Electronic Supplementary Material (ESI) for Organic & Biomolecular Chemistry.

Supporting Information

Solvent-Dependent Photophysics of a Red-Shifted, Biocompatible Coumarin Photocage

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1. General procedures

Chemicals and solvents
All reagents and anhydrous solvents were purchased from Sigma-Aldrich, Fischer Scientifc or Alfa Aesar and used as received unless otherwise stated.

Chromatography
Reactions were monitored using thin layer chromatography with Merck 60 F254 silica gel coated aluminium sheets and visualised using UV light of a wavelength of 254 nm. Flash column chromatography was carried out using silica gel 40-63 m, supplied by Merck.

Nuclear Magnetic Resonance (NMR)
^{1}H and ^{13}C nuclear magnetic resonance spectra were recorded at 600 MHz on a Bruker Avance III 600 Cryo at room temperature. All chemical shifts are quoted in ppm relative to internal resonance. The multiplicity of the signal is given by the following abbreviations: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, and br = broad signal. Peaks were allocated with the aid of HSQC, COSY and NOESY spectra. The coupling constants *J* are recorded in Hz.

Infrared Spectroscopy (IR)
Infrared spectra were recorded using a Bruker Alpha FT-IR.

UV-Vis
UV-Vis analysis was conducted with a Varian Cary 300 Bio UV-Vis spectrophotometer, using quartz cuvettes with a path length (l) of 1 cm. Molar absorption coefficients were calculated according to the Beer-Lambert Law:
$A = \log_{10} I/I_0 = \varepsilon \, l \, c$

LCMS, HRMS
LC-MS analysis was performed using a Waters Acquity system, equipped with an Acquity UPLC BEH C18 column (50 x 2.1 mm, 1.7 mm beads). Dr. Kersti Karu, Mass Spectrometry Manager at UCL Chemistry, undertook HRMS analysis. CI and EI data was acquired on a MAT 900 sector mass spectrometer. ESI data was acquired on a Waters LCT Premier XE.

Melting point
Melting point data was obtained using an Electrothermal IA9000.

Sample preparation for Transient Absorption Spectroscopy (TAS)

Samples for TAS were prepared in an air tight quartz cuvette with a 2 mm pathlength (Starna Scientific) sealed with septum seals (Starna Scientific GL/Septum Seal) at a concentration of 5 μM in either water or DMSO. The samples were then flushed with N_2, O_2, or air depending on the experiment for 20 minutes. This was repeated before every measurement.

2. Synthetic procedures

7-Iodo-4-methyl-2H-chromen-2-one (3) 7-amino-4-methyl-2H-chromen-2-one (6.60 g, 43.5 mmol) was dissolved in water (186 mL) in an ice bath, and conc. H_2SO_4 was added drop wise. $NaNO_2$ (3.09 g, 69.8 mmol) in water (21 mL) was added, and the reaction was stirred for 15 min. KI (10.86 g, 65.4 mmol) in water (42 mL) was added dropwise, and the mixture was stirred for 4 h. The aqueous phase was extracted with ethyl acetate, and the collected organic layers were washed with 25% (w/v) $Na_2S_2O_3$, 1 M HCl, 2 M NaOH and saturated brine, and dried over Na_2SO_4 followed by evaporating the solvent. The crude was purified by column chromatography (n-Hexane/EtOAc, 2:1). The product was a white powder (6.95 g, 24.3 mmol, 56%). TLC (n-hexane/EtOAc, 2:1): $R_f = 0.57$; mp: 154.1-155 °C; IR ν_{max} 3044.98 (Ar C-H), 1725.30 (C=O) cm^{-1}; ^{1}H-NMR (600 MHz, DMSO-d6, ppm) δ 7.84 (1H, d, *J* = 1.2 Hz, H-8), δ 7.74 (1H, dd, *J* = 8.4, 1.8 Hz, H-6), δ 7.54 (1H, d, *J* = 8.4 Hz, H-5), δ 6.45 (1H, d, *J* = 1.2 Hz, H-3), δ 2.41 (3H, d, *J* = 1.2 Hz, H-11); ^{13}C-NMR (151 MHz, DMSO-d6, ppm) δ 160.04 (C-2), δ 153.55 (C-9), δ 152.01 (C-4), δ 133.55 15 (C-6), δ 126.29 (C-5), δ 125.72 (C-7), δ 119.63 (C-8), δ 115.72 (C-10), δ 97.31 (C-3), δ 18.70 (C-11); HRMS (EI) *m/z*: $[M+H]^+$ $C_{10}H_7IO_2+H^+$ calcd.: 286.9563, found: 286.9564.

4-(Hydroxymethyl)-7-iodo-2H-chromen-2-one (4) SeO_2 (2.23 g, 20.05 mmol) and 7-iodo-4-methyl-2H-chromen-2-one (**3**) (3.00 g, 10.49 mmol) were suspended in *p*-xylene (210 mL), and the mixture was refluxed under vigorous stirring under argon atmosphere for 72 h. The mixture was filtered and the solvent removed under reduced pressure. The powder was dissolved in methanol, $NaBH_4$ (0.76 g, 20.05 mmol) was added, and the mixture was stirred at room temperature for 3 h. The suspension was neutralised with 1 M HCl (70 mL), diluted with water (50 mL), and partially concentrated under reduced pressure to remove methanol. The mixture was extracted with ethyl acetate, and the organic phase was washed with water and brine, dried over Na_2SO_4 and concentrated under vacuum. The obtained solid was purified by column chromatography (n-Hexane/EtOAc, 1:1) to yield the product as a yellow powder (1.431 g, 4.70 mmol, 45%). TLC (n-Hexane/EtOAc, 1:1): $R_f = 0.45$; mp: 166.8- 169.8 °C; IR ν_{max} 3455.83 (OH), 1678.38 (C=O) cm^{-1}; ^{1}H-NMR (600 MHz, DMSO-d6, ppm) δ 7.87 (1H, s, H-8), δ 7.70 (1H, d, *J* = 7.8 Hz, H-6), δ 7.46 (1H, *J* = 8.4 Hz, H-5), δ 6,49 (1H, s, H-3), δ 5.70 (1H, t, *J* = 4.8 Hz, H-12), δ 4.74 (2H, d, *J* = 4.2 Hz, H-11); ^{13}C-NMR (151 MHz, DMSO-d6, ppm) δ 159.51 (C-2), δ 156.27 (C-4), δ 153.05 (C-9), δ 133.13 (C-6), δ 125.81 (C-5), δ 125.16 (C-7), δ 116.87 (C-8), δ 111.09 (C-10), δ 98.39 (C-3), δ 58.93 (C-11); HRMS (EI) *m/z*: $[M+H]^+$ $C_{10}H_7IO_3+H^+$ calcd.: 302.9513, found: 302.9514.

7-Iodo-4-(((triisopropylsilyl)oxy)methyl)-2H-chromen-2-one (5) 4-(hydroxymethyl)-7-iodo-2H-chromen-2-one (**4**) (300 mg, 0.99 mmol), DMAP (12 mg, 0.09 mmol, 0.1 eq) and DIPEA (194 mg, 260 µL, 1.5 mmol) were suspended in dry DMF (6 mL). TIPS.Cl (386 mg, 428 µL, 2 mmol) was added under argon, and the mixture was stirred overnight under argon. The solvent was removed under reduced pressure and the crude product was resuspended in DCM before being washed with water and brine, dried with Na_2SO_4 and concentrated under reduced pressure. The crude was purified by flash column chromatography (neat DCM), and the product was obtained as a white solid (265 mg, 0.58 mmol, 58%). TLC (neat DCM): $R_f = 0.69$; mp: 85.1-87.3 C; IR ν_{max} 2959.66 (Alkyl C-H), 2940.44 (Alkyl C-H), 2862.61 (Alkyl C-H), 1724.49 (C=O), 1691.86 (C=C), 1625.47 (C=C), 1592.61 (C=C) cm^{-1}; ^{1}H-NMR (600 MHz, $CDCl_3$, ppm) δ 7.73 (1H, d, *J* = 1.2 Hz, 10 H-8), δ 7.58 (1H, dd, *J* = 6 Hz, 1.8, H-6), δ 7.14 (1H, d, *J* = 8.4 Hz, H-5), δ 6.71 (1H, t, *J* = 1.8 Hz, H-3), δ 4.94 (2H, d, *J* = 1.8 Hz, H-11), δ 1.24-1.19 (3H, m, H-12), 1.11 (18H, d, *J* = 7.2, H-13); ^{13}C-NMR (151 MHz, $CDCl_3$, ppm) δ 160.38 (C-2), δ 153.97 (C-10 or C-9), δ 153.52 (C-10 or C-9), δ 133.40 (C-6), δ 126.50 (C-8), δ 124.04 (C-5), δ 117.03 (C-4), δ 112.47 (C-3), δ 97.05 (C-7), δ 61.16 (C-11), δ 18.12 (C-13), δ 12.06 (C-12); HRMS (ESI) *m/z*: $[M+H]^+$ $C_{19}H_{27}IO_3Si+H^+$ calcd.: 459.0852, found: 459.0848.

***N,N*-Diethyl-4-vinylaniline (6)** Methyltriphenylphosphonium bromide (9.35 g, 26.20 mmol) and potassium tert-butoxide (2.97 g, 24.30 mmol) were mixed in dry THF (30 mL), and the suspension stirred for 30 min. 4-Diethyl-5-aminobenzaldehyde (1.57 g, 8.86 mmol) in dry THF (5 mL) was added dropwise, then the mixture was stirred for 48 h. MeOH (35 mL) was added and the solution filtered. The filtrate was concentrated and subsequently purified by flash column chromatography (n-Hexane/EtOAc, 1:1) gave N,N'-diethyl-4-vinylaniline as a yellow oil (1.03 g, 5.87 mmol, 66%). TLC (n-Hexane/EtOAc, 1:1): $R_f = 0.80$; IR ν_{max} 2966.60 (Alkyl C-H), 1605.70 (C=C), 1517.29 (C=C) cm^{-1}; ^{1}H-NMR (600 MHz, DMSO-d6, ppm) δ 7.24 (2H, d, *J* =10.2 Hz,H-4), δ 6.60 (2H, d, *J* =9 Hz, H-5), δ 6.55(1H, dd, *J* =17.7, 11.4 Hz, H-2), δ 5.50 (1H, d, *J* = 18 Hz, H-1a), δ 4.92 (1H, d, *J* = 10.8 Hz, H-1b), δ 3.32 (4H, q, *J* = 7.2 Hz, H-7), δ 1.07 (6H, t, *J* = 7.2 Hz, H-8); ^{13}C-NMR (151 MHz, DMSO-d6, ppm) δ 147.18 (C-6), δ 136.65 (C-2), δ 127.36 (C-5), δ 124.19 (C-3), δ 111.25 (C-4), δ 108.41 (C-1), δ 43.69 (C-7), δ 12.48 (C-8); HRMS (EI) *m/z*: $[M+H]^+$ $C_{12}H_{17}N+H^+$ calcd.: 176.1434, found: 176.1434.

(E) - 7 - (4 - (Diethylamino)styryl) - 4 - (((triisopropylsilyl) oxy) methyl) - 2 H - chromen - 2 - one (**7**) $Pd(OAc)_2$ (1.6 mg), (**7**) (223 mg, 0.48 mmol), (**6**) (90 mg, 0.55 mmol), triethanol amine (2 mL) and dry DMF (6 mL) were heated and stirred at 100 °C under argon overnight. Afterwards, DCM was added and the combined organic layers were washed with water and brine, dried with Na_2SO_4 and concentrated under reduced pressure. The crude was purified by flash column chromatography (neat DCM), and the product was obtained as brown oil (114 mg, 0.23 mmol, 47%). IR ν_{max} 2960.48 (Alkyl C-H), 2940.82 (Alkyl C-H), 2864.30 (Alkyl C-H), 1721.95 (C=O), 1589.97 (C=C), 1520.19 (C=C) cm^{-1}; TLC (neat DCM): $R_f = 0.43$; ^{1}H- NMR (600 MHz, $CDCl_3$, ppm) δ 7.41 (2H, d, *J* = 9 Hz, H-17), δ 7.38 and 7.35 (3H, H-5, H-6 and H-8), δ 7.14 (1H, d, *J* = 16.2 Hz, H-14), δ 6.86 (1H, d, *J* = 16.2 Hz, H-15), δ 6.67 (2H, d, J = 8.4 Hz, H-18), δ 6.63 (1H, s, H-3), δ 4.97 (2H, d, *J* = 1.8 Hz, H-11), δ 3.4 (4H, q, *J* = 7.2 Hz, H-20), δ 1.18-1.25 (9H, m, H-12 and H-21), δ 1.13 (18H, d, *J* = 7.2 Hz, H-13); ^{13}C-NMR (151 MHz, $CDCl_3$, ppm) δ 161.77 (C-2), δ 154.34 (C-9 or C-10), δ 154.21 (C-9 or C-10), δ 148.16 (C-20), δ 142.49 (C-7), δ 132.31 (C-14), δ 128.57 (C-17), δ 123.71 (C-16), δ 122.96 (C-5, C-6 or C-8), δ 121.91 (C-15), δ 121.61 (C-5, C-6 or C-8), δ 115.63 (C-4), δ 113.71 (C-5, C-6 15 or C-8), δ 111.68 (C-18), δ 110.49 (C-3), δ 61.33 (C-11), δ 18.16 (C-13), δ 12.78 and δ 12.11 (C-13 and C-21); HRMS (ESI) *m/z*: $[M+H]^+$ $C_{31}H_{43}NO_3Si+H^+$ calcd.: 506.3091, found: 506.3096.

