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Uncatalyzed, on water oxygenative cleavage of inert C-N bond with concomitant 8, 7-aminoshift in 8-aminoquinoline derivatives.

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1. General experimental information

All commercially available chemicals were used as received. Benzoyl peroxide was purchased from S D Fine-Chemicals. Thin-layer chromatography plates were visualized by exposure to UV or Iodine, and/or by immersion in an acidic staining solution of phosphomolybdic acid followed by heating on a hot plate. ^{1}H NMR spectra were obtained with 300, 400 and 500 MHz spectrometers, ^{13}C NMR spectra were obtained with 100 and 125 MHz spectrometers in $CDCl_3$ at 298 K with tetramethylsilane and $CDCl_3$ as the internal standard. Chemical shifts (δ) are reported in ppm relative to the residual solvent signal (δ = 7.26 ppm for ^{1}H NMR and δ = 77.0 ppm for ^{13}C NMR). Data for ^{1}H NMR are reported as follows: chemical shift (multiplicity, coupling constant, number of hydrogen atoms). Multiplicity is abbreviated as follows: s (singlet), d (doublet), t (triplet), q (quartet), m (multiplet). High-resolution mass spectra were determined with a Quadrupole time-of-flight (Q-TOF) mass spectrometer (QSTARXL, Applied Biosystems/MDS Sciex, and Foster city, USA).

2. General procedure for the synthesis of 7-aminoquinolin-8-yl benzoate derivatives

The 25 mL oven dried roundbottom flask was equipped with a magnetic stir bar and charged with charged with 8-aminoquinoline (144 mg, 1.0 mmol) in H_2O (3 mL) and benzoyl peroxide (1.2 mmol, 2×0. 6 equiv/0.5 h), at room temperature for 16 h. The crude compound obtained was washed with a saturated aqueous solution of $NaHCO_3$ to remove the unwanted benzoic acid formed, and then extracted with ethyl acetate. The combined organic layers were dried with Na_2SO_4, and the solvent was evaporated under reduced pressure. The crude product was purified by column chromatography (hexane/ethyl acetate) to obtain the desired product **3a** as Pale yellow solid, 182 mg (yield 69%).

General procedure for gram-scale synthesis of compound 3a: Following the same synthetic procedure for compound **3a**, the reaction of 8-aminoquinoline (1.0 g, 6.94 mmol) in H_2O (25 mL) and benzoyl peroxide (1.2 equiv, 2×0. 6 equiv/0.5 h), at room temperature for 16 h, to obtain the desired product **3a** (yield 65%) as pale yellow solid,

3. **General procedure for the synthesis of acylperoxides:** [1] Hydrogen peroxide (1.669 g, 35 wt. % in H_2O, 17.18 mmol) was added dropwise over 10 min to a cold (ice bath) solution of acid chloride (30mmol) in diethyl ether (7 mL), followed by dropwise addition of an aqueous solution of NaOH (1.517g, 37.93mmol, 10 mL) over 20 min. The resulting white precipitate was collected by filtration. After washing with water (3 × 5 mL) and diethyl ether (3 × 5 mL), the solid was crystallized from a cold acetone / water mixture (1: 3 v/v).

Procedure for the synthesis of 6-methoxy-8-nitroquinoline: [2]

To a solution of 4-methoxy-2-nitroaniline (5.09 g, 33.0 mmol, 1.0 equiv) in conc. HCl (40 mL) and conc. H_3PO_4 (15 mL), acrolein (6.5 mL, 97 mmol, 2.9 equiv) was slowly added at 80 °C for 1 h. The mixture was stirred at 95 °C for 6 h, and then cooled to 0 °C. After neutralization with aq. NH_3, the resulting powder was filtered off and dissolved in acetone. The solvent was removed and 6-methoxy-8 nitroquinoline was obtained as a brown solid (4.68 g, 70% yield).

Procedure for the synthesis of 6-methoxyquinolin-8-amine: [2]

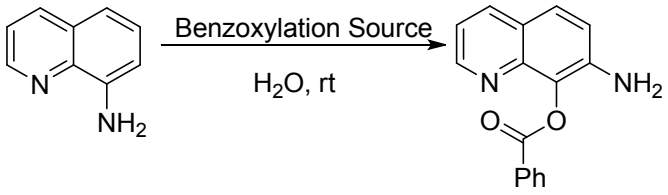
A mixture of 6-methoxy-8-nitroquinoline (2.82 g, 13.8 mmol, 1.0 equiv), activated charcoal (1.38 g), iron chloride (448 mg, 2.76 mmol, 0.20 equiv), and hydrazine monohydrate in methanol (80 mL) was stirred at 80 °C for 12 h. The reaction mixture was filtered through celite and the solvent was removed under reduced pressure to give 8-amino-6-methoxyquinoline (2.00 g, 83% yield).

General procedure for synthesis of 5-tosylquinolin-8-amine: [3]

To a 50 mL schlenk tube equipped with a magnetic stir bar was added a mixture of N-(5-tosylquinolin-8-yl)benzamide (8.0 mmol), NaOH (1.0 g, 25 mmol), and EtOH (25.0 mL). Upon completion of the reaction at 90°C for 12 h, the mixture was cooled to room temperature and then diluted with EtOAc (50 mL). The collected organic layer was washed with brine (100 mL), dried with Na_2SO_4, and filtered through a pad of celite the solvent was removed in vacuo by rotary evaporation, and isolated by silica-gel column chromatography, desired product (1.8 g, 83% yield).

4. Optimization of Reaction Conditions:

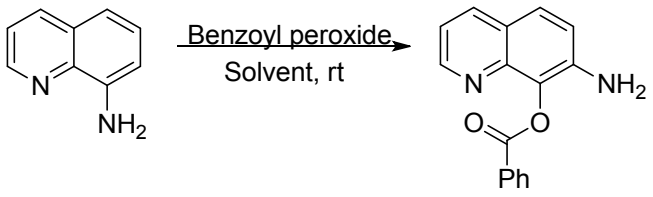
Table S1. Optimization of the Benzoxylation Source [a]



Entry	Benzoxylation source	Yield[b]
1	Benzoyl peroxide	69
2	Benzoic acid	00
3	Benzoic anhydride	00
4	Benzoyl chloride	00
5[c]	Phenyl acetylene	00
6 [c]	styrene	00
7	*m*-CPBA	00

[a] The reaction was performed with **1** (1.0 mmol), BenzoxylationSource(1.2 mmol 2×0. 6 equiv./0.5 h) in H_2O (5 mL) stirred at rt for 16 h in open air. [b] Isolated yields. [c] in the presence of TBHP, (*m*-CPBA= *meta*-chloroperbonzoic acid).

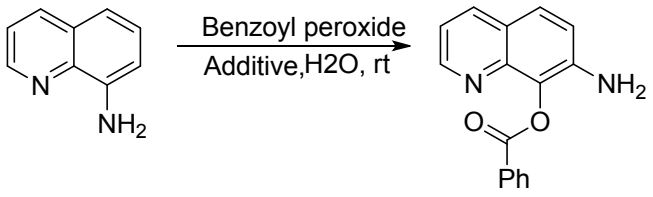
Table S2. Optimization of the Solvent[a]



Entry	Solvent	Yield[b]
1	ACN	55
2	THF	21
3	DMF	00
4	DMSO	00
5	Toluene	00
6	AcOH	00
7	MeOH	00
8	H_2O	69

[a] The reaction was performed with **1** (1.0 mmol), Benzoyl peroxide(1.2 mmol 2×0. 6 equiv./0.5 h) in solvent (5 mL) stirred at rt for 16 h in open air. [b] Isolated yields.

Table S3. Optimization of the Additive[a]

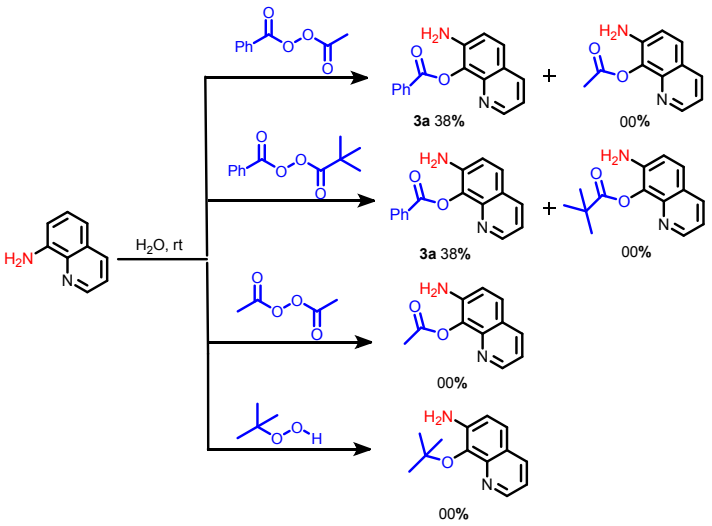


Entry	Additive	Yield[b]
1	1,10-Phenanthroline	59
2	4,4'-Bipyridine	36
3	2,2'-Bipyridine	24
4	Proline	00

[a] The reaction was performed with **1** (1.0 mmol), Benzoyl peroxide (1.2 mmol 2×0. 6 equiv./0.5 h), additive (2.0 mmol) in H_2O (5 mL) stirred at rt for 16 h in open air. [b] Isolated yields.

4. Oxygenation-amino migration reaction with mixed peroxide and *ter*-Butylhydroperoxide.

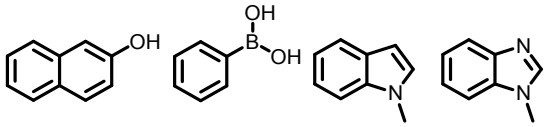
The 8-aminoquinoline was subjected to transition metal free oxygenation-amino migration reaction with mixed peroxide under standard reaction conditions employing aryl-alkyl acyl peroxides i.e., benzyl acetyl- and benzyl *t*-butyl peroxides. In both the cases the products obtained were found to be corresponding to the arylacyl 8-oxygenated 7-amino product 3a in 38% yield while the formation of the alkyl acyloxy product was not observed. Acetyl peroxide and TBHP failed to afford the expected oxygenated product under standard reaction conditions.



[a] The reaction was performed with **1** (1.0 mmol), mixed peroxide (1.2 mmol 2×0. 6 equiv./0.5 h) in H_20 (5 mL) stirred at rt for 16 h in open air. [b] Isolated yields.

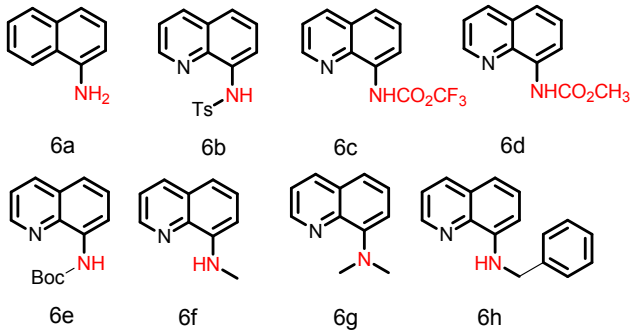
6. Scope of other nucleophiles:

We also subjected the electrophilic partner (phenyl boronic acid) and electron rich substrates (β-napthol, benzimidazole and indole) for the migration reaction with 8-aminoquinoline under standard reaction conditions and failed to achieve C-C bond forming reaction products at C8 position.



7. Scope of Migrating group:

In order to explore the migrating ability, different functionalities on the migrating Nitrogen have been evaluated. Amide, Sulfonamide Ts, Tf), carbamate (BoC), methylamine, dimethylamine and Benzylamine as migrating groups are resistant to benzoxylation reaction.



8. Crystallographic Data of Compound 3d

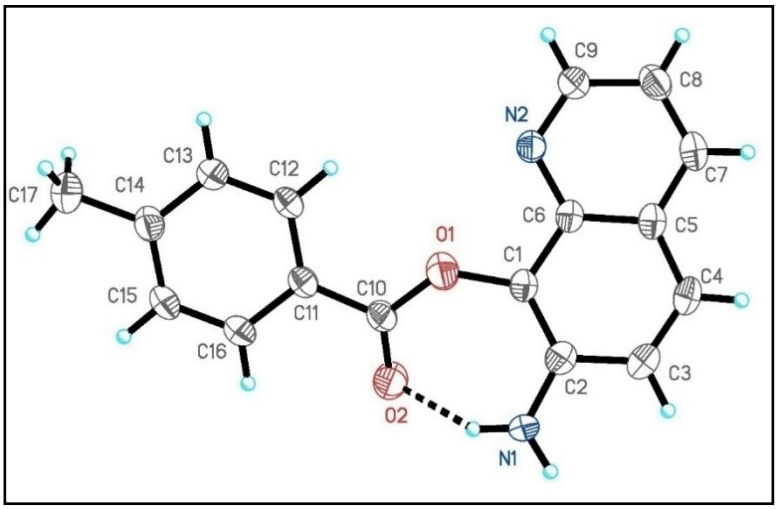


Fig-1 Crystal structure of 3d, A view of KA08, showing the atom-labelling scheme. Displacement ellipsoids are drawn at the 30% probability level and H atoms are

represented by circles of arbitrary radii. Intramolecular hydrogen bond is shown as dashed lines.

Crystal Data for KA172: $C_{17}H_{14}N_2O_2$ (*M* =278.30 g/mol): monoclinic, space group $P2_1/c$ (no. 14), *a* = 11.954(2) Å, *b* = 7.454(2) Å, *c* = 15.468(3) Å, *β* = 95.33(3)°, *V* = 1372.4(5) $Å^3$, *Z* = 4, *T* = 294.15 K, μ(MoKα) = 0.090 mm^{-1}, *Dcalc* = 1.347 g/cm^3, 24733 reflections measured (5.29° ≤ 2Θ ≤ 49.958°), 2413 unique (R_{int} = 0.0235, R_{sigma} = 0.0143) which were used in all calculations. The final R_1 was 0.0696 (I > 2σ(I)) and wR_2 was 0.2126 (all data). [4] CCDC 1559199 contains supplementary Crystallographic data for the structure. These data can be obtained free of charge at www.ccdc.cam.ac.uk/conts/retrieving.html [or from the Cambridge Crystallographic Data Centre (CCDC), 12 Union Road, Cambridge CB2 1EZ, UK; fax: +44(0) 1223 336 033; email: deposit@ccdc.cam.ac.uk].

9. References

1. Vinayak, B.; Navyasree, P.; Chandrasekharam, M. *Org. Biomol. Chem*. **2017**, *15*, 9200.

2. Kuninobu, Y.; Nishi, M.; Kanai, M. *Org. Biomol. Chem.*, **2016**, *14*, 8092.

3. Xu, J.; Shen, C.; Zhu, X.; Zhang, P.; Ajitha, M. J.; Huang, K. -W.; An, Z.; Liu, X. *Chem. Asian J.* **2016***, 11,* 882.

4. (a) Bruker (2001). SAINT (Version 6.28a) & SMART (Version 5.625). Bruker AXS Inc., Madison, Wisconsin, USA; (b) Sheldrick G. M. (2015**)** Acta Crystallogr C71: 3-8; (c) Bruker (2016). APEX3, SAINT and SADABS. Bruker AXS, Inc., Madison, Wisconsin, USA.

