## Supporting Information

# Visible-Light-Photocatalyzed C5-H Nitration of 8-Aminoquinoline Amides

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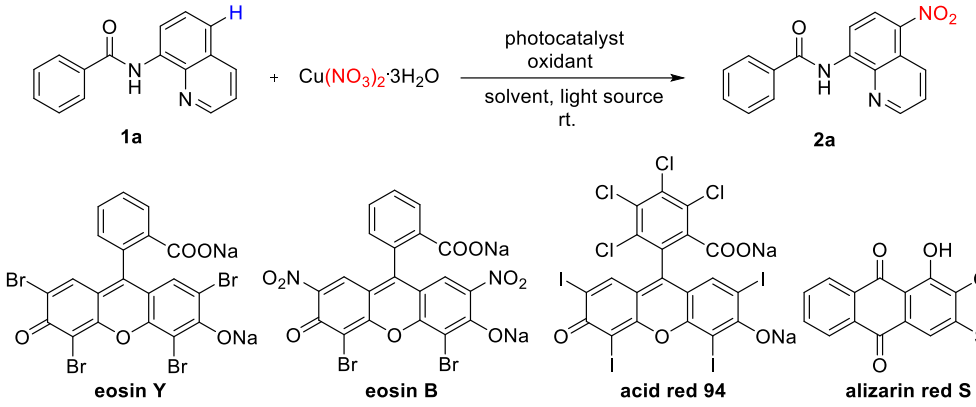
## 1. General Information

$^{1}H$ and $^{13}C$ NMR spectra were recorded on a Bruker DPX-400 spectrometer with $CDCl_3$ as the solvent and TMS as an internal standard. Melting points were measured using a WC-1 microscopic apparatus and are uncorrected. High-resolution mass spectra were obtained with MALDI-FTMS. All solvents were used directly without further purification. Dichloromethane, ethyl acetate, and hexane were used for column chromatography. The commercials were obtained from commercial sources and used as-received without further purification unless otherwise noted.

## 2. Optimization of Reaction Conditions

**Table S1.** Screening of reaction conditions[a]




| Entry. | Catalyst | Oxidant | Solvent | Yield (%)[b] |
|---|---|---|---|---|
| 1 | EosinB | $K_2S_2O_8$ | $CH_3CN$ | <5 |
| 2 | EosinB | $K_2S_2O_8$ | dioxane | <5 |
| 3 | EosinB | $K_2S_2O_8$ | DMF | <5 |
| 4 | EosinB | $K_2S_2O_8$ | toluene | <5 |
| 5 | EosinB | $K_2S_2O_8$ | acetone | <5 |
| 6 | EosinB | $K_2S_2O_8$ | THF | <5 |
| 7 | EosinB | $K_2S_2O_8$ | DCM | 56 |
| 8 | EosinB | $K_2S_2O_8$ | $CHCl_3$ | 49 |
| 9 | EosinB | $K_2S_2O_8$ | DCE | **68** |
| 10 | EosinB | $K_2S_2O_8$ | DMSO | <5 |
| 11 | EosinB | $Na_2S_2O_8$ | DCE | 61 |
| 12 | EosinB | $(NH_4)_2S_2O_8$ | DCE | 58 |
| 13 | EosinB | $PhI(OAc)_2$ | DCE | 36 |
| 14 | EosinB | TBHP | DCE | <5 |
| 15 | EosinY | $K_2S_2O_8$ | DCE | 65 |
| 16 | $Ru(bpy)_3Cl_2·6H_2O$ | $K_2S_2O_8$ | DCE | 76 |
| 17 | $Ru(bpy)_3(PF_6)_2$ | $K_2S_2O_8$ | DCE | 69 |
| 18 | $Ru(bpy)_3Cl_2$ | $K_2S_2O_8$ | DCE | 75 |
| 19 | Alizarin Red S | $K_2S_2O_8$ | DCE | 72 |
| 20 | **Acid Red 94** | **$K_2S_2O_8$** | **DCE** | **82** |
| 21[c] | Acid Red 94 | $K_2S_2O_8$ | DCE | 76 |
| 22[d] | Acid Red 94 | $K_2S_2O_8$ | DCE | 81 |
| 23[e] | Acid Red 94 | $K_2S_2O_8$ | DCE | 72 |
| 24[f] | Acid Red 94 | $K_2S_2O_8$ | DCE | 78 |
| 25[g] | Acid Red 94 | $K_2S_2O_8$ | DCE | 69 |
| 26[h] | Acid Red 94 | $K_2S_2O_8$ | DCE | 76 |

| | | | | |
|---|---|---|---|---|
| 27[i] | Acid Red 94 | $K_2S_2O_8$ | DCE | 68 |
| 28[j] | Acid Red 94 | $K_2S_2O_8$ | DCE | 73 |
| 29[k] | Acid Red 94 | $K_2S_2O_8$ | DCE | 66 |
| 30[l] | Acid Red 94 | $K_2S_2O_8$ | DCE | 62 |
| 31[m] | Acid Red 94 | $K_2S_2O_8$ | DCE | 43 |
| 32 | — | $K_2S_2O_8$ | DCE | 25 |
| 33[o] | Acid Red 94 | $K_2S_2O_8$ | DCE | 23 |

[a]reaction conditions: 1a (0.20 mmol), $Cu(NO_3)_2{\cdot}3H_2O$ (1.5 equiv), catalyst (5 mol %), oxidant (2.5 equiv), solvent (1.5 mL), and under household light at room temperature in air for 10 h; [b]isolated yield of **2a**. [c] $K_2S_2O_8$ (2 equiv); [d]$K_2S_2O_8$ (3 equiv); [e]$Cu(NO_3)_2{\cdot}3H_2O$ (1 equiv); [f]$Cu(NO_3)_2{\cdot}3H_2O$ (2 equiv); [g]catalyst (4 mol %); [h]under $N_2$; [i]under $O_2$; [j]for 8 h; [k]blue LED; [l]green LED; [m]red LED; and [o]in the dark.

### 3. Typical Procedure for Synthesizing the Products

(2a–2p, 2a′–2m′): To a 10 mL reaction tube, a mixture of amide (0.2 mmol), $Cu(NO_3)_2.3H_2O$ (0.3 mmol, 1.5 equiv), Acid Red 94 (0.01 mmol, 5 mol %), and $K_2S_2O_8$ (0.5 mmol, 2.5 equiv) was added in DCE (1.5 mL). The resulting mixture was stirred under the irradiation of 26 W household light under air at room temperature for 10 h. Upon completion, the mixture was filtered through a celite pad and washed with $CH_2Cl_2$, the solvent was removed under reduced pressure and then followed by recrystallization to produce the corresponding product using hexane–$CH_2Cl_2$ as a solvent.

(2q, 2r, and 2n′): To a 10 mL reaction tube, a mixture of amide (0.2 mmol), $Cu(NO_3)_2.3H_2O$ (0.3 mmol, 1.5 equiv), Acid Red 94 (0.01 mmol, 5 mol %), $K_2S_2O_8$ (0.5 mmol, 2.5 equiv), and DCE (1.5 mL) was added. Upon completion, the solvent was removed under reduced pressure, and the residue was purified by silica gel column chromatography to produce the corresponding product.

**Spectral Data of Product 2** *N-(5-nitroquinolin-8-yl)benzamide* (***2a***) [1]. Yellow solid in 82% yield; mp 215-216 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 11.07 (s, 1H), 9.30 (d, *J* = 8.6 Hz, 1H), 9.00 (d, *J* = 8.8 Hz, 1H), 8.95 (d, *J*= 3.3 Hz, 1H), 8.59 (d, *J* = 8.8 Hz, 1H), 8.08 (d, *J* = 7.28 Hz, 2H), 7.75 (dd, *J* = 8.8, 4.1 Hz, 1H), 7.66-7.63 (m, 1H), 7.60-7.56 (m, 2H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 165.7, 149.1, 140.9, 138.7, 137.8, 134.1, 133.4, 132.7,129.0, 127.9, 127.5, 124.7, 121.8, 113.7.

*2-methyl-N-(5-nitroquinolin-8-yl)benzamide* (***2b***) [1]. Yellow solid in 79% yield; mp 192-193 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 10.58 (s, 1H), 9.30 (d, *J* = 8.8 Hz, 1H), 9.01 (d, *J* =8.8 Hz, 1H), 8.88 (d, *J*= 2.8 Hz, 1H), 8.61 (d, *J*= 8.8 Hz, 1H), 7.74-7.69 (m, 2H), 7.74-7.69 (m, 1H), 7.38-7.34 (m, 2H), 2.62 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 168.3, 149.1, 141.0, 138.8, 137.6, 137.3, 135.5, 133.4, 131.7, 131.1, 127.9, 127.3 126.2, 124.7, 121.8, 113.7, 20.3.

*3-methyl-N-(5-nitroquinolin-8-yl)benzamide* (***2c***). Yellow solid in 82% yield; mp 201-202 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 11.04 (s, 1H), 9.30 (d, *J* = 8.5 Hz, 1H), 9.01 (d, *J* = 8.9 Hz, 1H), 8.96 (d, *J* = 2.8 Hz, 1H), 8.60 (d, *J* = 8.8Hz, 1H), 7.88 (d, *J* = 11.9 Hz, 2H), 7.75 (dd, *J* = 9.1, 4.1 Hz, 1H), 7.49-7.45 (m, 2H), 2.49 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 165.94, 149.1, 141.0, 139.0, 138.6, 137.8, 134.2, 133.4, 128.9, 128.2, 127.9, 124.7, 124.4, 121.8, 113.7, 21.5; HRMS (ESI): calculated for $C_{17}H_{13}N_3O_3$: $[M+H]^+$ requires 308.1030; found 308.1031.

*4-methyl-N-(5-nitroquinolin-8-yl)benzamide* (***2d***) [2]. Yellow solid in 80% yield; mp 210-211 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 11.05 (s, 1H), 9.31 (d, *J* = 8.7 Hz, 1H), 9.02 (d, *J* = 8.8 Hz, 1H), 8.96 (d, *J* = 3.4 Hz, 1H), 8.61 (d, *J* = 8.8 Hz, 1H), 7.99 (d, *J* = 7.8 Hz, 2H), 7.74 (dd, *J* = 8.9, 4.1 Hz, 1H), 7.38 (d, *J* = 7.9 Hz, 2H), 2.48 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 165.7, 149.0, 143.4, 141.0, 138.6, 137.8, 133.5, 131.4, 129.7, 128.0, 127.5, 124.7, 121.9, 113.7, 21.6; HRMS (ESI): calculated for $C_{17}H_{13}N_3O_3$: $[M+H]^+$ requires 308.1030; found 308.1033.

*2-methoxy-N-(5-nitroquinolin-8-yl)benzamide* (***2e***). Yellow solid in 75% yield; mp 208-209 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 12.68 (s, 1H), 9.26 (d, *J* = 7.9 Hz, 1H), 9.06 (d, *J* = 8.9 Hz, 1H), 8.93 (d, *J* = 2.8 Hz, 1H), 8.56 (d, *J* = 8.8Hz, 1H), 8.31 (d, *J* = 6.7, 1H), 7.69 (dd, *J* = 8.8, 4.1 Hz, 1H), 7.57-7.54 (m, 1H), 7.17-7.14 (m, 1H), 7.08 (d, J= 8.2 Hz, 1H), 4.20 (s, 3H); $^{13}$C

NMR (100 MHz, $CDCl_3$) $\delta$ 164.2, 157.9, 148.9, 142.2, 138.4, 138.2, 134.0, 133.1, 132.6, 128.1, 124.4, 121.9, 121.5, 121.4, 114.4, 111.7, 56.2; HRMS (ESI): calculated for $C_{17}H_{13}N_3O_4$: $[M+H]^+$ requires 324.0979; found 324.0977.

*4-methoxy-N-(5-nitroquinolin-8-yl)benzamide* (***2f***) [3]. Yellow solid in 78% yield; mp 260-261 °C; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ 11.03 (s, 1H), 9.34 (d, *J* = 8.6 Hz, 1H), 9.01 (d, *J*= 8.9 Hz, 1H), 8.96 (d, J= 3.6 Hz, 1H), 8.63 (d, *J* = 8.9 Hz, 1H), 8.07 (d, *J*= 8.7 Hz, 2H), 7.76 (dd, *J* = 8.9, 4.1 Hz, 1H), 7.07 (d, *J* = 8.6 Hz, 2H), 3.92 (s, 3H); $^{13}C$ NMR (100 MHz, $CDCl_3$) $\delta$ 165.2, 163.2, 149.0, 141.2, 138.5, 137.8, 133.5, 129.5, 128.1, 126.4, 124.7, 121.9, 114.3, 113.5, 55.6.

*3,5-dimethoxy-N-(5-nitroquinolin-8-yl)benzamide* (***2g***). Yellow solid in 78% yield; mp 200-201 °C; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ 11.00 (s, 1H), 9.30 (d, *J* = 8.8 Hz, 1H), 8.99-8.95 (m, 2H), 8.61 (d, *J* = 8.8 Hz, 1H), 7.76 (dd, *J* = 8.9, 4.1 Hz, 1H), 7.20 (s, 2H), 6.71 (s, 2H), 3.91 (s, 6H), $^{13}C$ NMR (100 MHz, $CDCl_3$) $\delta$ 165.6, 161.2, 149.2, 140.8, 138.8, 137.8, 136.3, 133.4, 127.9, 124.8, 121.8, 113.8, 105.5, 104.4, 55.7; HRMS (ESI): calculated for $C_{18}H_{15}N_3O_5$: $[M+H]^+$ requires 354.1084; found 354.1087.

*3-fluoro-N-(5-nitroquinolin-8-yl)benzamide* (***2h***). Yellow solid in 73% yield; mp 236-237 °C; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ 11.06 (s, 1H), 9.31 (d, *J* = 8.7 Hz, 1H), 9.01-8.98 (m, 2H), 8.61 (d, *J* = 8.8 Hz, 1H), 7.88 (d, *J* = 7.6 Hz, 1H), 7.80-7.76 (m, 2H), 7.60-7.55 (m, 1H),7.36-7.33 (m, 1H); $^{13}C$ NMR (100 MHz, $CDCl_3$) $\delta$ 164.4, 163.0, 149.2, 140.5, 139.0, 137.8, 136.4, 133.5, 130.8, 127.8, 124.8, 122.9, 121.8, 119.7, 114.9, 113.9; HRMS (ESI): calculated for $C_{16}H_{10}FN_3O_3$: $[M+H]^+$ requires 312.0779; found 312.0781.

*4-fluoro-N-(5-nitroquinolin-8-yl)benzamide* (***2i***). Yellow solid in 75% yield; mp 218-219 °C; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ 11.03 (s, 1H), 9.31 (d, J = 8.6 Hz, 1H), 9.01-8.96 (m, 2H), 8.60 (d, J= 8.8 Hz, 1H), 8.13-8.09 (m, 2H), 7.77 (dd, *J* = 9.2, 4.1 Hz, 1H), 7.29-7.24 (m, 2H); $^{13}C$ NMR (100 MHz, $CDCl_3$) $\delta$ 165.5, 164.6, 149.1, 140.7, 138.8, 137.7, 133.5, 130.4, 130.0, 127.9, 124.8, 121.8, 116.2, 113.7; HRMS (ESI): calculated for $C_{16}H_{10}FN_3O_3$: $[M+H]^+$ requires 312.0779; found 312.0778.

*3-chloro-N-(5-nitroquinolin-8-yl)benzamide* (***2j***). Yellow solid in 74% yield; mp 234-235 °C; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ 11.04 (s, 1H), 9.31 (d, J = 8.7 Hz, 1H), 8.99 (d, *J* = 8.8Hz, 2H), 8.62 (d, *J* = 8.8 Hz, 1H),8.07 (s, 1H), 7.96 (d, *J* = 7.5 Hz, 1H), 7.78 (dd, *J* = 9.1, 4.1 Hz, 1H), 7.62 (d, *J* = 7.8 Hz, 1H), 7.52 (t, *J* = 7.8Hz, 1H); $^{13}C$ NMR (100 MHz, $CDCl_3$) $\delta$ 164.4, 149.2, 140.5, 139.0, 137.8, 135.9, 135.3, 133.5, 132.7, 130.3, 127.9, 127.8, 125.4, 124.8, 121.8, 114.0; HRMS (ESI): calculated for $C_{16}H_{10}ClN_3O_3$: $[M+H]^+$ requires 328.0483; found 328.0483.

*4-chloro-N-(5-nitroquinolin-8-yl)benzamide* (***2k***) [2]. Yellow solid in 76% yield; mp 210-212 °C; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ 11.05 (s, 1H), 9.32 (d, *J* = 8.1 Hz, 1H), 9.01-8.97 (m, 2H), 8.62 (d, *J* = 8.8 Hz, 1H), 8.04 (d, *J* =8.5 Hz, 2H), 7.77 (dd, *J* = 9.1, 4.1 Hz, 1H), 7.56 (d, *J* = 8.4 Hz, 2H); $^{13}C$ NMR (100 MHz, $CDCl_3$) $\delta$ 164.7, 149.2, 140.6, 139.1, 138.9, 137.8, 133.5, 132.5, 129.4, 128.9, 127.8, 124.8, 121.8, 113.9; HRMS (ESI): calculated for $C_{16}H_{10}ClN_3O_3$: $[M+H]^+$ requires 328.0483; found 328.0484.

*3-bromo-N-(5-nitroquinolin-8-yl)benzamide* (***2l***). Yellow solid in 78% yield; mp 213-214 °C; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ 11.00 (s, 1H), 9.36 (d, *J* = 8.8 Hz, 1H), 8.96 (d, *J* = 8.9 Hz, 2H), 8.61 (d, *J* = 8.8 Hz, 1H), 8.23 (s, 1H), 8.01 (d, *J* = 7.7 Hz, 1H), 7.78-7.75 (m, 2H), 7.49 (t, *J*= 7.8 Hz, 1H); $^{13}C$ NMR (100 MHz, $CDCl_3$) $\delta$ 164.2, 149.2, 140.4, 139.0, 137.8, 136.1, 135.6, 133.5, 130.8, 130.5, 127.8, 125.9, 124.8, 123.3, 121.8, 114.0; HRMS (ESI): calculated for $C_{16}H_{10}BrN_3O_3$: $[M+H]^+$ requires 371.9978; found 371.9979.

*4-bromo-N-(5-nitroquinolin-8-yl)benzamide* (***2m***). Yellow solid in 72% yield; mp 279-280 °C; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ 11.06 (s, 1H), 9.32 (d, *J* = 8.2 Hz, 1H), 9.01-8.97 (m, 2H), 8.62 (d, *J* = 8.9 Hz, 1H),7.96 (d, *J* = 8.3Hz, 2H), 7.78 (dd, *J* = 8.9, 4.3 Hz, 1H), 7.72 (d, *J* = 8.5 Hz, 2H); $^{13}C$ NMR (100 MHz, $CDCl_3$) $\delta$ 164.8, 149.2, 140.6, 138.9, 137.8, 133.5, 133.0, 132.3, 129.0, 127.8, 127.6, 124.8, 121.8, 113.9; HRMS (ESI): calculated for $C_{16}H_{10}BrN_3O_3$: $[M+H]^+$ requires 371.9978; found 371.9977.

*N-(5-nitroquinolin-8-yl)-3-(trifluoromethyl)benzamide* (***2n***). Yellow solid in 75% yield; mp 181-182 °C; $^1H$ NMR (400 MHz, $CDCl_3$) $\delta$ 11.08 (s, 1H), 9.30 (d, *J* = 8.6 Hz, 1H), 8.99-8.97 (m, 2H), 8.61 (d, *J* = 8.8 Hz, 1H), 8.36 (s, 1H), 8.25 (d, *J* =7.6 Hz, 1H), 7.90 (d, *J* = 7.6 Hz, 1H), 7.79-7.72(m, 2H); $^{13}C$ NMR (100 MHz, $CDCl_3$) $\delta$ 164.2, 149.3, 140.3, 139.1, 137.7, 135.0,

133.7, 133.5, 130.4, 129.7, 129.2, 127.7, 124.9, 124.7, 122.1, 114.0; HRMS (ESI): calculated for $C_{17}H_{10}F_3N_3O_3$: $[M+H]^+$ requires 362.0747; found 362.0748.

*2-chloro-4-methoxy-N-(5-nitroquinolin-8-yl)benzamide* (***2p***). Yellow solid in 65% yield; mp 262-263 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 10.99 (s, 1H), 9.33 (d, *J* = 8.8 Hz, 1H), 8.99-8.97 (m, 2H), 8.62 (d, *J* = 8.8 Hz, 1H), 8.14 (d, *J* = 1.2 Hz, 1H), 8.02 (d, *J* = 8.6 Hz, 1H), 7.77 (dd, *J* = 8.9, 4.1 Hz, 1H), 7.10 (d, *J* = 8.5 Hz, 1H), 4.03 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 164.1, 158.5, 149.1, 140.8, 138.7, 137.8, 133.5, 129.7, 127.9, 127.7, 127.2, 124.8, 123.3, 121.9, 113.7, 111.8, 56.5; HRMS (ESI): calculated for $C_{17}H_{12}ClN_3O_4$: $[M+H]^+$ requires 358.0589; found 358.0591.

*N-(5-nitroquinolin-8-yl)thiophene-2-carboxamide* (***2q***) [3]. Yellow solid in 69% yield; mp 220-221 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 10.90 (s, 1H), 9.30 (d, *J* = 8.8 Hz, 1H), 8.96-8.95 (m, 1H), 8.91 (d, *J* = 8.8 Hz, 1H), 8.59 (d, *J* = 8.8 Hz, 1H), 7.88 (d, *J* =3.1 Hz, 1H), 7.76 (dd, *J* = 8.9, 4.1 Hz, 1H), 7.65 (d, *J* = 4.8 Hz, 1H), 7.24-7.21 (m, 1H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 160.2, 149.1, 140.6, 139.0, 138.7, 137.5, 133.5, 132.2, 129.4, 128.2, 127.9, 124.8, 121.9, 113.7.

*N-(5-nitroquinolin-8-yl)pivalamide* (***2r***)[2]. Yellow solid in 73% yield; mp 172-173 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 10.59 (s, 1H), 9.27-9.25 (m, 1H), 8.92 (d, *J*= 3.0 Hz, 1H), 8.84 (d, *J* = 8.8 Hz, 1H), 8.54 (d, *J* = 8.8 Hz, 1H), 7.71 (dd, *J* = 8.8, 4.1 Hz, 1H), 1.45 (s, 9H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 177.8, 149.0, 141.0, 138.3, 137.7, 133.3, 127.9, 124.6, 121.7, 113.4, 40.7, 27.6.

