*Supporting Information*

# Rh(III)-catalyzed annulation of *N*-methoxybenzamides with ynesulfonamides at room temperature: a practical and efficient route to 4-aminoisoquinolone derivatives

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## I. General remarks

NMR spectra were obtained on a Bruker AV II-400 MHz spectrometer. The $^{1}H$ NMR (400 MHz) chemical shifts were measured relative to $CDCl_3$ or DMSO-$d_6$ as the internal reference ($CDCl_3$: $\delta$ = 7.26 ppm; DMSO-$d_6$: $\delta$ = 2.50 ppm). The $^{13}C$ NMR (100 MHz) chemical shifts were given using $CDCl_3$ or DMSO-$d_6$ as the internal standard ($CDCl_3$: $\delta$ = 77.16 ppm; DMSO-$d_6$: $\delta$ = 39.52 ppm). High resolution mass spectra (HRMS) were obtained with a Waters-Q-TOF-Premier (ESI). X-Ray single-crystal diffraction data were collected on an Oxford Xcalibur E X-ray single crystal diffractometer. Melting points were determined with XRC-1 and are uncorrected.

Unless otherwise noted, all reagents were obtained from commercial suppliers and used without further purification. *N*-Methoxylbenzamide derivatives, ynesulfonamides and CsF-Celite were prepared according to the literature procedures.[1-3] MeOH was dried over Mg and distilled prior to use.

## II. Optimization of the Rh-catalyzed annulation of *N*-methoxylbenzamide 1a with *N*,4-dimethyl-*N*-(phenylethynyl)benzenesulfonamide 2a

A sealable tube with a magnetic stir bar was charged with $[RhCp^*Cl_2]_2$ (7.8 mg, 12.5 μmol, 5 mol%), NaOAc (41 mg, 0.50 mmol, 2.0 equiv), *N*-methoxylbenzamide **1a** (37.8 mg, 0.25 mmol), ynesulfonamide **2a** (85.6 mg, 0.30 mmol, 1.2 equiv) and solvent (1.0 mL) under an $N_2$ atmosphere. The reaction mixture was stirred at room temperature for 16 h. The resulting solution was subsequently diluted with 5 mL of dichloromethane, filtered through a celite pad and washed with 10-20 mL of dichloromethane. The combined organic phases were evaporated, and the resulting residue was purified by column chromatography on silica gel to provide the desired product.

## III. General procedure for the Rh-catalyzed annulation reaction

A sealable tube with a magnetic stir bar was charged with $[RhCp^*Cl_2]_2$ (7.8 mg, 12.5 μmol, 5 mol%), NaOAc (41.0 mg, 0.5 mmol, 2.0 equiv), *N*-methoxylbenzamide

derivatives **1** (0.25 mmol), ynesulfonamide **2** (0.30 mmol, 1.2 equiv), and MeOH (1.0 mL) under an $N_2$ atmosphere. The reaction mixture was stirred at room temperature for 16 h. The resulting solution was subsequently diluted with 5 mL of dichloromethane, filtered through a celite pad and washed with 10-20 mL of dichloromethane. The combined organic phases were evaporated, and the resulting residue was purified by column chromatography on silica gel to provide the desired product.

## IV. Debenzylation of 3m

A sealable tube with a magnetic stir bar was charged with 4-methyl-*N*-(1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)-*N*-phenylbenzenesulfonamide **3m** (46.6 mg, 0.1 mmol), CsF-Celite (0.2 mmol), and MeCN (1.0 mL) under an $N_2$ atmosphere. The reaction mixture was stirred at 120 °C for 8 h. The resulting solution was subsequently diluted with 5 mL of dichloromethane, filtered through a celite pad and washed with 10-20 mL of dichloromethane. The combined organic phases were evaporated and the resulting residue was purified by column chromatography on silica gel to provide the desired product **4**.

## V. Single crystal X-ray structure of 3m

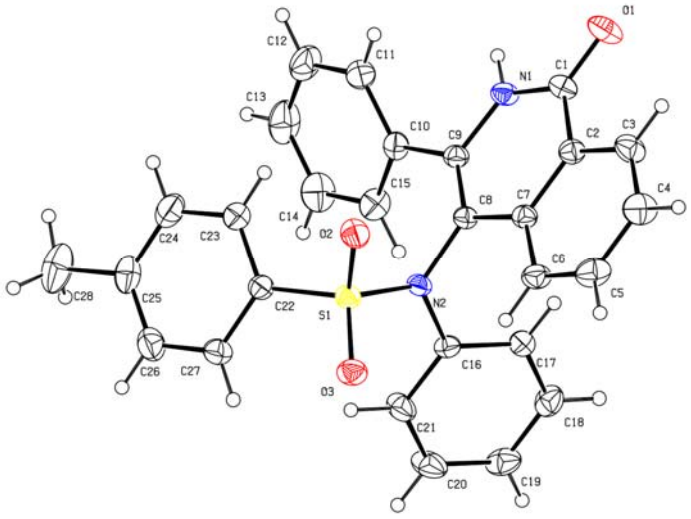
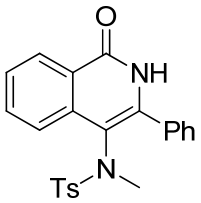


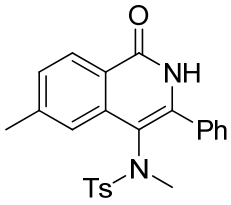

**Fig. S1** ORTEP diagram of **3m**. Thermal ellipsoids are shown at the 50% probability level.

## VI. Experimental data for the described substances




**_N_,4-Dimethyl-_N_-(1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)benzenesulfonamide (3a)**

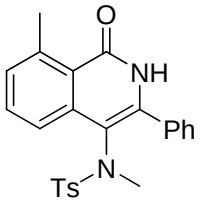
Following the general procedure. *N*-Methoxylbenzamide **1a** (37.8 mg, 0.25 mmol) and *N*,4-dimethyl-*N*-(phenylethynyl)benzenesulfonamide **2a** (85.5 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3a** as a white solid (86 mg, 86% yield). M.p.: 228-230 °C. $^{1}$H NMR (400 MHz, $CDCl_3$): $\delta$ = 2.37 (s, 3H), 3.27 (s, 3H), 7.04 (d, $J$ = 8.4 Hz, 2H), 7.19 (d, $J$ = 8.0 Hz, 2H), 7.37-7.52 (m, 6H), 7.59 (d, $J$ = 8.0 Hz, 1H), 7.64-7.68 (m, 1H), 8.34 (d, $J$ = 8.0 Hz, 1H), 9.70 (s, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 21.6, 39.3, 117.3, 123.8, 125.8, 127.2, 127.6, 128.2, 128.5, 128.9, 129.4, 129.7, 133.3, 133.8, 136.5, 137.3, 142.1, 143.3, 162.4 ppm. HRMS (ESI): calcd for $C_{23}H_{20}N_2NaO_3S$ $[M+Na]^+$ 427.1092, found 427.1096.




**_N_,4-Dimethyl-_N_-(6-methyl-1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)benzenesulfonamide (3b)**

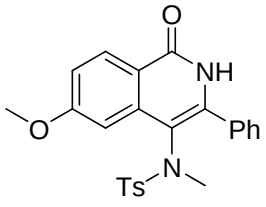
Following the general procedure. *N*-Methoxy-4-methylbenzamide **1b** (41.3 mg, 0.25 mmol) and *N*,4-dimethyl-*N*-(phenylethynyl)benzenesulfonamide **2a** (85.5 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 12/1, v/v) afforded **3b** as a white solid (81 mg, 78% yield). M.p.: 226-228 °C. $^{1}$H NMR (400 MHz, $CDCl_3$): $\delta$ = 2.33 (s, 3H), 2.39 (s, 3H), 3.24 (s, 3H),

7.06-7.10 (m, 3H), 7.28-7.30 (m, 3H), 7.40-7.49 (m, 5H), 8.24 (d, $J$ = 8.0 Hz, 1H), 9.18 (s, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 21.6, 22.2, 39.3, 117.0, 123.5, 123.6, 127.7, 128.3, 128.5, 128.8, 129.0, 129.4, 129.7, 133.9, 136.9, 137.0, 142.3, 143.3, 143.9, 162.1 ppm. HRMS (ESI): calcd for $C_{24}H_{23}N_2O_3S$ $[M+H]^+$ 419.1429, found 419.1434.




**_N_,4-Dimethyl-_N_-(8-methyl-1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)benzenesulfonamide (3c)**

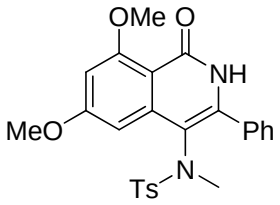
Following the general procedure. *N*-Methoxy-2-methylbenzamide **1c** (41.3 mg, 0.25 mmol) and *N*,4-dimethyl-*N*-(phenylethynyl)benzenesulfonamide **2a** (85.5 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3c** as a white solid (31 mg, 30% yield). When the reaction was performed at 80 °C for 16 h, the yield was 71%. M.p.: 229-231 °C. $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ = 2.37 (s, 3H), 2.72 (s, 3H), 3.22 (s, 3H), 7.03 (d, $J$ = 8.0 Hz, 2H), 7.19-7.22 (m, 3H), 7.34-7.38 (m, 2H), 7.41-7.49 (m, 5H), 10.52 (s, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 21.6, 23.6, 39.3, 117.3, 121.7, 124.0, 127.6, 128.68, 128.74, 129.35, 129.37, 130.2, 132.4, 133.7, 136.8, 139.0, 142.2, 142.7, 143.1, 163.8 ppm. HRMS (ESI): calcd for $C_{24}H_{22}N_2NaO_3S$ $[M+Na]^+$ 441.1249, found 441.1241.




**_N_-(6-Methoxy-1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)-_N_,4-dimethylbenzenesulfonamide (3d)**

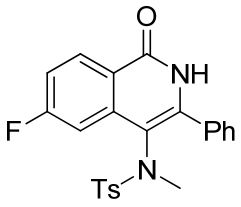
Following the general procedure. *N,*4-Dimethoxybenzamide **1d** (45.3 mg, 0.25 mmol) and *N*,4-dimethyl-*N*-(phenylethynyl)benzenesulfonamide **2a** (85.5 mg, 0.30 mmol)

were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3d** as a white solid (64 mg, 59% yield). M.p.: 226-228 °C. $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ = 2.37 (s, 3H), 3.23 (s, 3H), 3.78 (s, 3H), 6.97 (d, $J$ = 2.4 Hz, 1H), 7.06 (d, $J$ = 8.4 Hz, 2H), 7.06 (d, $J$ = 8.8 Hz, 1H), 7.20 (d, $J$ = 8.4 Hz, 2H), 7.39-7.50 (m, 5H), 8.27 (d, $J$ = 8.8 Hz, 1H), 9.13 (s, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 21.6, 39.0, 55.5, 104.9, 114.0, 116.9, 117.1, 127.8, 128.5, 129.0, 129.1, 129.5, 129.7, 130.3, 133.9, 136.6, 139.5, 142.9, 143.4, 163.9 ppm. HRMS (ESI): calcd for $C_{24}H_{23}N_2O_4S$ $[M+H]^+$ 435.1379, found 435.1378.



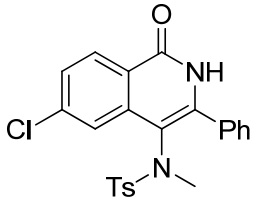

***N*-(6,8-Dimethoxy-1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)-*N*,4-dimethylbenzenesulfonamide (3e)**

Following the general procedure. *N*,2,4-Trimethoxybenzamide **1e** (55.3 mg, 0.25 mmol) and *N*,4-dimethyl-*N*-(phenylethynyl)benzenesulfonamide **2a** (85.5 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3e** as a white solid (50 mg, 44% yield). When the reaction was performed at 80 °C for 16 h, the yield was 85%. M.p.: 225-226 °C. $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ = 2.36 (s, 3H), 3.20 (s, 3H), 3.80 (s, 3H), 3.94 (s, 3H), 7.01 (d, $J$ = 8.0 Hz, 2H), 7.15 (d, $J$ = 8.4 Hz, 2H), 7.33-7.36 (m, 3H), 7.39-7.43 (m, 3H), 7.45 (d, $J$ = 8.8 Hz, 1H), 9.59 (s, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 21.6, 39.3, 56.8, 61.8, 116.7, 119.2, 120.0, 120.6, 127.6, 128.5, 128.9, 129.35, 129.38, 132.4, 133.8, 136.5, 140.0, 143.2, 150.2, 152.0, 160.8 ppm. HRMS (ESI): calcd for $C_{25}H_{24}N_2NaO_5S$ $[M+Na]^+$ 487.1304, found 487.1310.



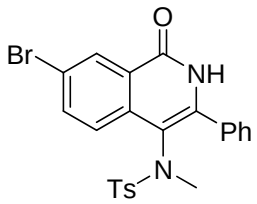
***N*-(6-Fluoro-1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)-*N*,4-dimethylbenzenesulfonamide (3f)**

Following the general procedure. 4-Fluoro-*N*-methoxybenzamide **1f** (42.3 mg, 0.25 mmol) and *N*,4-dimethyl-*N*-(phenylethynyl)benzenesulfonamide **2a** (85.5 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3f** as a white solid (89 mg, 84% yield). M.p.: 221-223 °C. $^{1}$H NMR (400 MHz, $CDCl_3$): $\delta$ = 2.38 (s, 3H), 3.22 (s, 3H), 7.06-7.11 (m, 3H), 7.18 (td, $J$ = 8.4 Hz, 2.4 Hz, 1H), 7.23 (d, $J$ = 8.4 Hz, 2H), 7.39-7.50 (m, 5H), 8.30-8.35 (m, 1H), 9.67-9.82 (m, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 21.6, 39.1, 109.2, 109.5, 115.7, 116.0, 116.8, 116.9, 122.3, 127.6, 128.5, 128.9, 129.5, 129.9, 131.4, 131.5, 133.4, 136.4, 139.9, 140.0, 143.6, 143.8, 161.8, 164.8, 167.4 ppm. HRMS (ESI): calcd for $C_{23}H_{19}FN_2NaO_3S$ $[M+Na]^+$ 445.0998, found 445.0995.



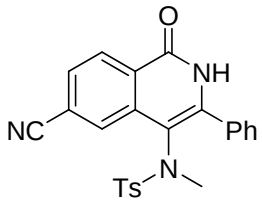

***N*-(6-Chloro-1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)-*N*,4-dimethylbenzenesulfonamide (3g)**

Following the general procedure. 4-Chloro-*N*-methoxybenzamide **1g** (46.3 mg, 0.25 mmol) and *N*,4-dimethyl-*N*-(phenylethynyl)benzenesulfonamide **2a** (85.5 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3g** as a white solid (68 mg, 62% yield). M.p.: 224-226 °C. $^{1}$H NMR (400 MHz, $CDCl_3$): $\delta$ = 2.40 (s, 3H), 3.22 (s, 3H), 7.13 (d, $J$ = 8.4 Hz, 2H), 7.15 (d, $J$ = 1.6 Hz, 1H), 7.32 (d, $J$ = 8.4 Hz, 2H), 7.41 (dd, $J$ = 8.4 Hz, 1.6 Hz, 1H), 7.43-7.52 (m, 5H), 8.27 (d, $J$ = 8.4 Hz, 1H), 9.28 (s, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 21.7, 39.2, 116.4, 123.3, 124.1, 127.6, 127.8, 128.5, 129.1, 129.7, 130.06, 130.08, 133.4, 136.5, 138.4, 140.1, 143.8, 143.9, 161.5 ppm. HRMS (ESI): calcd for $C_{23}H_{19}ClN_2NaO_3S$ $[M+Na]^+$ 461.0703, found 461.0705.




***N*-(7-Bromo-1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)-*N*,4-dimethylbenzenesulfonamide (3h)**

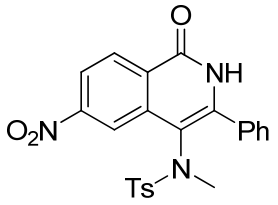
Following the general procedure. 3-Bromo-*N*-methoxybenzamide **1h** (57.3 mg, 0.25 mmol) and *N*,4-dimethyl-*N*-(phenylethynyl)benzenesulfonamide **2a** (85.5 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3h** as a white solid (75 mg, 62% yield). M.p.: 234-236 °C. $^{1}$H NMR (400 MHz, $CDCl_3$): $\delta$ = 2.38 (s, 3H), 3.22 (s, 3H), 7.05 (d, $J$ = 8.0 Hz, 2H), 7.18 (d, $J$ = 8.4 Hz, 2H), 7.38-7.43 (m, 4H), 7.46-7.50 (m, 2H), 7.74 (dd, $J$ = 8.8 Hz, $J$ = 2.0 Hz, 1H), 8.44 (d, $J$ = 2.0 Hz, 1H), 9.76 (s, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 21.6, 39.3, 117.1, 121.3, 125.7, 127.2, 127.6, 128.4, 129.0, 129.5, 129.9, 130.8, 133.4, 136.2, 136.3, 136.5, 142.6, 143.5, 161.2 ppm. HRMS (ESI): calcd for $C_{23}H_{19}BrN_2NaO_3S$ $[M+Na]^+$ 505.0197, found 505.0199.




***N*-(6-Cyano-1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)-*N*,4-dimethylbenzenesulfonamide (3i)**

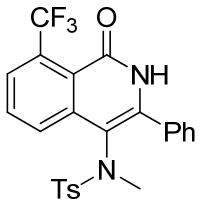
Following the general procedure. 4-Cyano-*N*-methoxybenzamide **1i** (44.0 mg, 0.25 mmol) and *N*,4-dimethyl-*N*-(phenylethynyl)benzenesulfonamide **2a** (85.5 mg, 0.30 mmol) were used. The reaction mixture was stirred at 80 ºC for 16 h. Purification via column chromatography on silica gel (DCM/ acetone = 10/1, v/v) afforded **3i** as a white solid (80 mg, 75% yield). M.p.: 236-238 °C. $^{1}$H NMR (400 MHz, DMSO-$d_6$): $\delta$ = 2.38 (s, 3H), 3.17 (s, 3H), 7.23 (m, 4H), 7.33 (s, 1H), 7.42-7.52 (m, 5H), 7.87 (dd, $J$ = 8.0 Hz, $J$ = 1.6 Hz, 1H), 8.36 (d, $J$ = 8.0 Hz, 1H), 12.02 (s, 1H) ppm. $^{13}$C NMR (100

MHz, $CDCl_3$): $\delta$ = 21.7, 39.2, 116.3, 116.8, 117.9, 127.5, 128.1, 128.35, 128.44, 129.0, 129.2, 129.4, 129.9, 130.4, 133.0, 136.3, 137.4, 144.5, 144.7, 161.0 ppm. HRMS (ESI): calcd for $C_{24}H_{19}N_3NaO_3S$ $[M+Na]^+$ 452.1045, found 452.1044.




**_N_,4-Dimethyl-_N_-(6-nitro-1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)benzenesulfonamide (3j)**

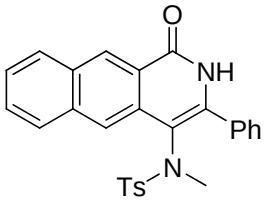
Following the general procedure. *N*-Methoxy-4-nitrobenzamide **1j** (49 mg, 0.25 mmol) and *N*,4-dimethyl-*N*-(phenylethynyl)benzenesulfonamide **2a** (85.5 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3j** as a pale yellow solid (82 mg, 73% yield). M.p.: 239-241 °C. $^1$H NMR (400 MHz, DMSO-$d_6$): $\delta$ = 2.35 (s, 3H), 3.16 (s, 3H), 7.19 (m, 4H), 7.42-7.52 (m, 5H), 8.06 (d, $J$ = 2.0 Hz, 1H), 8.24 (dd, $J$ = 8.8 Hz, $J$ = 2.4 Hz, 1H), 8.47 (d, $J$ = 8.8 Hz, 1H), 12.08 (s, 1H) ppm. $^{13}$C NMR (100 MHz, DMSO-$d_6$): $\delta$ = 20.9, 38.6, 115.3, 118.6, 120.3, 127.0, 128.2, 128.8, 129.0, 129.4, 129.6, 129.9, 132.5, 135.7, 137.5, 143.5, 145.9, 150.1, 160.1 ppm. HRMS (ESI): calcd for $C_{23}H_{19}N_3NaO_5S$ $[M+Na]^+$ 472.0943, found 472.0938.




**_N_,4-Dimethyl-_N_-(1-oxo-3-phenyl-8-(trifluoromethyl)-1,2-dihydroisoquinolin-4-yl)benzenesulfonamide (3k)**

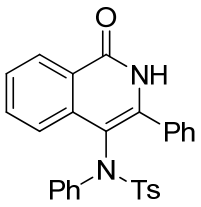
Following the general procedure. *N*-Methoxy-2-(trifluoromethyl)benzamide **1k** (54.8 mg, 0.25 mmol) and *N*,4-dimethyl-*N*-(phenylethynyl)benzenesulfonamide **2a** (85.5 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3k** as a white solid (66 mg, 53% yield). M.p.:

220-223 °C. $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ = 2.38 (s, 3H), 3.24 (s, 3H), 7.03 (d, $J$ = 8.0 Hz, 2H), 7.16 (d, $J$ = 8.4 Hz, 2H), 7.36-7.48 (m, 5H), 7.72 (t, $J$ = 8.0 Hz, 1H), 7.89 (d, $J$ = 7.6 Hz, 1H), 7.94 (d, $J$ = 8.4 Hz, 1H), 10.68 (s, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 21.6, 39.5, 116.7, 122.9, 126.7, 126.8, 127.6, 128.2, 128.4, 129.0, 129.5, 129.8, 130.3, 130.6, 132.2, 132.8, 136.4, 140.5, 143.4, 144.0, 160.1 ppm. HRMS (ESI): calcd for $C_{24}H_{20}F_3N_2O_3S$ $[M+H]^+$ 473.1147, found 473.1151.




**_N_,4-Dimethyl-_N_-(1-oxo-3-phenyl-1,2-dihydrobenzo[g]isoquinolin-4-yl)benzenesulfonamide (3l)**

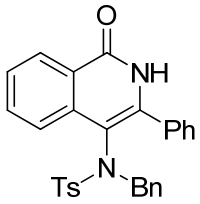
Following the general procedure. *N*-Methoxy-2-naphthamide **1l** (50.3 mg, 0.25 mmol) and *N*,4-dimethyl-*N*-(phenylethynyl)benzenesulfonamide **2a** (85.5 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3l** as a white solid (95 mg, 84% yield). M.p.: > 250 °C. $^1$H NMR (400 MHz, DMSO-$d_6$): $\delta$ = 2.36 (s, 3H), 3.21 (s, 3H), 7.13 (d, $J$ = 8.4 Hz, 2H), 7.16 (d, $J$ = 8.4 Hz, 2H), 7.37-7.41 (m, 2H), 7.44-7.49 (m, 3H), 7.56 (d, $J$ = 9.2 Hz, 1H), 7.68 (td, $J$ = 7.6 Hz, $J$ = 0.8 Hz,, 1H), 7.77 (td, $J$ = 7.2 Hz, $J$ = 1.2 Hz, 1H), 8.06 (d, $J$ = 7.2 Hz, 1H), 8.18 (d, $J$ = 8.8 Hz, 1H), 10.16 (d, $J$ = 8.8 Hz, 1H), 12.03 (s, 1H) ppm. $^{13}$C NMR (100 MHz, DMSO-$d_6$): $\delta$ = 21.0, 30.7, 116.2, 118.3, 121.0, 126.3, 126.5, 127.0, 128.2, 128.4, 128.9, 129.2, 129.4, 131.3, 131.5, 132.7, 134.0, 136.0, 139.1, 143.1, 144.6, 161.9 ppm. HRMS (ESI): calcd for $C_{27}H_{22}N_2NaO_3S$ $[M+Na]^+$ 477.1249, found 477.1245.