10. Spectroscopic Data of all Compounds

7-aminoquinolin-8-yl benzoate (3a): Pale yellow solid, 182.2 mg (yield: 69%), mp: 101-103 °C. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 11.95 (s, 1H), 10.47 (s, 1H), 8.80-8.75 (m, 1H), 8.13-8.08 (m, 3H), 7.65-7.60 (m, 1H), 7.59-7.54 (m, 3H), 7.34-7.30 (m, 2H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 166.5, 148.7, 147.7, 141.1, 136. 1, 133.1, 132.5, 128.9, 127.6, 125.1, 122.6, 119.1, 117.6. ESI-HRMS: calcd for $C_{16}H_{13}O_2N_2$ = 265.09715, Found 265.09705.

7-aminoquinolin-8-yl 2-methylbenzoate (3b): Pale yellow solid, 208.6 mg (yield: 75%), mp: 97-99 °C. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 11.79 (s, 1H), 10.44 (s, 1H), 8.73-8.69 (m, 1H), 8.13-8.07 (m, 1H), 7.76 (d, *J* = 7.62 Hz, 1H), 7.58 (d, *J* = 9.00 Hz, 1H), 7.47-7.42 (m, 1H), 7.36-7.28 (m, 4H), 2.63 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 169.5, 148.7, 147.8, 140.9, 137.1, 136.0, 134.6, 131.5, 130.9, 127.6, 126.1, 125.2, 122.6, 119.1, 117.9, 20.3. ESI-HRMS: calcd for $C_{17}H_{15}O_2N_2$ = 279.11280, Found 279.11414.

7-aminoquinolin-8-yl 3-methylbenzoate (3c): Pale yellow solid, 211.4 mg (yield: 76%), mp: 86-88 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 11.96 (s, 1H), 10.92 (s, 1H), 8.79-8.75 (m, 1H), 8.10-8.06 (m, 1H), 7.91-7.87 (m, 2H), 7.55 (d, *J* = 9.04 Hz, 1H), 7.46 -7.42 (m, 2H), 7.33-7.29 (m, 2H), 2.47 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.6, 148.6, 147.8, 141.0, 138.8, 135.9, 133.2, 128.7, 128.3, 124.9, 124.4, 122.5, 121.5, 119.0, 117.6, 21.36. ESI-HRMS: calcd for $C_{17}H_{15}O_2N_2$ = 279.11280, Found 279.11415.

7-aminoquinolin-8-yl 4-methylbenzoate (3d): Pale yellow solid, 224.5 mg (yield: 80%), mp: 148-150 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 12.02 (s, 1H), 10.93 (s, 1H), 8.79-8.71 (m, 1H), 8.11-8.08 (m, 1H), 8.01 (d, *J* = 8.19 Hz, 2H), 7.57-7.54 (m,1H), 7.36 (d, *J* = 7.94 Hz, 2H), 7.34-7.30 (m, 2H), 2.46 (s, 3H).^{13}C NMR (125 MHz, $CDCl_3$): δ = 166.4, 148.6, 147.7, 143.2, 140.9, 135.9, 130.1, 129.5, 127.5,

124.9, 122.5, 119.0, 117.7, 21.5. ESI-HRMS: calcd for $C_{17}H_{14}O_2N_2$ = 279.1151, Found 279.1149.

7-aminoquinolin-8-yl 3,5-dimethylbenzoate (3e): Pale yellow solid, 227.8 mg (yield: 78%), mp: 143-145 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 11.96 (s, 1H), 10.87 (s, 1H), 8.81-8.77 (m, 1H), 8.12-8.07 (m, 1H), 7.72-7.67 (m,1H), 7.56 (d, *J* = 9.04 Hz, 2H), 7.35-7.29 (m, 2H), 7.26-7.23 (m,1H), 2.44 (s, 6H).^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.0, 148.7, 147.8, 138.6, 136.1, 134.1, 133.1,125.3, 125.0, 122.63, 119.1, 117.8, 21.3. ESI-HRMS: calcd for $C_{18}H_{17}O_2N_2$ = 293.12845, Found 293.12993.

7-aminoquinolin-8-yl 4-methoxybenzoate (3f): Pale yellow solid, 235.3 mg (yield: 80%), mp: 221-223 °C. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 12.08 (s, 1H), 10.90 (s, 1H), 8.80-8.77 (m, 1H), 8.12-8.07 (m, 3H), 7.56 (d, *J* = 8.85 Hz, 1H), 7.35-7.30 (m, 2H), 7.06 (d, *J* = 8.85 Hz, 2H), 3.91 (s, 3H).^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.1, 163.1, 148.6, 147.8, 141.1, 136.1, 129.6, 125.3, 124.8, 122.6, 119.1, 117.9, 114.1, 55.5. ESI-HRMS: calcd for $C_{17}H_{15}O_3N_2$ = 295.10772, Found 295.10779.

7-aminoquinolin-8-yl 4-fluorobenzoate (3g): Pale yellow solid, 208.7 mg (yield: 74%), mp: 109-111 °C. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 11.84 (s, 1H), 10.93 (s, 1H), 8.78-8.77 (m, 1H), 8.14-8.10 (m, 3H), 7.57 (d, *J* = 9.00 Hz, 1H), 7.34-7.31 (m, 2H), 7.26-7.23 (m, 2H).^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.6, 165.3, 164.1. 148.7, 147.8, 141.0, 136.1, (130.1-130.0 d) 129.2, 125.1, 122.6, 119.1, 117.5, 116.1, 115.9. ESI-HRMS: calcd for $C_{16}H_{12}O_2N_2F$ = 283.08773, Found 283.08735.

7-aminoquinolin-8-yl 2-bromobenzoate (3h): Pale yellow solid, 225.7 mg (yield: 66%), mp: 155-157 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 11.48 (s, 1H), 10.58 (s, 1H), 8.73-8.69 (m, 1H), 8.12-8.07 (m, 1H), 7.79-7.72 (m, 2H), 7.60 (d, *J* = 9.04 Hz, 1H), 7.50-7.46 (m, 1H), 7.43-7.39 (m, 1H), 7.35-7.29 (m, 2H).^{13}C NMR (100 MHz, $CDCl_3$): δ = 167.1, 148.7, 147.8, 140.9, 136. 5, 136.1, 133.9, 132.0, 129.7, 127.6, 125.5, 122.5, 119.9, 119.2, 117.5. ESI-HRMS: calcd for $C_{16}H_{12}O_2N_2Br$ = 343.00767, Found 343.00978.

7-aminoquinolin-8-yl 4-bromobenzoate (3i): Pale yellow solid, 232.5 mg (yield: 68%), mp: 178-180 °C. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 11.78 (s, 1H), 10.96 (s, 1H), 8.80-8.77 (m, 1H), 8.13-8.10 (m, 1H), 7.98 (d, *J* = 8.54 Hz, 2H), 7.71 (d, *J* = 8.54 Hz, 2H), 7.58 (d, *J* = 9.00 Hz, 1H), 7.35-7.32 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 165.5, 148.7, 147.9, 141.0, 136.1, 132.2, 129.2, 127.4, 125.3, 122.6, 119.2, 117.4. ESI-HRMS: calcd for $C_{16}H_{12}O_2N_2Br$ = 343.0077, Found 343.0077.

7-aminoquinolin-8-yl 4-iodobenzoate (3j): Pale yellow solid, 238.5 mg (yield: 61%), mp: 141-143 °C. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 12.08 (s, 1H), 10.98 (s, 1H), 8.76-8.72 (m, 1H), 8.31-8.26 (m, 1H), 8.11-8.09 (m, 2H), 7.94-7.91 (m, 1H), 7.65-7.62 (m, 1H), 7.59-7.56 (m, 2H), 7.41-7.37(m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.6, 149.2, 148.1, 140.5, 133.3, 132.7, 128.9, 127.6, 124.4, 120.5, 118.5, 93.5. ESI-HRMS: calcd for $C_{16}H_{12}O_2N_2I$ = 390.99380, Found 390.99403.

7-aminoquinolin-8-yl [1,1'-biphenyl]-4-carboxylate (3k): Pale yellow solid, 241.5 mg (yield: 71%), mp: > 250 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 11.99 (s, 1H), 11.04 (s, 1H), 8.82-8.79 (m, 1H), 8.20 (d, *J* = 8.43 Hz, 2H), 8.14-8.10 (m, 1H) 7.80 (d, *J* = 8.55 Hz, 2H), 7.69-7.66 (m, 2H), 7.58 (d, *J* = 9.04 Hz, 1H), 7.52-7.48 (m, 2H), 7.45-7.40 (m, 1H), 7.36-7.32 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.3, 148.7, 147.9, 145.3, 141.2, 139.8, 136.2, 131.8, 128.9, 128.2, 127.6, 127.3, 125.1, 122.7, 119.2, 117.8. ESI-HRMS: calcd for $C_{22}H_{17}O_2N_2$ = 341.12845, Found 341.12846.

7-aminoquinolin-8-yl 2-naphthoate (3l): Pale yellow solid, 213.6 mg (yield: 68%), mp: 210-212 °C. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 12.02 (s, 1H), 11.10 (s, 1H), 8.81-8.79 (m, 1H), 8.62 (s, 1H), 8.12-8.08 (m, 2H), 8.04-7.98 (m, 2H), 7.92-7.89 (m, 1H), 7.62-7.54 (m, 3H), 7.35-7.30 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.4, 148.7, 147.8, 141.1, 136.1, 135.1, 132.5, 130.1, 129.2, 128.8, 128.2, 127.7, 126.1, 125.1, 123.4, 122.6, 119.1, 117.7. ESI-HRMS: calcd for $C_{20}H_{15}O_2N_2$ = 315.11280, Found 315.11459.

7-aminoquinolin-8-yl thiophene-3-carboxylate (3n): Pale yellow solid, 207.9 mg (yield: 77%), mp: 185-187 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 11.68 (s, 1H), 10.86 (s, 1H), 8.80-8.75 (m, 1H), 8.12-8.08 (m, 1H), 7.92-7.90 (m, 1H), 7.68-7.62 (m, 1H),

7.57-7.54 (m, 1H), 7.34-7.30 (m, 2H) 7.23-7.20 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 161.1, 148.6, 147.5, 140.7, 137.6, 136.1, 131.9, 129.7, 128.1, 124.9, 122.5, 119.1, 117.3. ESI-HRMS: calcd for $C_{14}H_{11}O_2N_2S$ = 271.05357, Found. 271.05486.

7-aminoquinolin-8-yl benzo[b]thiophene-2-carboxylate (3o): Pale yellow solid, 252.8 mg (yield: 79%), mp: 193-195 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 11.62 (s, 1H), 11.02 (s, 1H), 8.86-8.82 (m, 1H), 7.98-7.92 (m, 2H), 7.59 (d, *J* = 8.92 Hz, 1H), 7.51-7.45 (m, 2H), 7.32-7.30 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 161.6, 148.8, 147.8, 141.6, 140.9, 139.0, 137.1, 136.2, 127.0, 126.9, 125.4, 125.3, 125.2, 122.8, 122.7, 122.6, 119.28, 117.4.

7-amino-2-methylquinolin-8-yl benzoate (4a): Pale yellow solid, 172.4 mg (yield: 62%), mp: 140-142 °C. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 11.94 (s, 1H), 11.06 (s, 1H), 8.12-8.09 (m, 2H), 7.95 (d, *J* = 8.24 Hz, 1H), 7.64-7.60 (m, 1H), 7.59 -7.55 (m, 2H), 7.48 (d, *J* = 8.85 Hz, 1H), 7.25-7.23 (m, 1H), 7.17 (d, *J* = 8.24 Hz, 1H) 2.72 (s, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 166.0, 1, 157.6, 147.7, 140.4, 136.1, 133.2, 132.4, 128.9, 128.3, 127. 5, 124.7, 121.2, 120.5, 119.7, 117.1, 25.3.

7-amino-6-methylquinoline-5,8-diyl dibenzoate (4b): Pale yellow solid, 208.6 mg (yield: 75%), mp: 212-214 °C. ^{1}H NMR (400 MHz, $CDCl_3$+CD_2Cl_2): δ = 12.28 (s, 1H), 10.90 (s, 1H), 8.78-8.73 (m, 1H), 8.38-8.30 (m, 2H), 8.15-8.11 (m, 2H), 8.05-8.01 (m, 1H), 7.76-7.69 (m, 1H), 7.64-7.55 (m, 5H) 7.31-7.27 (m, 1H), 2.35 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.6, 164.56, 148.3, 147.6, 141.6, 139.4, 134.1, 133.1, 132.5, 130.4, 130.16, 128.9, 128.83, 128.60, 127.7, 123.8, 119.3, 116.9, 116.0, 10.86. ESI-HRMS: calcd for $C_{24}H_{19}O_4N_2$ = 399.13393, Found. 399.13677.

7-amino-6-methoxyquinolin-8-yl benzoate (4c): Pale yellow solid, 229.4 mg (yield: 78%), mp: 220-222 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 12.34 (s, 1H), 10.97 (s, 1H), 8.69-8.64 (m, 1H), 8.15-8.10 (m, 2H), 8.04-8.00 (m, 1H), 7.64-7.56 (m, 3H), 7.34-7.28 (m, 1H) 6.96-6.90 (m, 1H), 4.04 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.7, 151.5, 146.1, 140.6, 137.1, 134.5, 132.6, 130.4, 129.9, 128.9, 127.7,

122.9, 119.7, 118.1, 101.7, 56.1. ESI-HRMS: calcd for $C_{17}H_{15}O_3N_2$ = 295.10772, Found. 295.10948.

7-amino-5-chloroquinolin-8-yl benzoate (4d): Pale yellow solid, 178.8 mg (yield: 60%), mp: 151-153 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 12.14 (s, 1H), 10.93 (s, 1H), 8.89-8.81 (m, 1H), 8.49 (d, *J* = 8.43 Hz, 1H), 8.11 (d, *J* = 7.70 Hz, 2H), 7.68-7.57 (m, 3H), 7.47-7.39 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.5, 149.3, 147.6, 141.1, 133.4, 132.8, 132.7, 128.9, 127.6, 122.4, 120.6, 119.7, 117.0. ESI-HRMS: calcd for $C_{16}H_{12}O_2N_2Cl$ = 299.05818, Found. 299.05993.

7-amino-5-iodoquinolin-8-yl benzoate (4e): Pale yellow solid, 210.6 mg (yield: 54%), mp: 203-205 °C. ^{1}H NMR (500 MHz, $CDCl_3$): δ = 12.08 (s, 1H), 10.98 (s, 1H), 8.75-8.72 (m, 1H), 8.30-8.26 (m, 1H), 8.11-8.09 (m, 2H), 7.93 (s, 1H), 7.66-7.62 (m, 1H), 7.59-7.56 (m, 2H), 7.41-7.38 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ = 166.6, 149.2, 148.0, 140.6, 140.5, 133.3, 132.7, 128.9, 127.6, 124.4, 122.5, 120.6, 118.5, 93.5. ESI-HRMS: calcd for $C_{16}H_{12}O_2N_2I$ = 390.99380, Found. 390.99691.