*N-(2-methyl-5-nitroquinolin-8-yl)benzamide* (***2a′***) [2]. Yellow solid in 75% yield; mp 202-203 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 11.08 (s, 1H), 9.12 (d, *J* = 8.9 Hz, 1H), 8.91 (d, *J* = 8.8, 1H), 8.49 (d, *J* = 8.8 Hz, 1H), 8.05 (d, *J* = 7.3 Hz, 2H), 7.66-7.57 (m, 4H), 2.81 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 165.5, 158.5, 140.1, 138.7, 137.3, 134.3, 133.3, 132.6, 129.1, 127.4, 126.7, 125.6, 119.9, 113.7, 25.2; HRMS (ESI): calculated for $C_{17}H_{13}N_3O_3$: $[M+H]^+$ requires 308.1030; found 308.1035.

*2-methyl-N-(2-methyl-5-nitroquinolin-8-yl)benzamide* (***2b′***). Yellow solid in 75% yield; mp 209-210 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 10.62 (s, 1H), 9.15 (d, *J* = 8.9 Hz, 1H), 8.96 (d, *J* = 8.8, 1H), 8.51 (d, *J* = 8.8 Hz, 1H), 7.72 (d, *J* = 7.4 Hz, 1H), 7.58 (d, *J* = 8.9 Hz, 1H), 7.48-7.44 (m, 1H), 7.39-7.35 (m, 2H), 2.75 (s, 3H), 2.64 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 168.2, 158.6, 140.3, 138.9, 137.2, 137.2, 135.6, 133.3, 131.8, 131.1, 127.5, 126.7, 126.3, 125.6, 120.0, 113.7, 25.1, 20.4; HRMS (ESI): calculated for $C_{18}H_{15}N_3O_3$: $[M+H]^+$ requires 322.1186; found 322.1190.

*3-methyl-N-(2-methyl-5-nitroquinolin-8-yl)benzamide* (***2c′***). Yellow solid in 79% yield; mp 184-185 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 11.04 (s, 1H), 9.15 (d, *J* = 8.9 Hz, 1H), 8.93 (d, *J* = 8.8 Hz, 1H), 8.51 (d, *J* = 8.8 Hz, 1H), 7.91 (s, 1H), 7.81 (d, *J* = 6.9 Hz, 1H), 7.59 (d, *J* = 8.9 Hz, 1H), 7.49-7.43 (m, 2H), 2.83 (s, 3H), 2.47 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 165.7, 158.4, 140.2, 139.0, 138.7, 137.3, 134.3, 133.4, 133.3, 128.9, 128.3, 126.8, 125.6, 124.2, 120.0, 113.7, 25.2, 21.5; HRMS (ESI): calculated for $C_{18}H_{15}N_3O_3$: $[M+H]^+$ requires 322.1186; found 322.1190.

*4-methyl-N-(2-methyl-5-nitroquinolin-8-yl)benzamide* (***2d′***). Yellow solid in 78% yield; mp 206-207 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 10.99 (s, 1H), 9.09 (d, *J* = 8.9 Hz, 1H), 8.86 (d, *J* = 8.8 Hz, 1H), 8.44 (d, *J* = 8.8 Hz, 1H), 7.92 (d, *J* = 7.9 Hz, 2H), 7.55 (d, *J* = 8.9 Hz, 1H), 7.37 (d, *J* = 7.8 Hz, 2H), 2.81 (s, 3H), 2.45 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 165.4, 158.4, 143.3, 140.2, 138.5, 137.2, 133.2, 131.3, 129.7, 127.4, 126.8, 125.6, 120.0, 113.5, 25.2, 21.6; HRMS (ESI): calculated for $C_{18}H_{15}N_3O_3$: $[M+H]^+$ requires 322.1186; found 322.1189.

*2-methoxy-N-(2-methyl-5-nitroquinolin-8-yl)benzamide* (***2e′***). Yellow solid in 75% yield; mp 258-259 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 12.46 (s, 1H), 9.17 (d, *J* = 8.9 Hz, 1H), 9.10 (d, *J* = 8.9 Hz, 1H), 8.51 (d, *J* = 8.9 Hz, 1H), 8.33 (d, *J* = 6.6 Hz, 1H), 7.60-7.55 (m, 2H), 7.18 (t, *J* = 7.6 Hz, 1H), 7.11 (d, *J* = 8.3 Hz, 1H), 4.23 (s, 3H), 2.86 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 164.3, 157.9, 157.8, 141.6, 137.8, 134.0, 133.2, 132.8, 127.0, 125.3, 121.7, 121.6, 120.1, 114.7, 111.6, 56.2, 25.3; HRMS (ESI): calculated for $C_{18}H_{15}N_3O_4$: $[M+H]^+$ requires 338.1135; found 338.1139.

*3-fluoro-N-(2-methyl-5-nitroquinolin-8-yl)benzamide* (***2f′***). Yellow solid in 71% yield; mp 251-252 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 11.10 (s, 1H), 9.17 (d, *J* = 8.9 Hz, 1H), 8.94 (d, *J* =

8.8 Hz, 1H), 8.53 (d, *J* = 8.8 Hz, 1H), 7.85 (d, J = 7.7 Hz, 1H), 7.78 (d, J = 9.2 Hz, 1H), 7.63-7.55 (m, 2H), 7.36-7.32 (m, 1H), 2.84 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 164.3, 161.8, 158.7, 139.8, 139.1, 137.4, 136.6, 133.5, 130.8, 126.7, 125.7, 122.8, 120.0, 119.6, 114.9, 113.9, 25.3; HRMS (ESI): calculated for $C_{17}H_{12}FN_3O_3$: $[M+H]^+$ requires 326.0935; found 326.0938.

*4-fluoro-N-(2-methyl-5-nitroquinolin-8-yl)benzamide* (***2g′***). Yellow solid in 66% yield; mp 218-219 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 11.07 (s, 1H), 9.16 (d, *J* = 8.9 Hz, 1H), 8.93 (d, *J* = 8.8, 1H), 8.52 (d, *J* = 8.8 Hz, 1H), 8.11-8.08 (m, 2H), 7.62 (d, *J* = 8.9 Hz, 1H), 7.29-7.25 (m, 2H), 2.83 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 166.7, 164.3, 158.5, 140.0, 138.9, 137.3, 133.5, 130.5, 129.9, 126.7, 125.7, 120.0, 116.2, 113.8, 25.3; HRMS (ESI): calculated for $C_{17}H_{12}FN_3O_3$: $[M+H]^+$ requires 326.0935; found 326.0938.

*3-chloro-N-(2-methyl-5-nitroquinolin-8-yl)benzamide* (***2h′***). Yellow solid in 67% yield; mp 215-216 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 11.08 (s, 1H), 9.15 (d, *J* = 8.9 Hz, 1H), 8.91 (d, *J* = 8.8 Hz, 1H), 8.51 (d, *J* = 8.8 Hz, 1H), 8.07 (s, 1H), 7.94 (d, *J* = 7.6 Hz, 1H), 7.62 (d, *J* = 9.2 Hz, 2H), 7.53 (t, *J* = 7.8 Hz, 1H), 2.83 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 164.1, 158.7, 139.7, 139.1, 137.3, 136.1, 135.4, 133.4, 132.6, 130.3, 127.9, 126.6, 125.7, 125.2, 120.0, 113.9, 25.3; HRMS (ESI): calculated for $C_{17}H_{12}ClN_3O_3$: $[M+H]^+$ requires 342.0640; found 342.0642.

*4-chloro-N-(2-methyl-5-nitroquinolin-8-yl)benzamide* (***2i′***) [2]. Yellow solid in 68% yield; mp 221-222 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 11.08 (s, 1H), 9.16 (d, *J* = 8.9 Hz, 1H), 8.93 (d, *J* = 8.8 Hz, 1H), 8.52 (d, *J* = 8.8 Hz, 1H), 8.02 (d, *J* = 8.2 Hz, 2H), 7.62 (d, *J* = 8.9 Hz, 1H), 7.56 (d, *J* = 8.2 Hz, 2H), 2.84 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 164.5, 158.6, 139.9, 140.0, 139.0, 137.3, 133.5, 132.7, 129.4, 128.8, 126.7, 125.7, 120.0, 113.9, 25.3; HRMS (ESI): calculated for $C_{17}H_{12}ClN_3O_3$: $[M+H]^+$ requires 342.0640; found 342.0641.

*3-bromo-N-(2-methyl-5-nitroquinolin-8-yl)benzamide* (***2j′***). Yellow solid in 66% yield; mp 203-204 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 11.09 (s, 1H), 9.16 (d, *J* = 8.9 Hz, 1H), 8.91 (d, *J* = 8.8 Hz, 1H), 8.51 (d, *J* = 8.8 Hz, 1H), 8.23 (s, 1H), 7.99 (d, *J* = 7.7 Hz, 1H), 7.76 (d, *J* = 7.9 Hz, 1H), 7.62 (d, *J* = 8.9 Hz, 1H), 7.47 (t, *J* = 7.8 Hz, 1H), 2.88 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 164.0, 158.7, 139.7, 139.1, 137.3, 136.2, 135.5, 133.4, 130.9, 130.5, 126.6, 125.7, 125.7, 123.3, 119.9, 113.9, 25.3; HRMS (ESI): calculated for $C_{17}H_{12}BrN_3O_3$: $[M+H]^+$ requires 386.0135; found 386.0136.

*4-bromo-N-(2-methyl-5-nitroquinolin-8-yl)benzamide* (***2k′***). Yellow solid in 71% yield; mp 249-250 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 11.09 (s, 1H), 9.15 (d, *J* = 8.9 Hz, 1H), 9.17 (d, *J* = 9.0, 1H), 8.93 (d, *J* = 8.8 Hz, 1H), 8.52 (d, *J* = 8.8 Hz, 1H), 7.94(d, *J* = 8.4 Hz, 2H), 7.44 (d, *J* =8.4 Hz, 2H), 7.61 (d, *J* = 8.9 Hz, 1H), 2.83 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 164.7, 158.6, 139.8, 139.0, 137.3, 133.5, 133.2, 132.4, 128.9, 127.5, 126.7, 125.7, 120.0, 113.9, 25.3; HRMS (ESI): calculated for $C_{17}H_{12}BrN_3O_3$: $[M+H]^+$ requires 386.0135; found 386.0136.

*N-(2-methyl-5-nitroquinolin-8-yl)-3-(trifluoromethyl)benzamide* (***2l′***). Yellow solid in 56% yield; mp 191-192 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 11.19 (s, 1H), 9.15 (d, *J* = 8.9 Hz, 1H), 8.92 (d, *J* = 8.8 Hz, 1H), 8.53 (d, *J* = 8.8 Hz, 1H), 8.34 (s, 1H), 8.26 (d, *J* = 7.7 Hz, 1H), 7.90 (d, *J* = 7.7 Hz, 1H), 7.74 (t, *J* = 7.7 Hz, 1H), 7.63 (d, *J* = 8.9 Hz, 1H), 2.84 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 164.0, 158.7, 139.6, 139.2, 137.3, 135.1, 133.5, 131.7, 130.5, 129.8, 129.1, 126.6, 125.8, 124.5, 123.6, 119.9, 113.9, 25.2; HRMS (ESI): calculated for $C_{18}H_{12}F_3N_3O_3$: $[M+H]^+$ requires 376.0904; found 376.0907.

*N-(2-methyl-5-nitroquinolin-8-yl)-4-(trifluoromethyl)benzamide* (***2m′***). Yellow solid in 59% yield; mp 208-209 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 11.16 (s, 1H), 9.18 (d, *J* = 8.9 Hz, 1H), 8.96 (d, *J* = 8.8 Hz, 1H), 8.54 (d, *J* = 8.8 Hz, 1H), 8.20 (d, *J* = 8.0 Hz, 2H), 7.87 (d, *J* = 8.1 Hz, 2H), 7.64 (d, *J* = 8.9 Hz, 1H), 2.84 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 164.3, 158.7, 139.6, 139.3, 137.6, 137.4, 134.1, 133.5, 127.9, 126.6, 126.2, 125.8, 123.6, 120.0, 114.1, 25.3; HRMS (ESI): calculated for $C_{18}H_{12}F_3N_3O_3$: $[M+H]^+$ requires 376.0904; found 376.0905.

*N-(2-methyl-5-nitroquinolin-8-yl)thiophene-2-carboxamide* (***2n′***). Yellow solid in 72% yield; mp 257-258 °C; $^1$H NMR (400 MHz, $CDCl_3$) $\delta$ 10.98 (s, 1H), 9.16 (d, *J* = 8.8 Hz, 1H), 8.85 (d, *J* = 8.8 Hz, 1H), 8.51 (d, *J* = 8.7 Hz, 1H), 7.85 (d, *J* = 2.4 Hz, 1H), 7.67 (d, *J* = 4.5 Hz, 1H), 7.61 (d, *J* = 8.9 Hz,1H), 7.23 (d, *J* = 3.9 Hz, 1H), 2.84 (s, 3H); $^{13}$C NMR (100 MHz, $CDCl_3$) $\delta$ 160.1, 158.5, 139.9, 139.2, 138.8, 137.1, 133.4, 132.0, 129.3, 128.2, 126.8, 125.7, 120.0, 113.7, 25.2; HRMS (ESI): calculated for $C_{15}H_{11}N_3O_3S$: $[M+H]^+$ requires 314.0594; found 314.0596.

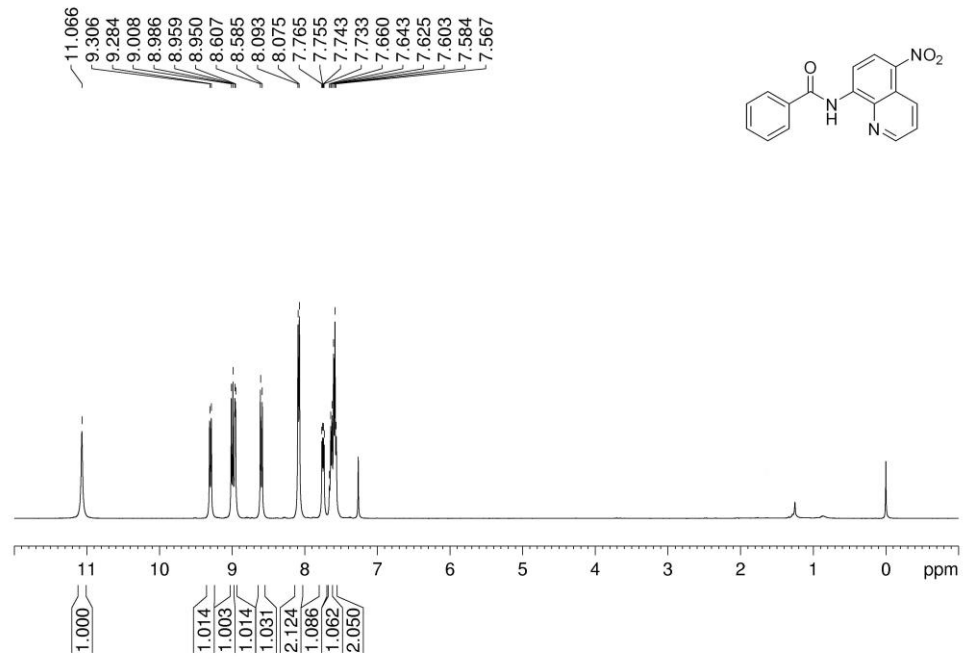
**References**

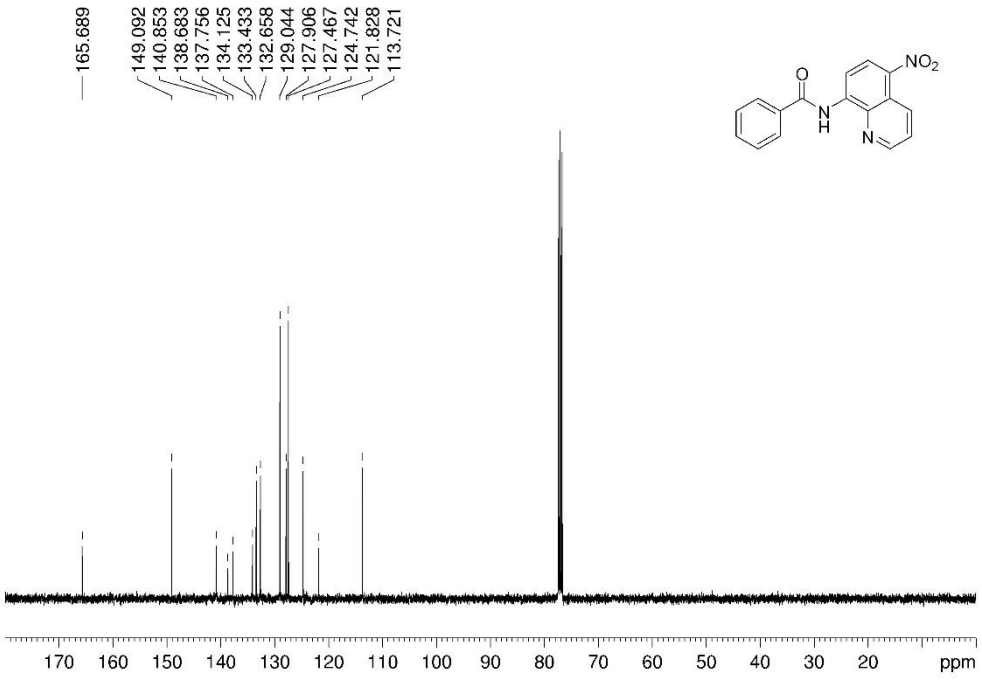
1. Zhu, X.; Qiao, L.; Ye, P.; Ying, B.; Xu, J.; Shen, C.; Zhang, P. Copper-catalyzed rapid C–H nitration of 8-amino-quinolines by using sodium nitrite as the nitro source under mild conditions. *RSC Adv*. **2016**, *6*, 89979–89983.

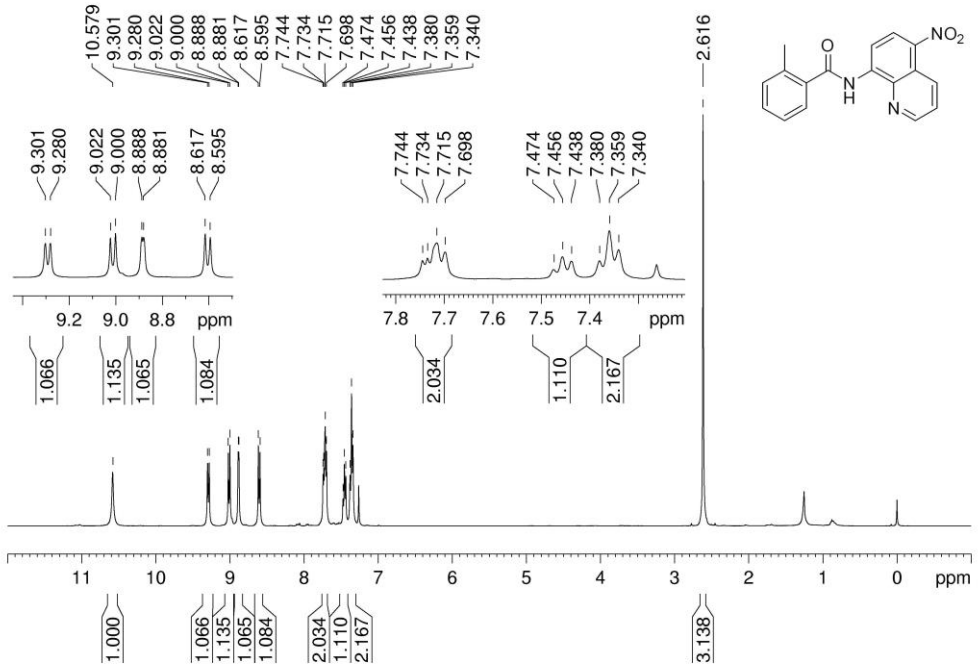
2. He, Y.; Zhao, N.-N.; Qiu, L.-Q.; Zhang, X.-Y.; Fan, X.-S. Regio-and chemoselective mono-and bisnitration of 8-amino quinoline amides with Fe $(NO_3)_3 \cdot 9H_2O$ as promoter and nitro source. Organic letters. *Org. Lett*. **2016**, *18*, 6054–6057.

3. Whiteoak, C.J.; Planas, O.; Company, A.; Ribas, X. A First Example of Cobalt-Catalyzed Remote C–H Functionalization of 8-Aminoquinolines Operating through a Single Electron Transfer Mechanism. *Adv. Synth. Catal.* **2016**, *358*, 1679–1688.