**4-Methyl-_N_-(1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)-_N_-phenylbenzenesulfo**

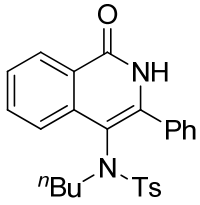
**namide (3m)**

Following the general procedure. *N*-Methoxybenzamide **1a** (37.8 mg, 0.25 mmol) and 4-methyl-*N*-phenyl-*N*-(phenylethynyl)benzenesulfonamide **2b** (99.3 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3m** as a white solid (98 mg, 84% yield). M.p.: 244-246 °C. $^1$H NMR (400 MHz, DMSO-$d_6$): $\delta$ = 2.32 (s, 3H), 7.03-7.08 (m, 3H), 7.13-7.16 (m, 4H), 7.21-7.25 (m, 2H), 7.33-7.40 (m, 4H), 7.45-7.57 (m, 3H), 7.65-7.69 (m, 1H), 8.31 (d, $J$ = 8.0 Hz, 1H), 11.82 (s, 1H) ppm. $^{13}$C NMR (100 MHz, DMSO-$d_6$): $\delta$ = 20.9, 113.3, 119.7, 123.8, 123.9, 125.7, 126.9, 127.2, 127.6, 128.3, 128.7, 129.2, 129.5, 129.6, 132.6, 132.7, 136.2, 137.0, 141.9, 143.8, 144.1, 161.3 ppm. HRMS (ESI): calcd for $C_{28}H_{22}N_2NaO_3S$ $[M+Na]^+$ 489.1249, found 489.1256.



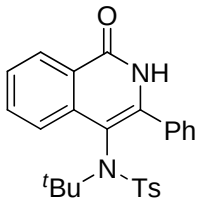

***N*-Benzyl-4-methyl-*N*-(1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)benzenesulfonamide (3n)**

Following the general procedure. *N*-Methoxybenzamide **1a** (37.8 mg, 0.25 mmol) and *N*-benzyl-4-methyl-*N*-(phenylethynyl)benzenesulfonamide **2c** (108.3 mg, 0.30 mmol) were used. The reaction was performed at 80 °C for 16 h. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3n** as a white solid (102 mg, 85% yield). M.p.: 201-203 °C. $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ = 2.45 (s, 3H), 4.43 (d, $J$ = 14.0 Hz, 1H), 4.58 (d, $J$ = 14.0 Hz, 1H), 6.61 (d, $J$ = 7.2 Hz, 2H), 6.91 (d, $J$ = 7.2 Hz, 2H), 7.04 (t, $J$ = 7.2 Hz, 2H), 7.16-7.23 (m, 5H), 7.36-7.55 (m, 6H), 8.33 (d, $J$ = 8.4 Hz, 1H), 9.21 (s, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 21.7, 54.0, 114.0, 124.4, 125.8, 127.1, 128.2, 128.35, 128.44, 128.5, 129.1, 129.3, 129.6, 130.2, 132.9, 133.4, 134.5, 136.7, 137.2, 143.6, 144.0, 161.9 ppm. HRMS (ESI): calcd for $C_{29}H_{24}N_2NaO_3S$ $[M+Na]^+$ 503.1405, found 503.1408.




***N*-Butyl-4-methyl-*N*-(1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)benzenesulfonamide (3o)**

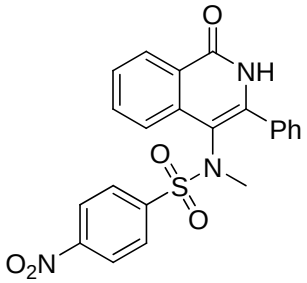
Following the general procedure. *N*-Methoxybenzamide **1a** (37.8 mg, 0.25 mmol) and *N*-butyl-4-methyl-*N*-(phenylethynyl)benzenesulfonamid*e* **2d** (98.1 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3o** as a white solid (98 mg, 88% yield). M.p.: 208-210 °C. $^{1}$H NMR (400 MHz, $CDCl_3$): $\delta$ = 0.71 (t, $J$ = 7.6 Hz, 3H), 0.97-1.10 (m, 2H), 1.15-1.35 (m, 2H), 2.43 (s, 3H), 3.23-3.31 (m, 1H), 3.40-3.48 (m, 1H), 7.17 (d, $J$ = 8.0 Hz, 2H), 7.40-7.59 (m, 10H), 8.36 (dd, $J$ = 8.0 Hz, 1.2 Hz, 1H), 9.09 (s, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 13.7, 20.2, 21.7, 30.4, 51.2, 115.5, 124.5, 125.7, 127.1, 128.1, 128.6, 129.3, 129.5, 129.8, 132.8, 133.6, 137.4, 137.9, 142.6, 143.6, 162.2 ppm. HRMS (ESI): calcd for $C_{26}H_{26}N_2NaO_3S$ $[M+Na]^+$ 469.1562, found 469.1560.




***N*-(*tert*-Butyl)-4-methyl-*N*-(1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)benzenesulfonamide (3p)**

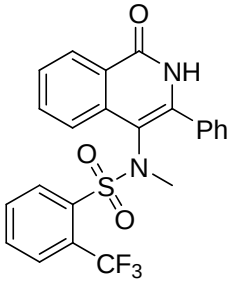
Following the general procedure. *N*-Methoxybenzamide **1a** (37.8 mg, 0.25 mmol) and *N*-*tert*-butyl-4-methyl-*N*-(phenylethynyl)benzenesulfonamide **2e** (98.1 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3p** as a white solid (79 mg, 71% yield). M.p.: 230-232 °C. $^{1}$H NMR (400 MHz, $CDCl_3$): $\delta$ = 1.15 (s, 9H), 2.39 (s, 3H), 7.01 (d, $J$ = 8.0 Hz, 1H), 7.09 (d, $J$ = 8.0 Hz, 2H), 7.22-7.25 (m, 1H), 7.39 (t, $J$ = 7.2 Hz, 1H), 7.50-7.56 (m, 5H), 7.94-7.96 (m, 2H), 8.32 (d, $J$ = 8.0 Hz, 1H), 9.16 (br, 1H) ppm. $^{13}$C

NMR (100 MHz, $CDCl_3$): $\delta$ = 21.6, 30.7, 63.9, 117.0, 125.3, 125.6, 126.8, 127.8, 128.8, 129.0, 129.3, 129.9, 130.0, 131.8, 134.8, 138.5, 140.1, 143.2, 143.6, 161.8 ppm. HRMS (ESI): calcd for $C_{26}H_{26}N_2NaO_3S$ $[M+Na]^+$ 469.1562, found 469.1562.




**_N_-Methyl-4-nitro-_N_-(1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)benzenesulfonamide (3q)**

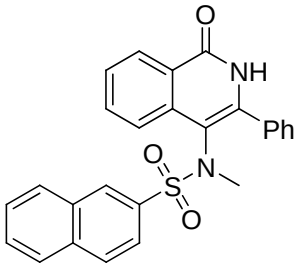
Following the general procedure. *N*-Methoxybenzamide **1a** (37.8 mg, 0.25 mmol) and *N*,4-dimethyl-*N*-(phenylethynyl)benzenesulfonamide **2f** (94.8 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3q** as a white solid (74 mg, 68% yield). M.p.: 232-234 °C. $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ = 3.40 (s, 3H), 7.32-7.38 (m, 4H), 7.41-7.49 (m, 3H), 7.57 (t, $J$ = 7.6 Hz, 1H), 7.63 (d, $J$ = 8.0 Hz, 1H), 7.73-7.77 (m, 1H), 8.04 (d, $J$ = 8.8 Hz, 2H), 8.41 (d, $J$ = 7.6 Hz, 1H), 8.99 (s, 1H) ppm. $^{13}$C NMR (100 MHz, DMSO-$d_6$): $\delta$ = 39.7, 115.2, 122.8, 124.2, 125.4, 126.9, 127.3, 128.1, 128.7, 129.1, 132.7, 133.0, 136.6, 142.9, 144.6, 149.3, 161.2 ppm. HRMS (ESI): calcd for $C_{22}H_{18}N_3O_5S$ $[M+H]^+$ 436.0967, found 436.0969.




**_N_-Methyl-_N_-(1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)-2-(trifluoromethyl)benzenesulfonamide (3r)**

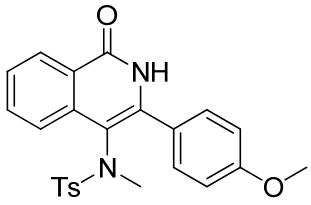
Following the general procedure. *N*-Methoxybenzamide **1a** (37.8 mg, 0.25 mmol)

and *N*-methyl-*N*-(phenylethynyl)-2-(trifluoromethyl)benzenesulfonamide **2g** (101.7 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3r** as a white solid (97 mg, 85% yield). M.p.: 188-190 °C. $^{1}$H NMR (400 MHz, $CDCl_3$): $\delta$ = 3.37 (s, 3H), 7.31-7.41 (m, 6H), 7.46 (d, $J$ = 8.0 Hz, 1H), 7.50-7.57 (m, 2H), 7.67-7.70 (m, 2H), 7.73 (s, 1H), 8.32 (dd, $J$ = 8.0 Hz, 0.8 Hz, 1H), 10.01 (s, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 40.0, 116.8, 121.8, 123.3, 124.37, 124.41, 124.5, 124.6, 125.8, 127.4, 128.4, 128.9, 129.1, 129.18, 129.21, 129.3, 129.7, 130.1, 130.5, 131.3, 131.6, 133.3, 133.5, 137.0, 141.0, 142.2, 162.5 ppm. HRMS (ESI): calcd for $C_{23}H_{17}F_3N_2NaO_3S$ $[M+Na]^+$ 481.0810, found 481.0812.



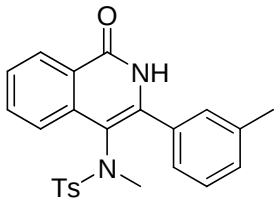

***N*-Methyl-*N*-(1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)naphthalene-2-sulfonamide (3s)**

Following the general procedure. *N*-Methoxybenzamide **1a** (37.8 mg, 0.25 mmol) and *N*-methyl-*N*-(phenylethynyl)naphthalene-2-sulfonamide **2h** (96.3 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3s** as a white solid (100 mg, 91% yield). M.p.: > 250 °C. $^{1}$H NMR (400 MHz, $CDCl_3$): $\delta$ = 3.35 (s, 3H), 7.20-7.28 (m, 4H), 7.37-7.40 (m, 2H), 7.48-7.52 (m, 1H), 7.55-7.67 (m, 5H), 7.78 (d, $J$ = 8.0 Hz, 1H), 7.84 (d, $J$ = 8.0 Hz, 1H), 8.00 (s, 1H), 8.35 (d, $J$ = 8.0 Hz, 1H), 9.58 (s, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 39.7, 117.2, 122.7, 123.8, 127.3, 127.4, 127.8, 128.2, 128.4, 128.8, 128.9, 128.99, 129.02, 129.5, 129.7, 132.0, 133.4, 133.6, 134.8, 136.5, 137.3, 142.0, 162.4 ppm. HRMS (ESI): calcd for $C_{26}H_{21}N_2O_3S$ $[M+H]^+$ 441.1273, found 441.1274.




***N*-(3-(4-Methoxyphenyl)-1-oxo-1,2-dihydroisoquinolin-4-yl)-*N*,4-dimethylbenzenesulfonamide (3t)**

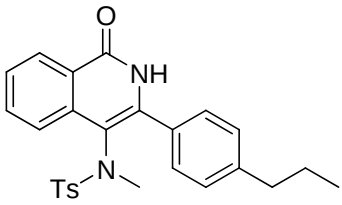
Following the general procedure. *N*-Methoxybenzamide **1a** (37.8 mg, 0.25 mmol) and *N*-((4-methoxyphenyl)ethynyl)-*N*,4-dimethylbenzenesulfonamide **2i** (94.5 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3t** as a white solid (89 mg, 82% yield). M.p.: 243-245 °C. $^{1}$H NMR (400 MHz, $CDCl_3$): $\delta$ = 2.38 (s, 3H), 3.28 (s, 3H), 3.86 (s, 3H), 6.84-6.88 (m, 2H), 7.05 (d, $J$ = 8.4 Hz, 2H), 7.24 (s, 1H), 7.32-7.36 (m, 2H), 7.47-7.51 (m, 1H), 7.55 (d, $J$ = 8.0 Hz, 1H), 7.63-7.67 (m, 1H), 8.36 (dd, $J$ = 8.0 Hz, 0.8 Hz, 1H), 9.39 (s, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 21.6, 39.4, 55.5, 114.3, 117.2, 123.6, 125.6, 125.9, 127.1, 127.5, 128.2, 129.3, 129.8, 133.3, 136.9, 137.5, 141.7, 143.1, 160.8, 162.4 ppm. HRMS (ESI): calcd for $C_{24}H_{23}N_2O_4S$ $[M+H]^+$ 435.1379, found 435.1380.




***N*,4-Dimethyl-*N*-(1-oxo-3-m-tolyl-1,2-dihydroisoquinolin-4-yl)benzenesulfonamide (3u)**

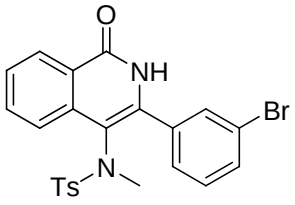
Following the general procedure. *N*-methoxybenzamide **1a** (37.8 mg, 0.25 mmol) and *N*,4-dimethyl-*N*-(m-tolylethynyl)benzenesulfonamide **2j** (89.7 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/Acetone = 10/1, v/v) afforded **3u** as a white solid (94 mg, 90% yield). M.p.: 218-220 °C. $^{1}$H NMR (400 MHz, $CDCl_3$): $\delta$ = 2.30 (s, 3H), 2.37 (s, 3H), 3.27 (s, 3H), 7.03 (d, $J$ = 8.0 Hz, 2H), 7.18-7.29 (m, 6H), 7.48-7.52 (m, 1H), 7.63-7.70 (m, 2H), 8.34 (d, $J$ = 7.6 Hz, 1H), 9.74 (s, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 21.5, 21.6, 39.4, 117.3,

123.8, 125.6, 125.7, 127.2, 127.5, 128.2, 128.8, 129.1, 129.3, 130.4, 133.4, 133.6, 136.6, 137.5, 138.7, 142.1, 143.1, 162.5 ppm. HRMS (ESI): calcd for $C_{24}H_{23}N_2O_3S$ $[M+H]^+$ 419.1429, found 419.1426.




***N*,4-Dimethyl-*N*-(1-oxo-3-(4-propylphenyl)-1,2-dihydroisoquinolin-4-yl)benzenesulfonamide (3v)**

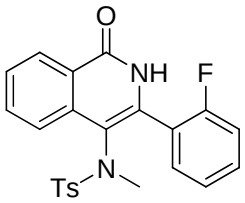
Following the general procedure. *N*-Methoxybenzamide **1a** (37.8 mg, 0.25 mmol) and *N*,4-dimethyl-*N*-((4-propylphenyl)ethynyl)benzenesulfonamide **2k** (98.1 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3v** as a white solid (96 mg, 86% yield). M.p.: 228-230 °C. $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ = 1.02 (t, $J$ = 7.2 Hz, 3H), 1.66-1.76 (m, 2H), 2.37 (s, 3H), 2.65 (t, $J$ = 8.0 Hz, 2H), 3.27 (s, 3H), 7.03 (d, $J$ = 8.0 Hz, 2H), 7.17 (d, $J$ = 8.0 Hz, 2H), 7.24 (d, $J$ = 8.4 Hz, 2H), 7.33 (d, $J$ = 8.4 Hz, 2H), 7.47 -7.51 (m, 1H), 7.60 (d, $J$ = 8.0 Hz, 1H), 7.64-7.68 (m, 1H), 8.35 (d, $J$ = 8.0 Hz, 1H), 9.46 (br, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 14.1, 21.6, 24.5, 38.0, 39.4, 117.2, 123.7, 125.7, 127.1, 127.6, 128.2, 128.3, 128.9, 129.3, 131.1, 133.3, 136.8, 137.5, 142.2, 143.1, 144.6, 162.3 ppm. HRMS (ESI): calcd for $C_{26}H_{27}N_2O_3S$ $[M+H]^+$ 447.1742, found 447.1741.




***N*-(3-(3-Bromophenyl)-1-oxo-1,2-dihydroisoquinolin-4-yl)-*N*,4-dimethylbenzenesulfonamide (3w)**

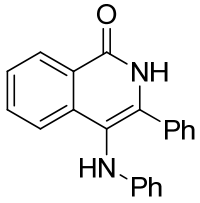
Following the general procedure. *N*-Methoxybenzamide **1a** (37.8 mg, 0.25 mmol) and *N*-((3-bromophenyl)ethynyl)-*N*,4-dimethylbenzenesulfonamide **2l** (108.9 mg, 0.30

mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3w** as a white solid (80 mg, 67% yield). M.p.: 220-222 °C. $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ = 2.40 (s, 3H), 3.32 (s, 3H), 7.08 (d, $J$ = 8.4 Hz, 2H), 7.24-7.28 (m, 3H), 7.41 (d, $J$ = 7.6 Hz, 1H), 7.51-7.57 (m, 3H), 7.62 (d, $J$ = 8.0 Hz, 1H), 7.67-7.71 (m, 1H), 8.36 (d, $J$ = 8.0 Hz, 1H), 10.38 (s, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 21.7, 39.6, 117.9, 122.8, 123.9, 125.9, 127.29, 127.33, 127.6, 128.3, 129.5, 130.3, 131.7, 132.6, 133.5, 135.4, 136.6, 137.2, 140.4, 143.5, 162.7 ppm. HRMS (ESI): calcd for $C_{23}H_{20}BrN_2O_3S$ $[M+H]^+$ 483.0378, found 483.0378.




***N*-(3-(2-Fluorophenyl)-1-oxo-1,2-dihydroisoquinolin-4-yl)-*N*,4-dimethylbenzenesulfonamide (3x)**

Following the general procedure. *N*-Methoxybenzamide **1a** (37.8 mg, 0.25 mmol) and *N*-((2-fluorophenyl)ethynyl)-*N*,4-dimethylbenzenesulfonamide **2m** (90.9 mg, 0.30 mmol) were used. Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **3x** as a white solid (84 mg, 79% yield). M.p.: 130-132 °C. $^1$H NMR (400 MHz, $CDCl_3$): $\delta$ = 2.39 (s, 3H), 3.21 (s, 3H), 7.08-7.13 (m, 3H), 7.24-7.28 (m, 3H), 7.43-7.54 (m, 4H), 7.60-7.64 (m, 1H), 8.34 (dd, $J$ = 8.0 Hz, 0.8 Hz, 1H), 9.70 (s, 1H) ppm. $^{13}$C NMR (100 MHz, $CDCl_3$): $\delta$ = 21.6, 38.20, 38.24, 116.1, 116.3, 118.9, 121.4, 121.5, 123.8, 124.6, 124.7, 126.1, 127.5, 127.7, 128.3, 129.5, 131.56, 131.58, 131.7, 131.8, 133.2, 136.4, 136.7, 136.8, 143.5, 158.6, 161.0, 162.4 ppm. HRMS (ESI): calcd for $C_{23}H_{19}FN_2NaO_3S$ $[M+Na]^+$ 445.0998, found 445.1003.




**3-Phenyl-4-(phenylamino)isoquinolin-1(2H)-one (4)**

A flame-dried Schlenk tube with a magnetic stirring bar was charged with 4-methyl-*N*-(1-oxo-3-phenyl-1,2-dihydroisoquinolin-4-yl)-*N*-phenylbenzenesulfonamide **3m** (46.6 mg, 0.1 mmol), CsF-Celite (0.2 mmol, 50.4 mg) and MeCN (1 mL) under an $N_2$ atmosphere. The reaction mixture was stirred at 120 °C for 8 h, Purification via column chromatography on silica gel (DCM/acetone = 10/1, v/v) afforded **4** as a white solid (20 mg, 64% yield). M.p.: 226-228 °C. $^1$H NMR (400 MHz, DMSO-$d_6$): $\delta$ = 6.46 (d, $J$ = 8.0 Hz, 2H), 6.53 (t, $J$ = 7.2 Hz, 1H), 7.01 (t, $J$ = 7.6 Hz, 2H), 7.30 (s, 1H), 7.36-7.37 (m, 3H), 7.49-7.56 (m, 4H), 7.65-7.69 (m, 1H), 8.26 (d, $J$ = 7.6 Hz, 1H), 11.42 (s, 1H) ppm. $^{13}$C NMR (100 MHz, DMSO-$d_6$): $\delta$ = 112.5, 113.8, 116.6, 123.5, 126.0, 126.5, 127.2, 127.9, 128.8, 128.9, 129.1, 132.5, 133.2, 137.7, 139.5, 148.8, 161.6 ppm. HRMS (ESI): calcd for $C_{21}H_{17}N_2O$ $[M+H]^+$ 313.1341, found 313.1339.

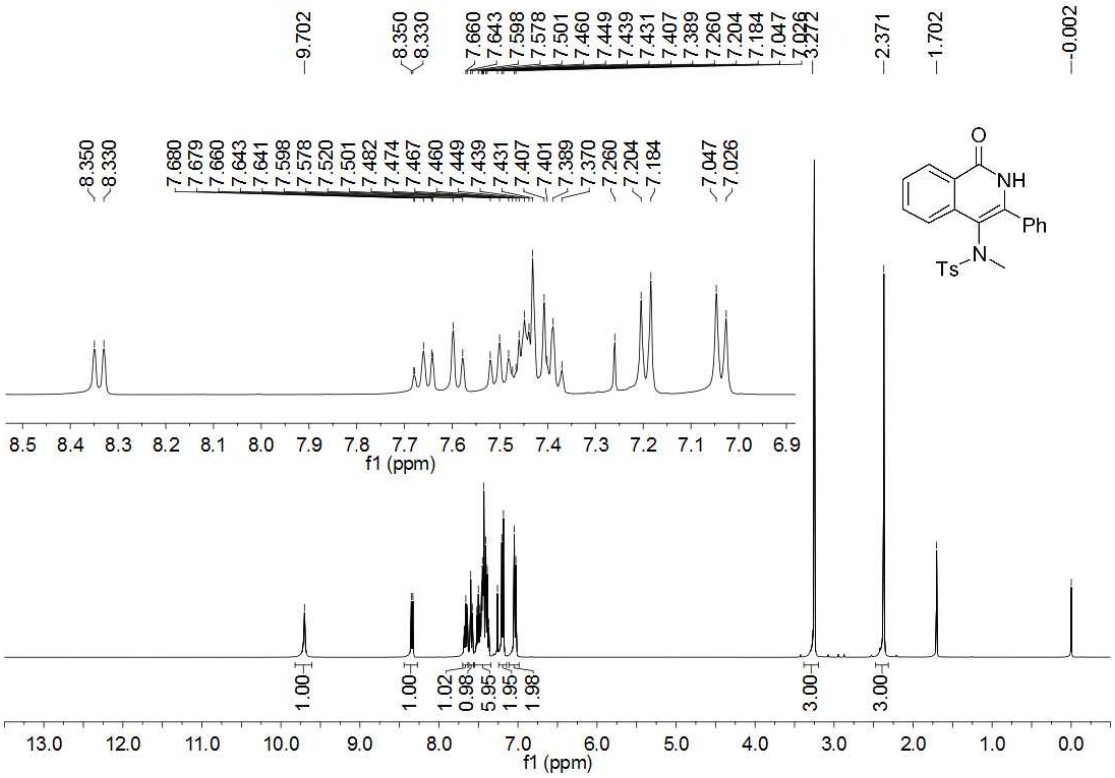
## VII. References

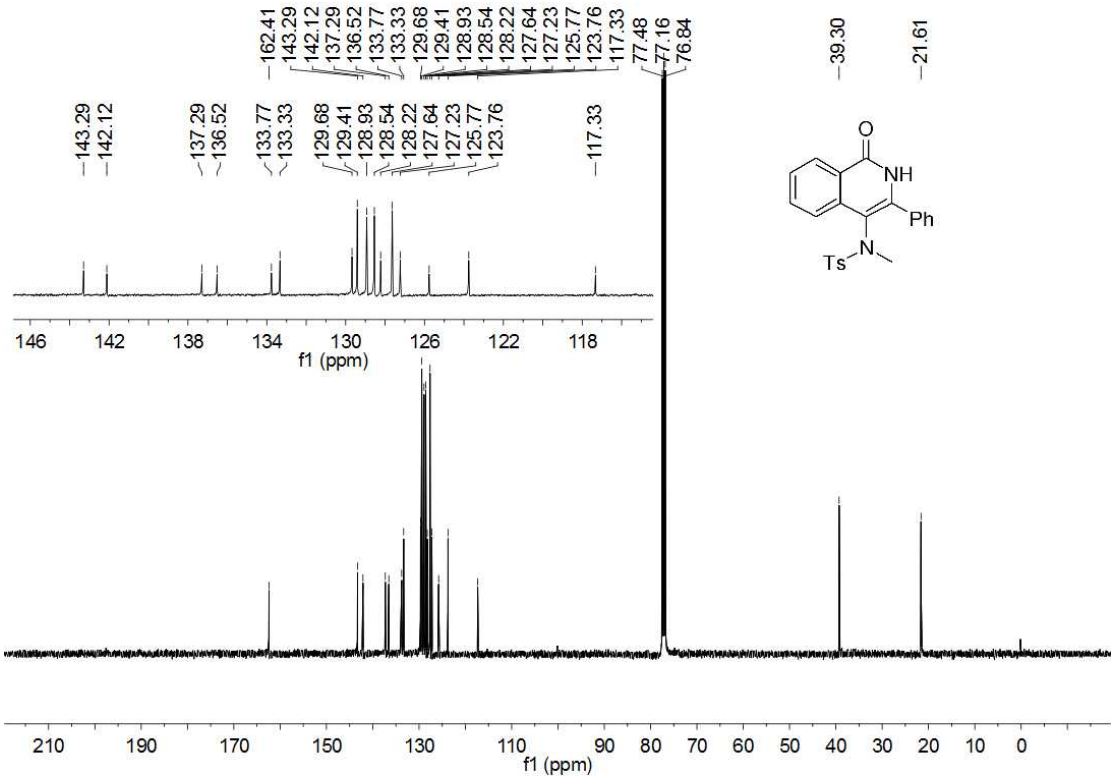
1 B. Li, H. Feng, S. Xu and B. Wang, *Chem. Eur. J.,* 2011, **17**, 12573.

