Isolation of 2-Alkyl-4-quinolones with Unusual Side Chains from a Chinese *Pseudomonas aeruginosa* Isolate

Jianye Li, Weiwei Sun, Muhammad Saalim, Guixiang Wei, Diana A. Zaleta-Pinet, and Benjamin R. Clark

Supporting Information

Contents

Procedures for 16S rDNA amplification

The 16S rRNA genes were amplified using PrimeSTAR® HS DNA Polymerase (Takara, DaLian, China) in Mastercycler Nexus gradient (Eppendorf, Germany) with universal primers 27F (5`-AGAGTTTGATCCTGGCTCAG-3`) and 1541R (5`-AAGGAGGTGATCCAGCCGCA-3`). The total reaction volume was 50 µL. The mixtures were composed of 10 µL 5×Primer Buffer, 4 µL dNTP Mixture (2.5 mM), 1 µL 1:50 diluted primer (27F and 1541R), 200 ng DNA template, 0.5 µL HS DNA polymerase and RNA-free H_2O. The PCR three-step reaction started from denaturation at 98℃ for 10s, primer annealing followed at 55℃ for 15 s, and the extension was performed at 72℃ for 1 min 30 s (30 cycles). After PCR cloning, agarose gel electrophoresis was run to confirm the sample was clean. The amplified DNA products were sequenced by TsingKe Biological Technology in Beijing. Subsequently, the 16S rDNA sequences were analyzed by using gene BLAST in the NCBI database.

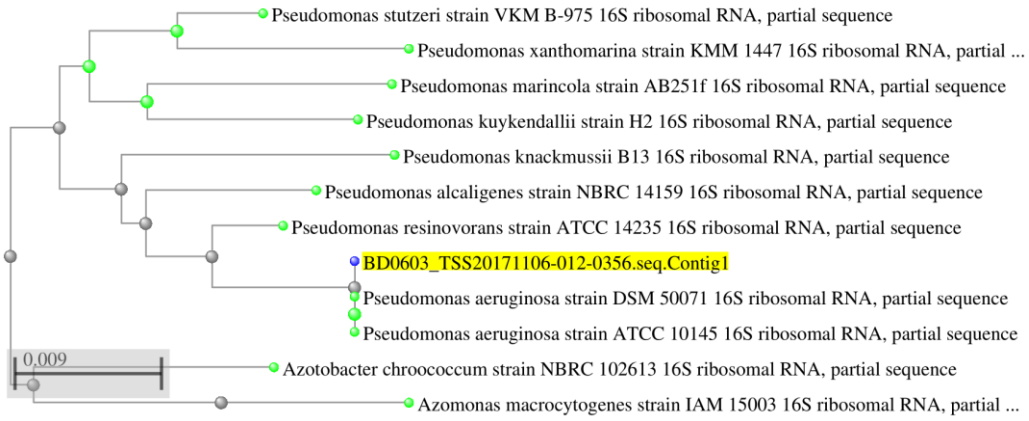


Figure S1. Phylogenetic analysis of BD06-03 based on 16S rDNA sequences. Phylogeny reconstruction was analyzed by use of the neighbor-joining statistical method and test of phylogeny using Bootstrap method.

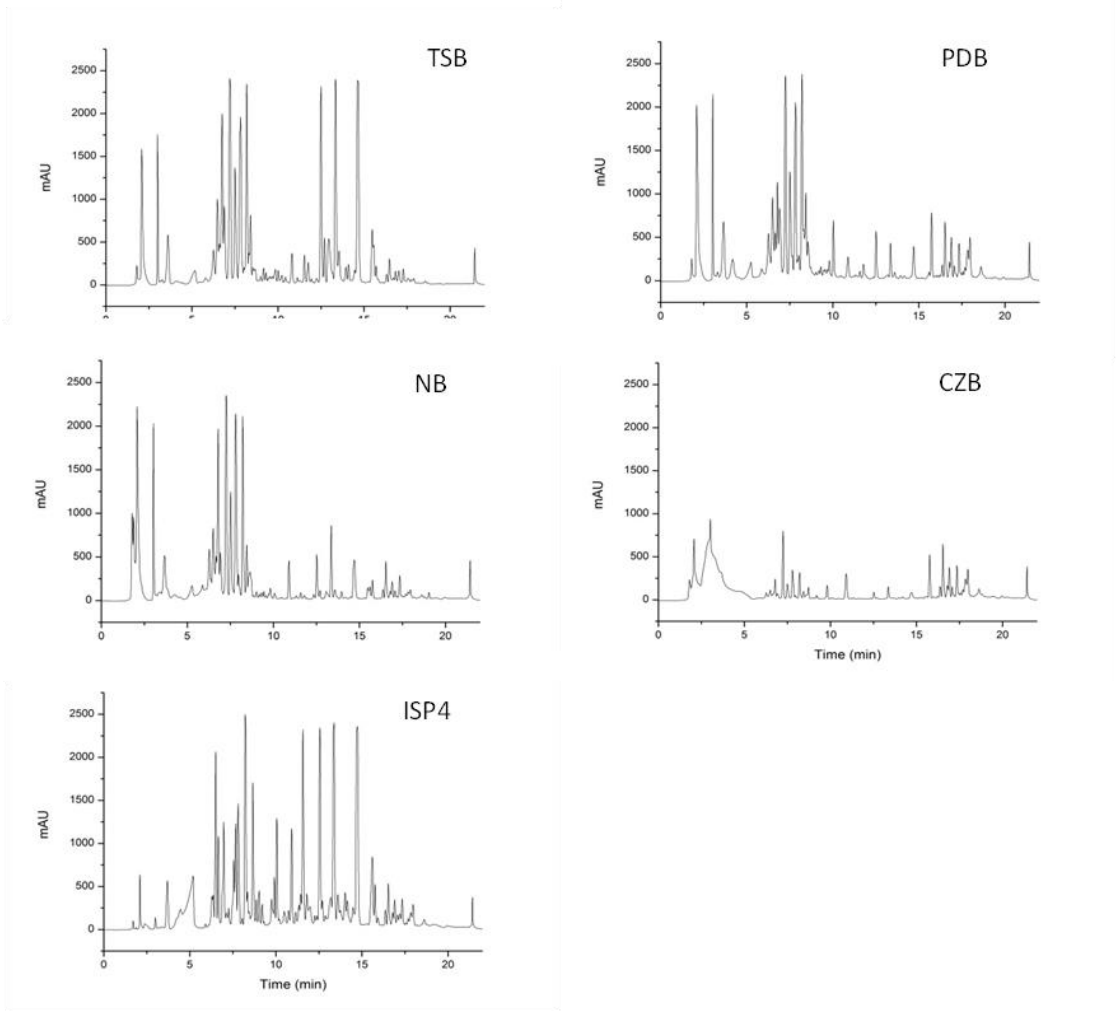


Figure S2. HPLC chromatograms (210 nm) of DCM extracts from strain BD06-03 grown in different media including TSB, PDB, NB, CZB, and ISP4. Standard analytical gradient: flow rate: 0.8 mL/min; gradient: 10%-100% ACN; Column: SB-C_{18}, 4.6 ×150 mm, 3.5 μm.

Extraction and Separation (expanded).

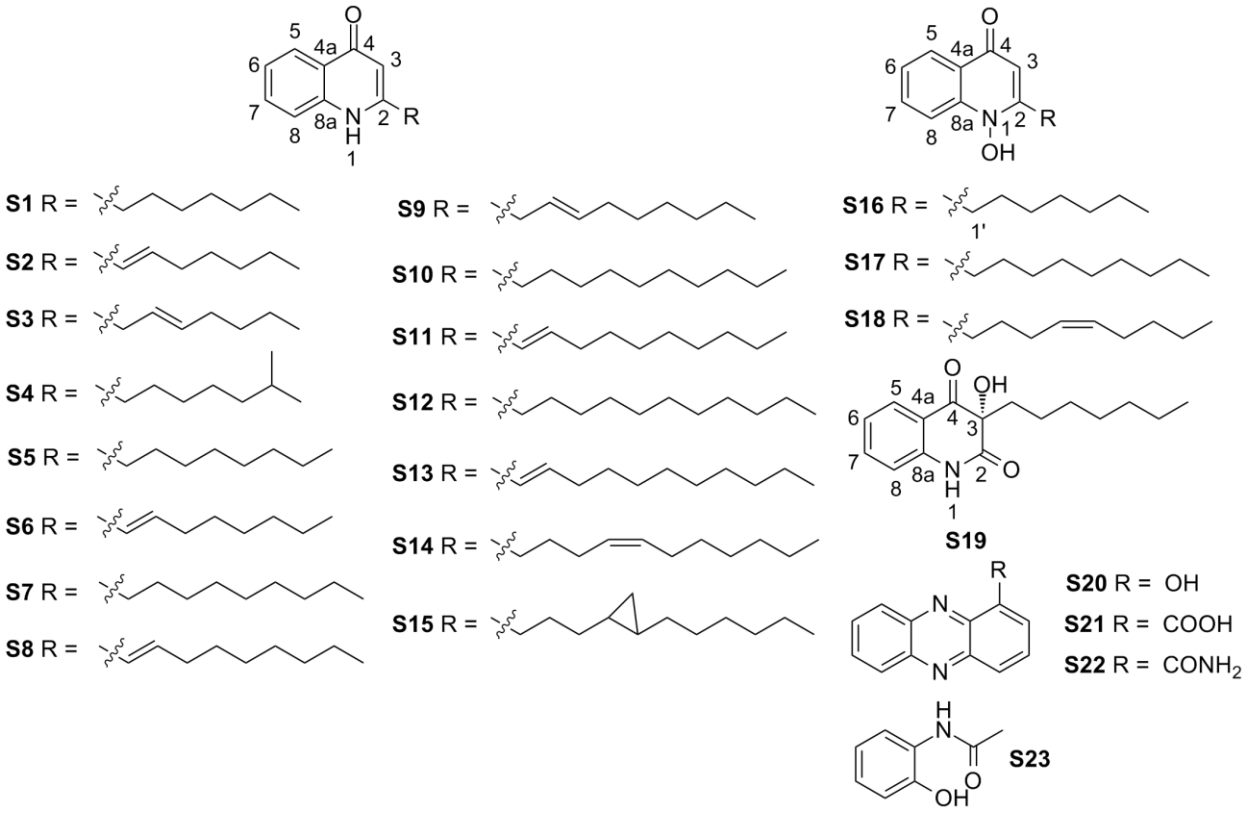
After seven days of cultivation, all culture flasks were combined and extracted with equal volumes of CH_2Cl_2, EtOAc and *n*-butanol (BuOH) three times each (all 10 L). The solvent was removed under vacuum (Savant SC 210A, Ameritech), to yield dry solvent extracts: CH_2Cl_2 extract (1.1 g), EtOAc extract (0.5 g) and BuOH extract (0.8 g).

The CH_2Cl_2 extract (1.1 g) was fractionated through HP-20 resin in an open column, eluting with H_2O-MeOH by a stepwise elution gradient (100:0, 80:20, 60:40, 40:60, 20:80, 0:100). Fractions of 60% MeOH (Fr.1), 80% MeOH (Fr. 2) and 100% MeOH (Fr.3) were selected as the primary fractions for the continued separation.

Fr.1 (60% MeOH) (80 mg) was subjected to semi-preparative HPLC (ZORBAX SB-$C_{18,}$ 5 μm, 9.4 x 250 mm, Agilent Technologies Co.), with an isocratic elution of 10% MeCN in H_2O at a flow rate of 3 mL/min, to yield *N*-(2-hydroxyphenyl)-acetamide (R_t 7.0 min,1.1 mg).

Fr.3 (1.4 g) was subjected to silica gel column chromatography, eluting with CH_2Cl_2-MeOH (100:0→0:100) to afford seven subfractions (Fr. 3-1 to Fr. 3-5). Subfraction Fr. 3-1 was further purified on a Shimadzu LC-20 AR semi-preparative HPLC (Pursuit XRs5 C18), using an isocratic elution (25% MeCN) to yield 1-hydroxyphenazine (**S20**, 6 mg), phenazine-1-carboxylic acid (**S21**, 16 mg) and phenazine-1-carboxamide (**S22**, 4 mg). Subfraction Fr. 3-2, Fr. 3-3 and Fr. 3-4 were purified by semi-preparative HPLC (ZORBAX SB-C18), eluting with 25% MeCN for 20 min and 38% MeCN for 25 min then 44% MeCN for 30 min and then 55% MeCN 15 min then 20 min to 100% MeCN for 30 min to yield compound **2** (1.0 mg), compound **5** (0.7 mg), compound **6** (1.8 mg), compound **S3** (1.6 mg), compound **S4** (1.1 mg), compound **S9** (3.2 mg), compound **S14** (7.2 mg), compound **S15** (1.2 mg), 2-heptyl-1-hydroxyl-4-quinolone (**S16**) (9 mg), 2-nonyl-1-hydroxyl-4-quinolone (**S17**) (2.2 mg), 2-(*Z*-undec-4-enyl)-1-hydroxyl-4-quinolone (**S18**) (1.2 mg), 3-heptyl-3-hydroxy- 1,2,3,4-tetrahydroquinoline-2,4-dione (**S19**) (4.5 mg) and several two-compound mixtures. These mixtures were poorly separated with an ACN-H_2O system, thus, they were further purified on a Shimadzu LC-20 AR semi-preparative HPLC (ZORBAX SB-C18), using an isocratic elution (67% MeOH) to yield compounds **S1** (12.0 mg) and compound **S2** (3.0 mg), compound **S5** (8.0 mg) and compound **S6** (3.0 mg) (70% MeOH), compound **S7** (6.0 mg) and compound **S8** (3.0 mg) (73% MeOH), compound **S10** (3.0 mg) and compound **S11** (2.0 mg) (78% MeOH), and compound **S12** (5.0 mg) and compound **S13** (3.0 mg) (80% MeOH).

Experimental data for known compounds



*2-heptyl-4-quinolone (HHQ) (**S1**)*: colorless solid; UV-Vis (MeOH) λ_{max} 212 nm, 236 nm, 316 nm, 326 nm; ^{1}H NMR (methanol-d_4, 600 MHz) and ^{13}C NMR (methanol-d_4, 150 MHz) spectra matched well (Table S2) with literature data.[S1] HRESIMS *m/z* 244.1693 $[M+H]^+$ (calcd for $C_{16}H_{22}NO$, 244.1696).

*2-(E-hept-1-enyl)-4-quinolone (**S2**)*: colorless solid; UV-Vis (MeOH) λ_{max} 210 nm, 258nm, 309 nm, 334 nm; For ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra, see Table S2. HRESIMS *m/z* 242.1534 $[M+H]^+$ (calcd for $C_{16}H_{20}NO$, 242.1539).[S2]

*2-(E-hept-2-enyl)-4-quinolone (**S3**)*: colorless solid; UV-Vis (MeOH) λ_{max} 211 nm, 240nm, 316 nm, 327 nm; ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra matched well (Table S2) with literature data.[S3] HRESIMS *m/z* 242.1534 $[M+H]^+$ (calcd for $C_{16}H_{20}NO$, 242.1539).

*2-(6-methyl)-heptyl-4-quinolone (**S4**)*: colorless solid; UV-Vis (MeOH) λ_{max} 212 nm, 235nm, 315 nm, 325 nm; ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra matched well (Table S2) with literature data.[12] HRESIMS *m/z* 537.3489 $[2M+Na]^+$ (calcd for $C_{34}H_{46}N_2O_2Na$, 537.3457).

*2-octyl-4-quinolone (**S5**)*: colorless solid; UV-Vis (MeOH) λ_{max} 211 nm, 238nm, 316 nm, 327 nm; ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra matched well (Table S3) with literature data.[10] HRESIMS *m/z* 537.3521 $[2M+Na]^+$ (calcd for $C_{34}H_{46}N_2O_2Na$, 537.3457).

*2-(E-oct-1-enyl)-4-quinolone (**S6**)*: colorless solid; UV-Vis (MeOH) λ_{max} 210 nm, 258 nm, 309 nm, 334 nm; For ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra, see Table S3.[10] HRESIMS *m/z* 533.3151 $[2M+Na]^+$ (calcd for $C_{34}H_{42}N_2O_2Na$, 533.3144).

*2-nonyl-4-quinolone (**S7**)*: colorless solid; UV-Vis (MeOH) λ_{max} 211 nm, 238 nm, 316 nm, 327 nm; ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra matched well (Table S3) with literature data.[10] HRESIMS *m/z* 565.3825 $[2M+Na]^+$ (calcd for $C_{36}H_{50}N_2O_2Na$, 565.3770).

*2-(E-non-1-enyl)-4-quinolone (**S8**)*: colorless solid; UV-Vis (MeOH) λ_{max} 210 nm, 258nm, 309 nm, 334 nm; ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra matched well (Table S3) with literature data.[10] HRESIMS *m/z* 561.3502 $[2M+Na]^+$ (calcd for $C_{36}H_{46}N_2O_2Na$, 561.3457).

*2-(E-non-2-enyl)-4-quinolone (**S9**)*: colorless solid; UV-Vis (MeOH) λ_{max} 211 nm, 238nm, 316 nm, 327 nm; ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra matched well (Table S3) with literature data.[S3] HRESIMS *m/z* 561.3493 $[2M+Na]^+$ (calcd for $C_{36}H_{46}N_2O_2Na$, 561.3457).

*2-decyl-4-quinolone (**S10**)*: colorless solid; UV-Vis (MeOH) λ_{max} 211 nm, 238nm, 316 nm, 327 nm; For ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra, see Table S4. HRESIMS *m/z* 308.2019 $[M+Na]^+$ (calcd for $C_{19}H_{27}NONa$, 308.1990).[14]

*2-(E-dec-1-enyl)-4-quinolone (**S11**)*: colorless solid; UV-Vis (MeOH) λ_{max} 210 nm, 258nm, 309 nm, 334 nm; For ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra, see Table S4. HRESIMS *m/z* 306.1913 $[M+Na]^+$ (calcd for $C_{19}H_{25}NONa$, 306.1834).[S4]

*2-undecyl-4-quinolone (**S12**)*: colorless solid; UV-Vis (MeOH) λ_{max} 211 nm, 236nm, 314 nm, 325 nm; ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra matched well (Table S4) with literature data.[10] HRESIMS *m/z* 300.2335 $[M+H]^+$ (calcd for $C_{20}H_{30}NO$, 300.2322).

*2-(E-undec-1-enyl)-4-quinolone (**S13**)*: colorless solid; UV-Vis (MeOH) λ_{max} 210 nm, 258 nm, 309 nm, 334 nm; ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra matched well (Table S4) with literature data.[S5] HRESIMS *m/z* 298.2177 $[M+H]^+$ (calcd for $C_{20}H_{28}NO$, 298.2165).

*2-(Z-undec-4-enyl)-4-quinolone (**S14**)*: colorless solid; UV-Vis (MeOH) λ_{max} 211 nm, 238 nm, 316 nm, 327 nm; ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra matched well (Table S4) with literature data.[10] HRESIMS *m/z* 298.2176 $[M+H]^+$ (calcd for $C_{20}H_{28}NO$, 298.2165).

*2-(3-(2-hexylcyclopropyl)propyl)-4-quinolone (**S15**)*: colorless solid; UV-Vis (MeOH) λ_{max} 211 nm, 238 nm, 316 nm, 327 nm; ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra matched well (Table S5) with literature data.[10] HRESIMS *m/z* 312.2388 $[M+H]^+$ (calcd for $C_{21}H_{30}NO$, 312.2322).

*2-heptyl-1-hydroxyl-4-quinolone (**S16**)*: colorless solid; UV-Vis (MeOH) λ_{max} 216 nm, 242nm, 328 nm; ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra matched well (Table S5) with literature data.[7] HRESIMS *m/z* 260.1639 $[M+H]^+$ (calcd for $C_{16}H_{22}NO_2$, 260.1651).

*2-nonyl-1-hydroxyl-4-quinolone (**S17**)*: colorless solid; UV-Vis (MeOH) λ_{max} 214 nm, 242nm, 330 nm, 336 nm; ^{1}H NMR (methanol-d_4, 600 MHz) and ^{13}C NMR (methanol-d_4, 150

MHz) data matched well (Table S5) with literature data.[7] HRESIMS *m/z* 288.1969 $[M+H]^+$ (calcd for $C_{18}H_{26}NO_2$, 288.1964).

*2-(Z-undec-4-enyl)-1-hydroxyl-4-quinolone (**S18**)*: colorless solid; UV-Vis (MeOH) λ_{max} 214 nm, 242 nm, 330 nm, 338 nm; ^{1}H NMR (methanol-d_4, 600 MHz) and ^{13}C NMR (methanol-d_4, 150 MHz) matched well (Table S5) with literature data.[10]

*3-heptyl-3-hydroxy-1,2,3,4-tetrahydroquinoline-2,4-dione (**S19**)*: colorless solid; UV-Vis (MeOH) λ_{max} 236 nm, 256 nm, 338 nm; ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra matched well (Table S5) with literature data.[S6] HRESIMS *m/z* 298.1414 $[M+Na]^+$ (calcd for $C_{16}H_{21}NNaO_3$, 298.1419).

*1-hydroxyphenazine (**S20**)*: yellow solid; UV-Vis (MeOH) λ_{max} 202 nm, 262 nm, 368 nm; ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra matched well (Table S6) with literature data.[S7] HRESIMS *m/z* 197.0715 $[M+H]^+$ (calcd for $C_{12}H_9N_2O$, 197.0715).

*Phenazine-1-carboxylic acid (**S21**)*: chartreuse solid; UV-Vis (MeOH) λ_{max} 207 nm, 254 nm, 370 nm; ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra matched well (Table S6) with literature data.[10] HRESI(-)MS *m/z* 179.0571 $[M-COOH]^-$ (calcd for $C_{12}H_7N_2$, 179.0615).

*Phenazine-1-carboxamide (**S22**)*: green solid; UV-Vis (MeOH) λ_{max} 204 nm, 248 nm, 368 nm; ^{1}H NMR ($CDCl_3$, 600 MHz) and ^{13}C NMR ($CDCl_3$, 150 MHz) spectra matched well (Table S6) with literature data.[10] HRESIMS *m/z* 246.0639 $[M+Na]^+$ (calculated for $C_{13}H_9N_3ONa$, 246.0643).

*N-(2-hydroxyphenyl)-acetamide (**S23**)*: colorless solid; UV-Vis (MeOH) λ_{max} 204 nm, 216 nm, 240 nm, 280 nm; ^{1}H NMR (d_6-DMSO, 600 MHz) and ^{13}C NMR (d_6-DMSO, 150 MHz) matched well (Table S6) with literature data.[S8] HRESIMS *m/z* 174.0525 $[M+Na]^+$ (calcd for $C_8H_9NO_2Na$, 174.0531).

Synthetic procedures

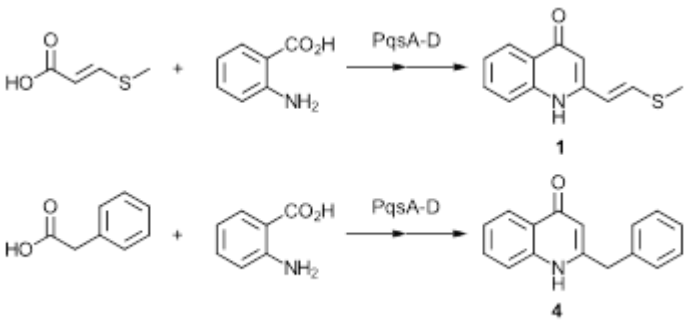
3-(Methylthio)acrylic acid. 20% Sodium thiomethoxide aqueous solution (1001.0 mg, 2.86 mmol) was added to stirred propiolic acid (200.0 mg, 2.86 mmol). The mixture was stirred overnight at room temperature. Hydrochloric acid (1 M) was added to adjust the pH to 2-3, and the mixture was extracted with dichloromethane (20 × 2 mL). The organic layer was dried ($MgSO_4$) and concentrated to give a pale yellow solid, which was shown by ^{1}H NMR to be exclusively 3-methylthioacrylic acid (189.0 mg, 56%, *Z*/*E* = 20:3).[S9] Major isomer *Z* ^{1}H NMR (400 MHz, $CDCl_3$) δ 11.49 (br, 1H), 7.20 (d, 10.2 Hz, 1H), 5.86 (d, 10.2 Hz, 1H), 2.41 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 19.7, 112.8, 155.5, 172.5.

Phenylacetic acid. Sodium hydroxide solution (1 M, 5 ml) was added to methyl phenyl acetate (0.50 g, 3.3 mmol) in 10 ml methanol. The mixture was stirred at 70 ℃ for 2 hours. The solution was cooled to room temperature and hydrochloric acid (1 M) was added to adjust the pH to 2-3, and the mixture was extracted with dichloromethane (20 × 2 mL). The organic layer was dried ($MgSO_4$) and concentrated to give a colorless solid (0.44 g, 98%). ^{1}H NMR (400 MHz, $CDCl_3$) δ 9.8 (br, 1H), 7.30-7.38 (m, 5H), 3.67 (s, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 40.9, 127.1, 128.4, 129.2, 133.1, 177.9.

Feeding studies.

Three cultures of *Pseudomonas aeruginosa* BD06-03 were grown in 50 mL ISP4 liquid medium. One flask was retained as a control cuture, to the other two were added 15 mg 3-(methylthio)acrylic acid and 15 mg phenylacetic acid, respectively. The cultures were incubated in a rotary incubator shaker for 4 days at 30 ℃ and 200 rpm. After four days, 1 g HP20 resin was added to adsorb the secondary metabolites produced by the microbes and incubated for another day. Through filtration, the resin was separated from the medium, before methanol was used to extract secondary metabolites adsorbed by the resin, and the organic extracts subjected to HPLC analysis.

No significant differences in the HPLC profiles of the three cultures were observed (Figure S3).



Scheme S1. Possible biosynthetic origin of quinolones **1** and **4**.

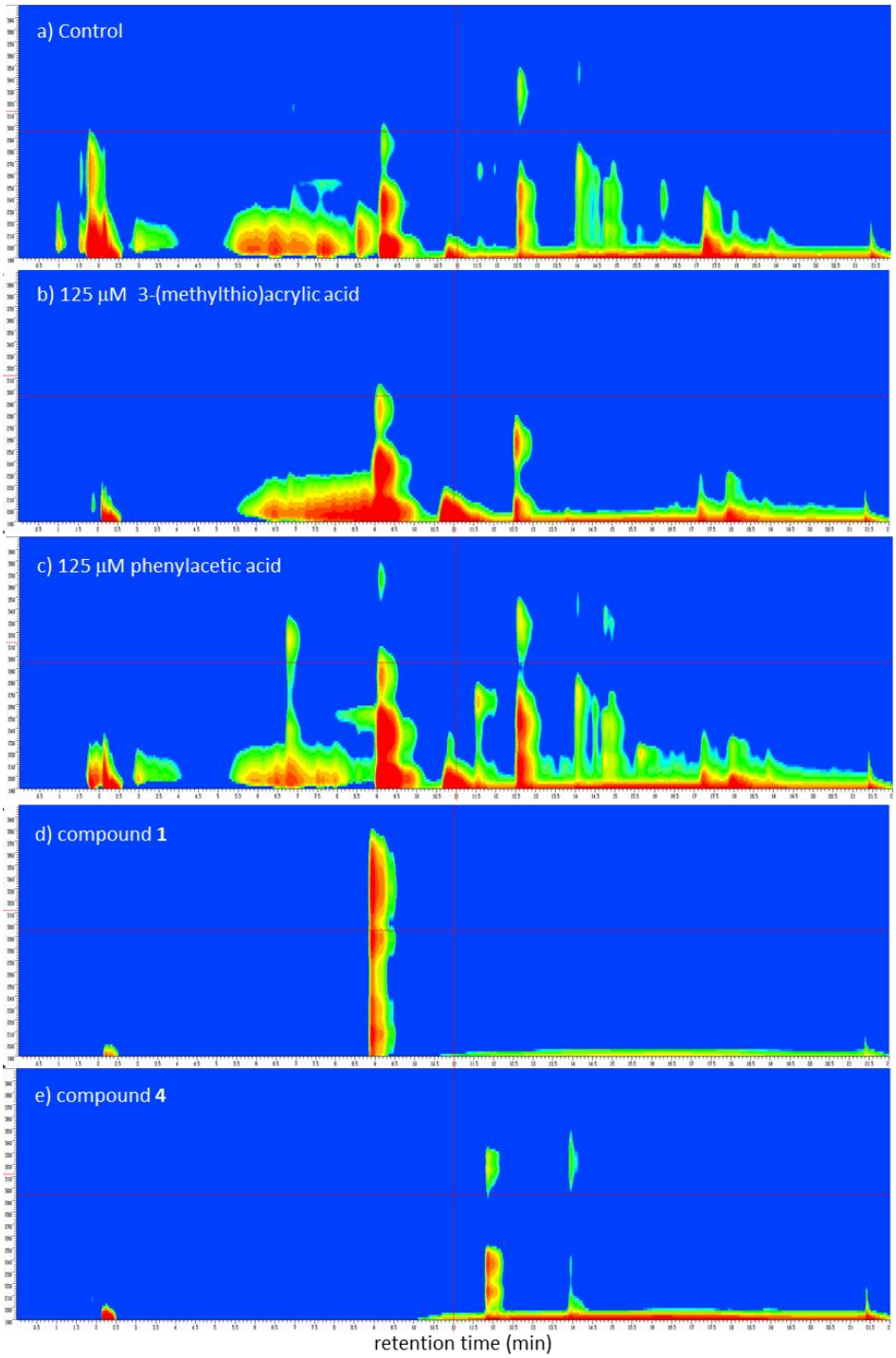


Figure S3. HPLC-DAD analysis of methanolic extracts from precursor feeding studies for *P. aeruginosa* BD06-03. a) control culture; b) feeding study with 125 mM 3-(methylthio)acrylic acid; c) feeding s**tudy** with 125 mM phenylacetic acid; d) standard for compound **1**; e) standard for compound **4**.

MTT Assay

The MTT assay was performed on HeLa cell line which was cultured at 37 °C under 5% CO_2 in DMEM supplemented with 10% FBS. Cell counting was performed manually by using haemocytometer and Nikon Eclipse TS100 microscope. Upon reaching 80−90% confluency, the cells were diluted with fresh media and seeded into a 96-well plate (4000 cells per well) and incubated for 24 h. After 24 h the media was removed and premixed concentrations of test compounds and media were added to the plate. The test compounds were dissolved in DMSO so that the concentration of DMSO was kept at 0.5%. DMSO (0.5%) dissolved in media was used as the negative control while cisplatin was used as the positive control. After 72 h, the media was replaced with fresh 0.5 mg/mL MTT dissolved in PBS and incubated for 4 h. The MTT solution was then replaced with 100 µL of DMSO to dissolve formazan crystals formed by metabolically active living cells.[S10] Absorbance values at 490 nm were measured using a plate reader. The percentage of viable cells was calculated from the ratio of ΔA490 (between the sample and a blank with no cells and no drug) to ΔA490, reference (between a control with no drug and the blank).[S11] To determine IC_{50} values, the average percentage of viable cells was plotted against the corresponding concentration test compounds and the data fit to a sigmoidal equation using GraphPad Prism 6.0.

Table S1. Cytotoxic activity of selected compounds against HeLa cells.

Test Compound	IC_{50} (µg/ml)
1	86.7
2	*n/a*
3	*n/a*
4	*n/a*
6	*n/a*
S1	*n/a*
S2	*n/a*
S3	*n/a*
S5	*n/a*
S7	*n/a*
S8	158
S9	*n/a*
S13	*n/a*
S14	*n/a*
S16	168
S17	154
S18	*n/a*
Cisplatin	86

n/a = not active at 250 µg/ml

Disc Diffusion Assay

The antimicrobial effects of compounds **S1**, **S2, S7, S8, S12, S13, S14, S21** were assessed using well diffusion assays. 200 μL suspensions (approximate 1 × 107 CFU / mL) of the test microbes (Table S2) were spread across the agar surface of petri dishes. Wells were punched into the agar using a sterile pipette tip. Test substance (10 μL, dissolved in DMSO at a concentration of 2 mg/mL) was added into the wells and incubated at suitable temperature for 24 h. DMSO was used as negative control, and ampicillin (10 μL, 2 mg/mL) used as positive control. Anti-microbial activity was evaluated by measuring the diameter of the zone of inhibition. Weak activity was observed against two *Staphylococcus* species (Table S3).

Table S2. Microbes used in antimicrobial testing

ATCC® No.	Species	Media	Temperature
12600	*Staphylococcus aureus*	NB	37°C
14990	*Staphylococcus epidermidis*	NB	37°C
25175	*Streptococcus mutans*	BHI	37°C
13525	*Pseudomonas fluorescens*	NB	26°C
8043	*Enterococcus hirae*	BHI	37°C
25238	*Moraxella catarrhalis*	BHI	37°C
15692	*Pseudomonas aeruginosa*	NB	37°C
6633	*Bacillus subtilis subsp.spizizenii*	BHI	30°C
ATCC® No.	Species	Media	Temperature
76615	*Candida albicans*	YM	25°C
22019	*Candida parapsilosis*	YM	25°C
10571	*Candida rugosa*	YM	25°C
750	*Candida tropicalis*	YM	25°C
34103	*Rhizopus stolonifer*	PDA	25°C
16888	*Aspergillus niger*	PDA	30°C
2601	*Saccharomyces kudriavzevii*	YM	30°C
10106	*Penicillium chrysogenum*	PDA	25°C

Table S3. Zones of inhibition of selected compounds against *Staphylococcus* species (mm)

Comp.	*Staphylococcus aureus* ATCC 12600	*Staphylococcus epidermidis* ATCC 14990
S1	*N/A*	*N/A*
S2	10	*N/A*
S7	*N/A*	*N/A*
S8	*11*	*11*
S12	*N/A*	*N/A*
S13	*11*	*11*
S14	*14*	14
S21	*N/A*	*N/A*
Penicillin	39	39

Table S4. ^{1}H NMR (600 MHz) and ^{13}C NMR (150 MHz) assignments of compounds **S1-S4**

position	**S1** ($CDCl_3$)		**S2** ($CDCl_3$)		**S3** ($CDCl_3$)		**S4** ($CDCl_3$)	
	δ_C, type	δ_H, (*J* in Hz)	δ_C, type	δ_H, (*J* in Hz)	δ_C, type	δ_H, (*J* in Hz)		
1	NH	12.40, s	NH	10.23, s	NH	8.19, br	NH	8.01 (br)
2	155.3, C	-	147.8, C	-	150.9, C	-	152.2, C	-
3	108.2, CH	6.24, s	107.6, CH	6.32, s	109.4, CH	6.18, s	109.5, CH	6.19, s
4	178.9, CO	-	179.6, CO	-	179.4, CO	-	177.2, CO	-
4a	125.0, C	-	125.4, C	-	125.1, C	-	129.1, C	-
5	125.3, CH	8.36, d (8.1)	125.8, CH	8.34, d (8.1)	126.2, CH	8.34, d (8.1)	126.3, CH	8.35, d (8.0)
6	123.5, CH	7.32, t (7.5)	123.8, CH	7.31, dt (8.0, 4.1)	124.0, CH	7.32, t (7.5)	123.6, CH	7.32, t (7.5)
7	131.7, CH	7.58, t (7.6)	132.1, CH	7.57, d (3.8)	132.1, CH	7.57, t (7.6)	132.0, CH	7.57, t (7.5)
8	118.5, CH	7.79, d (8.4)	117.9, CH	7.57, d (3.8)	117.1, CH	7.29	117.0, CH	7.28, d (8.2)
8a	140.7, C	-	140.2, C	-	139..5, C	-	139.8, C	-
1'	34.4, CH_2	2.69, t (7.8)	124.2,CH	6.28, d (16.0)	37.4, CH_2	3.36, d (7.0)	34.6, CH_2	2.63, t (7.9)
2'	31.6, CH_2	1.71, p (7.7)	139.2, CH	6.64, dt (15.3, 6.9)	123.2, CH	5.54, dt (16.0, 7.5)	28.6, CH_2	1.73, m
3'					137.6, CH	5.78, dt, (14.1,	27.1, CH_2	
	29.2, CH_2	1.09-1.34, m	33.1, CH_2	2.22, q (7.0)		6.6)		1.23-1.41, m
4'	29.0, CH_2	1.09-1.34, m	28.4, CH_2	1.43, p (7.1)	32.2, CH_2	2.12, q (7.1)	31.5, CH_2	1.23-1.41, m
5'	29.0, CH_2	1.09-1.34, m	31.4, CH_2	1.22-1.32, m	31.4, CH_2	1.29-1.47, m	38.7, CH_2	1.23-1.41, m
6'	22.6, CH_2	1.09-1.34, m	22.5, CH_2	1.22-1.32, m	22.3, CH_2	1.29-1.47, m	28.0, CH	1.55, m
7'	14.0, CH_3	0.80, t (7.0)	14.0, CH_3	0.85, t (6.9)	13.9, CH3	0.93, t (7.2)	22.7, CH_3	0.85, d (6.6)
8'							22.7, CH_3	0.85, d (6.6)

Table S5. ^{1}H NMR (600 MHz) and ^{13}C NMR assignments of compounds **S5-S9**

position	**S5**[a] ($CDCl_3$)		**S6**[b] ($CDCl_3$)		**S7**[a] ($CDCl_3$)		**S8**[a] ($CDCl_3$)		**S9**[a] ($CDCl_3$)	
	δ_C, type	δ_H, (*J* in Hz)	δ_C, type	δ_H, (*J* in Hz)	δ_C, type	δ_H, (*J* in Hz)	δ_C, type	δ_H, (*J* in Hz)	δ_C, type	δ_H, (*J* in Hz)
1	NH	11.36, br	NH	9.06, br	NH	11.07, br	NH	9.85, br	NH	9.83, br
2	154.4, C	-	154.8, C	-	154.4, C	-	152.7, C	-	151.4, C	-
3	108.4, CH	6.22, s	108.2, CH	6.29, s	108.5, CH	6.22, s	107.7, CH	6.32, s	109.8, CH	6.21, s
4	178.9, CO	-	179.3, CO	-	178.9, C0	-	179.1,CO	-	179.3, CO	-
4a	125.1, C	-	126.2, C	-	125.1, C	-	124.1, C	-	125.1, C	-
5	125.6, CH	8.35, d (8.1)	126.6, CH	8.33, d (7.9)	125.6, CH	8.35, d (8.1)	125.9, CH	8.34, d (8.1)	126.7, CH	8.34, d (8.0)
6	123.5, CH	7.32, t (7.5)	125.7, CH	7.31, t (7.5)	123.5, CH	7.32, t (7.5)	123.6, CH	7.31, t (7.5)	124.4, CH	7.32, t (7.5)
7	131.7, CH	7.57, t (7.3)	132.3, CH	7.57, t (7.0)	131.8, CH	7.58, t (8.2)	132.0, CH	7.57, t (7.6)	132.6, CH	7.56, t (6.6)
8	118.0, CH	7.66, d (8.1)	123.7, CH	7.42, d (7.7)	118.0,CH	7.63, d (8.3)	117.6, CH	7.52, d (8.2)	118.1, CH	7.45, m
8a	140.3, C	-	139.7, C	-	140.3, C	-	139.8, C	-	140.2, C	-
1'	34.4, CH_2	2.67, t (7.6)	124.3, CH	6.25, d (15.8)	34.4, CH_2	2.67, t (7.8)	125.5, CH	6.26, d (16.0)	37.4, CH	3.39, s
2'	31.7, CH_2	1.65-1.82, m	138.6, CH	6.55, m	31.8, CH_2	1.72, p (7.7)	138.8, CH	6.61, dt (15.9, 6.9)	123.9, CH	5.54, m
3'	29.2, CH_2	1.65-1.82, m	33.2, CH_2	2.26, q (6.5)	29.4, CH_2	1.14-1.36, m	33.0, CH_2	2.23, qd (7.1, 1.6)	137.7, CH	5.71, dt (13.8, 6.5)
4'	29.1, CH_2	1.13-1.35, m	31.8, CH_2	1.47, m	29.3, CH_2	1.14-1.36, m	31.7, CH_2	1.44, m	33.3, CH_2	2.04, q (7.1)
5'	29.0, CH_2	1.13-1.35, m	29.0, CH_2	1.23-1.37, m	29.2, CH_2	1.14-1.36, m	29.1, CH_2	1.18-1.33, m	29.2, CH_2	1.36, m
6'	28.8, CH_2	1.13-1.35, m	28.8, CH_2	1.23-1.37, m	29.1, CH_2	1.14-1.36, m	29.0, CH_2	1.18-1.33, m	29.1, CH_2	1.16-1.32, m
7'	22.5, CH_2	1.13-1.35, m	22.7, CH_2	1.23-1.37, m	28.8, CH_2	1.14-1.36, m	28.6, CH_2	1.18-1.33, m	31.8, CH_2	1.16-1.32, m
8'	14.0, CH_3	0.83, t (7.1)	14.2, CH_3	0.88, t (6.8)	22.6, CH_2	1.14-1.36, m	22.6, CH_2	1.18-1.33, m	22.9, CH_2	1.16-1.32, m
9'					14.0, CH_3	0.85, t (7.1)	14.0, CH_3	0.87, t (6.9)	14.3, CH_3	0.87, t (6.7)

[a] 125 MHz for ^{13}C NMR, [b] 100 MHz for ^{13}C NMR.

Table S6. ^{1}H NMR (600 MHz) and ^{13}C NMR (150 MHz) assignments of compounds **S10-S14**

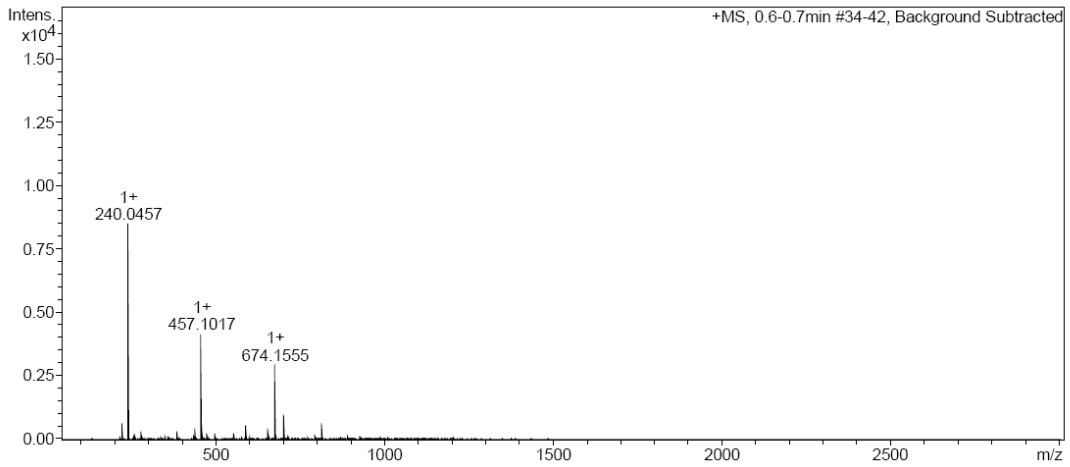
position	**S10** ($CDCl_3$)		**S11** ($CDCl_3$)		**S12** ($CDCl_3$)		**S13** ($CDCl_3$)		**S14** ($CDCl_3$)	
	δ_C, type	δ_H, (*J* in Hz)	δ_C, type	δ_H, (*J* in Hz)	δ_C, type	δ_H, (*J* in Hz)	δ_C, type	δ_H, (*J* in Hz)	δ_C, type	δ_H, (*J* in Hz)
1	NH	11.16, br	NH	10.02, br	NH	11.5, br	NH	12.5, br	NH	11.57, br
2	153.2, C	-	n/o	-	155.6, C	-	148.5, C	-	154.6 C	-
3	108.9, CH	6.41, s	108.0, CH	6.48, s	107.8, CH	6.35, s	104.3, CH	6.75, s	108.5, CH	6.24, s
4	178.5, CO	-	n/o	-	177.9, CO	-	178.1, CO	-	179.1, CO	-
4a	125.5, C	-	n/o	-	124.3, C	-	125.7, C	-	125.2, C	-
5	126.0, CH	8.36, d (8.1)	126.3, CH	8.32, d (8.1)	125.3, CH	8.36, d (8.1)	124.8, CH	8.33, d (8.2)	125.6, CH	8.36, d (8.1)
6	123.7, CH	7.39, t (7.5)	123.8, CH	7.35, t (7.4)	124.1, CH	7.37, t (7.4)	125.0, CH	7.42, t (7.6)	123.6, CH	7.32, t (7.5)
7	131.9, CH	7.63, t (7.4)	132.3, CH	7.60, t (7.5)	132.1, CH	7.60, t (7.5)	132.8, CH	7.64, t (7.6)	131.8, CH	7.57, t (7.5)
8	117.3, CH	7.78, d (4.5)	117.2, CH	7.67, d (6.4)	118.5, CH	7.78, d (6.6)	119.1, CH	8.11, d (8.0)	118.2, CH	7.67, d (8.3)
8a	139.7, C	-	n/o	-	140.5, C	-	140.5, C	-	140.5, C	-
1'	34.5, CH_2	2.74, t (7.8)	124.2, CH	6.34, d (15.9)	34.5, CH_2	2.73, t (7.3)	123.1, CH	6.53, d (15.8)	34.0, CH_2	2.70, t (7.9)
2'	28.6, CH_2	1.72, q (7.7)	138.5, CH	6.62, dt (14.3, 6.7)	29.1, CH_2	1.73, p (7.8)	143.0, CH	6.82, dt (14.3, 6.7)	28.9, CH_2	1.80, p (7.4)
3'	29.2, CH_2	1.12-1.36, m	33.1, CH_2	2.19, q (7.0)	29.2, CH_2	1.16-1.34, m	33.3, CH_2	2.12, q (7.1)	26.7, CH_2	2.07, q (7.3)
4'	29.5, CH_2	1.12-1.36, m	28.8, CH_2	1.42, p (6.8)	29.6, CH_2	1.16-1.34, m	28.7, CH_2	1.36, m	128.1, CH	5.26, m
5'	29.4, CH_2	1.12-1.36, m	29.2, CH_2	1.17-1.34, m	29.6, CH_2	1.16-1.34, m	31.9, CH_2	1.16-1.28, m	131.4, CH	5.34, m
6'	29.3, CH_2	1.12-1.36, m	29.3, CH_2	1.17-1.34, m	29.6, CH_2	1.16-1.34, m	29.5, CH_2	1.16-1.28, m	27.3, CH_2	1.92, q (7.2)
7'	29.3, CH_2	1.12-1.36, m	29.4, CH_2	1.17-1.34, m	29.5, CH_2	1.16-1.34, m	29.5, CH_2	1.16-1.28, m	29.5, CH_2	1.12-1.33, m
8'	31.9, CH_2	1.12-1.36, m	31.9, CH_2	1.17-1.34, m	29.3, CH_2	1.16-1.34, m	29.5, CH_2	1.16-1.28, m	29.1, CH_2	1.12-1.33, m
9'	22.7, CH_2	1.12-1.36, m	22.7, CH_2	1.17-1.34, m	31.9, CH_2	1.16-1.34, m	29.5, CH_2	1.16-1.28, m	31.8, CH_2	1.12-1.33, m
10'	14.1, CH_3	0.85, t (7.1)	14.1, CH_3	0.87, t (6.9)	28.9, CH_2	1.16-1.34, m	22.7, CH_2	1.16-1.28, m	22.6, CH_2	1.12-1.33, m
11'					14.2, CH_3	0.85, t (7.1)	14.2, CH_3	0.85, t (7.1)	14.1, CH_3	0.84, t (7.1)

