



Supporting Information

for

Deoxygenative C2-heteroarylation of quinoline *N*-oxides: facile access to α -triazolylquinolines

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Experimental details

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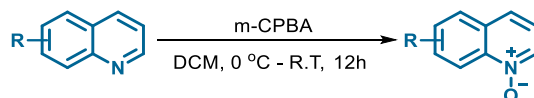
Experimental section

General information and methods

All reactions were carried out under nitrogen atmosphere in screw-cap reaction tubes. All the solvents used for the reactions were dried by following the reported procedures [1]. Unless otherwise noted, all materials were purchased from commercial suppliers and used as received. All sulfonyl azides were prepared in-house using conventional procedures [2]. Reactions were monitored using thin-layer chromatography (SiO₂). A gradient elution using petroleum ether and ethyl acetate was performed based on Merck aluminium TLC sheets (silica gel 60 F₂₅₄). TLC plates were visualized with UV light (254 nm). For column chromatography, silica gel (100–200 mesh) from SRL Co. was used. NMR studies were performed on a Bruker Advance DPX at 400 MHz (¹H) or 500 MHz (¹H) and at 100 MHz (¹³C) or 125 MHz (¹³C), respectively. Chemical shifts (δ) are reported in ppm, using the residual solvent peak in CDCl₃ (δ_H = 7.26 and δ_C = 77.16) ppm as internal standards, and coupling constants (*J*) are given in Hz. HRMS were recorded with a Bruker MaXis impact mass spectrometer using ESI-TOF techniques. Melting points were measured with a Buchi Melting Point B-545 apparatus.

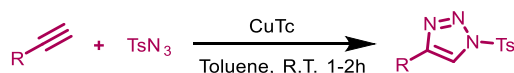
Experimental procedures

(a) General procedure for the synthesis of quinoline *N*-oxides [3]



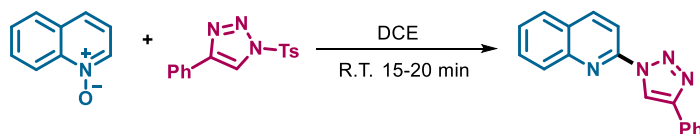
The quinoline *N*-oxides were prepared by following a reported procedure. To a 100 mL round-bottom flask equipped with a magnetic stir bar, substituted quinoline (10 mmol, 1.0 equiv) in CH₂Cl₂ was added *m*-CPBA (15 mmol, 1.5 equiv) portion wise over 1 h at 0 °C. The reaction mixture was allowed to stir for 12 h at rt. After completion, the reaction mixture was quenched with aqueous 1 M NaOH solution, extracted with DCM and sat. NaHCO₃. The combined organic layer was washed with brine and dried over Na₂SO₄, concentrated under reduced pressure, and purified by column chromatography (EA/petroleum ether 1:9) to get the desired product in up to 90% yield.

(b) General procedure for the synthesis of *N*-sulfonyl-1,2,3-triazoles [4]



In a 50 mL round-bottom flask equipped with a magnetic stir bar, substituted terminal alkyne (0.5 mmol, 1.0 equiv), sulfonyl azide (0.5 mmol, 1.0 equiv) and copper(I) thiophene-2-carboxylate (5 mol %) in toluene (10 mL) were placed. The resulting mixture was stirred for 1–2 h at rt. After the completion of the reaction, this was quenched with saturated aq NH_4Cl solution and extracted with EtOAc. The combined organic phases were washed with brine, dried over Na_2SO_4 , and concentrated under reduced pressure. The resulting residue was purified by recrystallization (DCM/hexane 1:9) to afford the desired product in up to 95% yield.

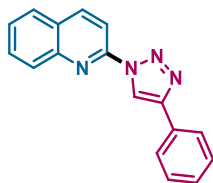
(c) General procedure of α -triazolyl quinoline



To an oven dried reaction tube equipped with a magnetic stirring bar was added Quinoline *N*-oxide **5** (0.2 mmol, 1.0 equiv), 4-phenyl-1-tosyl -1*H*-1,2,3-triazole **6a** (0.24 mmol, 1.2 equiv). The nitrogen was passed through the reaction mixture three times followed by addition of 1,2-dichloroethane (2 mL) *via* syringe. The reaction mixture was allowed to stir at R.T for 15-20 min. After completion of the reaction, solvent was evaporated under reduced pressure and the residue was purified by column chromatography (EA:Pet ether 1:9) to get the desired product **3a** in 92% yield. All the compounds are synthesized by following the same procedure.

Spectroscopic data of the compounds

3a



2-(4-Phenyl-1*H*-1,2,3-triazol-1-yl)quinoline

50 mg, 92 % yield, white solid

Melting Point: 150-152°C

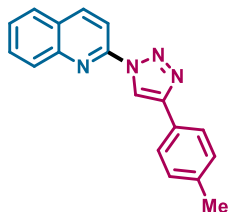
^1H NMR (500 MHz, CDCl_3): δ 9.03 (s, 1H), 8.44 – 8.36 (m, 2H), 8.09 (d, J = 8.4 Hz, 1H), 8.01 (d, J = 7.5 Hz, 2H), 7.91 (d, J = 8.1 Hz, 1H), 7.80 (t, J = 7.6 Hz, 1H), 7.61 (t, J = 7.5 Hz, 1H), 7.49 (t, J = 7.5 Hz, 2H), 7.39 (t, J = 7.3 Hz, 1H).

¹³C NMR (100 MHz, CDCl₃): δ 148.3, 148.0, 146.6, 139.8, 131.0, 130.4, 129.1, 129.0, 128.7, 128.1, 128.0, 127.2, 126.1, 117.0, 112.8.

HRMS (ESI): Calcd. for C₁₇H₁₃N₄ [M+H]⁺ 273.1135, found 273.1133.

The spectroscopic data is consistent with a literature report [5].

3b



2-(4-(*p*-Tolyl)-1*H*-1,2,3-triazol-1-yl)quinoline

54 mg, 94 % yield, white solid

Melting Point: 154-156°C

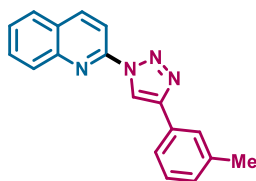
¹H NMR (400 MHz, CDCl₃): δ 8.88 (s, 1H), 8.33 – 8.23 (m, 2H), 7.99 (d, J = 8.5 Hz, 1H), 7.83 – 7.78 (m, 3H), 7.70 (ddt, J = 8.4, 7.0, 1.4 Hz, 1H), 7.50 (ddt, J = 8.1, 7.0, 1.1 Hz, 1H), 7.22 (d, J = 7.8 Hz, 2H), 2.34 (s, 3H).

¹³C NMR (100 MHz, CDCl₃): δ 148.0, 146.5, 139.6, 138.5, 130.8, 129.7, 128.9, 127.9, 127.5, 127.1, 126.0, 116.6, 112.7, 21.4.

HRMS (ESI): Calcd. for C₁₈H₁₅N₄ [M+H]⁺ 287.1291, found 287.1297.

The spectroscopic data is consistent with a literature report [5].

3c



2-(4-(*m*-Tolyl)-1*H*-1,2,3-triazol-1-yl)quinoline

49 mg, 85 % yield, white solid.

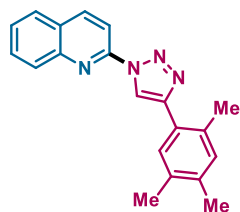
Melting Point: 151-153°C

¹H NMR (400 MHz, CDCl₃): δ 8.97 (d, J = 0.7 Hz, 1H), 8.39 – 8.30 (m, 2H), 8.05 (d, J = 8.4 Hz, 1H), 7.89 – 7.82 (m, 2H), 7.80 – 7.73 (m, 2H), 7.57 (t, J = 7.5 Hz, 1H), 7.36 (t, J = 7.6 Hz, 1H), 7.19 (d, J = 7.6 Hz, 1H), 2.44 (s, 3H).

¹³C NMR (100 MHz, CDCl₃): δ 148.3, 147.9, 146.5, 139.6, 138.7, 130.8, 130.2, 129.4, 128.9, 128.9, 127.9, 127.1, 126.7, 123.2, 116.9, 112.7, 21.6.

HRMS (ESI): Calcd. for C₁₈H₁₅N₄ [M+H]⁺ 287.1291, found 287.1291.

3d



2-(4-(2,4,5-Trimethylphenyl)-1H-1,2,3-triazol-1-yl)quinoline

52 mg, 83 % yield, white solid

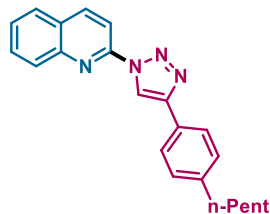
Melting Point: 145-147°C

¹H NMR (500 MHz, CDCl₃): δ 8.88 (s, 1H), 8.45 – 8.37 (m, 2H), 8.09 (d, J = 8.4 Hz, 1H), 7.90 (d, J = 8.0 Hz, 1H), 7.82 – 7.76 (m, 1H), 7.73 (s, 1H), 7.63 – 7.58 (m, 1H), 7.10 (s, 1H), 2.55 (s, 3H), 2.32 (s, 3H), 2.30 (s, 3H).

¹³C NMR (125 MHz, CDCl₃): δ 148.2, 146.7, 139.7, 137.1, 134.4, 133.1, 132.5, 130.9, 130.2, 129.0, 128.00, 127.98, 127.1, 127.0, 118.8, 112.9, 21.1, 19.6, 19.4.

HRMS (ESI): Calcd. for C₂₀H₁₉N₄ [M+H]⁺ 315.1604, found 315.1607.

3e



2-(4-(4-Pentylphenyl)-1H-1,2,3-triazol-1-yl)quinoline

62 mg, 90 % yield, white solid

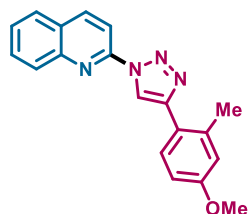
Melting Point: 143-145°C

¹H NMR (400 MHz, CDCl₃): δ 8.97 (s, 1H), 8.43 – 8.30 (m, 2H), 8.06 (d, J = 7.9 Hz, 1H), 7.95 – 7.84 (m, 3H), 7.77 (t, J = 7.2 Hz, 1H), 7.57 (t, J = 7.4 Hz, 1H), 7.30 (d, J = 7.5 Hz, 2H), 2.66 (t, J = 7.6 Hz, 2H), 1.71 – 1.62 (m, 2H), 1.39 – 1.32 (m, 4H), 0.91 (t, J = 5.9 Hz, 3H).

¹³C NMR (100 MHz, CDCl₃): δ 148.0, 146.6, 143.6, 139.6, 130.8, 129.1, 129.1, 128.9, 127.9, 127.7, 127.1, 126.1, 126.0, 116.6, 112.7, 35.9, 31.6, 31.2, 22.7, 14.2.

HRMS (ESI): Calcd. for C₂₂H₂₂N₄Na [M+Na]⁺ 365.1737, found 365.1736.

3f



2-(4-(4-Methoxy-2-methylphenyl)-1H-1,2,3-triazol-1-yl)quinoline

55mg, 87 % yield, white solid

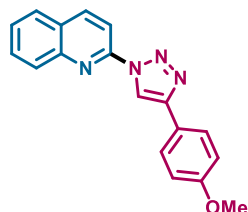
Melting Point: 152-154°C

¹H NMR (400 MHz, CDCl₃): δ 8.83 (s, 1H), 8.44 – 8.34 (m, 2H), 8.08 (d, J = 8.4 Hz, 1H), 7.89 (d, J = 8.1 Hz, 1H), 7.85 (d, J = 9.2 Hz, 1H), 7.78 (t, J = 7.3 Hz, 1H), 7.59 (t, J = 7.4 Hz, 1H), 6.91 – 6.82 (m, 2H), 3.86 (s, 3H), 2.59 (s, 3H).

¹³C NMR (100 MHz, CDCl₃): δ 159.8, 148.1, 147.6, 146.6, 139.7, 137.7, 130.9, 130.5, 129.0, 128.0, 127.1, 122.4, 118.5, 116.5, 112.8, 111.6, 55.4, 21.9.

HRMS (ESI): Calcd. for C₁₉H₁₇N₄O [M+H]⁺ 317.1397, found 317.1399.

3g



2-(4-(4-Methoxyphenyl)-1H-1,2,3-triazol-1-yl)quinoline

57 mg, 95 % yield, white solid

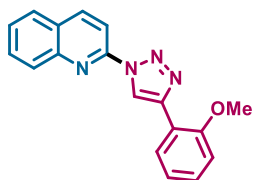
Melting Point: 149-151°C

¹H NMR (500 MHz, CDCl₃): δ 8.95 (s, 1H), 8.45 – 8.37 (m, 2H), 8.08 (d, J = 8.4 Hz, 1H), 7.96 – 7.88 (m, 3H), 7.80 (t, J = 7.7 Hz, 1H), 7.61 (t, J = 7.5 Hz, 1H), 7.02 (d, J = 8.5 Hz, 2H), 3.88 (s, 3H).

¹³C NMR (125 MHz, CDCl₃): δ 160.1, 148.2, 148.1, 146.7, 139.7, 130.9, 129.0, 128.03, 128.01, 127.5, 127.2, 123.1, 116.2, 114.5, 112.9, 55.5.

HRMS (ESI): Calcd. for C₁₈H₁₅N₄O [M+H]⁺ 303.1240, found 303.1237.

3h



2-(4-(2-Methoxyphenyl)-1H-1,2,3-triazol-1-yl)quinoline

55mg, 91 % yield, white solid

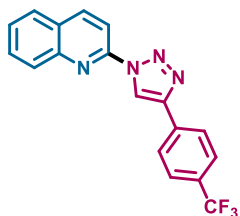
Melting Point: 144-146°C

¹H NMR (400 MHz, CDCl₃): δ 9.18 (s, 1H), 8.46 (d, J = 7.3 Hz, 1H), 8.37 (dd, J = 27.2, 8.8 Hz, 2H), 8.11 (d, J = 8.4 Hz, 1H), 7.87 (d, J = 8.0 Hz, 1H), 7.77 (t, J = 7.5 Hz, 1H), 7.57 (t, J = 7.4 Hz, 1H), 7.36 (t, J = 7.4 Hz, 1H), 7.13 (t, J = 7.4 Hz, 1H), 7.03 (d, J = 8.2 Hz, 1H), 4.03 (s, 3H).

¹³C NMR (100 MHz, CDCl₃): δ 156.2, 148.3, 146.6, 139.5, 130.7, 129.4, 129.0, 128.1, 127.9, 127.0, 121.1, 120.2, 119.2, 113.0, 111.0, 55.6.

HRMS (ESI): Calcd. for C₁₈H₁₅N₄O [M+H]⁺ 303.1240, found 303.1242.

3i



2-(4-(4-(Trifluoromethyl)phenyl)-1H-1,2,3-triazol-1-yl)quinoline

55 mg, 81 % yield, white solid

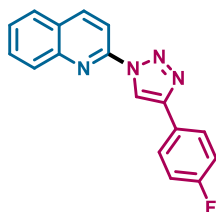
Melting Point: 195-197°C

¹H NMR (400 MHz, CDCl₃): δ 9.10 (s, 1H), 8.39 (s, 2H), 8.14 – 8.05 (m, 3H), 7.91 (d, J = 8.1 Hz, 1H), 7.81 (t, J = 7.6 Hz, 1H), 7.73 (d, J = 8.2 Hz, 2H), 7.62 (t, J = 7.5 Hz, 1H).

¹³C NMR (100 MHz, CDCl₃): δ 147.8, 146.9, 146.6, 139.9, 133.8, 131.1, 129.0, 128.1, 128.0, 127.4, 126.9 (q = 271.8 Hz), 126.2, 126.1 (q, J = 3.7 Hz), 117.9, 112.7.

HRMS (ESI): Calcd. for C₁₈H₁₁F₃N₄Na [M+Na]⁺ 363.0828, found 363.0822.

3j



2-(4-(4-Fluorophenyl)-1H-1,2,3-triazol-1-yl)quinoline

49 mg, 84 % yield, white solid

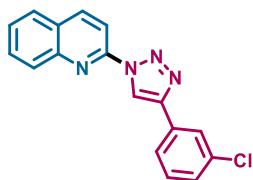
Melting Point: 157-159 °C

¹H NMR (400 MHz, CDCl₃): δ 8.96 (s, 1H), 8.37 (s, 2H), 8.06 (d, J = 8.4 Hz, 1H), 7.99 – 7.92 (m, 2H), 7.88 (d, J = 8.0 Hz, 1H), 7.78 (t, J = 7.5 Hz, 1H), 7.59 (t, J = 7.4 Hz, 1H), 7.16 (t, J = 8.5 Hz, 2H).

¹³C NMR (100 MHz, CDCl₃): δ 163.0 (d, J = 247.8 Hz), 147.9, 147.4, 146.6, 139.8, 131.0, 128.9, 128.0 (d, J = 4.3 Hz), 127.98, 127.9, 127.8, 127.2, 126.6 (d, J = 3.2 Hz), 116.8, 116.1 (d, J = 21.8 Hz), 112.7.

HRMS (ESI): Calcd. for C₁₇H₁₂FN₄ [M+H]⁺ 291.1041, found 291.1043.

3k



2-(4-(3-Chlorophenyl)-1H-1,2,3-triazol-1-yl)quinoline

52 mg, 85 % yield, white solid

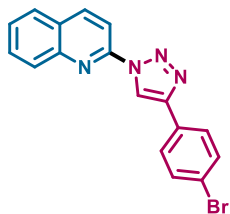
Melting Point: 152-154 °C

¹H NMR (400 MHz, CDCl₃): δ 9.01 (s, 1H), 8.34 (s, 2H), 8.06 (d, J = 8.3 Hz, 1H), 7.98 (s, 1H), 7.87 (t, J = 8.4 Hz, 2H), 7.78 (t, J = 7.4 Hz, 1H), 7.59 (t, J = 7.5 Hz, 1H), 7.40 (t, J = 7.8 Hz, 1H), 7.34 (d, J = 7.9 Hz, 1H).

¹³C NMR (125 MHz, CDCl₃): δ 147.8, 147.0, 146.5, 139.8, 135.0, 132.1, 131.0, 130.3, 128.9, 128.6, 128.03, 127.97, 127.3, 126.1, 124.1, 117.4, 112.6.

HRMS (ESI): Calcd. for C₁₇H₁₂ClN₄[M+H]⁺ 307.0745, found 307.0743.

3l



2-(4-(4-Bromophenyl)-1H-1,2,3-triazol-1-yl)quinoline

63 mg, 90 % yield, white solid

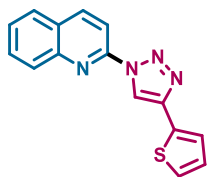
Melting Point: 142-144 °C

¹H NMR (400 MHz, CDCl₃): δ 9.03 (s, 1H), 8.40 (s, 2H), 8.08 (d, J = 8.4 Hz, 1H), 7.91 (d, J = 8.1 Hz, 1H), 7.87 (d, J = 8.5 Hz, 2H), 7.80 (ddt, J = 8.4, 7.0, 1.4 Hz, 1H), 7.64 – 7.59 (m, 3H).

¹³C NMR (100 MHz, CDCl₃): δ 147.9, 147.3, 146.6, 139.9, 132.3, 131.0, 129.3, 129.0, 128.1, 128.0, 127.6, 127.3, 122.6, 117.2, 112.7.

HRMS (ESI): Calcd. for C₁₇H₁₂BrN₄ [M+H]⁺ 351.0240, found 351.0244.

3m



2-(4-(Thiophen-2-yl)-1H-1,2,3-triazol-1-yl)quinoline

46 mg, 82 % yield, white solid

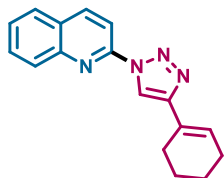
Melting Point: 158-160 °C

¹H NMR (500 MHz, CDCl₃): δ 8.90 (s, 1H), 8.41 – 8.33 (m, 2H), 8.06 (d, J = 8.4 Hz, 1H), 7.89 (d, J = 8.1 Hz, 1H), 7.85 (d, J = 1.9 Hz, 1H), 7.78 (t, J = 7.7 Hz, 1H), 7.62 – 7.56 (m, 2H), 7.44 (dd, J = 4.8, 3.0 Hz, 1H).

¹³C NMR (125 MHz, CDCl₃): δ 148.0, 146.6, 144.5, 139.7, 131.6, 130.9, 128.9, 128.01, 127.98, 127.2, 126.6, 126.1, 122.0, 116.7, 112.8.

HRMS (ESI): Calcd. for C₁₅H₁₁N₄S [M+H]⁺ 279.0699, found 279.0671.

3n



2-(4-(Cyclohex-1-en-1-yl)-1H-1,2,3-triazol-1-yl)quinoline

42mg, 75 % yield, white semi-solid

Melting Point: 128-130 °C

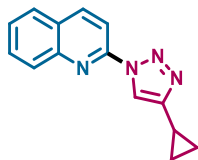
¹H NMR (400 MHz, CDCl₃): δ 8.61 (s, 1H), 8.35 – 8.33 (m, 2H), 8.03 (d, J = 8.5 Hz, 1H), 7.87 (d, J = 8.1 Hz, 1H), 7.78 – 7.74 (m, 1H), 7.57 (t, J = 7.0 Hz, 1H), 6.75 – 6.72 (m, 1H), 2.51 – 2.47 (m, 2H), 2.28 – 2.24 (m, 2H), 1.84 – 1.80 (m, 2H), 1.73 – 1.69 (m, 2H).

¹³C NMR (100 MHz, CDCl₃): δ 149.9, 148.2, 146.6, 139.6, 130.8, 128.9, 127.94, 127.89, 127.02, 127.00, 126.3, 115.6, 112.8, 26.5, 25.5, 22.6, 22.3.

HRMS (ESI): Calcd. for C₁₇H₁₇N₄ [M+H]⁺ 277.1448, found 277.1455.

The spectroscopic data is consistent with a literature report [5].

3o



2-(4-cyclopropyl-1H-1,2,3-triazol-1-yl)quinoline

36 mg, 77 % yield, white solid

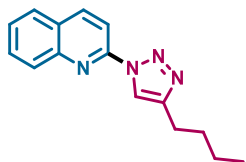
Melting Point: 83-85°C

¹H NMR (500 MHz, CDCl₃): δ 8.46 (s, 1H), 8.33 (s, 2H), 8.02 (d, J = 8.5 Hz, 1H), 7.87 (d, J = 8.1 Hz, 1H), 7.76 (t, J = 7.7 Hz, 1H), 7.57 (t, J = 7.5 Hz, 1H), 2.13 – 2.04 (m, 1H), 1.07 – 1.01 (m, 2H), 0.98 – 0.95 (m, 2H).

¹³C NMR (125 MHz, CDCl₃): δ 151.2, 148.1, 146.6, 139.6, 130.8, 128.9, 127.93, 127.87, 127.0, 117.1, 112.8, 8.1, 6.9.

HRMS (ESI): Calcd. for C₁₄H₁₃N₄ [M+H]⁺ 237.1135, found 237.1136.

3p



2-(4-Butyl-1H-1,2,3-triazol-1-yl)quinoline

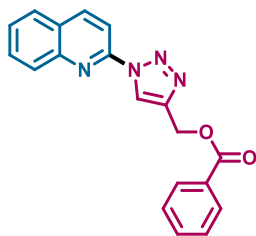
37 mg, 73 % yield, colorless oil

¹H NMR (400 MHz, CDCl₃): δ 8.53 (s, 1H), 8.33 (s, 2H), 8.03 (d, J = 8.5 Hz, 1H), 7.86 (d, J = 8.1 Hz, 1H), 7.78 – 7.73 (m, 1H), 7.57 (t, J = 7.5 Hz, 1H), 2.84 (t, J = 7.7 Hz, 2H), 1.81 – 1.72 (m, 2H), 1.50 – 1.41 (m, 2H), 0.97 (t, J = 7.4 Hz, 3H).

¹³C NMR (100 MHz, CDCl₃): δ 149.2, 148.2, 146.6, 139.6, 130.8, 128.9, 127.92, 127.88, 127.0, 118.3, 112.8, 31.5, 25.5, 22.4, 14.0.

HRMS (ESI): Calcd. for C₁₅H₁₇N₄ [M+H]⁺ 253.1448, found 253.1446.

3q



(1-(Quinolin-2-yl)-1H-1,2,3-triazol-4-yl)methyl benzoate

53 mg, 80 % yield, white solid

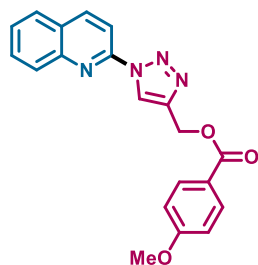
Melting Point: 149-151°C

¹H NMR (400 MHz, CDCl₃): δ 8.93 (s, 1H), 8.39 – 8.34 (m, 2H), 8.10 (d, J = 7.7 Hz, 2H), 8.06 (d, J = 8.5 Hz, 1H), 7.89 (d, J = 8.1 Hz, 1H), 7.79 (t, J = 7.7 Hz, 1H), 7.62 – 7.54 (m, 2H), 7.44 (t, J = 7.7 Hz, 2H), 5.61 (s, 2H).

¹³C NMR (100 MHz, CDCl₃): δ 166.6, 147.8, 146.6, 143.7, 139.9, 133.4, 131.0, 130.0, 129.9, 129.1, 128.6, 128.1, 128.0, 127.3, 121.7, 112.7, 58.2.

HRMS (ESI): Calcd. for C₁₉H₁₄N₄NaO₂[M+Na]⁺ 353.1009, found 353.1006

3r



(1-(Quinolin-2-yl)-1H-1,2,3-triazol-4-yl)methyl 4-methoxybenzoate

60 mg, 83 % yield, white solid

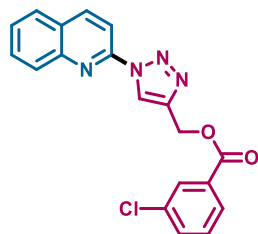
Melting Point: 140-142°C

¹H NMR (500 MHz, CD-Cl₃): δ 8.92 (s, 1H), 8.39 – 8.34 (m, 2H), 8.07 – 8.02 (m, 3H), 7.89 (d, J = 8.0 Hz, 1H), 7.81 – 7.76 (m, 1H), 7.60 (t, J = 7.5 Hz, 1H), 6.91 (d, J = 8.9 Hz, 2H), 5.58 (s, 2H), 3.85 (s, 3H).

¹³C NMR (125 MHz, CDCl₃): δ 166.3, 163.7, 147.8, 146.5, 143.9, 139.8, 132.0, 131.0, 129.0, 128.1, 128.0, 127.3, 122.2, 121.6, 113.8, 112.7, 57.9, 55.6.

HRMS (ESI): Calcd. for C₂₀H₁₇N₄O₃ [M+H]⁺ 361.1295, found 361.1299

3s



(1-(Quinolin-2-yl)-1H-1,2,3-triazol-4-yl)methyl 3-chlorobenzoate

58 mg, 79 % yield, white solid

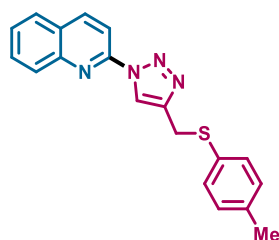
Melting Point: 139-141°C

¹H NMR (500 MHz, CDCl₃): δ 8.93 (s, 1H), 8.39 – 8.34 (m, 2H), 8.07 – 8.03 (m, 2H), 7.97 (d, J = 7.8 Hz, 1H), 7.89 (d, J = 8.1 Hz, 1H), 7.80 – 7.76 (m, 1H), 7.62 – 7.58 (m, 1H), 7.53 (dd, J = 8.0, 1.0 Hz, 1H), 7.38 (t, J = 7.9 Hz, 1H), 5.61 (s, 2H).

¹³C NMR (125 MHz, CDCl₃): δ 165.4, 147.8, 146.5, 143.7, 139.9, 134.7, 133.4, 131.5, 131.0, 130.0, 129.9, 129.0, 128.1, 128.0, 127.4, 121.8, 112.7, 58.5.

HRMS (ESI): Calcd. for C₁₉H₁₃ClKN₄O₂[M+K]⁺ 403.0568, found 403.0568

3t



2-(4-((p-Tolylthio)methyl)-1H-1,2,3-triazol-1-yl)quinoline

50 mg, 75 % yield, white solid

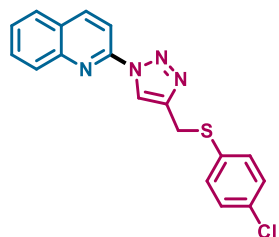
Melting Point: 127-129°C

¹H NMR (400 MHz, CDCl₃): δ 8.61 (s, 1H), 8.36 – 8.29 (m, 2H), 8.02 (d, J = 8.5 Hz, 1H), 7.87 (d, J = 8.1 Hz, 1H), 7.79 – 7.74 (m, 1H), 7.61 – 7.55 (m, 1H), 7.32 (d, J = 8.1 Hz, 2H), 7.10 (d, J = 8.0 Hz, 2H), 4.31 (s, 2H), 2.30 (s, 3H).

¹³C NMR (100 MHz, CDCl₃): δ 147.9, 146.5, 146.0, 139.7, 137.0, 131.8, 130.9, 130.5, 130.0, 129.0, 128.0, 127.9, 127.2, 119.8, 112.7, 29.8, 21.2.

HRMS (ESI): Calcd. for C₁₉H₁₆N₄NaS [M+Na]⁺ 355.0988, found 355.0985

3u



2-(4-(((4-Chlorophenyl)thio)methyl)-1H-1,2,3-triazol-1-yl)quinoline

55 mg, 78 % yield, white solid

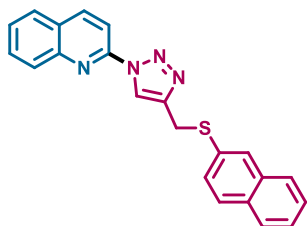
Melting Point: 135-137°C

¹H NMR (400 MHz, CDCl₃): δ 8.63 (s, 1H), 8.37 – 8.29 (m, 2H), 8.02 (d, J = 8.5 Hz, 1H), 7.87 (d, J = 8.1 Hz, 1H), 7.77 (t, J = 7.6 Hz, 1H), 7.58 (t, J = 7.5 Hz, 1H), 7.33 (d, J = 8.5 Hz, 2H), 7.25 (d, J = 8.4 Hz, 2H), 4.32 (s, 2H).

¹³C NMR (100 MHz, CDCl₃): δ 147.8, 146.5, 145.5, 139.8, 134.0, 132.8, 131.2, 130.9, 129.3, 129.0, 128.0, 127.9, 127.2, 119.8, 112.6, 29.3.

HRMS (ESI): Calcd. for C₁₈H₁₄ClN₄S [M+H]⁺ 353.0622, found 353.0627

3v



2-(4-((Naphthalen-2-ylthio)methyl)-1H-1,2,3-triazol-1-yl)quinoline

49 mg, 67 % yield, white solid

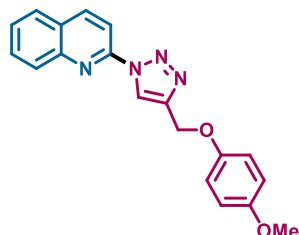
Melting Point: 151-153°C

¹H NMR (500 MHz, CDCl₃): δ 8.67 (s, 1H), 8.35 – 8.29 (m, 2H), 7.98 (d, J = 8.5 Hz, 1H), 7.88 – 7.84 (m, 2H), 7.79 – 7.73 (m, 4H), 7.57 (t, J = 7.5 Hz, 1H), 7.50 (d, J = 8.6 Hz, 1H), 7.47 – 7.41 (m, 2H), 4.46 (s, 2H).

¹³C NMR (125 MHz, CDCl₃): δ 147.9, 146.5, 145.7, 139.7, 133.9, 133.1, 132.1, 130.9, 129.0, 128.8, 128.0, 127.91, 127.8, 127.6, 127.41, 127.39, 127.2, 126.7, 126.0, 119.9, 112.7, 29.0.

HRMS (ESI): Calcd. for C₂₂H₁₇N₄S [M+H]⁺ 369.1168, found 369.1164

3w



2-(4-((4-Methoxyphenoxy)methyl)-1H-1,2,3-triazol-1-yl)quinoline

47 mg, 71 % yield, white solid

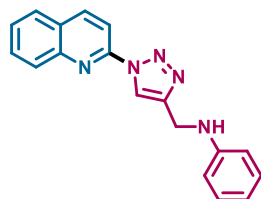
Melting Point: 137-139°C

¹H NMR (500 MHz, CDCl₃): δ 8.85 (s, 1H), 8.36 (s, 2H), 8.04 (d, J = 8.5 Hz, 1H), 7.88 (d, J = 8.0 Hz, 1H), 7.77 (t, J = 7.6 Hz, 1H), 7.59 (t, J = 7.4 Hz, 1H), 6.99 (d, J = 8.8 Hz, 2H), 6.86 (d, J = 8.7 Hz, 2H), 5.29 (s, 2H), 3.77 (s, 3H).

¹³C NMR (125 MHz, CDCl₃): δ 154.4, 152.5, 147.9, 146.5, 145.2, 139.8, 130.9, 129.0, 128.0, 127.9, 127.3, 120.5, 116.0, 114.8, 112.7, 62.8, 55.8.

HRMS (ESI): Calcd. for C₁₉H₁₆N₄NaO₂[M+Na]⁺ 355.1165, found 355.1164.

3x



N-((1-(Quinolin-2-yl)-1H-1,2,3-triazol-4-yl)methyl)aniline

45 mg, 75 % yield, white solid

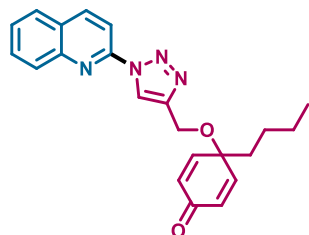
Melting Point: 147-149°C

¹H NMR (400 MHz, CDCl₃): δ 8.70 (s, 1H), 8.33 (s, 2H), 8.01 (d, J = 8.5 Hz, 1H), 7.87 (d, J = 8.1 Hz, 1H), 7.79 – 7.73 (m, 1H), 7.58 (t, J = 7.4 Hz, 1H), 7.22 (t, J = 7.9 Hz, 2H), 6.81 – 6.70 (m, 3H), 4.59 (s, 2H), 4.39 (d, J = 23.9 Hz, 1H).

¹³C NMR (100 MHz, CDCl₃): δ 147.9, 147.6, 147.0, 146.5, 139.7, 130.9, 129.5, 129.0, 128.0, 127.9, 127.2, 119.3, 118.2, 113.3, 112.7, 40.1.

HRMS (ESI): Calcd. for C₁₈H₁₆N₅ [M+H]⁺ 302.1400, found 302.1395

3y



4-Butyl-4-((1-(quinolin-2-yl)-1H-1,2,3-triazol-4-yl)methoxy)cyclohexa-2,5-dien-1-one

49 mg, 66 % yield, white solid

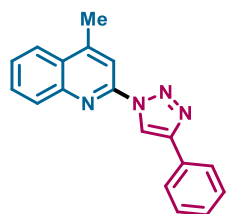
Melting Point: 119-121°C

¹H NMR (400 MHz, CDCl₃): δ 8.76 (s, 1H), 8.39 – 8.34 (m, 2H), 8.05 (d, J = 8.4 Hz, 1H), 7.90 (d, J = 8.0 Hz, 1H), 7.81 – 7.76 (m, 1H), 7.60 (t, J = 7.5 Hz, 1H), 6.90 (d, J = 10.2 Hz, 2H), 6.43 (d, J = 10.2 Hz, 2H), 4.63 (s, 2H), 1.85 – 1.80 (m, 2H), 1.31 – 1.24 (m, 4H), 0.86 (d, J = 7.1 Hz, 3H).

¹³C NMR (125 MHz, CDCl₃): δ 185.6, 150.9, 147.9, 146.6, 145.9, 139.8, 131.7, 131.0, 129.0, 128.04, 127.99, 127.3, 120.3, 112.7, 76.5, 59.4, 39.3, 25.7, 23.0, 14.0.

HRMS (ESI): Calcd. for C₂₂H₂₂KN₄O₂[M+K]⁺ 413.1374, found 413.1367.

3z



4-Methyl-2-(4-phenyl-1H-1,2,3-triazol-1-yl)quinoline

49 mg, 85 % yield, white solid

Melting Point: 156-158°C

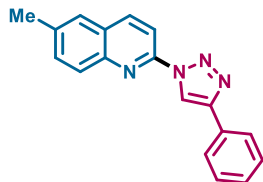
¹H NMR (400 MHz, CDCl₃): δ 9.01 (s, 1H), 8.26 (s, 1H), 8.06 (dd, J = 12.4, 8.4 Hz, 2H), 8.00 (d, J = 7.3 Hz, 2H), 7.77 (t, J = 7.2 Hz, 1H), 7.61 (t, J = 7.5 Hz, 1H), 7.48 (t, J = 7.6 Hz, 2H), 7.39 (t, J = 7.4 Hz, 1H), 2.83 (s, 3H).

¹³C NMR (100 MHz, CDCl₃): δ 148.7, 147.8, 146.5, 130.6, 130.4, 129.5, 129.1, 128.6, 128.1, 126.9, 126.1, 124.2, 117.1, 113.0, 19.3.

HRMS (ESI): Calcd. for C₁₈H₁₅N₄[M+H]⁺ 287.1291, found 287.1295.