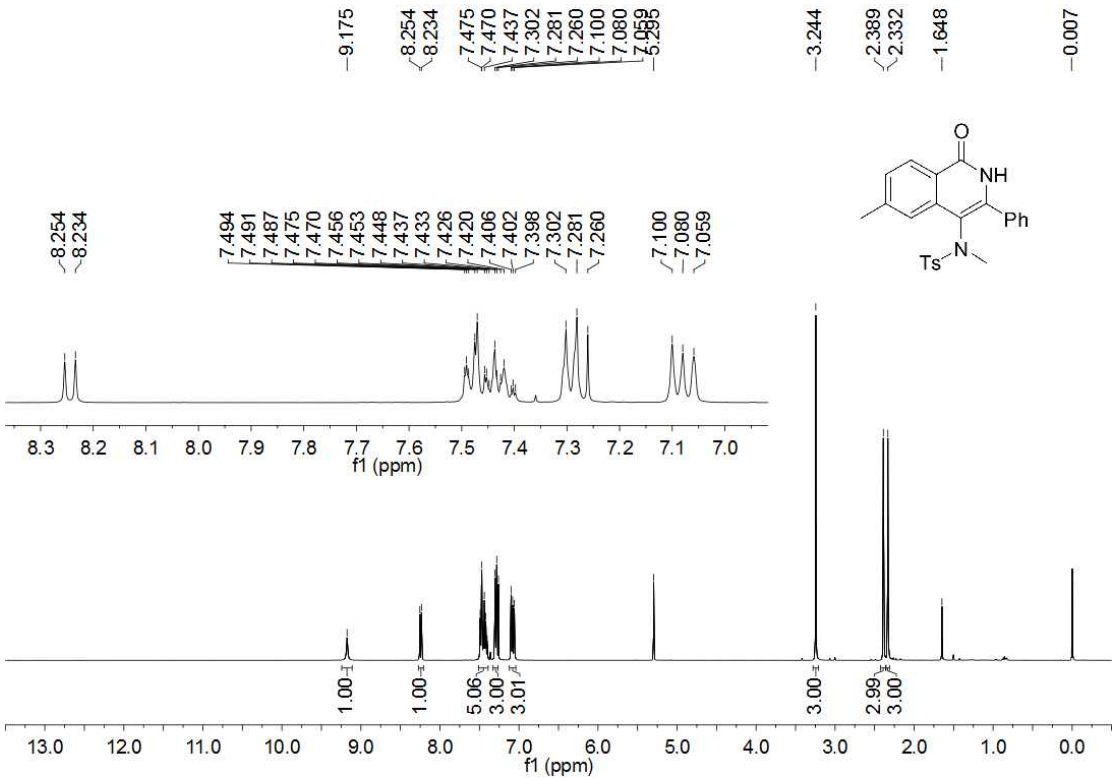
2 (*a*) C.-F. Xu, M. Xu, Y.-X. Jia and C.-Y. Li, *Org. Lett.,* 2011, **13**, 1556; (*b*) B. Yao, Z. Liang, T. Niu and Y. Zhang, *J. Org. Chem.,* 2009, **74**, 4630