Table S7. ^{1}H and ^{13}C NMR data of compounds **S15-S19**

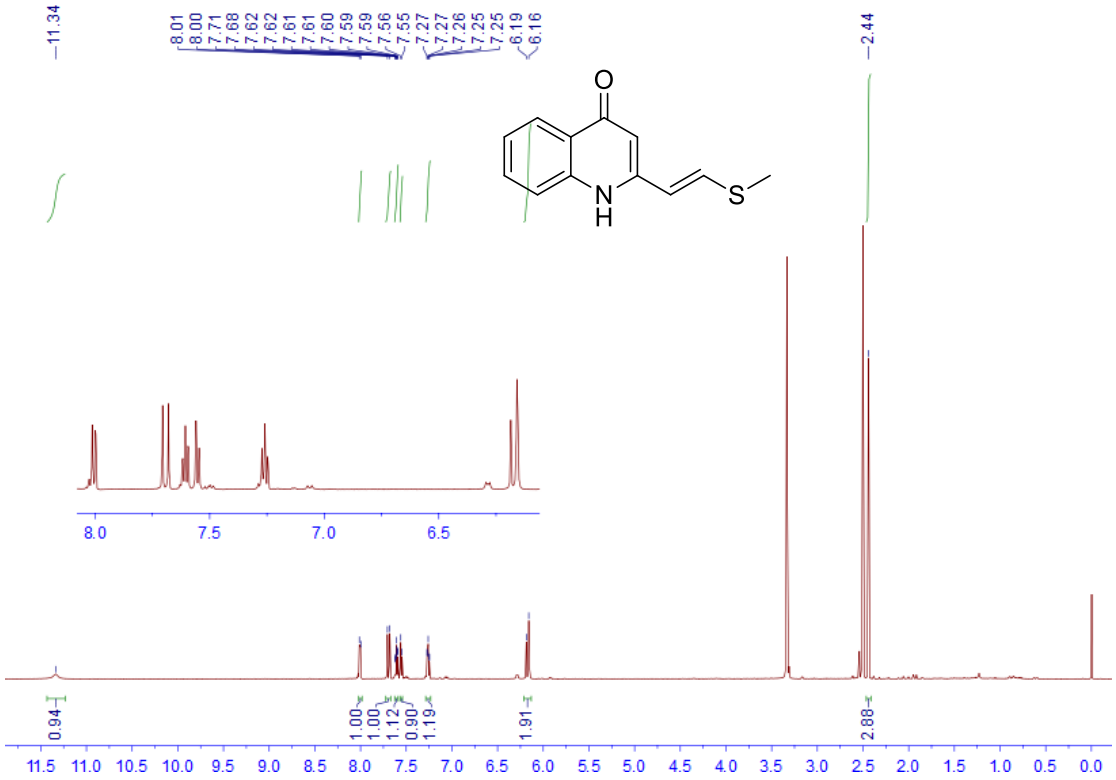
position	**S15** ($CDCl_3$)		**S16** (Methanol-d_4)		**S17** (Methanol-d_4)		**S18** (Methanol-d_4)		**S19** ($CDCl_3$)	
	δ_C, type	δ_H, (*J* in Hz)	δ_C, type	δ_H, (*J* in Hz)	δ_C, type	δ_H, (*J* in Hz)	δ_C, type	δ_H, (*J* in Hz)	δ_C, type	δ_H, (*J* in Hz)
1	NH	8.49, br	N	-	N	-	N	-	NH	9.76, br
2	152.6, C	-	156.4, C	-	156.4, C	-	156.0, C	-	173.9, CO	-
3	109.2, CH	6.19, s	107.5, CH	6.32, s	107.5, CH	6.34, s	107.5,CH	6.34, s	82.3, C	-
4	179.2, CO	-	173.9, CO	-	174.0, CO	-	174, CO	-	195.5, CO	-
4a	125.5, C	-	125.5, C	-	125.5, C	-	125.7, C	--	119.1, C	-
5	126.3, CH	8.35, dd (8.2, 1.4)	125.8, CH	8.25, d (8.0)	125.9, CH	8.26, dd (8.0, 1.0)	125.8, CH	8.26, d, (8.0)	127.8, CH	7.89, d (7.6)
6	123.6, CH	7.32, t (7.4)	125.9, CH	7.49, t (7.6)	126.0, CH	7.51, t (7.4)	125.9, CH	7.49, t (7.7)	124.0, CH	7.17, t (7.6)
7	131.9, CH	7.57, t (7.1)	133.6, CH	7.79, t (7.6)	133.6, CH	7.81, t (7.5)	133.4, CH	7.79, t (7.7)	136.4, CH	7.57, t (7.7)
8	116.9, CH	7.32	116.8, CH	8.08, d (8.6)	116.9, CH	8.11 d (8.7)	117.2, CH	8.14, d (8.6)	116.8, CH	7.12, d (7.3)
8a	139.7, C	-	142.0, C	-	142.0, C		142.1, C		140.3, C	-
1'	34.4, CH_2	2.67, q (7.0)	32.6, CH_2	2.90, t (7.6)	32.6, CH_2	2.93, t (8.0)	32.2, CH_2	2.95, t (7.6)	41.1, CH_2	1.84-1.96, m
2'	28.4, CH_2	1.85, p (7.6)	28.8, CH_2	1.76, m	28.8, CH_2	1.78, m	28.8, CH2	1.85, m	22.7, CH_2	1.35-1.45, m
3'	28.0, CH_2	1.53, m	30.4, CH_2	1.20-1.50, m	33.1, CH_2	1.31-1.46, m	27.8, CH_2	2.21, m	31.6, CH_2	1.10-1.26, m
4'	15.6, CH	0.69, m	32.9, CH_2	1.20-1.50, m	30.6, CH_2	1.31-1.46, m	129.7, CH	5.44, m	29.2, CH_2	1.10-1.26, m
5'	15.6, CH	0.69, m	30.1, CH_2	1.20-1.50, m	30.5, CH_2	1.31-1.46, m	132.1, CH	5.44, m	28.9, CH_2	1.10-1.26, m
6'	28.3, CH_2	1.20-1.41, m	23.7, CH_2	1.20-1.50, m	30.4, CH_2	1.31-1.46, m	28.3, CH_2	2.05, m	22.5, CH_2	1.10-1.26, m
7'	30.0, CH_2	1.20-1.41, m	14.4, CH_3	0.90, t (6.9)	30.4, CH_2	1.31-1.46, m	32.9, CH_2	1.2-1.4, m	14.0, CH_3	0.82, t
8'	29.4, CH_2	1.20-1.41, m			23.8, CH_2	1.31-1.46, m	30.8, CH_2	1.2-1.4, m	OH	3.93, br
9'	32.0, CH_2	1.20-1.41, m			14.4, CH_3	0.9, t (7.1)	30.0, CH_2	1.2-1.4, m		
10'	22.7, CH_2	1.20-1.41, m					23.7, CH_2	1.2-1.4, m		
11'	14.1, CH_3	0.88, t (7.1)					14.4, CH_3	0.88, t (6.8)		
CH_2	11.0, CH_2	-0.29, m; 0.61, m								

Table S8. ^{1}H NMR (600 MHz) and ^{13}C NMR (150 MHz) assignments of compound **S20**-**S23**

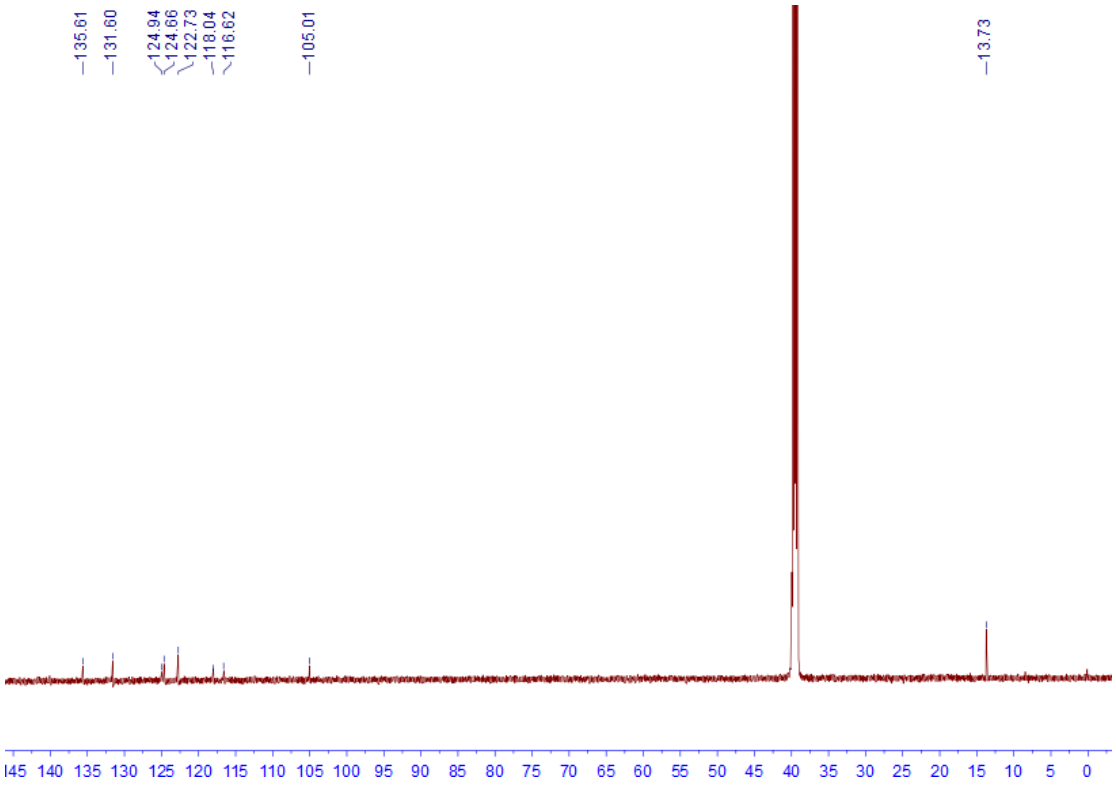
position	**S20** (Methanol-d_4)		**S21** ($CDCl_3$)		**S22** ($CDCl_3$)		position	**S23** (DMSO-d_6)	
	δ_C, type	δ_H, (J in Hz)	δ_C, type	δ_H, (J in Hz)	δ_C, type	δ_H, (J in Hz)		δ_C, type	δ_H, (J in Hz)
1	154.6, C	-	125.1, C	-	129.1, C	-	1	126.5, C	-
2	111.1, CH	7.19, dd (7.5, 1.0)	137.4, CH	8.98, d (7.0)	136.2, CH	9.02, dd (7.1, 1.5)	2	148.4, C	-
3	133.4, CH	7.78, dd (8.9, 7.4)	130.2, CH	8.29, d (8.6)	130.1, CH	7.98, dd (8.7, 7.2)	3	116.1, CH	6.84, d (8.1)
4	120.0, CH	7.68, dd (9.0, 0.8)	135.1, CH	8.53, d (8.7)	134.6, CH	8.44, dd (8.7, 1.5)	4	124.7, CH	6.92, t (8.3)
4a	145.0, C	-	144.1, C	-	143.7, C	-	5	122.4, CH	6.74, t (7.6)
5a	144.5, C	-	143.4, C	-	143.4, C	-	6	118.9, CH	7.66, d (8.1)
6	131.6, CH	7.86-7.94, m	133.2, CH	8.01, m	131.3, CH	7.90-7.95, m	1-CH_3	23.7, CH3	2.08, s
7					129.3, CH		1-CON	169.1, CO	
	130.6, CH	8.31, d (8.6)	128.0, CH	8.01, m		8.25, m	H		9.29, s
8	129.8, CH	8.18, dd (8.3, 1.3)	130.1, CH	8.35, d (8.6)	130.0, CH	8.30, m	2-OH	-	9.83, s
9	132.4, CH	7.86-7.94, m	131.7, CH	8.01, m	132.0, CH	7.90-7.95, m			
9a	143.0, C		140.1, C	-	141.7, C	-			
10a	137.2, C		139.9, C	-	140.0, C	-			
1-CO			165.8, CO	15.53, s	166.7, CO	10.73, br s; 6.25, br s			



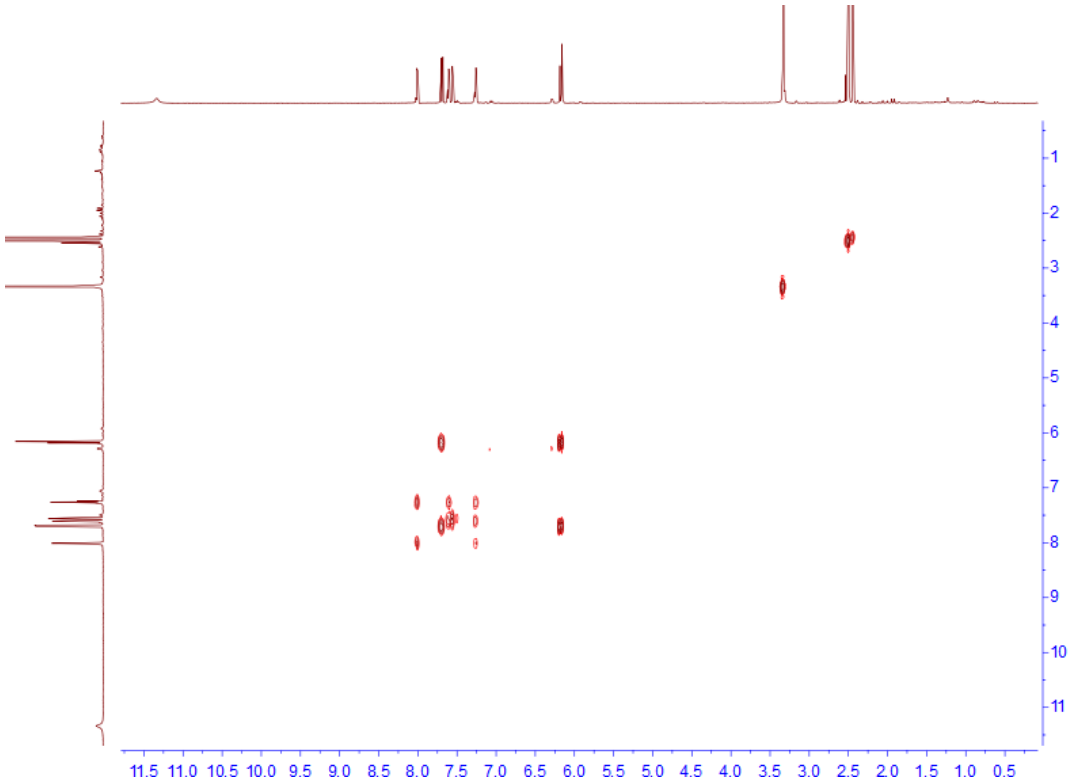
HRESI MS spectra of compound **1**



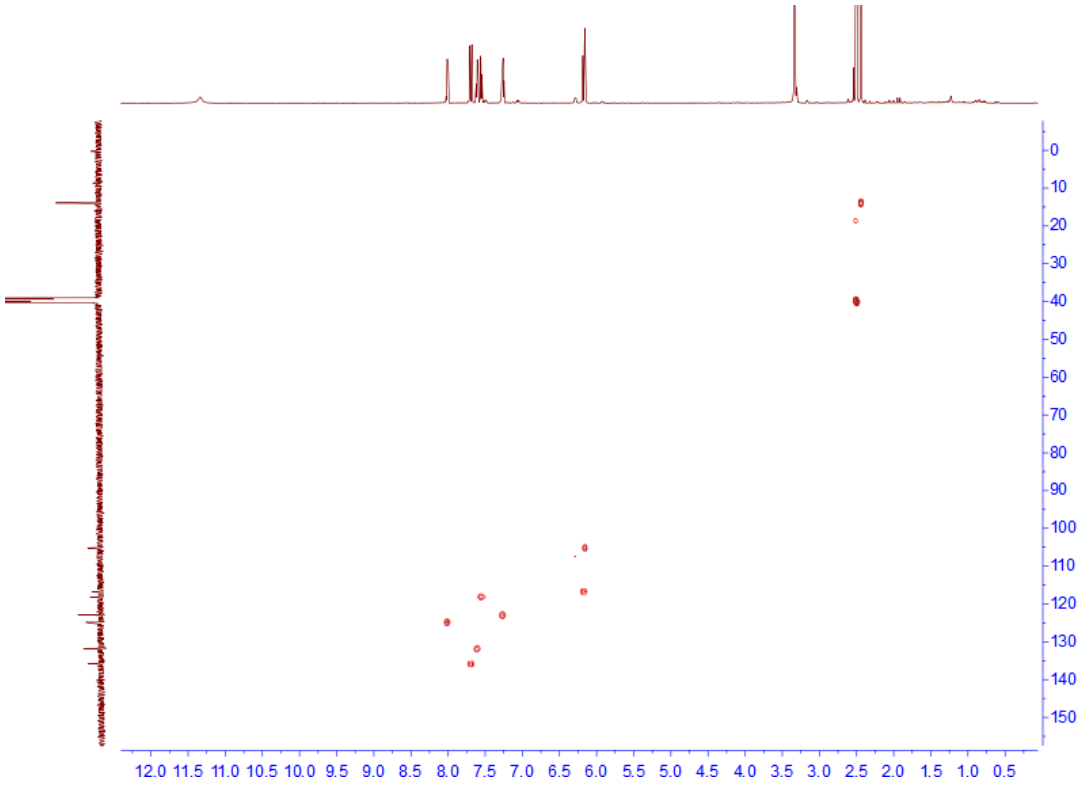
^{1}H-NMR (600 MHz, DMSO-d_6) spectrum of compound **1**



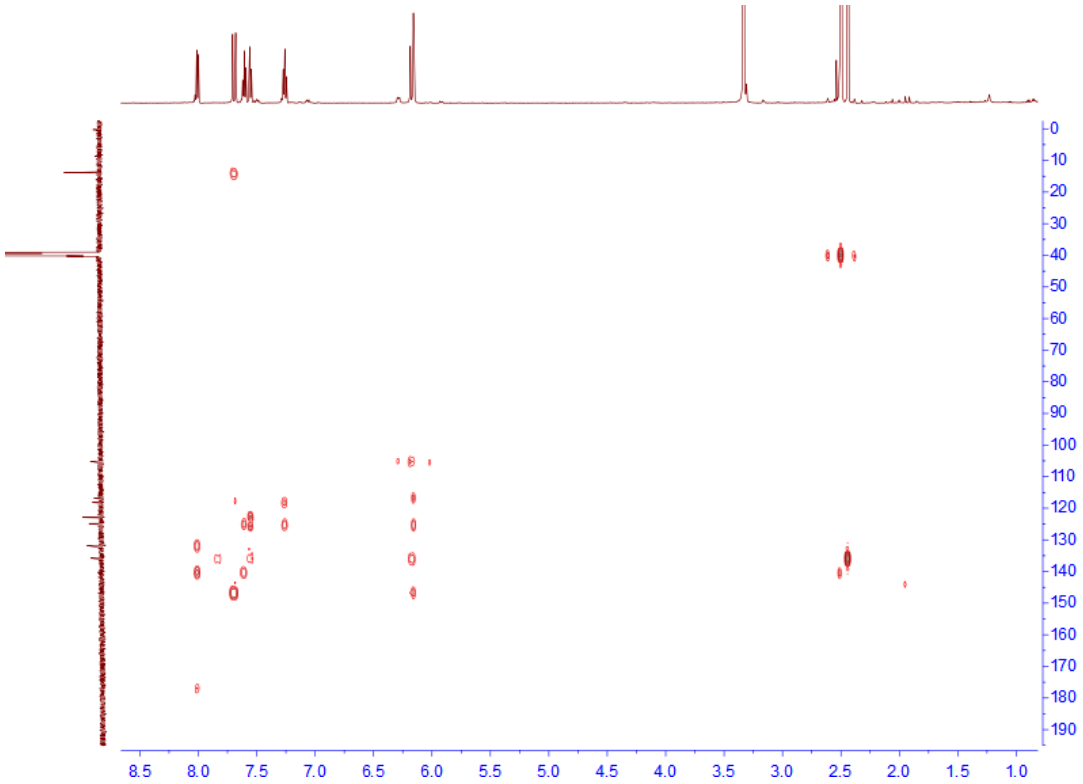
^{13}C-NMR (150 MHz, DMSO-d_6) spectrum of compound **1**



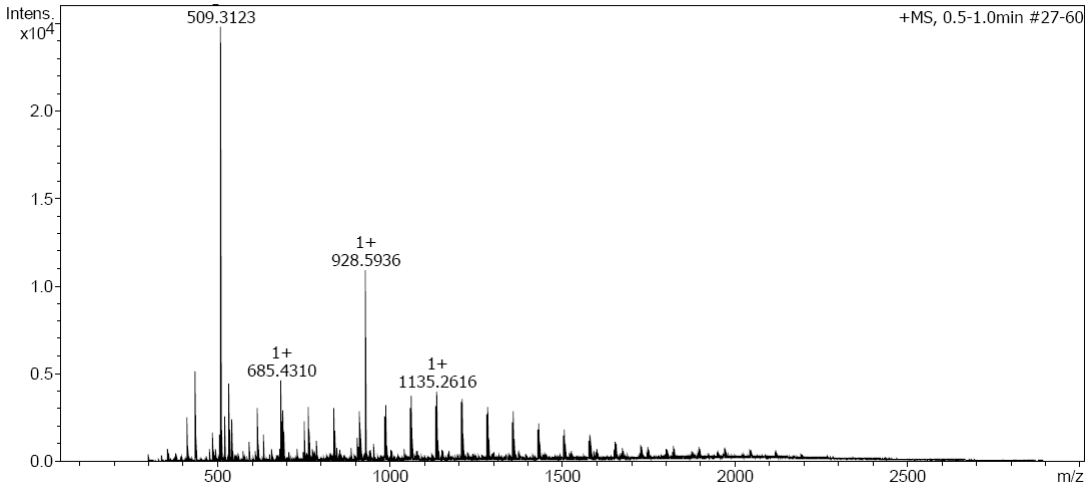
COSY spectrum of compound **1**



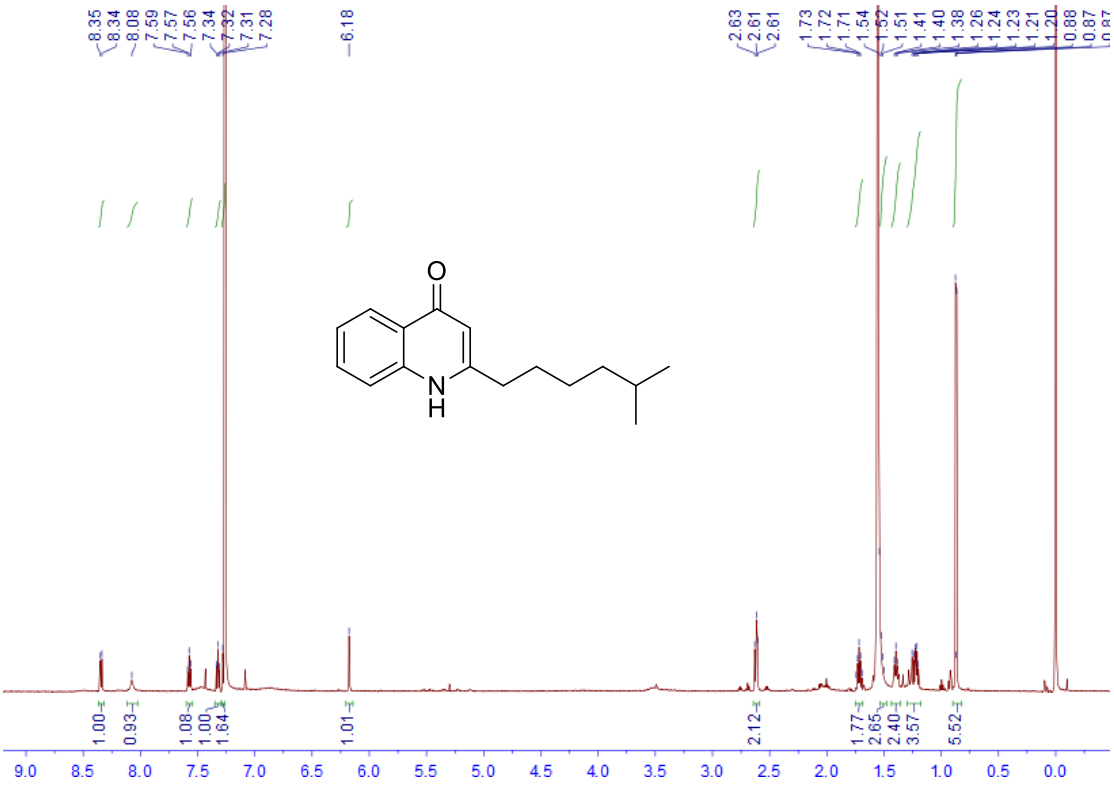
HSQC spectrum of compound **1**



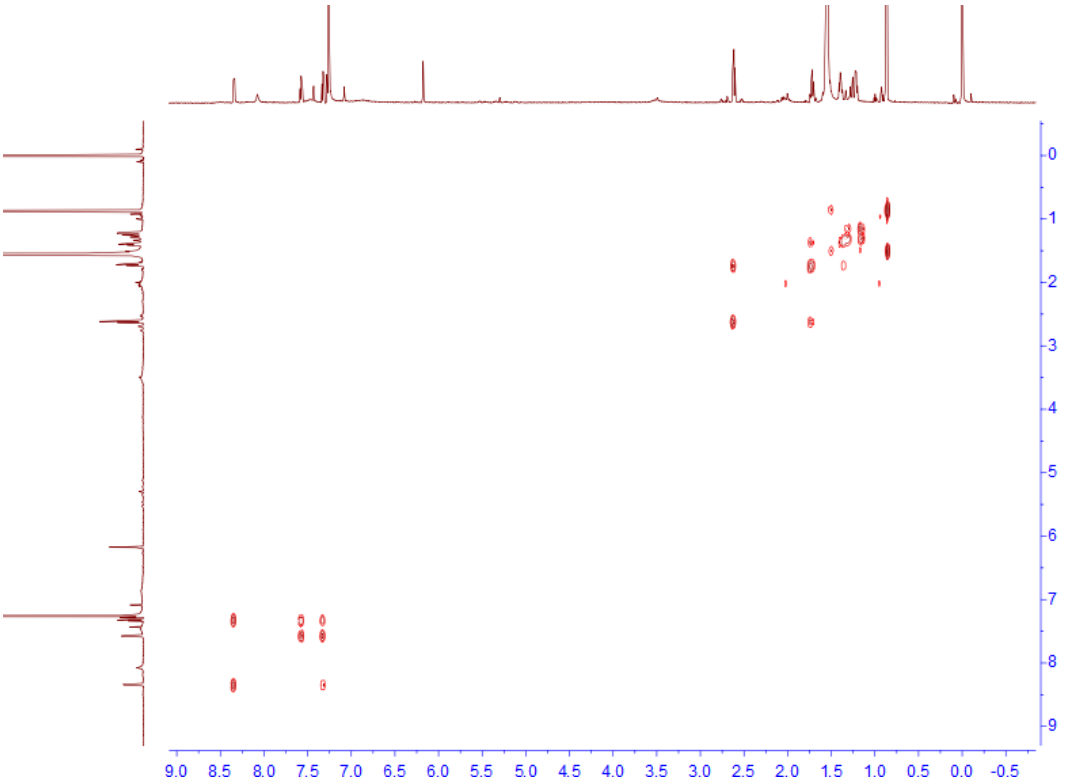
HMBC spectrum of compound **1**



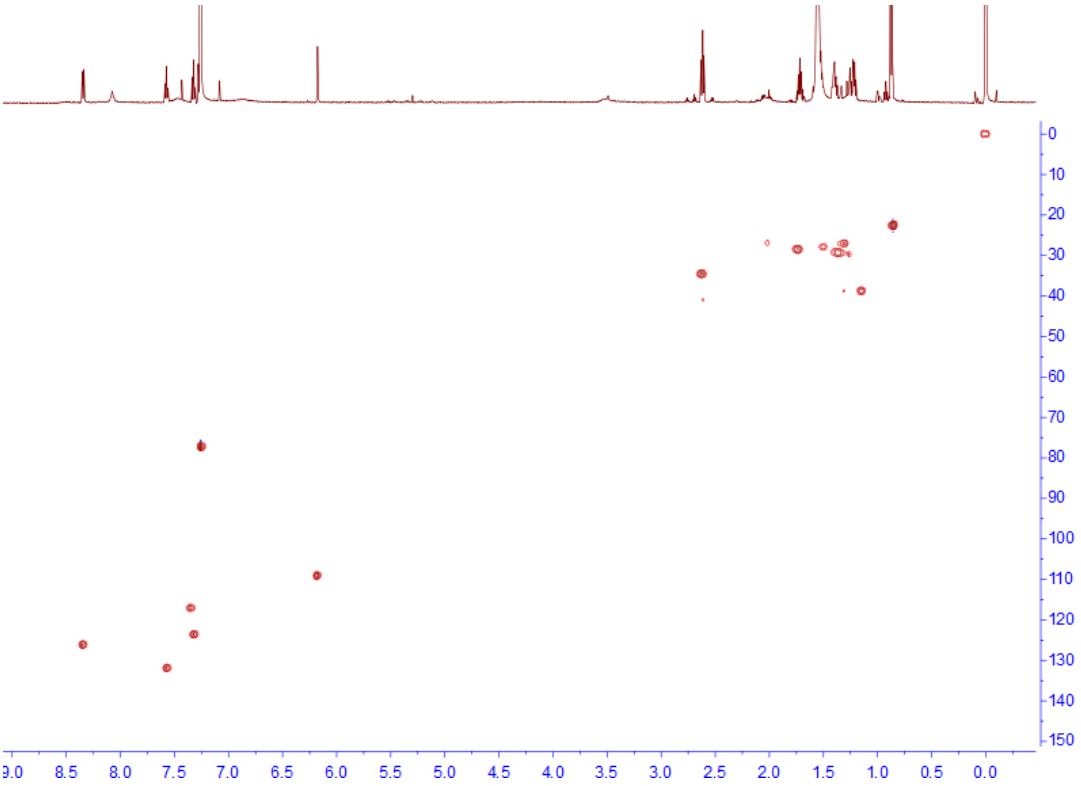
HRESI MS spectra of compound **2**



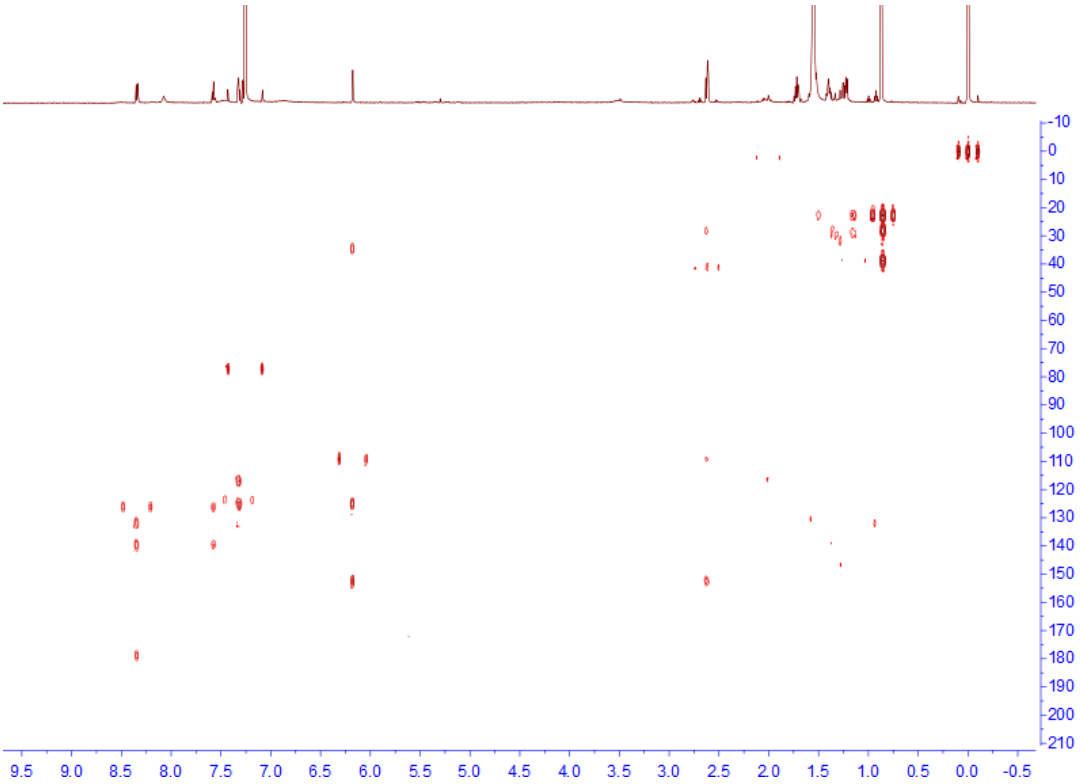
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **2**



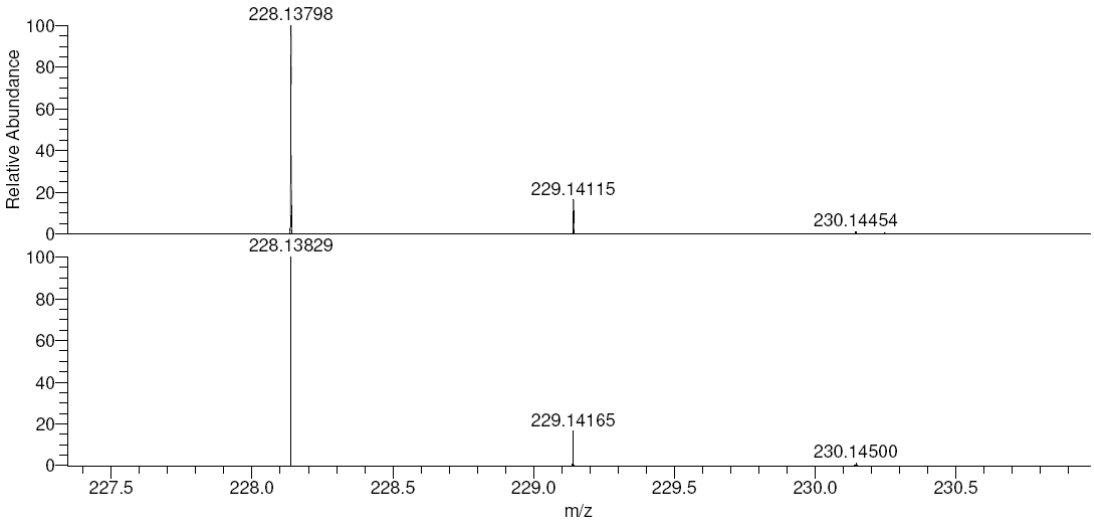
COSY spectrum of compound **2**



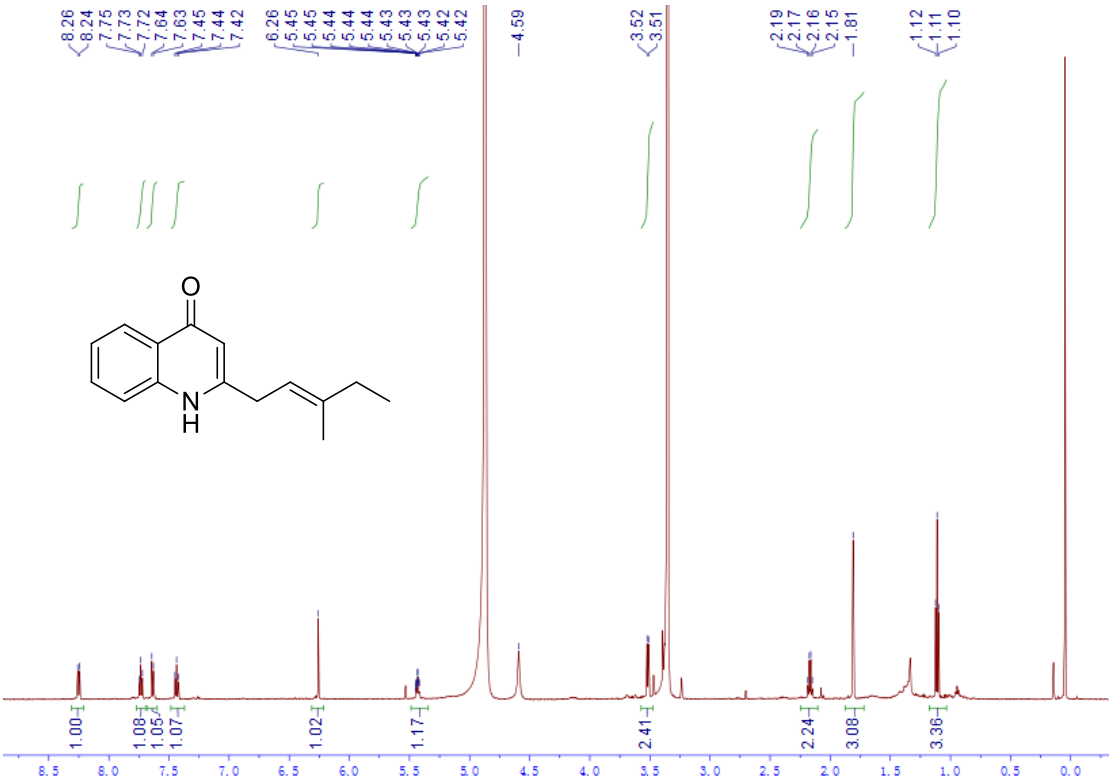
HSQC spectrum of compound **2**



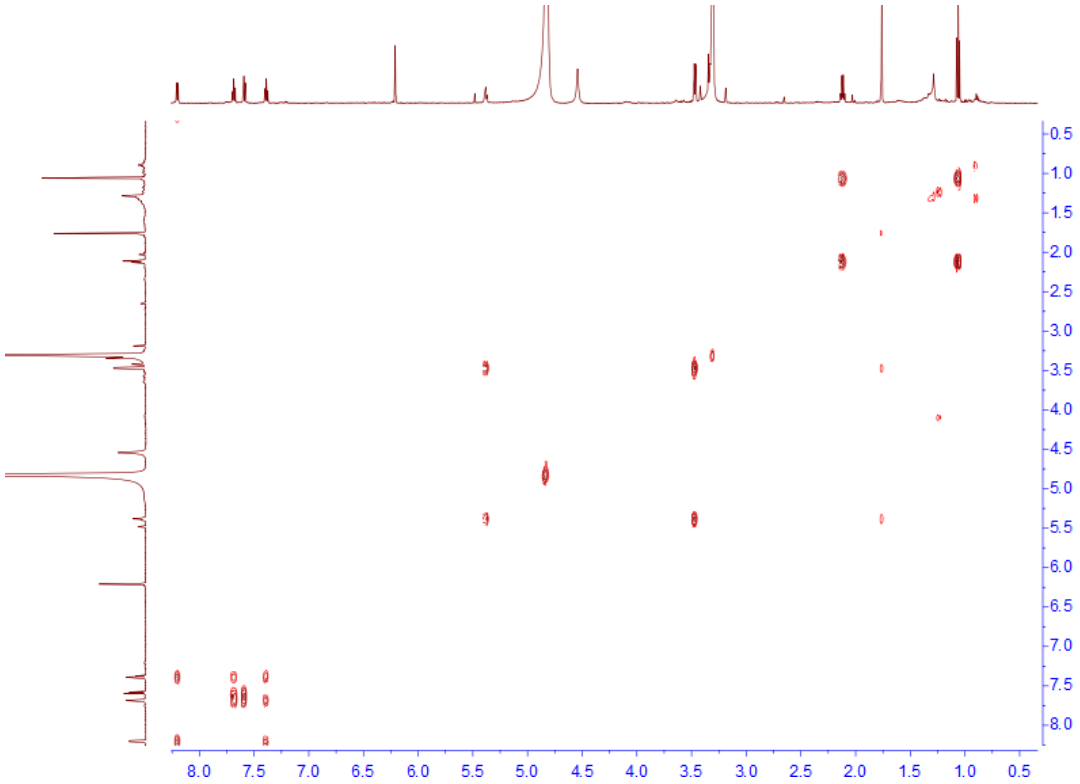
HMBC spectrum of compound **2**



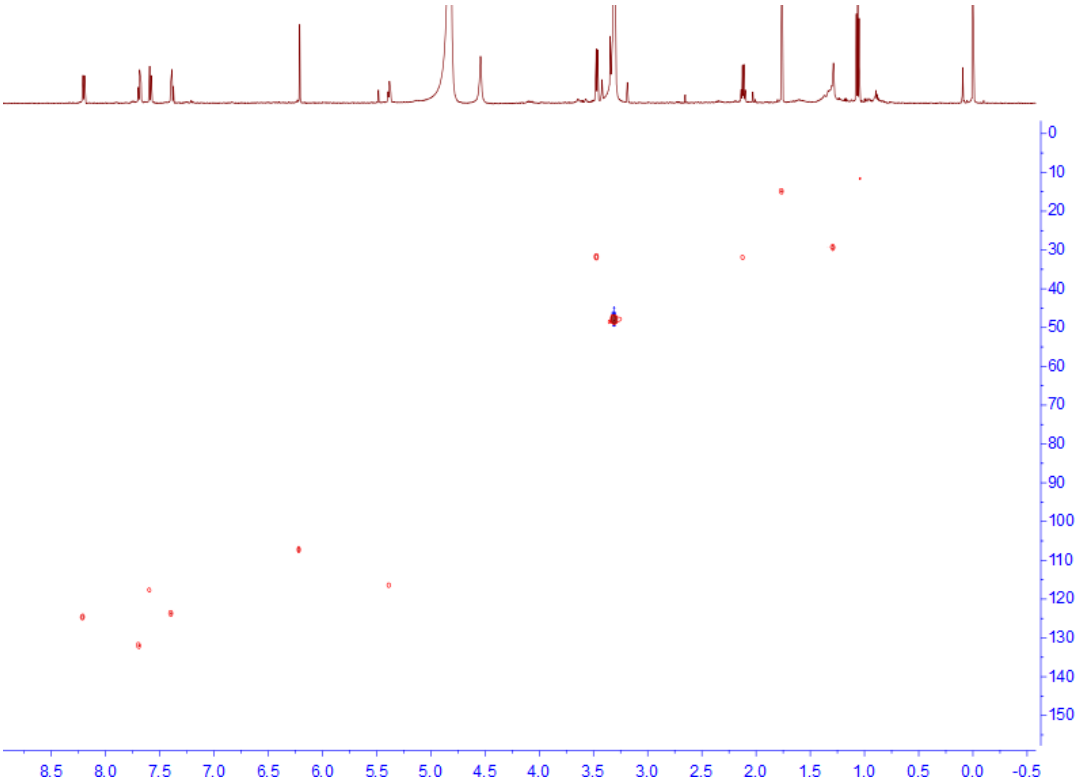
HRESI MS spectra of compound **3**



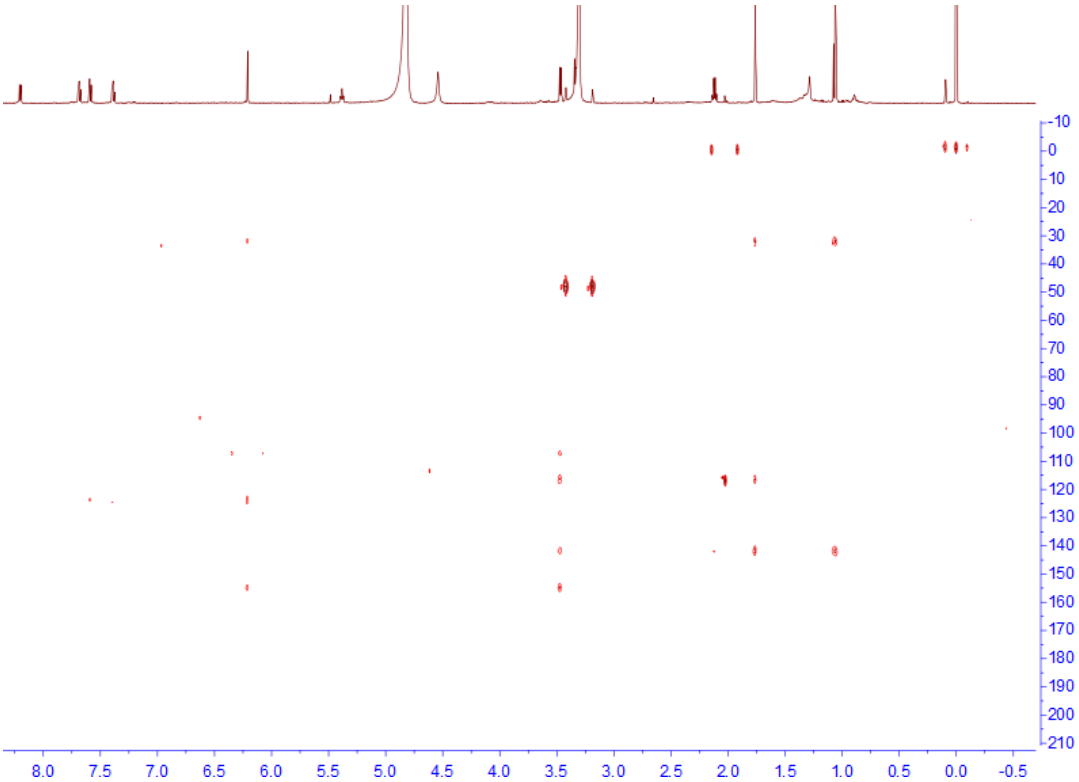
^{1}H-NMR (600 MHz, methanol-d_4) spectrum of compound **3**