The spectroscopic data is consistent with a literature report [5].

3aa



6-Methyl-2-(4-phenyl-1H-1,2,3-triazol-1-yl)quinoline

50 mg, 88 % yield, white solid

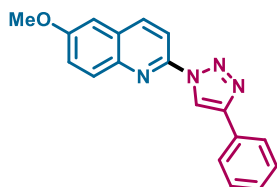
Melting Point: 151-153°C

¹H NMR (500 MHz, CDCl₃): δ 9.00 (s, 1H), 8.36 (d, J = 8.8 Hz, 1H), 8.28 (d, J = 8.8 Hz, 1H), 8.01 – 7.96 (m, 3H), 7.66 (s, 1H), 7.62 (dd, J = 8.6, 1.8 Hz, 1H), 7.49 (t, J = 7.6 Hz, 2H), 7.41 – 7.37 (m, 1H), 2.57 (s, 3H).

¹³C NMR (125 MHz, CDCl₃): δ 148.3, 147.5, 145.2, 139.1, 137.4, 133.3, 130.5, 129.2, 128.7, 128.2, 127.0, 126.2, 117.1, 112.9, 21.8.

HRMS (ESI): Calcd. for C₁₈H₁₅N₄ [M+H]⁺ 287.1291, found 287.1290.

3ab



6-Methoxy-2-(4-phenyl-1H-1,2,3-triazol-1-yl)quinoline

54 mg, 90 % yield, white solid

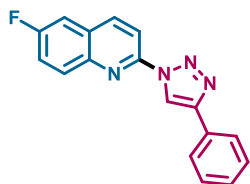
Melting Point: 146-148°C

¹H NMR (500 MHz, CDCl₃): δ 8.94 (s, 1H), 8.32 (d, J = 8.8 Hz, 1H), 8.23 (d, J = 8.8 Hz, 1H), 7.98 (d, J = 7.2 Hz, 2H), 7.95 (d, J = 9.2 Hz, 1H), 7.47 (t, J = 7.6 Hz, 2H), 7.42 (dd, J = 9.2, 2.7 Hz, 1H), 7.38 (t, J = 7.4 Hz, 1H), 7.12 (d, J = 2.7 Hz, 1H), 3.93 (s, 3H).

¹³C NMR (125 MHz, CDCl₃): δ 158.4, 148.1, 146.2, 142.2, 138.3, 130.4, 130.2, 129.1, 129.0, 128.6, 126.1, 123.6, 116.8, 112.9, 105.6, 55.8.

HRMS (ESI): Calcd. for C₁₈H₁₅N₄O [M+H]⁺ 303.1240, found 303.1243.

3ac



6-Fluoro-2-(4-phenyl-1H-1,2,3-triazol-1-yl)quinoline

47 mg, 81 % yield, white solid

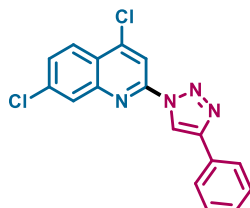
Melting Point: 142-144°C

¹H NMR (400 MHz, CDCl₃): δ 8.92 (s, 1H), 8.38 (d, J = 8.8 Hz, 1H), 8.27 (d, J = 8.8 Hz, 1H), 8.06 – 8.00 (m, 1H), 7.96 (d, J = 7.4 Hz, 2H), 7.55 – 7.44 (m, 4H), 7.37 (t, J = 7.4 Hz, 1H).

¹³C NMR (100 MHz, CDCl₃): δ 160.8 (d, J = 249.4 Hz), 148.3, 147.5, 143.4, 138.9 (d, J = 5.3 Hz), 131.3 (d, J = 9.2 Hz), 130.2, 129.0, 128.6, 128.5, 126.0, 121.0 (d, J = 25.7 Hz), 116.8, 113.5, 111.2 (d, J = 22.1 Hz).

HRMS (ESI): Calcd. for C₁₇H₁₂FN₄ [M+H]⁺ 291.1041, found 291.1041.

3ad



4,7-Dichloro-2-(4-phenyl-1H-1,2,3-triazol-1-yl)quinoline

53 mg, 77 % yield, white solid

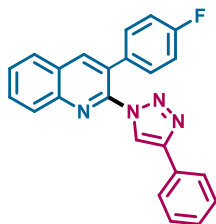
Melting Point: 129-131°C

¹H NMR (400 MHz, CDCl₃): δ 8.44 (s, 1H), 8.27 (d, J = 1.9 Hz, 1H), 8.24 (s, 1H), 8.18 (d, J = 8.9 Hz, 1H), 7.97 (d, J = 7.0 Hz, 2H), 7.60 (dd, J = 8.9, 2.0 Hz, 1H), 7.50 (t, J = 7.3 Hz, 2H), 7.44 (t, J = 7.3 Hz, 1H).

¹³C NMR (100 MHz, CDCl₃): δ 150.9, 149.7, 147.9, 145.2, 137.9, 135.1, 130.3, 129.8, 129.2, 128.9, 128.8, 126.7, 125.7, 124.3, 113.4.

HRMS (ESI): Calcd. for C₁₇H₁₀Cl₂N₄Na [M+Na]⁺ 363.0175, found 363.0182.

3ae



3-(4-Fluorophenyl)-2-(4-phenyl-1*H*-1,2,3-triazol-1-yl)quinoline

51 mg, 70 % yield, white solid

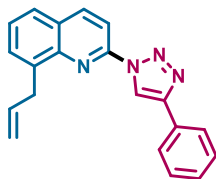
Melting Point: 153-155°C

¹H NMR (400 MHz, CDCl₃): δ 8.35 (s, 2H), 8.17 (d, *J* = 8.5 Hz, 1H), 7.96 (d, *J* = 8.1 Hz, 1H), 7.88 (d, *J* = 7.3 Hz, 2H), 7.83 (d, *J* = 7.2 Hz, 1H), 7.70 (t, *J* = 8.1 Hz, 1H), 7.44 (t, *J* = 7.6 Hz, 2H), 7.35 (t, *J* = 7.4 Hz, 1H), 7.26 – 7.20 (m, 2H), 7.05 (t, *J* = 8.6 Hz, 2H).

¹³C NMR (100 MHz, CDCl₃): δ 162.8 (d, *J* = 248.2 Hz), 147.4, 146.2, 146.1, 140.8, 131.2, 130.5 (d, *J* = 8.3 Hz), 130.2, 129.5, 129.3, 129.0, 128.5 (d, *J* = 9.2 Hz), 128.3, 127.8, 126.4, 126.0, 120.3, 115.6 (d, *J* = 21.8 Hz).

HRMS (ESI): Calcd. for C₂₃H₁₅FN₄Na [M+Na]⁺ 389.1173, found 389.1175

3af



8-Allyl-2-(4-phenyl-1*H*-1,2,3-triazol-1-yl)quinoline

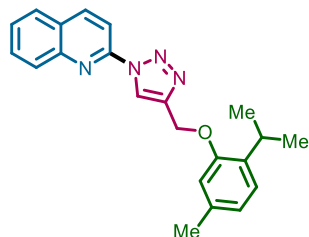
53 mg, 84 % yield, colorless oil

¹H NMR (500 MHz, CDCl₃): δ 8.97 (s, 1H), 8.43 – 8.36 (m, 2H), 8.01 (d, *J* = 7.2 Hz, 2H), 7.78 (d, *J* = 8.1 Hz, 1H), 7.66 (d, *J* = 6.9 Hz, 1H), 7.56 – 7.52 (m, 1H), 7.50 (t, *J* = 7.7 Hz, 2H), 7.40 (t, *J* = 7.4 Hz, 1H), 6.25 – 6.15 (m, 1H), 5.23 (dd, *J* = 17.1, 1.6 Hz, 1H), 5.16 (dd, *J* = 10.0, 1.5 Hz, 1H), 4.09 (d, *J* = 6.7 Hz, 2H).

¹³C NMR (125 MHz, CDCl₃): δ 148.3, 147.1, 144.8, 140.2, 138.9, 137.4, 130.5, 130.4, 129.1, 128.7, 128.2, 127.1, 126.4, 126.2, 116.9, 116.3, 112.5, 35.7.

HRMS (ESI): Calcd. for C₂₀H₁₆N₄Na [M+Na]⁺ 335.1267, found 335.1272.

4a



2-(4-((2-Isopropyl-5-methylphenoxy)methyl)-1H-1,2,3-triazol-1-yl)quinoline

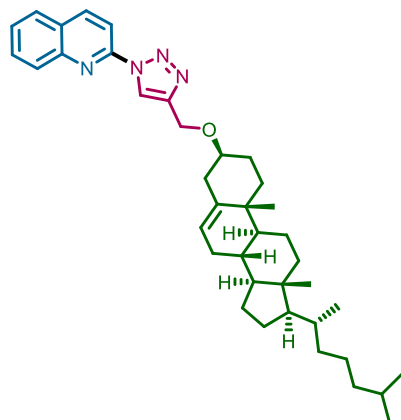
50 mg, 70 % yield, colorless oil

¹H NMR (500 MHz, CDCl₃): δ 8.84 (s, 1H), 8.38 (s, 2H), 8.08 (d, J = 8.4 Hz, 1H), 7.90 (d, J = 8.1 Hz, 1H), 7.79 (t, J = 7.2 Hz, 1H), 7.61 (t, J = 7.4 Hz, 1H), 7.14 (d, J = 7.6 Hz, 1H), 6.87 (s, 1H), 6.80 (d, J = 7.9 Hz, 1H), 5.34 (s, 2H), 3.40 – 3.33 (m, 1H), 2.35 (s, 3H), 1.24 (d, J = 6.9 Hz, 6H).

¹³C NMR (125 MHz, CDCl₃): δ 155.5, 148.0, 146.6, 139.8, 136.6, 134.6, 131.0, 129.1, 128.1, 128.0, 127.3, 126.2, 122.3, 122.0, 112.9, 112.8, 62.5, 26.7, 23.0, 21.5.

HRMS (ESI): Calcd. for C₂₂H₂₂N₄NaO [M+Na]⁺381.1686, found 381.1690.

4b



2-(4-(((3S,8S,9S,10R,13R,14S,17R)-10,13-Dimethyl-17-((R)-6-methylheptan-2-yl)-2,3,4,7,8,9,10,11,12,13,14,15,16,17-tetradecahydro-1H-cyclopenta[a]phenanthren-3-yl)oxy)methyl)-1H-1,2,3-triazol-1-yl)quinoline

81 mg, 68 % yield, colorless oil

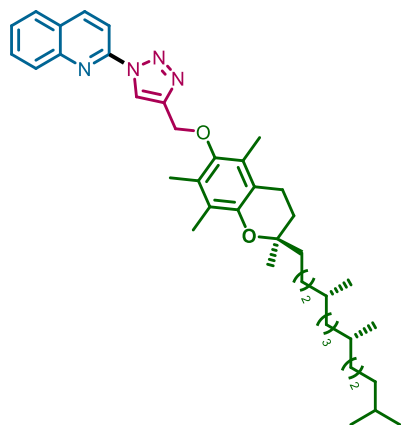
¹H NMR (400 MHz, CDCl₃): δ 8.79 (s, 1H), 8.36 (s, 2H), 8.06 (d, J = 8.4 Hz, 1H), 7.89 (d, J = 7.3 Hz, 1H), 7.78 (ddd, J = 8.4, 7.0, 1.4 Hz, 1H), 7.62 – 7.57 (m, 1H), 5.40 – 5.36 (m, 1H), 4.82 (s, 2H), 3.44 – 3.35 (m, 1H), 2.50 – 2.43 (m, 1H), 2.34 – 2.27 (m, 1H), 2.04 – 1.95 (m, 3H), 1.92 – 1.79 (m, 2H), 1.58 – 1.42 (m, 7H), 1.41 – 1.20 (m, 5H), 1.19 – 1.05 (m, 7H), 1.02 (s, 3H), 1.00

– 0.94 (m, 2H), 0.91 (d, $J = 6.5$ Hz, 3H), 0.87 (d, $J = 1.7$ Hz, 3H), 0.85 (d, $J = 1.7$ Hz, 3H), 0.68 (s, 3H).

^{13}C NMR (125 MHz, CDCl_3): δ 148.1, 146.7, 146.6, 140.9, 139.7, 130.9, 129.1, 128.0, 128.0, 127.2, 122.0, 120.2, 112.8, 79.1, 61.6, 56.9, 56.3, 50.3, 42.5, 39.9, 39.7, 39.2, 37.4, 37.0, 36.3, 35.9, 32.10, 32.05, 28.5, 28.4, 28.2, 24.4, 24.0, 23.0, 22.7, 21.2, 19.5, 18.9, 12.0.

HRMS (ESI): Calcd. for $\text{C}_{39}\text{H}_{55}\text{N}_4\text{O}$ $[\text{M}+\text{H}]^+$ 595.4370, found 595.4363.

4c



2-(4-(((*R*)-2,5,7,8-Tetramethyl-2-((4*R*,8*R*)-4,8,12-trimethyltridecyl)chroman-6-yl)oxy)methyl)-1*H*-1,2,3-triazol-1-yl)quinoline

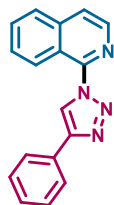
78 mg, 61 % yield, colorless oil

^1H NMR (400 MHz, CDCl_3): δ 8.93 (s, 1H), 8.40 (s, 2H), 8.08 (d, $J = 8.4$ Hz, 1H), 7.91 (d, $J = 8.2$ Hz, 1H), 7.82 – 7.76 (m, 1H), 7.61 (dd, $J = 11.1, 4.0$ Hz, 1H), 4.97 (s, 2H), 2.61 (t, $J = 6.7$ Hz, 2H), 2.28 (s, 3H), 2.23 (s, 3H), 2.12 (s, 3H), 1.86 – 1.76 (m, 2H), 1.56 – 1.48 (m, 3H), 1.42 – 1.36 (m, 3H), 1.29 – 1.20 (m, 11H), 1.16 – 1.04 (m, 7H), 0.88 – 0.85 (m, $J = 6.9$ Hz, 12H).

^{13}C NMR (100 MHz, CDCl_3): δ 148.2, 147.9, 146.5, 145.6, 139.7, 130.8, 128.9, 127.94, 127.93, 127.85, 127.1, 126.0, 123.1, 120.1, 117.7, 112.7, 74.9, 66.4, 40.1, 39.4, 37.4, 32.8, 32.8, 32.73, 32.71, 28.0, 24.83, 24.82, 24.5, 23.9, 22.7, 22.6, 21.1, 20.7, 19.8, 19.7, 14.1, 13.0, 12.1, 11.9.

HRMS (ESI): Calcd. for $\text{C}_{41}\text{H}_{59}\text{N}_4\text{O}_2$ $[\text{M}+\text{H}]^+$ 639.4633, found 639.4637.

6a



1-(4-Phenyl-1H-1,2,3-triazol-1-yl)isoquinoline

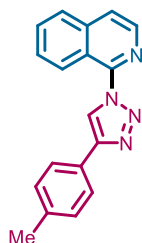
44 mg, 80 % yield, white solid

¹H NMR (400 MHz, CDCl₃): δ 8.88 (d, J = 8.7 Hz, 1H), 8.69 (s, 1H), 8.41 (d, J = 5.6 Hz, 1H), 7.96 (d, J = 7.4 Hz, 2H), 7.91 (d, J = 8.7 Hz, 1H), 7.78 – 7.74 (m, 2H), 7.69 (t, J = 7.7 Hz, 1H), 7.45 (t, J = 7.6 Hz, 2H), 7.35 (t, J = 7.0 Hz, 1H).

¹³C NMR (100 MHz, CDCl₃): δ 152.1, 147.3, 140.5, 139.0, 131.4, 130.3, 129.2, 129.1, 128.6, 127.1, 126.6, 126.1, 122.7, 122.0, 120.7.

HRMS (ESI): Calcd. for C₁₇H₁₃N₄ [M+H]⁺ 273.1135, found 273.1137.

6b



1-(4-(p-Tolyl)-1H-1,2,3-triazol-1-yl)isoquinoline

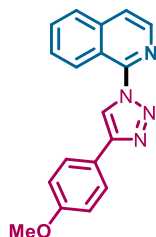
48 mg, 83 % yield, white solid

¹H NMR (500 MHz, CDCl₃): δ 8.93 (d, J = 8.6 Hz, 1H), 8.69 (s, 1H), 8.45 (d, J = 4.0 Hz, 1H), 7.94 (d, J = 8.2 Hz, 1H), 7.88 (d, J = 8.0 Hz, 2H), 7.82 – 7.78 (m, 2H), 7.73 (t, J = 7.5 Hz, 1H), 7.30 (d, J = 7.8 Hz, 2H), 2.41 (s, 3H).

¹³C NMR (125 MHz, CDCl₃): δ 147.3, 140.5, 139.0, 138.5, 131.4, 129.8, 129.7, 129.1, 127.5, 127.0, 126.7, 126.0, 125.9, 122.6, 120.3, 21.4.

HRMS (ESI): Calcd. for C₁₈H₁₅N₄ [M+H]⁺ 287.1291, found 287.1293.

6c



1-(4-(4-Methoxyphenyl)-1H-1,2,3-triazol-1-yl)isoquinoline

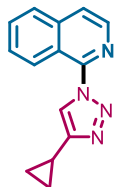
54 mg, 89 % yield, white solid

¹H NMR (400 MHz, CDCl₃): δ 8.92 (d, J = 8.6 Hz, 1H), 8.63 (s, 1H), 8.44 (d, J = 5.6 Hz, 1H), 7.94 – 7.88 (m, 3H), 7.81 – 7.76 (m, 2H), 7.72 (t, J = 7.7 Hz, 1H), 7.01 (d, J = 8.7 Hz, 2H), 3.86 (s, 3H).

¹³C NMR (100 MHz, CDCl₃): δ 159.9, 152.0, 147.2, 140.5, 139.0, 131.3, 129.1, 127.4, 127.0, 126.7, 122.9, 122.5, 122.0, 119.8, 114.5, 55.5.

HRMS (ESI): Calcd. for C₁₈H₁₅N₄O [M+H]⁺ 303.1240, found 303.1241.

6d



1-(4-Cyclopropyl-1H-1,2,3-triazol-1-yl)isoquinoline

34 mg, 71 % yield, colorless liquid

¹H NMR (400 MHz, CDCl₃): δ 8.82 (d, J = 8.6 Hz, 1H), 8.40 (d, J = 5.6 Hz, 1H), 8.16 (s, 1H), 7.92 (d, J = 8.2 Hz, 1H), 7.80 – 7.73 (m, 2H), 7.71 – 7.66 (m, 1H), 2.15 – 2.08 (m, 1H), 1.07 – 1.02 (m, 2H), 1.01 – 0.96 (m, 2H).

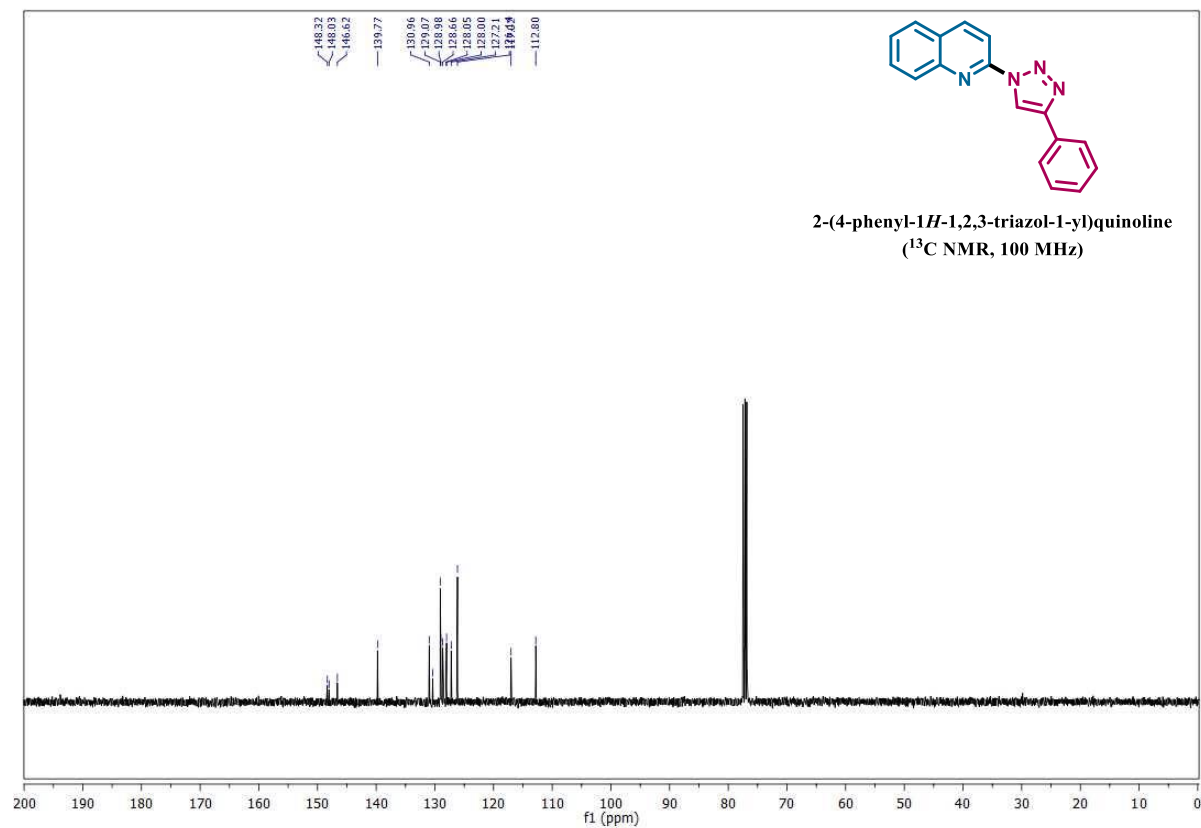
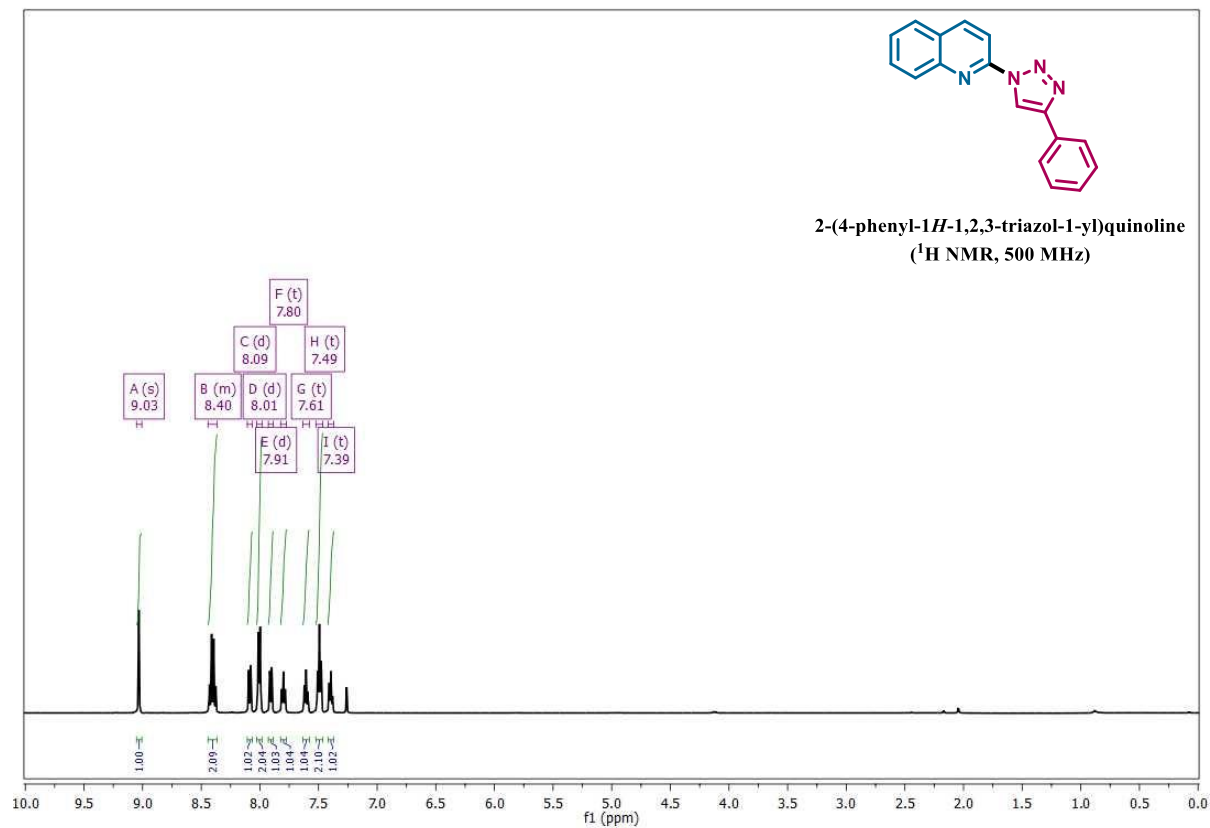
¹³C NMR (100 MHz, CDCl₃): δ 150.1, 147.4, 140.4, 138.9, 131.3, 129.0, 127.0, 126.7, 122.4, 122.0, 120.8, 8.0, 6.8.

HRMS (ESI): Calcd. for C₁₄H₁₃N₄ [M+H]⁺ 237.1135, found 237.1137.

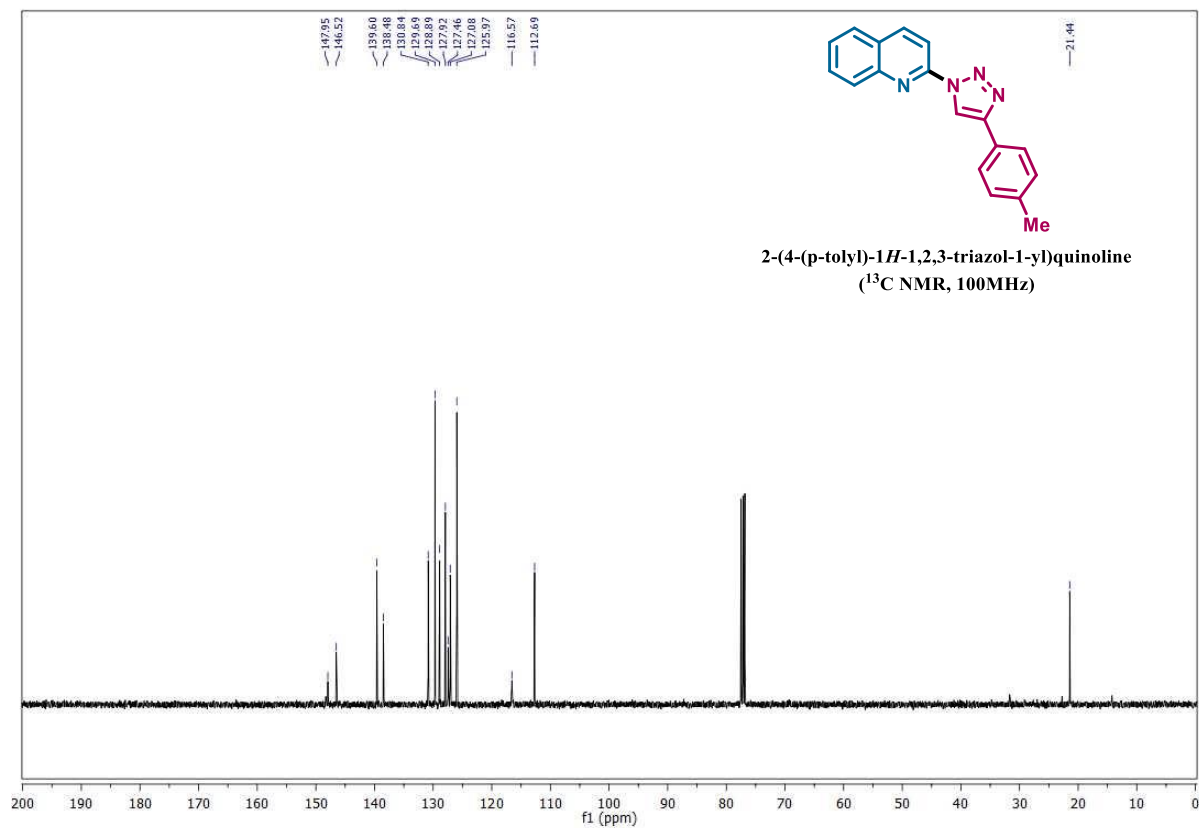
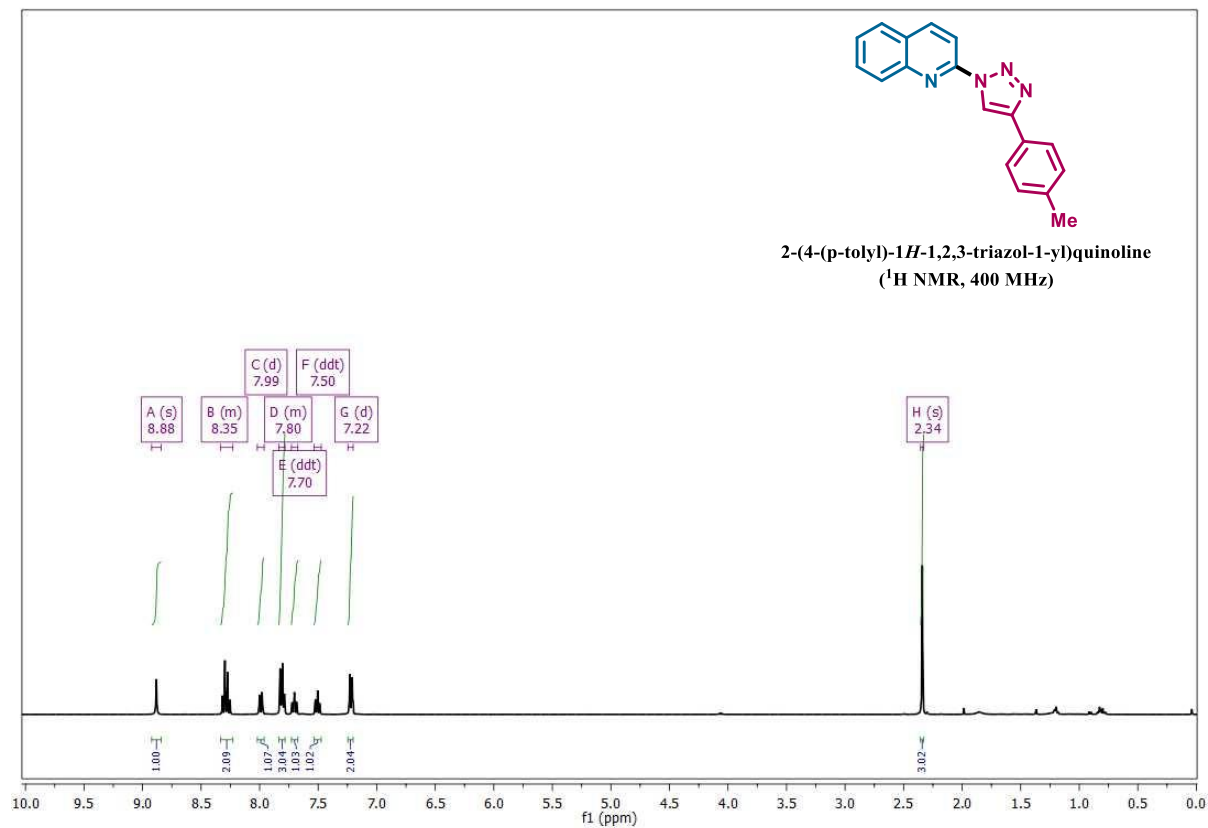
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1. Bradley, D.; Williams, G.; Lawton, M. *J. Org. Chem.* **2010**, 75, 8351–8354.
2. Serwinski, P. R.; Esat, B.; Lahti, P. M.; Liao, Y.; Walton, R.; Lan, J. *J. Org. Chem.* **2004**, 69, 5247–5260.
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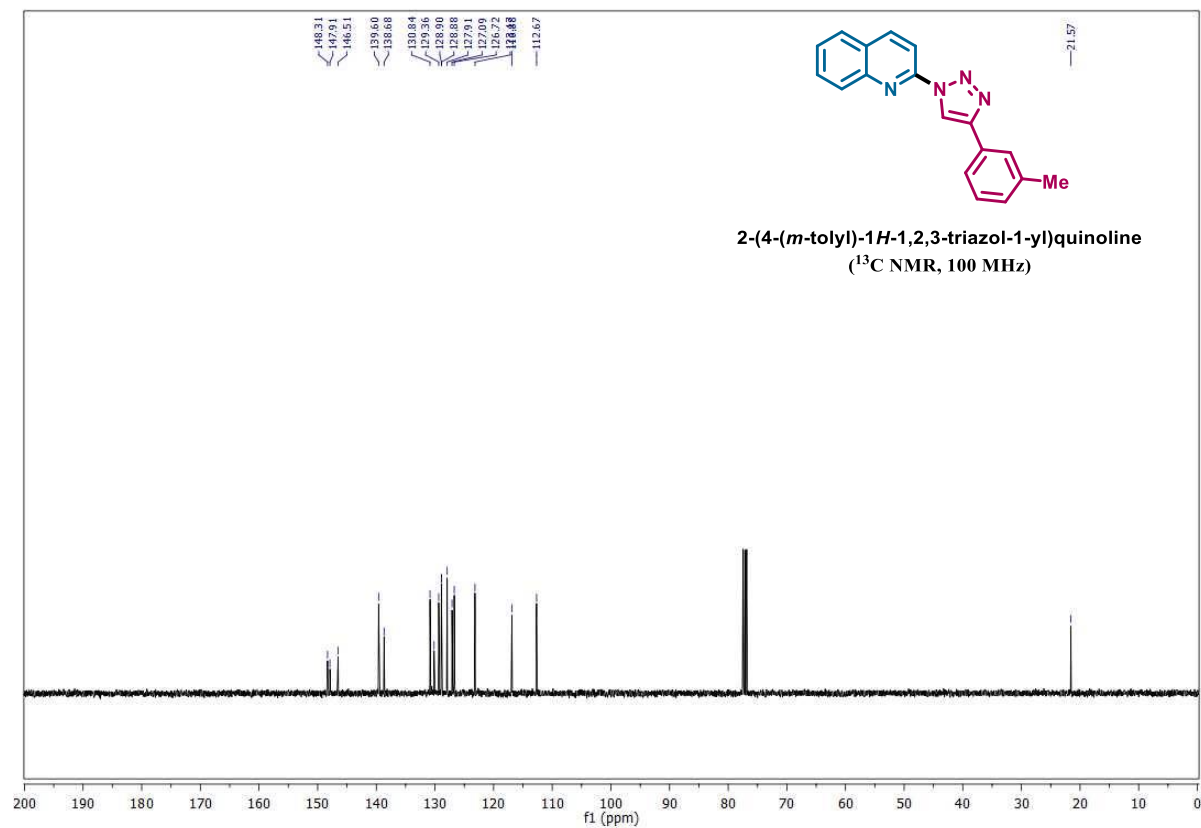
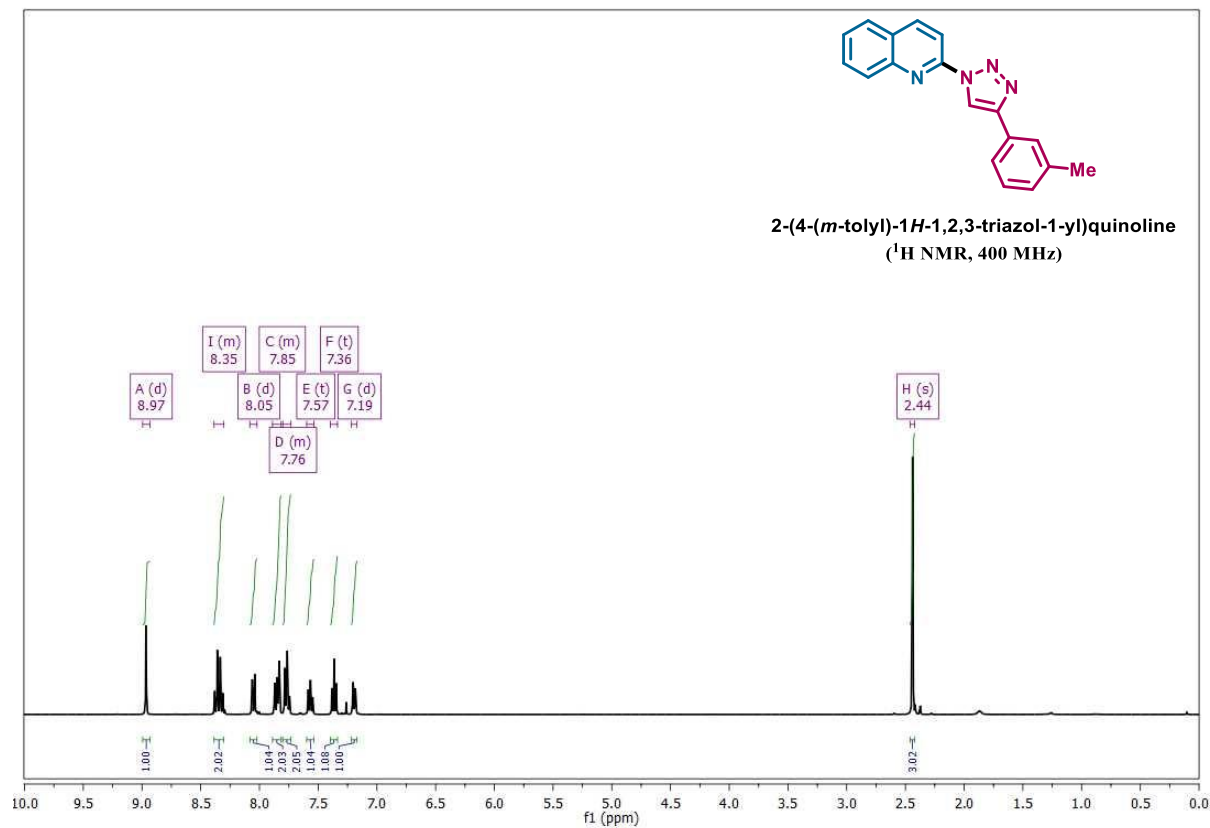
¹H and ¹³C NMR Spectra of 3a



