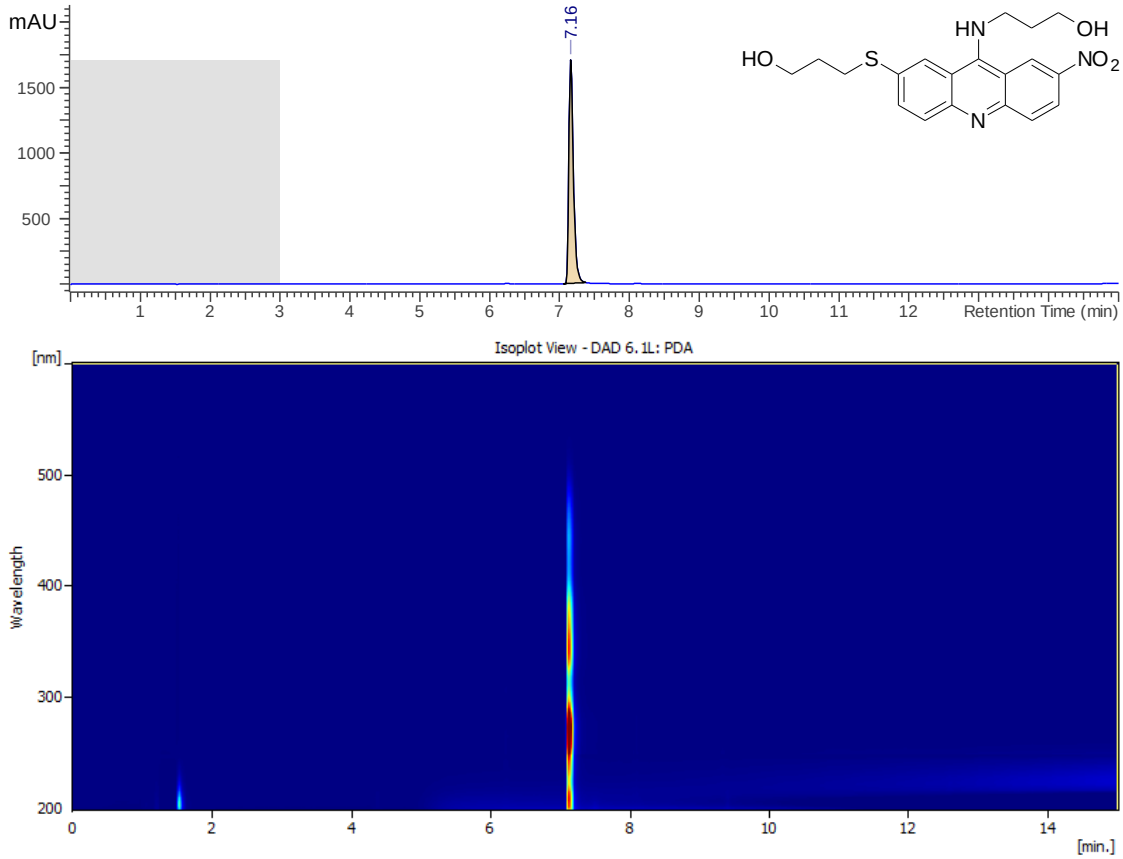
HPLC (gradient 5–50, Knauer Eurospher II 100-10 C18A) of **3** (upper trace 254 nm)



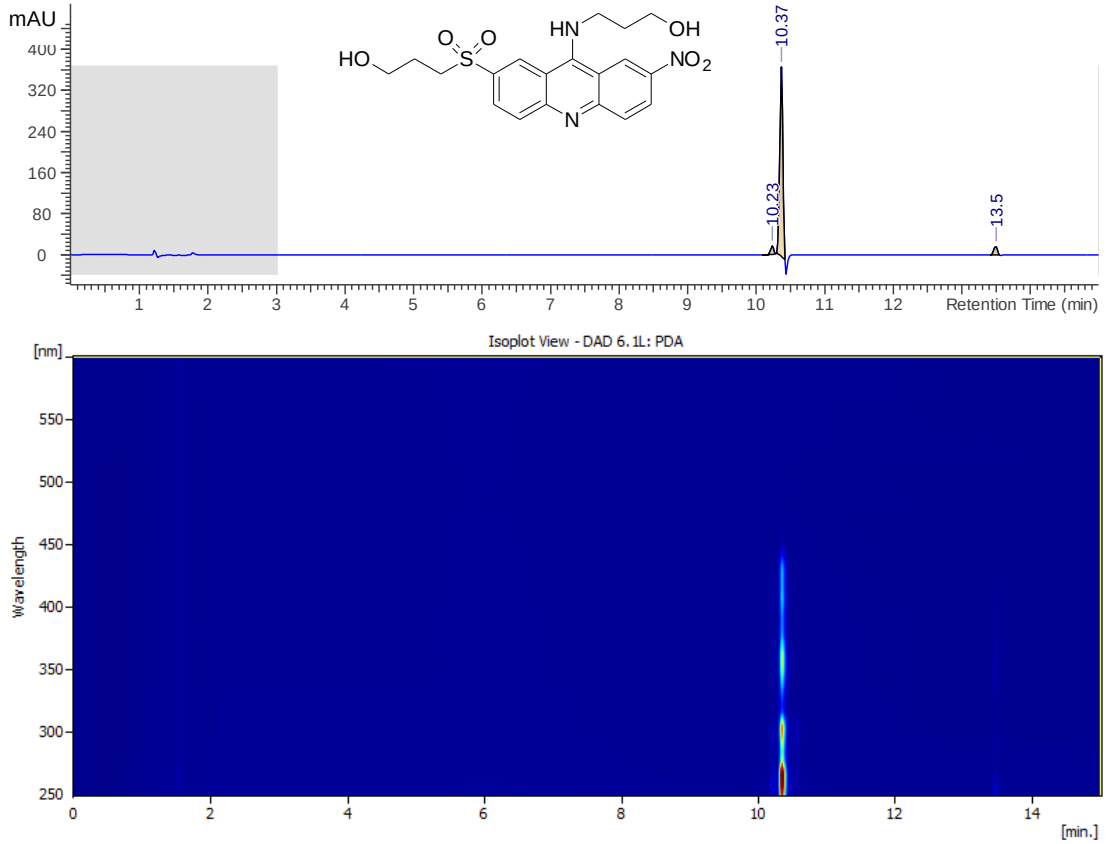
HPLC (gradient 20–100) of **15** (upper trace 254 nm)



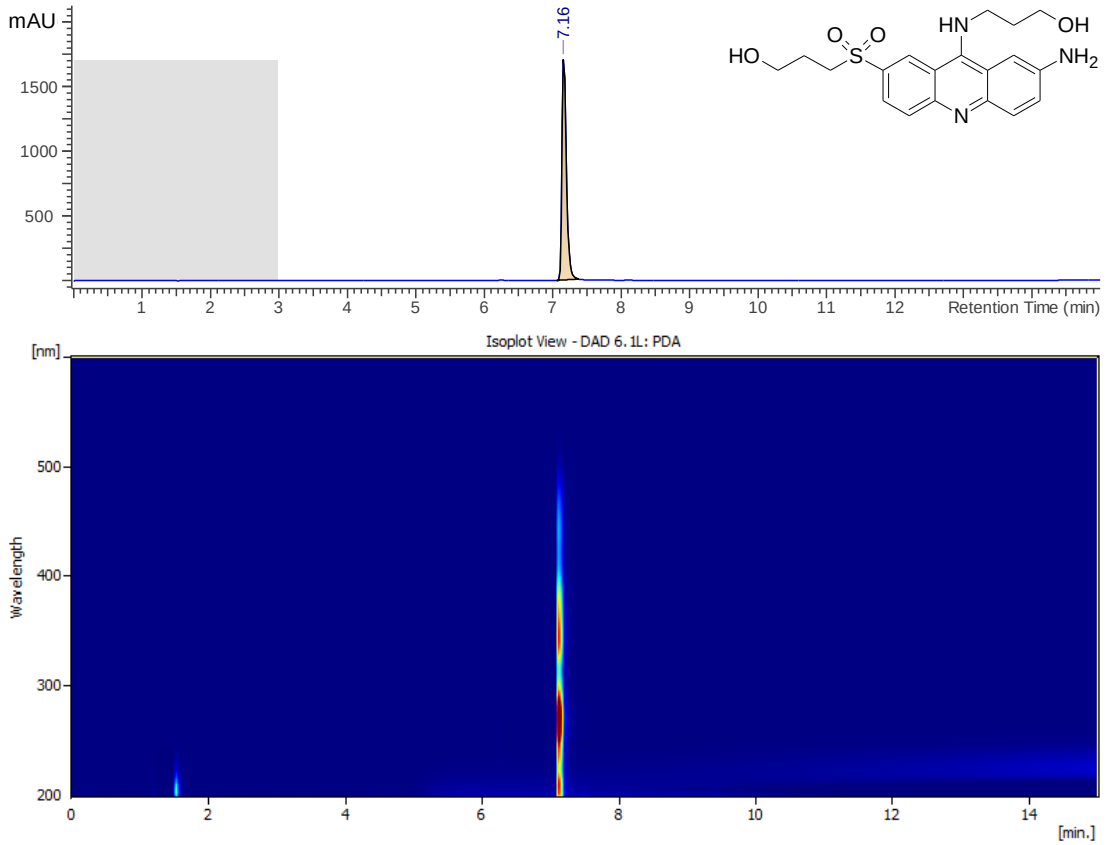
HPLC (gradient 20–100) of **16** (upper trace 350 nm)



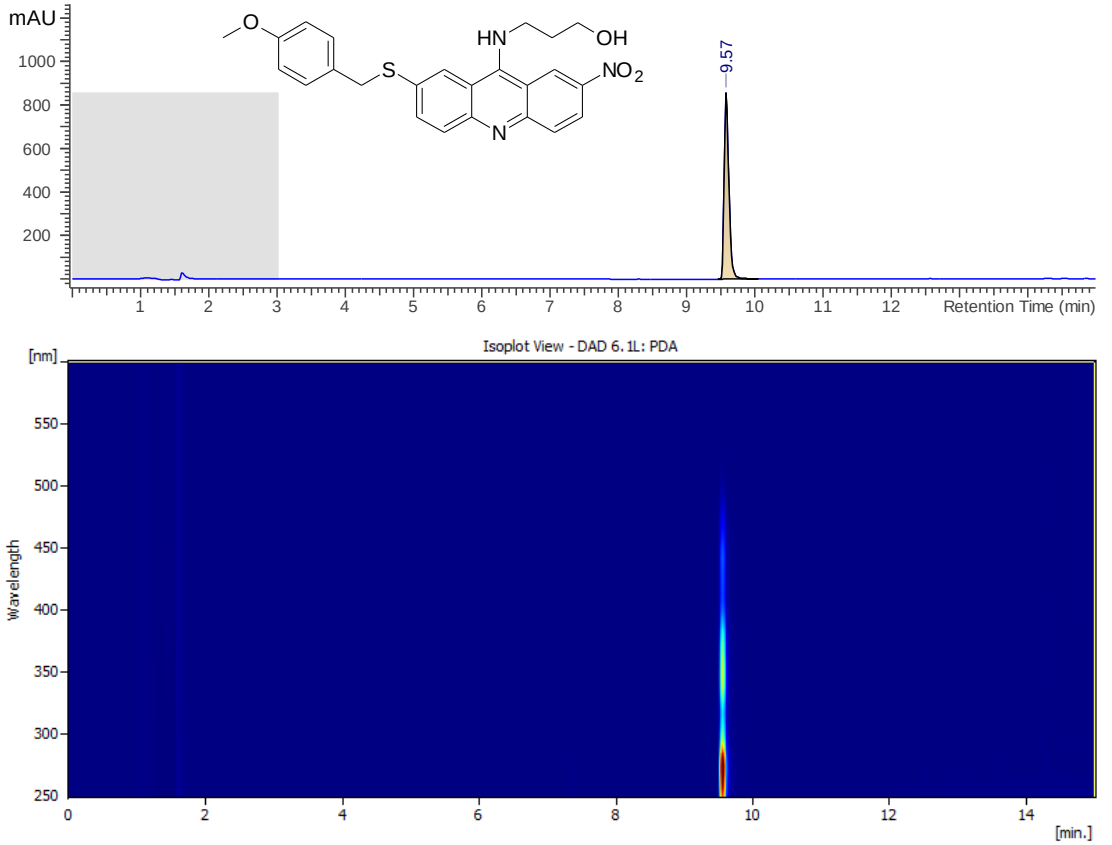
HPLC (gradient 5–50) of **17** (upper trace 254 nm)



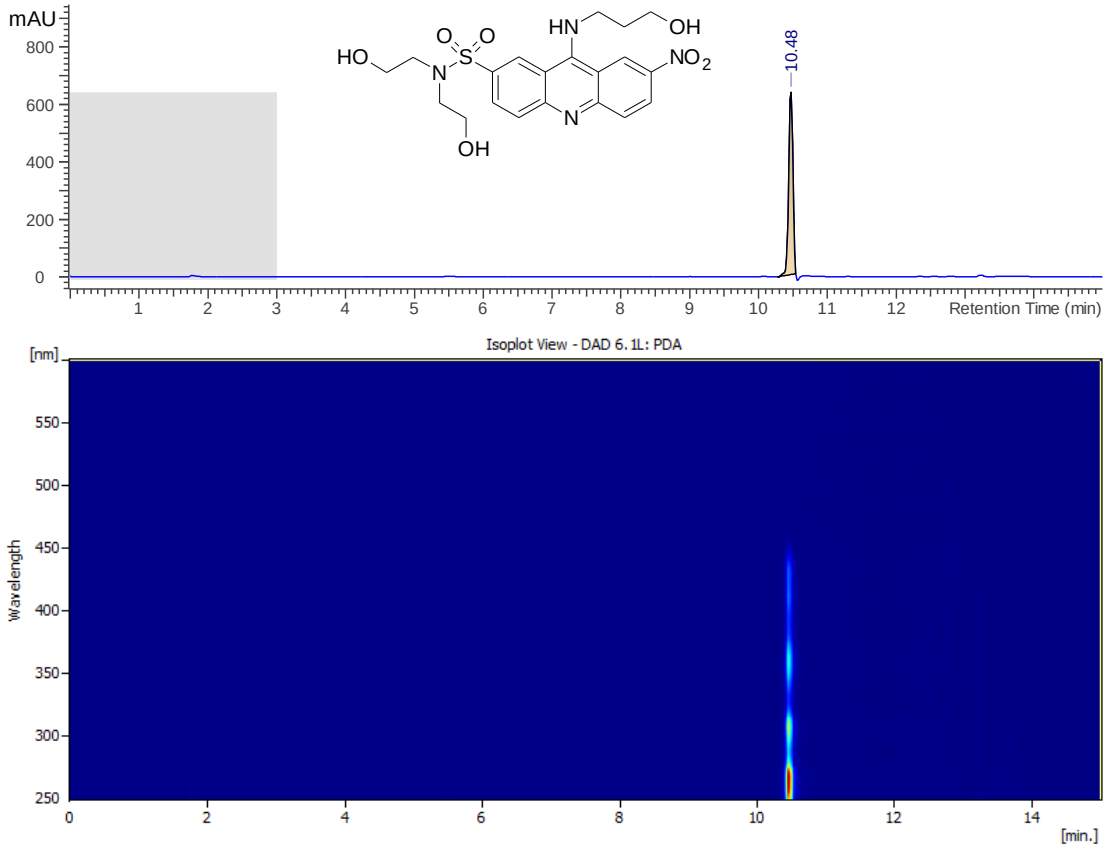
HPLC (gradient 5–50) of **4** (upper trace 350 nm)



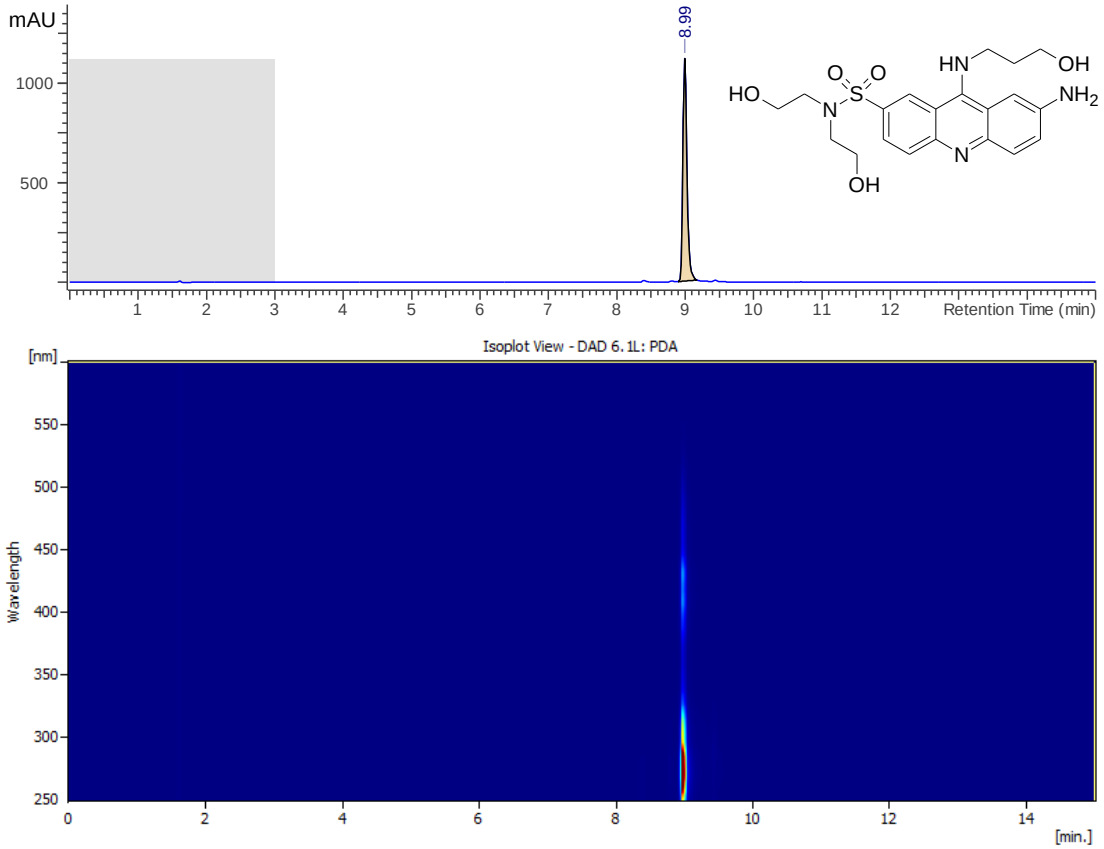
HPLC (gradient 20–100) of **18** (upper trace 350 nm)



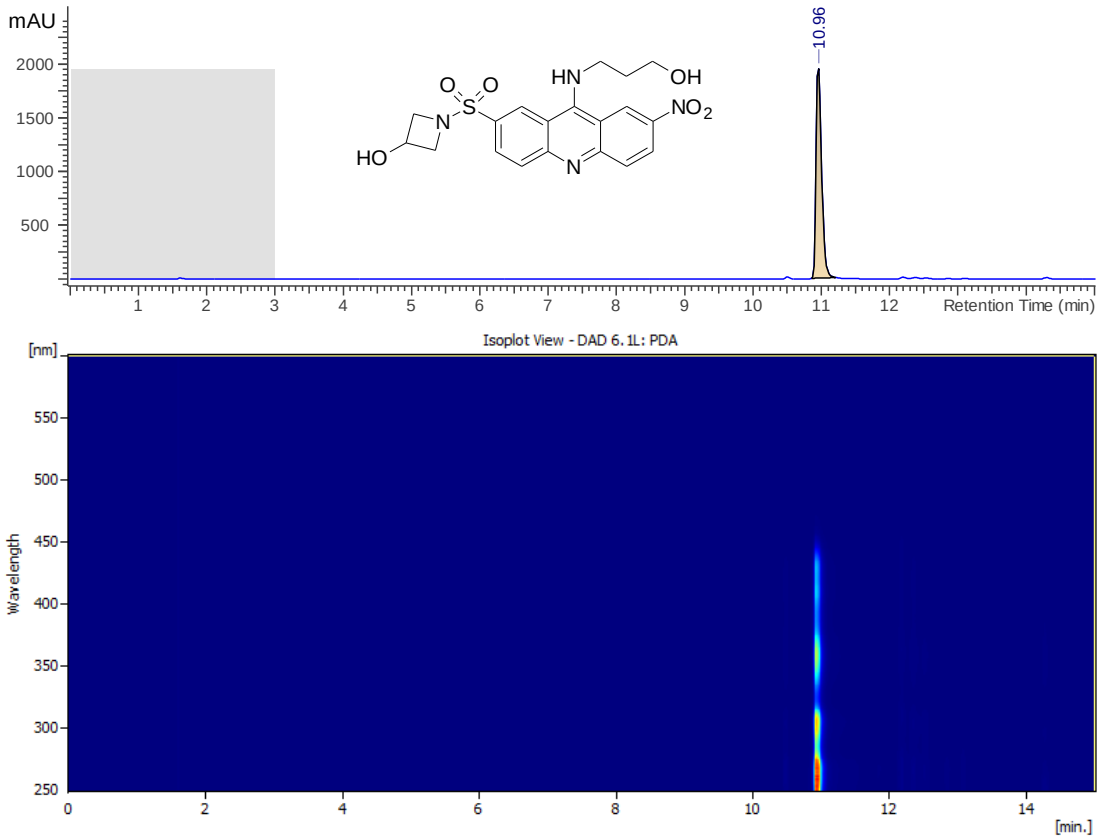
HPLC (gradient 5–50) of **20** (upper trace 254 nm)



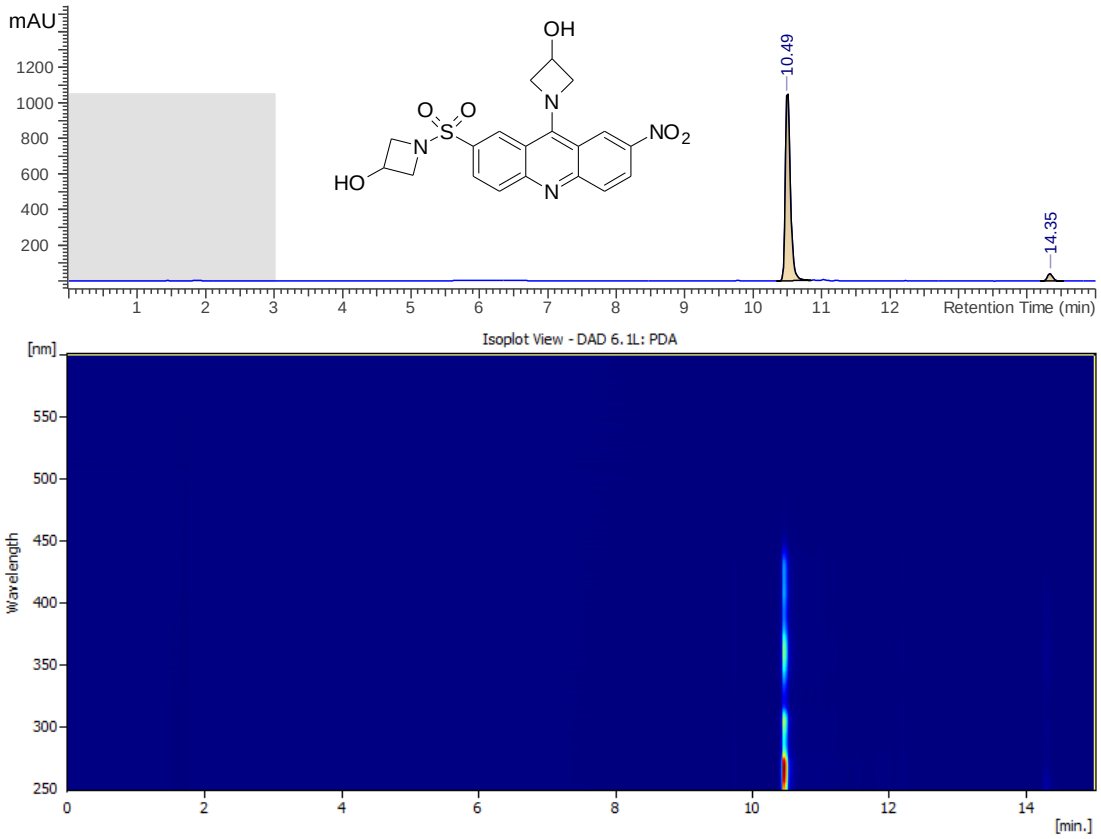
HPLC (gradient 5–50) of **5** (upper trace 254 nm)



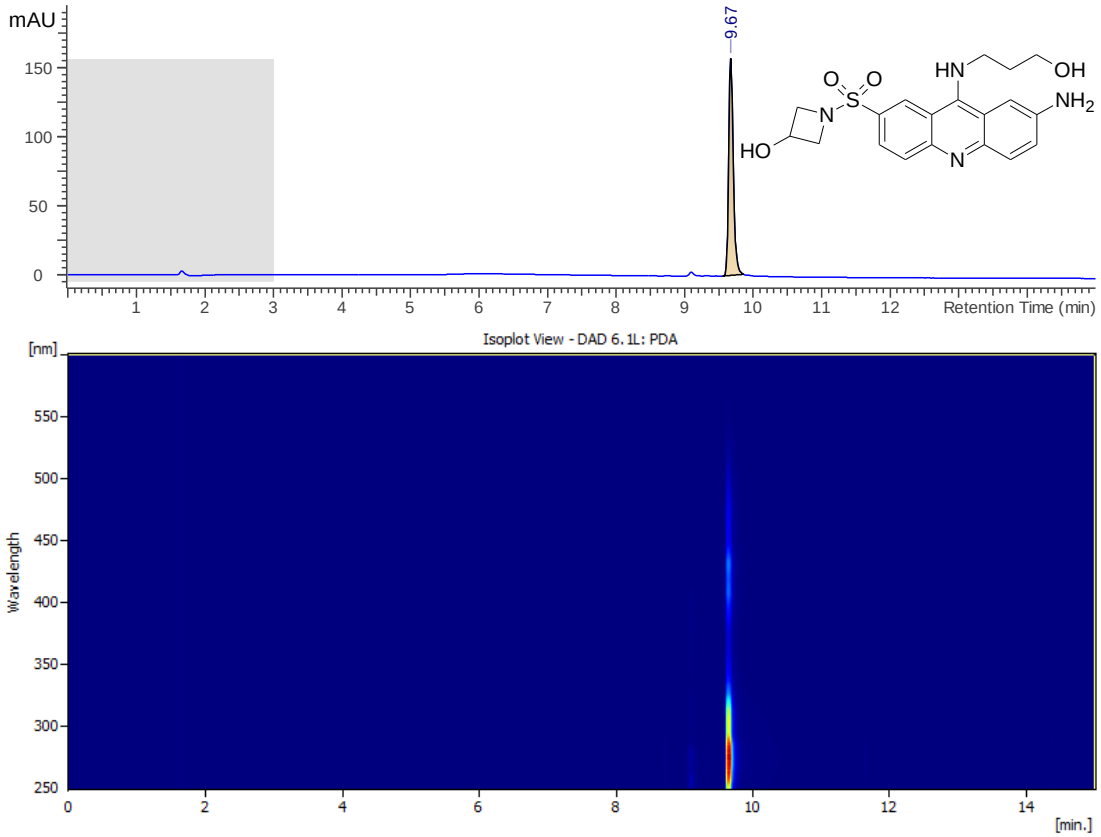
HPLC (gradient 5–50) of **21** (upper trace 350 nm)