## 4. Copies of $^{1}H$ and $^{13}C$ NMR Spectra of the Products

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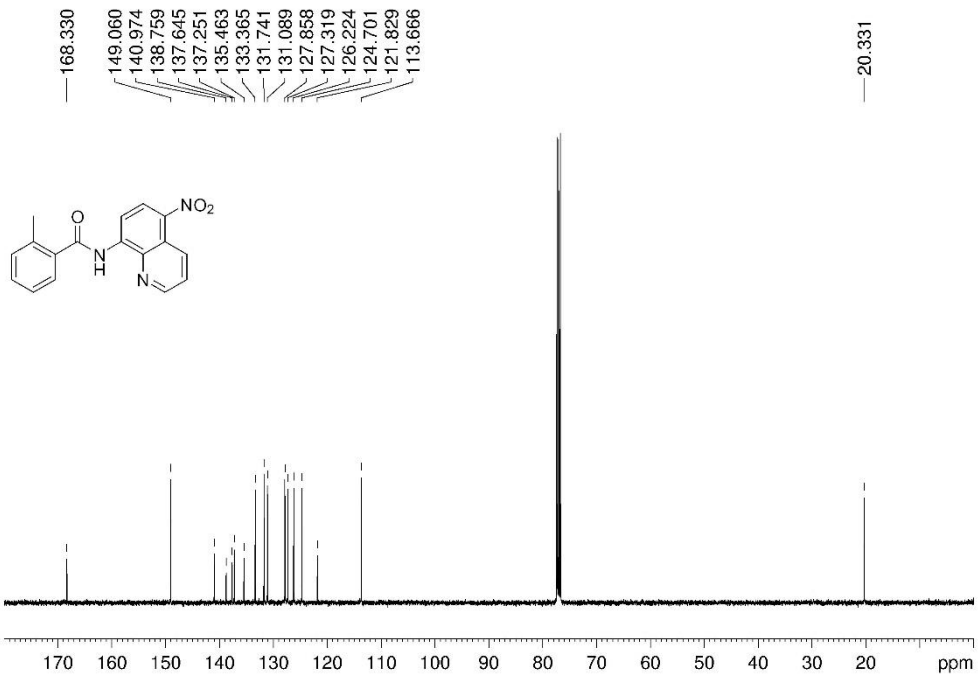
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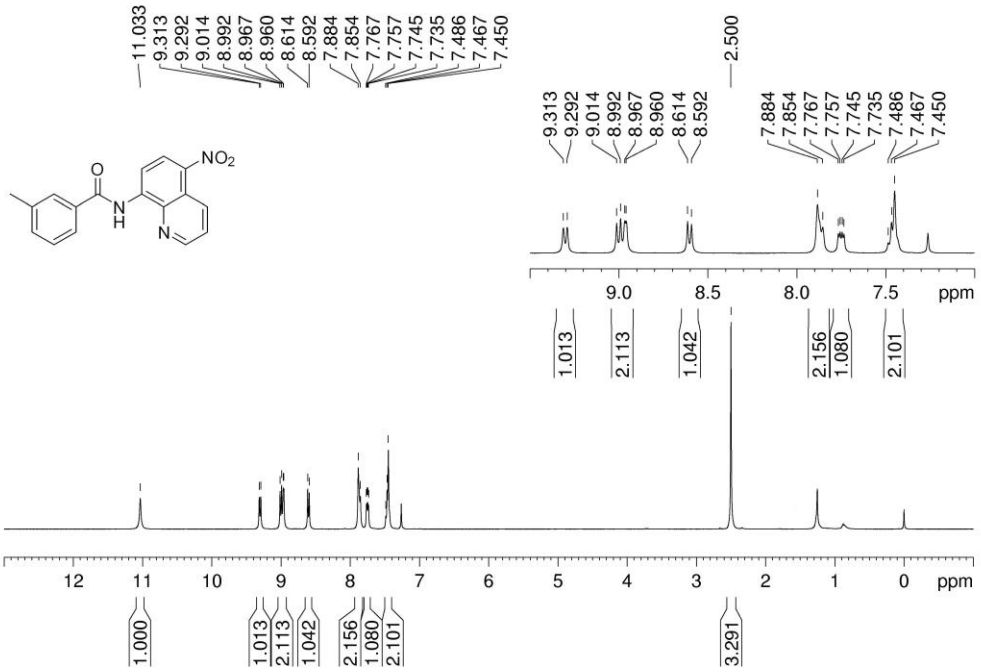
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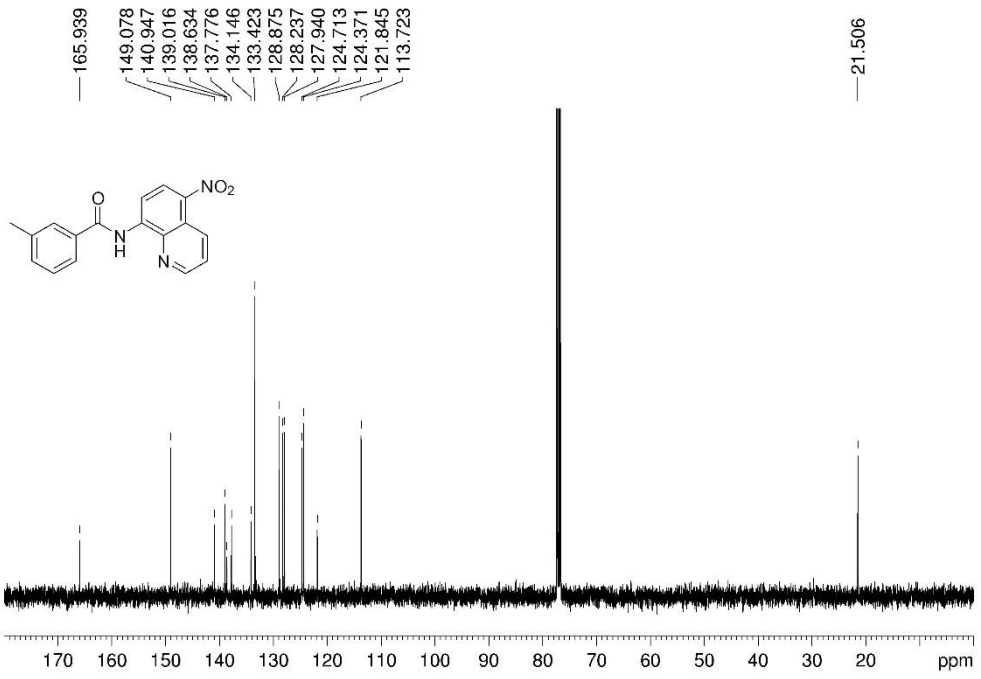
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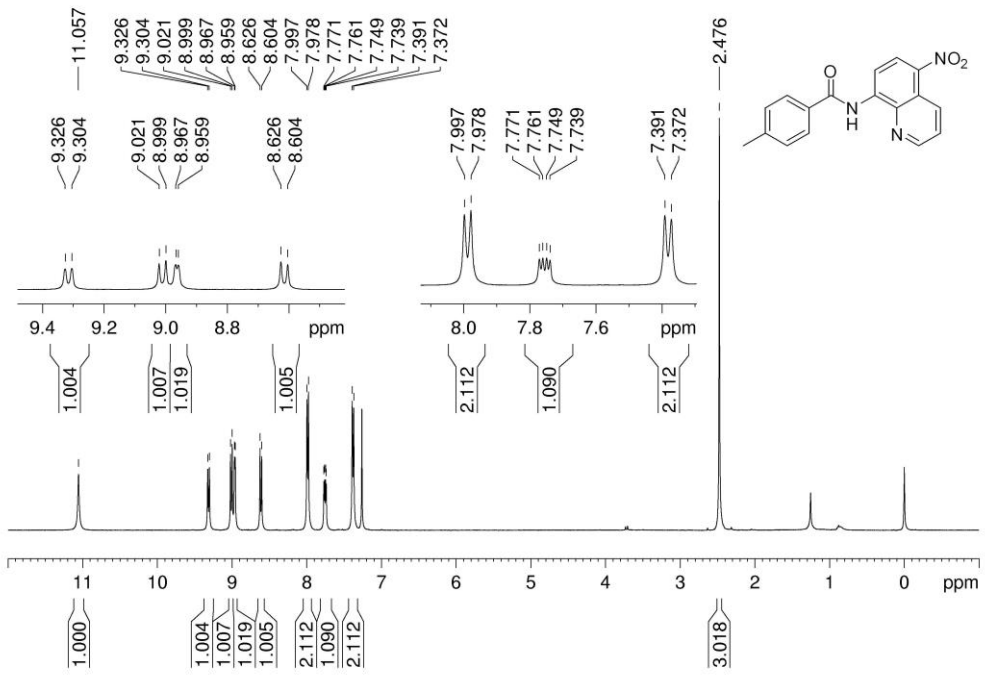
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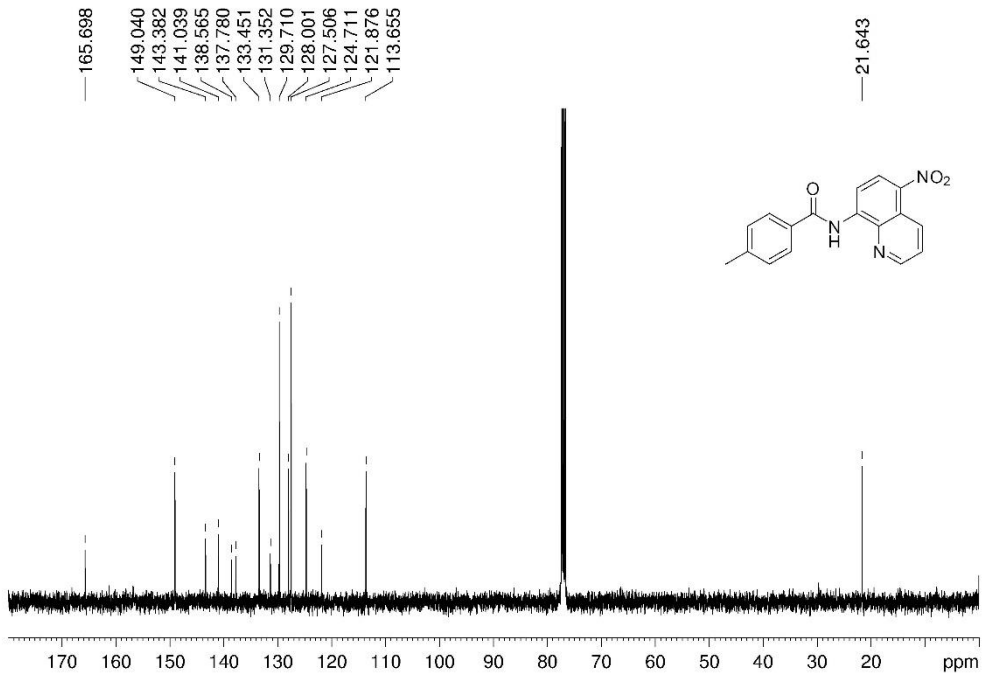
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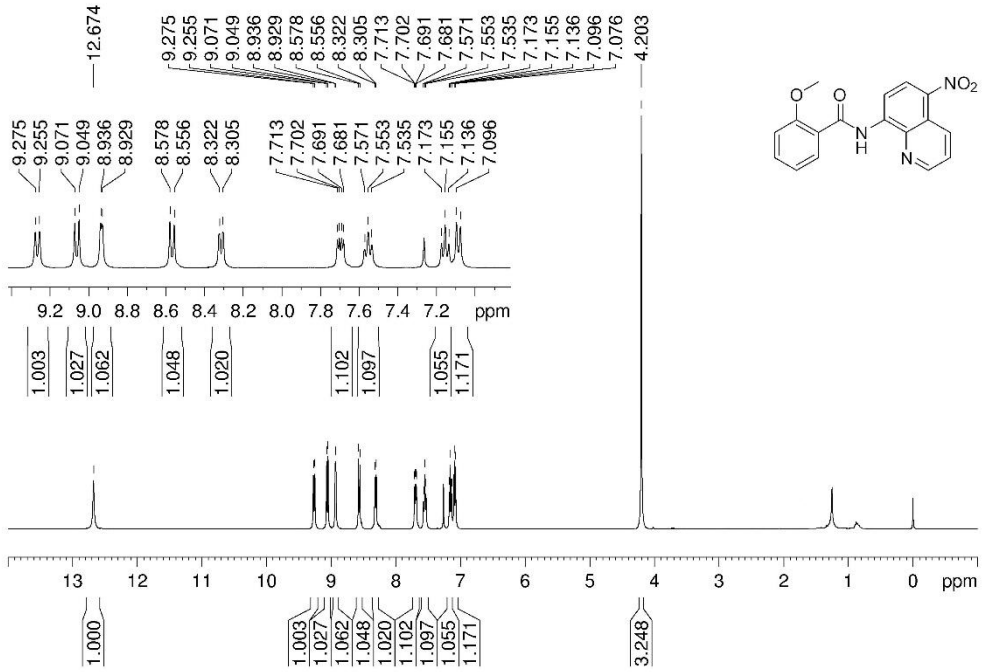
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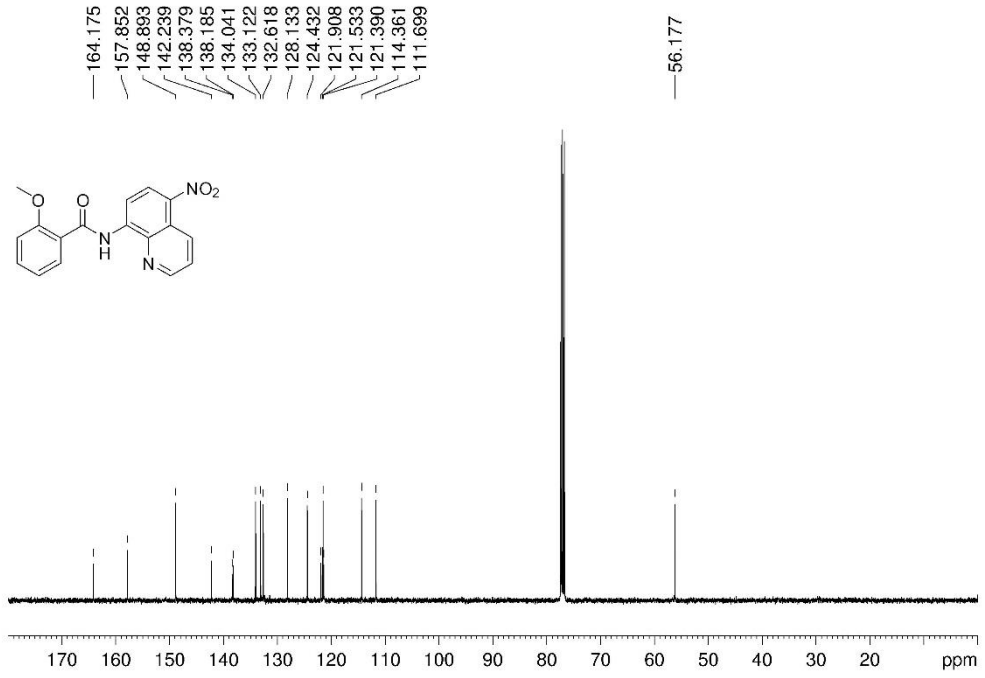
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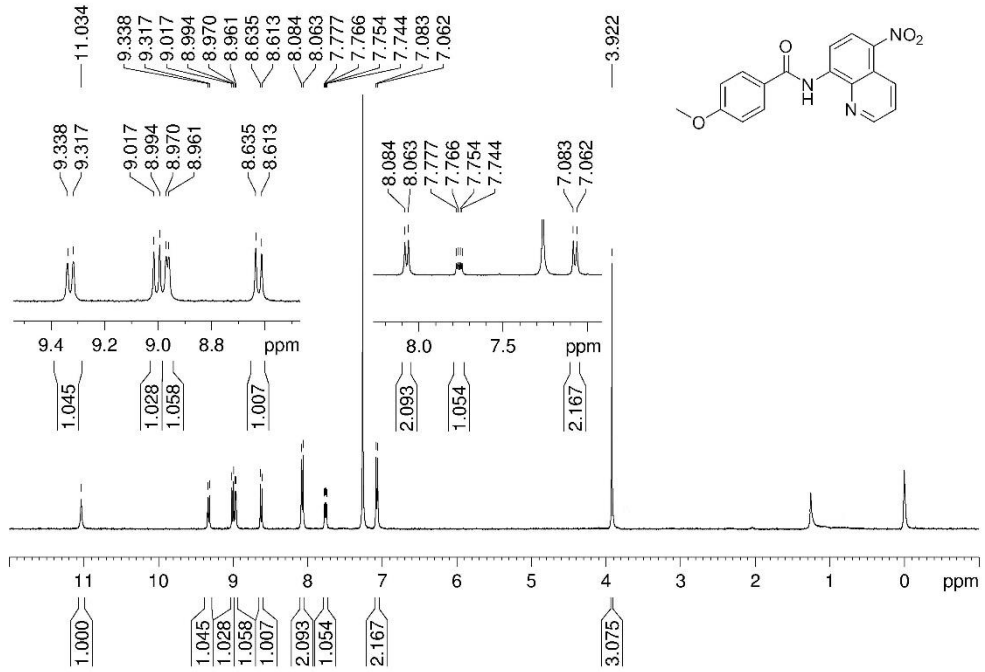
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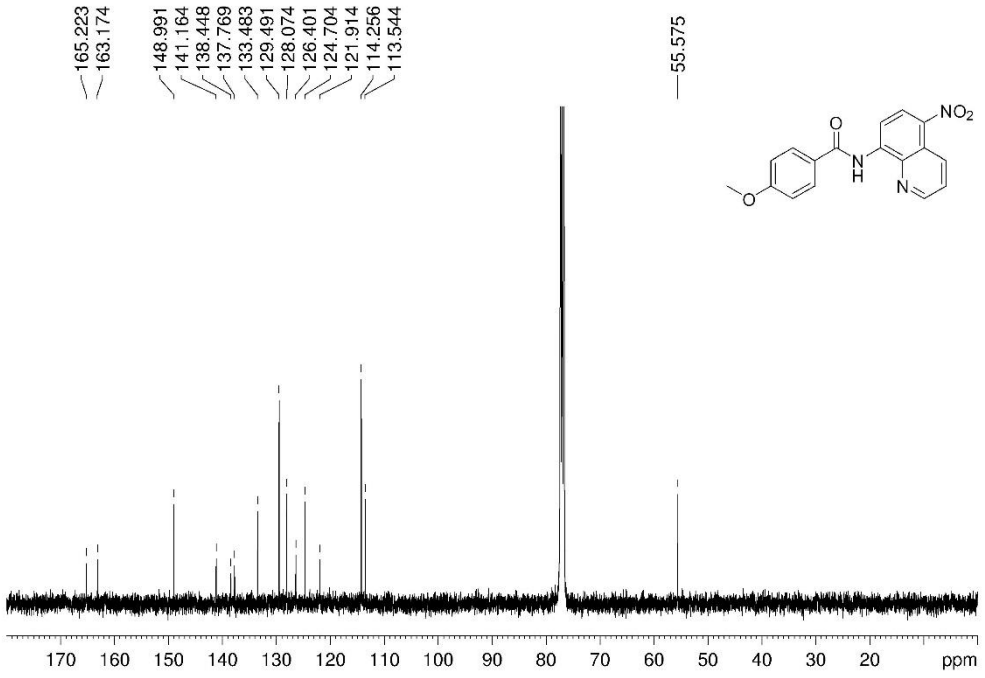
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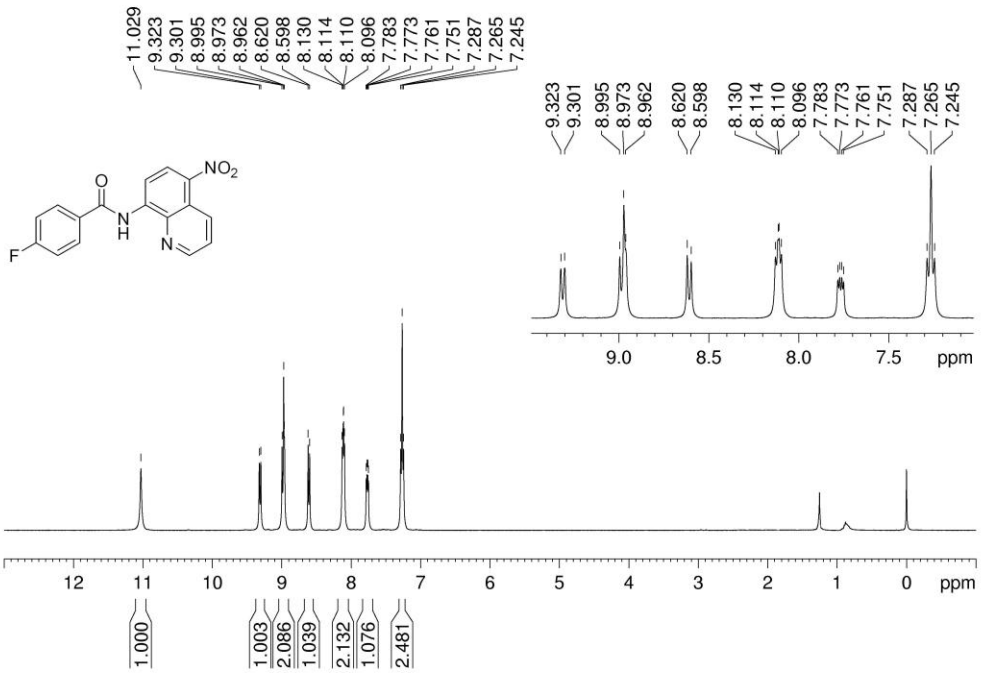
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8.598
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8.110
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7.783
7.773
7.761
7.751
7.287
7.265
7.245
NO2
O
N
H
F
N
9.0
8.5
8.0
7.5
ppm
12
11
10
9
8
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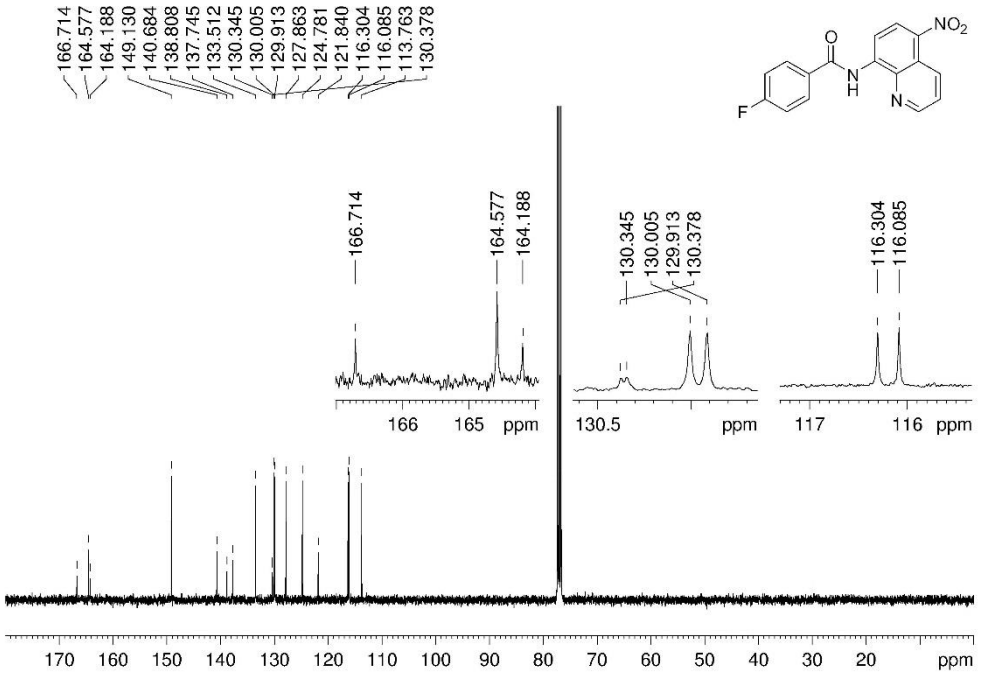
2.481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130.005
129.913
127.863
124.781
121.840
116.304
116.085
113.763
130.378
NO2
O
N
H
F
166.714
164.577
164.188
130.345
130.005
129.913
130.378
116.304
116.085
166
165
ppm
130.5
ppm
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150
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80
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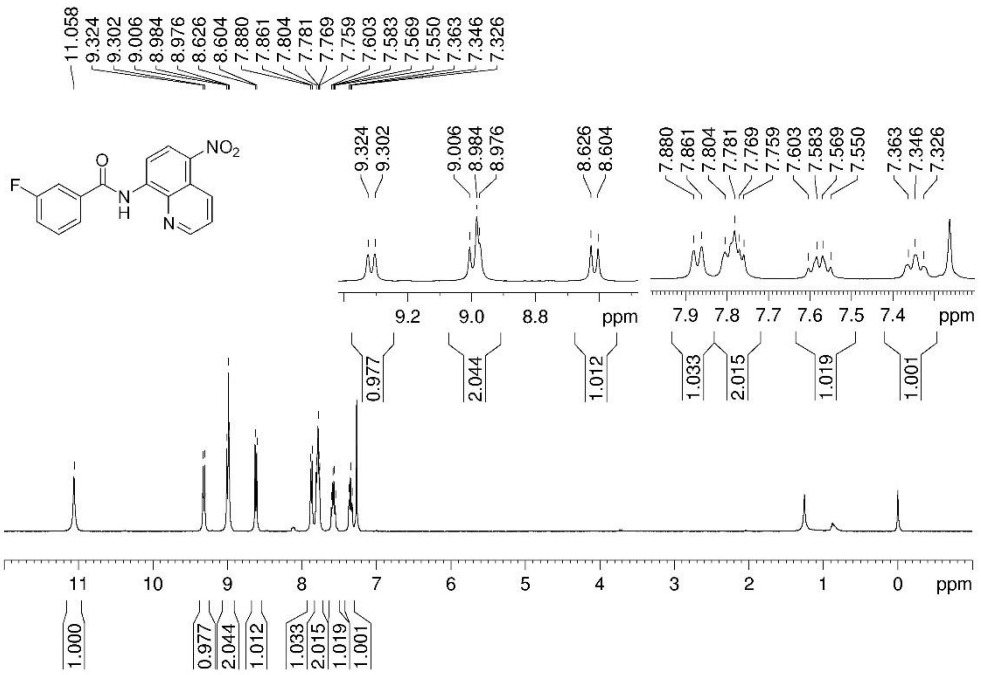
20
ppm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7.861
7.804
7.781
7.769
7.759
7.603
7.583
7.569
7.550
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7.346
7.326
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F
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N
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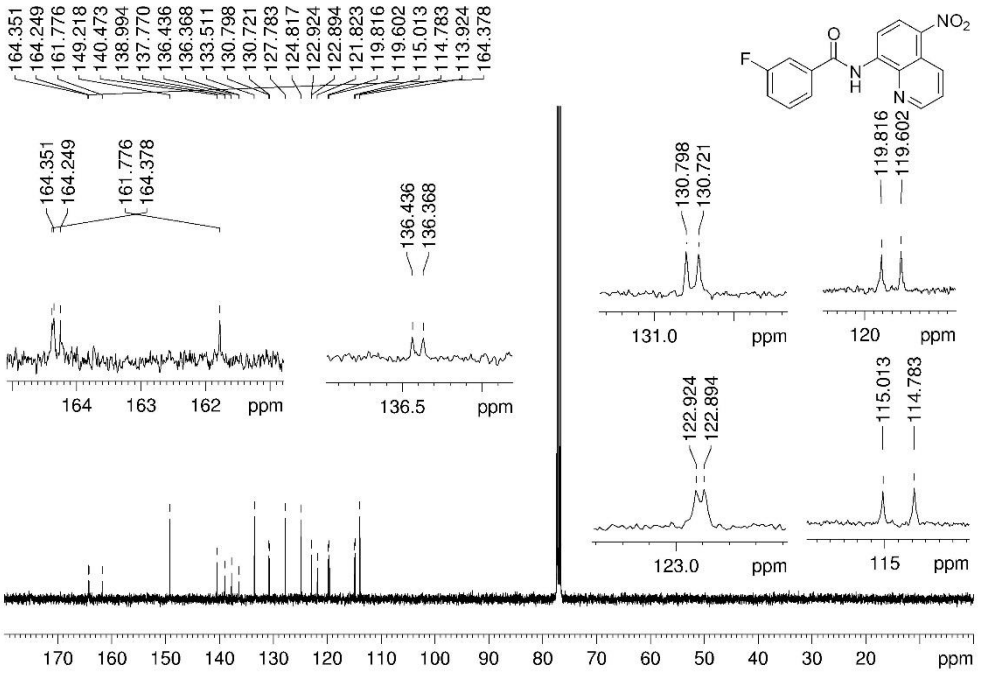
1.001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122.924
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119.602
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114.783
113.924
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NO2
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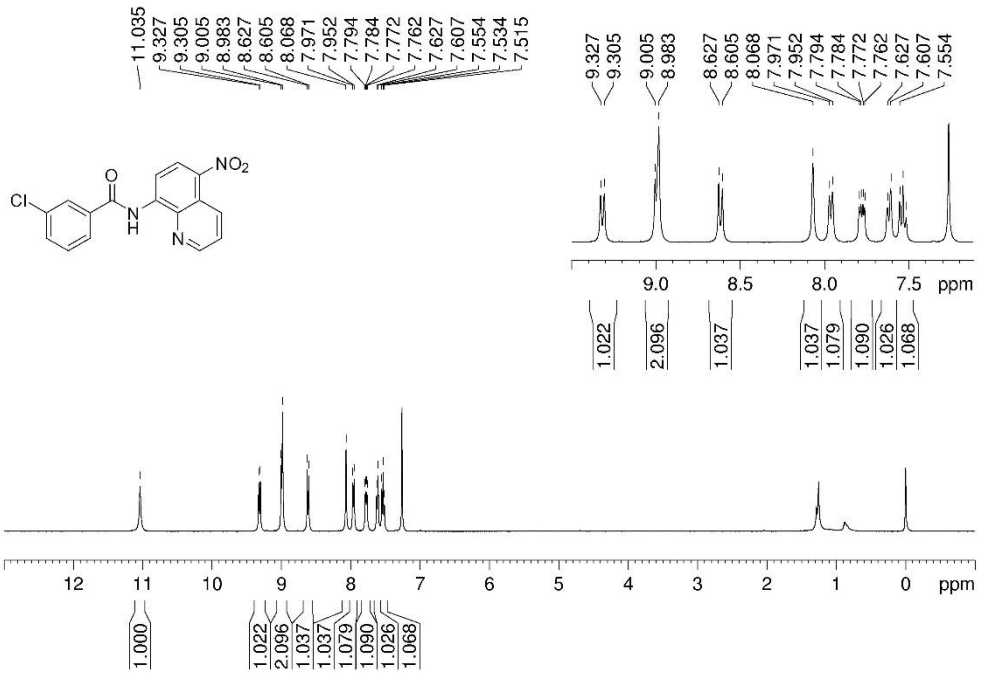
F
N
H
N
ppm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9.005
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8.627
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8.068