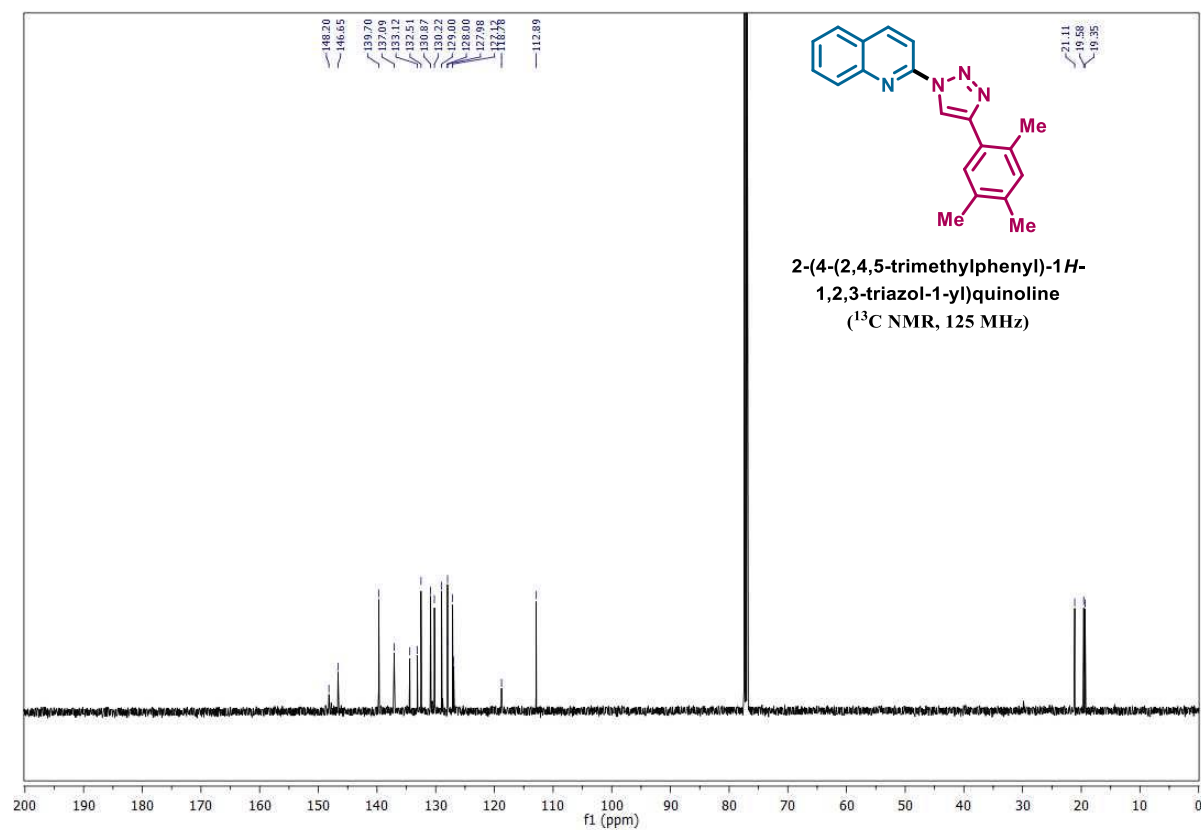
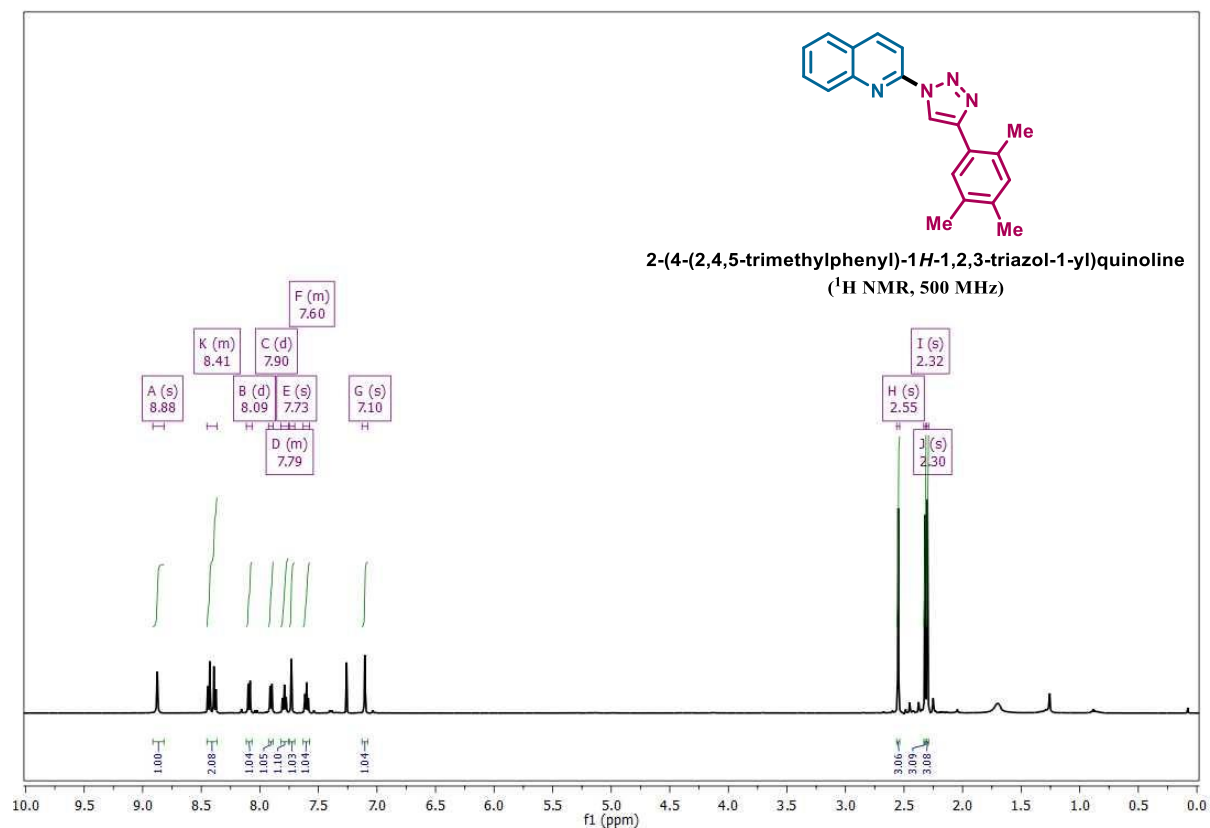
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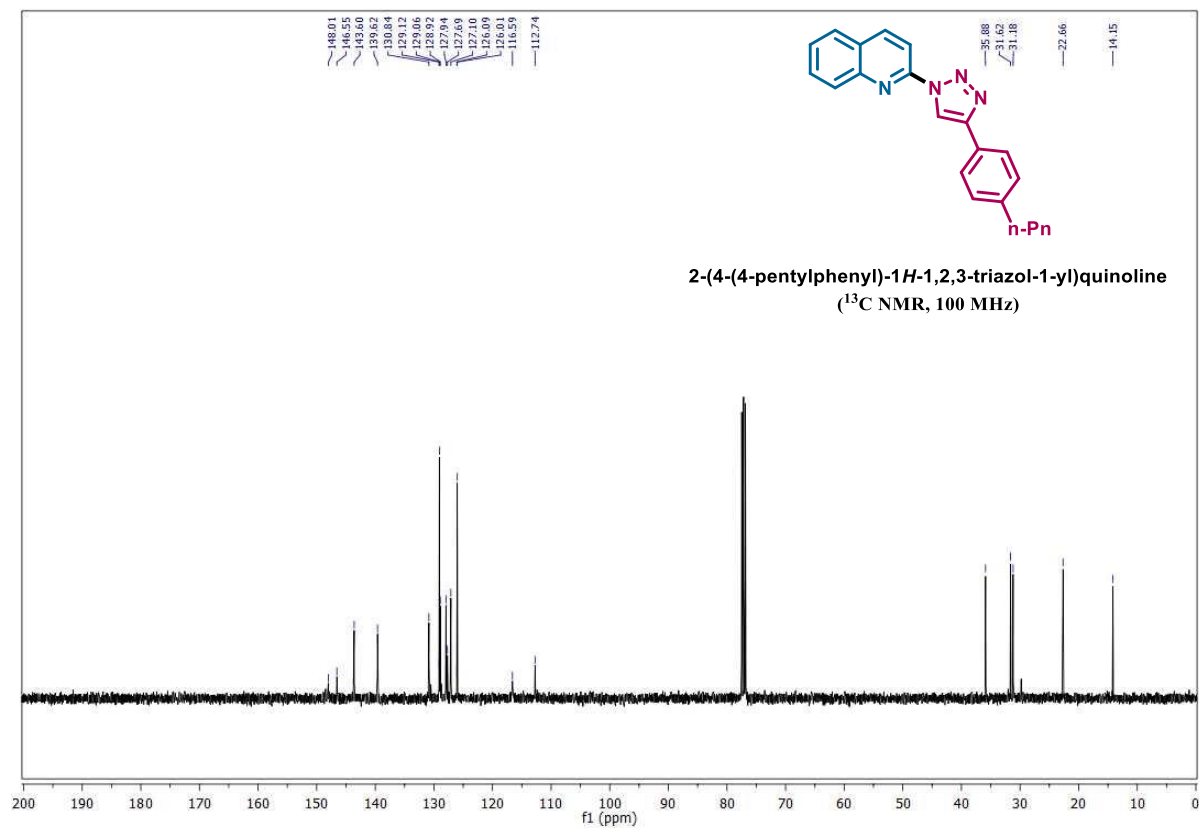
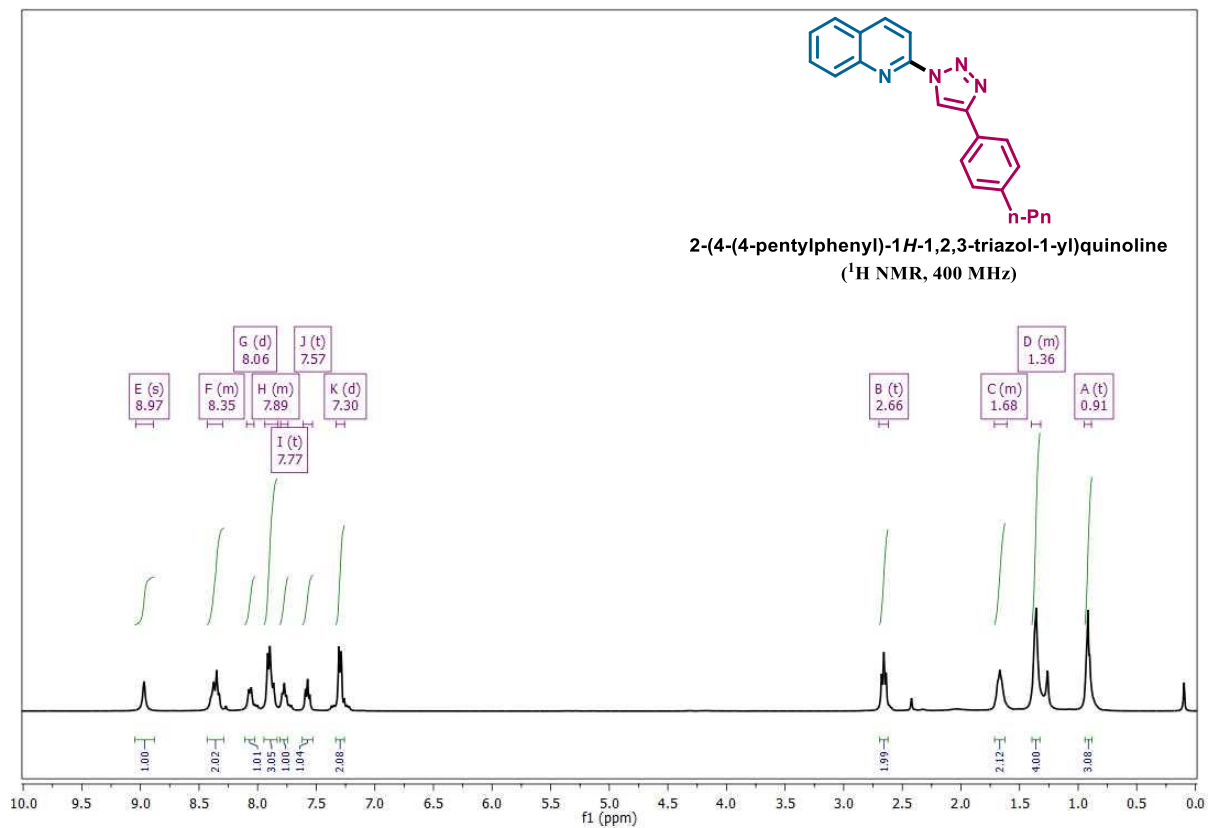
¹H and ¹³C NMR Spectra of 3c



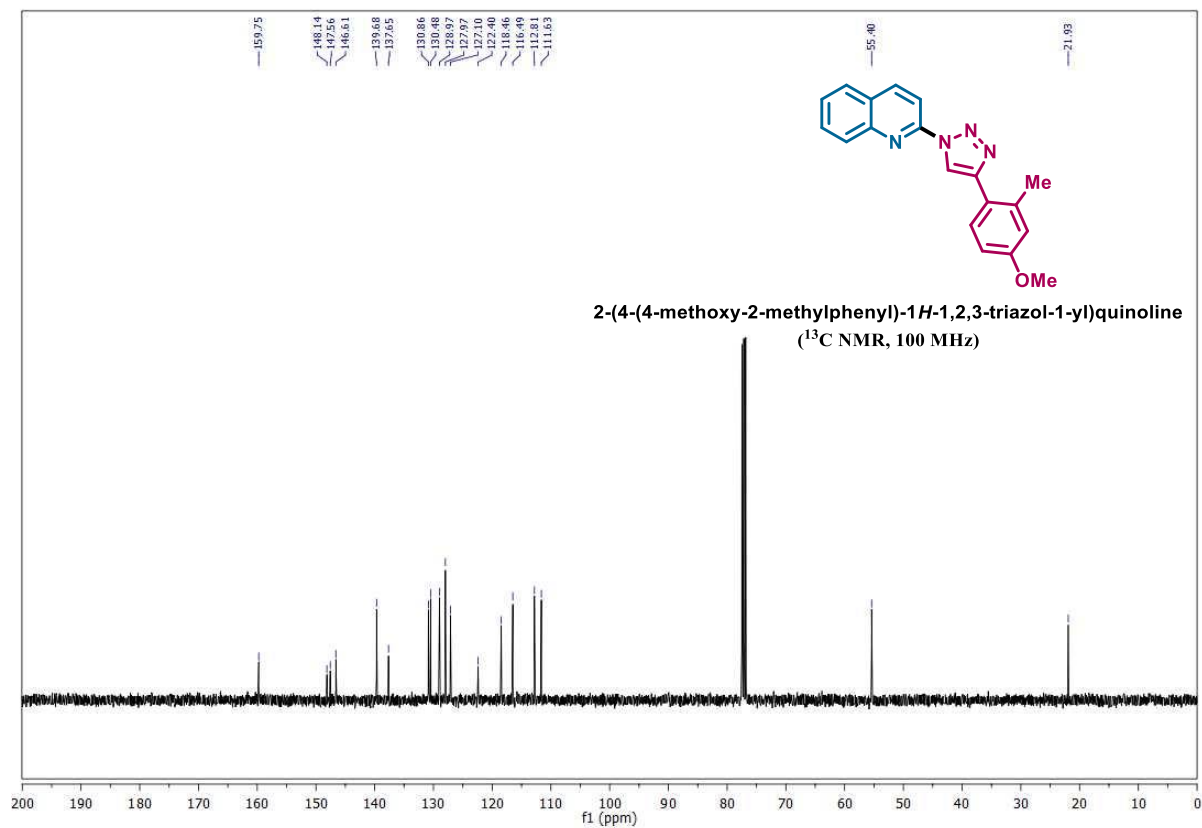
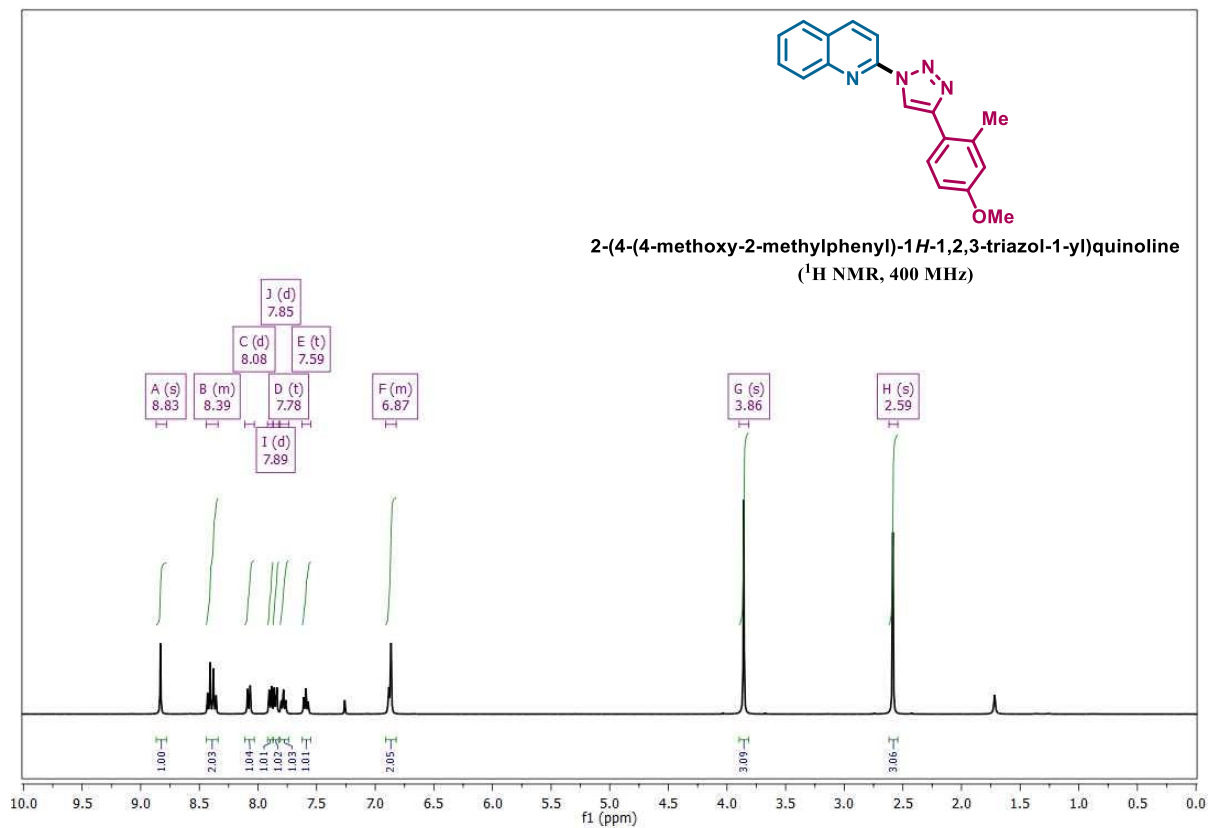
¹H and ¹³C NMR Spectra of 3d



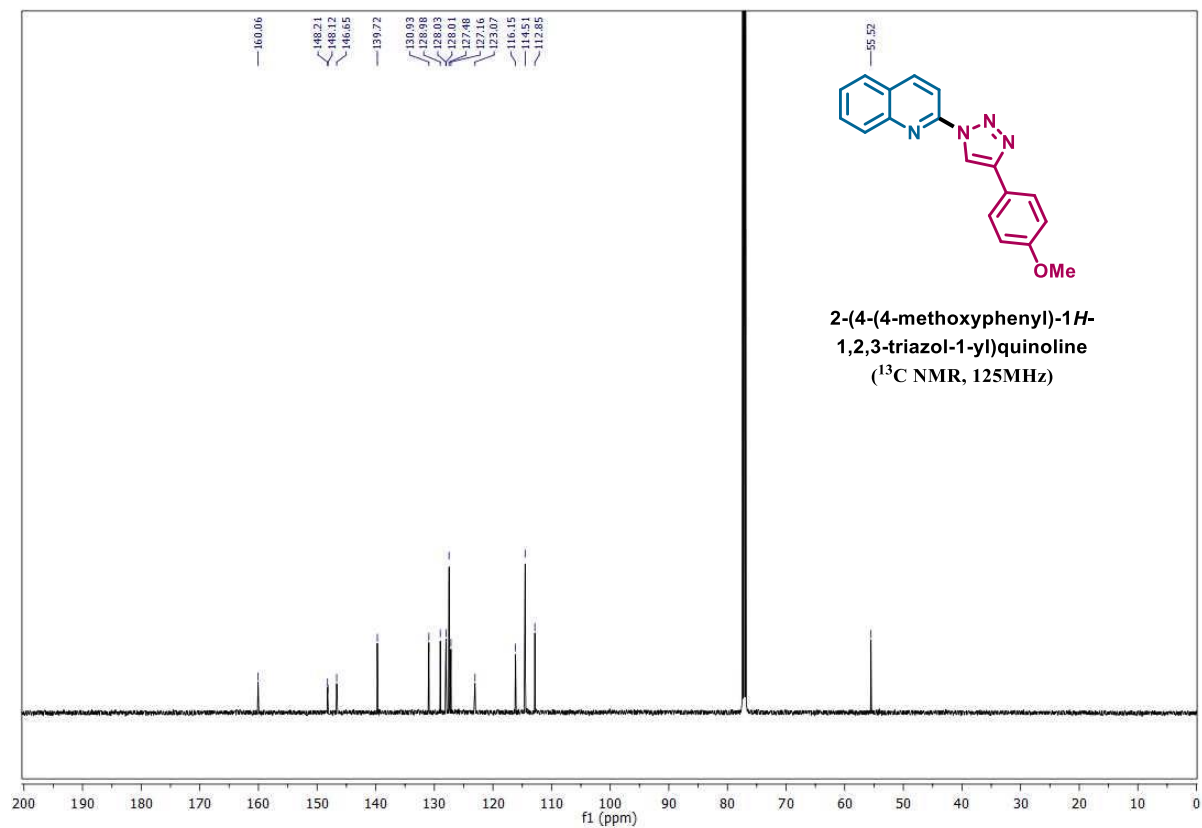
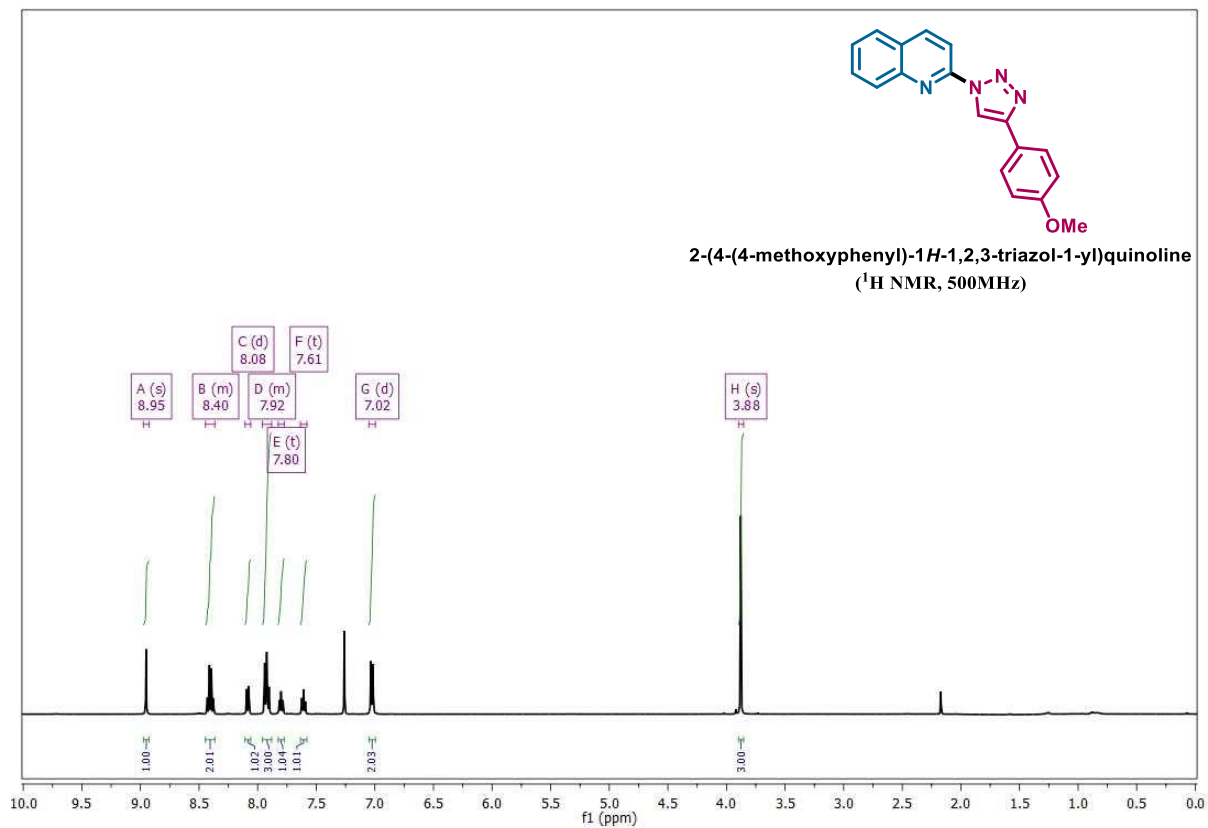
¹H and ¹³C NMR Spectra of 3e



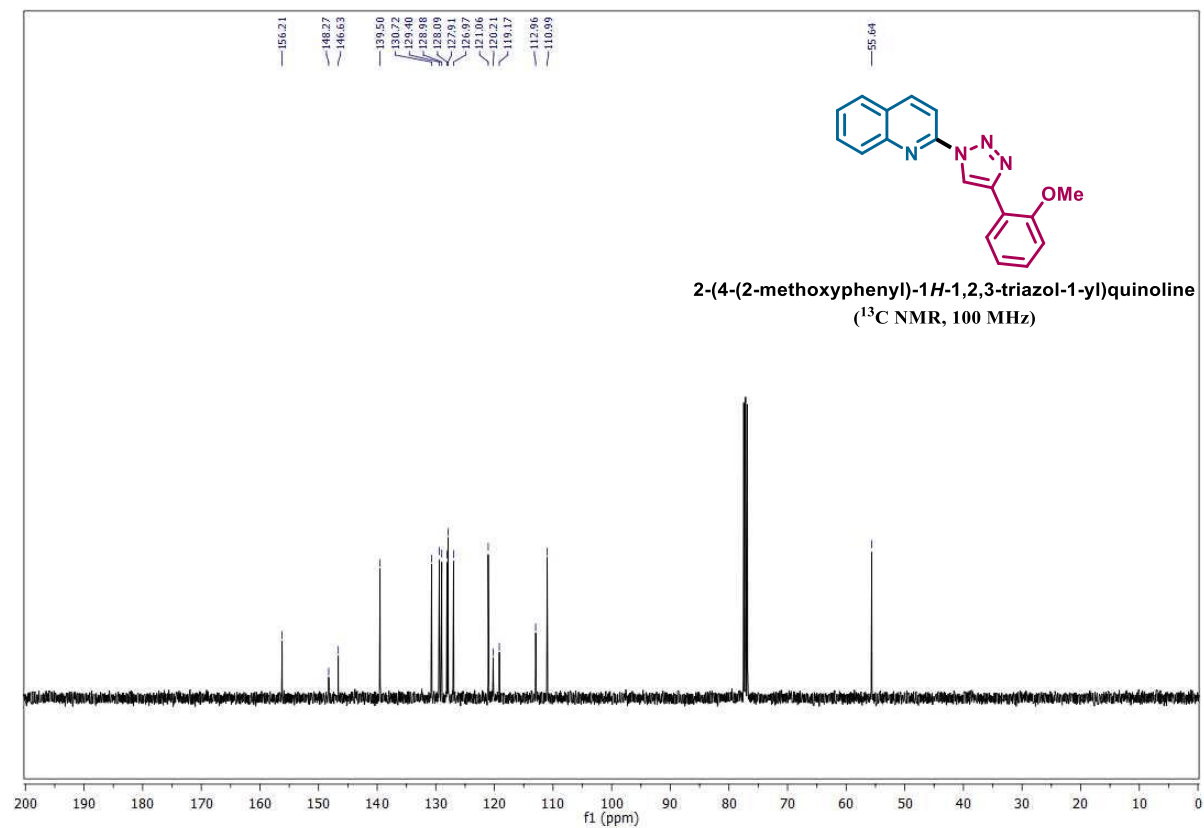
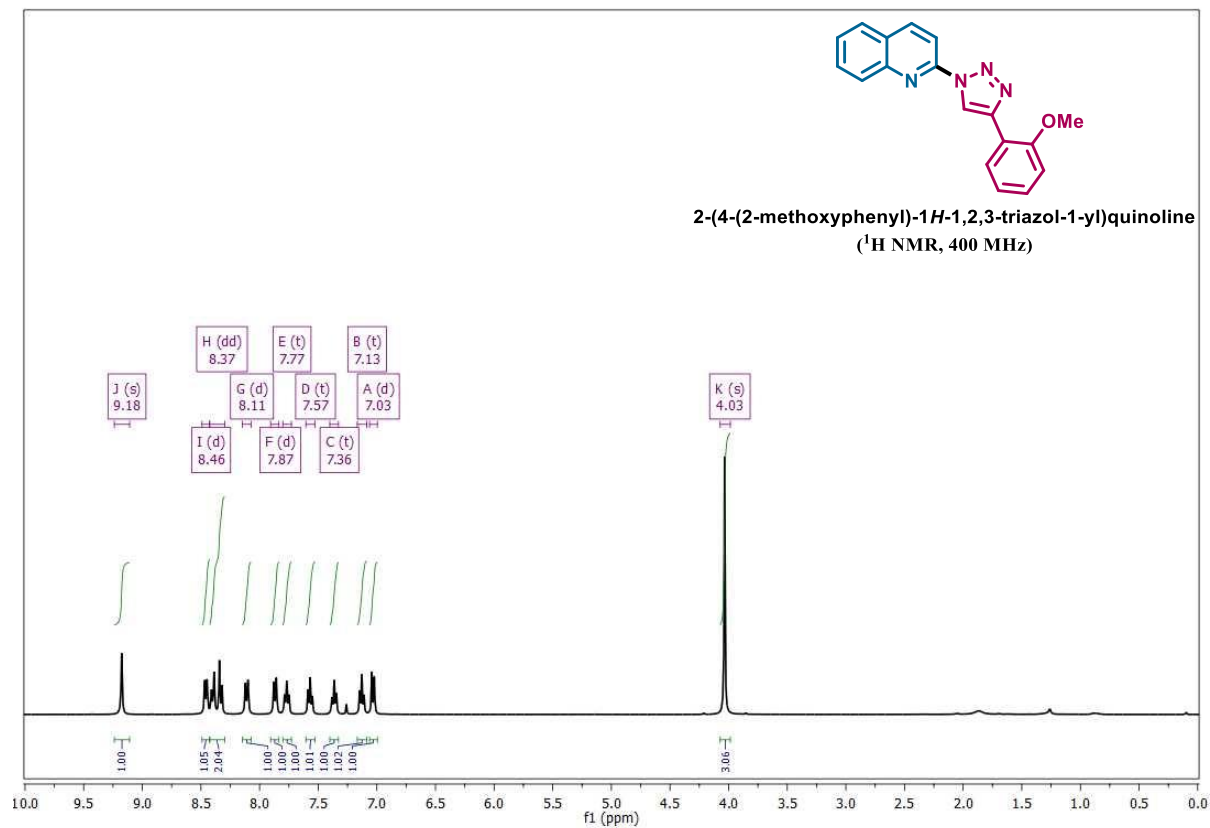
¹H and ¹³C NMR Spectra of 3f



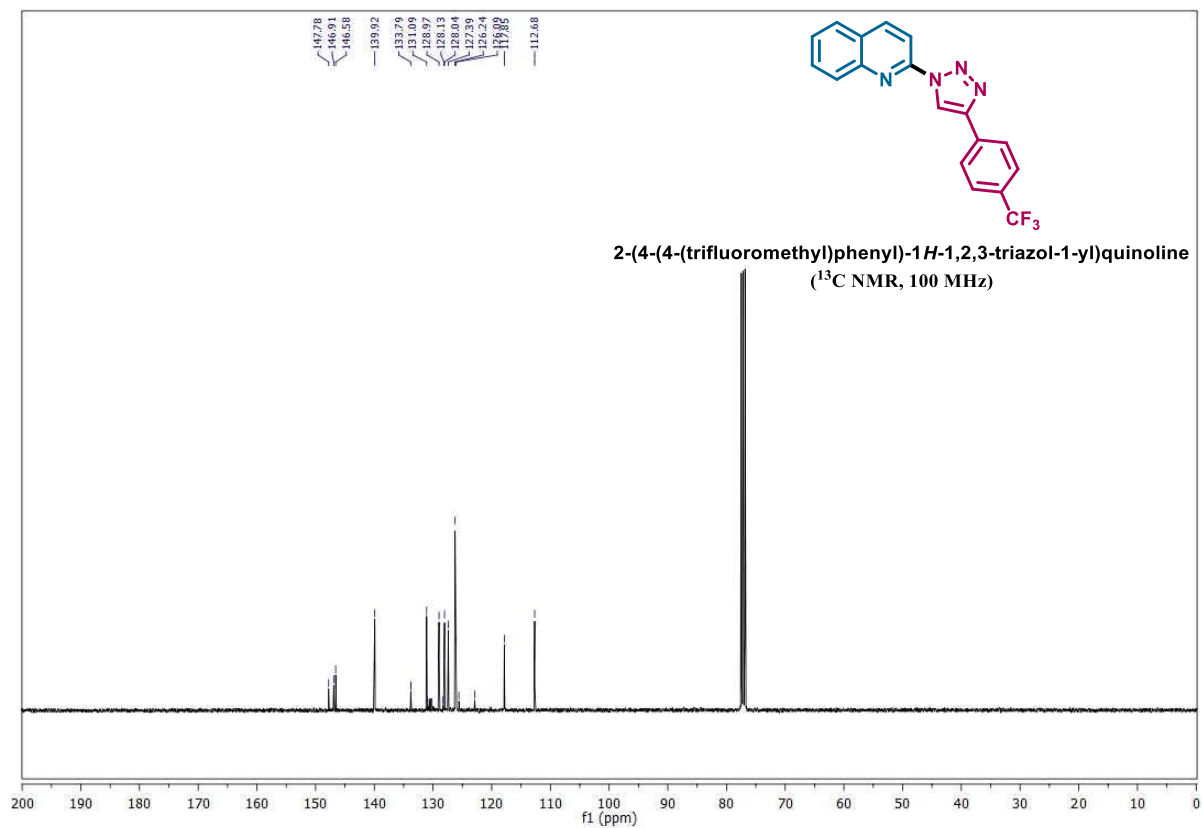
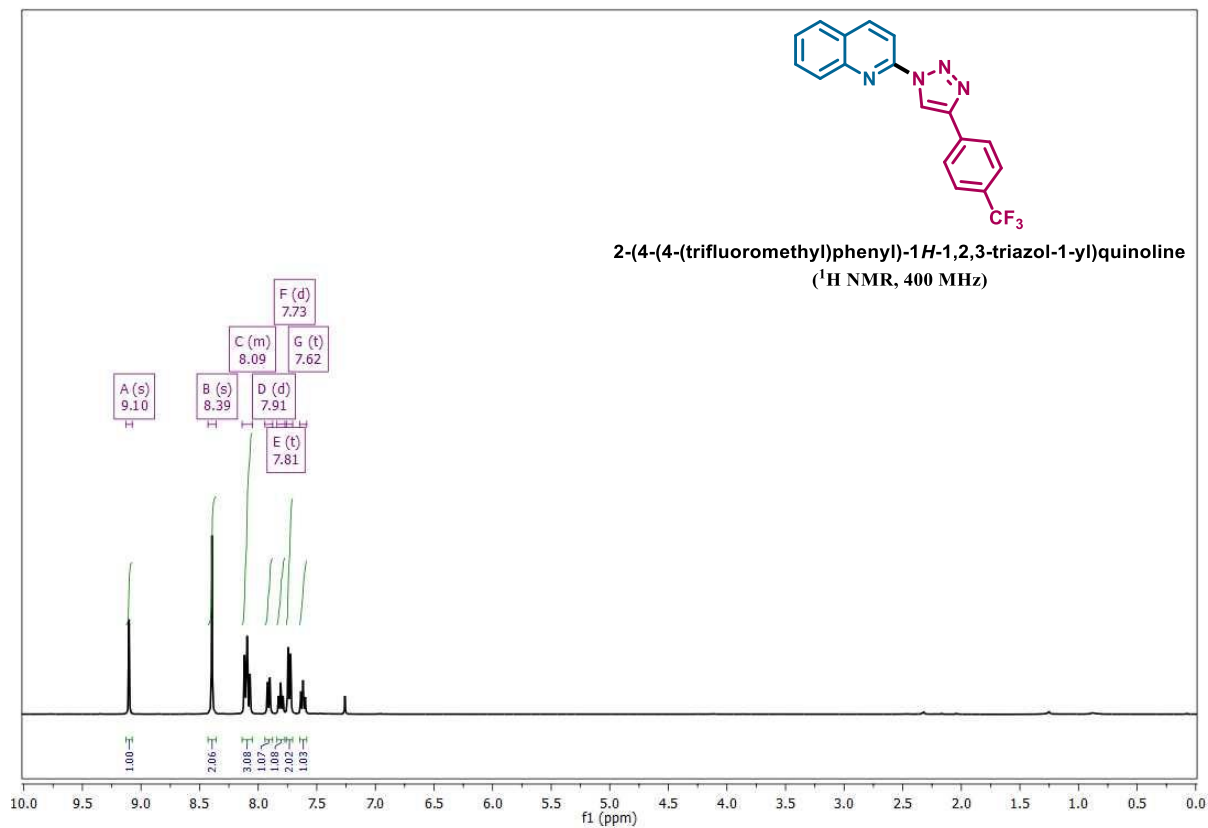
¹H and ¹³C NMR Spectra of 3g