3 F. Tamaddon, A. Nasiri and S. Farokhi, *Catal. Commun.,* 2011, **12**, 1477.

## VIII. Copies of $^{1}H$ and $^{13}C$ NMR spectra

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2.389
2.332
1.648
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NH
Ph
Ts
N
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3.00
3.01
3.00
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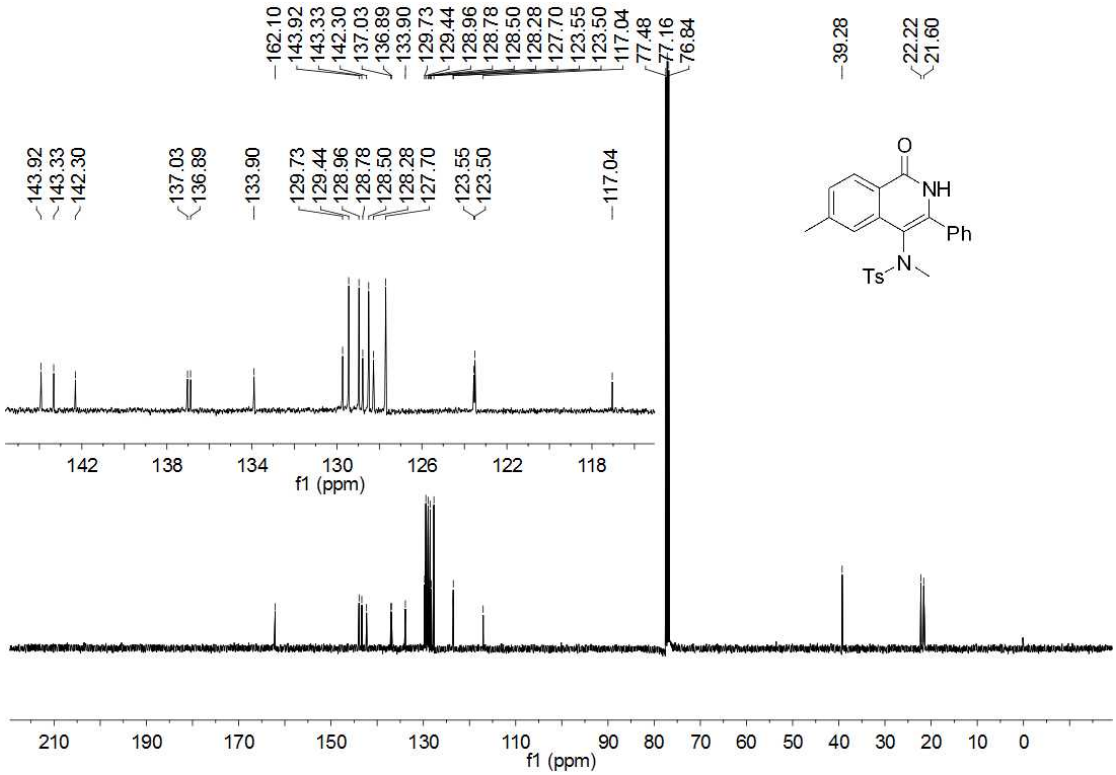
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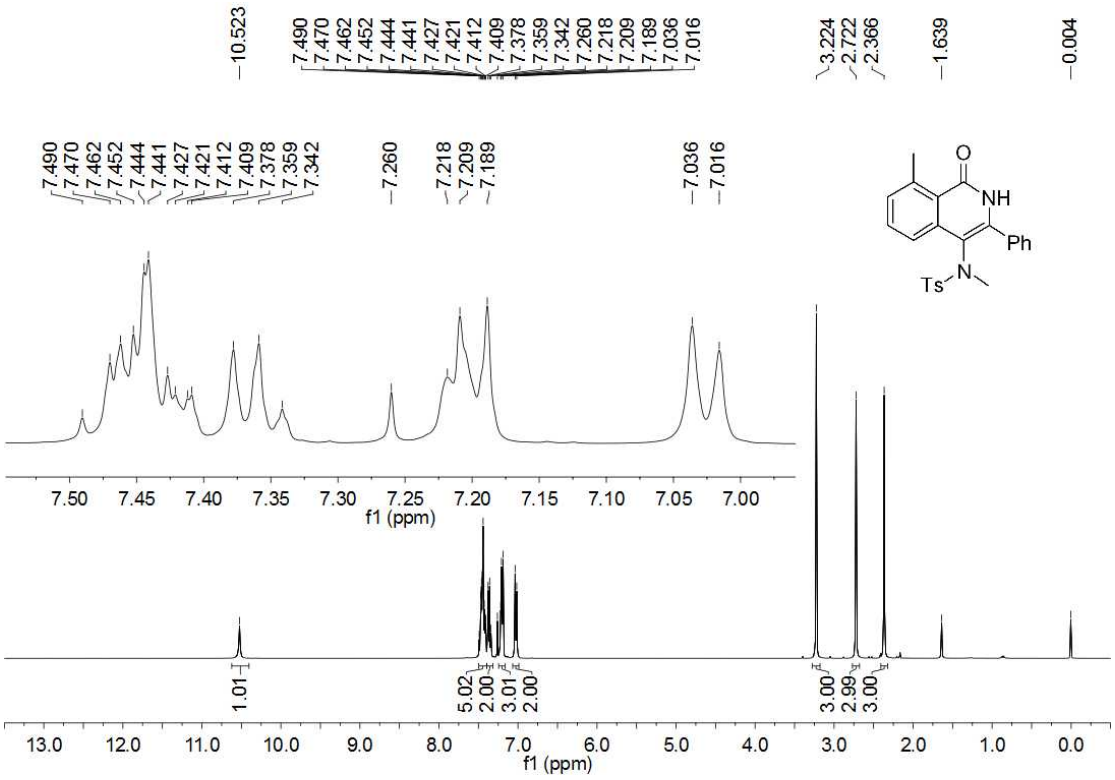
NH
Ph
Ts
N
f1 (ppm)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7.189
7.036
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2.366
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Ph
Ts
N
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5.02
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3.00
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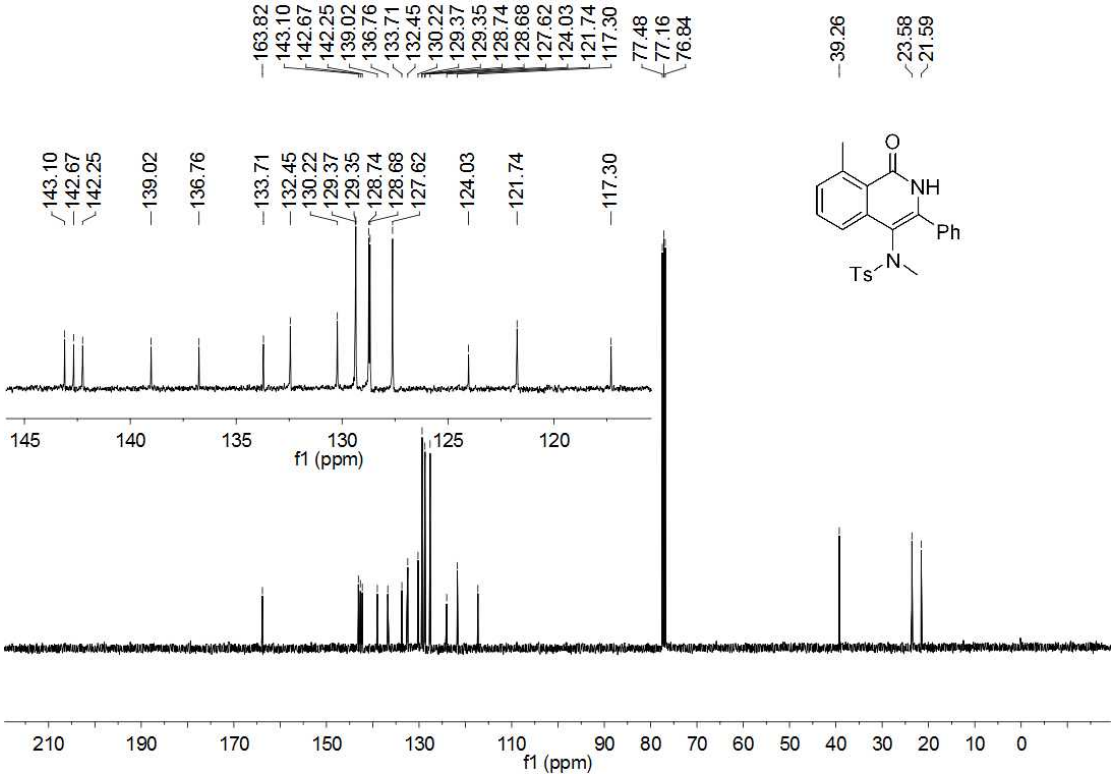
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127.62
124.03
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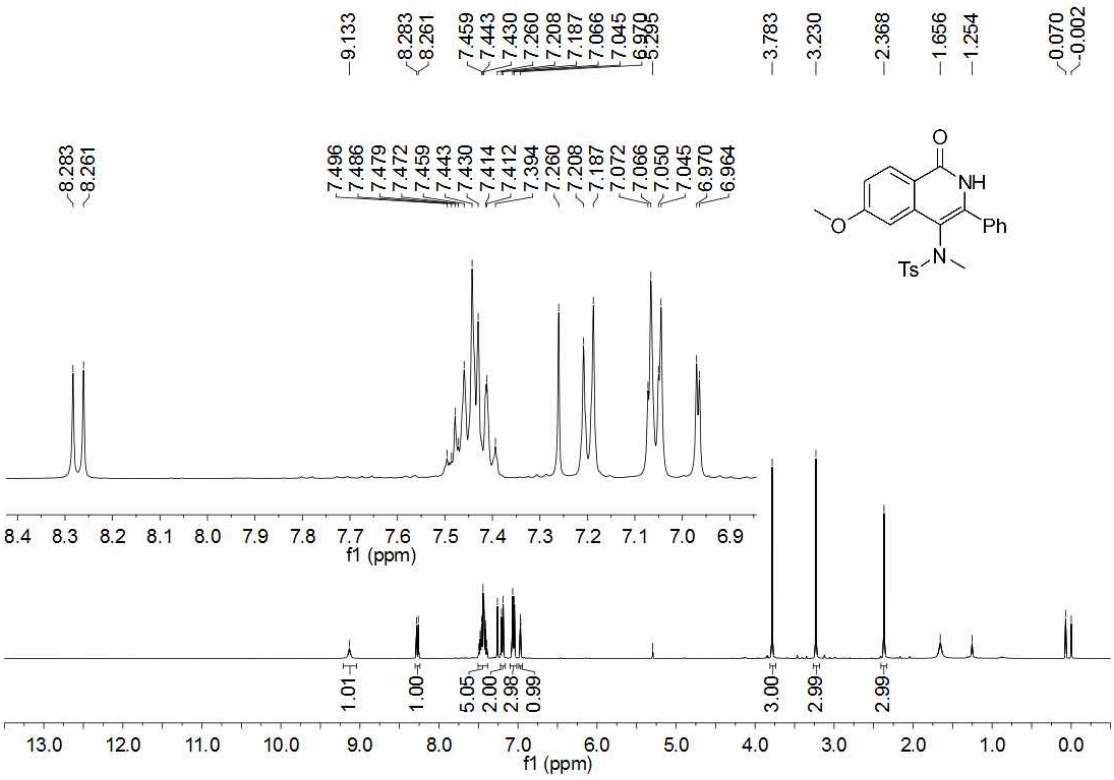
f1 (ppm)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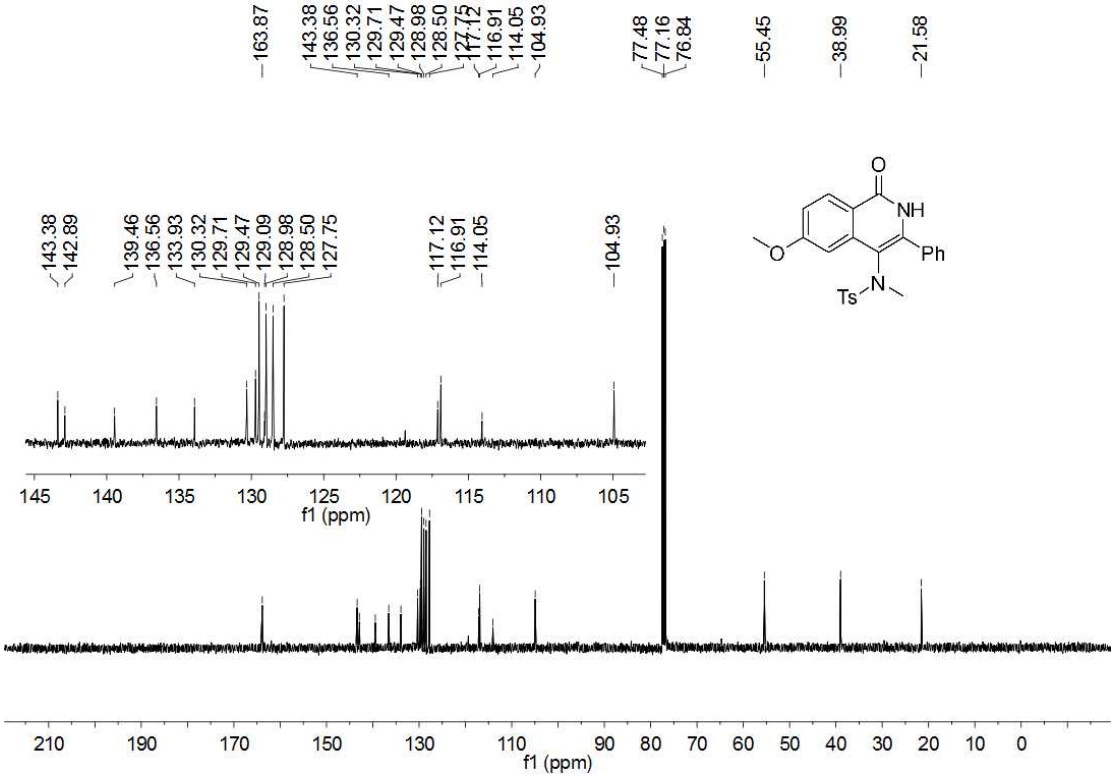
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Ph
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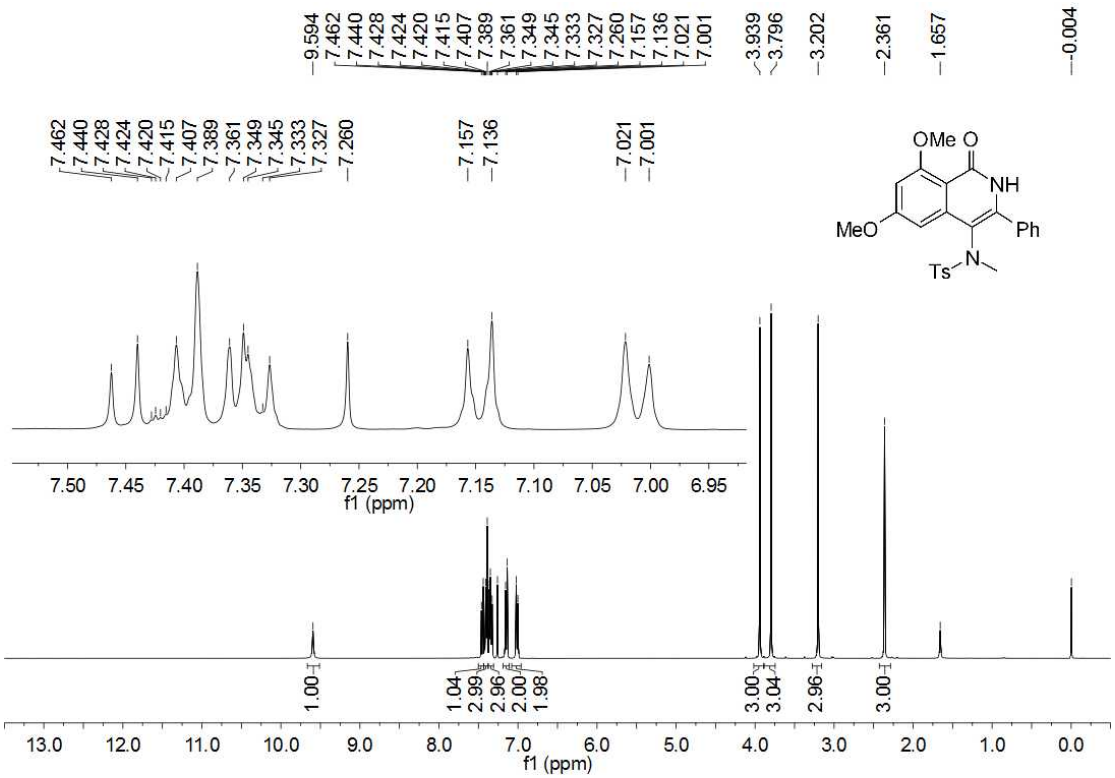
N
O
f1 (ppm)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7.157
7.136
7.021
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3.202
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MeO
Ph
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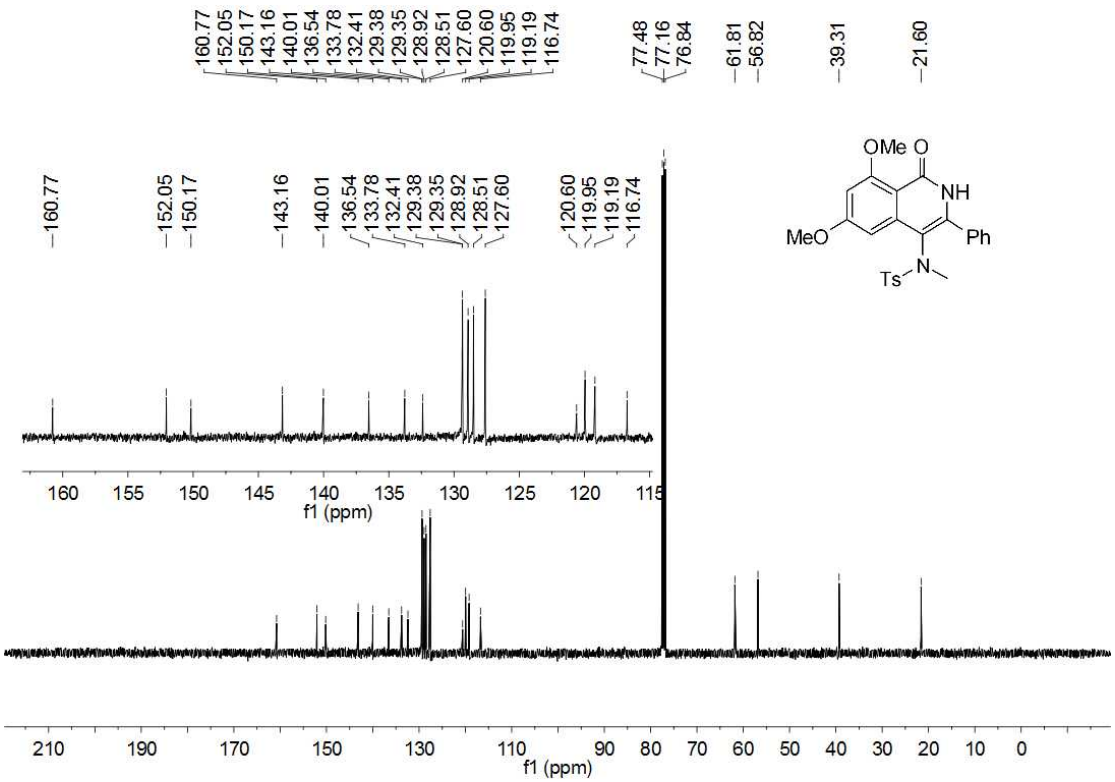
1.98
3.00
3.04
2.96
3.00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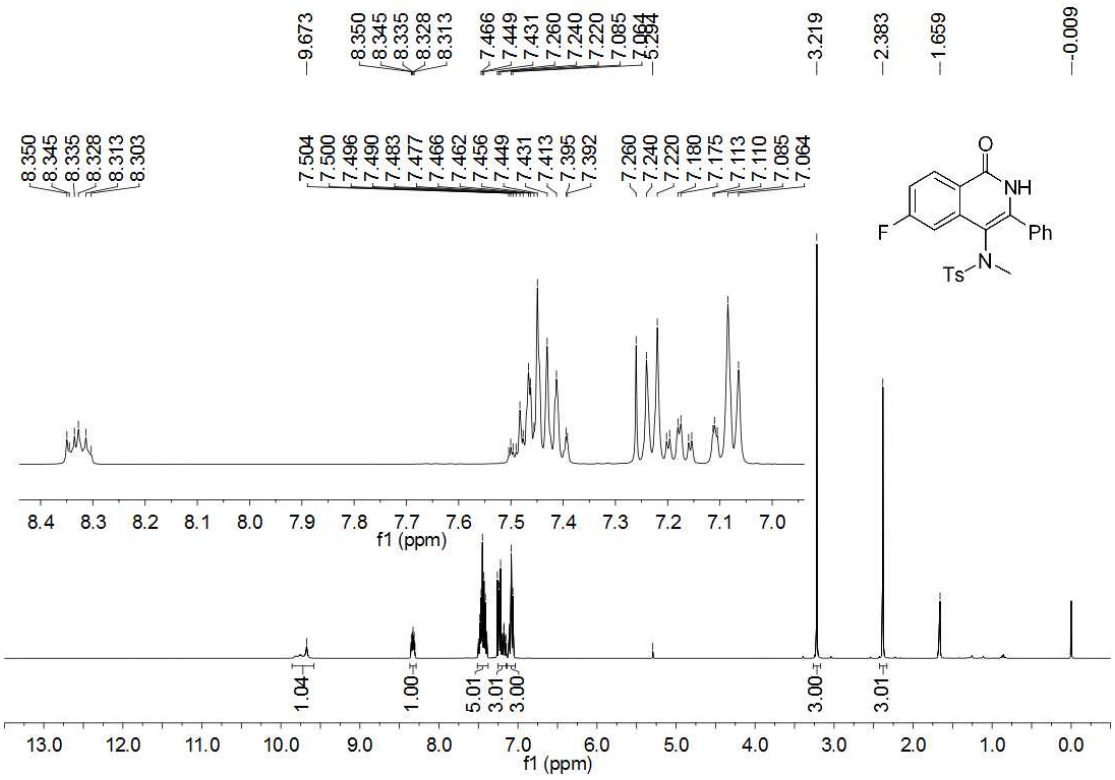
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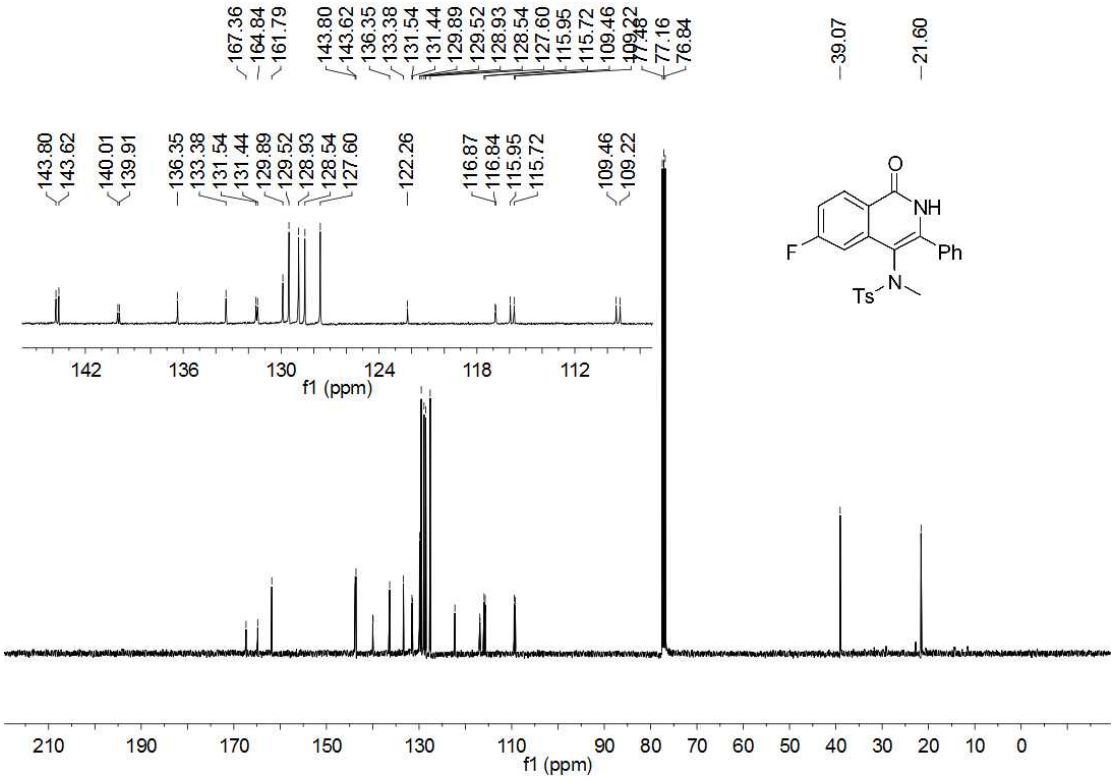
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Ph
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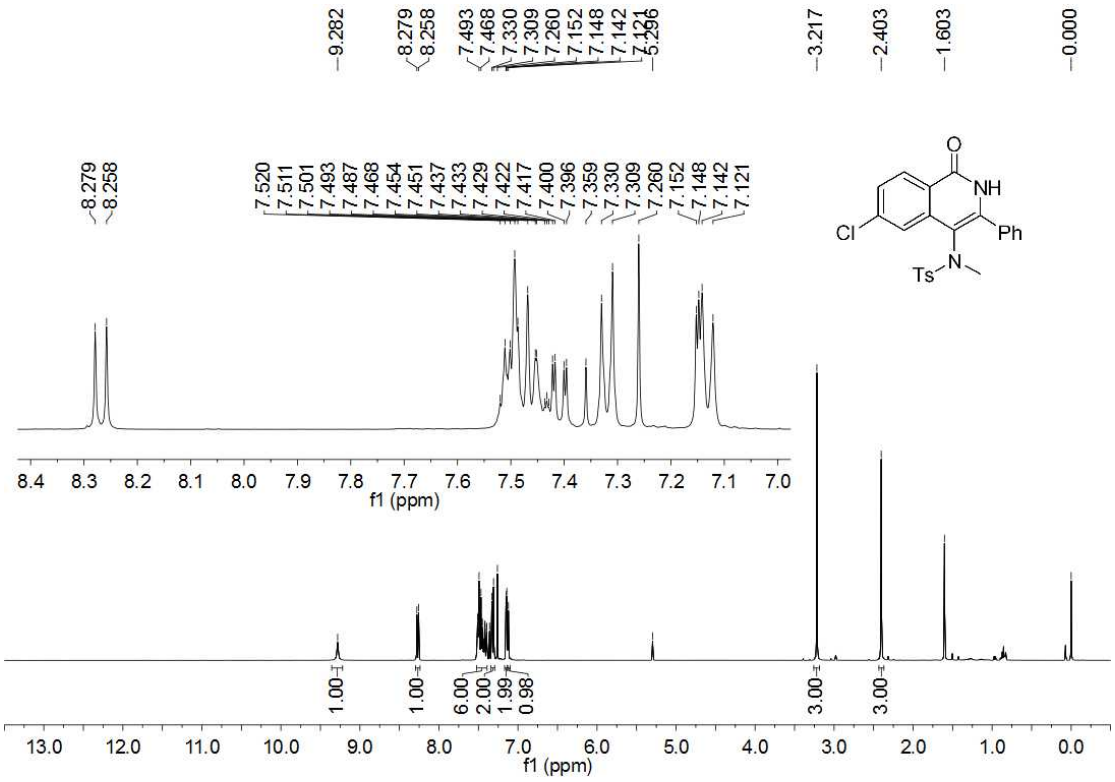
f1 (ppm)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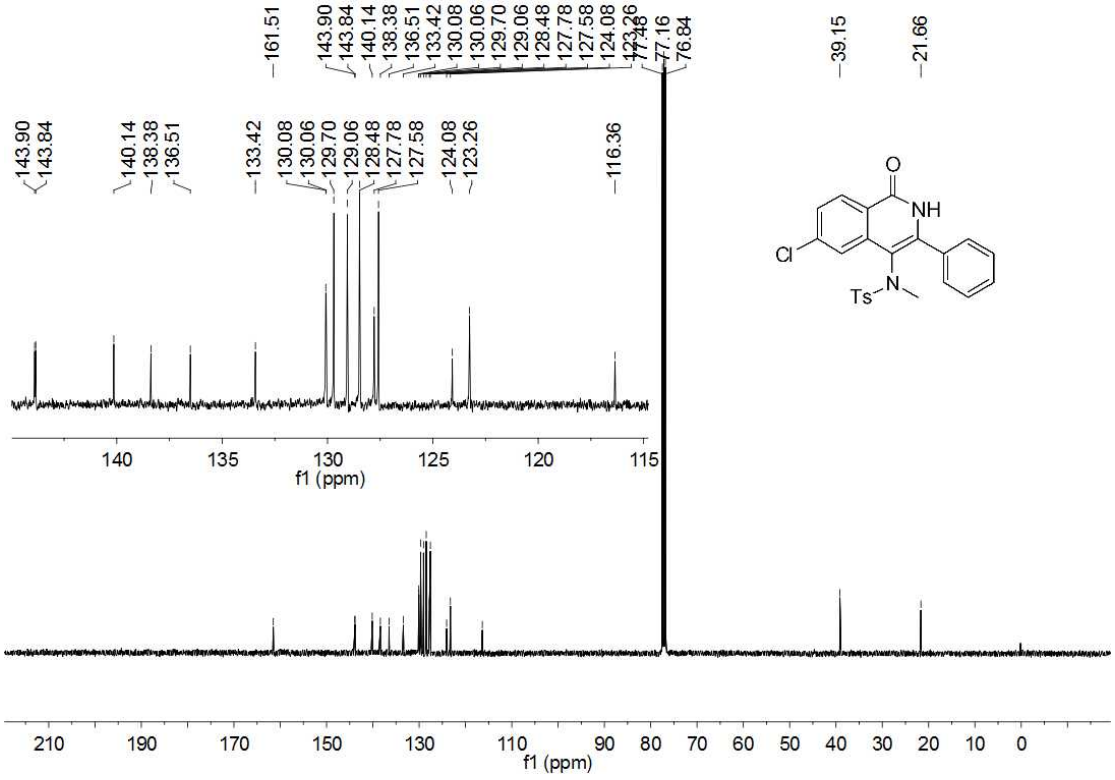
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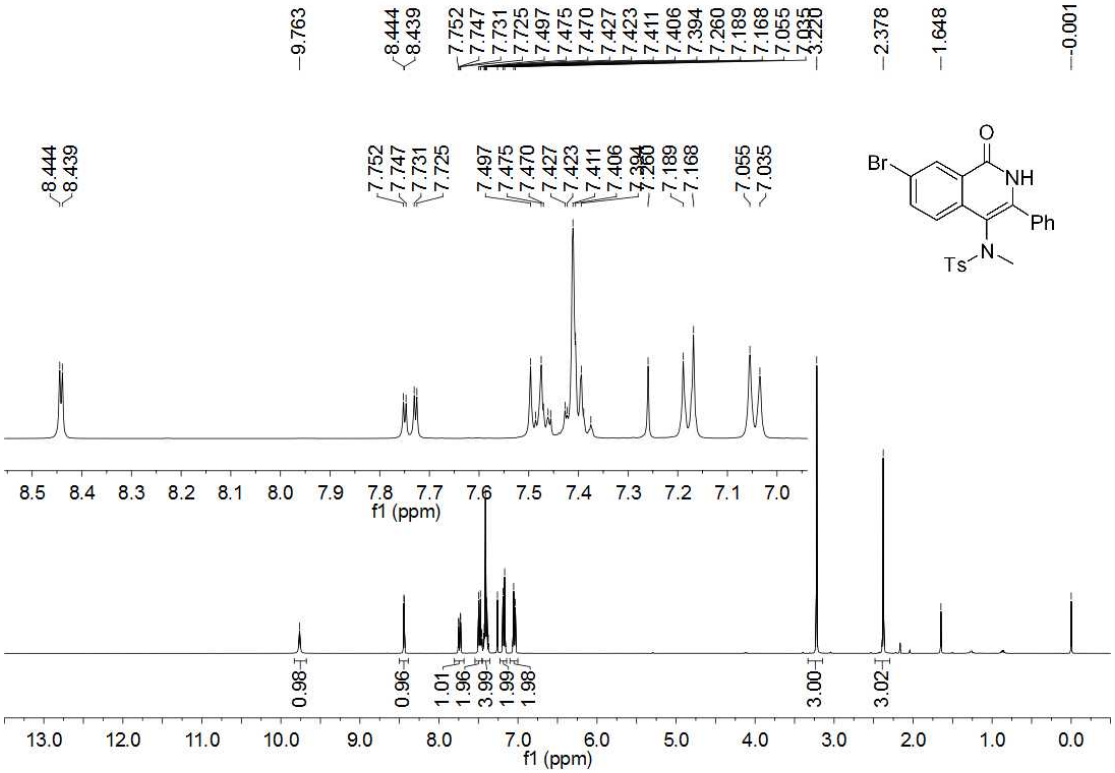
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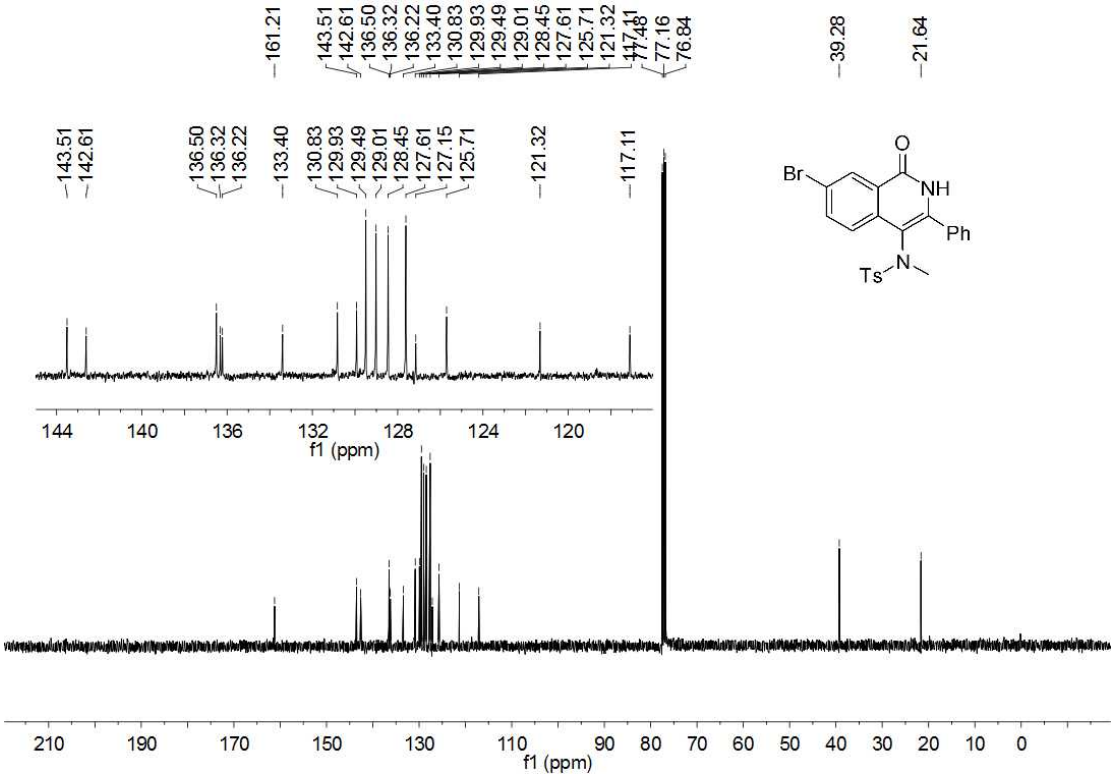
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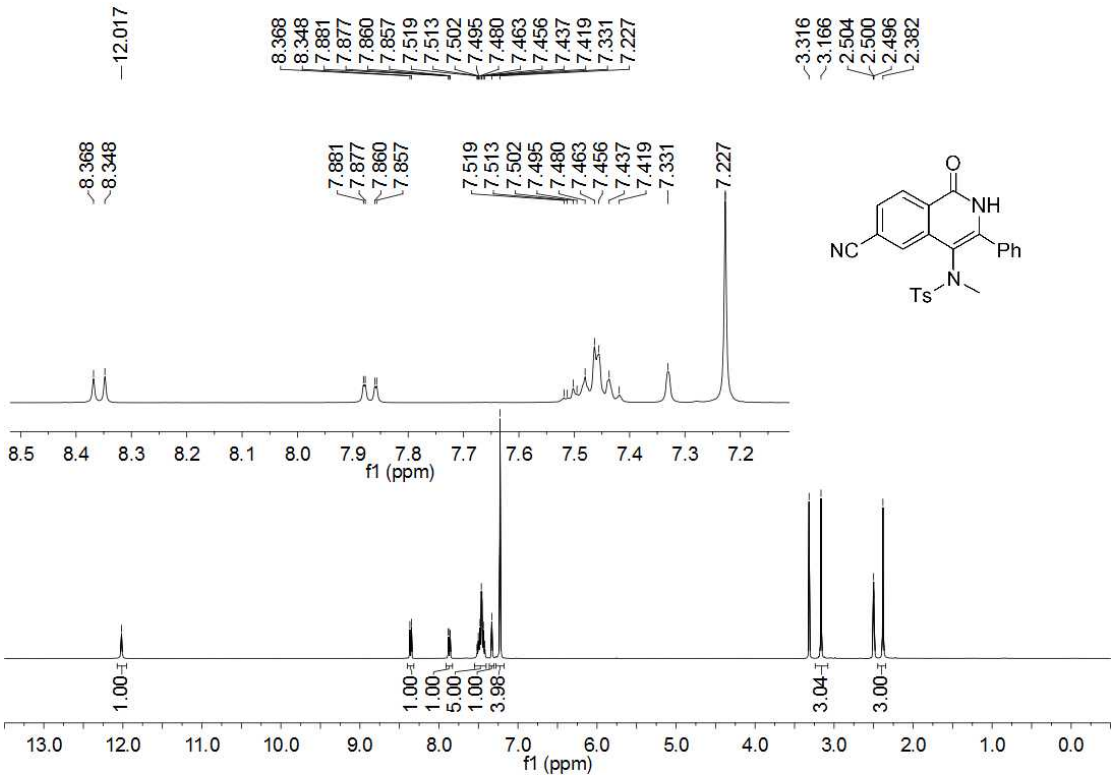
N
f1 (ppm)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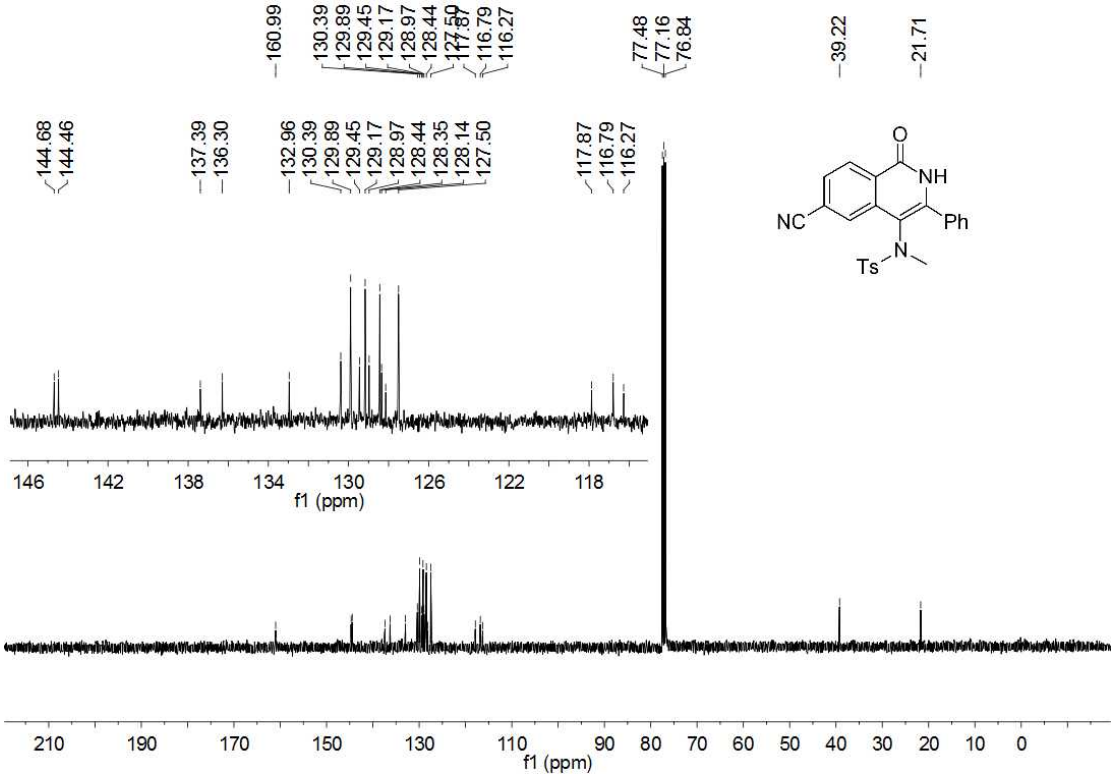
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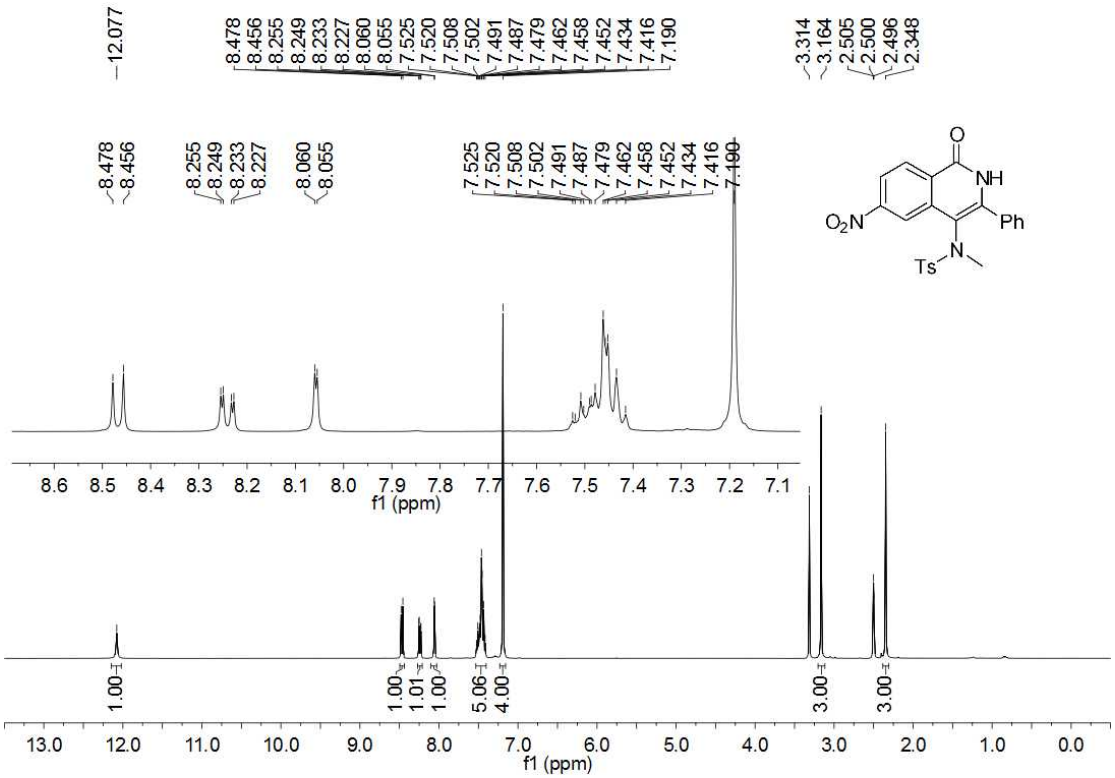
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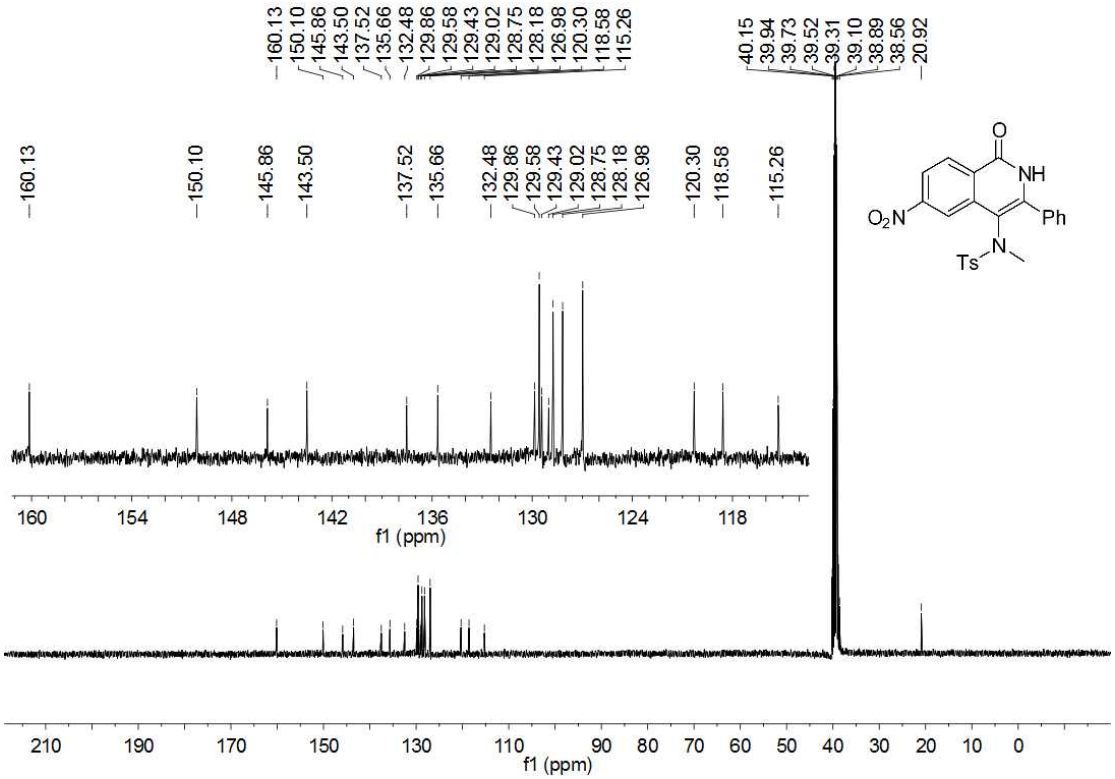
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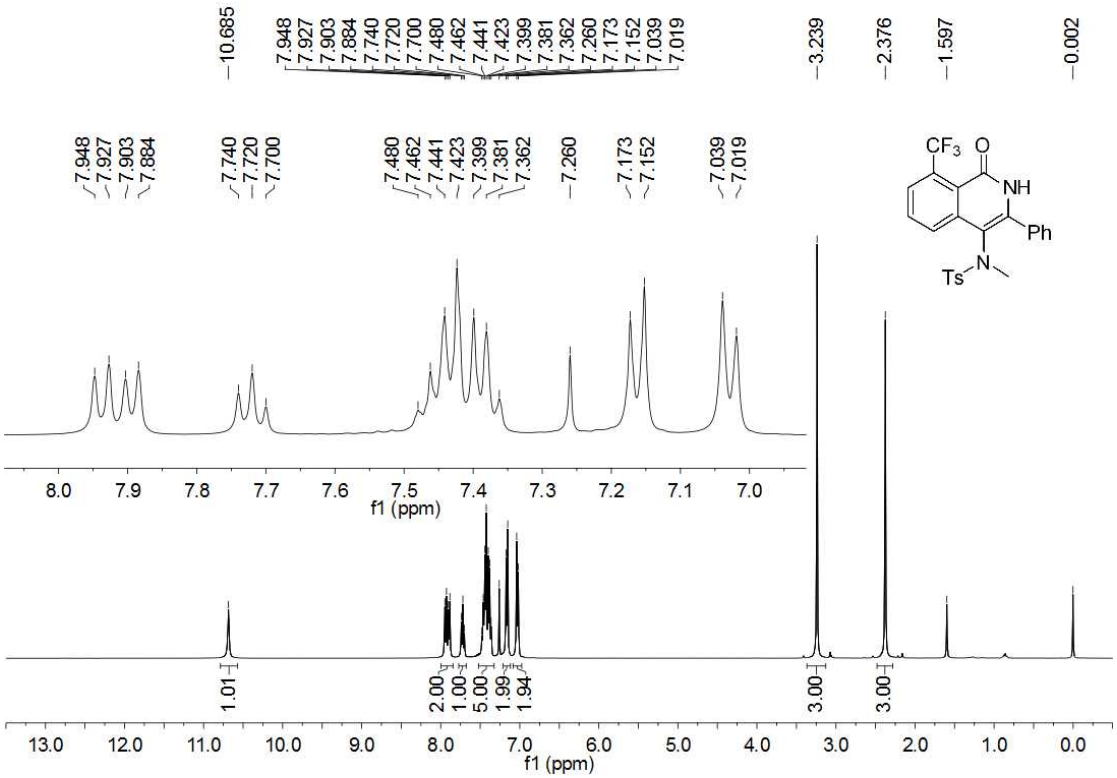
f1 (ppm)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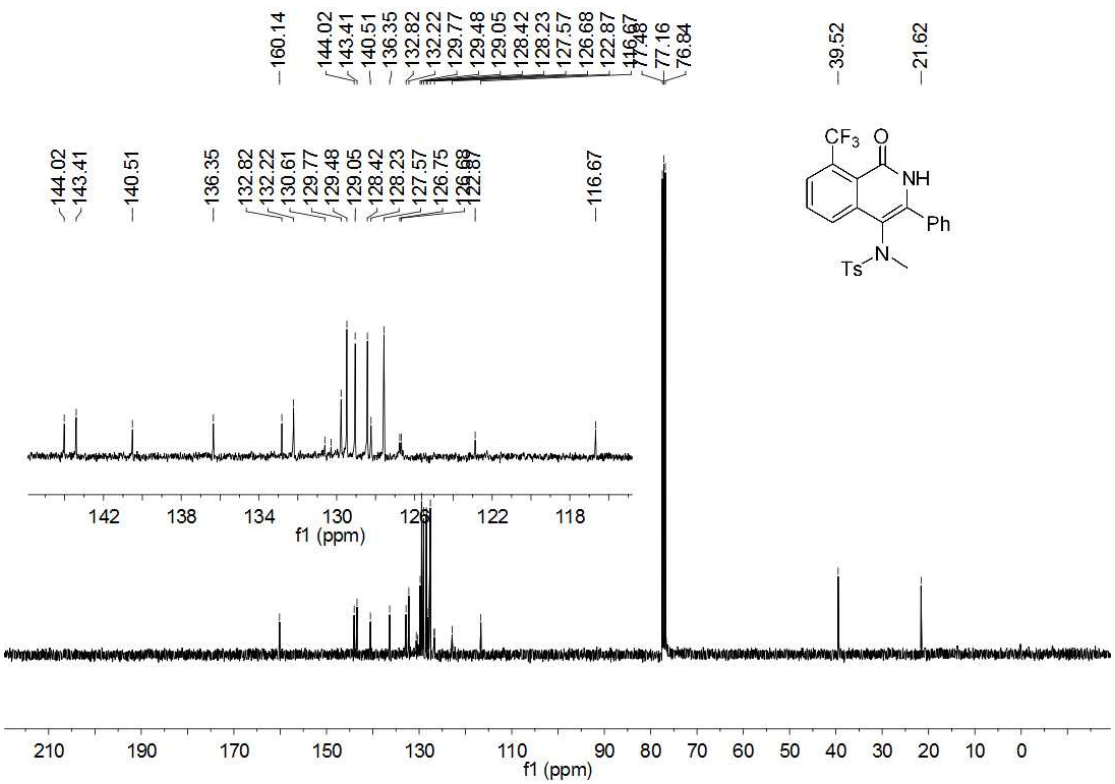
