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Supplementary information

Fe_3O_4@SiO_2 core/shell functionalized by gallic acid: a novel, robust and water-compatible heterogeneous magnetic nanocatalyst for environmentally friendly synthesis of acridine-1,8-diones

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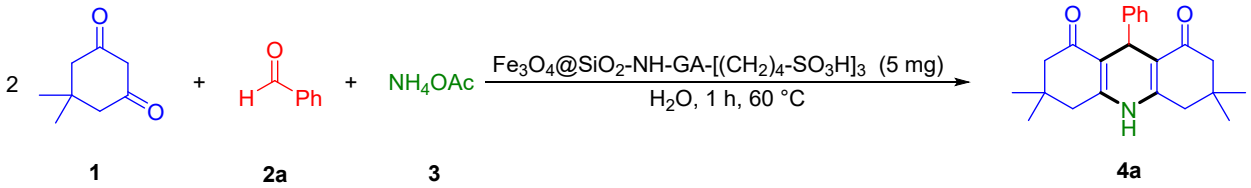
Experimental section

Chemical and instrument

All chemicals were purchased from Merck, Acros, and Sigma-Aldrich and used without further purification. The power and oscillation of the used ultrasonic device in catalyst synthesis was 120 (V) and 40 (kHz) and the final catalyst was characterized as follows: The fourier transform infrared spectrometer (FT-IR) model Shimadzu FT-IR 8300 was applied to FT-IR measurement using KBr pellet in the range of 400 to 4000 wavenumbers/cm^{-1}. Also, the X-ray diffraction (XRD) patterns were recorded by a GNR (Italy) XRD explorer X-ray diffractometer using CuKα radiation (λ = 1.54178 Å) with a 2θ scan range of 10° to 80°. Moreover, the presence of elements in the magnetic samples was proved by energy dispersive X-ray spectrometry (EDX) attached to a Philips scanning electron microscope (SEM), Transmission electron microscope (TEM) images were taken on a ZEISS EM10C-100KV microscope, and field emission scanning electron microscope (FE-SEM) images were taken on a ZEISS SIGMA VP microscope, Dynamic light scattering (DLS) measurements were performed on a HORIBA LB-550. To obtain thermal gravimetric analysis (TGA) data, a device from TA company model Q600 made in USA was used and vibrating sample magnetometer (VSM) measurements were analyzed using BHV-55 model vibrating sample magnetometer. Finally, zeta potential analysis was performed on a HORIBA Z-100. The reaction progress has been checked by thin layer chromatography (TLC). The final products characterized by melting points in open capillary tubes were determined with a Büchi B-545 melting point apparatus, and nuclear magnetic resonance (NMR) spectroscopy using Devices Brucker DPX-400 spectrometer that work for ^{13}C at 101 MHz and for ^{1}H at 400 MHz and a spectrometer Brucker DPX-300 that work for ^{13}C at 75 MHz and ^{1}H at 300 Hz in pure deuterated dimethyl sulfoxide (DMSO-d_6) and deuterated chloroform ($CDCl_3$).

Calculation of green chemistry metrics

In order to assess the environmental sustainability of our catalytic system, important green chemistry metrics such as the environmental factor (E-factor), atom economy, reaction mass efficiency (RME), process mass intensity (PMI) and eco-score (scale) were scrutinized. Taking the $Fe_3O4@SiO_2$-NH-GA-$[(CH_2)_4$-$SO_3H]_3$-catalyzed reaction involving dimedone, benzaldehyde, and ammonium acetate as a model reaction, these metrics were obtained as follows:



Compound code	1	2a	3	4a
M.W. (g/mol)	140	106	77	349
M.W. (mg)	2×140	106	84.7	349

The total mass of reactants = 470.7

Obtained product = 349 × 0.9 = 314.1

Environmental factor (E-factor):

E-factor = Amount of waste /Amount of product

The Amount of waste = (total mass of raw materials - the total mass of product)

The Amount of waste = (470.7 – 314.1) = 156.6

E-factor = 156.6 /314.1 = 0.50 $KgKg^{-1}$

$$\% \text{ Atom economy} = 100 \times \frac{Molecular\ weight\ of\ the\ desired\ product}{Molecular\ weight\ all\ of\ reactants}$$

$$\% \text{ Atom economy} = 100 \times \frac{349}{280 + 106 + 77} = 75.4\%$$

$$\text{Reaction mass efficiency (RME)} = \frac{mass\ of\ product}{\Sigma\ mass\ of\ stoichiometric\ reactants} \times 100$$

Reaction mass efficiency (RME) = $\frac{314.1}{470.7} \times 100$ = 67%

Process mass intensity (PMI) = $\frac{\Sigma\,(mass\ of\ stoichiometric\ reactants\ +\ solvent}{mass\ of\ product}$

PMI = $\frac{470.7 + 2}{314.1}$ = 1.51

Ideal value of PMI = E-factor + 1 = 0.50 + 1 =1.50

E-score has been calculated for the reaction based on the following 6 parameters below (See Beilstein Journal of Organic Chemistry 2006, 2, 3.)

Entry	Parameter	Values	Penalty Points
1	Yield	100-90/2	5
2	Cost of reactants	Inexpensive	0
3	Safety of reactants	5+5+5+5	20
4	Technical setup	Common setup	0
5	Temperature /time	60 °C, <1 h	2
6	Workup and purification	Classical chromatography	10
Total penalty points			37

Eco-Score = 100 - the sum of individual penalties = 100-37 = 63

Eco-scale from 0 to 100 using the following scores: > 75, excellent; > 50, acceptable; and < 50, inadequate.

Characterization of the products

3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4a) (Table 4, entry 1)

White solid; Yield = 92%, M.P. 272-275 ˚C (Lit. 274-276 °C [1]); IR (KBr): ῡ (cm^{-1}) = 3280, 3196, 3066, 2960, 1644, 1610, 1486, 1224. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 9.40 (s, 1H, N-*H*), 7.23-7.08 (m, 5H, Ar*H*), 4.88 (s, 1H, C*H*Ar), 2.53 (d, *J* = 16.96 Hz, 2H, CH_2), 2.40 (d, *J* = 17.12 Hz, 2H, CH_2), 2.25 (d, *J* = 16.12 Hz, 2H, CH_2), 2.06 (d, *J* = 16.32 Hz, 2H, CH_2), 1.08 (s, 6H, $2CH_3$), 0.93 (s, 6H, $2CH_3$). ^{13}C NMR (101MHz, DMSO-d_6) δ (ppm): 26.4, 29.0, 32.1, 32.7, 50.1, 111.4, 125.4, 127.5, 127.5, 147.1, 149.3, 194.3.

3,3,6,6-tetramethyl-9-(2-nitrophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4b) (Table 4, entry 2)

Light yellow solid; Yield = 88%, M.P. 294-296 °C(Lit. 295-297 °C[2]); IR (KBr): ῡ (cm^{-1}) = 3424, 3286, 3204, 2958, 1612, 1370, 1224. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 9.58 (s, 1H, N-*H*), 7.60-7.32 (m, 4H, Ar*H*), 5.64 (s, 1H, C*H*Ar), 2.29 (d, *J* = 8.68 Hz, 2H, CH_2), 2.20 (d, *J* = 16.60 Hz, 2H, CH_2), 2.13 (d, *J* = 16.16 Hz, 2H, CH_2), 2.06 (d, *J* = 16.24 Hz, 2H, CH_2), 1.06 (s, 6H, 2CH_3), 0.91 (s, 6H, 2CH_3). ^{13}C NMR (101MHz, $CDCl_3$) δ (ppm): 20.5, 22.6, 28.5, 39.8, 49.9, 67.1, 113.2, 127.7, 129.2, 129.9, 131.3, 139.9, 148.0, 148.0, 195.1.

3,3,6,6-tetramethyl-9-(3-nitrophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4c) (Table 4, entry 3)

Light yellow solid; Yield = 94%, M.P. 293-295 °C(Lit. 291-293 °C[1]); IR (KBr): ῡ (cm^{-1}) = 3272, 3186, 3066, 2960, 1646, 1610, 1488, 1346, 1224. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 9.50 (s, 1H, N-*H*), 7.49-7.98 (m, 4H, Ar*H*), 4.92 (s, 1H, C*H*Ar), 2.49 (d, *J* = 16.64 Hz, 2H, CH_2), 2.37 (d, *J* = 17.08 Hz, 2H, CH_2), 2.21 (d, *J* = 16.16 Hz, 2H, CH_2), 2.00 (d, *J* = 16.12 Hz, 2H, CH_2), 1.02 (s, 6H, 2CH_3), 0.86 (s, 6H, 2CH_3). ^{13}C NMR (101MHz, DMSO-d_6) δ (ppm): 26.3, 29.0, 32.1, 33.4, 49.9, 110.5, 120.7, 121.9, 134.4, 147.3, 149.1, 150.0, 194.4.

3,3,6,6-tetramethyl-9-(4-nitrophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4d) (Table 4, entry 4)

Light yellow solid; Yield = 96%, M.P. 299-301 °C(Lit. 297-299 °C[1]); IR (KBr): ῡ (cm^{-1}) = 3386, 3074, 2960, 1644, 1480, 1342, 1222. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 9.50 (s, 1H, N-*H*), 8.08 (d, *J* = 8.60 Hz, 2H, Ar*H*), 7.42 (d, *J* = 8.68 Hz, 2H , Ar*H*), 4.90 (s, 1H, C*H*Ar), 2.49 (d, *J* = 17.00 Hz, 2H, CH_2), 2.34 (d, *J* = 17.08 Hz, 2H, CH_2), 2.20 (d, *J* = 16.16 Hz, 2H, CH_2), 1.99 (d, *J* = 16.36 Hz, 2H, CH_2), 1.01 (s, 6H, 2CH_3), 0.86 (s, 6H, 2CH_3). ^{13}C NMR (101MHz, DMSO-d_6) δ (ppm): 27.1, 29.4, 32.7, 34.4, 50.5, 112.8, 123.4, 129.0, 130.9, 147.8, 153.7, 195.1.

9-(2-chlorophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4e) (Table 4, entry 5)

Light yellow solid; Yield = 85%, M.P. 292-294 ^{o}C(Lit. 290-299 ^{o}C[4]); IR (KBr): ῡ (cm^{-1}) = 3280, 3202, 3072, 2954, 1636, 1608, 1486, 1224, 750. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 9.35 (s, 1H, N-*H*), 7.29 (d, *J* = 7.08 Hz, 2H, Ar*H*), 7.20-7.13 (m, 2H, Ar*H*), 7.05 (d, *J* = 7.44 Hz, 2H, Ar*H*), 5.08 (s, 1H, C*H*Ar), 2.45 (d, *J* = 17.00 Hz, 2H, CH_2), 2.28 (d, *J* = 17.00 Hz, 2H, CH_2), 2.15 (d, *J* = 16.16 Hz, 2H, CH_2), 1.93 (d, *J* = 16.12 Hz, 2H, CH_2), 1.01 (s, 6H, 2CH_3), 0.87 (s, 6H, 2CH_3). ^{13}C NMR (101MHz, DMSO-d_6) δ (ppm): 26.3, 29.1, 31.9, 32.9, 50.2, 110.7, 126.1, 126.9, 129.0, 131.9, 132.2, 144.0, 149.6, 194.1.

9-(3-chlorophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4f) (Table 4, entry 6)

Light yellow solid; Yield = 87%, M.P. 292-294 ^{o}C(Lit. 290 ^{o}C[4]); IR (KBr): ῡ (cm^{-1}) = 3416, 3182, 3064, 2962, 1620, 1616, 1490, 1220, 694. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 9.50 (s, 1H, N-*H*), 7.22 (s, 1H, Ar*H*), 7.22-7.08 (m, 1H, Ar-*H*), 7.05 (t, *J* = 7.80 Hz, 1H, Ar*H*), 7.00-6.97 (m, 1H, Ar*H*), 5.00 (s, 1H, C*H*Ar), 2.25 (d, *J* = 16.88 Hz, 2H, CH_2), 2.19 (d, *J* = 4.92 Hz, 2H, CH_2), 2.15 (d, J = 5.52 Hz, 2H, CH_2), 2.10 (d, *J* = 16.36 Hz, 2H, CH_2), 1.01 (s, 6H, 2CH_3), 0.90 (s, 6H, 2CH_3). ^{13}C NMR (101MHz, $CDCl_3$) δ (ppm): 27.1, 29.5, 32.6, 40.8, 50.7, 112.8, 126.2, 126.6, 128.0, 129.1, 133.7, 148.5, 148.8, 195.67.

9-(4-chlorophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4g) (Table 4, entry 7)

White solid; Yield = 87%, M.P. 294-296 ^{o}C(Lit. 298-300 ^{o}C[5]); IR (KBr): ῡ (cm^{-1}) = 3552, 3478, 3408, 2960, 1644, 1618, 1488, 1222, 844. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 9.38 (s, 1H, N-*H*), 7.23 (d, *J* = 8.40 Hz, 2H, Ar*H*), 7.15 (d, *J* = 8.48 Hz, 2H, Ar*H*), 4.78 (s, 1H, C*H*Ar), 2.46 (d, *J* = 17.04 Hz, 2H, CH_2), 2.32 (d, *J* = 17.04 Hz, 2H, CH_2), 2.18 (d, *J* = 16.12 Hz, 2H, CH_2), 1.98 (d, *J* = 16.08 Hz, 2H, - CH_2), 1.01 (s, 6H, 2CH_3), 0.86 (s, 6H, 2CH_3). ^{13}C NMR (101MHz, DMSO-d_6) δ (ppm): 27.1, 29.5, 39.6, 40.9, 50.7, 113.2, 128.1, 129.4, 131.5, 145.0, 148.2, 195.6.

9-(2-bromophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4h) (Table 4, entry 8)

White solid; Yield = 81%, M.P. 255-257 ^{o}C(Lit. 252-254 ^{o}C[6]); IR (KBr): ῡ (cm^{-1}) = 3276, 3182, 3064, 2962, 1640, 1612, 1486, 1222, 560. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 9.39, (s, 1H, N-*H*), 7.23-7.09 (m, 4H, Ar*H*), 4.80 (s, 1H, C*H*Ar), 2.46 (d, *J* = 21.12 Hz, 2H, CH_2), 2.35 (d, *J* = 17.04

Hz, 2H, CH_2), 2.19 (d, J = 16.08 Hz, 2H, CH_2), 2.01 (d, J = 16.00 Hz, 2H, CH_2), 1.01 (s, 6H, 2CH_3), 0.87 (s, 6H, 2CH_3). ^{13}C NMR (101MHz, DMSO-d_6) δ (ppm): 26.3, 29.0, 32.1, 33.0, 50.0, 110.8, 125.4, 126.1, 127.5, 129.5, 132.1, 149.3, 149.6, 194.4.

9-(5-bromo-2-hydroxyphenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4i) (Table 4, entry 9)

Light yellow solid; Yield = 80%, M.P. 238-240 °C(Lit. 235-238 °C[3]); IR (KBr): ῡ (cm^{-1}) = 3512, 3480, 3416, 2958, 1616, 1604, 1480, 1232, 626. ^{1}H NMR (300 MHz, DMSO-d_6) δ (ppm): 9.69 (s, 1H, O-H), 9.64 (s, 1H, N-*H*), 7.07 (d, J = 6.84 Hz, 1H, , Ar*H*), 6.98 (s, 1H, Ar*H*), 6.65 (d, J = 10.32 Hz, 1H, Ar*H*), 4.79 (s, 1H, C*H*Ar), 2.48 (d, J = 12.57 Hz, 2H, CH_2), 2.37 (d, J = 17.10 Hz, 2H, CH_2), 2.24 (d, J = 16.20 Hz, 2H, CH_2), 2.05 (d, J = 16.08 Hz, 2H, CH_2), 1.00 (s, 6H, 2CH_3), 0.91 (s, 6H, 2CH_3). ^{13}C NMR (75MHz, DMSO-d_6) δ (ppm): 26.7, 29.5, 32.6, 37.7, 50.2, 110.8, 113.4, 113.7, 119.6, 130.1, 131.9, 140.5, 143.9, 151.7, 153.7, 196.2.

3,3,6,6-tetramethyl-9-(m-tolyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4j) (Table 4, entry 10)

Yellow solid; Yield = 80%, M.P. 214-217 °C(Lit. 211-213 °C[7]); IR (KBr): ῡ (cm^{-1}) = 3278, 3182, 3066, 2956, 1642, 1604, 1488, 1220. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 9.33 (s, 1H, N-*H*), 7.12-6.90 (m, 4H, Ar*H*), 4.83 (s, 1H, C*H*Ar), 2.51 (d, J = 17.08 Hz, 2H, CH_2), 2.39 (d, J = 17.04 Hz, 2H, CH_2), 2.26 (s, 3H, CH_3), 2.23 (d, J = 16.28 Hz, 2H, CH_2), 2.05 (d, J = 16.28 Hz, 2H, -CH_2), 1.07 (s, 6H, 2CH_3), 0.93 (s, 6H, 2CH_3). ^{13}C NMR (101MHz, DMSO-d_6) δ (ppm): 19.3, 24.5, 27.2, 30.3, 30.8, 48.4, 109.6, 122.8, 124.2, 125.7, 126.6, 134.2, 145.2, 147.3, 192.5.

3,3,6,6,9-pentamethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4k) (Table 4, entry 11)

Light yellow solid; Yield = 74%, M.P. 270-273 °C(Lit. 269-279 °C[8]); IR (KBr): ῡ (cm^{-1}) = 3416, 3280, 3204, 2958, 1630, 1608, 1488, 1232. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 9.51 (s, 1H, N-*H*), 6.50 (s, 1H, C*H*Ar), 2.27 (d, J = 14.64 Hz, 2H, CH_2), 2.18 (s, 3H, CH_3), 2.14 (d, J = 8.60 Hz, 2H, CH_2), 1.93 (d, J = 6.28 Hz, 2H, CH_2), 1.66 (d, J = 8.64 Hz, 2H, CH_2), 1.02 (s, 6H, 2CH_3), 0.90 (s, 6H, 2CH_3). ^{13}C NMR (101MHz, $CDCl_3$) δ (ppm): 21.5, 22.5, 27.0, 29.5, 41.1, 50.9, 114.5, 148.3, 195.9.

9-ethyl-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4l) (Table 4, entry 12)

Light yellow solid; Yield = 70%, M.P. 291-293 °C(Lit. 282-283 °C[9]); IR (KBr): ū (cm^{-1}) =3468, 2951, 1608, 1395. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 9.61 (s, 1H, N-*H*), 3.14 (t, *J* = 11.38 Hz, 1H,C*H*CH_2), 2.28 (d, *J* = 9.12 Hz, 2H, CH_2), 2.20 (d, *J* = 12.64 Hz, 2H, CH_2), 2.11 (d, *J* = 8.40 Hz, 2H, CH_2), 2.03 (d, *J* = 14.56 Hz, 2H, CH_2), 1.40-1.31 (m, 2H, CH_2), 1.10 (s, 6H, 2CH_3), 0.99 (s, 6H, 2CH_3), 0.89 (t, *J* = 4.86 Hz, 3H, CH_2CH_3). ^{13}C NMR (101MHz, $CDCl_3$) δ (ppm): 11.1, 24.7, 29.4, 31.8, 32.6, 40.5, 46.4, 50.0, 115.4, 125.8, 127.6, 128.0, 145.7, 150.2, 195.6.

3,3,6,6-tetramethyl-9-(pyridin-3-yl)-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4m) (Table 4, entry 13)

Light yellow solid; Yield = 83%, M.P. 301-303 °C(Lit. 298-300 °C[10]); IR (KBr): ū (cm^{-1}) = 3361, 2936, 2877, 3815, 1612, 1601, 1545, 1403. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 9.48 (s, 1H, N-*H*), 7.37(d, *J* = 52.08 Hz, 2H, Ar*H*), 7.64-7.54 (m, 1H, Ar*H*), 7.33 (s, 1H, Ar*H*), 4.82 (s, 1H, C*H*Ar), 2.36 (d, *J* = 17.00 Hz, 2H, CH_2), 2.23 (d, *J* = 13.80 Hz, 2H, CH_2), 2.10 (d, *J* = 7.80 Hz, 2H, CH_2), 1.99 (d, *J* = 15.88Hz, 2H, CH_2), 1.01 (s, 6H, 2CH_3), 0.85 (s, 6H, 2CH_3). ^{13}C NMR (101MHz, DMSO-d_6) δ (ppm): 26.9, 28.9, 29.4, 31.8, 32.3, 32.6, 50.4, 110.8, 127.5, 136.8, 145.9, 148.1, 150.6, 163.9, 195.0.

3,3,6,6-tetramethyl-9,10-diphenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4n) (Table 4, entry 14)

White solid; Yield = 84%, M.P. 250-252 °C(Lit. 253-255 °C[11]); IR (KBr): ū (cm^{-1}) = 3272, 3024, 2954, 1598, 1484, 1262. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 7.87-7.11 (m, 10H, Ar*H*), 5.11 (s, 1H, C*H*Ar), 2.28 (d, *J* = 7.64 Hz, 2H, CH_2), 2.07 (d, *J* = 9.04 Hz, 2H, CH_2), 1.81 (d, *J* = 17.02 Hz, 2H, CH_2), 1.32 (d, *J* = 17.84 Hz, 2H, CH_2), 0.93 (s, 6H, 2CH_3), 0.77 (s, 6H, 2CH_3). ^{13}C NMR (101MHz, DMSO-d_6) δ (ppm): 25.5, 26.0, 29.2, 29.6, 49.5, 112.8, 113.0, 125.7, 127.4, 127.8, 128.2, 129.3, 138.4, 149.3, 150.2, 195.0.

10-(3-methoxyphenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4o) (Table 4, entry 15)

White solid; Yield = 84%, M.P. 260-262 °C(Lit. 184-187 °C[12]); IR (KBr): ū (cm^{-1}) = 3260, 2952, 1598, 1480, 1282. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.16-7.01 (m, 5H, Ar*H*), 6.99-6.94 (m, 2H, Ar*H*), 6.44 (dd, *J* = 8.2 Hz, *j*= 2.52, 2H, ArH), 6.26 (s 1H, Ar*H*), 5.15 (s, 1H, C*H*Ar), 3.68 (s, 3H, OCH_3), 2.34 (d, *J* = 16.28 Hz, 2H, CH_2), 2.24 (d, *J* = 16.40 Hz, 2H, CH_2), 2.19 (d, *J* = 16.16 Hz, 2H, CH_2), 2.12 (d, *J* = 16.28 Hz, 2H, CH_2), 1.02 (s, 6H, 2CH_3), 0.92 (s, 6H, 2CH_3). ^{13}C NMR (101

MHz, $CDCl_3$) δ (ppm): 27.2, 29.4, 39.4, 42.1, 50.6, 55.3, 100.5, 109.3, 109.6, 118.8, 125.8, 127.3, 128.2, 131.1, 136.3, 148.1, 150.1, 158.6, 192.9, 194.6.

10-(4-methoxyphenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10 hexahydroacridine -1,8(2H,5H)-dione (4p) (Table 4, entry 16)

Light yellow solid; Yield = 87%, M.P. 209-211 °C(Lit. 213-215 °C[13]); IR (KBr): ῡ (cm^{-1}) = 3286, 2966, 1586, 1490, 1234. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 7.16 (d, *J* = 5.72 Hz, 4H, Ar*H*), 7.07-7.03 (m, 1H, Ar*H*), 6.89-6.86 (m, 1H, Ar*H*), 6.71-6.67 (m, 3H, Ar*H*), 5.02 (s, 1H, C*H*Ar), 3.74 (s, 3H, OCH_3), 2.49 (d, *J* = 14.08 Hz, 2H, CH_2), 2.38 (d, *J* = 21.88 Hz, 2H, CH_2), 2.16 (d, *J* = 21.16 Hz, 2H, CH_2), 1.96 (d, *J* = 21.52 Hz, 2H, CH_2), 1.01 (s, 6H, 2CH_3), 0.93 (s, 6H, 2CH_3). ^{13}C NMR (101 MHz, DMSO-d_6) δ (ppm): 27.1, 29.6, 31.1, 32.4, 50.5, 55.6, 113.0, 114.8, 116.7, 126.1, 127.2, 127.6, 128.5, 130.0, 149.0, 152.6, 155.7, 193.4.

10-(2-chlorophenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4q) (Table 4, entry 17)

White solid; Yield = 73%, M.P. 208-211 °C(Lit. 188-190 °C[12]); IR (KBr): ῡ (cm^{-1}) = 3416, 2956, 1640, 1364, 1222, 698. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.65-7.00 (m, 9H, Ar*H*), 5.16 (s, 1H, C*H*Ar), 2.07 (d, *J* = 8.36 Hz, 2H, CH_2), 1.94 (d, *J* = 17.44 Hz, 2H, CH_2), 1.54 (d, *J* = 17.24 Hz, 2H, CH_2), 1.22 (d, *J* = 25.92 Hz, 2H, CH_2) 0.85 (s, 6H, 2CH_3), 0.76 (s, 6H, 2CH_3). ^{13}C NMR (101 MHz, $CDCl_3$) δ (ppm): 30.1, 32.2, 38.7, 41.7, 50.1, 114.8, 125.8, 127.7, 128.2, 128.7, 128.8, 130.8, 130.9, 130.9, 131.6, 146.1, 148.4, 195.7.

10-(3-chlorophenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4q) (Table 4, entry 18)

White solid; Yield = 77%, M.P. 262-264 °C(Lit. 177-180 °C[12]); IR (KBr): ῡ (cm^{-1}) = 3278, 3192, 3070, 1600, 1480, 1284, 696. ^{1}H NMR (300 MHz, DMSO-d_6) δ (ppm): 7.25-7.07 (m, 5H, Ar*H*), 6.95-6.88 (m, 4H, Ar*H*), 5.05 (s, 1H, C*H*Ar), 2.53 (d, *J* = 10.32 Hz, 2H, CH_2), 2.40 (d, *J* = 16.83 Hz, 2H, CH_2), 2.19 (d, *J* = 15.99 Hz, 2H, CH_2), 2.00 (d, *J* = 16.11 Hz, 2H, CH_2) ,1.03 (s, 6H, 2CH_3), 0.95 (s, 6H, 2CH_3). ^{13}C NMR (75MHz, DMSO-d_6) δ (ppm): 27.1, 29.5, 30.5, 32.5, 50.5, 107.1, 115.0, 122.8, 125.2, 126.3, 127.3, 128.6, 131.4, 131.7, 138.0, 148.6, 152.0, 193.6.

10-(4-chlorophenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4q) (Table 4, entry 19)

White solid; Yield = 78%, M.P. 295-297 °C(Lit. 301-303 °C[13]); IR (KBr): ῡ (cm^{-1}) = 3416, 3058, 2956, 1636, 1364, 1222, 698. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 7.48 (d, *J* = 8.24 Hz, 2H, Ar*H*), 7.34 (d, *J* = 7.52 Hz, 2H, Ar*H*), 7.17-7.12 (m, 4H, Ar*H*), 7.04 (t, *J* = 7.30 Hz, 1H, Ar*H*), 5.20 (s, 1H, CHAr), 2.13 (d, *J* = 16.28 Hz, 2H, CH_2), 2.06 (d, *J* = 16.60 Hz, 2H, CH_2), 1.98 (d, *J* = 17.36 Hz, 2H, CH_2),1.74 (d, *J* = 18.16 Hz, 2H, CH_2), 0.89 (s, 6H, 2CH_3), 0.74 (s, 6H, 2CH_3). ^{13}C NMR (101MHz, DMSO-d_6) δ (ppm): 26.8, 29.7, 32.4, 32.6, 50.1, 114.9, 118.1, 122.1, 126.0, 127.8, 128.1, 135.4, 137.6, 145.9, 149.1, 195.7.