7-amino-5-tosylquinolin-8-yl benzoate (4f): Pale yellow solid, 259.2 mg (yield: 62%), mp: 235-237 °C. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 12.12 (s, 1H), 11.19 (s, 1H), 9.04-9.01 (m, 1H), 8.83-8.79 (m, 1H), 8.25-8.23 (m, 1H), 8.12-8.09 (m, 2H), 7.86 (d, *J* = 8.43 Hz, 2H), 7.67-7.64 (m, 1H), 7.61-7.58 (m, 2H), 7.51-7.49 (m, 1H), 7.45-7.41 (m, 1H), 7.29 (d, *J* = 7.94 Hz, 1H), 2.38 (s, 3H). ^{13}C NMR (125 MHz, $CDCl_3$): δ = 167.1, 149.1, 146.0, 144.4, 140.9, 138.2, 133.6, 133.1, 132.4, 129.9, 129.0, 128.4, 127.7, 127.5, 126.3, 122.5, 120.6, 118.5, 21.5. ESI-HRMS: calcd for $C_{23}H_{19}O_4N_2S$ = 419.10600, Found 419.10891.

11. Copies of NMR spectra data

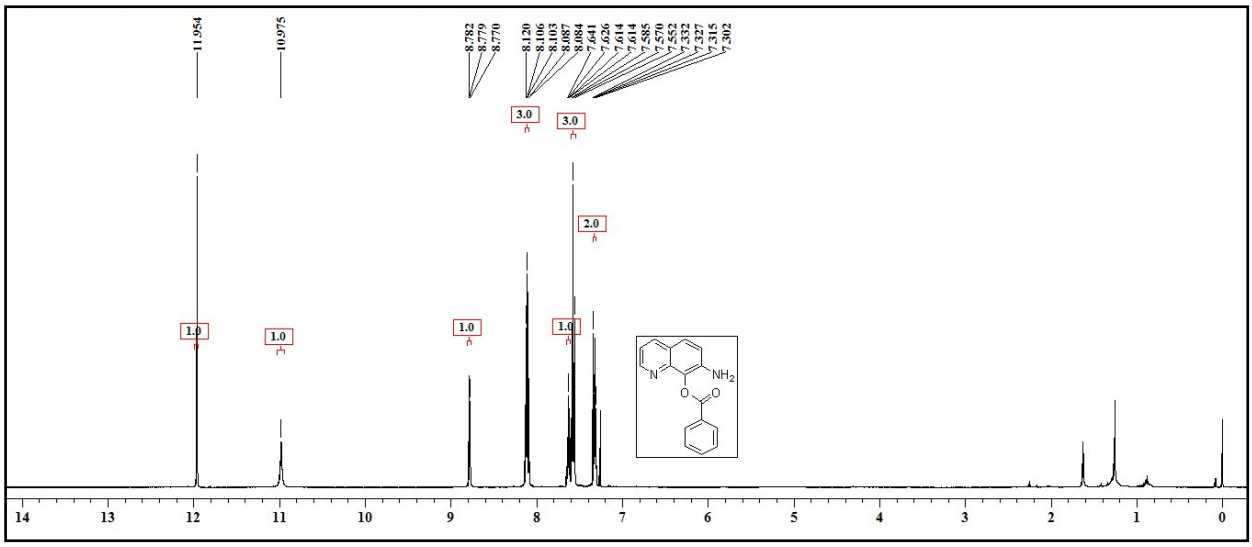


Figure S1. ^{1}H NMR spectrum of **3a**.

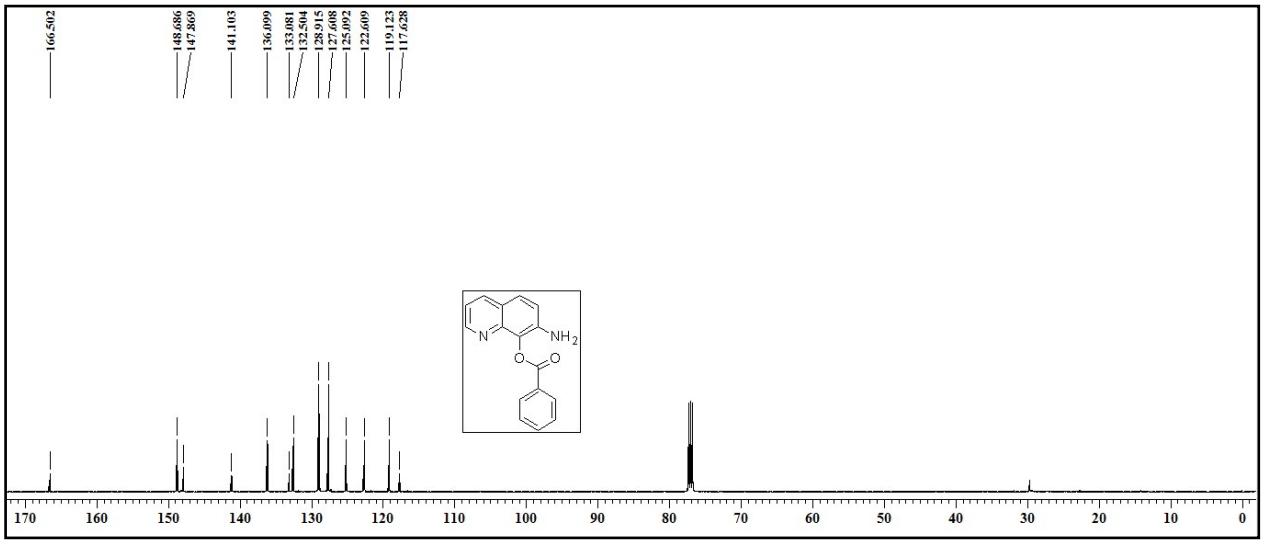


Figure S2. ^{13}C NMR spectrum of **3a**.

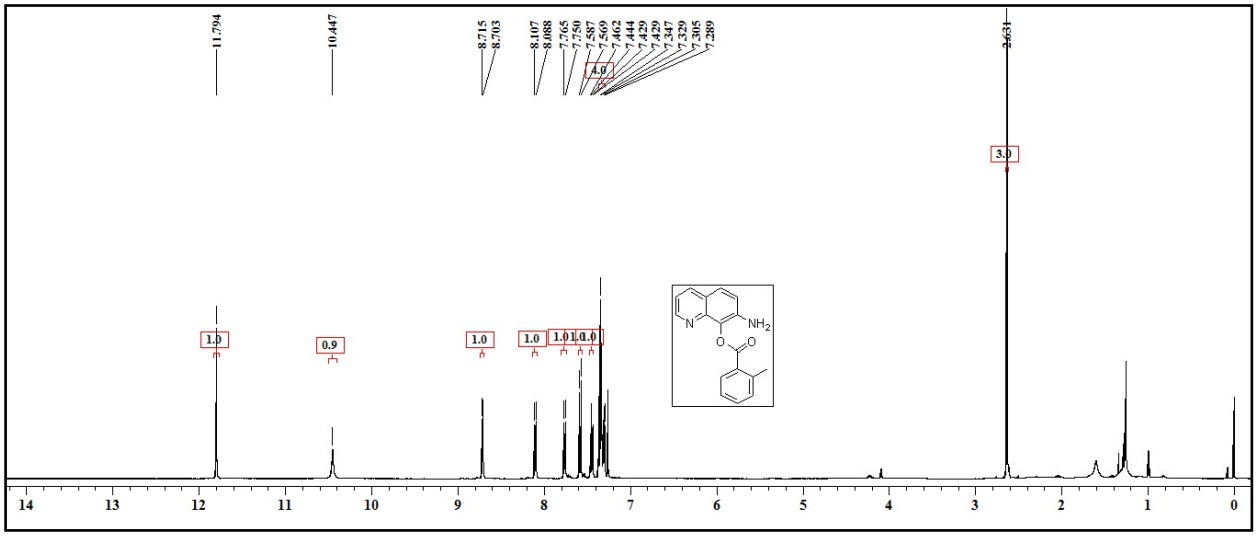


Figure S3. ^{1}H NMR spectrum of **3b**.

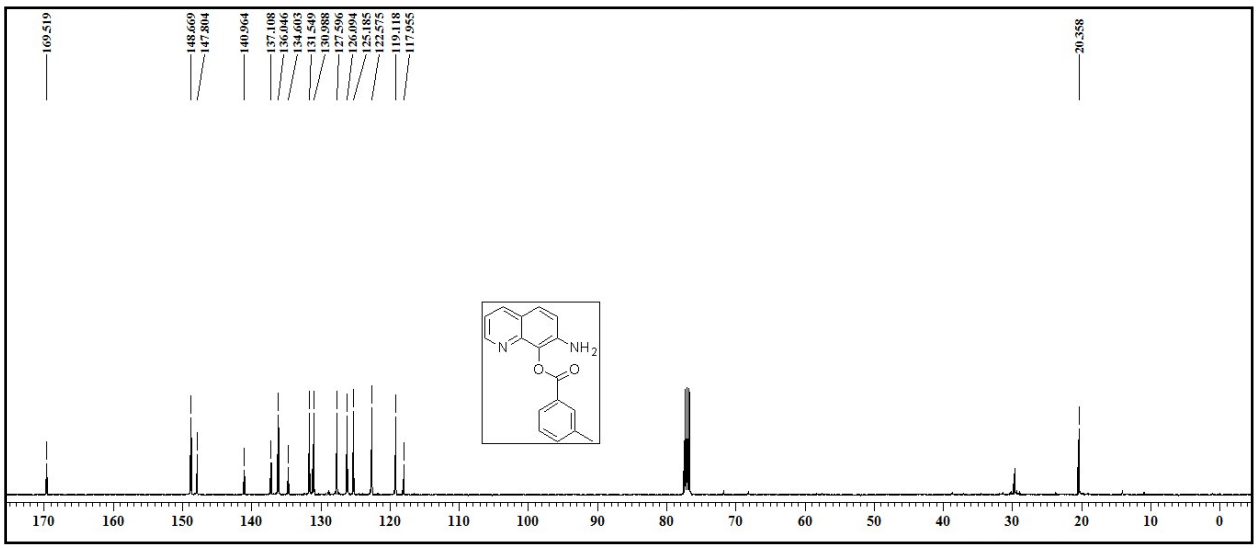


Figure S4. ^{13}C NMR spectrum of **3b**.

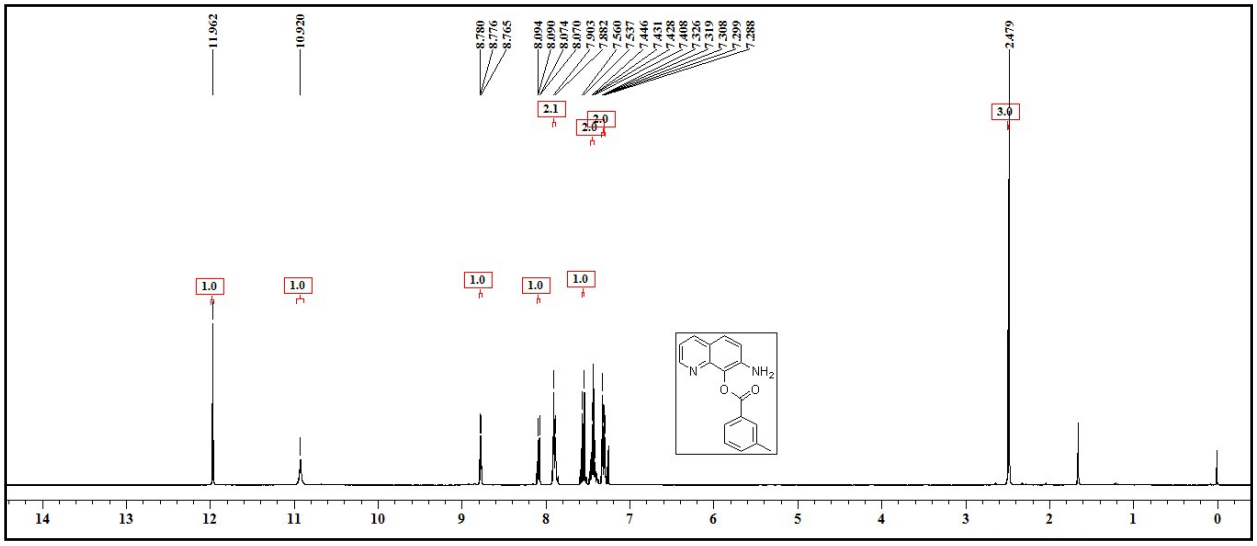


Figure S5. ^{1}H NMR spectrum of **3c**.

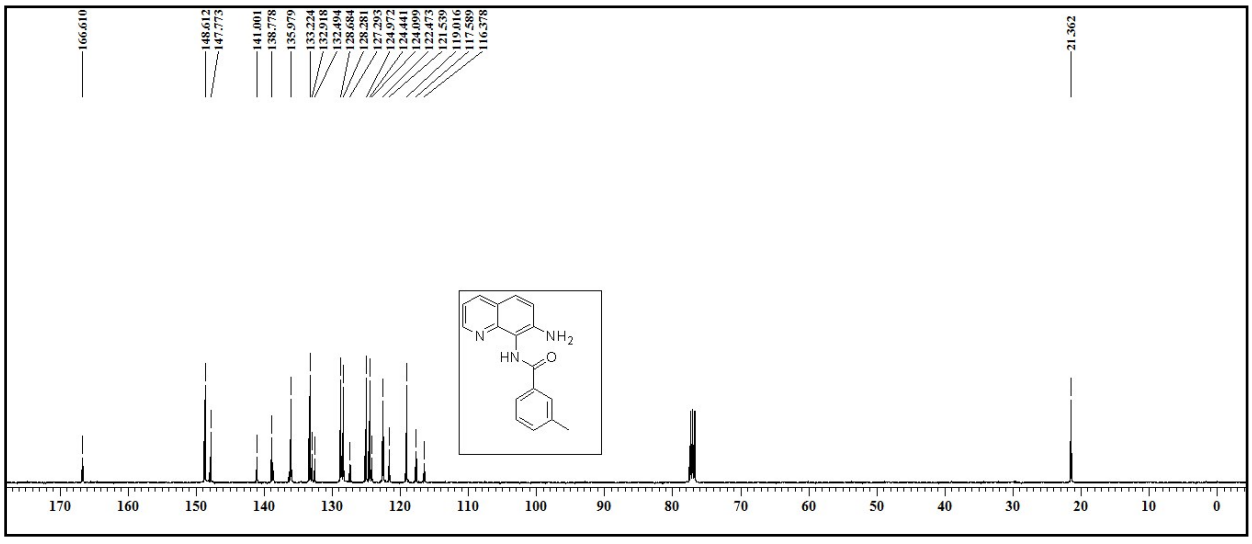


Figure S6. ^{13}C NMR spectrum of **3c**.