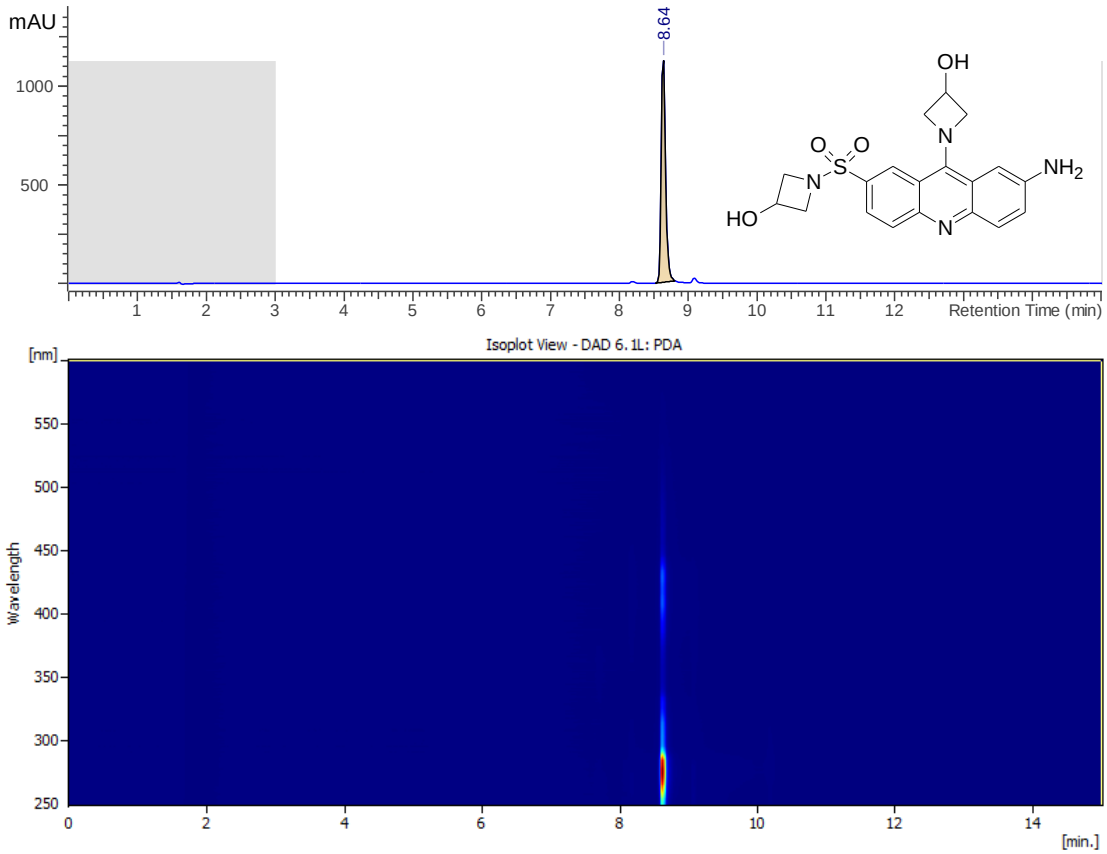
HPLC (gradient 5–50) of **22** (upper trace 350 nm)



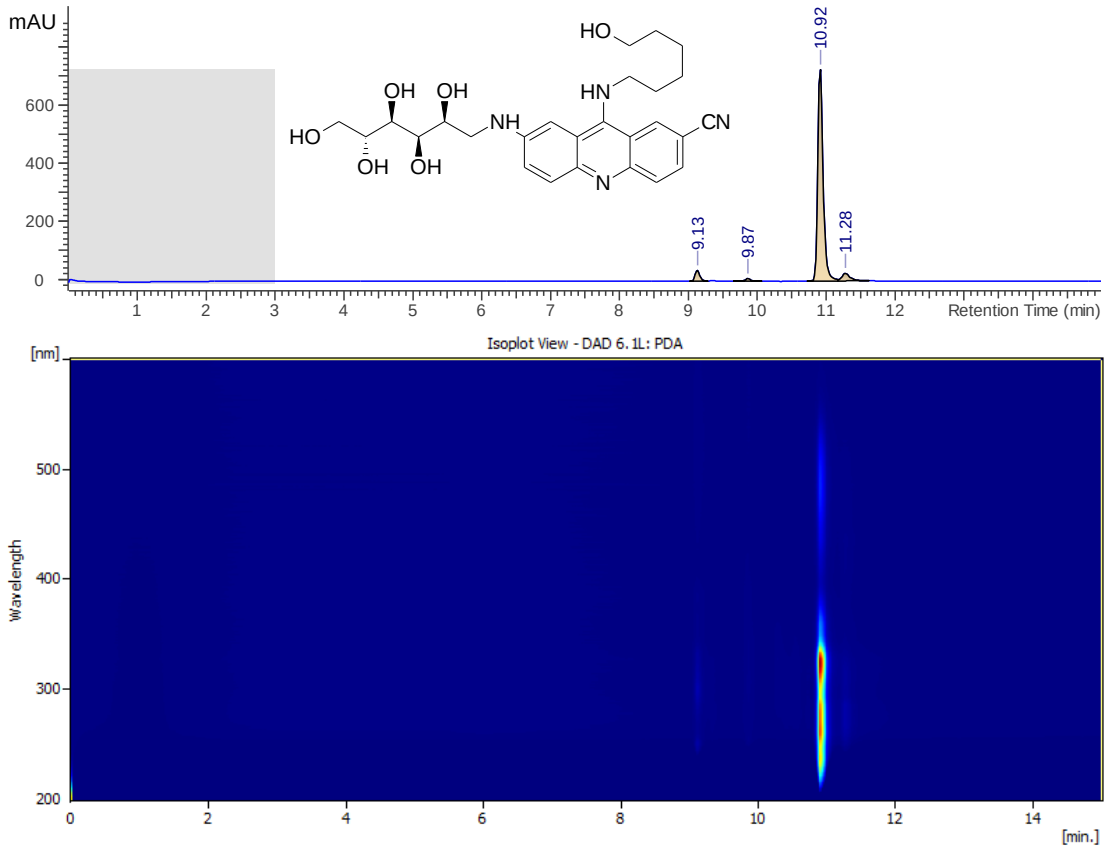
HPLC (gradient 5–50) of **6** (upper trace 350 nm)



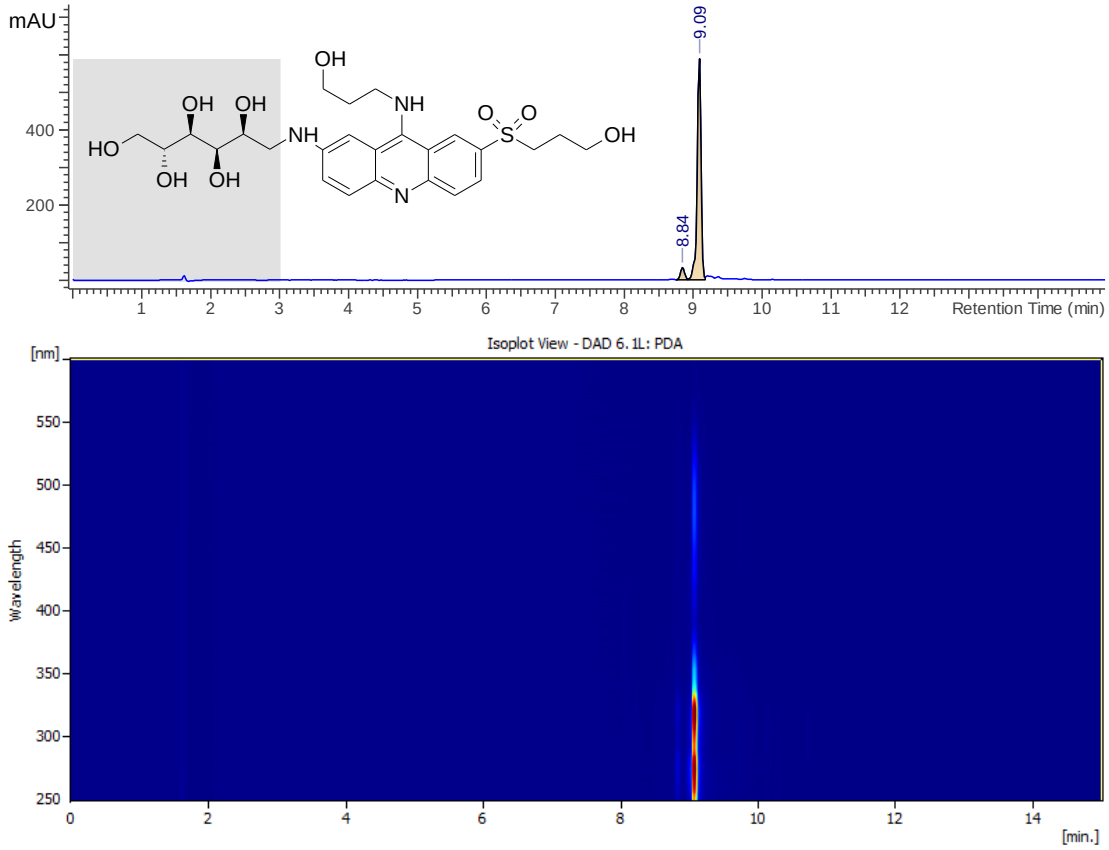
HPLC (gradient 5–50) of **7** (upper trace 254 nm)



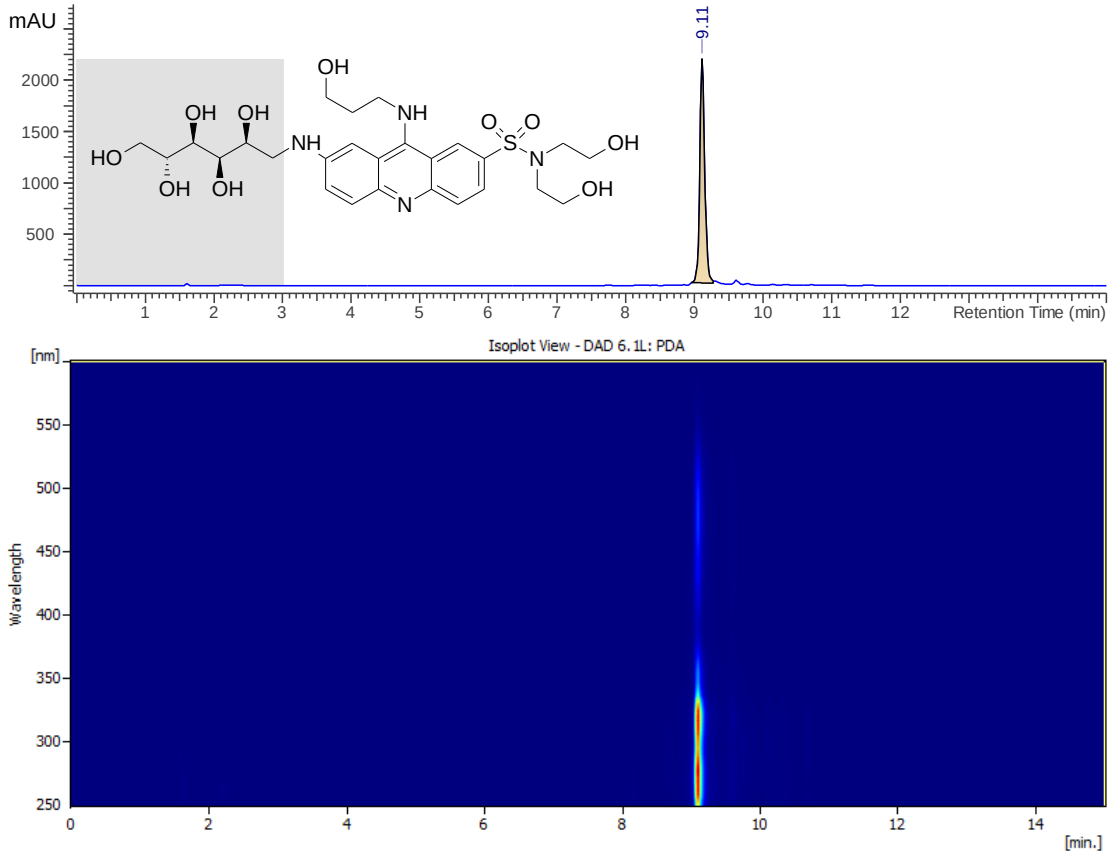
HPLC (gradient 5–50, Knauer Eurospher II 100-10 C18A) of **3**-G (upper trace 254 nm)



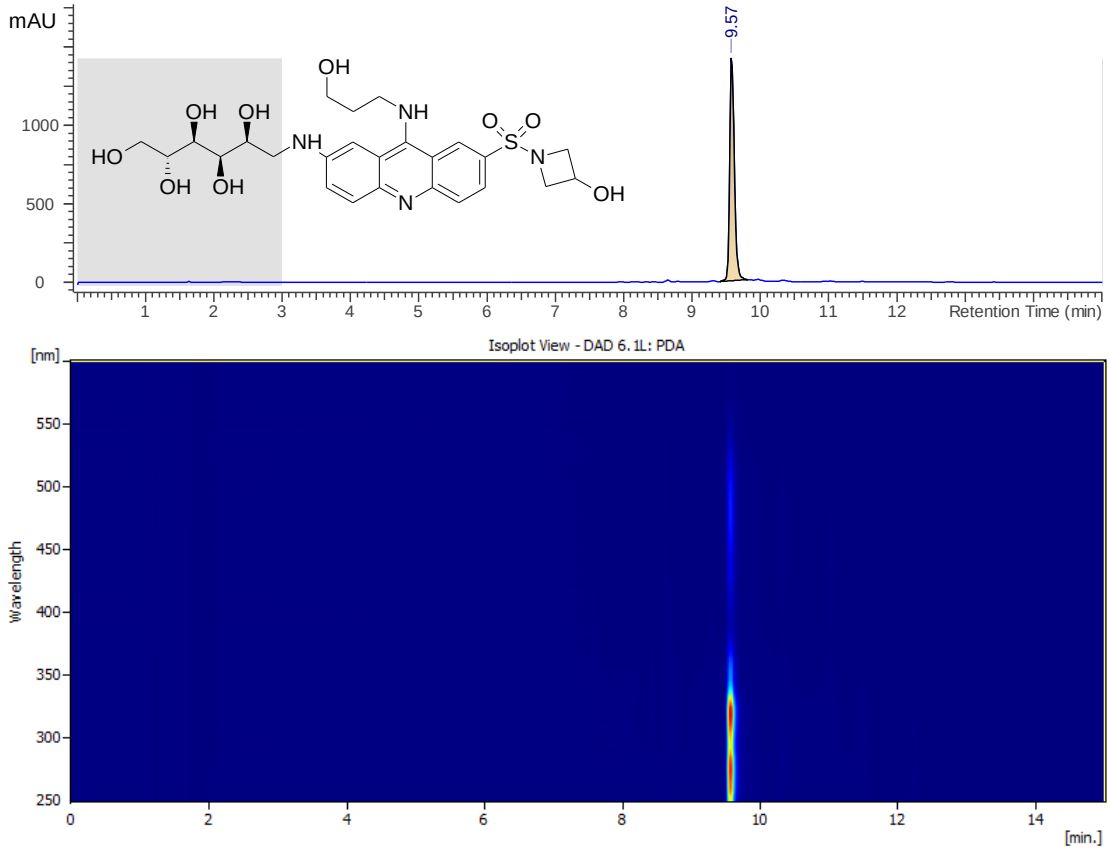
HPLC (gradient 5–50) of **4**-G (upper trace 254 nm)



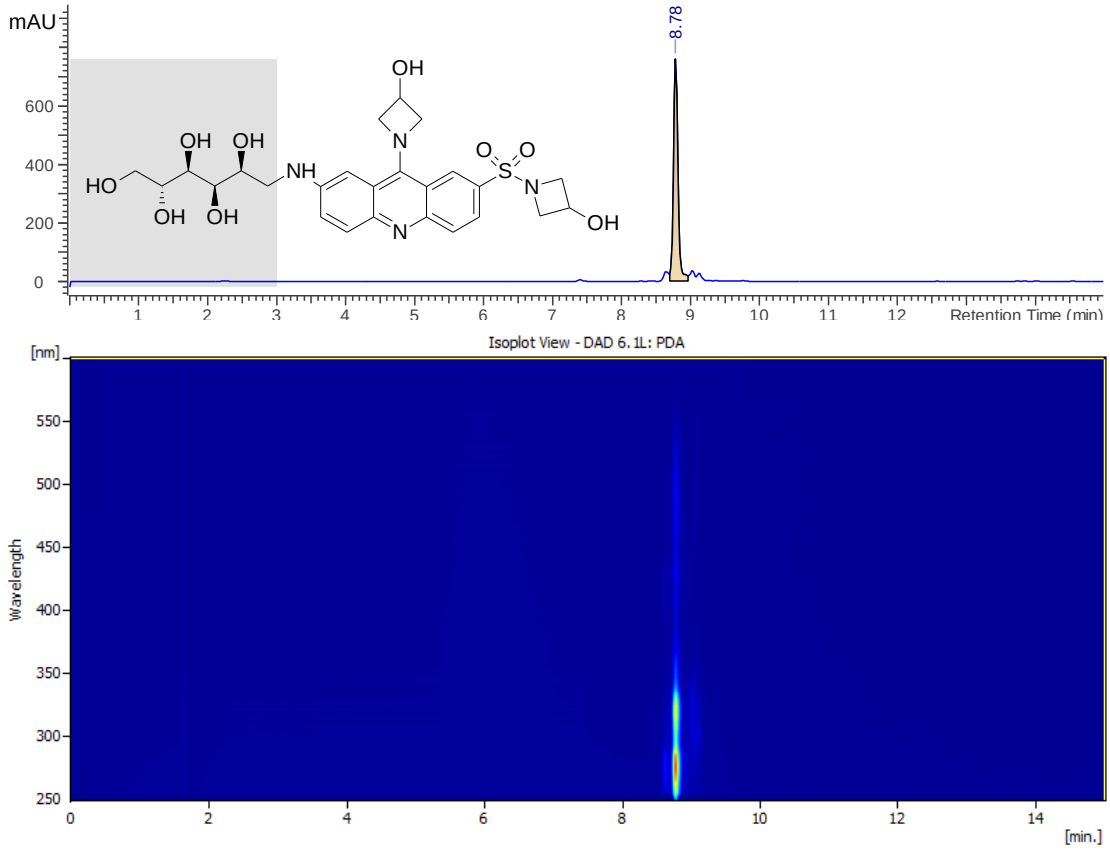
HPLC (gradient 5–50) of **5**-G (upper trace 254 nm)



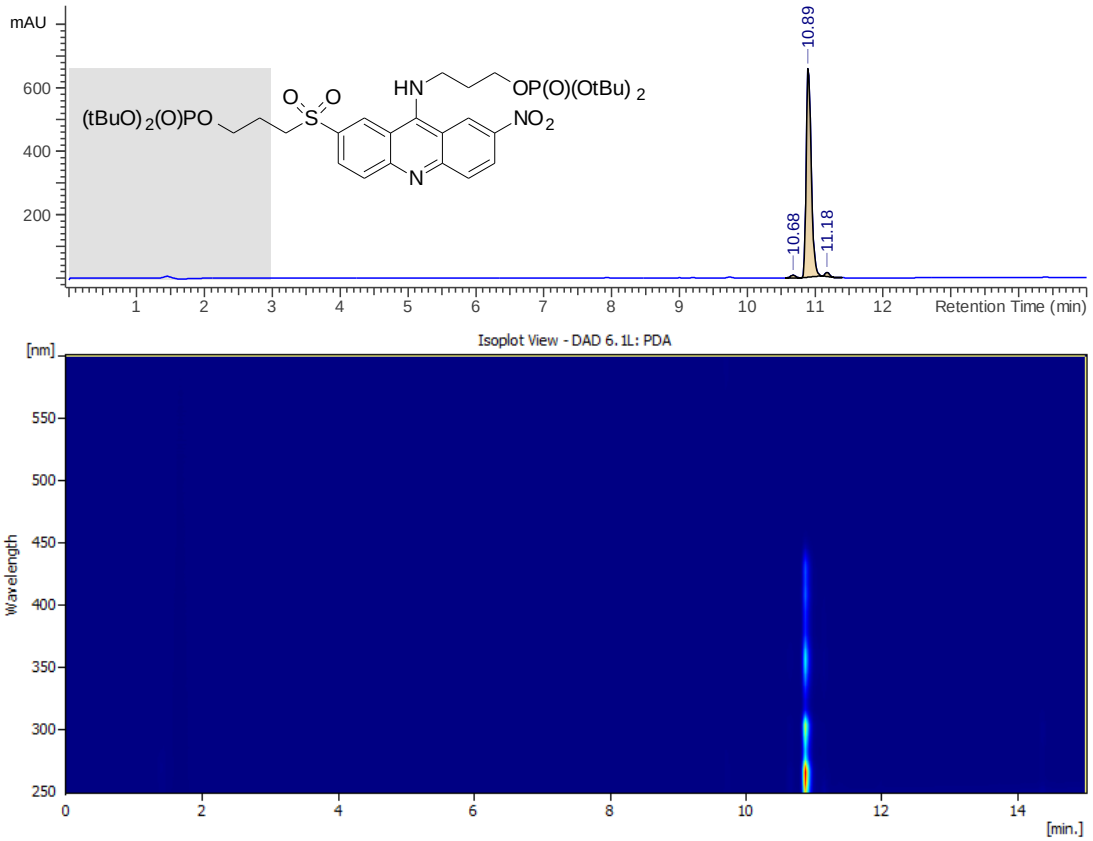
HPLC (gradient 5–50) of **6**-G (upper trace 254 nm)



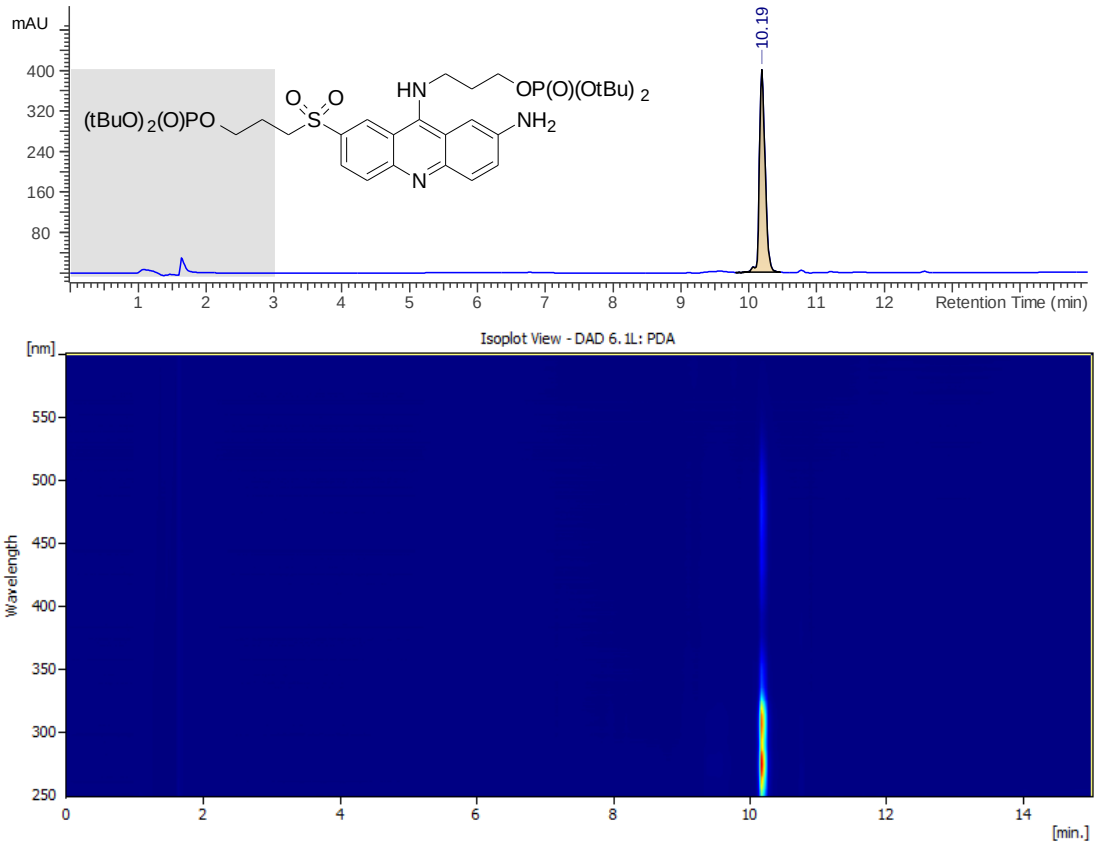
HPLC (gradient 5–50) of **7**-G (upper trace 254 nm)



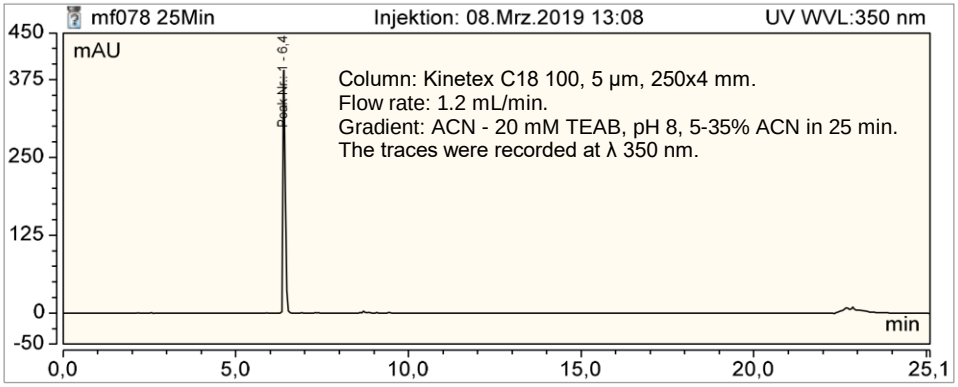
HPLC (gradient 20–100) of **23** (upper trace 350 nm)

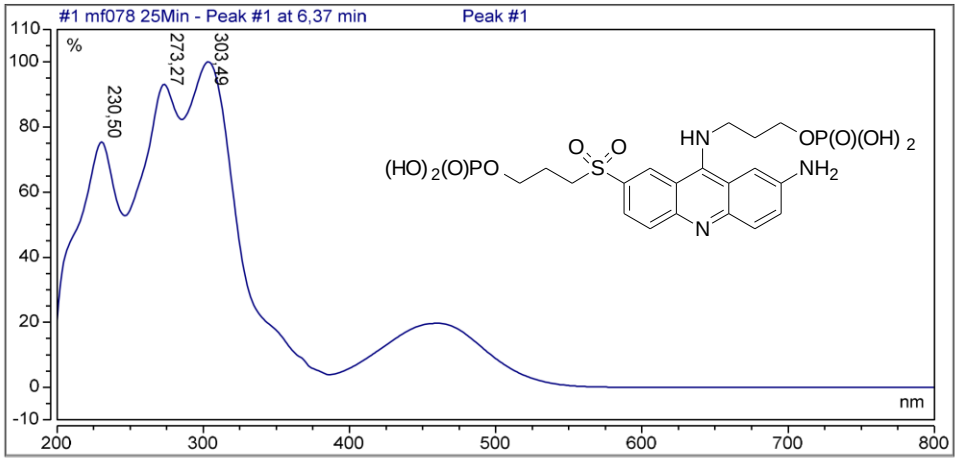


HPLC (gradient 20–100) of **24** (upper trace 350 nm)