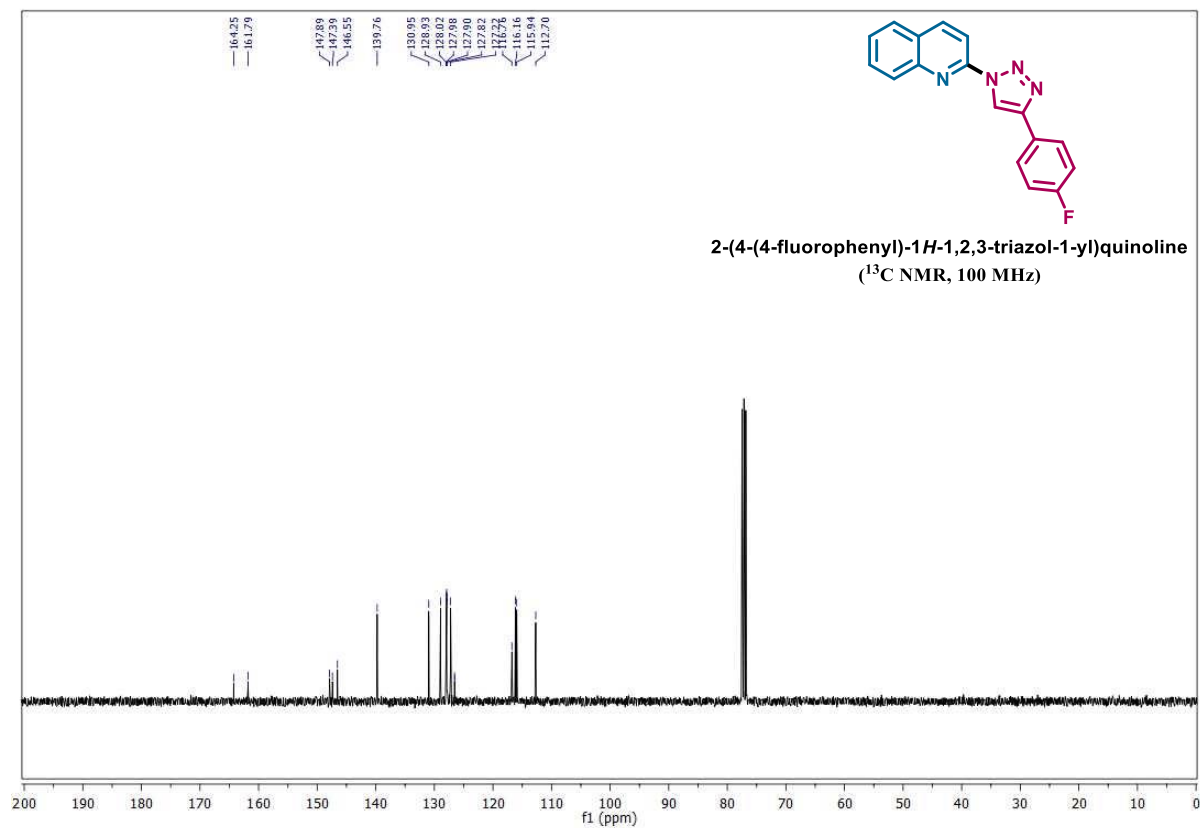
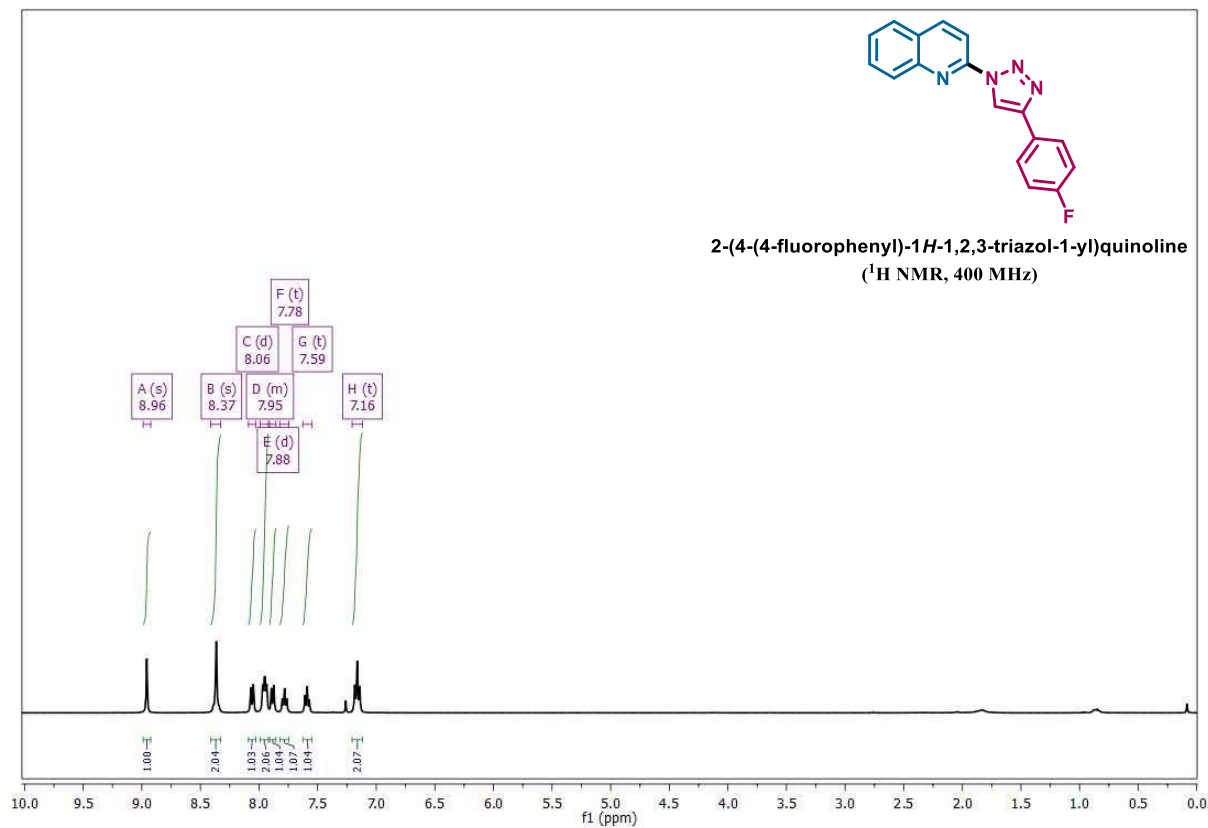
¹H and ¹³C NMR Spectra of 3h



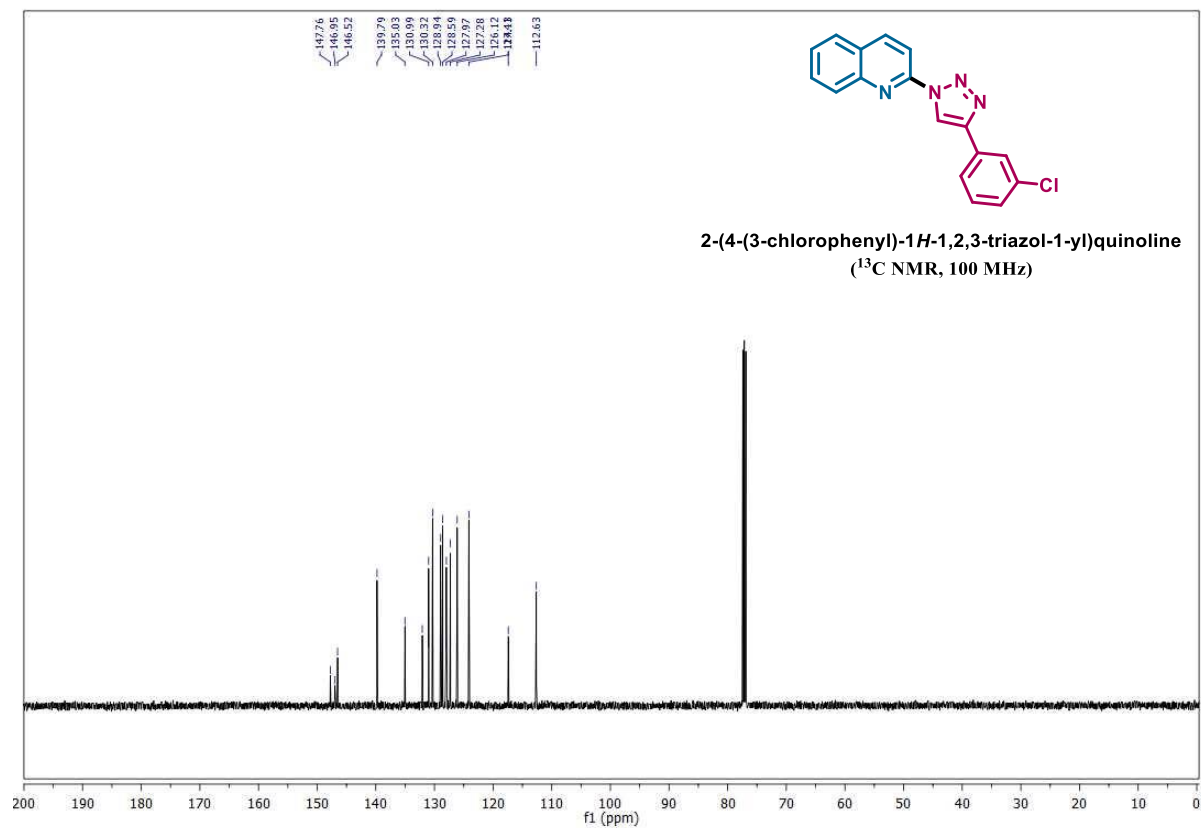
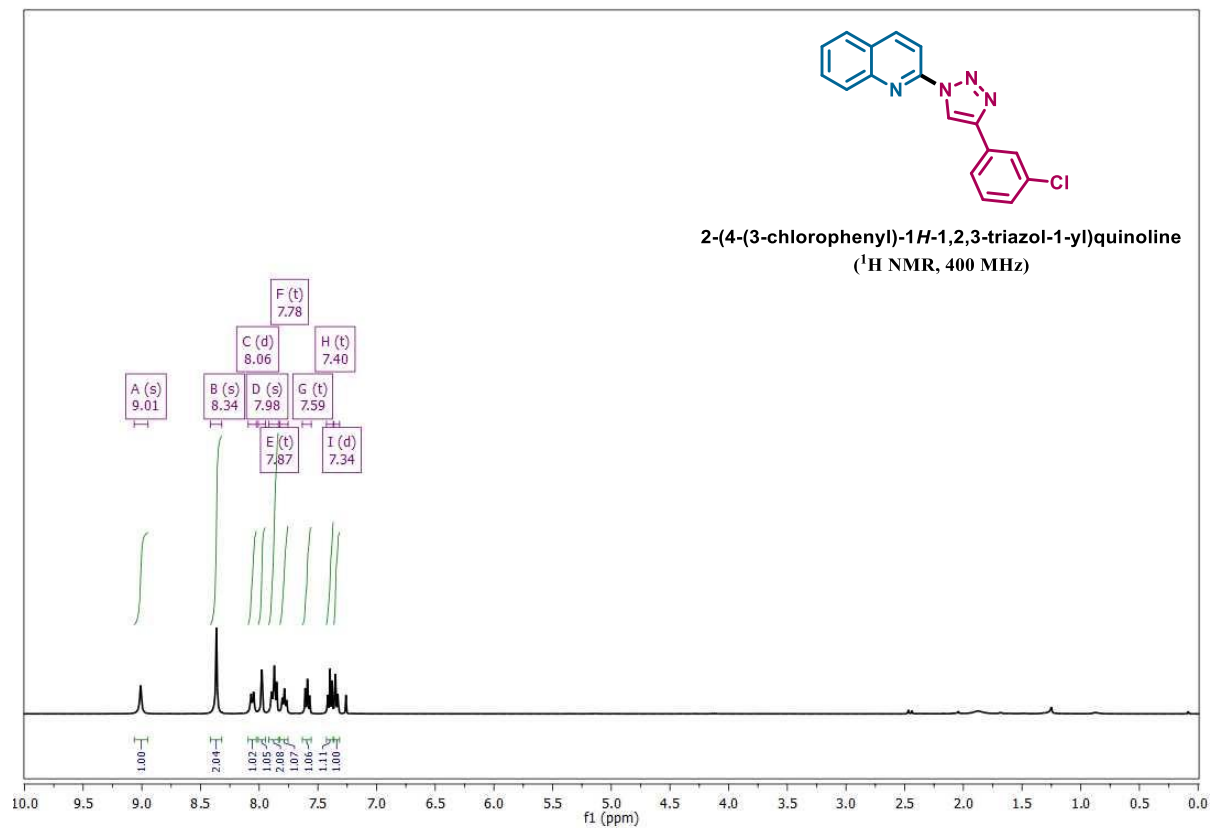
¹H and ¹³C NMR Spectra of 3i



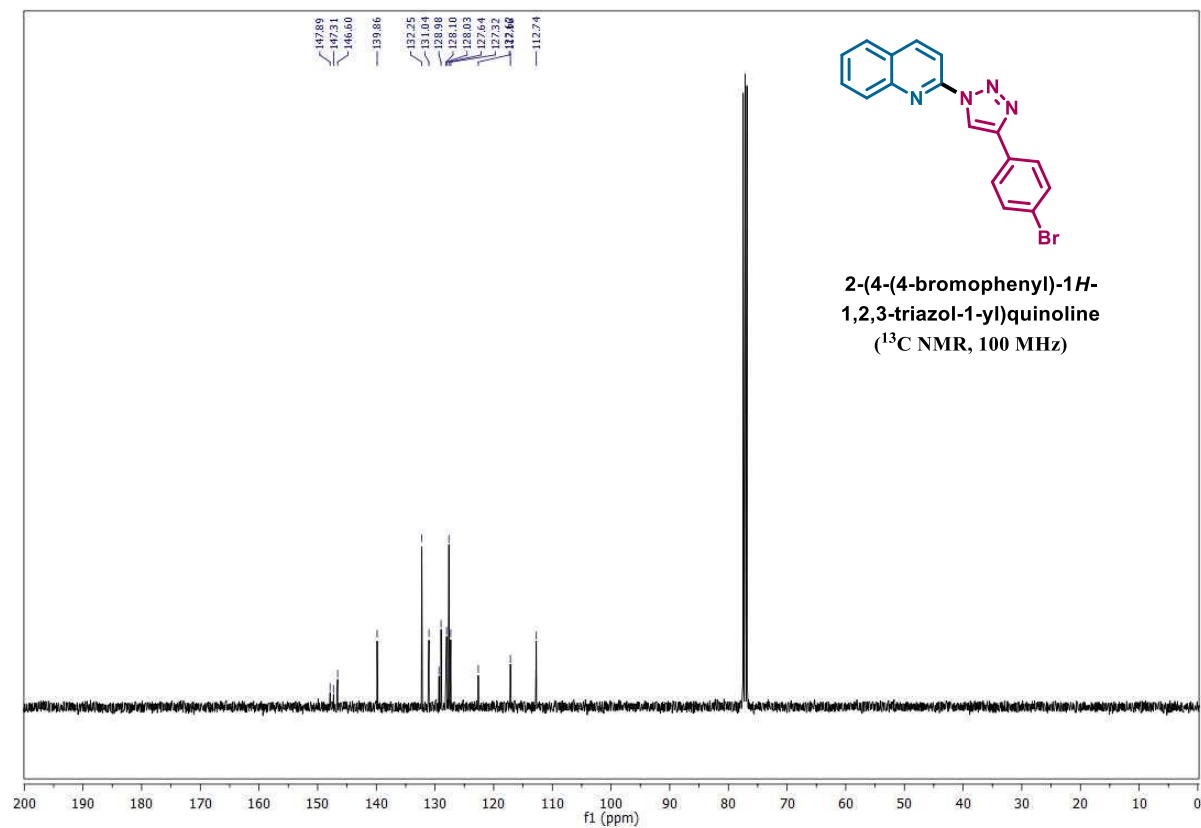
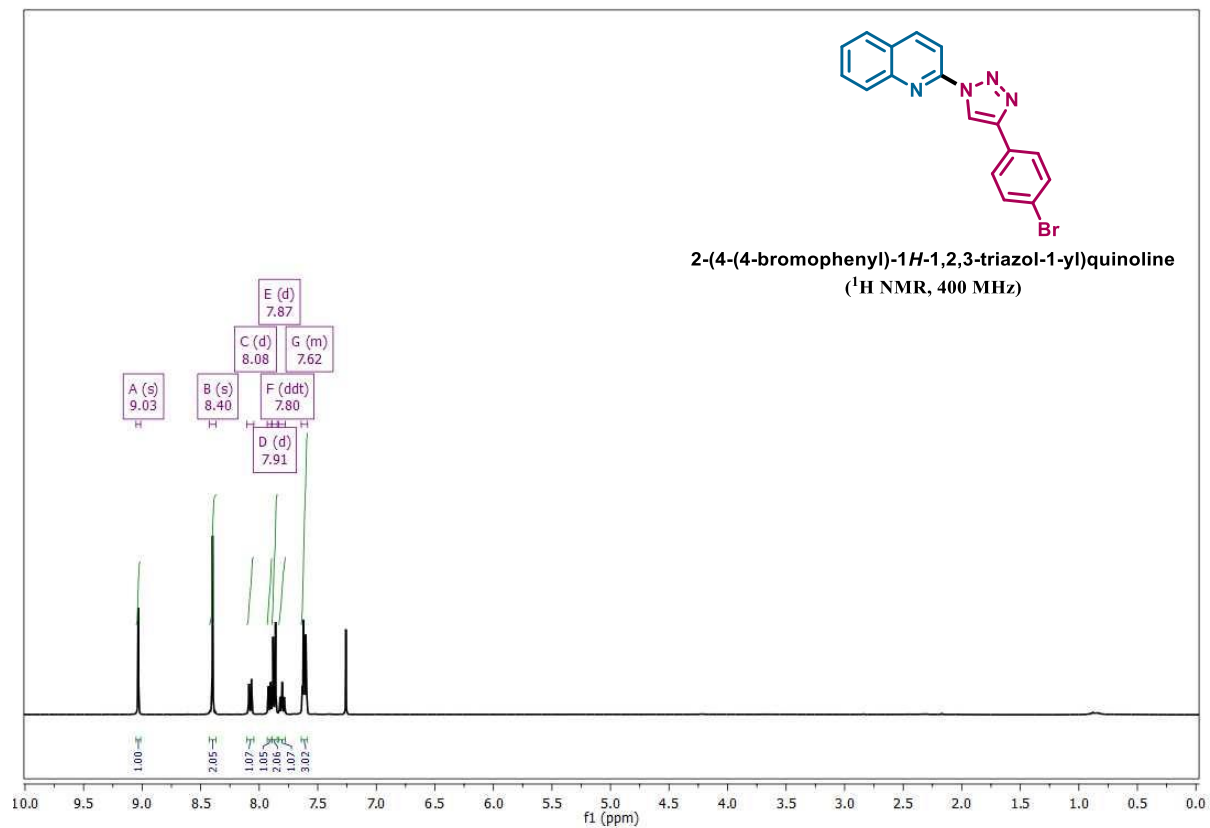
¹H and ¹³C NMR Spectra of 3j



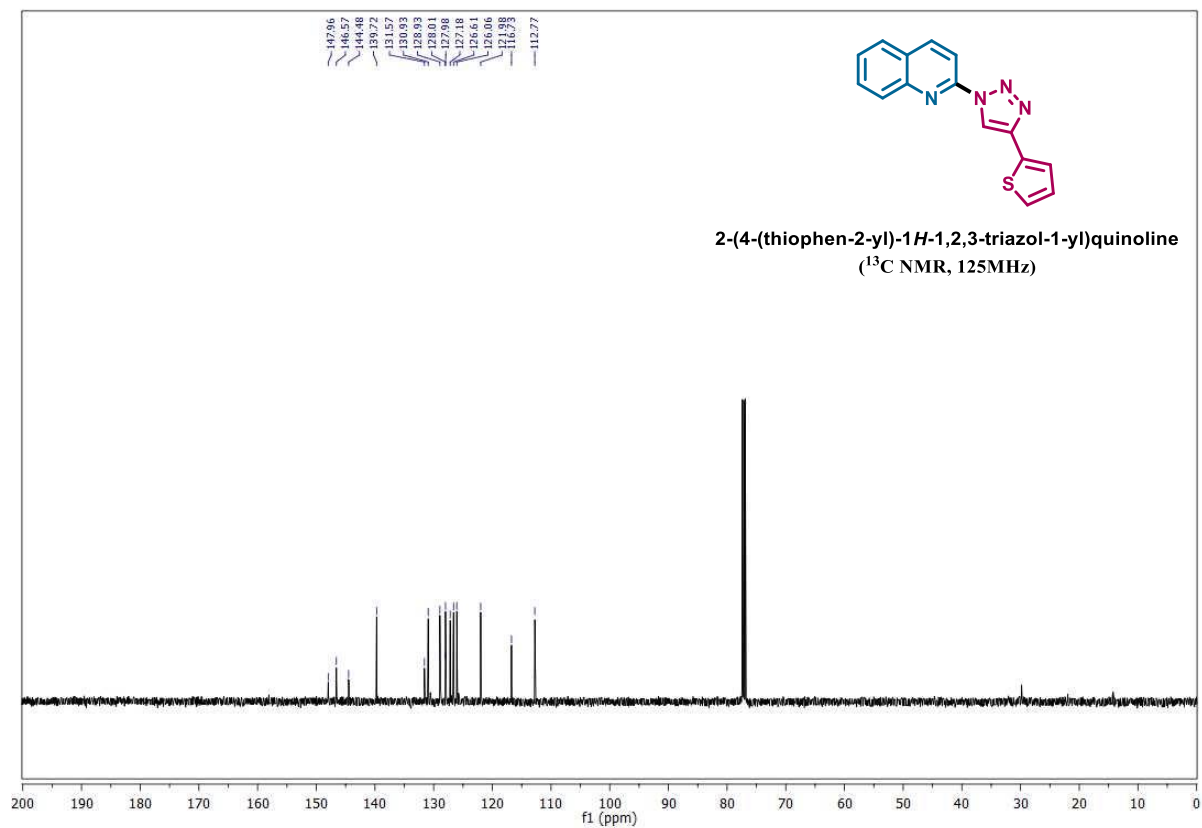
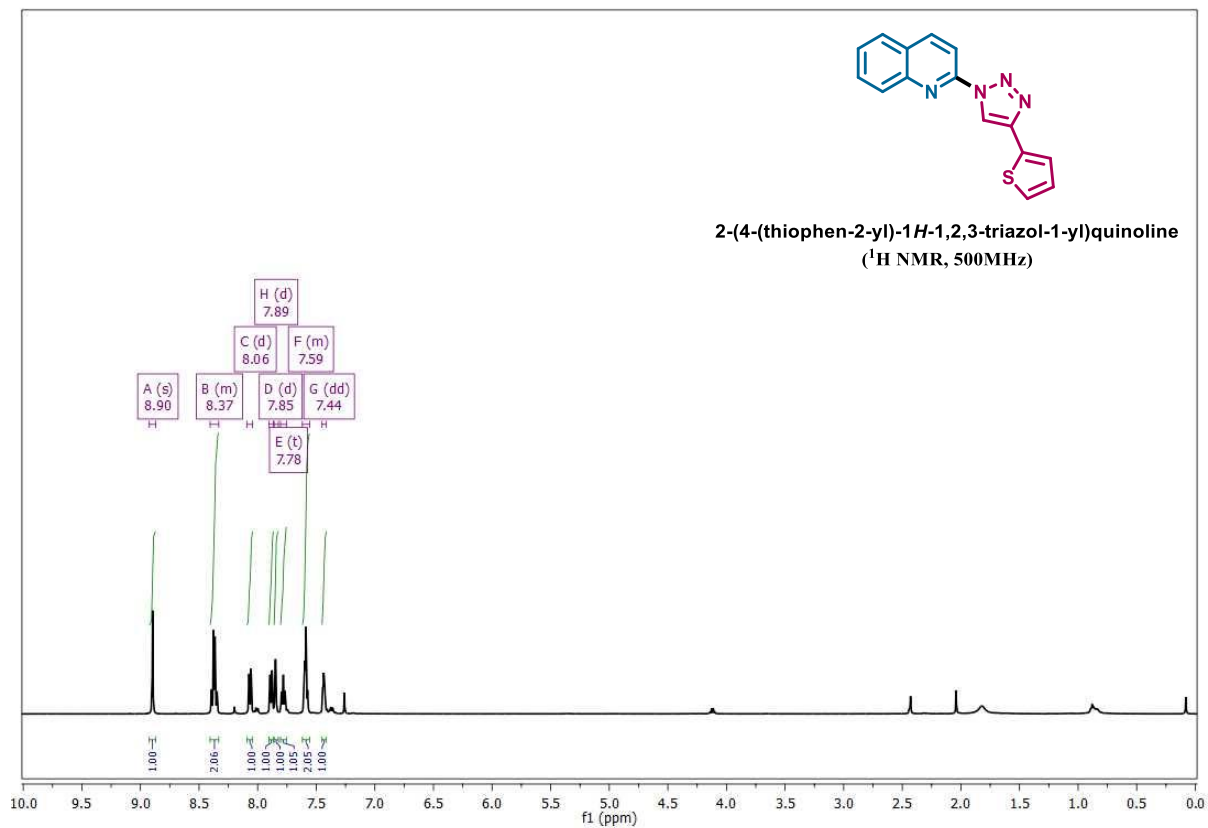
¹H and ¹³C NMR Spectra of 3k



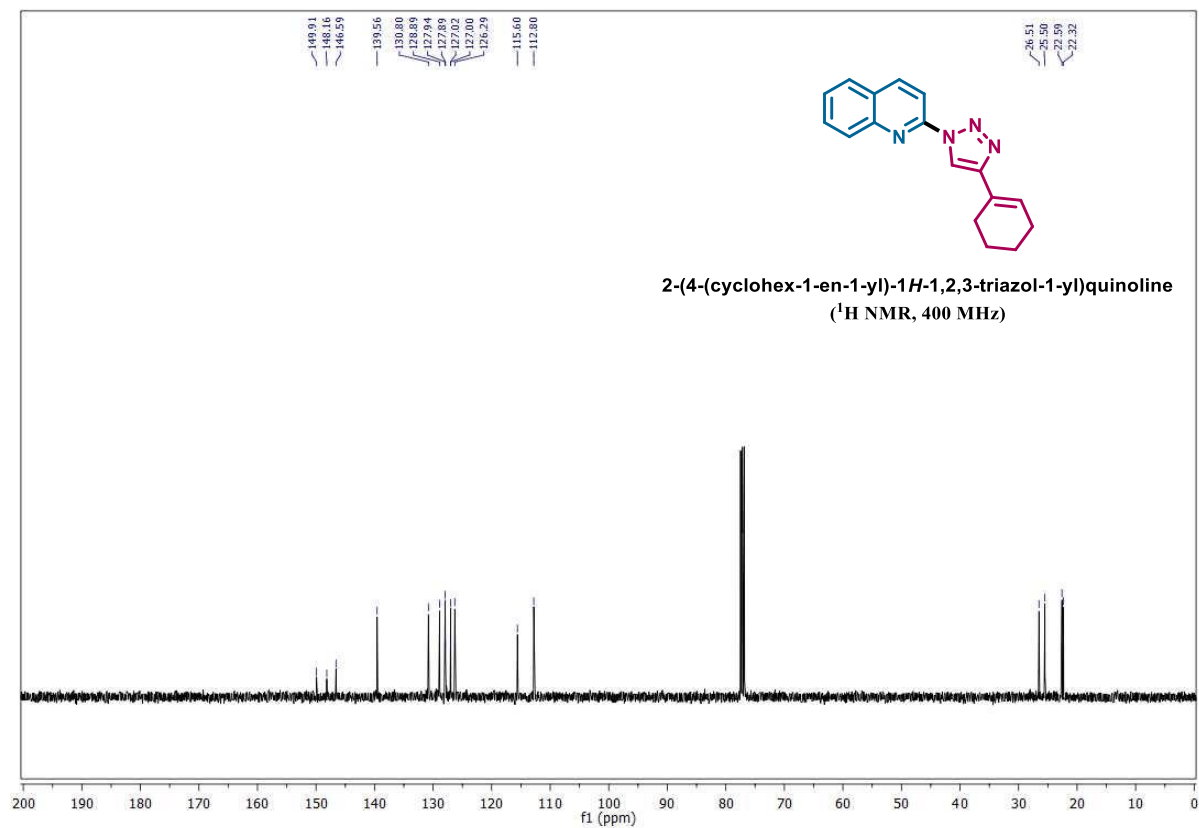
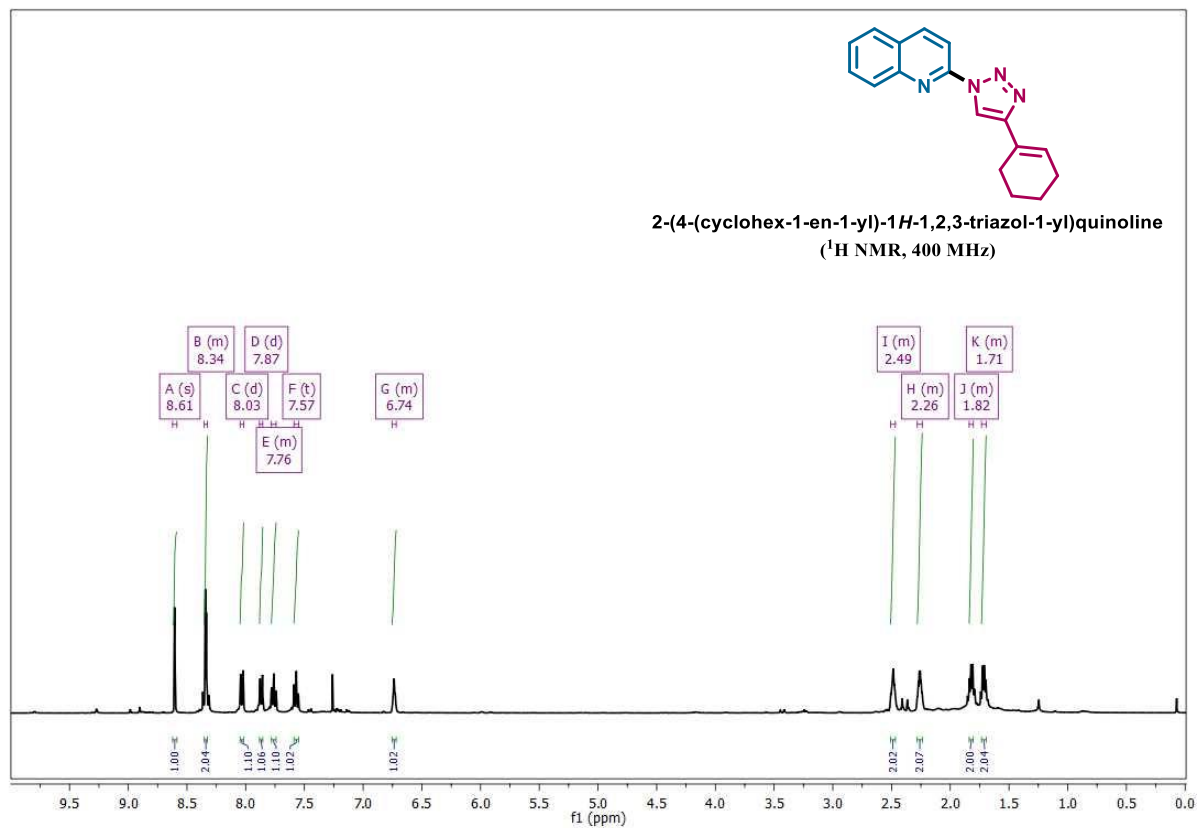
¹H and ¹³C NMR Spectra of 3I



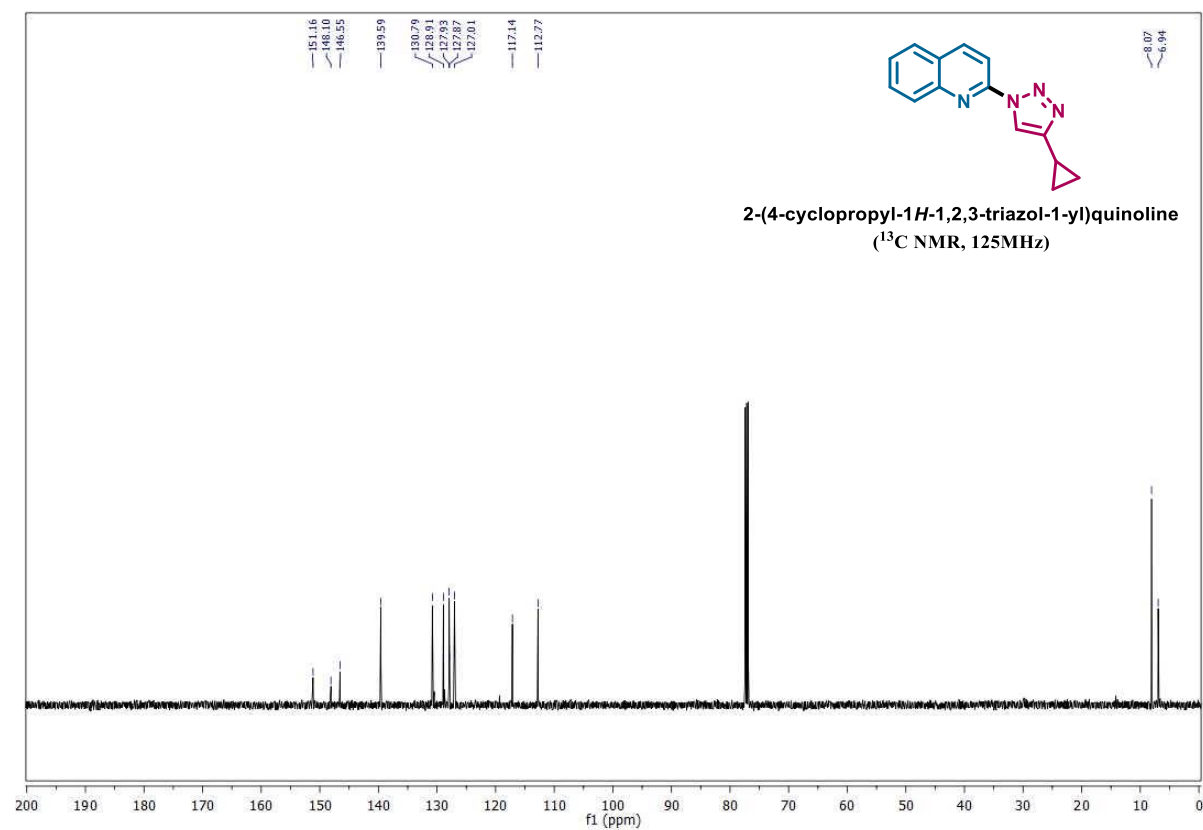
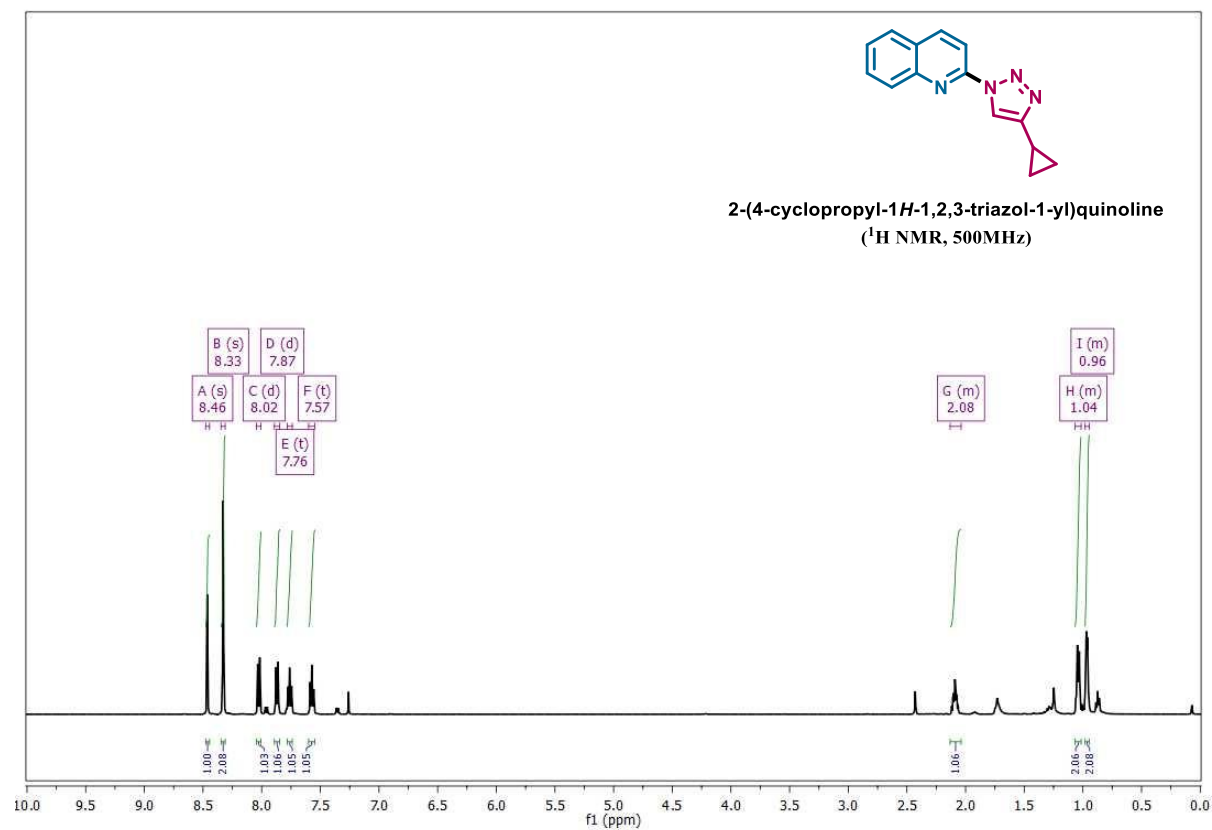
¹H and ¹³C NMR Spectra of 3m