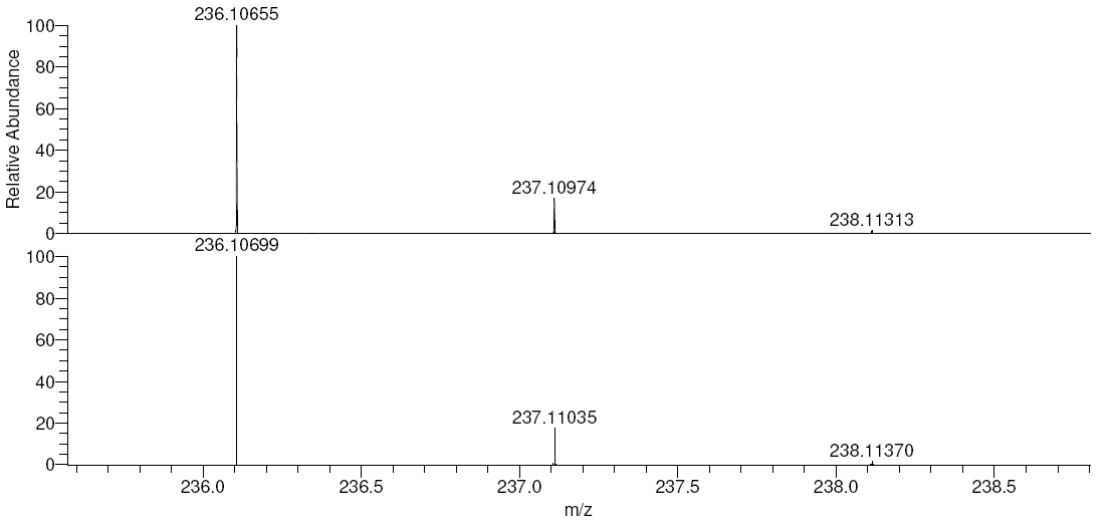
COSY spectrum of compound **3**



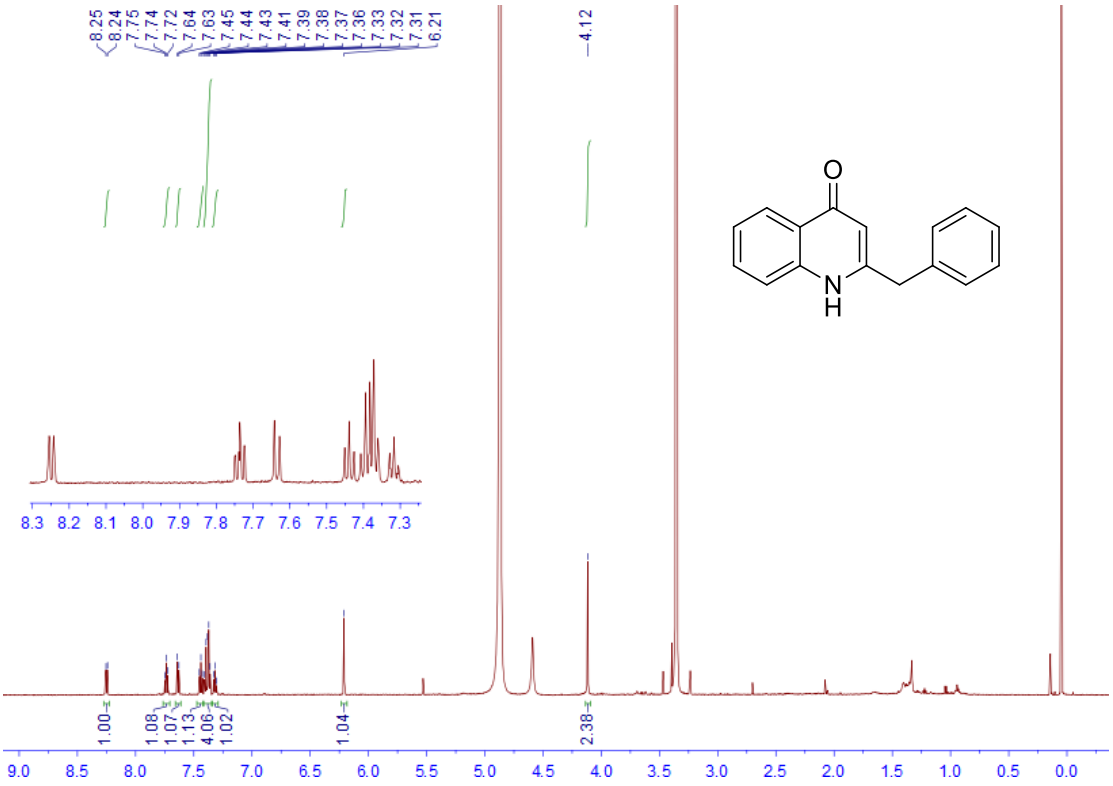
HSQC spectrum of compound **3**



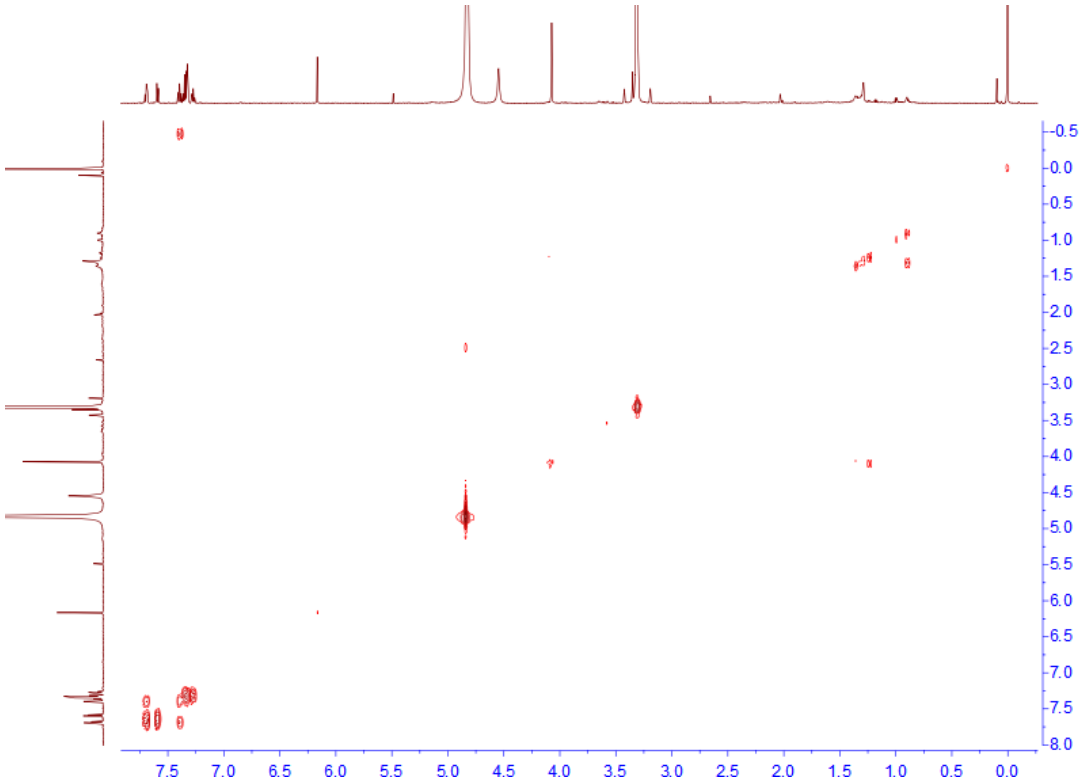
HMBC spectrum of compound **3**



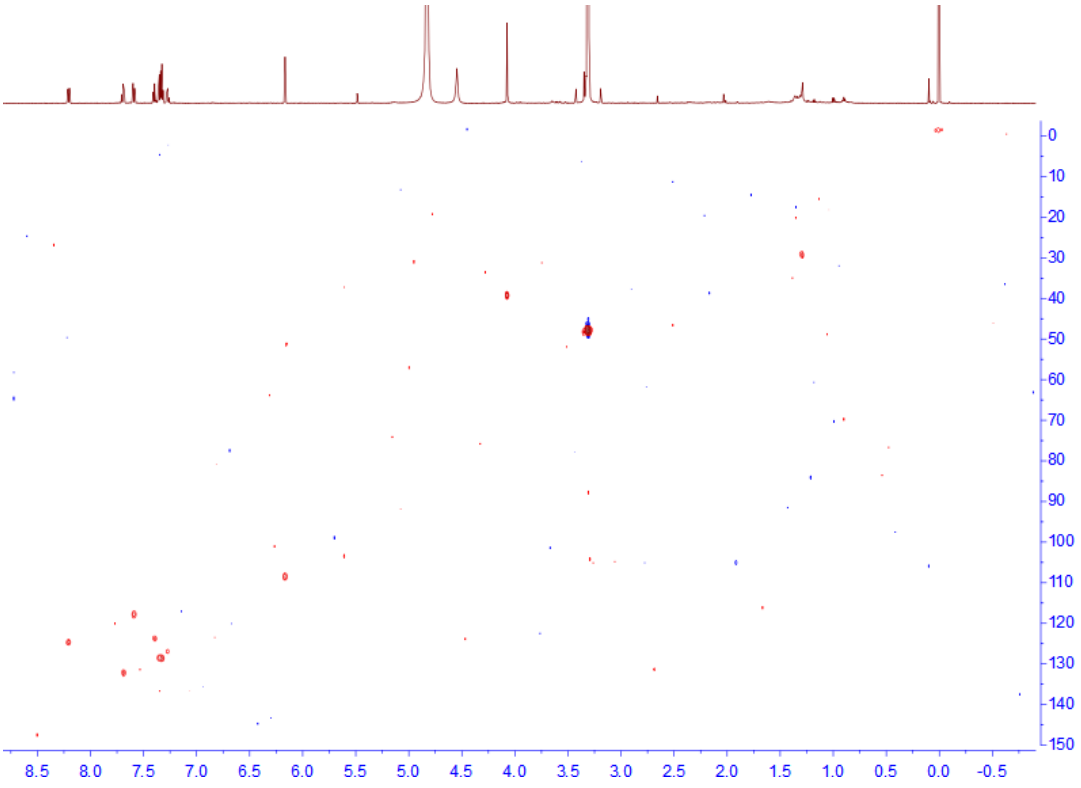
HRESI MS spectra of compound **4**



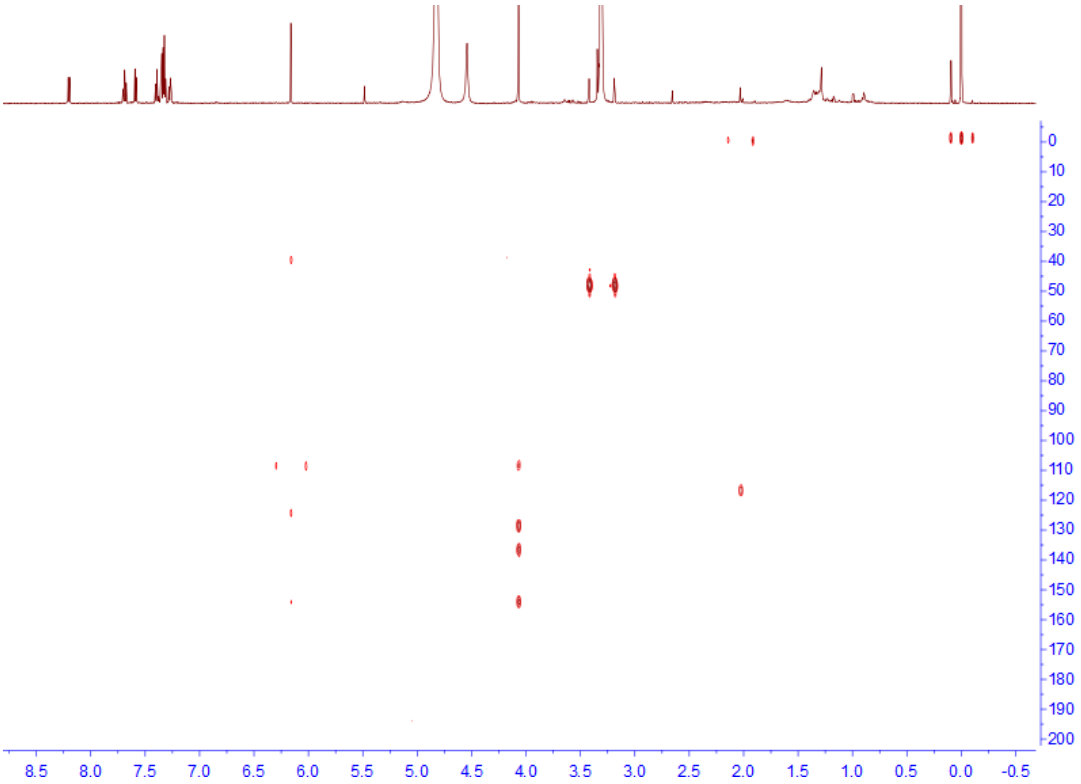
^{1}H-NMR (600 MHz, methanol-d_4) spectrum of compound **4**



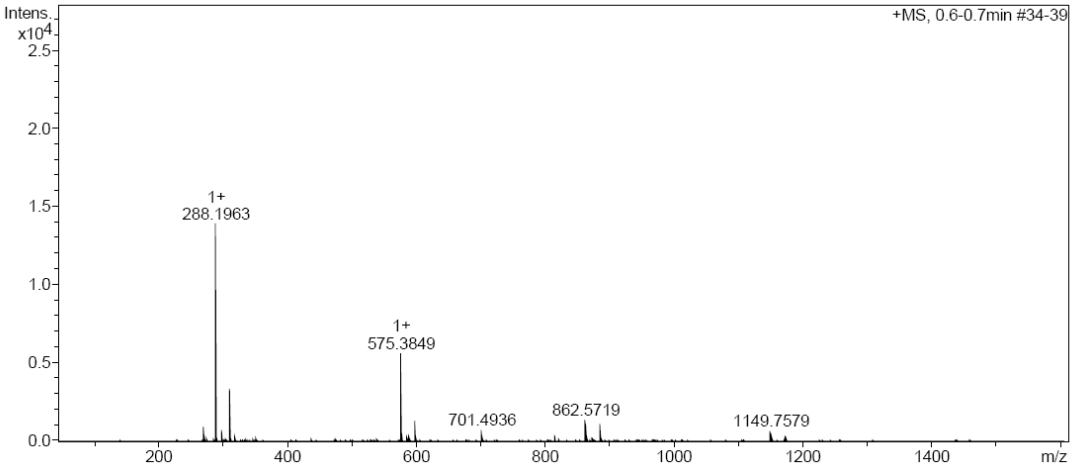
COSY spectrum of compound **4**



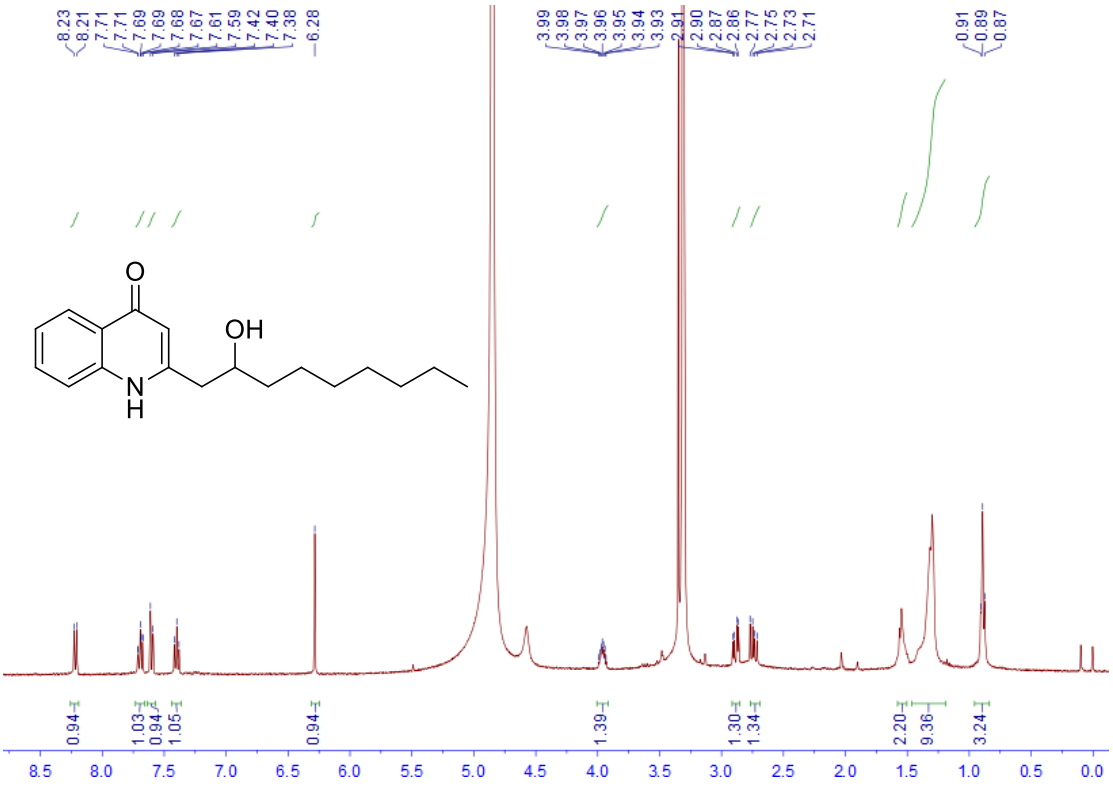
HSQC spectrum of compound **4**



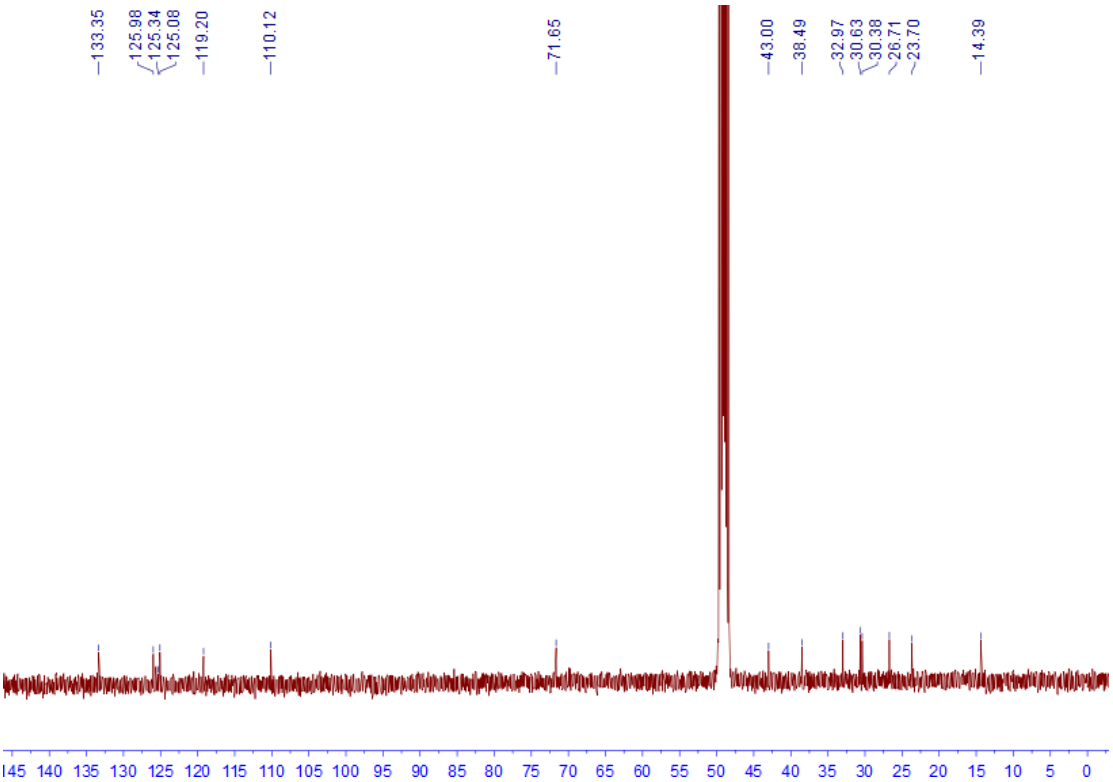
HMBC spectrum of compound **4**



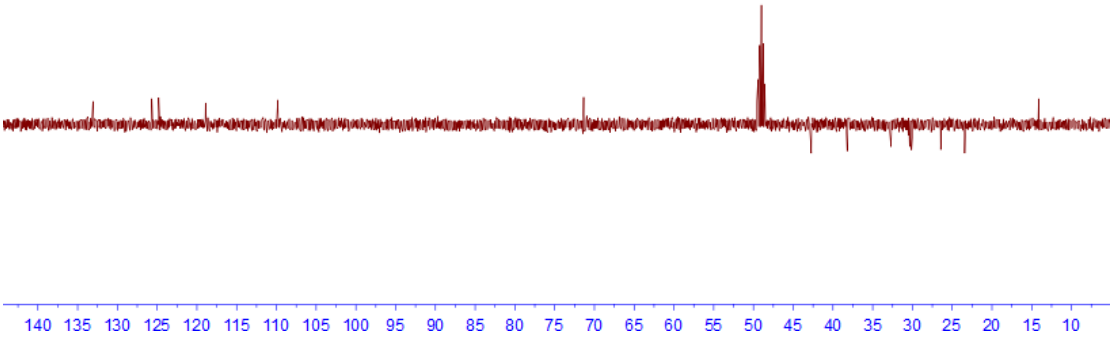
HRESI MS spectra of compound **5**



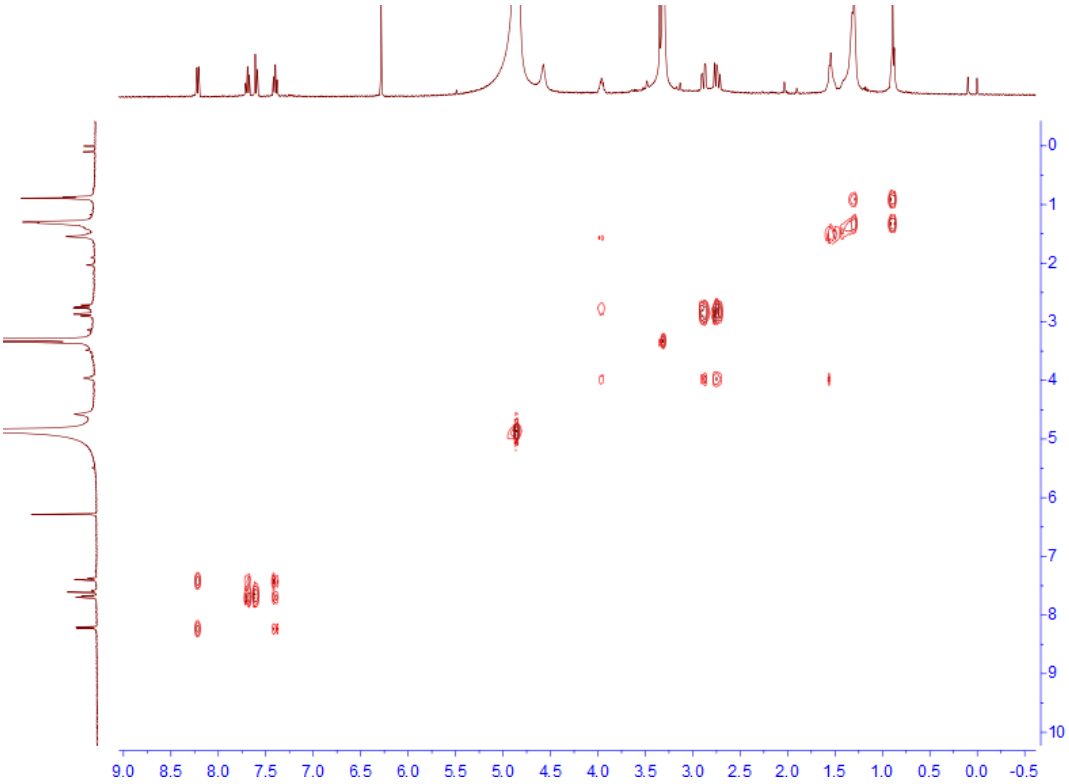
^{1}H-NMR (400 MHz, methanol-d_4) spectrum of compound **5**



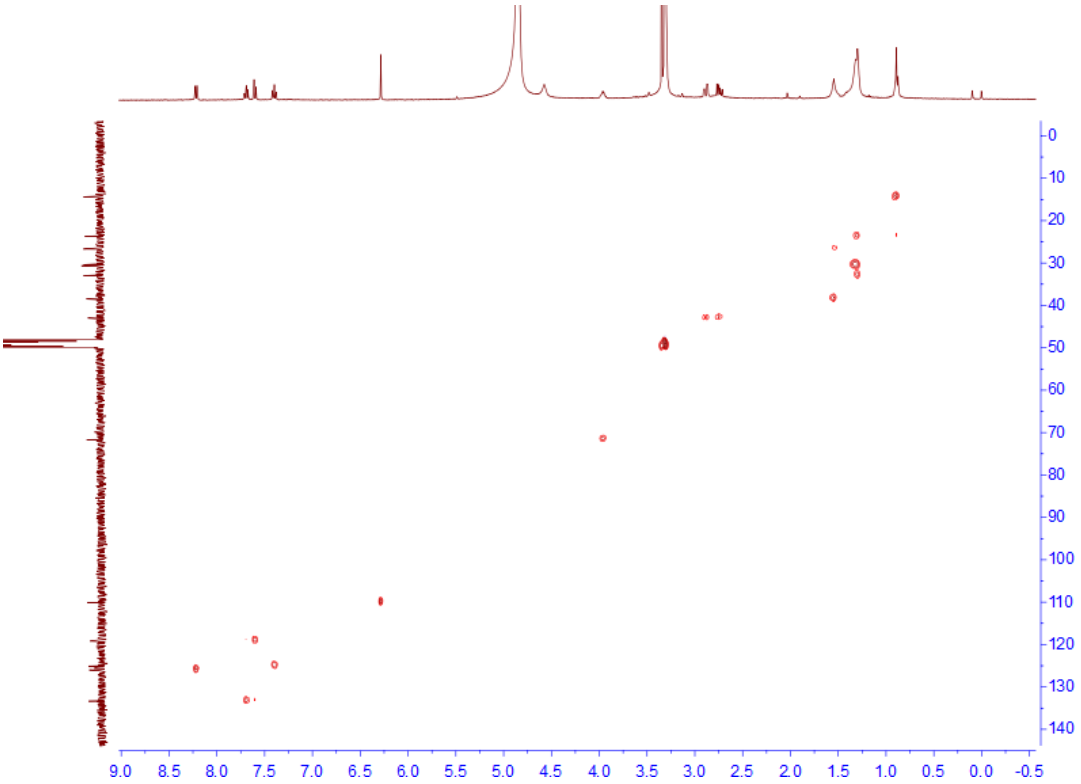
^{13}C-NMR (100 MHz, methanol-d_4) spectrum of compound **5**



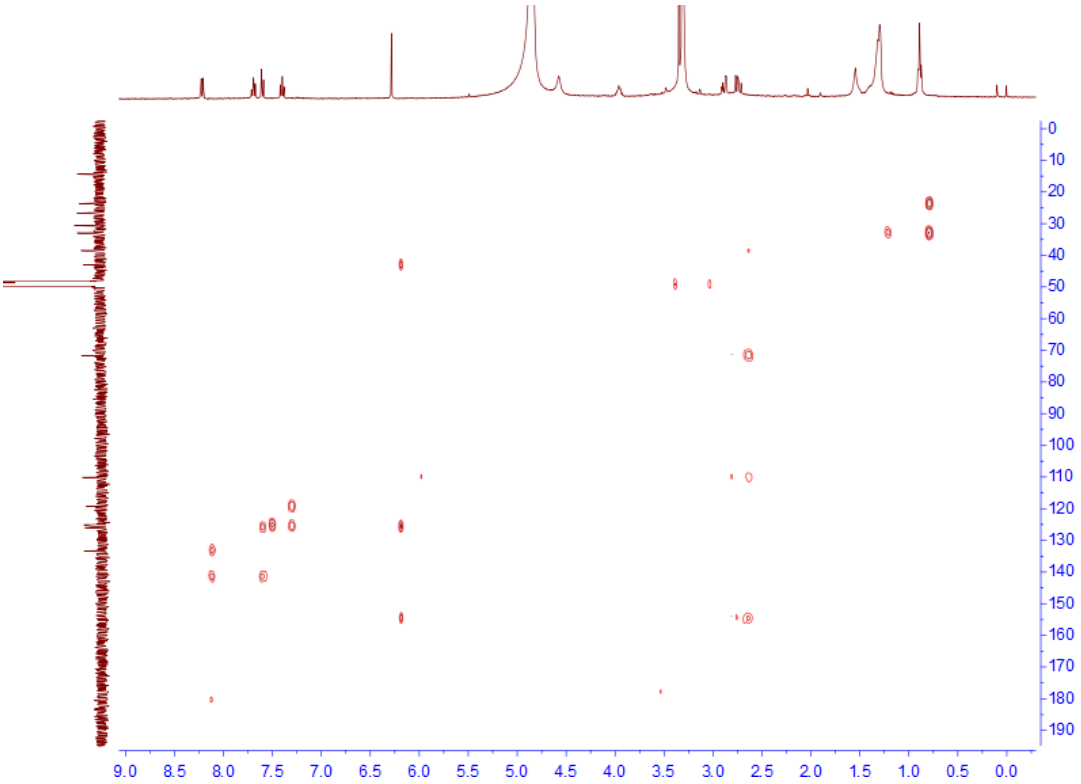
DEPT 135 spectrum of compound **5**



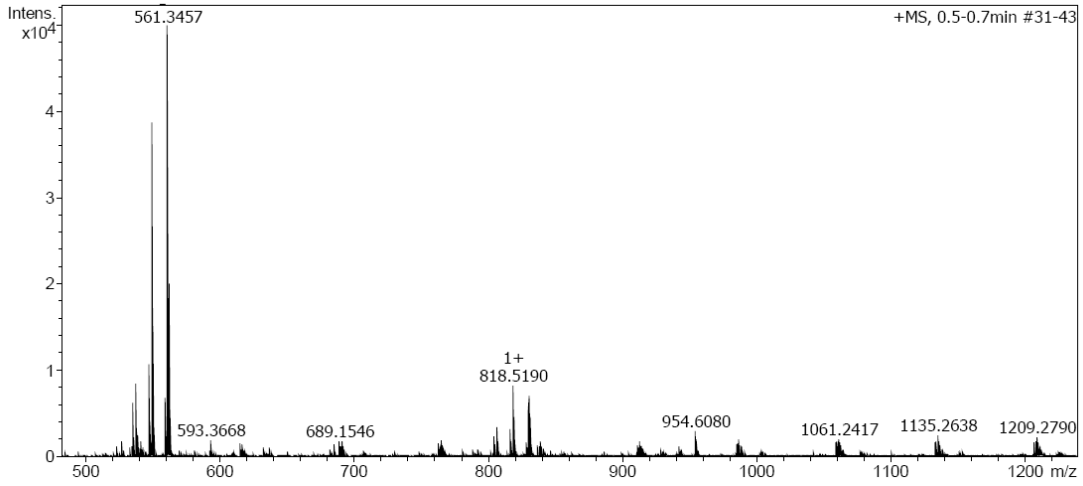
COSY spectrum of compound **5**



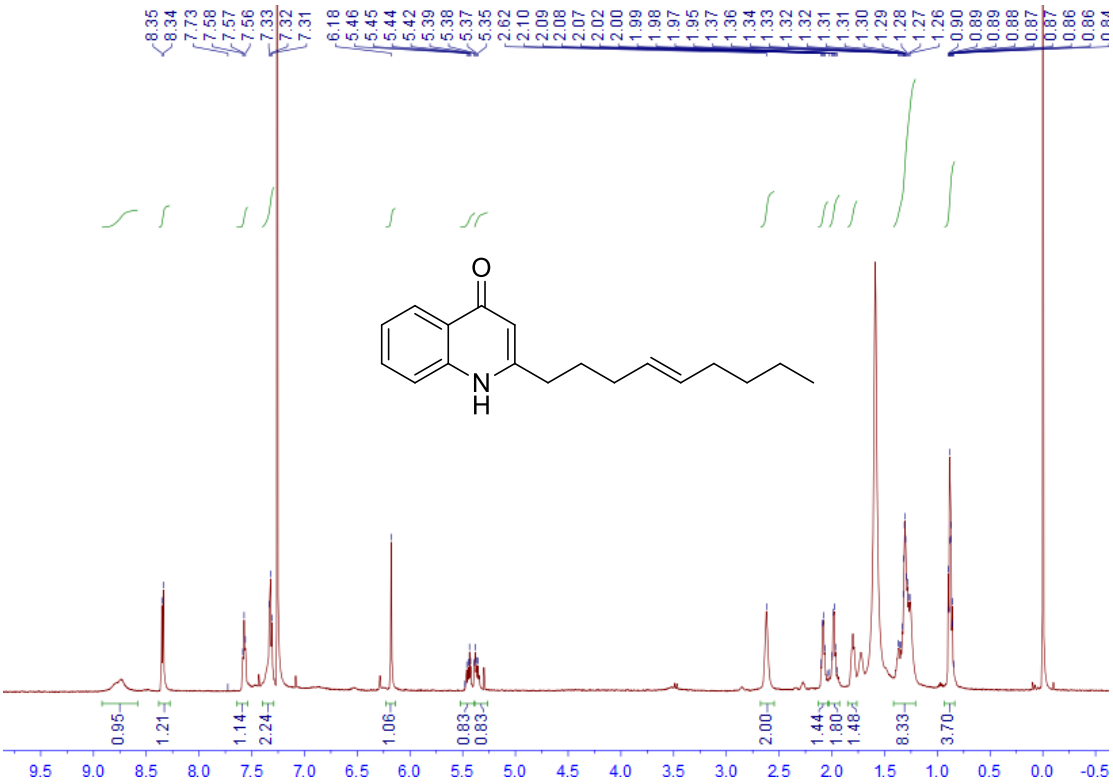
HSQC spectrum of compound **5**



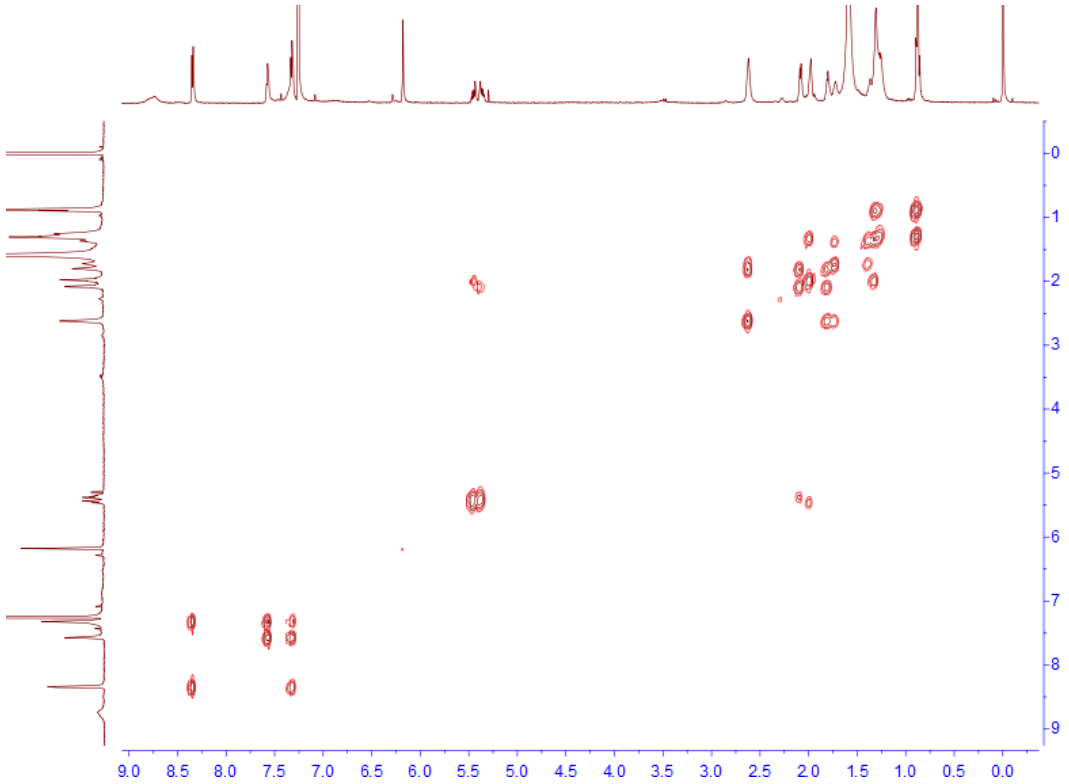
HMBC spectrum of compound **5**



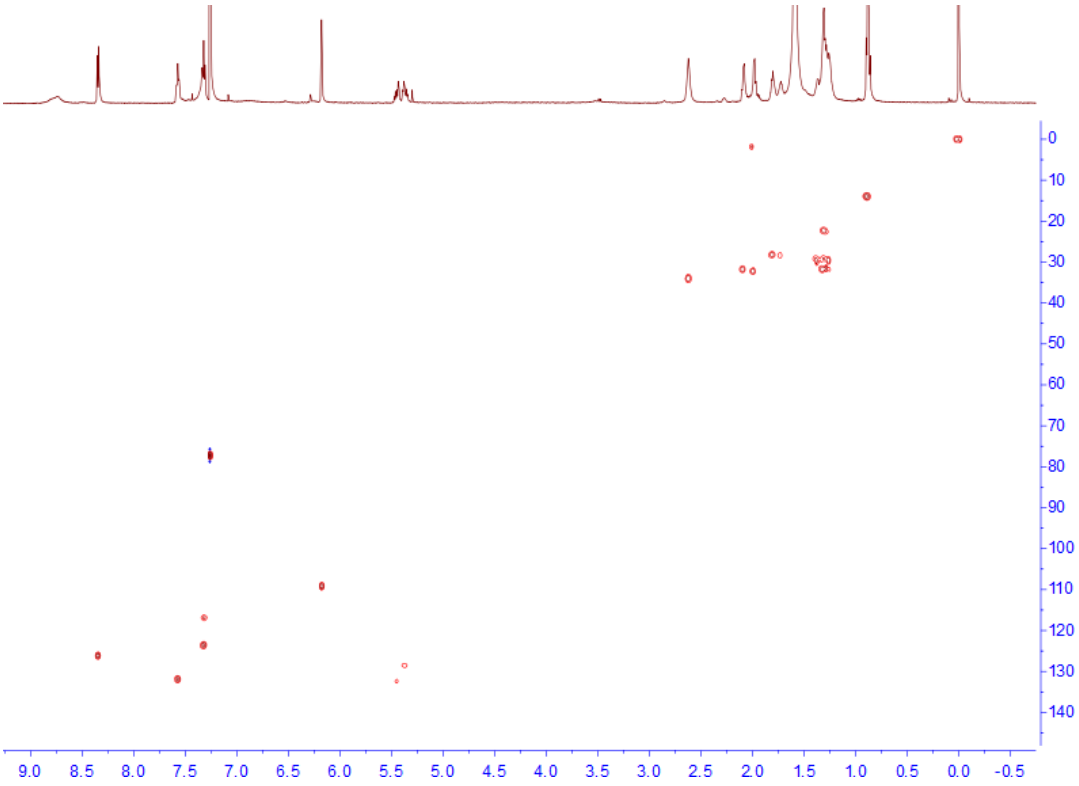
HRESI MS spectra of compound **6**



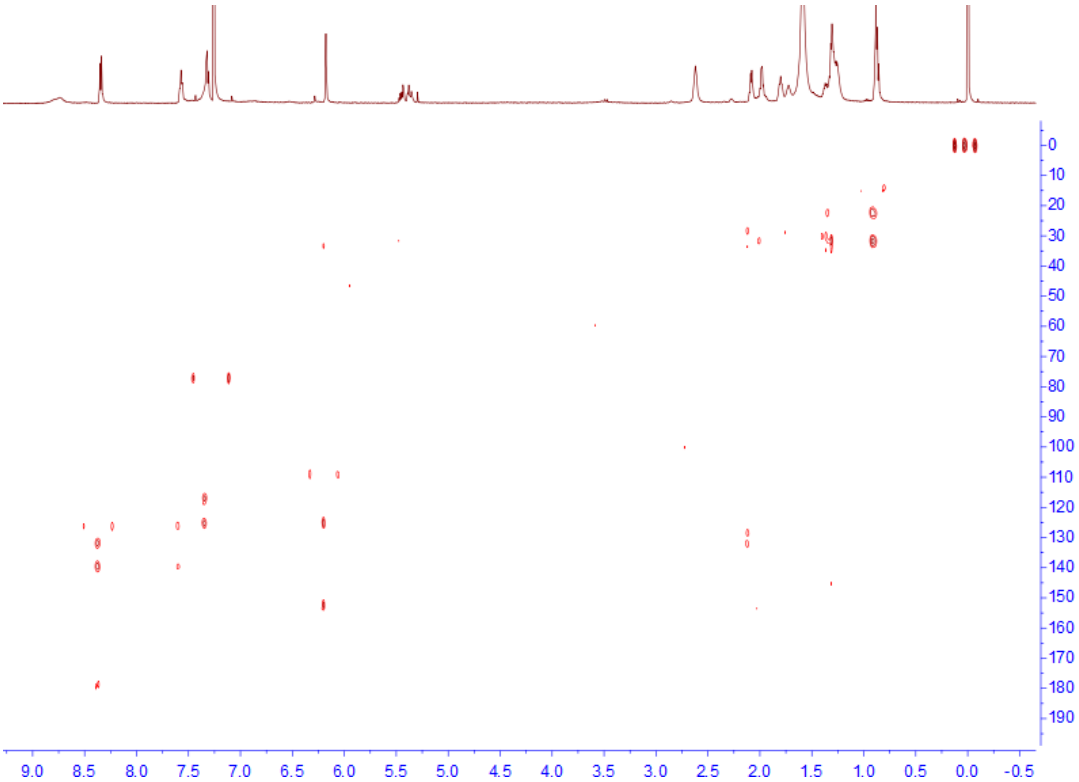
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **6**



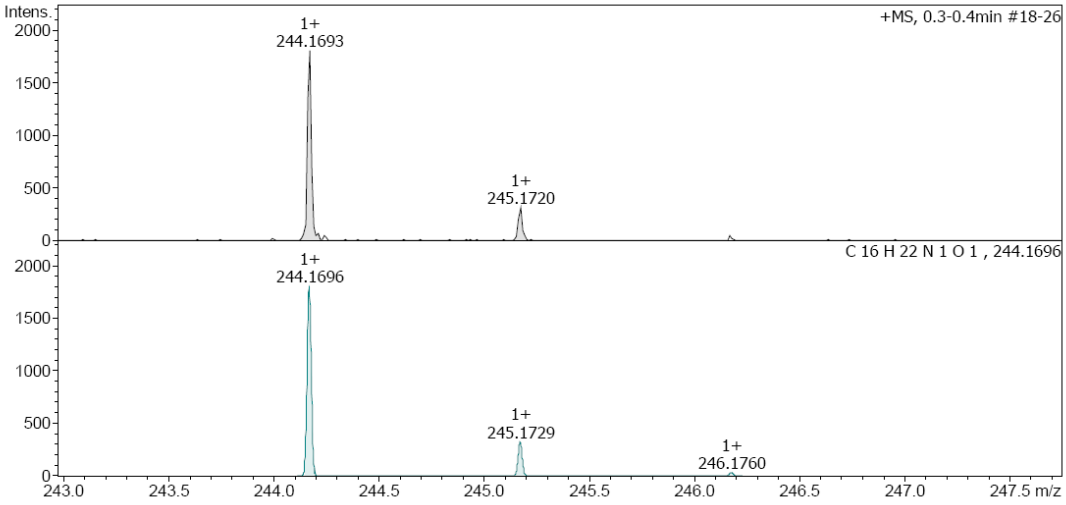
COSY spectrum of compound **6**



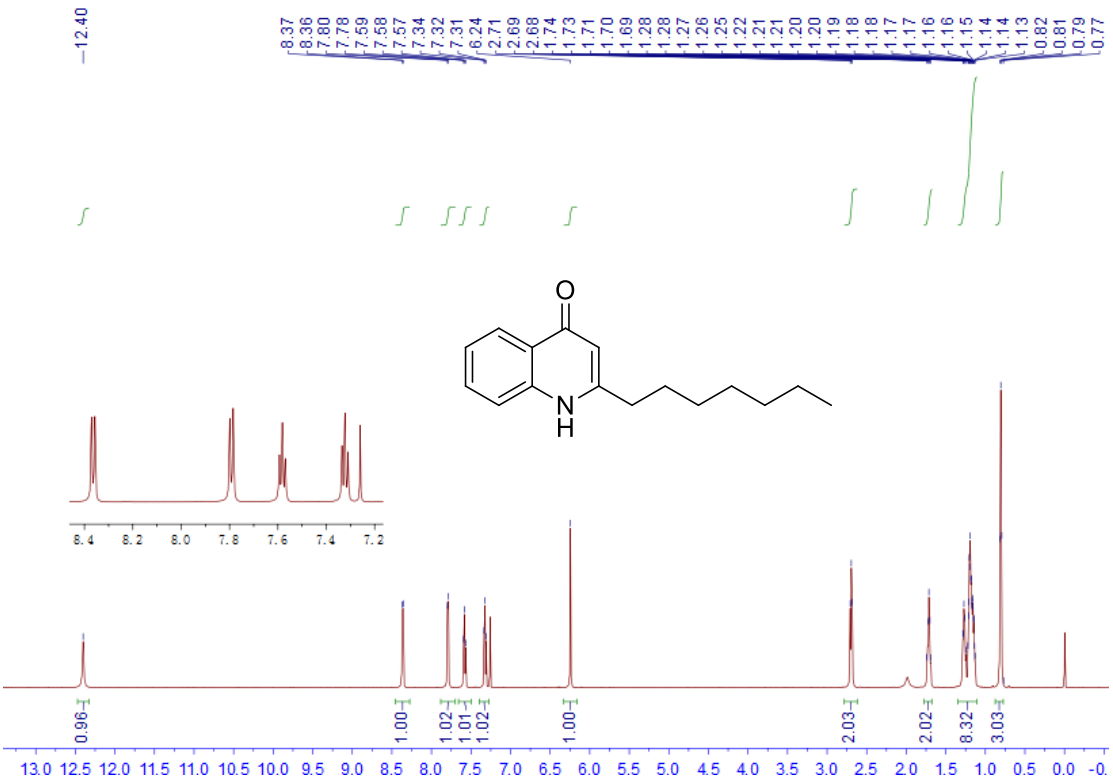
HSQC spectrum of compound **6**



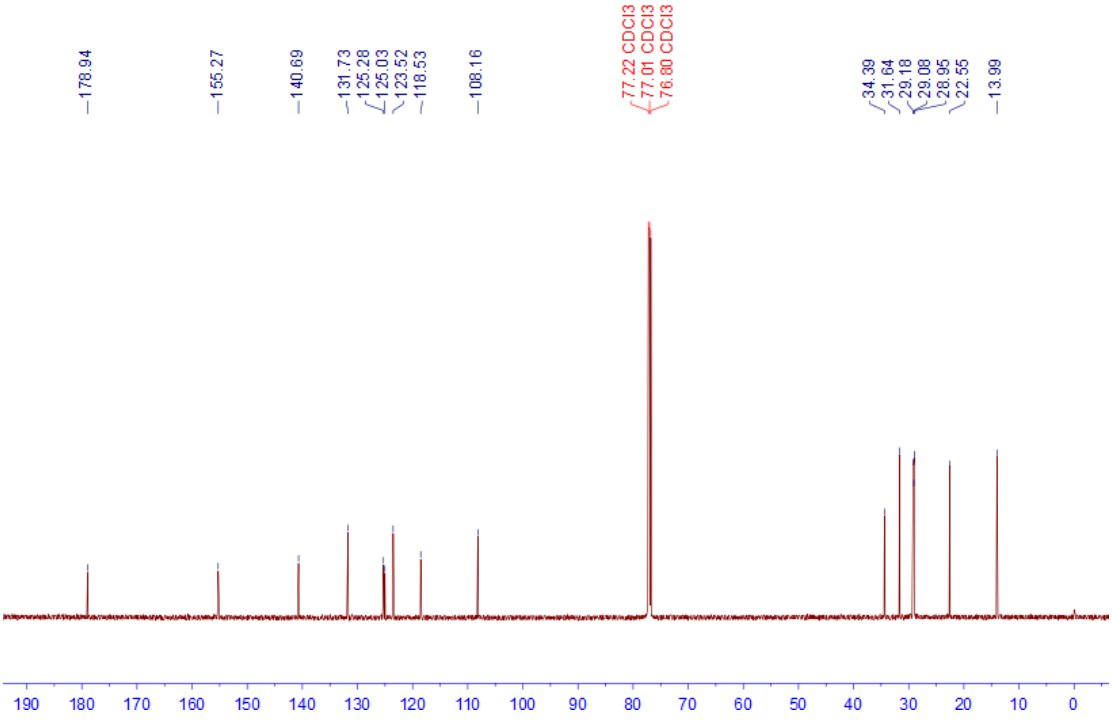
HMBC spectrum of compound **6**



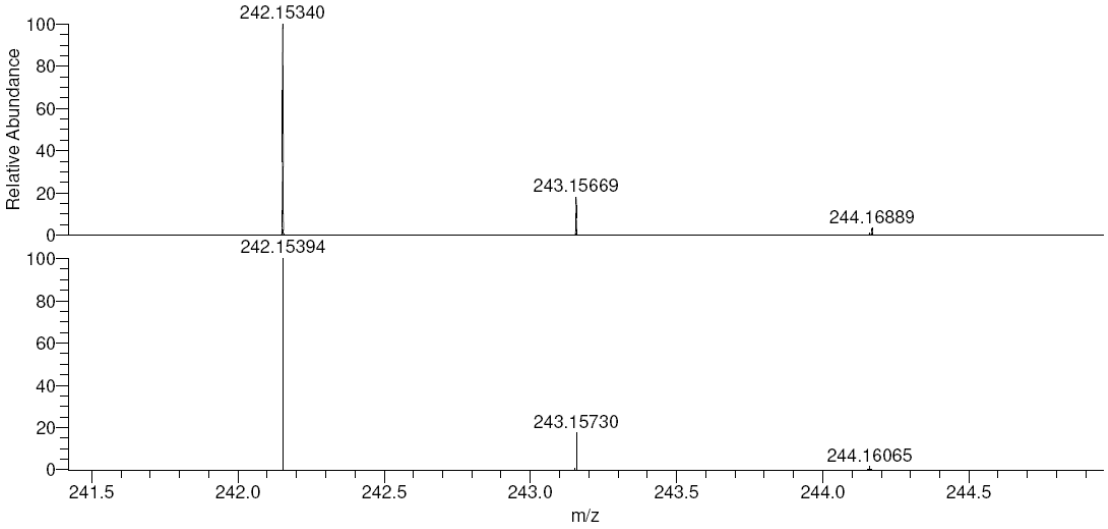
HRESI MS spectra of compound **S1**



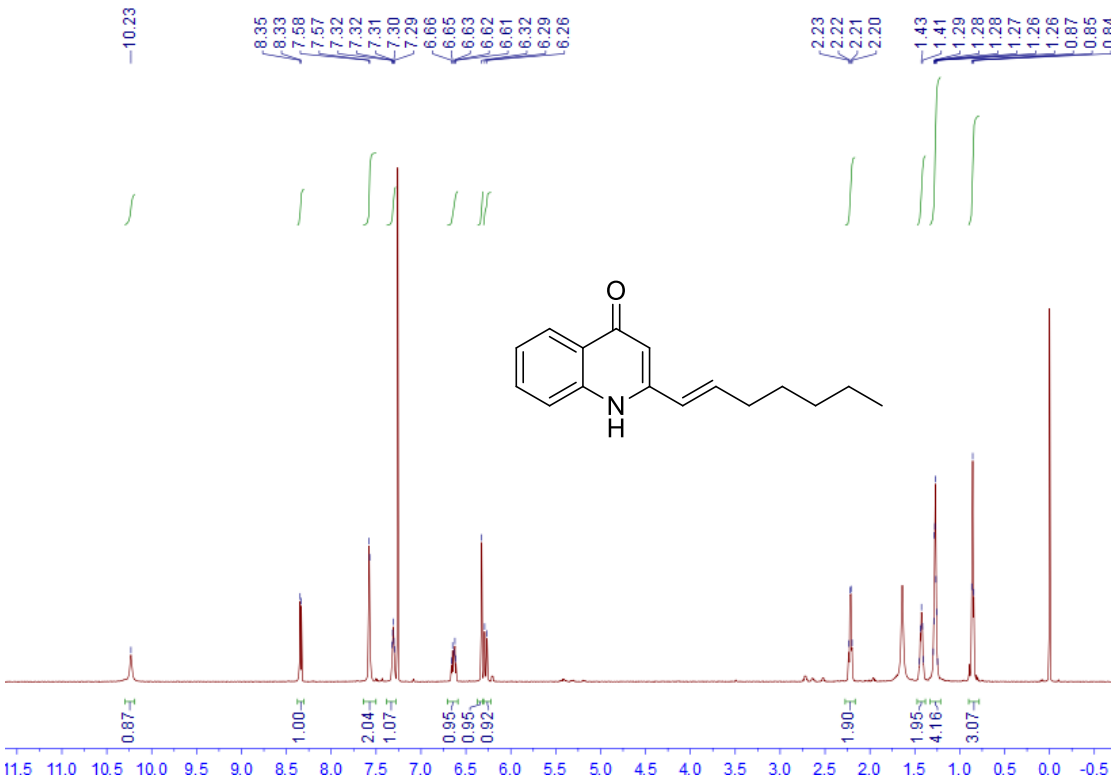
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S1**



