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Supplementary Materials

Morpholine Radical in the Electrochemical Reaction with Quinoline *N*-Oxide

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General electrolysis procedure

The electrochemical cell equipped with a magnetic stir bar was loaded with 1.38 mmol quinoline N-oxide, 0.14 mmol copper acetate, 1.65 (or 4.14) mmol morpholine and 5 mmol K_3PO_4 in acetonitrile (20 ml) at 25°C under argon. The reaction mixture was stirred at room temperature. 2*F* electricity (the electrolysis time is 75 min), or 3*F* (115 min) or 4*F* (150 min) have been passed at 60 mA current (3 mA/cm^2 current density). At the end of electrolysis precipitation of $K_3PO_4$was filtered out, the reaction mixture was evaporated on rotary evaporator, was washed with chloroform. The residue after removal of chloroform was purified by passing through chromatographic column with silica gel (hexane-ethyl acetate eluent).

Table S1. Electrochemical cross-coupling products of morpholine and *N*-oxide, 60 mA.

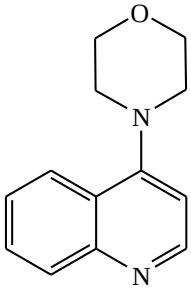
№	N-oxide	Ratio morpholine: N-oxide	Catalyst	Solvent	Base	Number of electrons (Faradays)	Product (yield, %)
1	quinoline *N*-oxide	1.2:1	$Cu(OAc)_2$	CH_3CN	-	2	**5** (54)
2	quinoline *N*-oxide	1.2:1	$Cu(OAc)_2$	CH_3CN	-	3	**6** (31)
3	quinoline *N*-oxide	2.4:1	$Cu(OAc)_2$	CH_3CN	-	4	**4** (48)
4	quinoline *N*-oxide	1.2:1	$Cu(OAc)_2$	CH_3CN	K_3PO_4	2	**5** (80)
5	quinoline *N*-oxide	1.2:1	$Cu(OAc)_2$	CH_3CN	K_3PO_4	3	**6** (67)
6	quinoline *N*-oxide	3:1	$Cu(OAc)_2$	CH_3CN	K_3PO_4	4	**4** (52)
7*	quinoline *N*-oxide	3:1	$Cu(OAc)_2$	CH_2Cl_2	K_3PO_4	4	**3** (64)
8	quinoline *N*-oxide	1.2:1	AgOAc	CH_3CN	-	2	**5** (32)
9	quinoline *N*-oxide	1.2:1	AgOAc	CH_3CN	-	3	**6** (24)
10	quinoline *N*-oxide	3:1	AgOAc	CH_3CN	-	4	**4** (46)
11	*iso*-quinoline *N*-oxide	1.2:1	$Cu(OAc)_2$	CH_3CN	-	3	**8** (62)
12	pyridine- *N*-oxide	1.2:1	$Cu(OAc)_2$	CH_3CN	-	3	not selectively
13	pyridine- *N*-oxide	1.2:1	$Cu(OAc)_2$	CH_2Cl_2	K_3PO_4	3	traces

14	phenylpyridine *N*-oxide	1.2:1	$Cu(OAc)_2$	CH_3CN	-	3	traces
15**	phenylpyridine *N*-oxide	1.2:1	$Cu(OAc)_2$	CH_3CN	K_3PO_4	3	**9** (14)

* additive of Et_4NBF_4 (0.02M) was used for better electroconductivity.

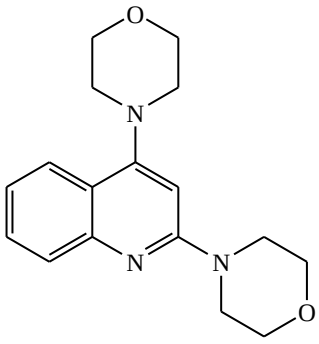
**by Spectrum ^1H NMR spectroscopy and mass-spectrum

4-(Quinolin-4-yl)morpholine (**3**) [1,2]



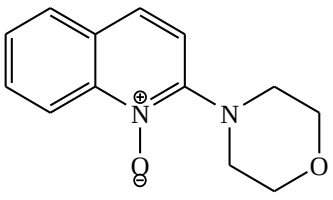
Yellow solid, m.p. 83–85 °C. Yield 0.19g (64%). ^{1}H NMR (399.9 MHz, $CDCl_3$): δ 8.71 (d, J = 8.8 Hz, 1H), 8.06 (d, J = 8.0 Hz, 1H), 7.85 (d, J = 8.1 Hz, 1H), 7.62 (t, J = 6.9 Hz, 1H), 7.45 (t, J = 7.1 Hz, 1H), 7.29 (d, J = 6.4 Hz, 1H), 4.04 (t, J = 4.7 Hz, 4H), 3.23 (t, J = 4.8 Hz, 4H). ^{13}C NMR (100.6 MHz, $CDCl_3$), δ ppm: 158.14 (C_i), 149.36 (CH), 141.95 (C_i), 130.95 (CH), 129.25 (CH), 128.63 (CH), 127.29 (C_i), 126.66 (CH), 118.09 (CH), 66.30 (CH_2), 53.85 (CH_2). MS (ESI), *m*/*z*: 215.1 $[M + 1]^+$. Anal. calc. (%): C 72.87; H 6.59; N 13.07. $C_{13}H_{14}N_2O$. Found (%): C 72.69; H 6.35; N 13.12.