3,3,6,6-tetramethyl-9-phenyl-10-propyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4t) (Table 4, entry 20)

Light yellow solid; Yield = 94%, M.P. 180-182 °C (Lit. new); IR (KBr): ῡ(cm^{-1}) = 2958, 1640, 1384, 1212. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.27 (d, *J* = 6.08 Hz, 2H, Ar*H*), 7.18 (t, *J* = 15.00 Hz, 2H, Ar*H*), 7.06 (t, *J* = 7.24 Hz, 1H, Ar*H*), 5.28 (s, 1H, C*H*Ar), 3.62 (t, *J* = 7.68 Hz, 2H, CH_2N), 2.54 (d, *J* = 16.60 Hz, 2H, CH_2), 2.41 (d, *J* = 16.72 Hz, 2H, CH_2), 2.31 (d, *J* = 7.24 Hz, 2H, CH_2), 2.23 (d, *J* = 8.24 Hz, 2H, CH_2), 1.68 (sext, *J* = 8.00 Hz, 2H, CH_2CH$_3$), 1.11 (s, 6H), 1.01 (s, 6H, 2CH_3), 0.90 (t, *J* = 3.06 Hz, 3H, 2CH_3), 2.41 (d, *J* = 16.72 Hz, 2H, CH_3). ^{13}C NMR (101MHz, $CDCl_3$) δ (ppm): 11.05, 24.70, 29.36, 31.84, 32.55, 40.47, 46.44, 49.96, 115.41, 125.81, 127.62, 127.95, 145.74, 150.16, 195.63.

3,3,6,6,10-pentamethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4u) (Table 4, entry 21)

Light yellow solid; Yield = 96%, M.P. 232-233 °C (Lit. 200-202 °C[14]); IR (KBr): ῡ(cm^{-1}) = 3470, 29.31, 16.17, 1325. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 7.44 (t, *J* = 8.34 Hz, 4H, Ar*H*), 7.33-7.36 (m, 1H, Ar*H*), 4.89 (s, 1H, C*H*Ar), 3.72 (s, 1H, CH_3N), 2.19 (d, *J* = 8.20 Hz, 2H, CH_2), 2.14 (d, *J* = 5.28 Hz, 2H, CH_2), 2.09 (d, *J* = 5.76 Hz, 2H, CH_2), 2.05 (d, *J* = 5.28 Hz, 2H, CH_2), 1.19 (s, 6H, 2CH_3), 1.07 (s, 6H, 2CH_3). ^{13}C NMR (101MHz, $CDCl_3$) δ (ppm): 26.81, 28.99, 34.99, 38.00, 50.62, 113.26, 128.14, 128.47, 128.61, 146.84, 153.70, 188.98.

9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione (4v) (Table 4, entry 22)

Light yellow solid; Yield = 92%, M.P. 307-308 °C (Lit. 310 °C [3]); IR (KBr): ῡ(cm^{-1}) = 3449, 2929, 1620, 1372. ^{1}H NMR (400 MHz, $CDCl_3$) δ (ppm): 9.33 (s, 1H, N-*H*), 7.33 (d, *J* = 7.80 Hz, 4H, Ar*H*), 7.13-7.05 (m, 1H, Ar*H*), 4.96 (s, 1H, C*H*Ar), 3.26 (t, *J* = 7.32 Hz, 4H CH_2CO), 2.98 (t, *J* = 6.12 Hz, 4H CH_2), 1.83 (quin, 4H, CH_2CH$_2$CO). ^{13}C NMR (101MHz, $CDCl_3$) δ (ppm): 21.05, 28.39, 30.05, 35.43, 112.19, 131.17, 132.78, 134.19, 142.67, 150.61, 195.72.

1,1'-(2,6-dimethyl-4-phenyl-1,4-dihydropyridine-3,5-diyl)bis(ethan-1-one) (4w)
(Table 4, entry 23)

Yellow solid; Yield = 94%, M.P. 186-187 ^{o}C (Lit. 184-186 ^{o}C [15]); IR (KBr): ū(cm^{-1}) = 3407, 2915, 1621, 1397. ^{1}H NMR (400 MHz, DMSO-d_6) δ (ppm): 8.98 (s, 1H, N-*H*), 7.33 (d, *J* = 19.88 Hz, 4H, Ar*H*), 7.17-7.10 (m, 1H, Ar*H*), 4.88 (s, 1H, C*H*Ar), 2.38 (s, 6H, 2CH_3CO), 2.16 (s, 6H, 2CH_3). ^{13}C NMR (101MHz, DMSO-d_6) δ (ppm): 20.06, 27.21, 33.96, 112.85, 128.09, 128.78, 129.61, 143.48, 147.28, 198.59.

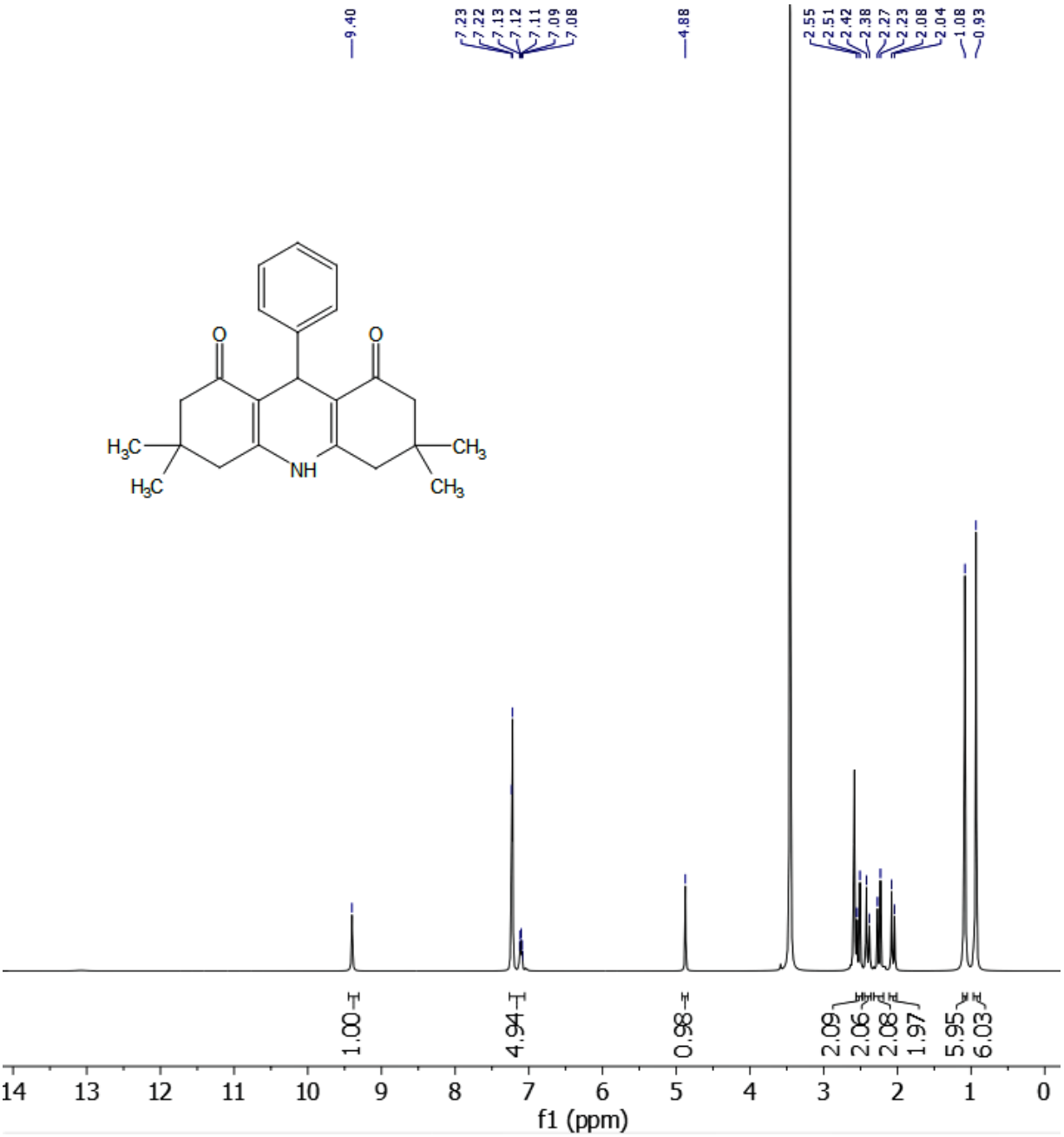


Figure S1: The ^{1}H NMR spectrum (400 MHz) of 3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

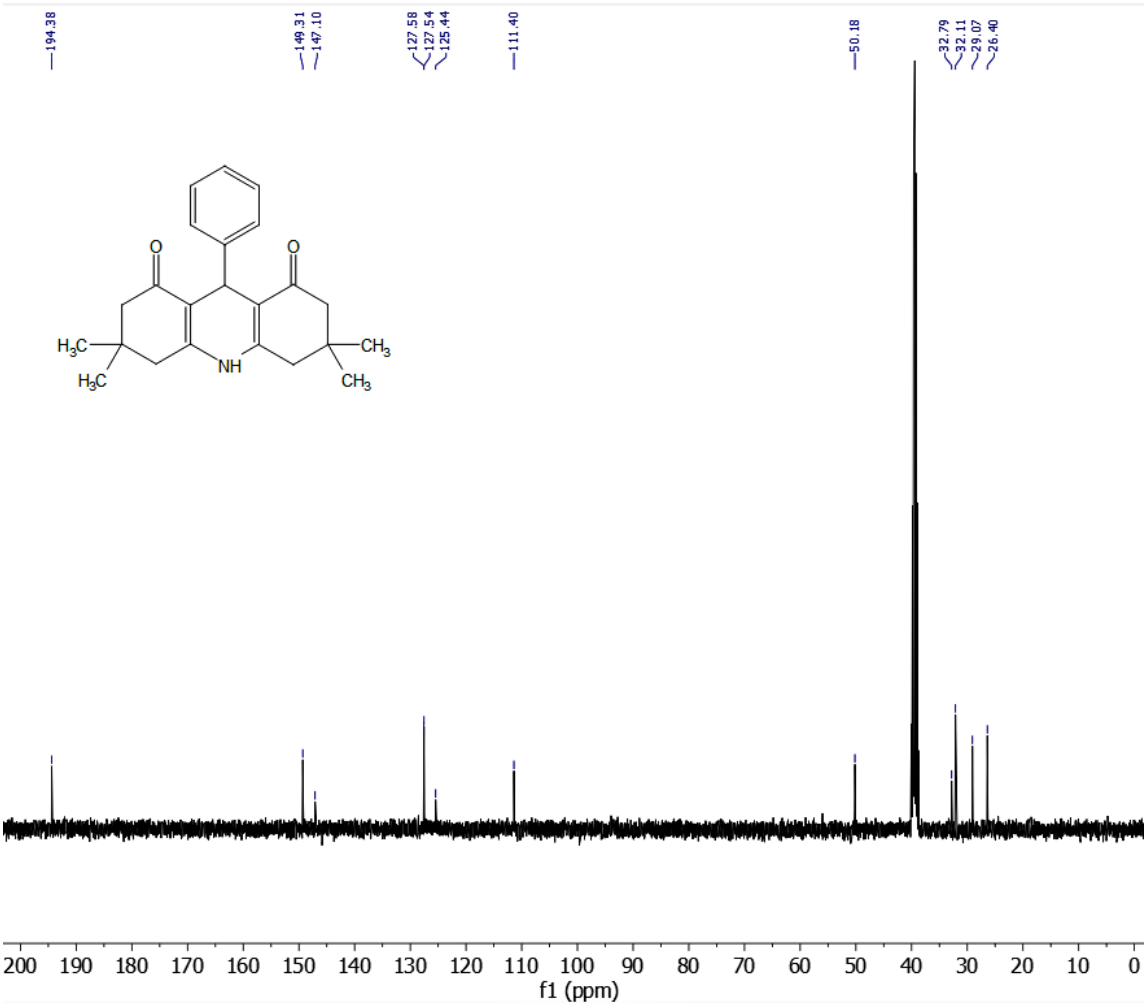


Figure S2: The ^{13}C NMR spectrum (101 MHz) of spectrum of 3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

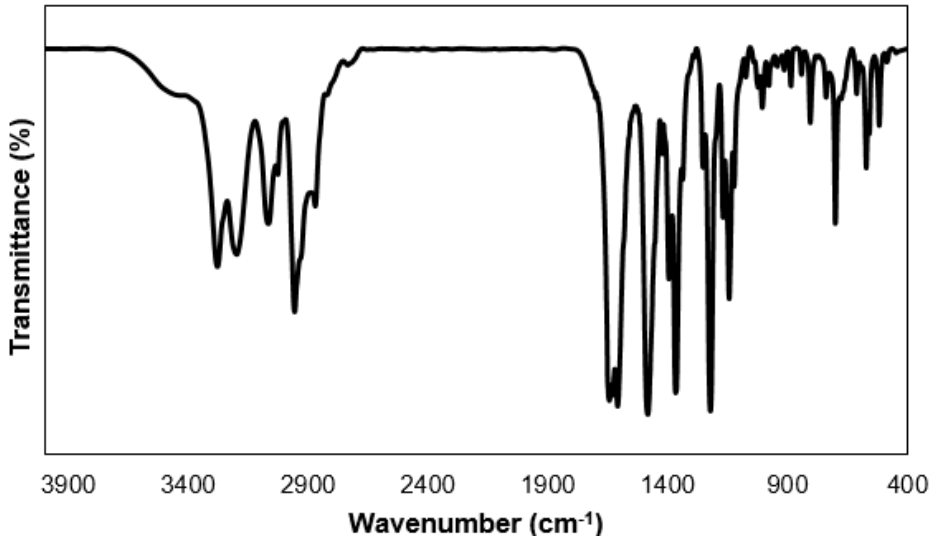


Figure S3: The FT-IR spectrum of 3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

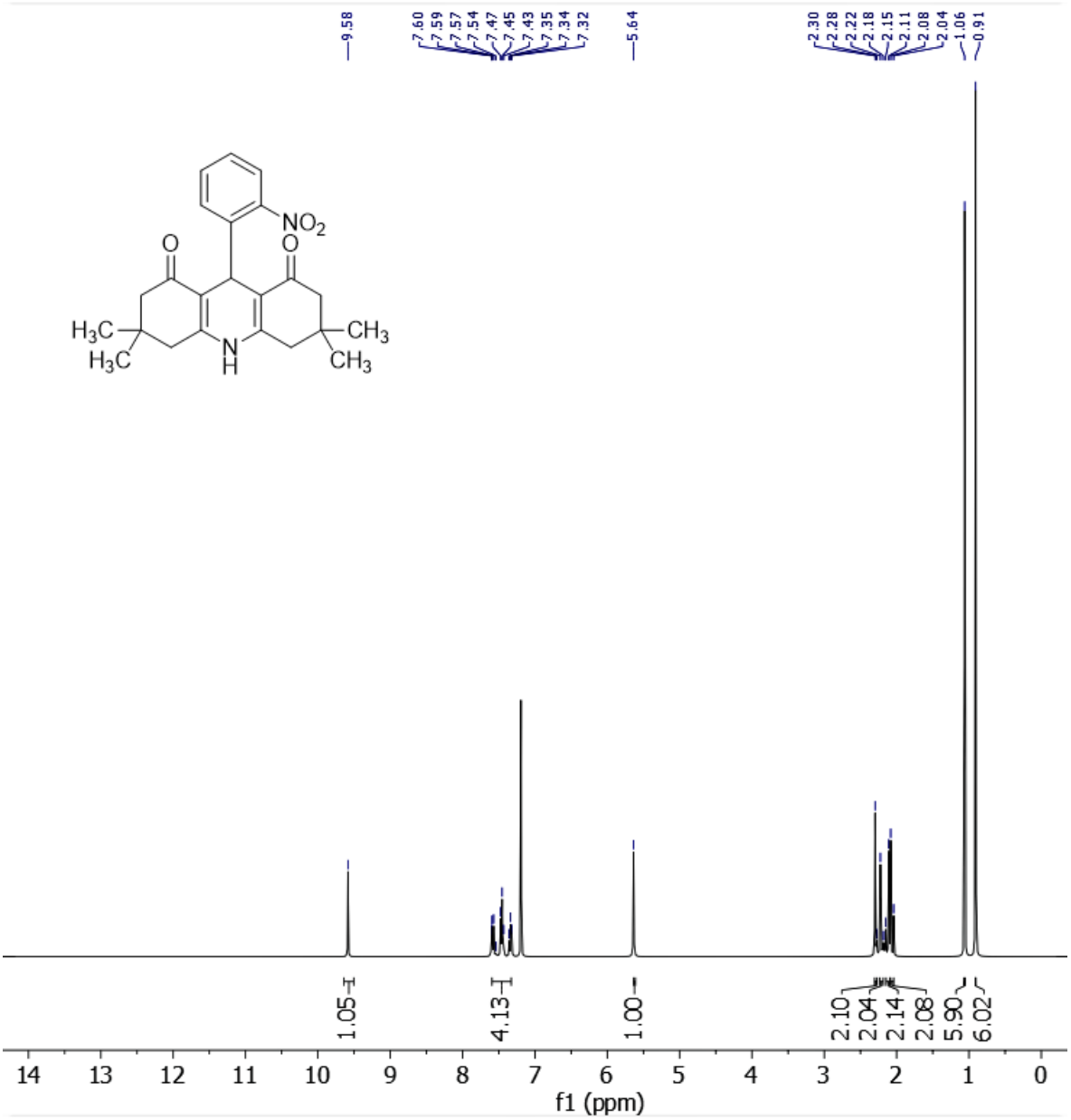


Figure S4: The ^{1}H NMR spectrum (400 MHz) of 3,3,6,6-tetramethyl-9-(2-nitrophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in $CDCl_3$

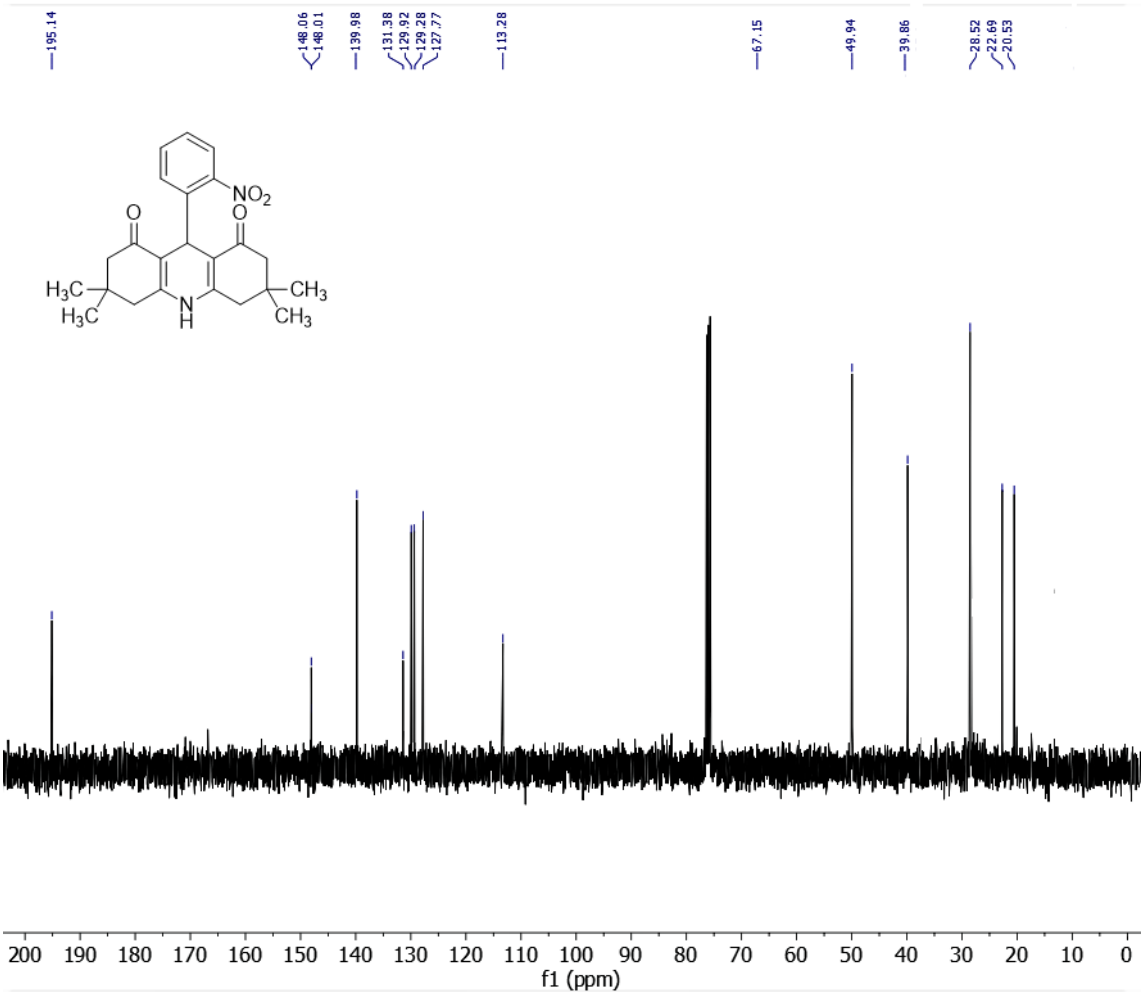


Figure S5: The ^{13}C NMR spectrum (101 MHz) of spectrum of 3,3,6,6-tetramethyl-9-(2-nitrophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in $CDCl_3$

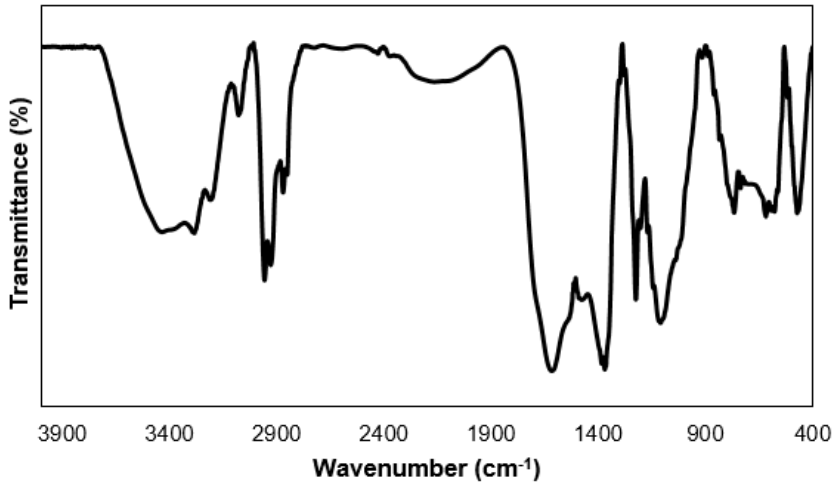


Figure S6: The FT-IR spectrum of 3,3,6,6-tetramethyl-9-(2-nitrophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

Figure S7: The ^{1}H NMR spectrum (400 MHz) of 3,3,6,6-tetramethyl-9-(3-nitrophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

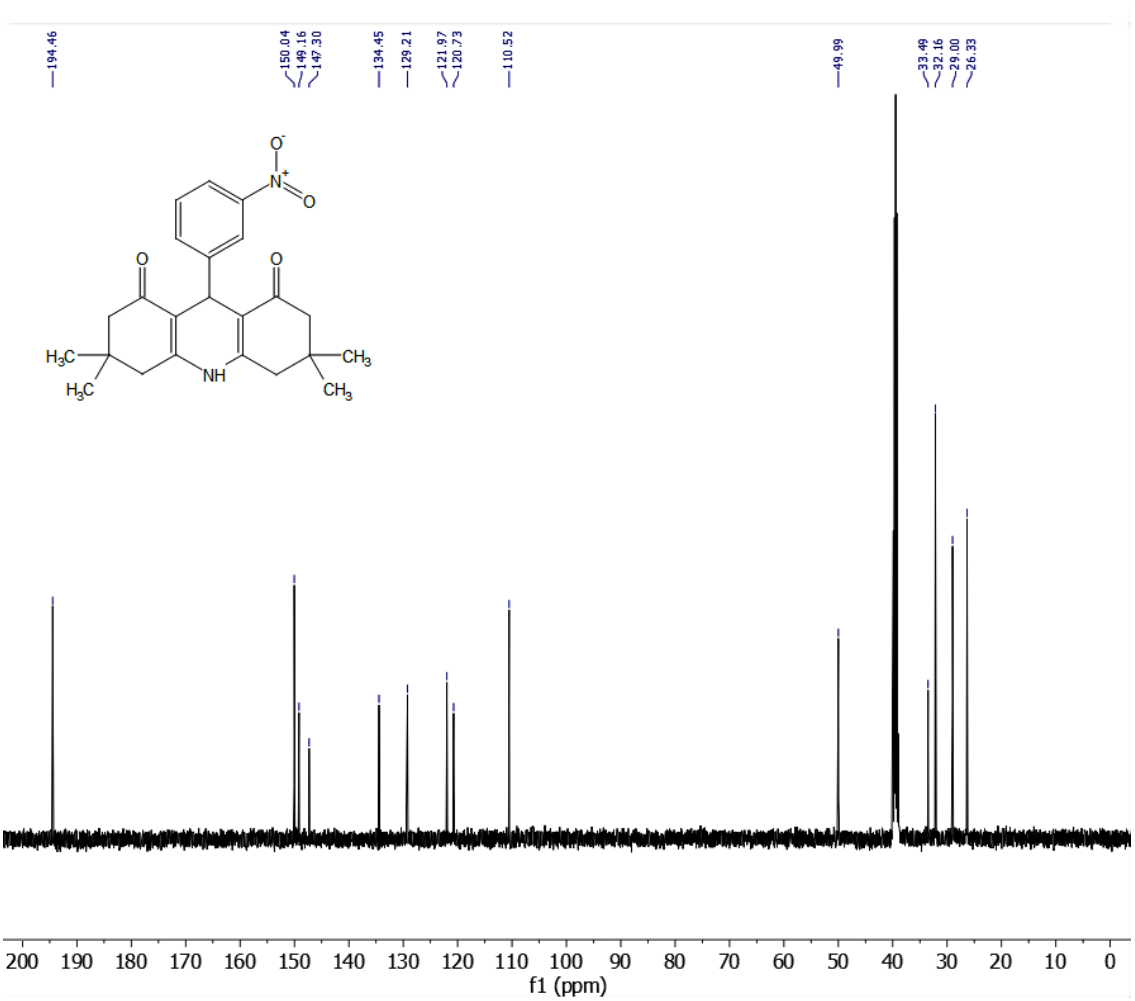


Figure S8: The ^{13}C NMR spectrum (101 MHz) of 3,3,6,6-tetramethyl-9-(3-nitrophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

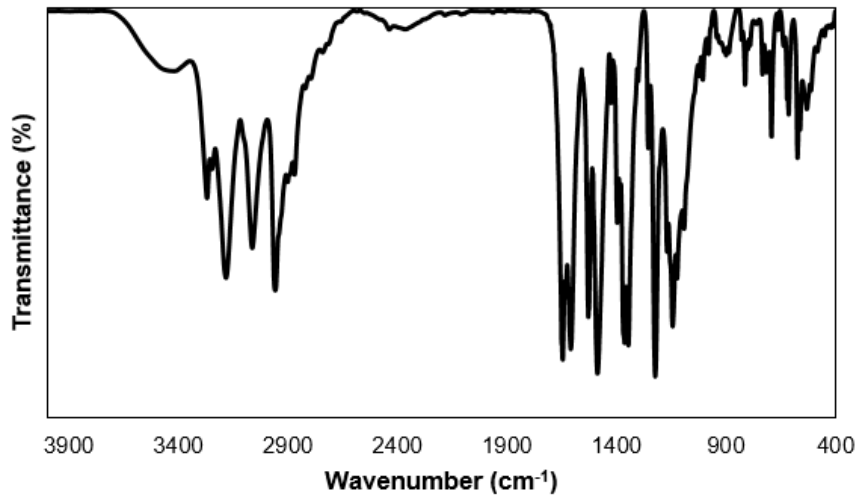


Figure S9: The FT-IR spectrum of 3,3,6,6-tetramethyl-9-(3-nitrophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