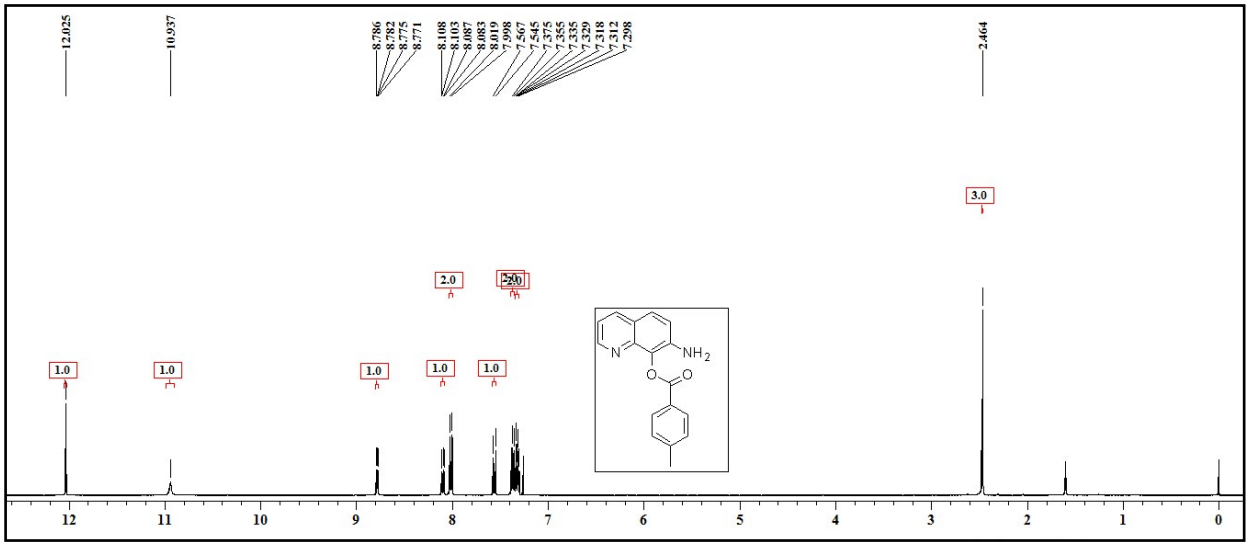


Figure S7. ^{1}H NMR spectrum of **3d**.

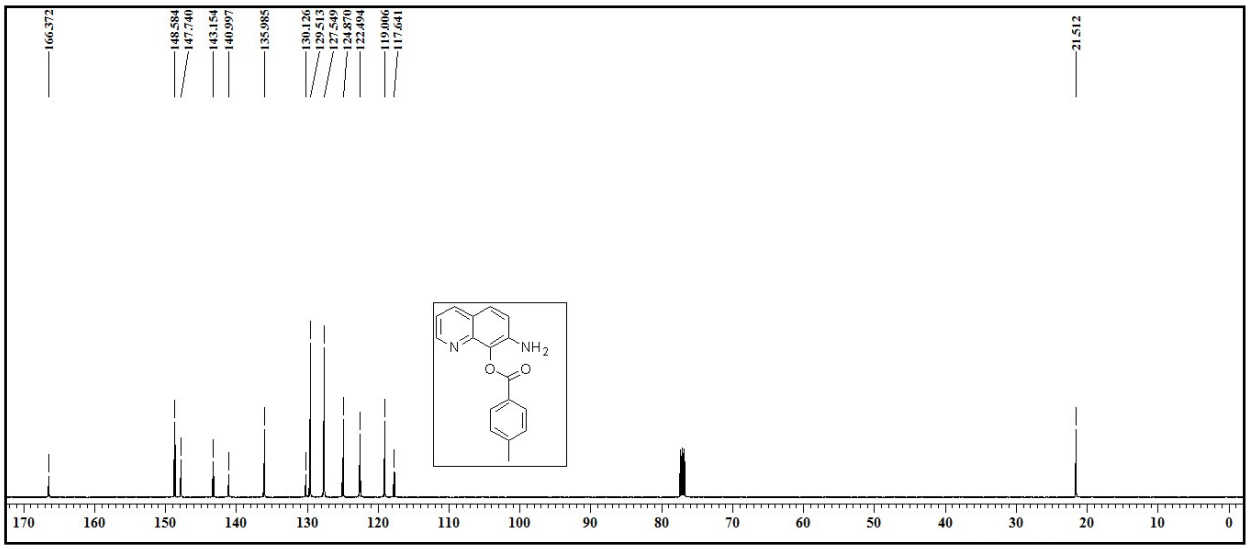


Figure S8. ^{13}C NMR spectrum of **3d**.

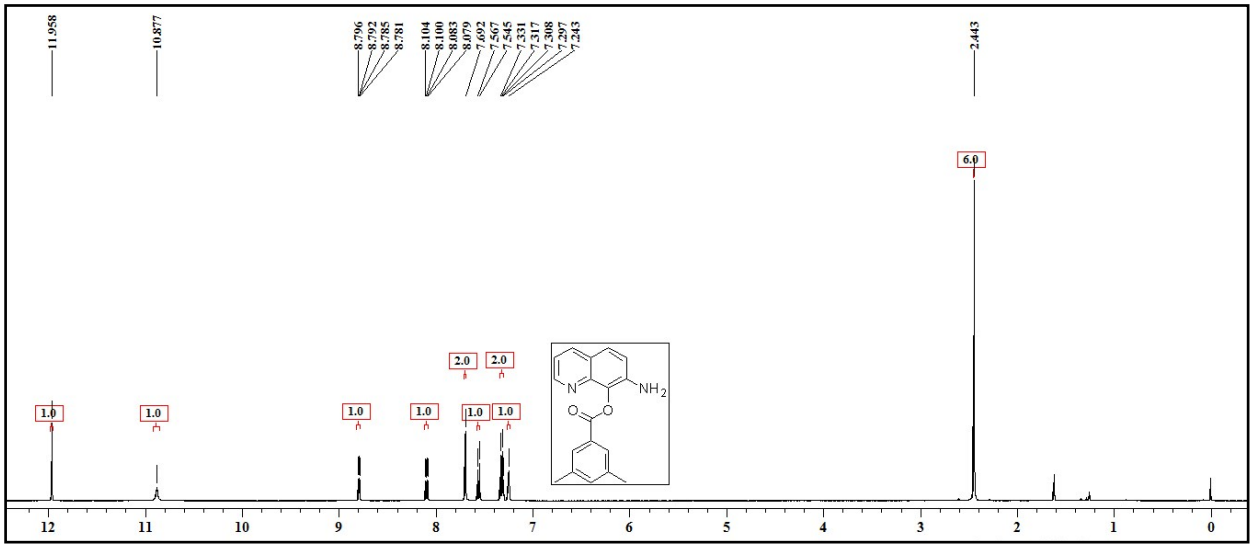


Figure S9. ^{1}H NMR spectrum of **3e**.

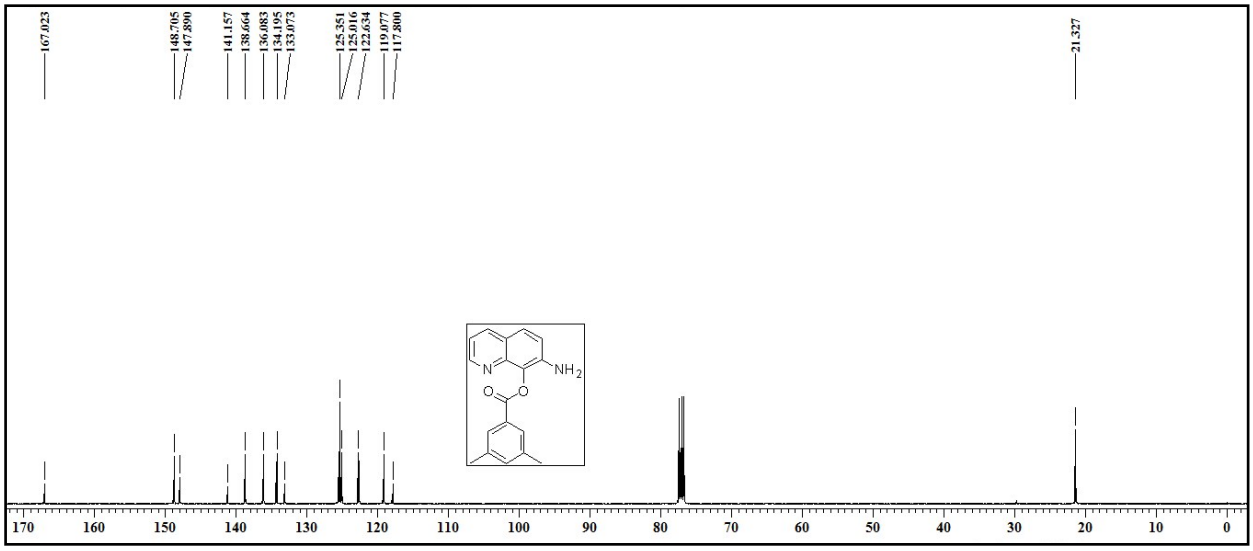


Figure S10. ^{13}C NMR spectrum of **3e**.

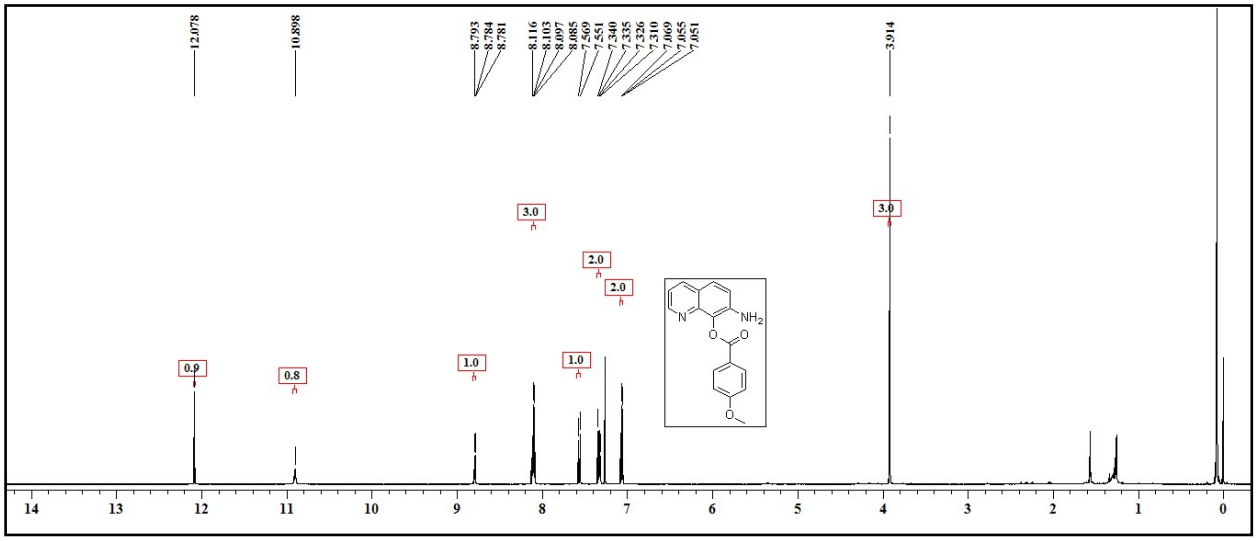


Figure S11. ^{1}H NMR spectrum of **3f**.

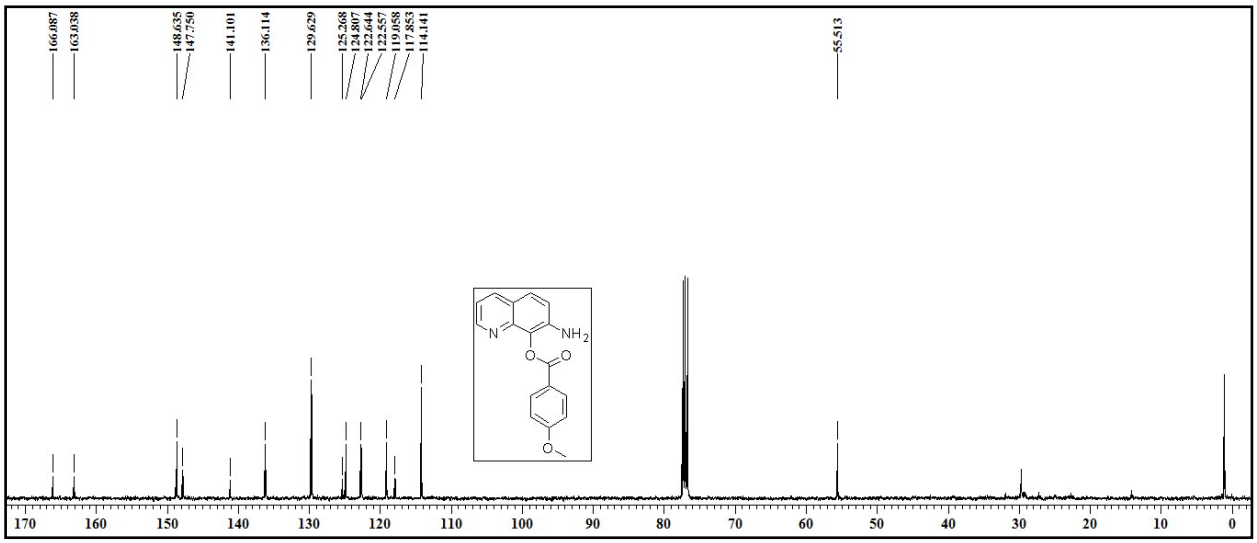


Figure S12. ^{13}C NMR spectrum of **3f**.

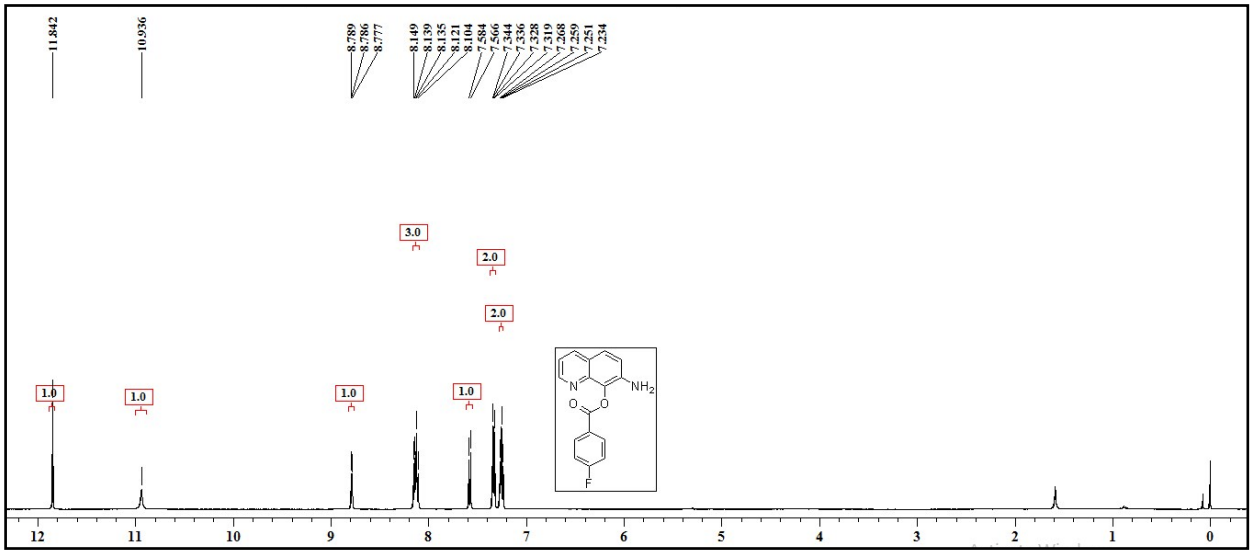


Figure S13. ^{1}H NMR spectrum of **3g**.