4,4'-(Quinoline-2,4-diyl)dimorpholine (4) [3]



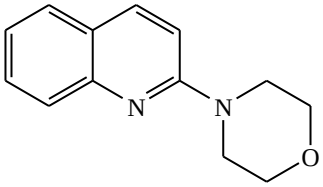
Yellow solid, m.p. 165–167 °C. Yield 0.21g (52%). ^{1}H NMR (399.9 MHz, $CDCl_3$): δ 8.28 (d, J = 7.5 Hz, 1H), 8.08 (m, 2H), 7.79 (d, J = 6.9 Hz, 1H), 7.55 (t, J = 7.1 Hz, 1H), 3.71 (t, J = 4.5 Hz, 4H), 3.67 (t, J = 4.8 Hz, 4H), 3.59 (t, J = 4.8 Hz, 4H), 3.40 (t, J = 4.85 Hz, 4H). ^{13}C NMR (100.6 MHz, $CDCl_3$), δ ppm: 159.22 (C_i), 152.74 (C_i), 141.32 (C_i), 129.83 (CH), 128.86 (CH), 128.77 (CH), 123.98 (C_i), 123.37 (CH), 109.47 (CH), 61.32. (CH_2), 61.07 (CH_2), 52.80 (CH_2), 52.74 (CH_2). MS (ESI), *m*/*z*: 300.2 $[M + 1]^+$. Anal. calc. (%): C 68.20; H 7.07; N 14.04. $C_{17}H_{21}N_3O_2$. Found (%): C 68.01; H 6.85; N 14.14.

2-Morpholinoquinoline 1-oxide (5) [4,5]



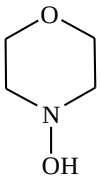
Yellow solid, m.p. 126–128 °C. Yield 0.25g (80%). ^{1}H NMR (399.9 MHz, $CDCl_3$): δ 8.82 (d, J = 8.6 Hz, 1H), 8.39 (d, J = 6.1 Hz, 1H), 7.95 (d, J = 8.1 Hz, 1H), 7.86–7.82 (m, 2H), 7.55 (t, J = 8.1 Hz, 1H), 3.92 (t, J = 4.7 Hz, 4H), 3.56 (t, J = 4.7 Hz, 4H). ^{13}C NMR (100.6 MHz, $CDCl_3$), δ ppm: 152.19 (C_i), 141.92 (C_i), 130.91 (CH), 129.21 (CH), 128.59 (CH), 126.63 (CH), 124.13 (C_i), 120.12 (CH), 118.51 (CH), 68.44 (CH_2), 46.85 (CH_2). MS (ESI), *m*/*z*: 231.1 $[M + 1]^+$. Anal. calc. (%): C 67.81; H 6.13; N 12.17; $C_{13}H_{14}N_2O_2$; Found (%): C 67.92; H 6.25; N 12.12.

2-Morpholinoquinoline (6) [6]



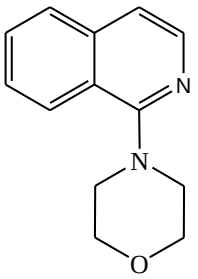
Pale yellow solid, m.p. 87–89 °C. Yield 0.19g (67%). ^{1}H NMR (399.9 MHz, $CDCl_3$): *δ* 8.18 (d, *J* = 8.68 Hz, 1H), 7.99 (d, *J* = 6.0 Hz, 1H), 7.75 (d, *J* = 6.0 Hz, 1H), 7.53 (t, *J* = 7.9 Hz, 1H), 7.40 (d, *J* = 8.0 Hz, 1H), 6.92 (d, *J* = 7.6 Hz, 1H), 3.86 (t, *J* = 4.6 Hz, 4H), 3.68 (t, J = 4.6 Hz, 4H). ^{13}C NMR (100.6 MHz, $CDCl_3$), δ ppm: 154.14 (C_i), 141.90 (C_i), 136.06 (CH), 129.19 (CH), 128.57 (CH), 124.11 (C_i), 121.41 (CH), 120.10 (CH), 110.24 (CH), 66.43 (CH_2), 45.56 (CH_2). MS (ESI), *m*/*z*: 215.3 $[M + 1]^+$. Anal. calc. (%): C 72.87; H 6.59; N 13.07; $C_{13}H_{14}N_2O$; Found (%): C 72.76; H 6.48; N 13.10.

Morpholin-4-ol (7) [7]



^{1}H NMR (399.9 MHz, $CDCl_3$): *δ* 8.08 (s, 1H), 3.70 (t, *J* = 4.7 Hz, 2H), 3.66 (t, *J* = 4.6 Hz, 2H), 3.58 (t, *J* = 4.6 Hz, 4H), 3.68 (t, J = 4.7 Hz, 4H). MS (ESI), *m*/*z*: 104.1 $[M + 1]^+$. Anal. calc. (%): C 46.59; H 8.80; N 13.58. $C_4H_9NO_2$; Found (%): C 46.77; H 8.49; N 13.45.

4-(Isoquinolin-1-yl)morpholine (8) [8]



White solid, m.p. 85–88 °C. Yield 0.18g (62%). ^{1}H NMR (399.9 MHz, $CDCl_3$): *δ* 8.22 (d, *J* = 8.4Hz, 1H), 8.14 (t, *J* = 6.1 Hz, 1H), 7.94–7.88 (m, 2H), 7.78 (t, *J* = 7.3 Hz, 1H), 7.49 (d, *J* = 6.6 Hz, 1H), 4.03 (m, 4H), 3.88 (m, 4H). ^{13}C NMR (100.6 MHz, $CDCl_3$), δ ppm: 159.69 (C_i), 139.69 (C_i), 137.38 (CH), 130.13 (CH), 127.30 (CH), 126.28 (CH), 125.09 (C_i), 122.74 (CH), 117.05 (CH), 68.01 (CH_2), 52.35 (CH_2). MS (ESI), *m*/*z*: 215.1 $[M + 1]^+$. Anal. calc. (%): C 72.87; H 6.59; N 13.07; $C_{13}H_{14}N_2O$; Found (%): C 72.69; H 6.42; N 13.15.