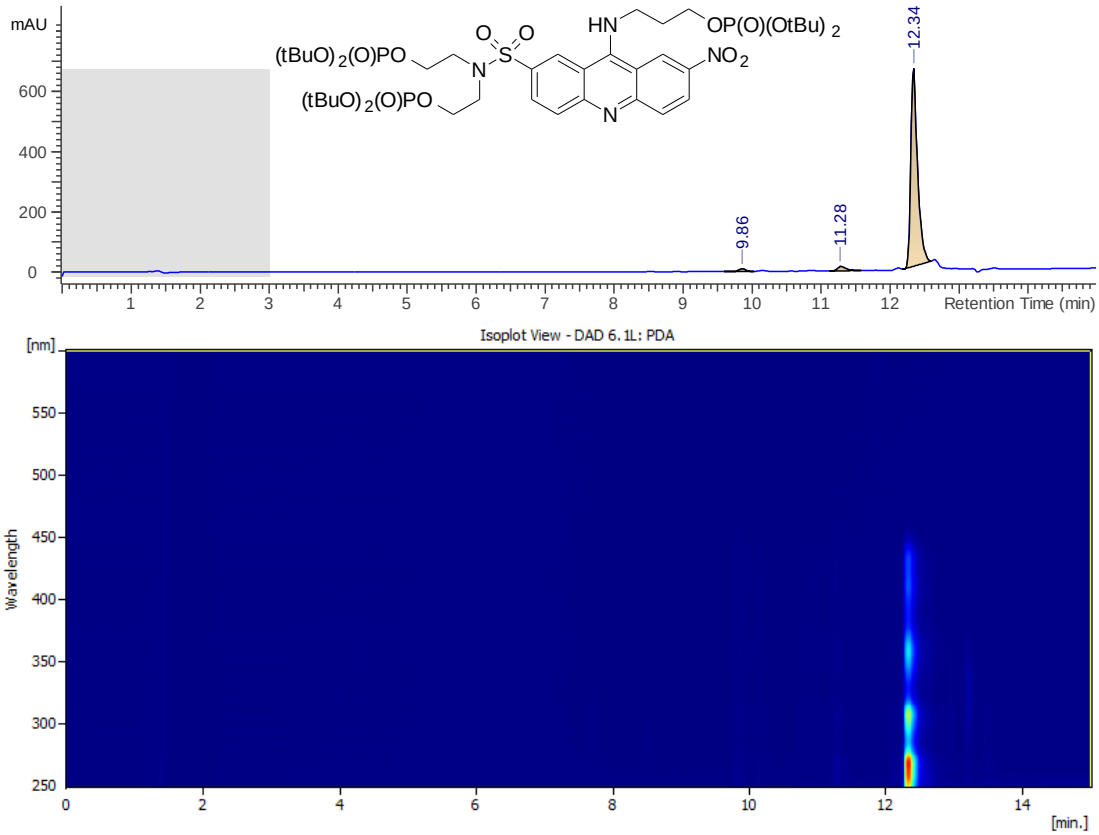


HPLC of **1**

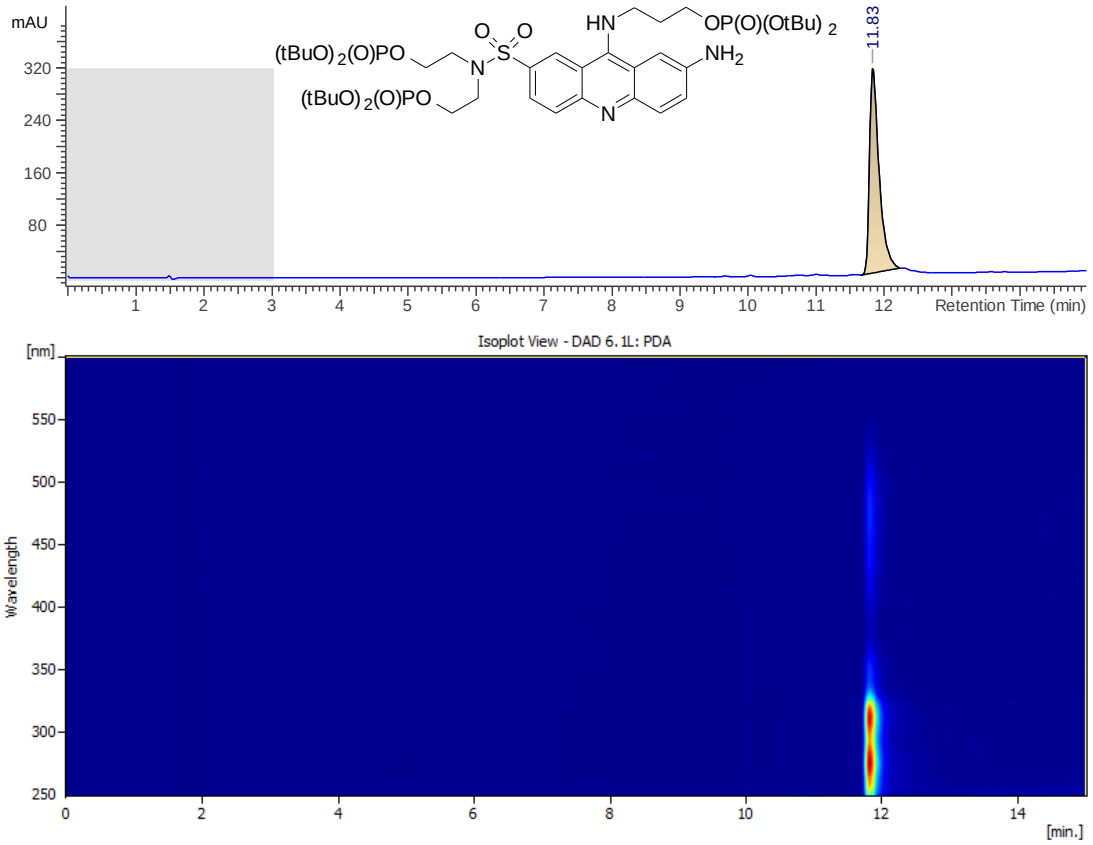




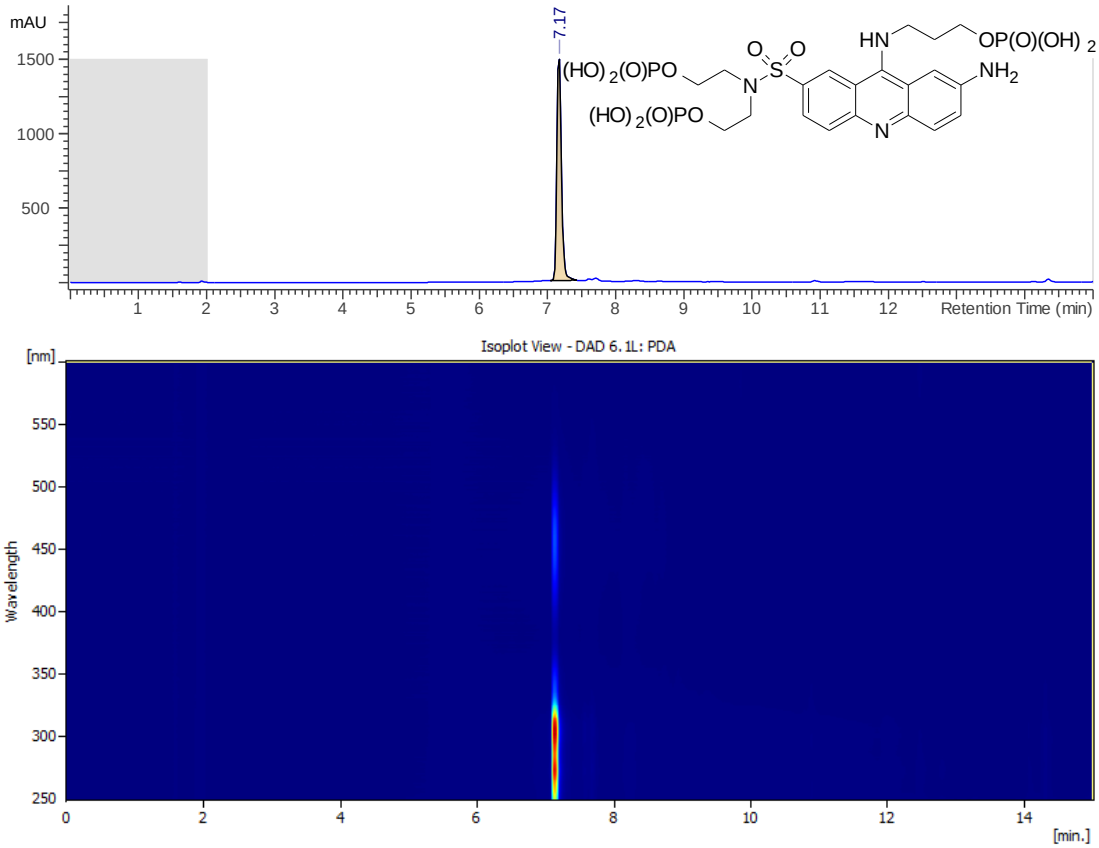
HPLC (gradient 20–100) of **25** (upper trace 254 nm)



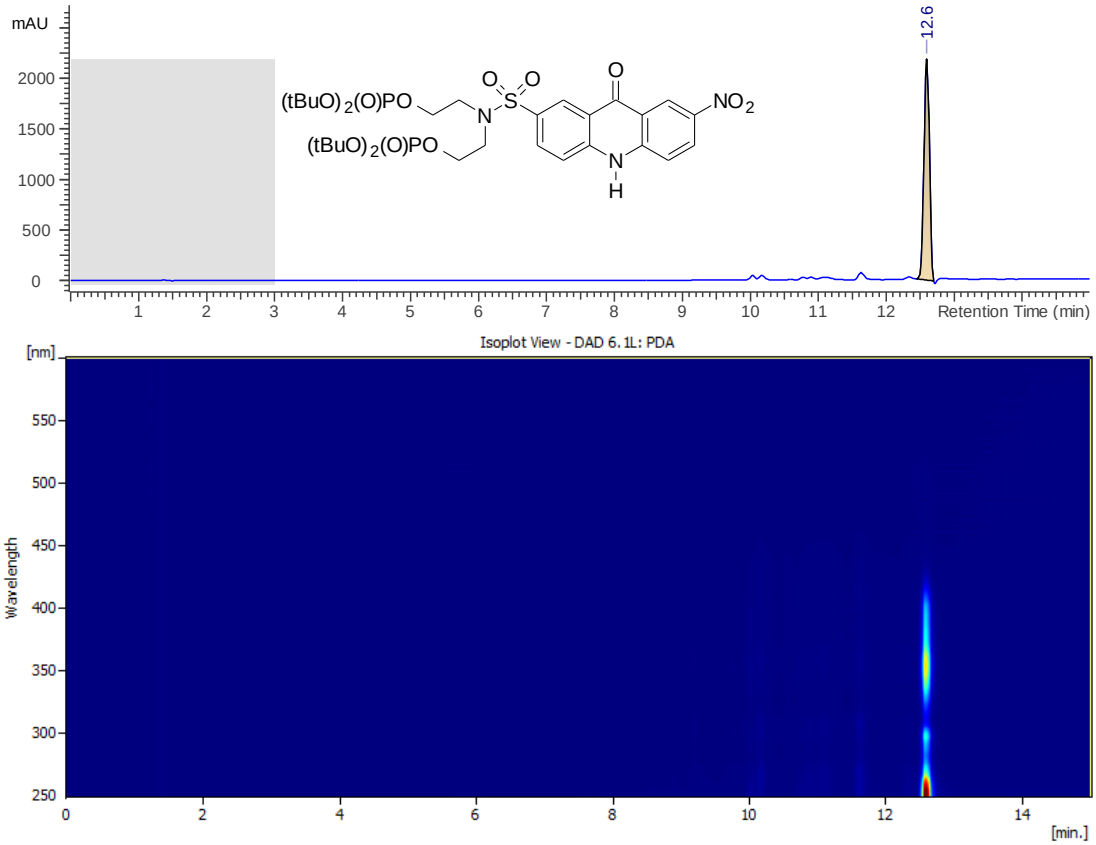
HPLC (gradient 20–100) of **27** (upper trace 254 nm)



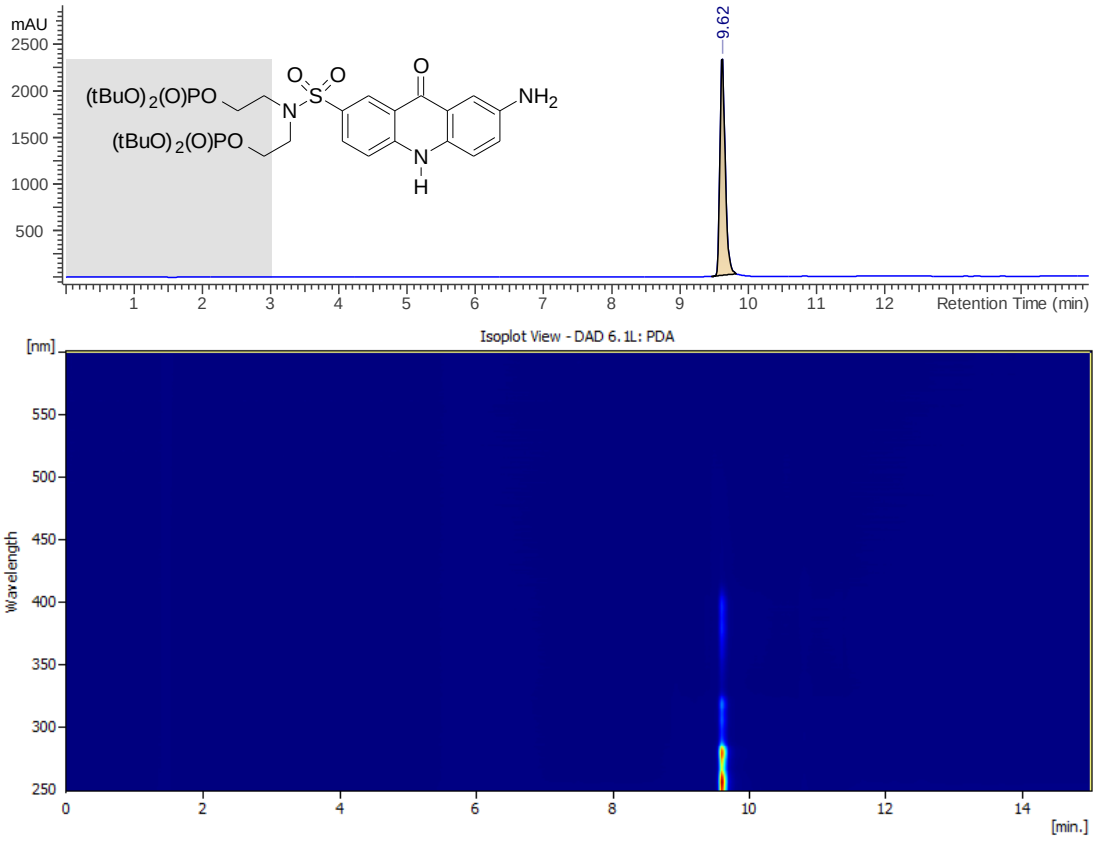
HPLC (Knauer Eurospher II 100-5 C18A, gradient TEAB-0–40) of **2** (upper trace 254 nm)



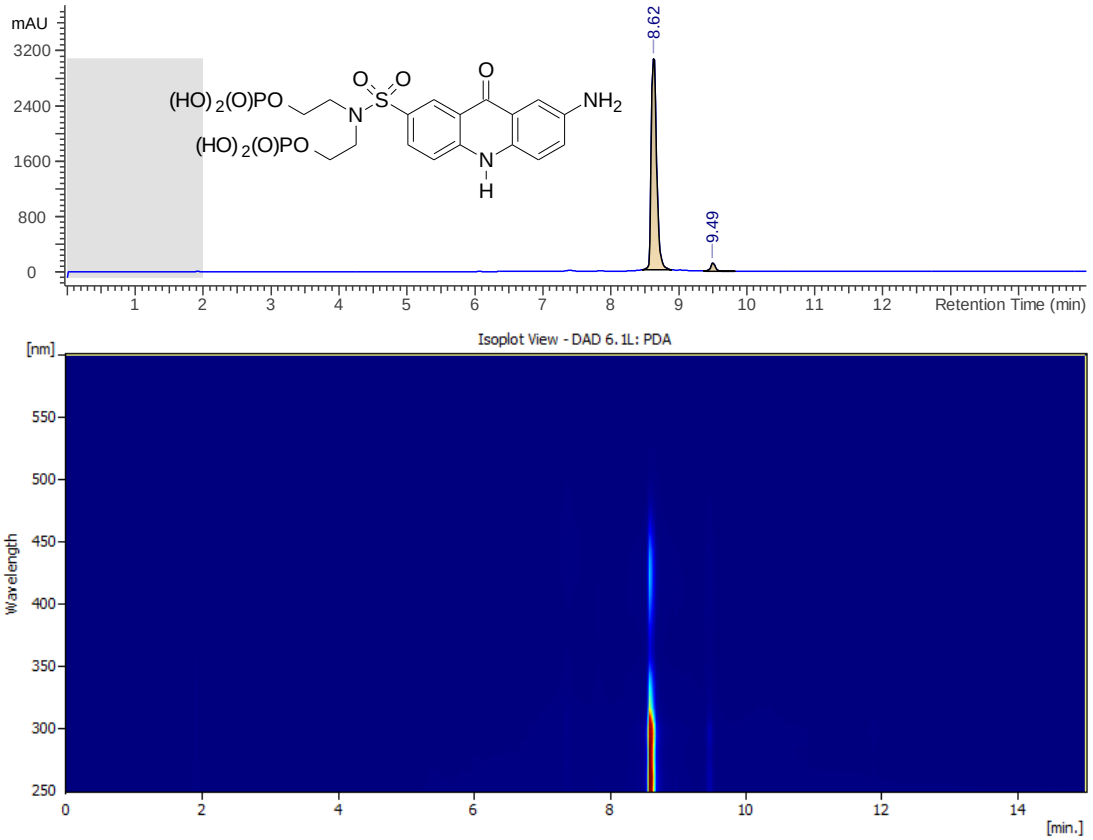
HPLC (gradient 20–100) of **26** (upper trace 254 nm)



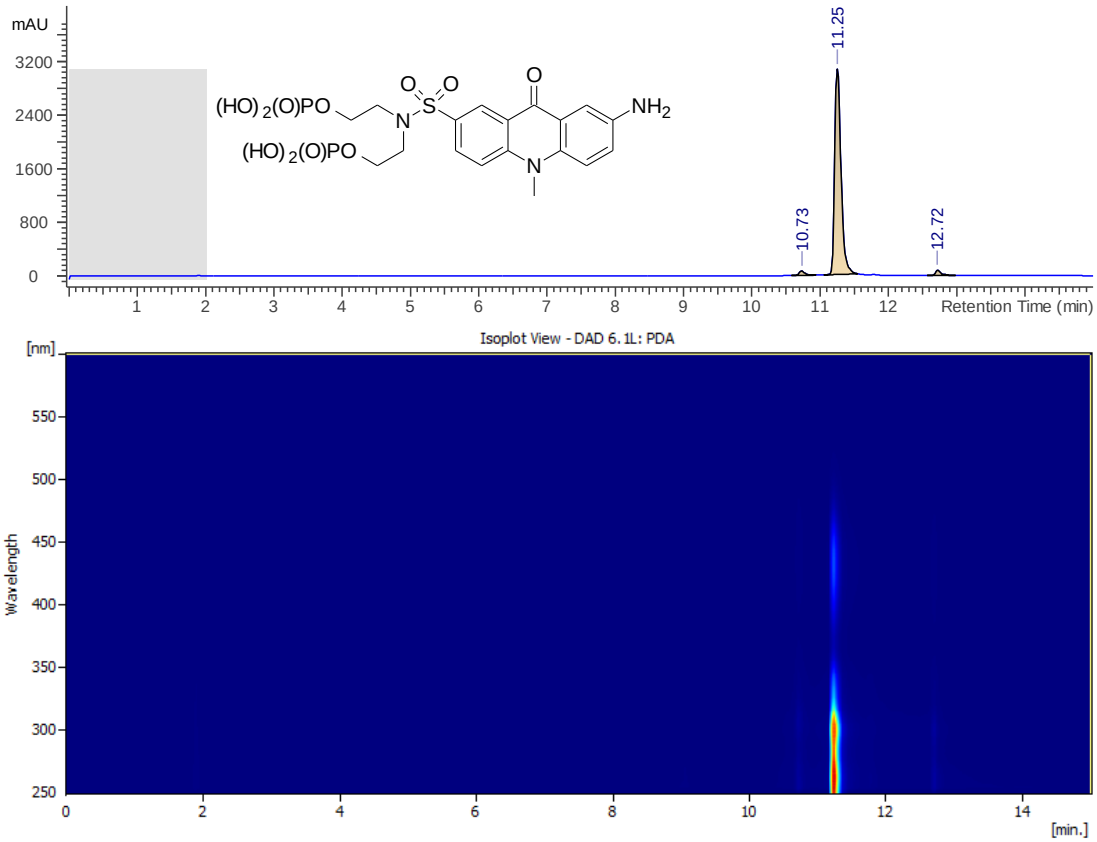
HPLC (gradient 20–100) of **28** (upper trace 254 nm)



HPLC (Knauer Eurospher II 100-5 C18A, gradient TEAB-0–40) of **29** (upper trace 254 nm)

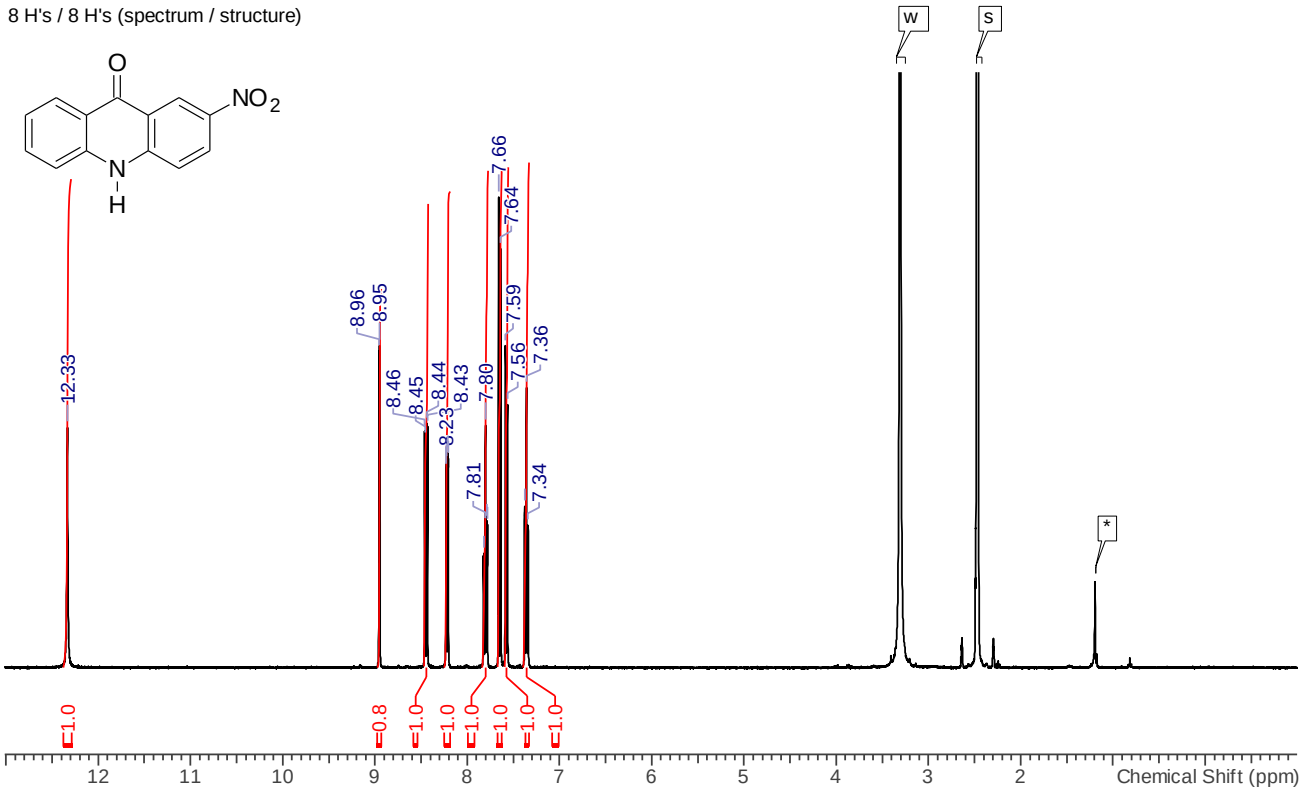


HPLC (Knauer Eurospher II 100-5 C18A, gradient TEAB-0–25) of **ASA** (upper trace 254 nm)