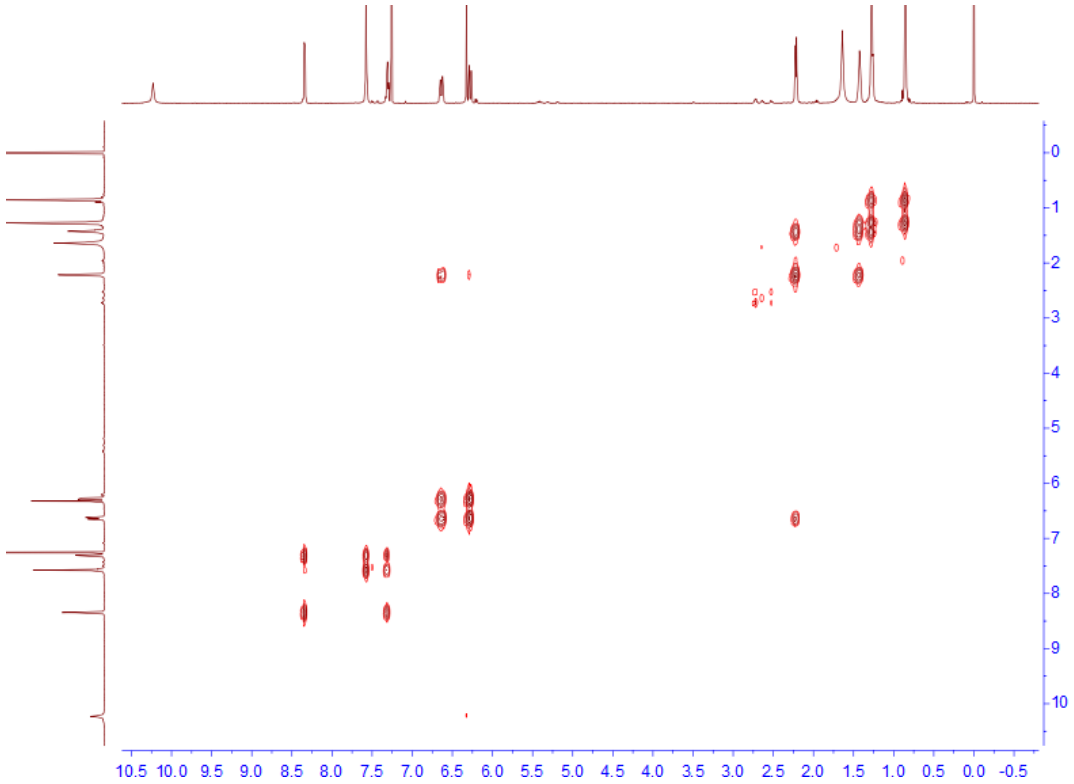
^{13}C-NMR (150 MHz, $CDCl_3$) spectrum of compound **S1**



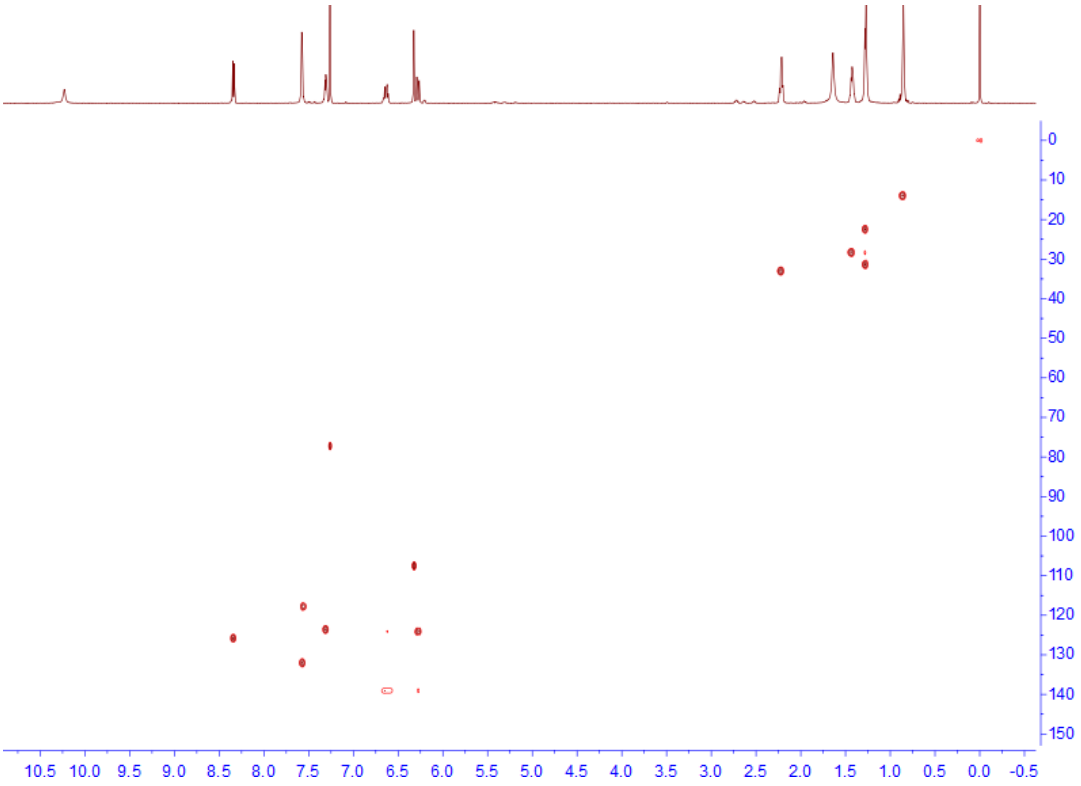
HRESI MS spectra of compound **S2**



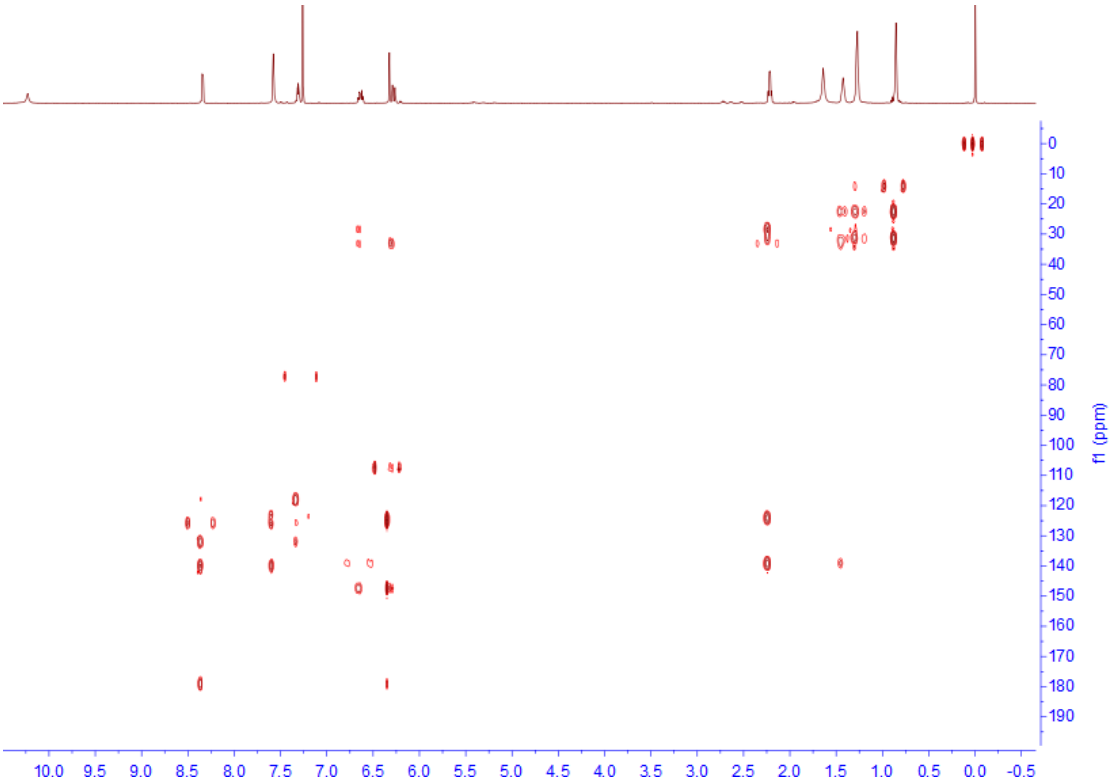
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S2**



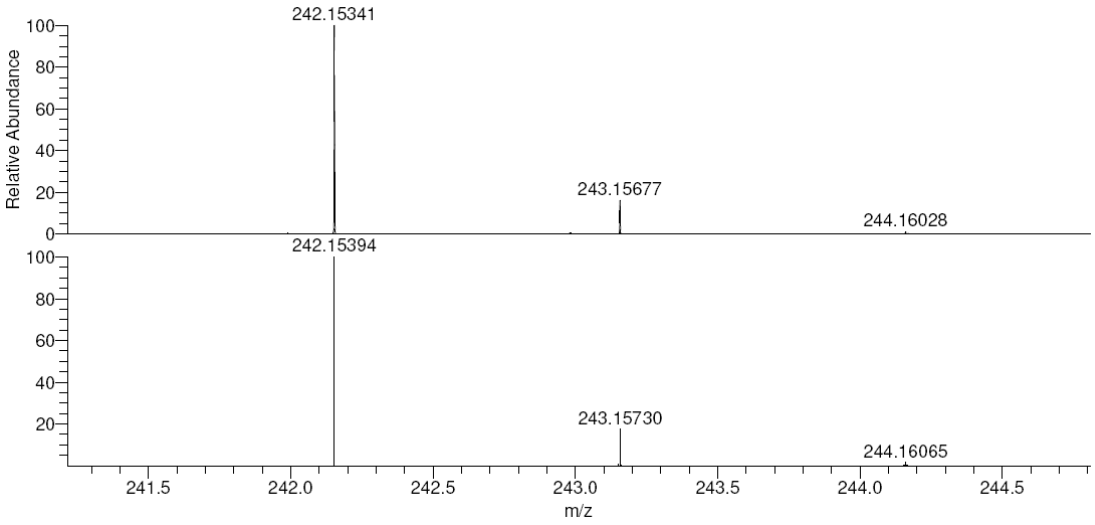
COSY spectrum of compound **S2**



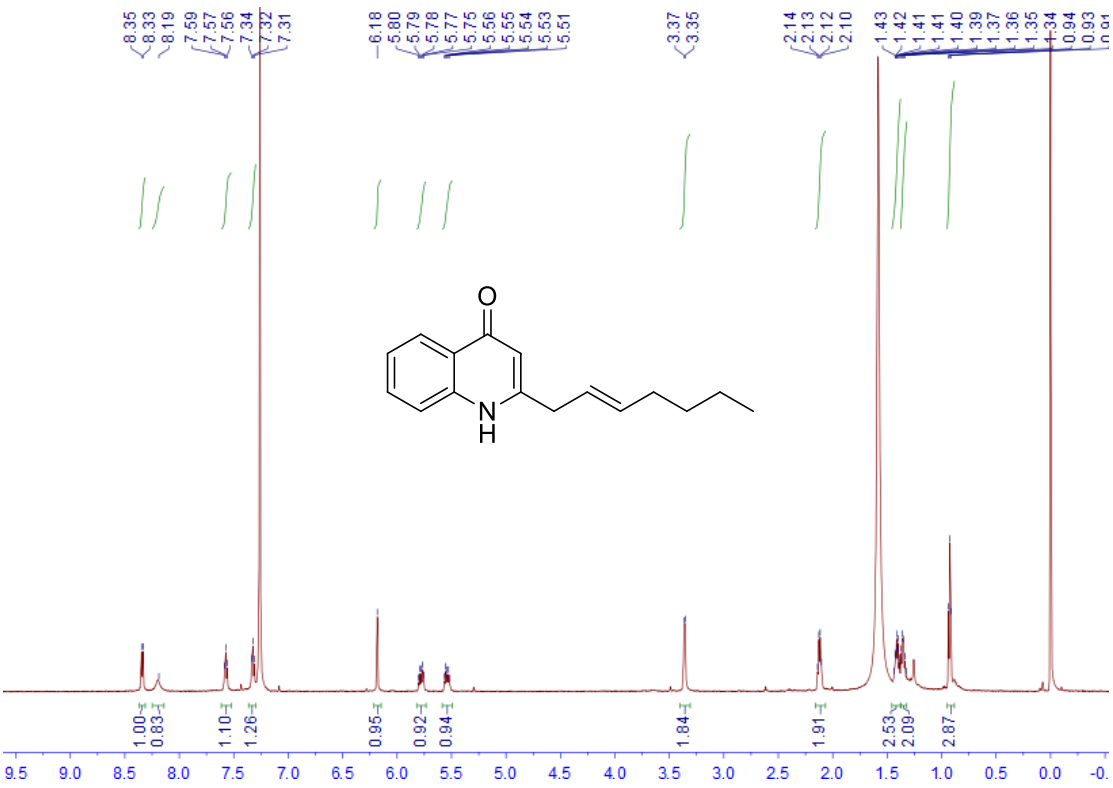
HSQC spectrum of compound **S2**



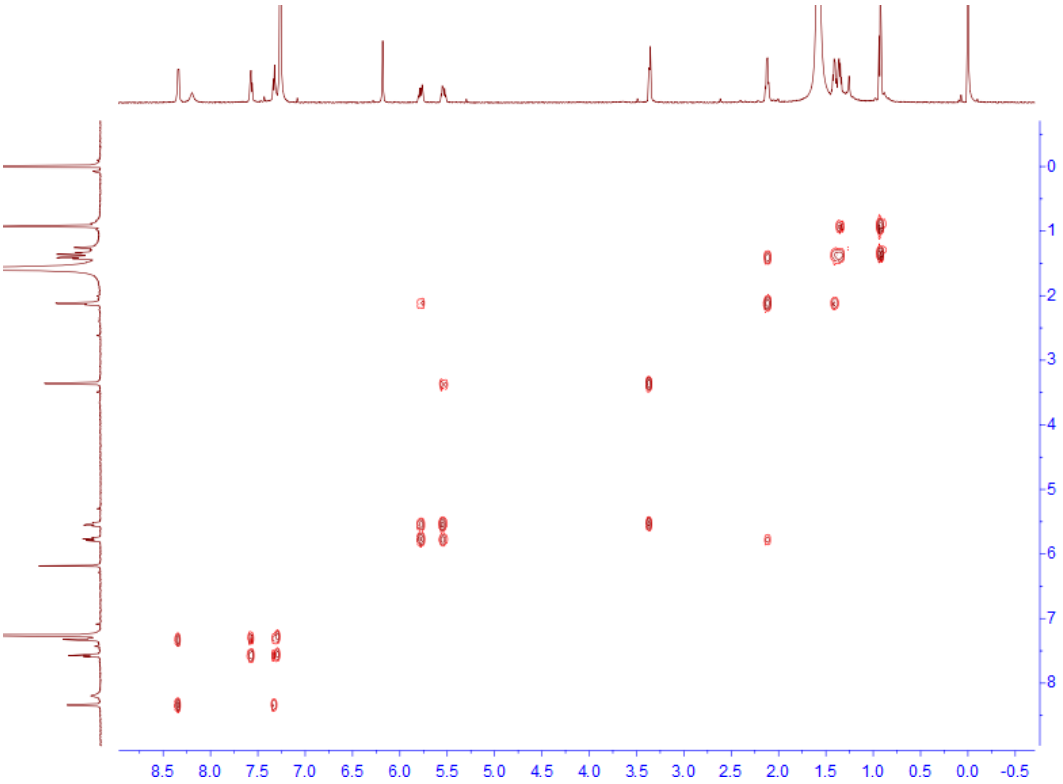
HMBC spectrum of compound **S2**



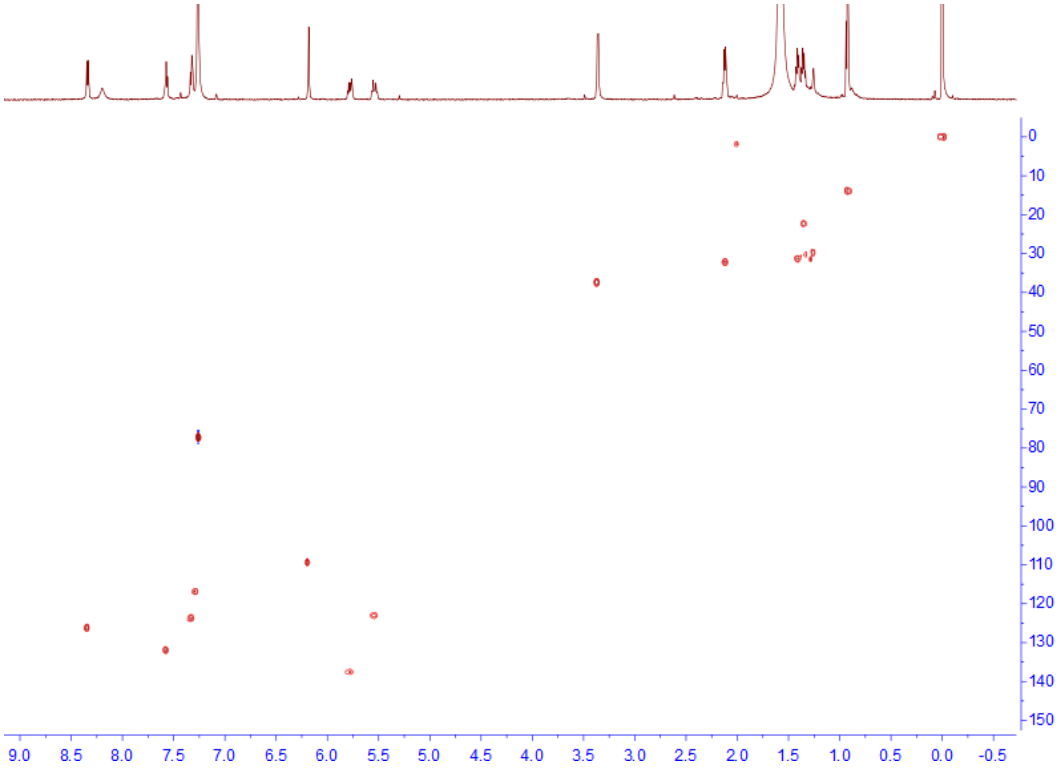
HRESI MS spectra of compound **S3**



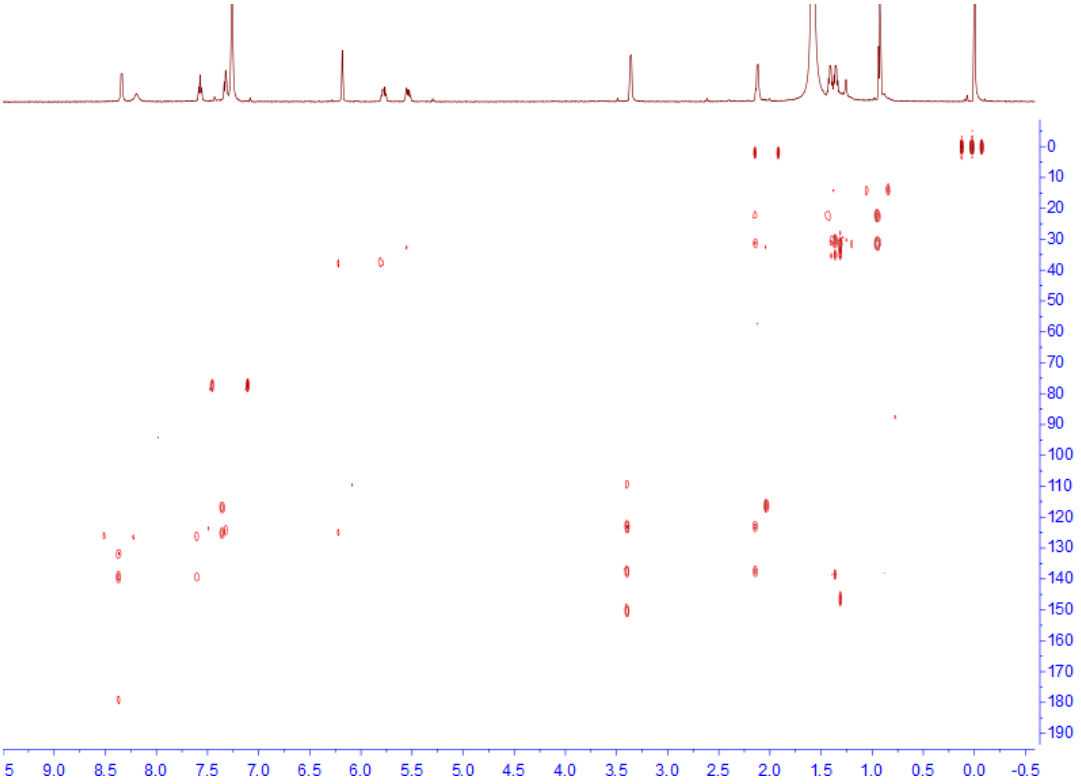
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S3**



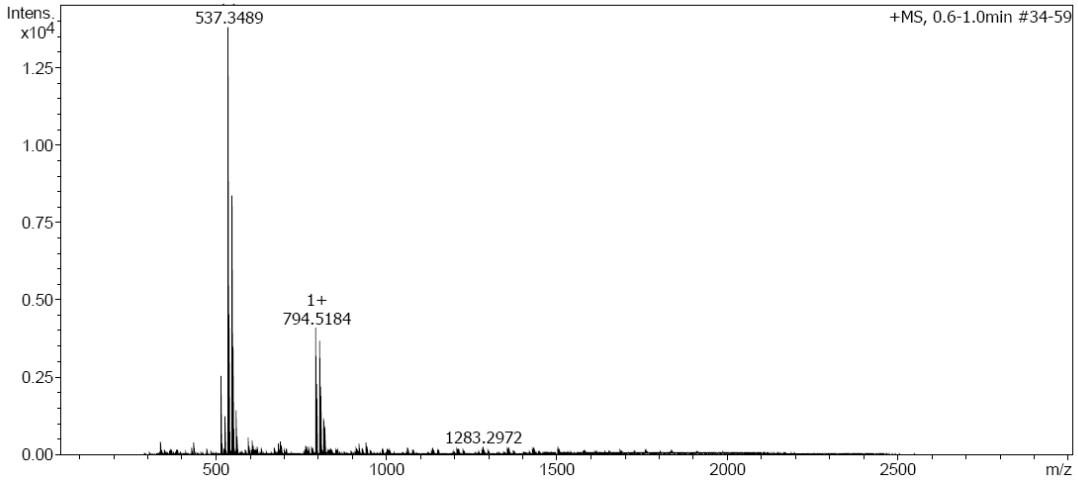
COSY spectrum of compound **S3**



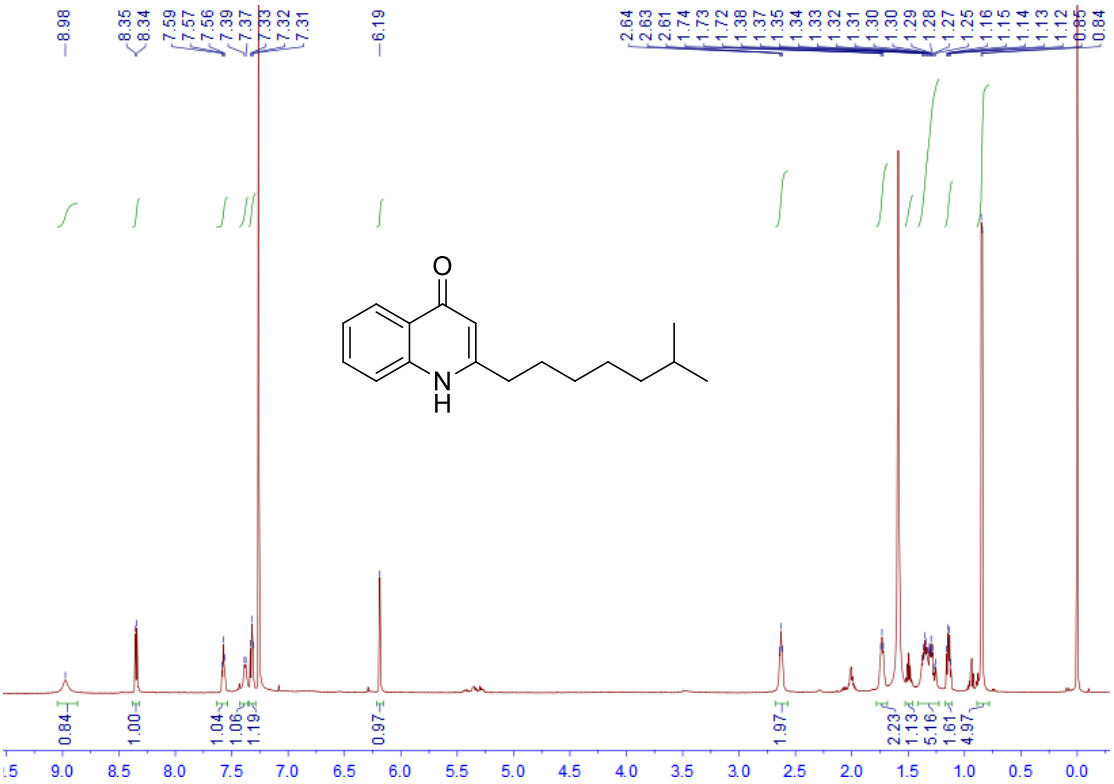
HSQC spectrum of compound **S3**



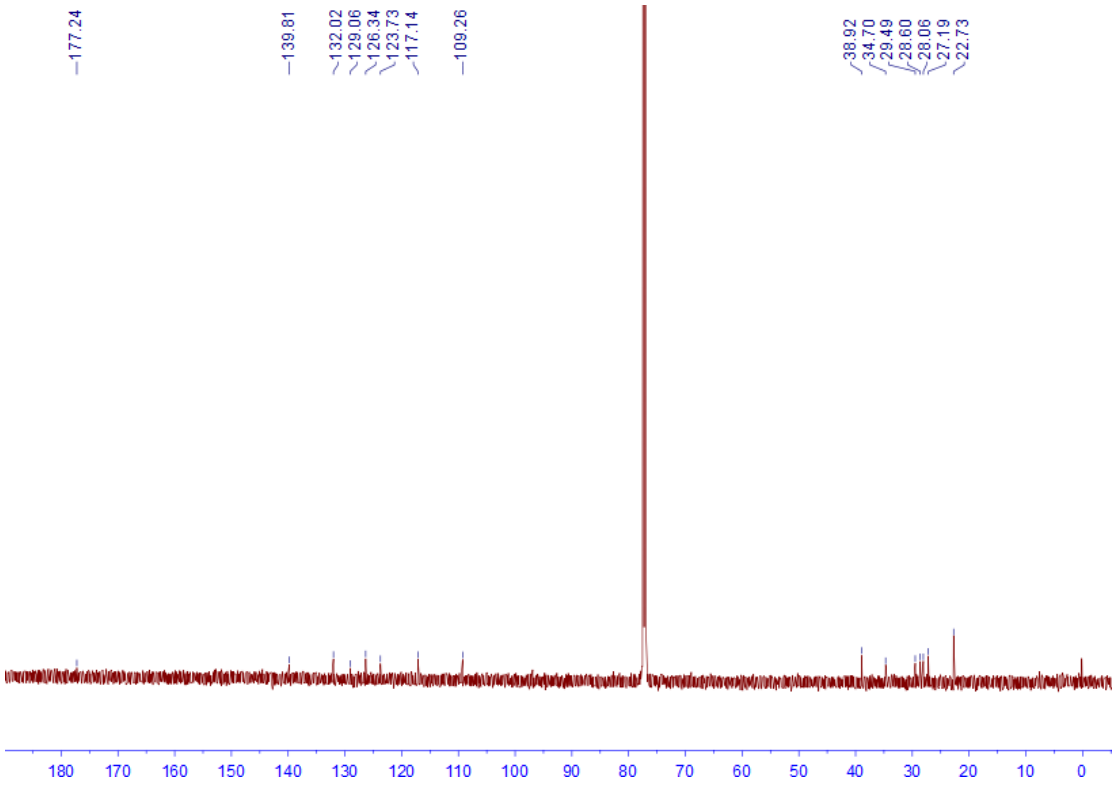
HMBC spectrum of compound **S3**



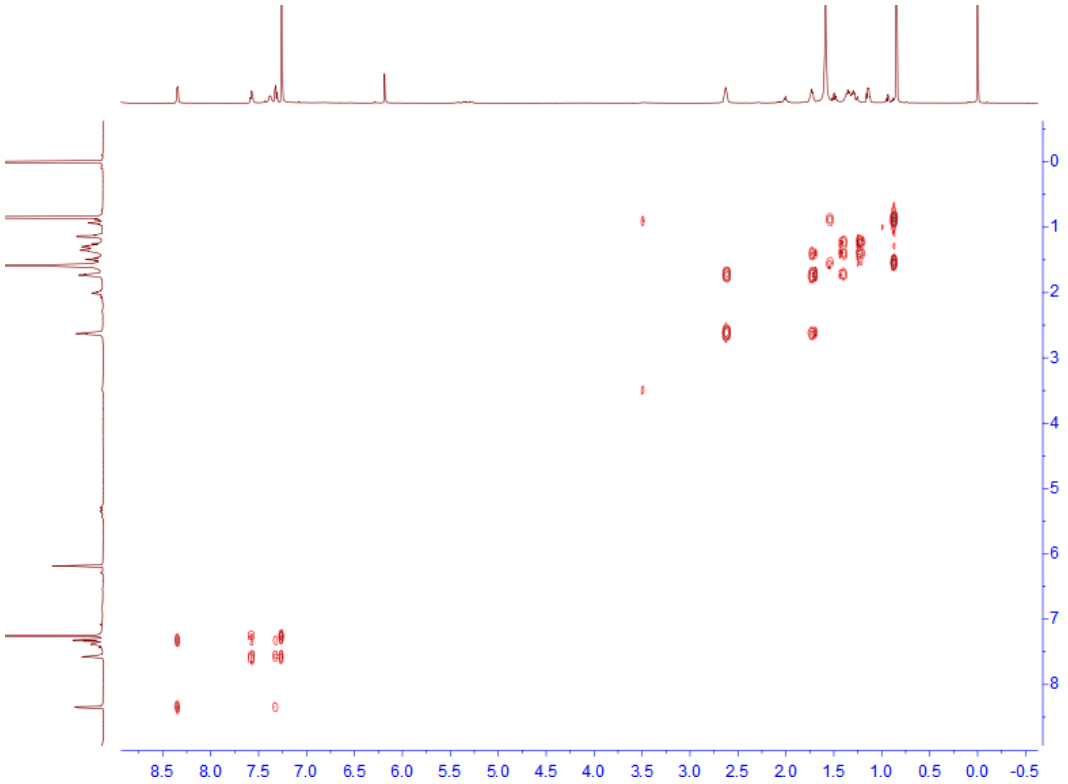
HRESI MS spectra of compound **S4**



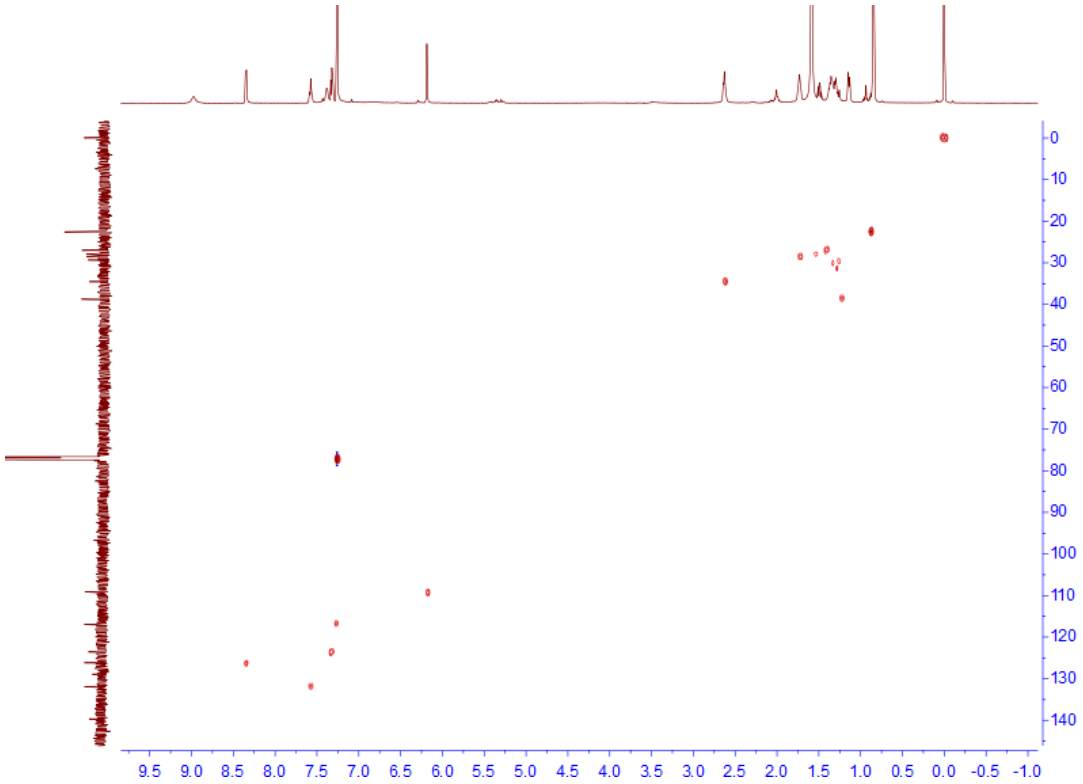
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S4**



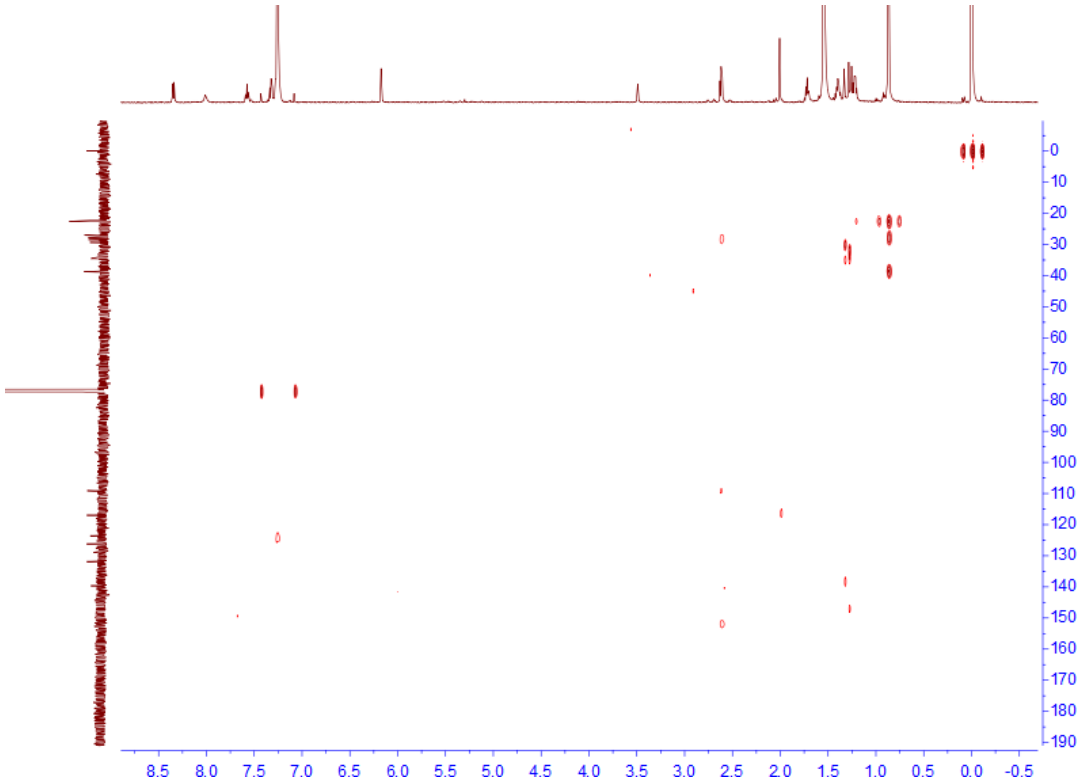
^{13}C-NMR (150 MHz, $CDCl_3$) spectrum of compound **S4**



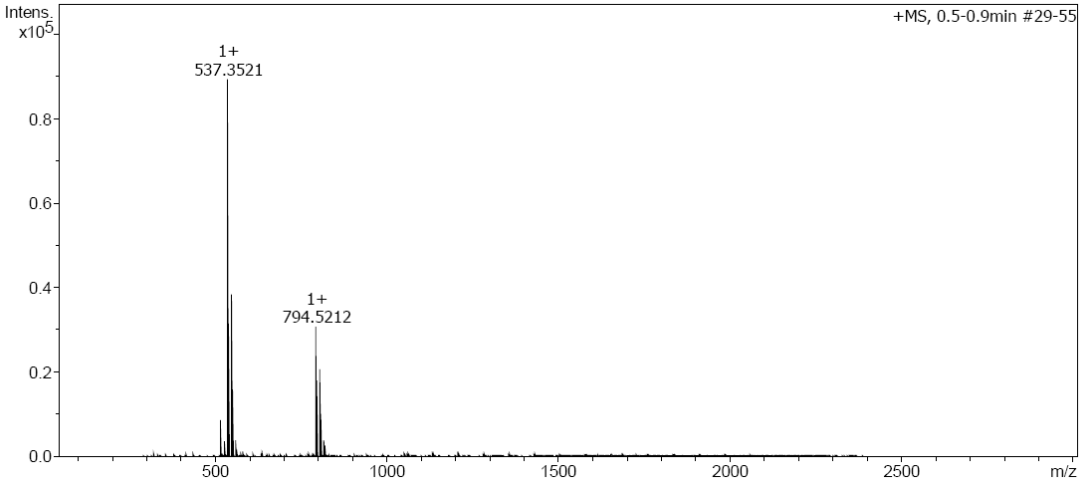
COSY spectrum of compound **S4**



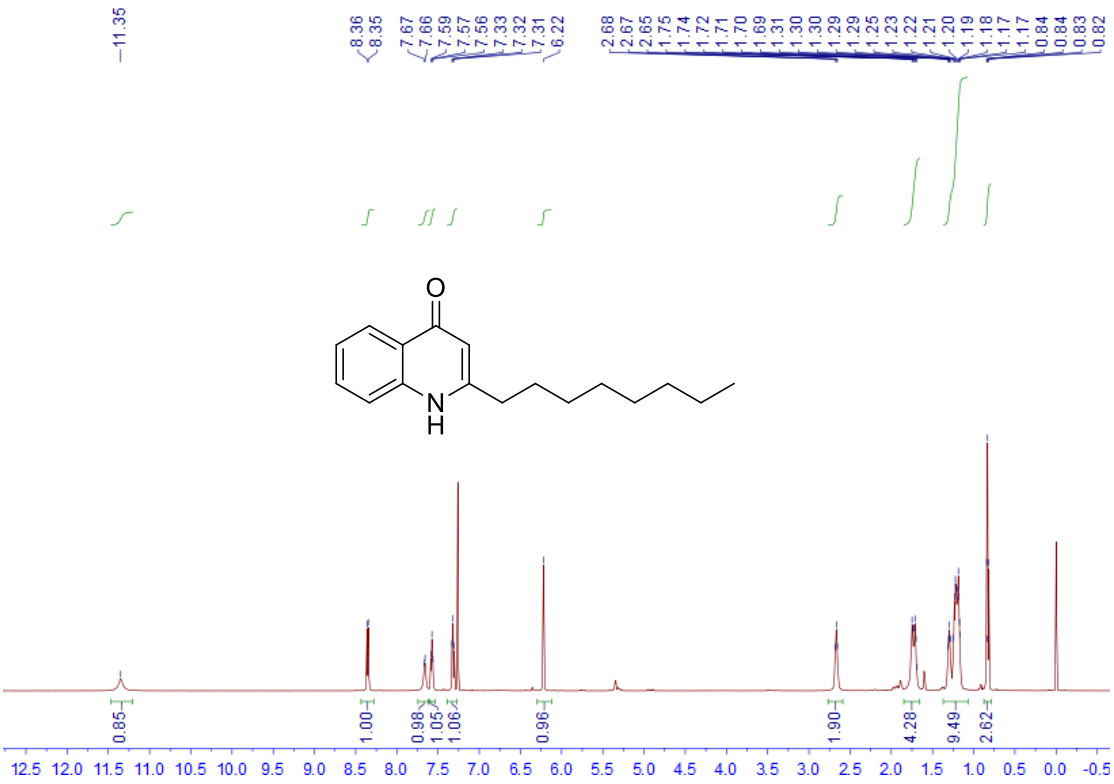
HSQC spectrum of compound **S4**



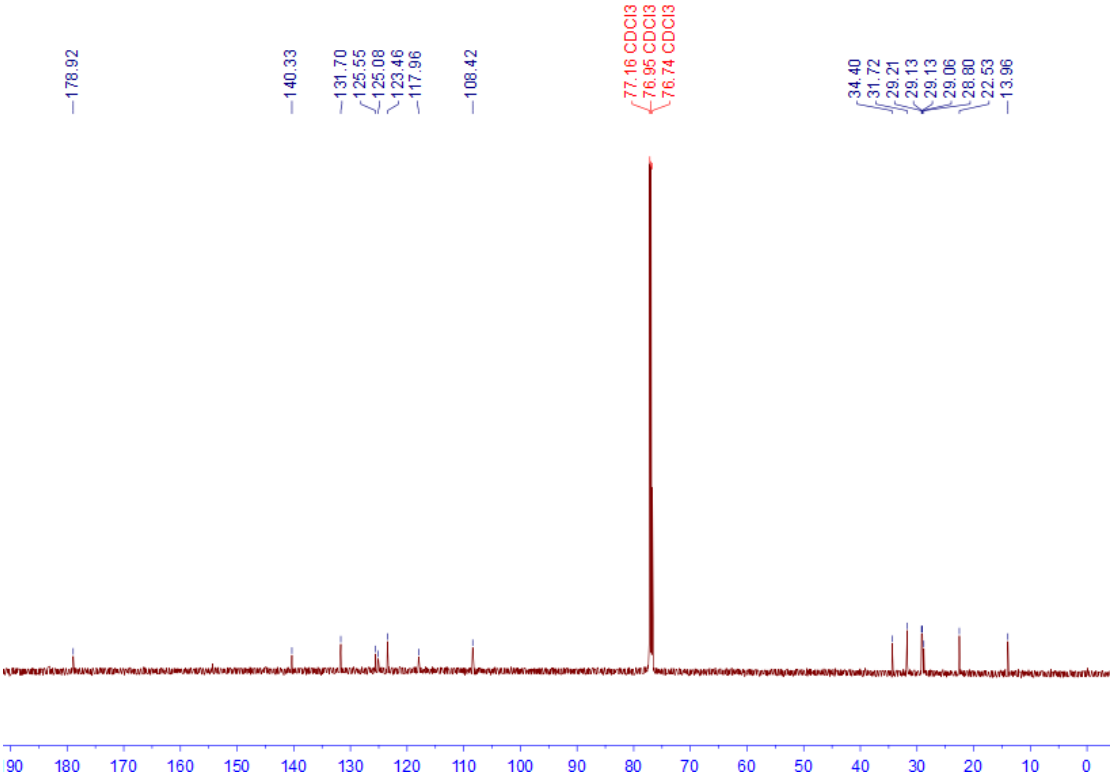
HMBC spectrum of compound **S4**



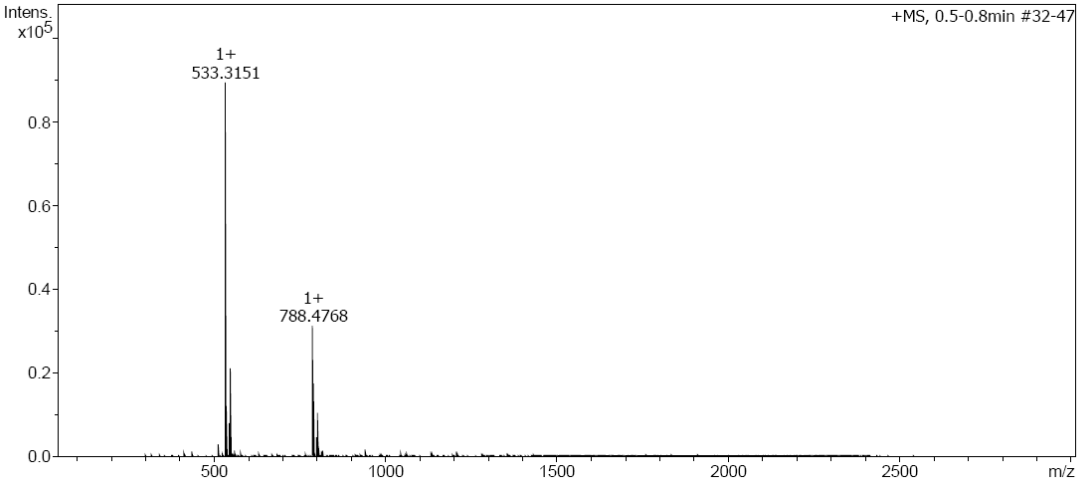
HRESI MS spectra of compound **S5**



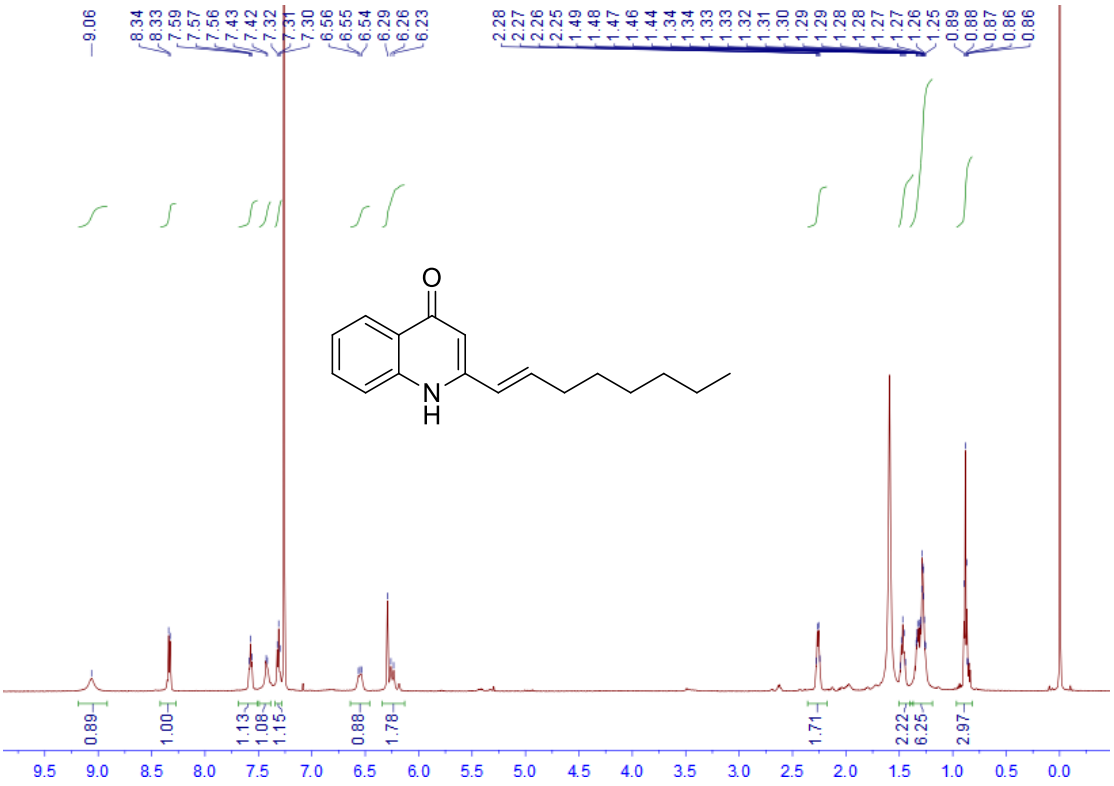
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S5**