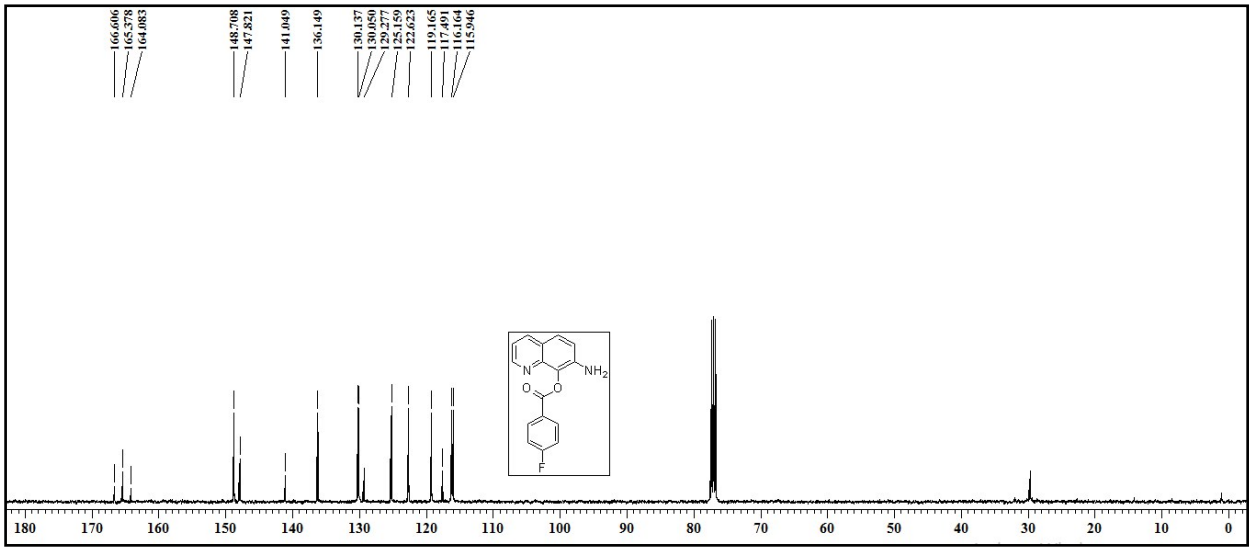


Figure S14. ^{13}C NMR spectrum of **3g**.

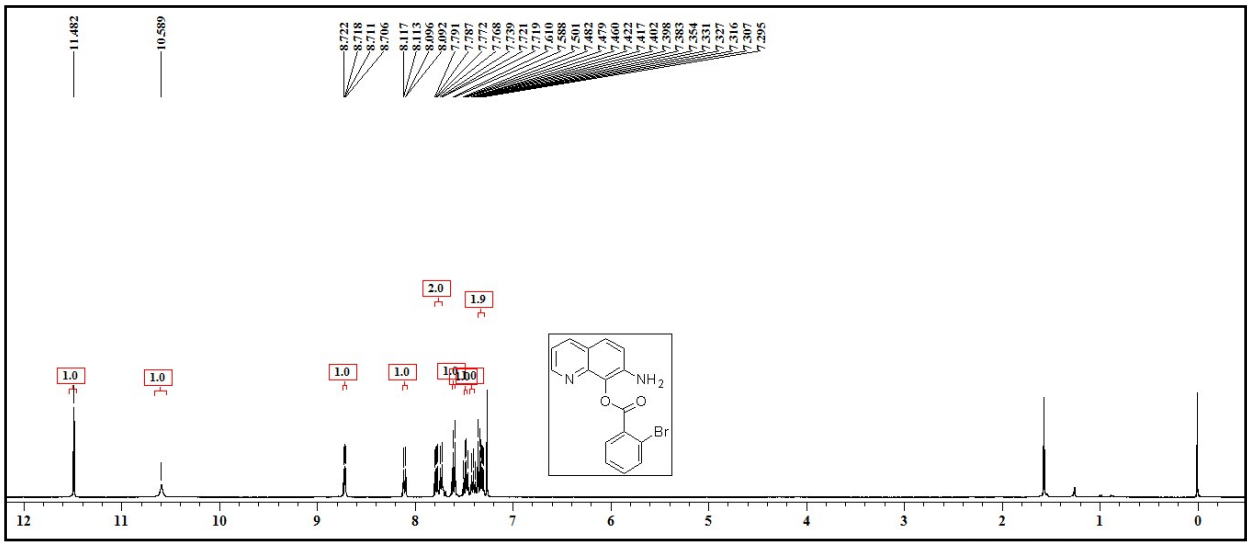


Figure S15. ^{1}H NMR spectrum of **3h**.

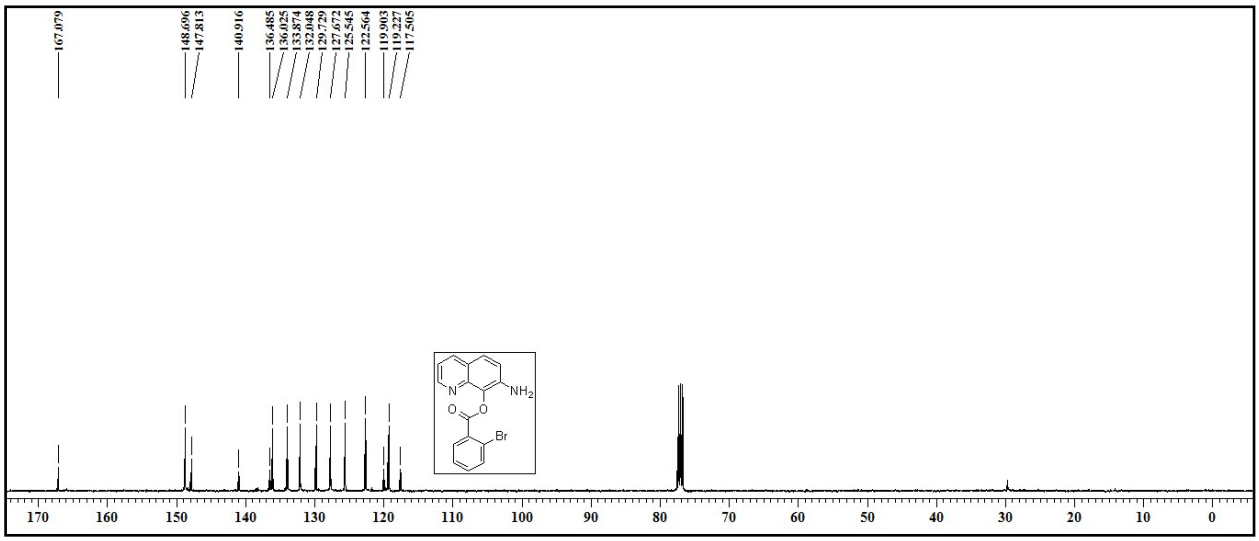


Figure S16. ^{13}C NMR spectrum of **3h**.

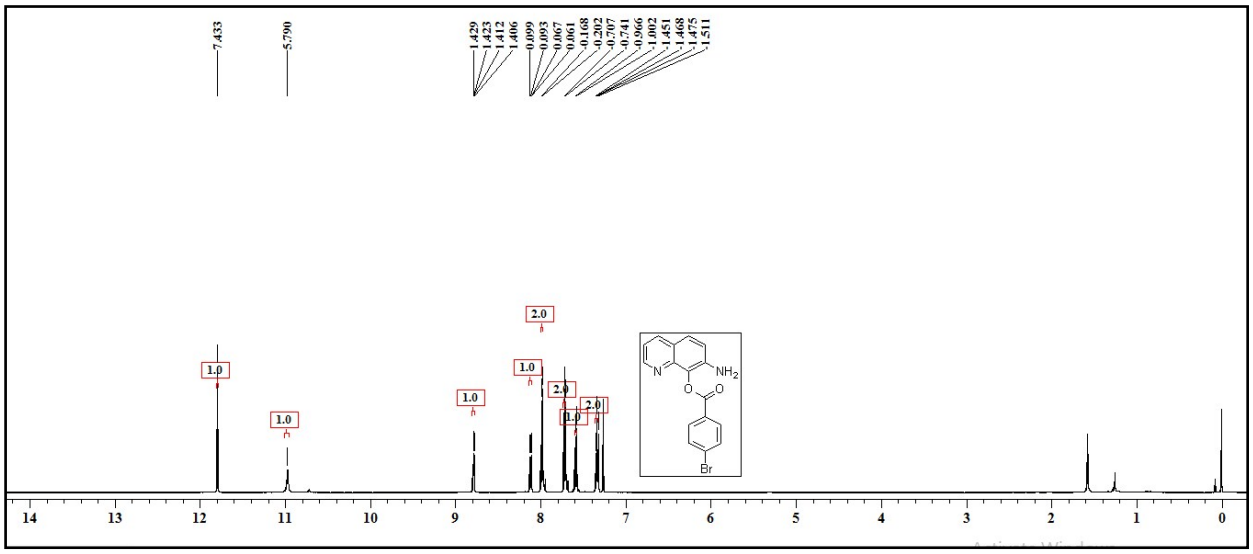


Figure S17. ^{1}H NMR spectrum of **3i**.

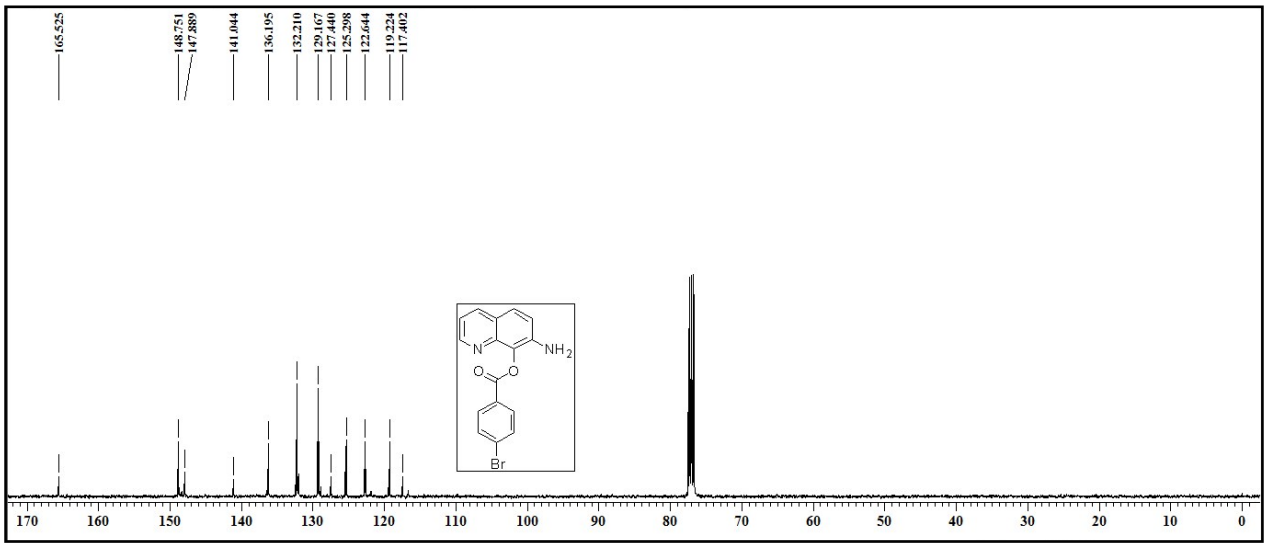


Figure S18. ^{13}C NMR spectrum of **3i**.

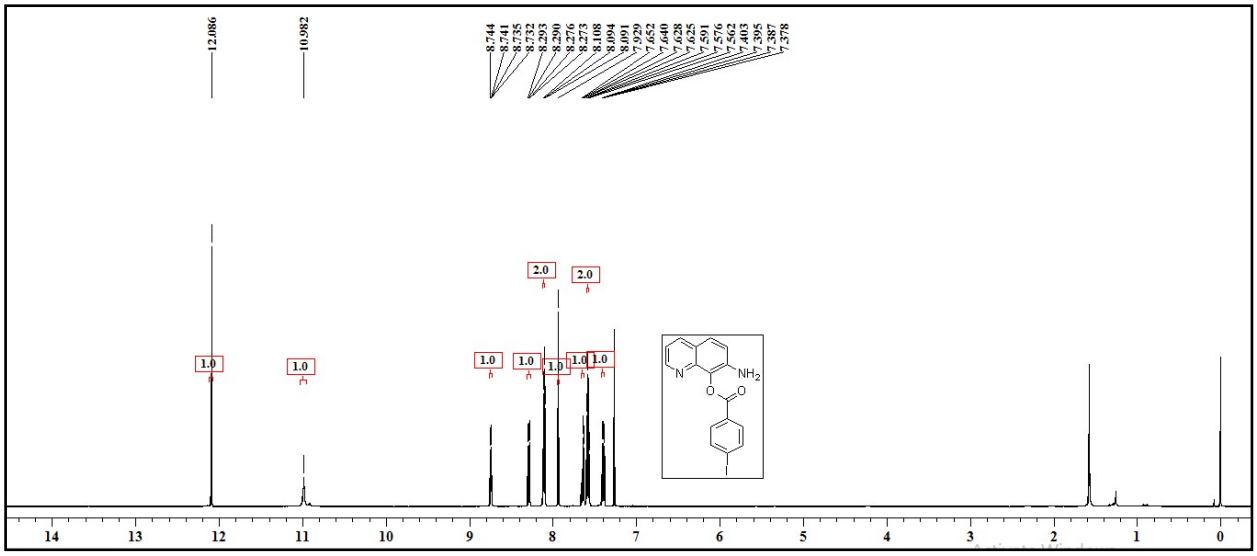


Figure S19. ^{13}C NMR spectrum of **3j**.

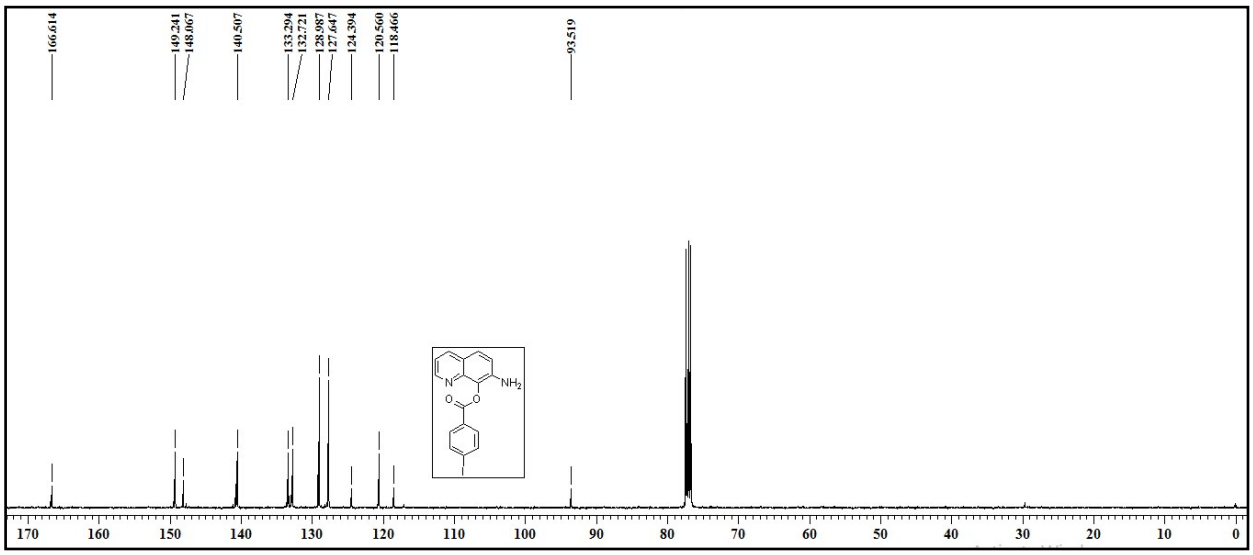


Figure S20. ^{13}C NMR spectrum of **3j**.