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Copies of ^{1}H, ^{13}C NMR Spectra for the Products

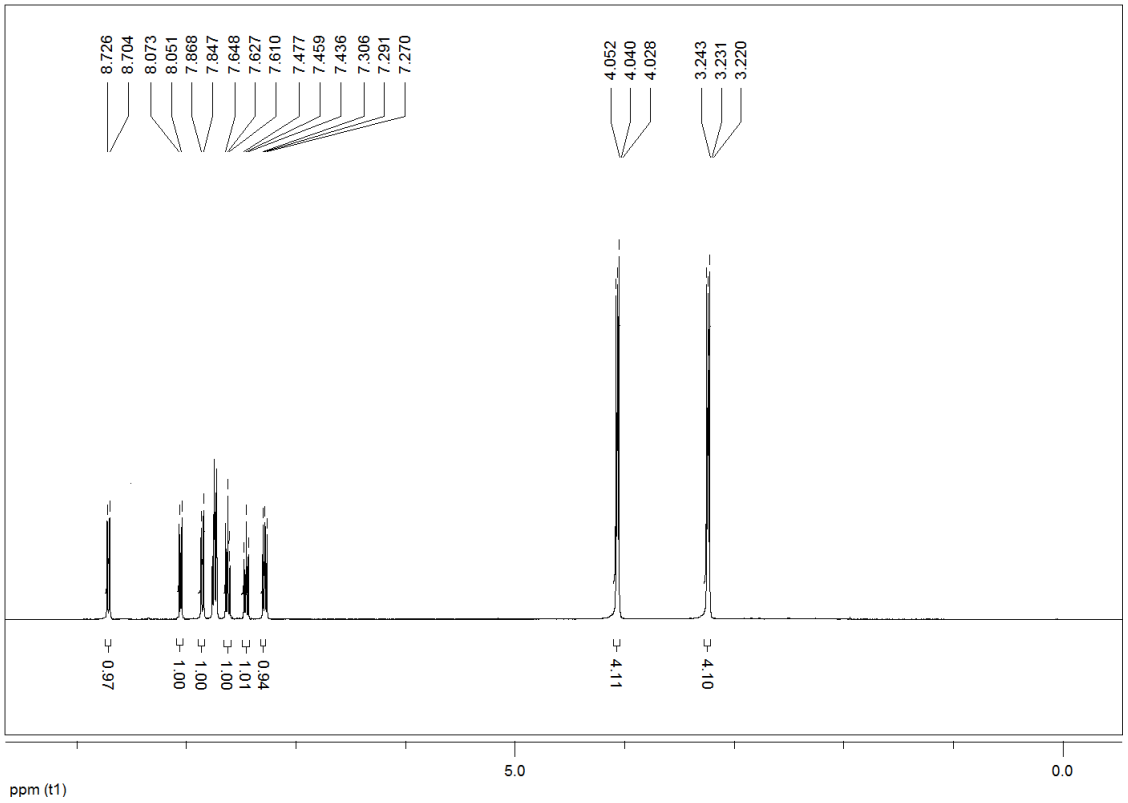

Figure S1. Spectrum ^{1}H NMR of 4-(Quinolin-4-yl)morpholine (**3**) in $CDCl_3$.

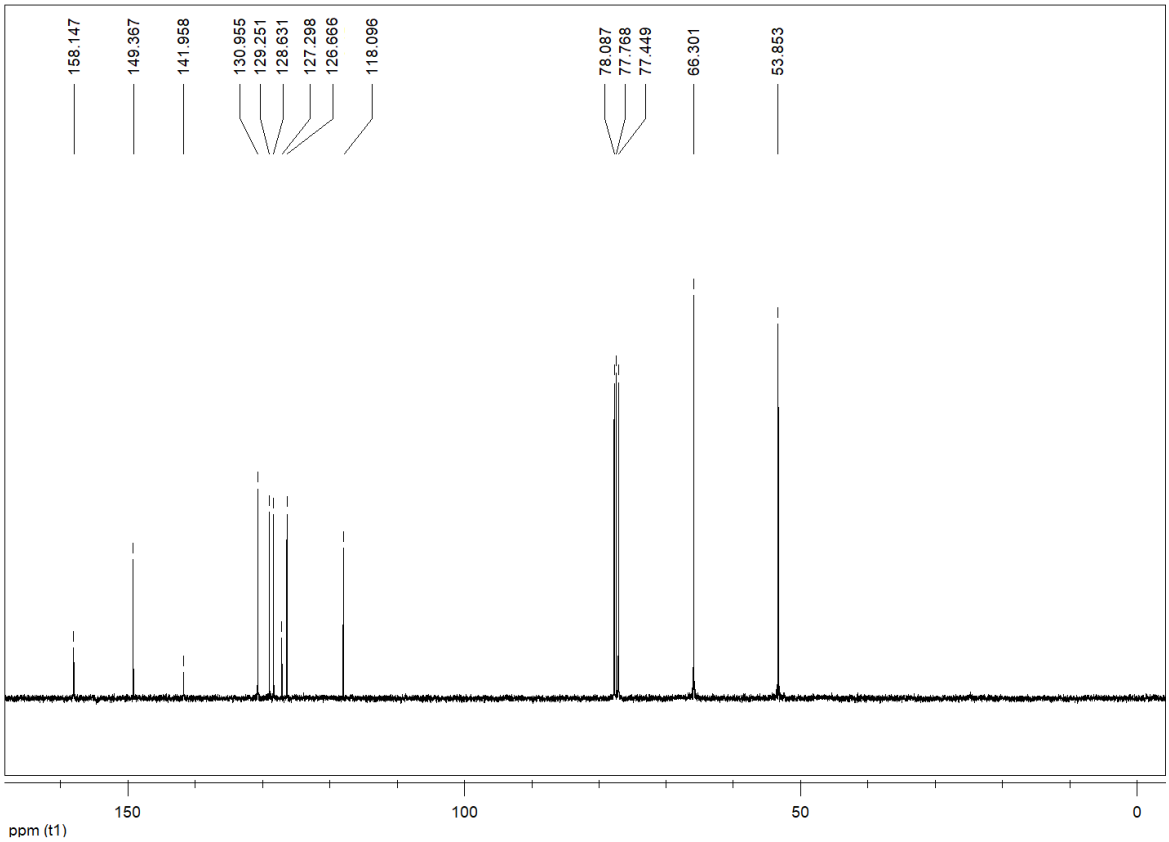

Figure S2. Spectrum ^{13}C NMR of 4-(Quinolin-4-yl)morpholine (**3**) in $CDCl_3$.