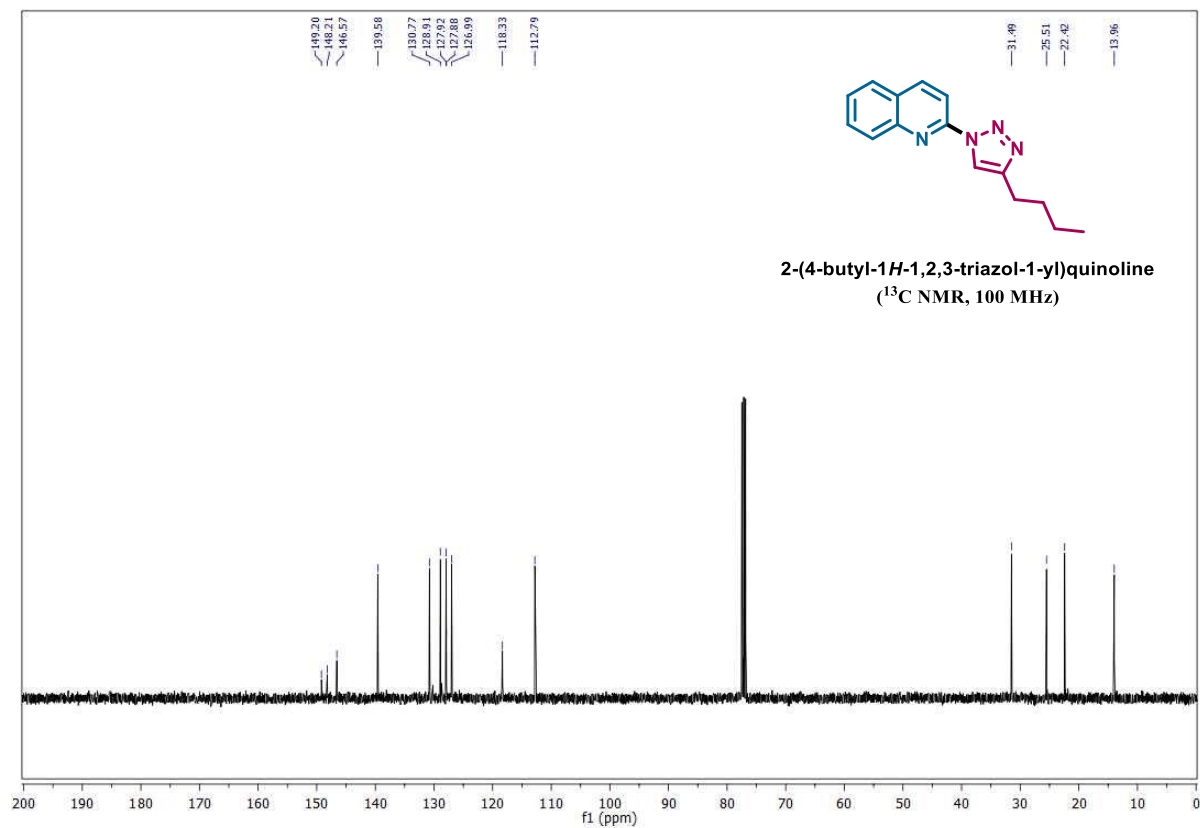
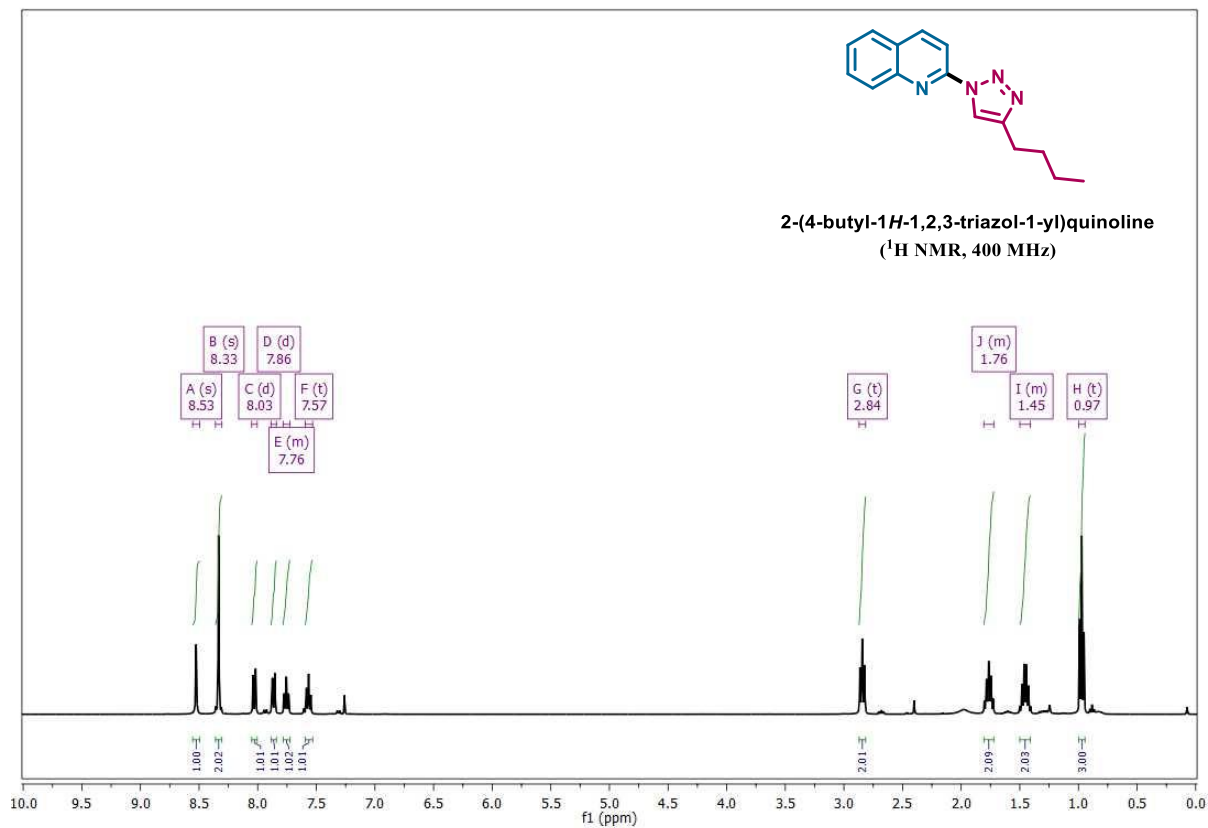
¹H and ¹³C NMR Spectra of 3n



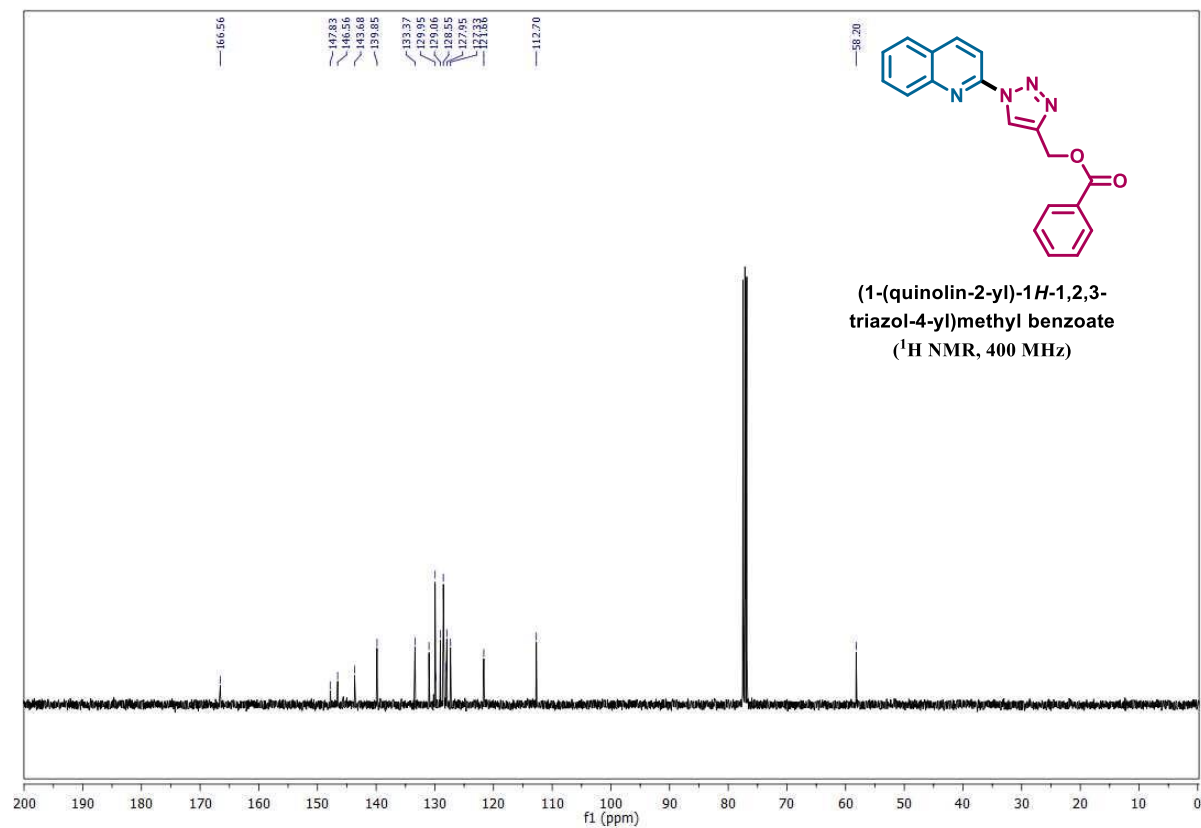
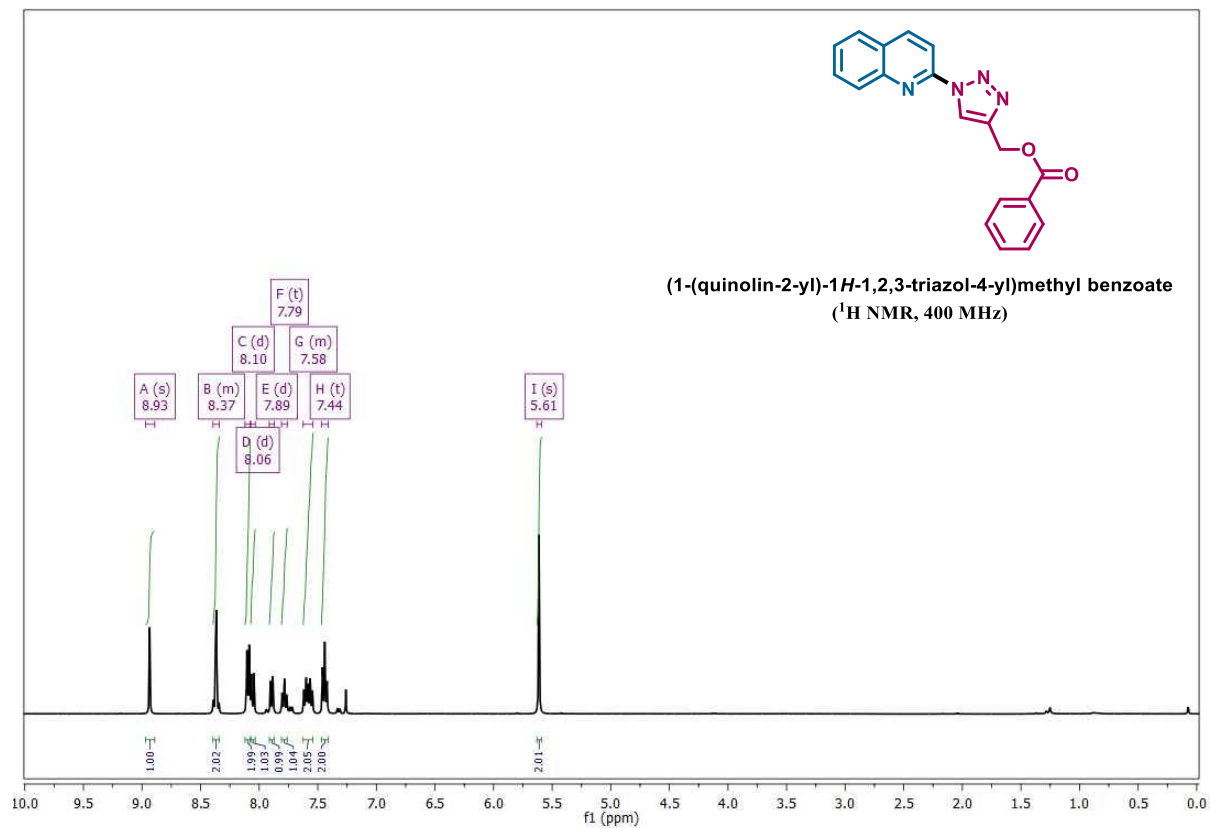
¹H and ¹³C NMR Spectra of 3o



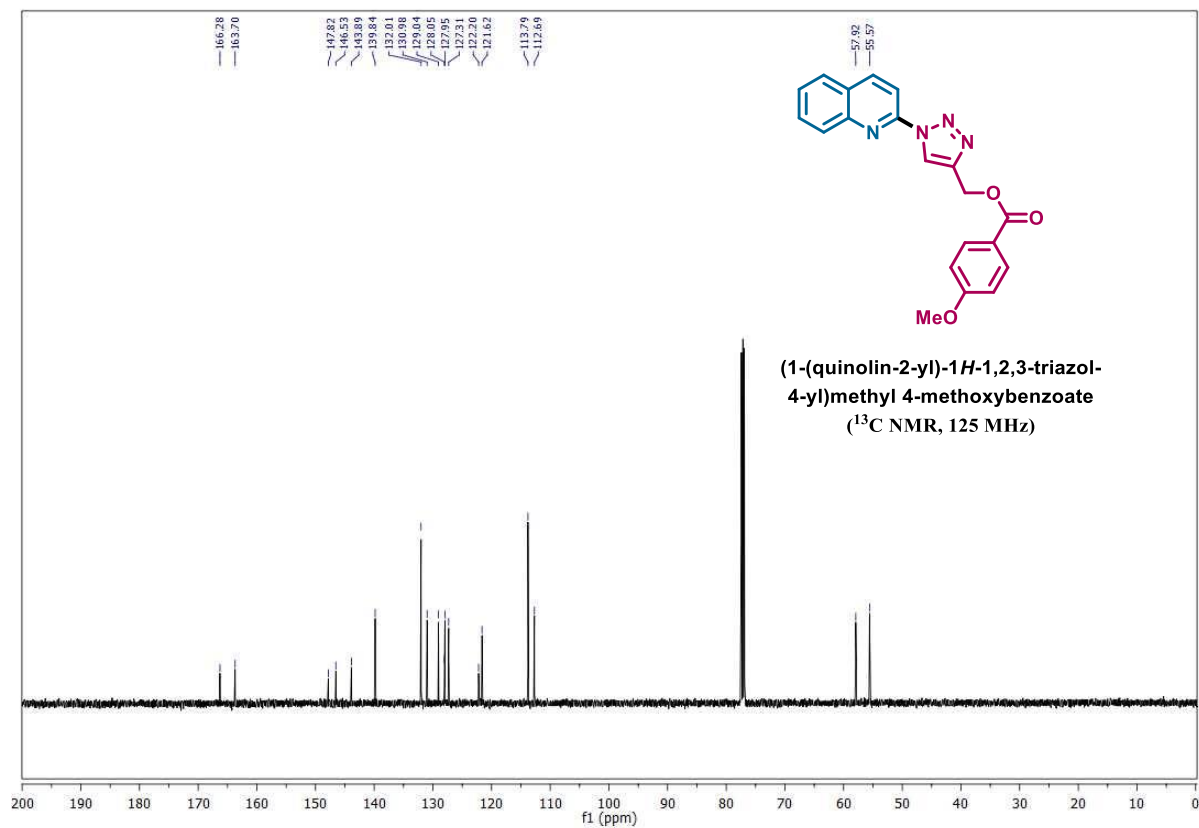
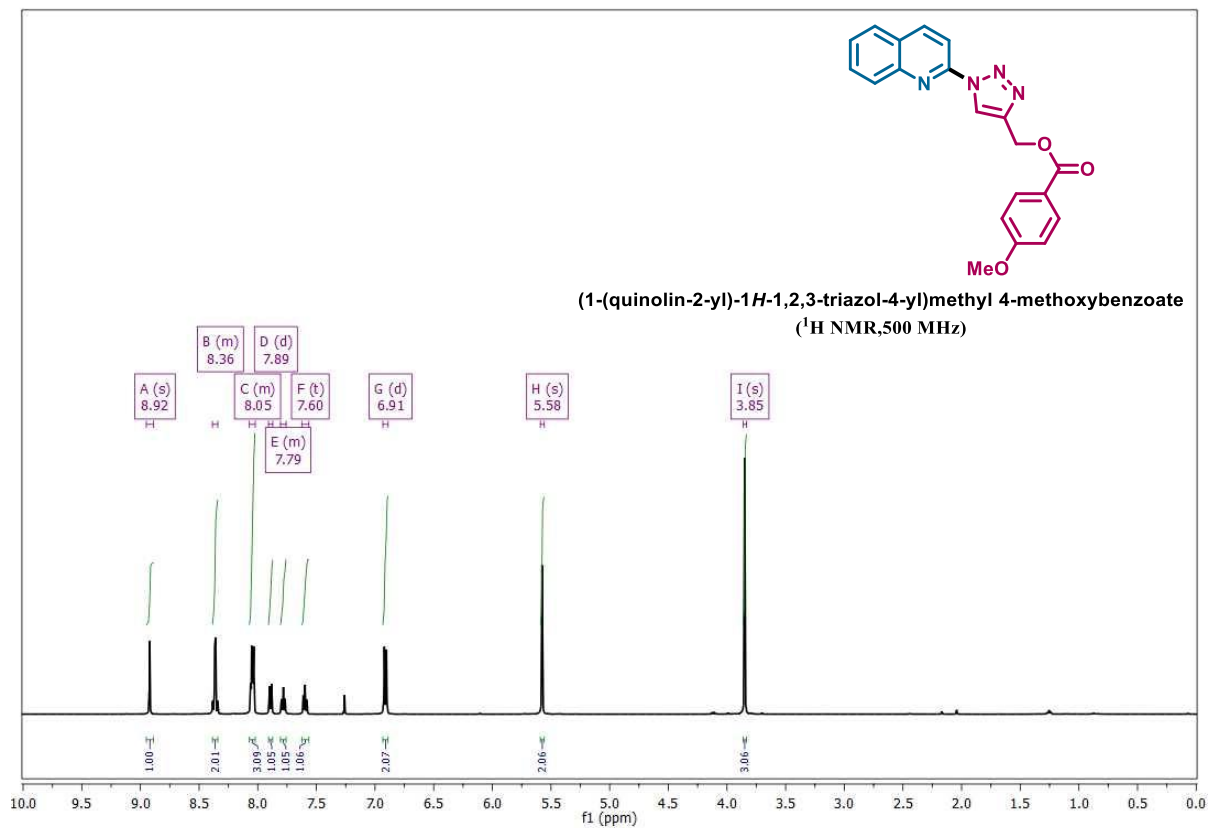
¹H and ¹³C NMR Spectra of 3p



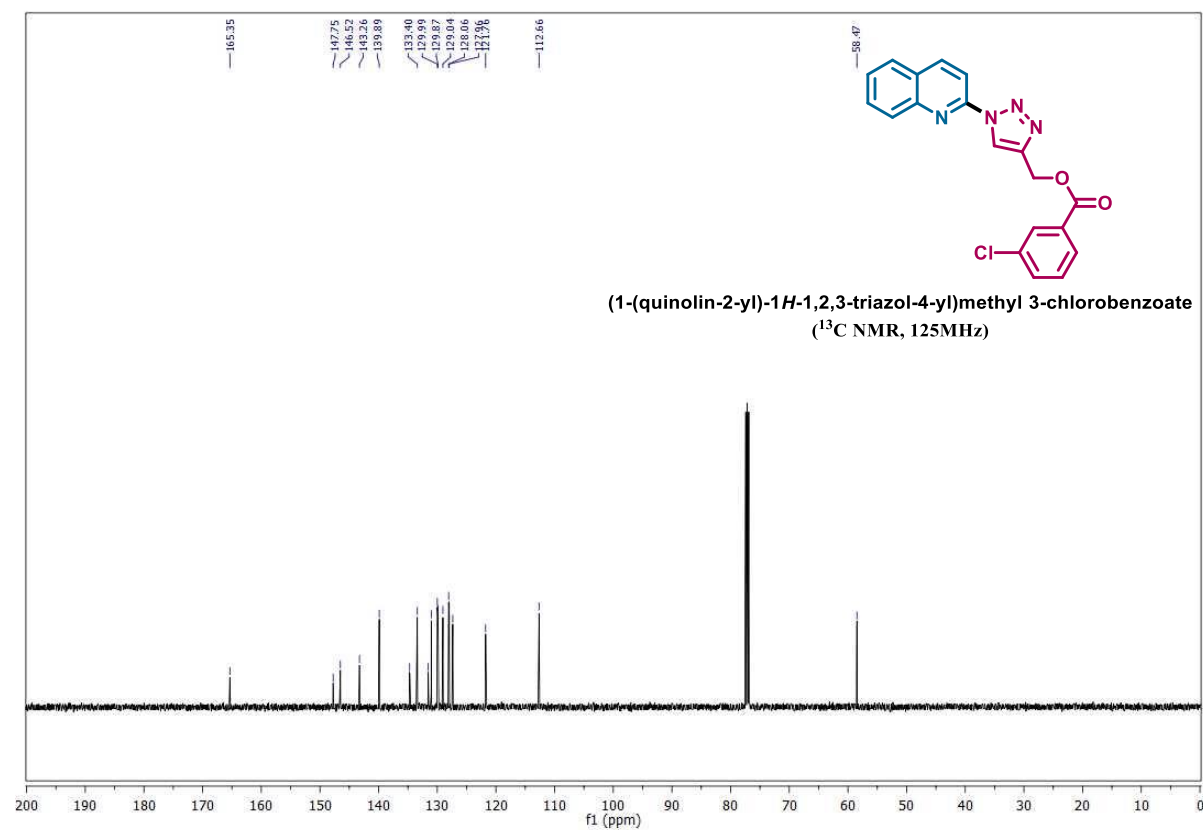
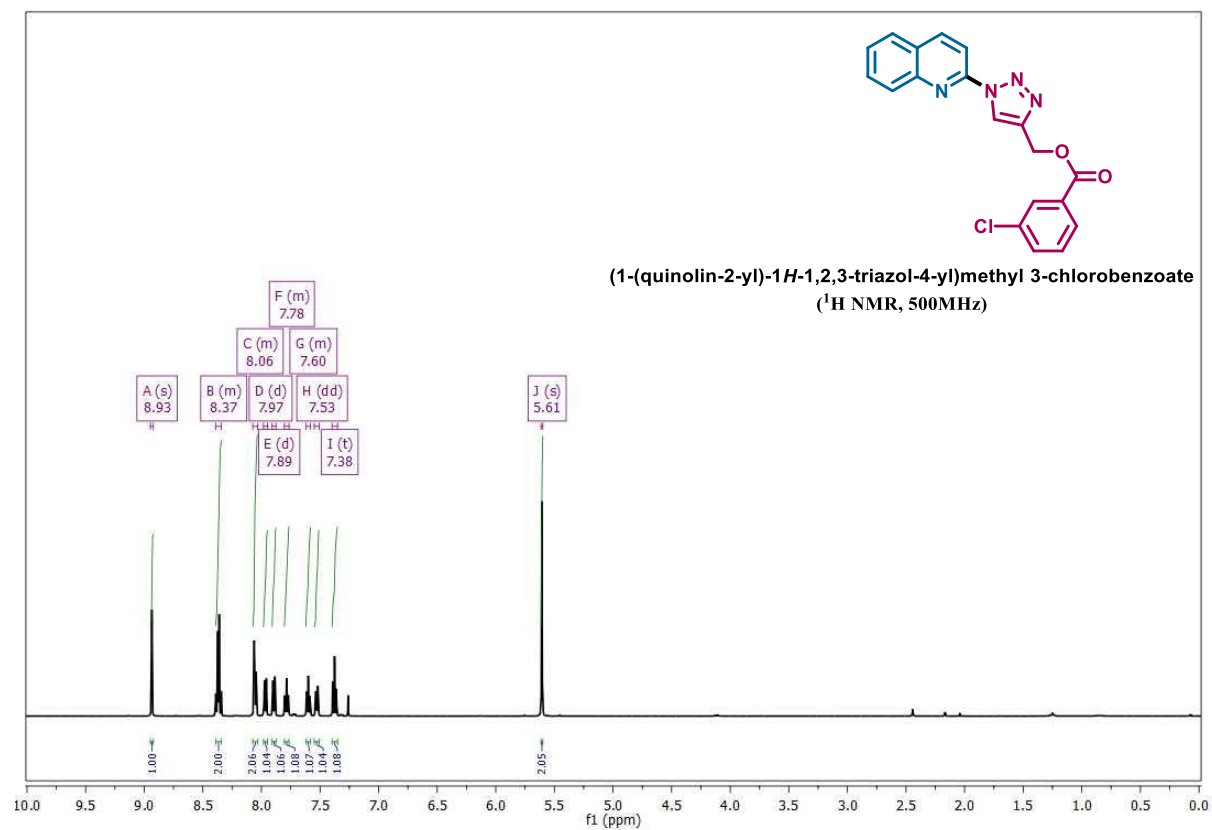
¹H and ¹³C NMR Spectra of 3q



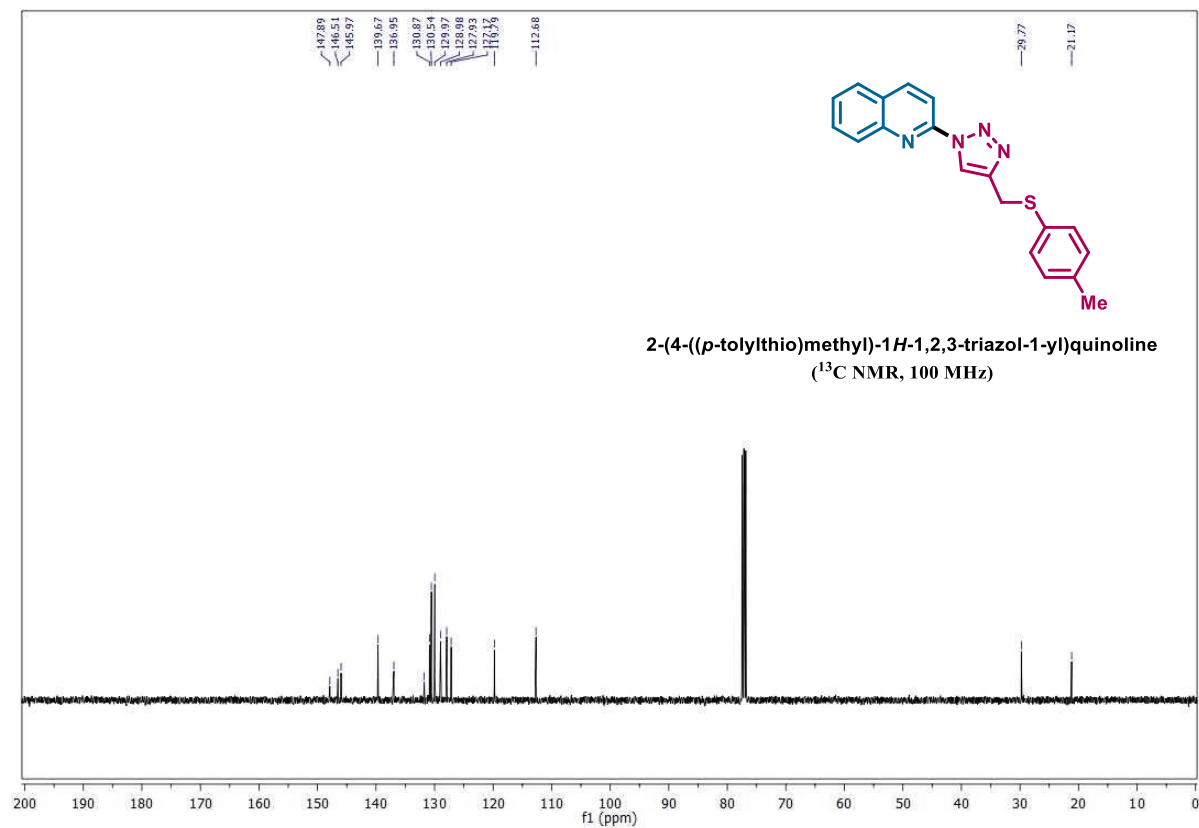
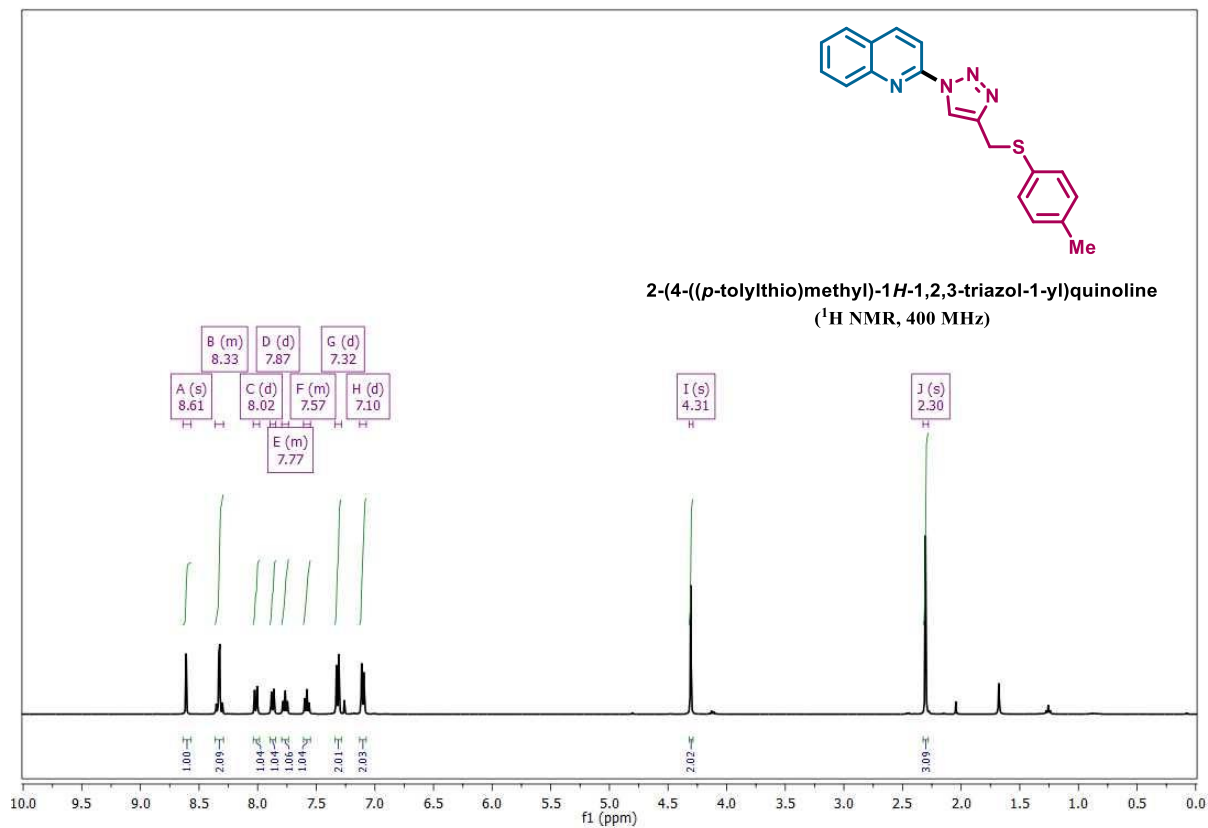
¹H and ¹³C NMR Spectra of 3r