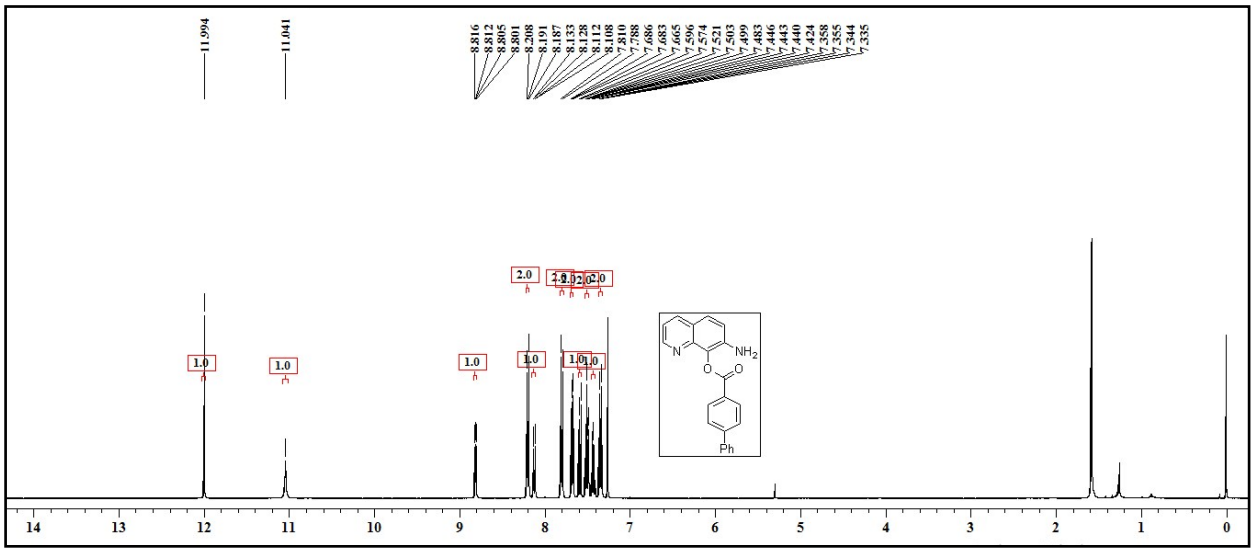


Figure S21. ^{1}H NMR spectrum of **3k**.

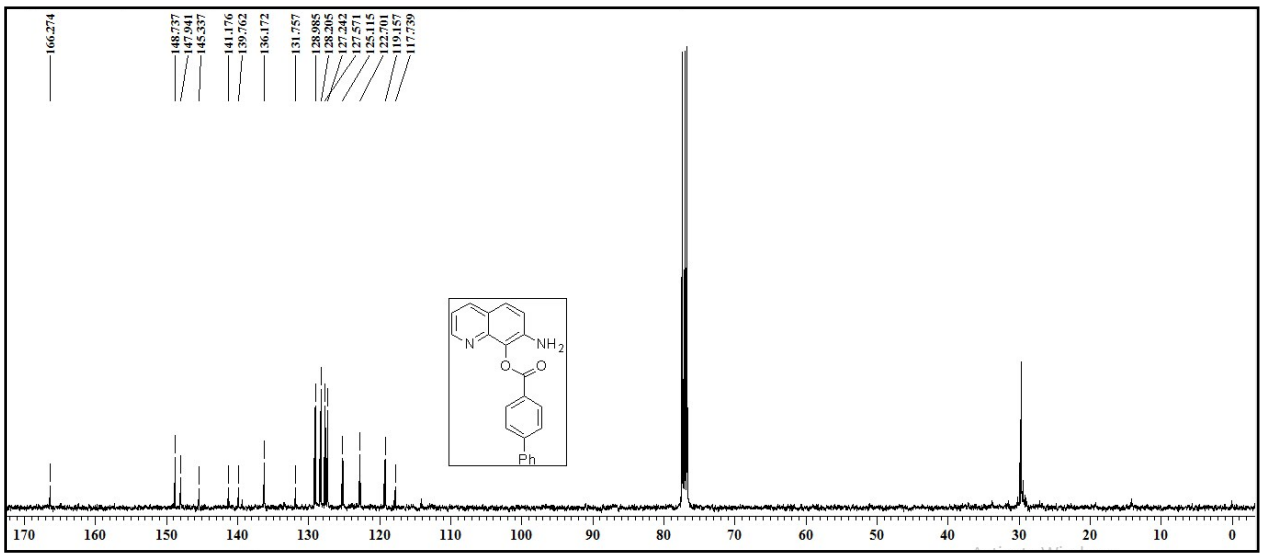


Figure S22. ^{13}C NMR spectrum of **3k**.

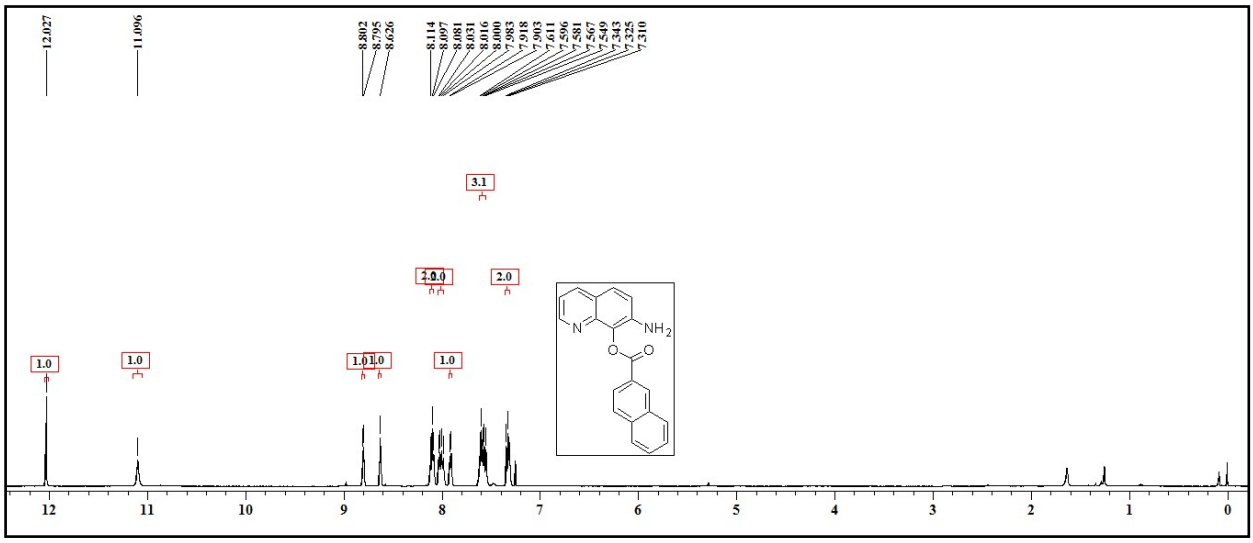


Figure S23. ^{1}H NMR spectrum of **3l**.

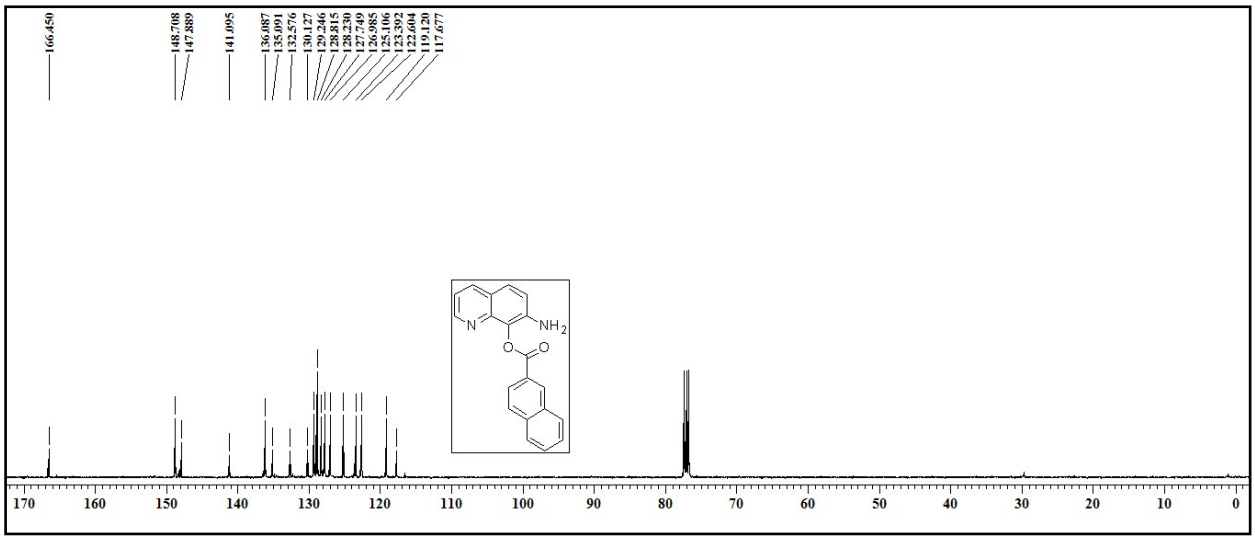


Figure S24. ^{13}C NMR spectrum of **3l**.

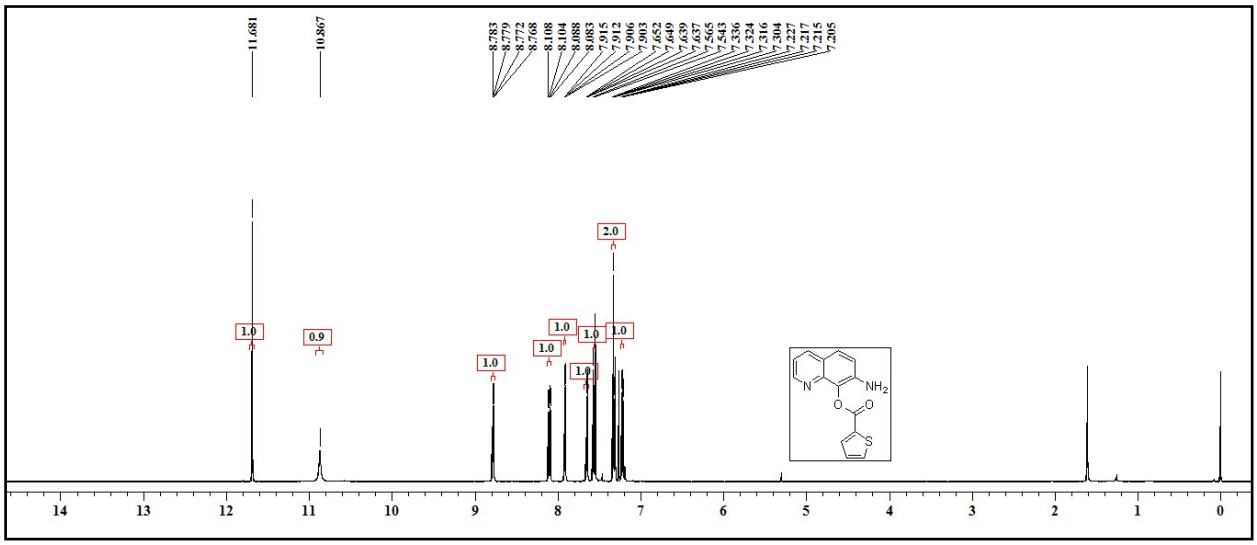


Figure S25. ^{1}H NMR spectrum of **3n**.

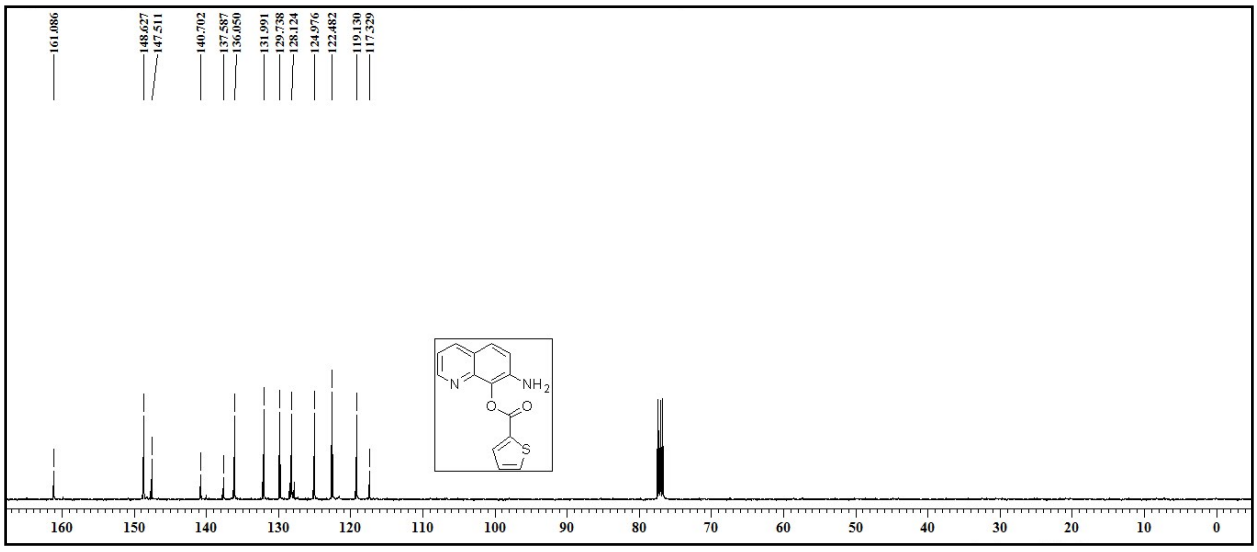


Figure S26. ^{13}C NMR spectrum of **3n**.

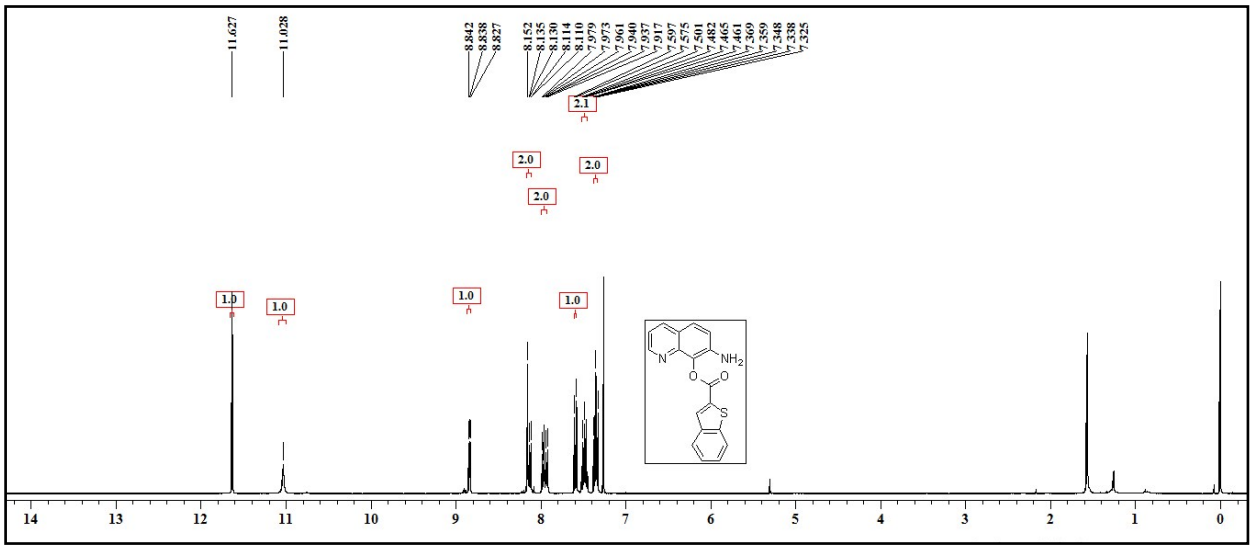


Figure S27. ^{1}H NMR spectrum of **3o**.