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7.794
7.784
7.772
7.762
7.627
7.607
7.554
7.534
7.515
NO2
O
N
H
Cl
N
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9.005
8.983
8.627
8.605
8.068
7.971
7.952
7.794
7.784
7.772
7.762
7.627
7.607
7.554
9.0
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8.0
7.5
ppm
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1.037
1.079
1.090
1.026
1.068
12
11
10
9
8
7
6
5
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ppm
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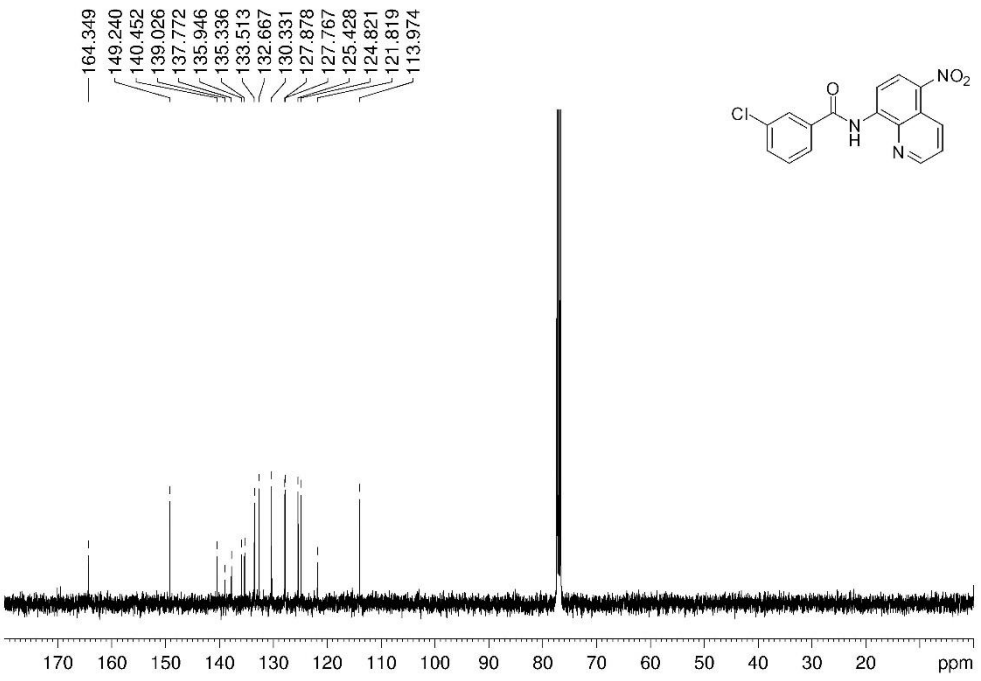
1.068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133.513
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127.878
127.767
125.428
124.821
121.819
113.974
NO2
O
N
H
Cl
N
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160
150
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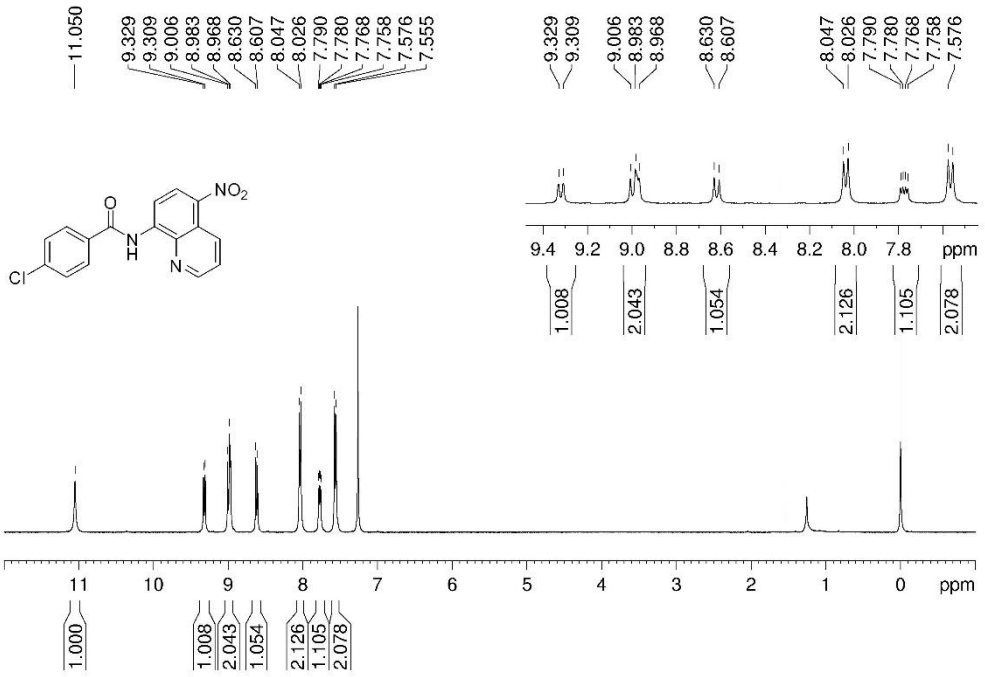
ppm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8.607
8.047
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7.780
7.768
7.758
7.576
7.555
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H
Cl
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1.054
2.126
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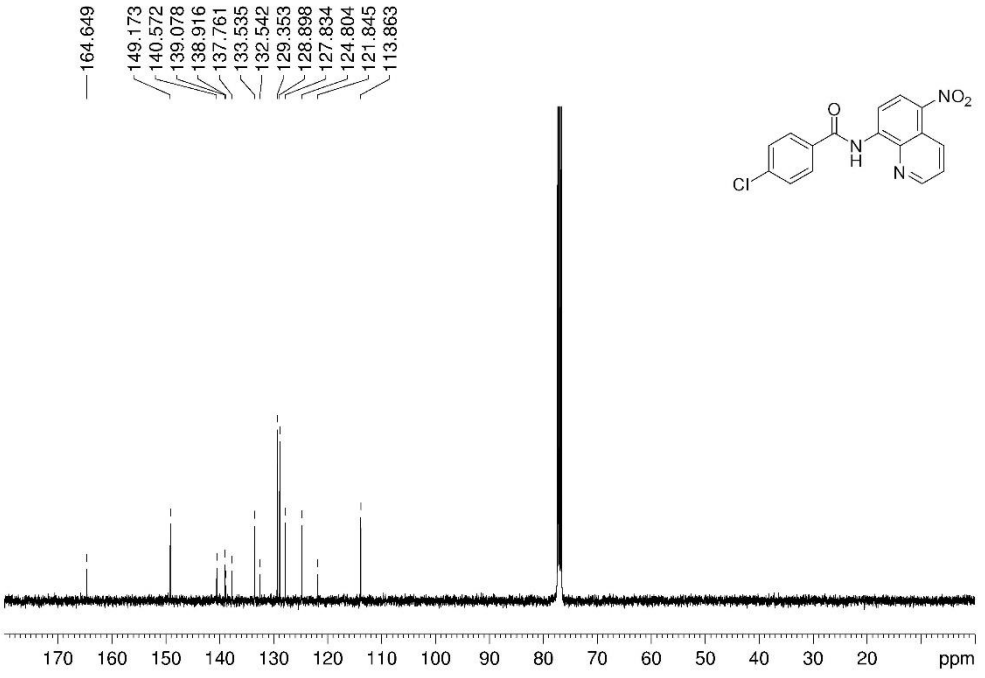
2.078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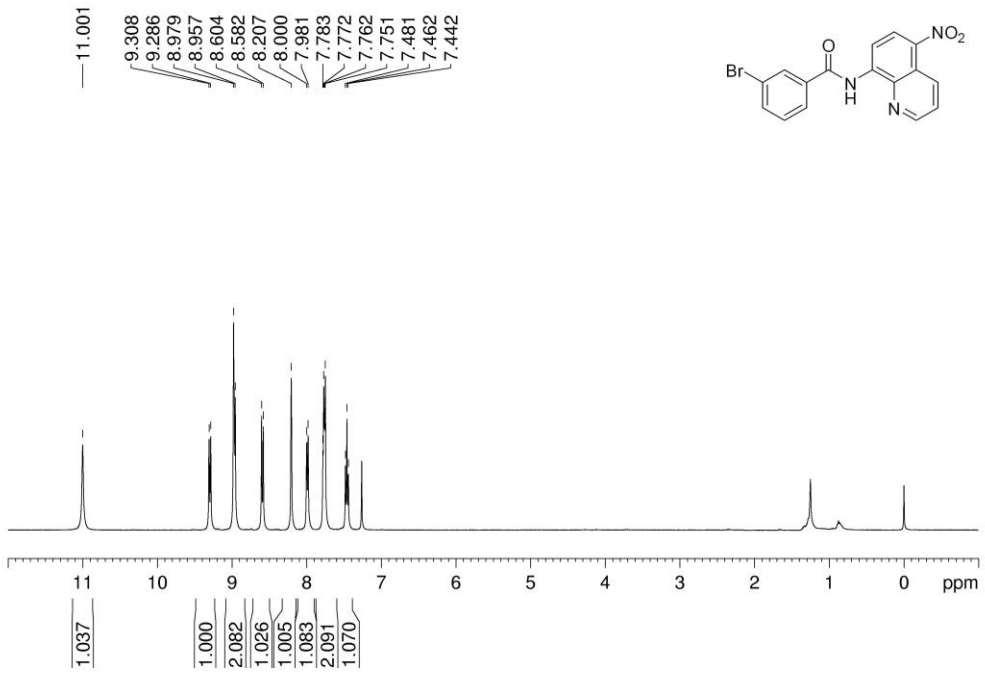
N
H
Cl
ppm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8.582
8.207
8.000
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7.783
7.772
7.762
7.751
7.481
7.462
7.442
Br
O
N
H
N
NO2
11
10
9
8
7
6
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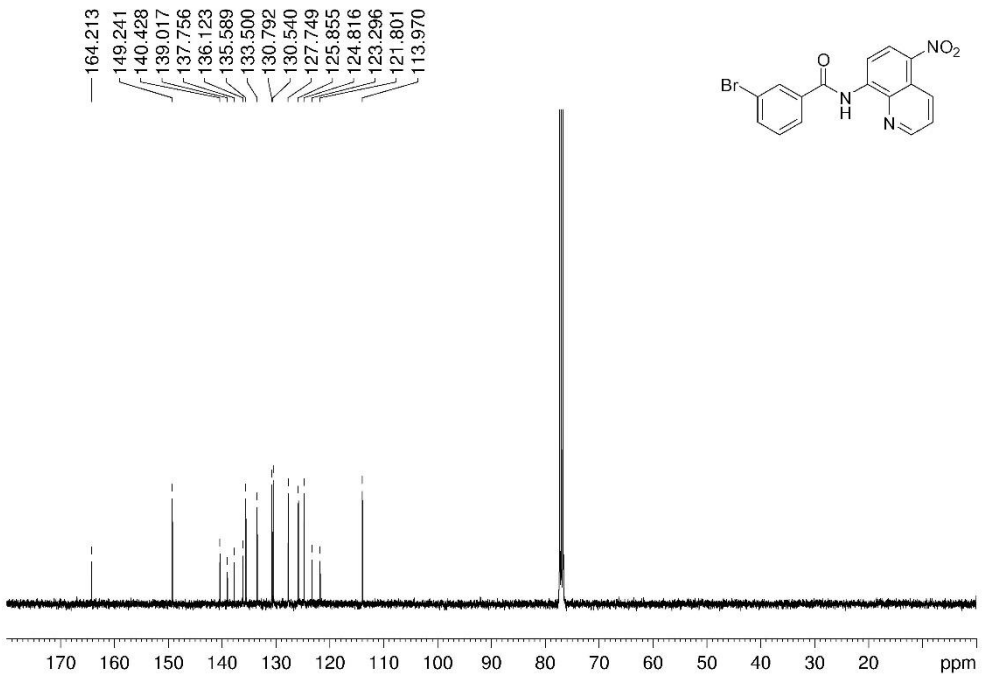
1.070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130.540
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124.816
123.296
121.801
113.970
Br
O
N
H
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130
120
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80
70
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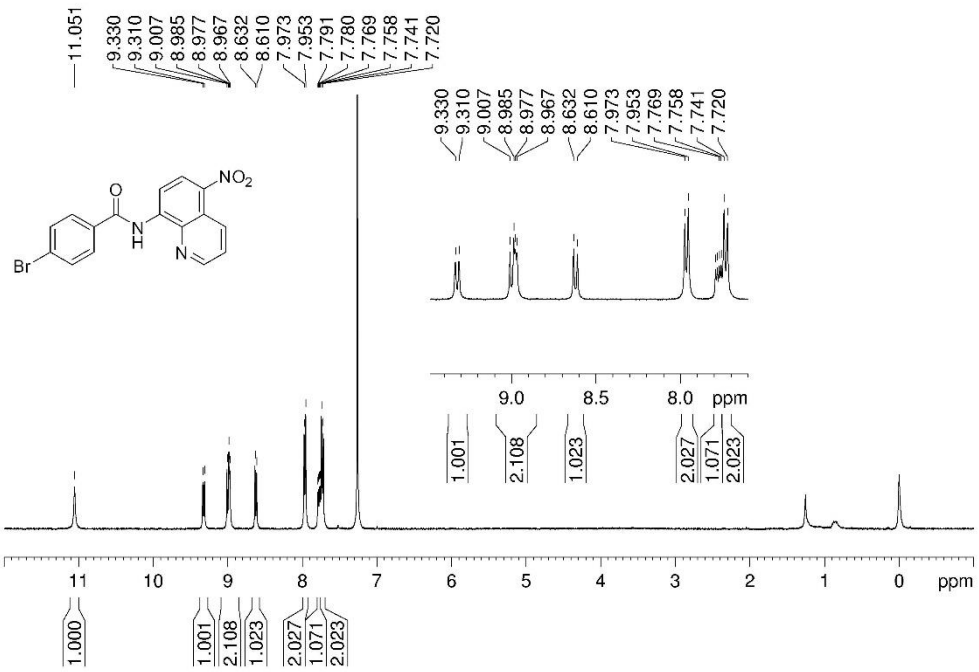
50
40
30
20
ppm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8.632
8.610
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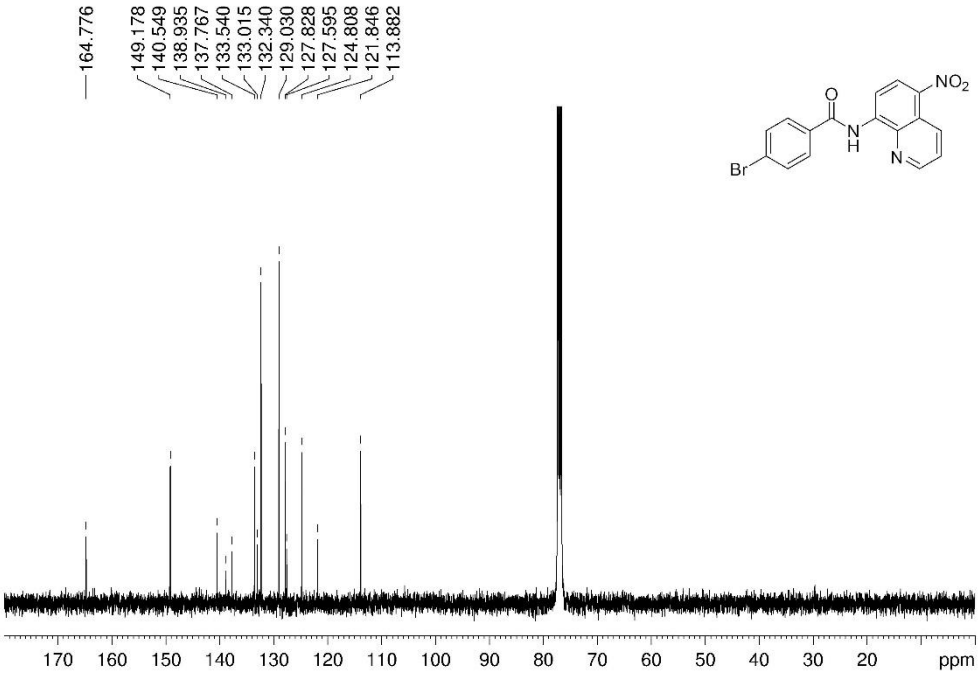
7.953
7.791
7.780
7.769
7.758
7.741
7.720
NO2
O
N
H
Br
9.0
8.5
8.0
ppm
1.001
2.108
1.023
2.027
1.071
2.023
11
10
9
8
7
6
5
4
3
2
1
0
ppm
1.000
1.001
2.108
1.023
2.027
1.071
2.023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121.846
113.882
NO2
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N
H
Br
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160
150
140
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120
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80
70
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40