(E) - 7 - (4 - (Diethylamino) styryl) - 4 - (((triisopropylsilyl) oxy) methyl) - 2H - chromene - 2 - thione (**8**) (E)-7-(4-(diethylamino)styryl)-4-(((triisopropylsilyl)oxy)methyl)-2H chromen-2-one (**7**) and Lawesson's reagent (720 mg, 1.77 mmol) were refluxed in dry toluene (50 mL) in the dark overnight. After evaporation of the resulting solution, the crude was purified by flash column chromatography (n-Hexane/DCM, 1:9), and the product was obtained as a red oil (300 mg, 0.58 mmol, 33%). IR ν_{max} 2942.01 (Alkyl C-H), 2865.06 (Alkyl C-H), 1587.60 (C=C), 1520.12 (C=C), 1501.94 (C=C) cm^{-1}; TLC (n-Hexane/DCM, 1:9): $R_f = 0.9$; ^{1}H-NMR (600 MHz, $CDCl_3$, ppm) δ 7.51 (1H, s, H-8), δ 7.39-7.42 (5H, m, H-3, H-5, H-6, H-17), δ 7.16 (1H, d, *J* = 16.2 Hz, H-14), δ 6.86 (1H, d, *J* = 16.2 Hz, H-15), δ 6.67 (2H, d, *J* = 9 Hz, H-18), δ 4.93 (2H, d, *J* = 1.2 Hz, H-11), δ 3.40 (4H, q, *J* = 7.2 Hz, H-20), δ 1.13-1.24 (9H, m, H-12 and H-21), δ 1.12 (18H, d, *J* = 7.2 Hz, H-13); ^{13}C-NMR (151 MHz, $CDCl_3$, ppm) δ 198.13 (C-2), δ 156.85 (C-9 or C-10), δ 154.40 (C-9 or C-10), δ 153.58 (C-19), δ 145.80 (C-4, C-7, C-16), δ 142.88 (C-4, C-7, C-16), δ 132.97 (C-14), δ 131.71 (C-4, C-7, C-16), δ 128.71 (C-3, C-5, C-6, C-17), δ 124.27 (C-3, C-5, C-6, C-17), 123.12 (C-3, C-5, C-6, C-17), δ 122.90 (C-15), 117.21 (C-3, C-5, C-6, C-17), 111.71 (C-18), δ 61.15 (C-11), δ 44.62 (C-20), δ 18.16 (C- 13), δ 12.76 (C-12 or C-21), δ 12.10 (C-12 or C-21); HRMS (ESI) *m/z*: $[M+H]^+$ $C_{31}H_{43}NO_2SSi+H^+$ calcd.: 522.2862, found: 522.2860.

(E) - 7 - (4- (Diethylamino) styryl) - 4 - (hydroxymethyl) - 2H - chromene - 2 - thione (1a) (E)-7-(4-(diethylamino)styryl)-4-(((triisopropylsilyl)oxy)methyl)-2H-chromene-2-thione (**8**) (64.5 5 mg, 0.13 mmol) was dissolved in dry THF (20 mL), and $Et_3N.3HF$ (209 mg, 1.3 mmol) was added. The mixture was stirred for 24 h at RT before being cooled with in an ice bath, quenched by addition of saturated $NaHCO_3$ (aq), extracted with DCM, dried over Na_2SO_4 and concentrated. The crude was purified using flash column chromatography (neat DCM). The product was obtained as red solid (18.5 mg, 0.05 mmol, 39%). TLC (neat DCM): R_f = 0.10; ^{1}H-NMR (600 MHz, $CDCl_3$, ppm) δ 7.72 (1H, d, *J* = 1.2 Hz, H-8), δ 7.70 (1H, d, *J* = 8.4 Hz, H-5), δ 7.60 (1H, dd, *J* = 8.4 Hz, 1.8, H-6), δ 7.46 (2H, d, *J* = 9 Hz, H-16), δ 7.43 (1H, d, *J* = 16.2 Hz, H-13), δ 7.24 (1H, s, H-3), δ 7.04 (1H, d, *J* = 16.2 Hz, H-14), δ 6.68 (2H, d, *J* = 9, H-17), δ 5.69 (1H, t, *J* = 4.8 Hz, H-12), δ 4.76 (2H, d, *J* = 3.6 Hz, H-11), δ 3.38 (4H, q, *J* = 6.6 Hz, H-20), δ 1.11 (6H, t, *J* = 6.6 Hz, H-21); ^{13}C-NMR (151 MHz, $CDCl_3$, ppm) δ 196.97 (C-2), δ 156.45 (C-9 or C-10), δ 148.92 (C-9 or C-10), δ 147.82 (C-18), δ 142.97 (C-7), δ 133.15 (C-13), δ 128.71 (C-16), δ 124.57 (C-5), δ 123.31 (C-6), δ 123.16 (C-3), δ 122.95 (C-15), δ 120.82 (C-14), δ 116.85 (C-4), δ 112.31 (C-8), δ 111.35 (C-17), δ 58.71 (C-11), δ 44.75 (C-20), δ 12.56 (C-21); HRMS (ESI) *m/z*: $[M+H]^+$ $C_{22}H_{23}NO_2S+H^+$ calcd.: 366.1528, found: 366.1525.

(E) - (7 - (4 - (Diethylamino) styryl) – 2 – thioxo - 2H – chromen - 4-yl) methyl acetate (1b) A mixture of (E)-7-(4-(diethylamino)styryl)-4-(hydroxymethyl)-2H-chromene-2-thione (**1a**) (520 mg, 1.43 mmol) and DCC (352 mg, 1.7 mmol), acetic acid (0.1 mL, 1.7 mmol, 1.2 eq) and DMAP (207 5 mg, 1.7 mmol, 1.2 eq) in dry DCM (100 mL) was stirred at 0 °C under argon overnight. The reaction mixture was filtered and washed with 1.2 M hydrochloric acid and saturated $NaHCO_3$ (aq) before being dried over Na_2SO_4 and concentrated under reduced pressure. The crude was purified using flash column chromatography (1% MeOH in DCM), and the product was obtained as a red solid (446 mg, 1.09 mmol, 76%). TLC (1% MeOH in DCM): R_f = 0.76; ^{1}H-NMR (700 MHz, DMSO-d6, ppm) δ 7.50 (1H, s, H-5. H-6 or H-8), δ 7.44 (2H, s, H-5. H-6 or H-8), δ 7.41 (2H, d, *J* = 8.4 Hz, H-16), δ 7.22 (1H, s, H-3), δ 7.17 (1H, d, *J* = 16.2 Hz, H-13), δ 6.85 (1H, d, *J* = 16.2 Hz, H-14), δ 6.67 (2H, d, *J* = 9 Hz, H-17), δ 5.23 (2H, s, H-11), δ 3.39 (4H, q, *J* = 7.2 Hz, H-20), δ 2.20 (3H, s, H-23), δ 1.20 (6H, t, *J* = 7.2 Hz, H-21); ^{13}C-NMR (151 MHz, DMSO-d6, ppm) δ 197.39 (C-2), δ 170.34 (C-22), δ 157.07 (C-9 or C-10), δ 148.35 (C-9 or C-10), δ 143.47 (C-18), δ 140.48 (C-7), δ 133.43 (C-13), δ 128.81 (C-16), δ 125.11 (C-5), δ 123.56 (C-6), δ 123.41 (C-3), δ 121.04 (C-15), δ 116.93 (C-14), δ 113.43 (C-4), δ 111.52 (C-8), δ 61.00 (C-11), δ 44.58 (C-20), δ 20.92 (C-23), δ 12.76 (C-21); HRMS (ESI) *m/z*: $[M+H]^+$ $C_{24}H_{25}NO_3S+H^+$ calcd.: 408.1628, found: 408.162.

3. Chemical analysis of compounds

3.1. Absorption profile of compound (1a)

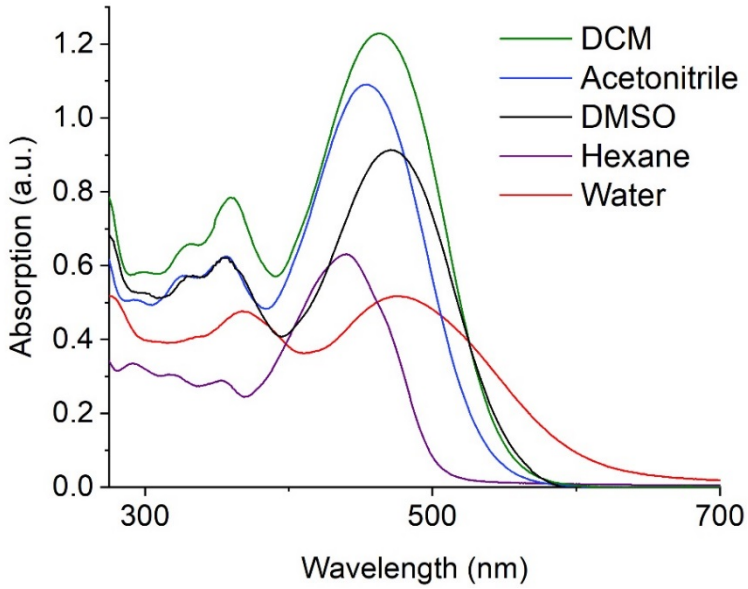


Figure S1 UV-Vis absorption profile of styryl thiocoumarin (1a). All 50 µM.

3.2. Absorption profile of compound (1b)

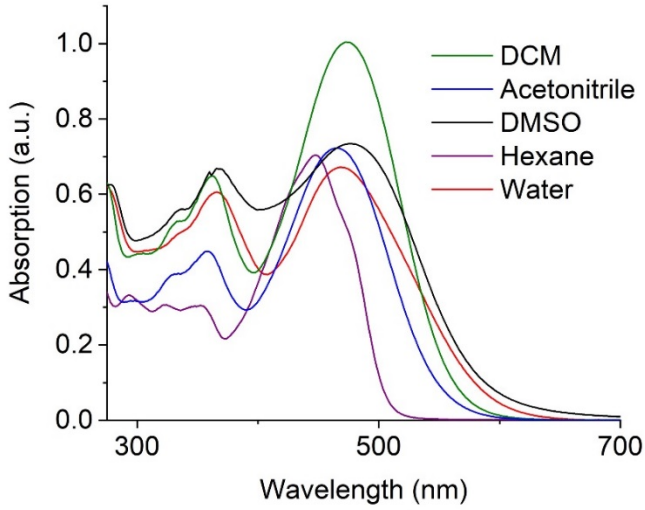


Figure S2 UV-Vis absorption profile of styryl thiocoumarin (1b). All 50 µM.

4. Transient absorption spectroscopy (TAS)

4.1. Experimental set up for transient absorption spectroscopy (TAS)

Microsecond TAS was recorded using laser pulses (6 ns, 532 nm, repetition rate 10 Hz) from a Nd:YAG laser (Spectra-Physics, INDI-40-1-) with a pump wavelength of 475 nm, using pump intensities of 3-170 μJcm^{-2}. The light output from a quartz tungsten halogen lamp (Bentham) was used as a probe and signals were recorded with Si and InGaAs photodiodes, housed in a preamplifier and an electronic filter (Costronics Electronics) connected to an Tektronix DPO4034B oscilloscope and PC. Probe wavelengths were selected *via* a Cornerstone 130 monochromator (Oriel Instruments). The set up is shown schematically below in Figure S3.

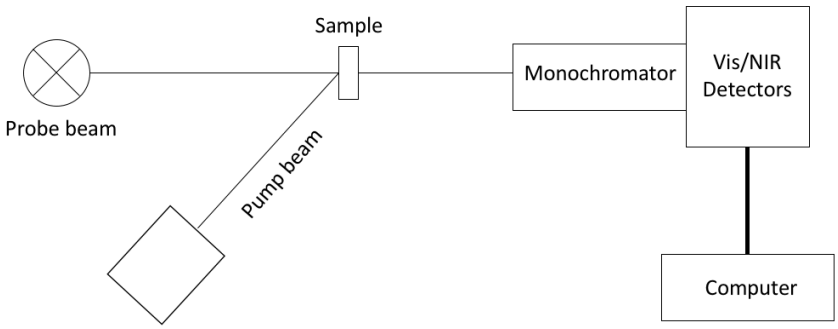


Figure S3 The sketch shows the experimental set up used to characterise the excited state of the photocage. The sample was excited with a beam from a pulsed laser of wavelength λ_{pump}. A probe beam with λ_{probe} was then applied to determine the absorption as a function of wavelength and time difference between excitation and probing. Probe wavelengths were selected *via* a monochromator.

4.2. Verification of kinetics of triplet formation - TAS

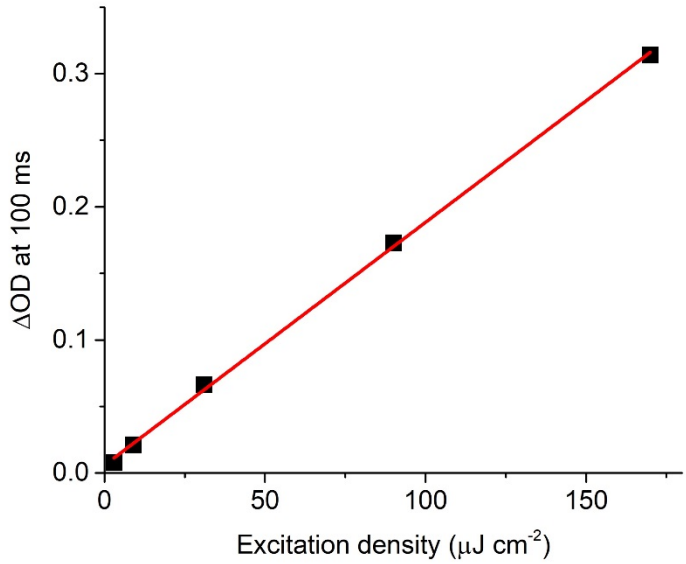


Figure S4 The graph shows a linear increase of change in optical density when increasing the excitation density. This is expected for first order kinetics and typical for triplet states.

4.3. Jablonski diagram showing ISC to a triplet state

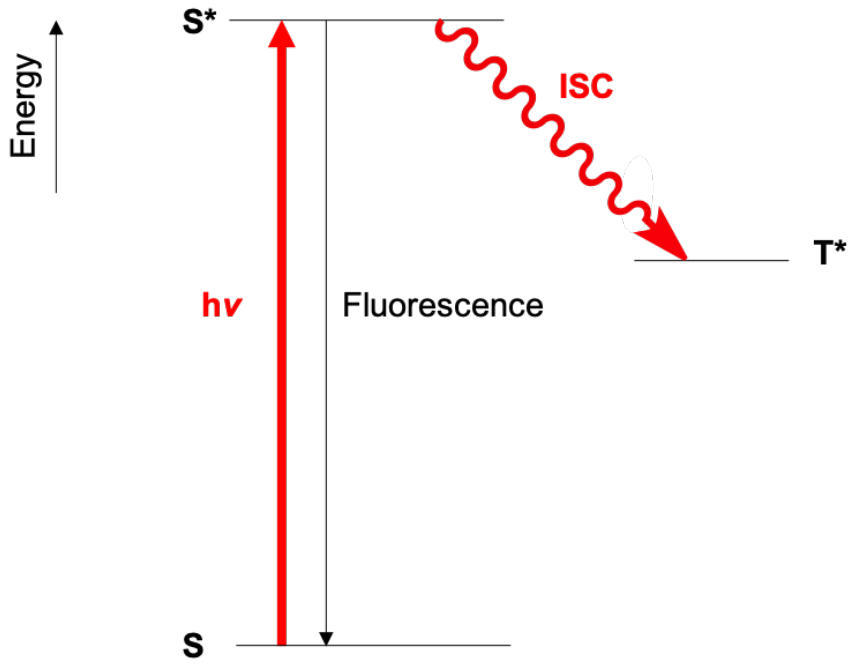


Figure S5 General Jablonski diagram showing an optically excited chromophore in the S_1 state can energetically relax via intersystem crossing to the triplet state, or decay via fluorescence to the ground state.