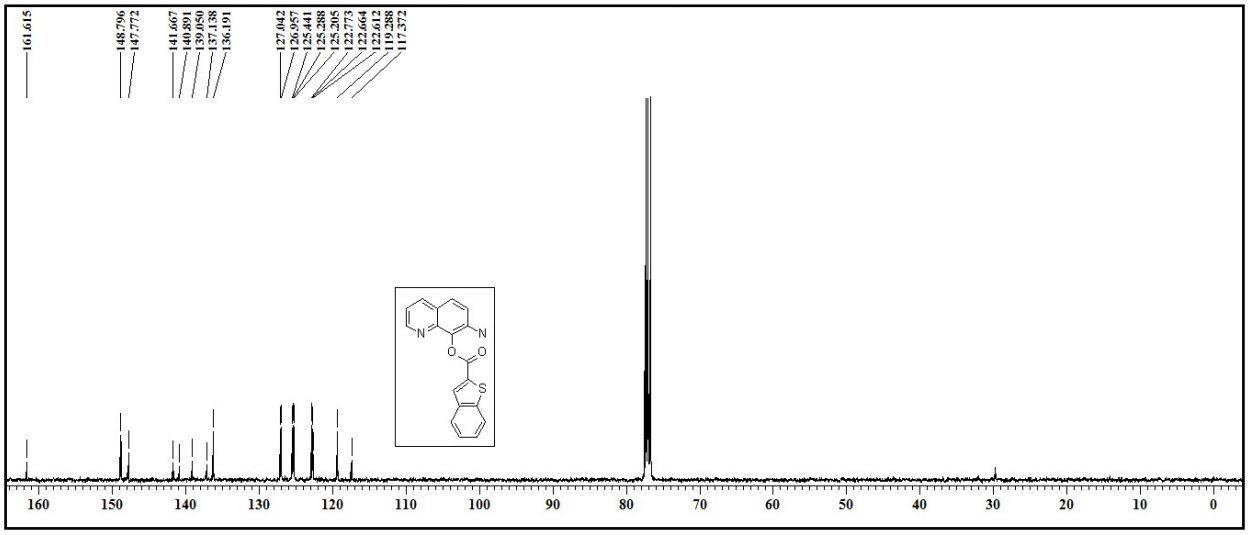


Figure S28. ^{13}C NMR spectrum of **3o**.

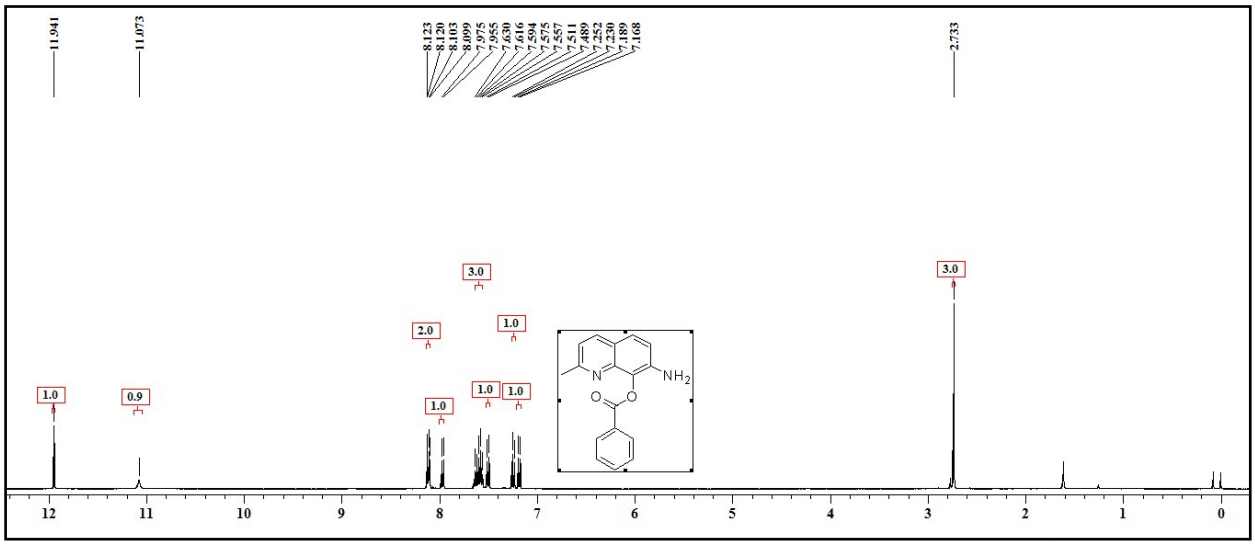


Figure S29. ^{1}H NMR spectrum of **4a**.

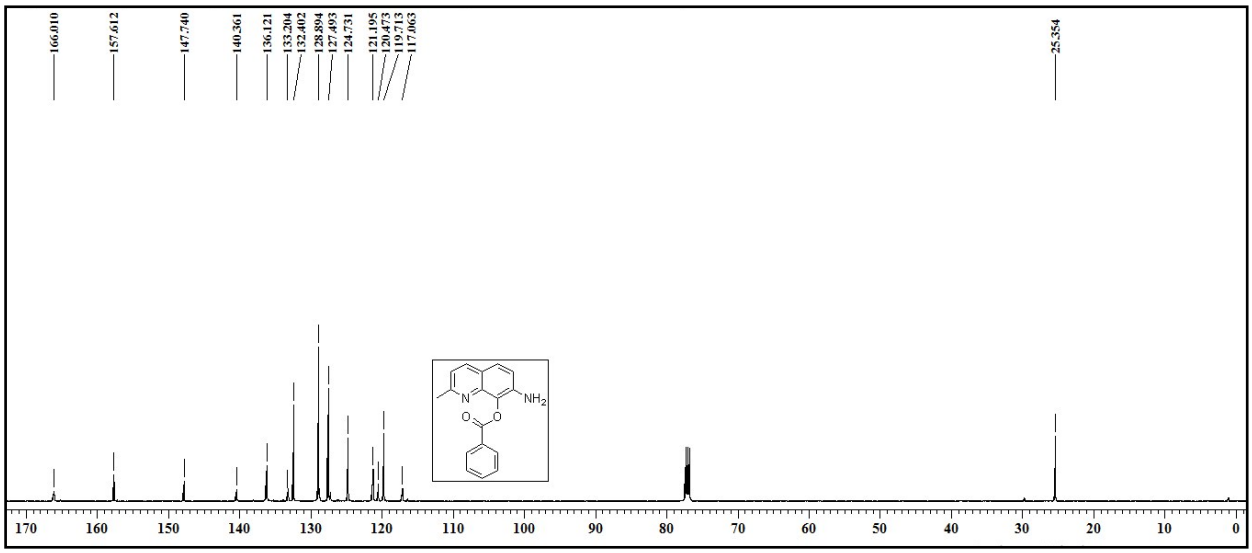


Figure S30. ^{13}C NMR spectrum of **4a**.

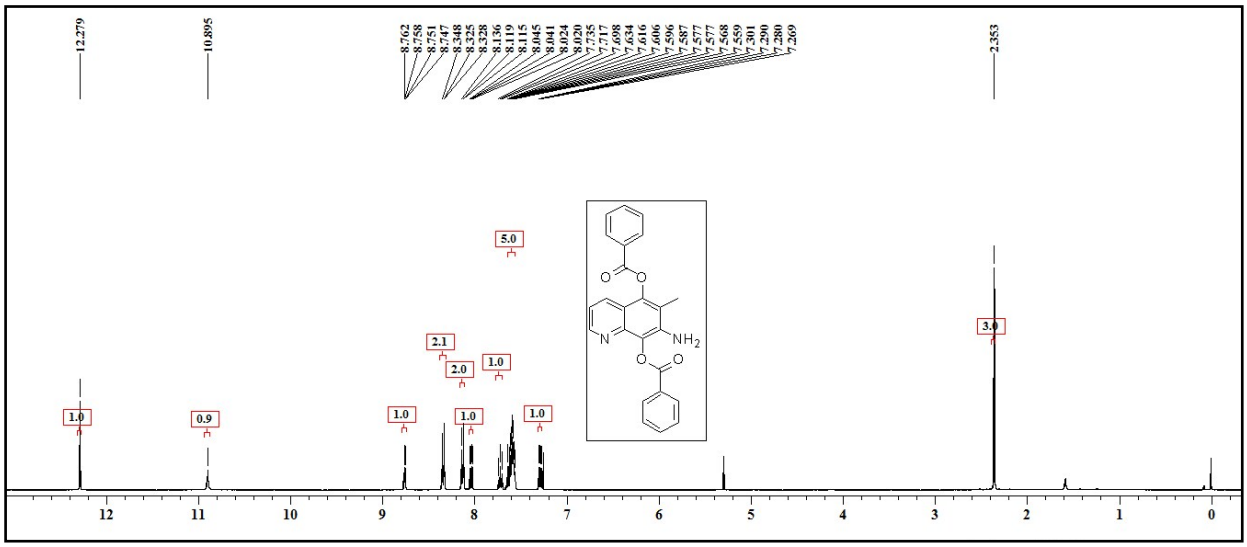


Figure S31. ^{1}H NMR spectrum of **4b**.

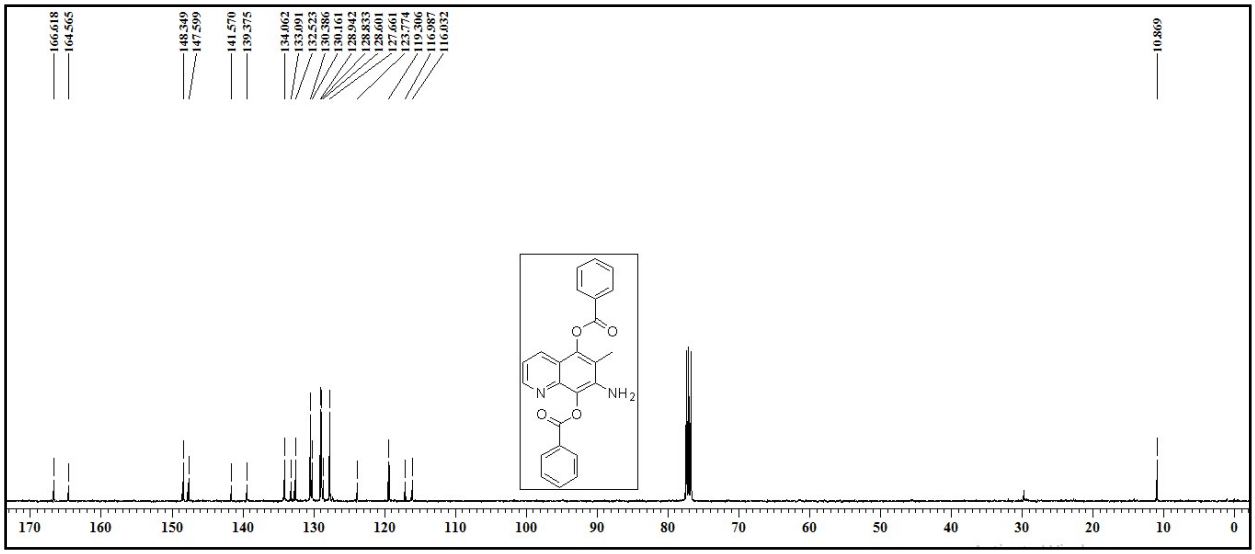


Figure S32. ^{13}C NMR spectrum of **4b**.

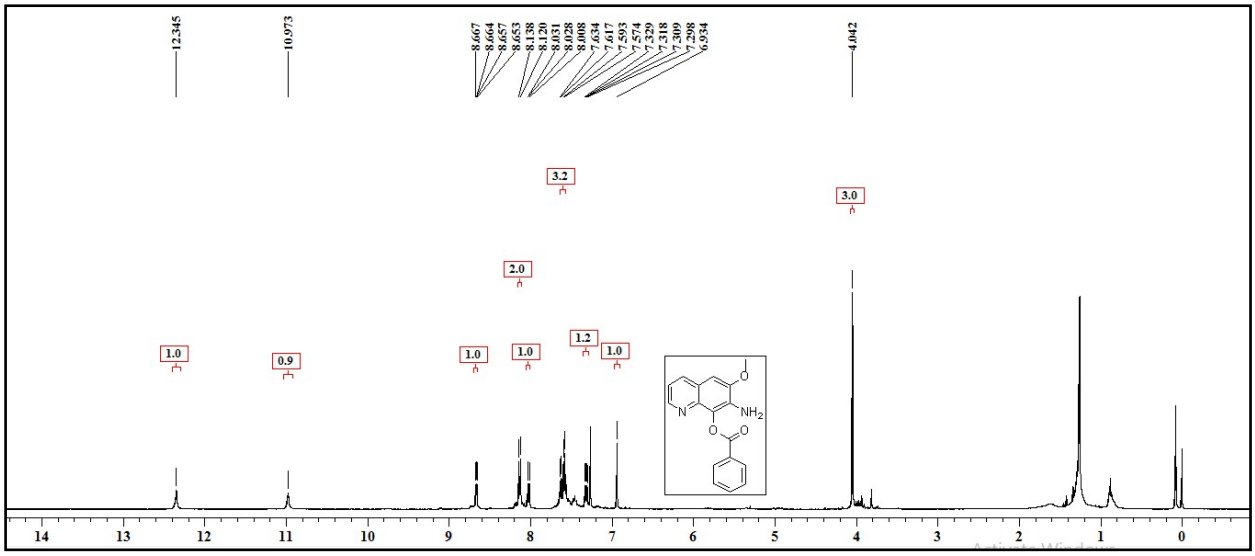


Figure S33. ^{1}H NMR spectrum of **4c**.