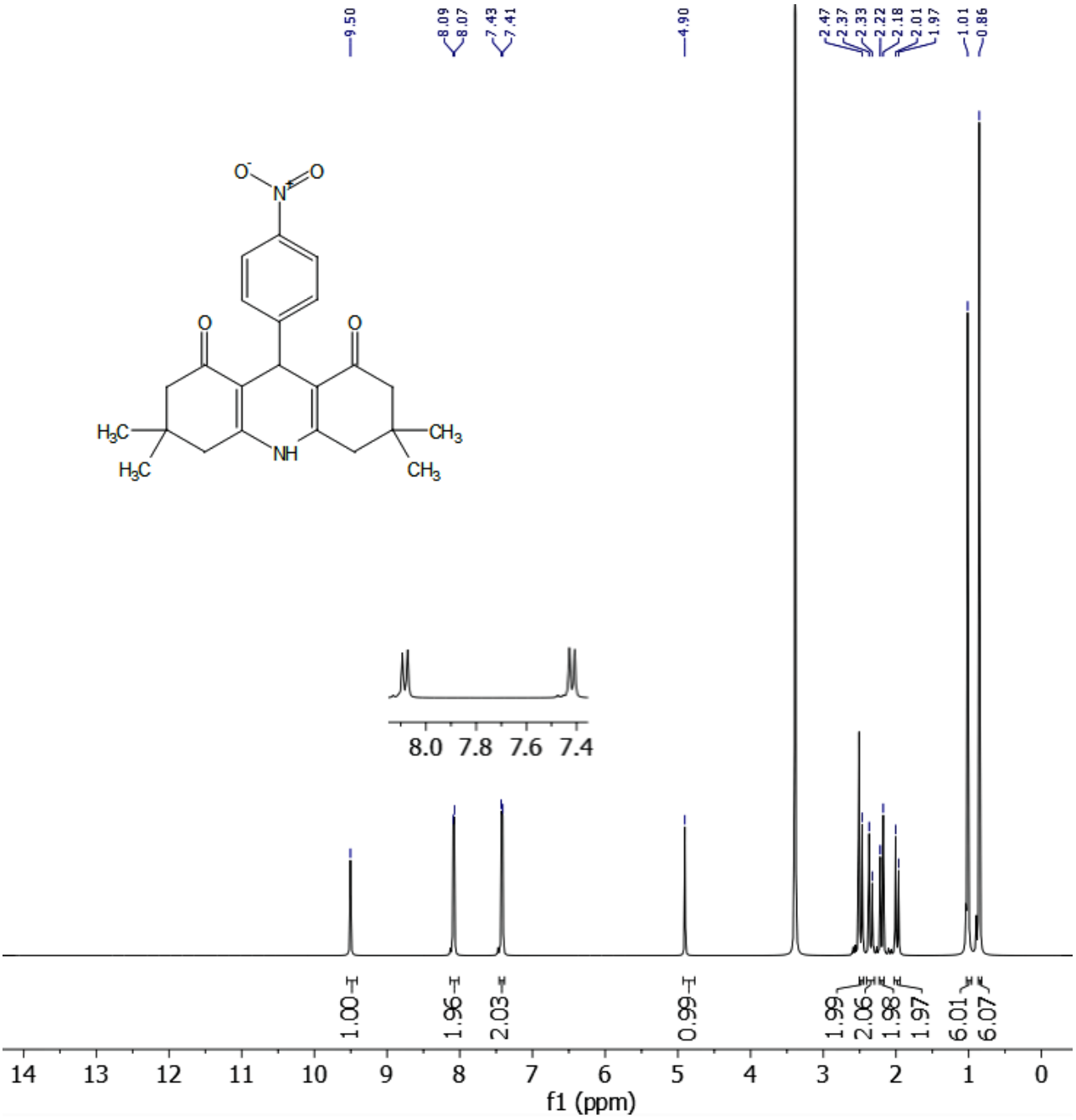


Figure S10: The ^{1}H NMR spectrum (400 MHz) of 3,3,6,6-tetramethyl-9-(4-nitrophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

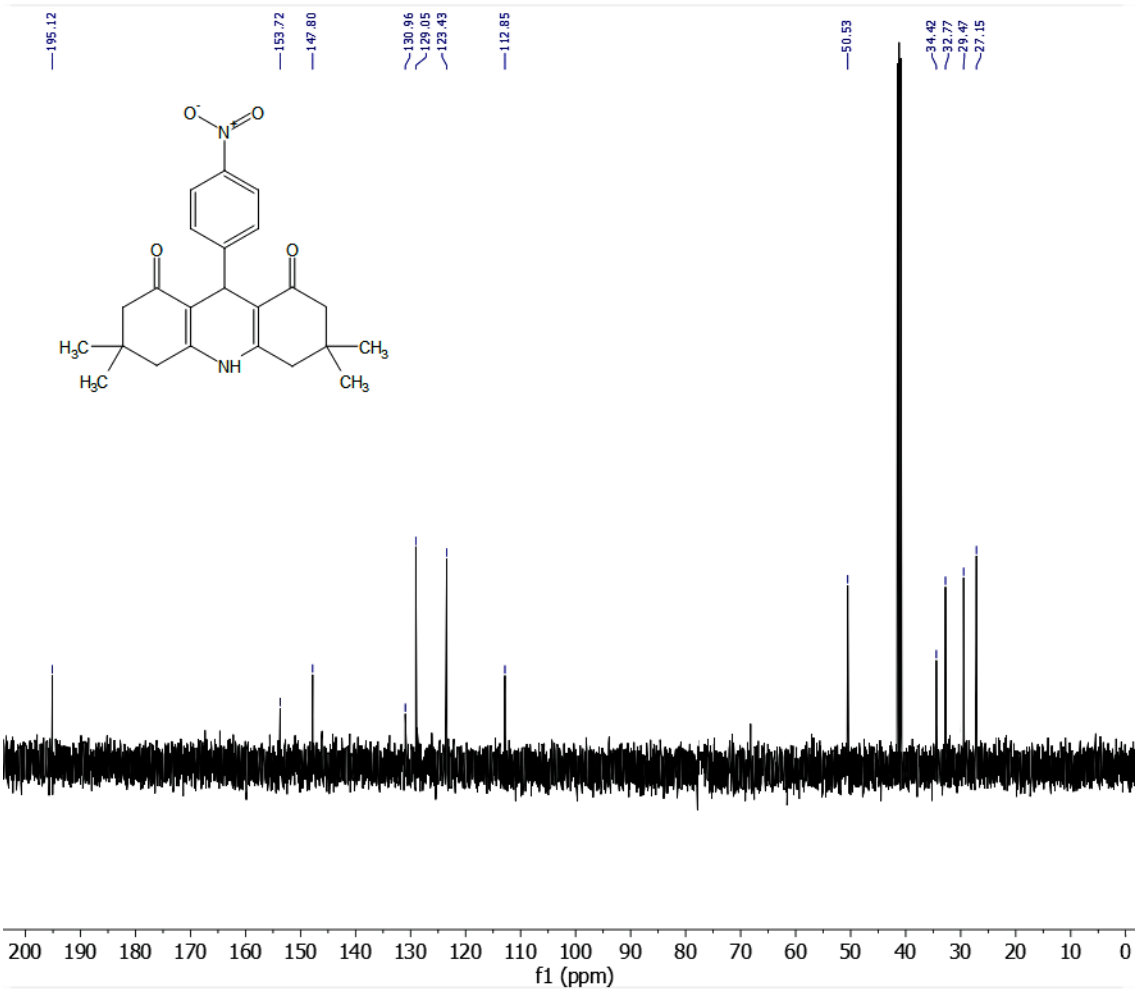


Figure S11: The ^{13}C NMR spectrum (101 MHz) of 3,3,6,6-tetramethyl-9-(4-nitrophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

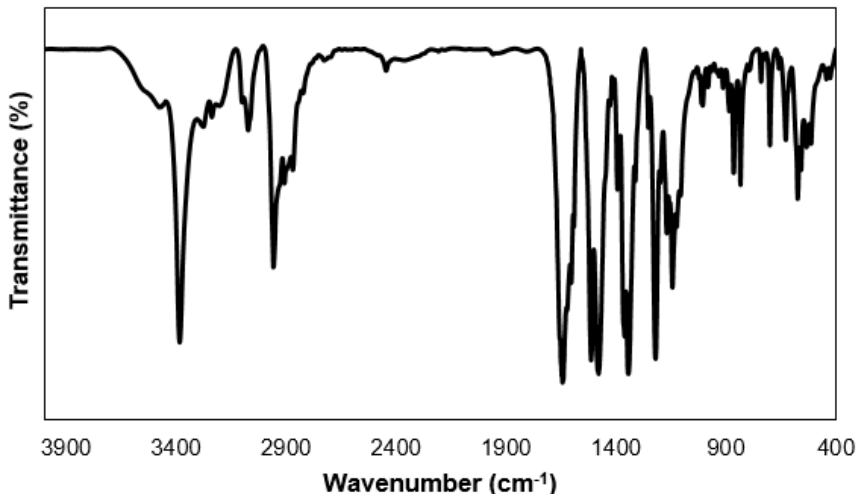


Figure S12: The FT-IR spectrum of 3,3,6,6-tetramethyl-9-(4-nitrophenyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

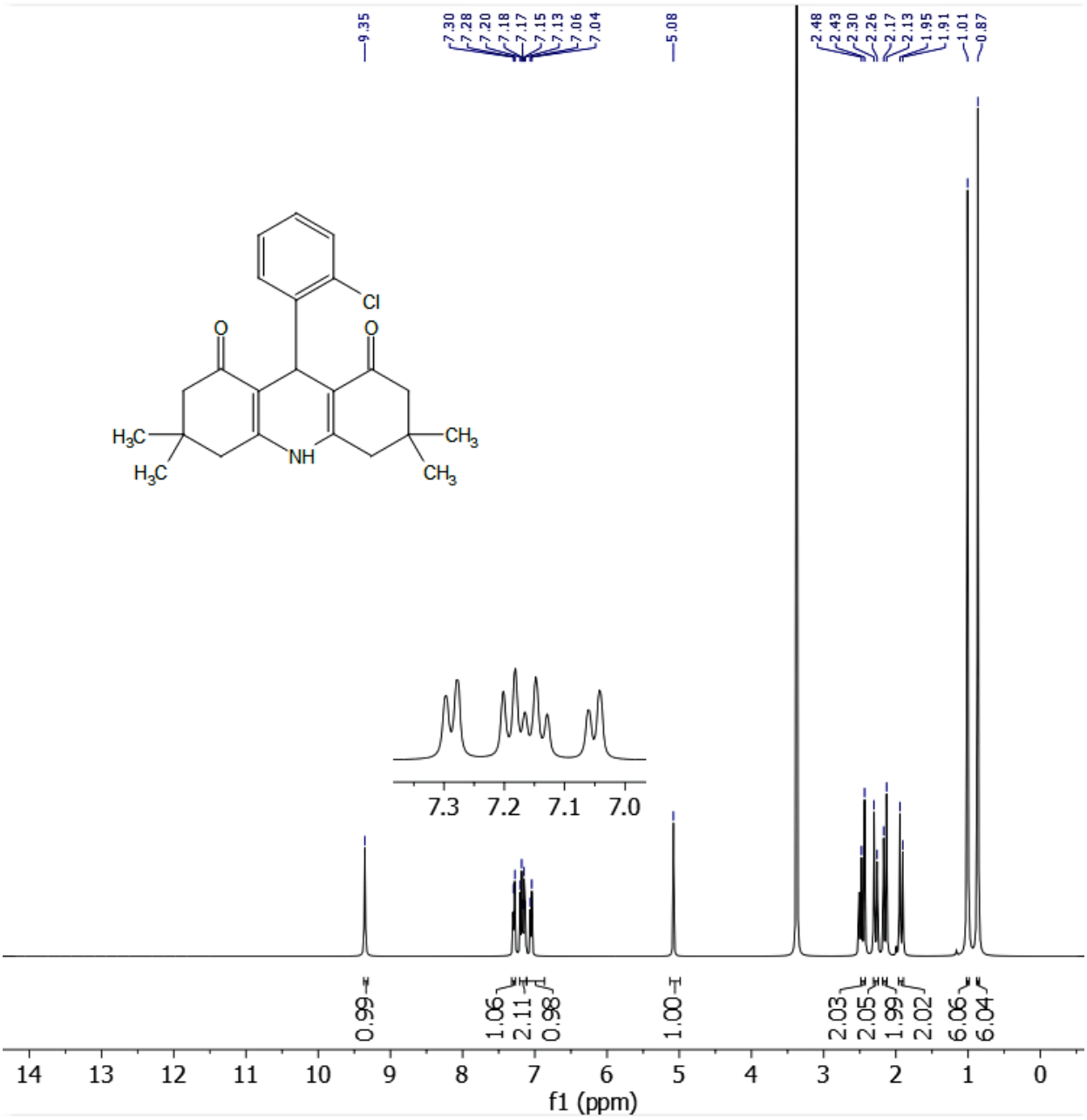


Figure S13: The ^{1}H NMR spectrum of (400 MHz) 9-(2-chlorophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

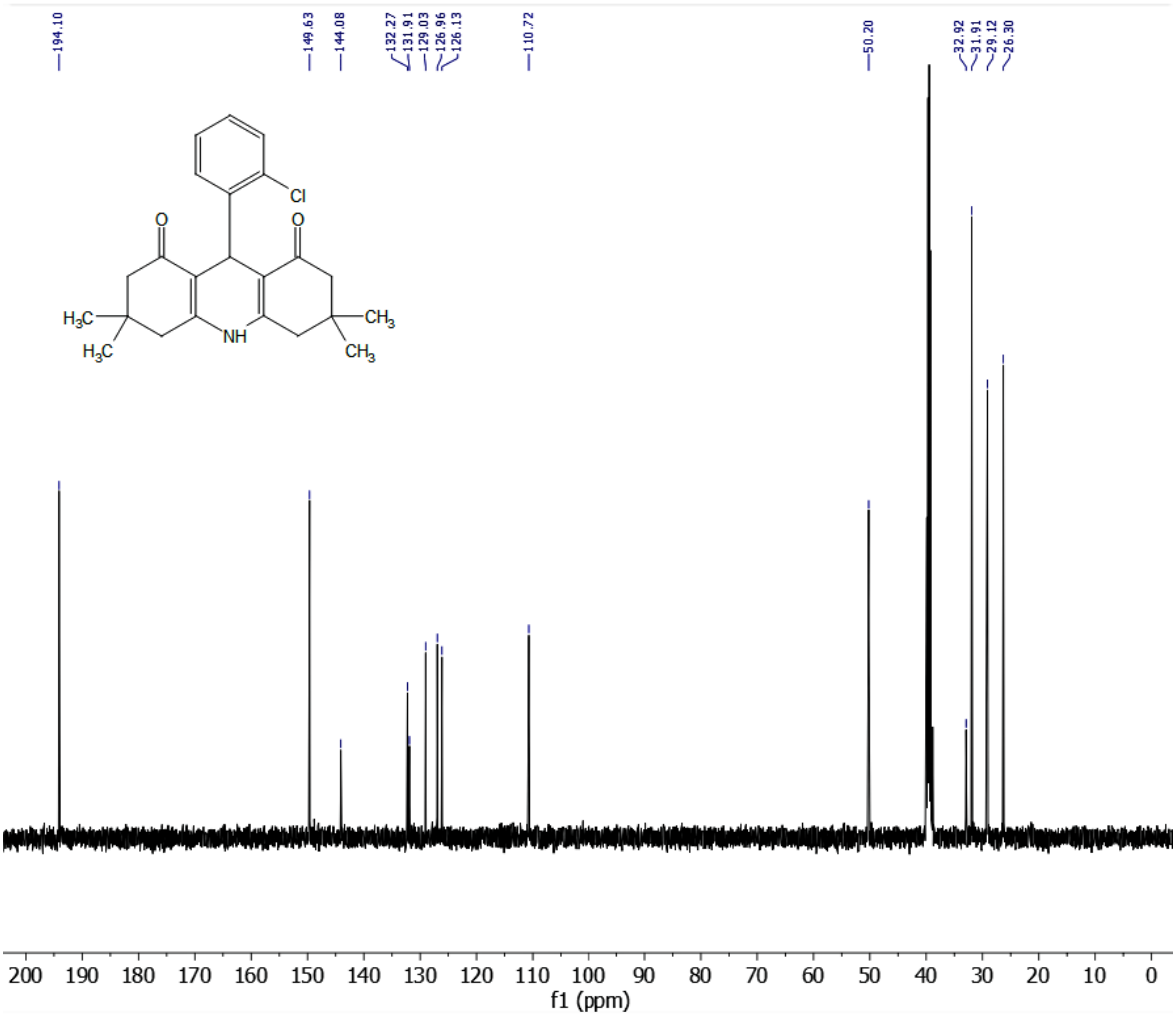


Figure S14: The ^{13}C NMR spectrum (101 MHz) of 9-(2-chlorophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

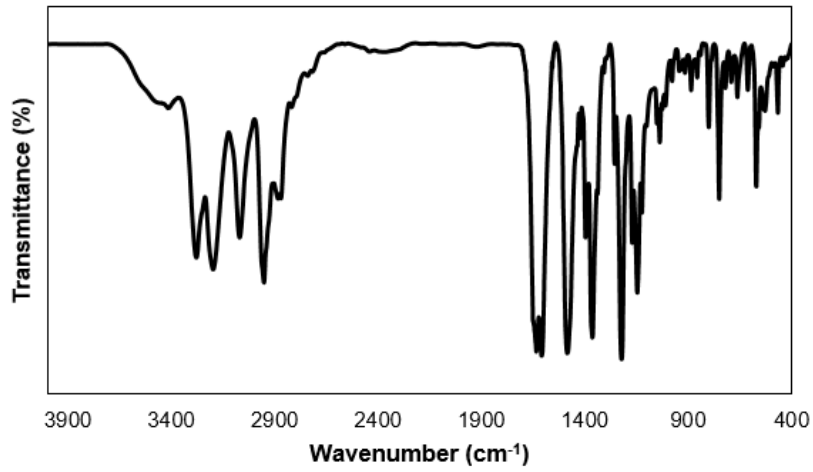


Figure S15: The FT-IR spectrum of 9-(2-chlorophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

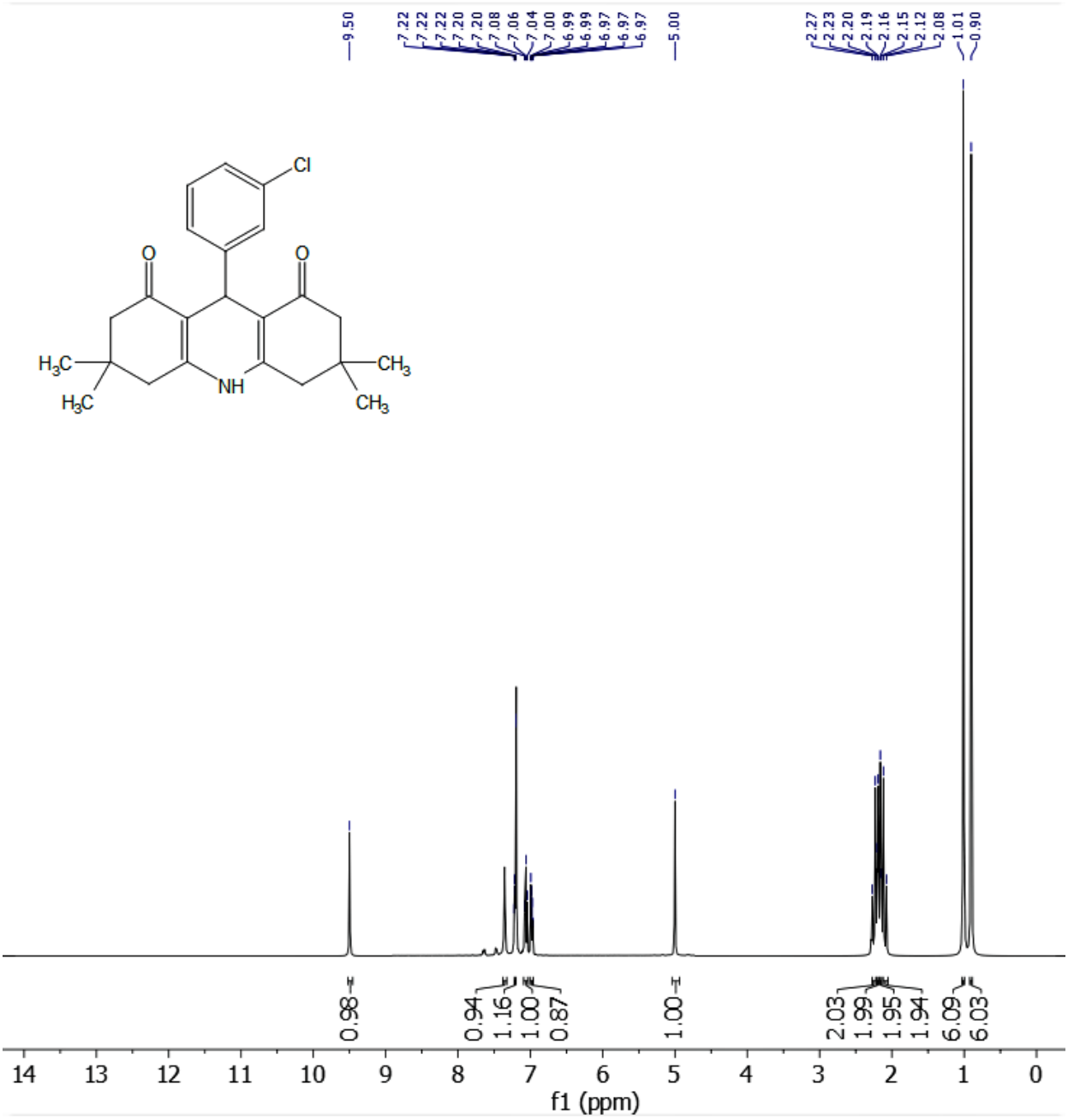


Figure S16: The ^{1}H NMR spectrum (400 MHz) of 9-(3-chlorophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in $CDCl_3$

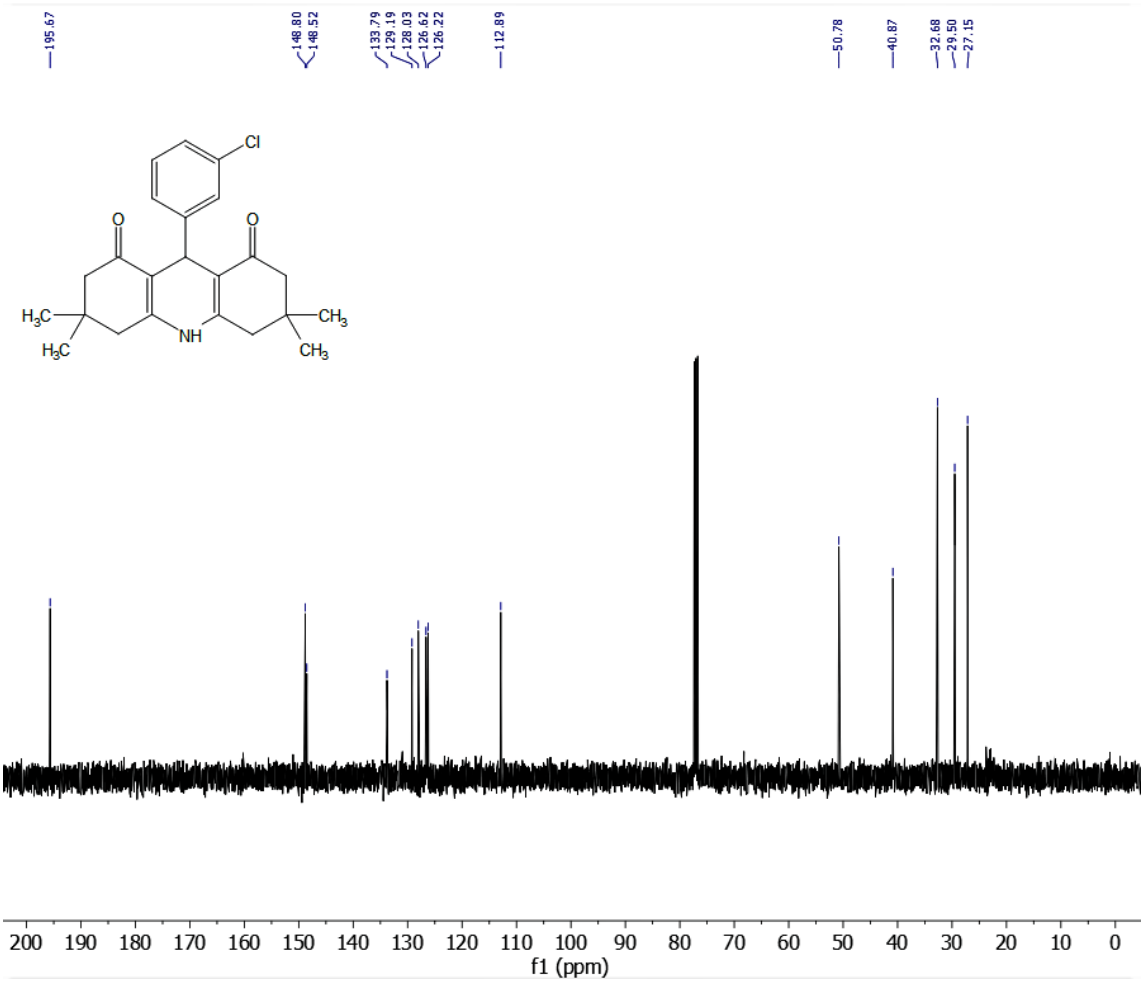


Figure S17: The ^{13}C NMR spectrum (101 MHz) of 9-(3-chlorophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione (4f) in $CDCl_3$

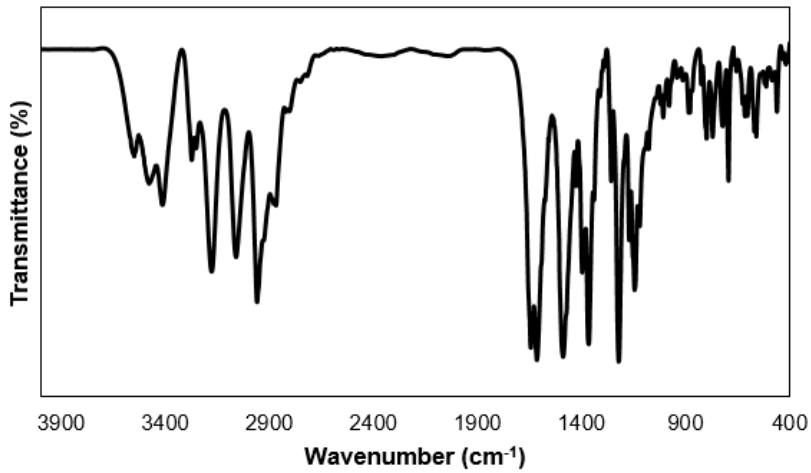


Figure S18: The FT-IR spectrum of 9-(3-chlorophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

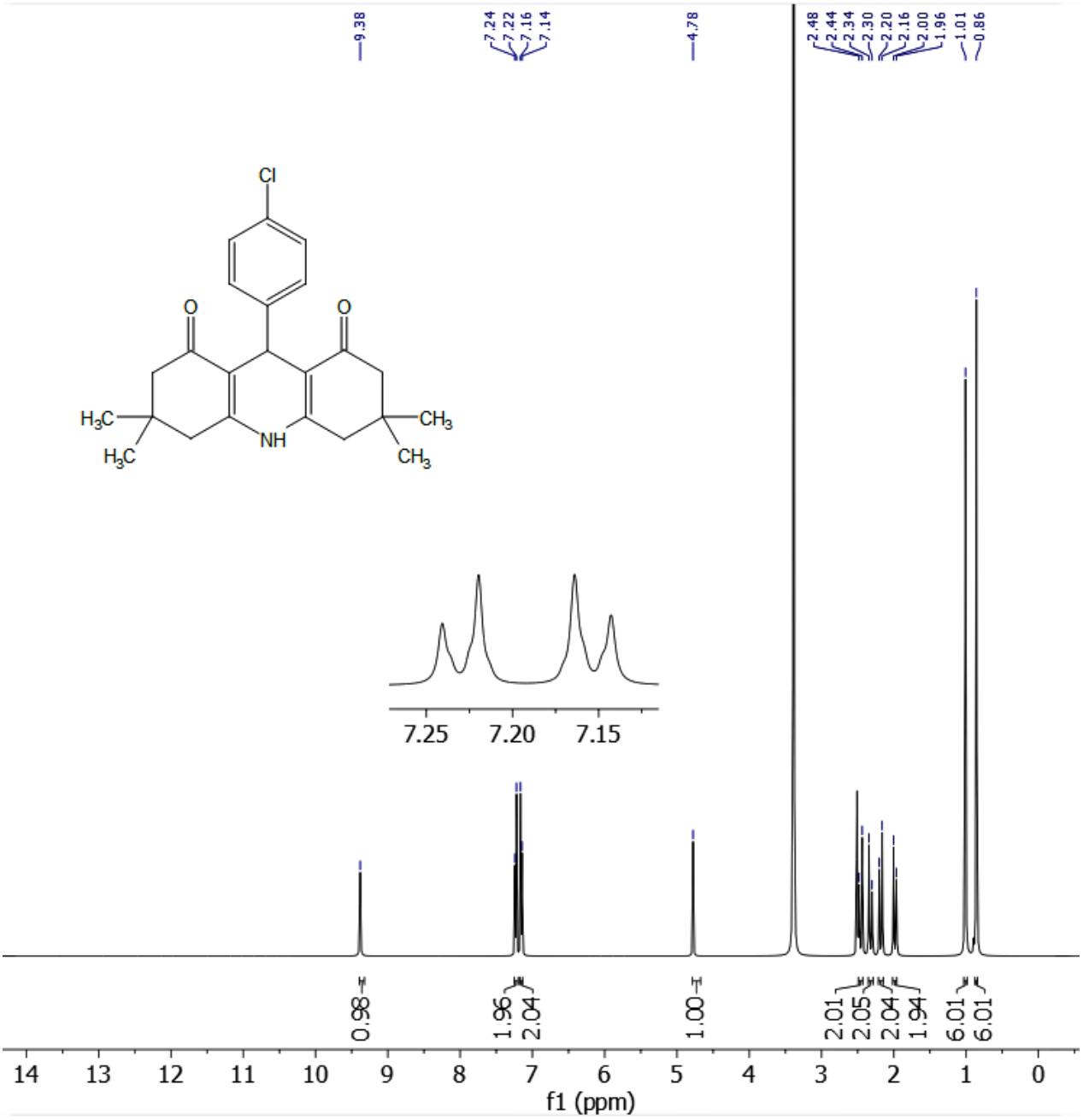


Figure S19: The ^{1}H NMR spectrum (400 MHz) of 9-(4-chlorophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