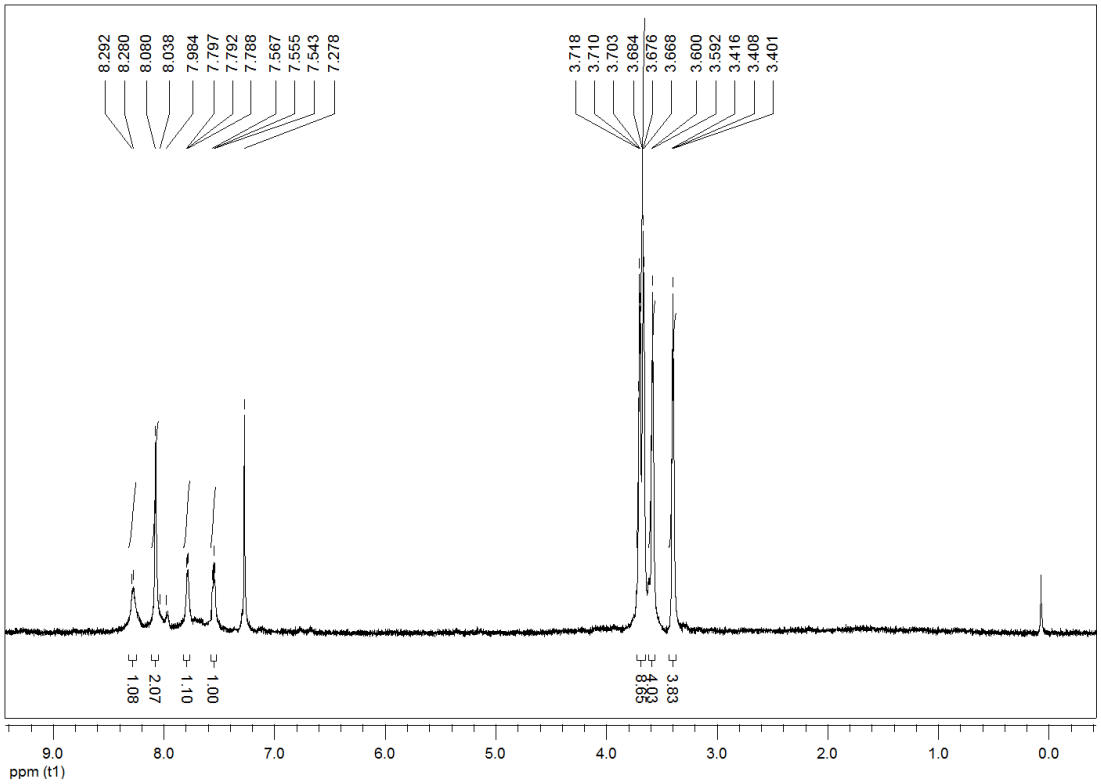

Figure S3. Spectrum ^{1}H NMR of 4,4'-(Quinoline-2,4-diyl)dimorpholine (**4**) in $CDCl_3$.