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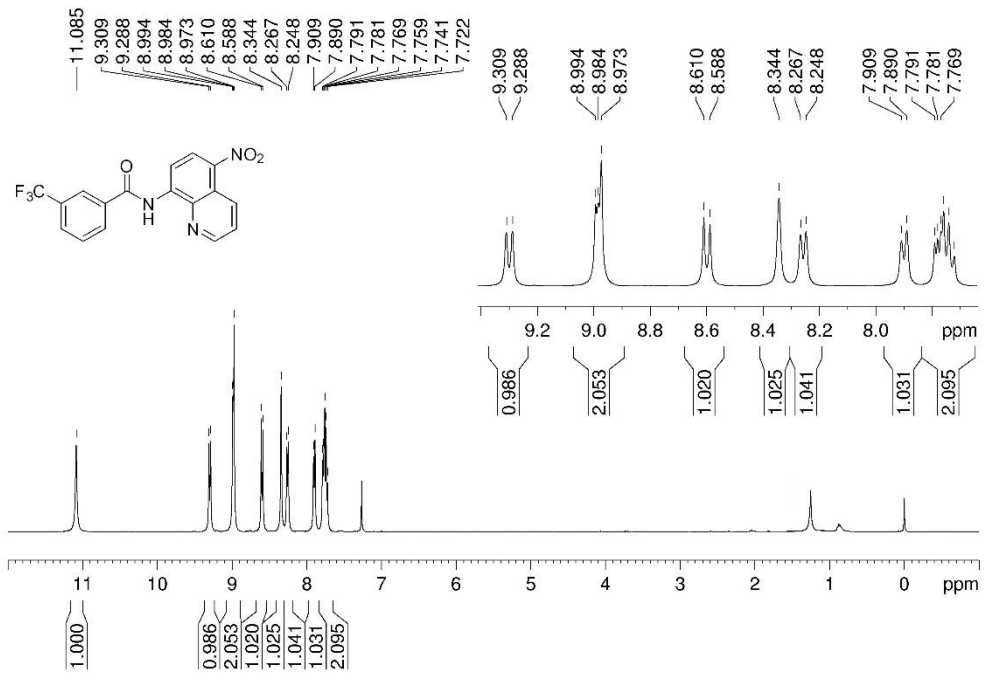
20
ppm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8.248
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7.890
7.791
7.781
7.769
7.759
7.741
7.722
NO2
F3C
O
N
H
N
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9.0
8.8
8.6
8.4
8.2
8.0
ppm
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1.020
1.025
1.041
1.031
2.095
11
10
9
8
7
6
5
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ppm
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1.020
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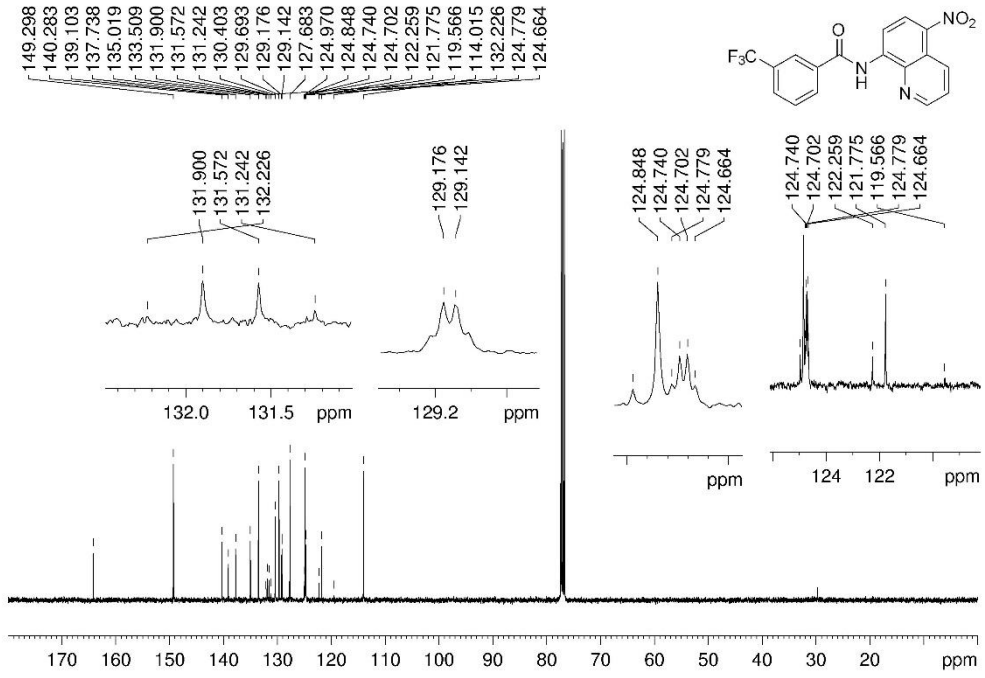
1.041
1.031
2.095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129.176
129.142
127.683
124.970
124.848
124.740
124.702
122.259
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119.566
114.015
132.226
124.779
124.664
NO2
F3C
O
N
H
N
131.900
131.572
131.242
132.226
132.0
131.5
ppm
129.176
129.142
129.2
ppm
124.848
124.740
124.702
124.779
124.664
ppm
124.740
124.702
122.259
121.775
119.566
124.779
124.664
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122
ppm
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150
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130
120
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80
70
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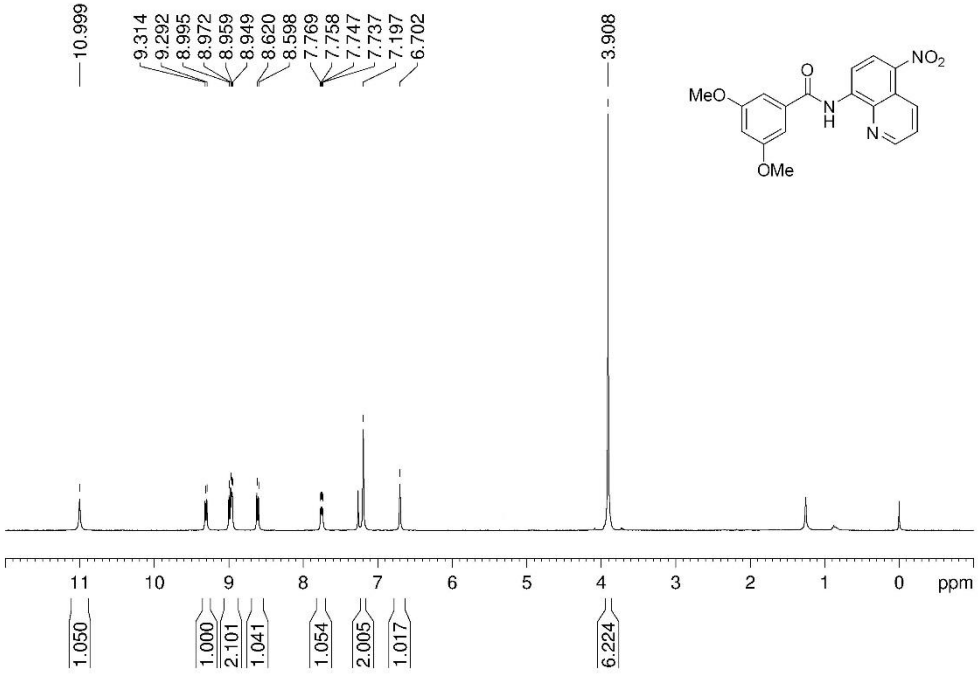
20
ppm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8.620
8.598
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7.758
7.747
7.737
7.197
6.702
3.908
MeO
OMe
O
N
H
N
NO2
11
10
9
8
7
6
5
4
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ppm
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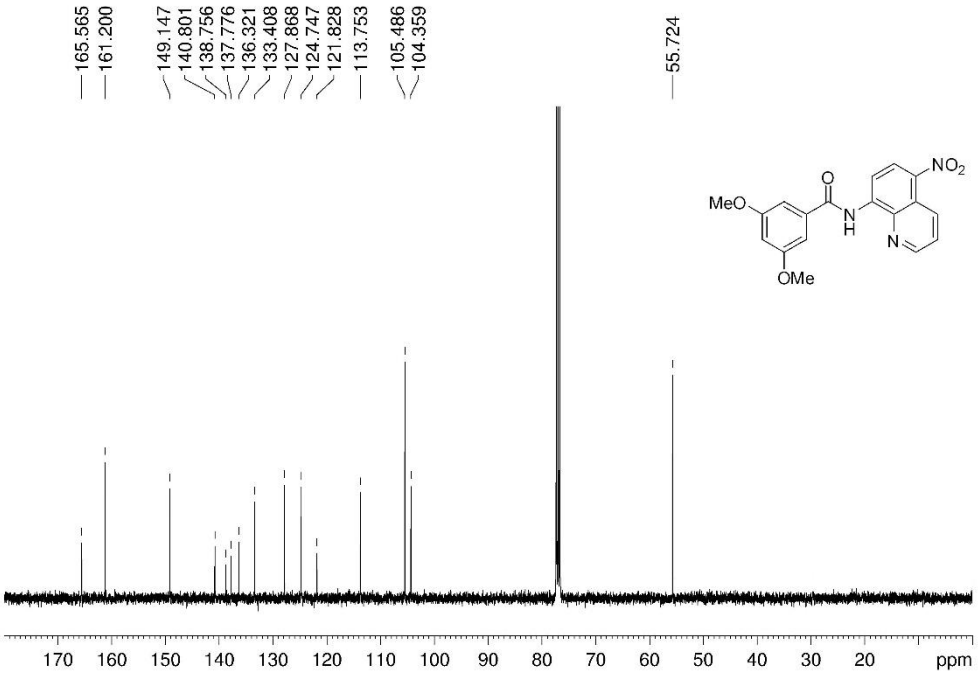
1.000
2.101
1.041
1.054
2.005
1.017
6.224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113.753
105.486
104.359
55.724
MeO
OMe
O
N
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80
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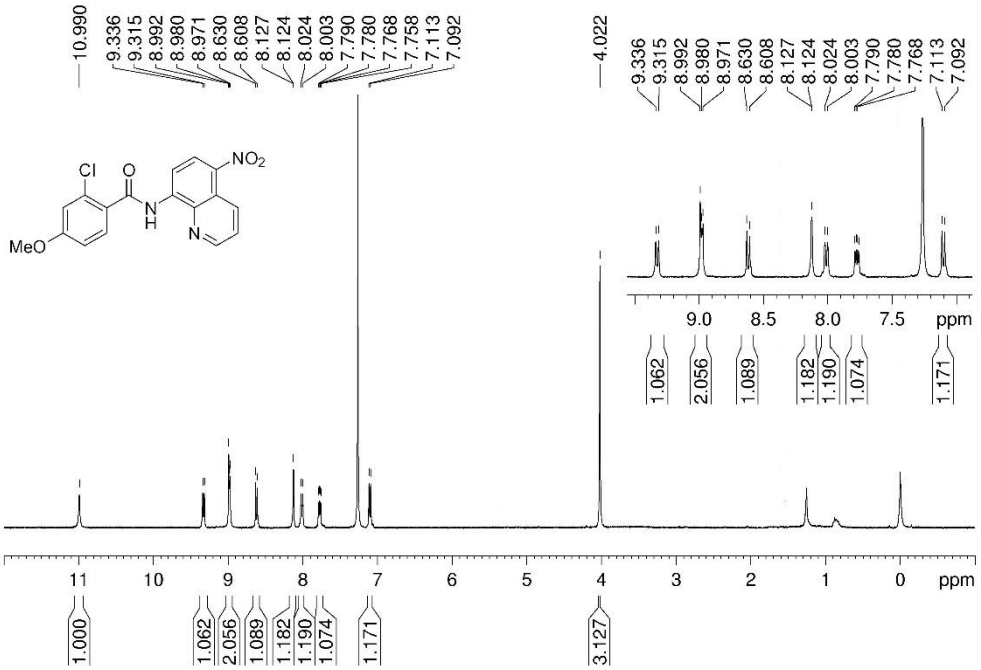
20
ppm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8.024
8.003
7.790
7.780
7.768
7.758
7.113
7.092
4.022
Cl
O
N
H
NO2
MeO
N
9.0
8.5
8.0
7.5
ppm
1.062
2.056
1.089
1.182
1.190
1.074
1.171
11
10
9
8
7
6
5
4
3
2
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ppm
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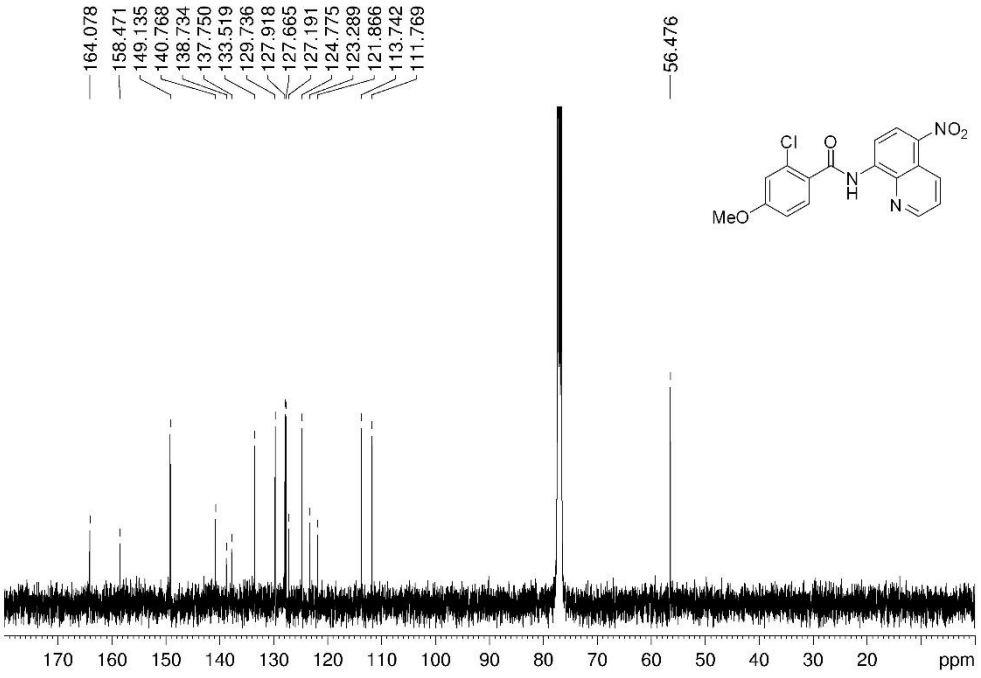
1.062
2.056
1.089
1.182
1.190
1.074
1.171
3.127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137.750
133.519
129.736
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127.665
127.191
124.775
123.289
121.866
113.742
111.769
56.476
Cl
O
N
H
NO2
MeO
N
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
ppm