5. Fluorescence spectra of compounds (1a) and (1b) in different solvents

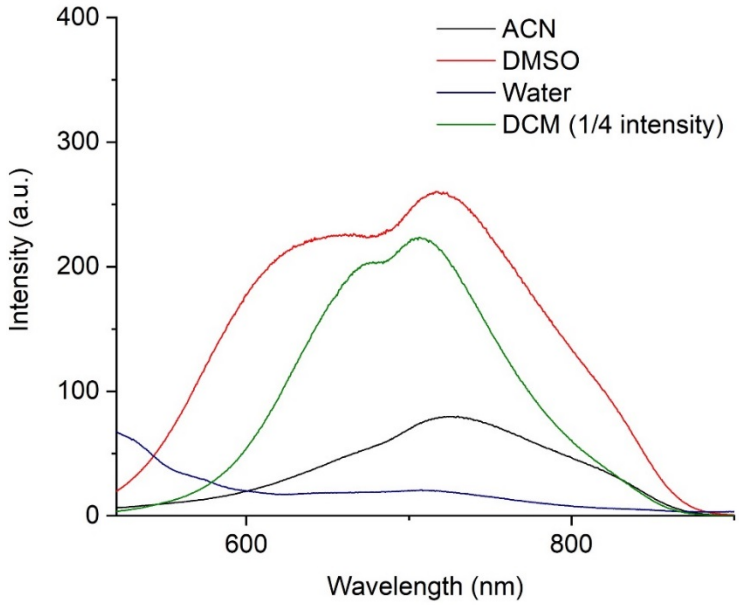


Figure S6 Fluorescence spectra of (**1a**) in different solvents. Excitation wavelength 475 nm, all 50 µM.

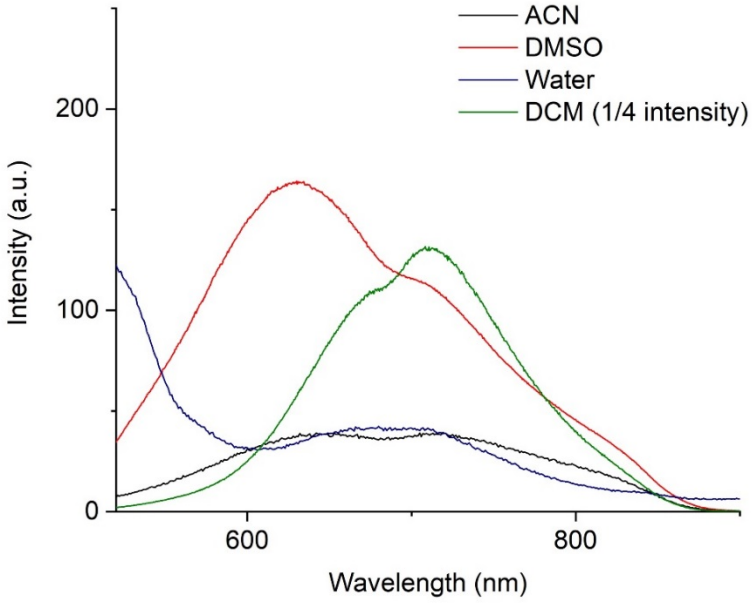


Figure S7 Fluorescence spectra of (**1b**) in different solvents. Excitation wavelength 475 nm, all 50 µM.

In both spectra, the strong increase towards the blue for the emission in water is due to the edge of the excitation beam.

6. Light source used for photouncaging experiments

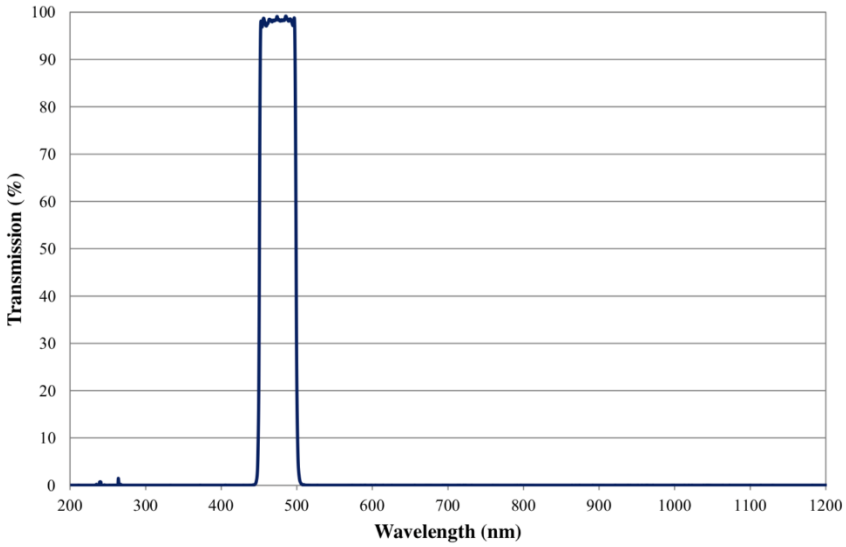


Figure S8 A Bentham IL1, quartz tungsten halogen lamp was used to irradiate the samples. The beam was guided through a bandpass filter with a center wavelength of 475 nm and a bandwith of 50 nm. The power density at 475 nm was measured to be 6.7 mW/cm^2 using a Thorlabs S120VC detector at room temperature.

7. NMR spectrum of photolysis products

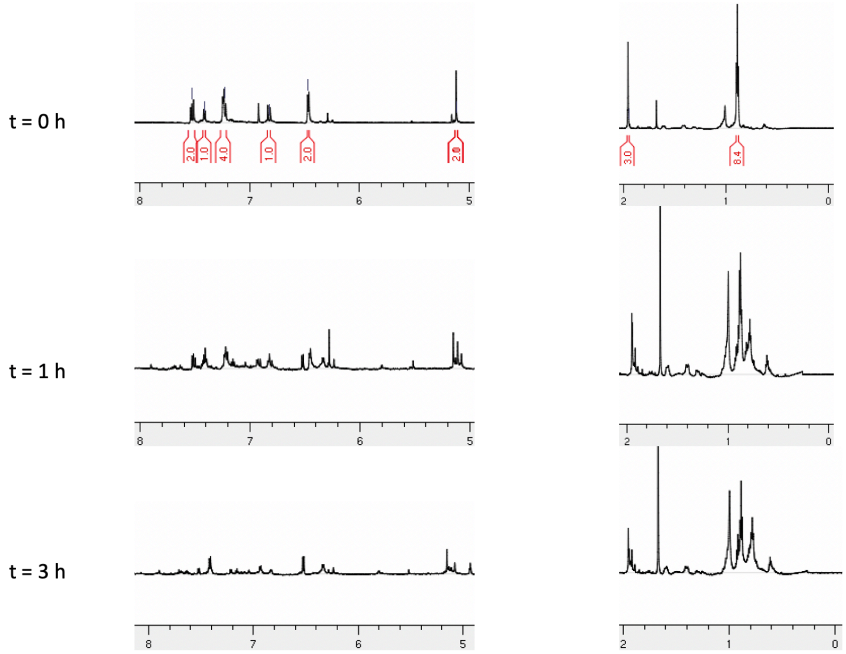


Figure S9 Example NMR showing photolysis products of compound (**1b**) in DMSO in air. The formation of smaller fragments can be seen. Similar results were observed for all other conditions.

8. Normalised absorption profile of compound (1b) in water and DMSO at different concentrations

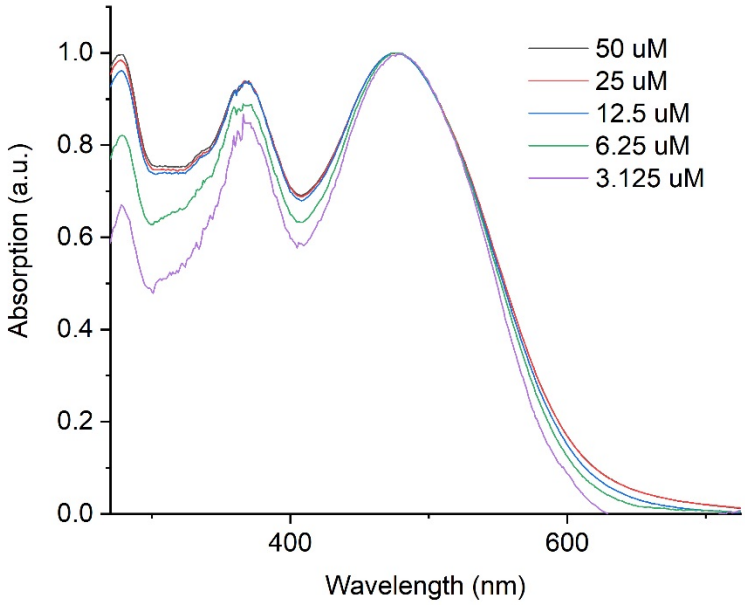


Figure S10 Normalised UV-Vis absorption profile of styryl thiocoumarin (**1b**) in water at different concentrations. The intensity of the peak at 275 nm decreases by approximately 35% relative to those of longer wavelength as the concentration decreases.

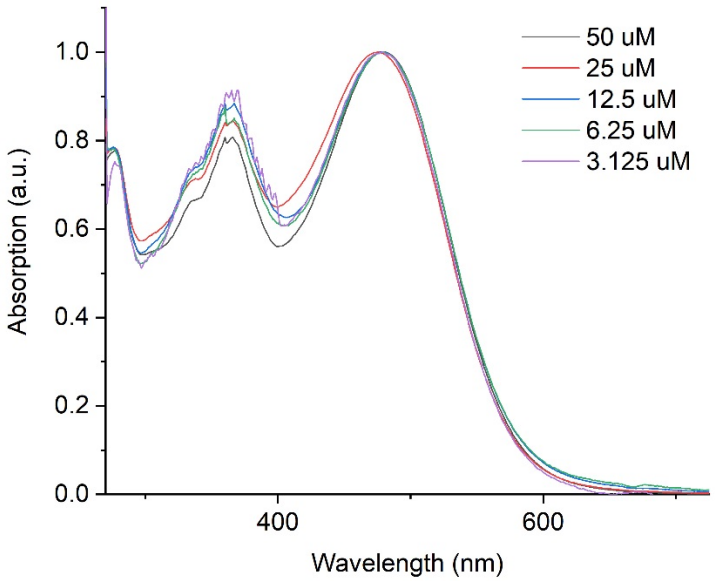


Figure S11 Normalised UV-Vis absorption profile of styryl thiocoumarin (**1b**) in DMSO at different concentrations. The intensity of the peak at 275 nm shows significantly less variation relative to those of longer wavelength as the concentration decreases.

9 HPLC analysis of photocages (1a) and (1b)

The photouncaging solutions were prepared at 50 μM in water and DMSO from frozen 10 mM DMSO stocks. Aliquots were taken out of the cuvette at the relevant time points and analysed using the HPLC protocol detailed below. The progress was determined by tracking the residual content of (**1b**) by HPLC using the protocol detailed in Figure S11, followed by normalization to the amount of starting material.

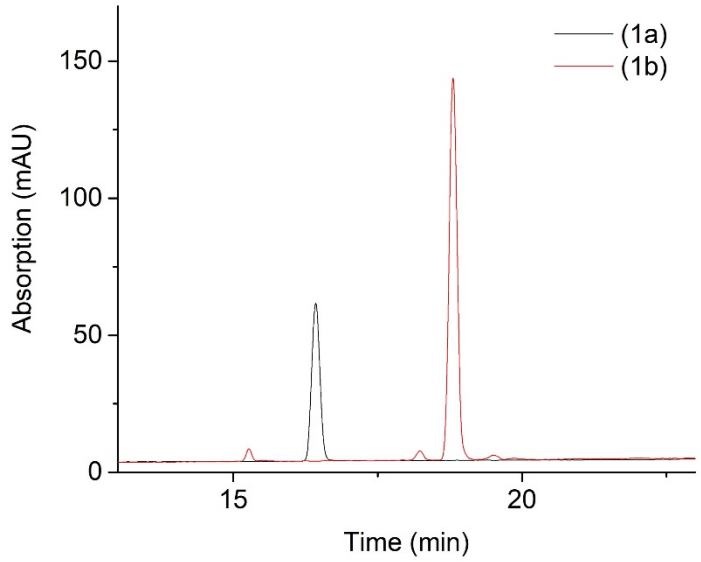


Figure S12 HPLC traces of photocages (**1a**) and (**1b**). Analytical HPLC analysis was performed using an Agilent Eclipse C18 column (250 x 4.6 mm, 5 μm beads), with an elution system of 5-100 % ACN in water over 22 min at 1 mL/min flow rate.