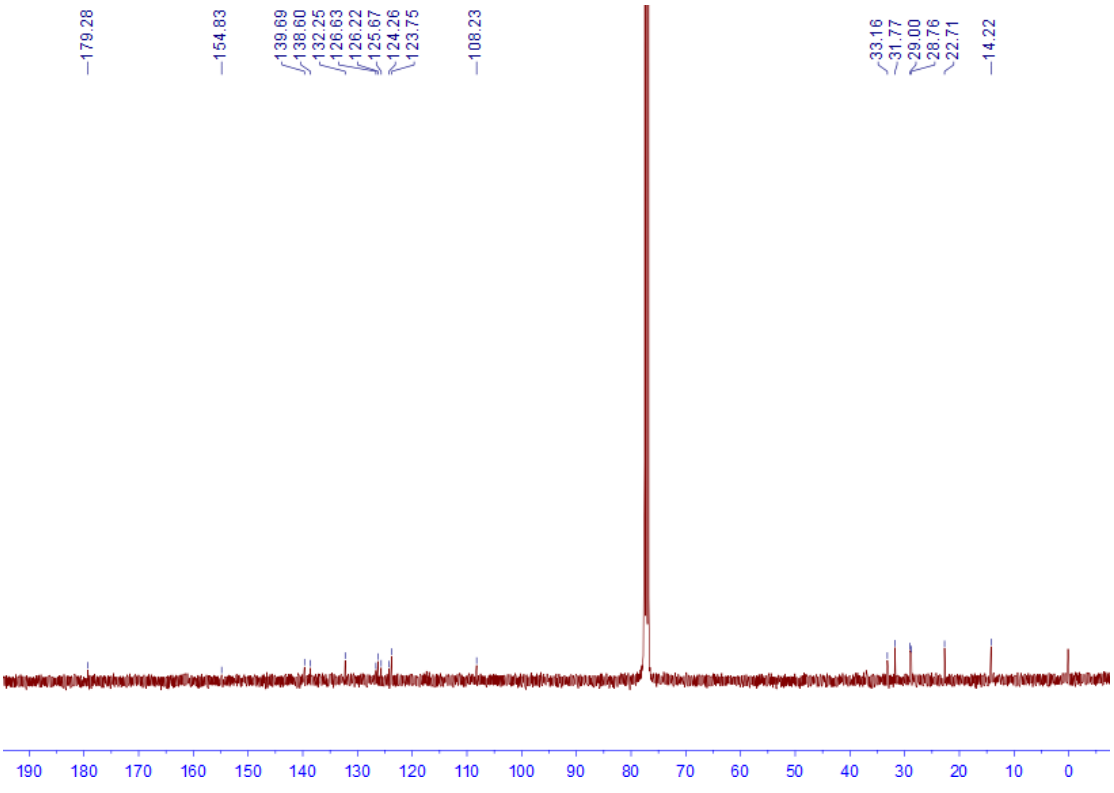
^{13}C-NMR (150 MHz, $CDCl_3$) spectrum of compound **S5**



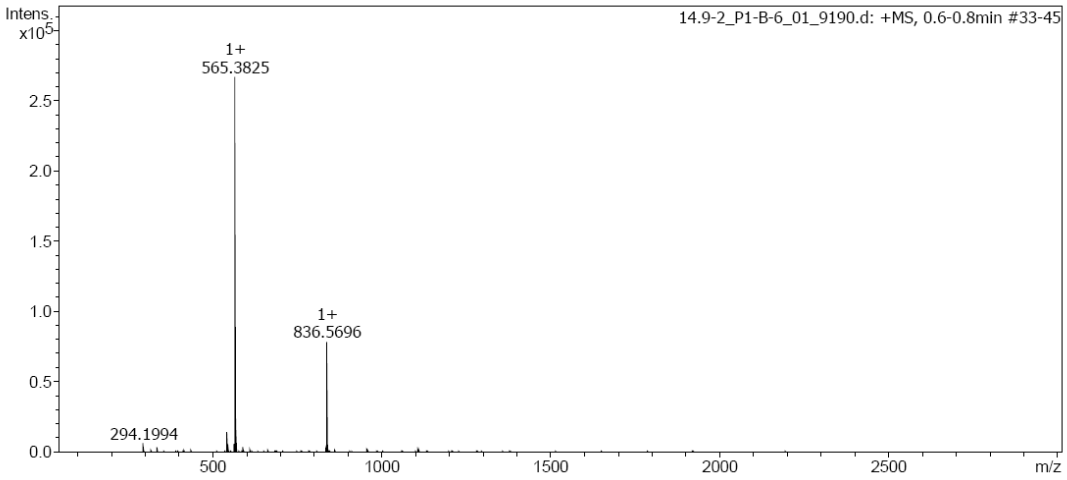
HRESI MS spectra of compound **S6**



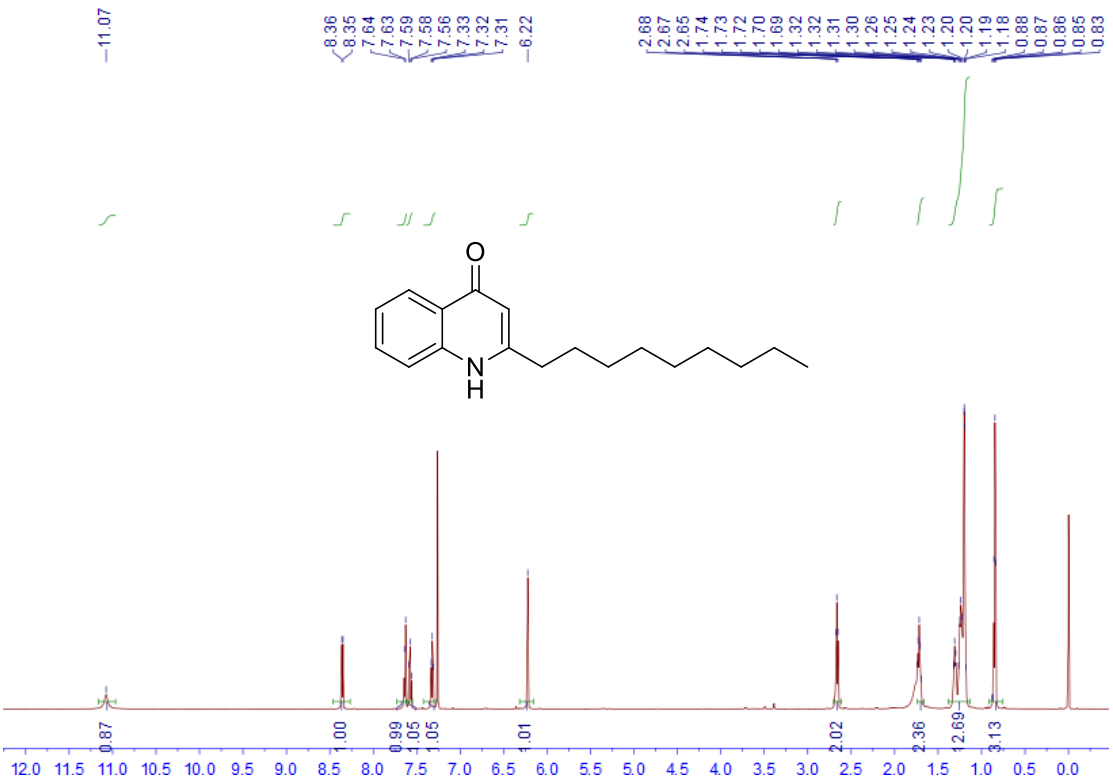
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S6**



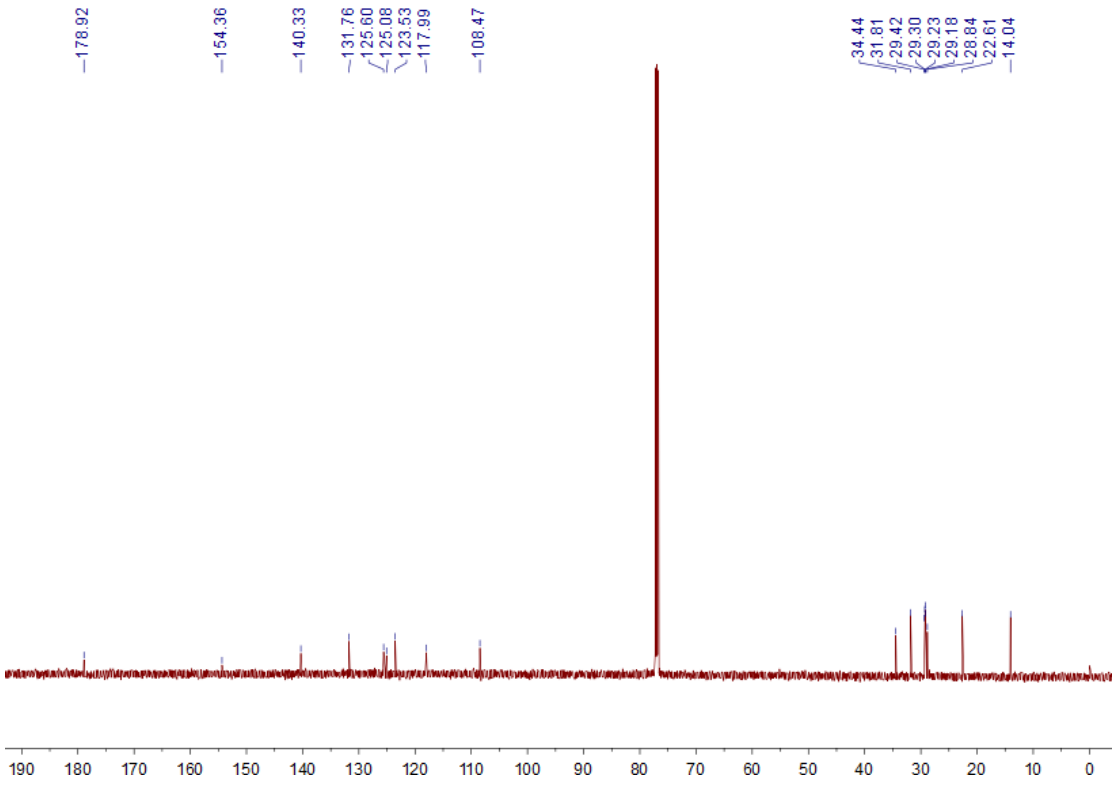
^{13}C-NMR (100 MHz, $CDCl_3$) spectrum of compound **S6**



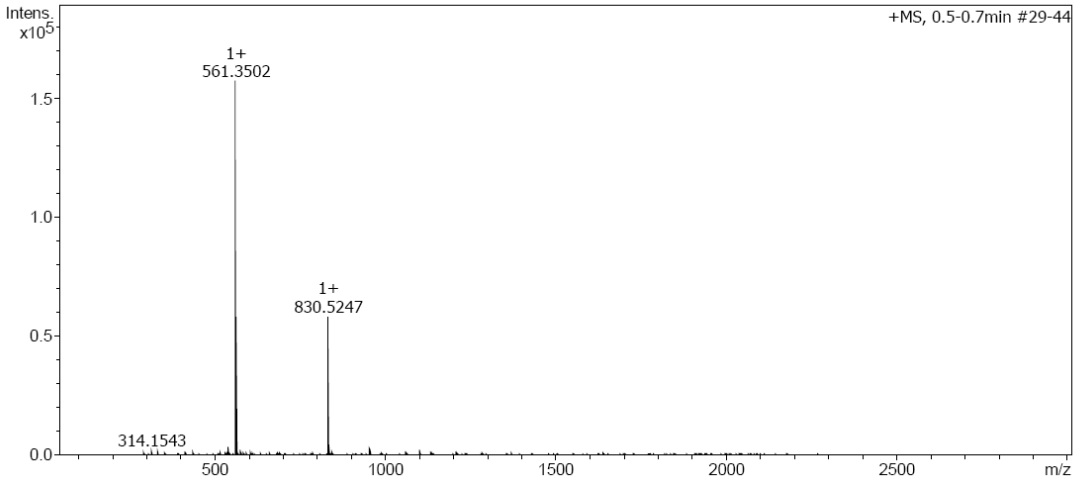
HRESI MS spectra of compound **S7**



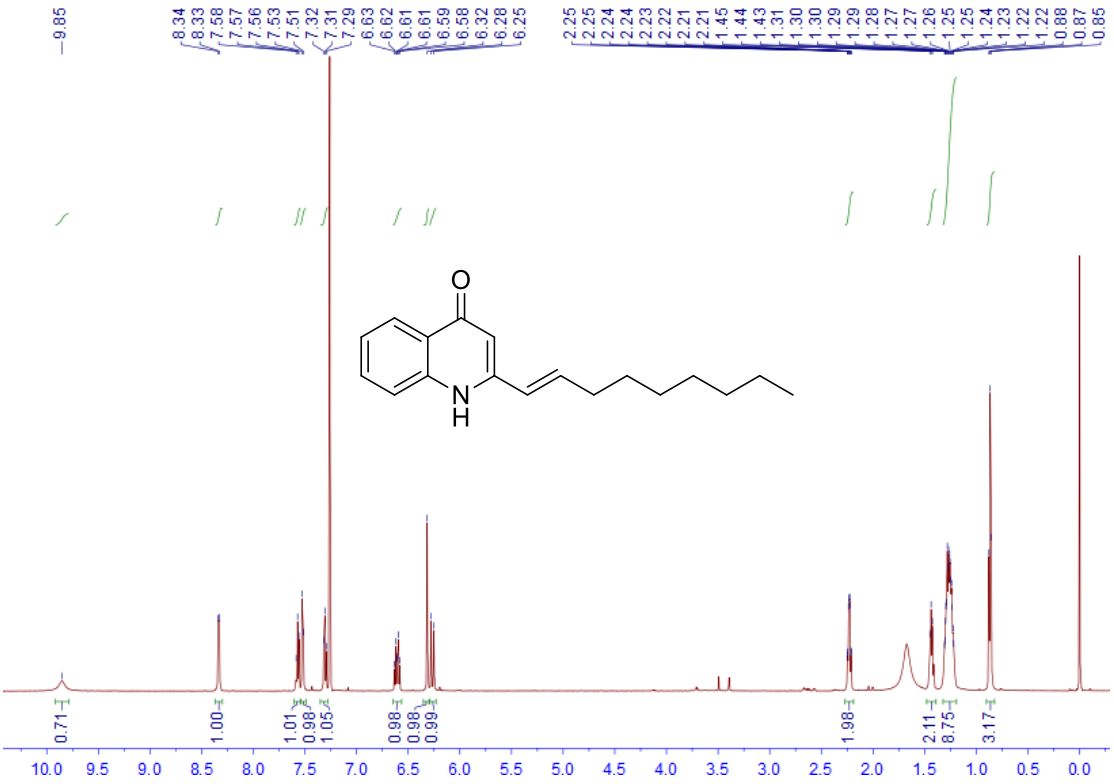
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S7**



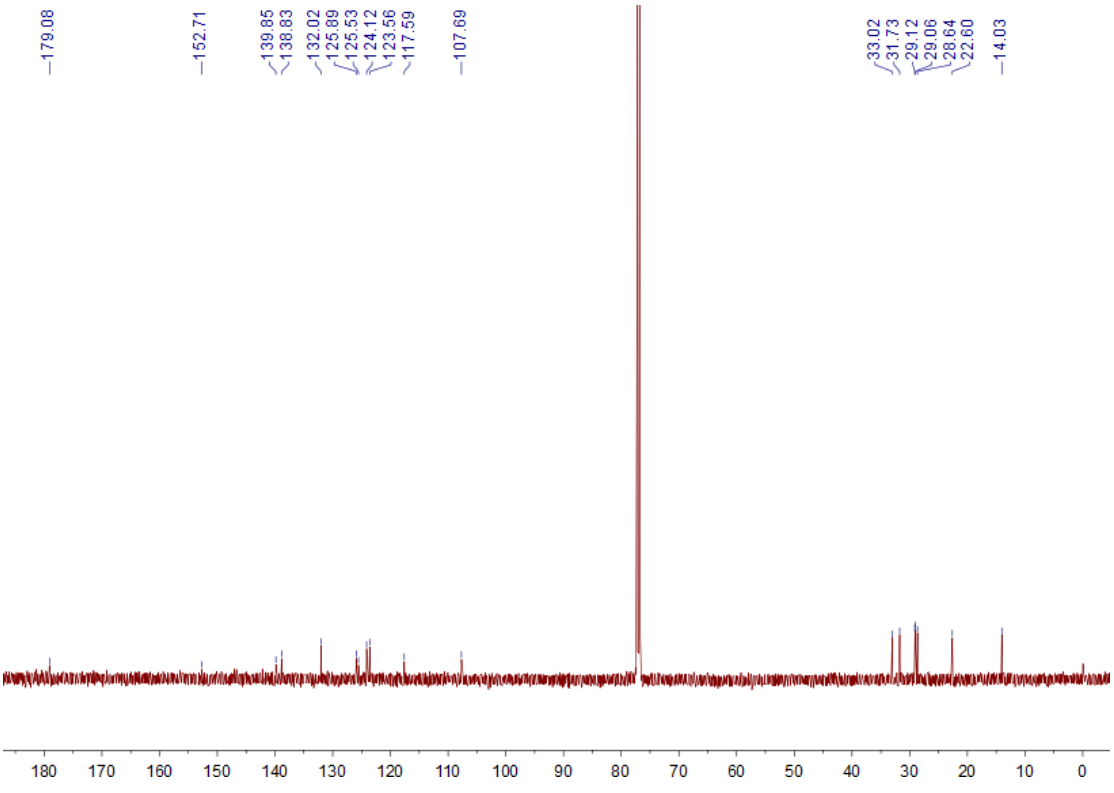
^{13}C-NMR (150 MHz, $CDCl_3$) spectrum of compound **S7**



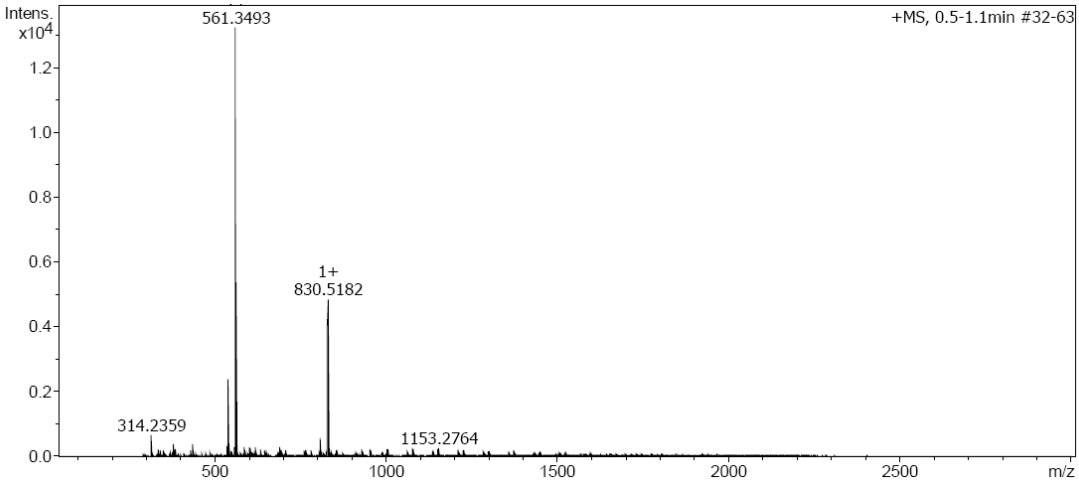
HRESI MS spectra of compound **14**



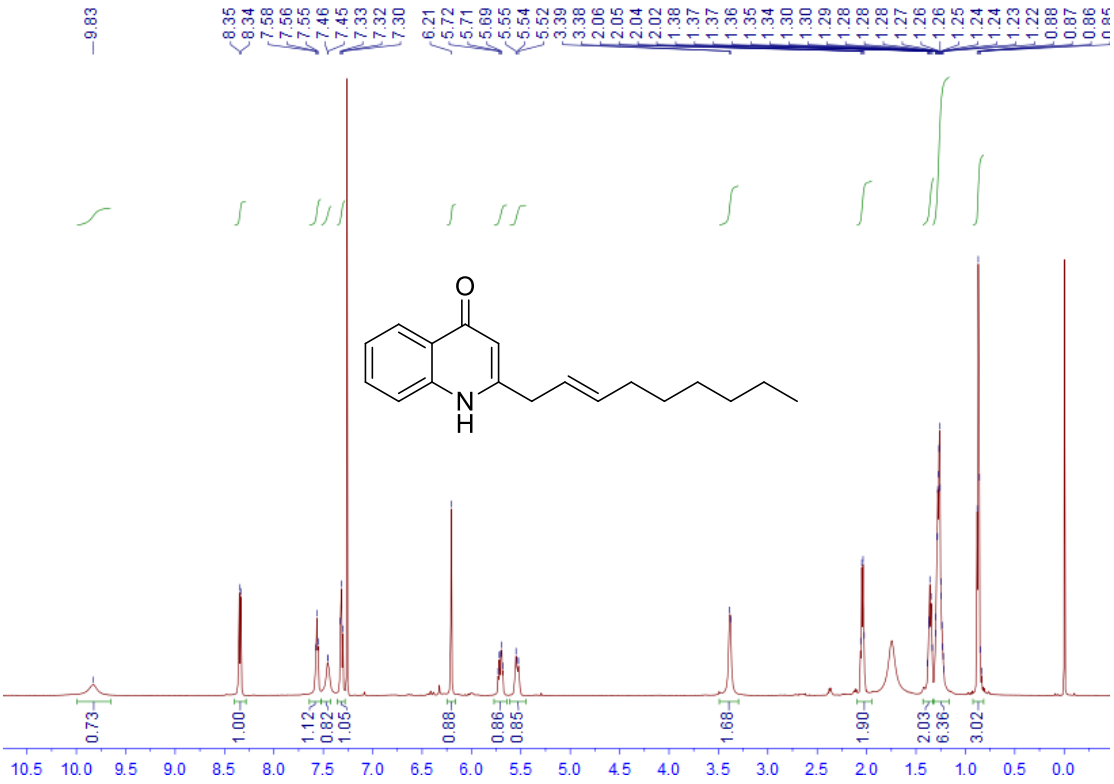
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S8**



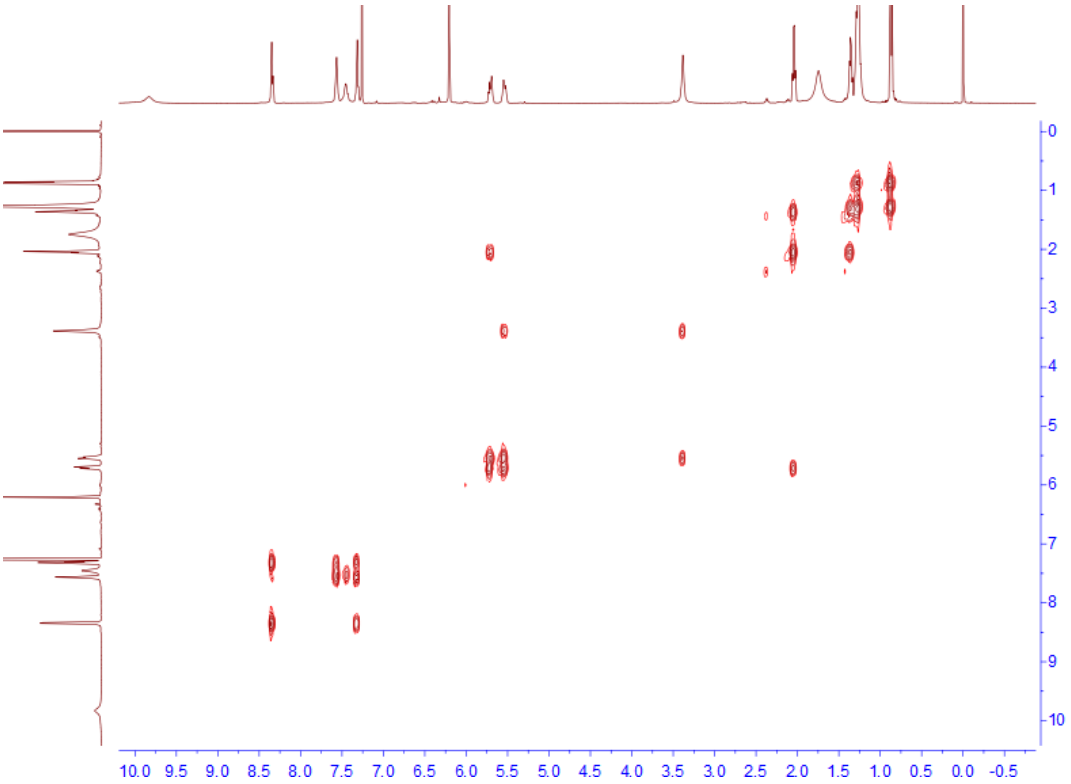
^{13}C-NMR (150 MHz, $CDCl_3$) spectrum of compound **S8**



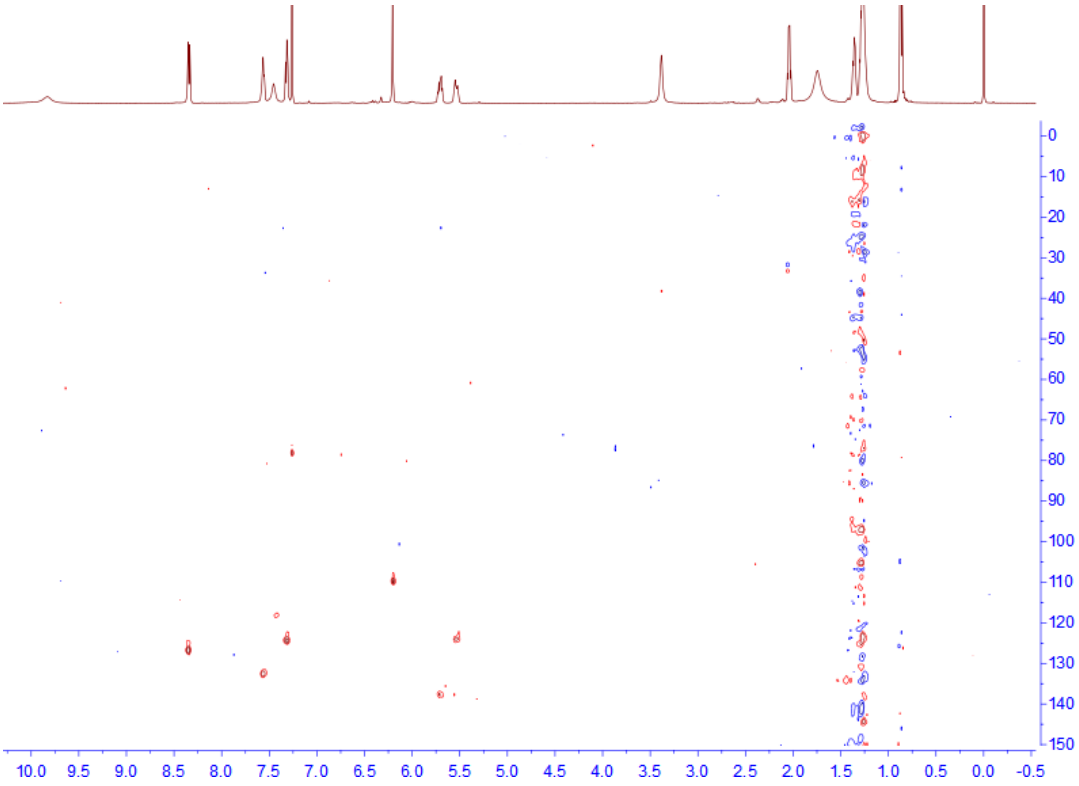
HRESI MS spectra of compound **S9**



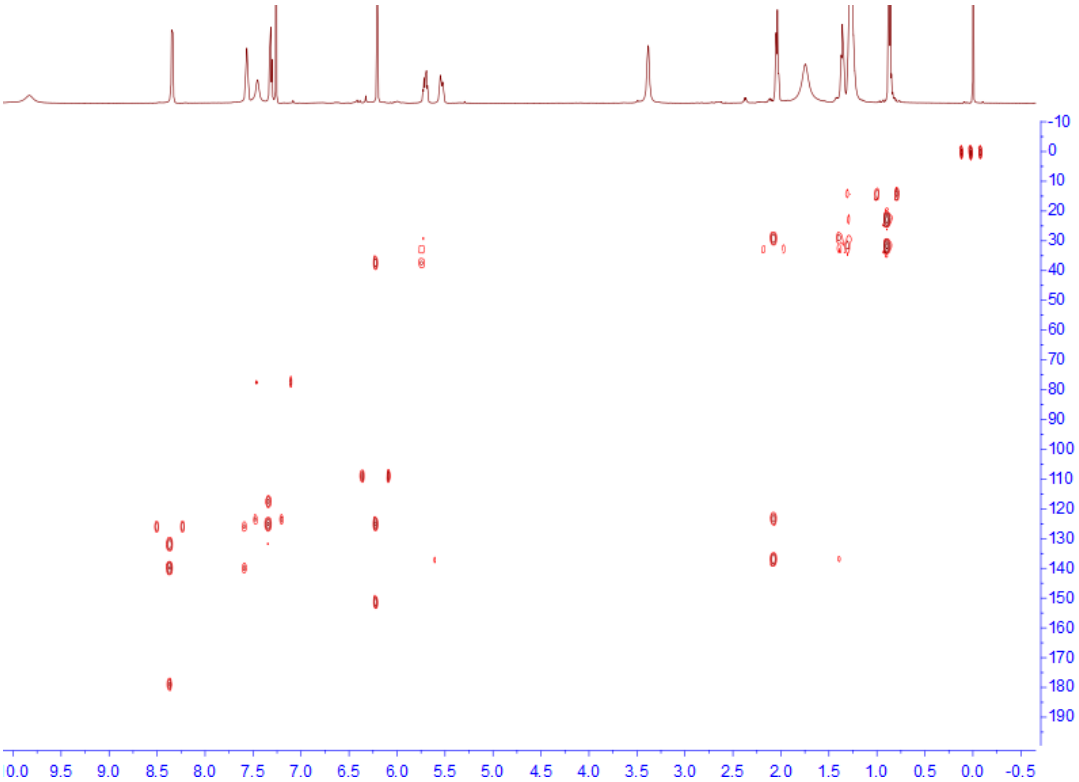
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S9**



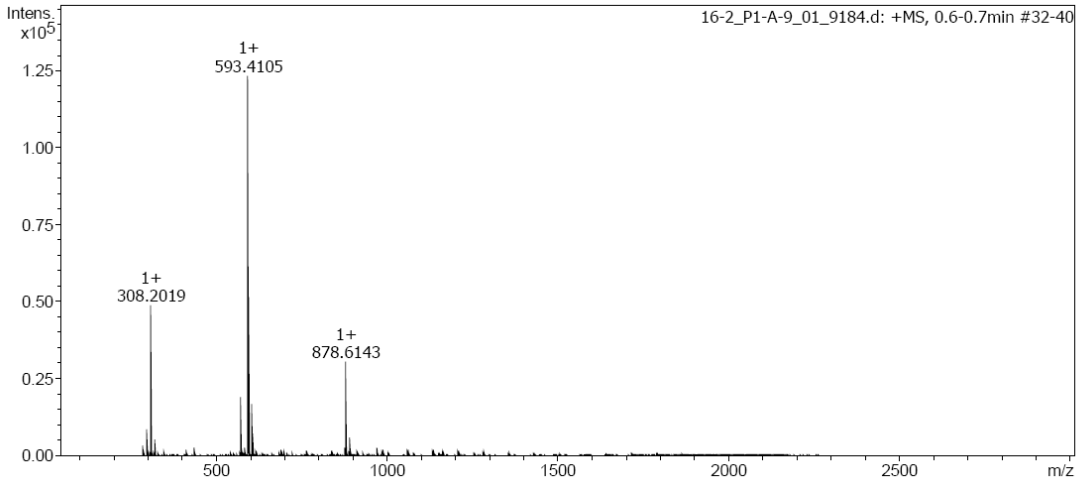
COSY spectrum of compound **S9**



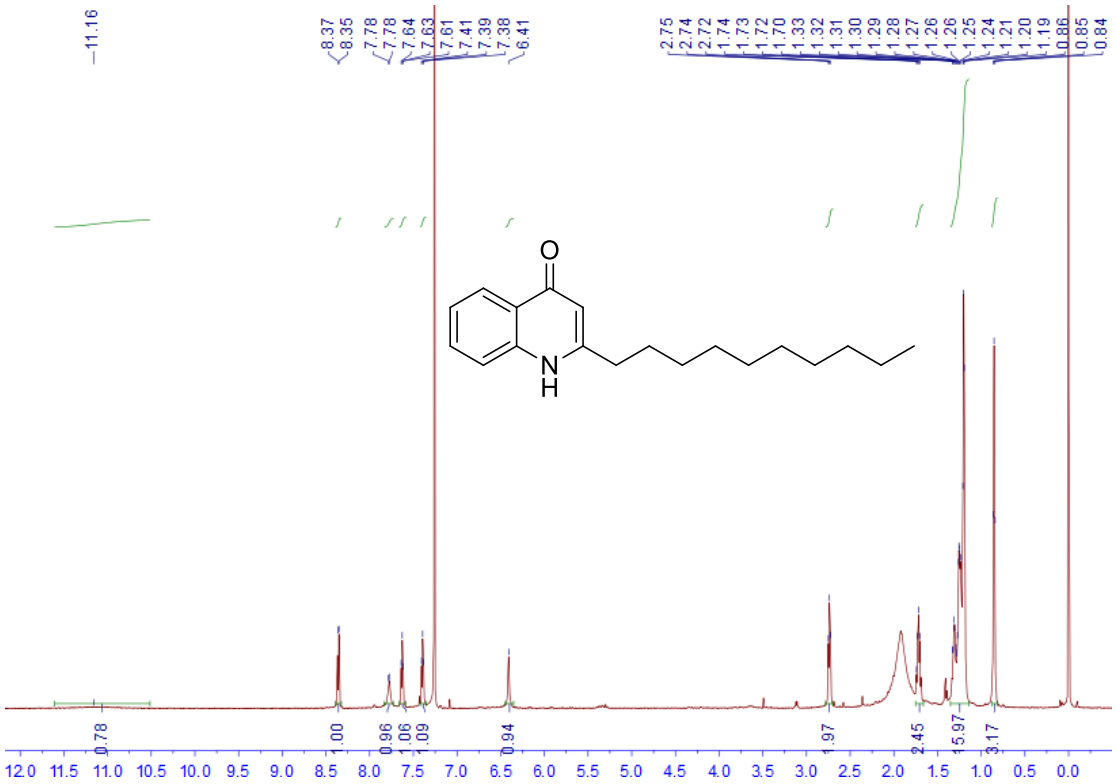
HSQC spectrum of compound **S9**



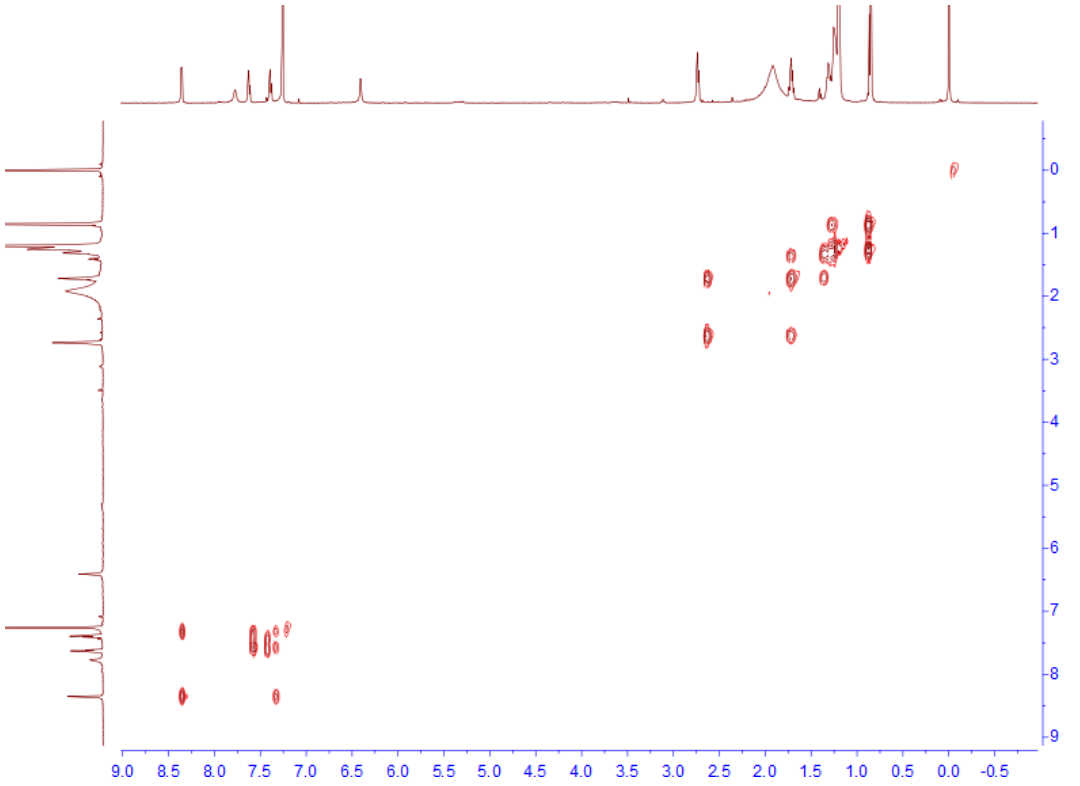
HMBC spectrum of compound **S9**



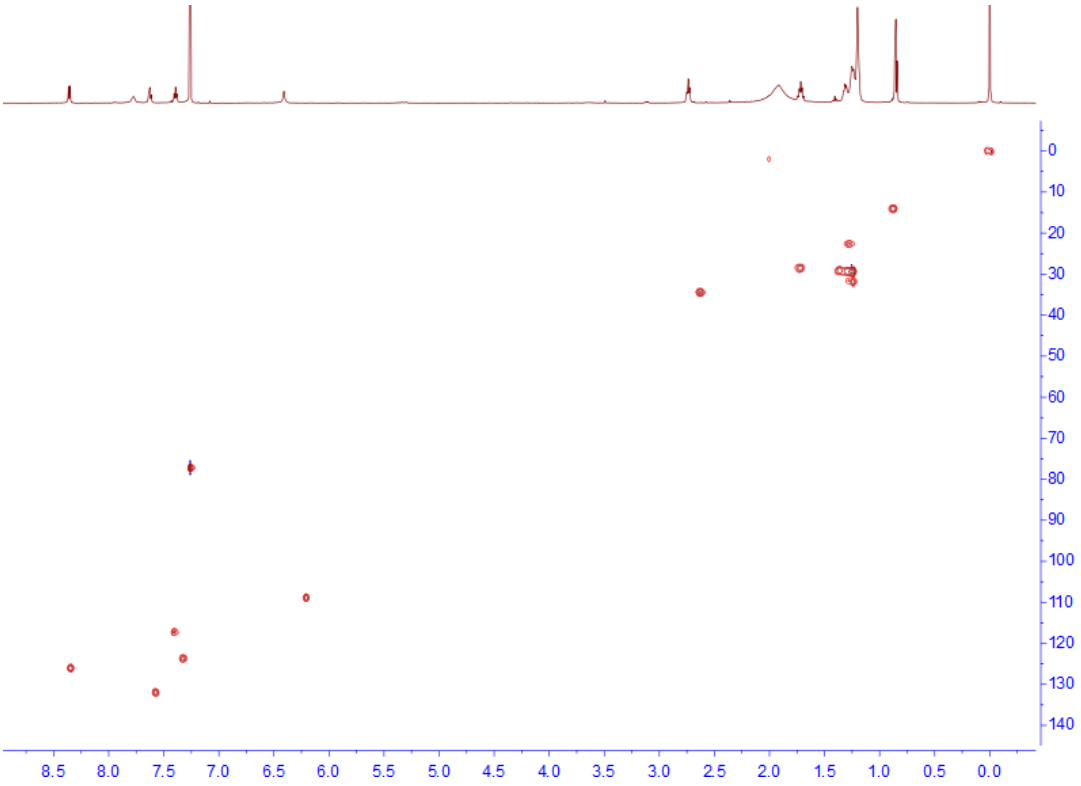
HRESI MS spectra of compound **S10**



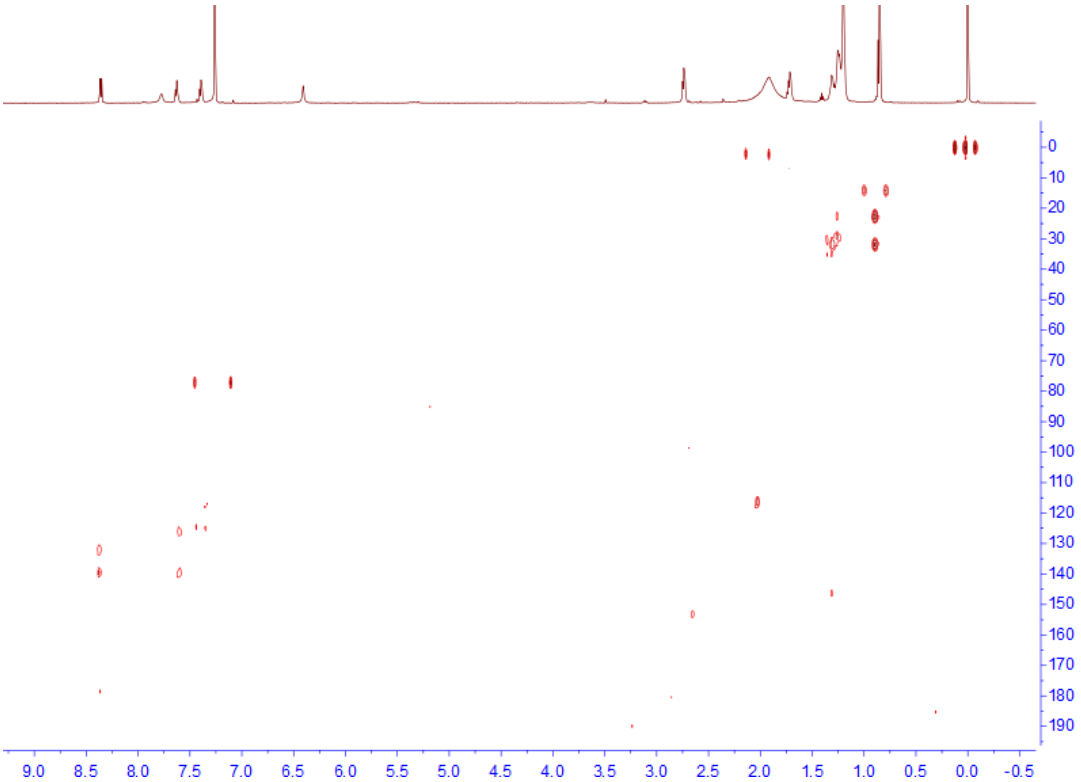
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S10**