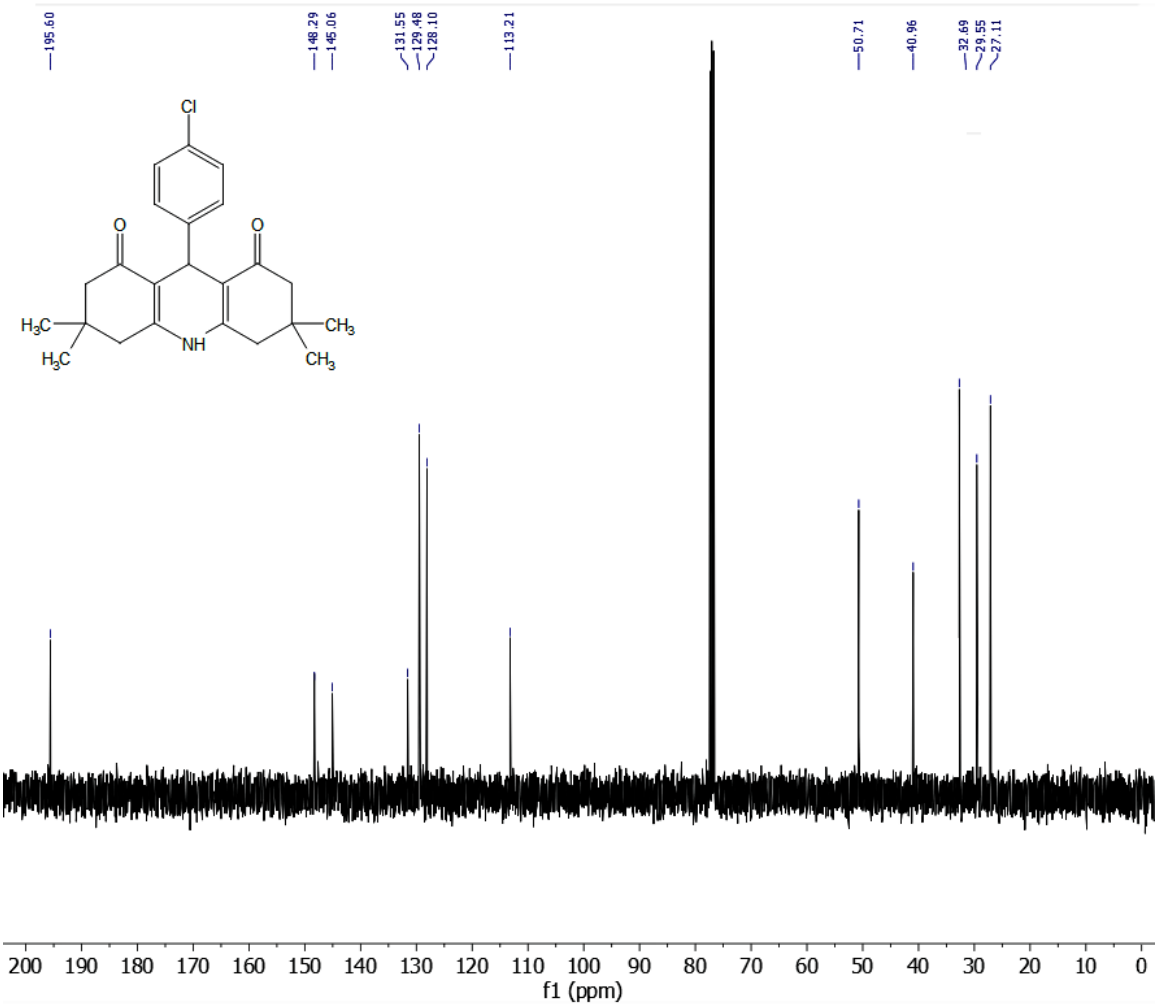


Figure S20: The ^{13}C NMR spectrum (101 MHz) of 9-(4-chlorophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

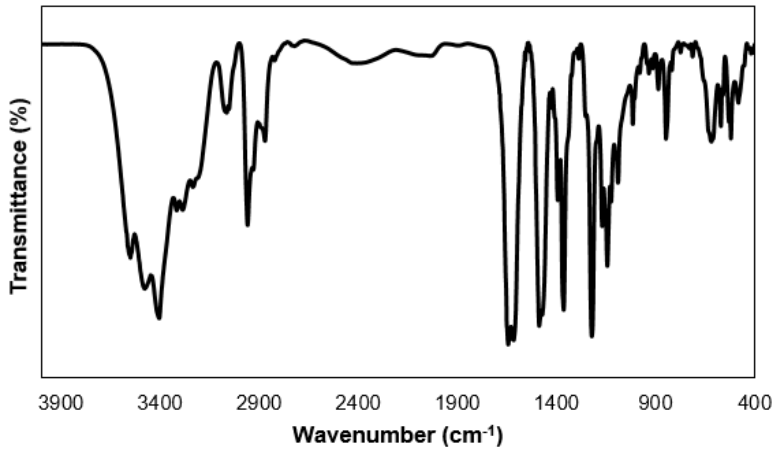


Figure S21: The FT-IR spectrum of 9-(4-chlorophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

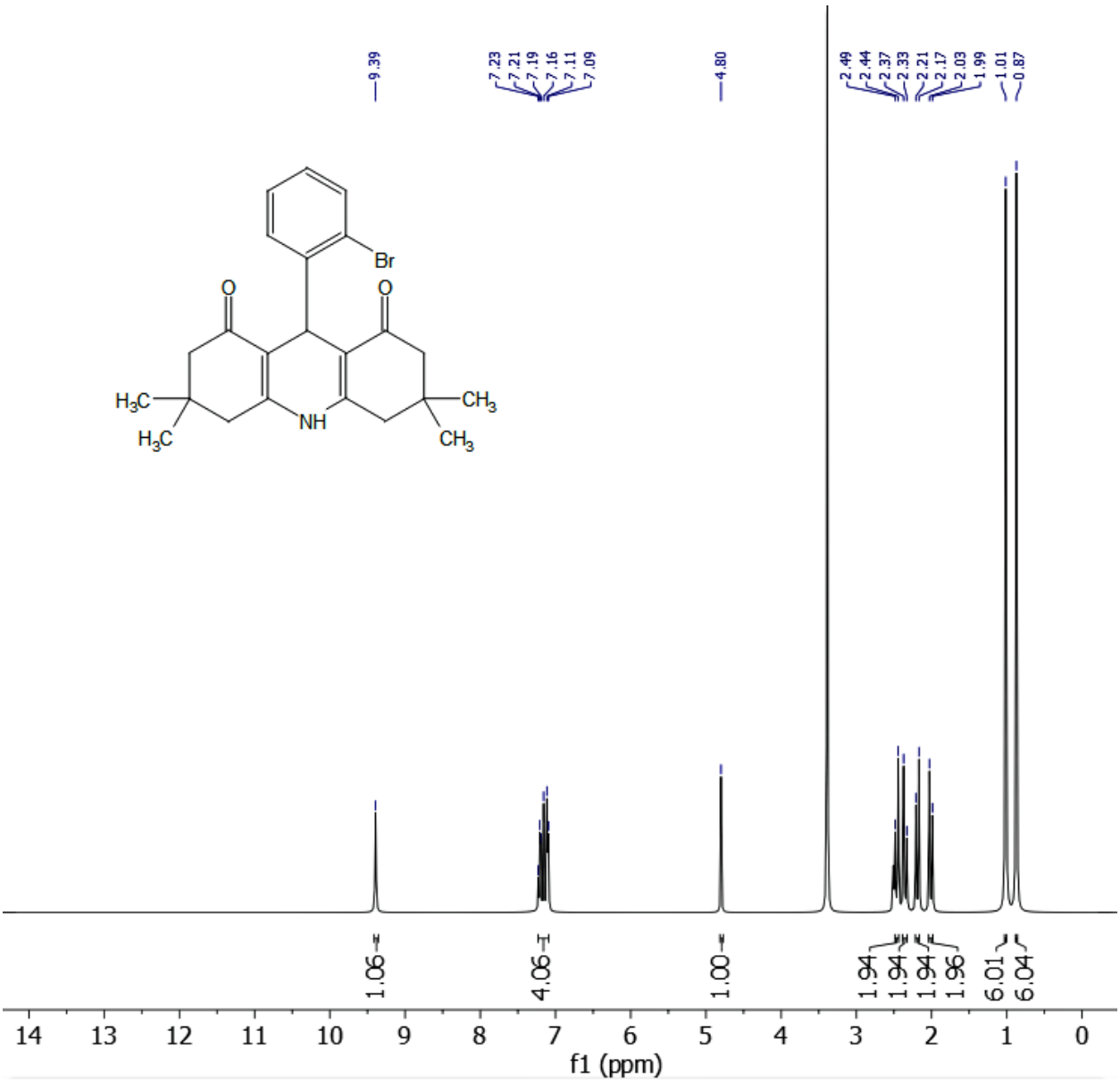


Figure S22: The ^{1}H NMR spectrum (400 MHz) of 9-(2-bromophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

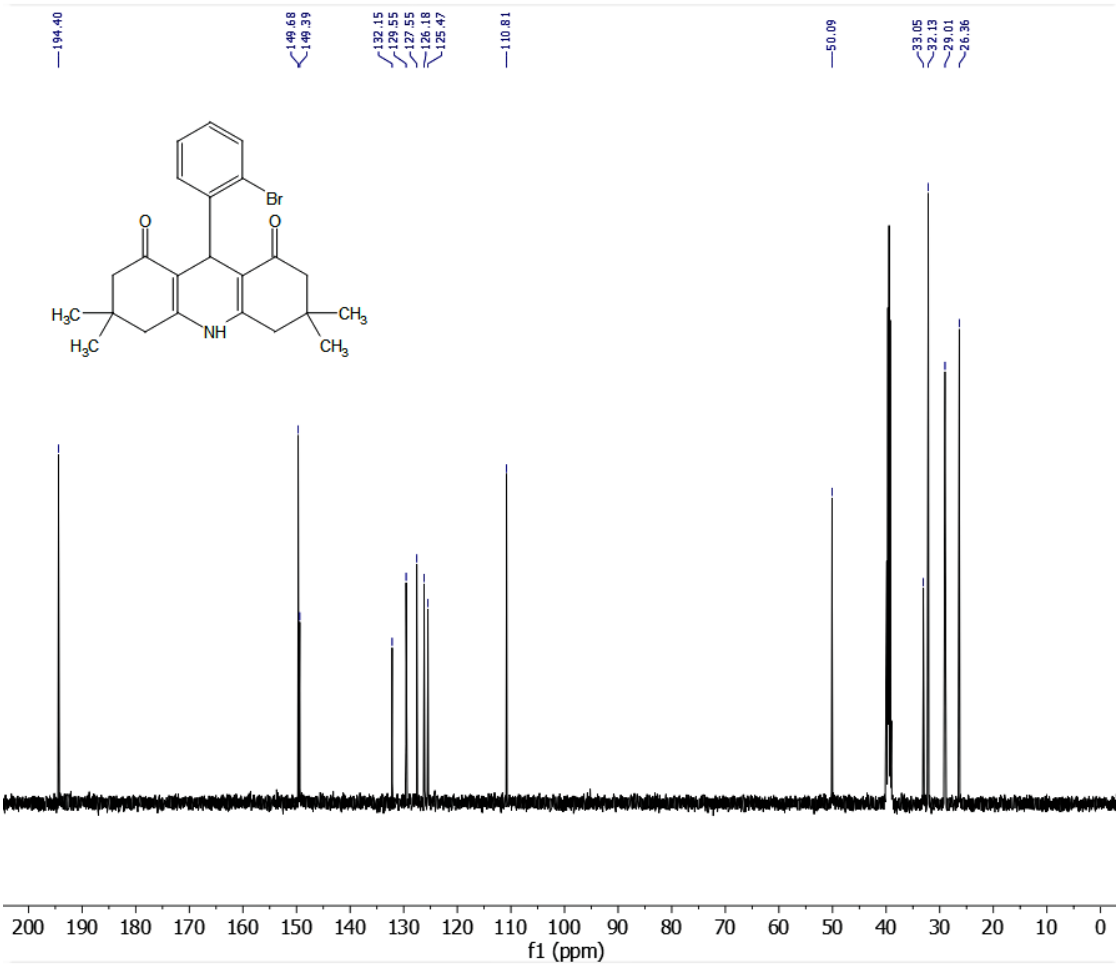


Figure S23: The ^{13}C NMR spectrum (101 MHz) of 9-(2-bromophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

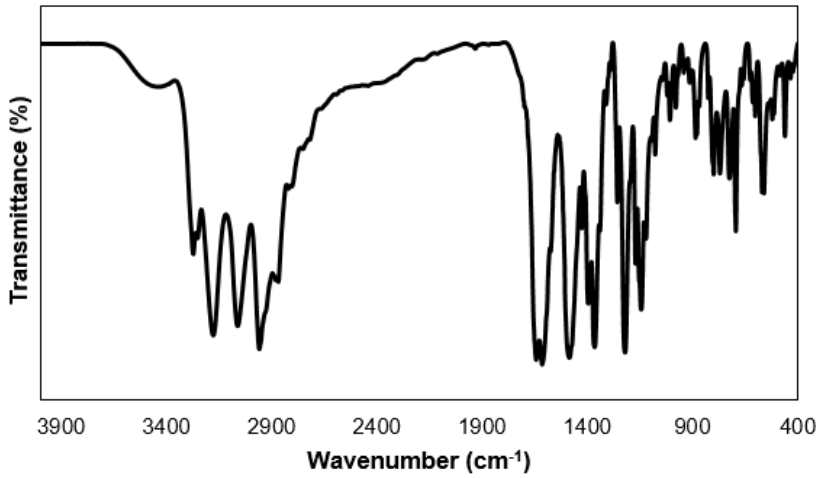


Figure S24: The FT-IR spectrum of 9-(2-bromophenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

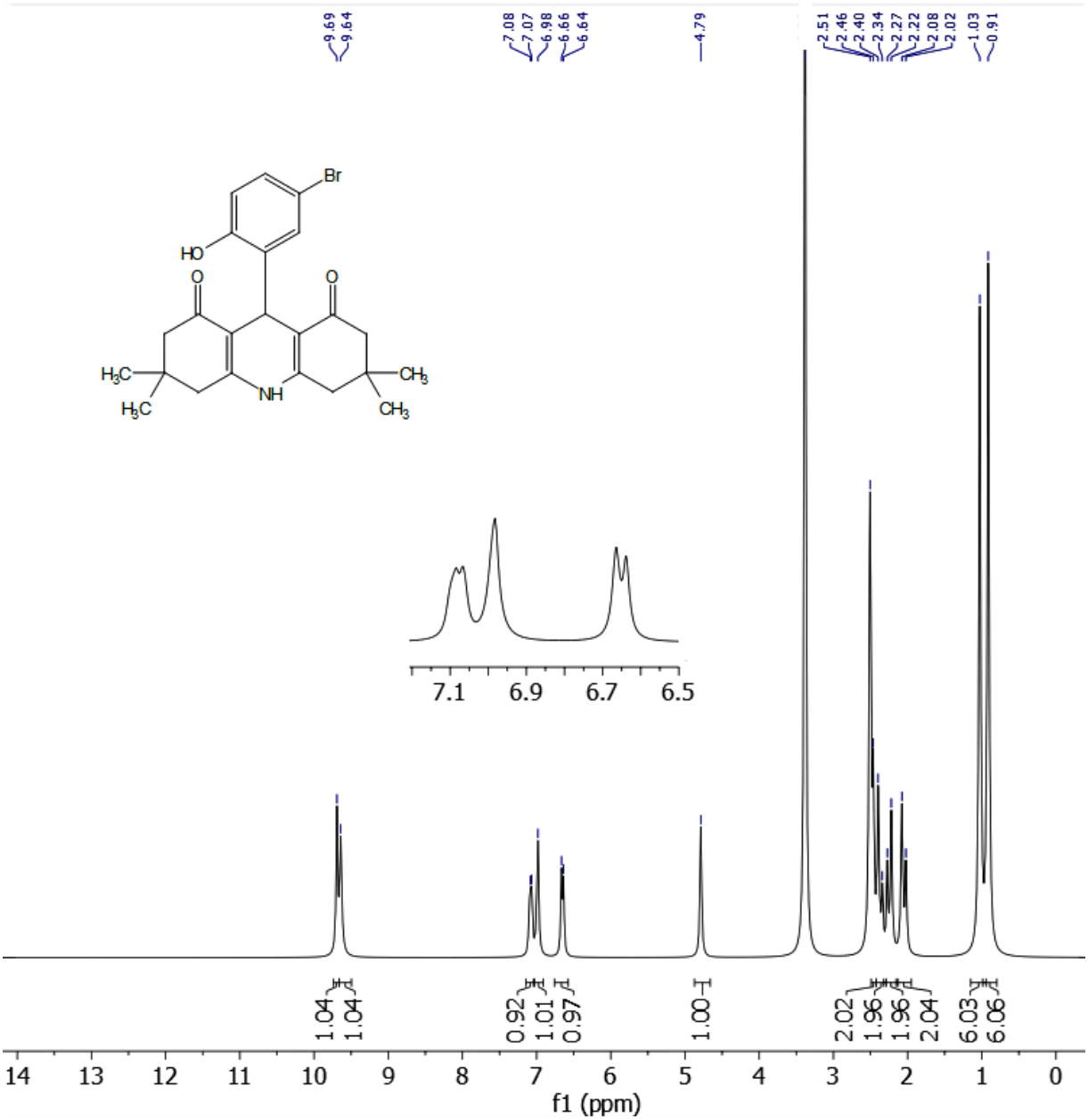


Figure S25: The ^{1}H NMR spectrum (300 MHz)of 9-(5-bromo-2-hydroxyphenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

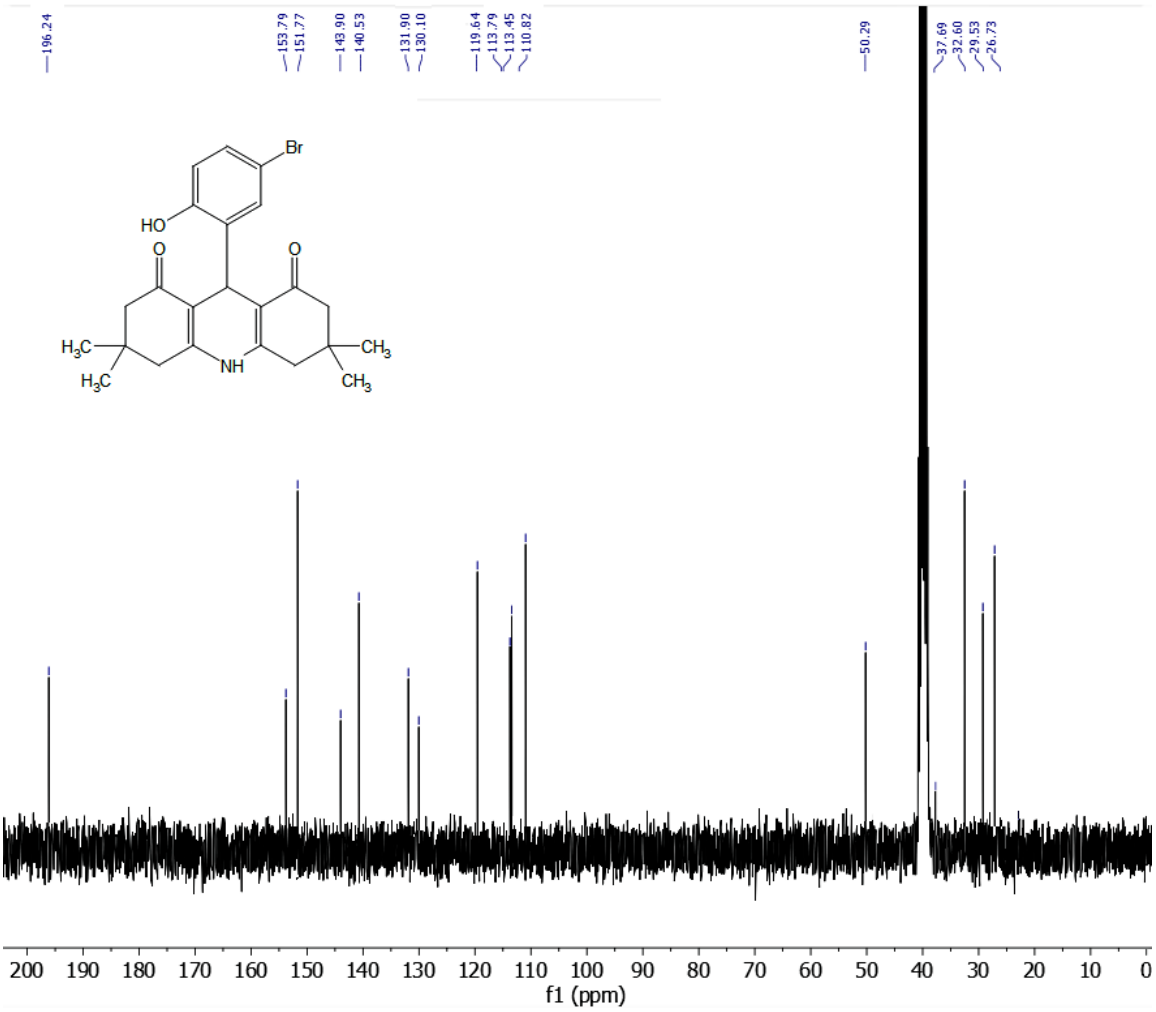


Figure S26: The ^{13}C NMR spectrum (76 MHz) of 9-(5-bromo-2-hydroxyphenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

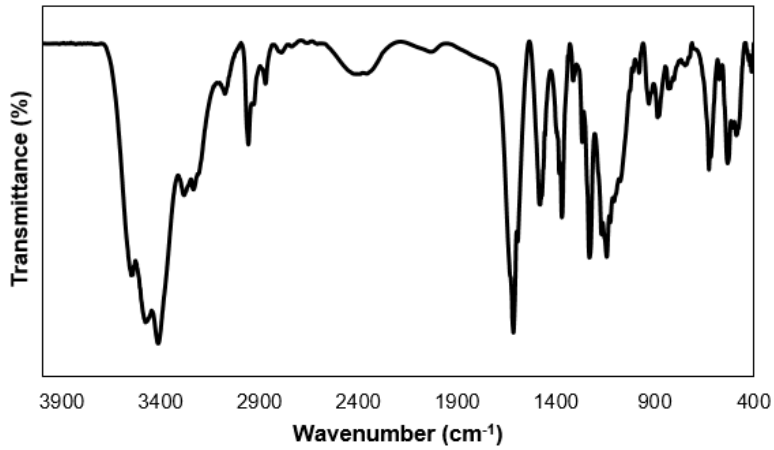


Figure S27: The FT-IR spectrum of 9-(5-bromo-2-hydroxyphenyl)-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

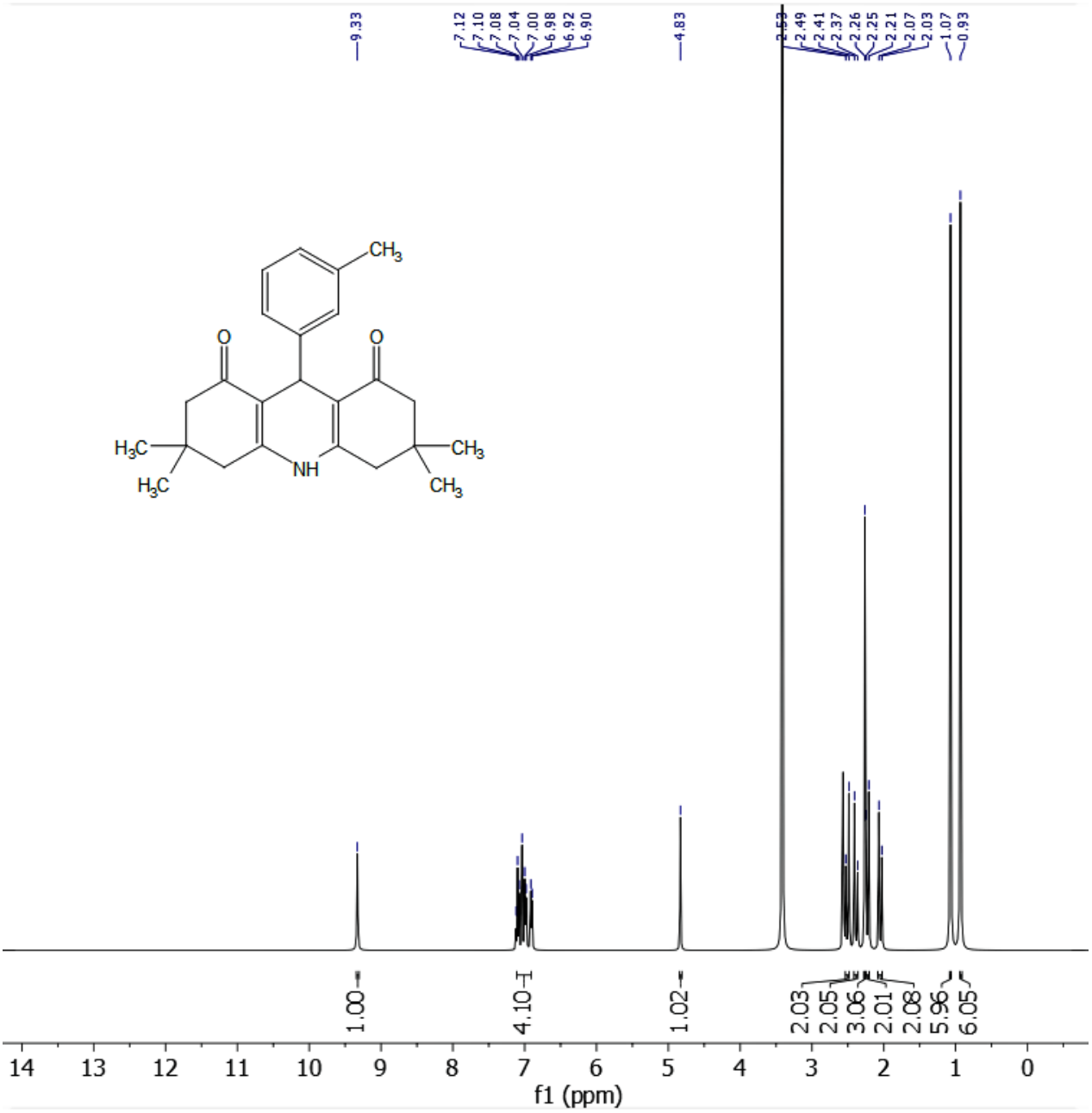


Figure S28: The ^{1}H NMR spectrum (400 MHz) of 3,3,6,6-tetramethyl-9-(*m*-tolyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