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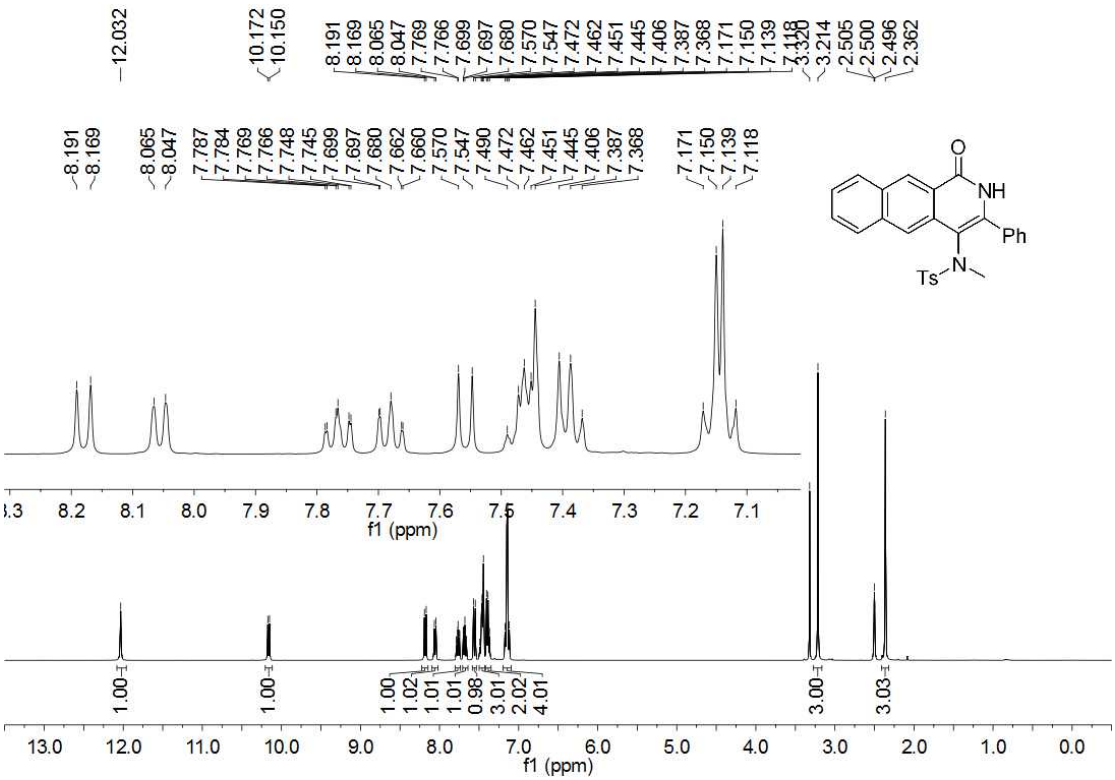
Ph
Ts
N
f1 (ppm)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Ph
Ts
N
O
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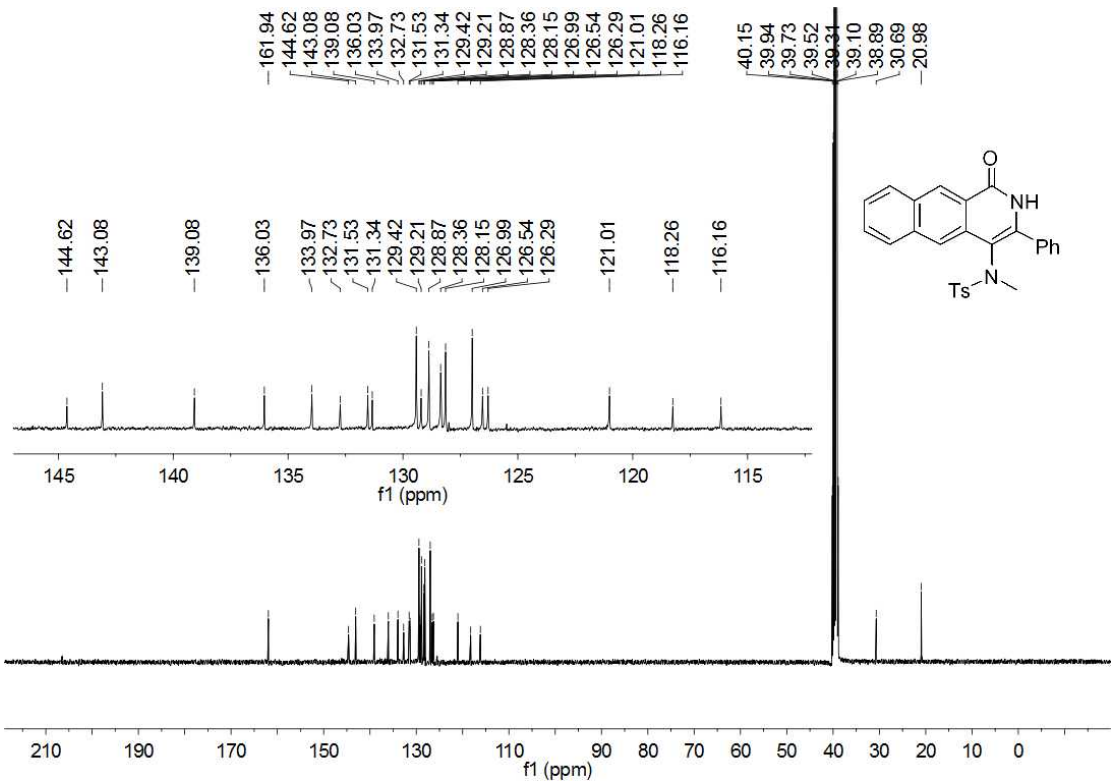
3.03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139.08
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133.97
132.73
131.53
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129.42
129.21
128.87
128.36
128.15
126.99
126.54
126.29
121.01
118.26
116.16
40.15
39.94
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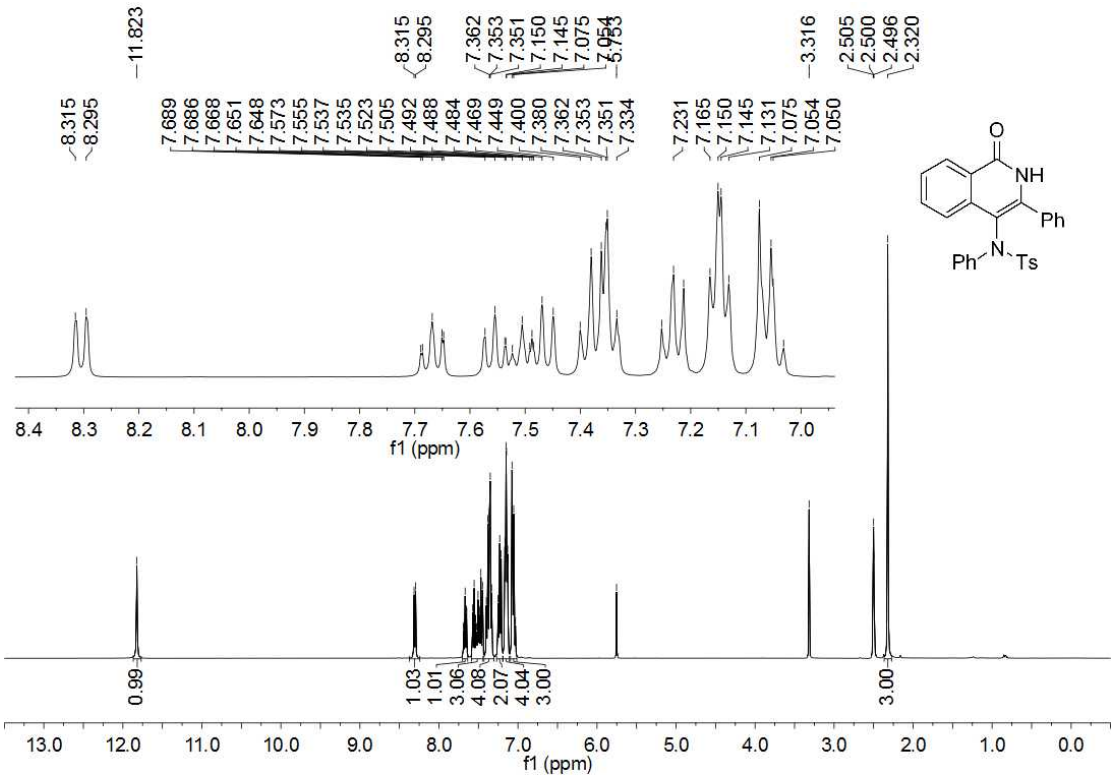
39.31
39.10
38.89
30.69
20.98
NH
Ph
Ts
N
O
f1 (ppm)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7.648
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7.537
7.535
7.523
7.505
7.492
7.488
7.484
7.469
7.449
7.400
7.380
7.362
7.353
7.351
7.334
7.231
7.165
7.150
7.145
7.131
7.075
7.054
7.050
3.316
2.505
2.500
2.496
2.320
NH
Ph
Ph
N
Ts
f1 (ppm)
0.99
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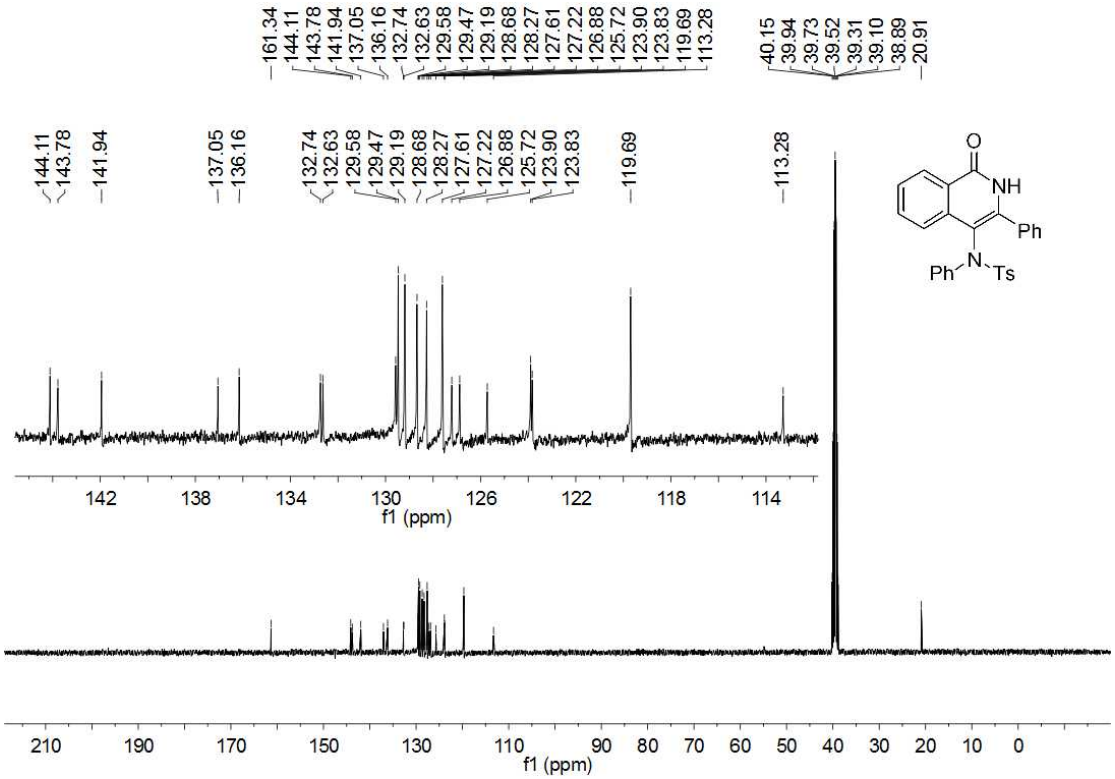
1.01
3.06
4.08
2.07
4.04
3.00
3.00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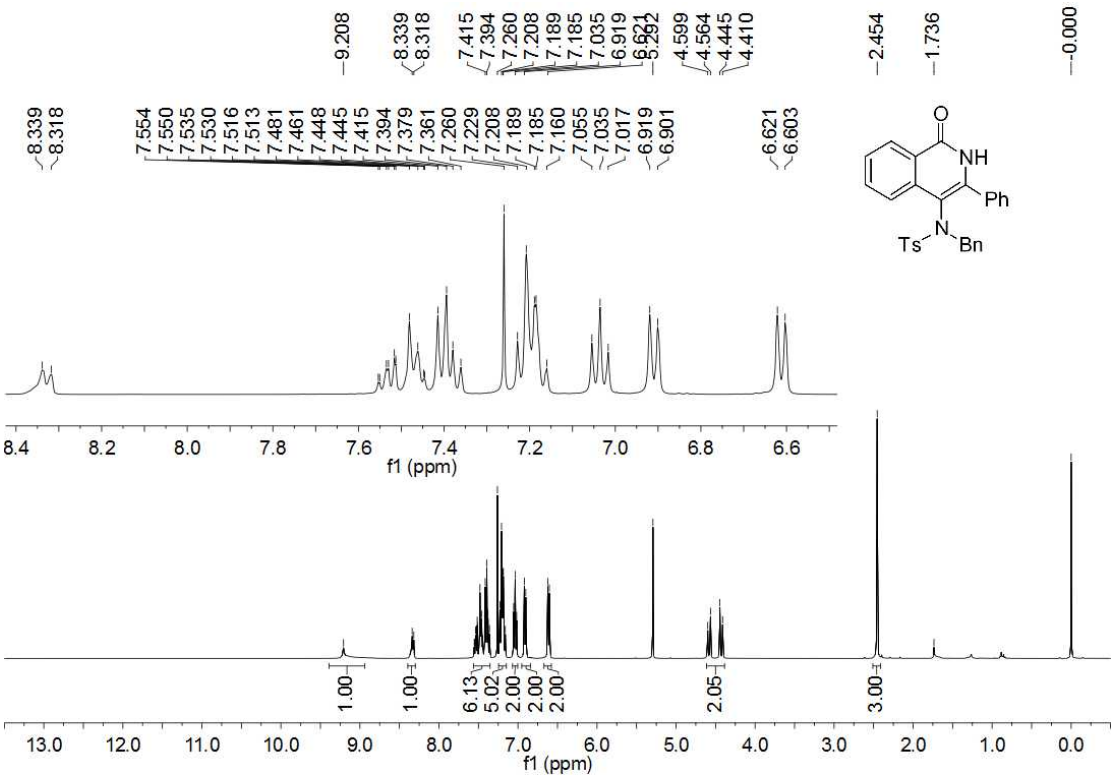
129.58
129.47
129.19
128.68
128.27
127.61
127.22
126.88
125.72
123.90
123.83
119.69
113.28
40.15
39.94
39.73
39.52
39.31
39.10
38.89
20.91
NH
Ph
Ph
N
Ts
f1 (ppm)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8.318
7.415
7.394
7.260
7.208
7.189
7.185
7.035
6.919
6.621
5.292
4.599
4.564
4.445
4.410
2.454
1.736
0.000
7.554
7.550
7.535
7.530
7.516
7.513
7.481
7.461
7.448
7.445
7.415
7.394
7.379
7.361
7.260
7.229
7.208
7.189
7.185
7.160
7.055
7.035
7.017
6.919
6.901
6.621
6.603
NH
Ph
N
Ts
Bn
f1 (ppm)
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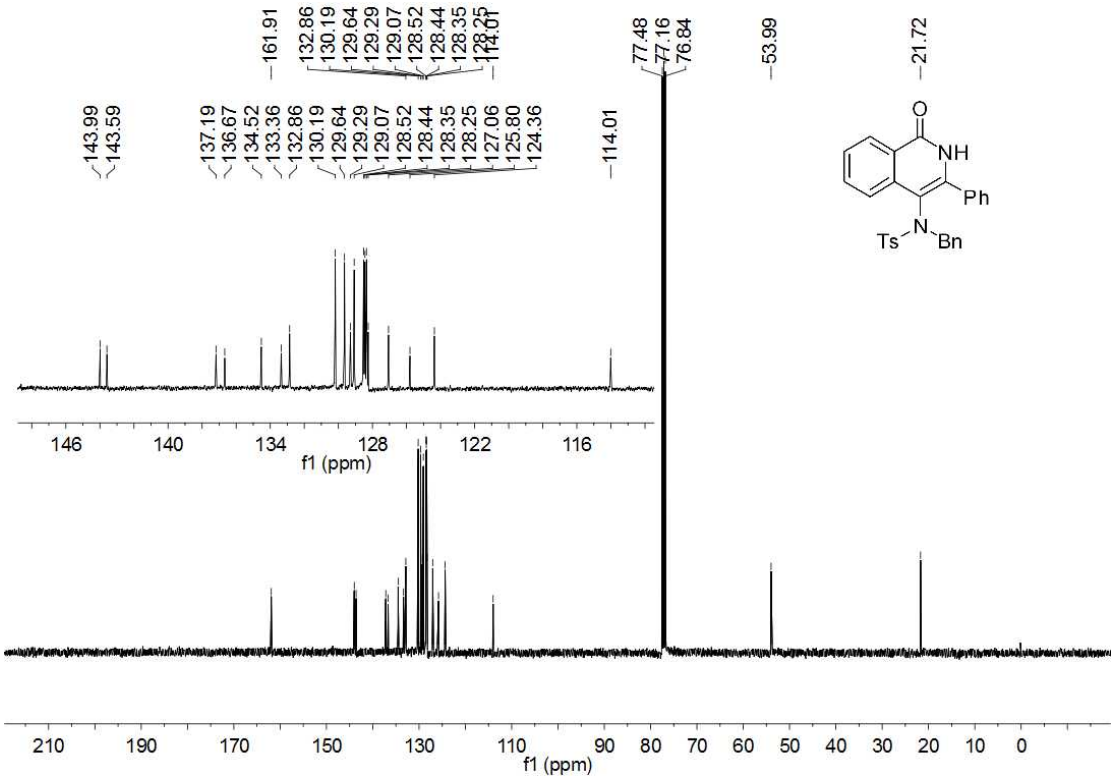
1.00
6.13
5.02
2.00
2.00
2.00
2.05
3.00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132.86
130.19
129.64
129.29
129.07
128.52
128.44
128.35
128.25
114.01
77.48
77.16
76.84
53.99
21.72
143.99
143.59
137.19
136.67
134.52
133.36
132.86
130.19
129.64
129.29
129.07
128.52
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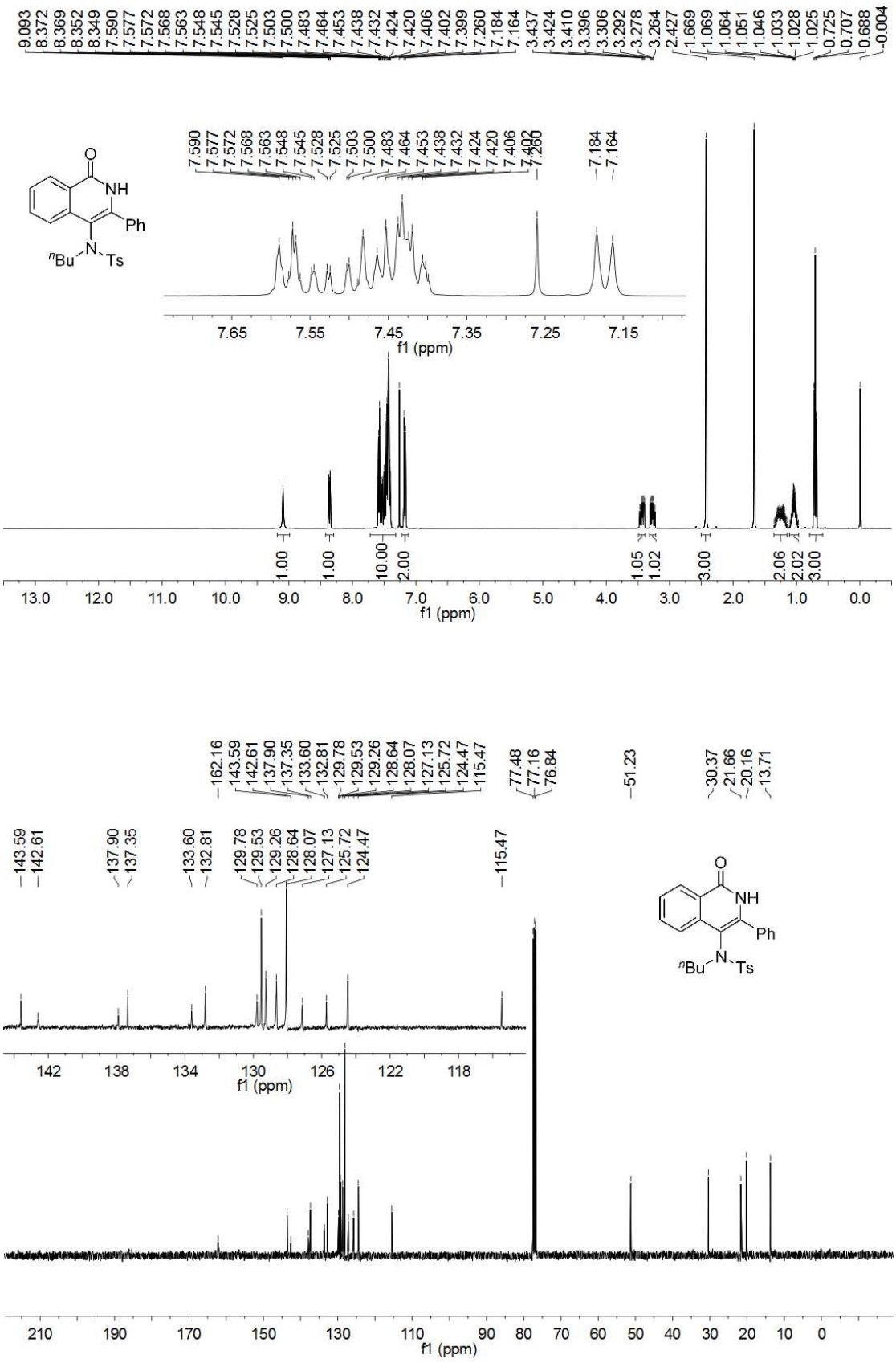
128.25
127.06
125.80
124.36
114.01
NH
Ph
N
Ts
Bn
f1 (ppm)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8.369
8.352
8.349
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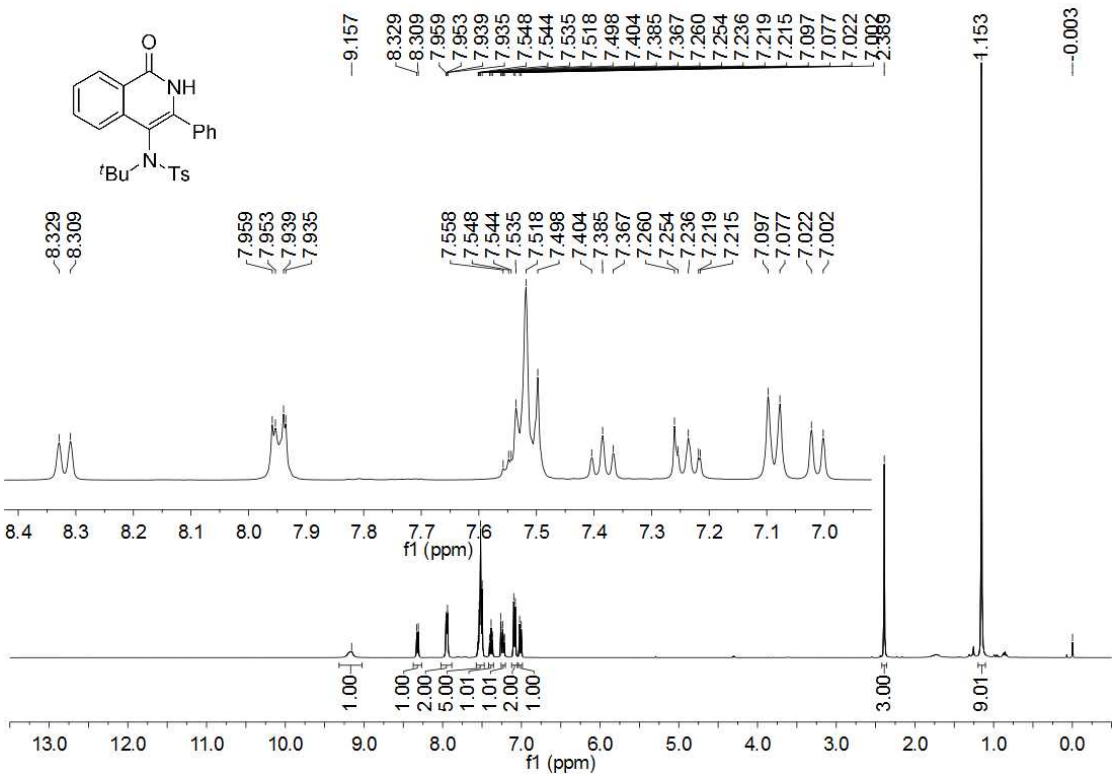
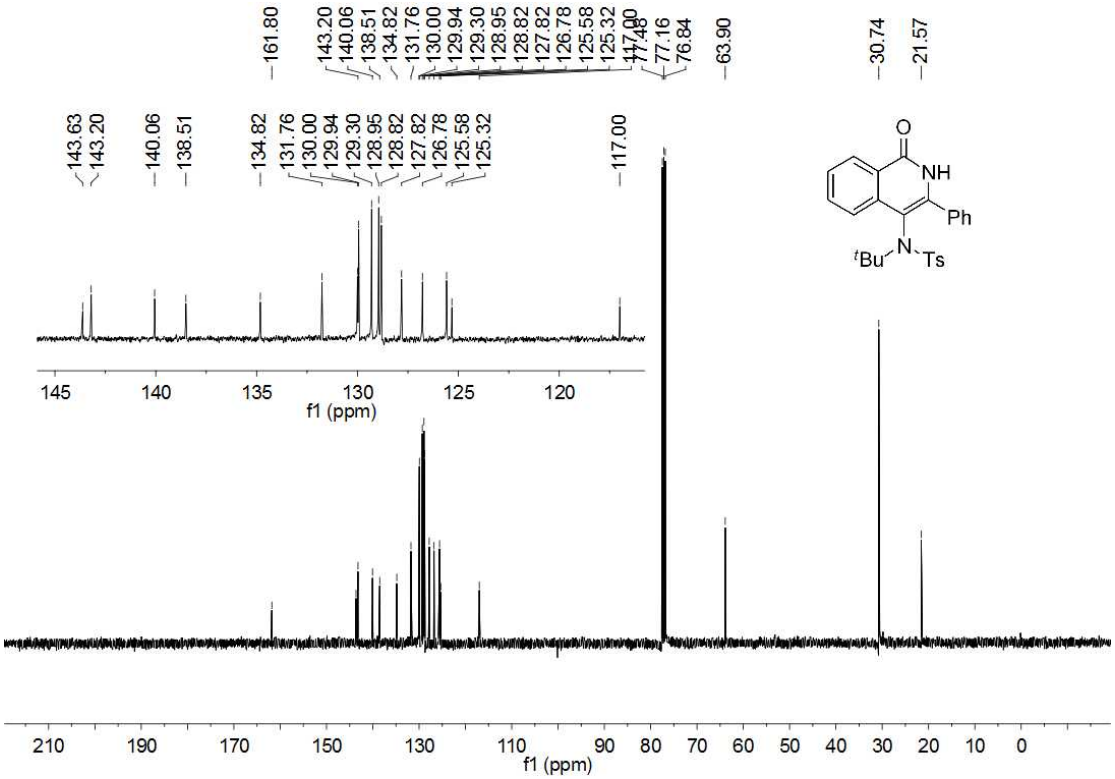
7.577
7.572
7.568
7.563
7.548
7.545
7.528
7.525
7.503
7.500
7.483
7.464
7.453
7.438
7.432
7.424
7.420
7.406
7.402
7.399
7.260
7.184
7.164
3.437
3.424
3.410
3.396
3.306
3.292
3.278
3.264
2.427
1.669
1.069
1.064
1.051
1.046
1.033
1.028
1.025
0.725
0.707
0.688
-0.004
O
NH
Ph
nBu
N
Ts
f1 (ppm)
1.00
1.00
10.00
2.00
1.05
1.02
3.00
2.06
2.02
3.00
162.16
143.59
142.61
137.90
137.35
133.60
132.81
129.78
129.53
129.26
128.64
128.07
127.13
125.72
124.47
115.47
77.48
77.16
76.84
51.23
30.37
21.66
20.16
13.71