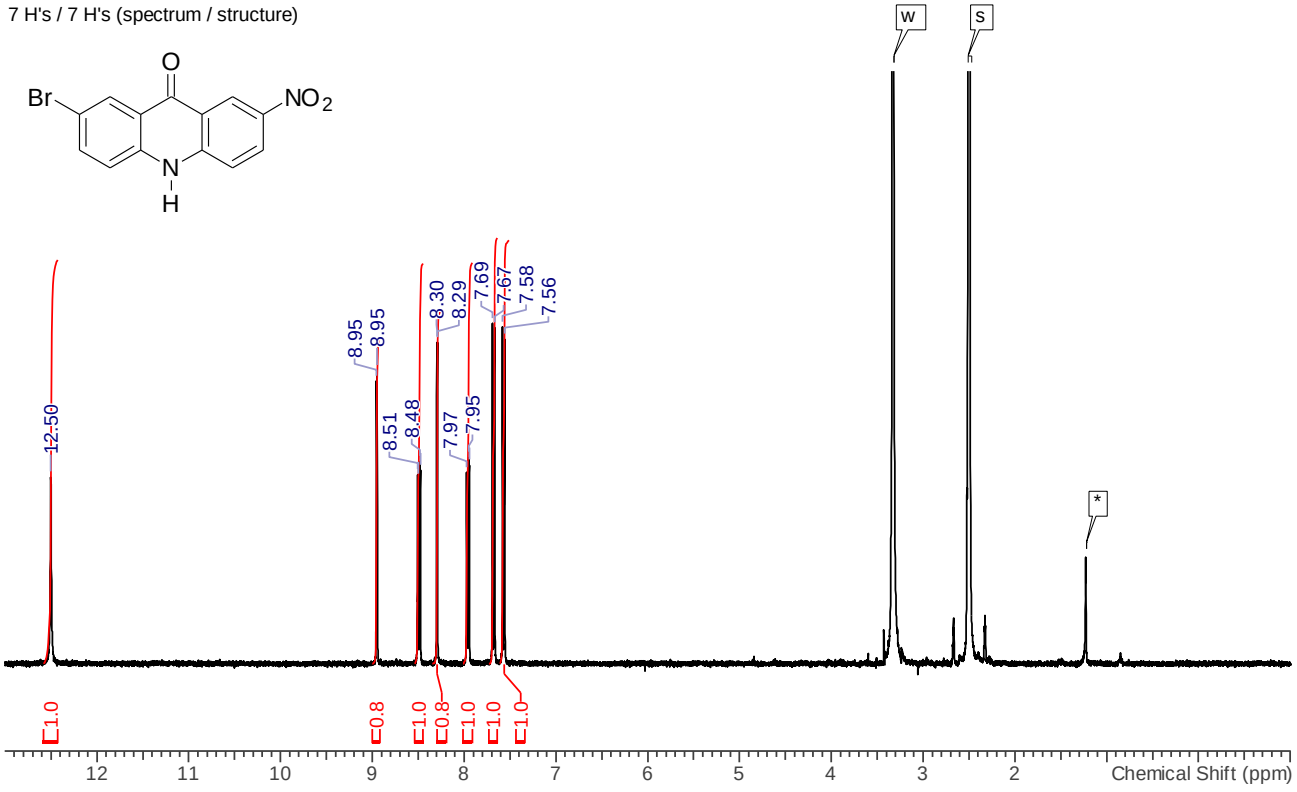


6. NMR Spectra

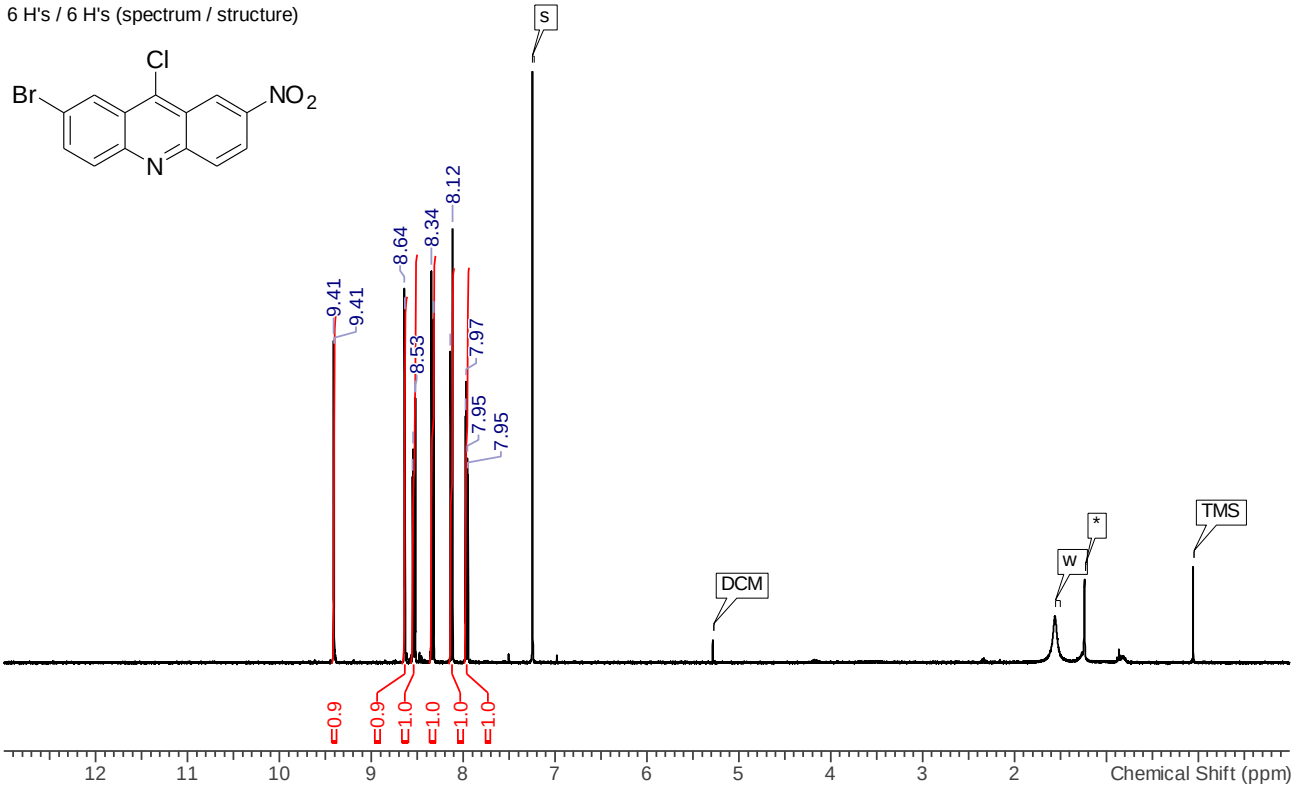
^{1}H NMR (DMSO-d$_6$, 400 MHz) for **9**; s: solvent, w: water, *: grease



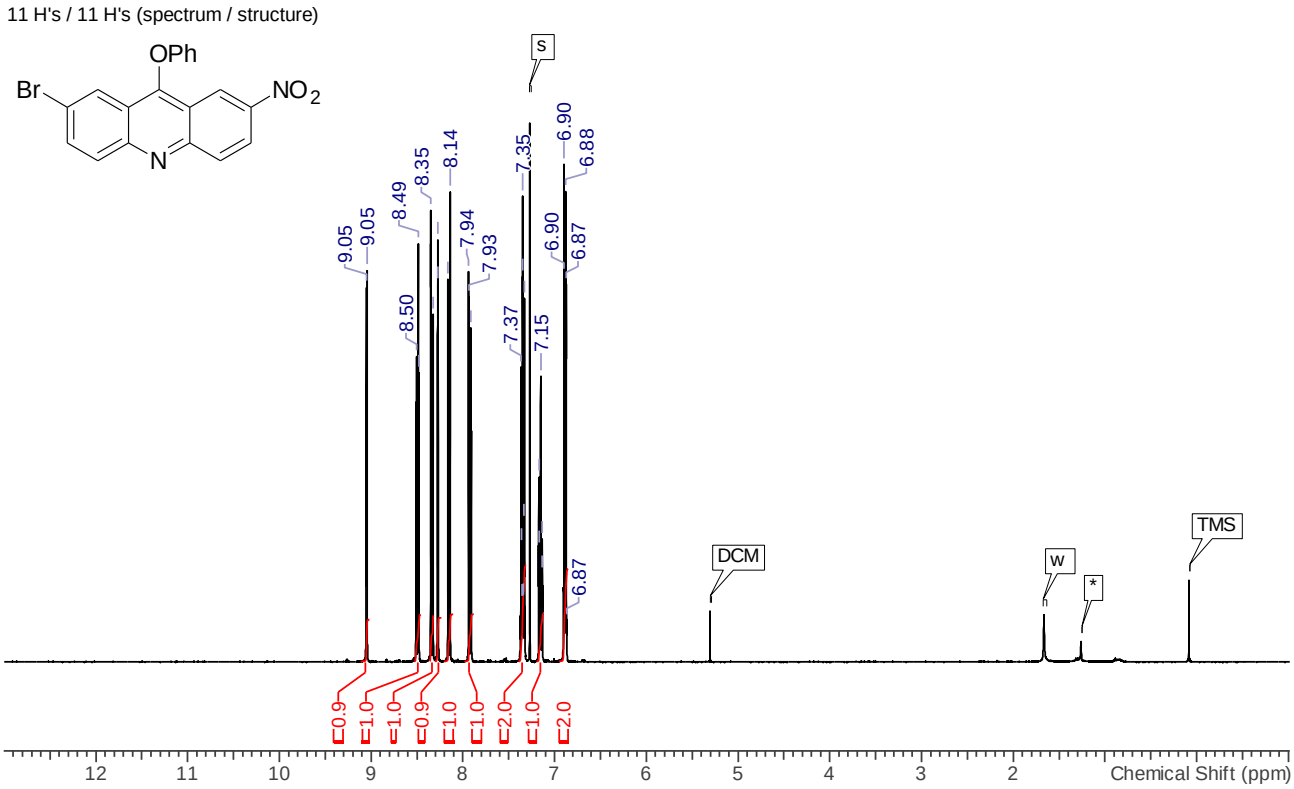
^{1}H NMR (DMSO-d$_6$, 400 MHz) for **10**; s: solvent, w: water, *: grease



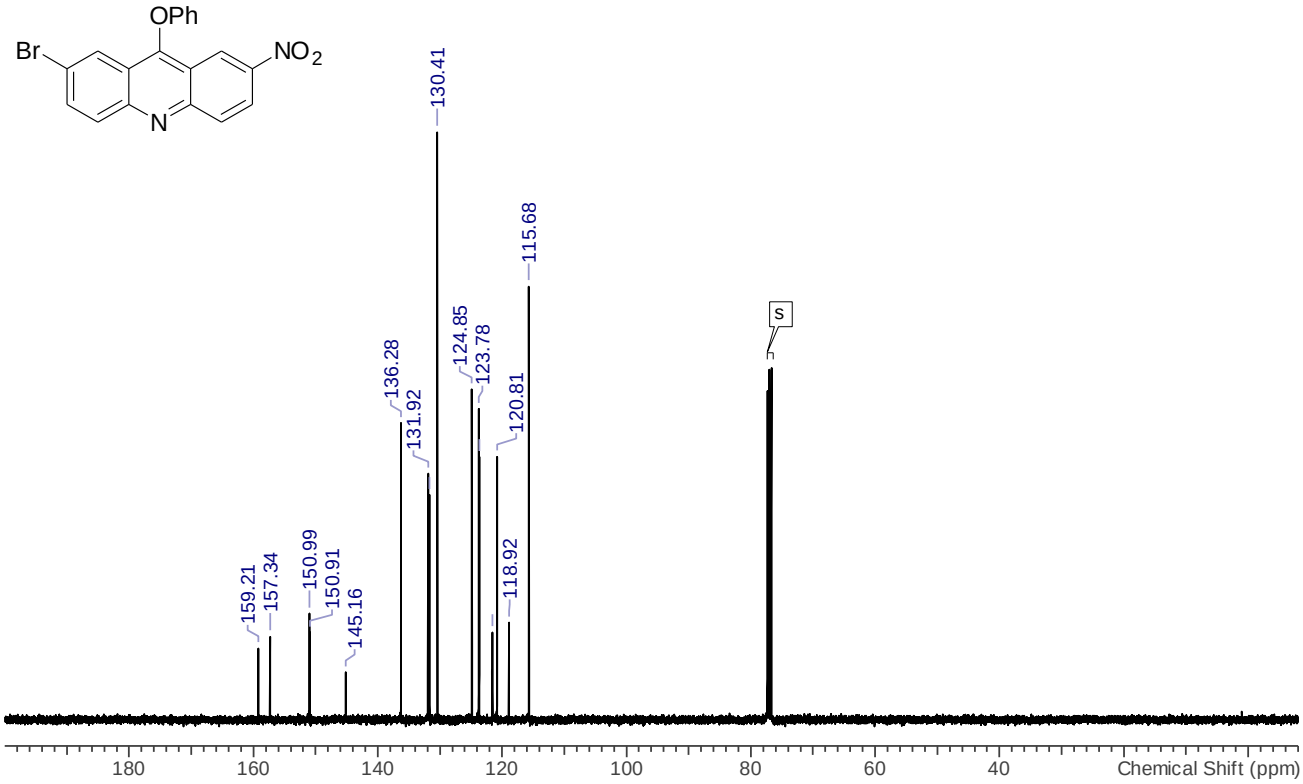
^{1}H NMR ($CDCl_3$, 400 MHz) for **11**; s: solvent, DCM: dichloromethane, w: water, *: grease, TMS: tetramethylsilane



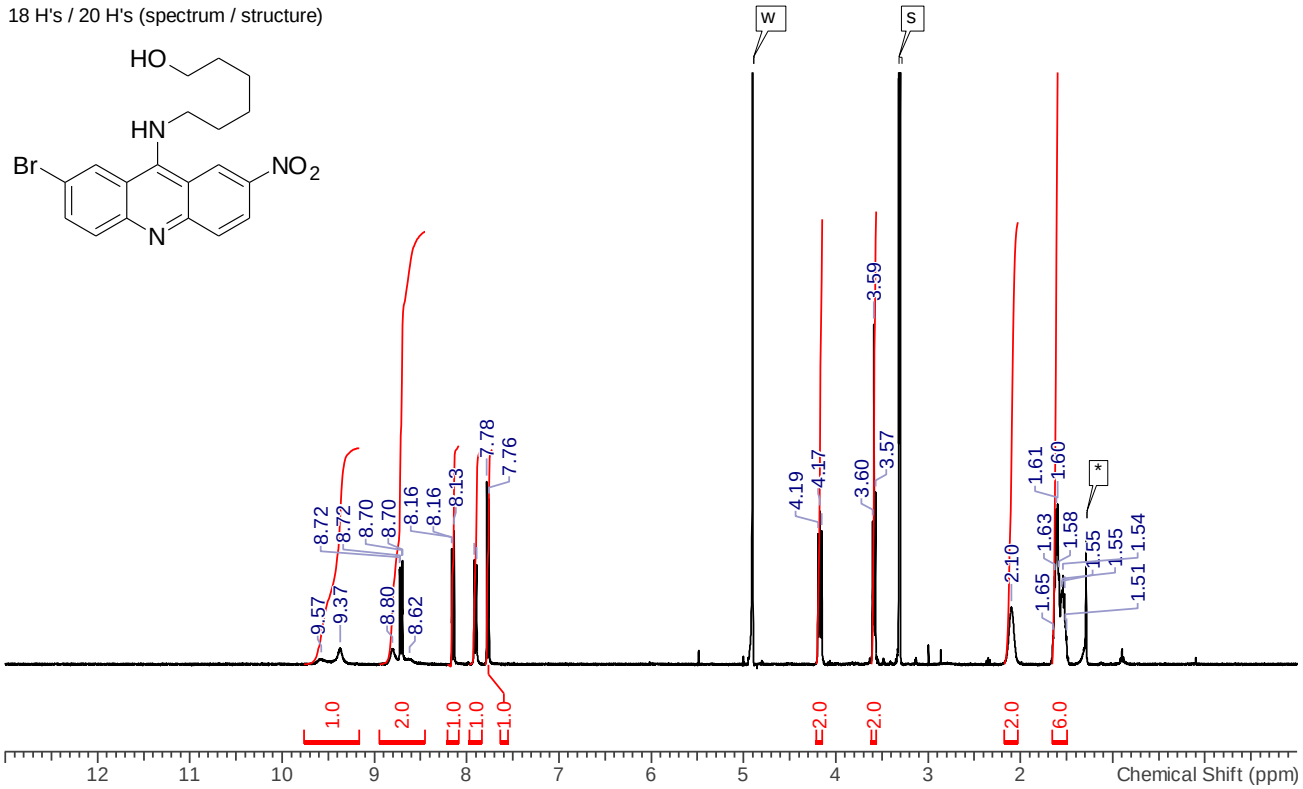
^{1}H NMR ($CDCl_3$, 400 MHz) for **12**; s: solvent, DCM: dichloromethane, w: water, *: grease, TMS: tetramethylsilane



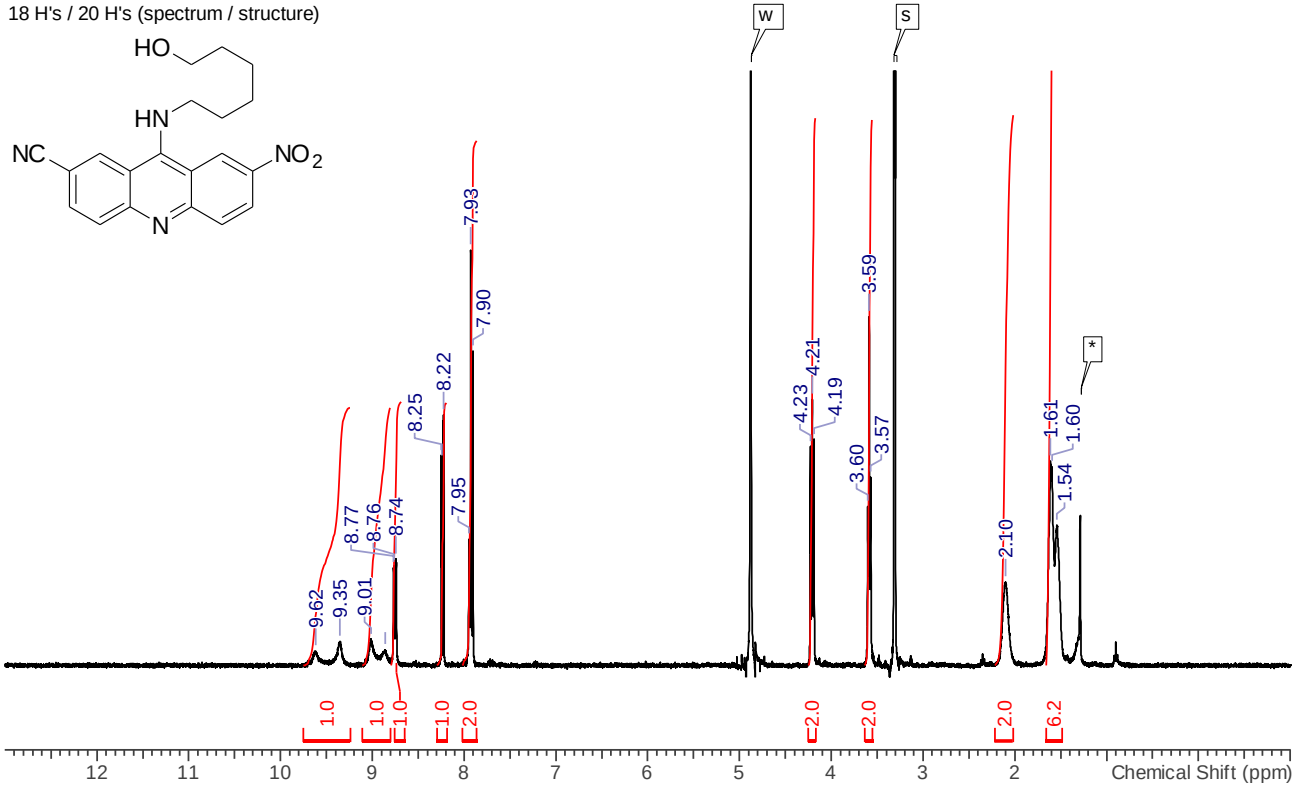
^{13}C NMR ($CDCl_3$, 100 MHz) for **12**; s: solvent



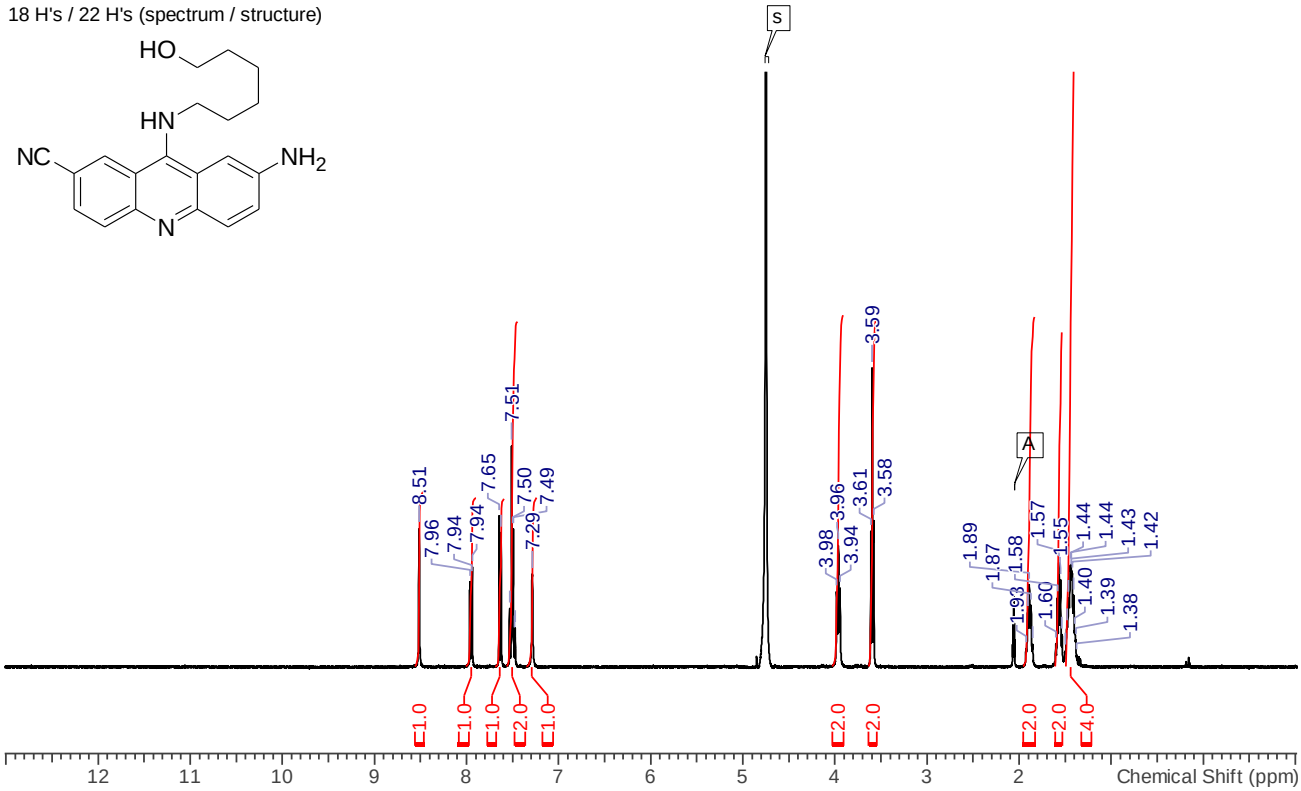
^{1}H NMR (400 MHz, MeOD-d_3 with TFA-d) for **13**; s: solvent, w: water, *: grease



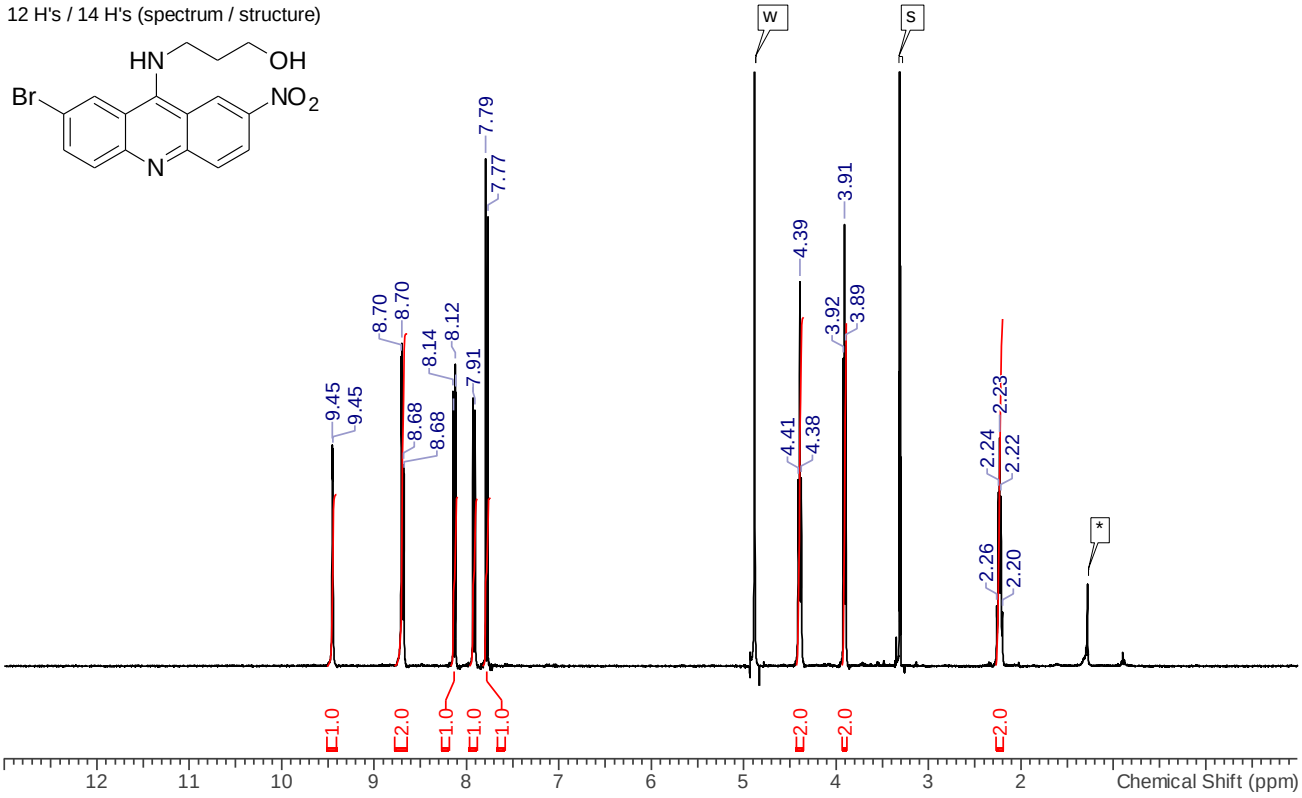
^{1}H NMR (400 MHz, MeOD-d$_3$ with TFA-d) for **14**; s: solvent, w: water, *: grease