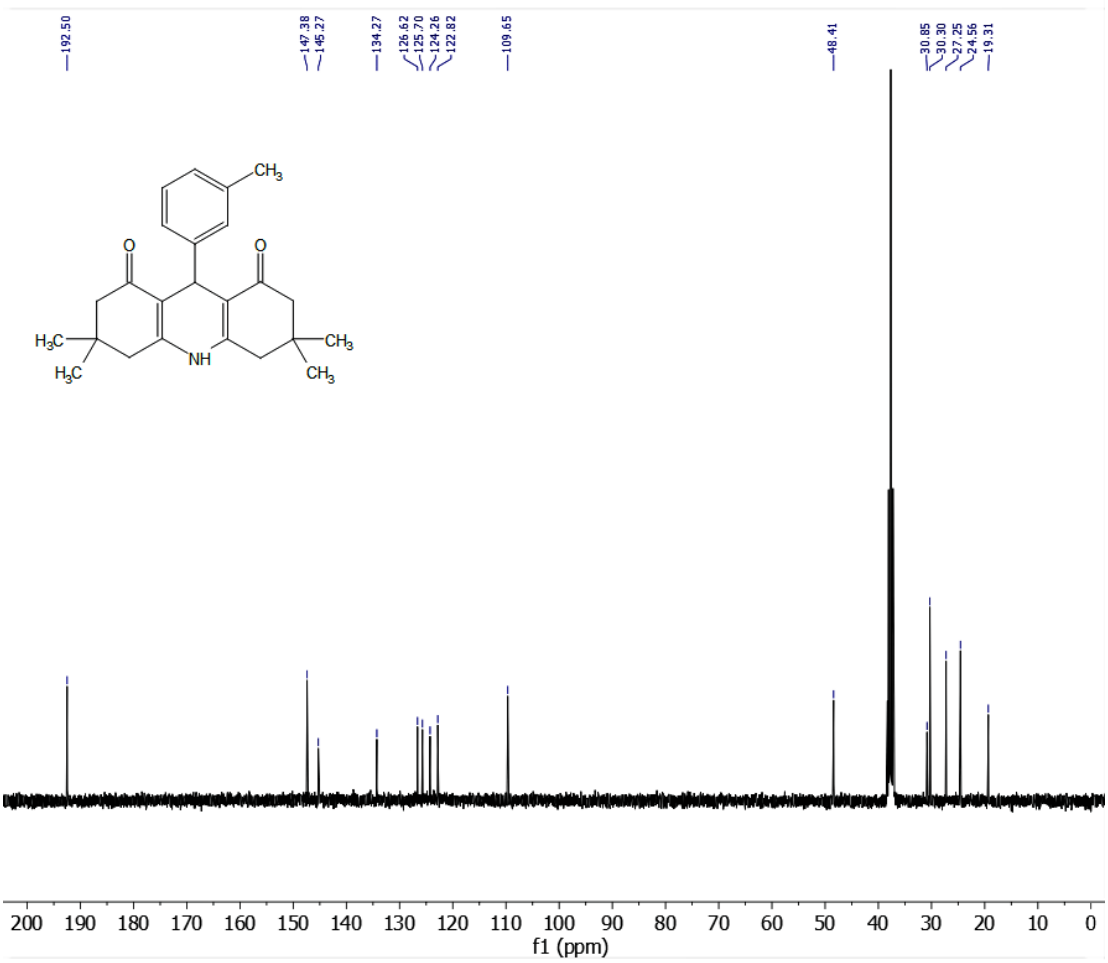


Figure S29: The ^{13}C NMR spectrum (101 MHz) of 3,3,6,6-tetramethyl-9-(*m*-tolyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

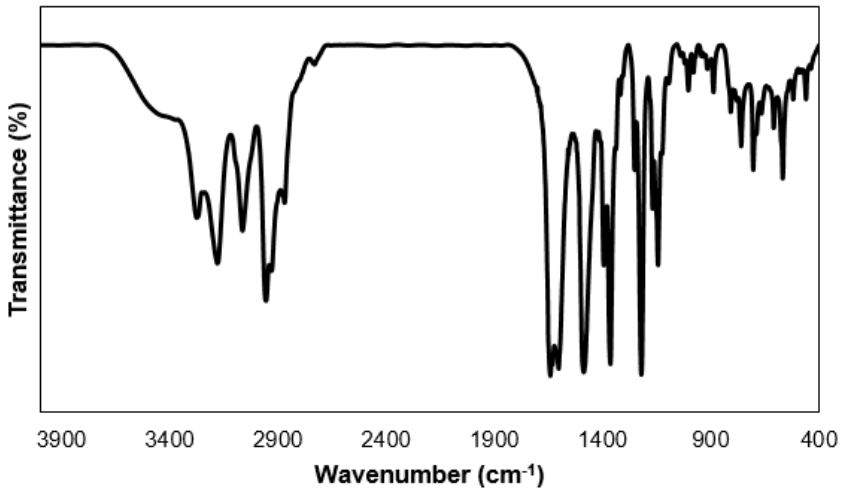


Figure S30: The FT-IR spectrum of 3,3,6,6-tetramethyl-9-(*m*-tolyl)-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

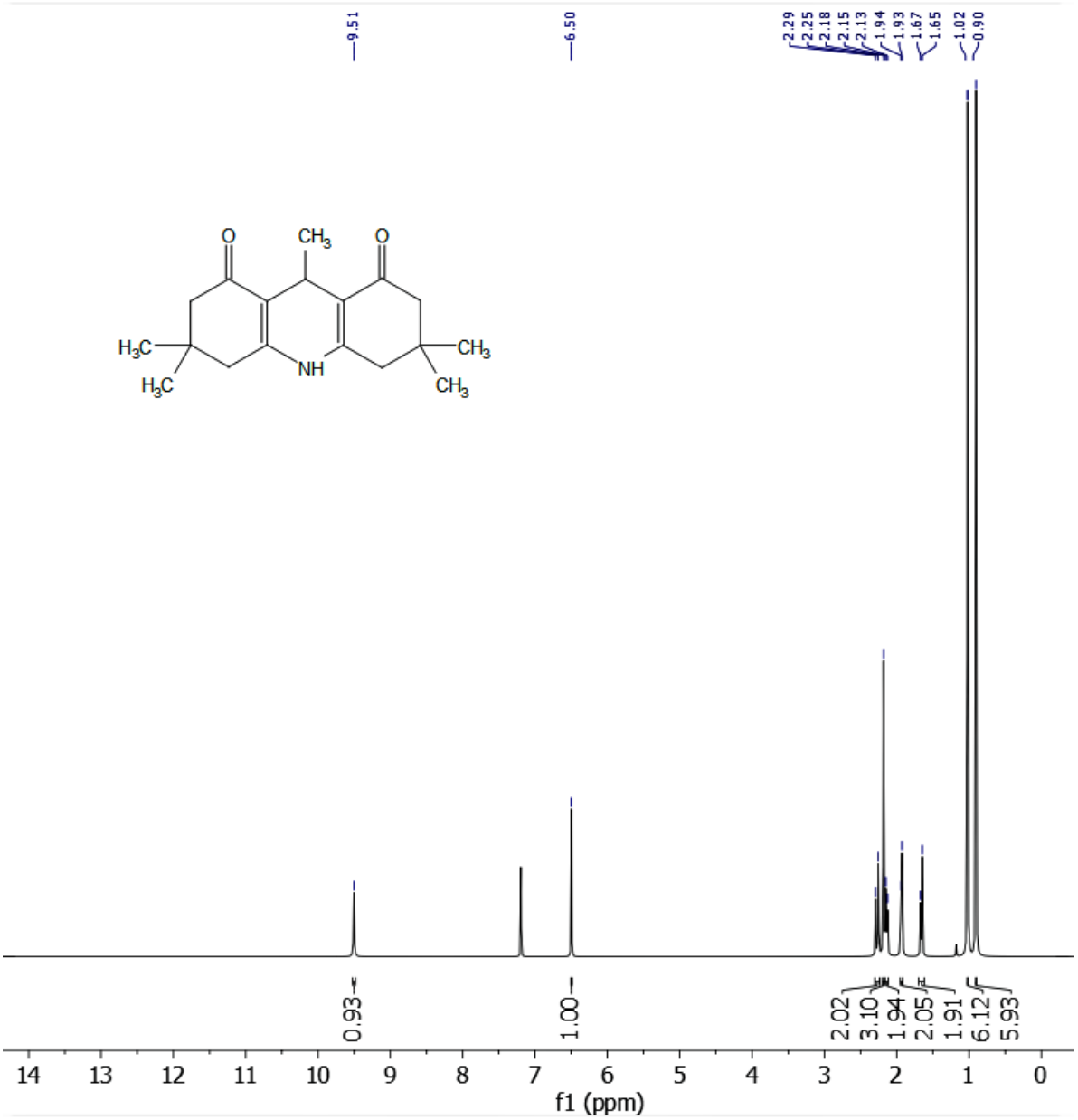


Figure S31: The ^{1}H NMR spectrum (400 MHz) of 3,3,6,6,9-pentamethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in $CDCl_3$

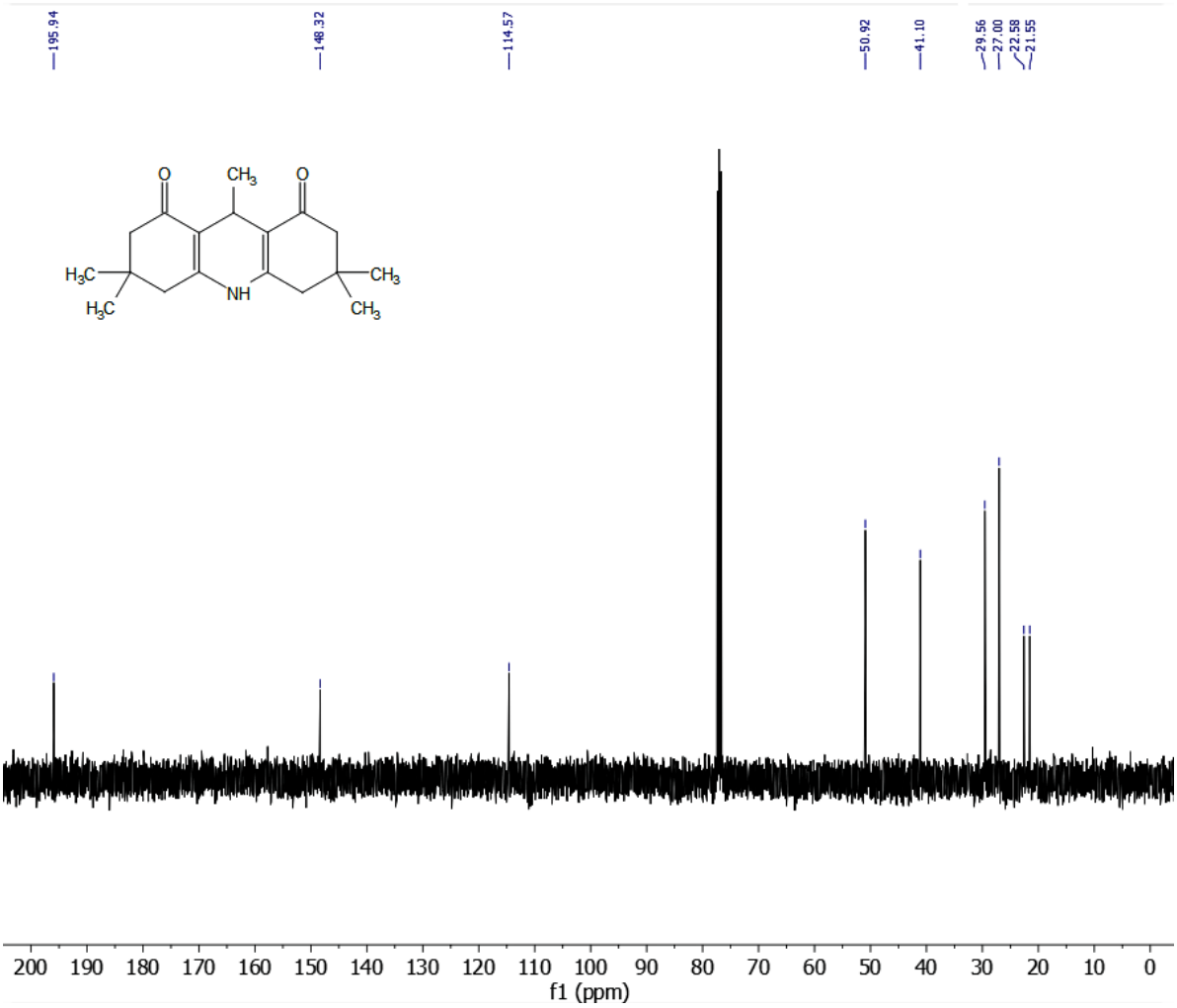


Figure S32: The ^{13}C NMR spectrum (101 MHz) of 3,3,6,6,9-pentamethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in $CDCl_3$

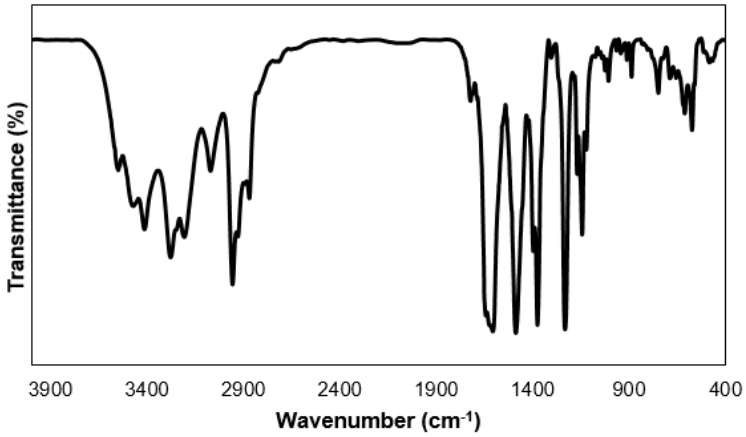


Figure S33: The FT-IR spectrum of 3,3,6,6,9-pentamethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

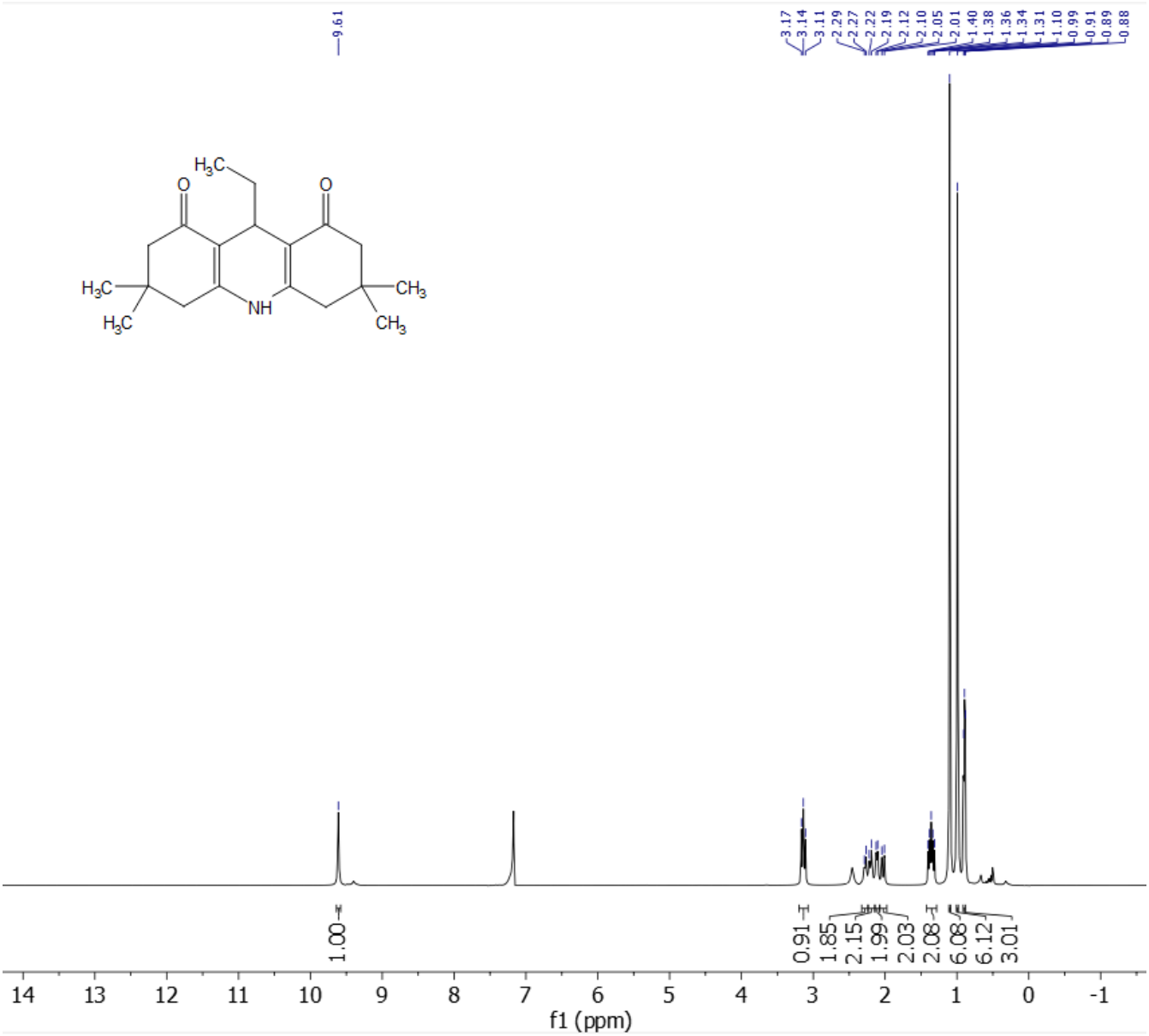


Figure S34: The ^{1}H NMR spectrum (400 MHz) of 9-ethyl-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione in $CDCl_3$

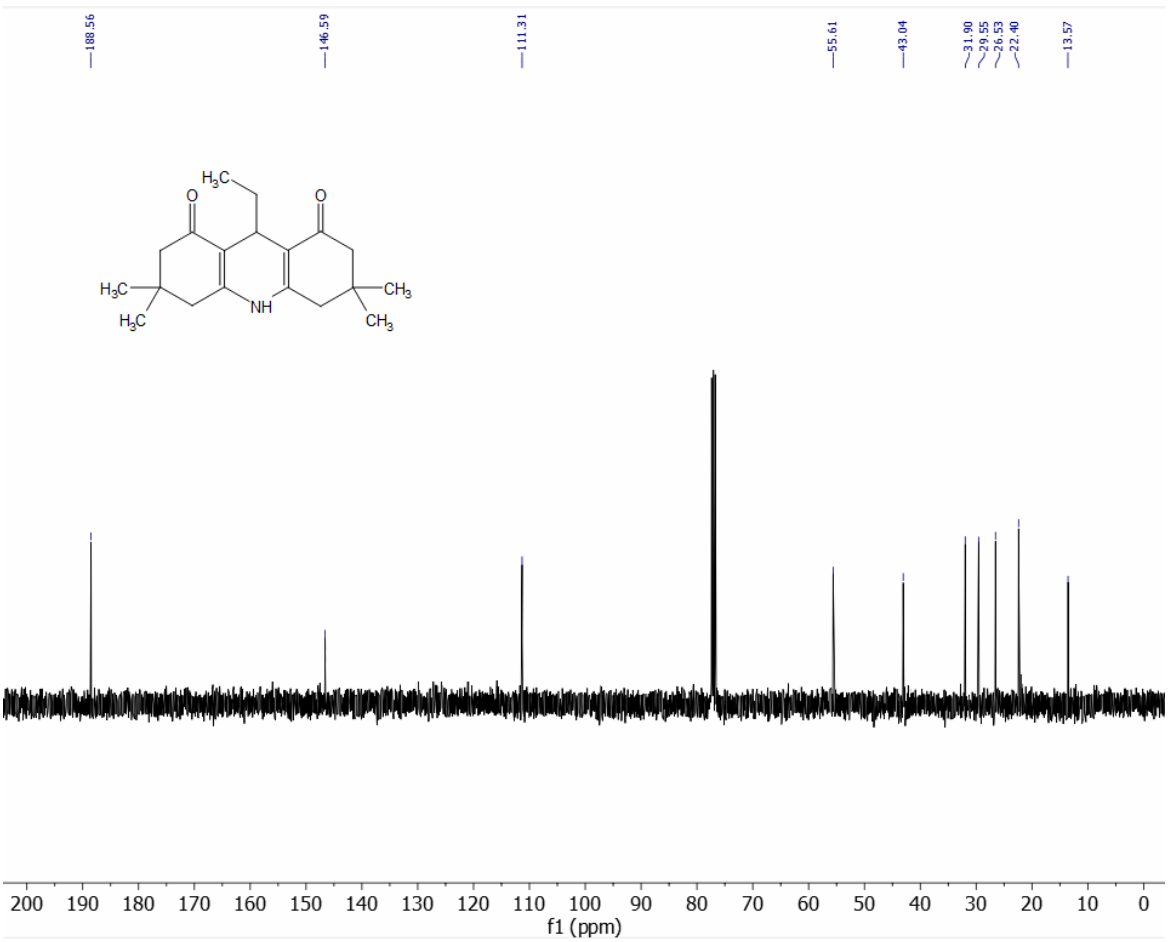


Figure S35: The ^{13}C NMR spectrum (101 MHz) of 9-ethyl-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione $CDCl_3$

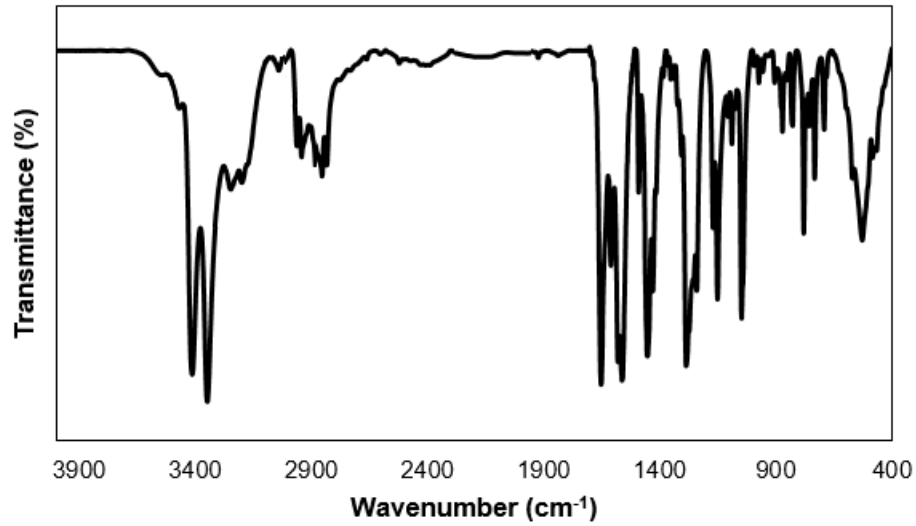


Figure S36: The FT-IR spectrum of 9-ethyl-3,3,6,6-tetramethyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione in KBr

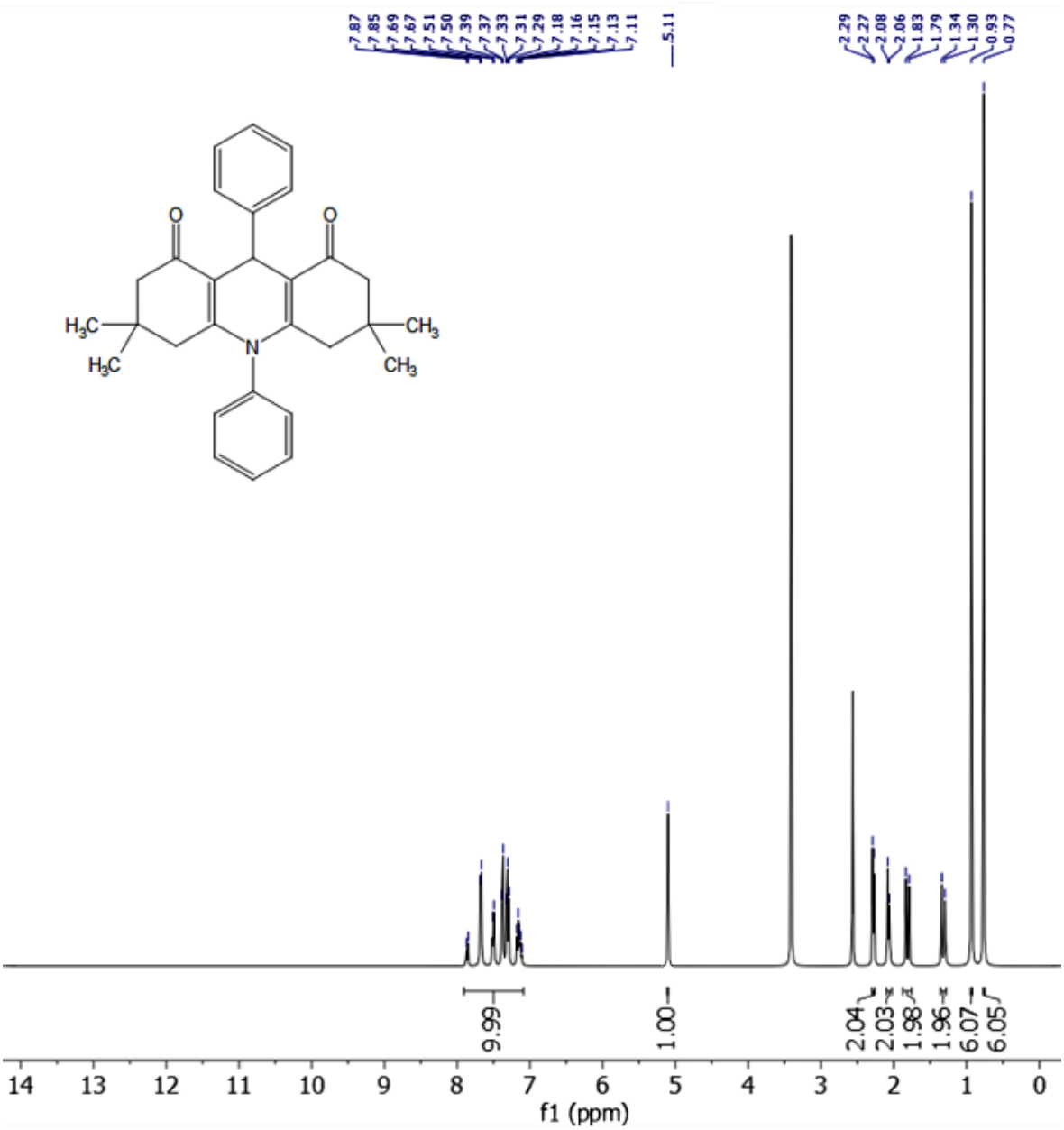


Figure S37: The ^{1}H NMR spectrum (400 MHz) of 3,3,6,6-tetramethyl-9,10-diphenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