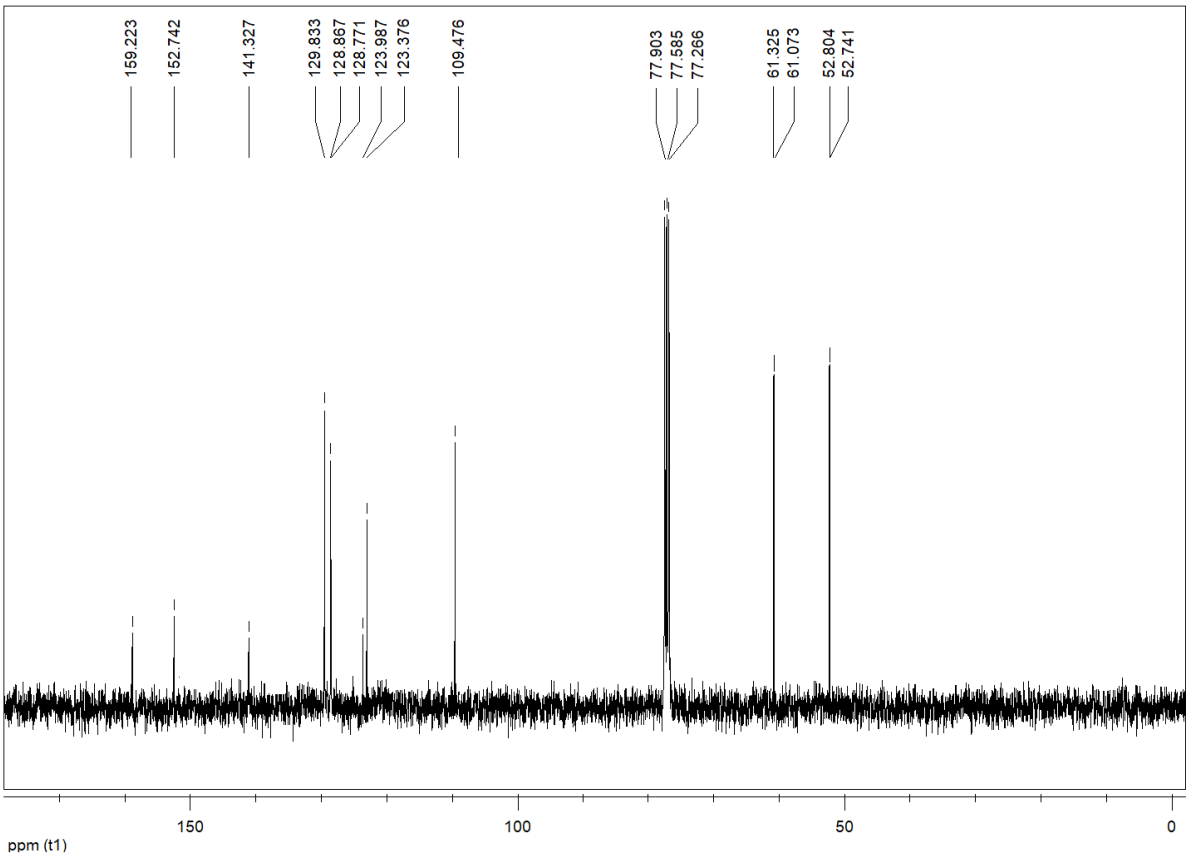

Figure S4. Spectrum ^{13}C NMR of 4,4'-(Quinoline-2,4-diyl)dimorpholine (**4**) in $CDCl_3$.

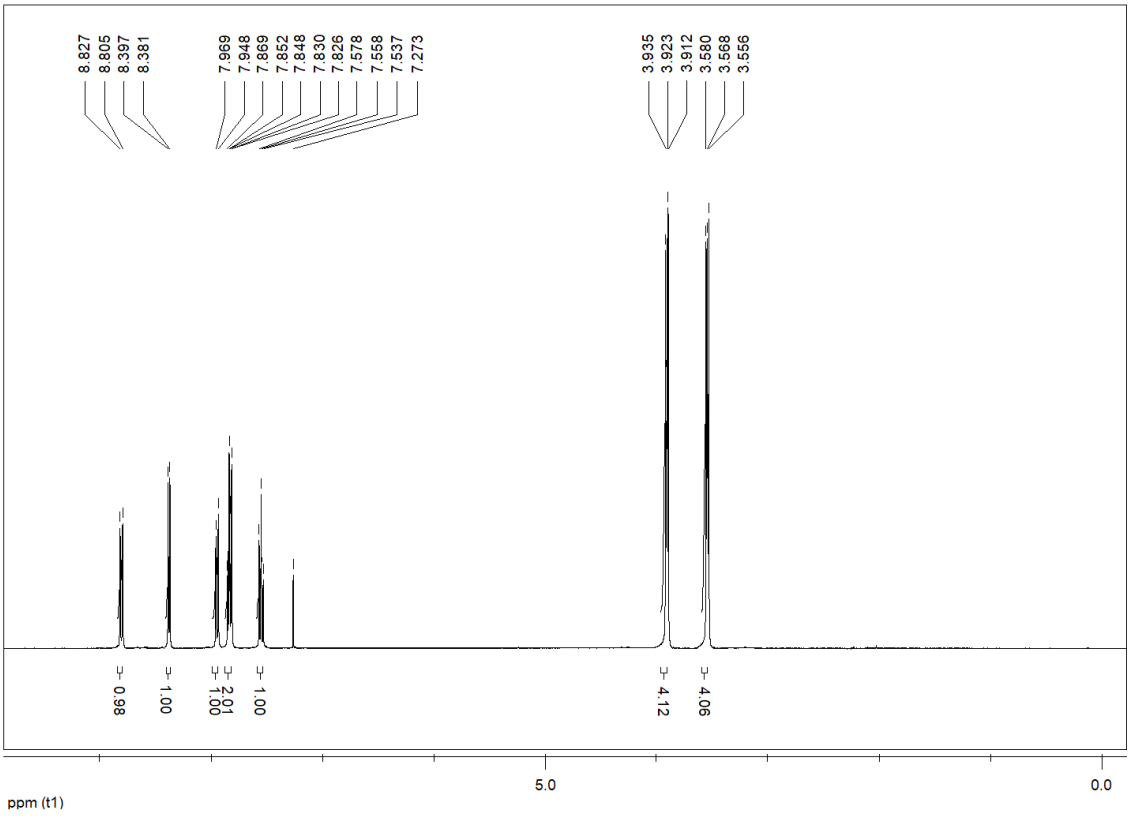

Figure S5. Spectrum ^{1}H NMR of 2-morpholinoquinoline 1-oxide (**5**) in $CDCl_3$.