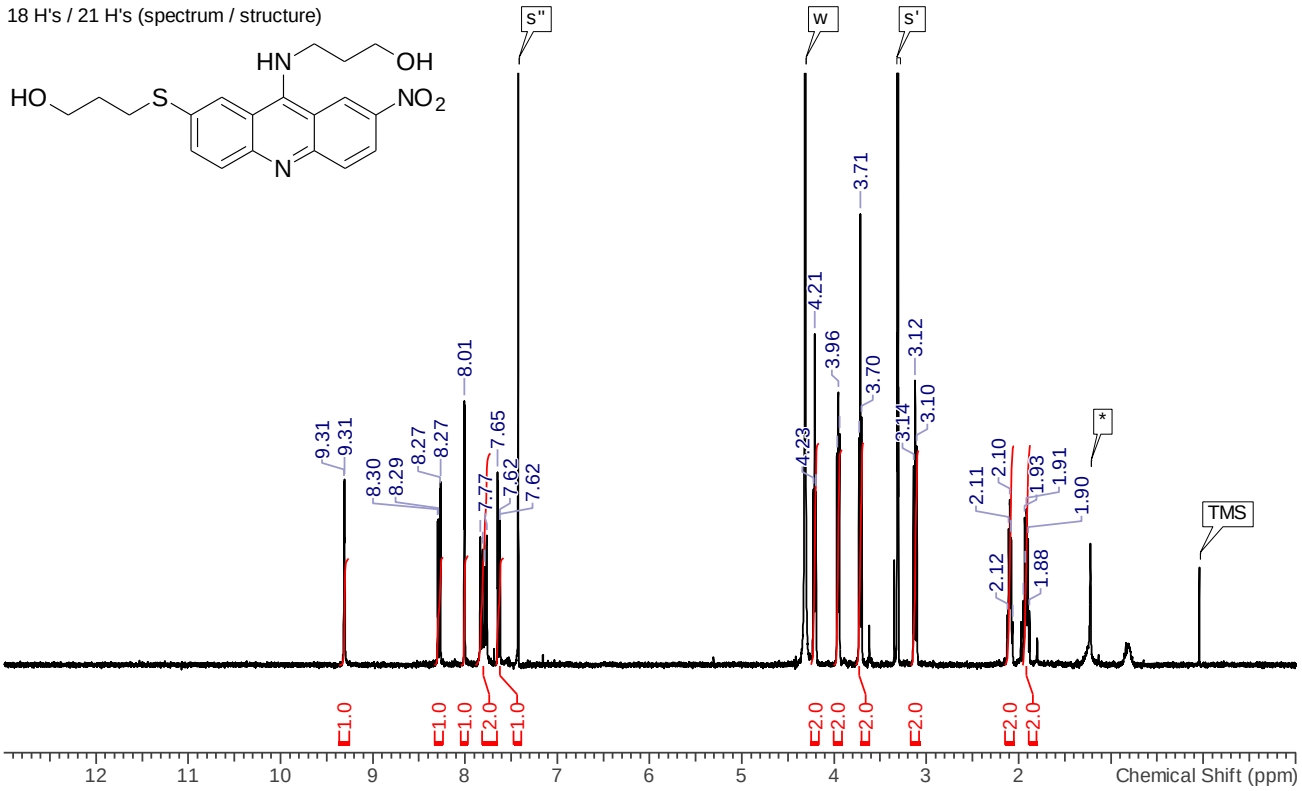
^{1}H NMR (400 MHz, D$_2$O) for **3**; s: solvent, A: acetonitrile



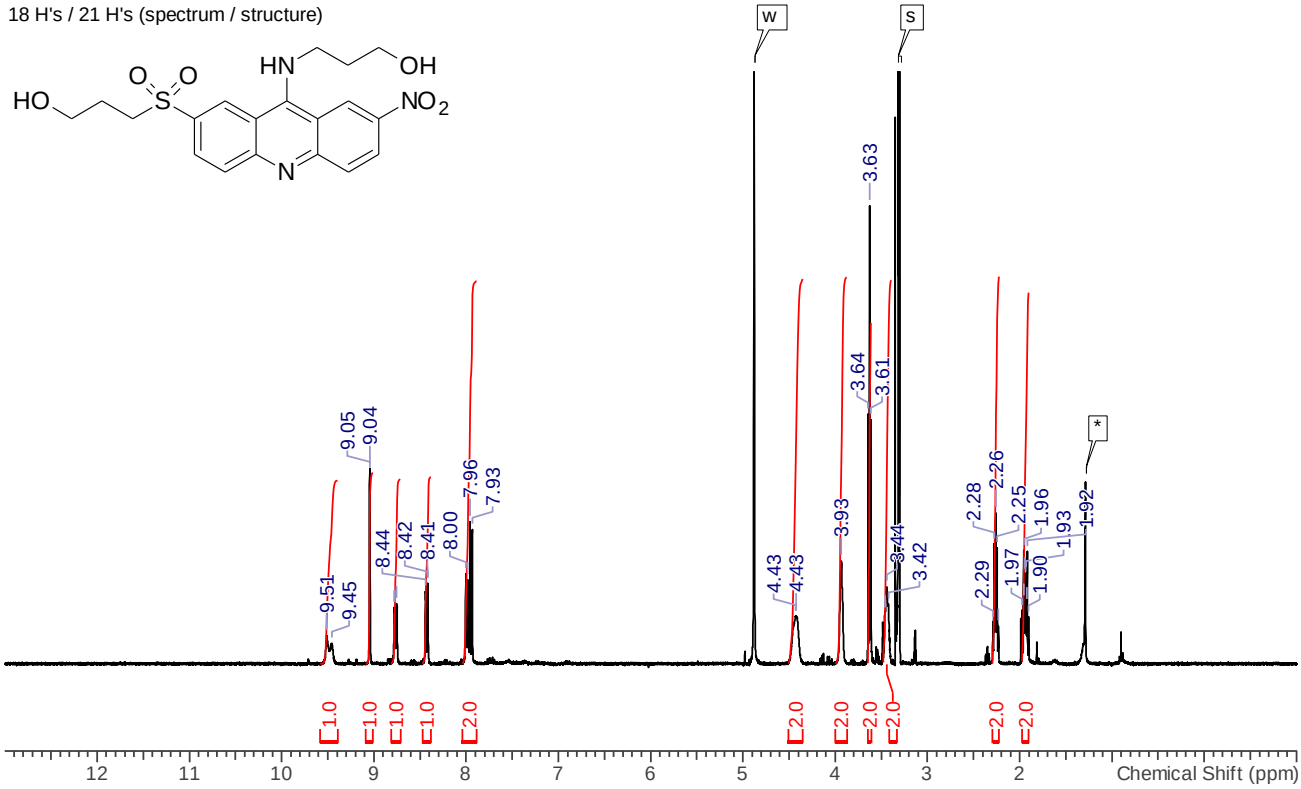
^{1}H NMR (400 MHz, MeOD-d_3 with TFA-d) for **15**; s: solvent, w: water, *: grease



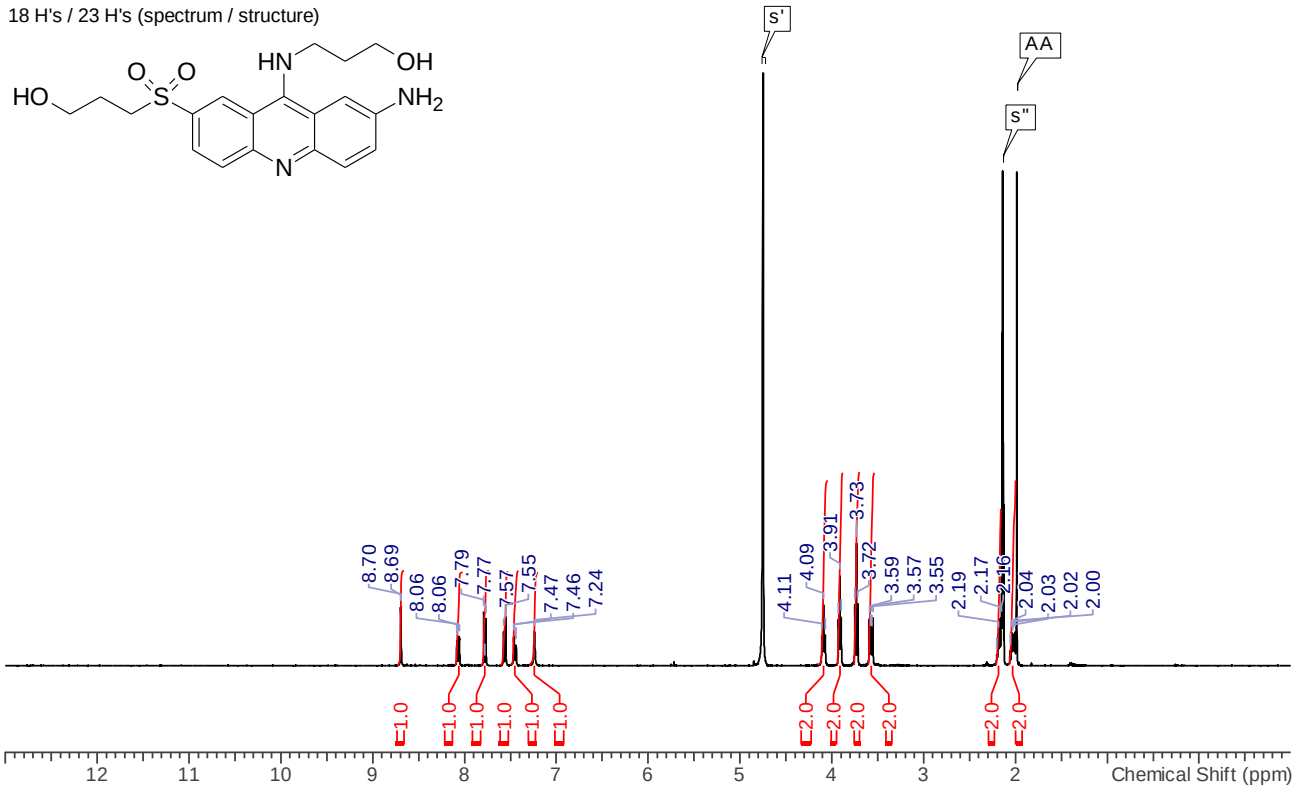
^{1}H NMR (400 MHz, $CDCl_3$/MeOD-d_3 7:3) for **16**; s': MeOD-d_3, s'': $CDCl_3$, w: water, *: grease



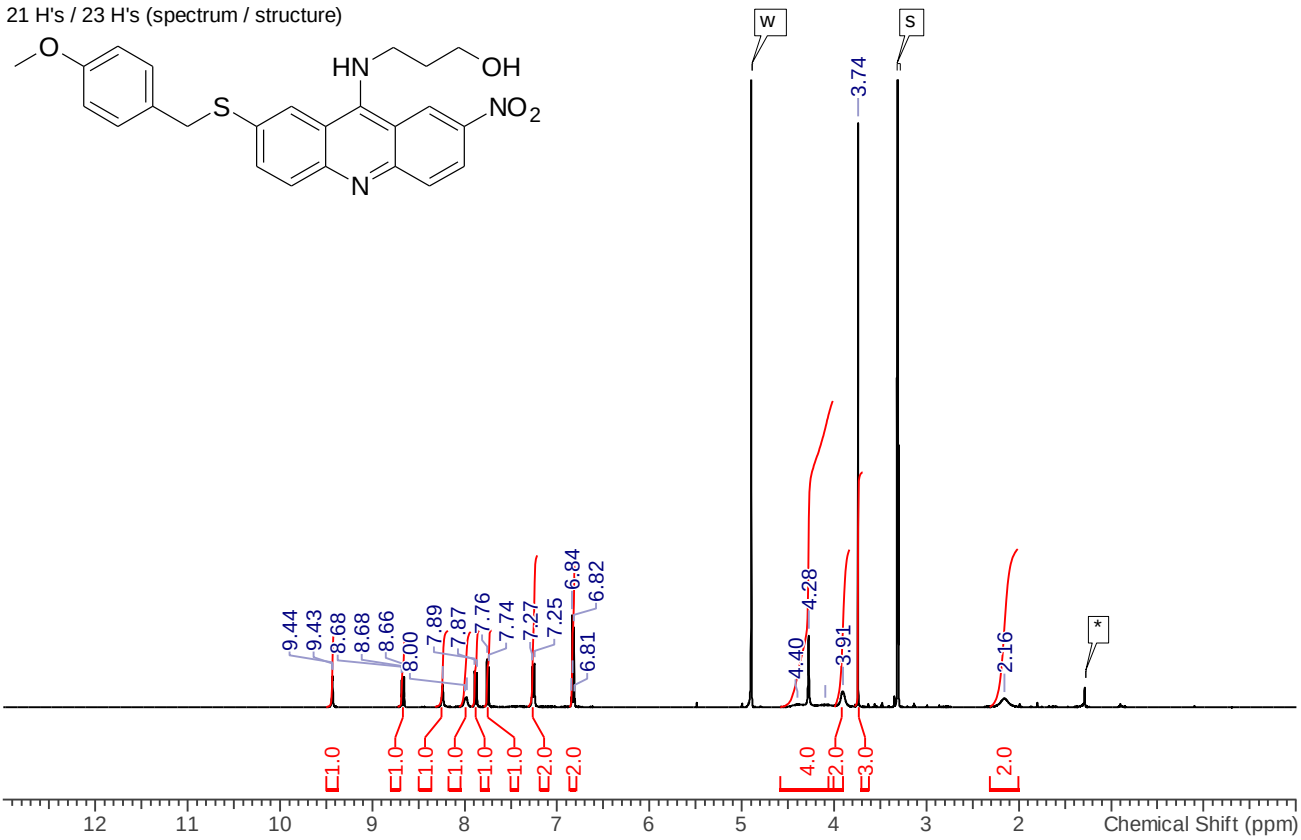
^{1}H NMR (400 MHz, MeOD-d_3 with TFA-d) for **17**; s: solvent, w: water, *: grease



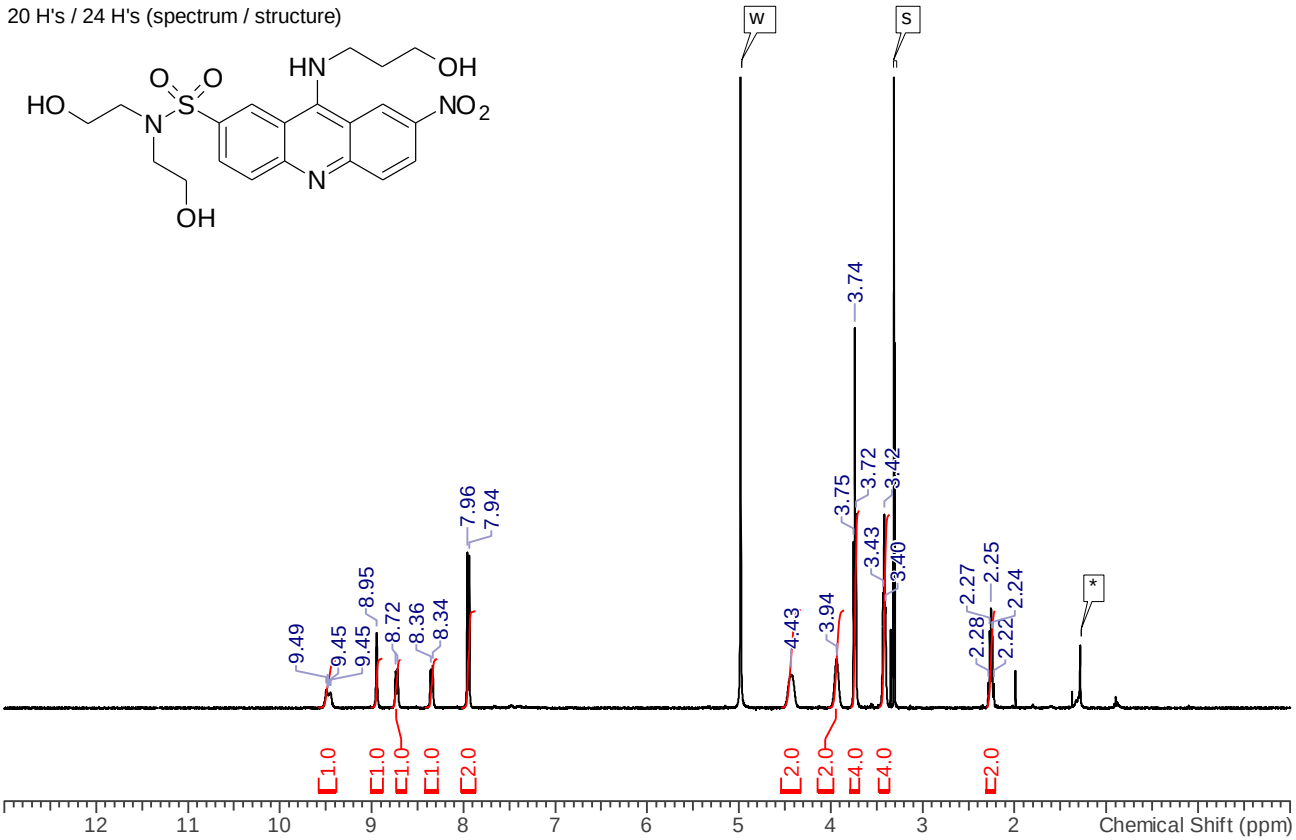
^{1}H NMR (400 MHz, D_2O/MeCN-d_3 6:1) for **4**; s': solvent residual peak of D_2O, s'': solvent residual peak of MeCN-d_3, AA: acetic acid



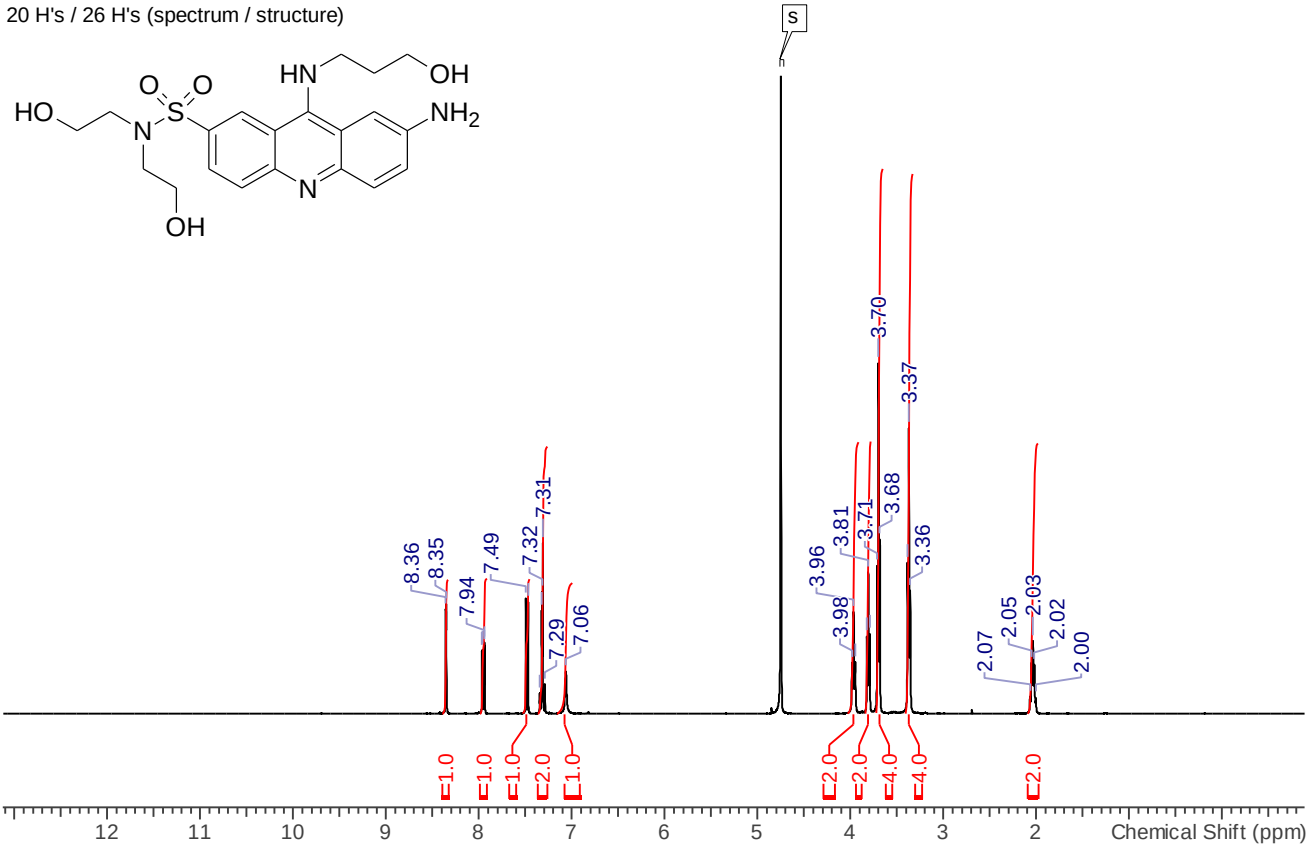
^{1}H NMR (400 MHz, MeOD-d$_3$ with TFA-d) for **18**; s: solvent, w: water, *: grease



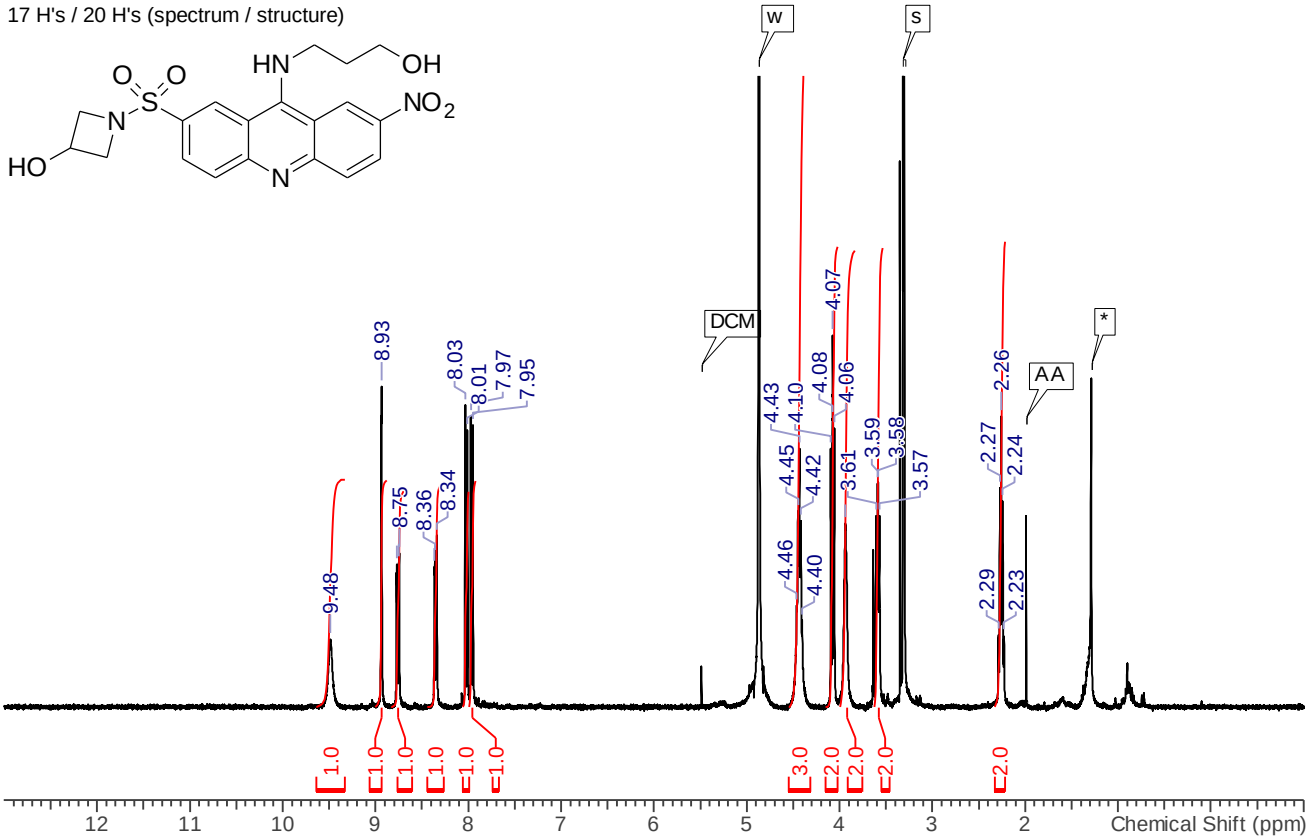
^{1}H NMR (400 MHz, MeOD-d$_3$ with TFA-d) for **20**; s: solvent, w: water, *: grease



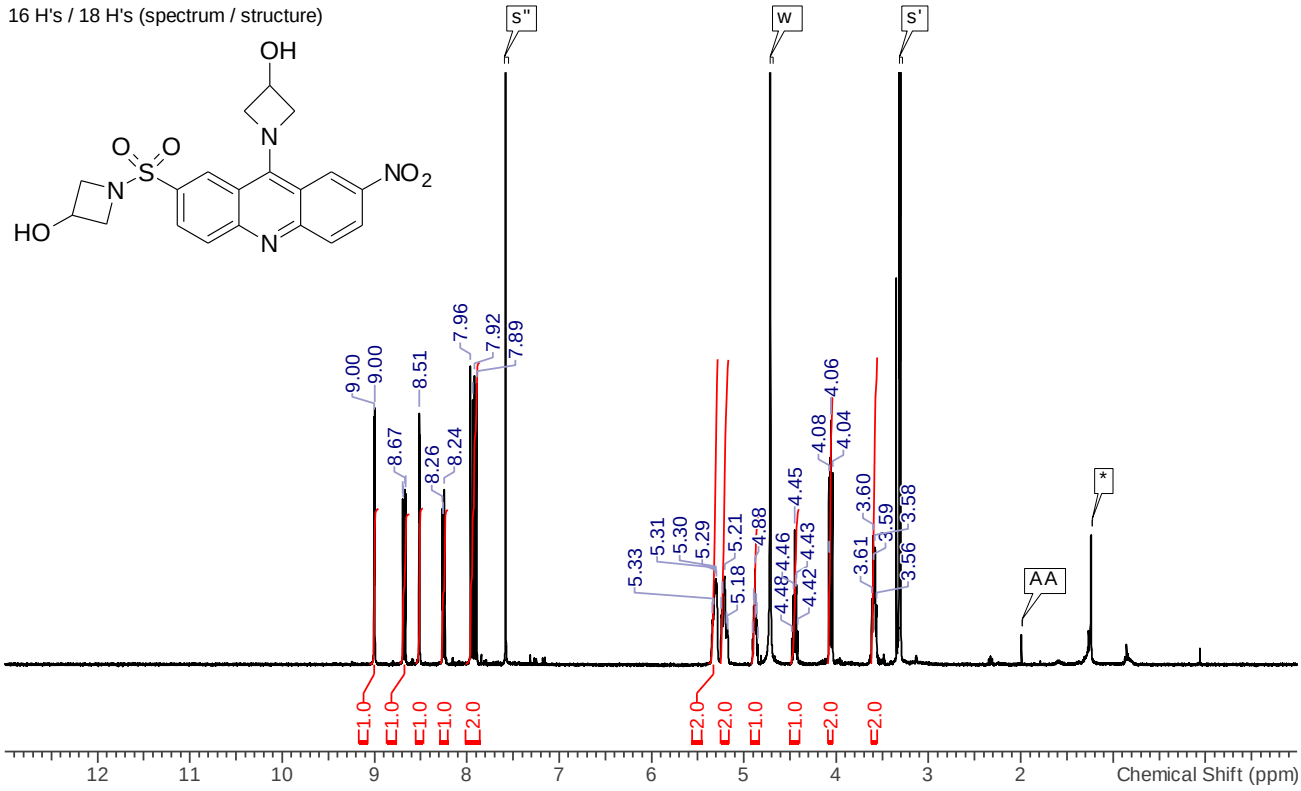
^{1}H NMR (400 MHz, D_2O) for **5**; s: solvent