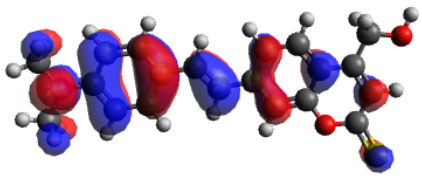
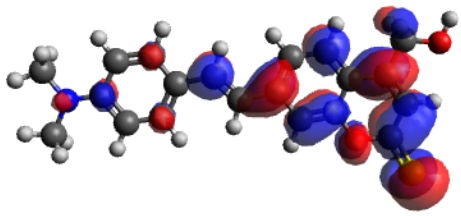
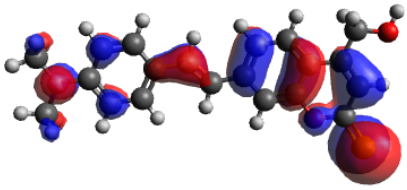
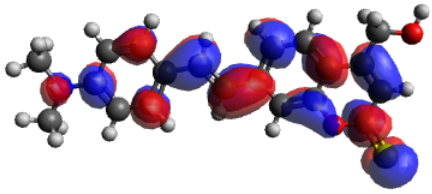
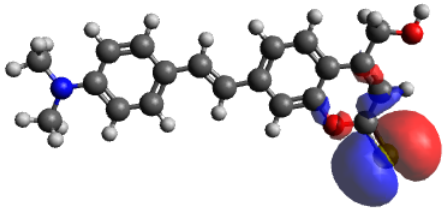
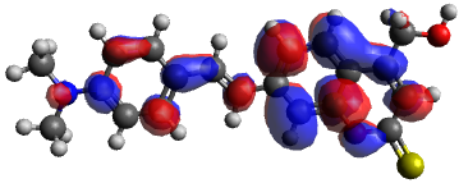
Table S1 Retention times of photocages (**1a**) and (**1b**).

	Retention time (min)
(1a)	15.4
(1b)	17.6

10. DFT and TD-DFT calculations for compounds 1a and 1b

10.1. Molecular orbitals of compound 1a in water

Table S2 Photocage (1a) MOs after a geometry optimisation using CAM-B3LYP/6-31G(d), with the SCRF method and Polarizable Continuum Model (PCM), and water as the solvent.

	
HOMO -6.21 eV	LUMO -1.3 eV
	
HOMO-1 -7.42eV	LUMO+1 00.1863 eV
	
HOMO-2 -7.84eV	LUMO+2

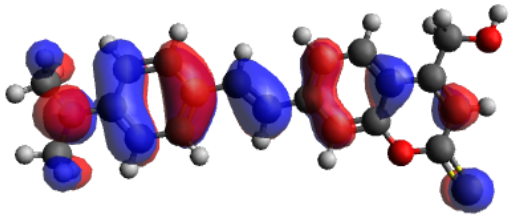
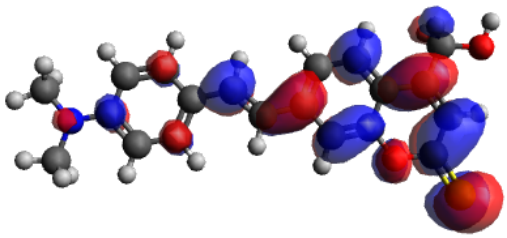
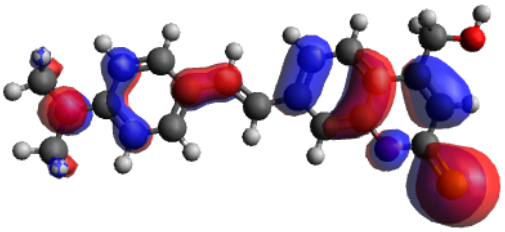
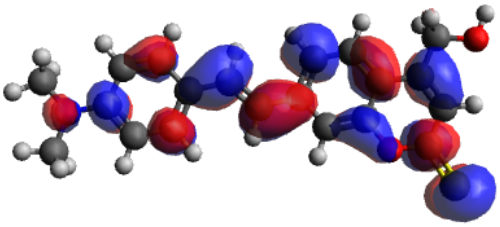
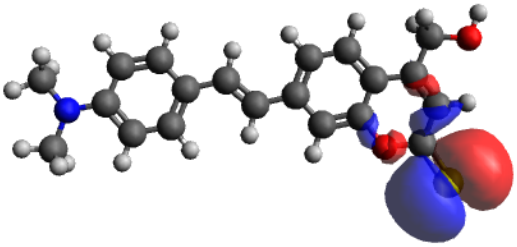
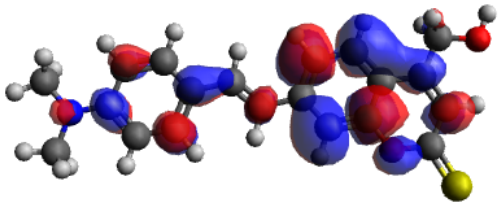
10.2. Singlet excitation energies and oscillator strengths of compound 1a in water

Table S3 Singlet excitation energies and oscillator strengths for (**1a**) using TD-DFT (CAM-B3LYP/6-31G(d)) with water as solvent.

Transition energy	Oscillator strength	MO transitions involved	Primary co-efficients
550 nm	f=1.98	HOMO→LUMO (π-π*)	0.66
		HOMO-1→LUMO	-0.15
391 nm	f=0.00	HOMO-2→LUMO (n-π*)	0.62
		HOMO-2→LUMO+1	-0.31
369 nm	f=0.35	HOMO-1→LUMO	0.53
		HOMO→LUMO+1	0.42
322 nm	f=0.12	HOMO→LUMO+1	0.52
		HOMO-1→LUMO	-0.38
264 nm	f=0.17	HOMO-5→LUMO	-0.38
		HOMO-1→LUMO+1	0.37

10.3. Molecular orbitals of compound 1a in heptane

Table S4 Photocage (**1a**) MOs after a geometry optimisation using CAM-B3LYP/6-31G(d), with the SCRF method and Polarizable Continuum Model (PCM), and heptane as the solvent.

	
HOMO -6.213 eV	LUMO -1.052 eV
	
HOMO-1 -7.174eV	LUMO+1 -0.058 eV
	
HOMO-2 -7.353eV	LUMO+2

10.4. Singlet excitation energies and oscillator strengths of compound 1a in heptane

Table S5 Singlet excitation energies and oscillator strengths for 1a using TD-DFT (CAM-B3LYP/6-31G(d)) with heptane as solvent:

Transition energy	Oscillator strength	MO transitions involved	Primary co-efficients
487 nm	f=0.00	HOMO-2→LUMO (n-π*)	0.65
		HOMO-2→LUMO+1	0.24
418 nm	f=1.30	HOMO→LUMO (π-π*)	0.59
		HOMO-1→LUMO	0.34
341 nm	f=0.34	HOMO-1→LUMO	0.58
		HOMO→LUMO	0.26
		HOMO→LUMO+1	0.24
292 nm	f=0.29	HOMO→LUMO+1	0.61
258 nm	f=0.23	HOMO-1→LUMO+1	-0.57

10.5. Singlet excitation energies and oscillator strengths of compound (1b) in DMSO

Table S6 Singlet excitation energies and oscillator strengths for (**1b**) using TD-DFT (CAM-B3LYP/6-31G(d)) with DMSO as solvent:

Transition energy	Oscillator strength	MO transitions involved	Primary co-efficients
556 nm	f=1.98	HOMO→LUMO (π-π*)	0.66
		HOMO-1→LUMO	-0.16
398 nm	f=0.00	HOMO-2→LUMO (n-π*)	0.62
		HOMO-2→LUMO+1	-0.30
371 nm	f=0.35	HOMO-1→LUMO	0.53
		HOMO→LUMO+1	0.42
325 nm	f=0.13	HOMO→LUMO+1	0.52
		HOMO-1→LUMO	0.37
265 nm	f=0.16	HOMO-1→LUMO+1	0.38
		HOMO-5→LUMO	-0.37

10.6. Singlet excitation energies and oscillator strengths of compound (1b) in water

Table S7 Singlet excitation energies and oscillator strengths for (**1b**) using TD-DFT (CAM-B3LYP/6-31G(d)) with water as solvent:

Transition energy	Oscillator strength	MO transitions involved	Primary co-efficients
559 nm	f=1.98	HOMO→LUMO (π-π*)	0.66
		HOMO-1→LUMO	-0.16
397 nm	f=0.00	HOMO-2→LUMO (n-π*)	0.62
		HOMO-2→LUMO+1	-0.30
372 nm	f=0.35	HOMO-1→LUMO	0.53
		HOMO→LUMO+1	0.42
326 nm	f=0.13	HOMO→LUMO+1	0.52
		HOMO-1→LUMO	-0.37
265 nm	f=0.15	HOMO-1→LUMO+1	0.37
		HOMO-5→LUMO	-0.38

11. Calculation of quantum yield of photolysis

The quantum yield (Φ) is defined as the ratio of caged molecules converted to the amount of photons absorbed an can be calculated according to the protocol by Nguyen *et al.* ACIE 2019, 58, 6620-6624, using the equations and information given below.

$$Photon\ Flux\ (photons.cm^{-2}s^{-1}) = \frac{Irradiance\ (mW/cm^2)}{Energy\ (J)}$$

$$\Phi\ (molecules.photons^{-1}) = \frac{Molecules\ destroyed\ (molecules.cm^{-2}s^{-1})}{Photon\ Flux\ (photons.cm^{-2}s^{-2})}$$

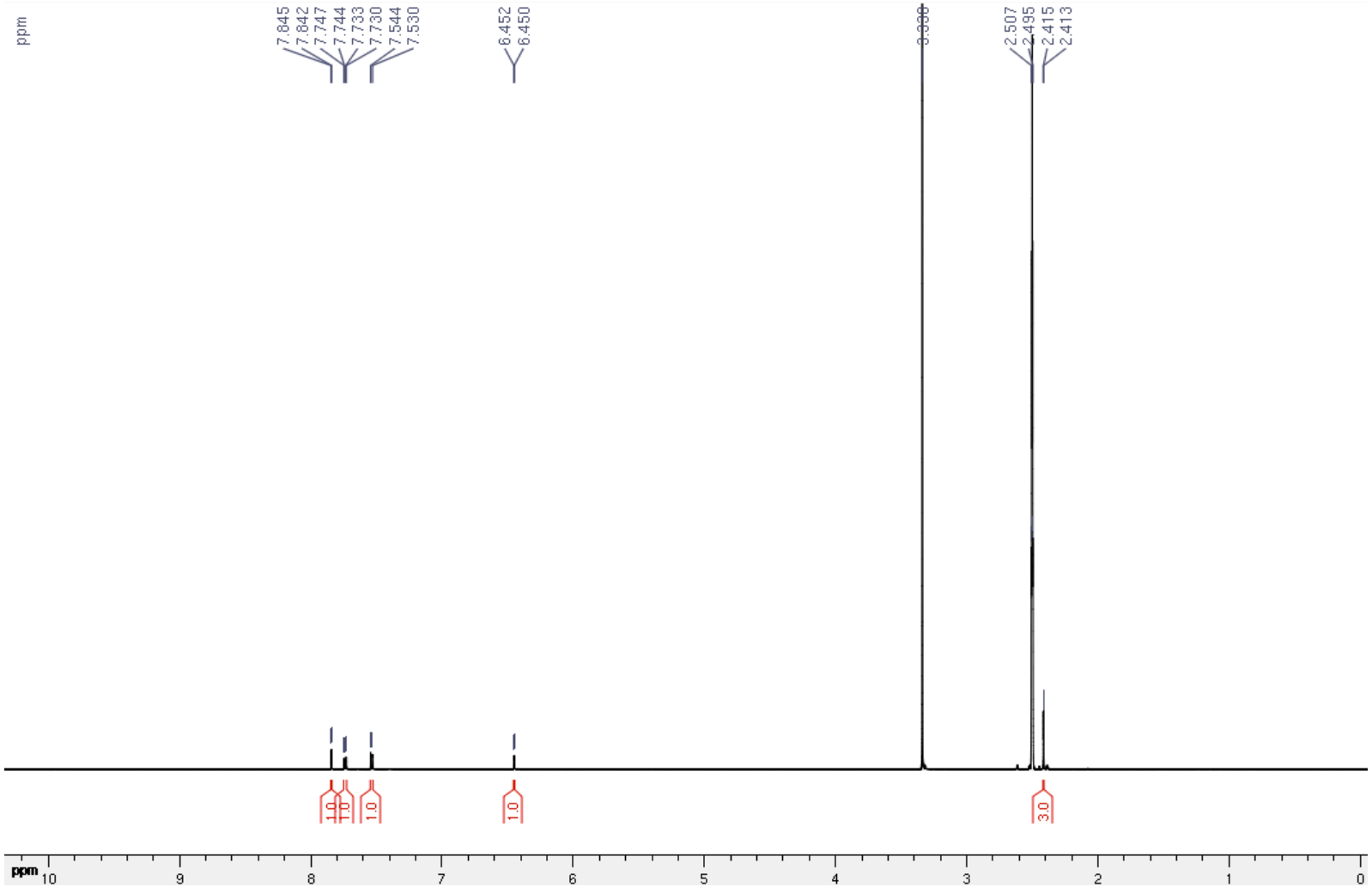
The calculated photon flux at $\lambda = 475$ nm at an irradiance of 6.7 mW/cm^2 was 1.6×10^{16} photons.cm^{-2}s^{-1}.