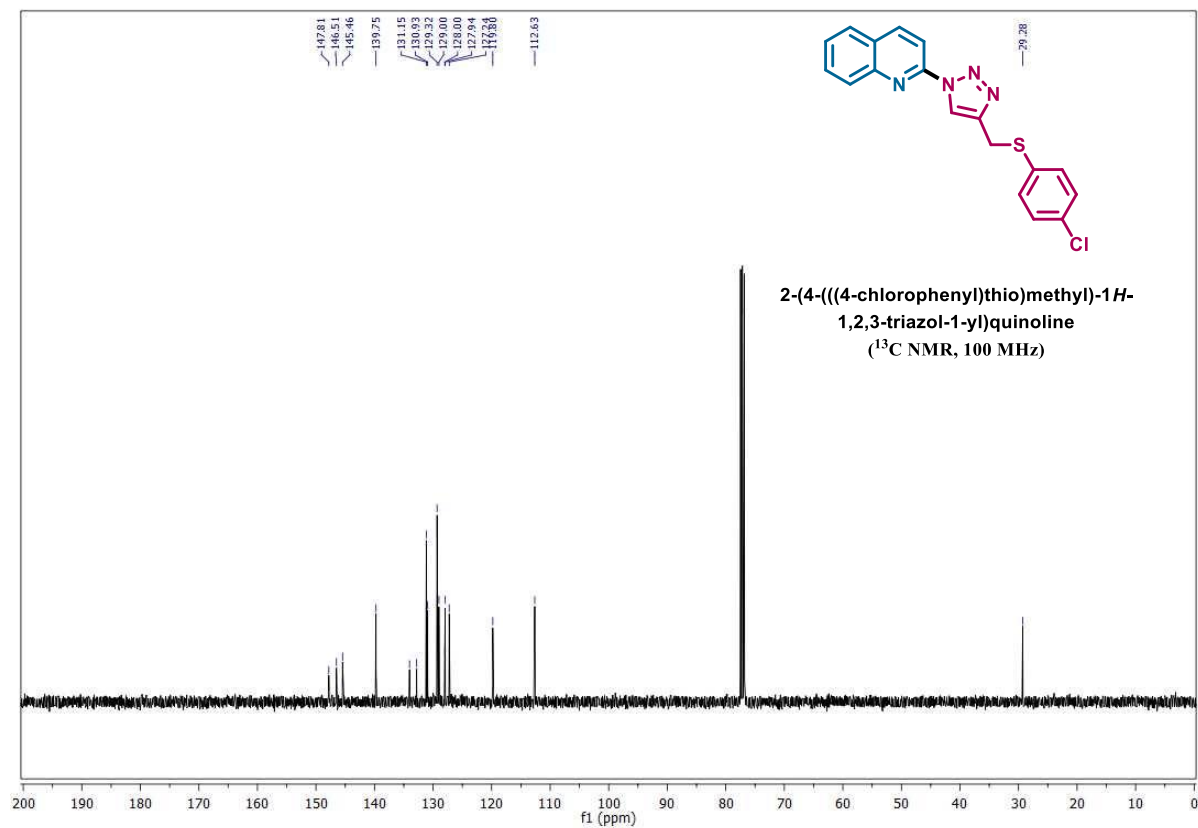
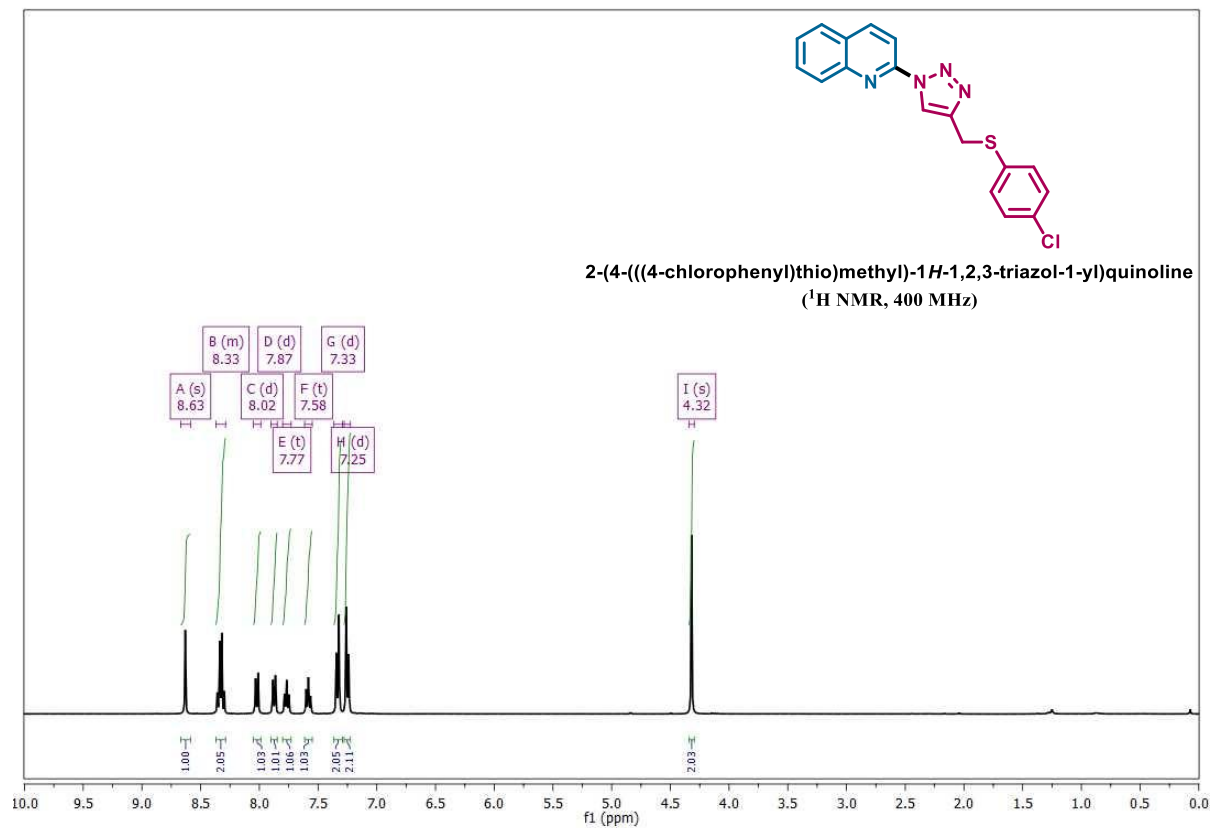
¹H and ¹³C NMR Spectra of 3s



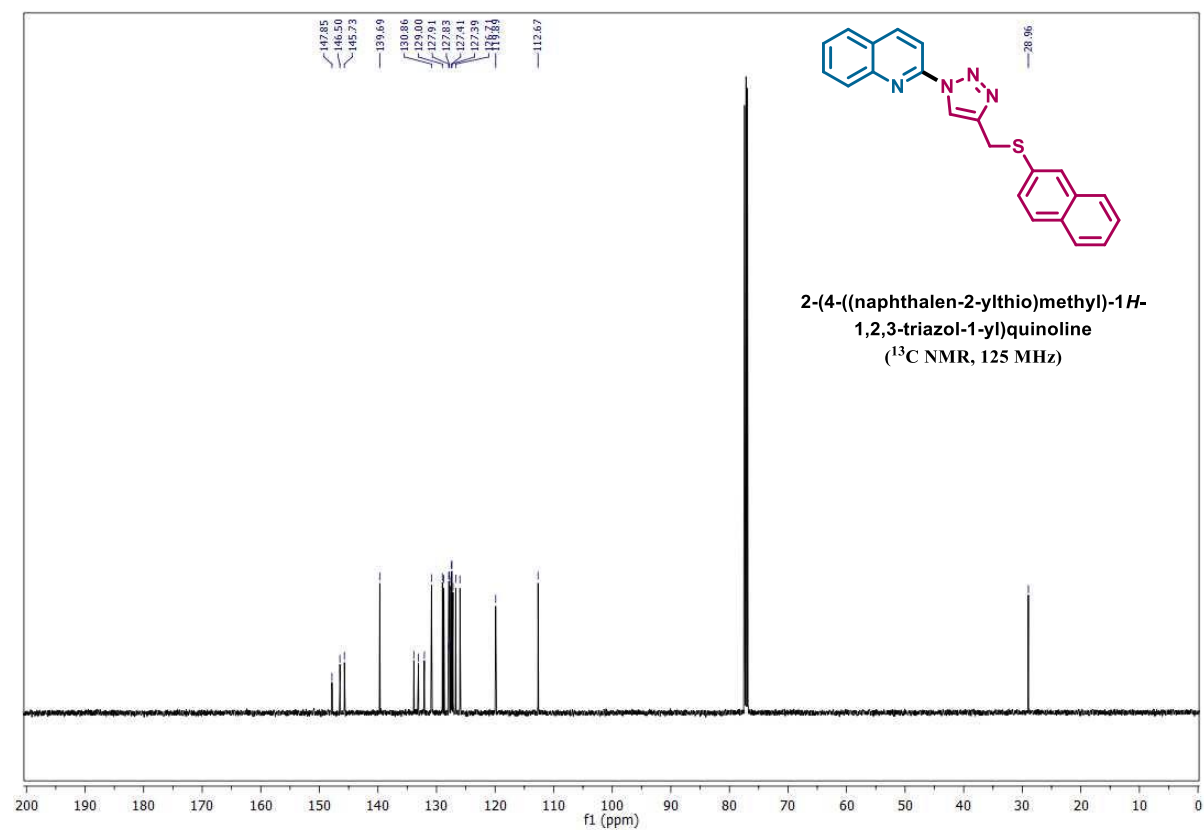
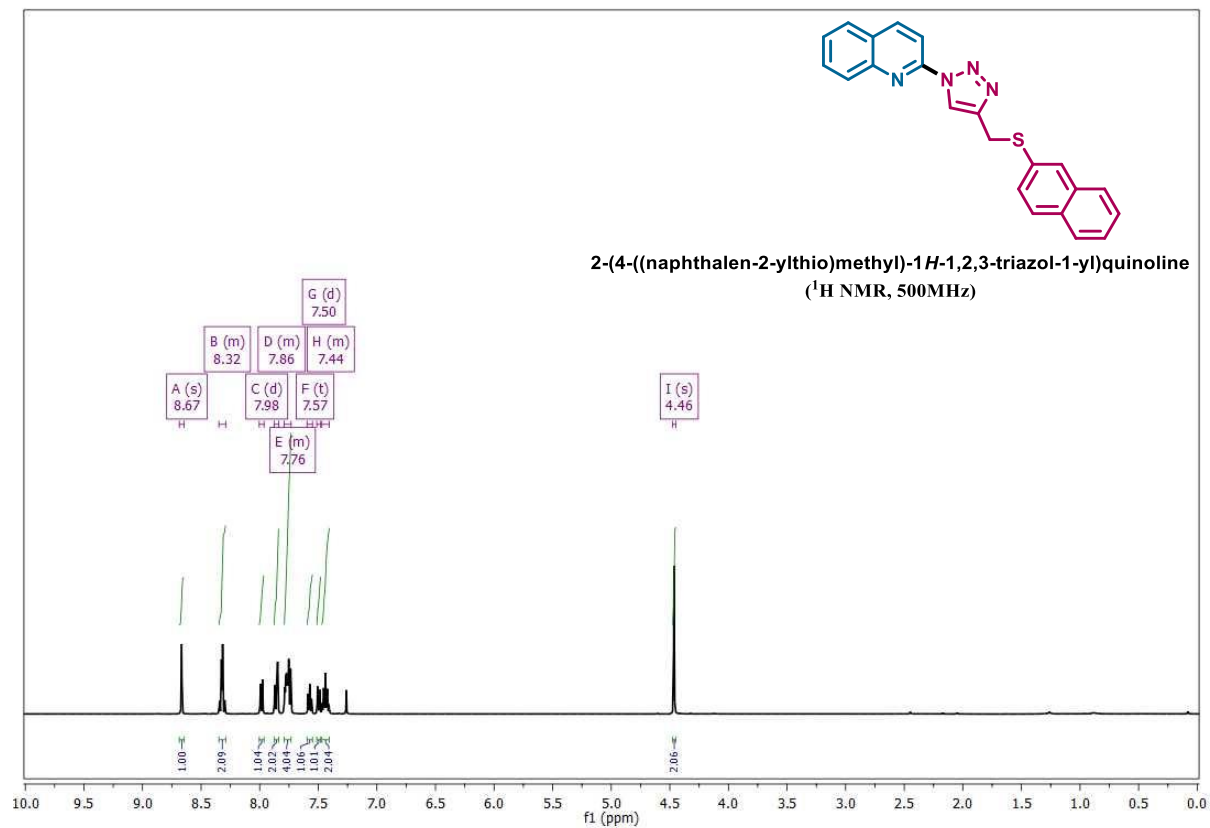
¹H and ¹³C NMR Spectra of 3t



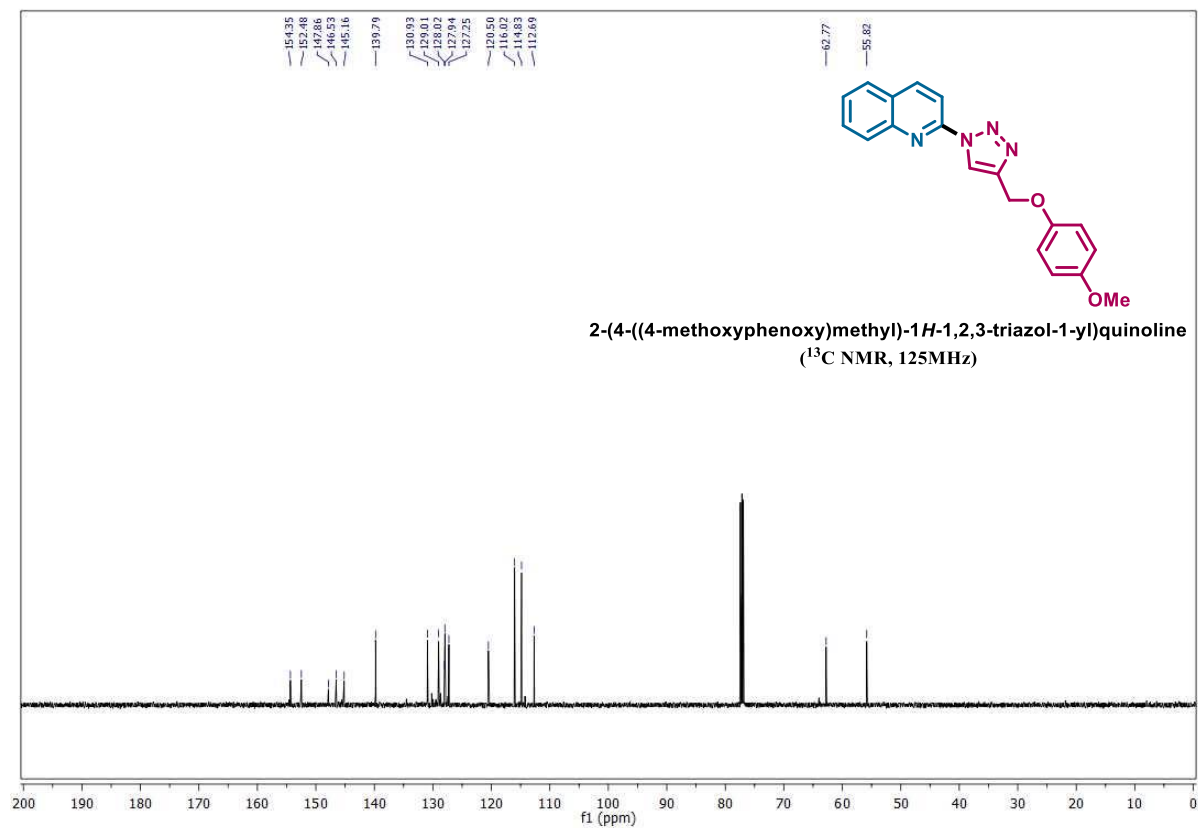
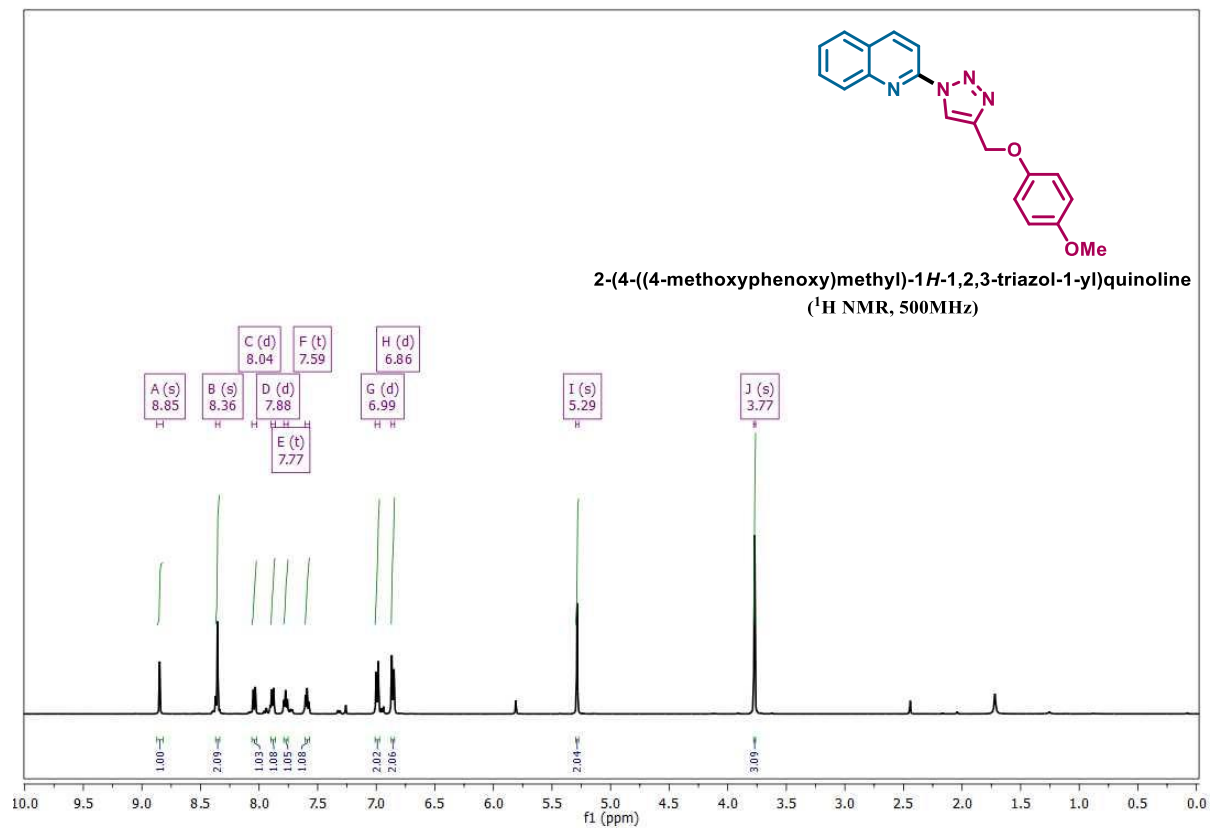
¹H and ¹³C NMR Spectra of 3u



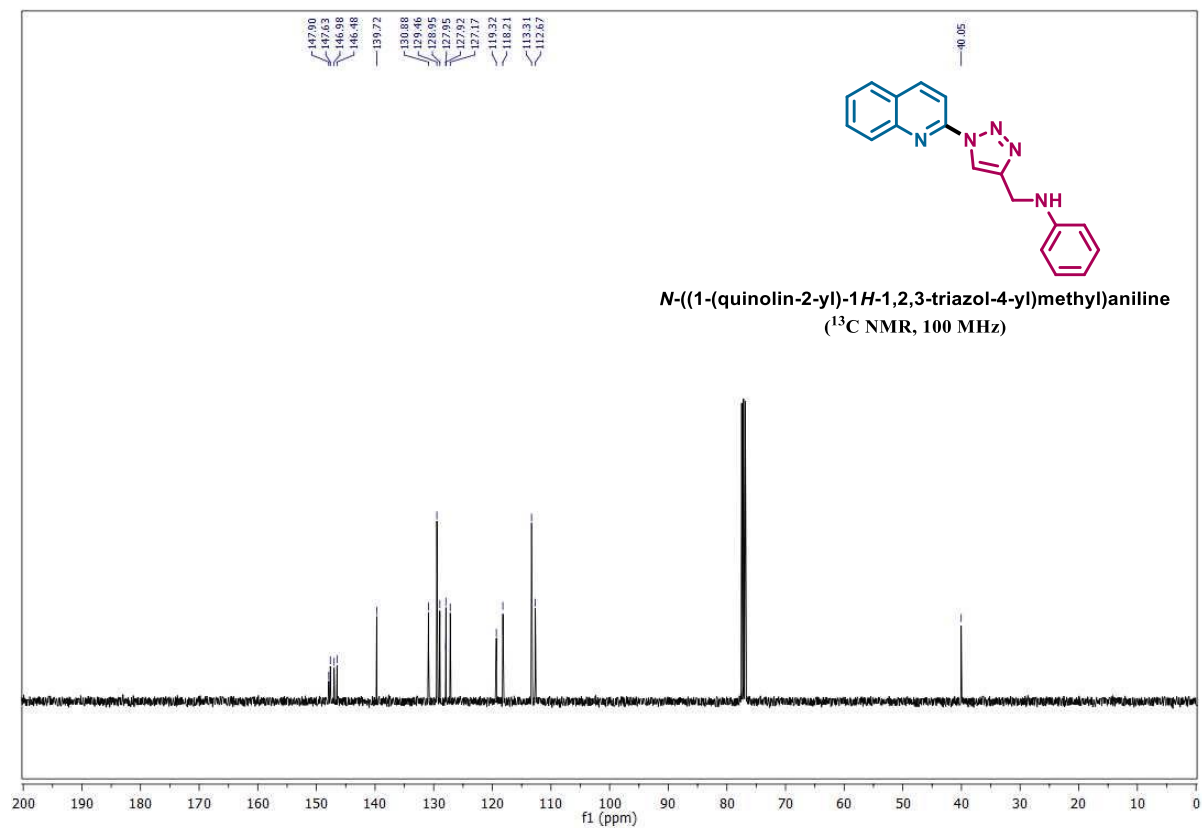
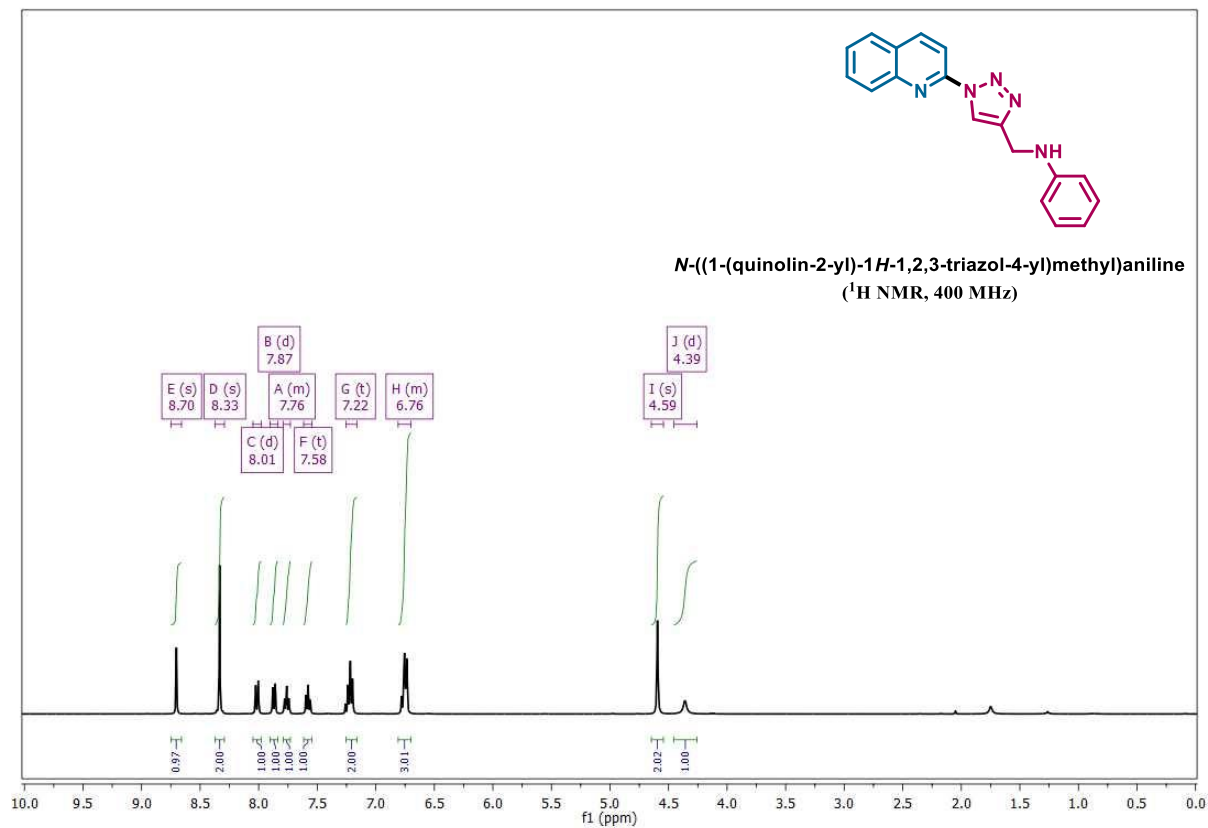
¹H and ¹³C NMR Spectra of 3v



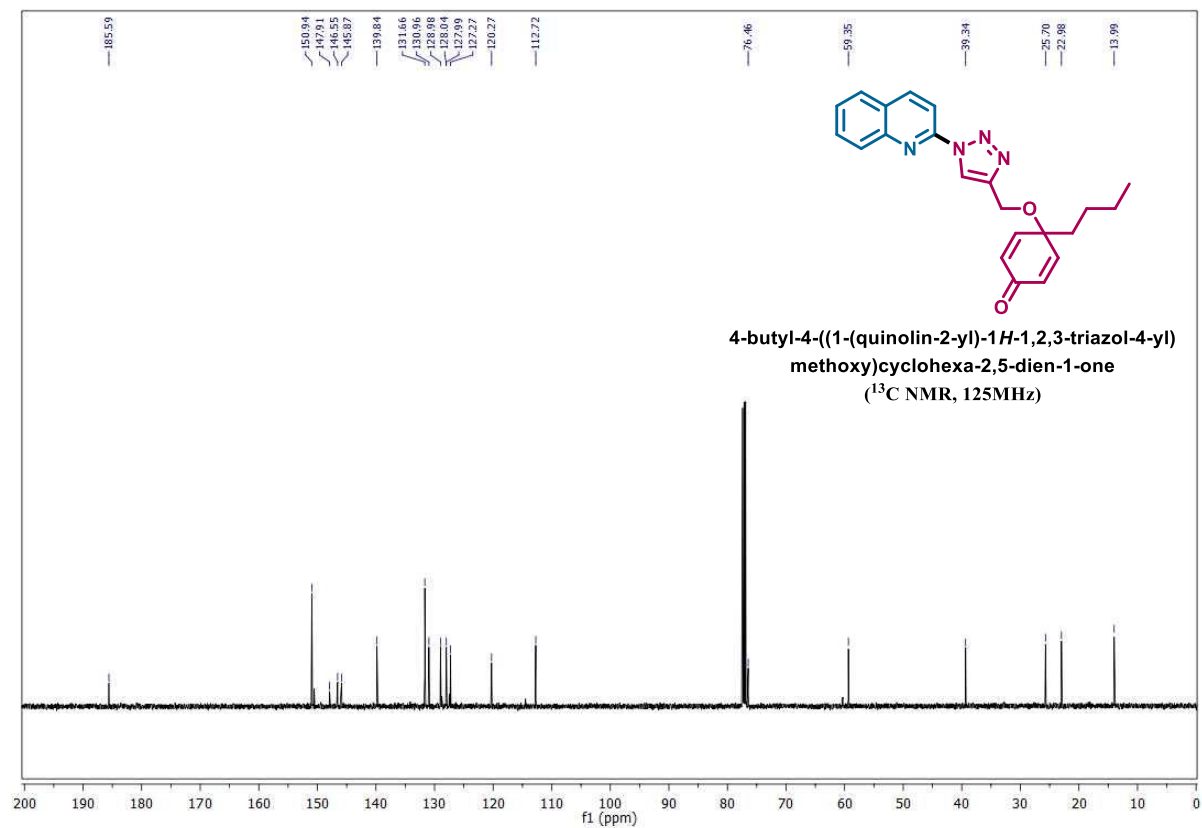
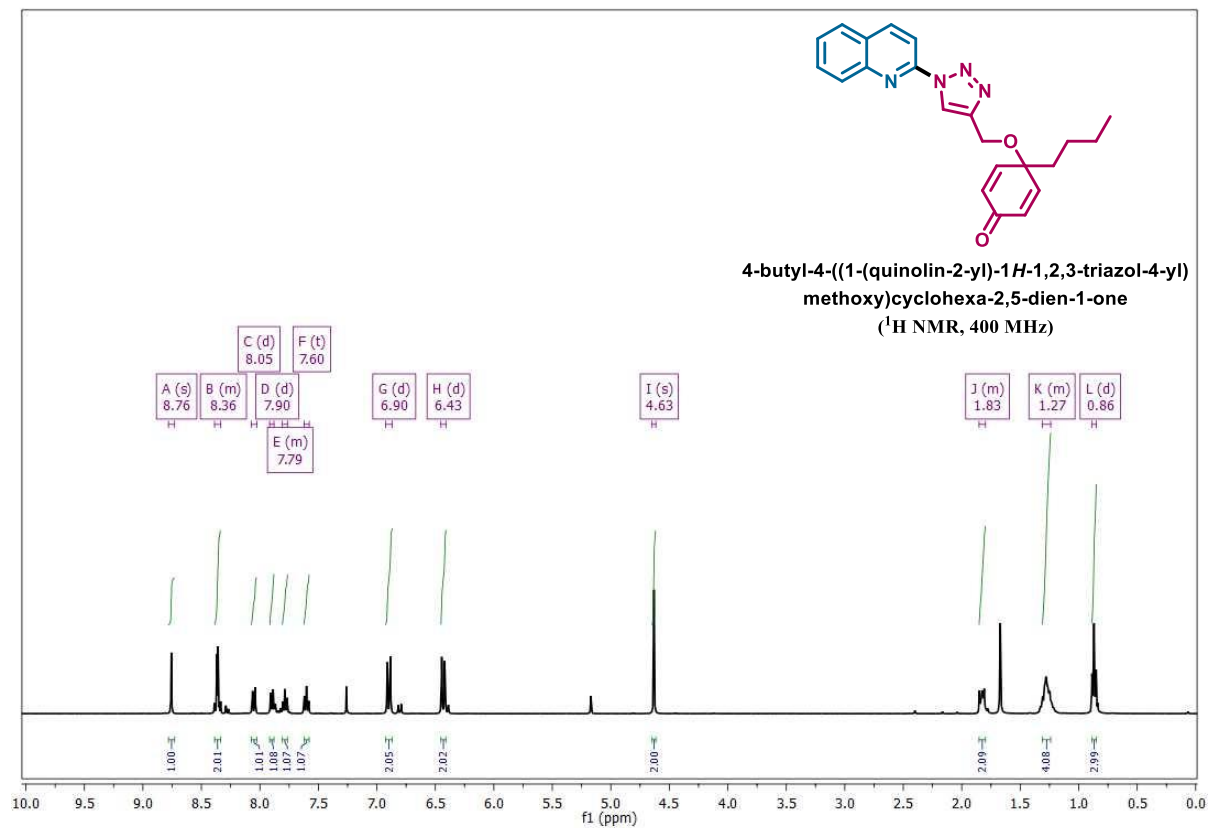
¹H and ¹³C NMR Spectra of 3w



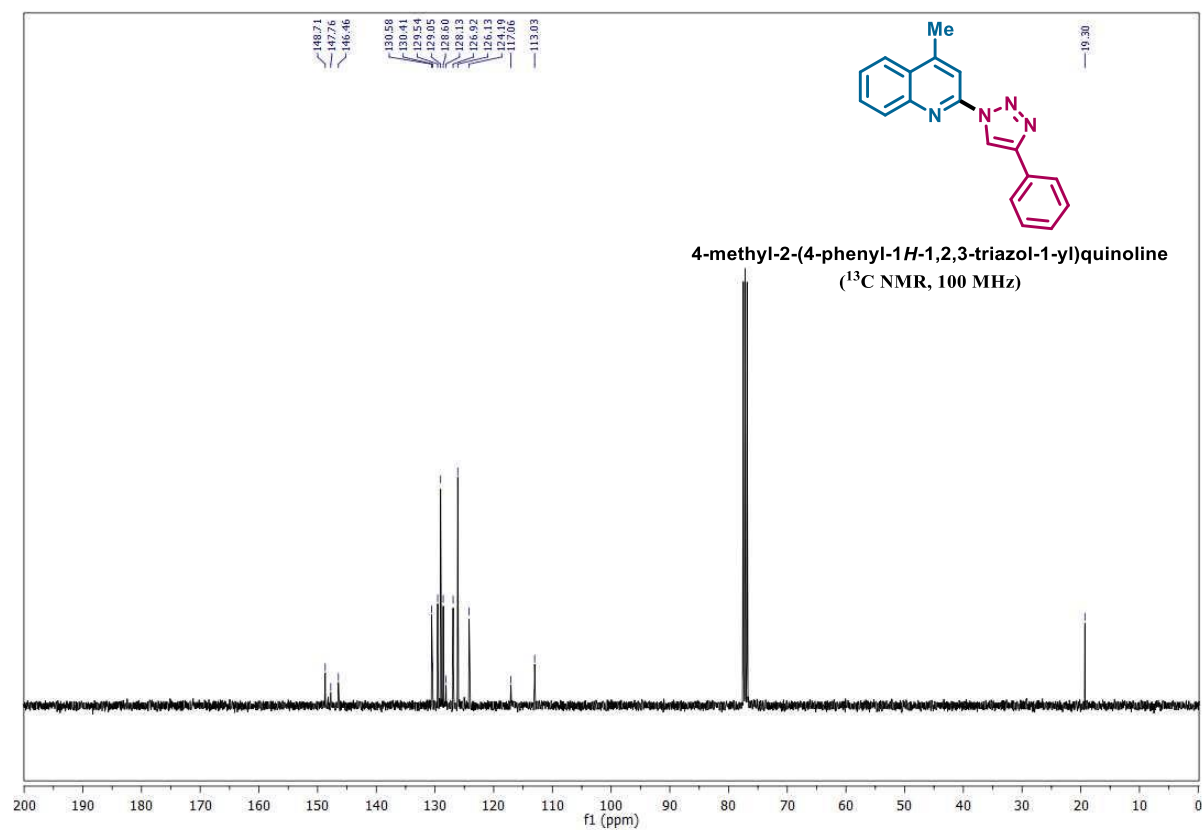
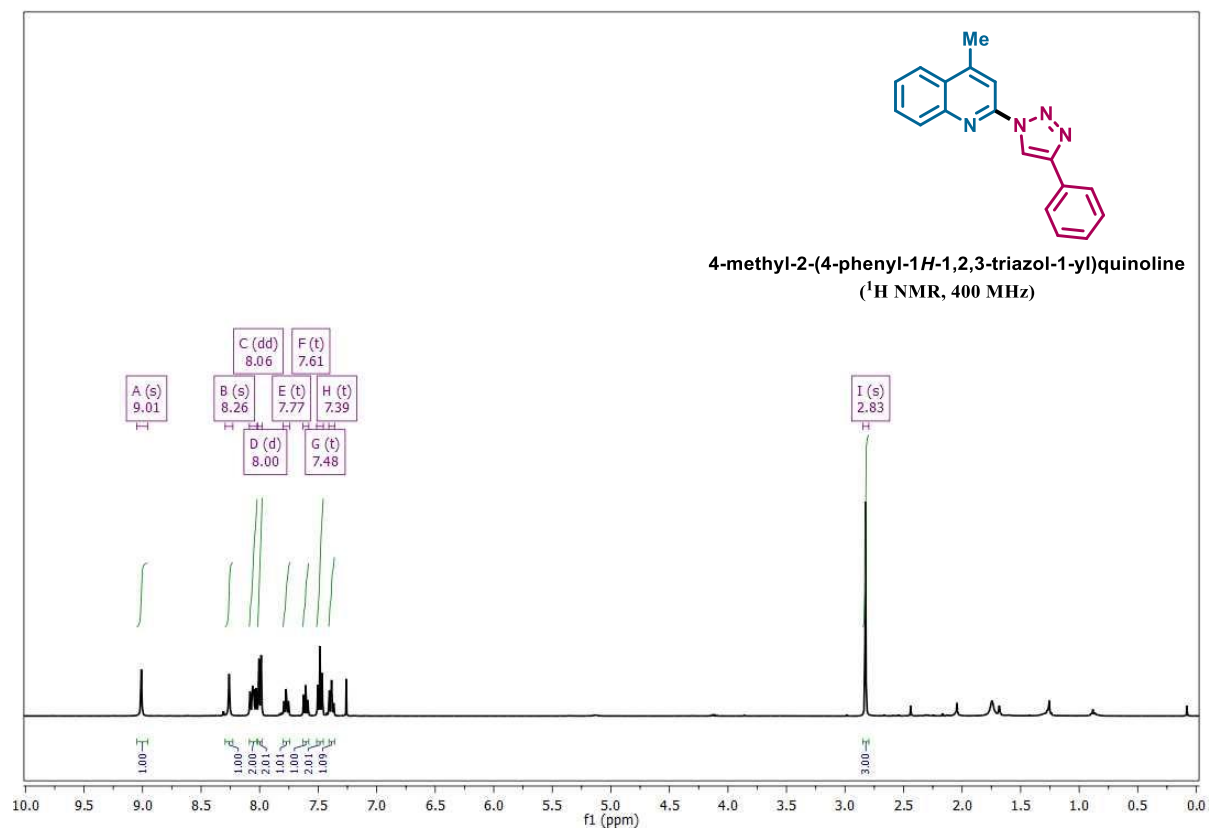
¹H and ¹³C NMR Spectra of 3x