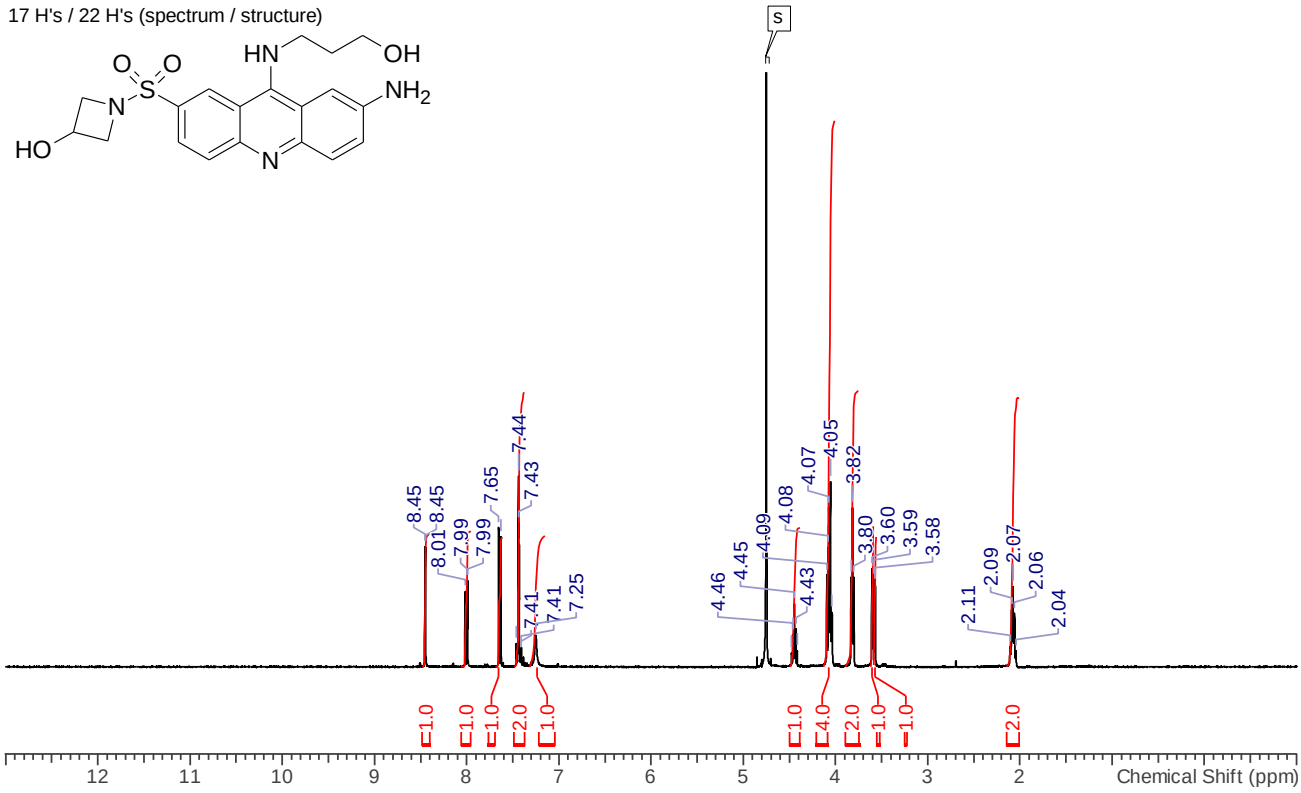
^{1}H NMR (400 MHz, MeOD-d_3 with TFA-d) for **21**; s: solvent, w: water, *: grease, AA: acetic acid



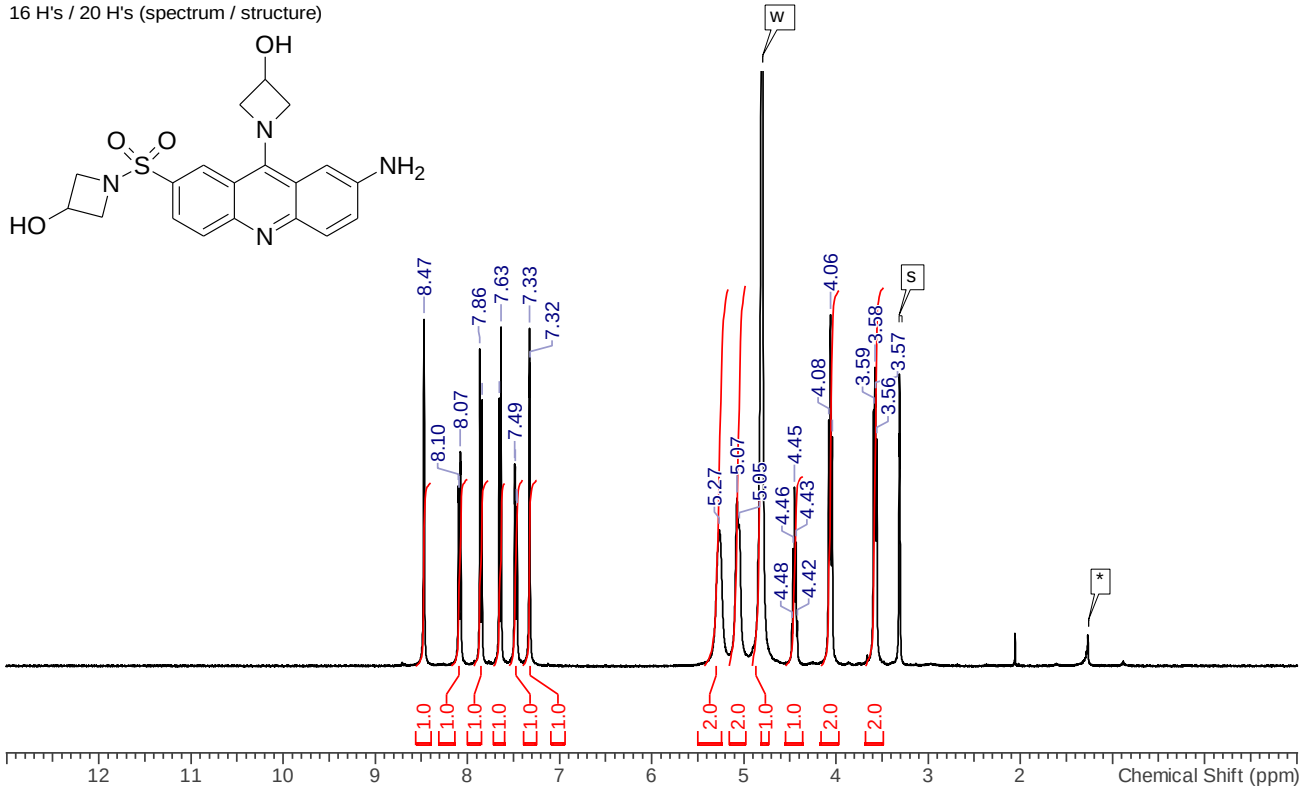
^{1}H NMR (400 MHz, MeOD-d_3/$CDCl_3$ 1:1 with TFA-d) for **22**; s': solvent residual peak of MeOD-d_3, s'': solvent residual peak of $CDCl_3$, w: water, *: grease, AA: acetic acid



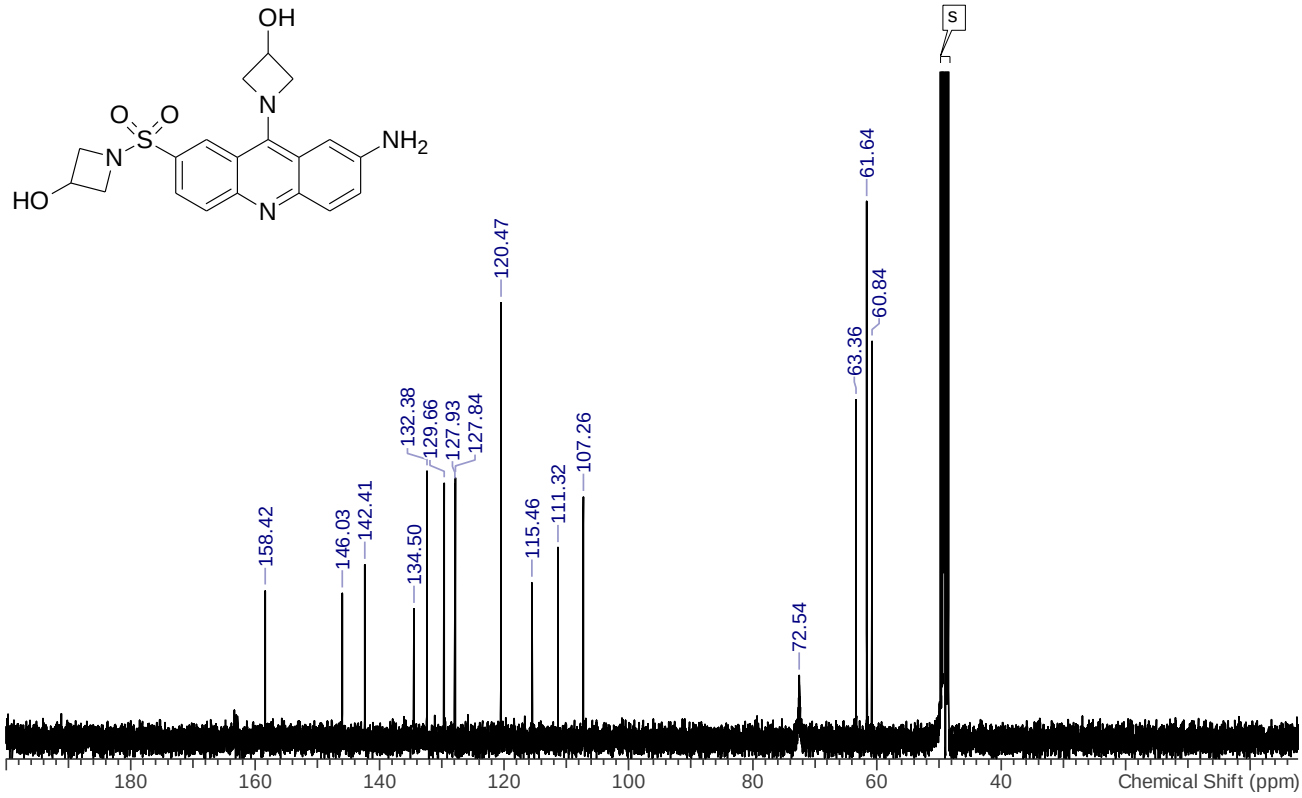
^{1}H NMR (400 MHz, D_2O) for **6**; s: solvent



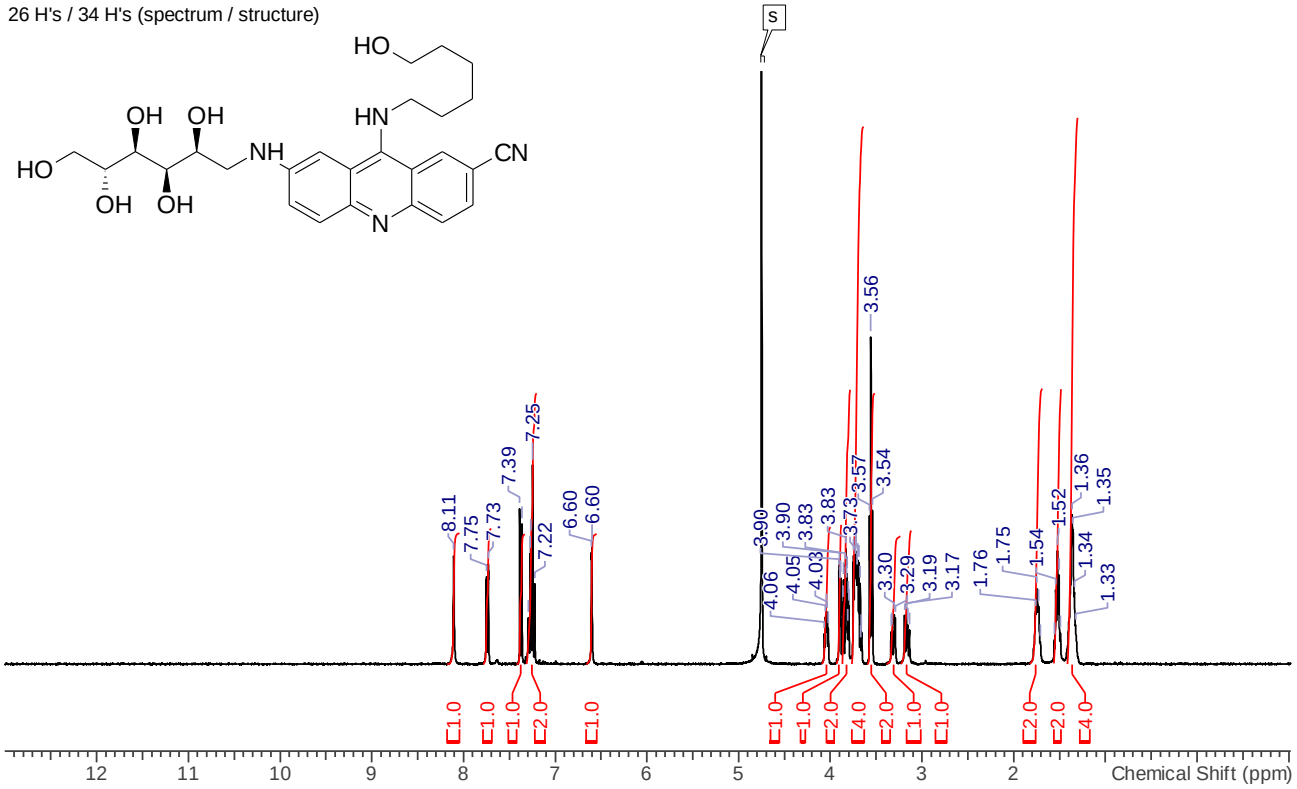
^{1}H NMR (400 MHz, MeOD-d$_3$) for **7**; s: solvent, w: water, *: grease



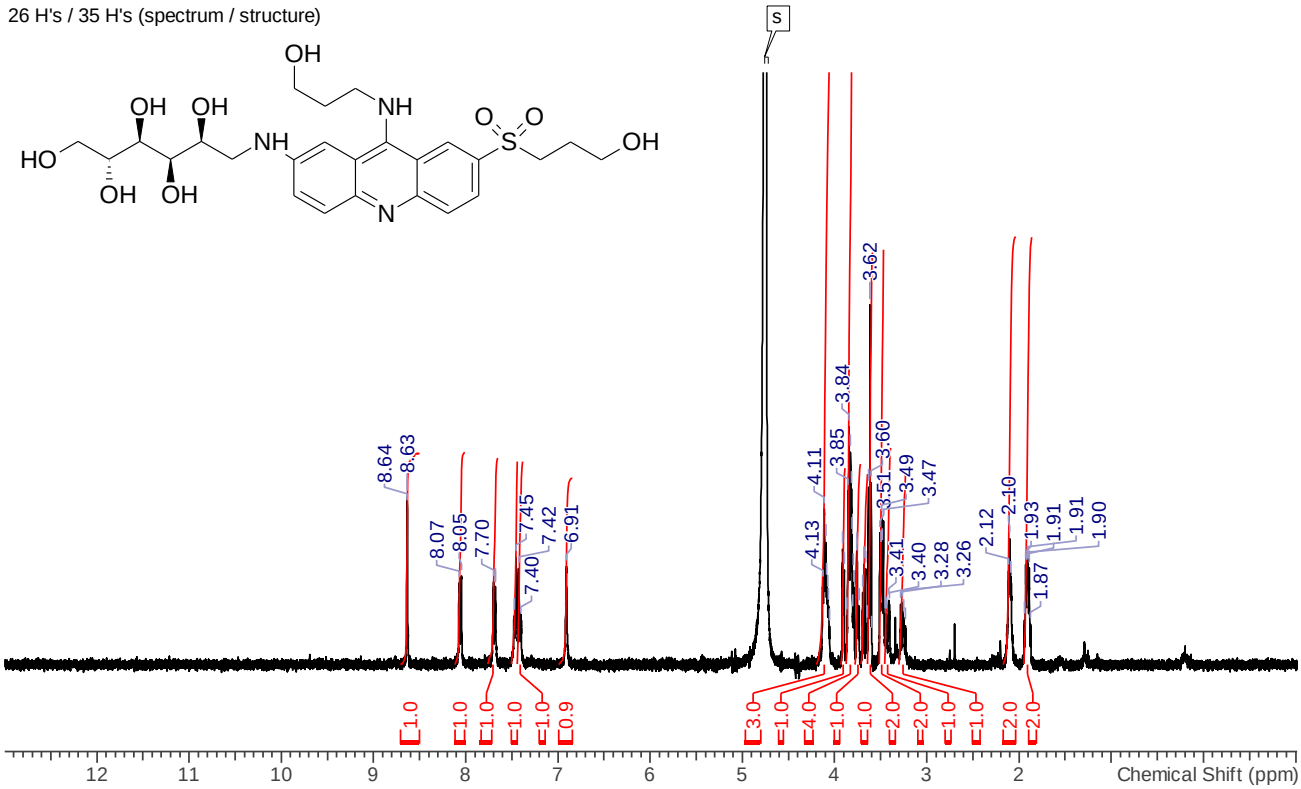
^{13}C NMR (100 MHz, MeOD-d$_3$) for **7**; s: solvent



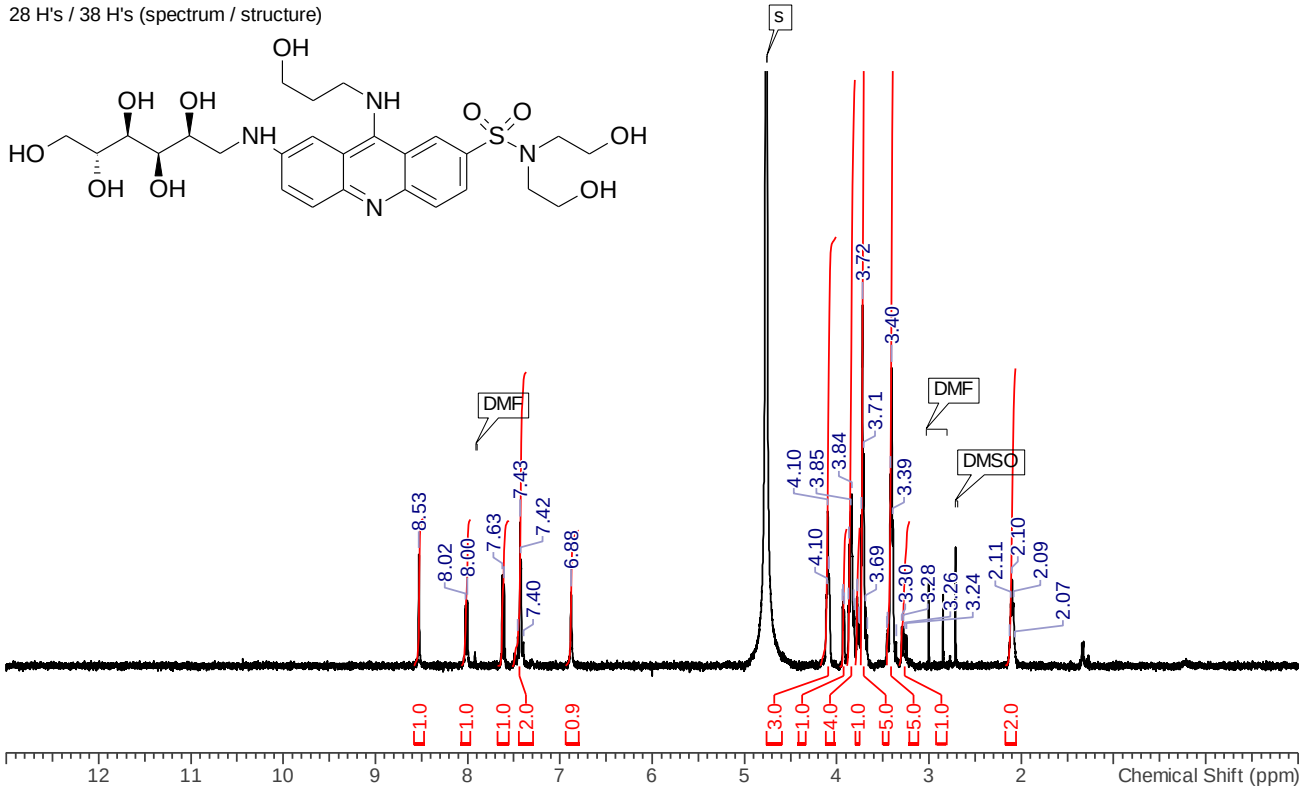
^{1}H NMR (400 MHz, D_2O) for **3**-G; s: solvent



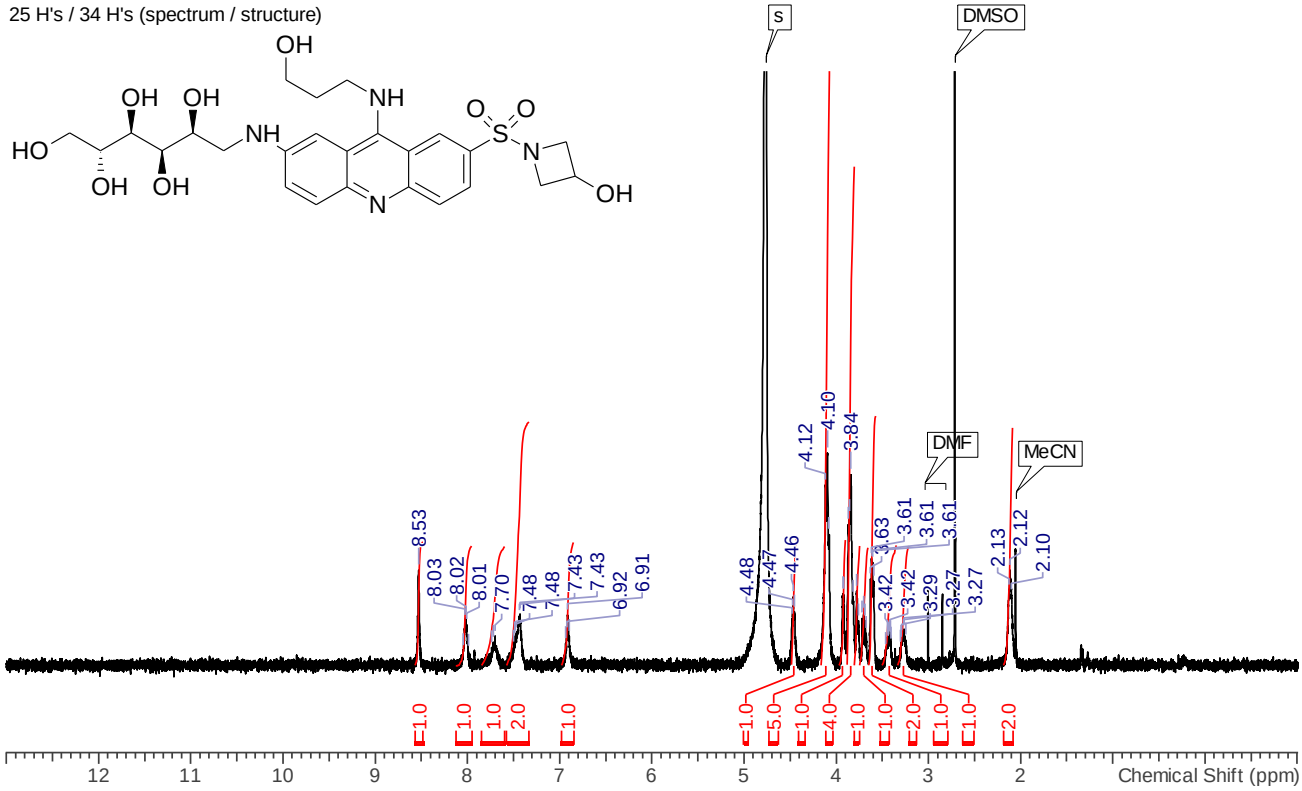
^{1}H NMR (400 MHz, D_2O) for **4**-G; s: solvent



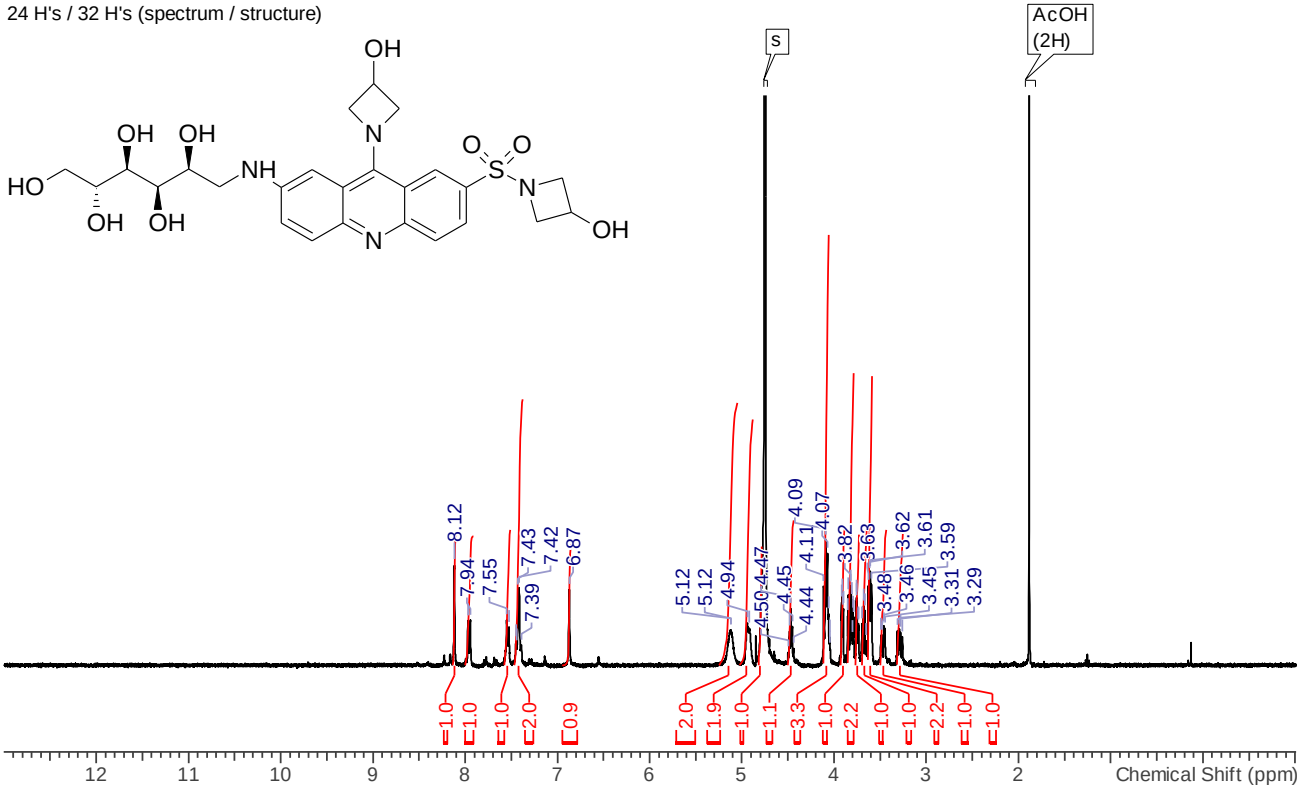
^{1}H NMR (400 MHz, D_2O) for **5**-G; s: solvent