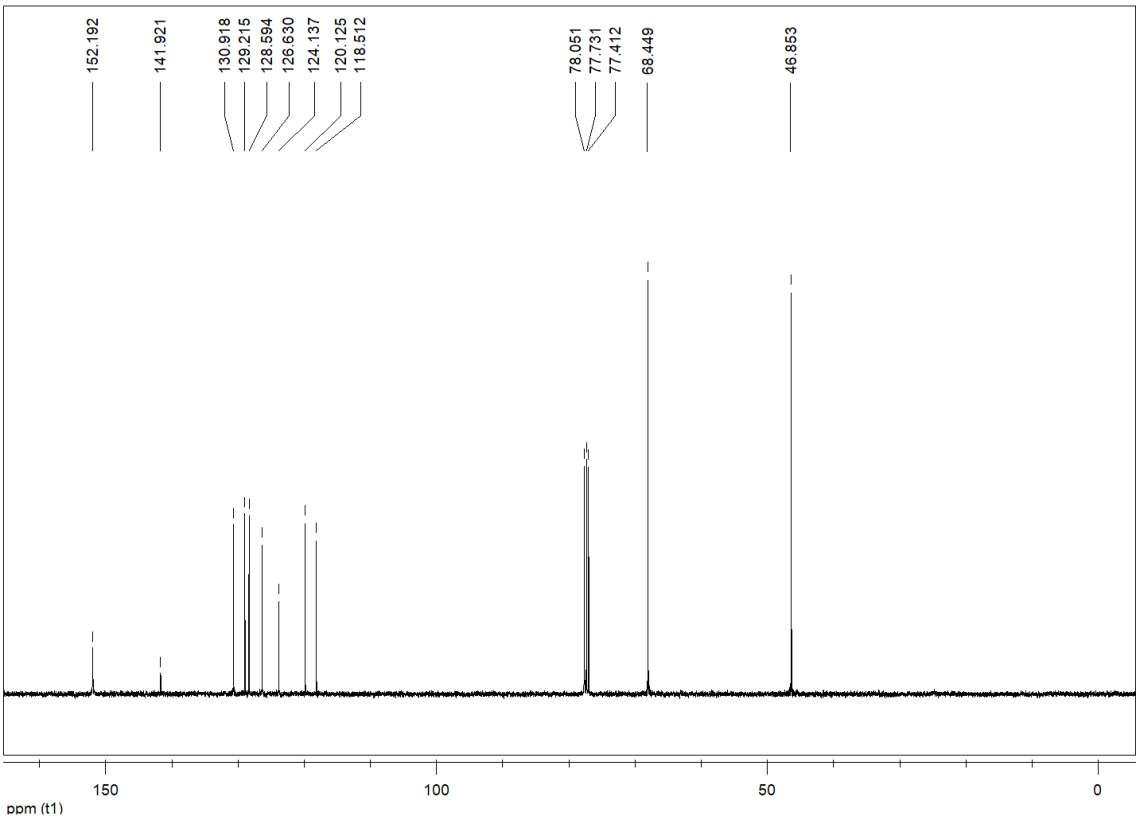

Figure S6. Spectrum ^{13}C NMR of 2- morpholinoquinoline 1-oxide (**5**) in $CDCl_3$.

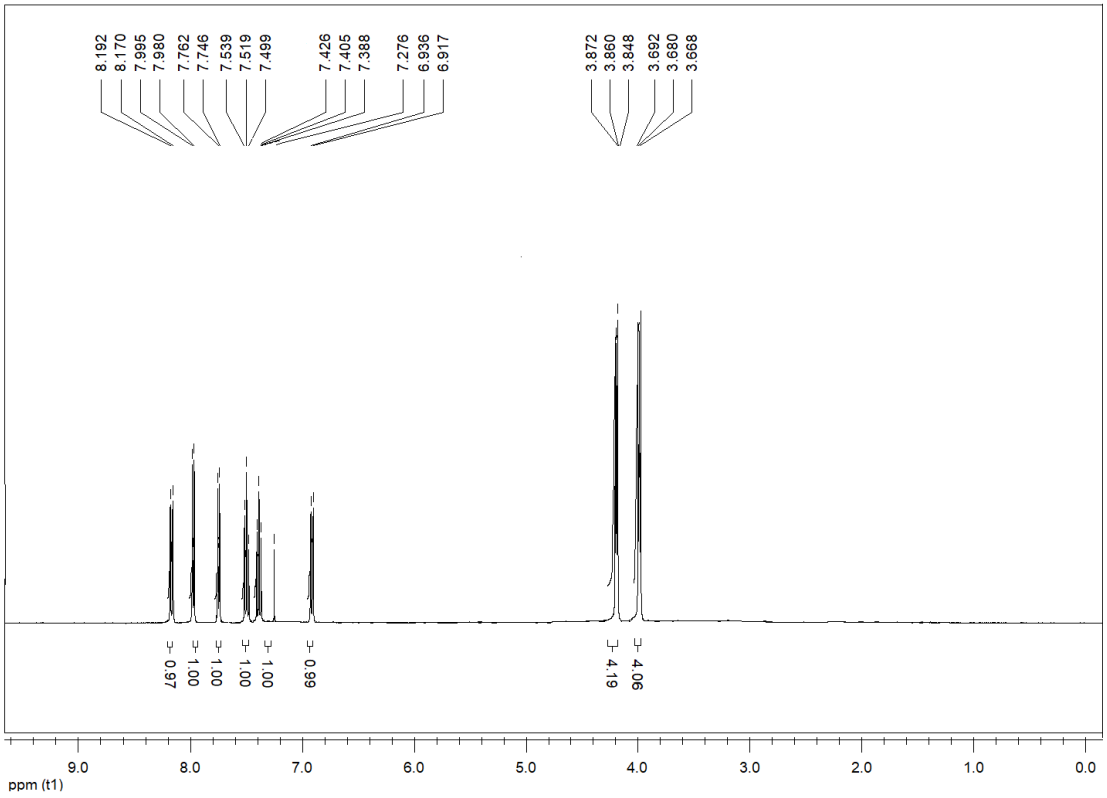

Figure S7. Spectrum ^{1}H NMR of 2-morpholinoquinoline (**6**) in $CDCl_3$.