O
NH
Ph
tBu
N
Ts
9.157
8.329
8.309
7.959
7.953
7.939
7.935
7.558
7.548
7.544
7.535
7.518
7.498
7.404
7.385
7.367
7.260
7.254
7.236
7.219
7.215
7.097
7.077
7.022
7.002
2.389
1.153
0.003
f1 (ppm)
1.00
1.00
2.00
5.00
1.01
1.01
2.00
1.00
3.00
9.01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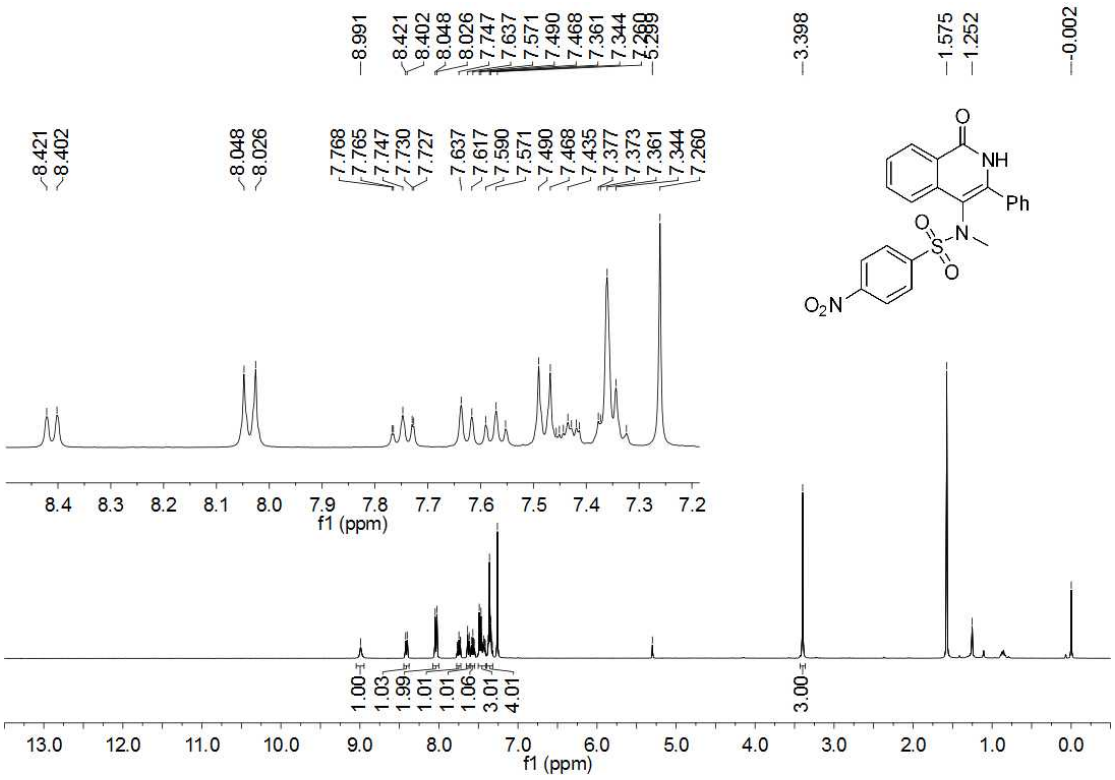
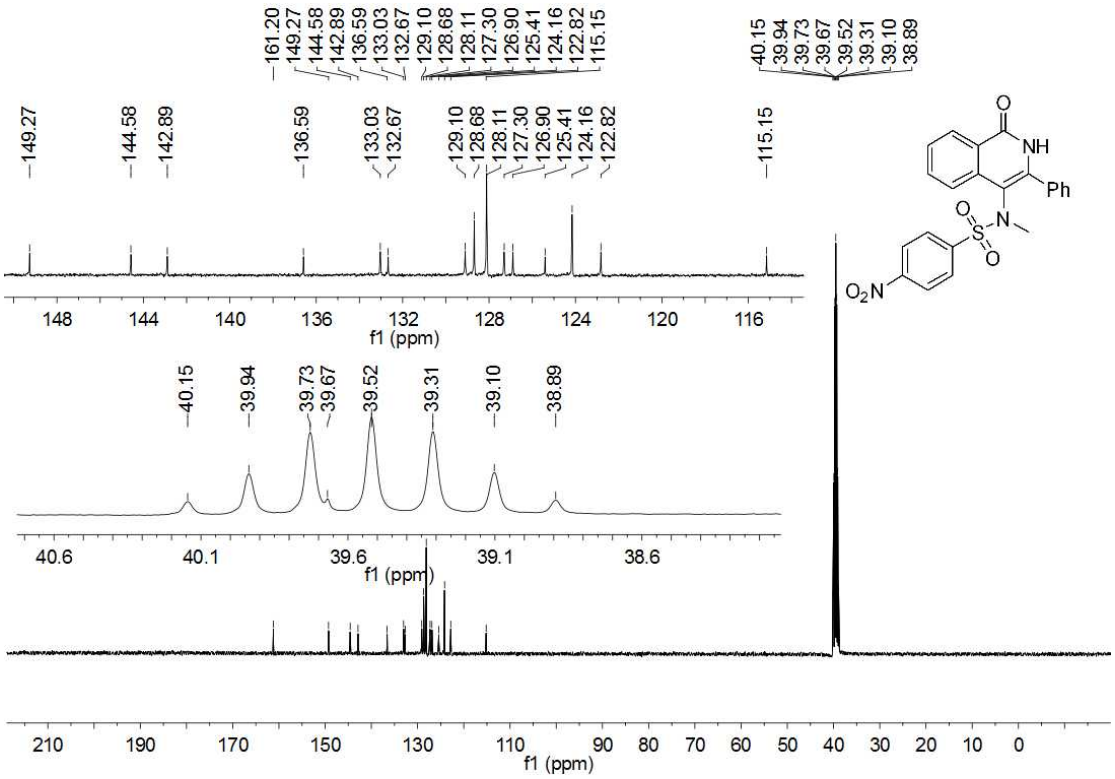
143.20
140.06
138.51
134.82
131.76
130.00
129.94
129.30
128.95
128.82
127.82
126.78
125.58
125.32
117.00
77.16
76.84
63.90
30.74
21.57
O
NH
Ph
tBu
N
Ts
f1 (ppm)