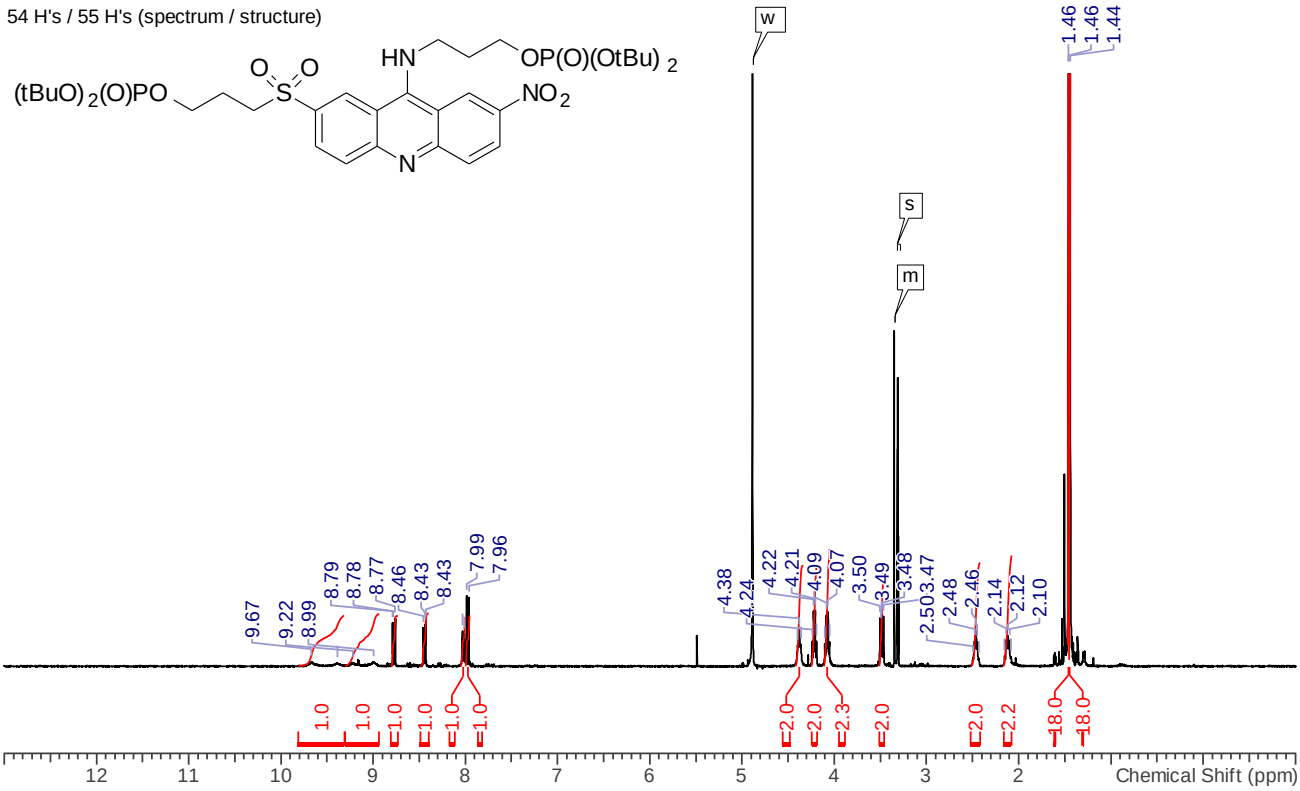
^{1}H NMR (400 MHz, D_2O) for **6**-G; s: solvent



^{1}H NMR (400 MHz, D_2O) for **7**-G; s: solvent

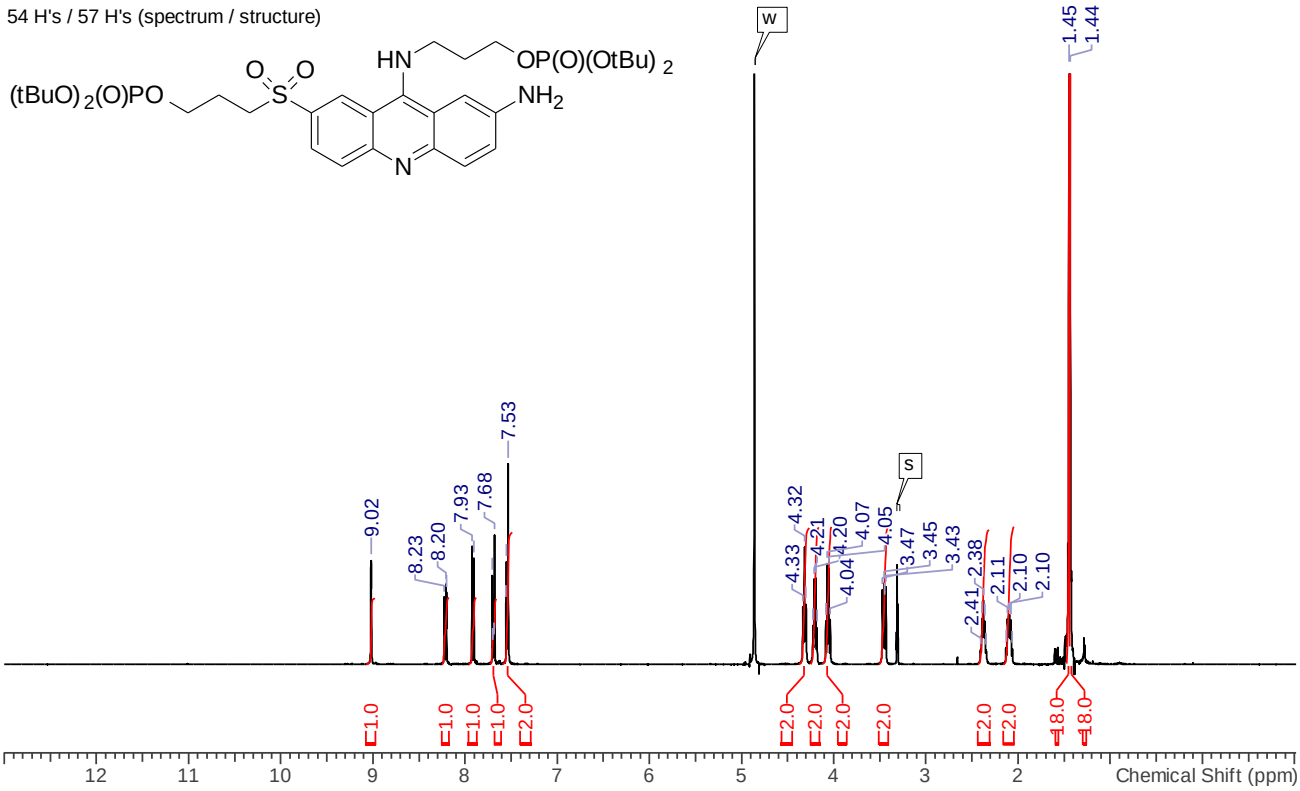


^{1}H NMR (400 MHz, MeOD-d_3 with TFA-d) for **23**; s: solvent, w: water, m: methanol



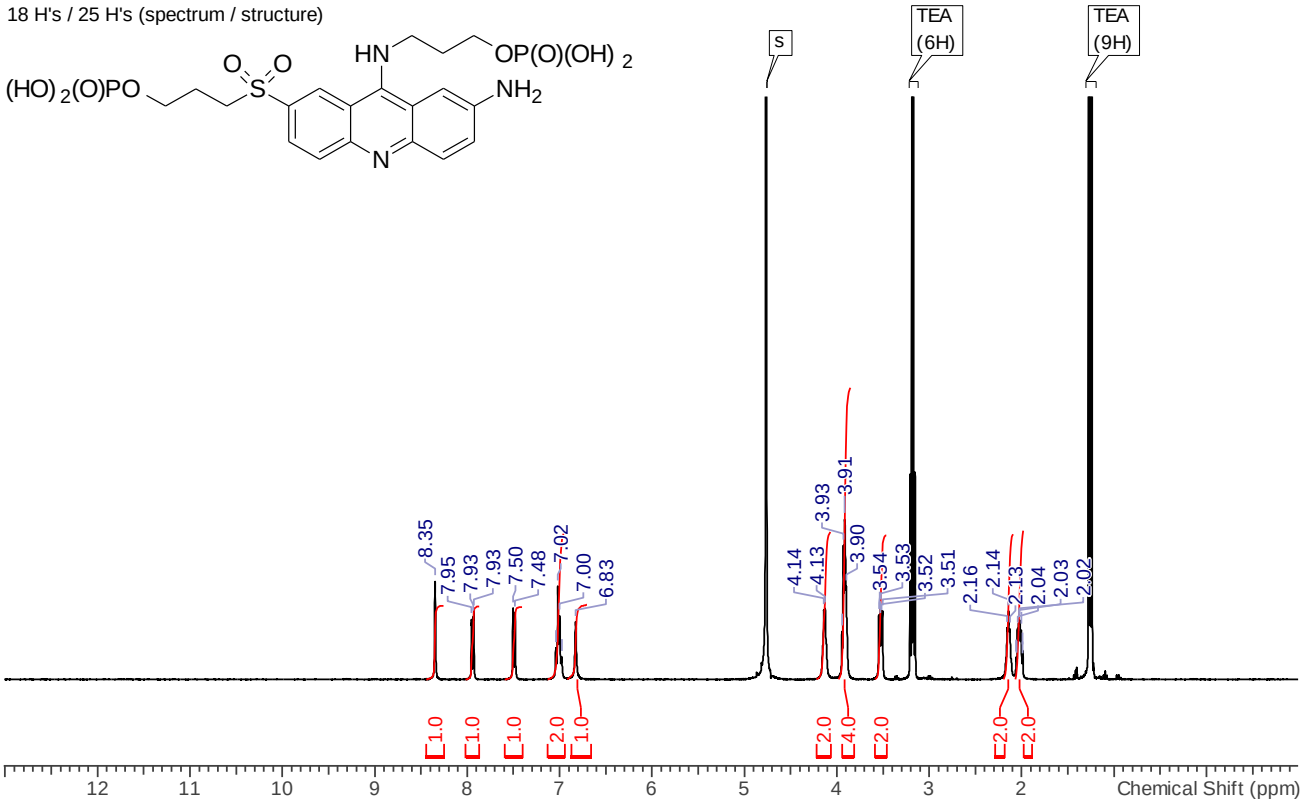
^{1}H NMR (400 MHz, MeOD-d_3) for **24**; s: solvent, w: water

54 H's / 57 H's (spectrum / structure)

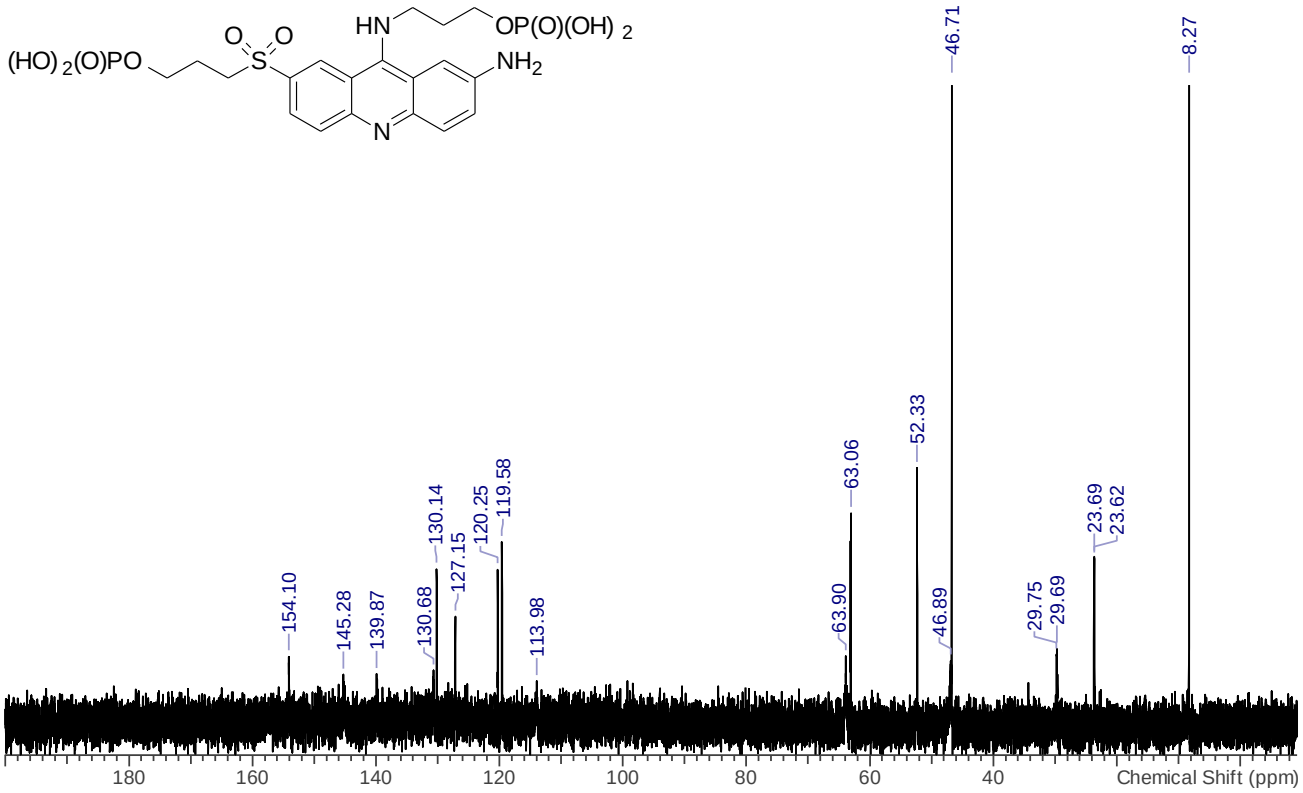


^{1}H NMR (400 MHz, D_2O) for **1**; s: solvent

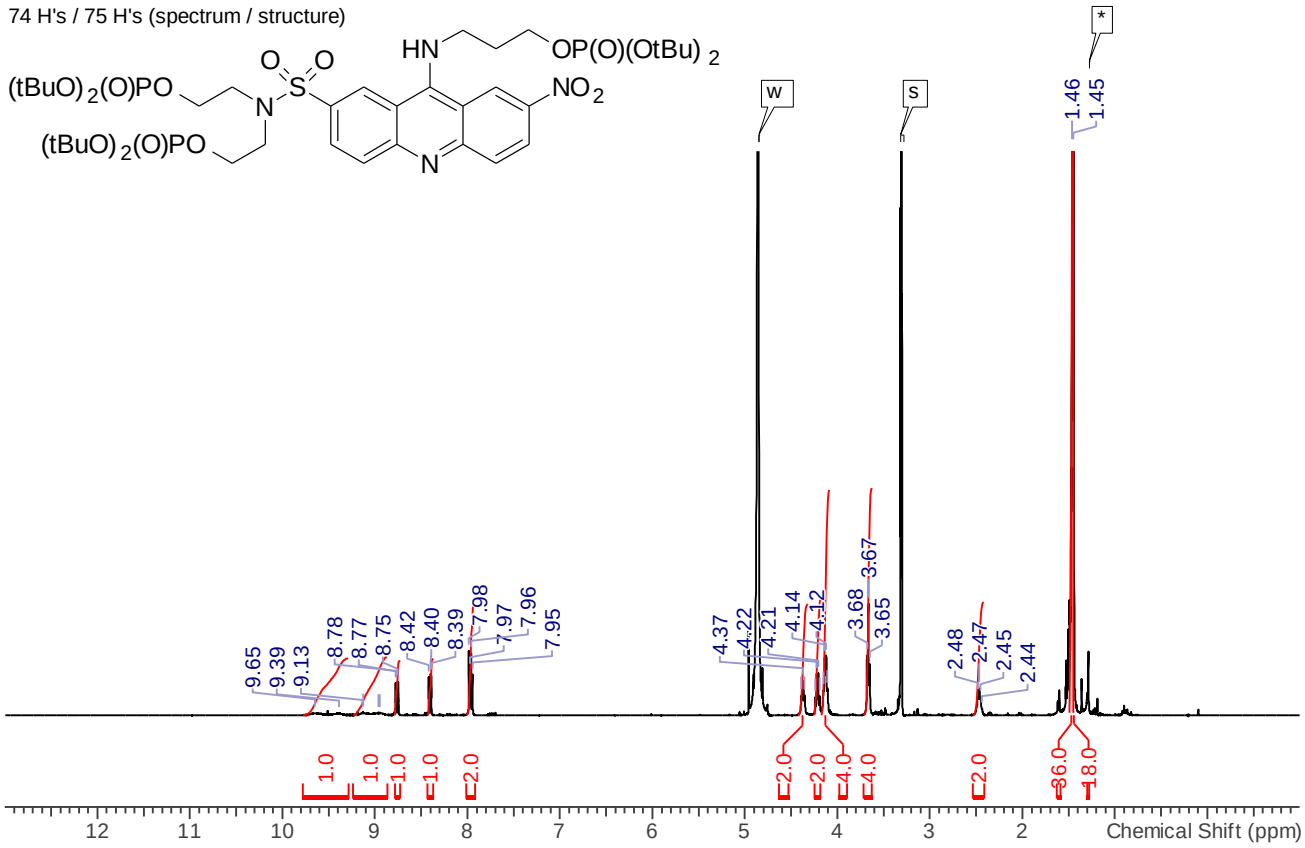
18 H's / 25 H's (spectrum / structure)



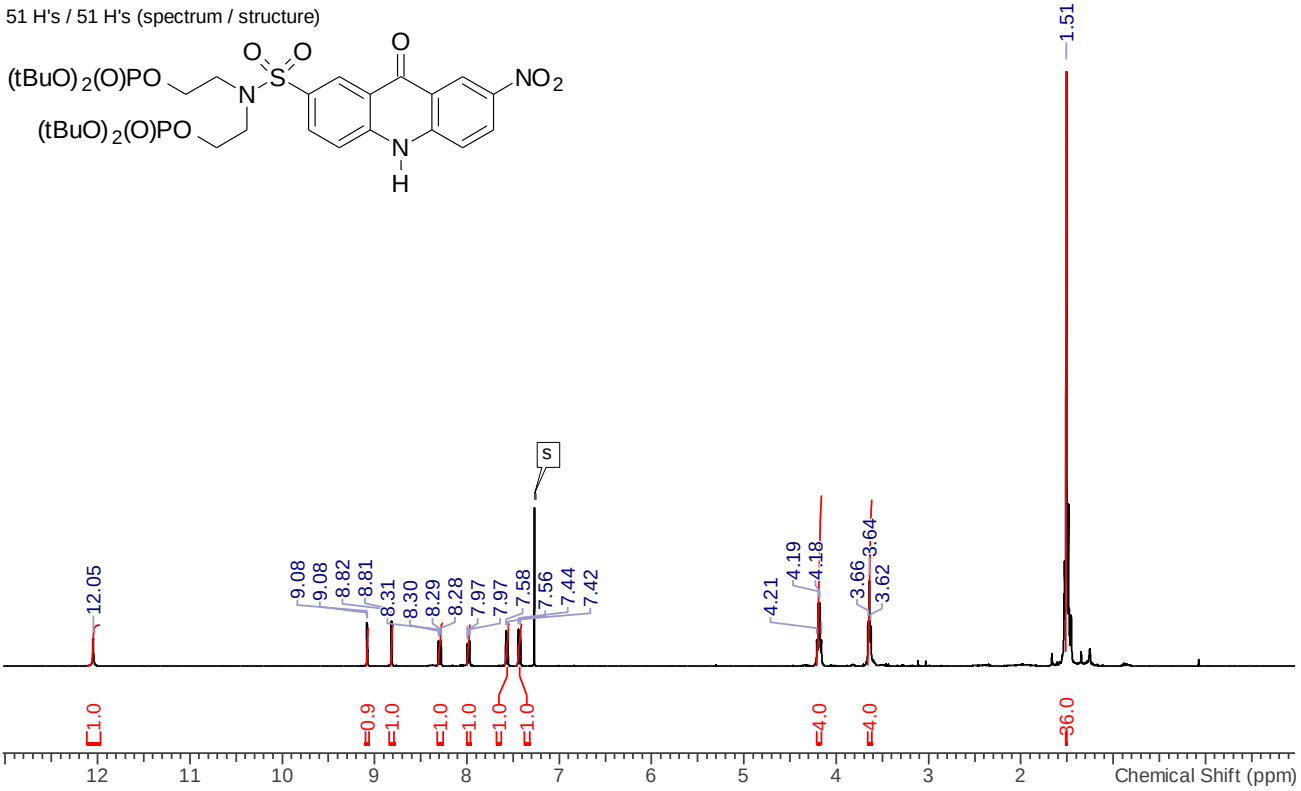
^{13}C NMR (100 MHz, D_2O) for **1**



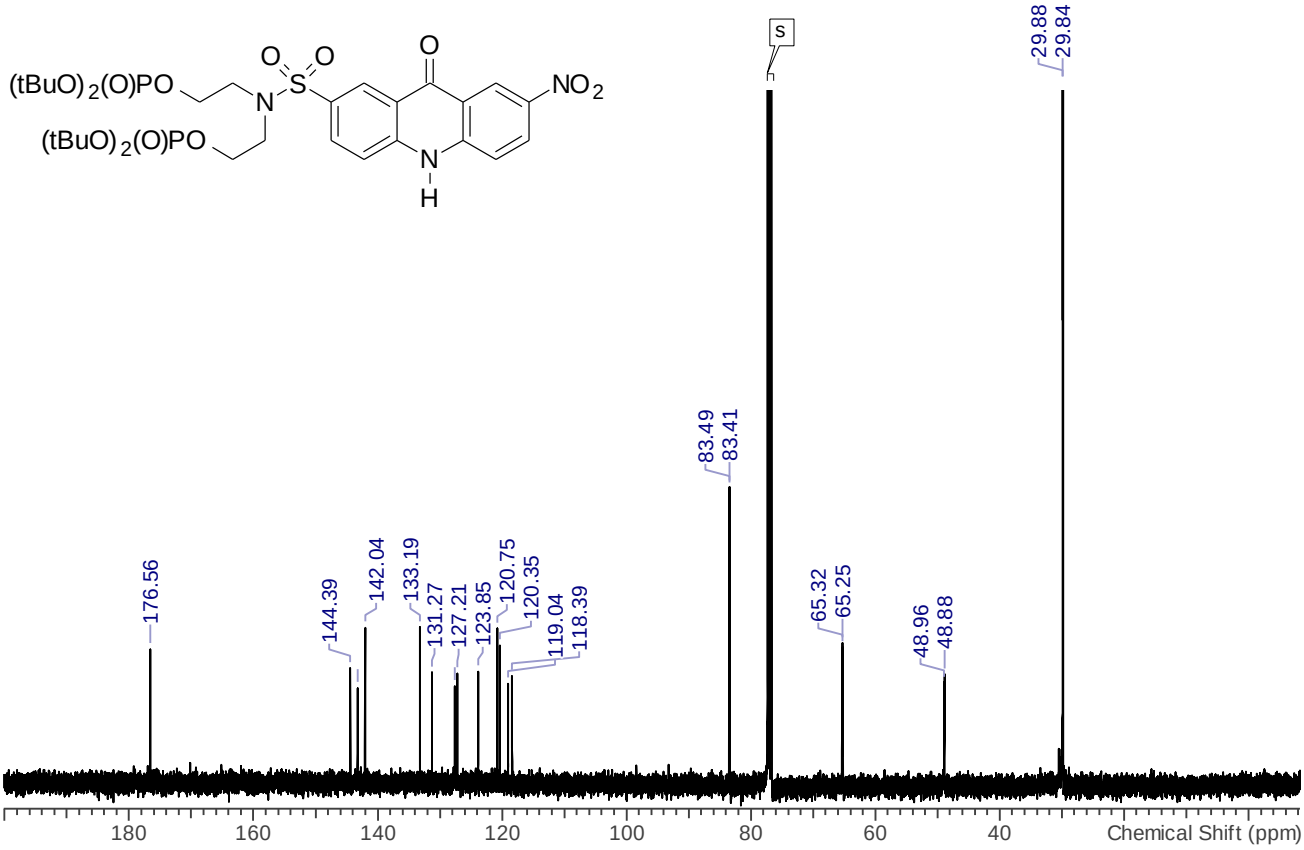
^{1}H NMR (400 MHz, MeOD-d_3 with TFA-d) for **25**; s: solvent, w: water, *: residual grease