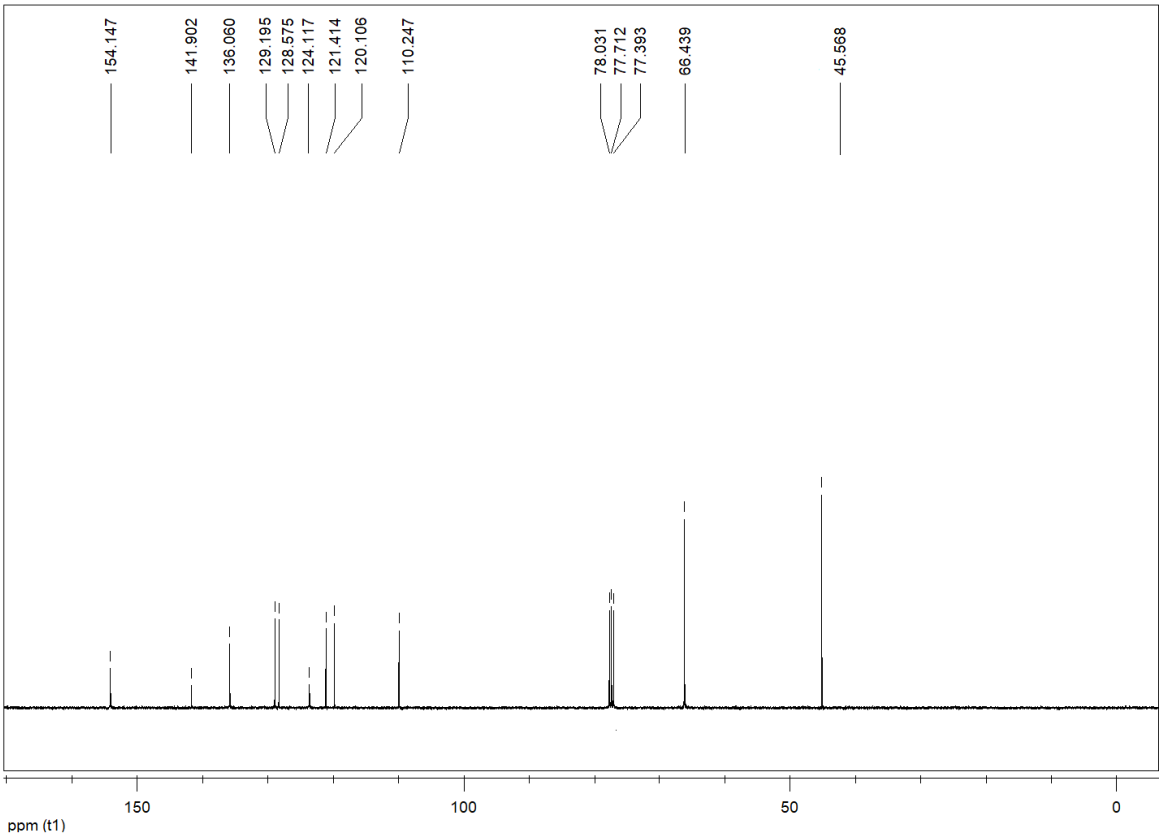

Figure S8. Spectrum ^{13}C NMR of 2-morpholinoquinoline (**6**) in $CDCl_3$.

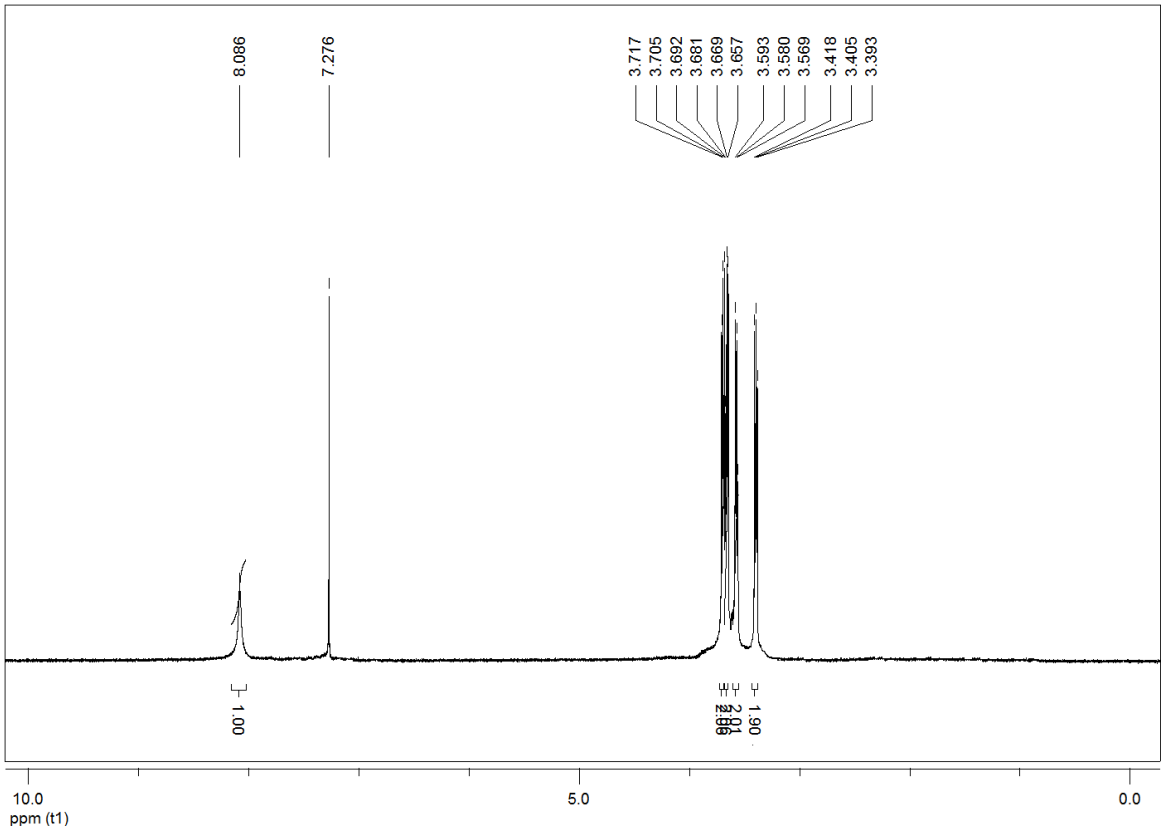

Figure S9. Spectrum ^{1}H NMR of morpholine-1-oxide (**7**) in $CDCl_3$.