8.991
8.421
8.402
8.048
8.026
7.768
7.765
7.747
7.730
7.727
7.637
7.617
7.590
7.571
7.490
7.468
7.435
7.377
7.373
7.361
7.344
7.260
3.398
1.575
1.252
0.002
NH
Ph
O2N
f1 (ppm)
1.00
1.03
1.99
1.01
1.01
1.06
3.01
4.01
3.00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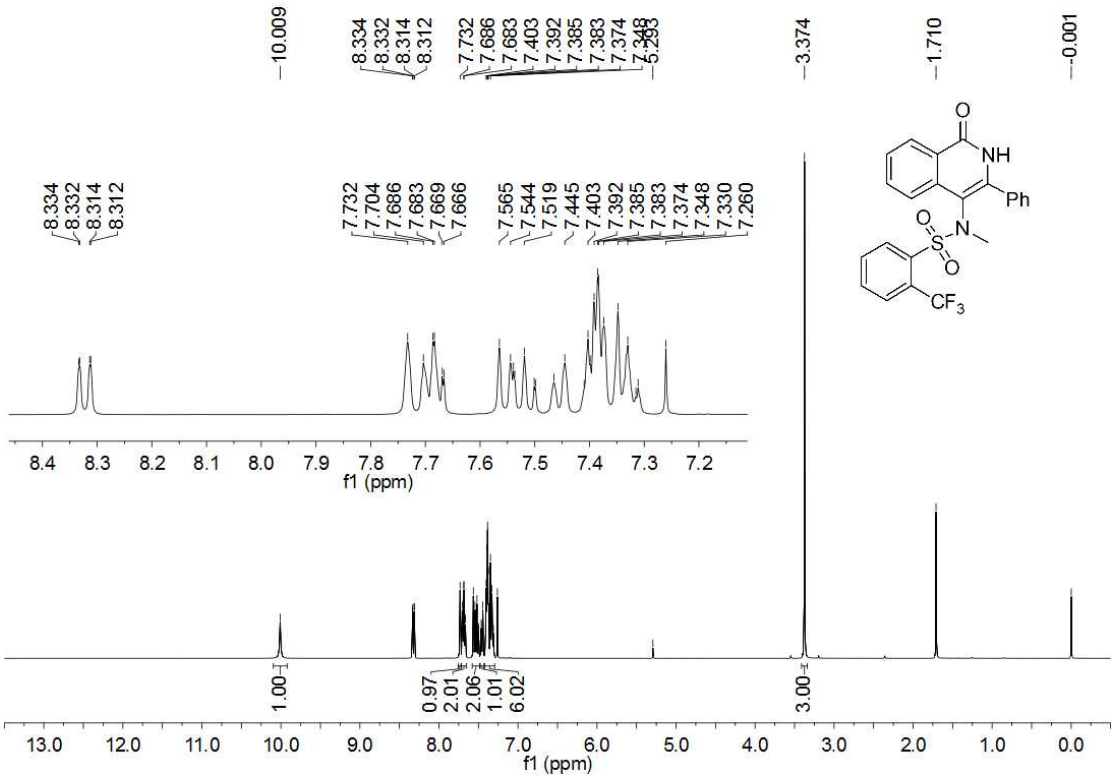
149.27
144.58
142.89
136.59
133.03
132.67
129.10
128.68
128.11
127.30
126.90
125.41
124.16
122.82
115.15
40.15
39.94
39.73
39.67
39.52
39.31
39.10
38.89
NH
Ph
O2N
f1 (ppm)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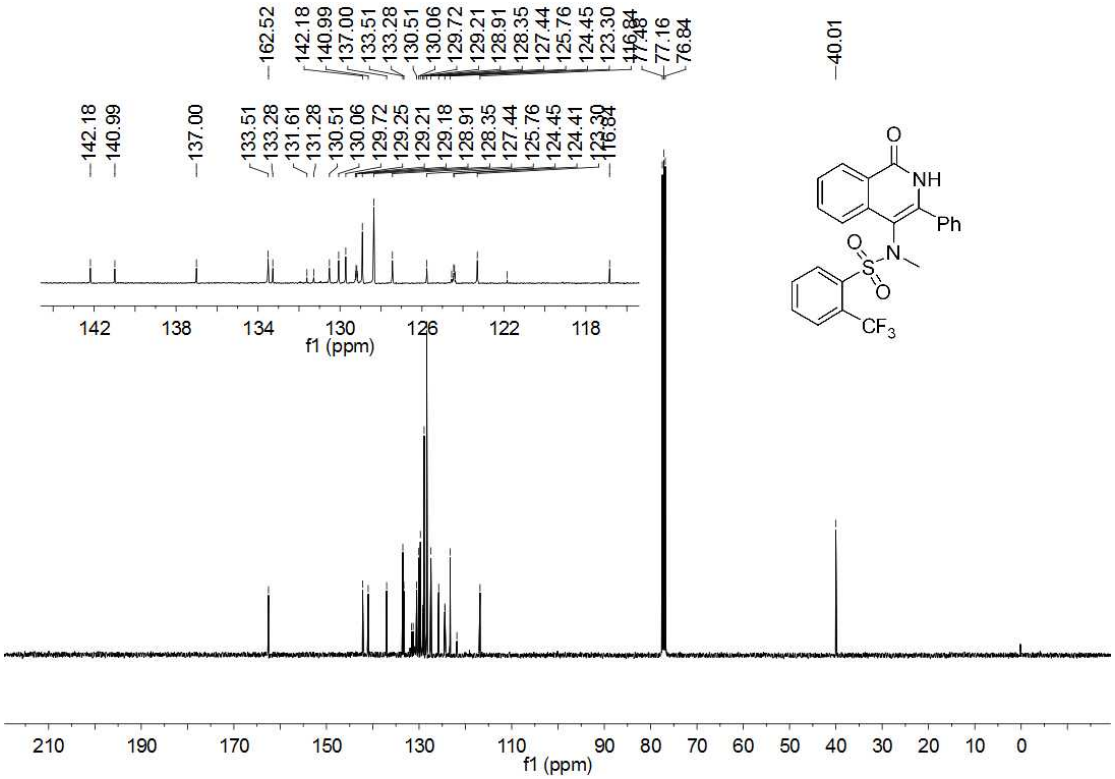
8.334
8.332
8.314
8.312
7.732
7.686
7.683
7.403
7.392
7.385
7.383
7.374
3.374
1.710
0.001
O
NH
Ph
N
S
O
CF3
1.00
0.97
2.01
2.06
1.01
6.02
3.00
f1 (ppm)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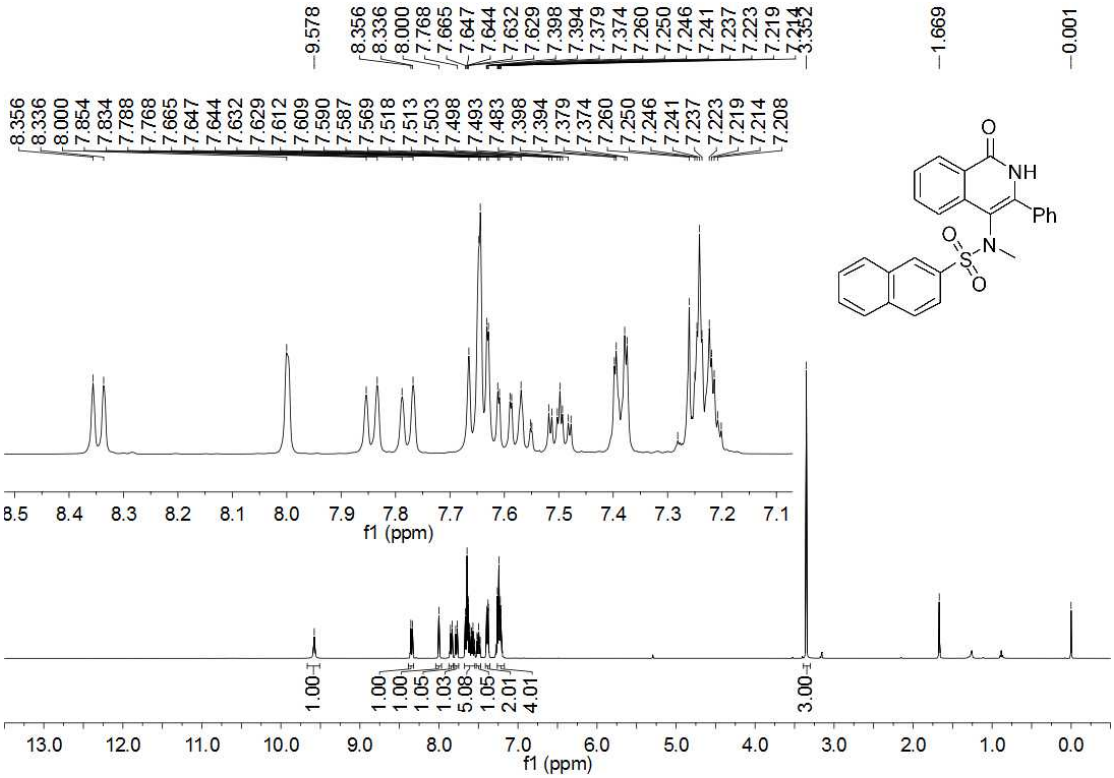
142.18
140.99
137.00
133.51
133.28
131.61
131.28
130.51
130.06
129.72
129.25
129.21
129.18
128.91
128.35
127.44
125.76
124.45
124.41
123.30
116.84
77.16
76.84
40.01
O
NH
Ph
N
S
O
CF3
f1 (ppm)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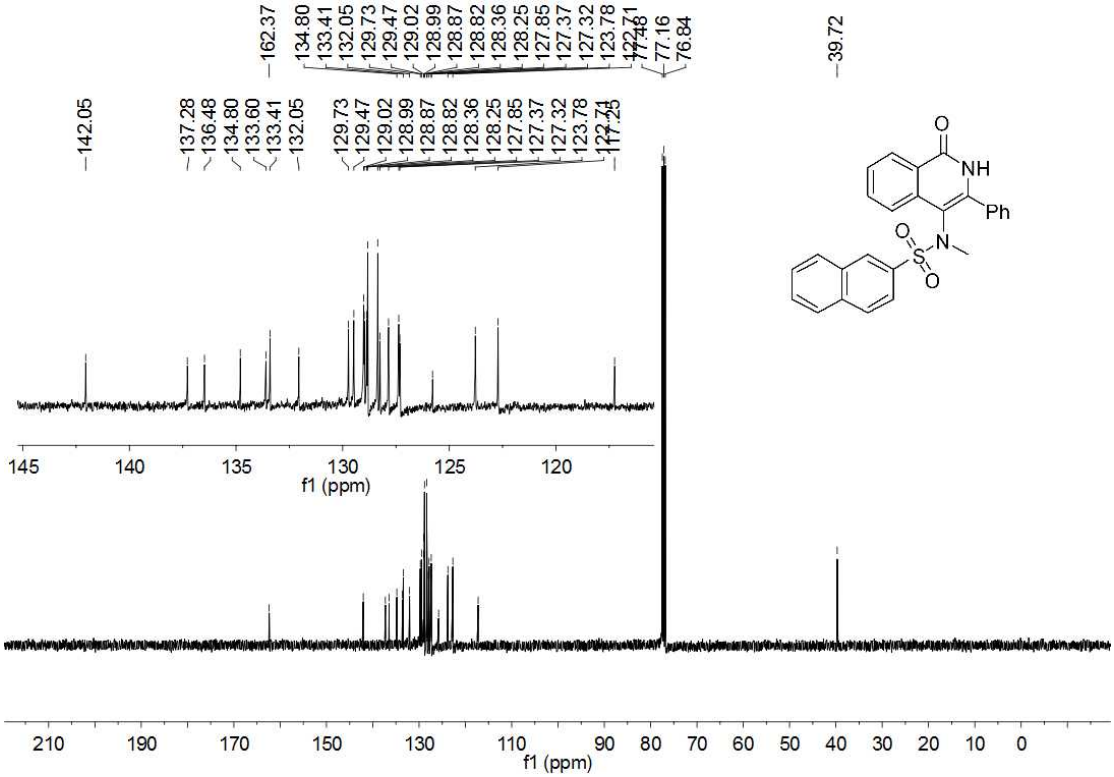
8.356
8.336
8.000
7.768
7.665
7.647
7.644
7.632
7.629
7.398
7.394
7.379
7.374
7.260
7.250
7.246
7.241
7.237
7.223
7.219
7.214
7.208
3.352
1.669
0.001
NH
Ph
O
S
N
f1 (ppm)
1.00
1.00
1.00
1.05
1.03
5.08
1.05
2.01
4.01
3.00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134.80
133.41
132.05
129.73
129.47
129.02
128.99
128.87
128.82
128.36
128.25
127.85
127.37
127.32
123.78
122.71
77.48
77.16
76.84
39.72
142.05
137.28
136.48
134.80
133.60
133.41
132.05
129.73
129.47
129.02
128.99
128.87
128.82
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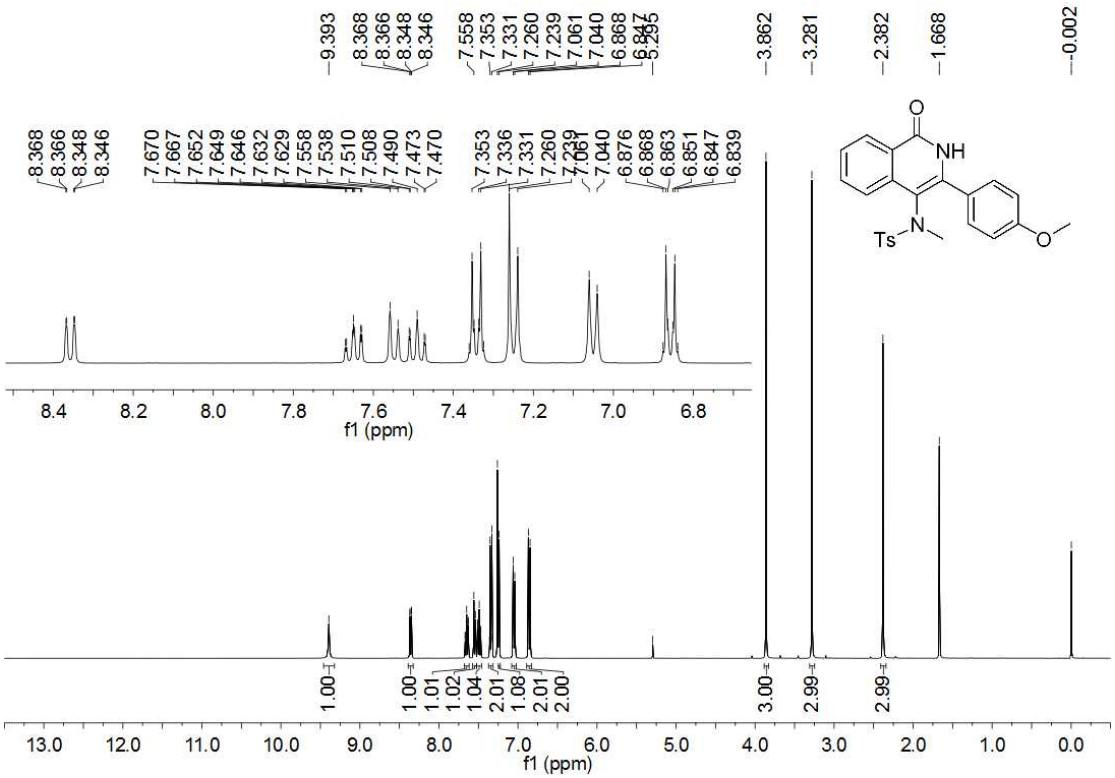
128.25
127.85
127.37
127.32
123.78
NH
Ph
O
S
N
f1 (ppm)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7.331
7.260
7.239
7.061
7.040
6.868
3.862
3.281
2.382
1.668
0.002
NH
O
Ts
N
f1 (ppm)
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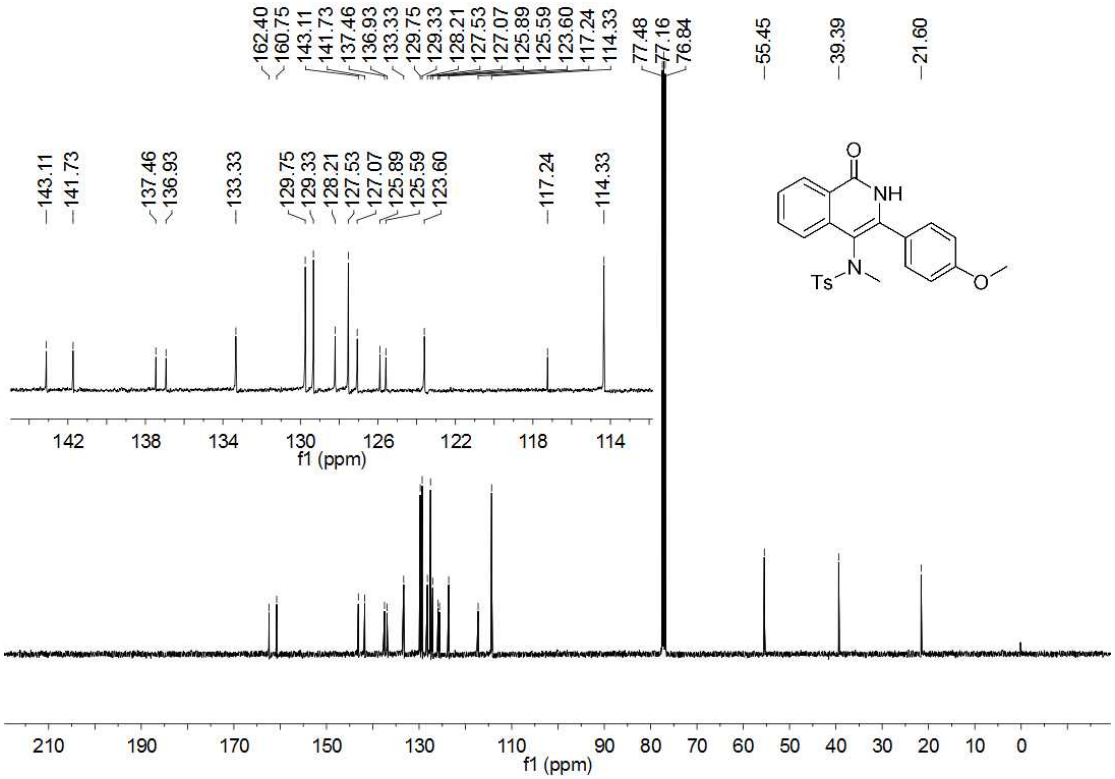
1.00
1.01
1.02
1.04
2.01
1.08
2.01
2.00
3.00
2.99
2.99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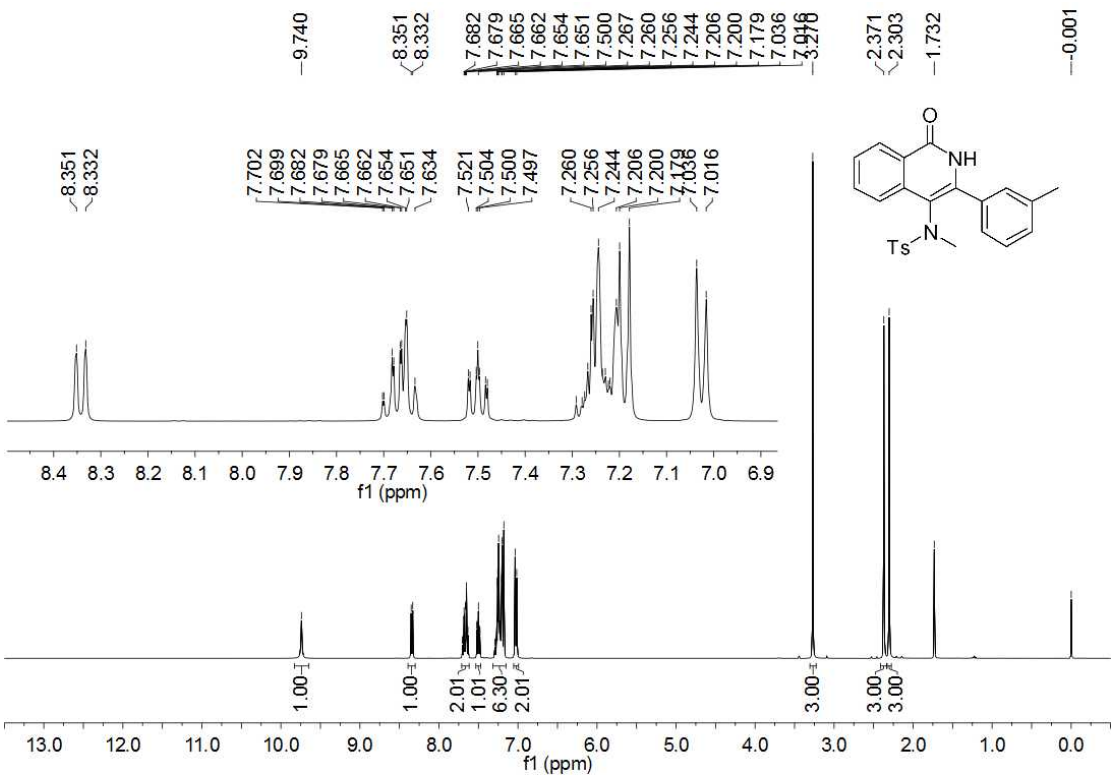
137.46
136.93
133.33
129.75
129.33
128.21
127.53
127.07
125.89
125.59
123.60
117.24
114.33
77.48
77.16
76.84
55.45
39.39
21.60
NH
O
Ts
N
f1 (ppm)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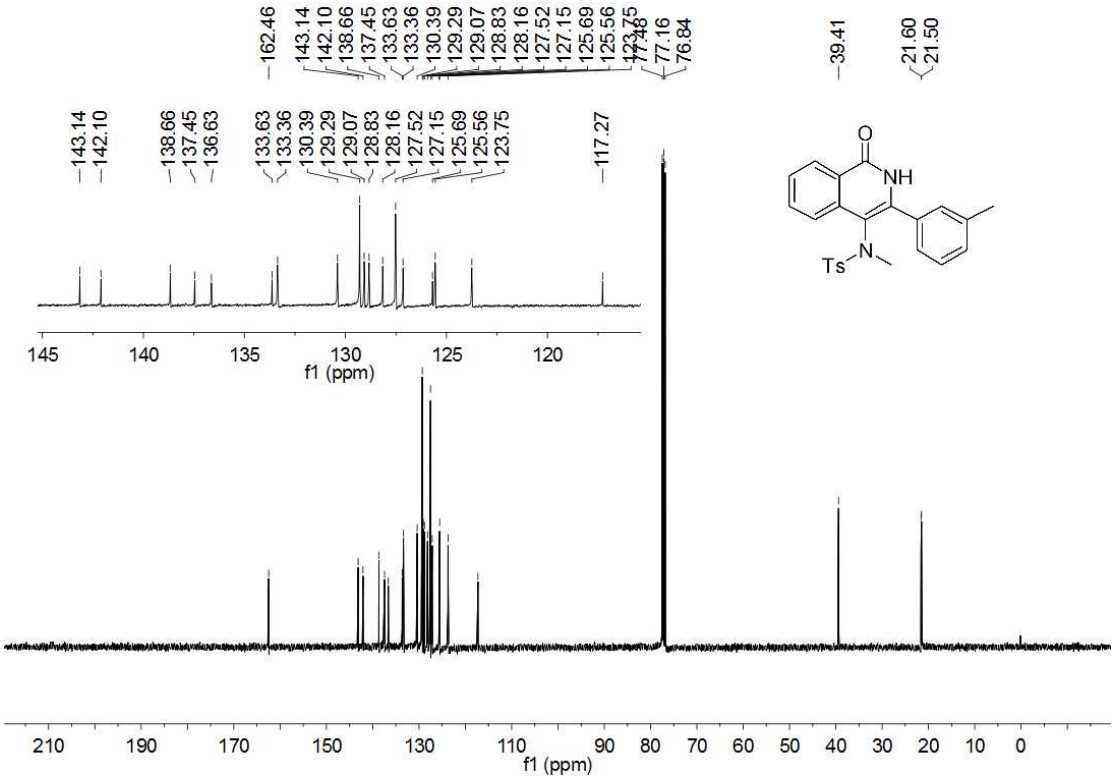
7.682
7.679
7.665
7.662
7.654
7.651
7.500
7.267
7.260
7.256
7.244
7.206
7.200
7.179
7.036
3.270
2.371
2.303
1.732
0.001
NH
Ts
N
f1 (ppm)
1.00
1.00
2.01
1.01
6.30
2.01
3.00
3.00
3.00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138.66
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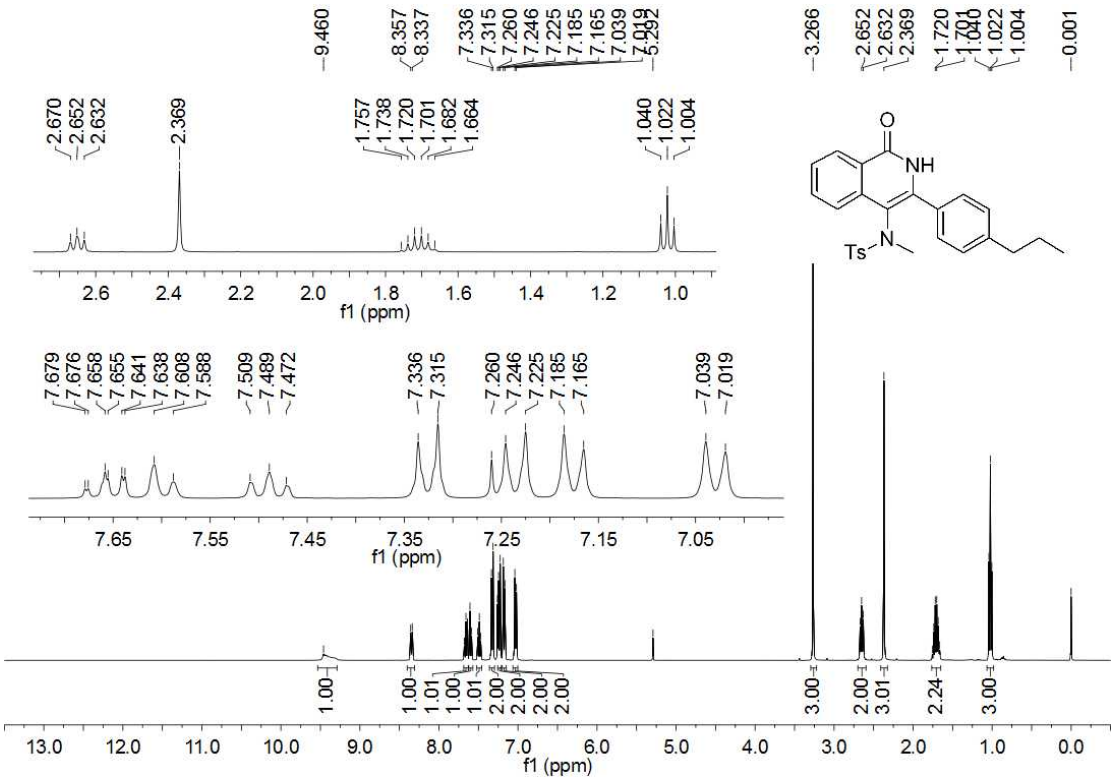
133.63
133.36
130.39
129.29
129.07
128.83
128.16
127.52
127.15
125.69
125.56
123.75
77.16
76.84
39.41
21.60
21.50
117.27
NH
Ts
N
f1 (ppm)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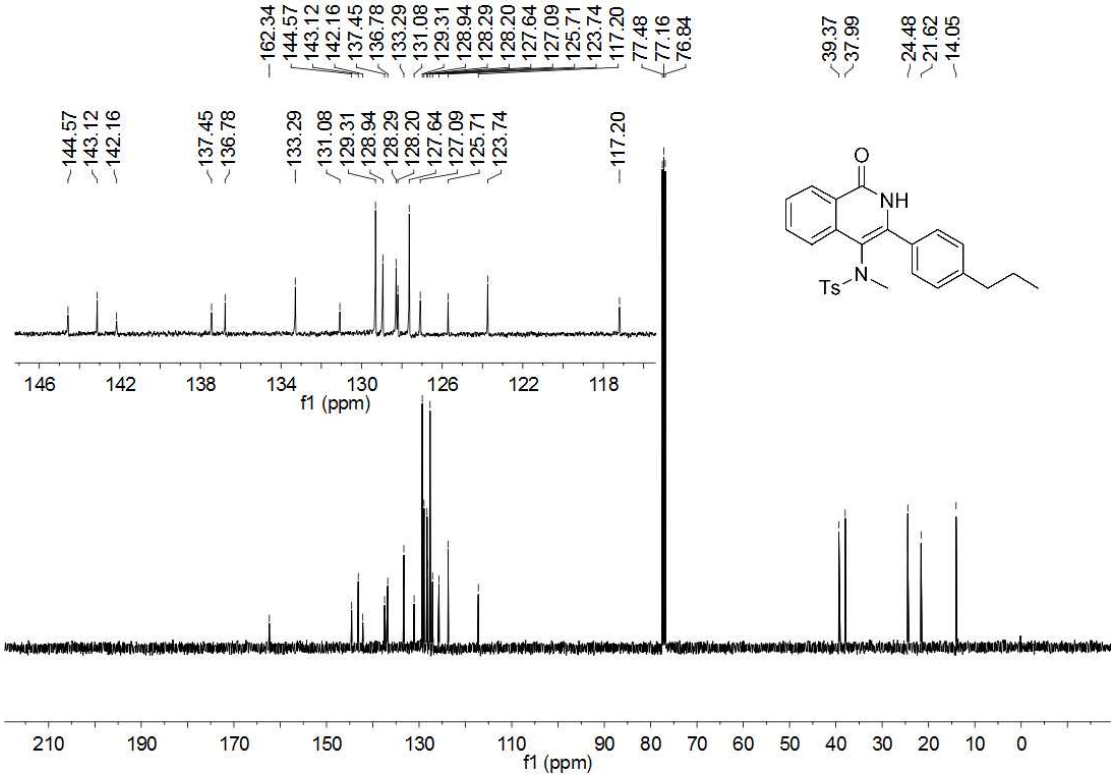
7.315
7.260
7.246
7.225
7.185
7.165
7.039
7.019
5.292
3.266
2.652
2.632
2.369
1.720
1.701
1.040
1.022
1.004
0.001
2.670
2.652
2.632
2.369
1.757
1.738
1.720
1.701
1.682
1.664
1.040
1.022
1.004
f1 (ppm)
7.679
7.676
7.658
7.655
7.641
7.638
7.608
7.588
7.509
7.489
7.472
7.336
7.315
7.260
7.246
7.225
7.185
7.165
7.039
7.019
f1 (ppm)
1.00
1.00
1.01
1.00
1.01
2.00
2.00
2.00
2.00
3.00
2.00
3.01
2.24
3.00
f1 (ppm)
O
NH
Ts
N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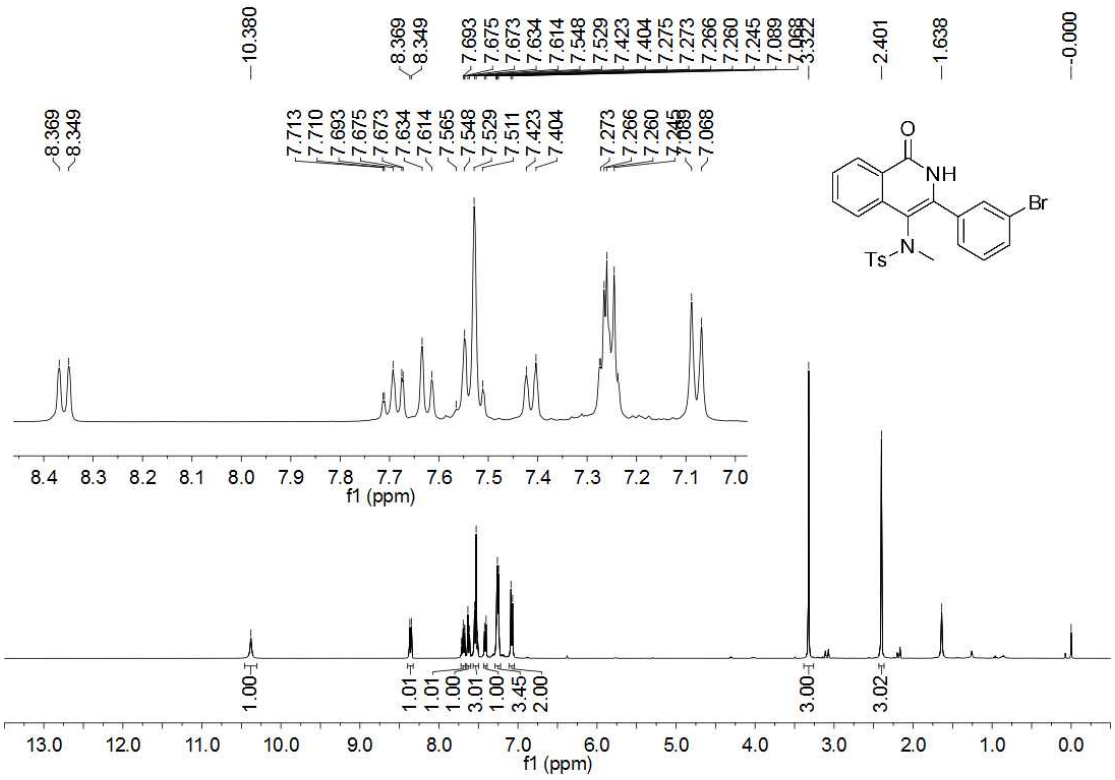
137.45
136.78
133.29
131.08
129.31
128.94
128.29
128.20
127.64
127.09
125.71
123.74
117.20
77.48
77.16
76.84
39.37
37.99
24.48
21.62
14.05
144.57
143.12
142.16
137.45
136.78
133.29
131.08
129.31
128.94
128.29
128.20
127.64
127.09
125.71
123.74
117.20
f1 (ppm)
f1 (ppm)
O
NH
Ts
N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8.369
8.349
7.693
7.675
7.673
7.634
7.614
7.548
7.529
7.423
7.404
7.275
7.273
7.266
7.260
7.245
7.089
7.068
3.322
2.401
1.638
0.000
O
NH
Br
Ts
N
f1 (ppm)
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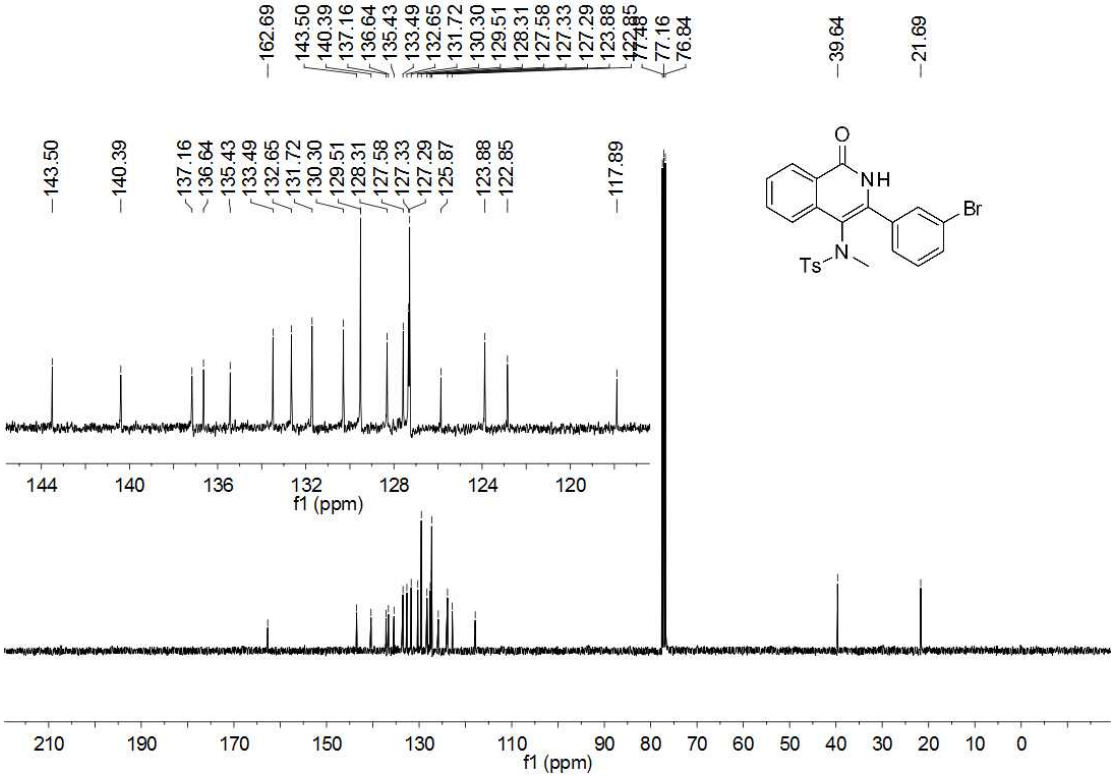
1.01
1.01
1.00
3.01
1.00
3.45
2.00
3.00
3.02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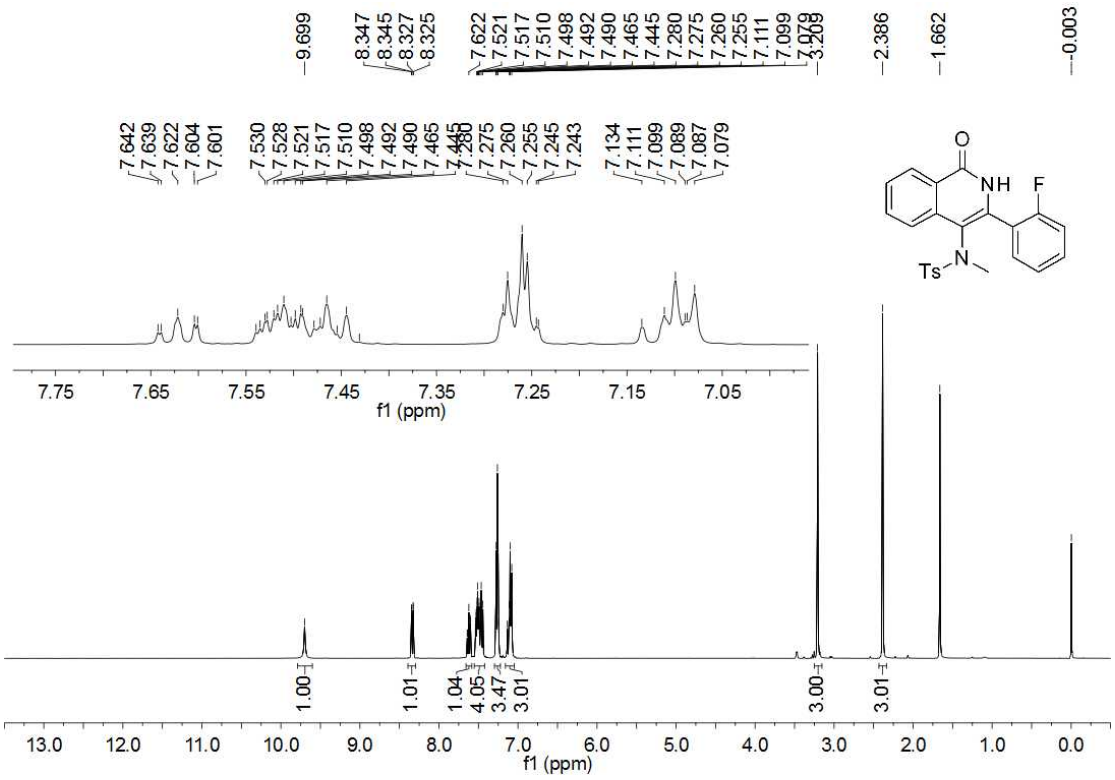
136.64
135.43
133.49
132.65
131.72
130.30
129.51
128.31
127.58
127.33
127.29
123.88
122.85
77.16
76.84
39.64
21.69
117.89
O
NH
Br
Ts
N
f1 (ppm)