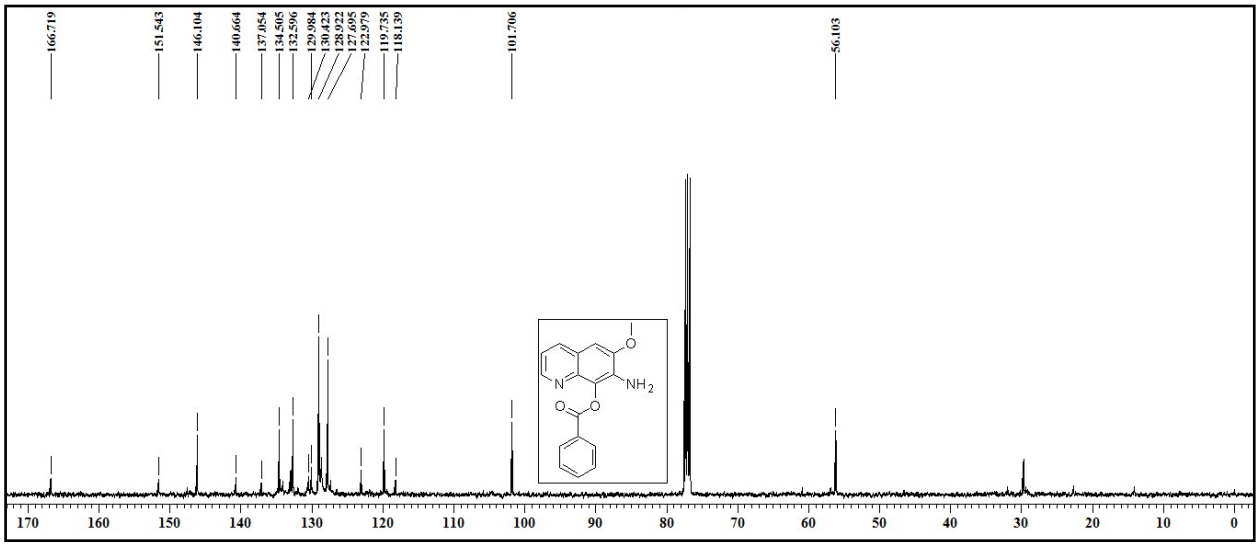


Figure S34. ^{13}C NMR spectrum of **4c**.

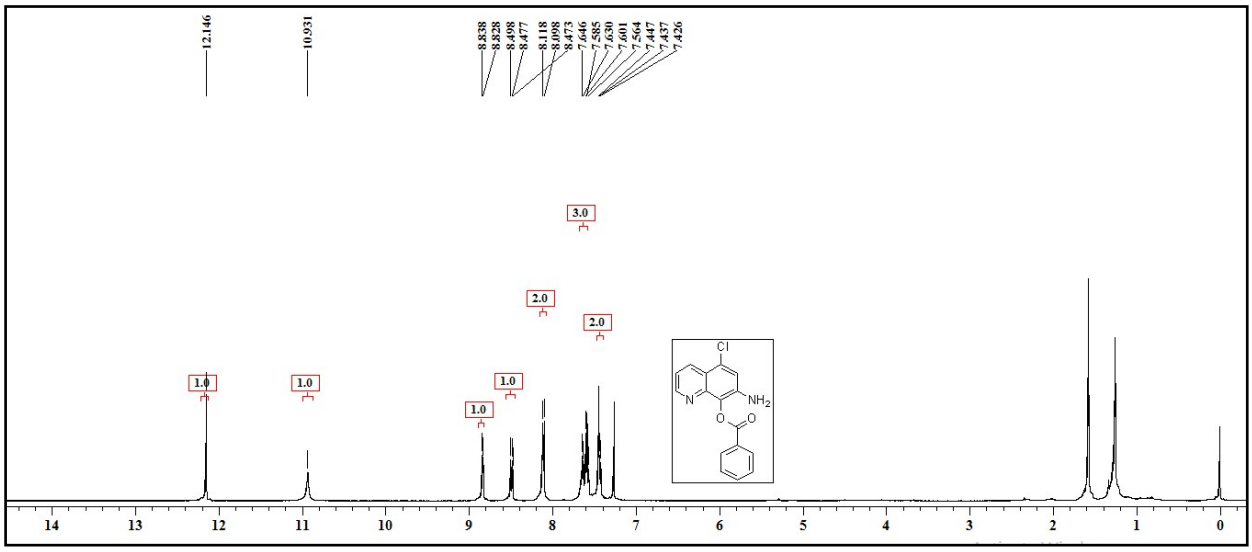


Figure S35. ^{1}H NMR spectrum of **4d**.

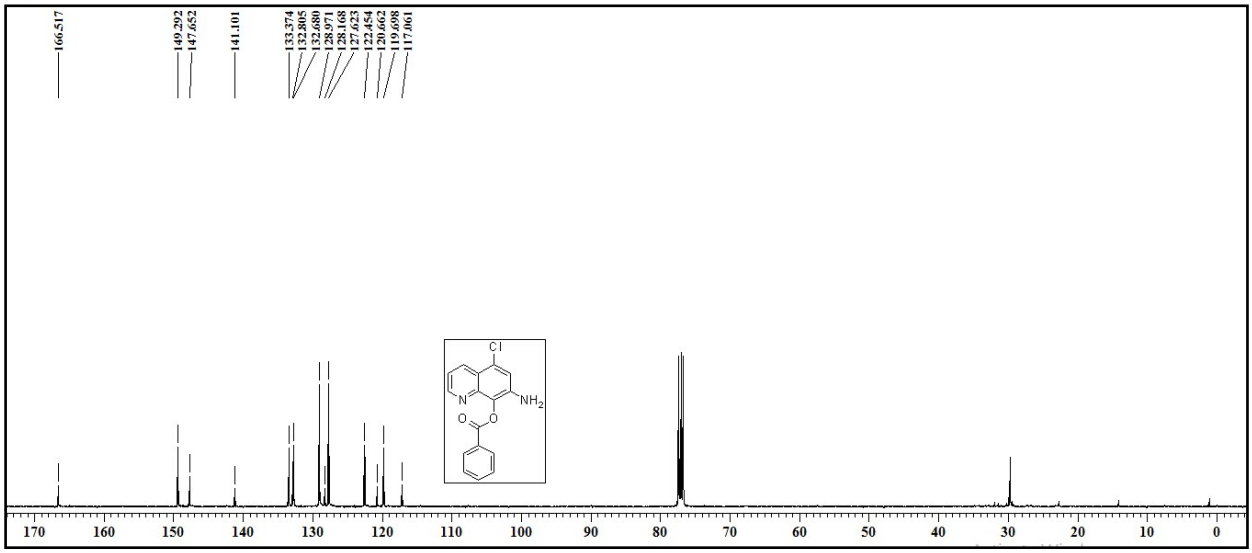


Figure S36. ^{13}C NMR spectrum of **4d**.

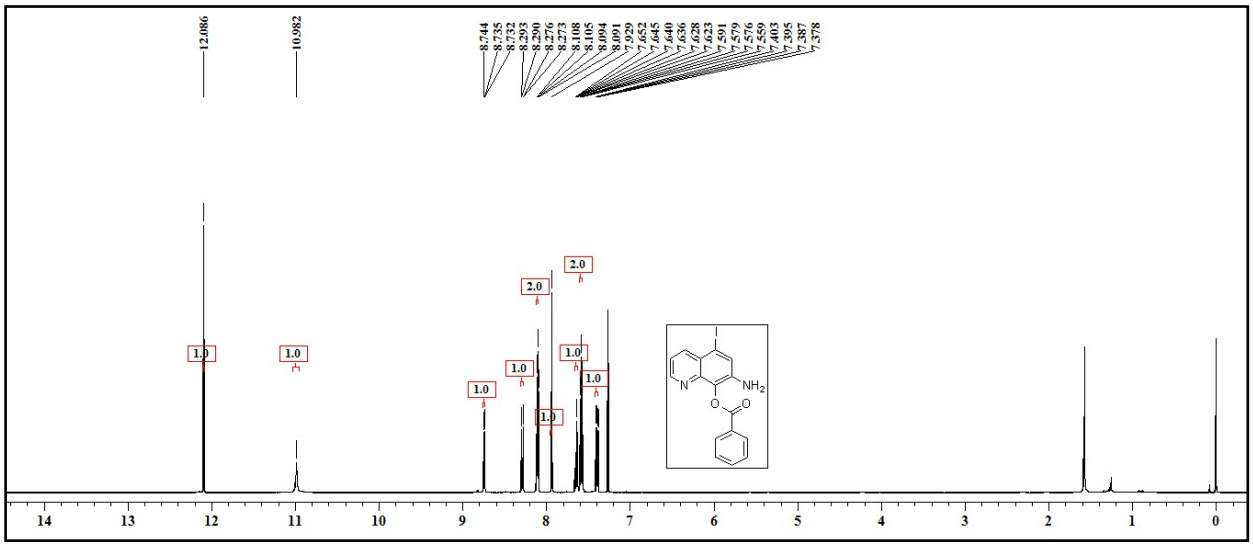


Figure S37. ^{1}H NMR spectrum of **4e**.

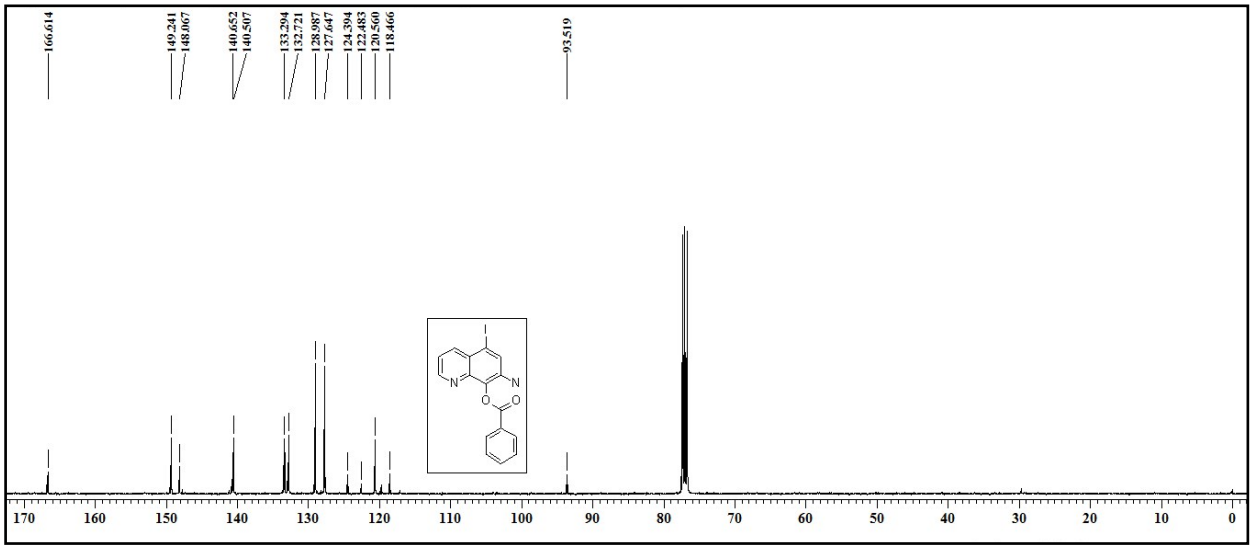


Figure S38. ^{13}C NMR spectrum of **4e**.

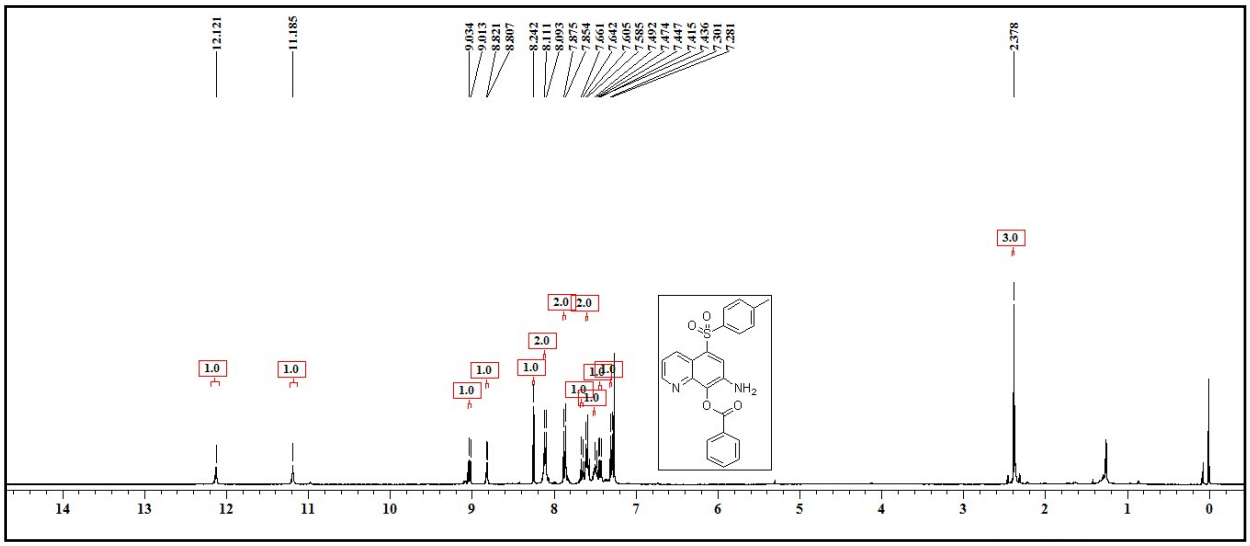


Figure S39. ^{1}H NMR spectrum of **4f**.

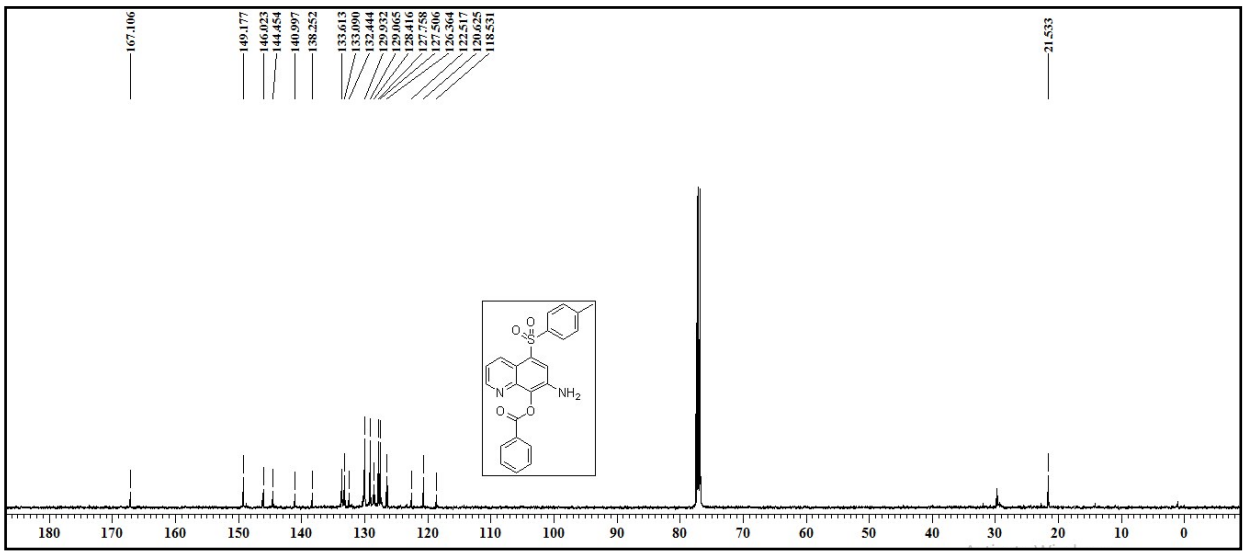


Figure S40. ^{13}C NMR spectrum of **4f**.