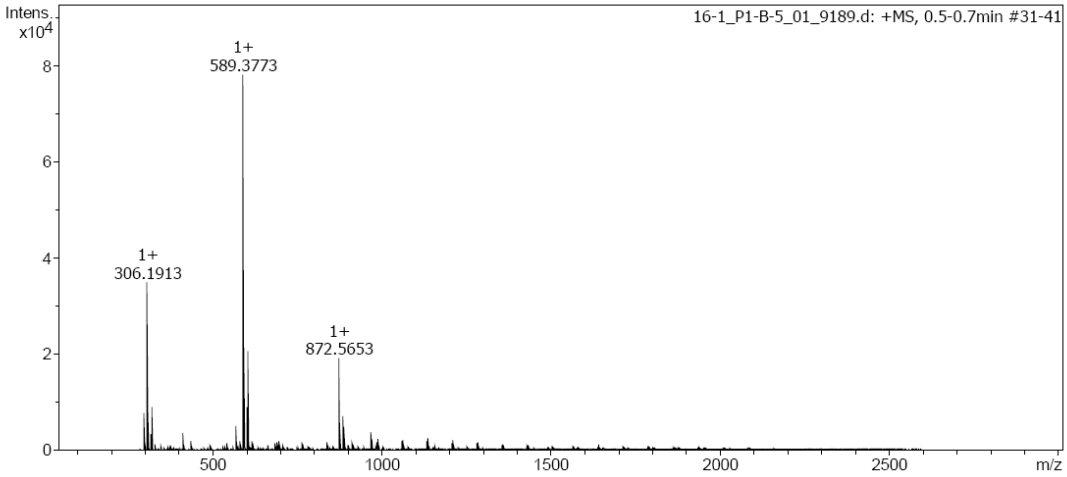
COSY spectrum of compound **S10**



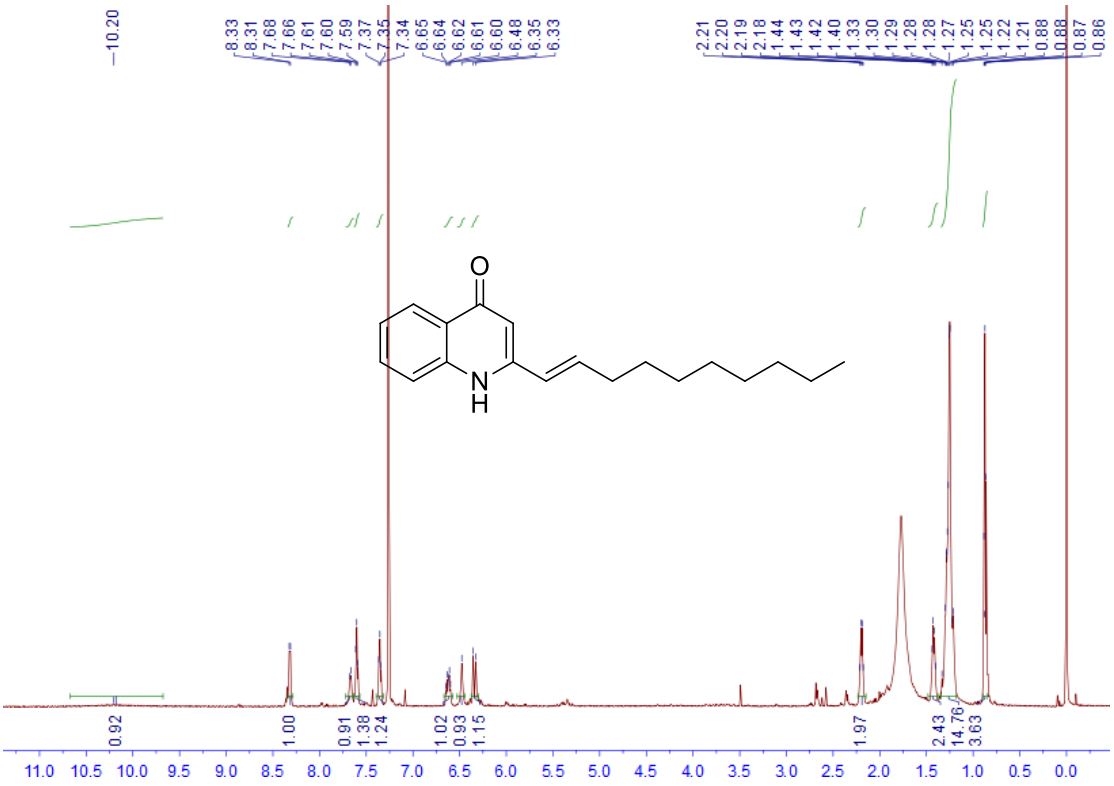
HSQC spectrum of compound **S10**



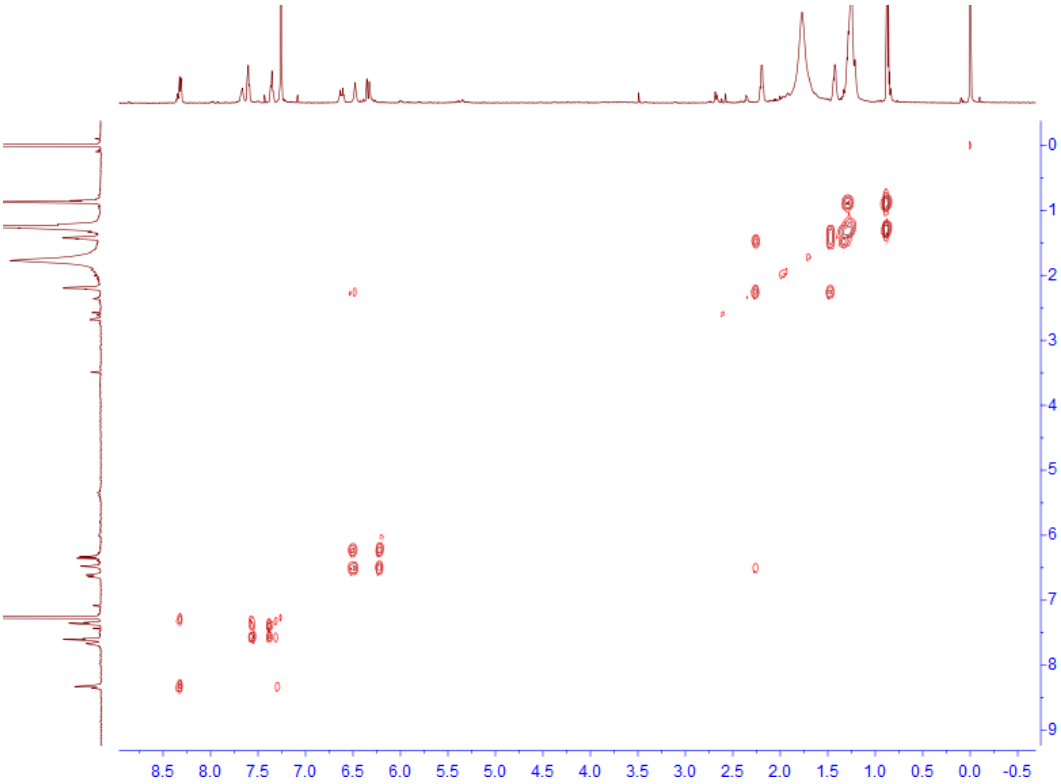
HMBC spectrum of compound **S10**



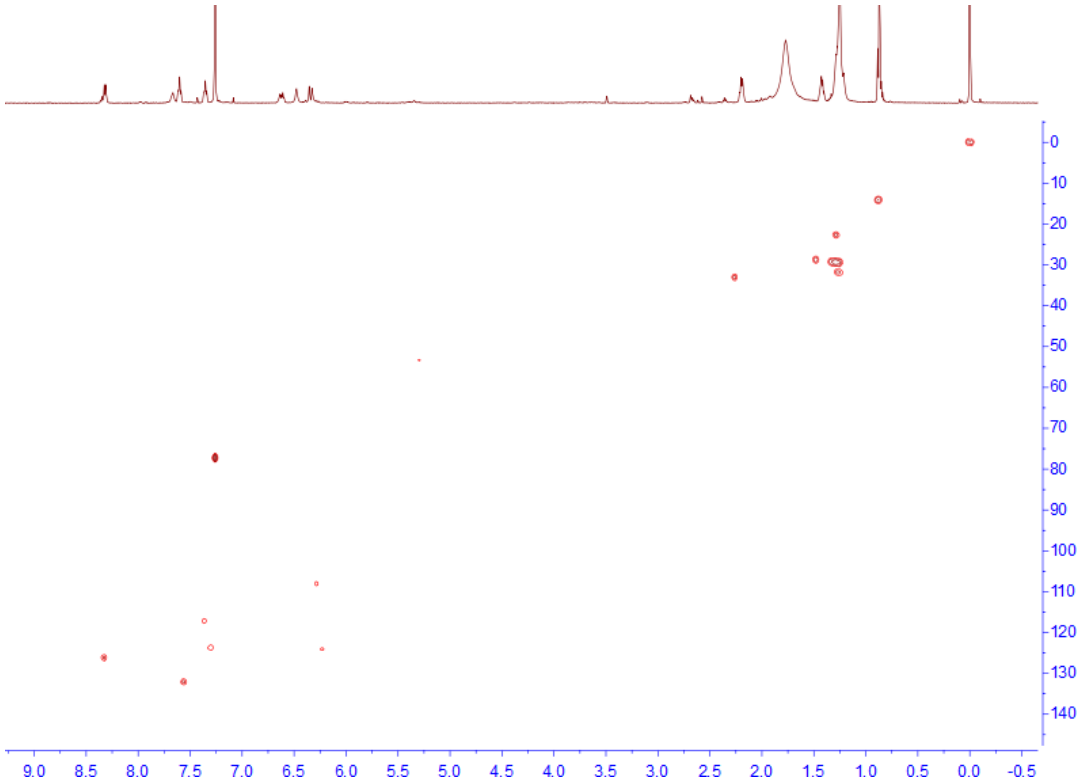
HRESI MS spectra of compound **S11**



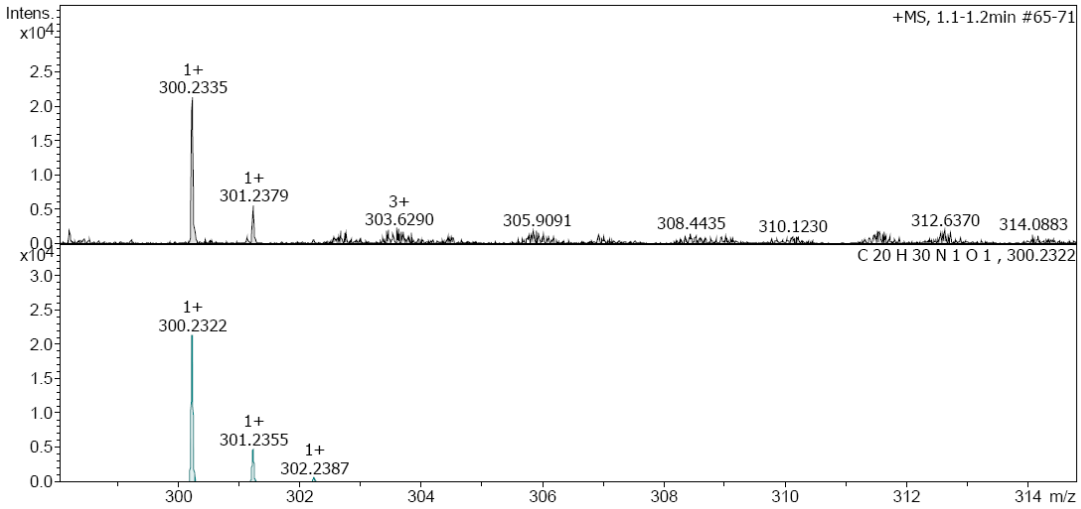
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S11**



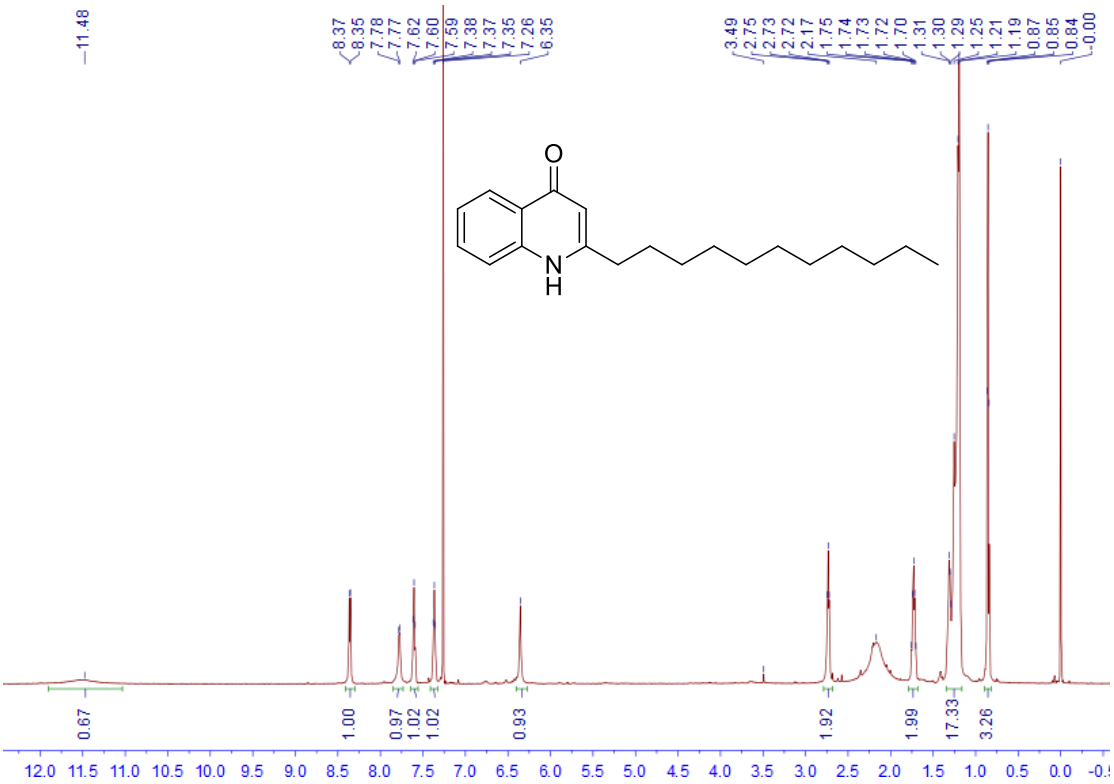
COSY spectrum of compound **S11**



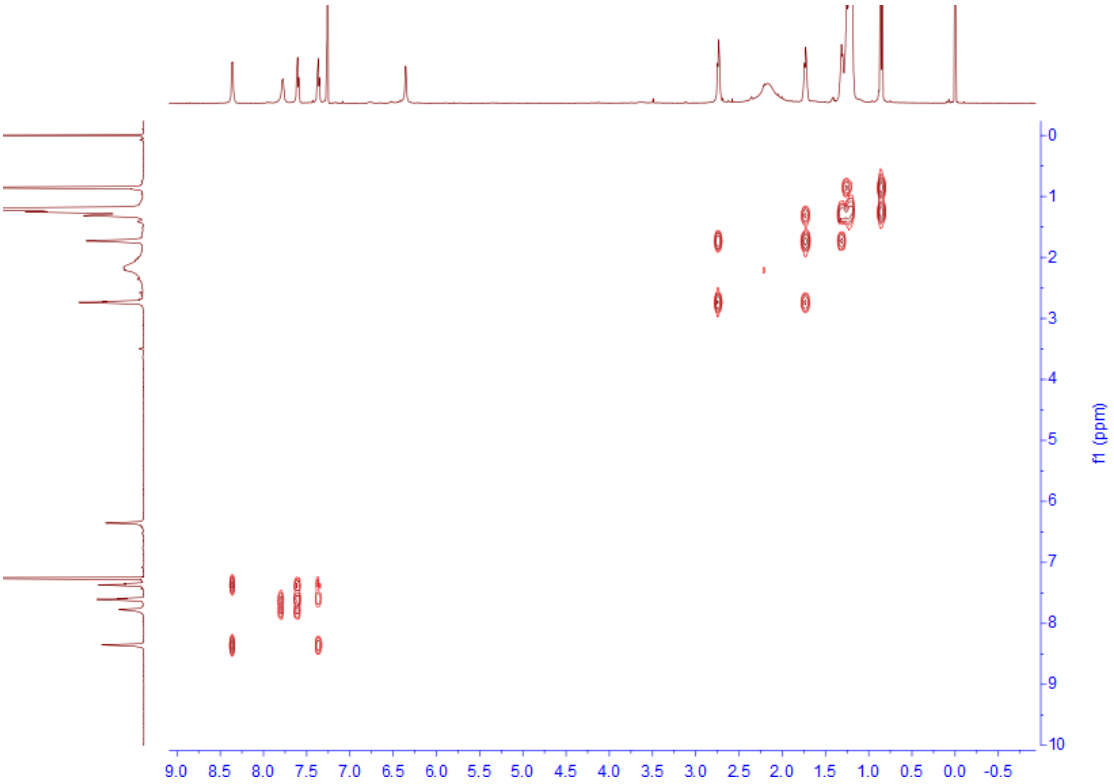
HSQC spectrum of compound **S11**



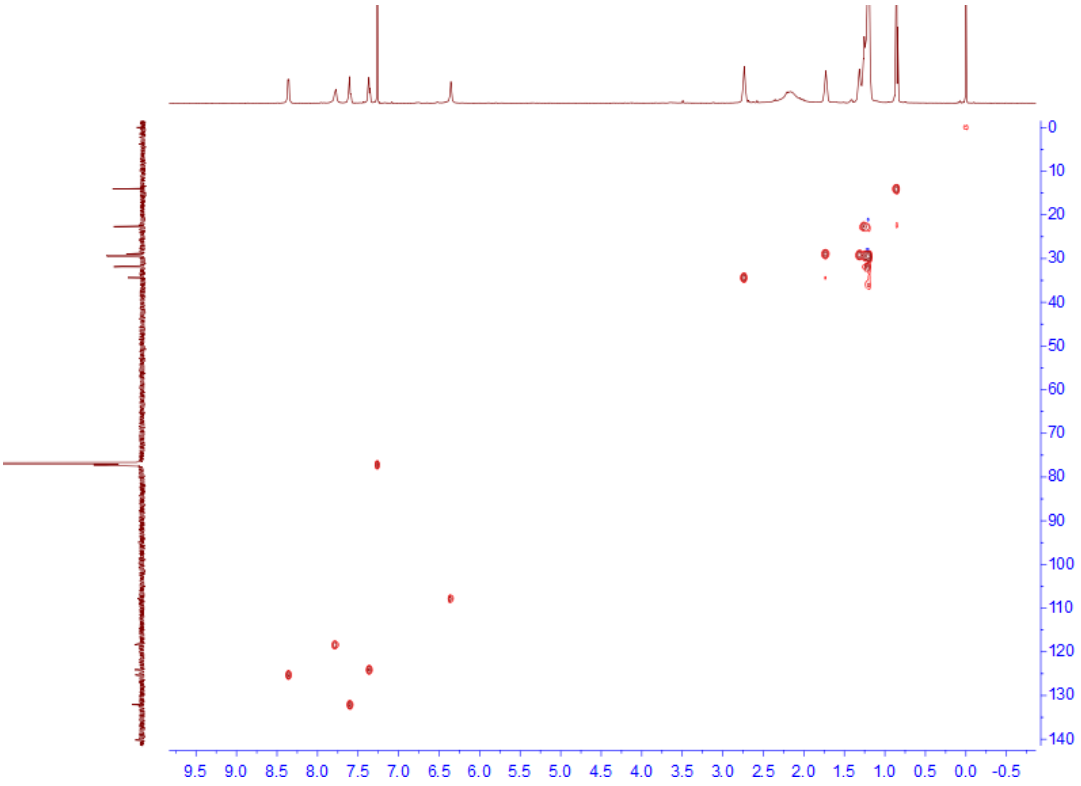
HRESI MS spectra of compound **S12**



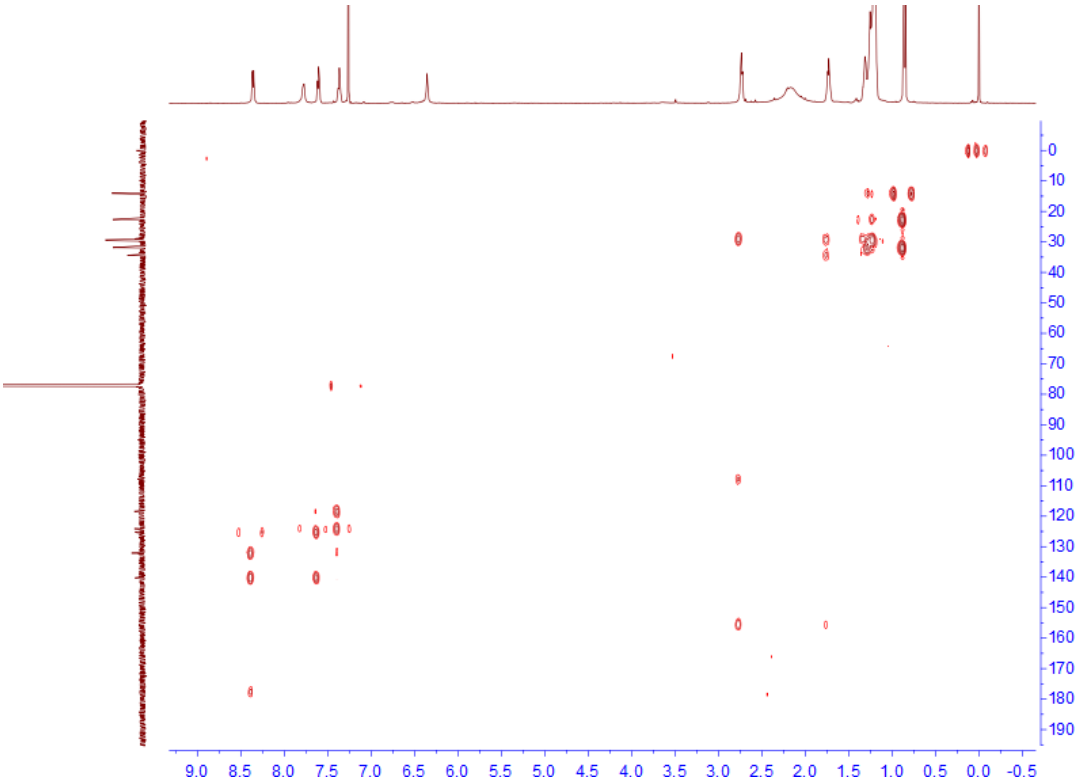
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S12**



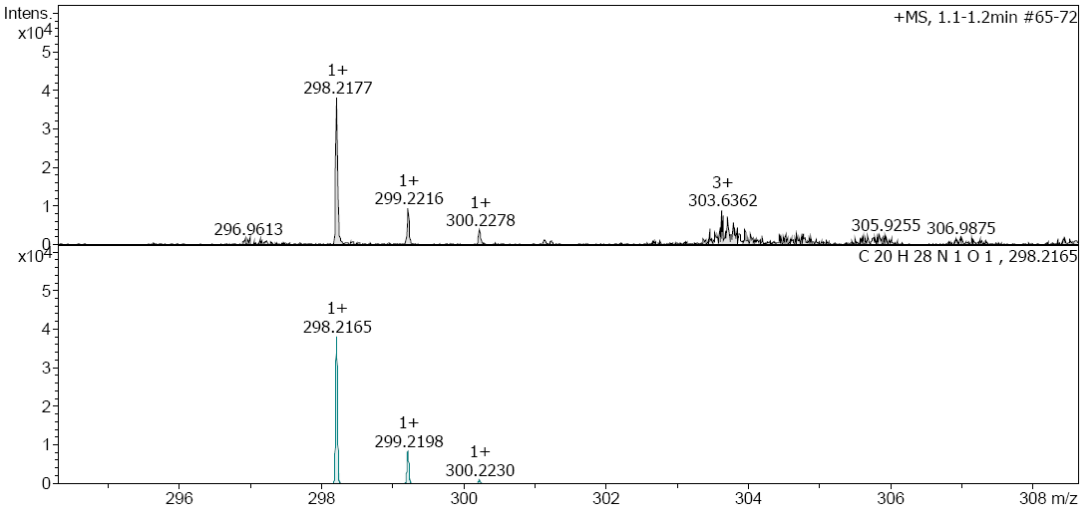
COSY spectrum of compound **S12**



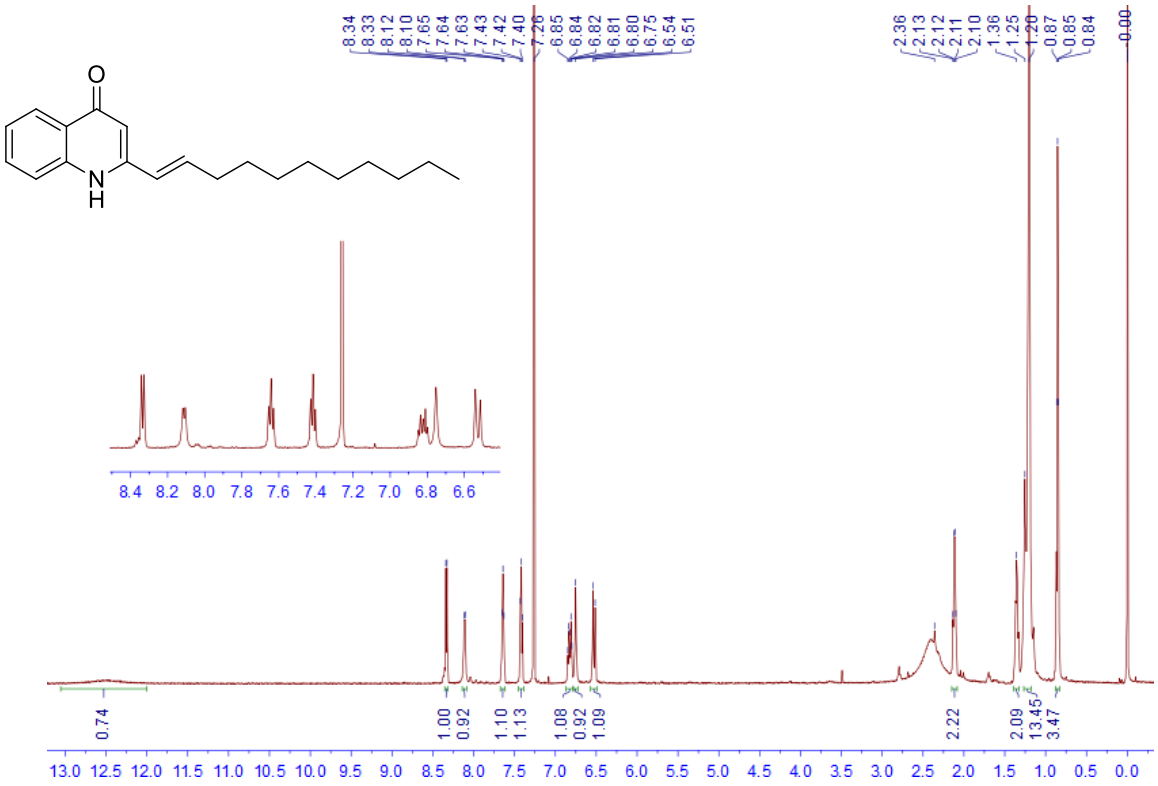
HSQC spectrum of compound **S12**



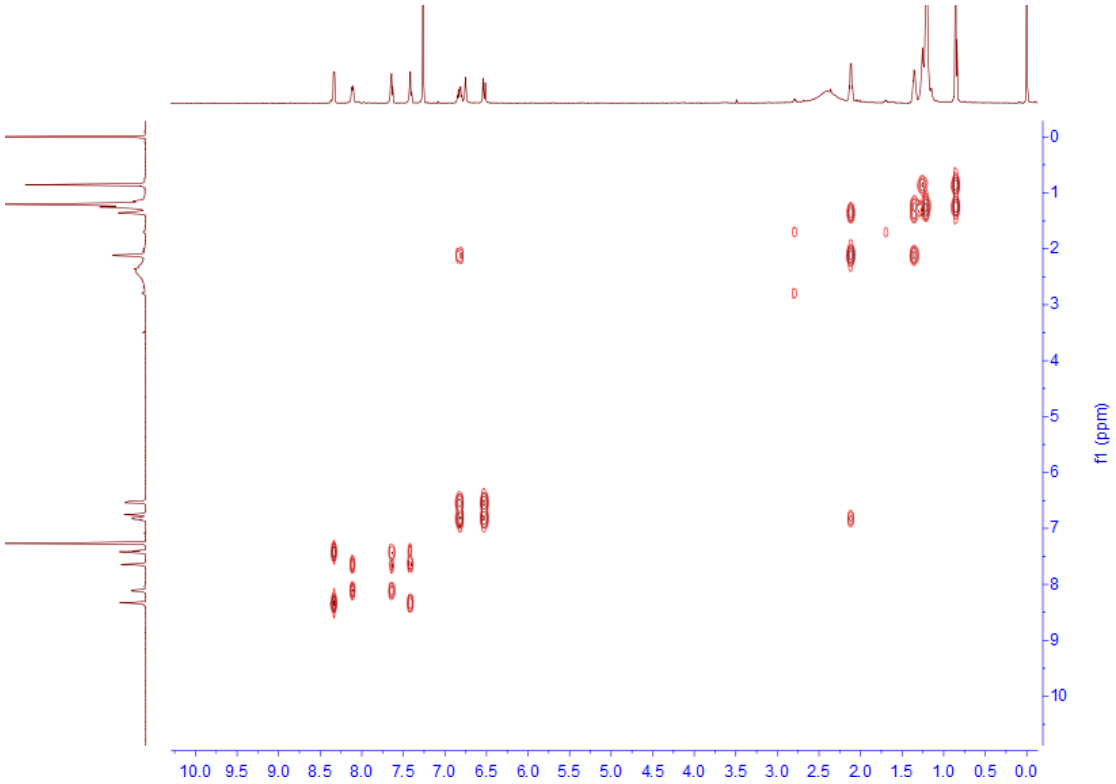
HMBC spectrum of compound **S12**



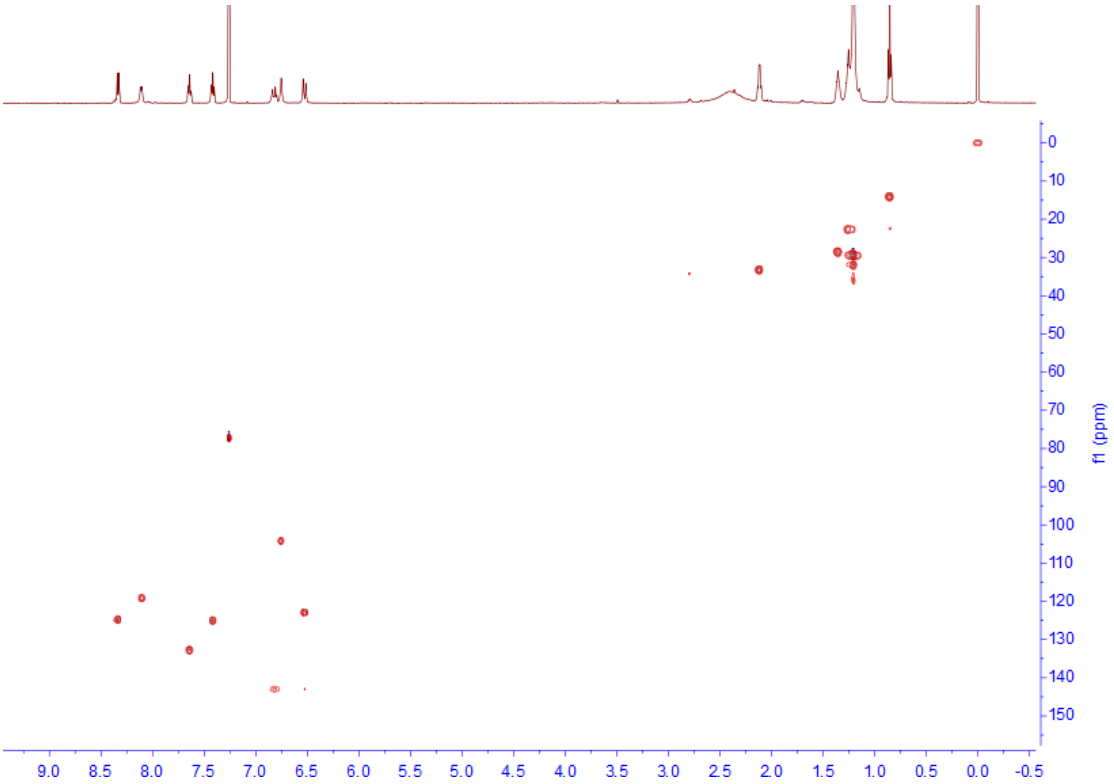
HRESI MS spectra of compound **S13**



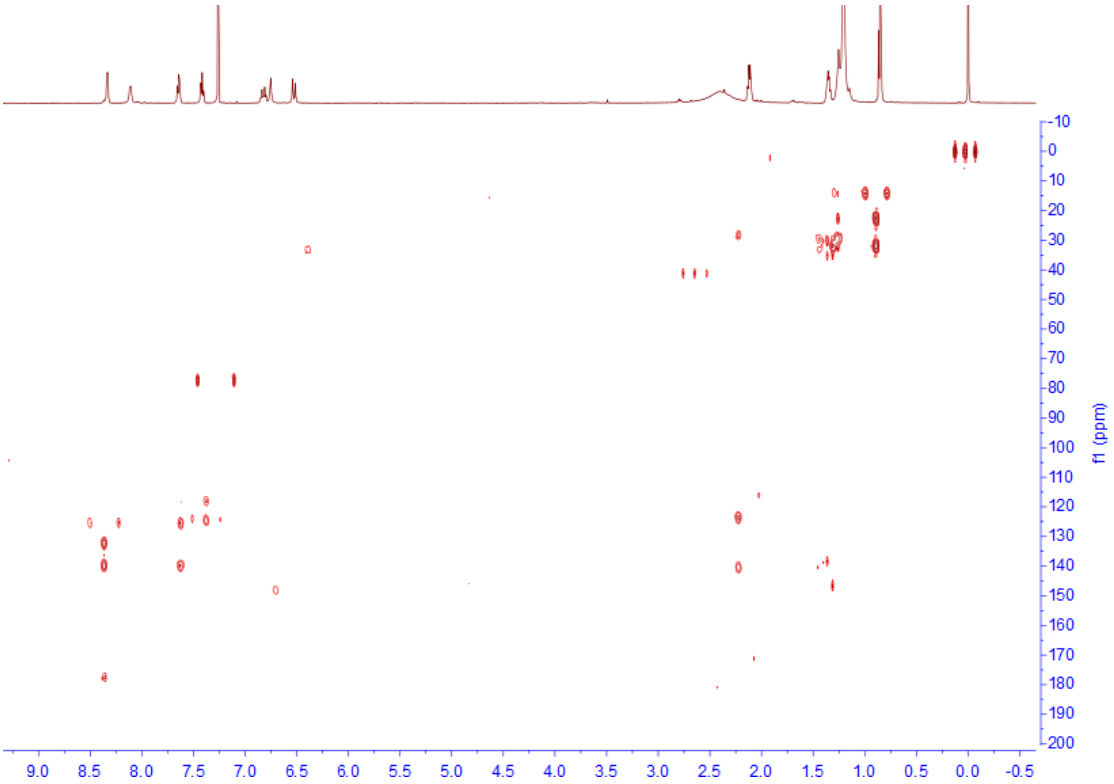
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S13**



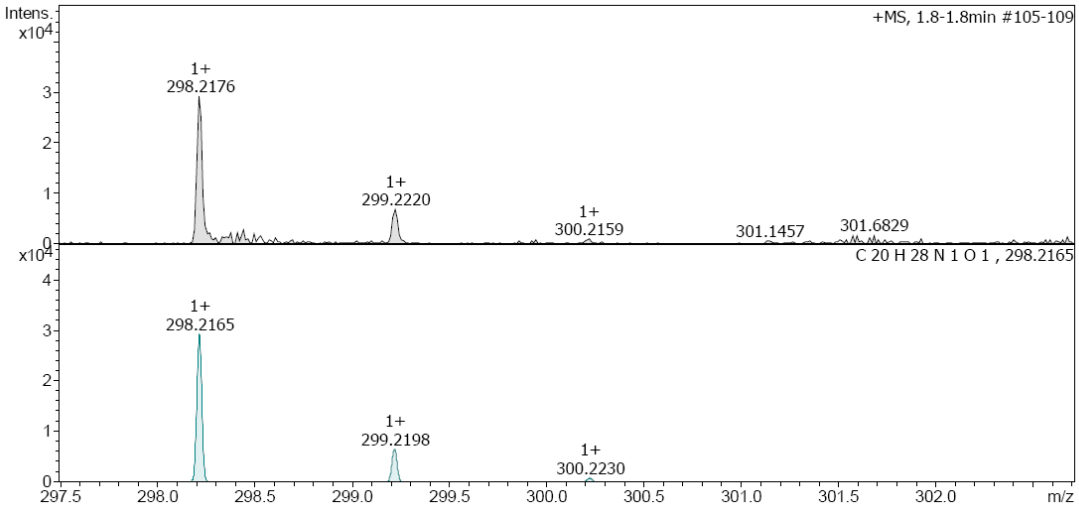
COSY spectrum of compound **S13**



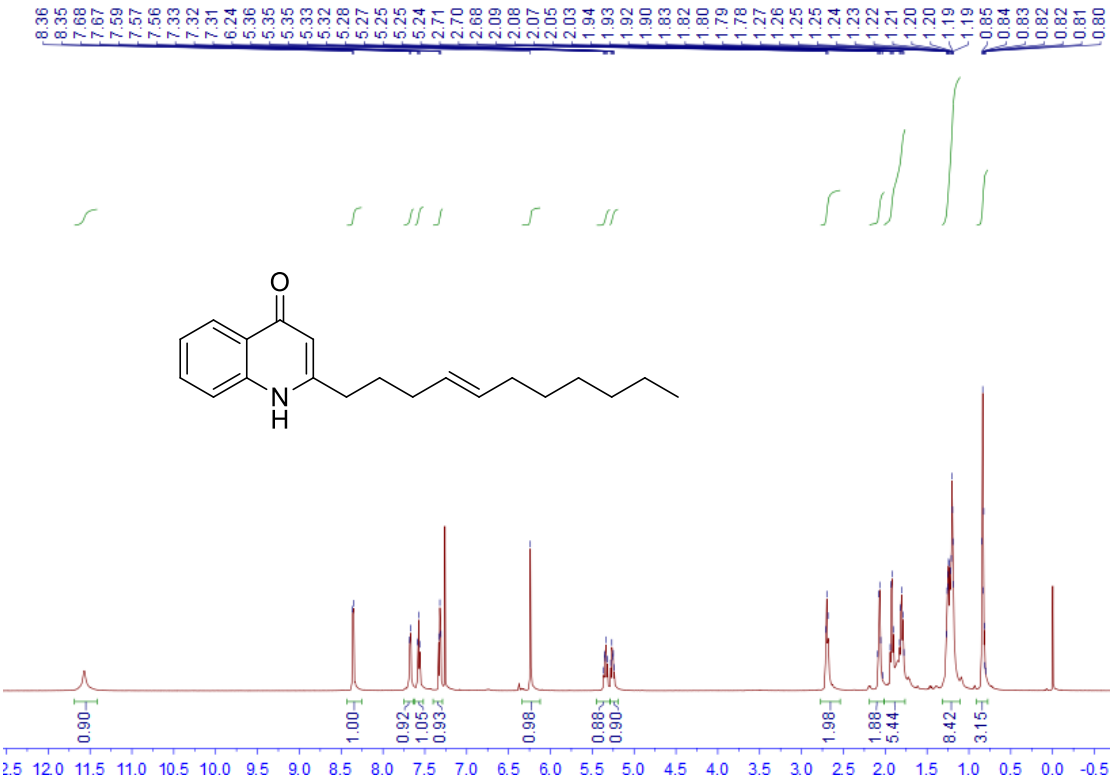
HSQC spectrum of compound **S13**



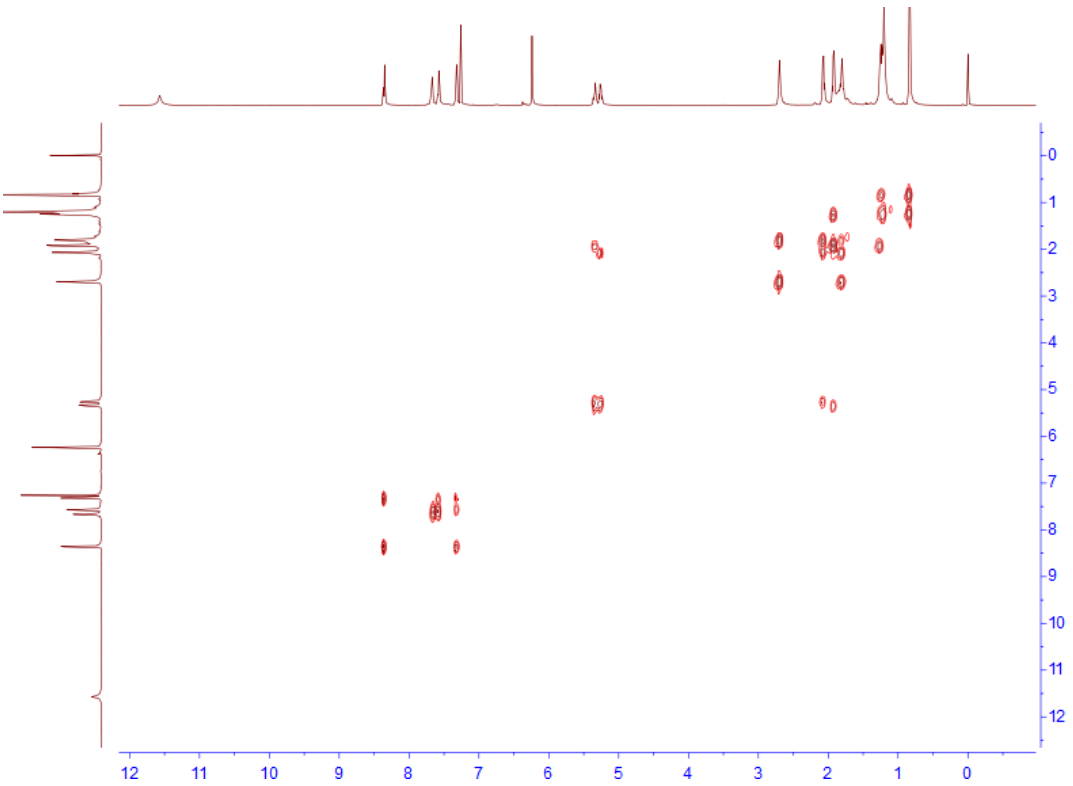
HMBC spectrum of compound **S13**



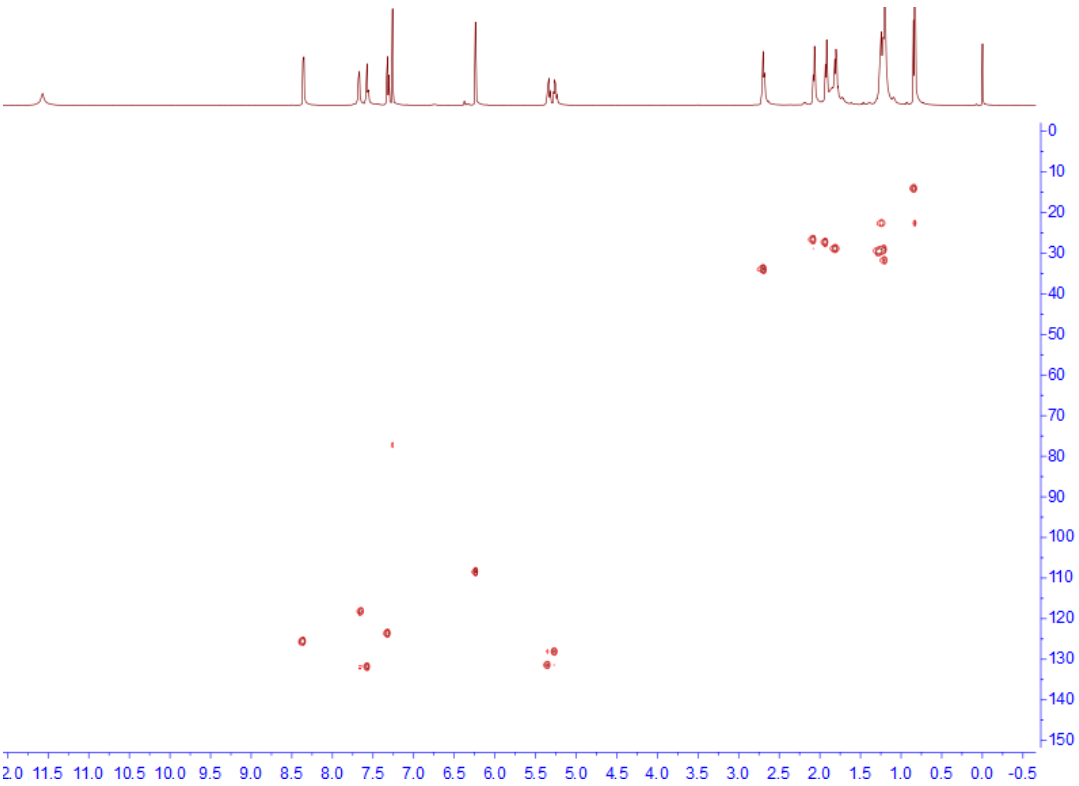
HRESI MS spectra of compound **S14**



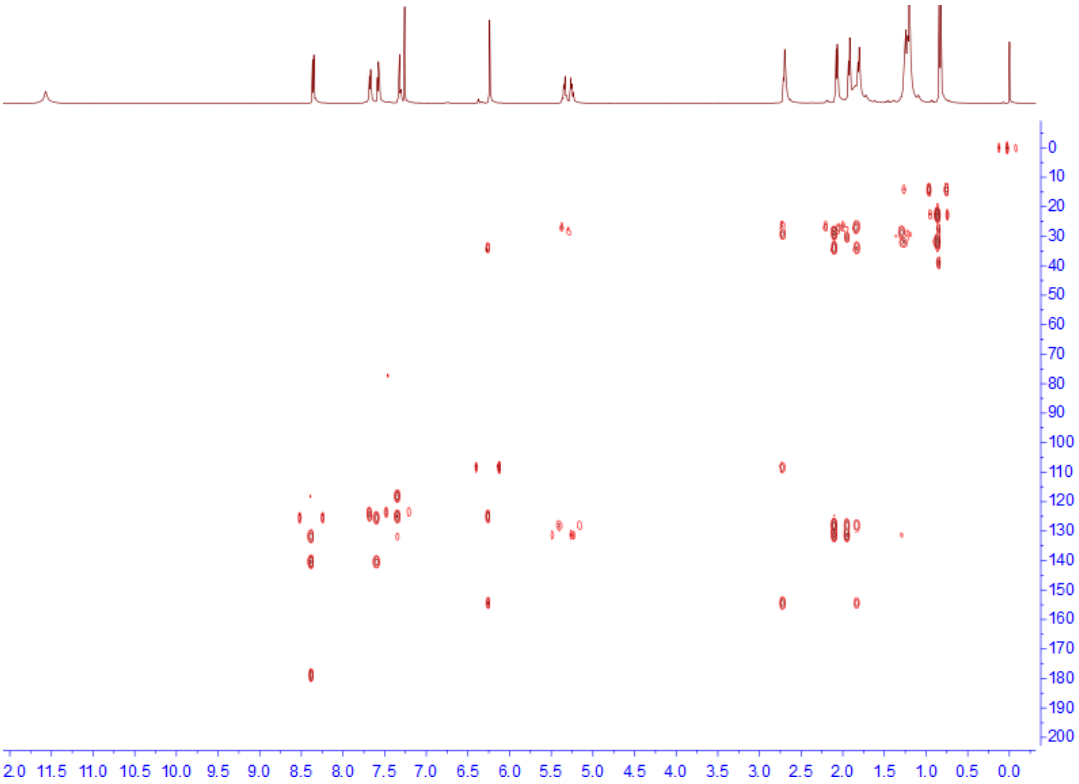
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S14**