9.699
8.347
8.345
8.327
8.325
7.622
7.521
7.517
7.510
7.498
7.492
7.490
7.465
7.445
7.280
7.275
7.260
7.255
7.111
7.099
3.209
2.386
1.662
0.003
O
NH
F
Ts
N
f1 (ppm)
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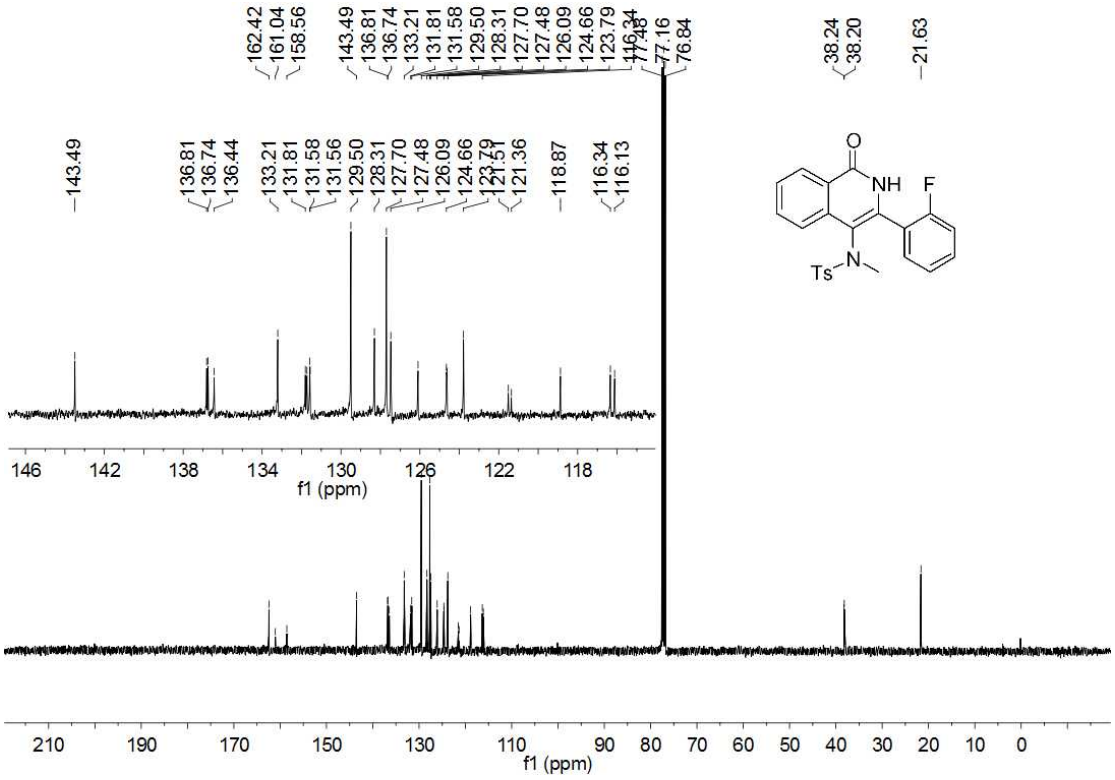
1.01
1.04
4.05
3.47
3.01
3.00
3.01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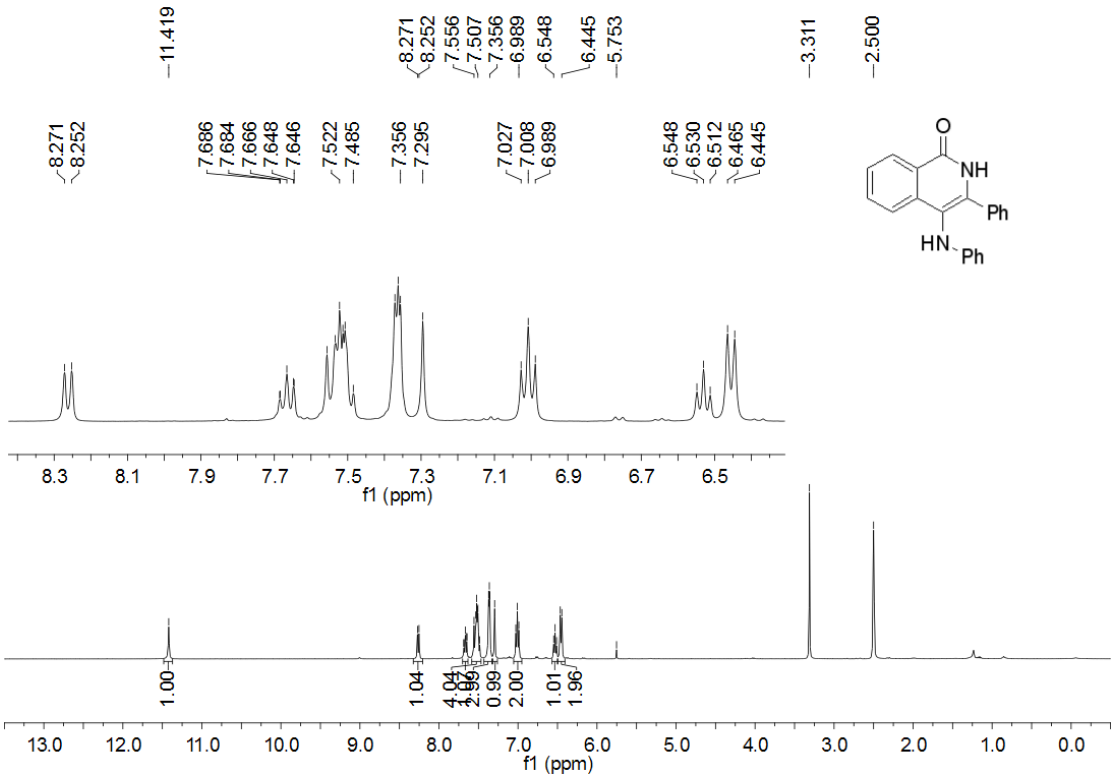
158.56
143.49
136.81
136.74
133.21
131.81
131.58
129.50
128.31
127.70
127.48
126.09
124.66
123.79
77.16
76.84
38.24
38.20
21.63
O
NH
F
Ts
N
f1 (ppm)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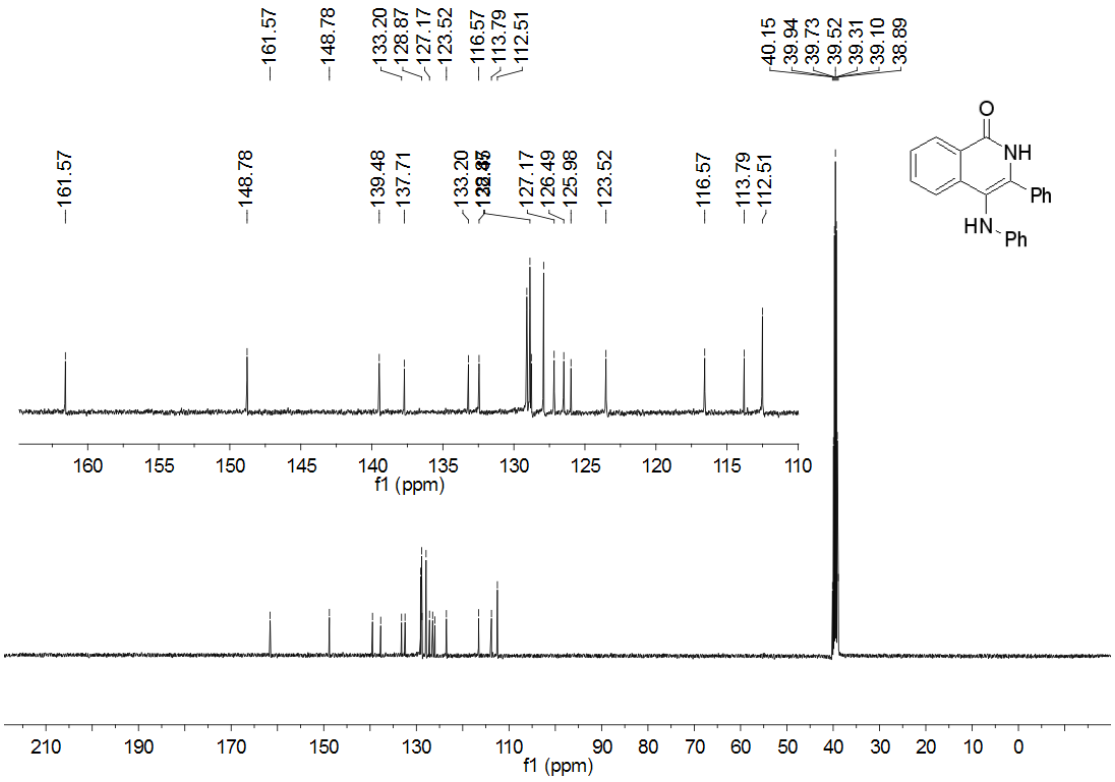
7.556
7.507
7.356
6.989
6.548
6.445
5.753
3.311
2.500
8.271
8.252
7.686
7.684
7.666
7.648
7.646
7.522
7.485
7.356
7.295
7.027
7.008
6.989
6.548
6.530
6.512
6.465
6.445
O
NH
Ph
HN
Ph
8.3
8.1
7.9
7.7
7.5
7.3
7.1
6.9
6.7
6.5
f1 (ppm)
1.00
1.04
4.04
2.99
0.99
2.00
1.01
1.96
13.0
12.0
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
f1 (ppm)


161.57
148.78
133.20
128.87
127.17
123.52
116.57
113.79
112.51
40.15
39.94
39.73
39.52
39.31
39.10
38.89
161.57
148.78
139.48
137.71
133.20
127.17
126.49
125.98
123.52
116.57
113.79
112.51
O
NH
Ph
HN
Ph
160
155
150
145
140
135
130
125
120
115
110
f1 (ppm)
210
190
170
150
130
110
90
80
70
60
50
40
30
20
10
0
f1 (ppm)