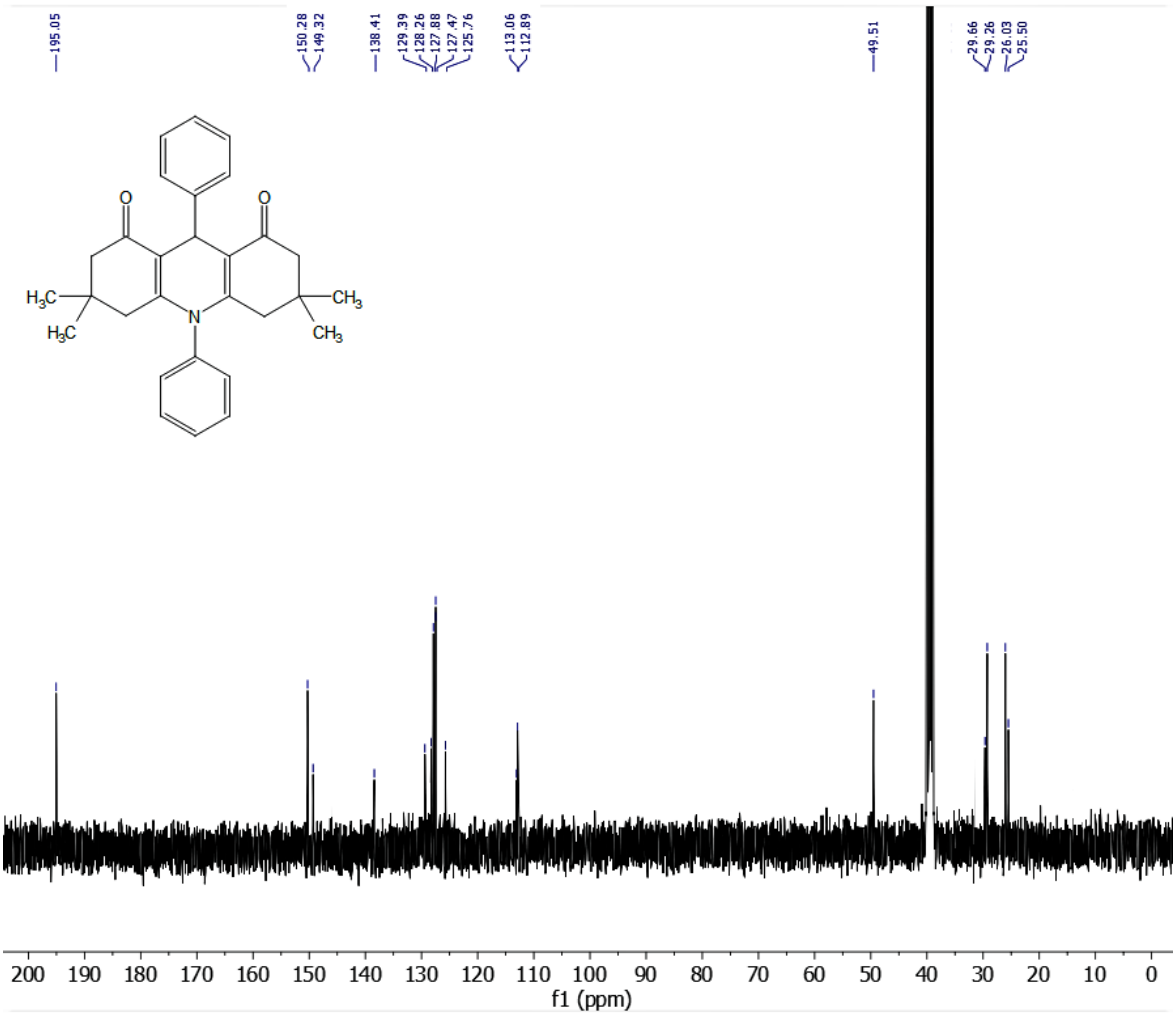


Figure S38: The ^{13}C NMR spectrum (101 MHz) of 3,3,6,6-tetramethyl-9,10-diphenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

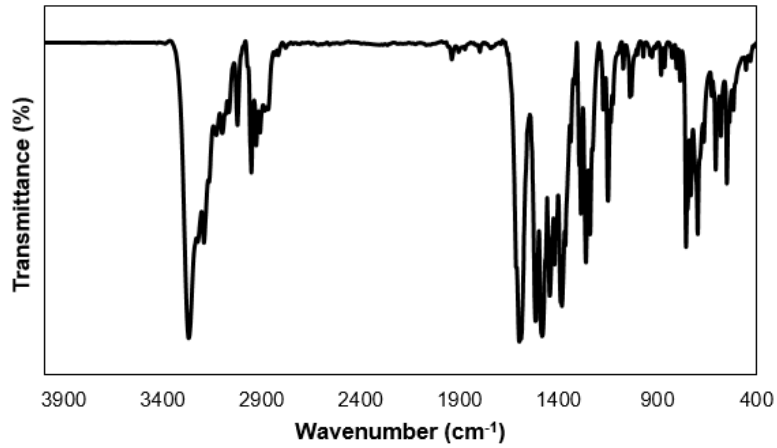


Figure S39: The FT-IR spectrum of 3,3,6,6-tetramethyl-9,10-diphenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

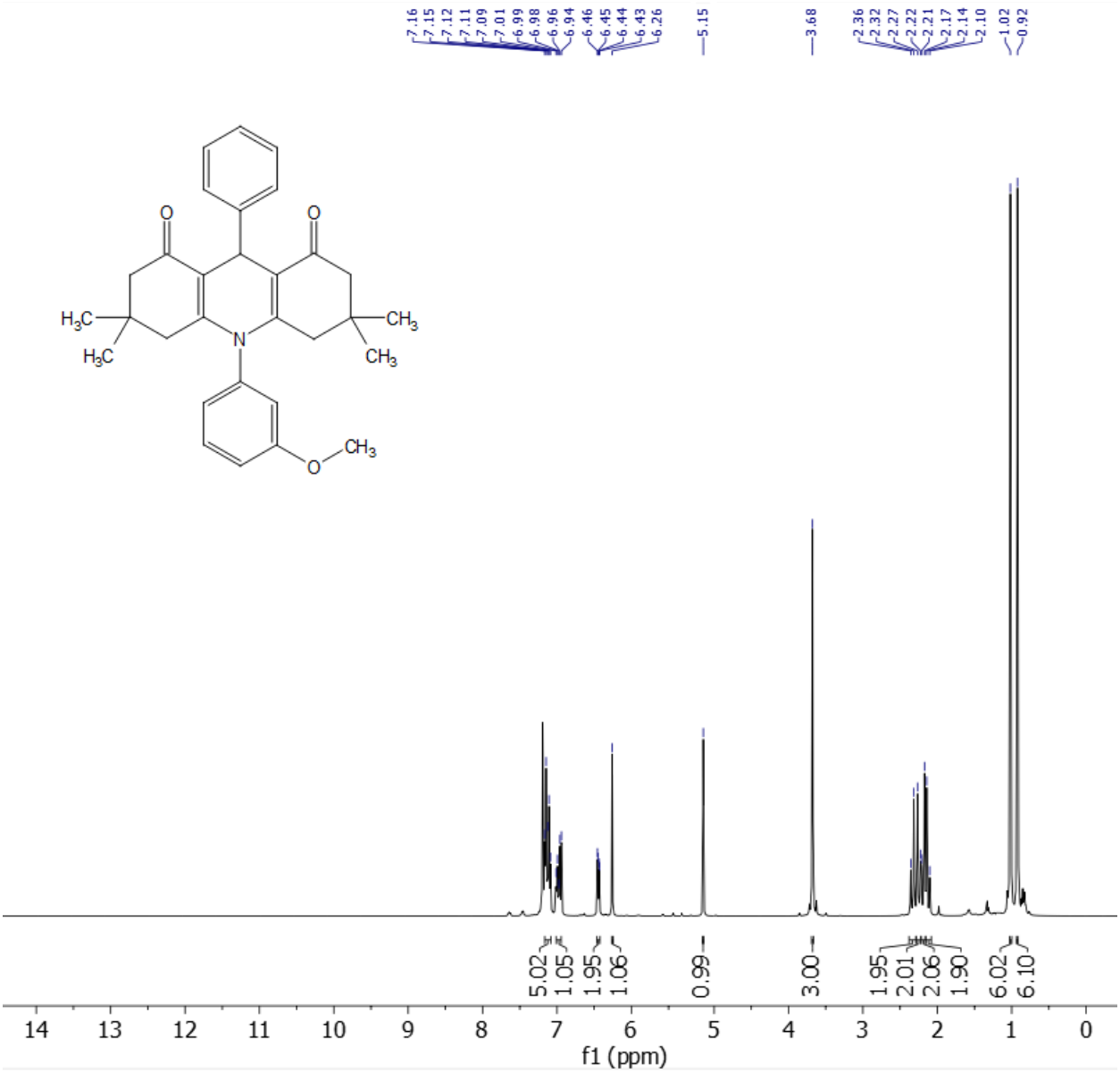


Figure S40: The ^{1}H NMR spectrum (400 MHz) of 10-(3-methoxyphenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in $CDCl_3$

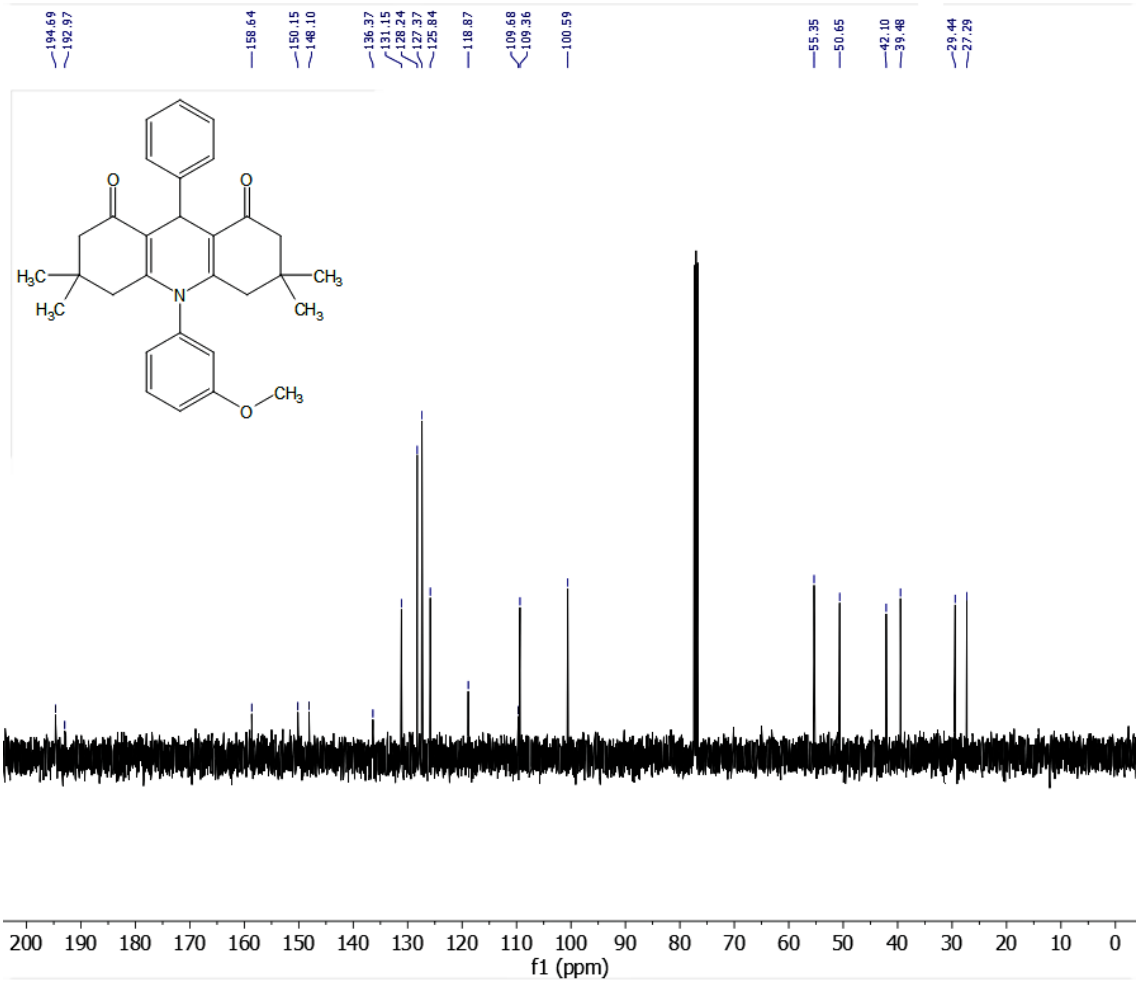


Figure S41: The ^{13}C NMR spectrum (101 MHz) of 10-(3-methoxyphenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in $CDCl_3$

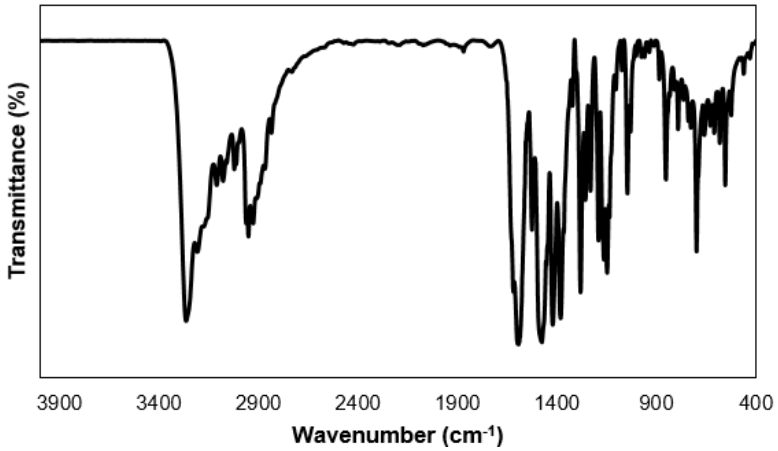


Figure S42: The FT-IR spectrum of 10-(3-methoxyphenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

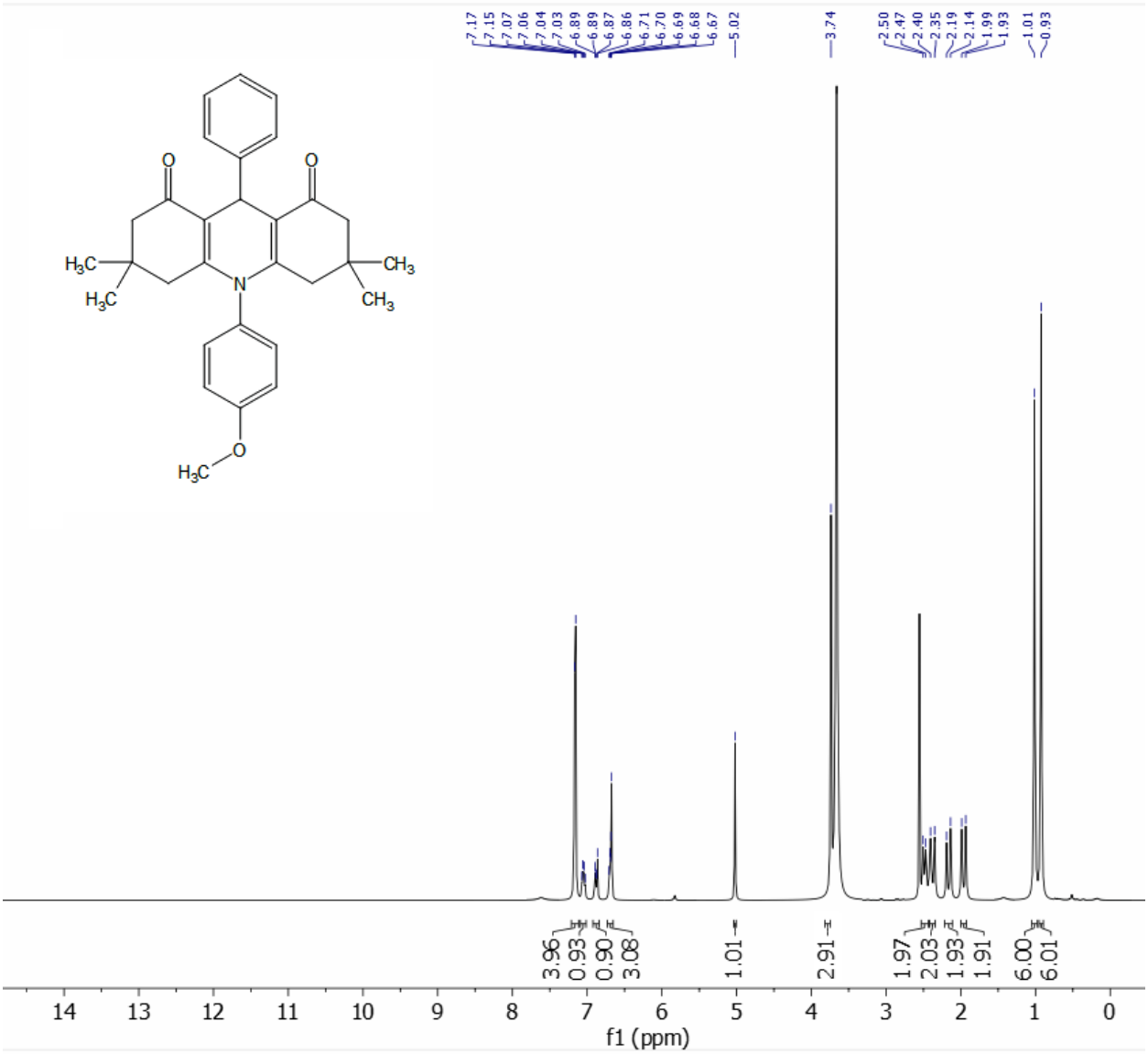


Figure S43: The ^{1}H NMR spectrum of (400 MHz) 10-(4-methoxyphenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

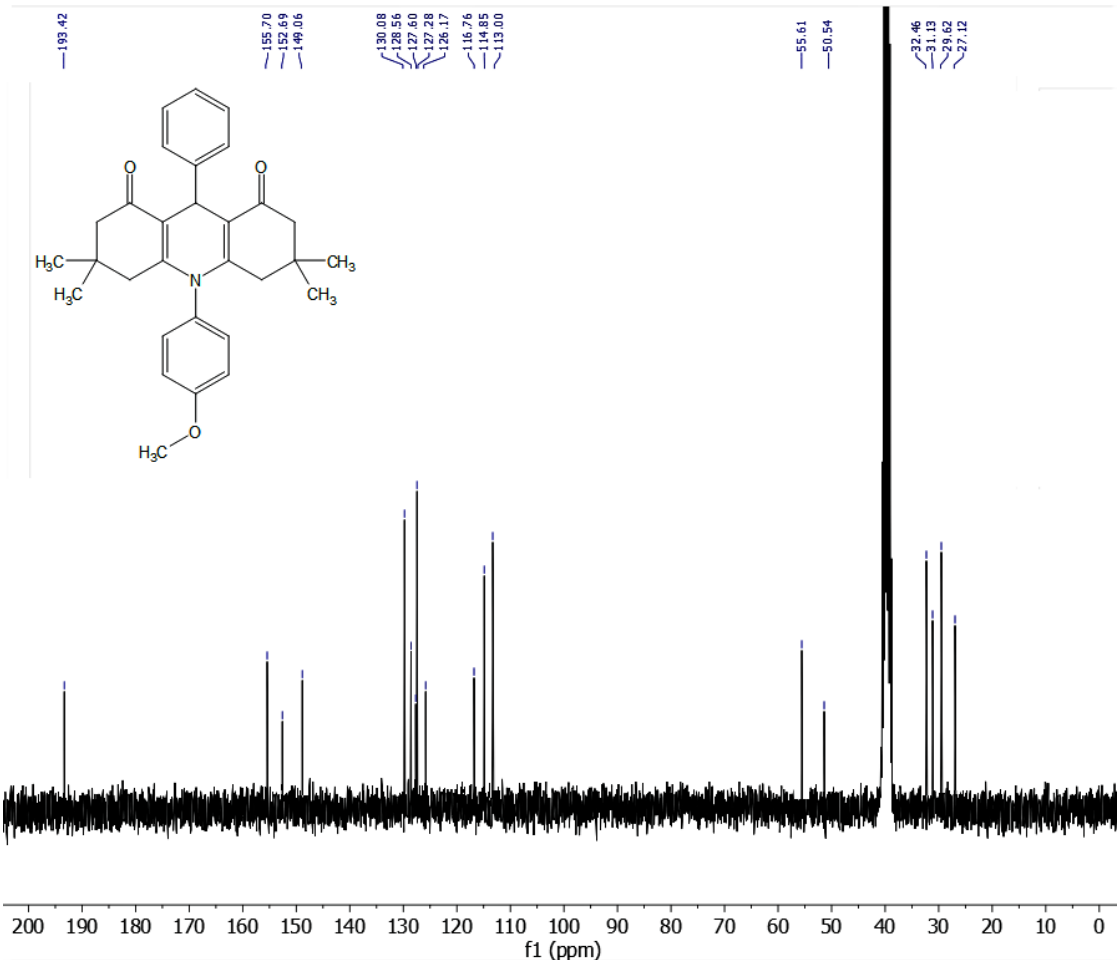


Figure S44: The ^{13}C NMR spectrum (101 MHz) of 10-(4-methoxyphenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

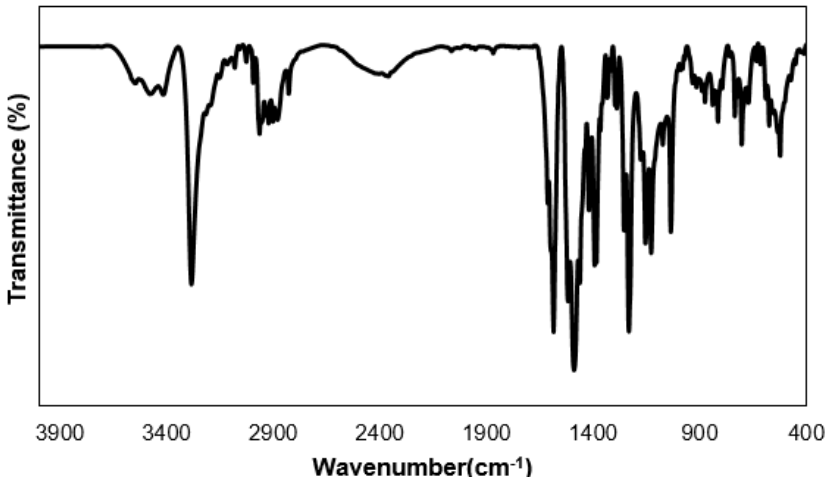


Figure S45: The FT-IR spectrum of 10-(4-methoxyphenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

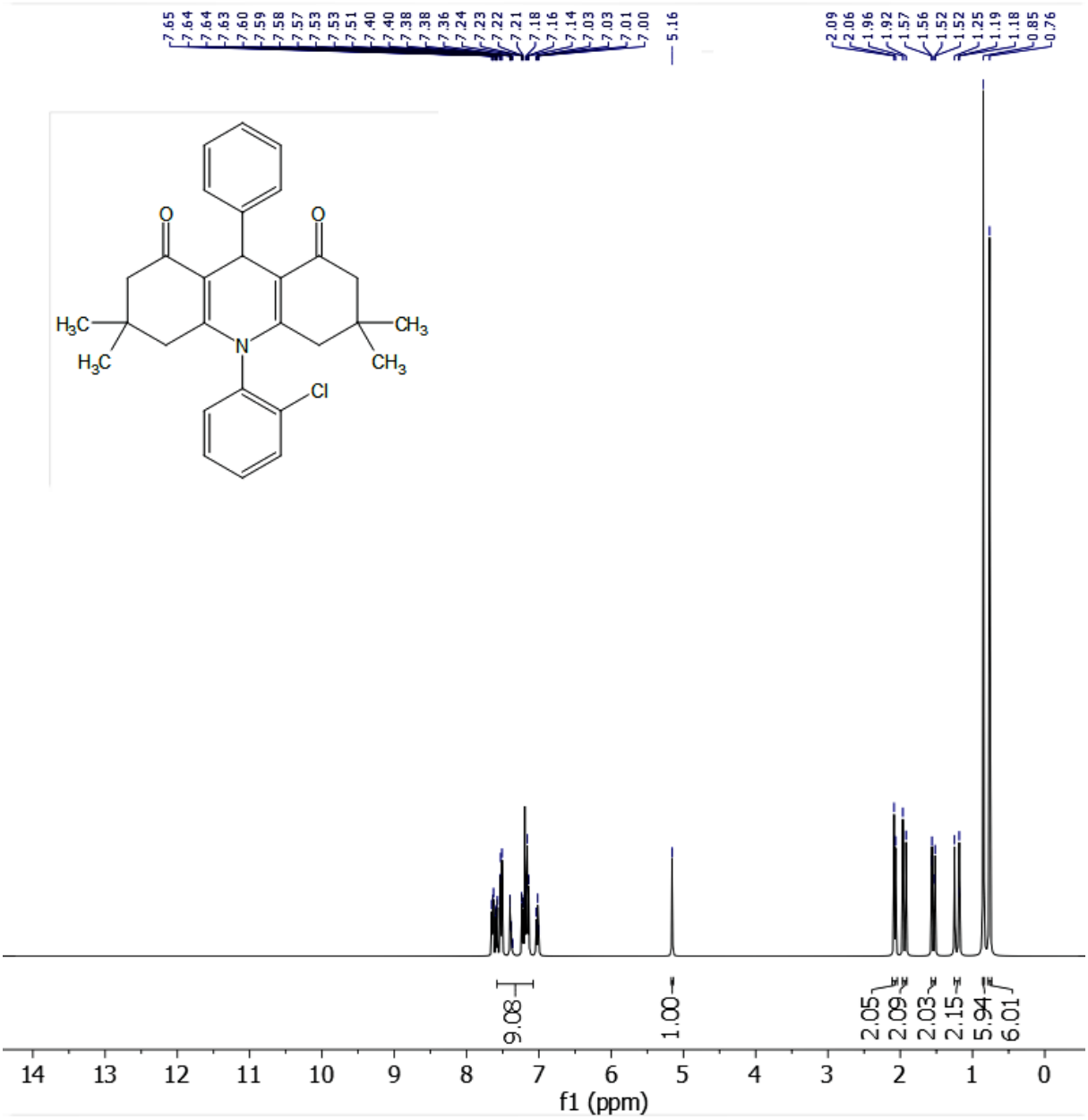


Figure S46: The ^{1}H NMR spectrum (400 MHz) of 10-(2-chlorophenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in $CDCl_3$

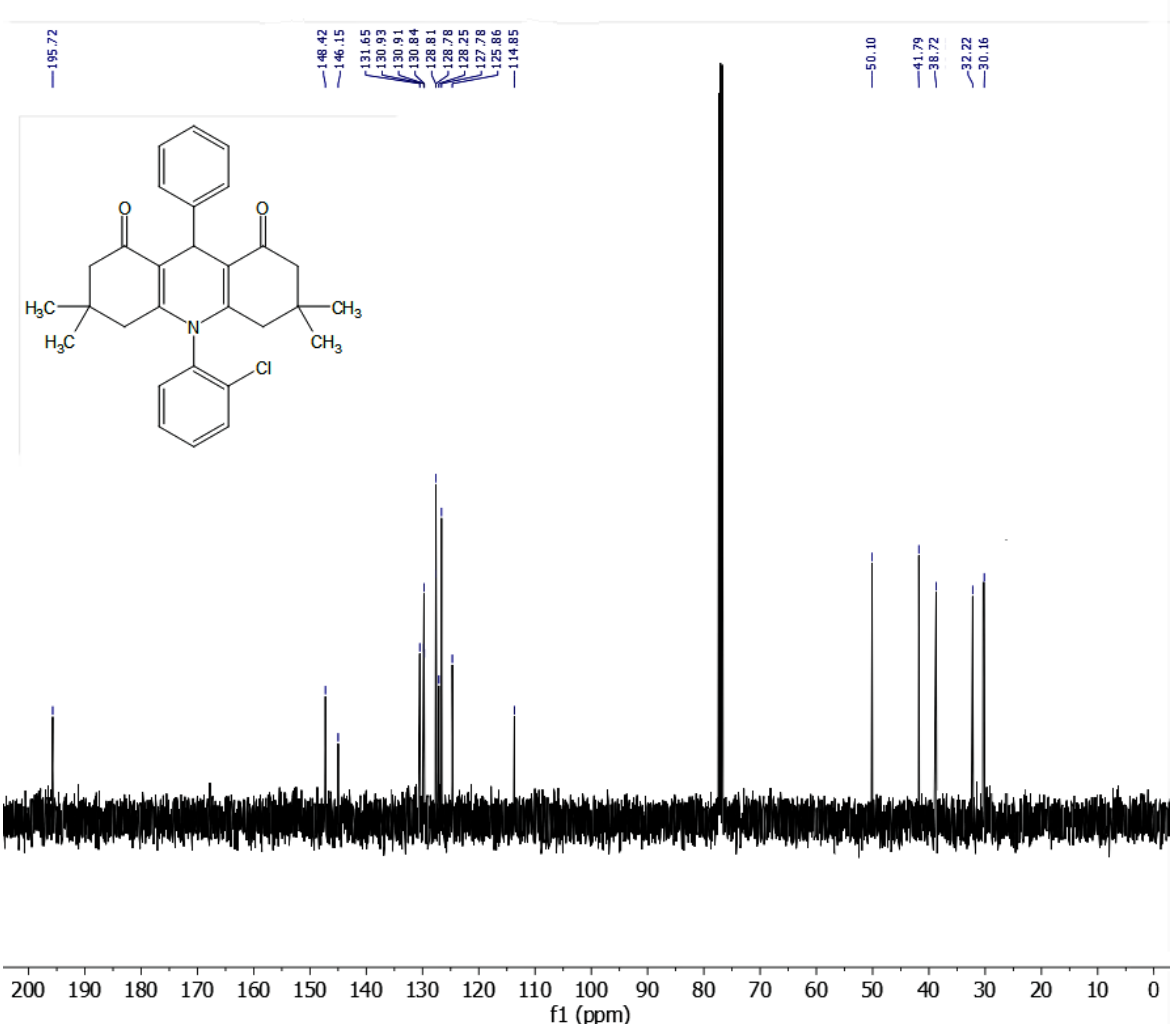


Figure S47: The ^{13}C NMR spectrum (101 MHz) of 10-(2-chlorophenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in $CDCl_3$