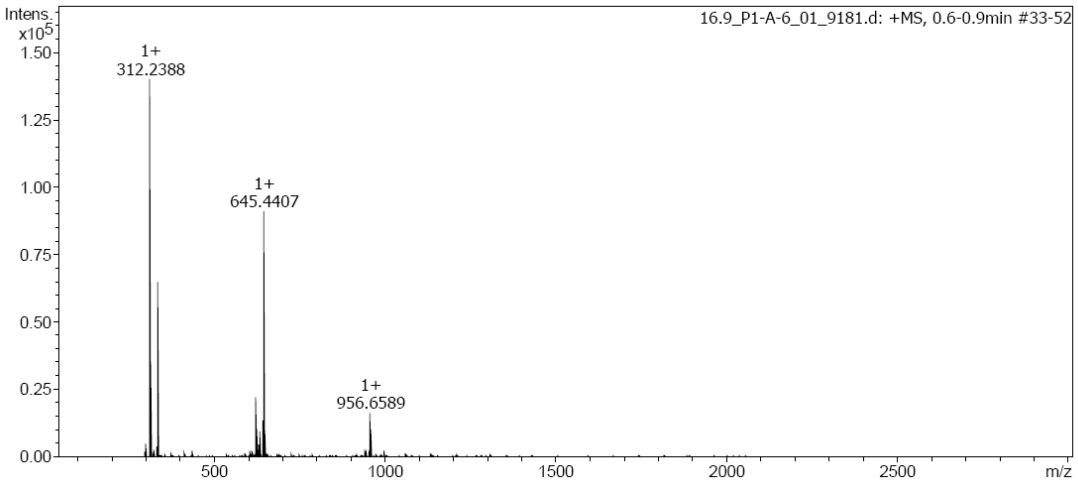
COSY spectrum of compound **S14**



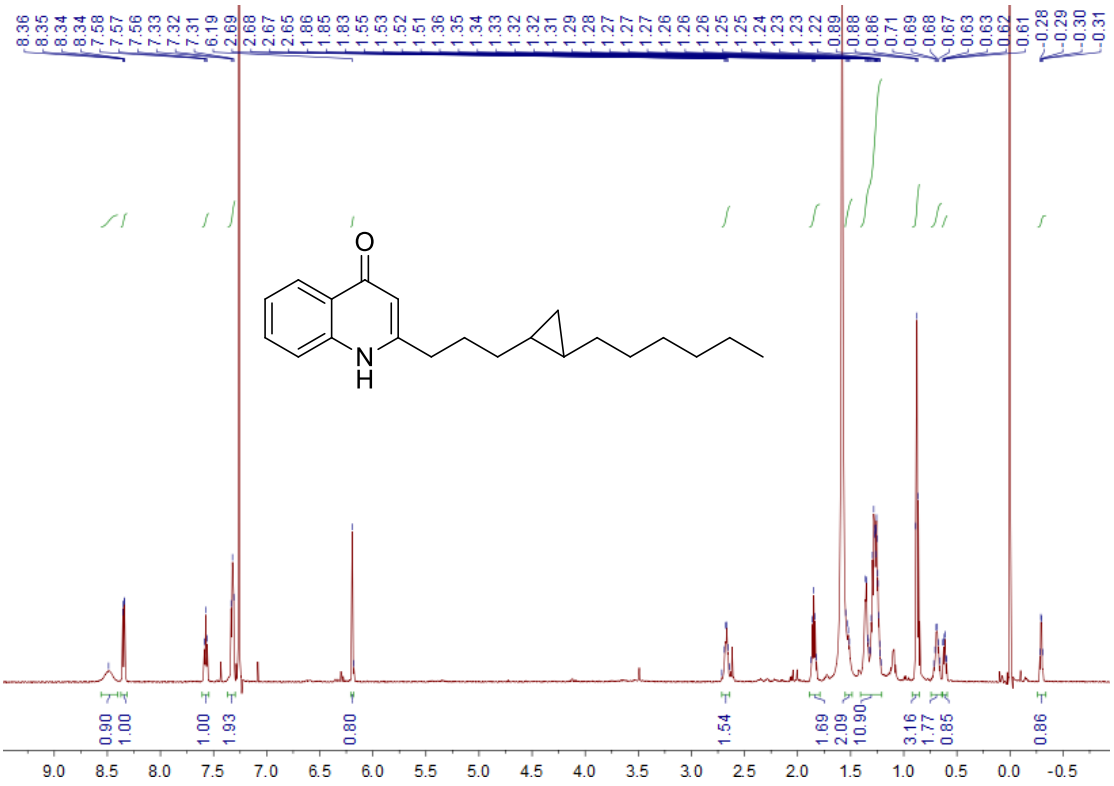
HSQC spectrum of compound **S14**



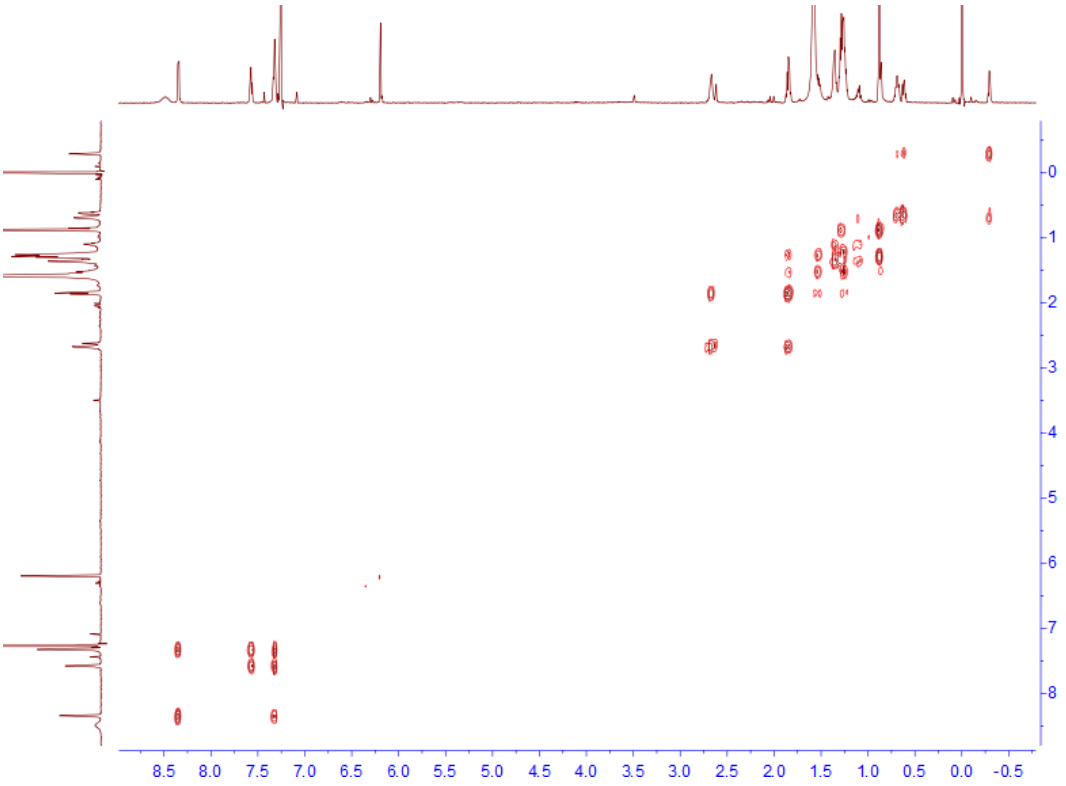
HMBC spectrum of compound **S14**



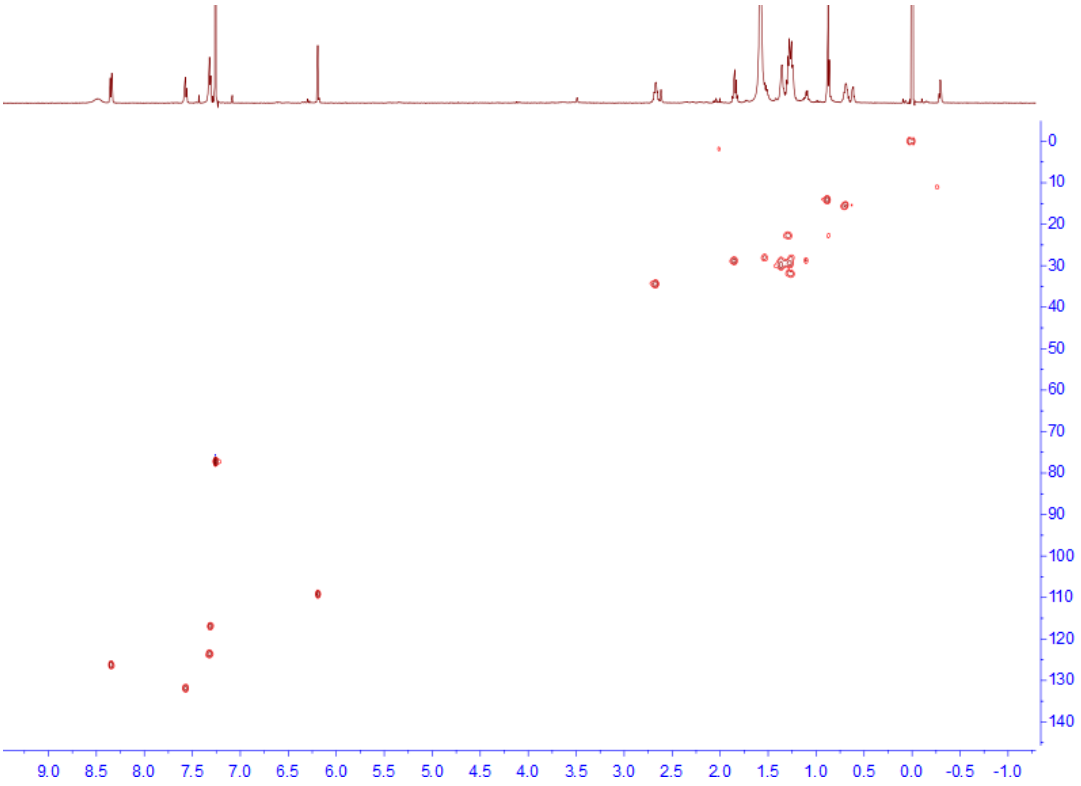
HRESI MS spectra of compound **S15**



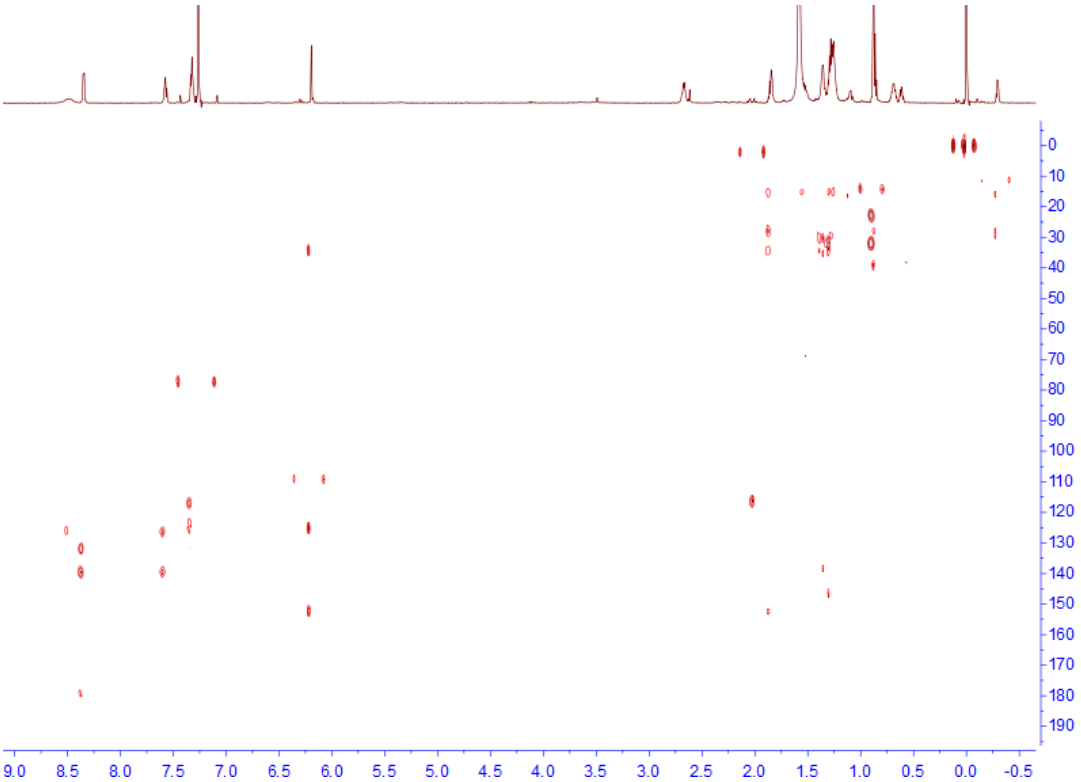
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S15**



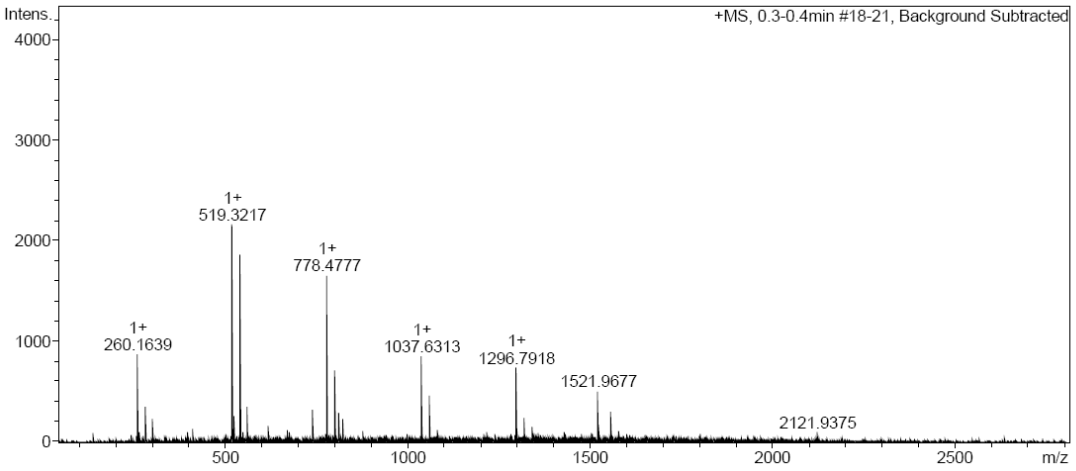
COSY spectrum of compound **S15**



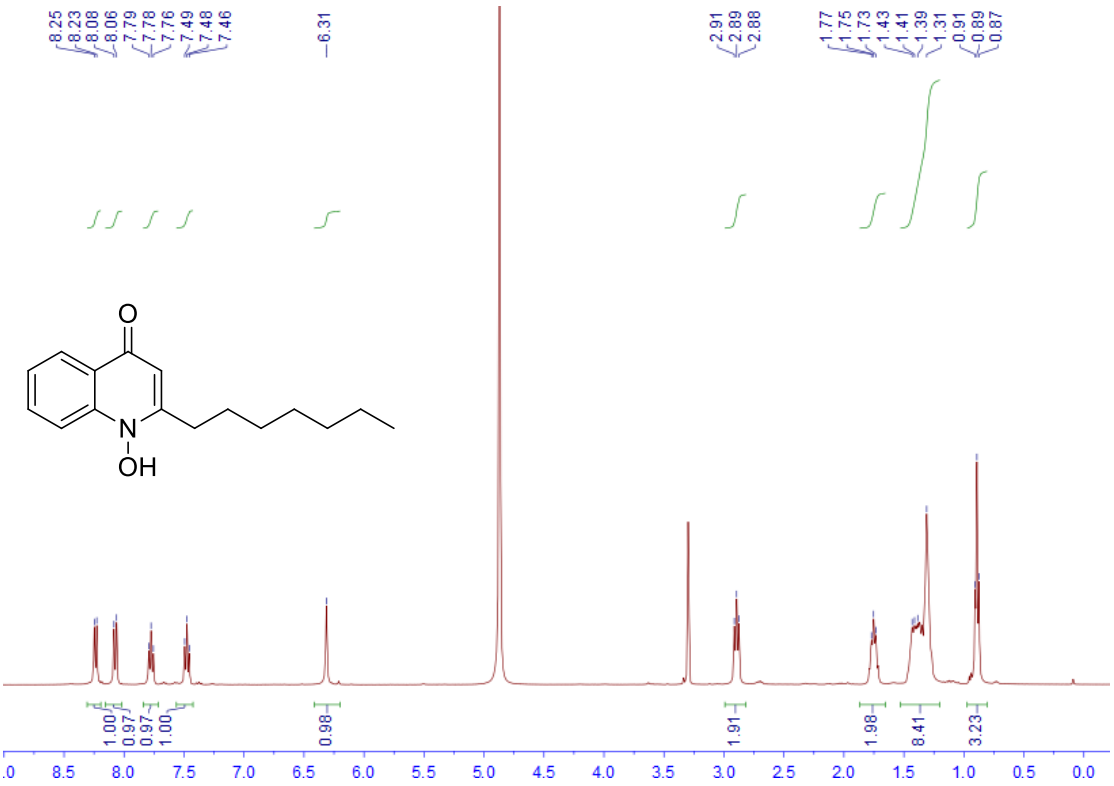
HSQC spectrum of compound **S15**



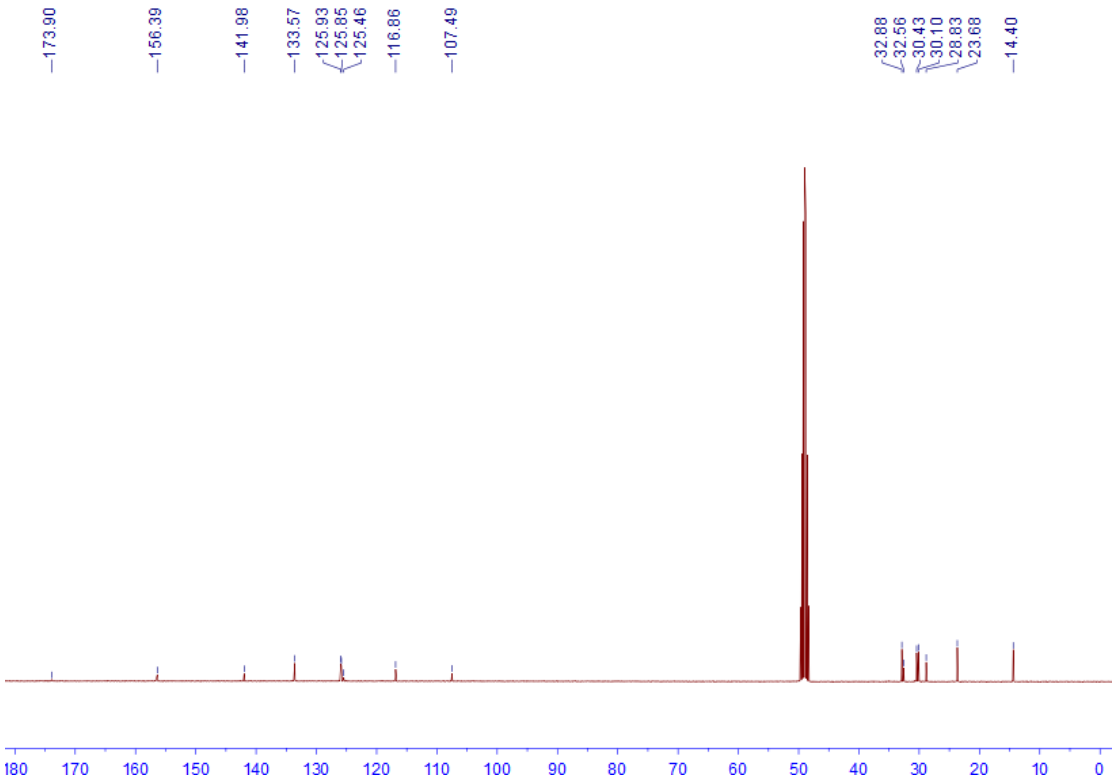
HMBC spectrum of compound **S15**



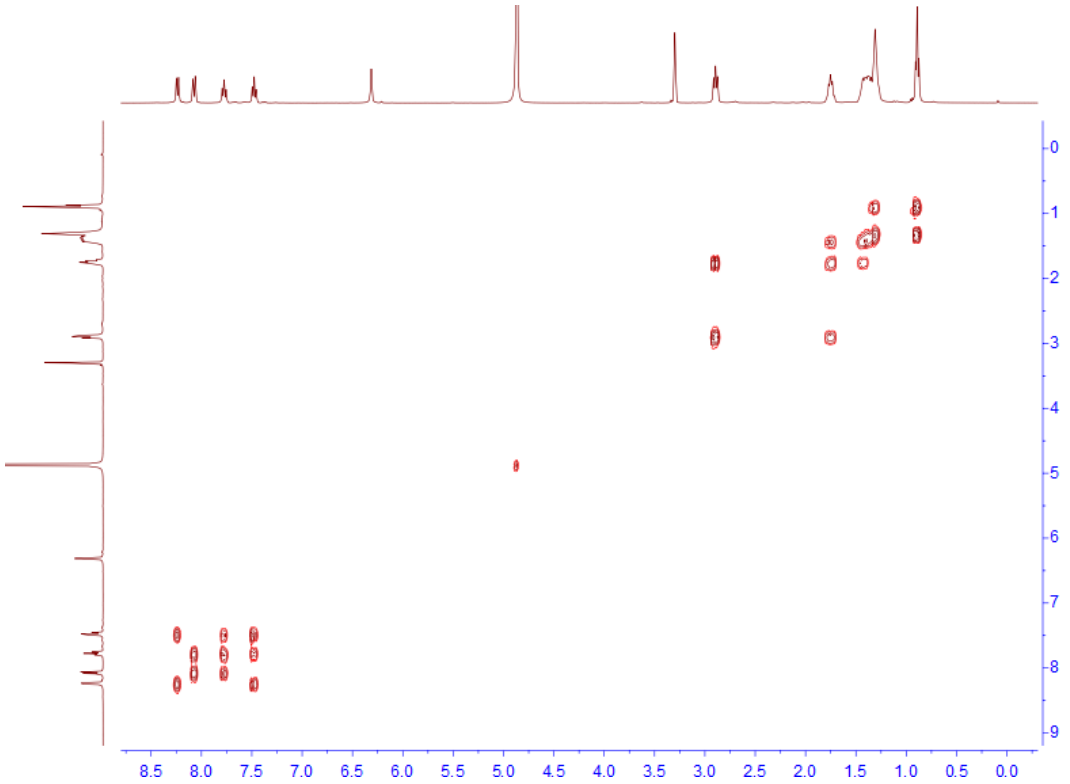
HRESI MS spectra of compound **S16**



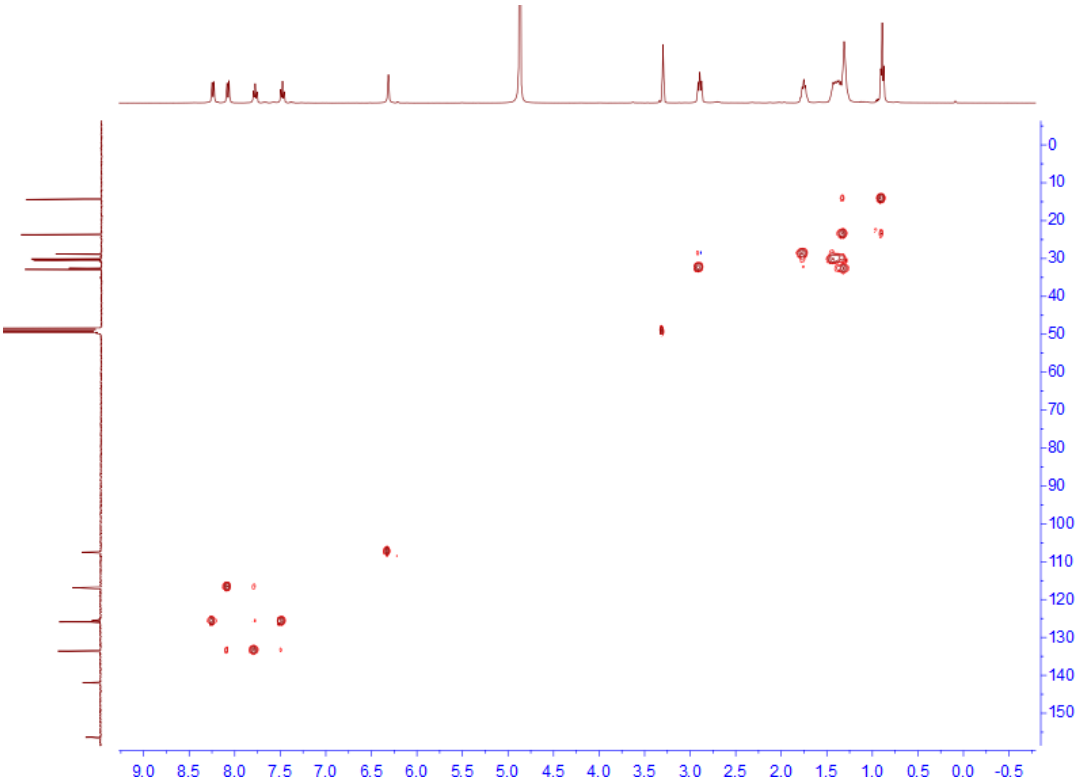
^{1}H-NMR (400 MHz, methanol-d_4) spectrum of compound **S16**



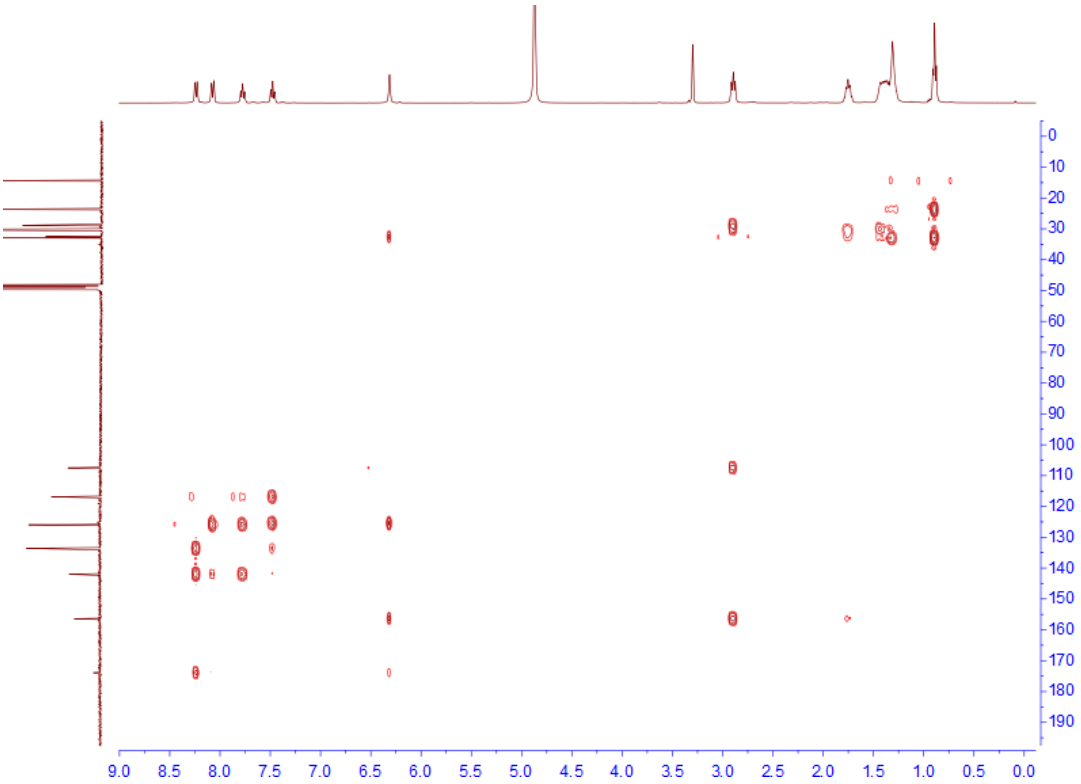
^{13}C-NMR (100 MHz, methanol-d_4) spectrum of compound **S16**



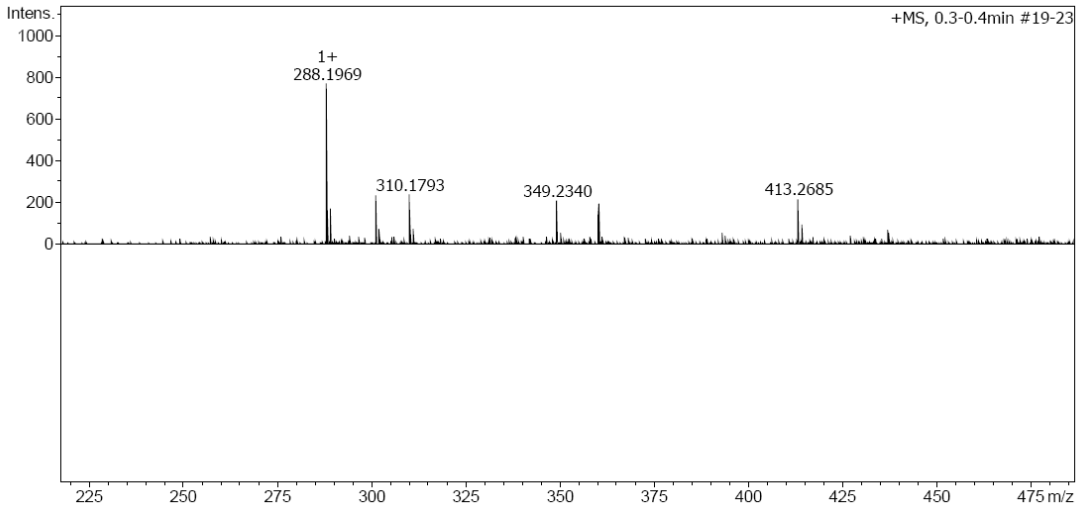
COSY spectrum of compound **S16**



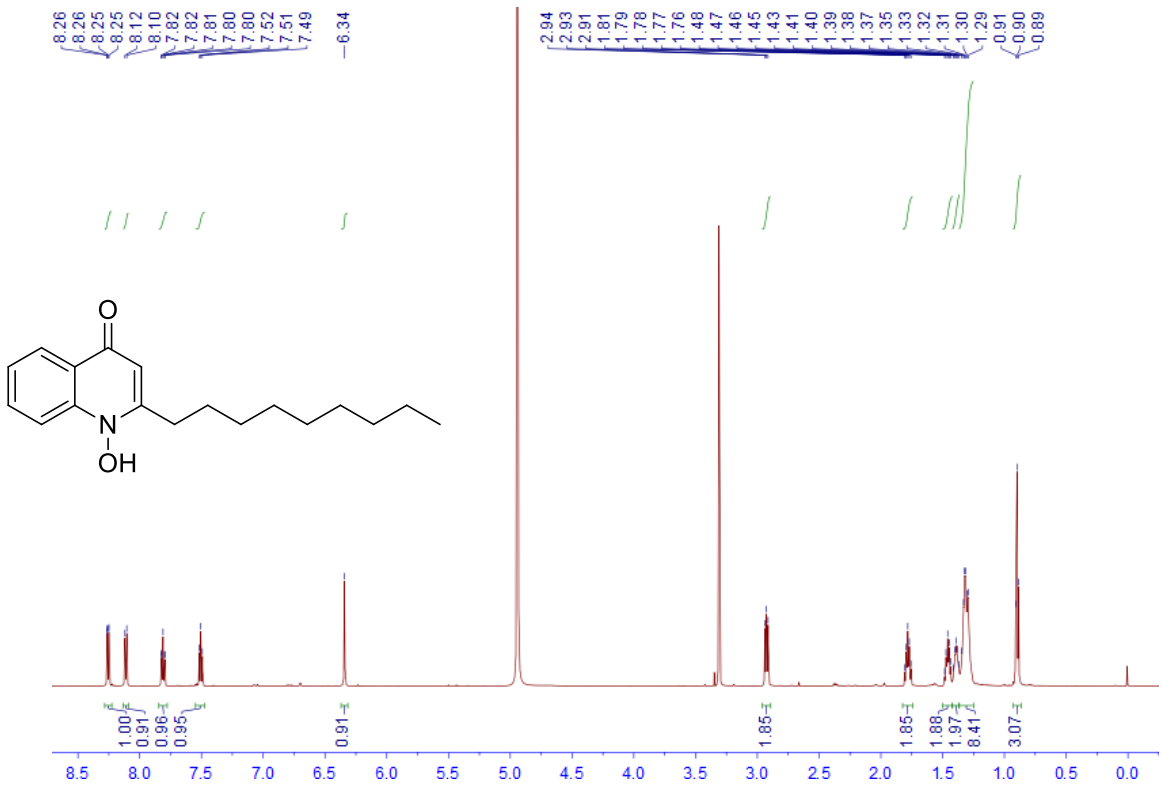
HSQC spectrum of compound **S16**



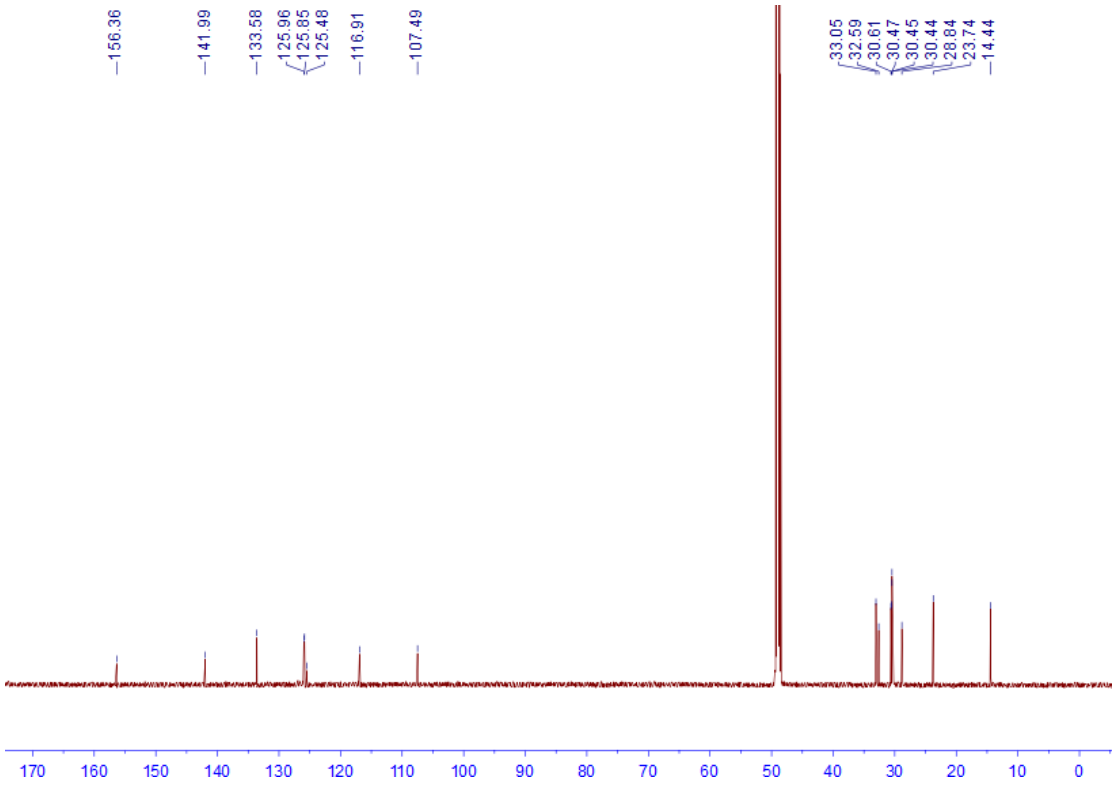
HMBC spectrum of compound **S16**



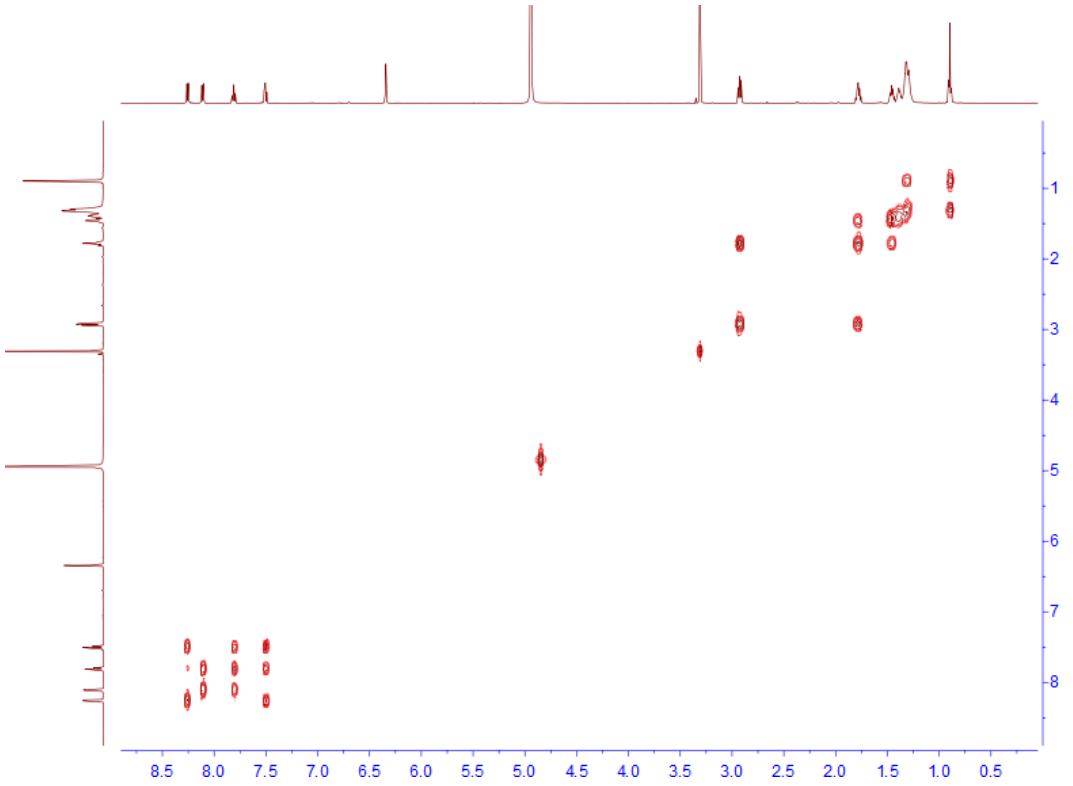
HRESI MS spectra of compound **S17**



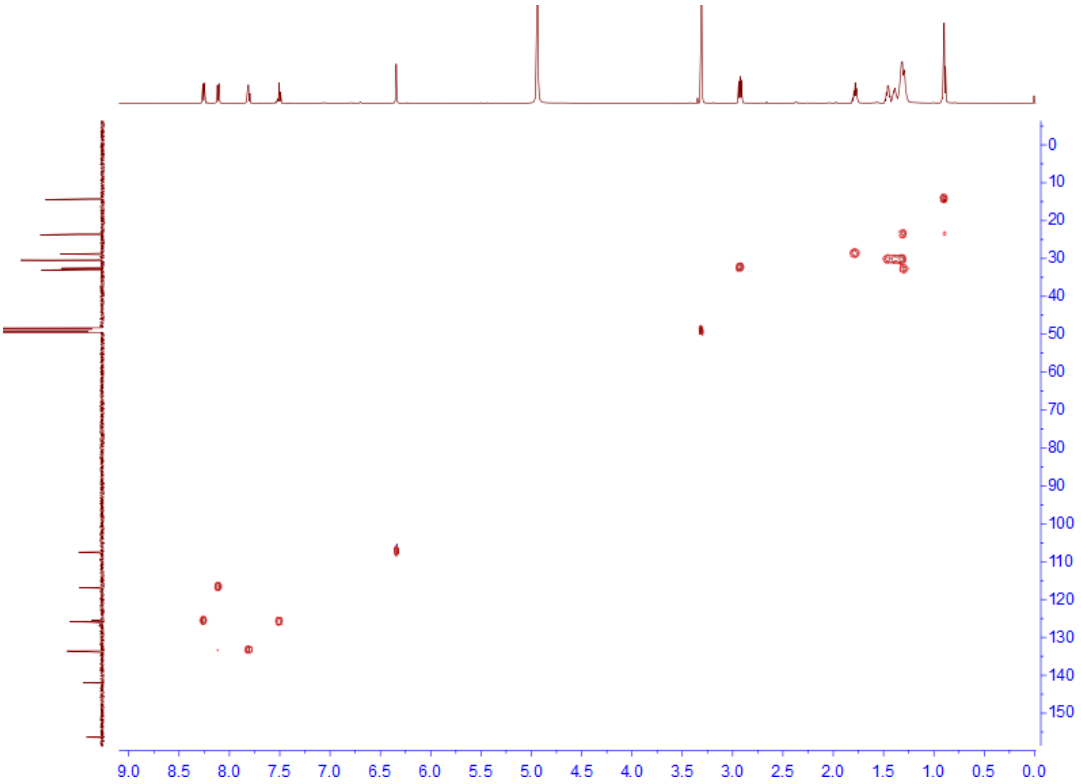
^{1}H-NMR (600 MHz, methanol-d_4) spectrum of compound **S17**



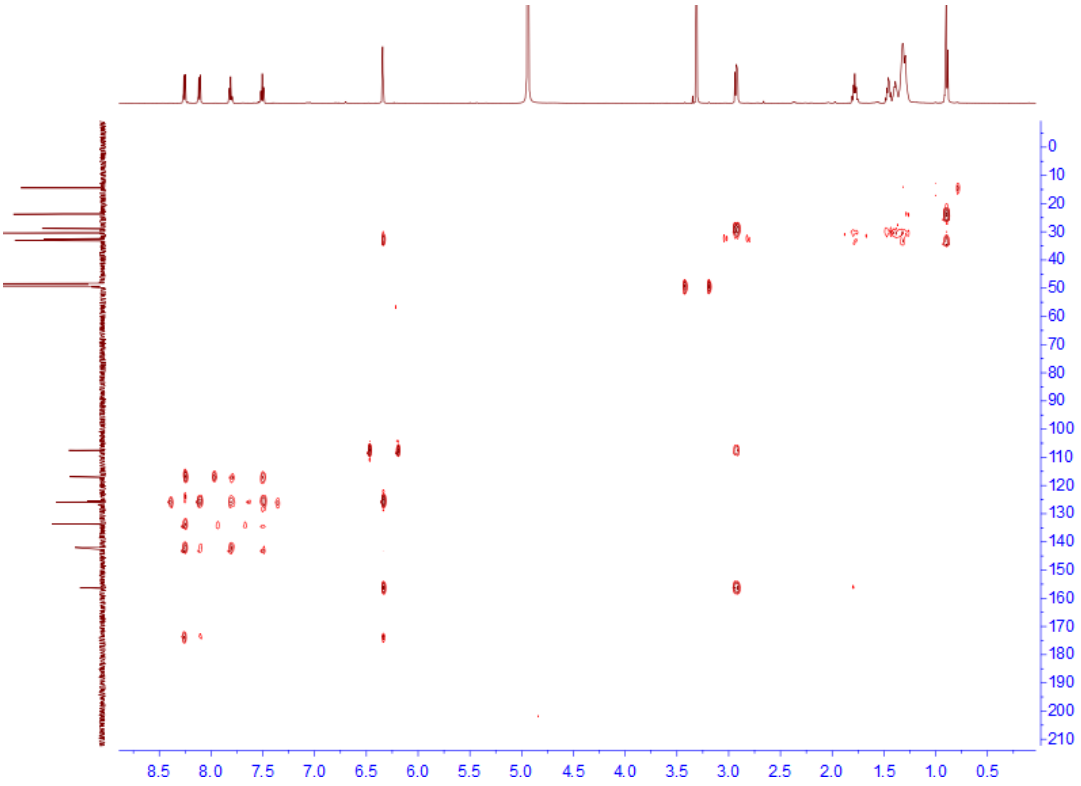
^{13}C-NMR (150 MHz, methanol-d_4) spectrum of compound **S17**



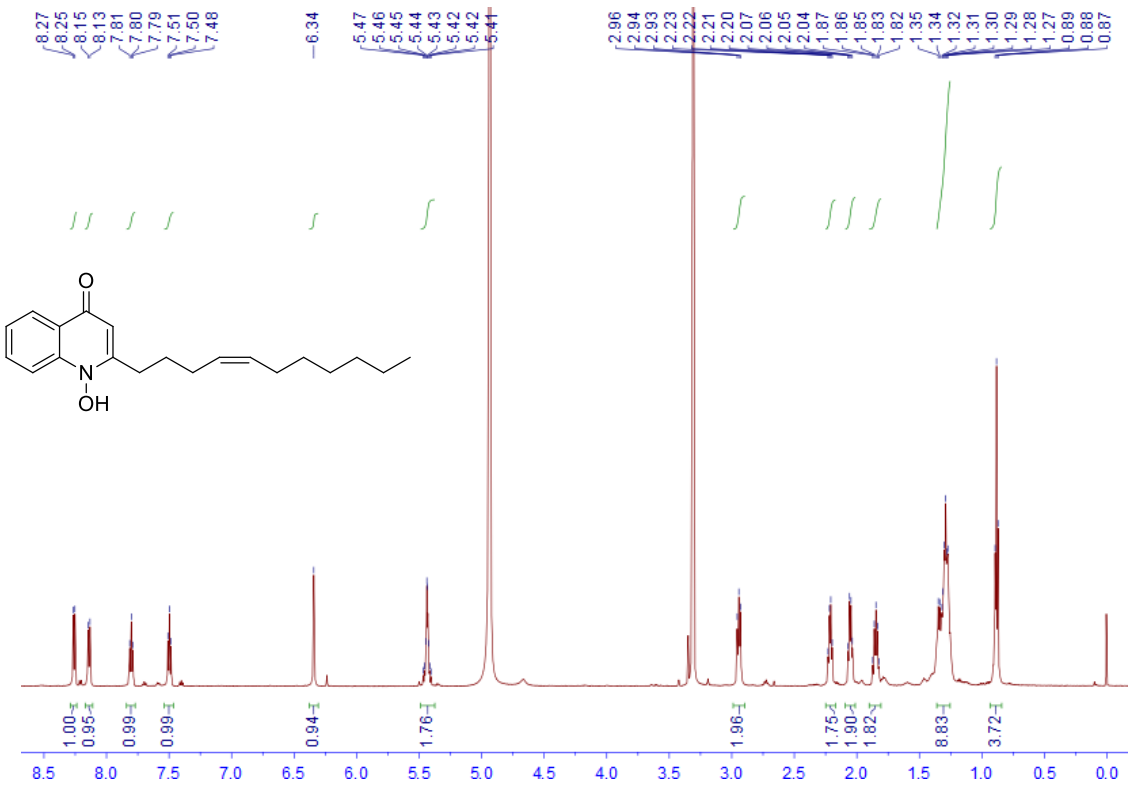
COSY spectrum of compound **S17**



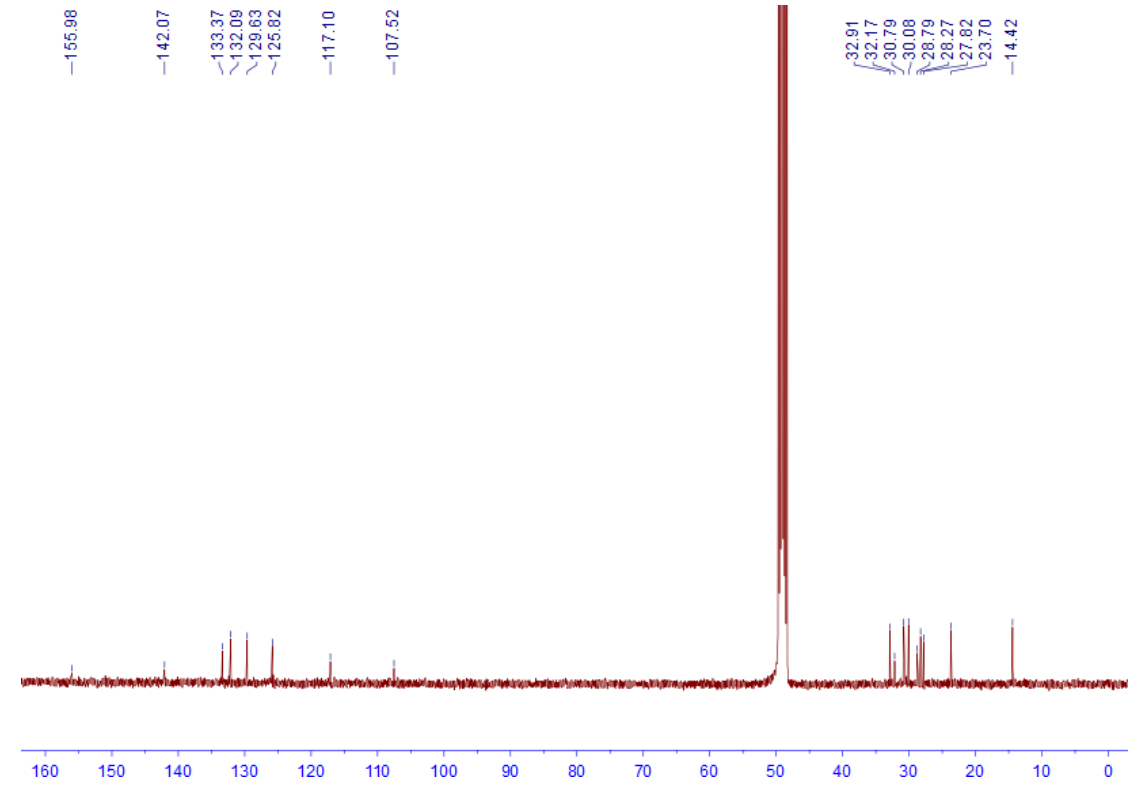
HSQC spectrum of compound **S17**



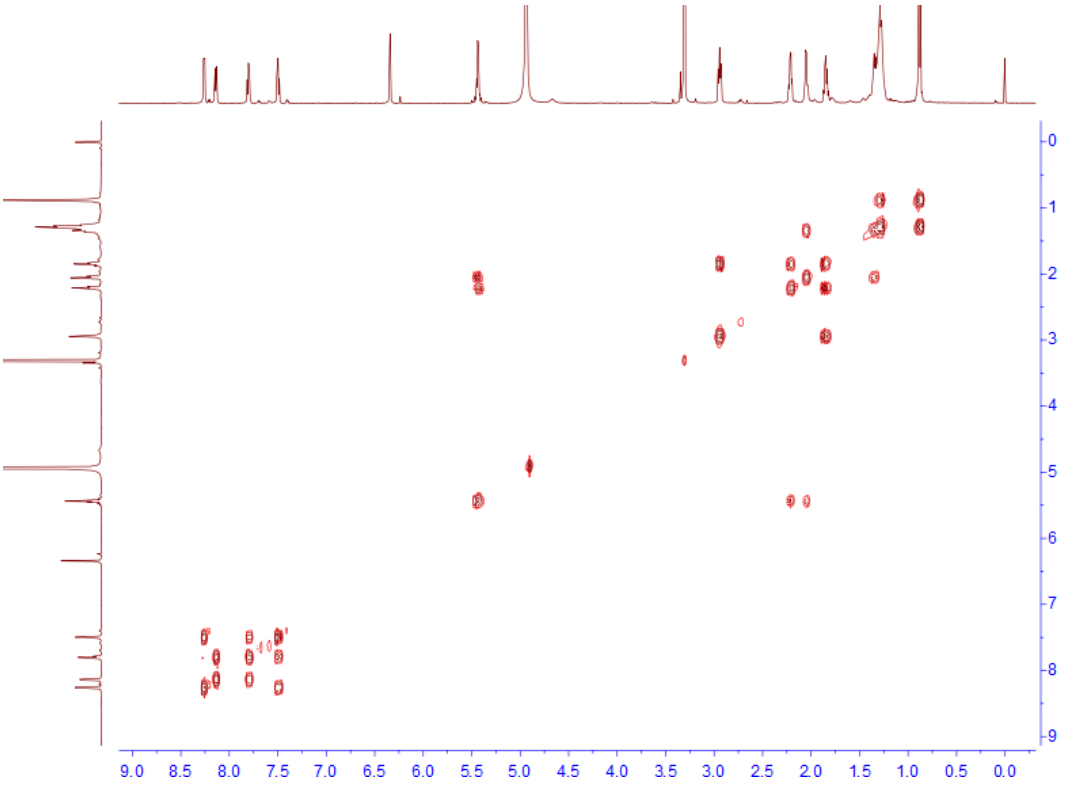
HMBC spectrum of compound **S17**



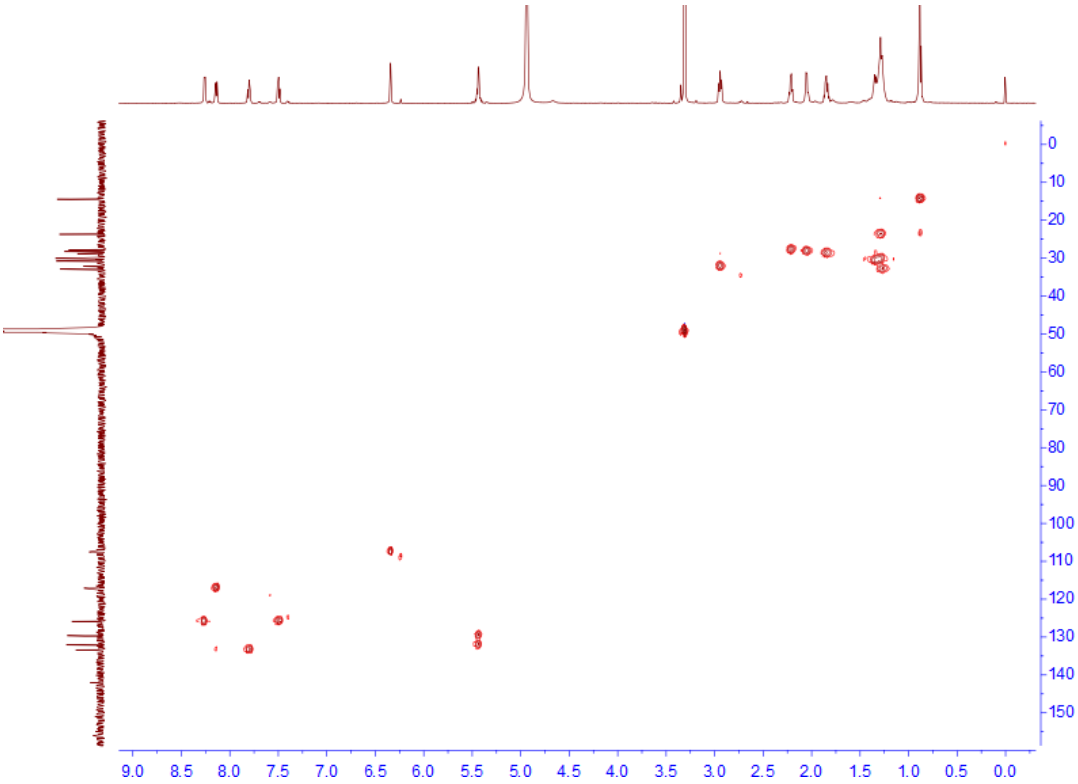
^{1}H-NMR (400 MHz, methanol-d_4) spectrum of compound **S18**