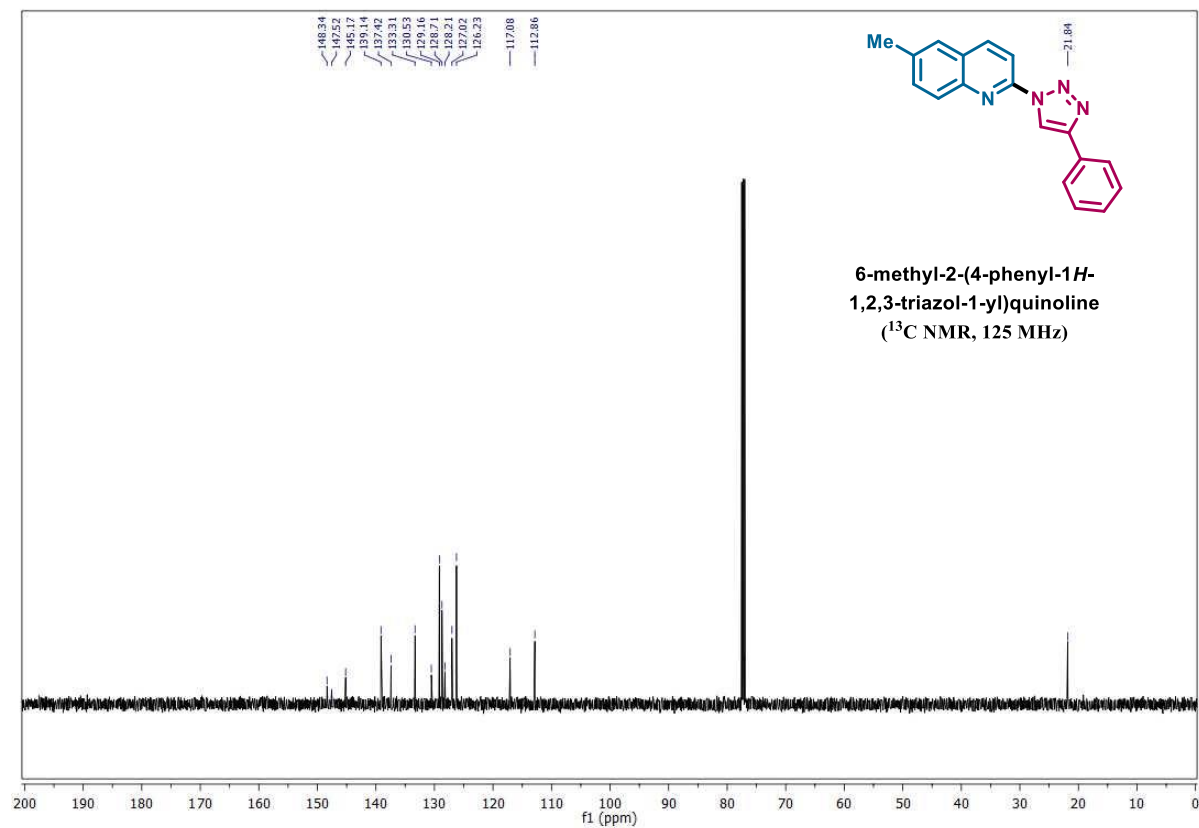
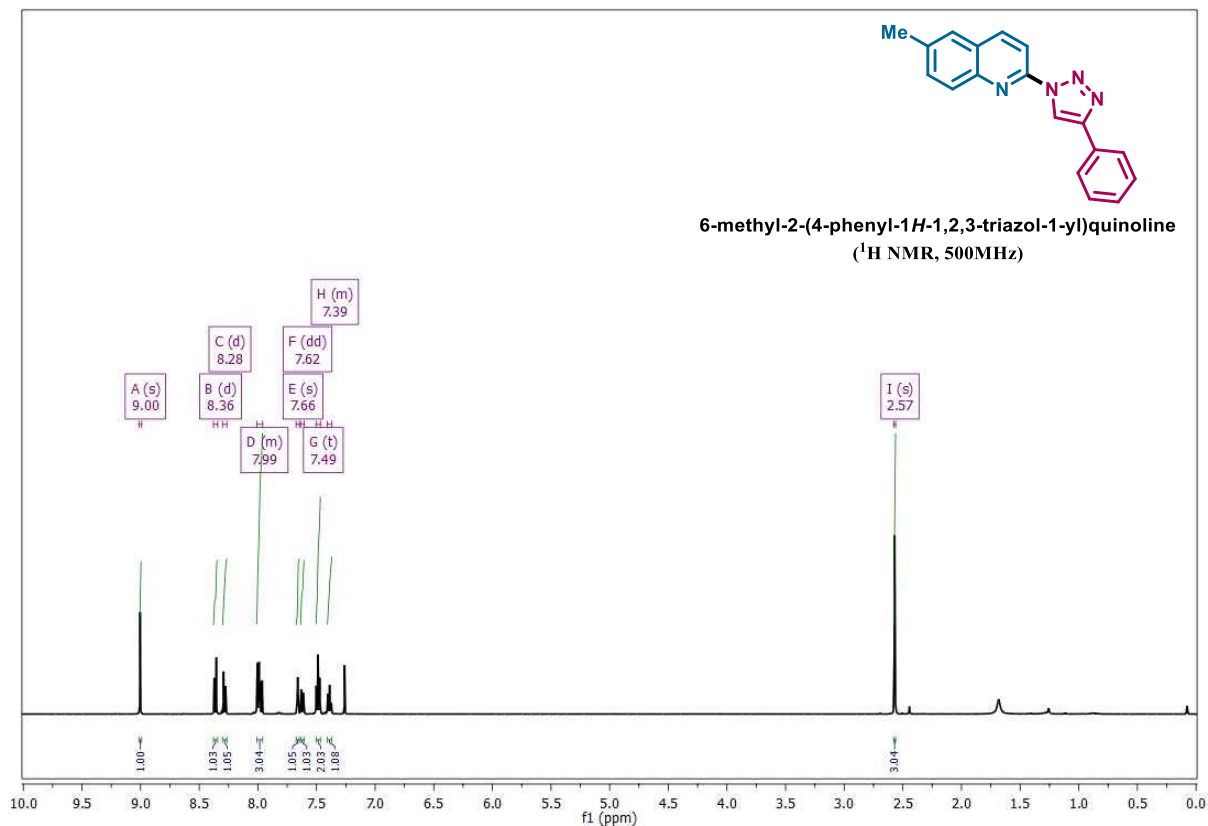
¹H and ¹³C NMR Spectra of 3y



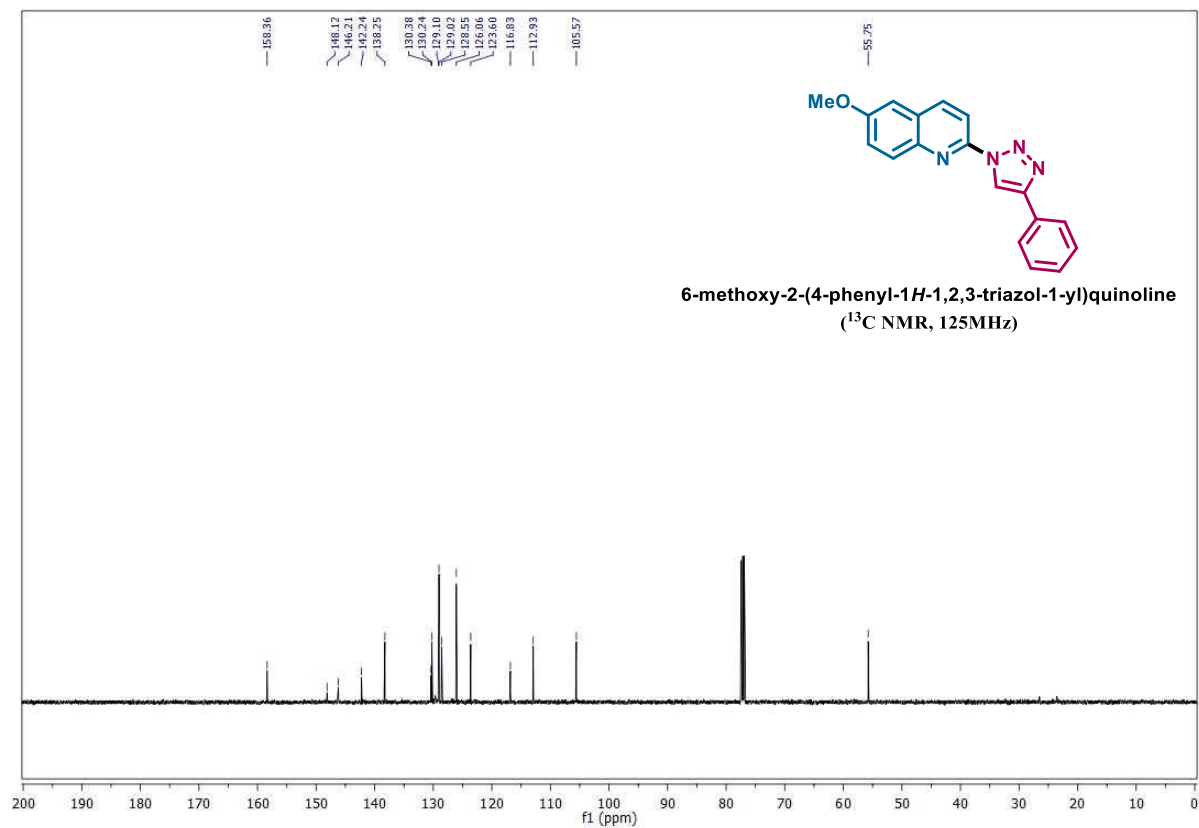
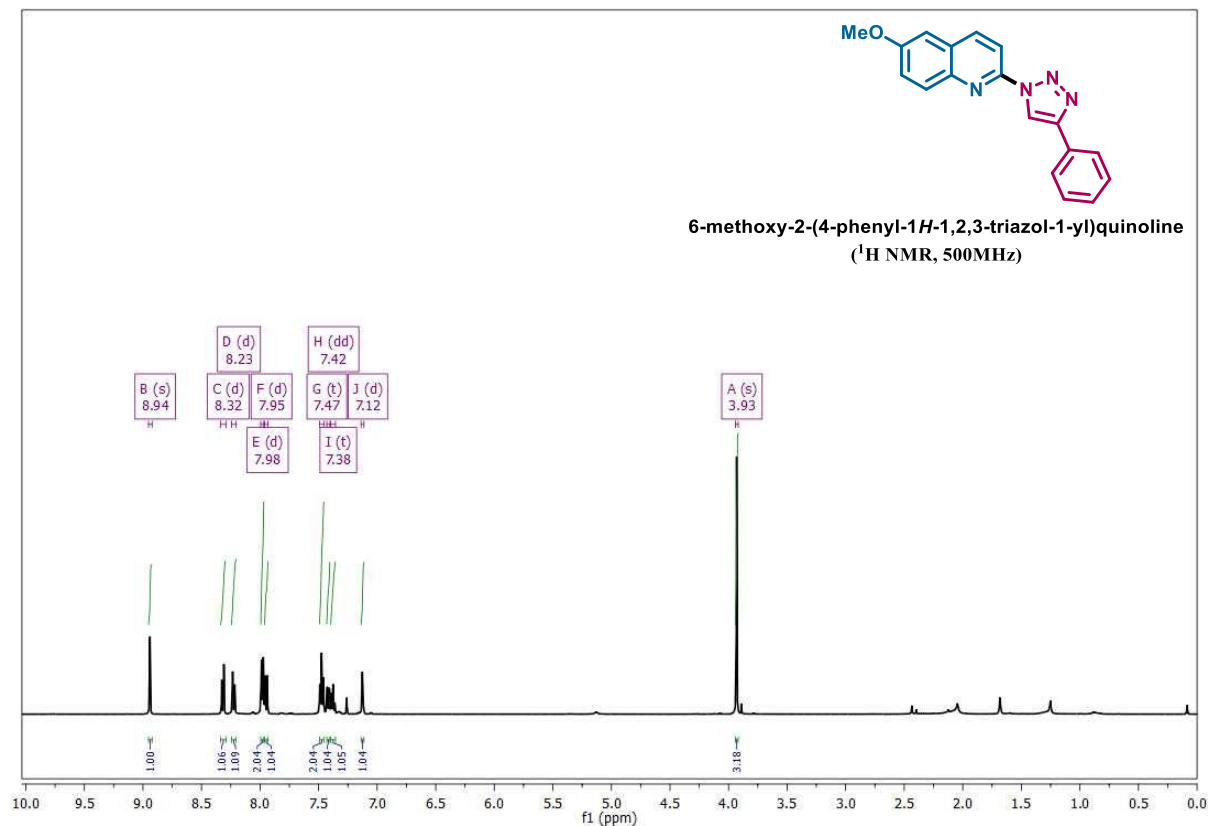
¹H and ¹³C NMR Spectra of 3z



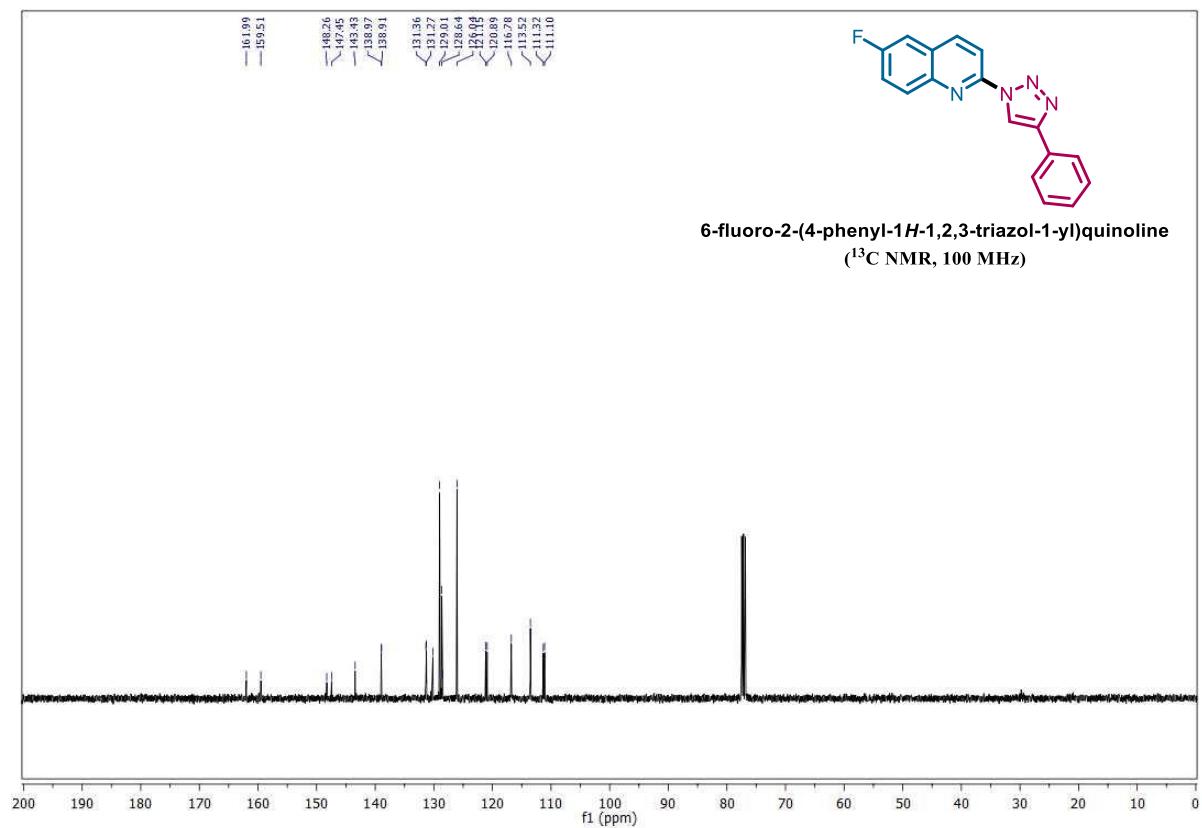
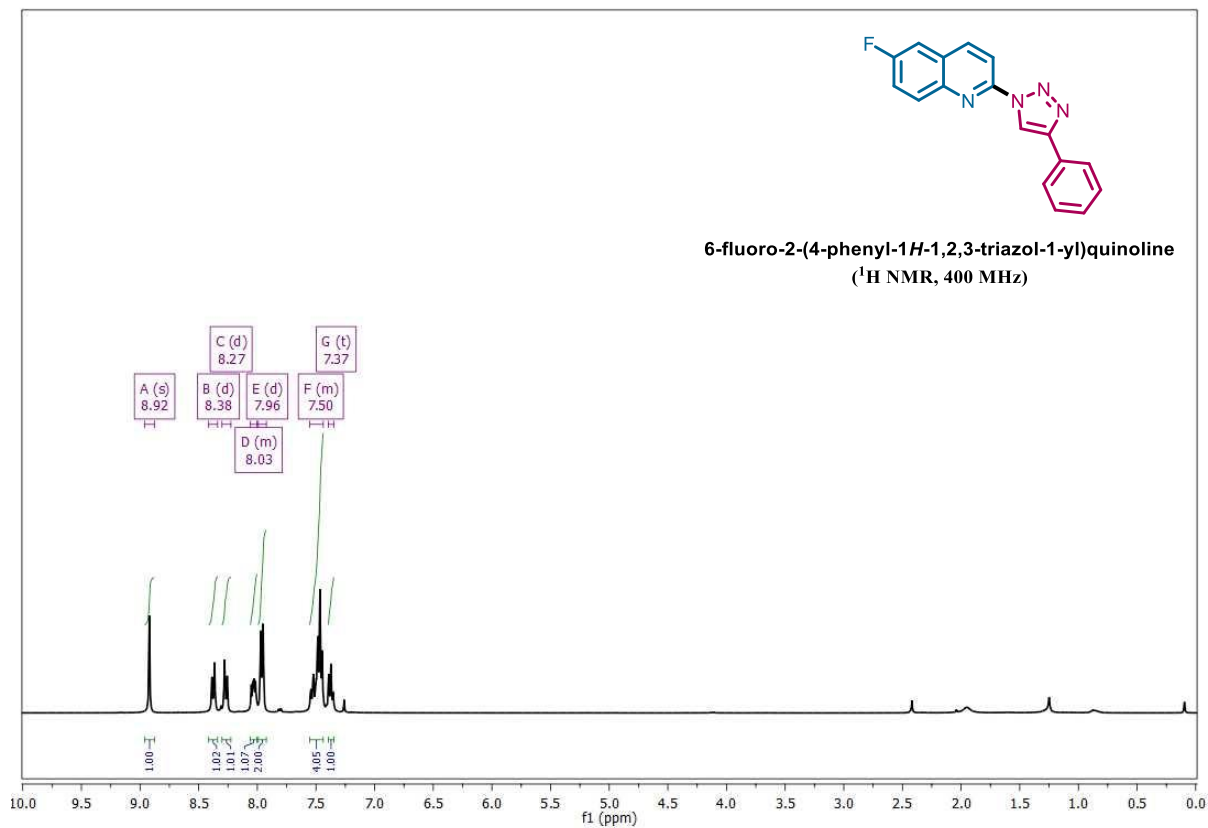
¹H and ¹³C NMR Spectra of 3aa



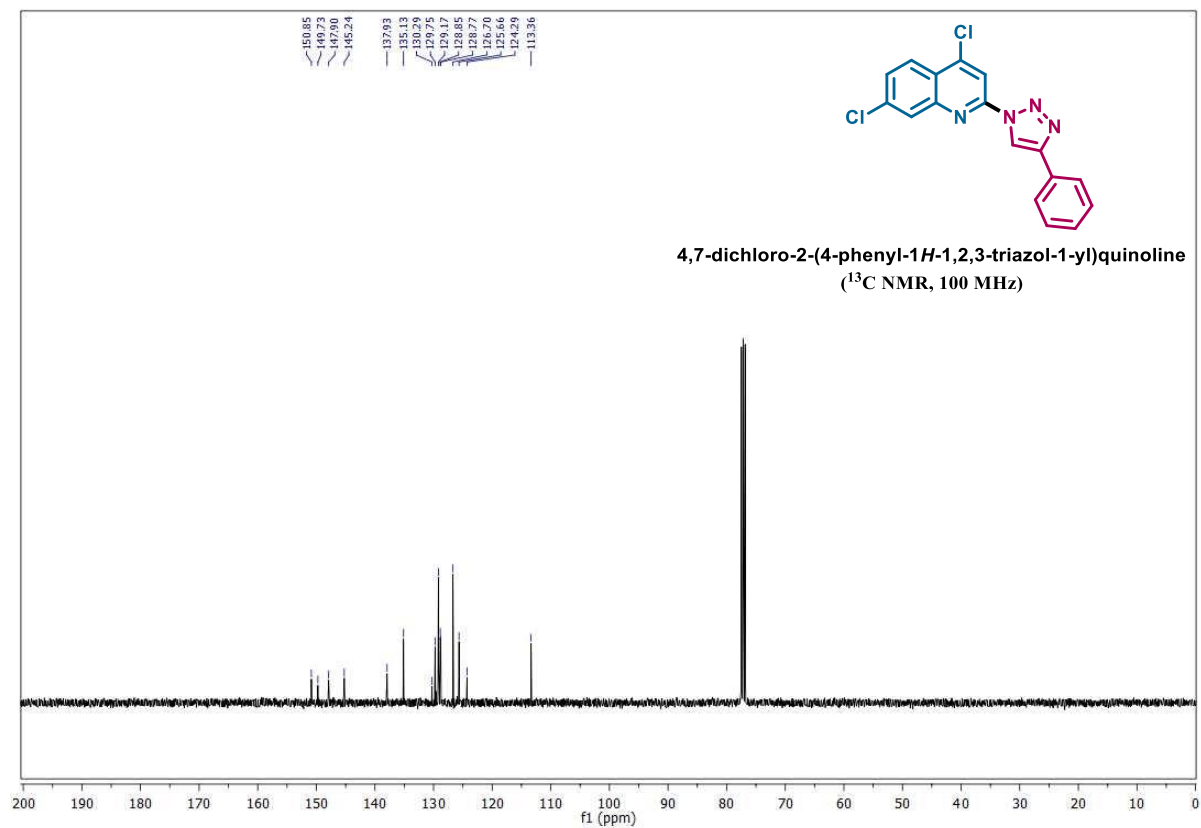
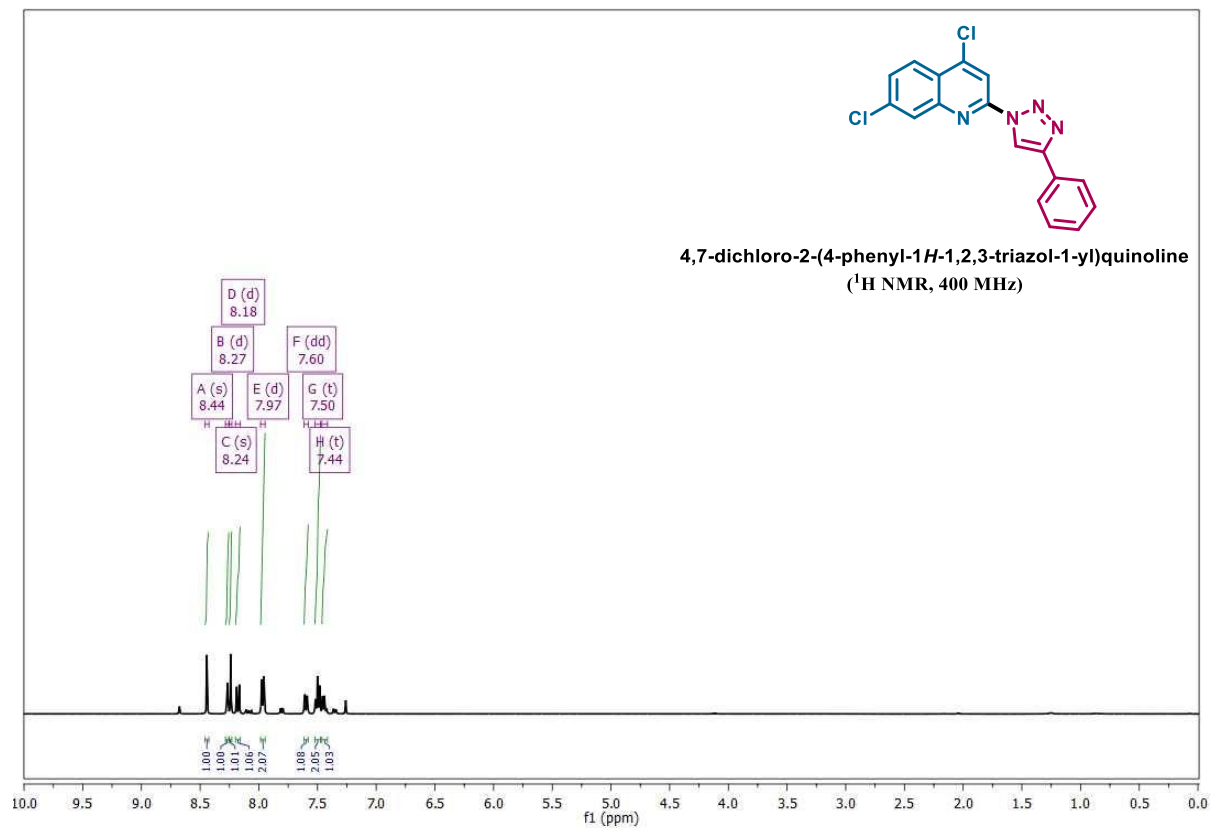
¹H and ¹³C NMR Spectra of 3ab



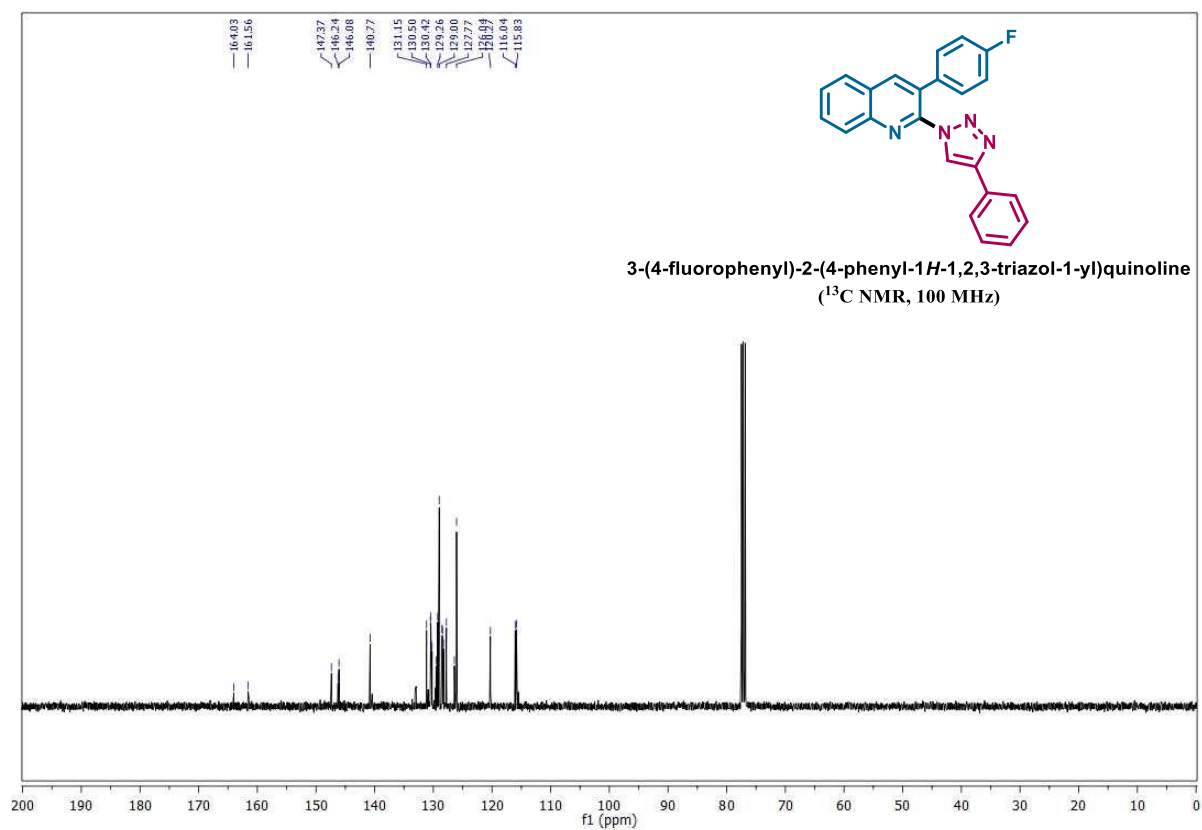
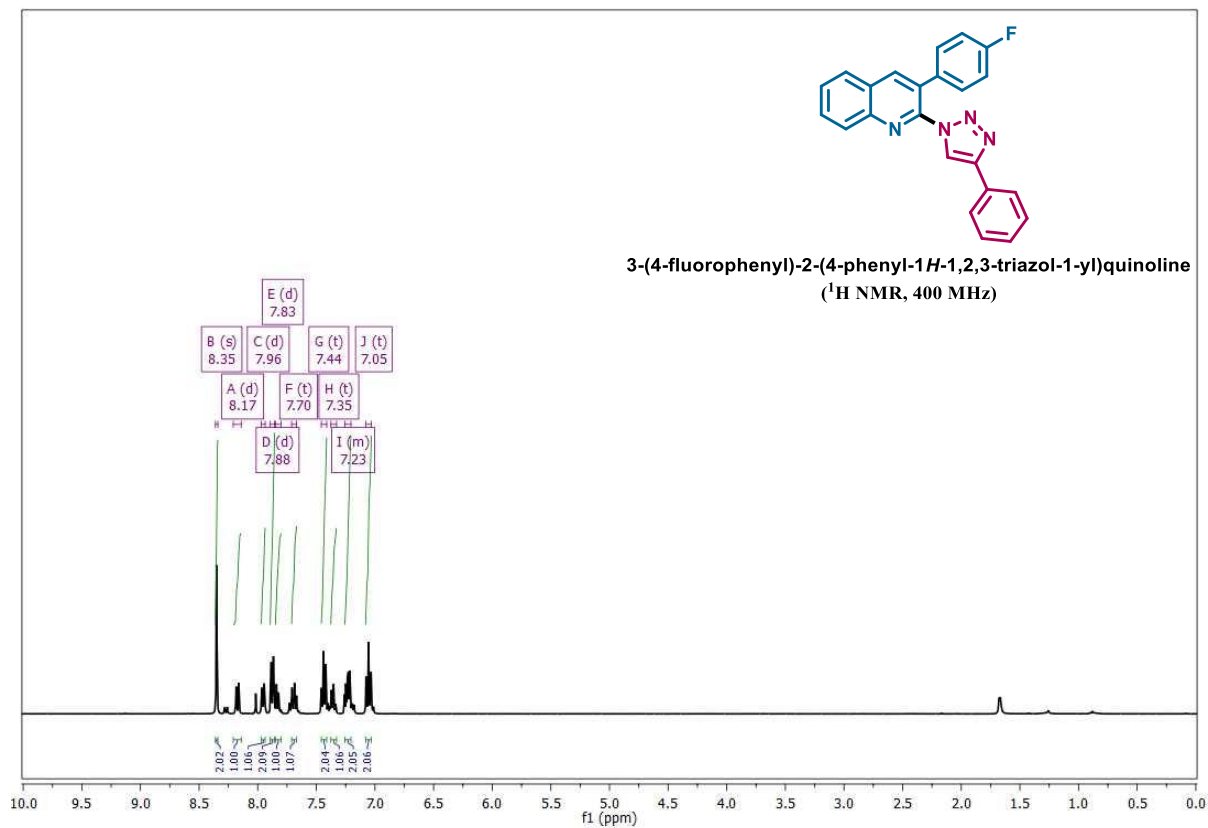
¹H and ¹³C NMR Spectra of 3ac



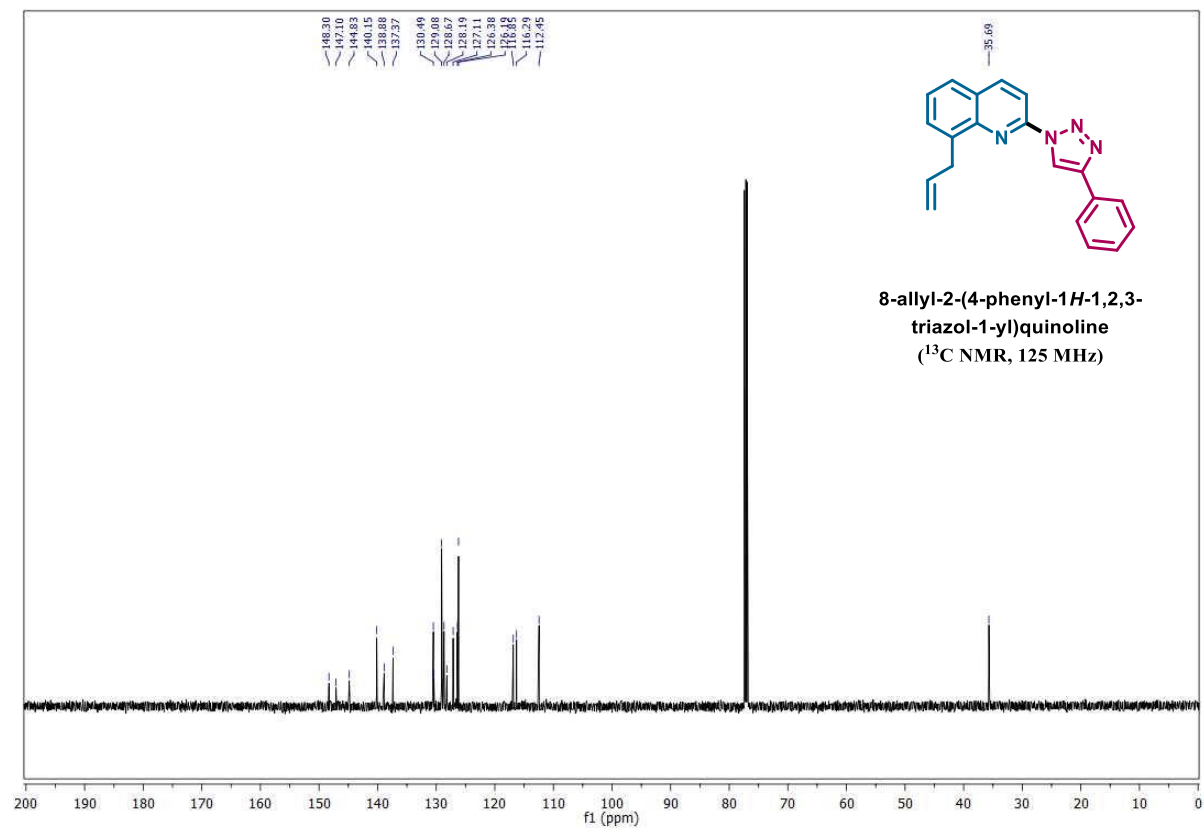
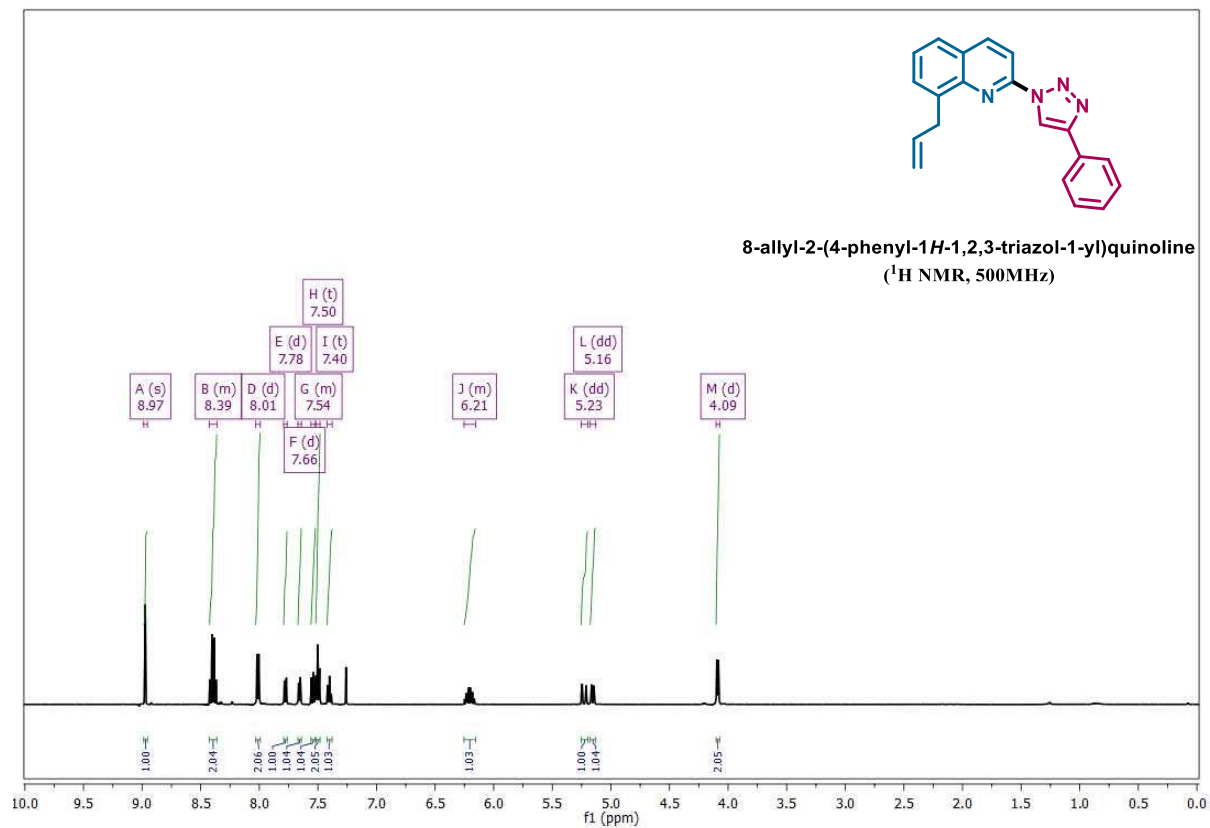
¹H and ¹³C NMR Spectra of 3ad