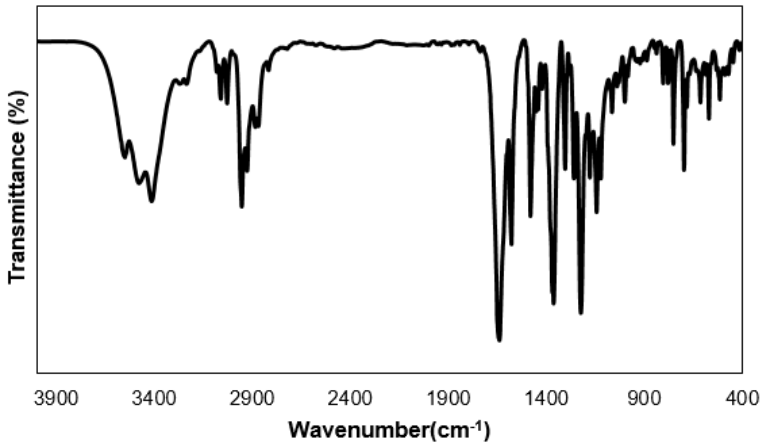


Figure S48: The FT-IR spectrum of 10-(2-chlorophenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

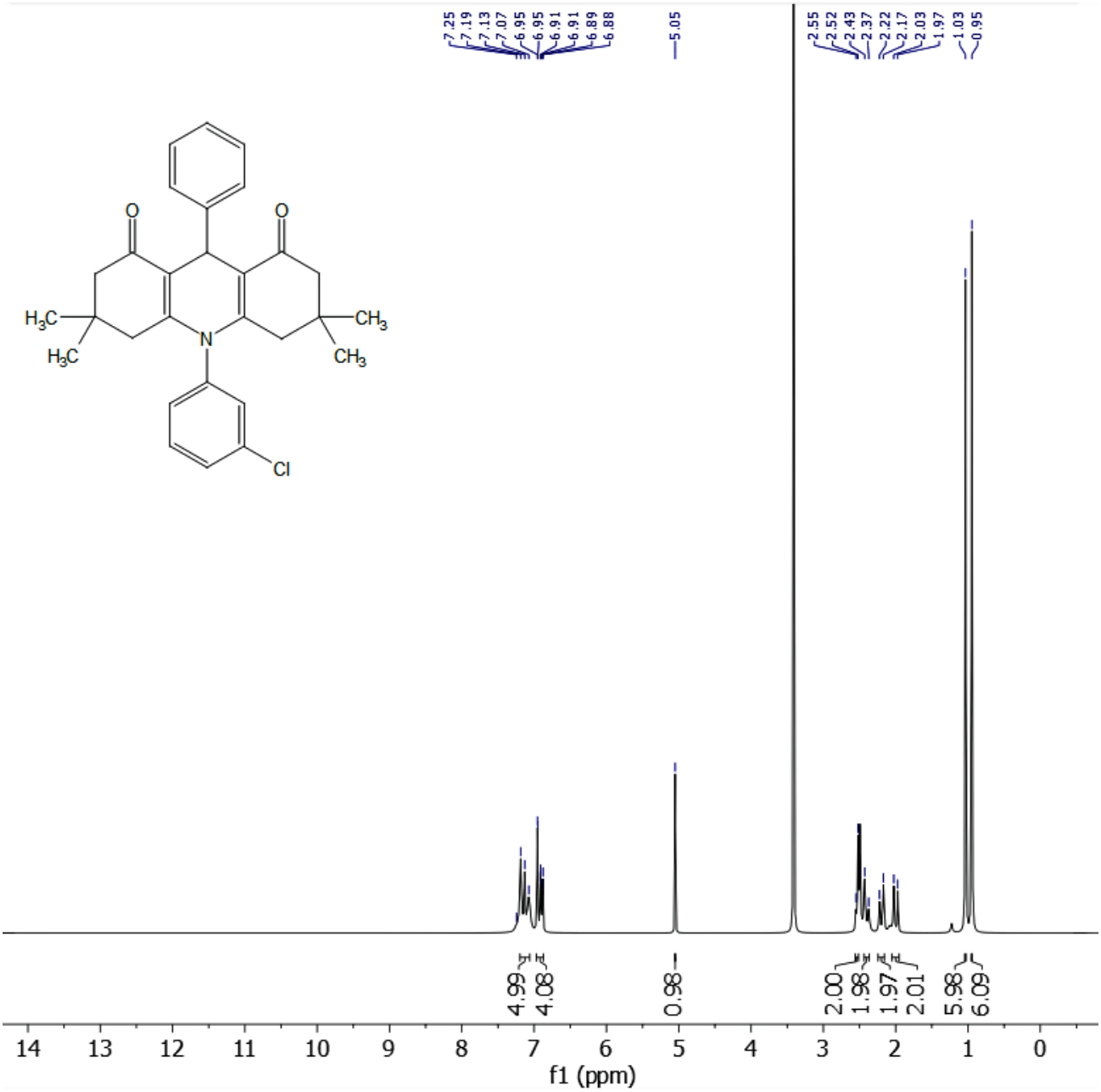


Figure S49: The ^{1}H NMR spectrum of (300 MHz) 10-(3-chlorophenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

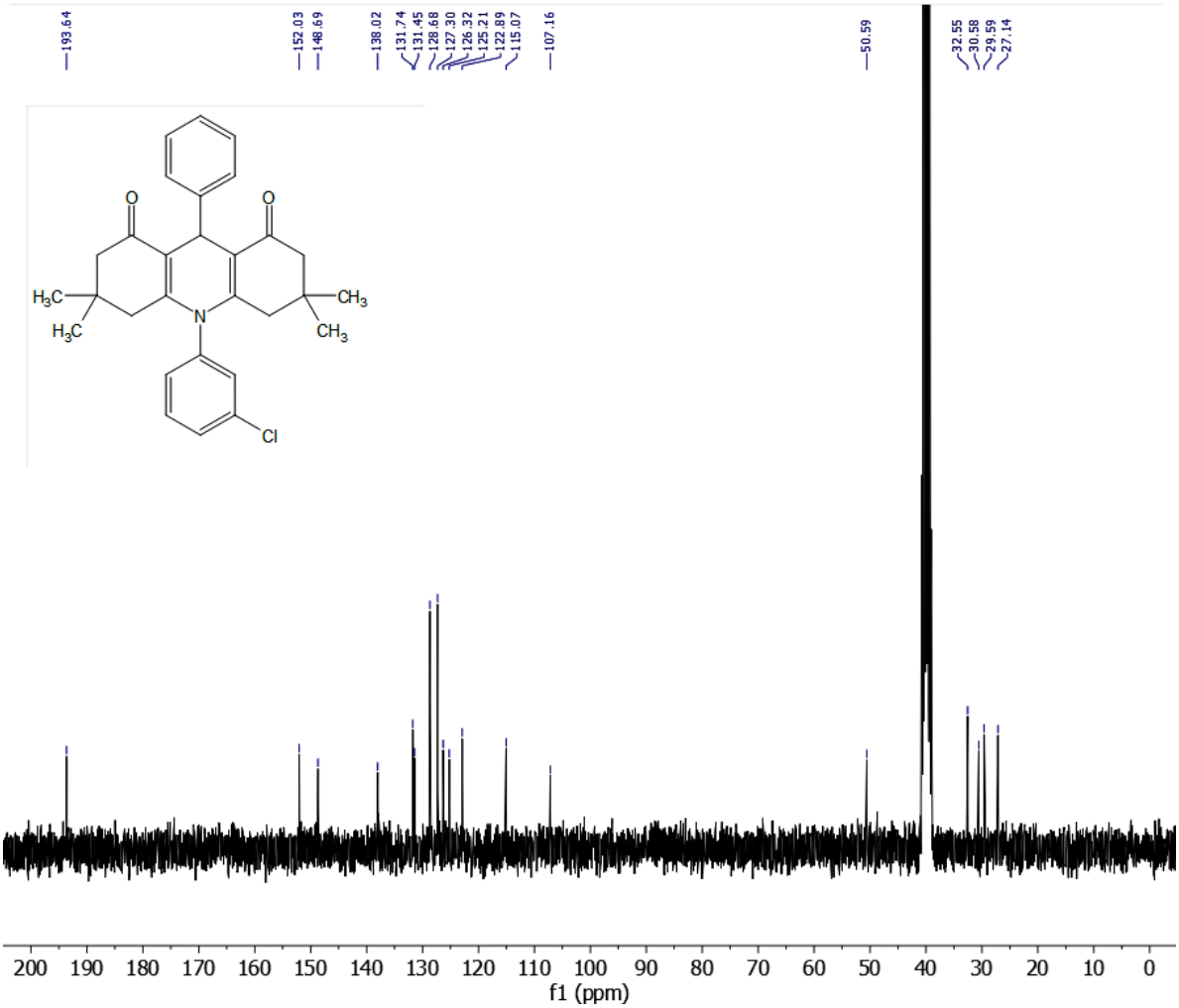


Figure S50: The ^{13}C NMR spectrum (76 MHz) of 10-(3-chlorophenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in DMSO-d_6

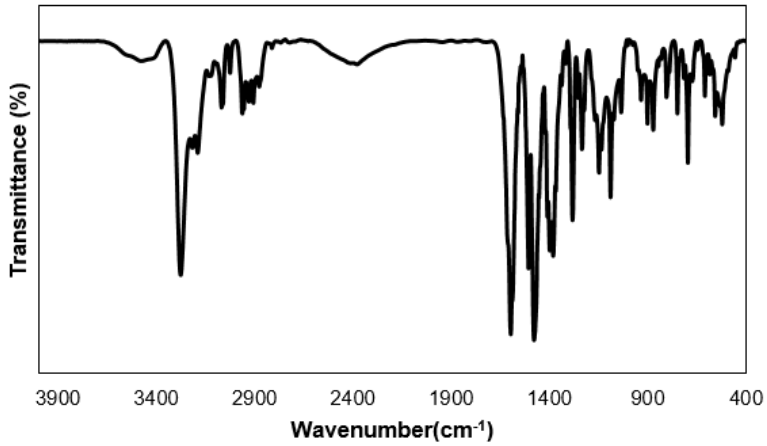


Figure S51: The FT-IR spectrum of 10-(3-chlorophenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

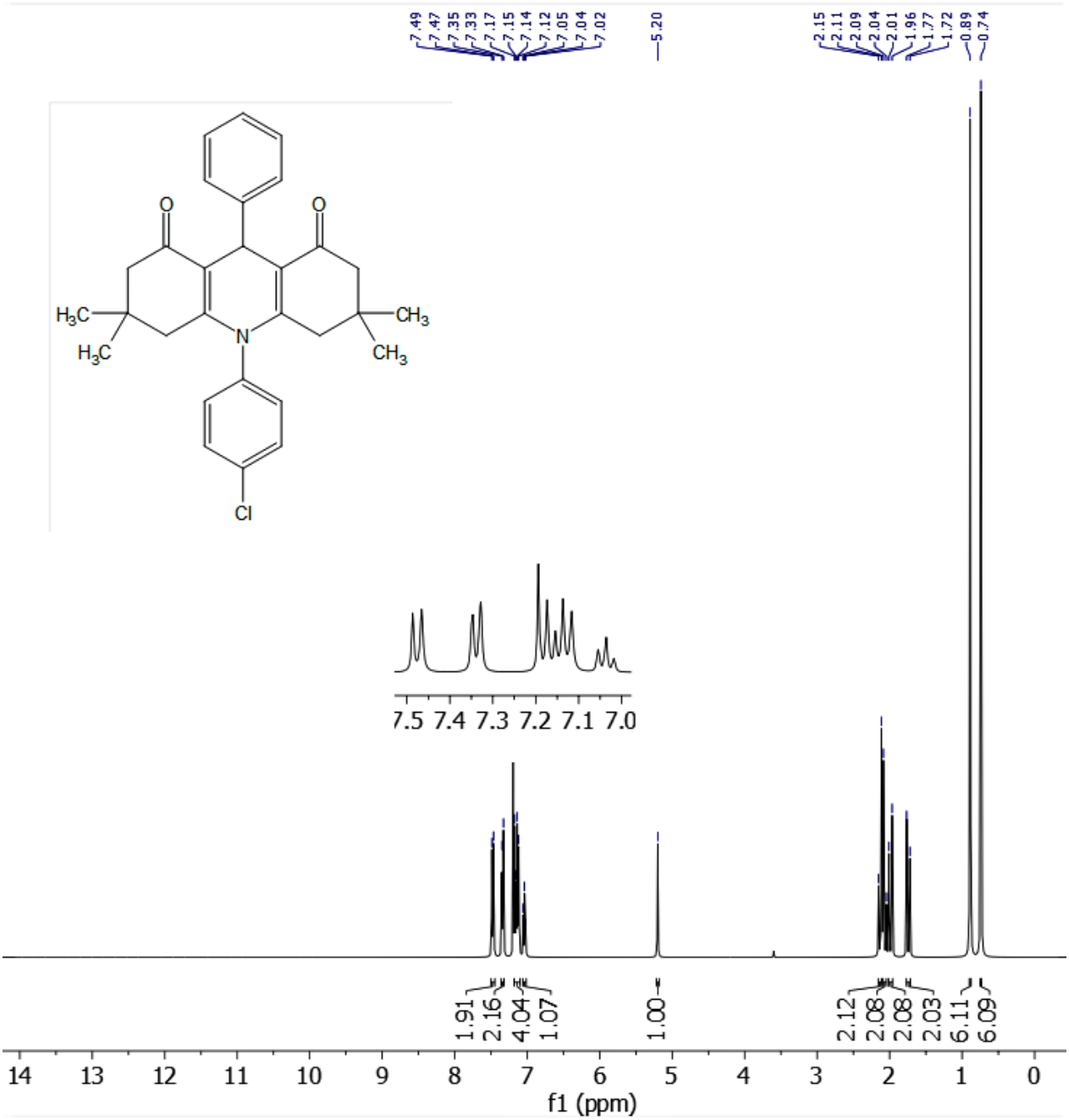


Figure S52: The ^{1}H NMR spectrum (400 MHz) of 10-(4-chlorophenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in $CDCl_3$

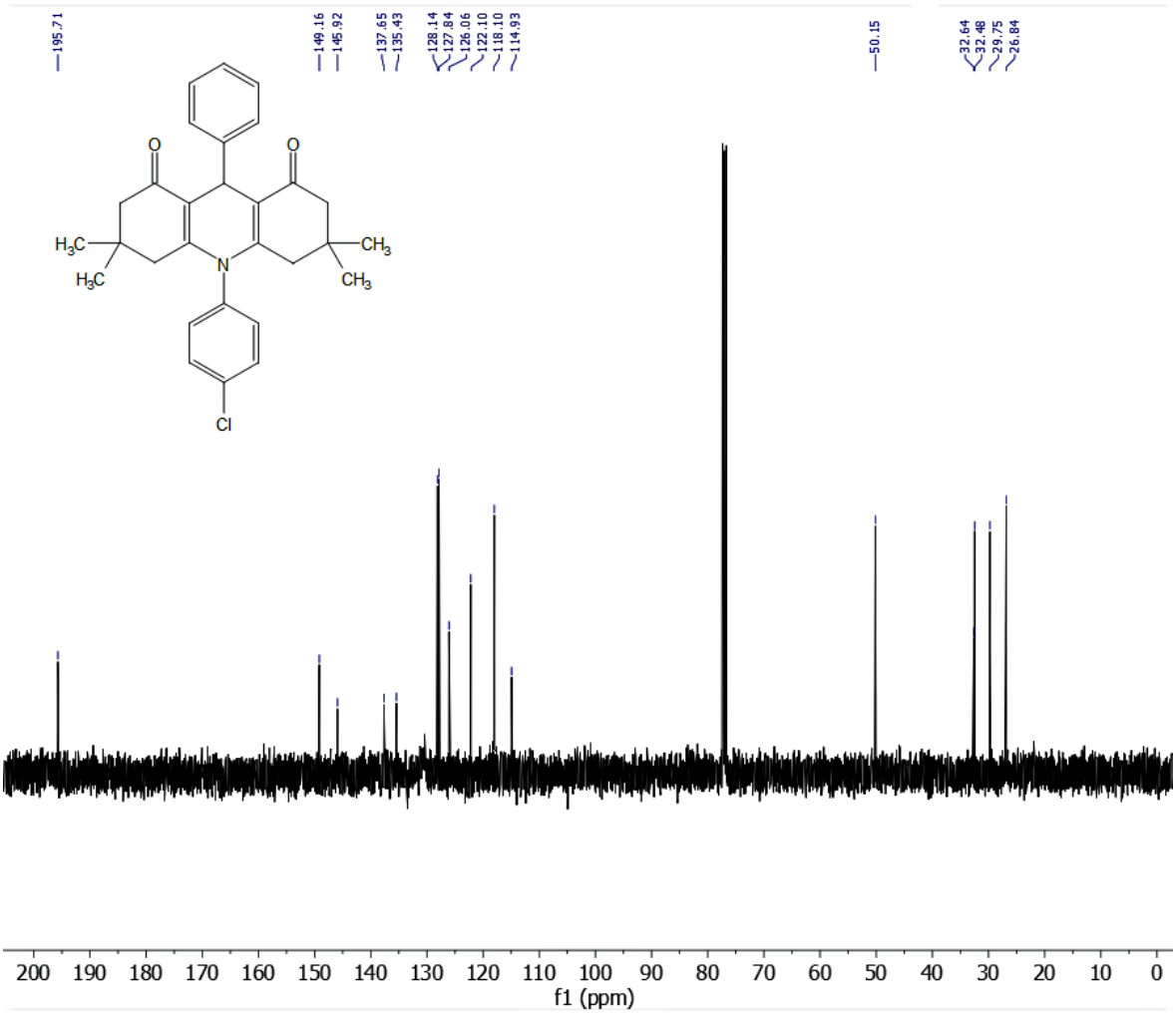


Figure S53: The ^{13}C NMR spectrum (101 MHz) of 10-(4-chlorophenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in $CDCl_3$

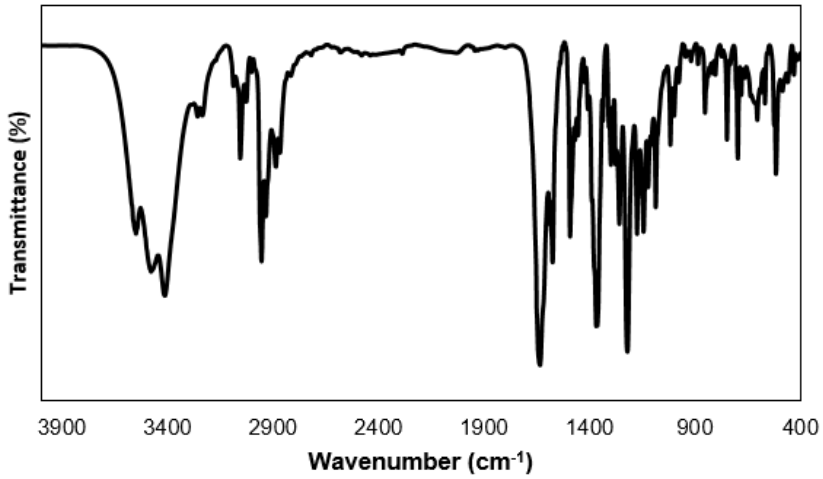


Figure S54: The FT-IR spectrum of 10-(4-chlorophenyl)-3,3,6,6-tetramethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2*H*,5*H*)-dione in KBr

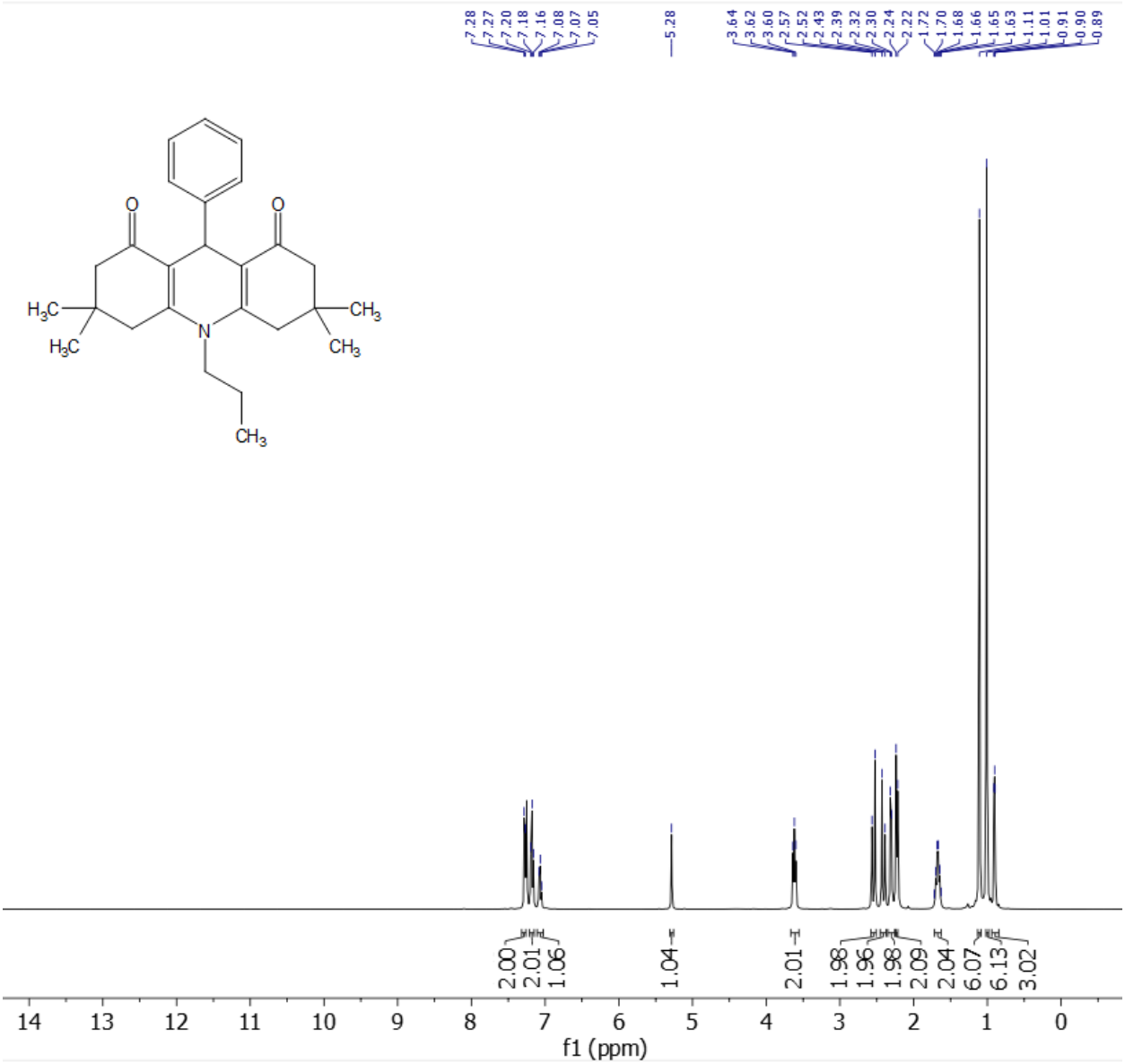


Figure S55: The ^{1}H NMR spectrum (400 MHz) of 3,3,6,6-tetramethyl-9-phenyl-10-propyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione in $CDCl_3$

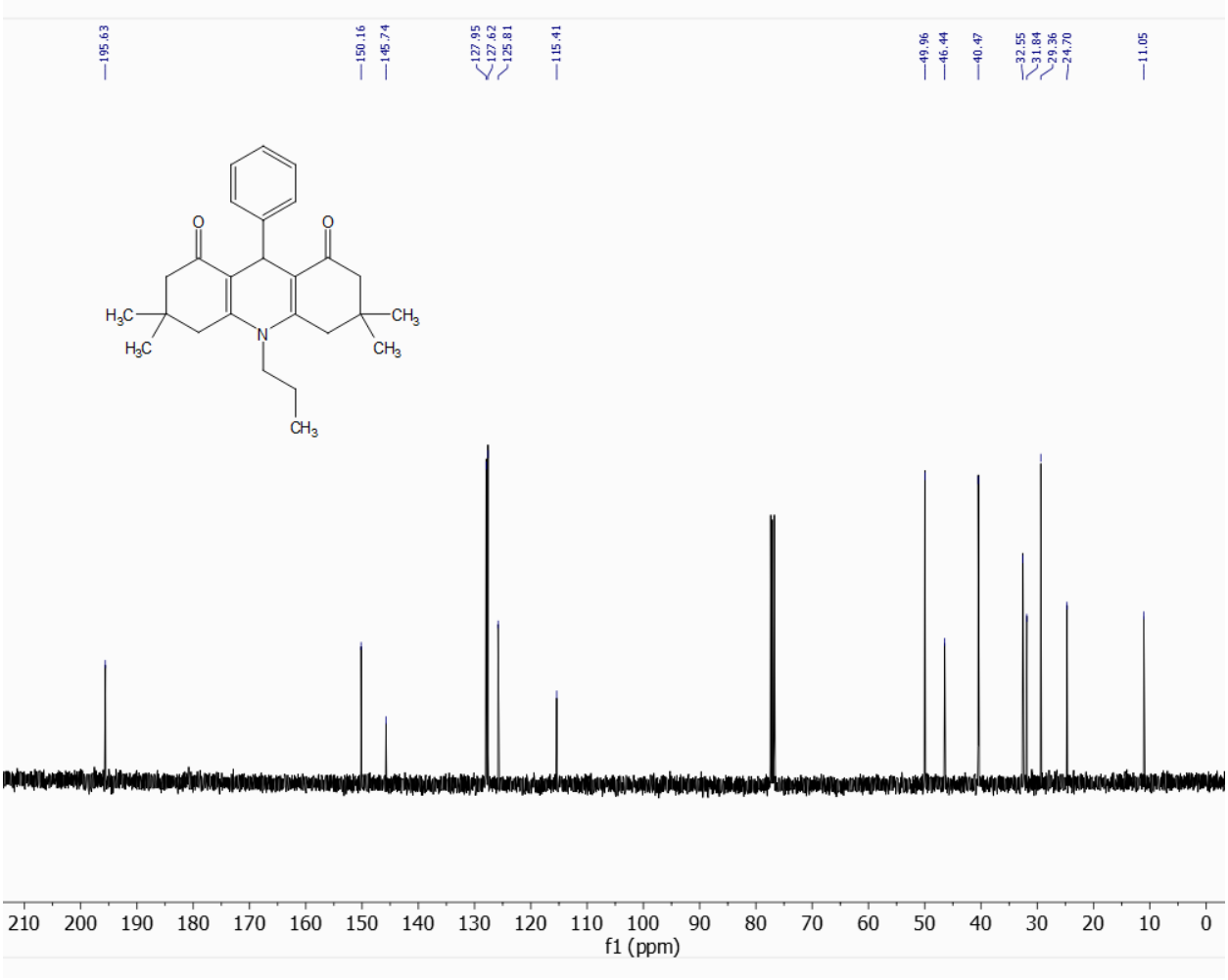


Figure S56: The ^{13}C NMR spectrum (101 MHz) of 3,3,6,6-tetramethyl-9-phenyl-10-propyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione in $CDCl_3$