Table S8 Summay of the calculated quantum yield values:

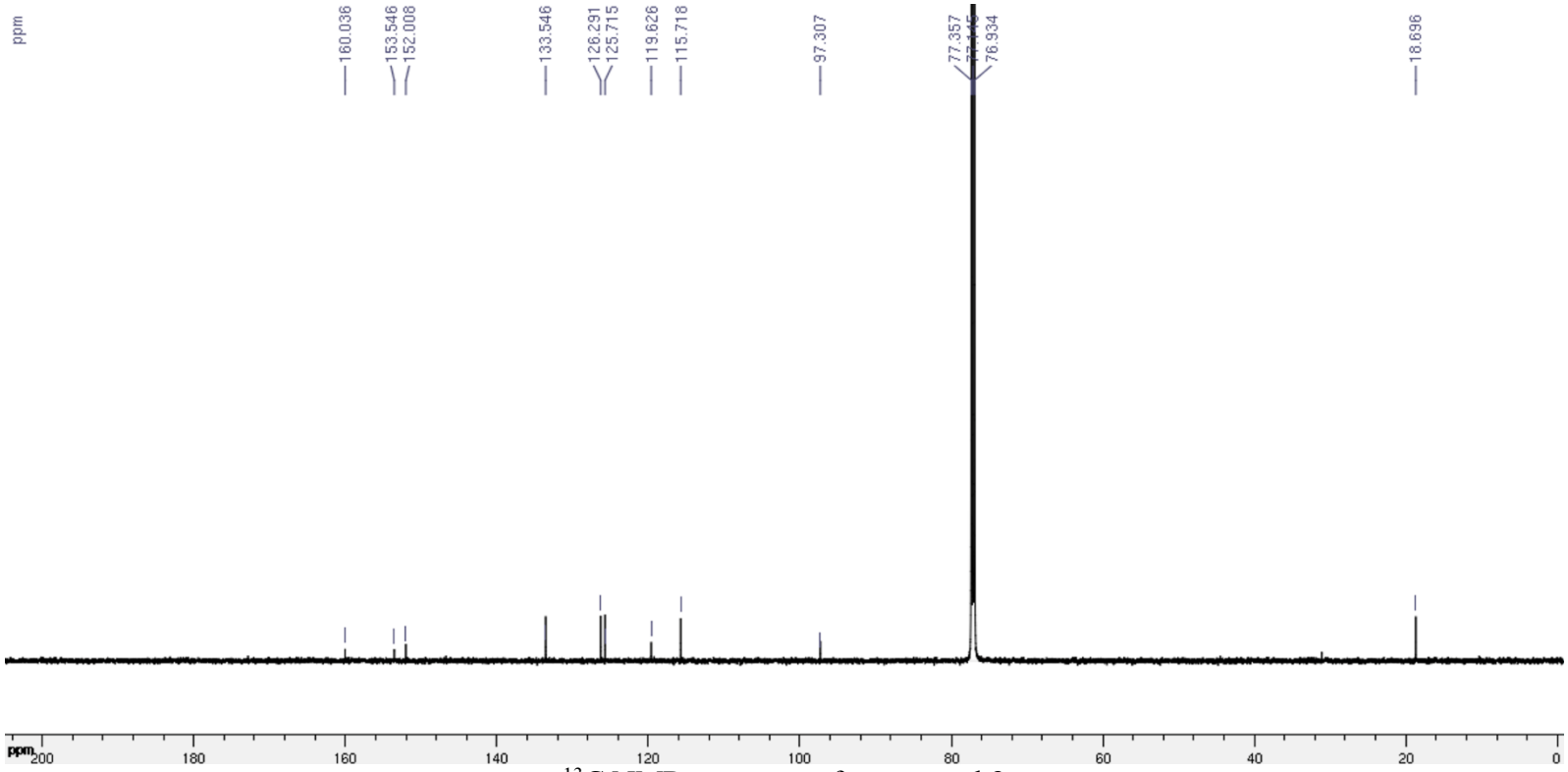
	Water (Argon)	Water (O_2)	DMSO (Argon)	DMSO (O_2)
k[1] ($\times 10^{-3}$ s^{-1})	17.8	37.9	71.4	12.8
Molecules destroyed ($\times 10^{15}$ molecules.cm^{-2}s^{-1})	0.54	1.14	2.13	0.39
Φ_{475}[2]	0.034	0.071	0.133	0.024
$\varepsilon_{475} \times \Phi_{475}$[3] (M^{-1} cm^{-1})	337	712	2049	375

[1] Photolysis rate constant for irradiation at 475 nm. [2] Quantum yield of photolysis at λ = 475 nm. [3] Product of molar absorption coefficient and quantum yield of photolysis at λ = 475 nm.