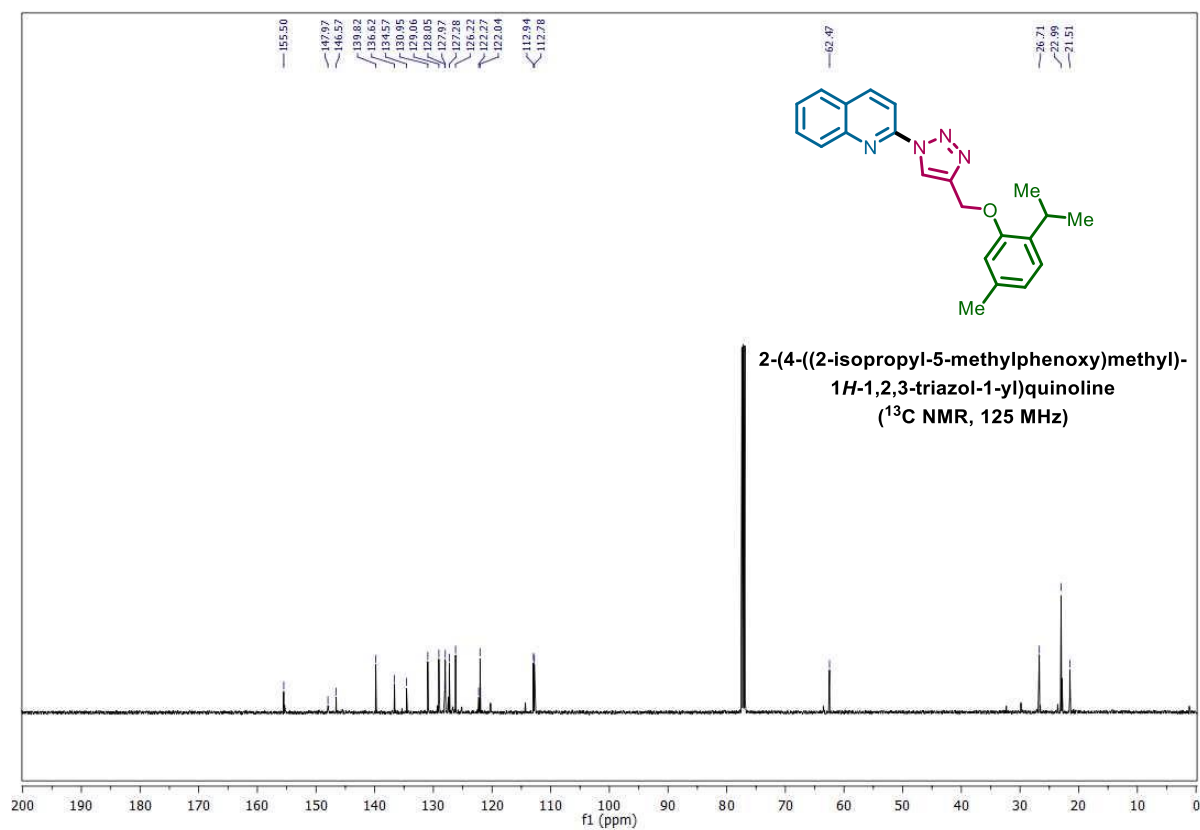
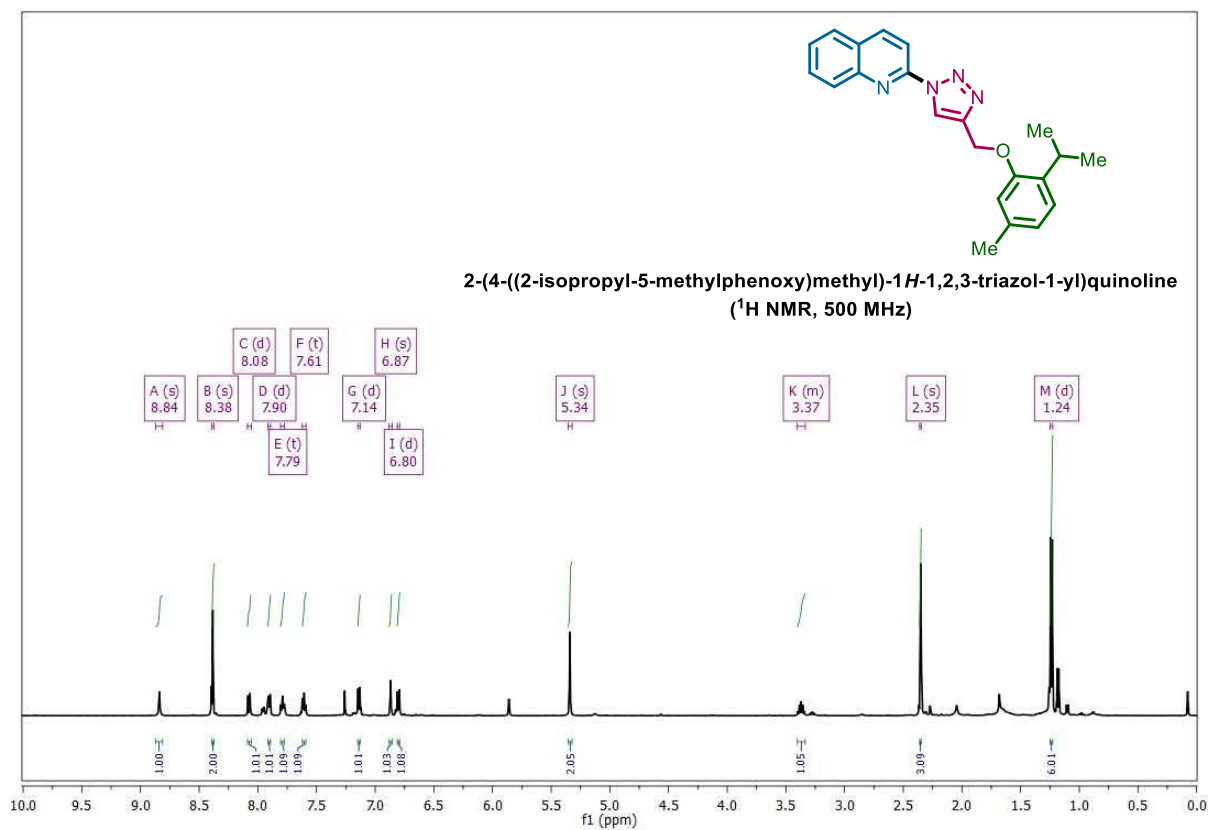
¹H and ¹³C NMR Spectra of 3ae



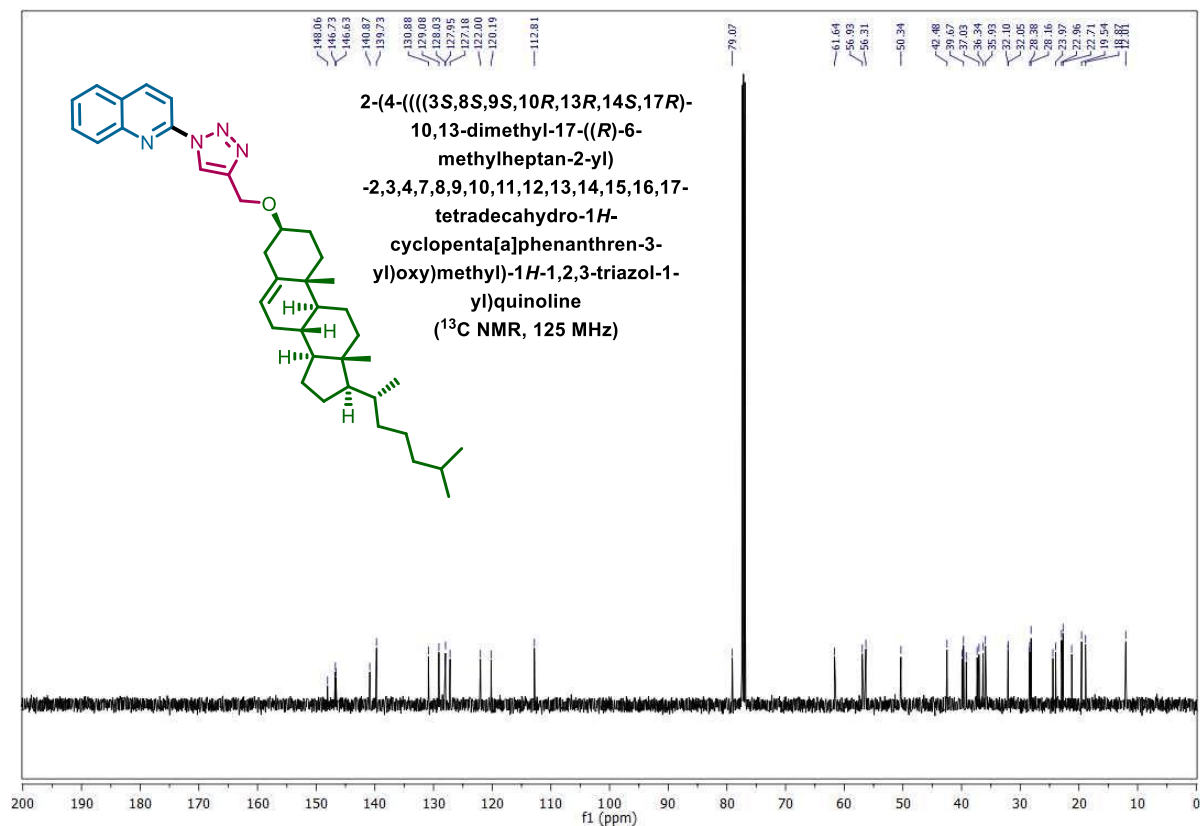
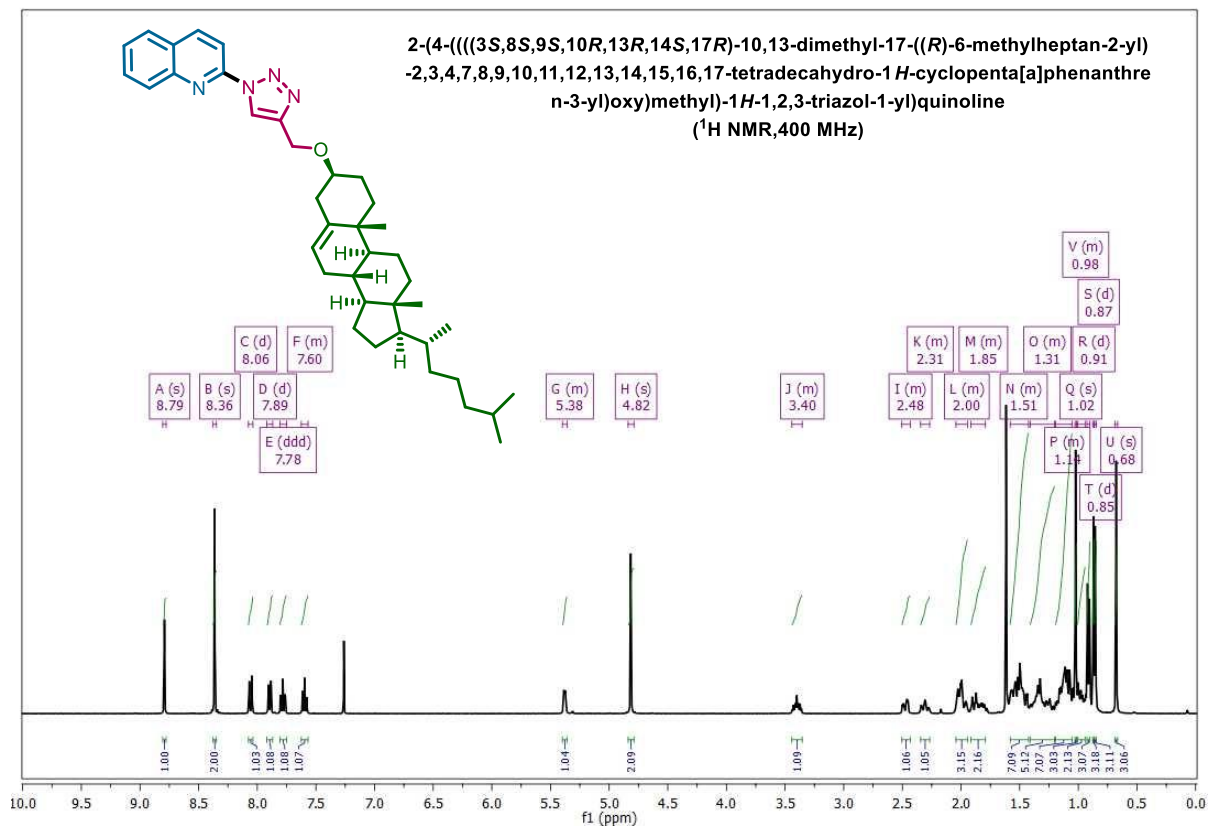
¹H and ¹³C NMR Spectra of 3af



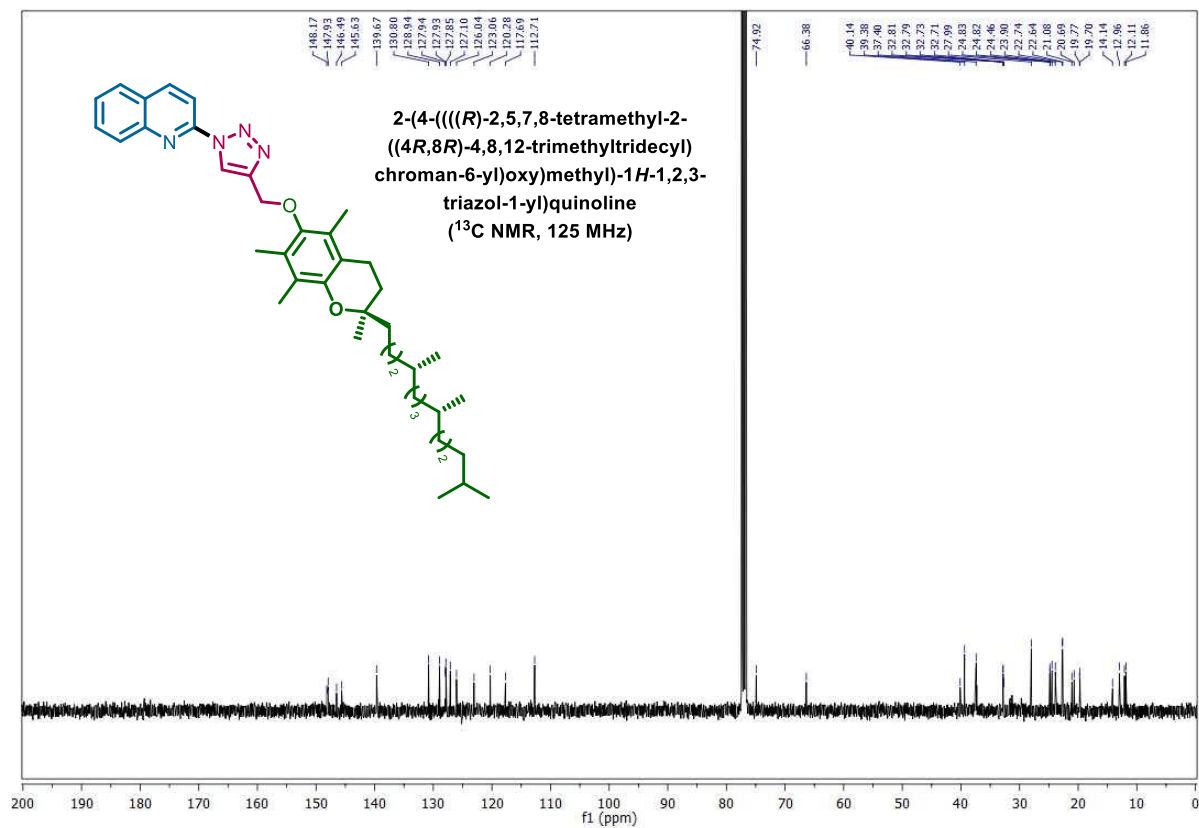
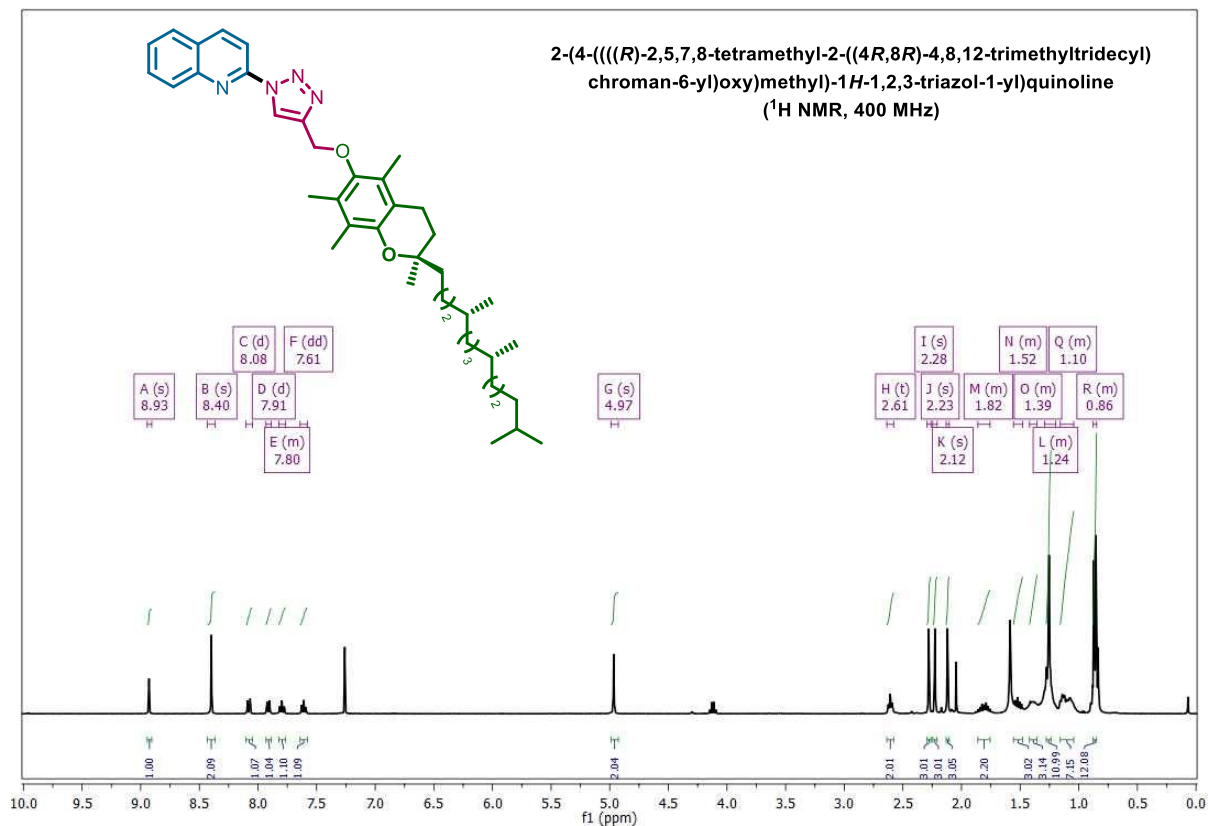
¹H and ¹³C NMR Spectra of 4a



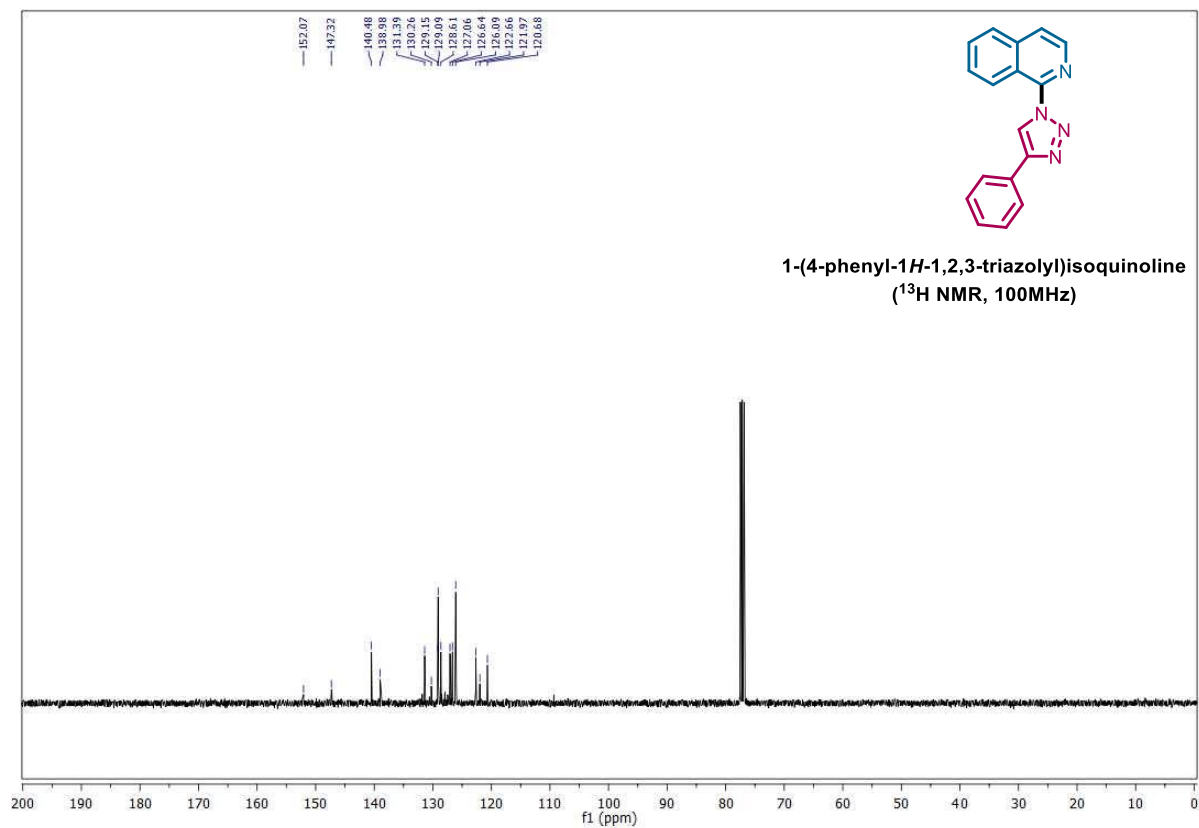
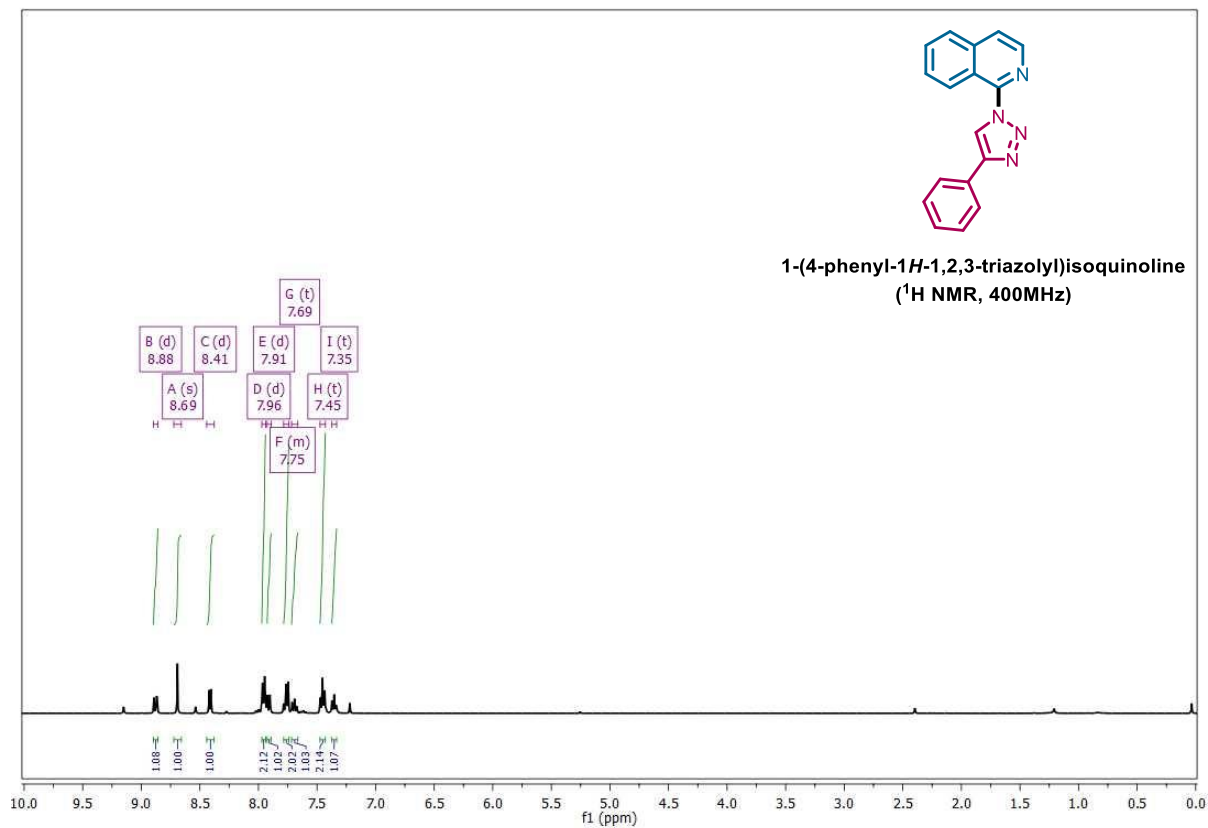
¹H and ¹³C NMR Spectra of 4b



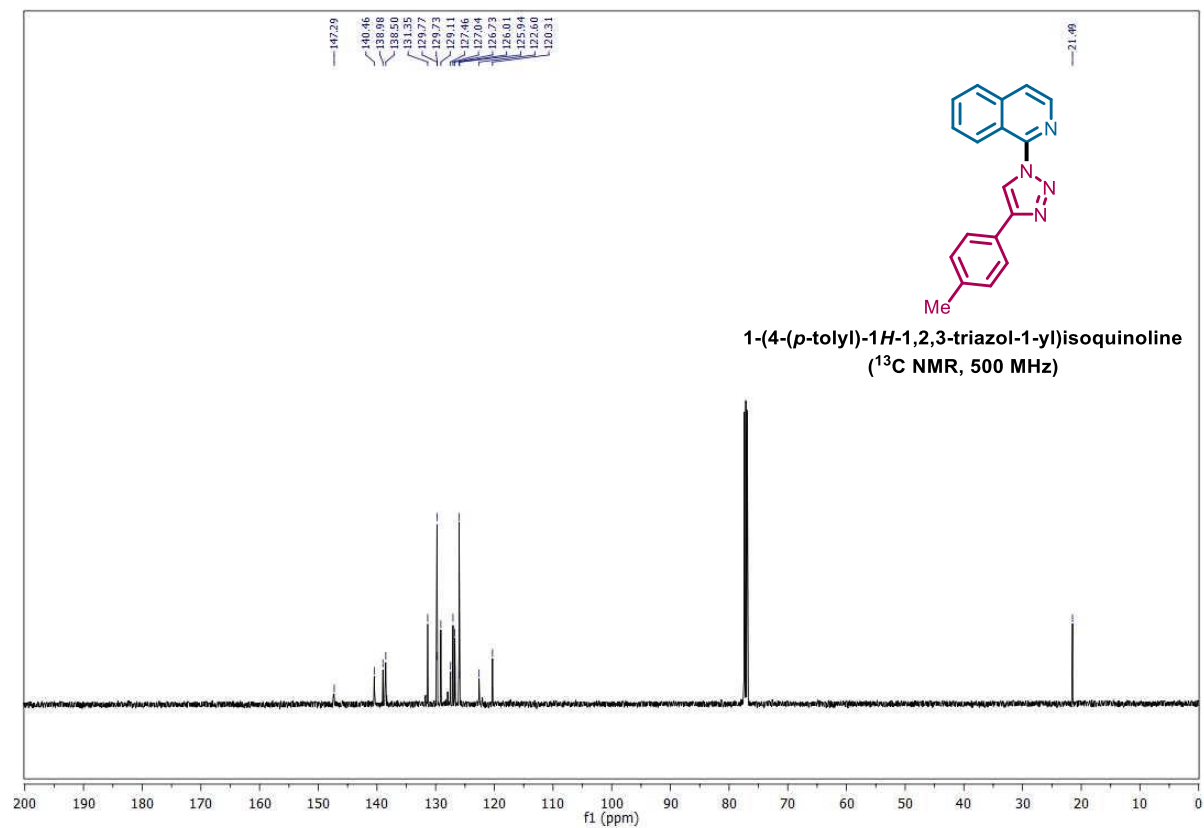
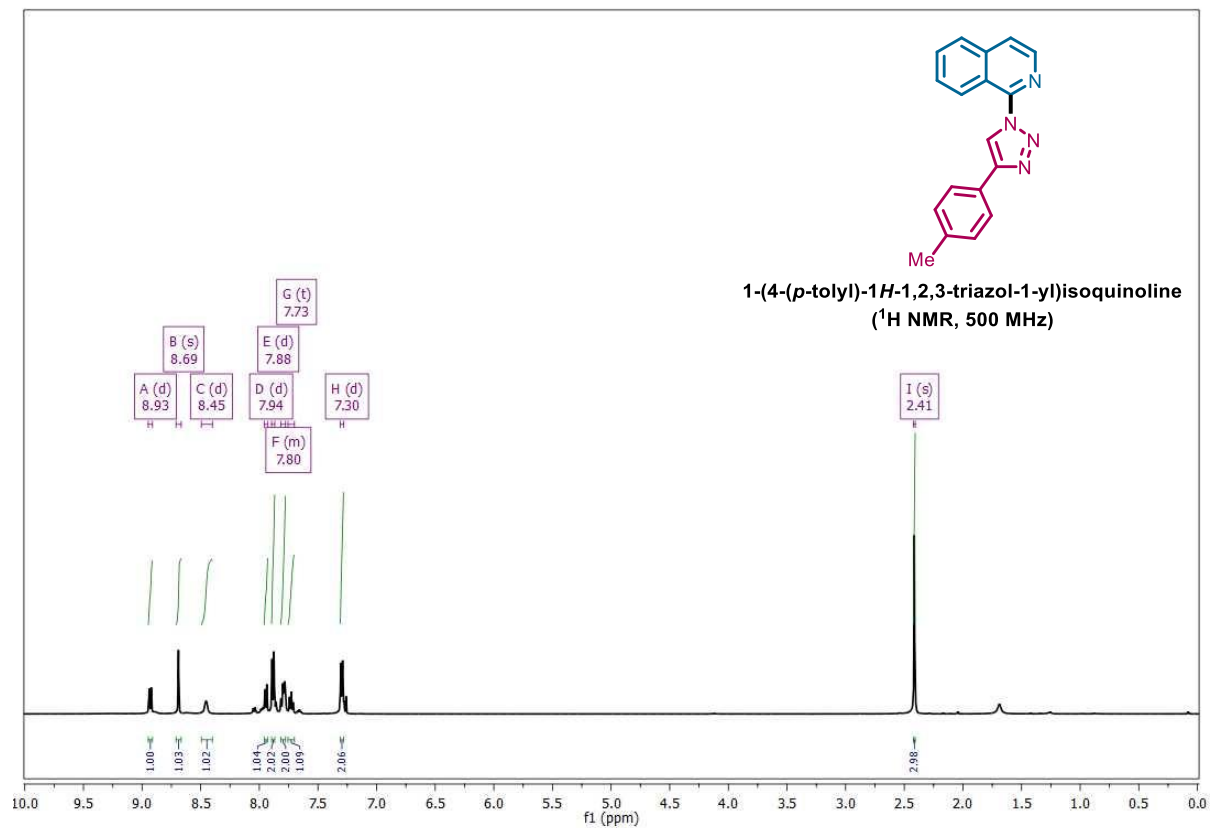
¹H and ¹³C NMR Spectra of 4c



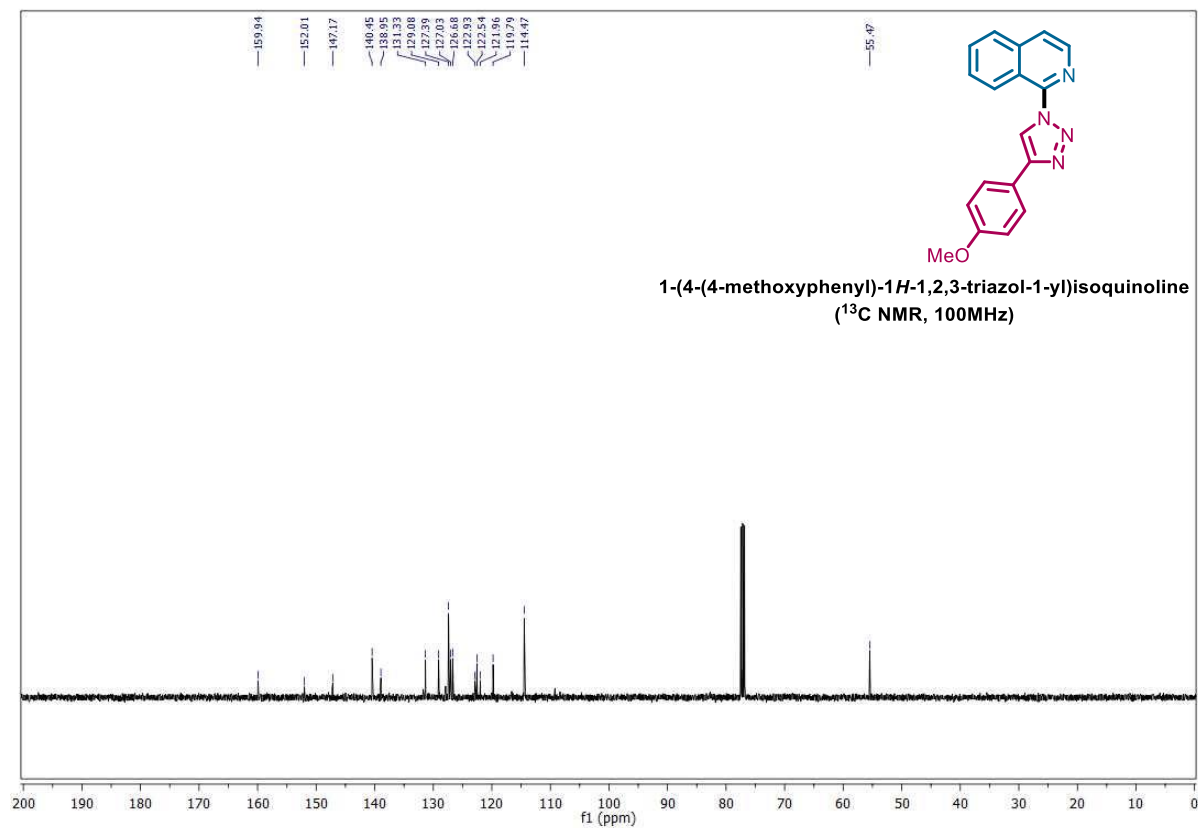
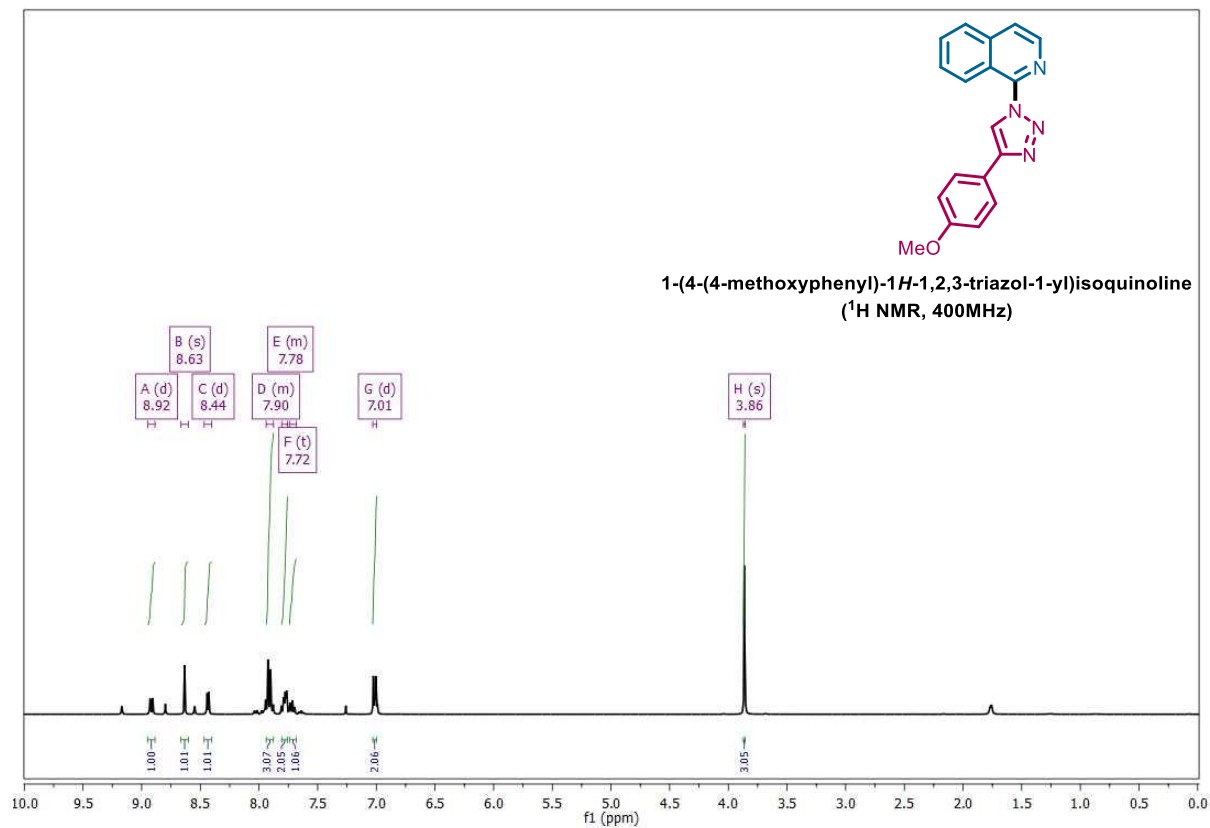
¹H and ¹³C NMR Spectra of 6a



¹H and ¹³C NMR Spectra of 6b



¹H and ¹³C NMR Spectra of 6c



¹H and ¹³C NMR Spectra of 6d