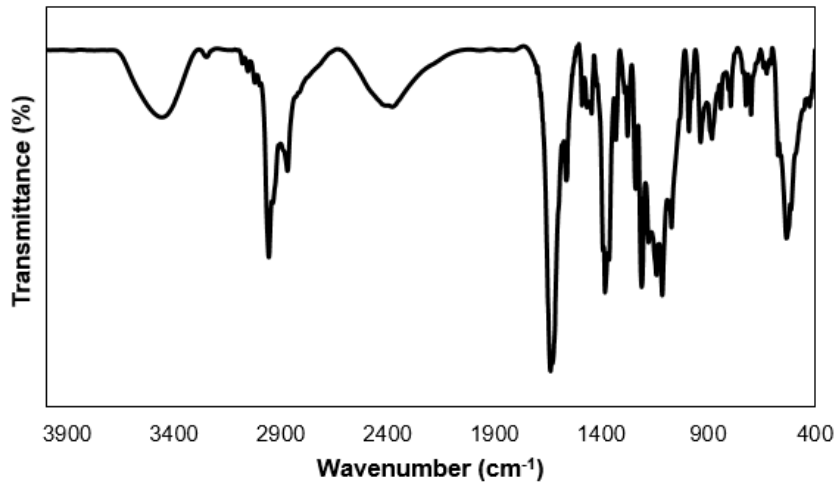


Figure S57: The FT-IR spectrum of 3,3,6,6-tetramethyl-9-phenyl-10-propyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione in KBr

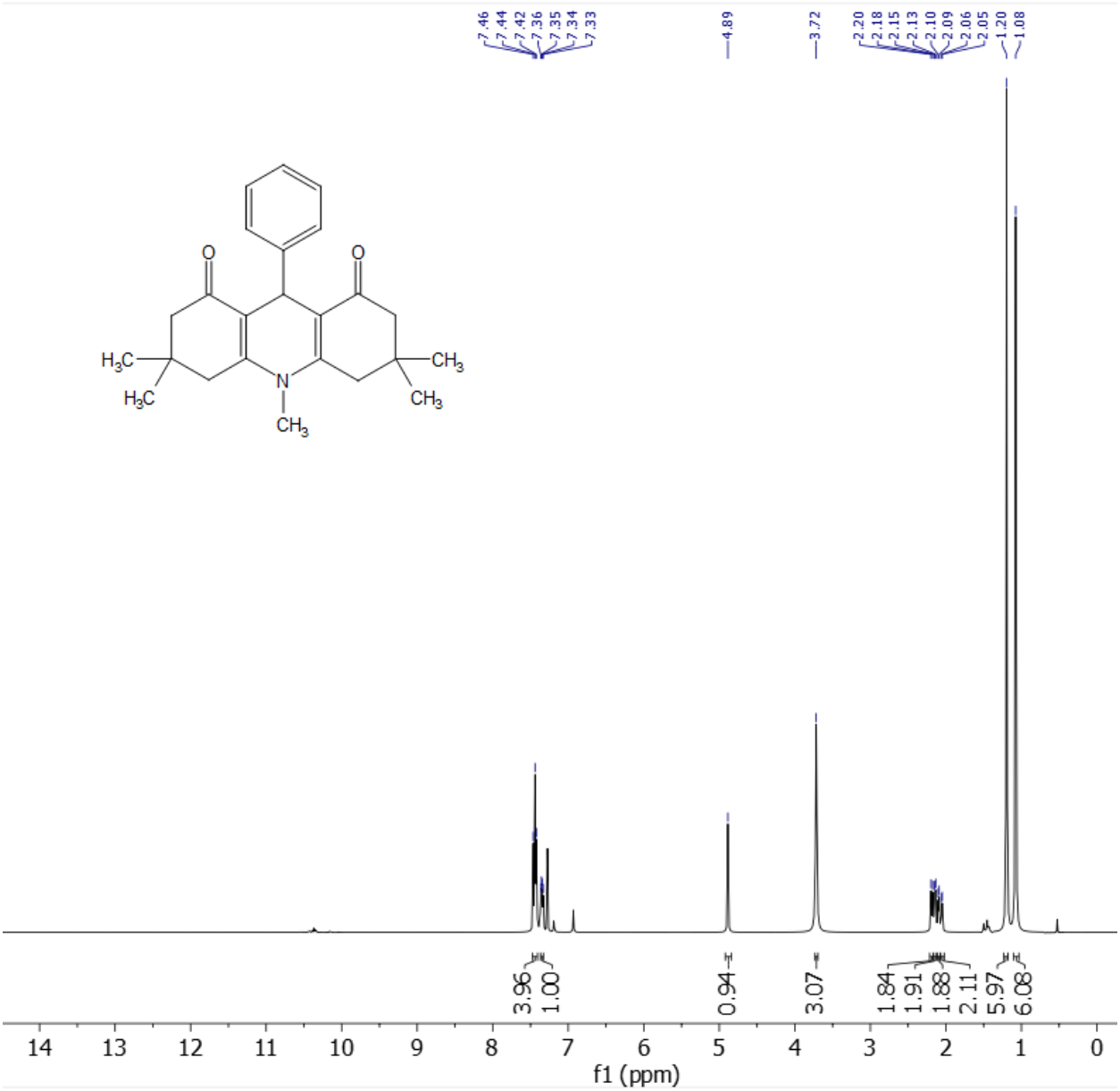


Figure S58: The ^{1}H NMR spectrum (400 MHz) of 3,3,6,6,10-pentamethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione in $CDCl_3$

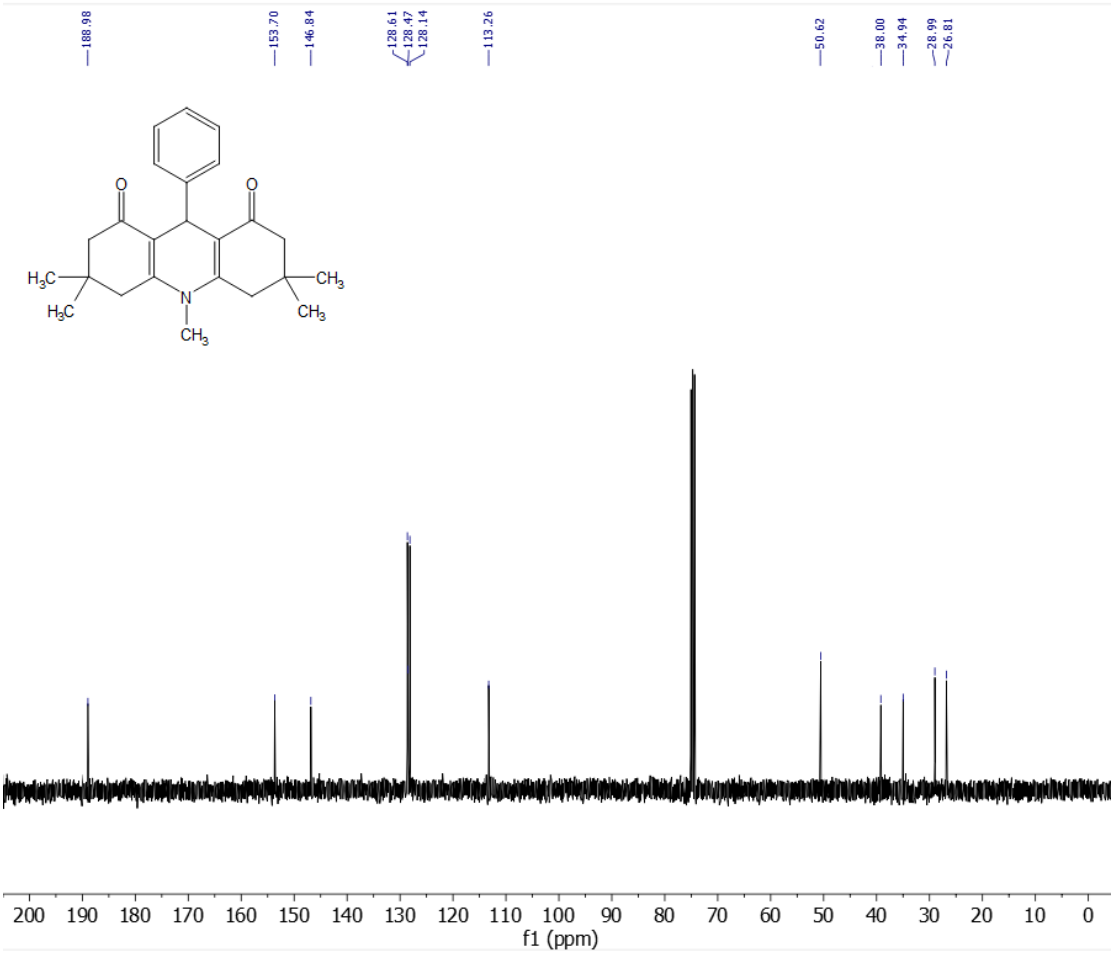


Figure S59: The ^{13}C NMR spectrum (101 MHz) of 3,3,6,6,10-pentamethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione in $CDCl_3$

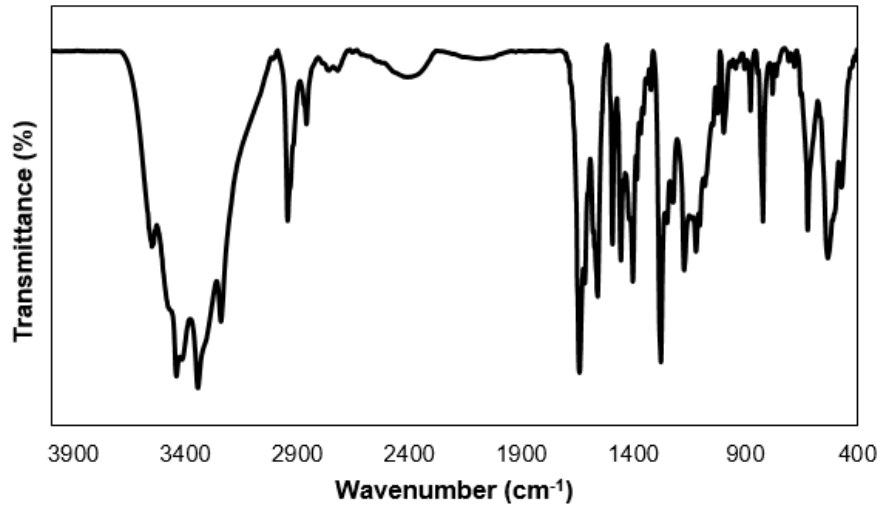


Figure S60: The FT-IR spectrum of 3,3,6,6,10-pentamethyl-9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione in KBr

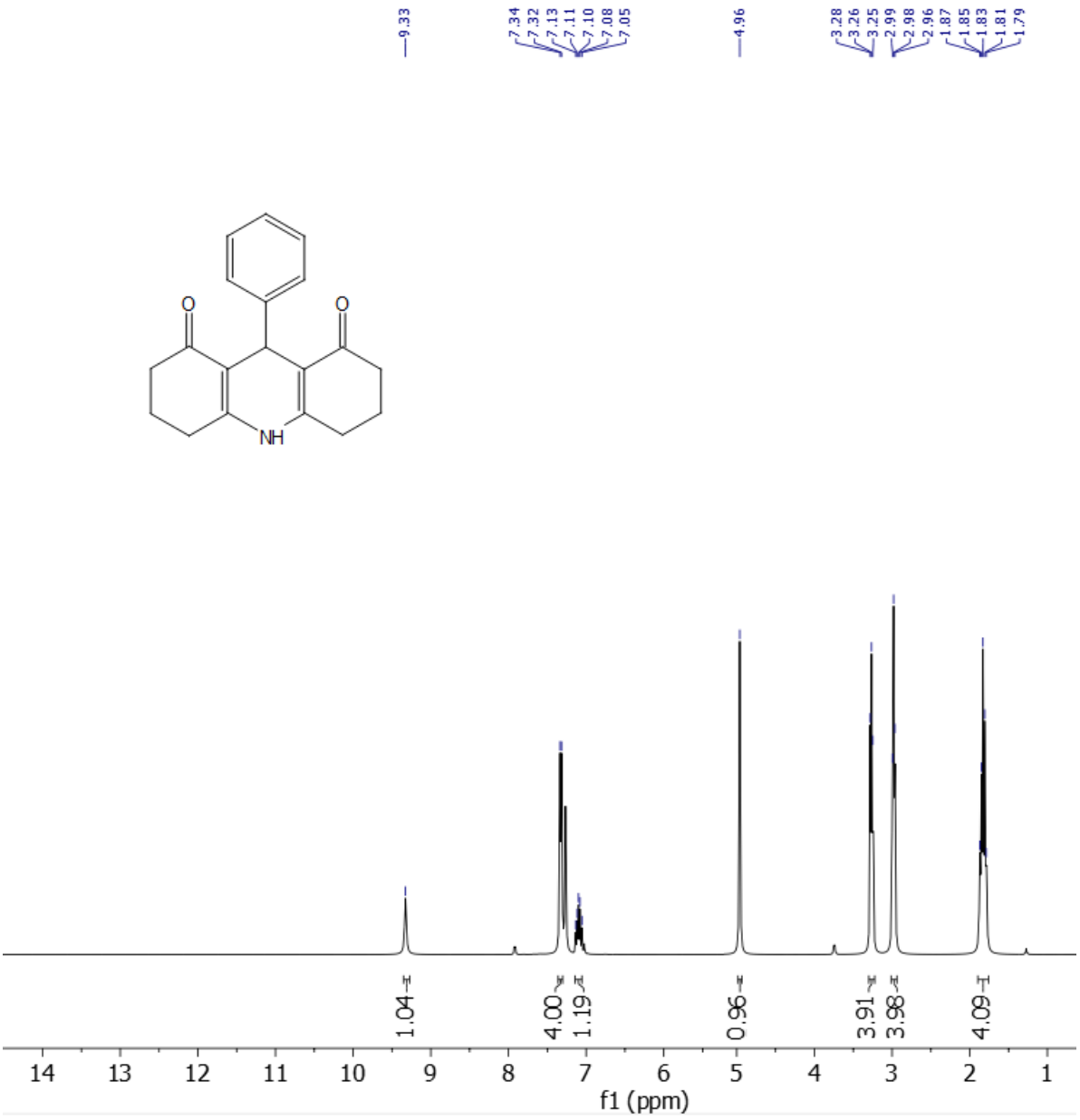


Figure S61: The ^{1}H NMR spectrum (400 MHz) of 9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione in $CDCl_3$

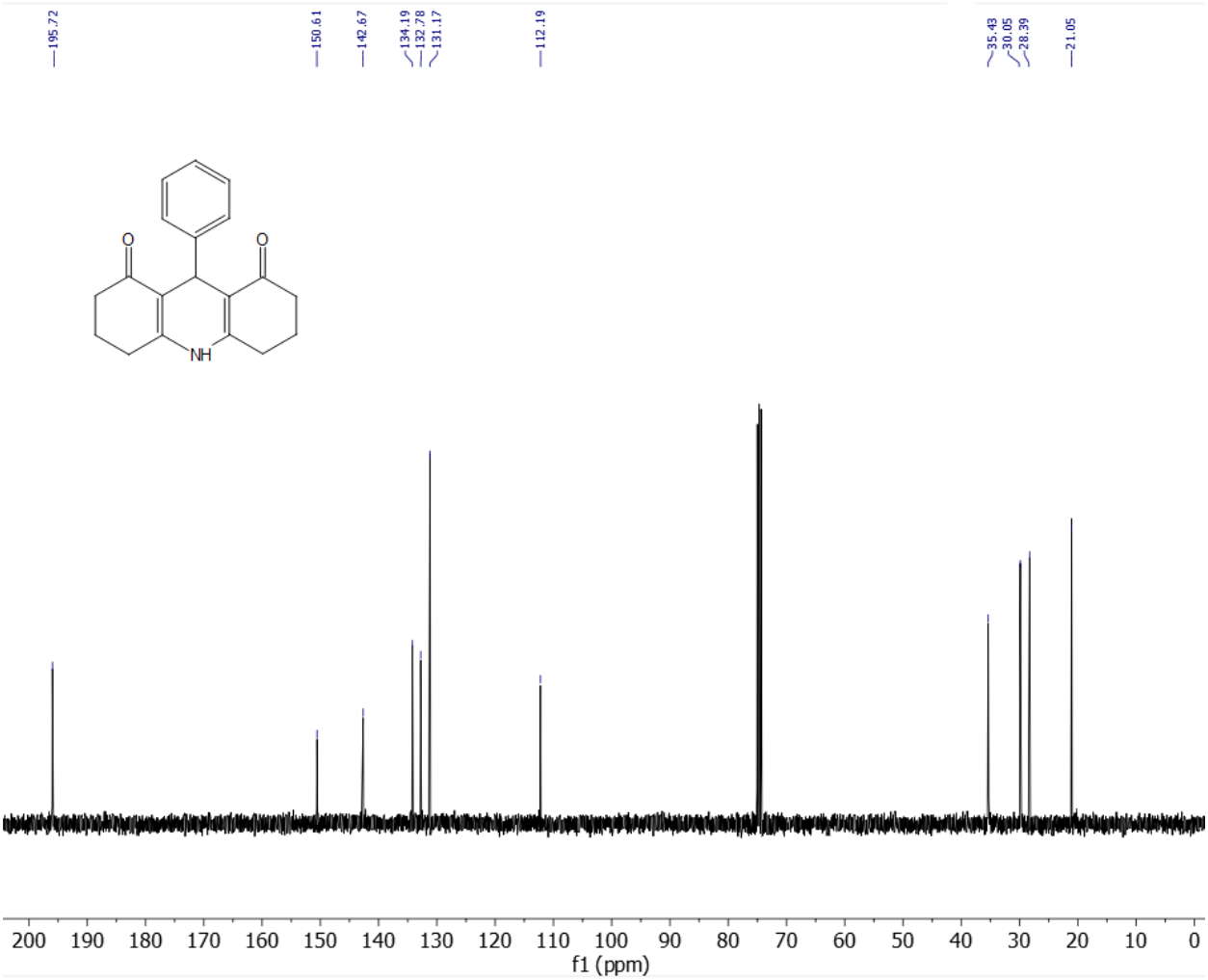


Figure S62: The ^{13}C NMR spectrum (101 MHz) of 9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione in $CDCl_3$

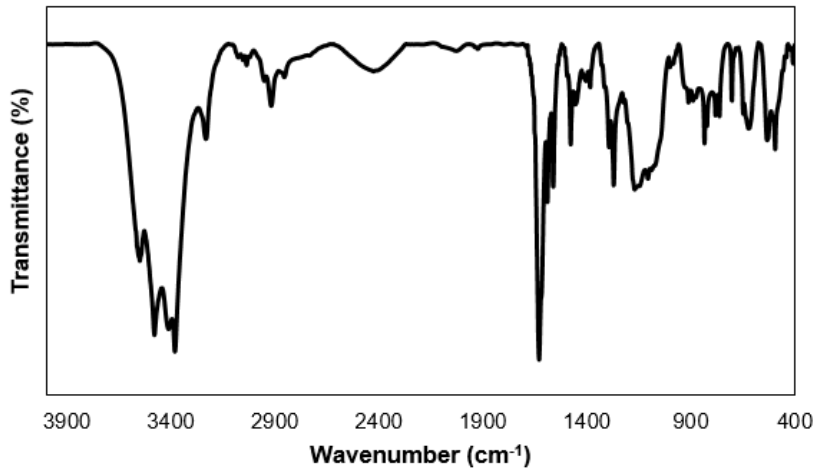


Figure S63: The FT-IR spectrum of 9-phenyl-3,4,6,7,9,10-hexahydroacridine-1,8(2H,5H)-dione in KBr

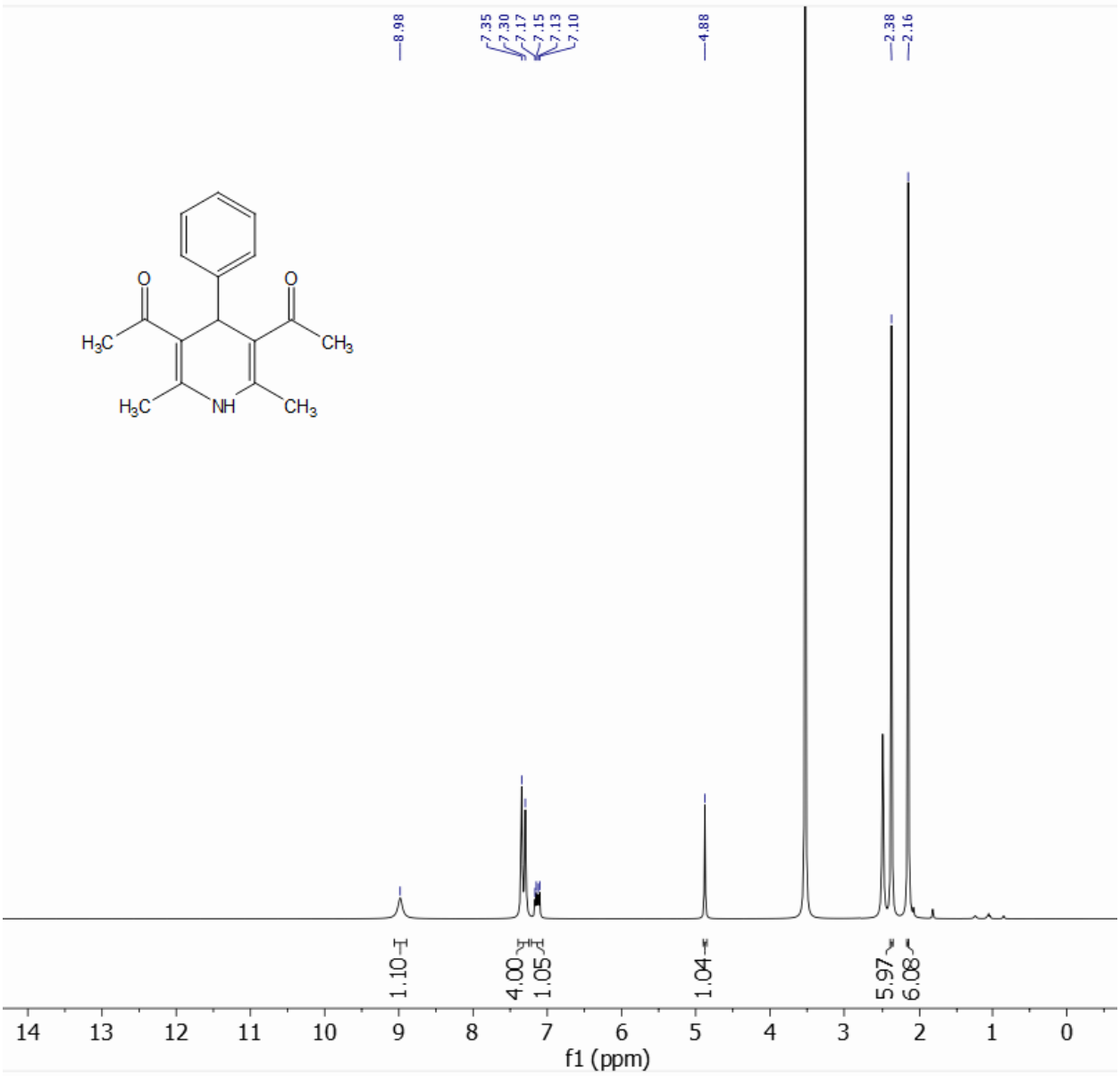


Figure S64: The ^{1}H NMR spectrum (400 MHz) of 1,1'-(2,6-dimethyl-4-phenyl-1,4-dihydropyridine-3,5-diyl)bis(ethan-1-one) in DMSO-d_6

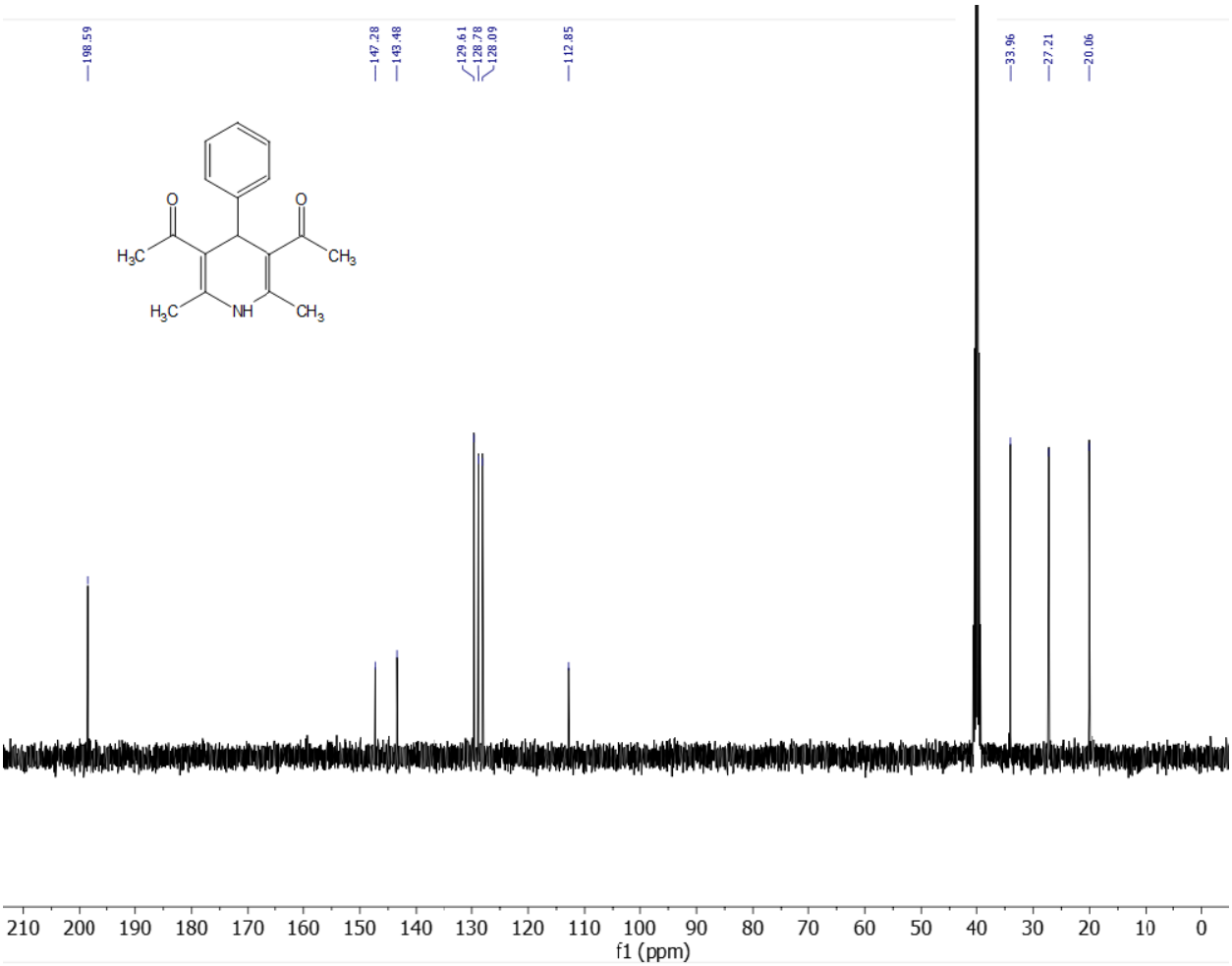


Figure S65: The ^{13}C NMR spectrum (101 MHz) of 1,1'-(2,6-dimethyl-4-phenyl-1,4-dihydropyridine-3,5-diyl)bis(ethan-1-one) in DMSO-d_6

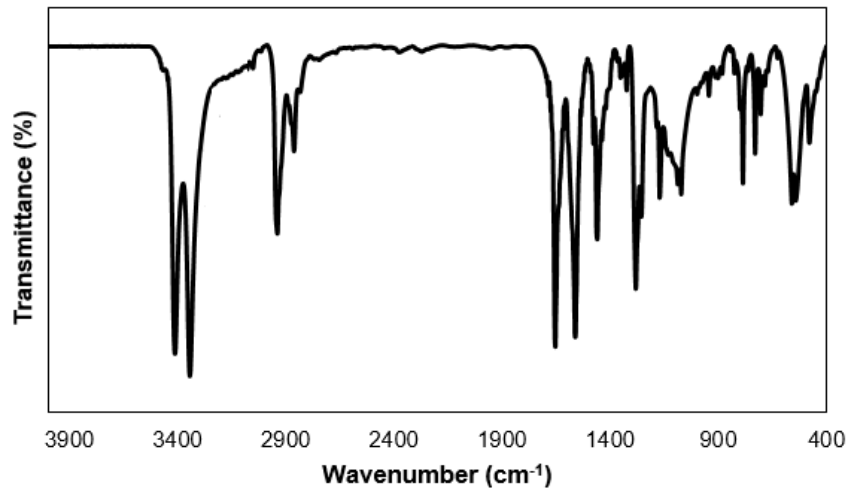


Figure S66: The FT-IR spectrum of 1,1'-(2,6-dimethyl-4-phenyl-1,4-dihydropyridine-3,5-diyl)bis(ethan-1-one) in KBr

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