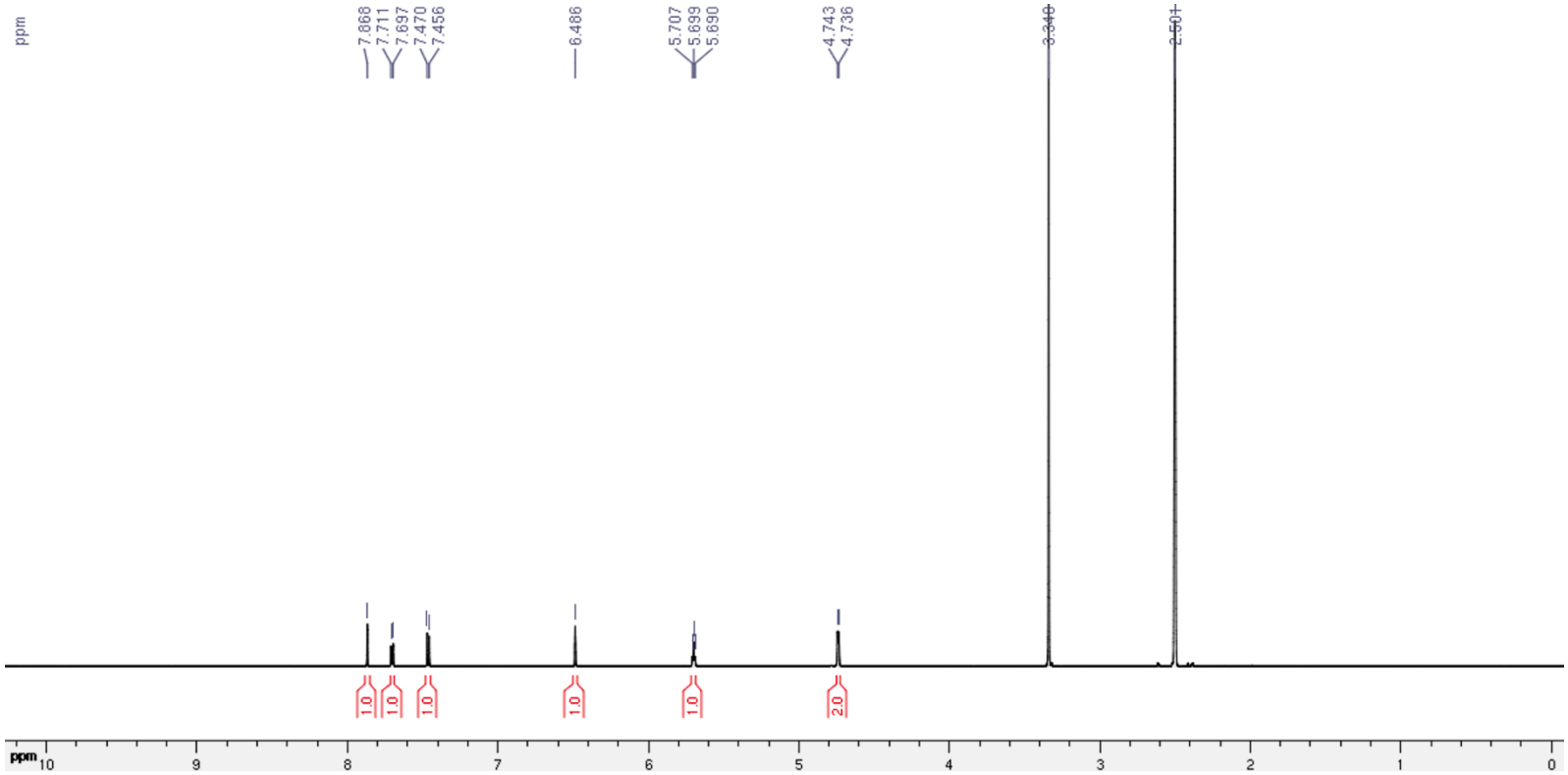
12 NMR spectra



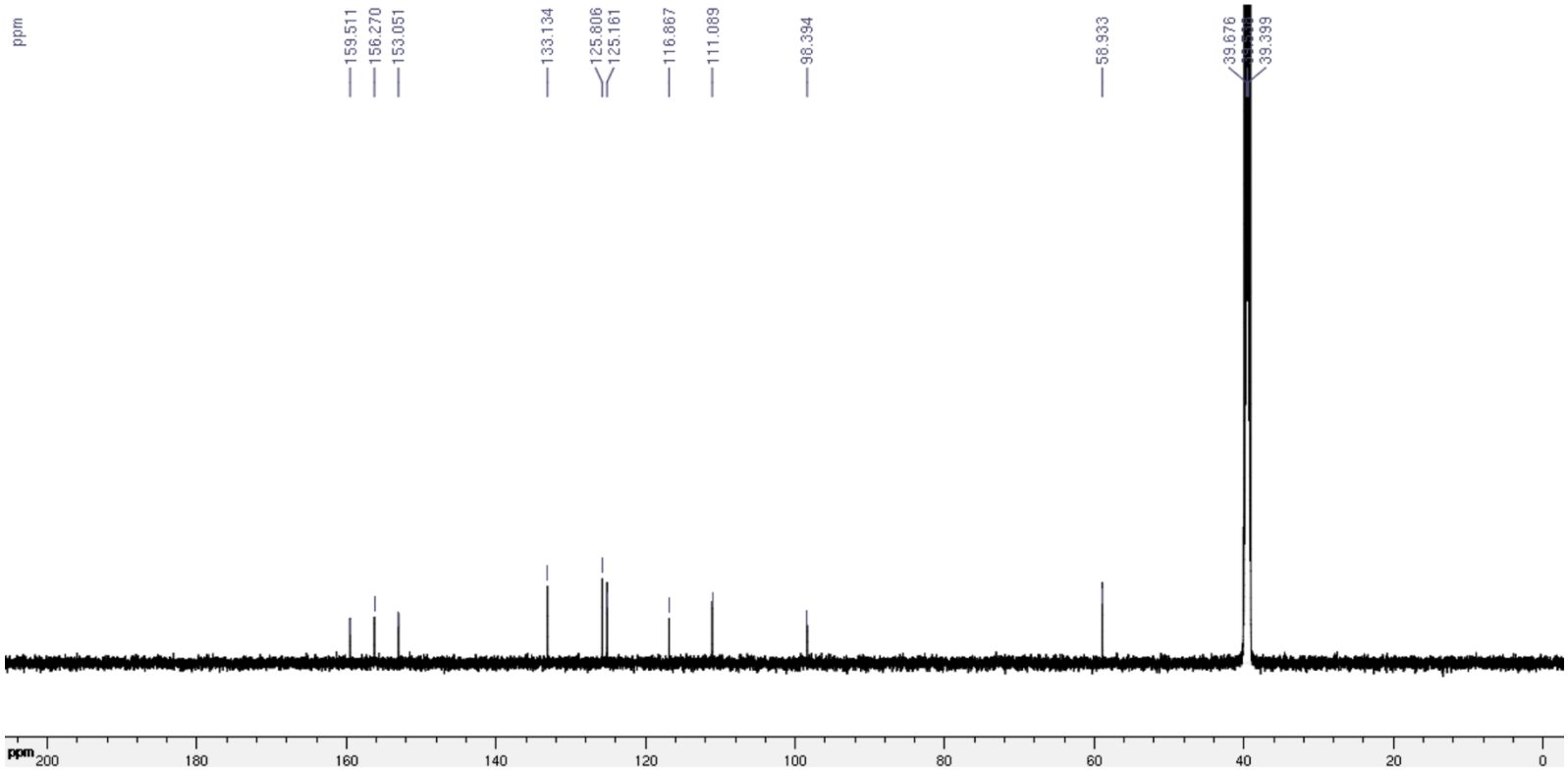
^{1}H NMR spectrum of compound **3**



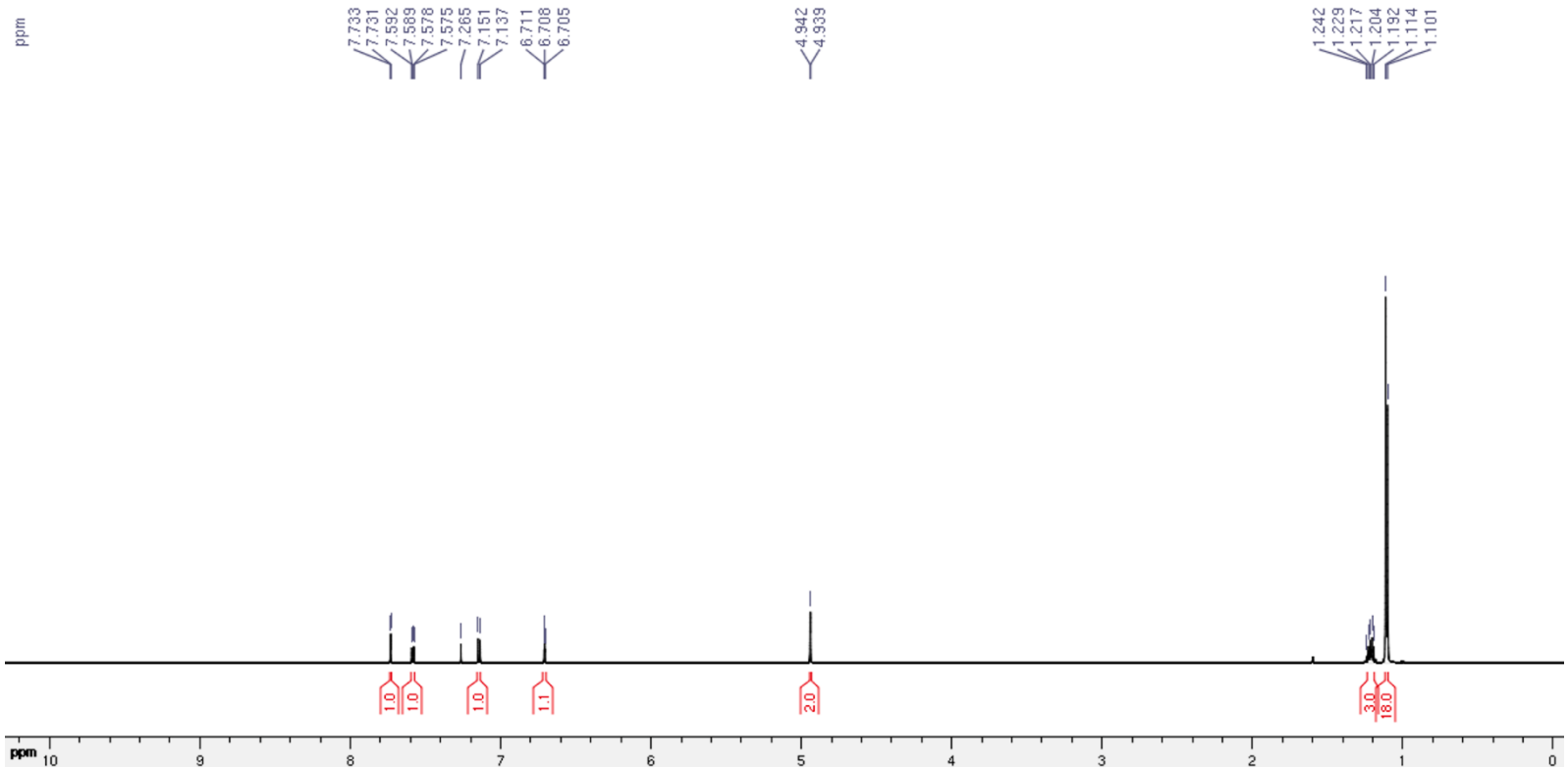
^{13}C NMR spectrum of compound **3**



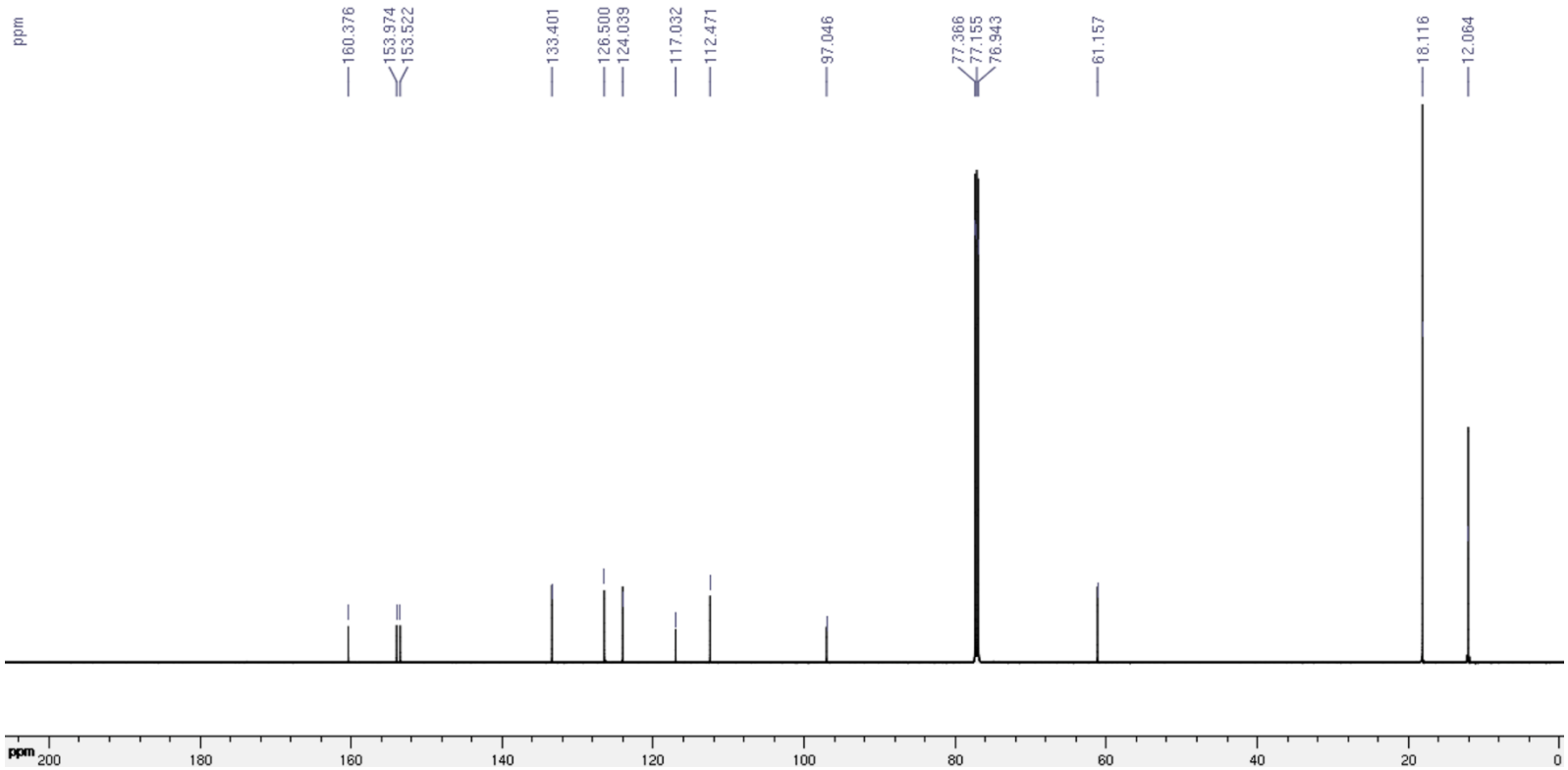
^{1}H NMR spectrum of compound **4**



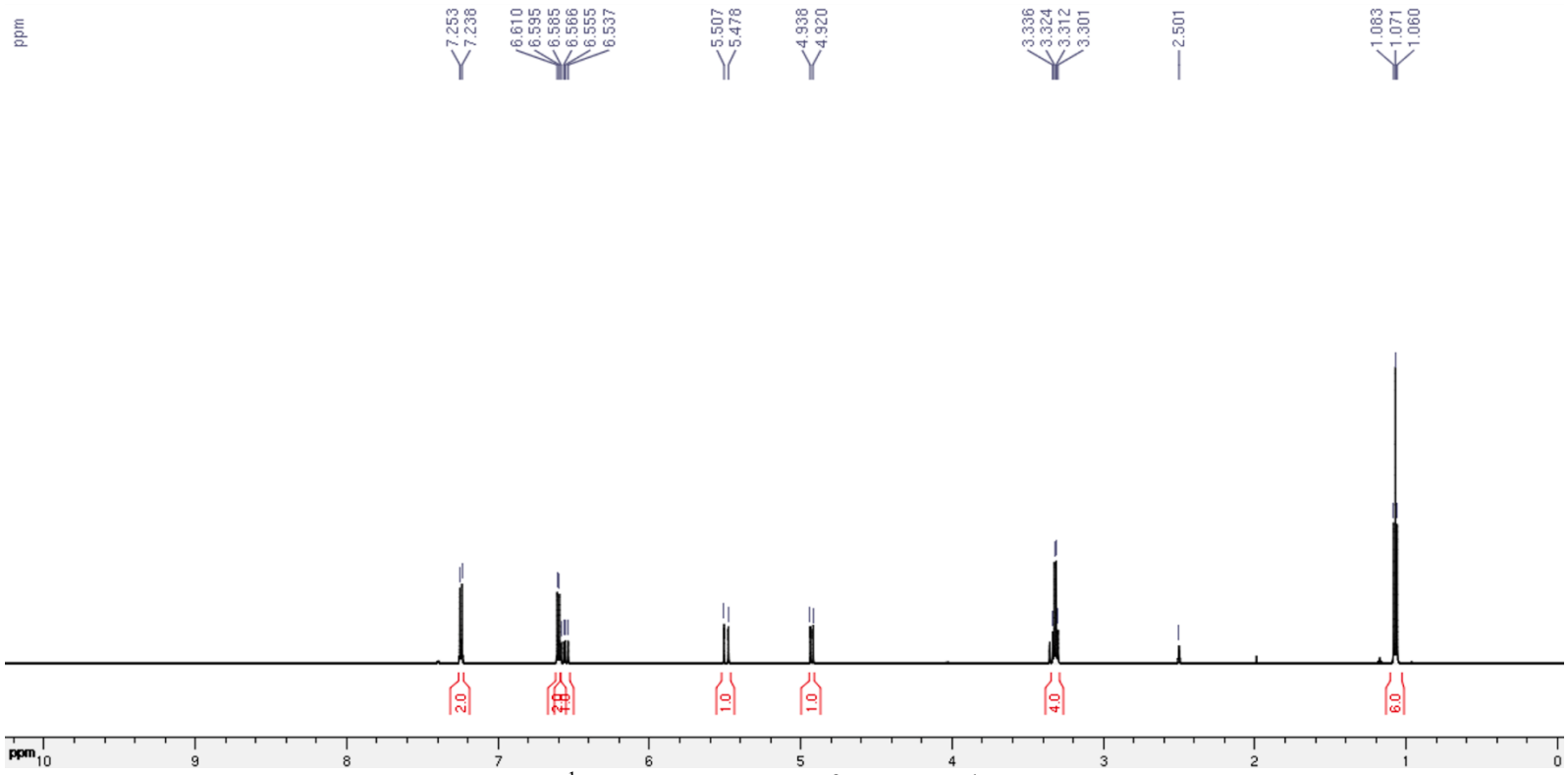
^{13}C NMR spectrum of compound **4**



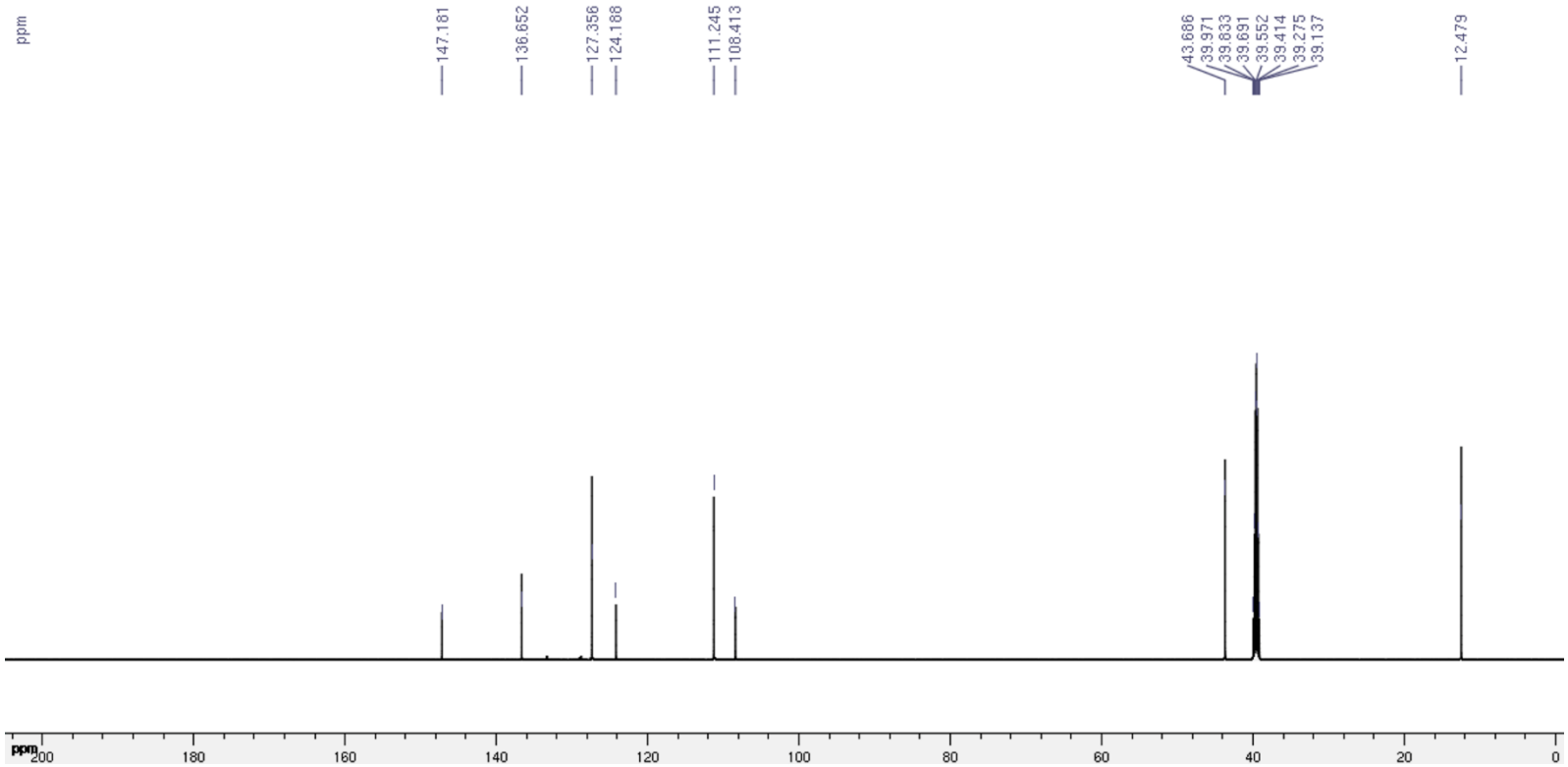