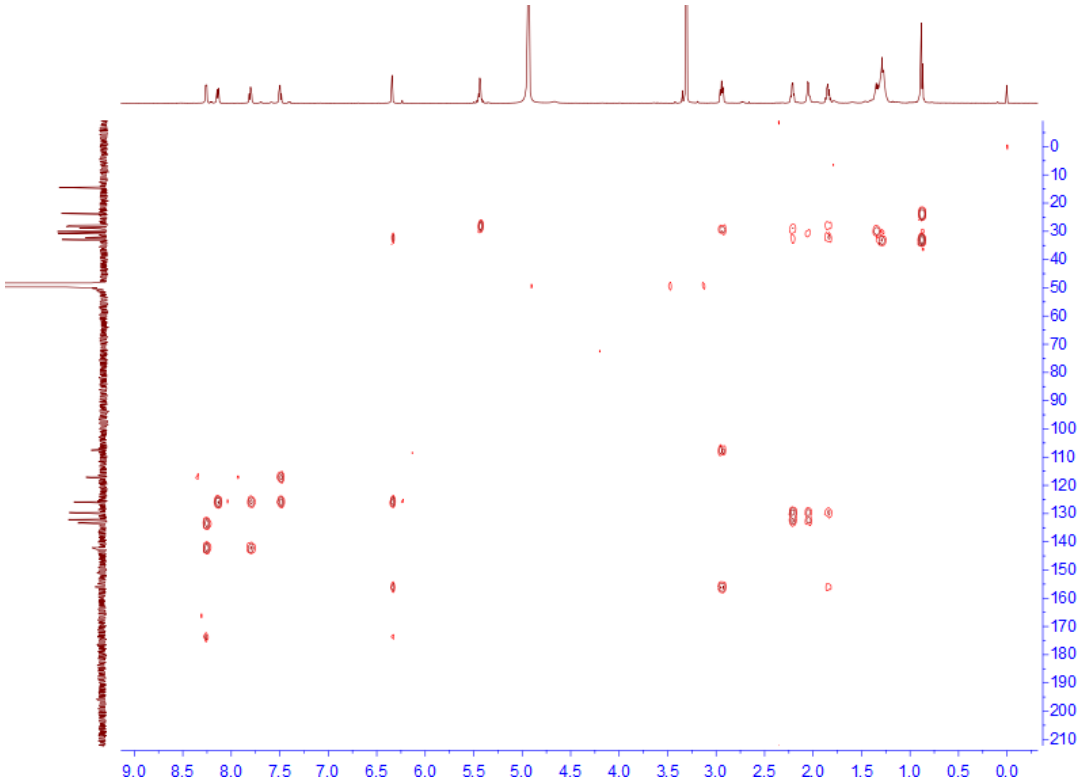
^{13}C-NMR (100 MHz, methanol-d_4) spectrum of compound **S18**



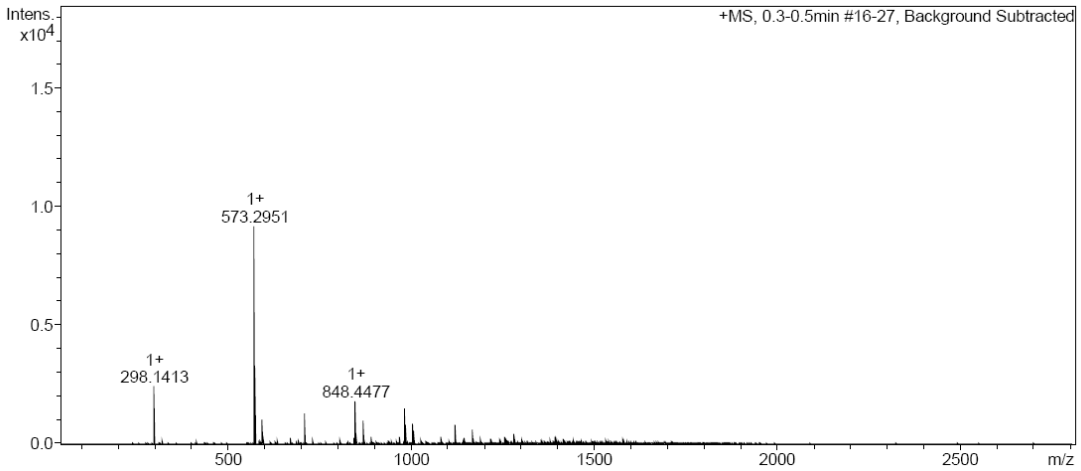
COSY spectrum of compound **S18**



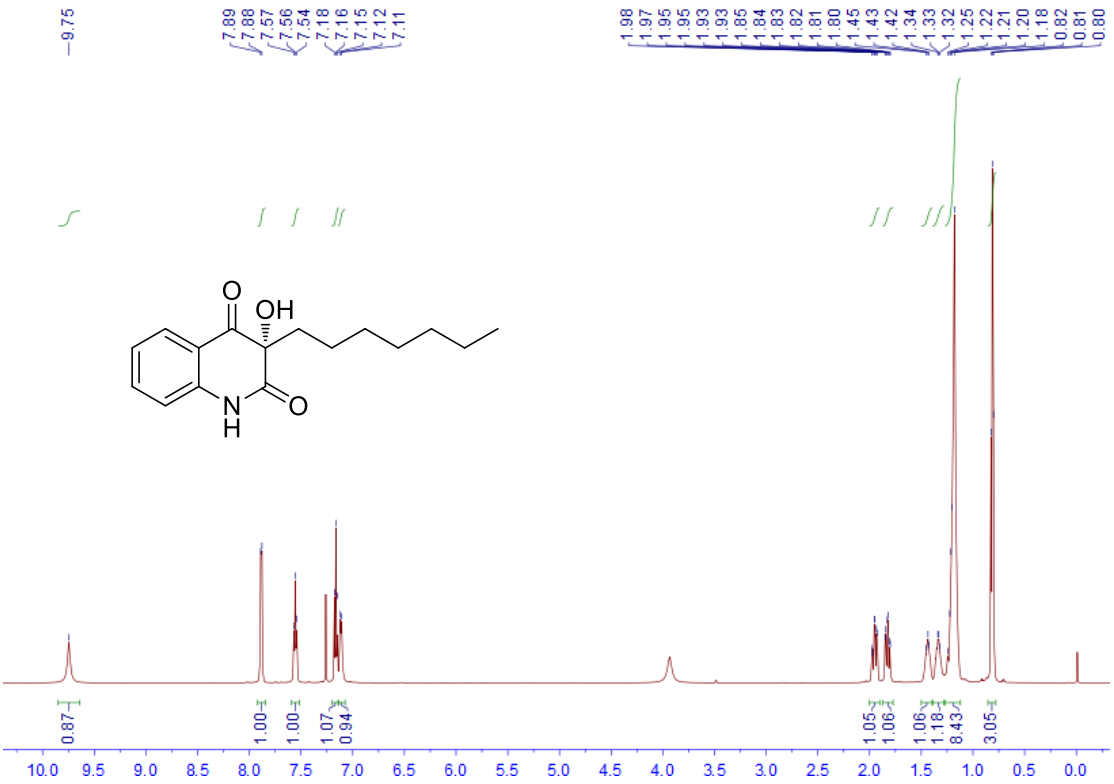
HSQC spectrum of compound **S18**



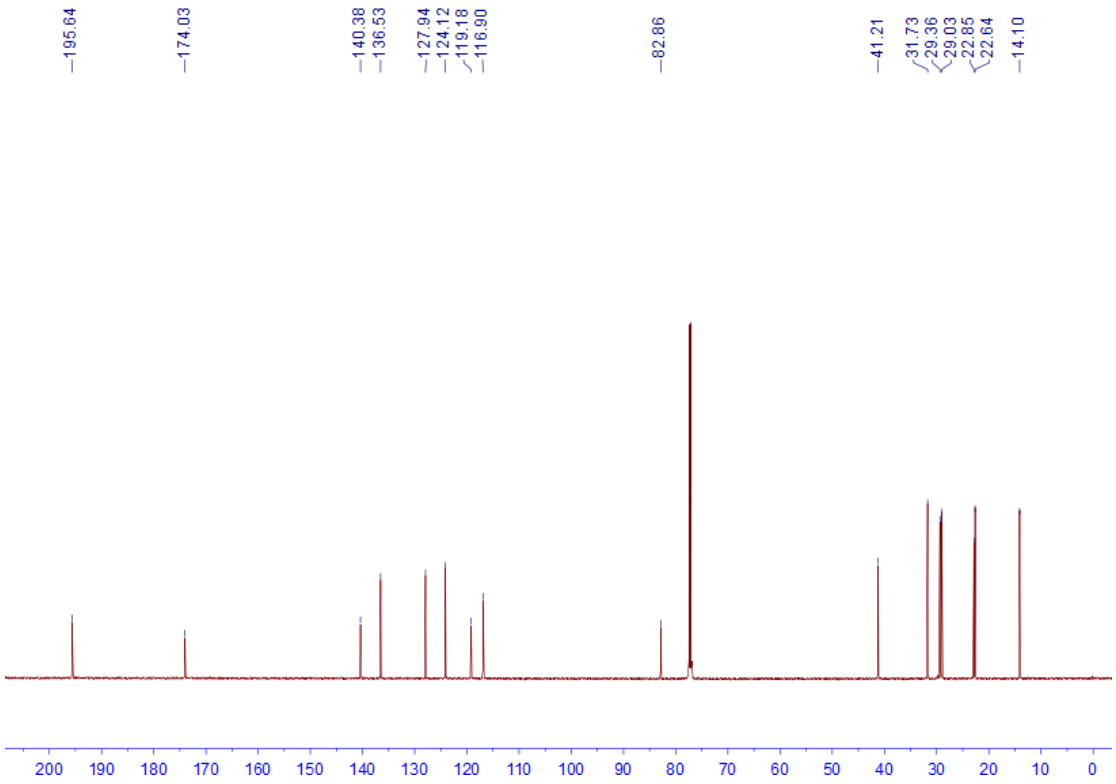
HMBC spectrum of compound **S18**



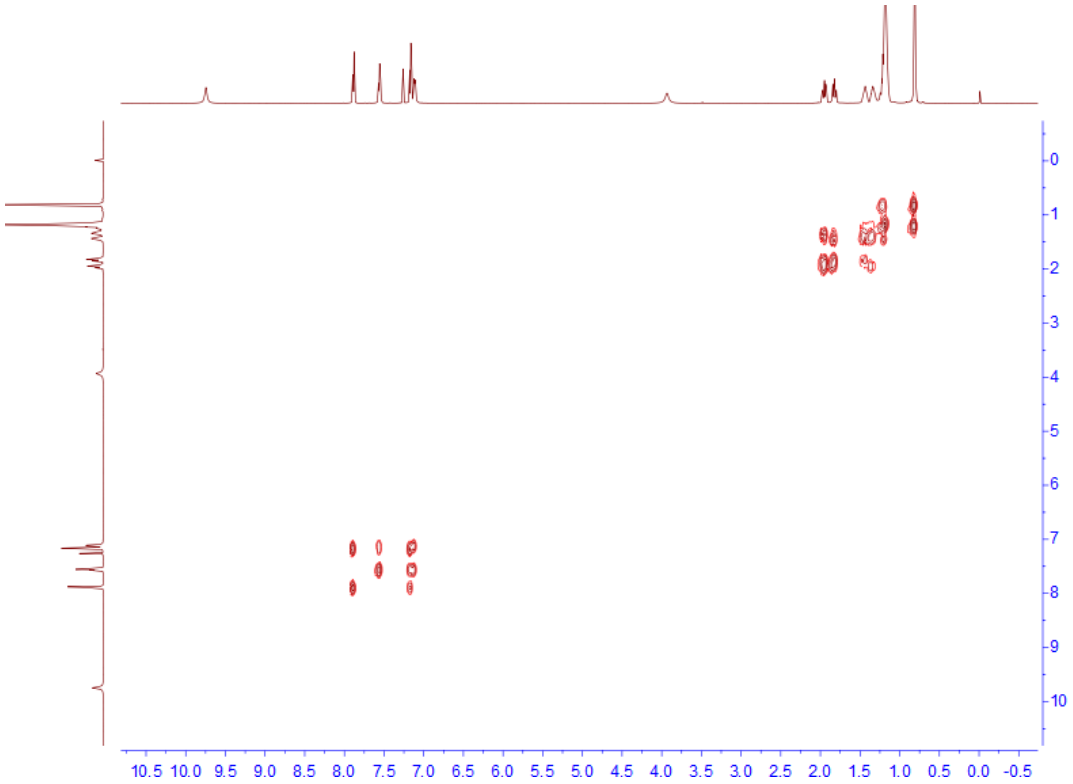
HRESI MS spectra of compound **S19**



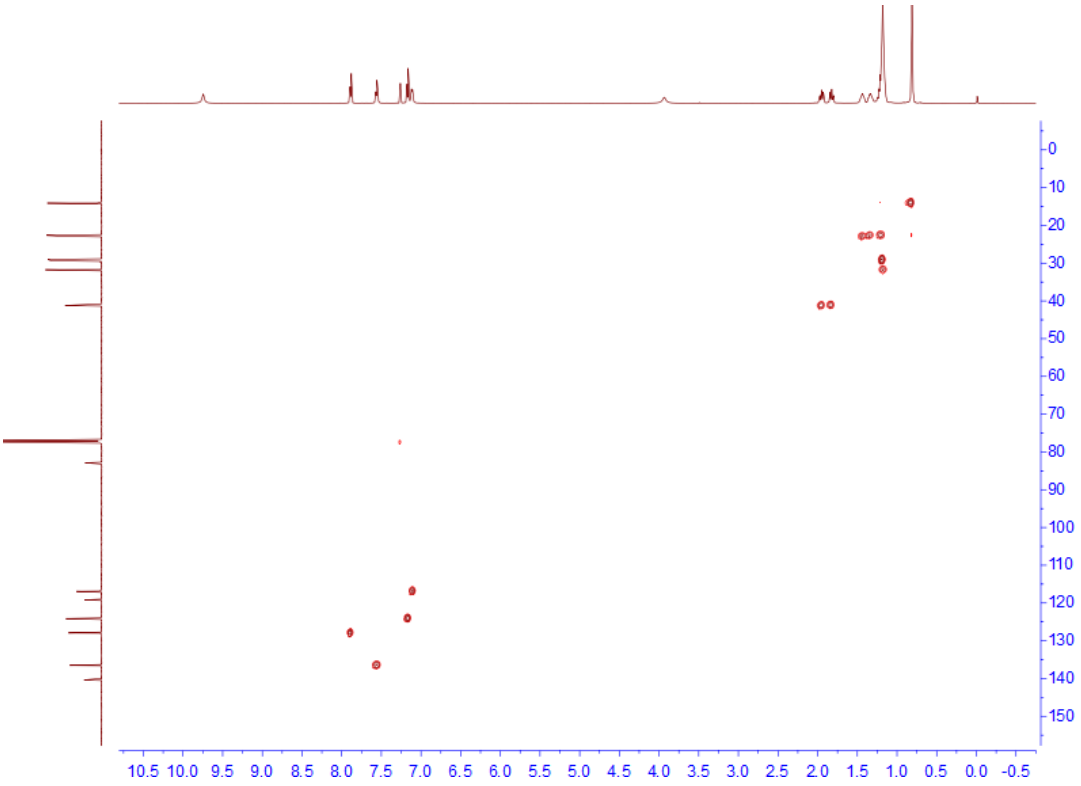
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S19**



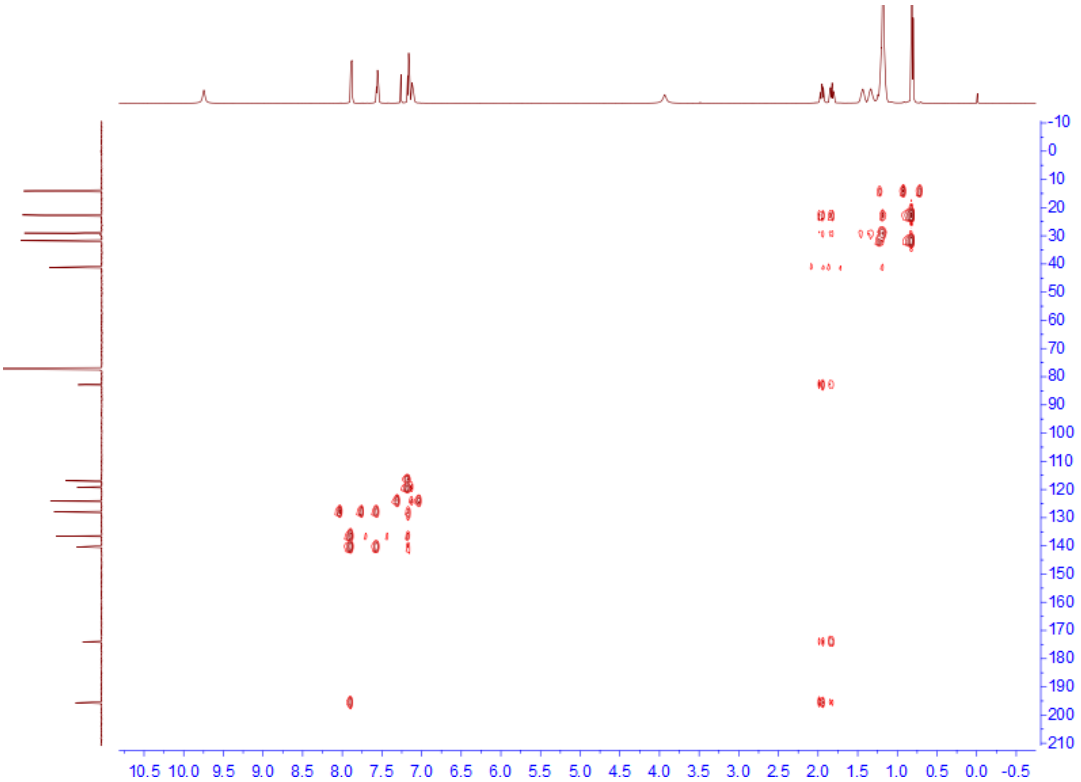
^{13}C-NMR (150 MHz, $CDCl_3$) spectrum of compound **S19**



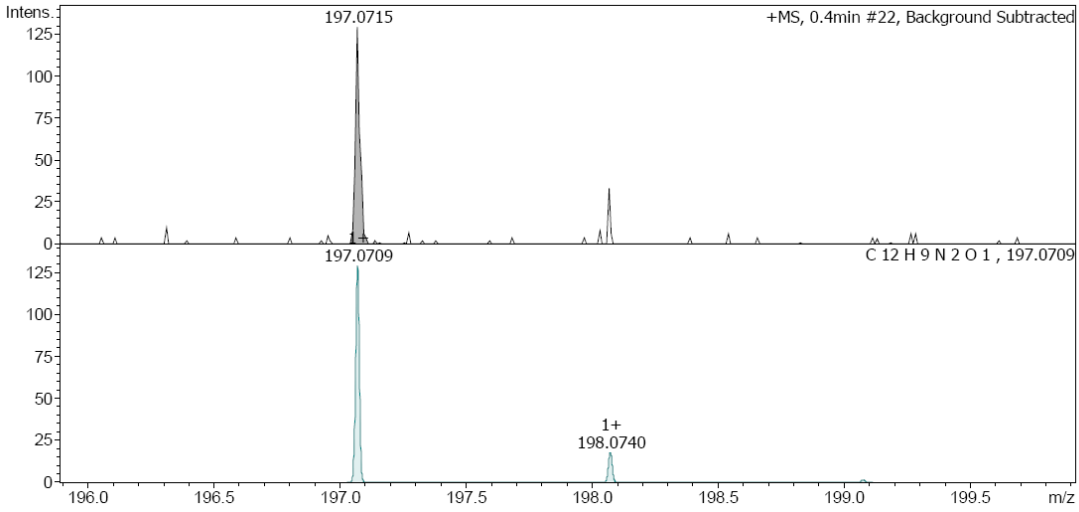
COSY spectrum of compound **S19**



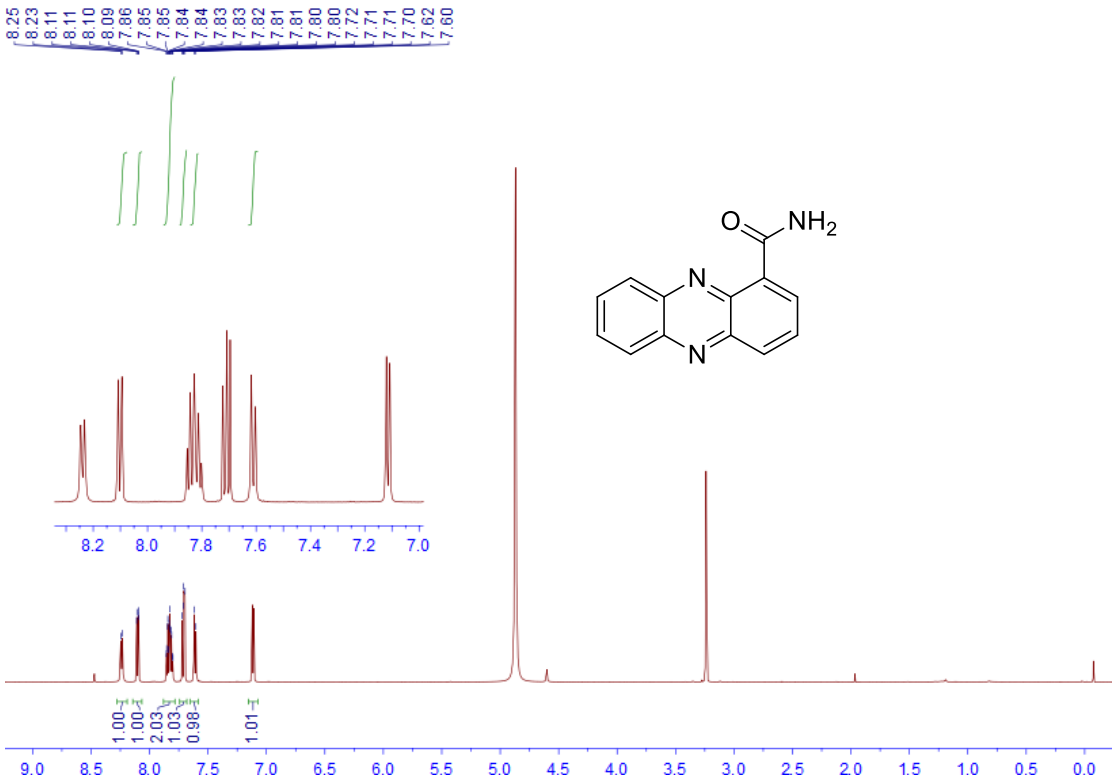
HSQC spectrum of compound **S19**



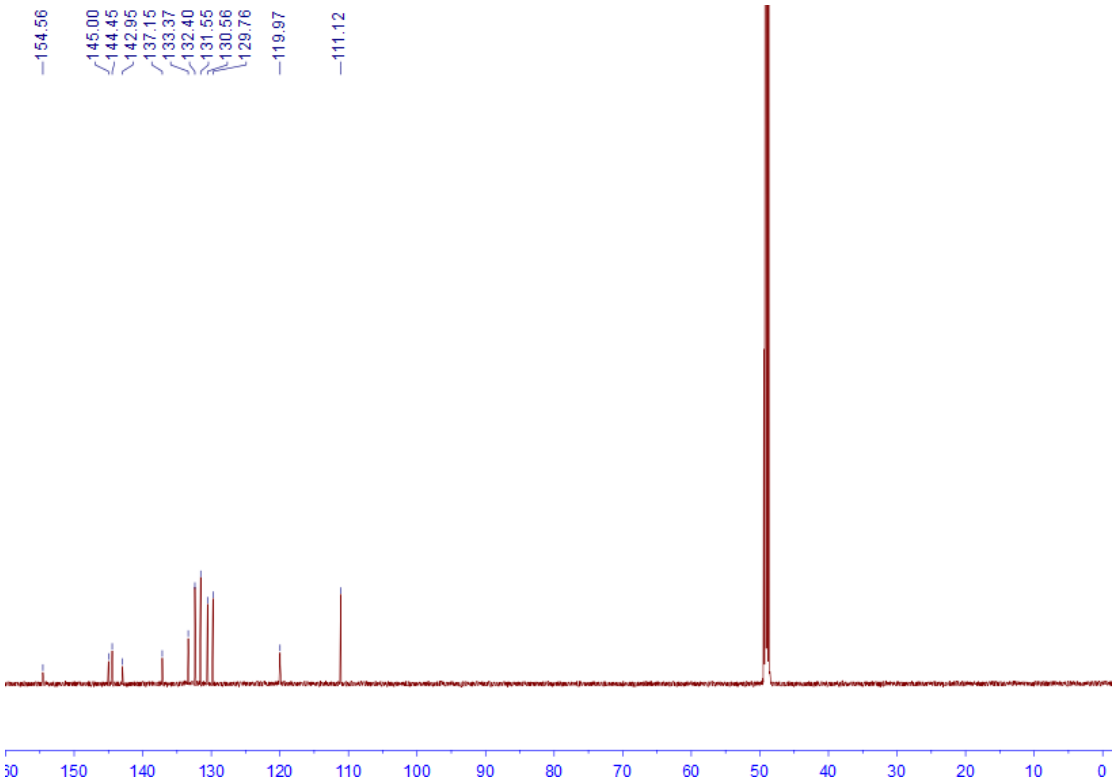
HMBC spectrum of compound **S19**



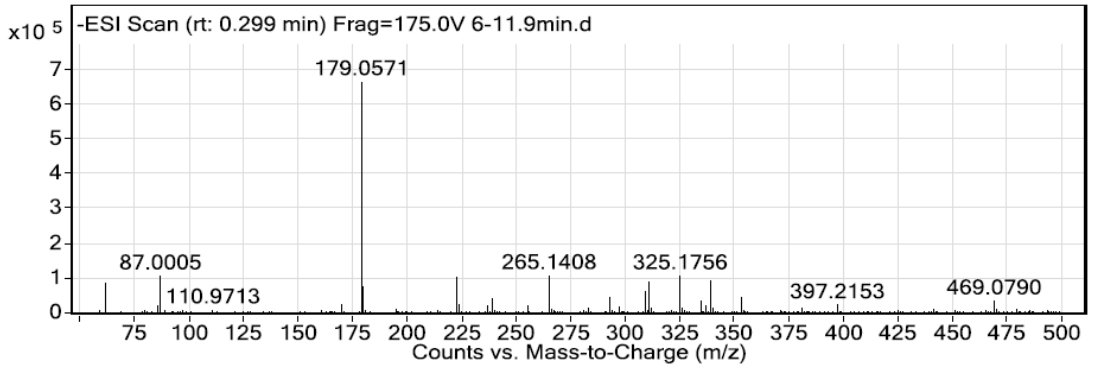
HRESI MS spectra of compound **S20**



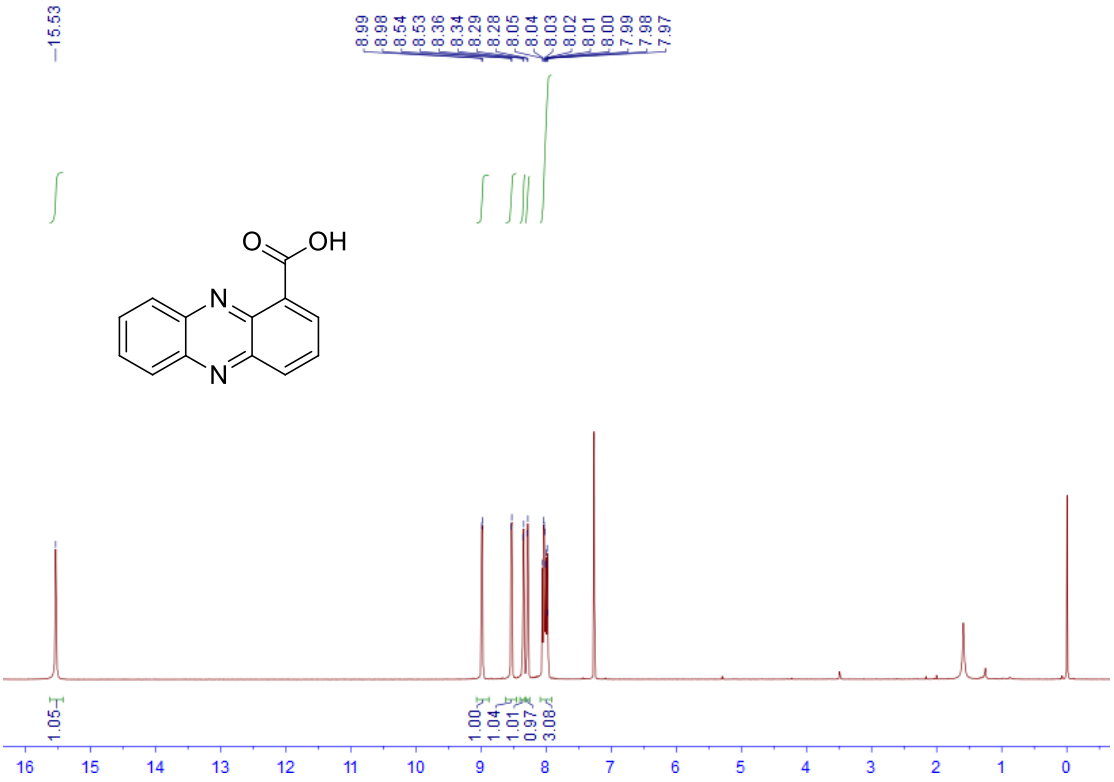
^{1}H-NMR (600 MHz, methanol-d_4) spectrum of compound **S20**



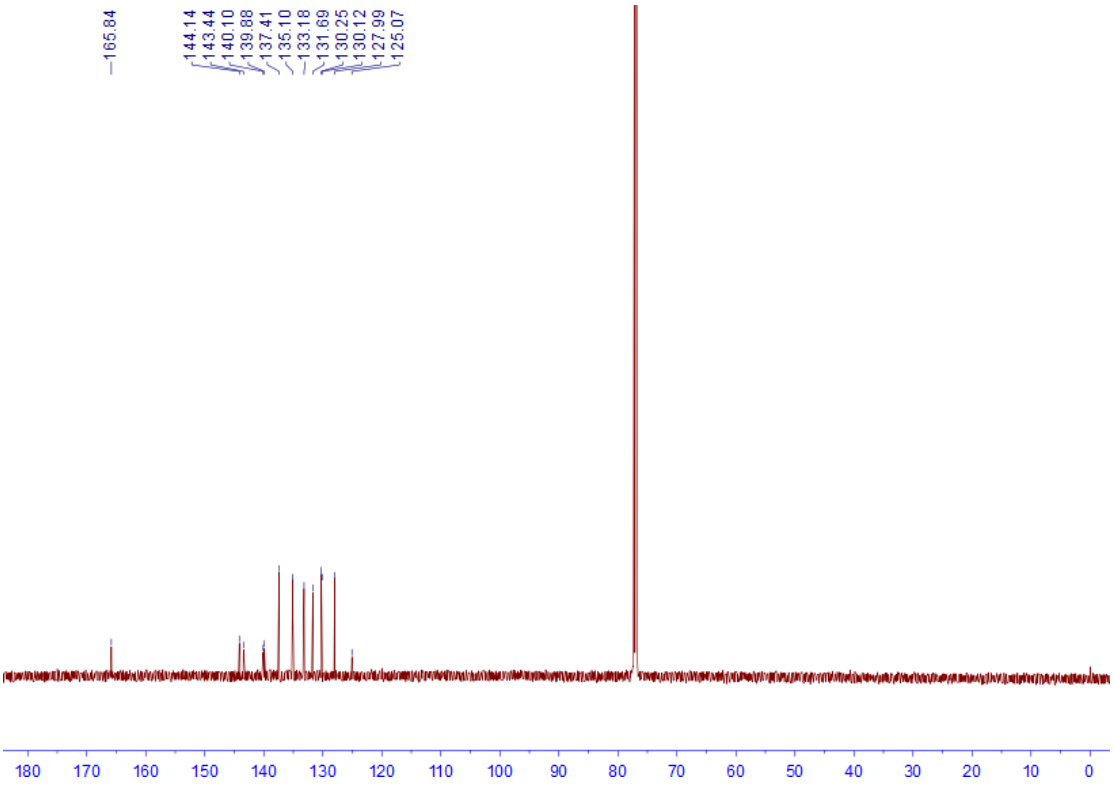
^{13}C-NMR (150 MHz, methanol-d_4) spectrum of compound **S20**



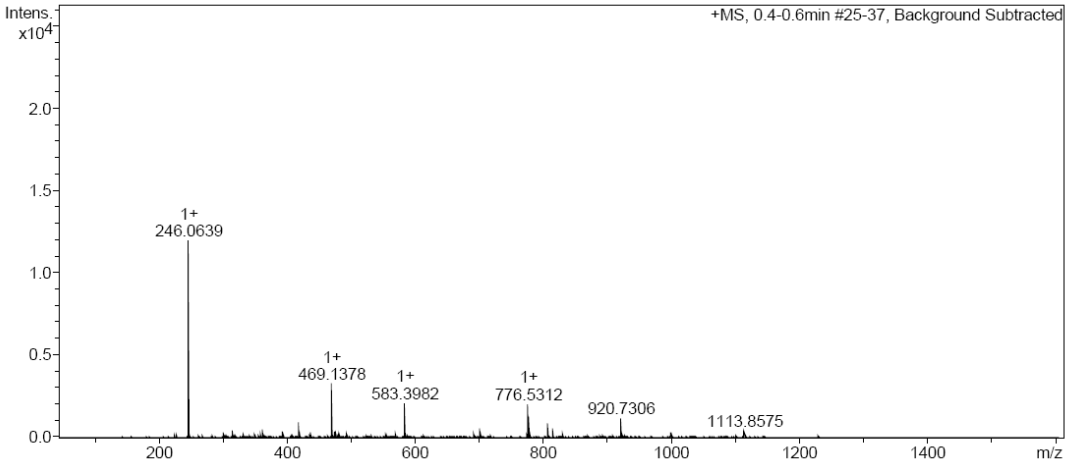
HRESI MS spectra of compound **S21**



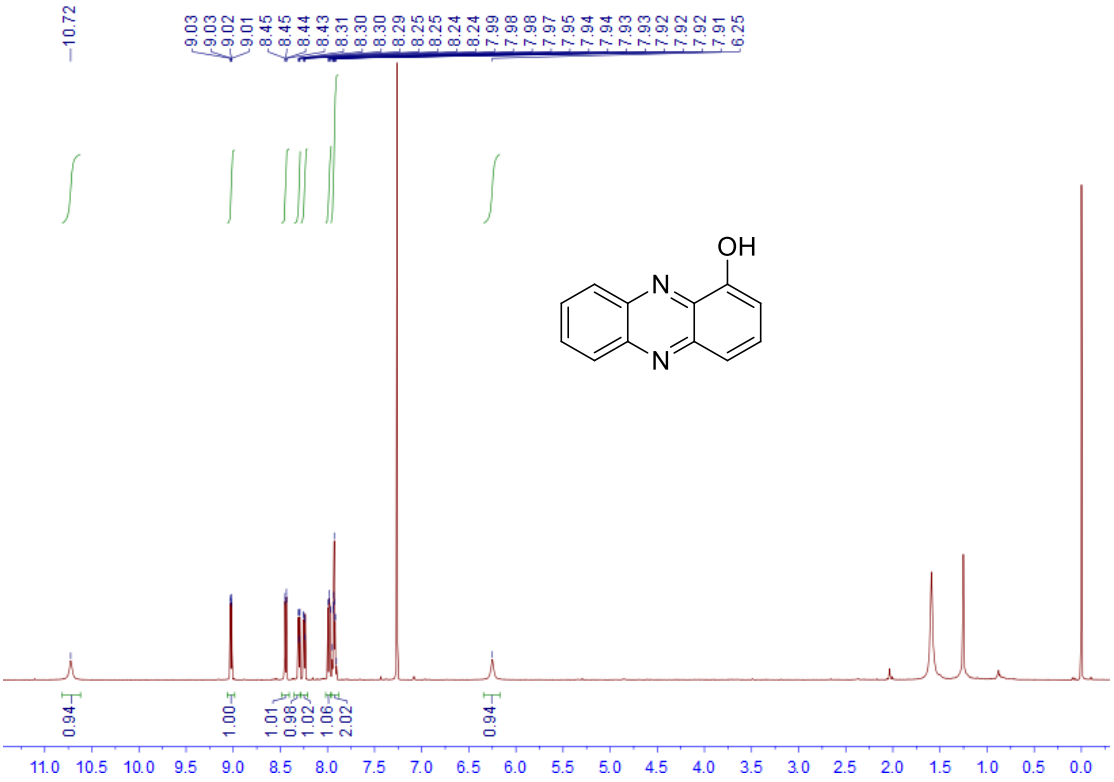
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S21**



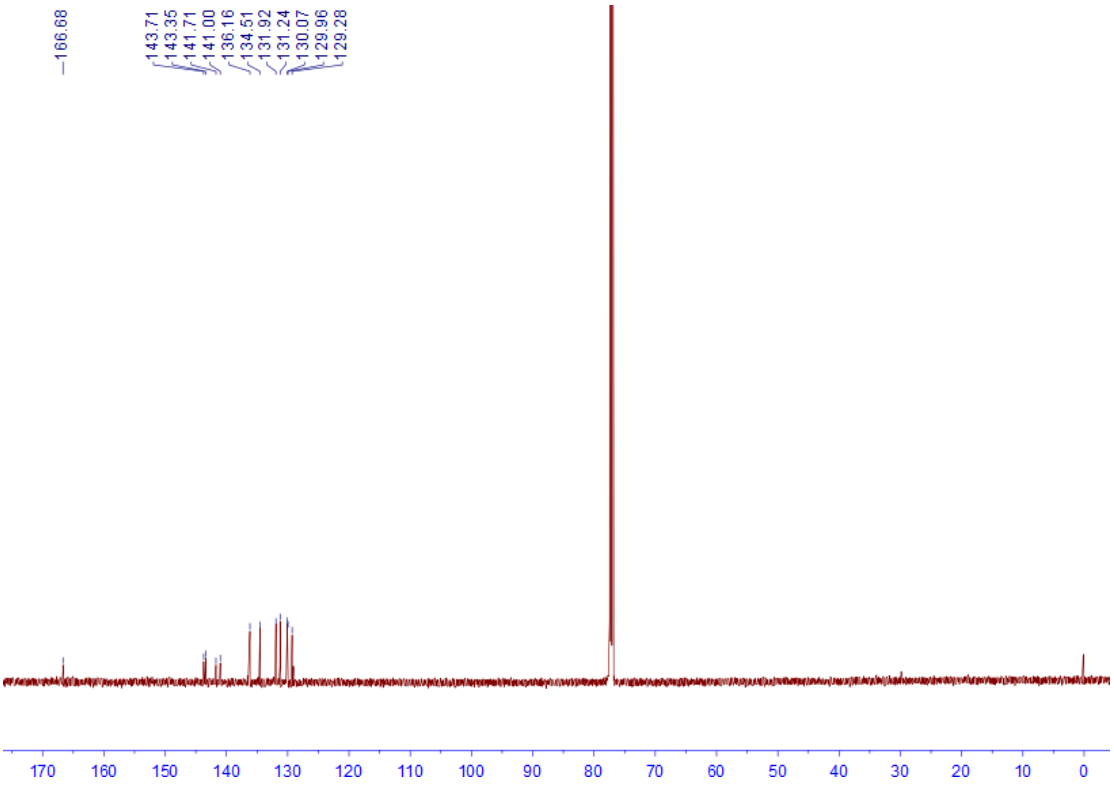
^{13}C-NMR (150 MHz, $CDCl_3$) spectrum of compound **S21**



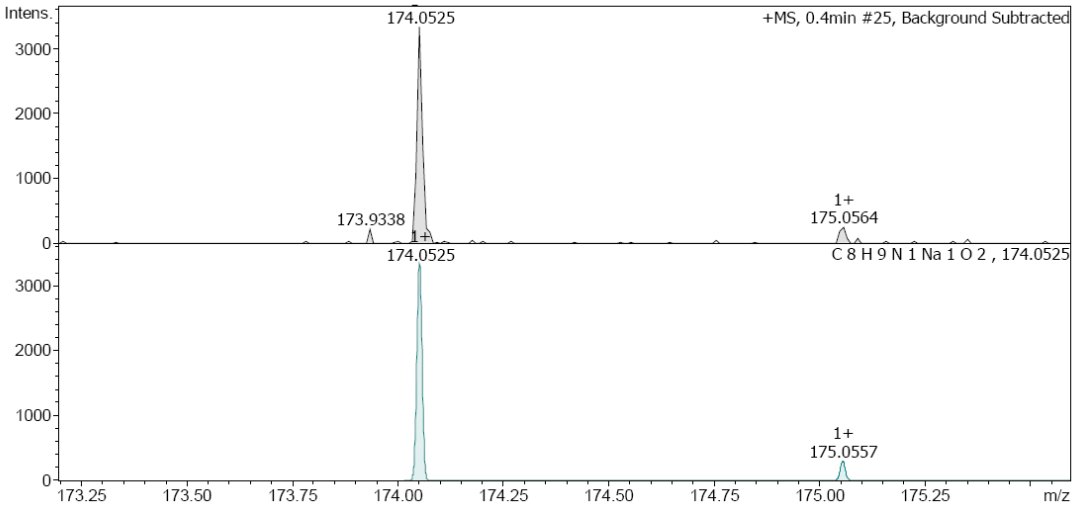
HRESI MS spectra of compound **S21**



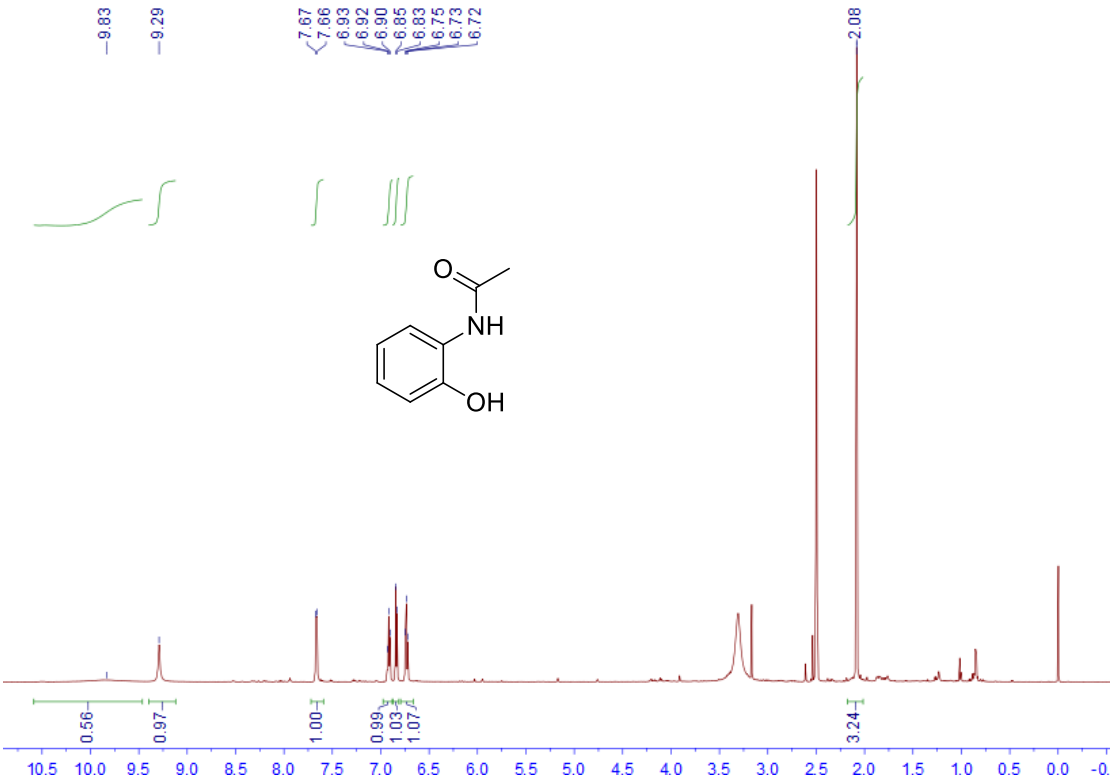
^{1}H-NMR (600 MHz, $CDCl_3$) spectrum of compound **S22**



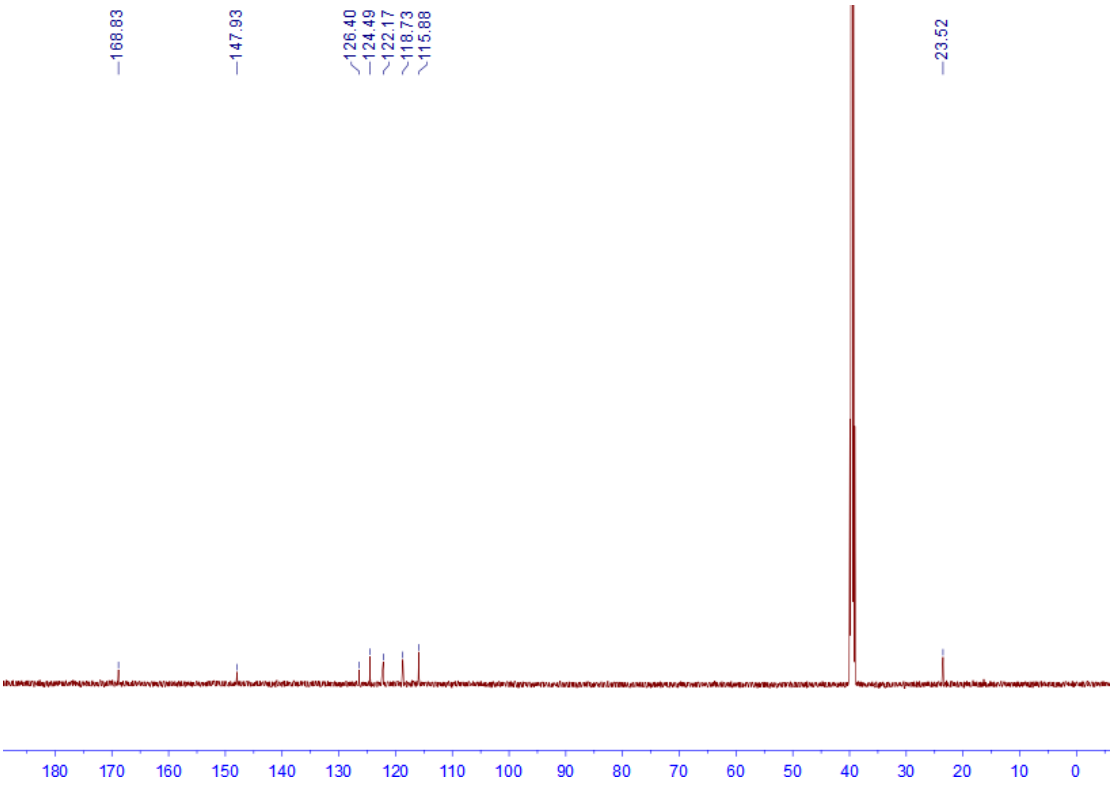
^{13}C-NMR (150 MHz, $CDCl_3$) spectrum of compound **S22**



HRESI MS spectra of compound **S23**



^{1}H-NMR (600 MHz, DMSO-d_6) spectrum of compound **S23**



^{13}C-NMR (150 MHz, DMSO-d_6) spectrum of compound **S23**

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