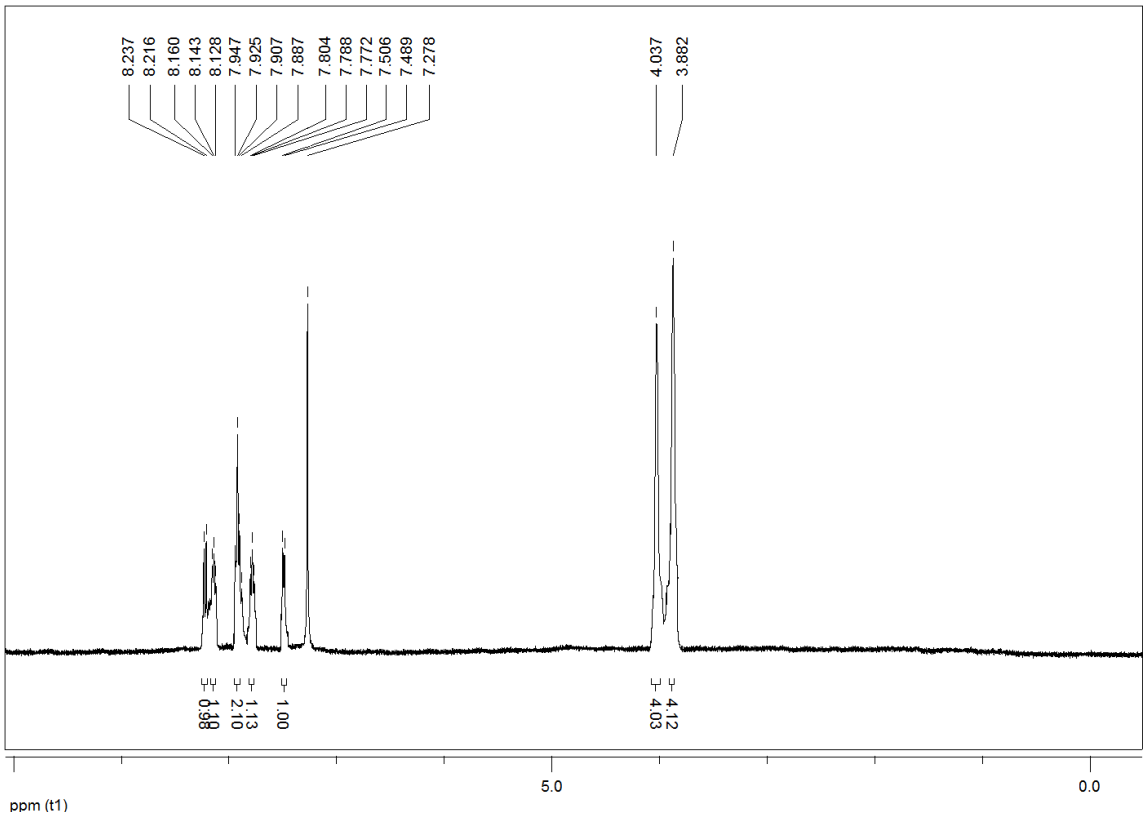

Figure S10. Spectrum ^{1}H NMR 4-(isoquinolin-1-yl)morpholine (**8**) in $CDCl_3$.

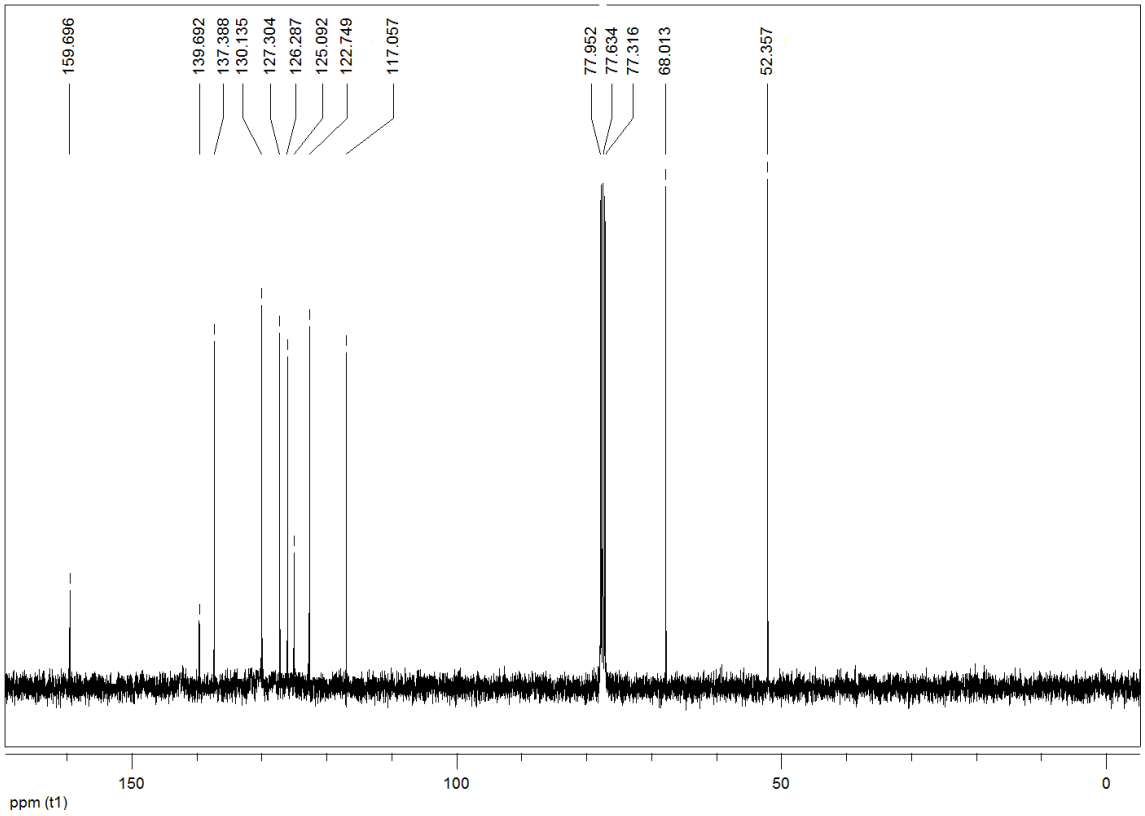

Figure S11. Spectrum ^{13}C NMR of 4-(isoquinolin-1-yl)morpholine (**8**) in $CDCl_3$.