^{1}H NMR spectrum of compound **5**



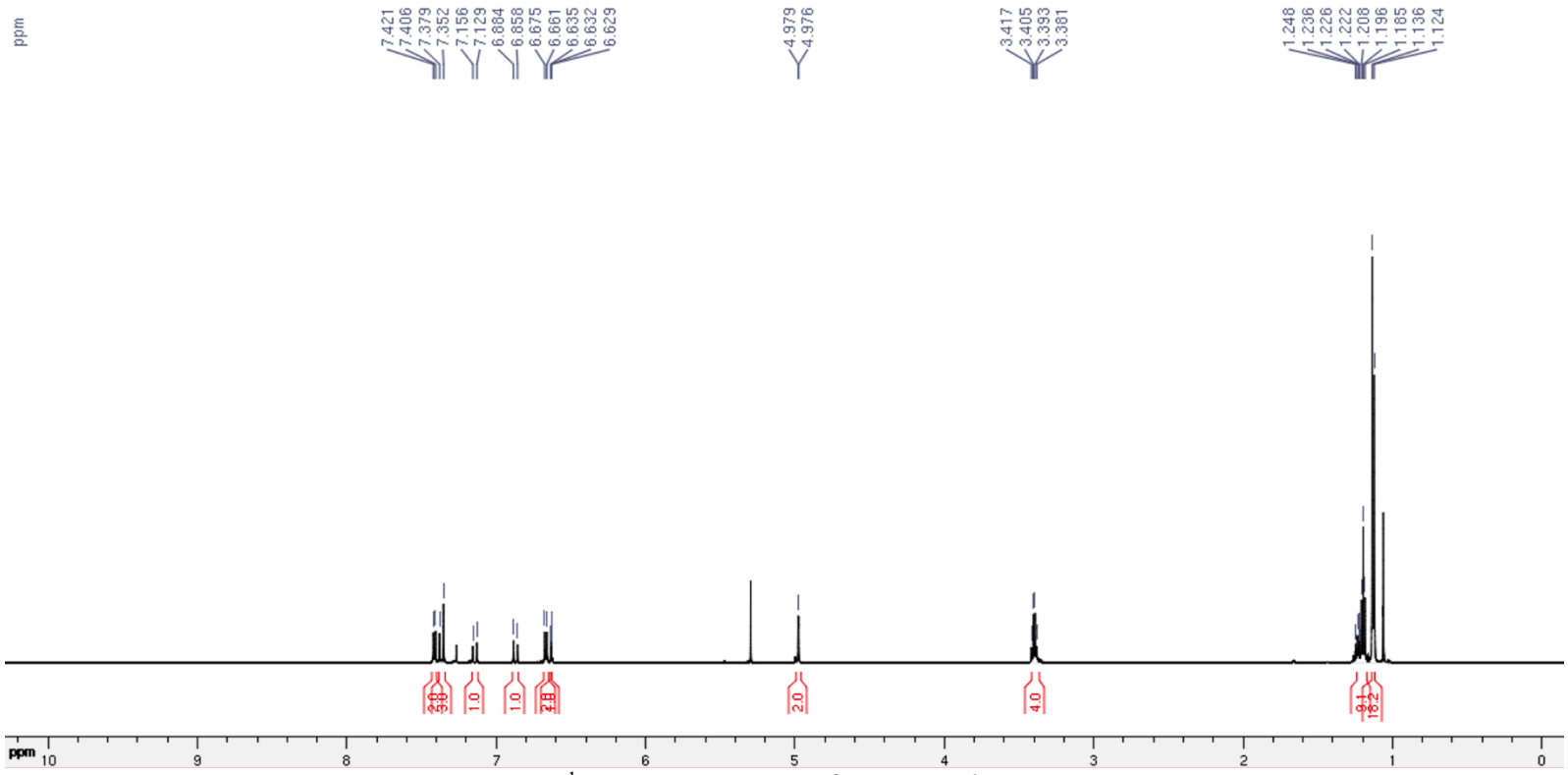
^{13}C NMR spectrum of compound **5**



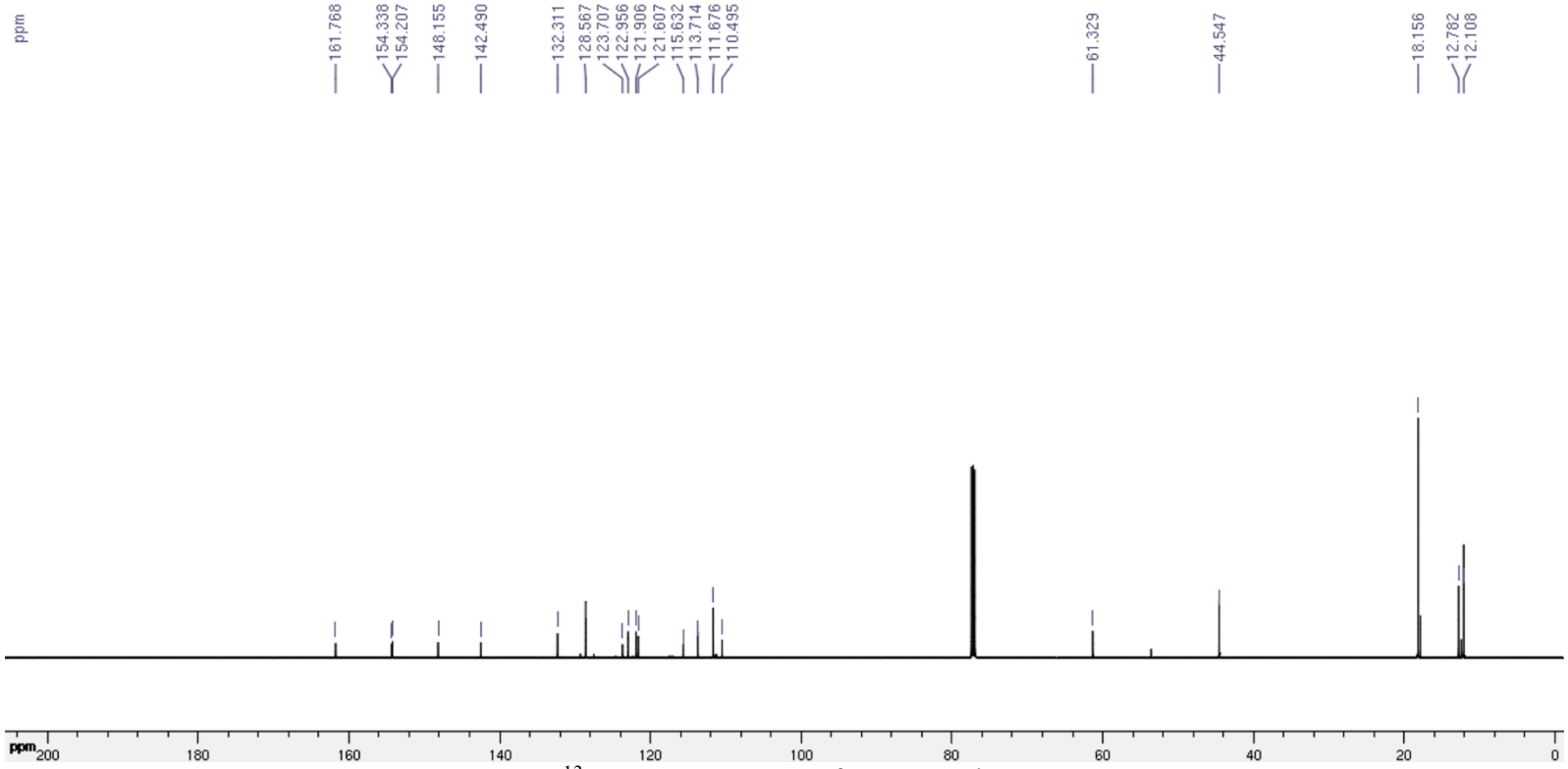
^{1}H NMR spectrum of compound **6**



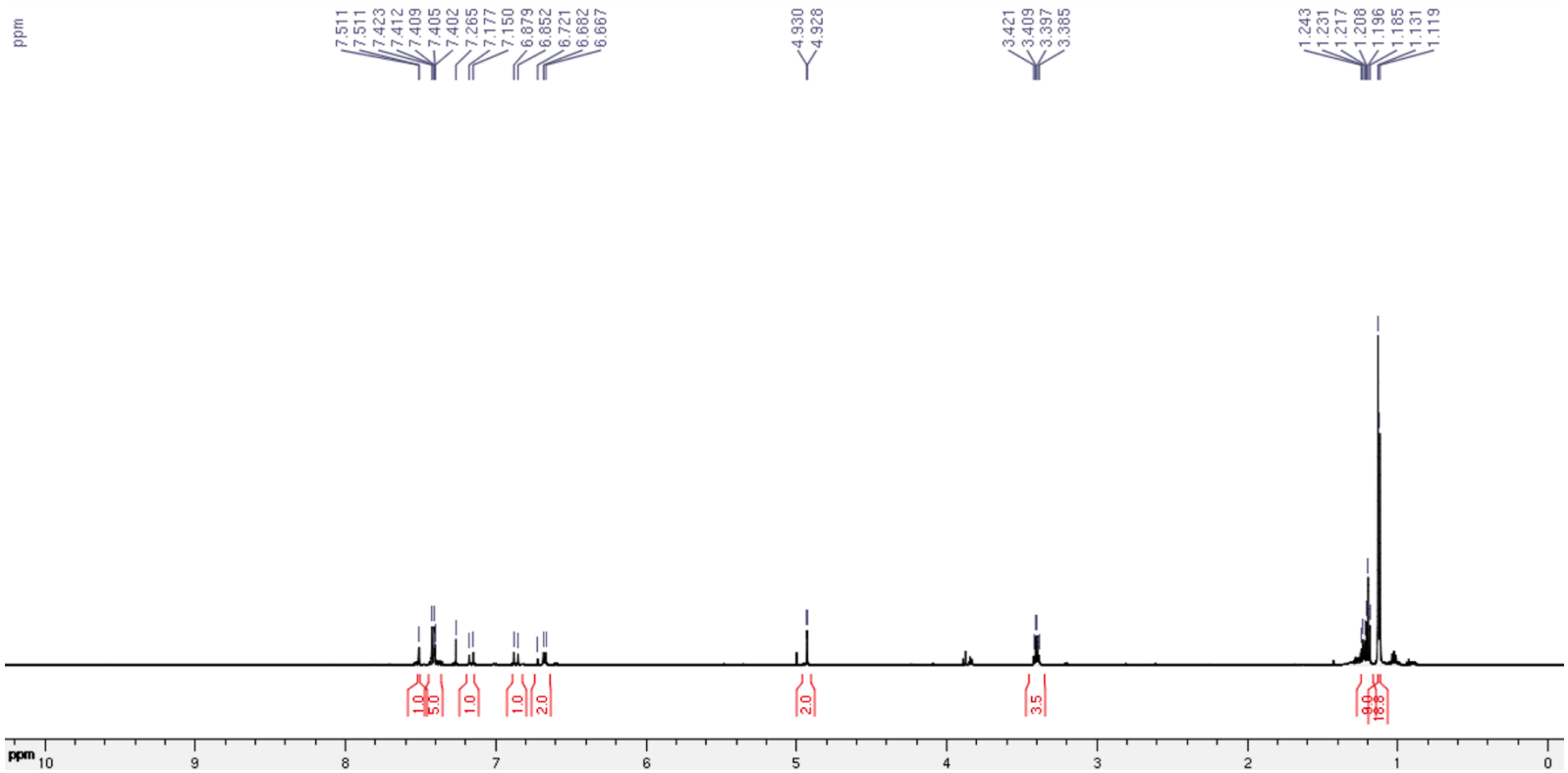
^{13}C NMR spectrum of compound **6**



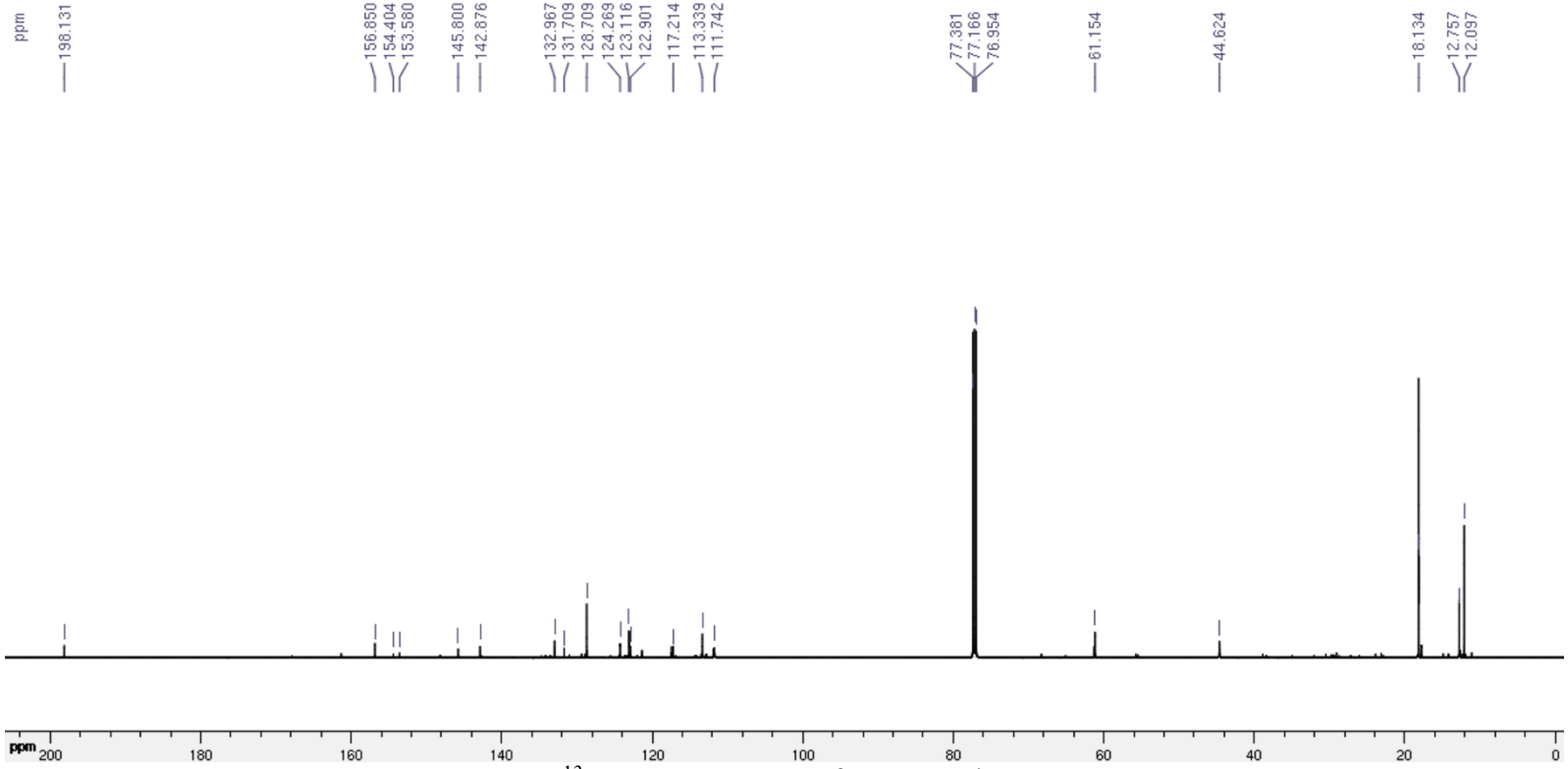
^{1}H NMR spectrum of compound **7**



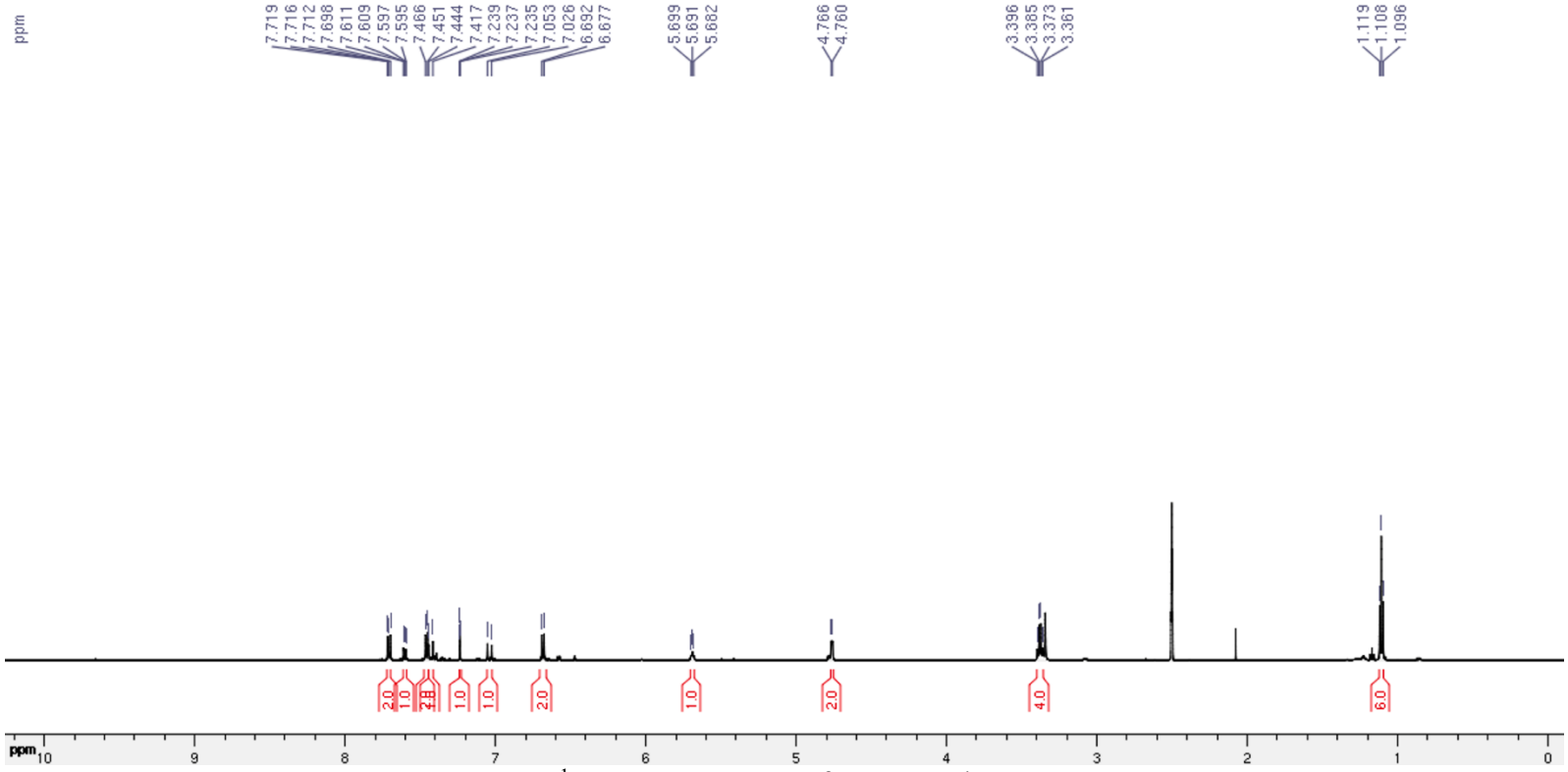