10.903
9.312
9.290
8.963
8.955
8.954
8.921
8.899
8.602
8.580
7.880
7.873
7.772
7.761
7.750
7.739
7.672
7.660
7.236
7.224
7.215
NO2
O
N
H
S
N
7.8
7.6
7.4
ppm
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9.2
9.0
8.8
ppm
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1.004
1.022
1.058
11
10
9
8
7
6
5
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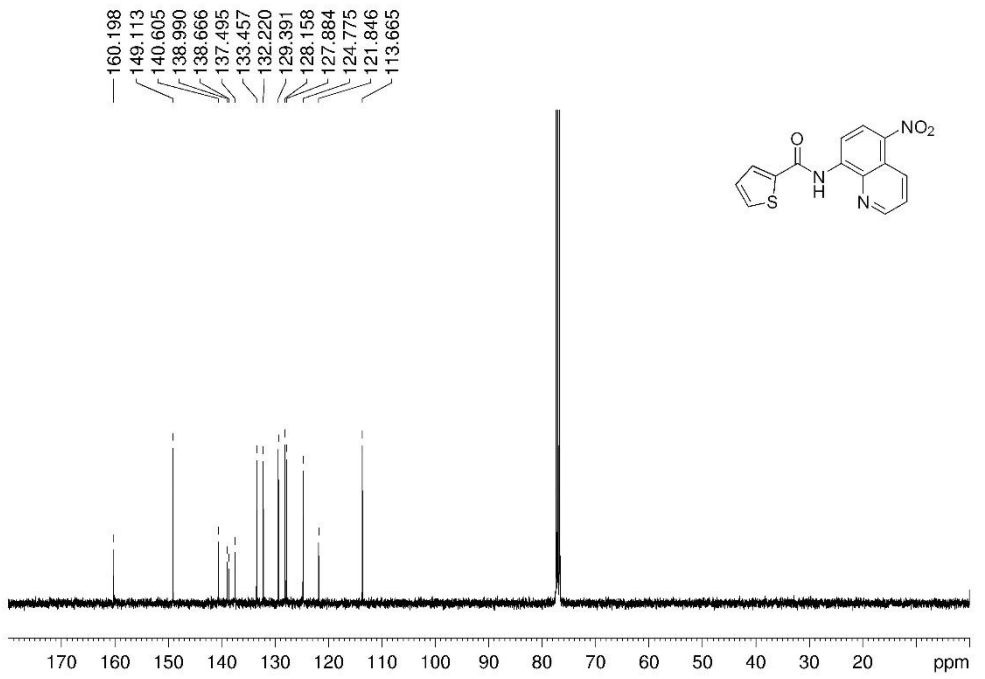
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132.220
129.391
128.158
127.884
124.775
121.846
113.665
NO2
O
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H
S
N
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150
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120
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80
70
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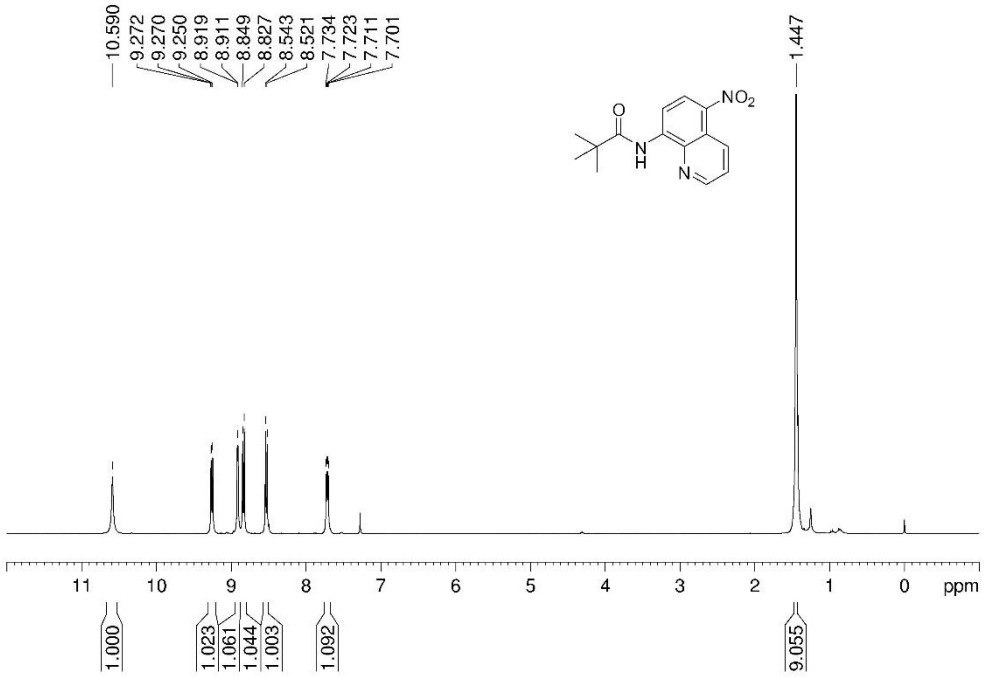
50
40
30
20
ppm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8.827
8.543
8.521
7.734
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7.711
7.701
1.447
NO2
O
N
H
N
11
10
9
8
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6
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2
1
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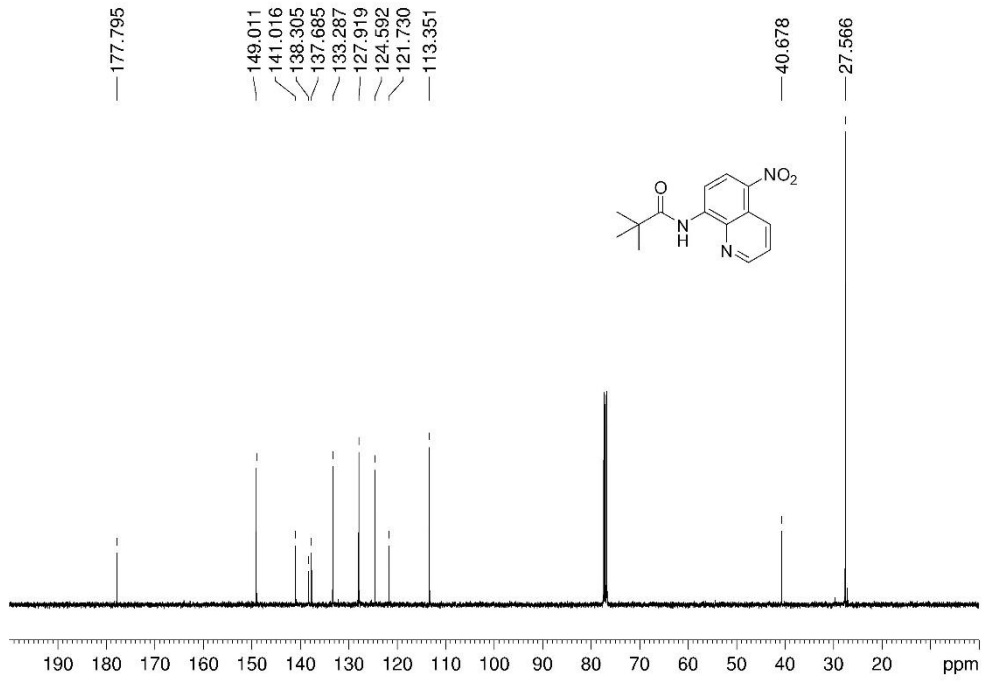
9.055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N
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80
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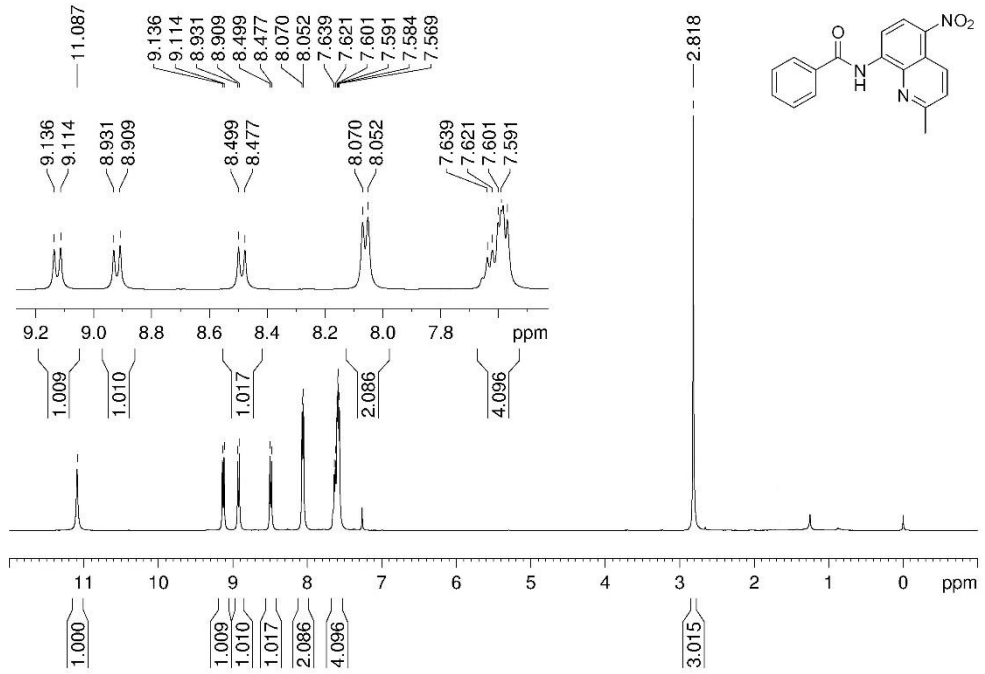
ppm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7.621
7.601
7.591
7.584
7.569
2.818
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O
N
H
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9.0
8.8
8.6
8.4
8.2
8.0
7.8
ppm
1.009
1.010
1.017
2.086
4.096
11
10
9
8
7
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4
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ppm
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1.010
1.017
2.086
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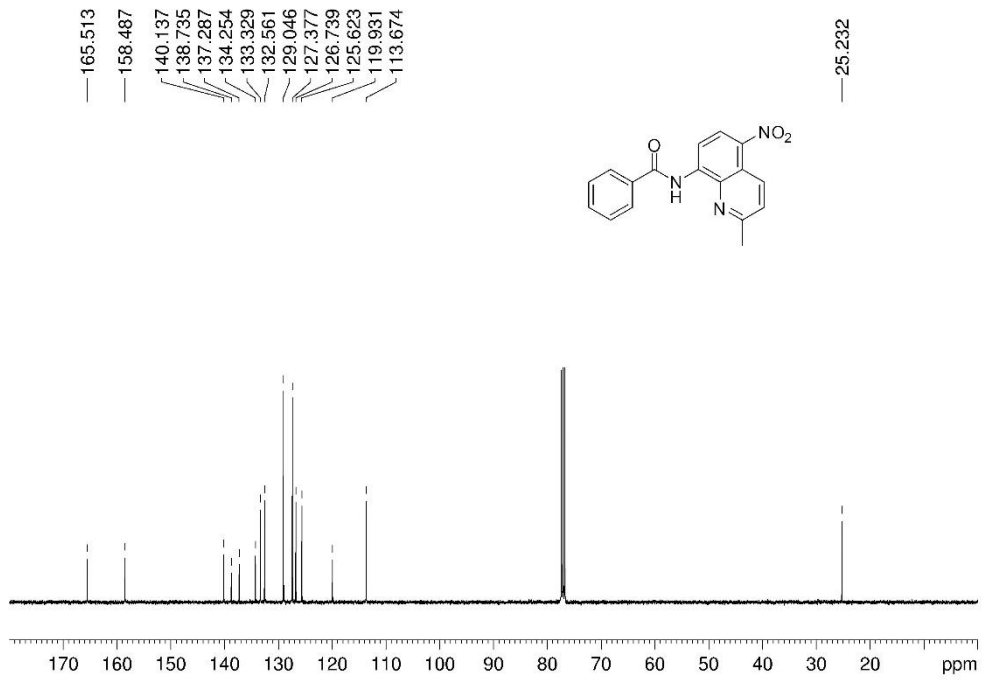
3.015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132.561
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127.377
126.739
125.623
119.931
113.674
25.232
NO2
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N
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150
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120
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80
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60
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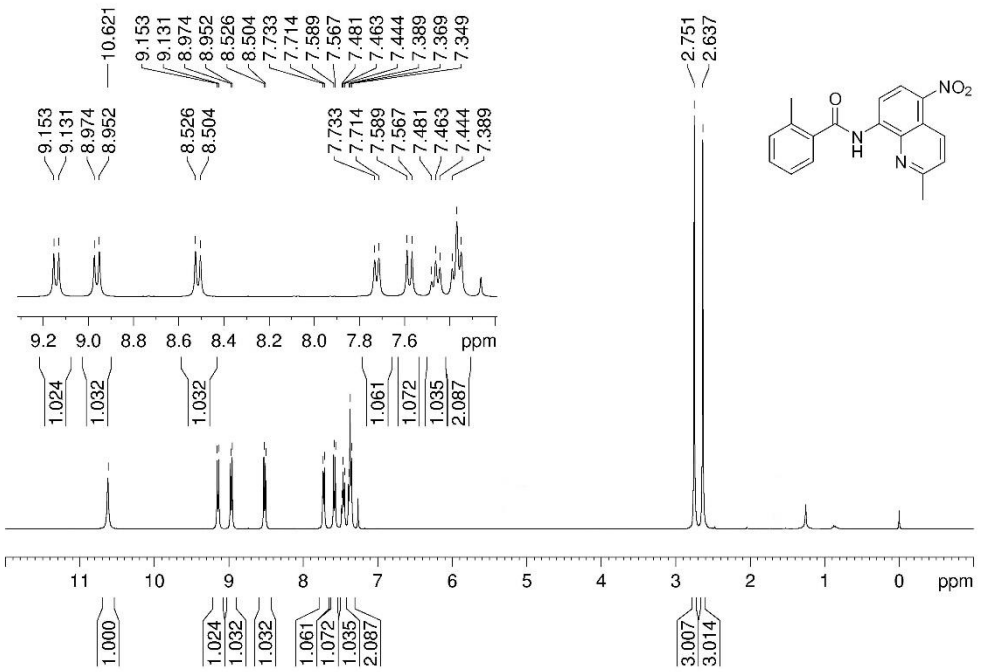
20
ppm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8.526
8.504
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7.481
7.463
7.444
7.389
7.369
7.349
2.751
2.637
NO2
O
N
H
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1.032
1.061
1.072
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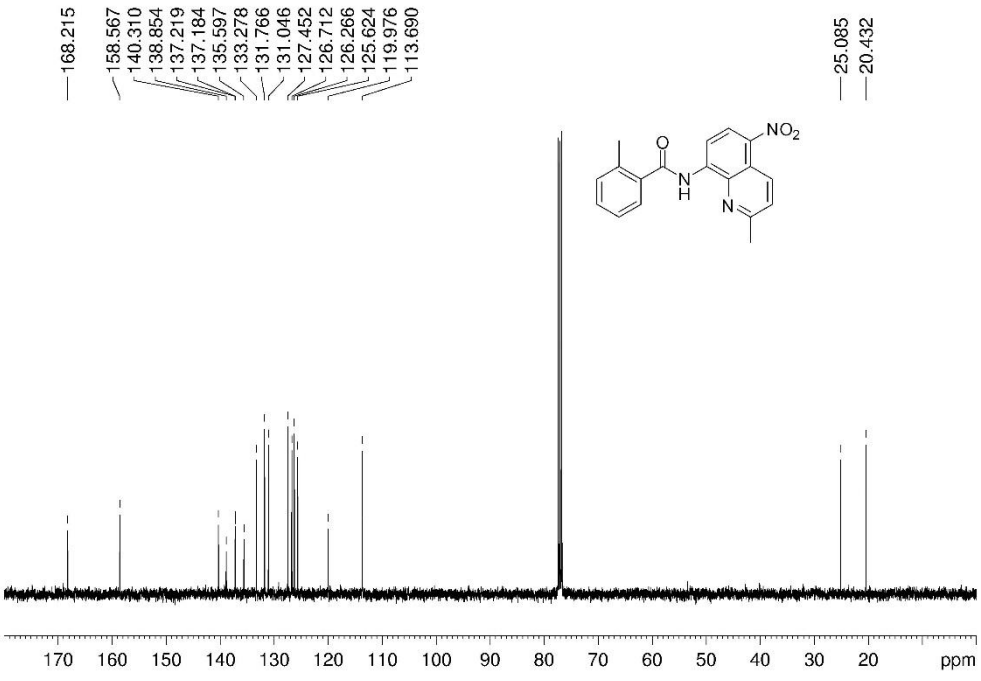
3.014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158.567
140.310
138.854
137.219
137.184
135.597
133.278
131.766
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126.266
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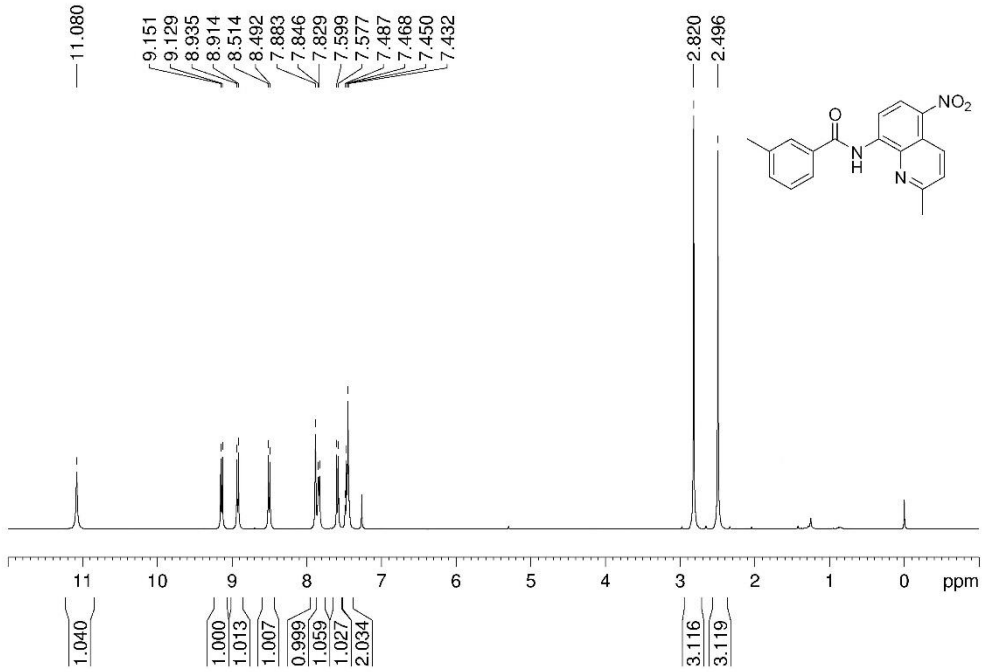
N
H
ppm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7.883
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7.577
7.487
7.468
7.450
7.432
2.820
2.496
NO2
O
N
H
N
11
10
9
8
7
6
5
4
3
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1.000
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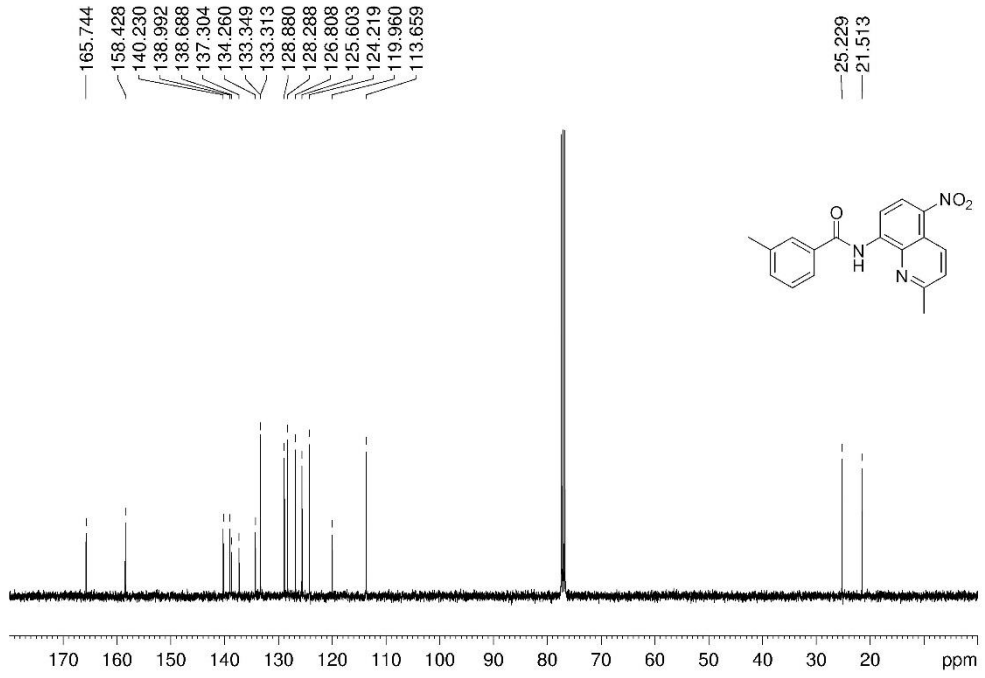
3.119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133.349
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128.288
126.808
125.603
124.219
119.960
113.659
25.229
21.513
NO2
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N
H
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80
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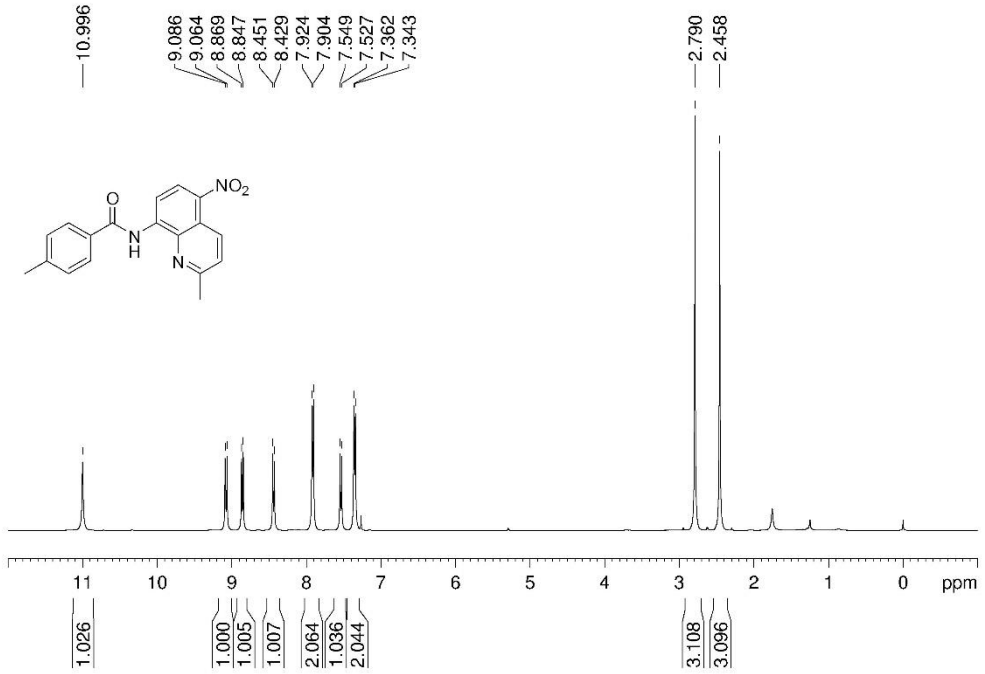
40
30
20
ppm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7.924
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7.549
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7.362
7.343
2.790
2.458
NO2
O
N
H
N
11
10
9
8
7
6
5