^{1}H NMR (400 MHz, $CDCl_3$) for **26**; s: solvent

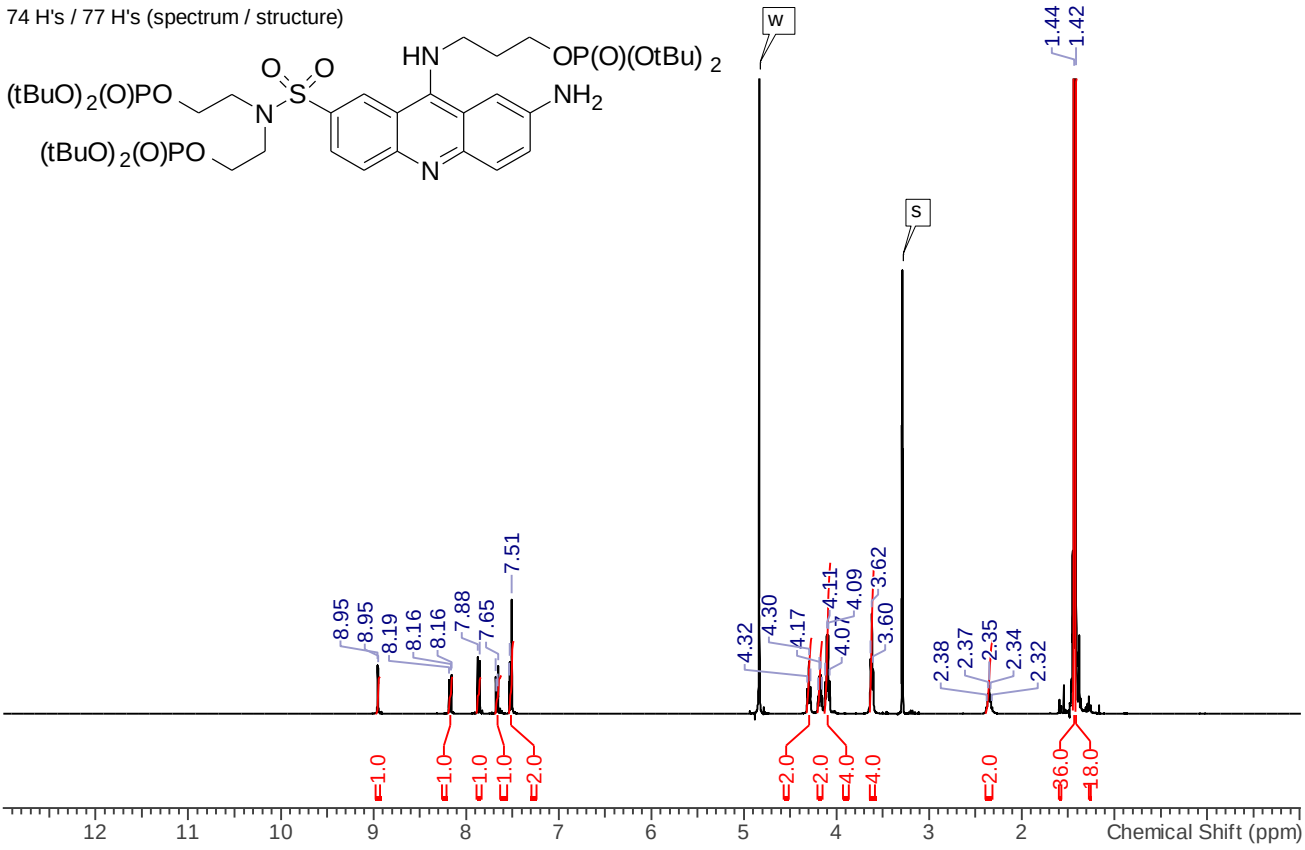


^{13}C NMR (100 MHz, $CDCl_3$) for **26**; s: solvent



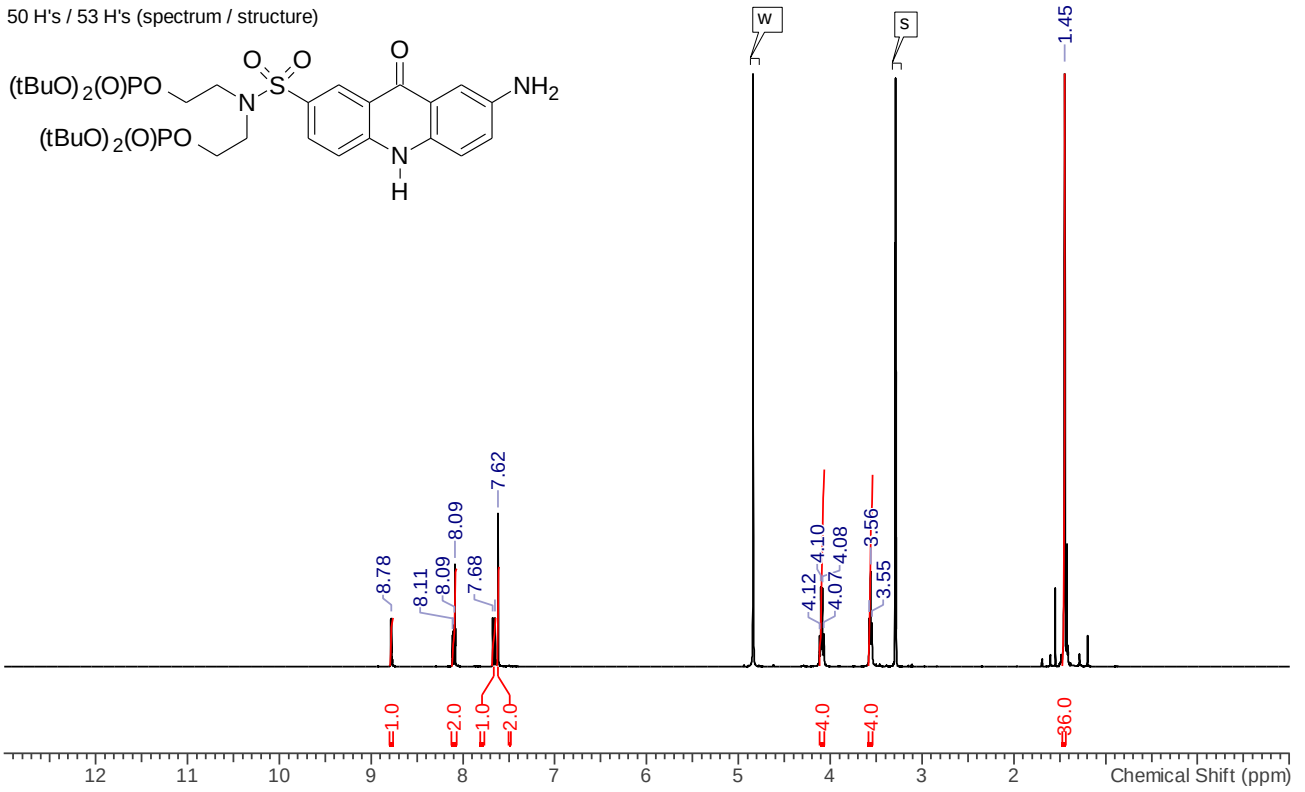
^{1}H NMR (400 MHz, MeOD-d$_3$) for **27**; s: solvent, w: water

74 H's / 77 H's (spectrum / structure)

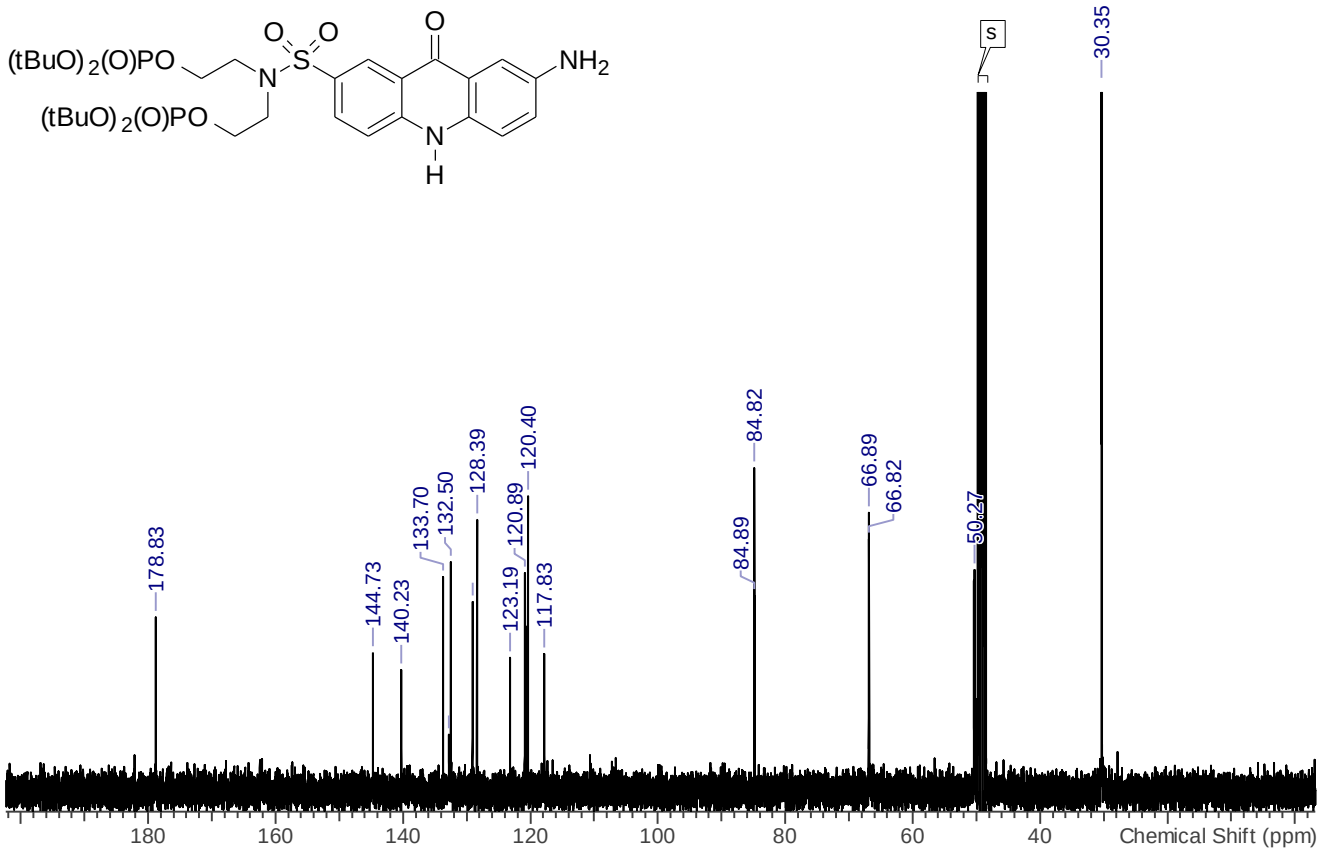


^{1}H NMR (400 MHz, MeOD-d$_3$) for **28**; s: solvent, w: water

50 H's / 53 H's (spectrum / structure)

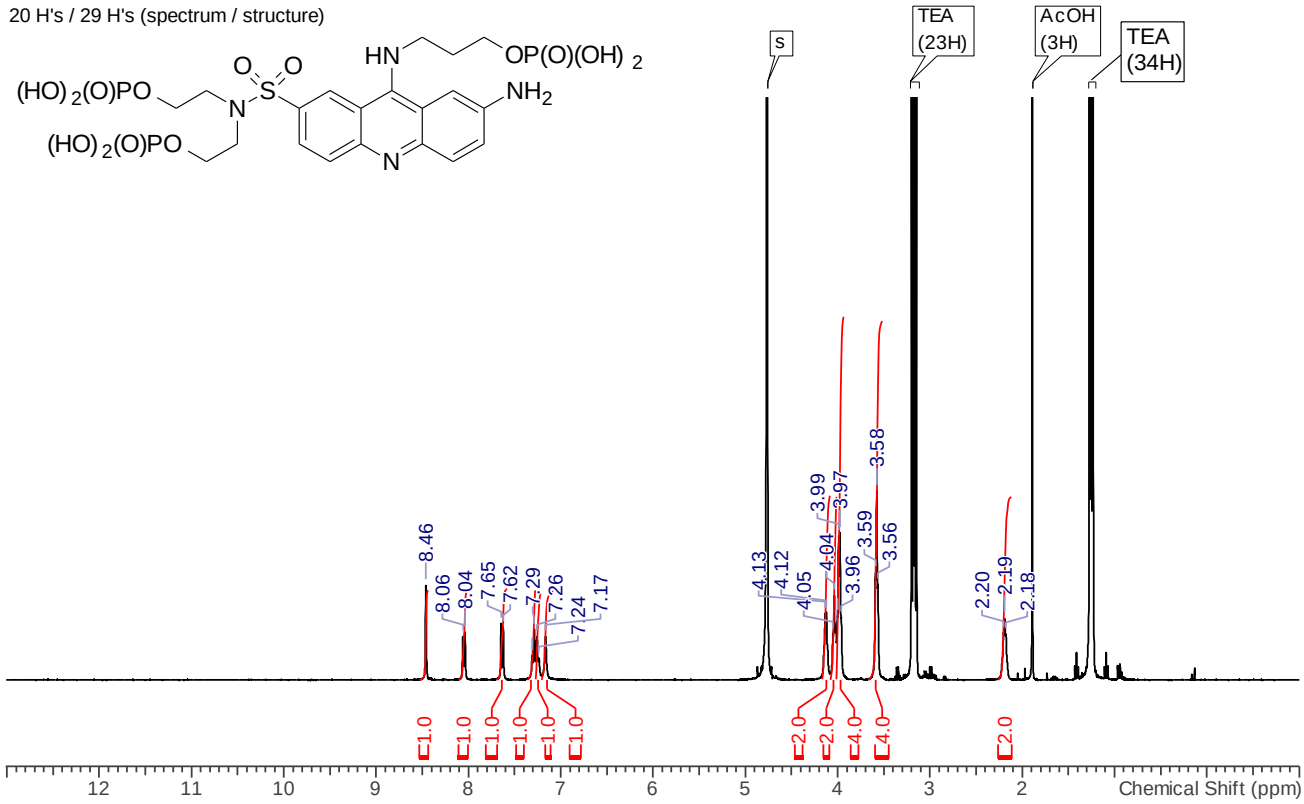


^{13}C NMR (100 MHz, MeOD-d$_3$) for **28**; s: solvent

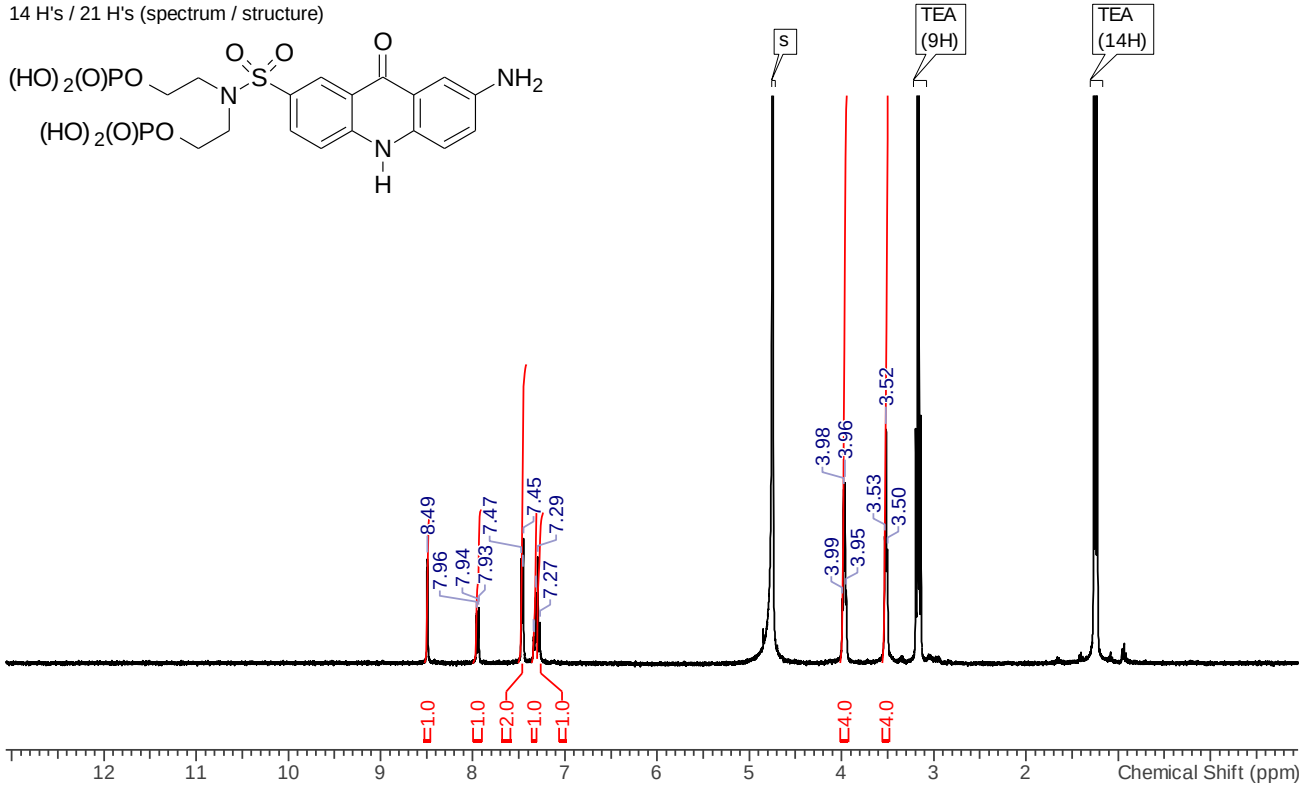


^{1}H NMR (400 MHz, D$_2$O) for **2**; s: solvent

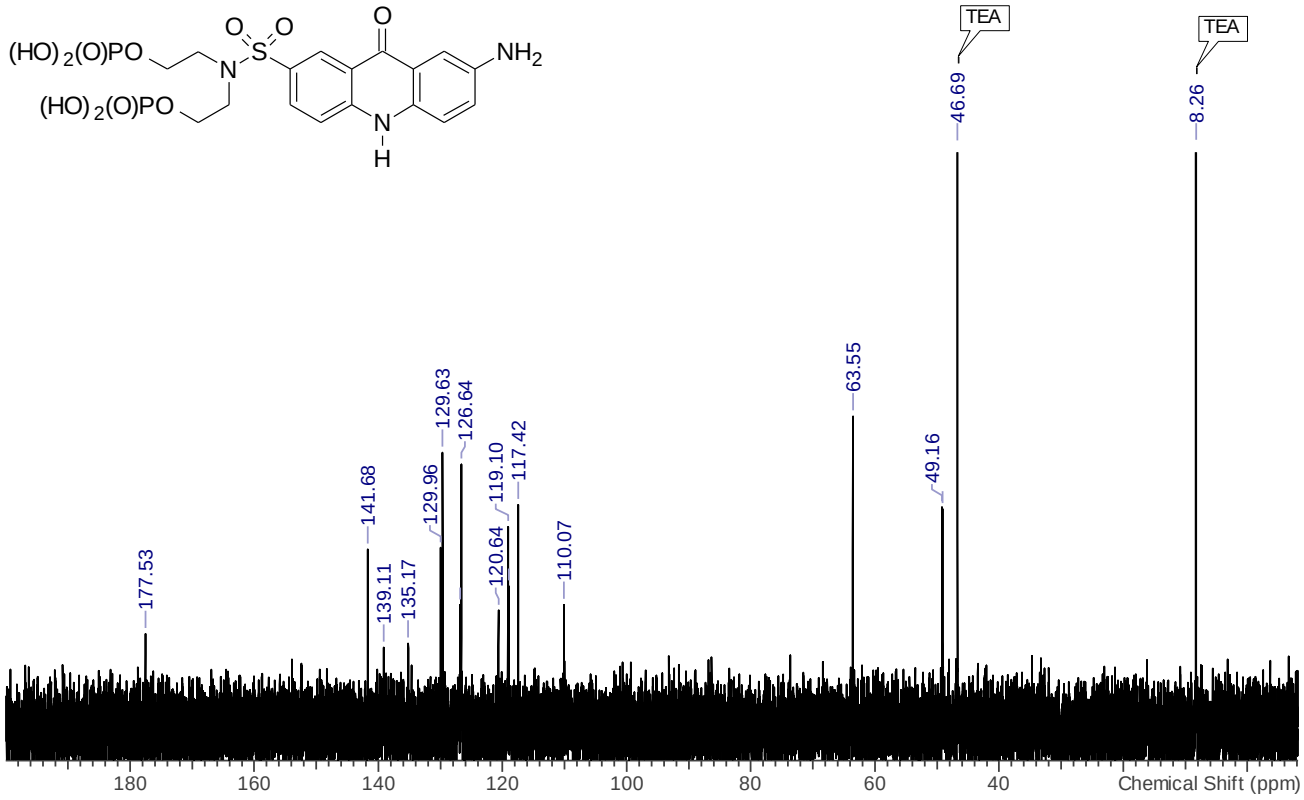
20 H's / 29 H's (spectrum / structure)



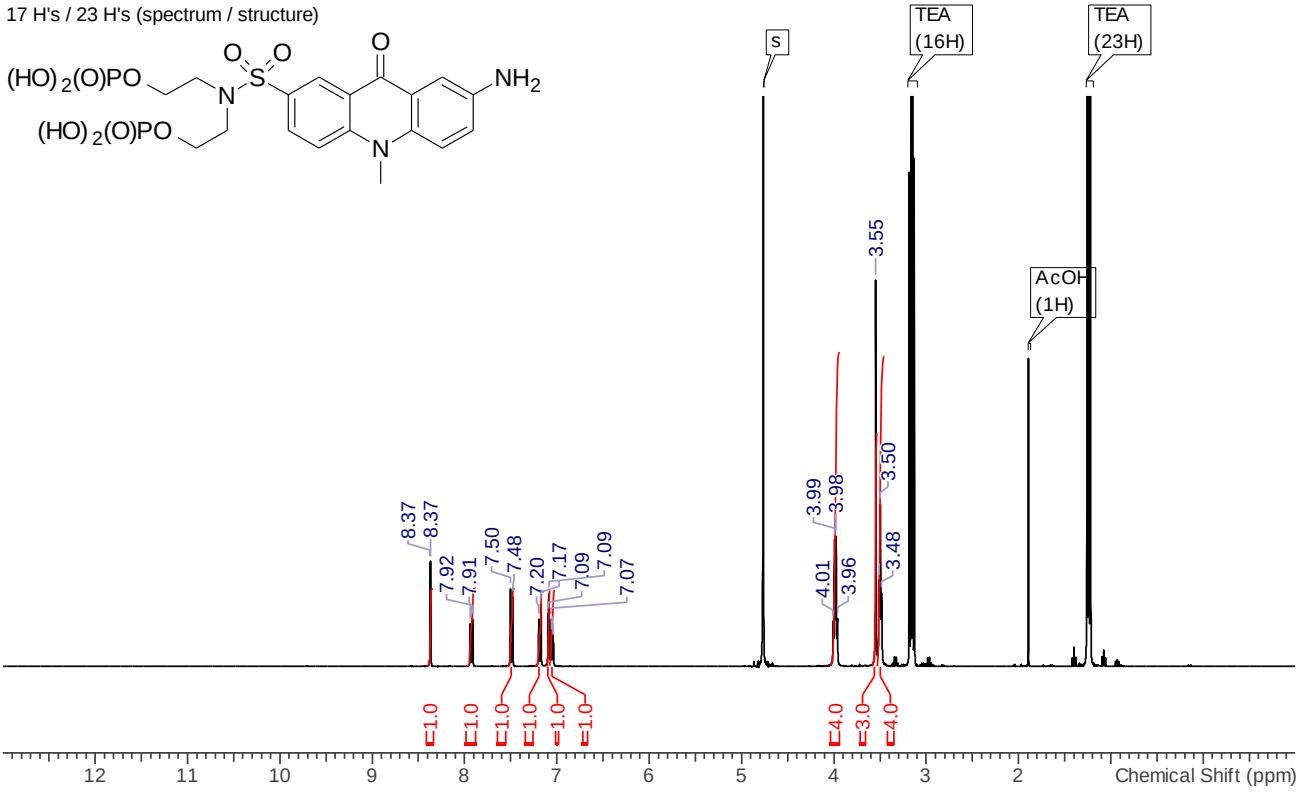
^{1}H NMR (400 MHz, D_2O) for **29**; s: solvent



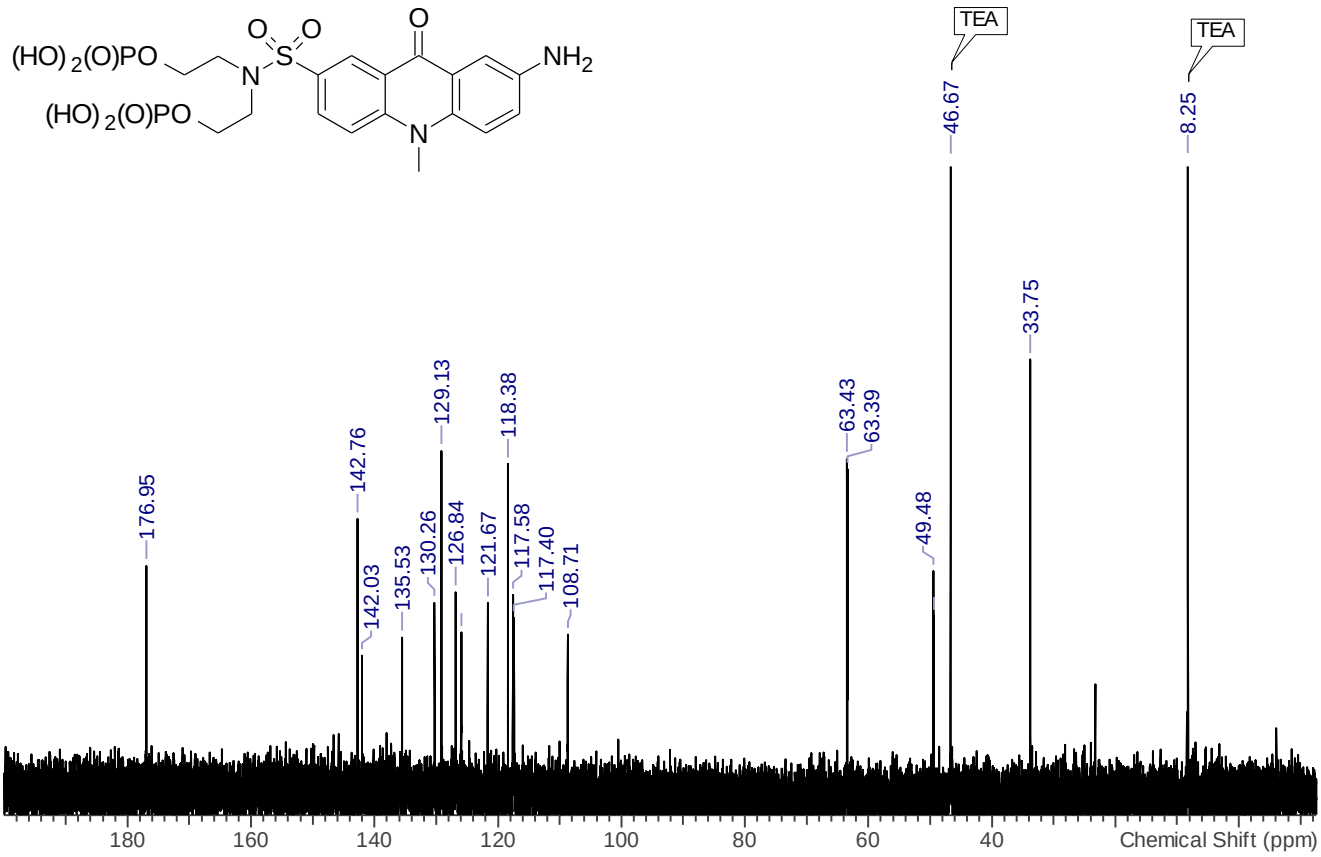
^{13}C NMR (100 MHz, D_2O) for **29**



^{1}H NMR (400 MHz, D_2O) for **ASA**; s: solvent



^{13}C NMR (100 MHz, D_2O) for **ASA**



7. References

1. Graves, P.; Smith, J. A. Fluorogenic peptides and their method of production. U.S. Patent 2011/0039289 A1, Feb. 17, 2011.

2. Kliegl, A.; Schaible, L., Die Konstitution der Bromierungsprodukte von Acridonen und N-Hydroxy-Acridonen. *Chem. Ber.* **1957**, 90 (1), 60–65.

3. Singh, K.; Singh, G., Synthesis of some acridine derivatives. II. *Indian J. Pharm.* **1952**, 14, 47–49.

4. Gaidukevich, A. N.; Bashura, G. S.; Pertsev, I. M.; Shtuchnaya, V. P.; Piminov, A. F.; Filipchik, N. I.; Lysenko, L. V., Preparation and antibacterial activity of certain 9-methylamino-7-nitroacridine derivatives. *Pharm. Chem. J.* **1975**, 9 (6), 379–382.

5. ^{13}C NMR spectra of (phosphorylated) 9-hydroxyalkylaminoacridines recorded in various deuterated solvents (MeOD-d_3 and D_2O with or without TFA-d, $CDCl_3$, DMF-d_7 or DMSO-d_6) appear unresolved as demonstrated by comparison of ^{13}C NMR spectra of compound **15** and 2-bromo-7-nitroacridin-9-amine in Figure S20 (10 mg of sample, 5000 scans).

6. Bellamy, F. D.; Ou, K., Selective reduction of aromatic nitro compounds with stannous chloride in non acidic and non aqueous medium. *Tetrahedron Lett.* **1984**, 25 (8), 839–842.

7. Itoh, T.; Mase, T., A General Palladium-Catalyzed Coupling of Aryl Bromides/Triflates and Thiols. *Org. Lett.* **2004**, 6 (24), 4587–4590.

8. Yu, B.; Liu, A.-H.; He, L.-N.; Li, B.; Diao, Z.-F.; Li, Y.-N., Catalyst-free approach for solvent-dependent selective oxidation of organic sulfides with oxone. *Green Chem.* **2012**, 14 (4), 957–962.

9. Pu, Y.-M.; Christesen, A.; Ku, Y.-Y., A simple and highly effective oxidative chlorination protocol for the preparation of arenesulfonyl chlorides. *Tetrahedron Lett.* **2010**, 51 (2), 418–421.

10. Hansch, C.; Leo, A.; Taft, R. W., A survey of Hammett substituent constants and resonance and field parameters. *Chem. Rev.* **1991**, 91 (2), 165–195.