^{13}C NMR spectrum of compound **7**



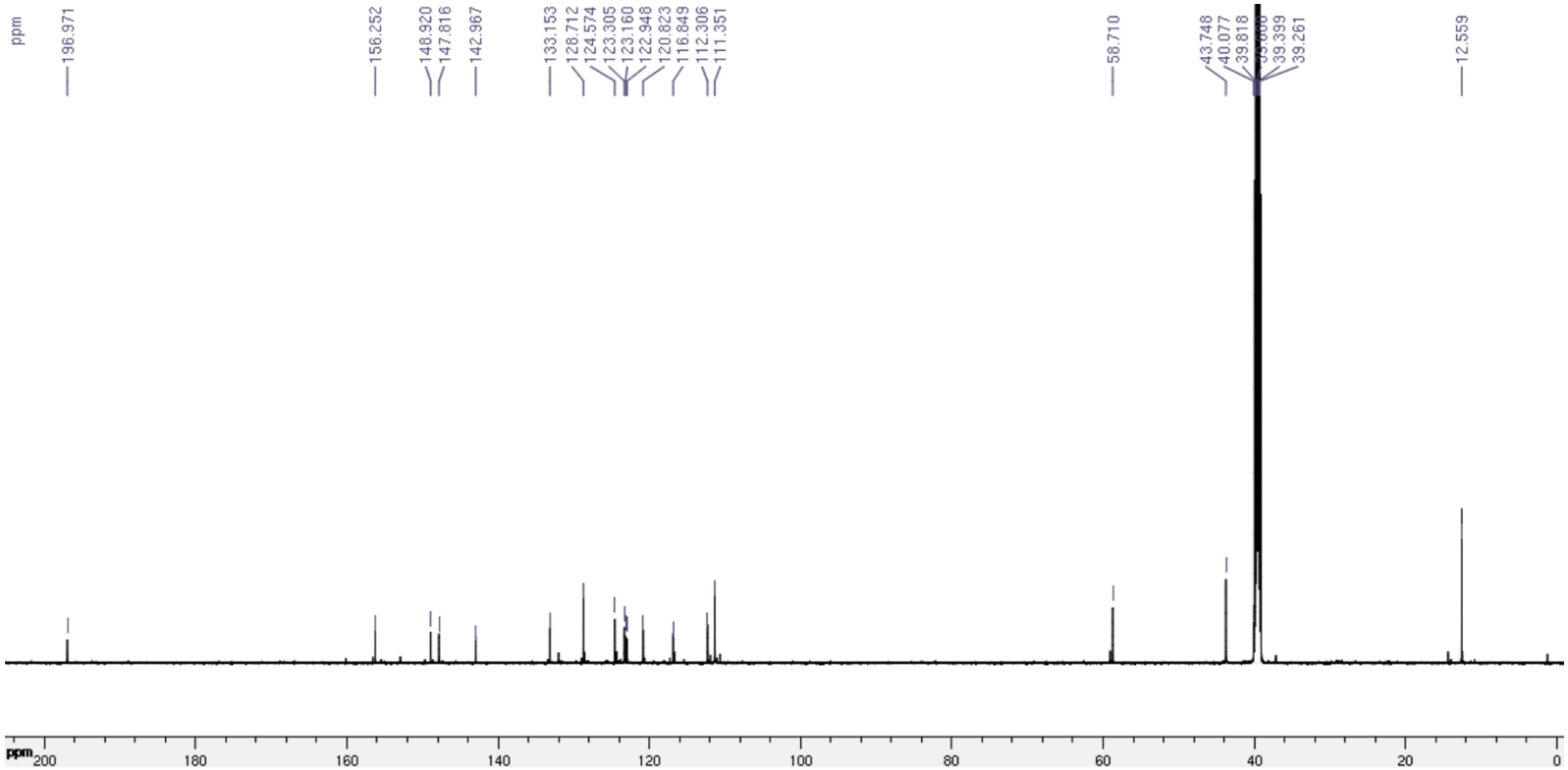
^{1}H NMR spectrum of compound **8**



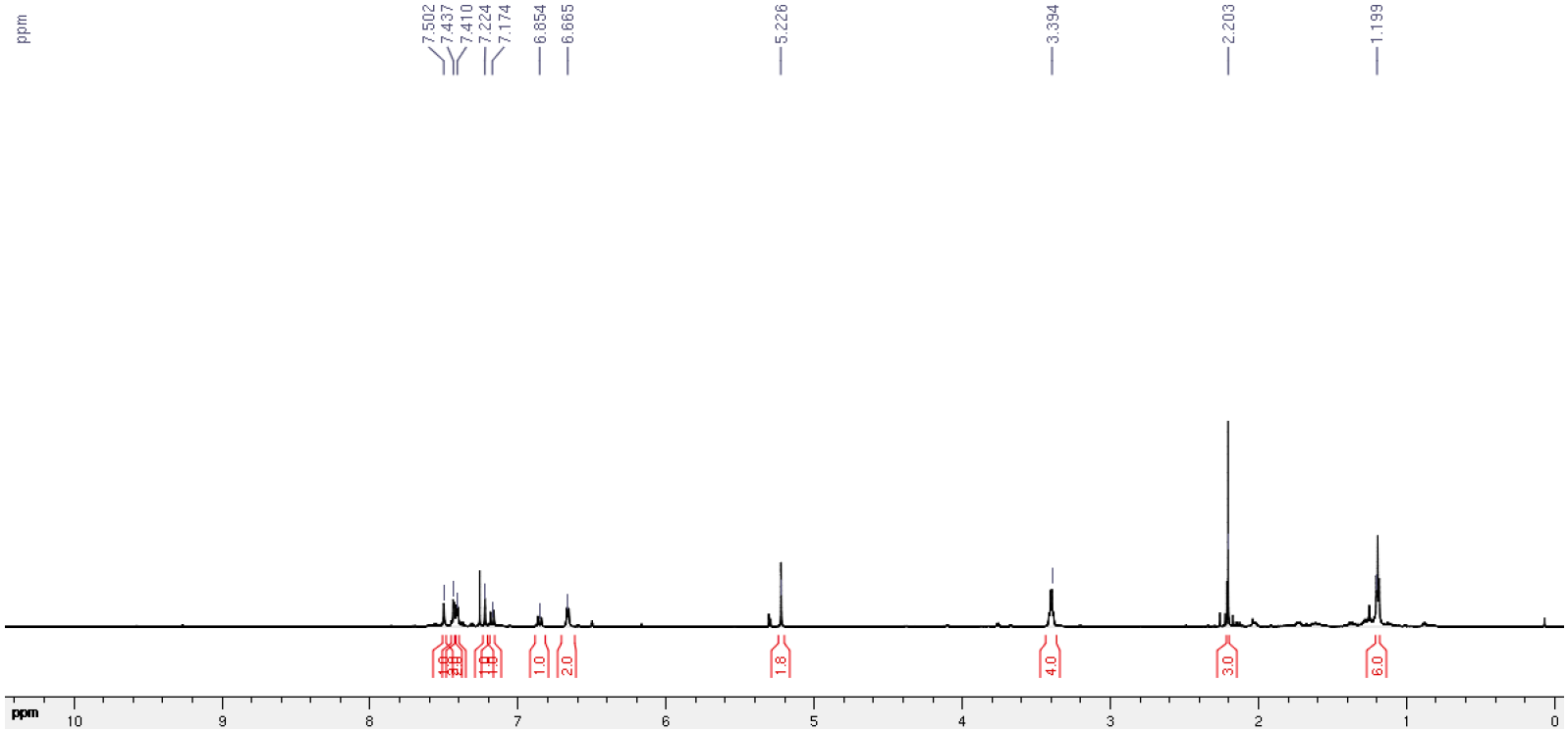
^{13}C NMR spectrum of compound **8**



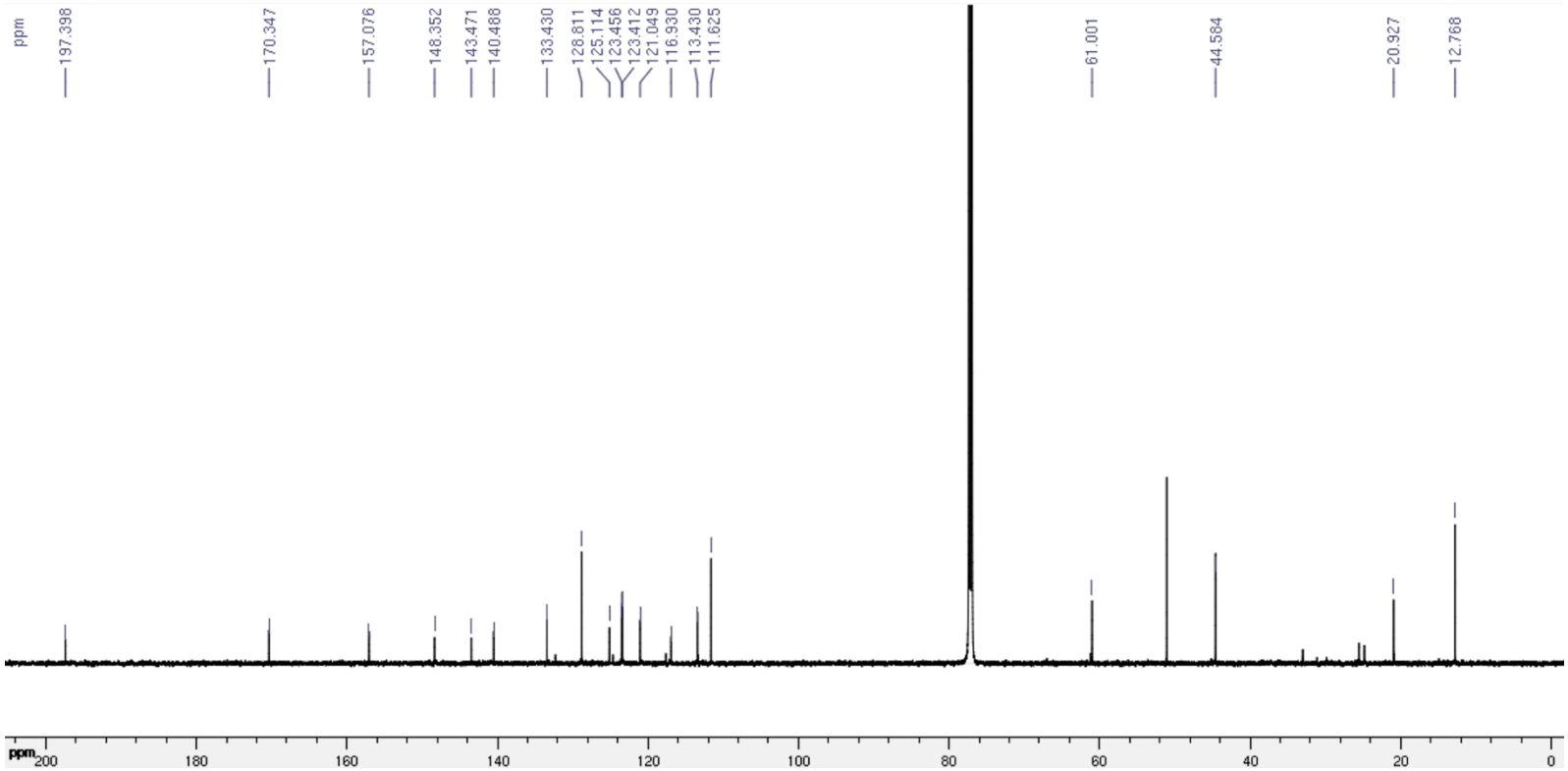
^{1}H NMR spectrum of compound **1a**



^{13}C NMR spectrum of compound **1a**



^{1}H NMR spectrum of compound **1b**



^{13}C NMR spectrum of compound **1b**