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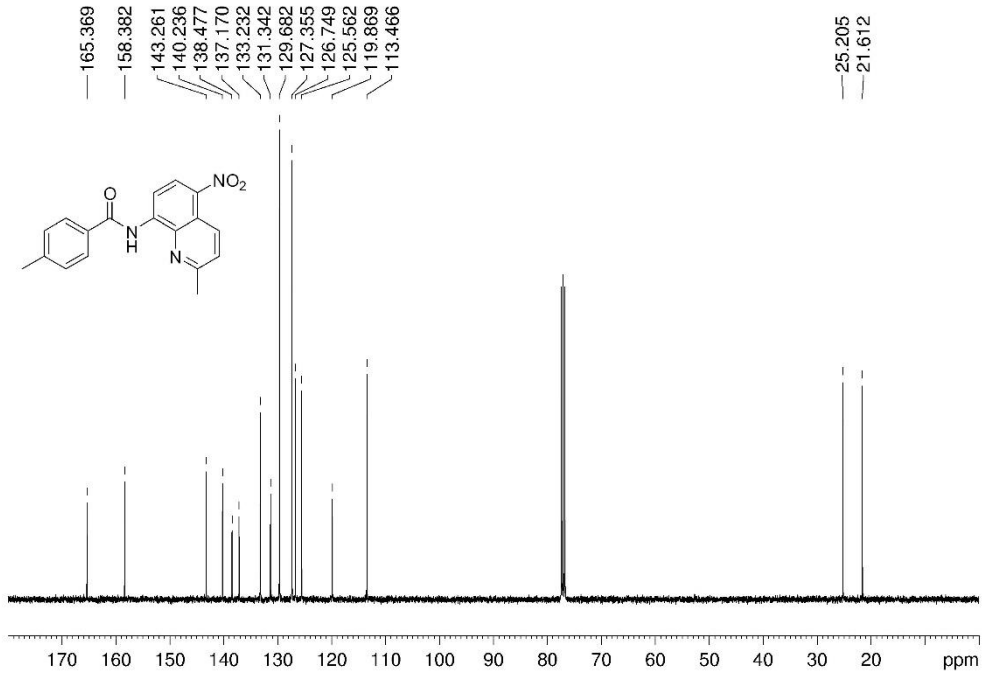
3.096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131.342
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127.355
126.749
125.562
119.869
113.466
25.205
21.612
NO2
O
N
H
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150
140
130
120
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100
90
80
70
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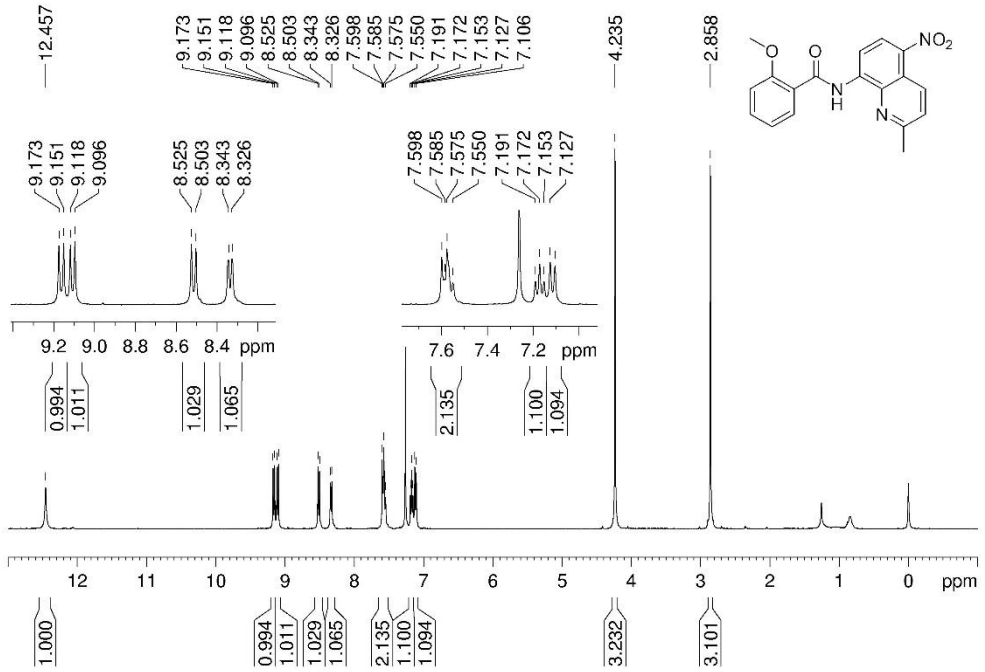
50
40
30
20
ppm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9.173
9.151
9.118
9.096
8.525
8.503
8.343
8.326
7.598
7.585
7.575
7.550
7.191
7.172
7.153
7.127
7.106
4.235
2.858
NO2
O
N
H
9.2 9.0 8.8 8.6 8.4 ppm
7.6 7.4 7.2 ppm
0.994
1.011
1.029
1.065
2.135
1.100
1.094
12 11 10 9 8 7 6 5 4 3 2 1 0 ppm
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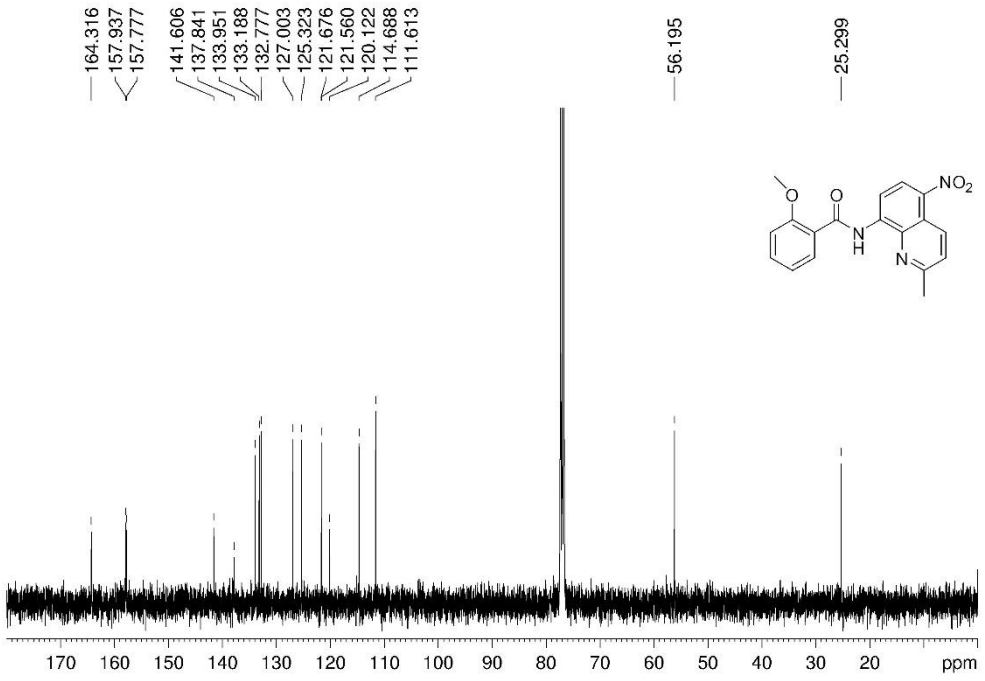
3.101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132.777
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121.676
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111.613
56.195
25.299
NO2
O
N
H
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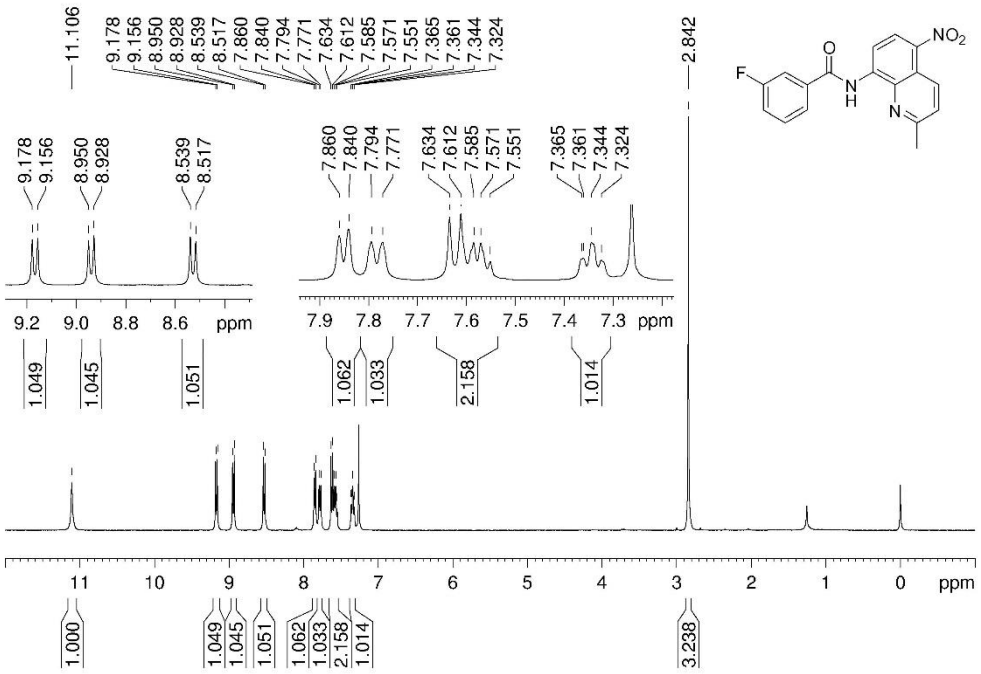
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7.860
7.840
7.794
7.771
7.634
7.612
7.585
7.571
7.551
7.365
7.361
7.344
7.324
2.842
NO2
F
O
N
H
N
9.2
9.0
8.8
8.6
ppm
7.9
7.8
7.7
7.6
7.5
7.4
7.3
ppm
1.049
1.045
1.051
1.062
1.033
2.158
1.014
11
10
9
8
7
6
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3
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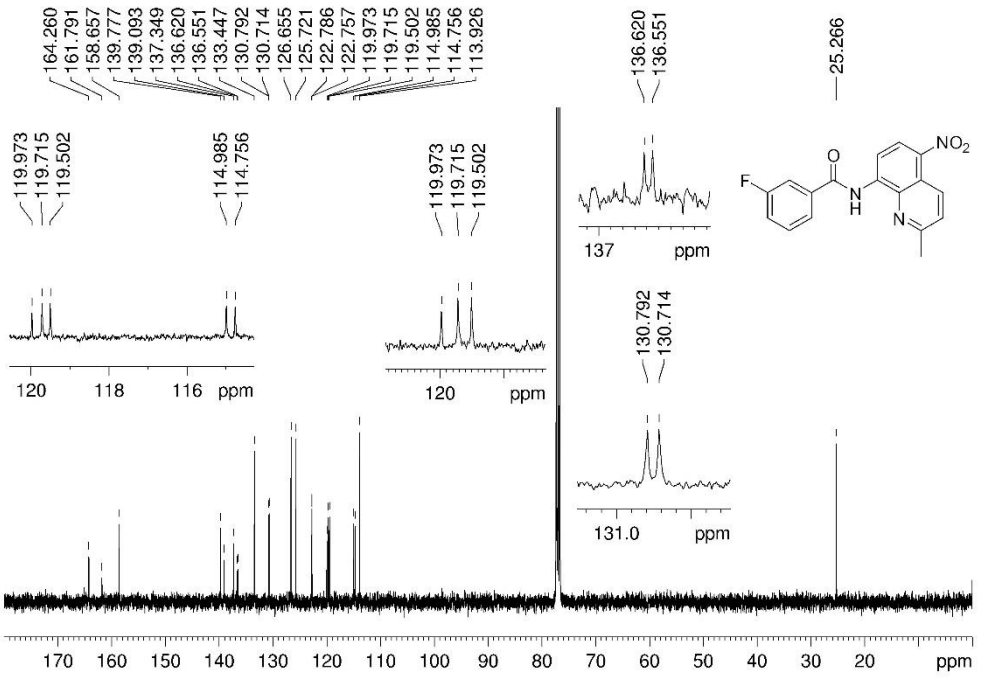
ppm
1.000
3.238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161.791
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139.777
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137.349
136.620
136.551
133.447
130.792
130.714
126.655
125.721
122.786
122.757
119.973
119.715
119.502
114.985
114.756
113.926
136.620
136.551
25.266
NO2
F
O
N
H
N
120
118
116
ppm
137
ppm
130.792
130.714
131.0
ppm
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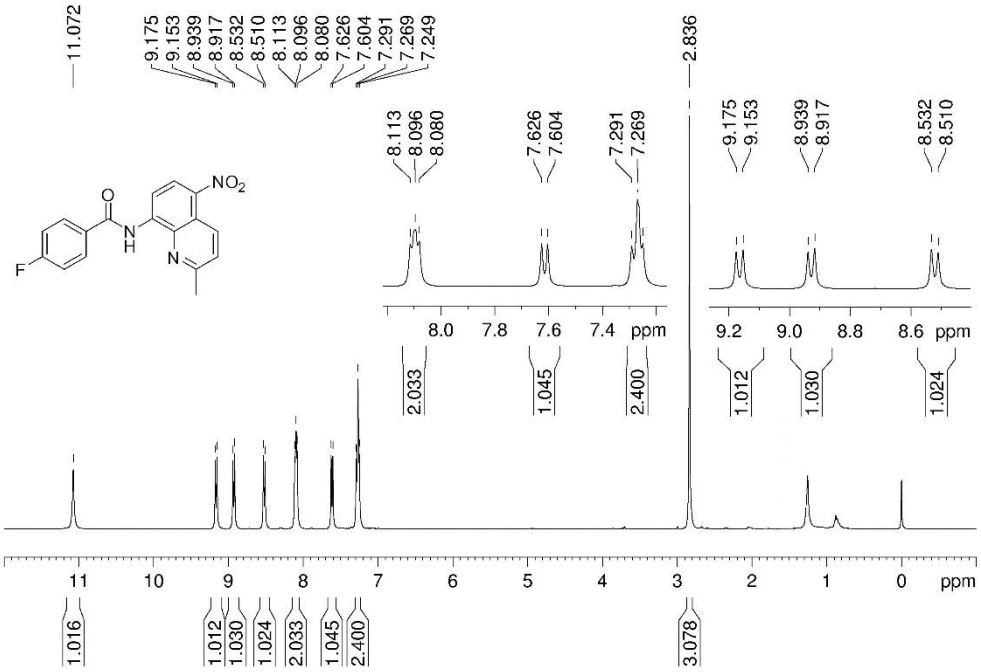
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
ppm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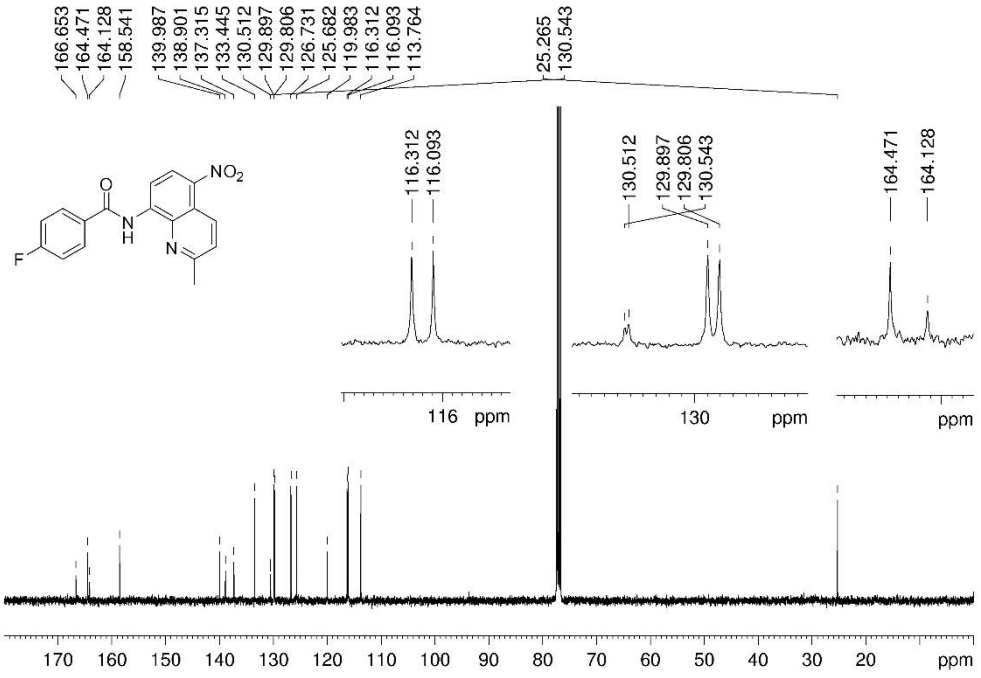
9.175
9.153
8.939
8.917
8.532
8.510
8.113
8.096
8.080
7.626
7.604
7.291
7.269
7.249
2.836
NO2
O
N
H
F
N
8.0
7.8
7.6
7.4
ppm
9.2
9.0
8.8
8.6
ppm
2.033
1.045
2.400
1.012
1.030
1.024
11
10
9
8
7
6
5
4
3
2
1
0
ppm
1.016
1.012
1.030
1.024
2.033
1.045
2.400
3.078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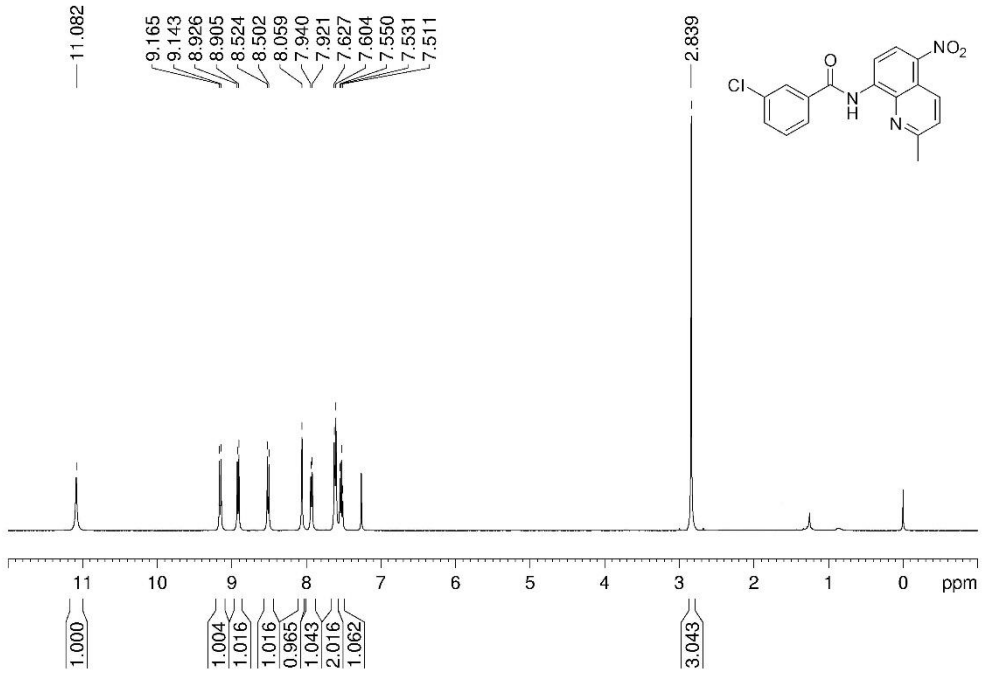
164.471
164.128
158.541
139.987
138.901
137.315
133.445
130.512
129.897
129.806
126.731
125.682
119.983
116.312
116.093
113.764
25.265
130.543
NO2
O
N
H
F
N
116.312
116.093
130.512
129.897
129.806
130.543
164.471
164.128
116
ppm
130
ppm
ppm
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
ppm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9.165
9.143
8.926
8.905
8.524
8.502
8.059
7.940
7.921
7.627
7.604
7.550
7.531
7.511
2.839
Cl
O
N
H
N
NO2
11
10
9
8
7
6
5
4
3
2
1
0
ppm
1.000
1.004
1.016
1.016
0.965
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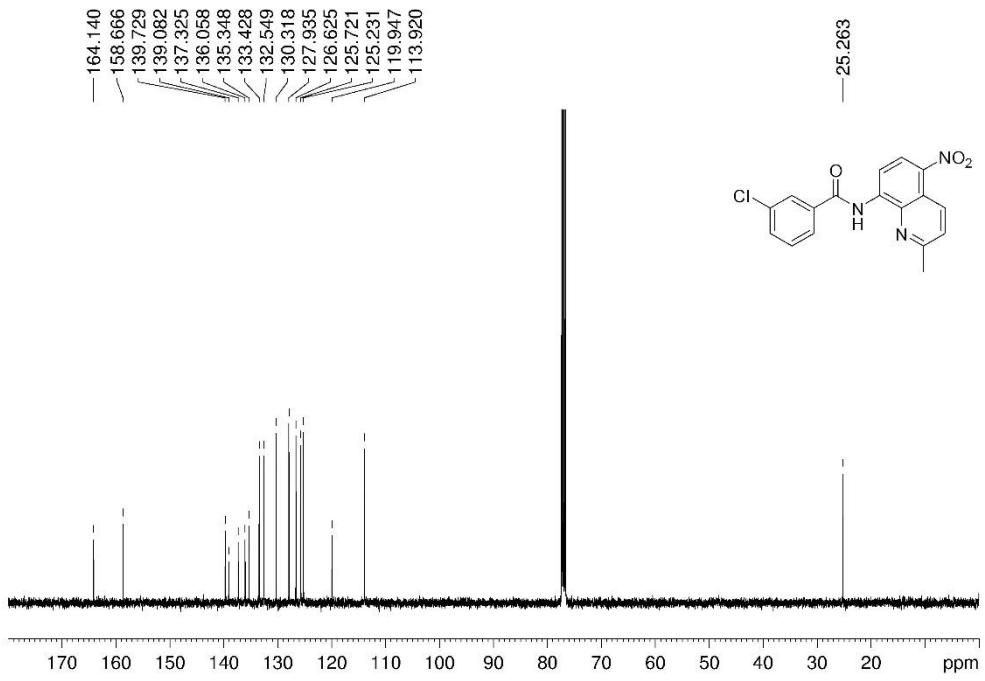
2.016
1.062
3.043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136.058
135.348
133.428
132.549
130.318
127.935
126.625
125.721
125.231
119.947
113.920
25.263
Cl
O
N
H
N
NO2
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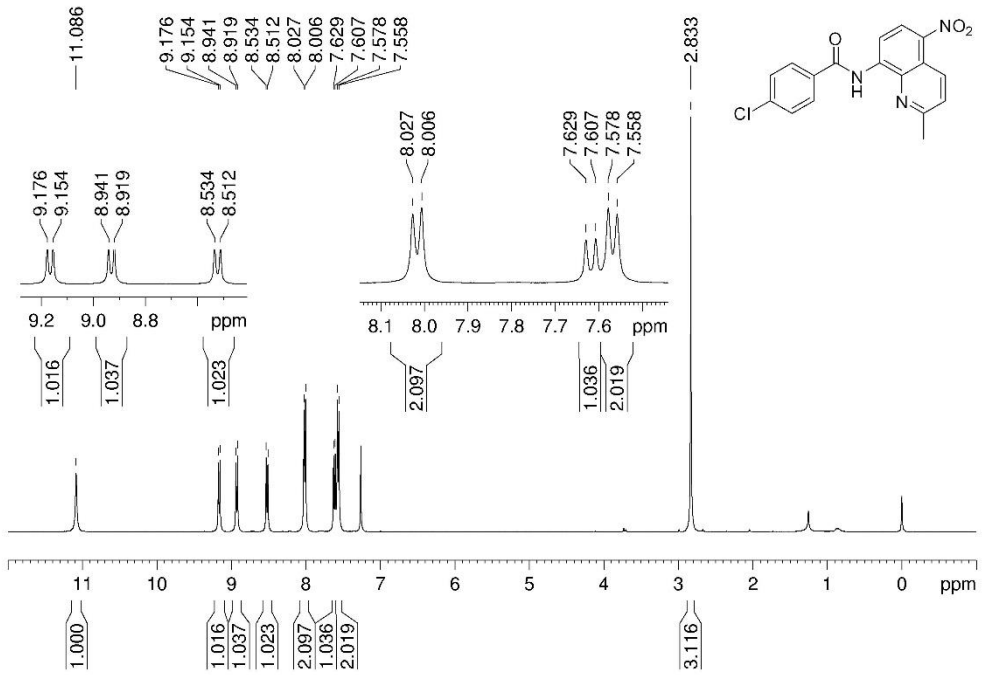
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
ppm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9.154
8.941
8.919
8.534
8.512
8.027
8.006
7.629
7.607
7.578
7.558
2.833
NO2
O
N
H
N
Cl
9.2
9.0
8.8
ppm
8.1
8.0
7.9
7.8
7.7
7.6
ppm
1.016
1.037
1.023
2.097
1.036
2.019
11
10
9
8
7
6
5
4
3
2
1
0
ppm
1.000
1.016
1.037
1.023
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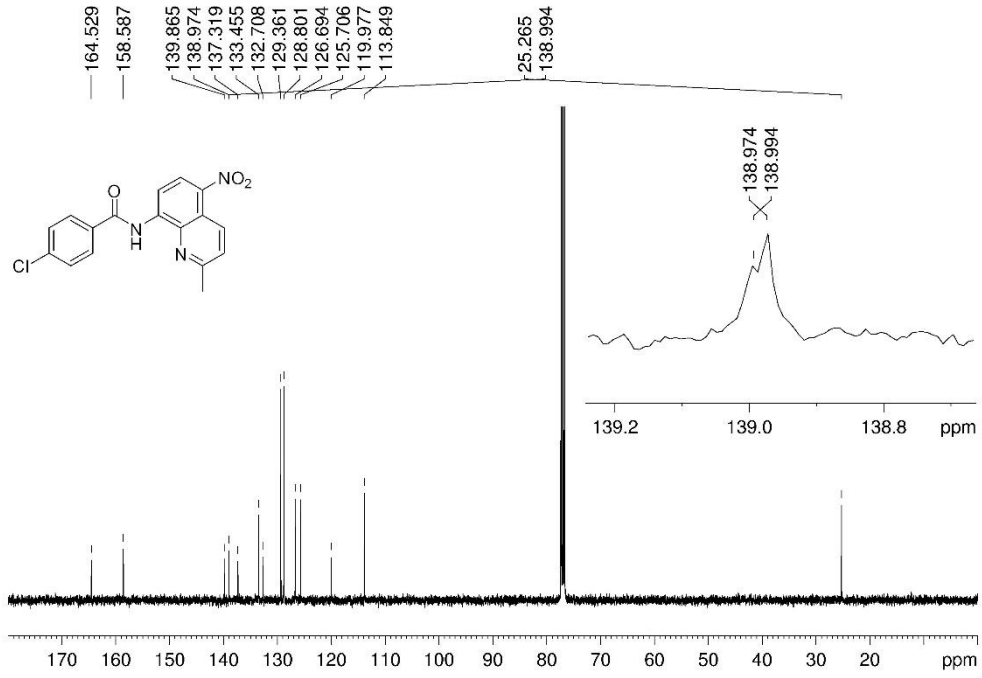
1.036
2.019
3.116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129.361
128.801
126.694
125.706
119.977
113.849
25.265
138.994
138.974
138.994
NO2
O
N
H
N
Cl
139.2
139.0
138.8
ppm
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160
150
140
130
120
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100
90
80
70
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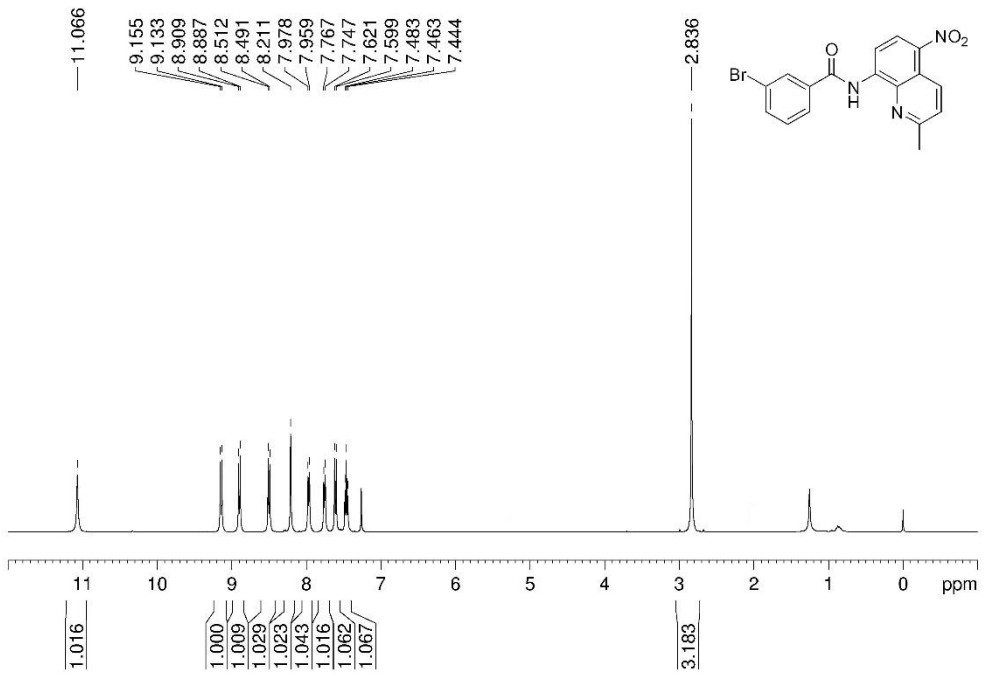
50
40
30
20
ppm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8.491
8.211
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7.767
7.747
7.621
7.599
7.483
7.463
7.444
2.836
Br
O
N
H
N
NO2
11
10
9
8
7
6
5
4
3
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ppm
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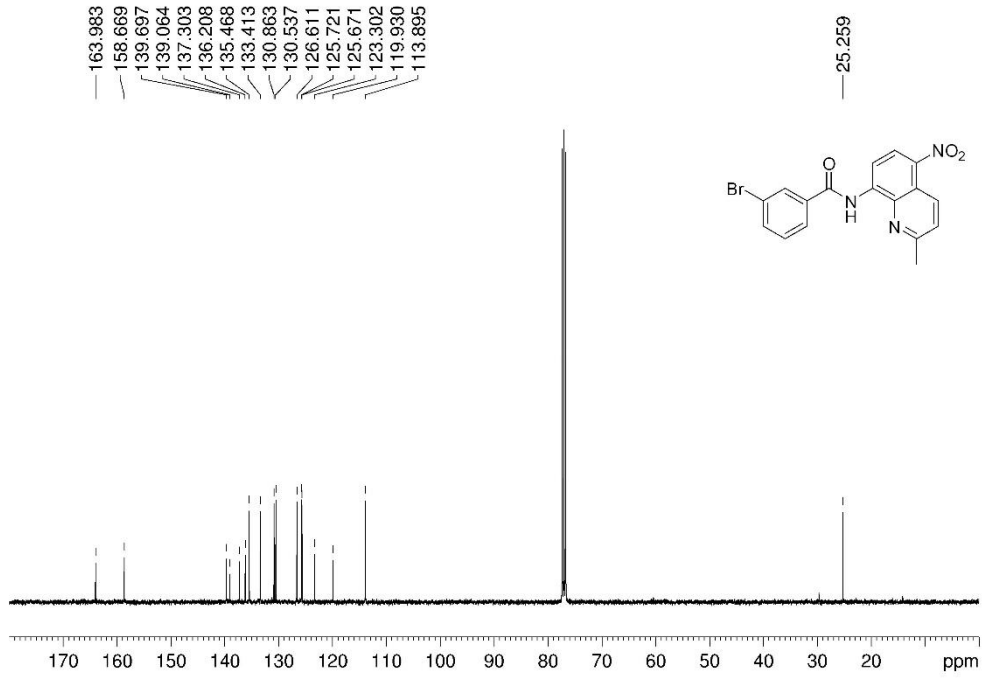
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125.721
125.671
123.302
119.930
113.895
25.259
Br
O
N
H
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NO2
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80
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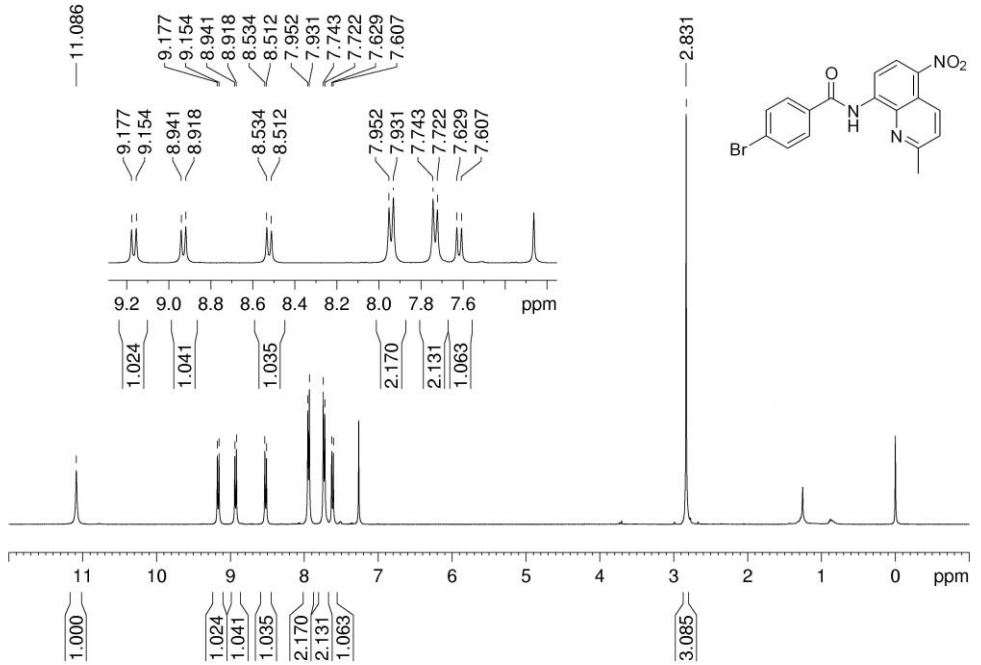
50
40
30
20
ppm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7.931
7.743
7.722
7.629
7.607
2.831
NO2
O
N
H
Br
N
9.2 9.0 8.8 8.6 8.4 8.2 8.0 7.8 7.6 ppm
1.024
1.041
1.035
2.170
2.131
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11 10 9 8 7 6 5 4 3 2 1 0 ppm
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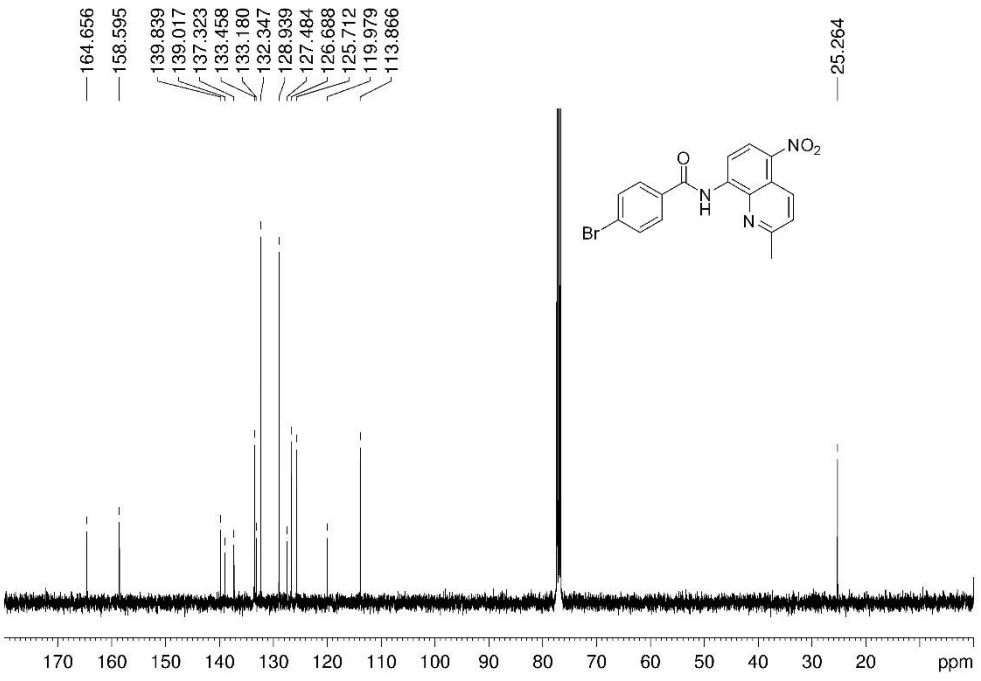
1.041
1.035
2.170
2.131
1.063
3.085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133.180
132.347
128.939
127.484
126.688
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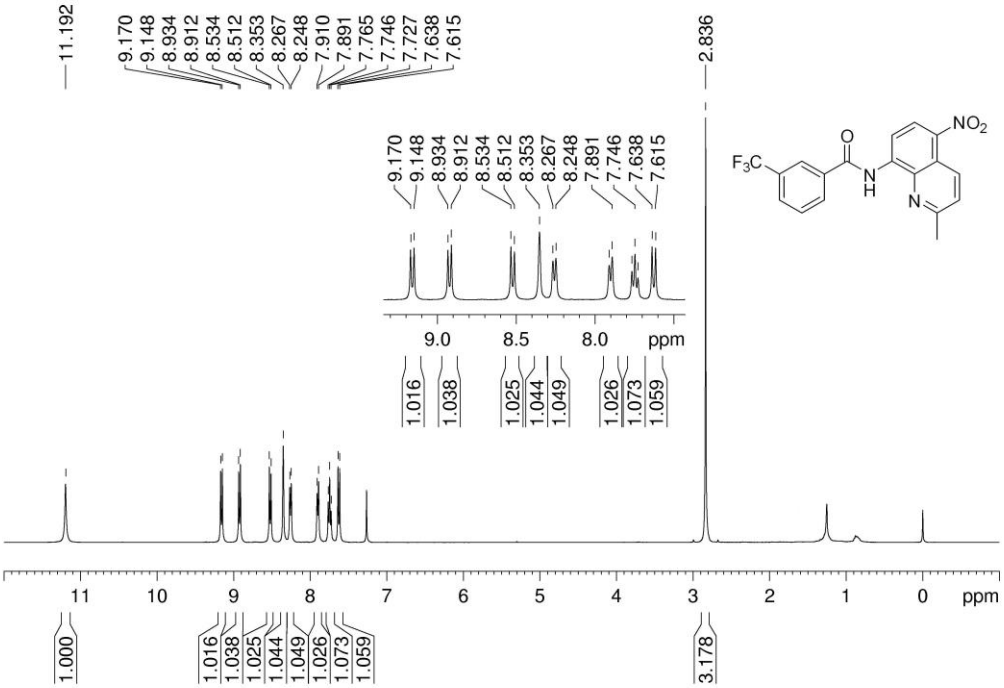
113.866
25.264
NO2
O
N
H
Br
N
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 ppm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8.353
8.267
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7.910
7.891
7.765
7.746
7.727
7.638
7.615
2.836
9.0
8.5
8.0
ppm
1.016
1.038
1.025
1.044
1.049
1.026
1.073
1.059
11
10
9
8
7
6
5
4
3
2
1
0
ppm
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3.178
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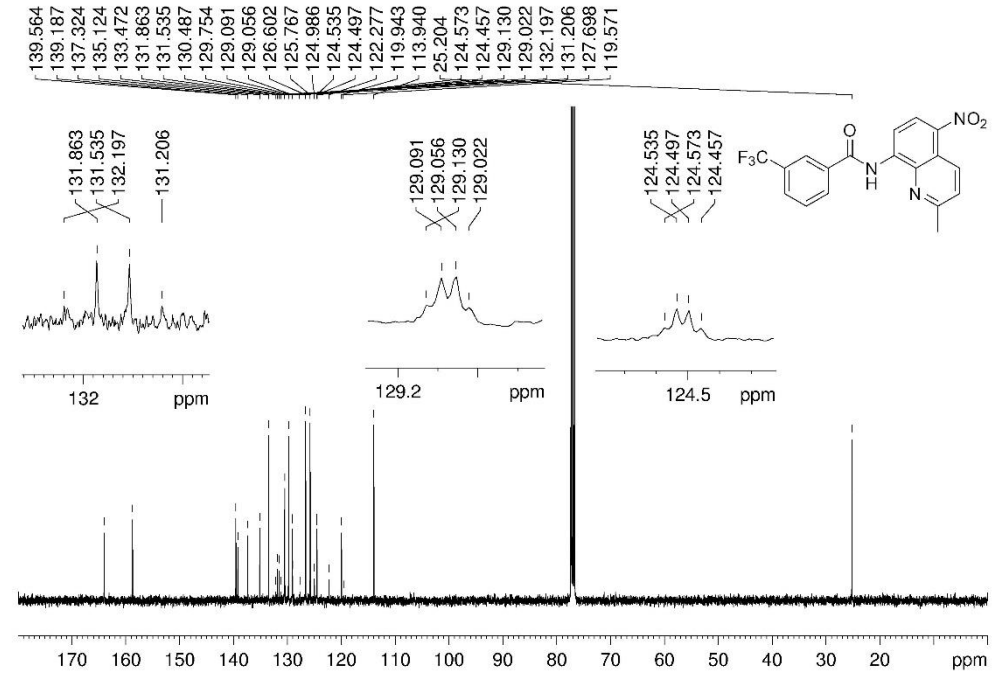
F3C
O
N
H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129.056
126.602
125.767
124.986
124.535
124.497
122.277
119.943
113.940
25.204
124.573
124.457
129.130
129.022
132.197
131.206
127.698
119.571
131.863
131.535
132.197
131.206
132
ppm
129.091
129.056
129.130
129.022
129.2
ppm
124.535
124.497
124.573
124.457
124.5
ppm
170
160
150
140
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120
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100
90
80
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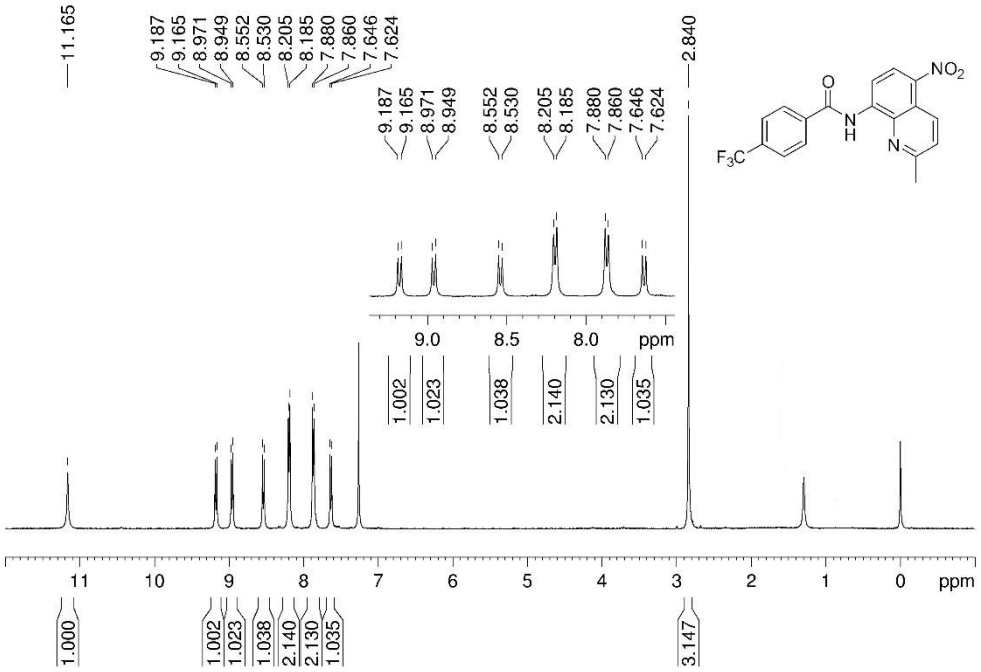
30
20
ppm
NO2
F3C
O
N
H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8.530
8.205
8.185
7.880
7.860
7.646
7.624
2.840
NO2
O
N
H
N
F3C
9.0
8.5
8.0
ppm
1.002
1.023
1.038
2.140
2.130
1.035
11
10
9
8
7
6
5
4
3
2
1
0
ppm
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1.038
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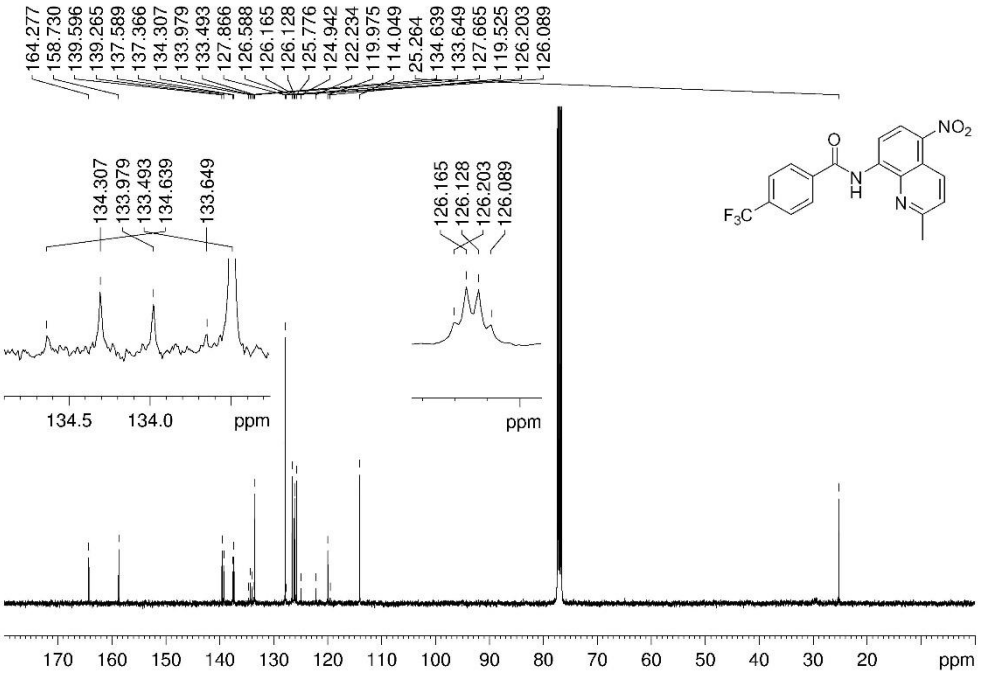
3.147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133.979
133.493
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126.588
126.165
126.128
125.776
124.942
122.234
119.975
114.049
25.264
134.639
133.649
127.665
119.525
126.203
126.089
NO2
O
N
H
N
F3C
134.307
133.979
133.493
134.639
133.649
134.5
134.0
ppm
126.165
126.128
126.203
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ppm
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160
150
140
130
120
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80
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40
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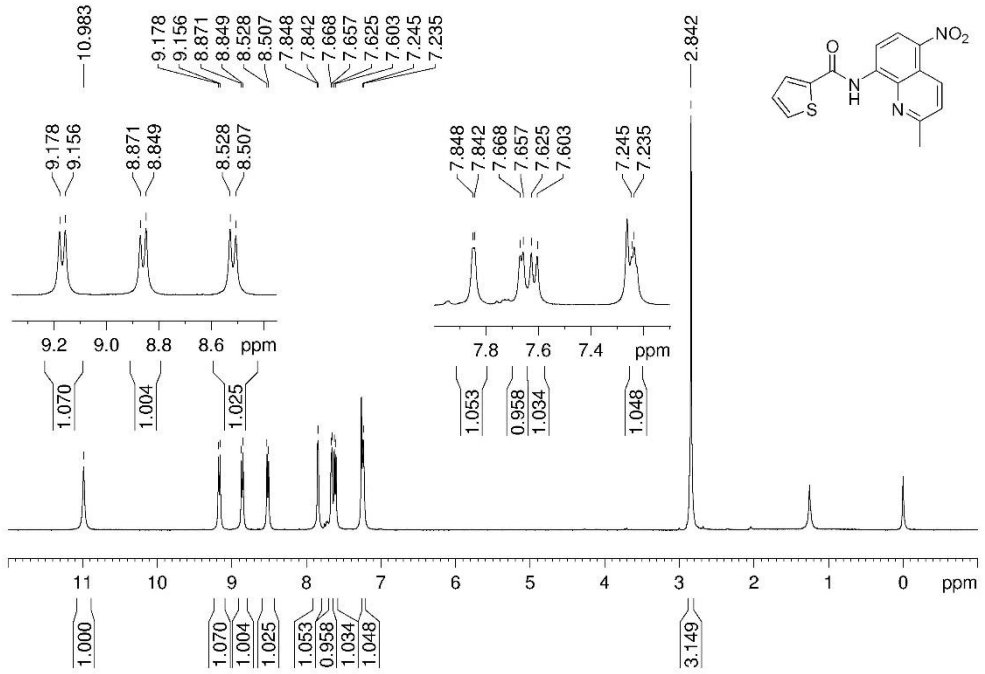
20
ppm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8.528
8.507
7.848
7.842
7.668
7.657
7.625
7.603
7.245
7.235
2.842
NO2
O
N
H
S
N
9.2
9.0
8.8
8.6
ppm
7.8
7.6
7.4
ppm
1.070
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1.025
1.053
0.958
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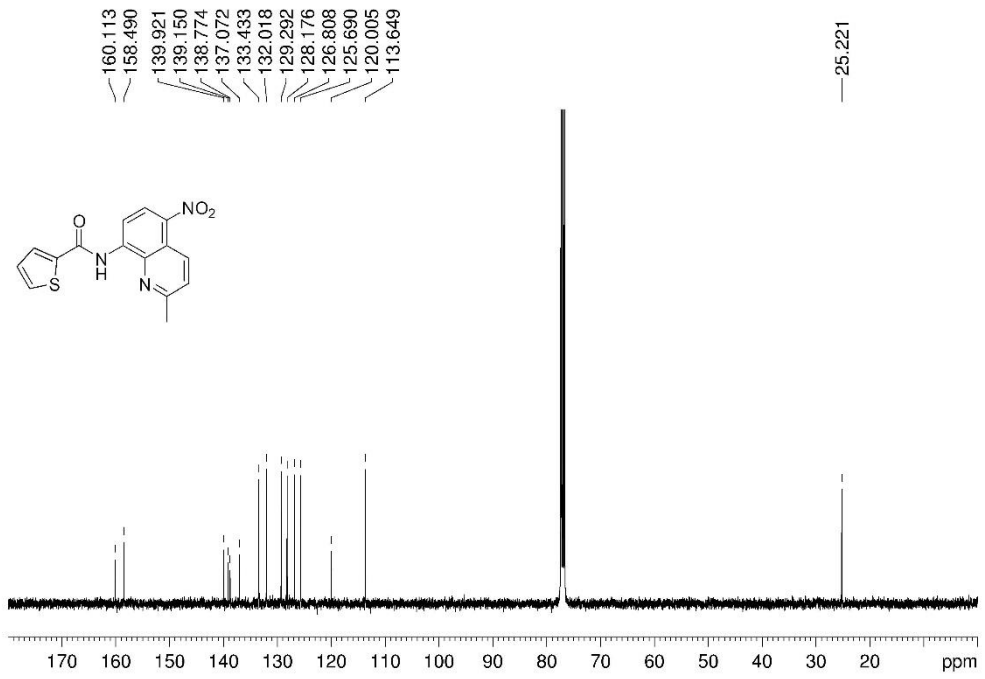
1.048
1.000
3.149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139.150
138.774
137.072
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132.018
129.292
128.176
126.808
125.690
120.005
113.649
25.221
NO2
O
N
H
S
N
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
ppm