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Supporting Information

Direct Alkylation of Quinolines with Organolithium-Activated 1,1-Diborylalkanes

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Supporting Information

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1. General experimental details

Unless otherwise stated, all air-sensitive manipulations were conducted by standard Schlenk techniques. All solvents were freshly distilled before used. Glassware was dried at 120 ^{o}C for at least 3 h prior to use. Unless otherwise noted, all of chemicals were purchased from Alfa Aesar, Sigma-Aldrich, TCI and used without further purification. Tetrahydrofuran (THF) was purified using Pure Solv MD-4-solvent purification system, from Innovative Technology by passing the solvent through two activated alumina columns after purging with argon. All other reagents were directly used as purchased without further purification. Analytical thin layer chromatography (TLC) was performed on Merck pre-coated silica gel 60 F254 plates. Visualization on TLC was achieved by the use of UV light (254 nm), or treatment with $KMnO_4$ stain followed by heating. Column chromatography was undertaken on silica gel (400-630 mesh) using a proper eluent system. NMR spectrums were acquired on 300 MHz, 500 MHz and 600 MHz Bruker instruments at the POSTECH-NMR facility. Chemical shifts are reported in ppm relative to a residual solvent peak ($CDCl_3$ = 7.26 ppm for ^{1}H and 77.16 ppm for ^{13}C). High-resolution mass spectra (HRMS) were obtained from the KBSI (Korea Basic Science Institute) in Daegu by electron impact (EI) ionization technique (magnetic sector−electric sector double focusing mass analyzer) and from the Chiral Material Core Facility Center of Sungkyunkwan University in Suwon by Supercritical Fluid Chromatograph combined with Xevo G2-XS QTOF Mass Spectrometer (Waters, Milford, MA, USA).

Note: Organolithium solution was purchased from Sigma-Aldrich and used as received:

- Methyllithium: 3.1 M solution in dimethoxymethane
- *n*-Butyllithium: 1.6 M solution in hexanes
- *sec*-Butyllithium: 1.4 M solution in cyclohexane
- *tert*-Butyllithium: 1.7 M solution in pentane
- Phenyllithium: 1.9 M solution in dibutylether

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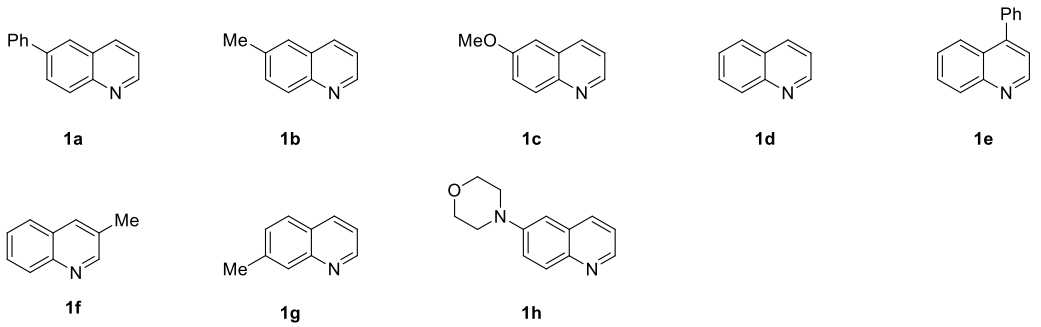
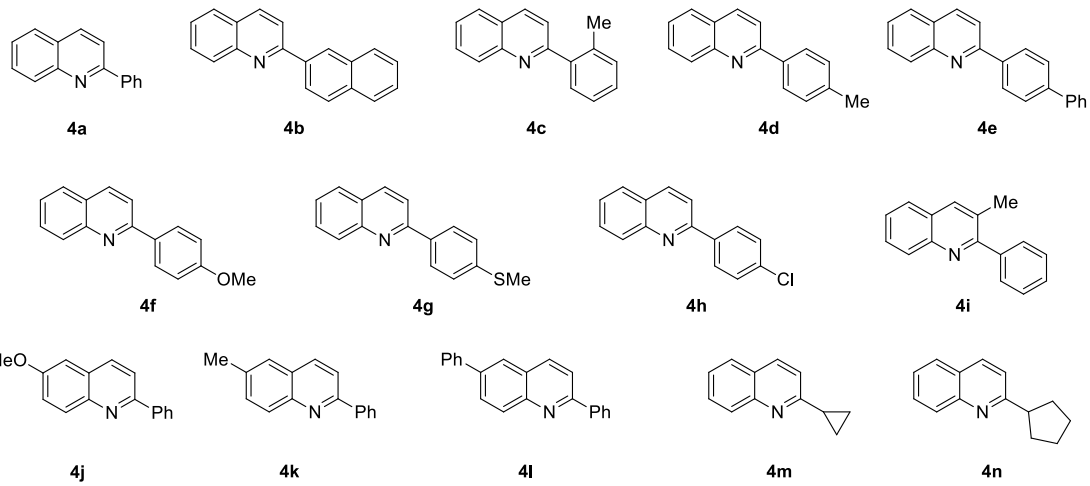
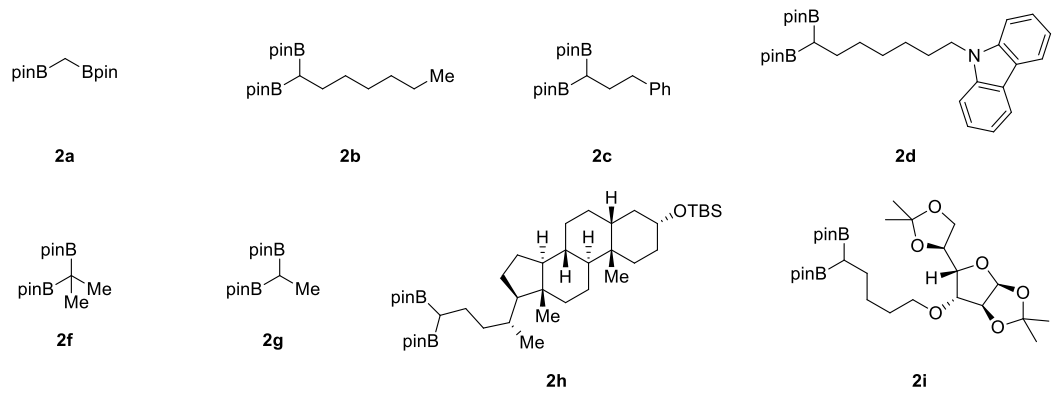
2. General procedure for the preparation of starting materials







- Heterocyclic compounds **1b**, **1c**, **1d**, **1f**, and **1g** were purchased from commercial sources and used as received.
- Heterocyclic compounds **1a**,[1] **1e**,[2] **1h**,[3] **4a-4h**,[4] **4i**,[5] **4j-4l**,[6] **4m**,[4] and **4n**[7] were synthesized according to literature procedures.

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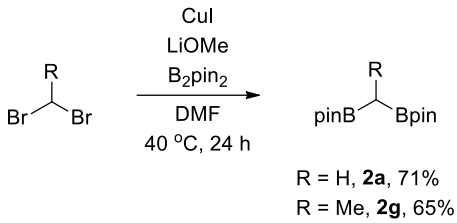
2.1. Preparation of 1,1-diborylalkane 2

2.1.1. Diborylation of 1,1-dibromoalkane



- Synthesis of diborylmethane **2a**: To a 500 mL round bottom flask containing a magnetic stir bar, dibromomethane (7.7 mL, 110 mmol), CuI (2.1 g, 11 mmol), LiOMe (10.4 g, 275 mmol) and B_2pin_2 (50.9 g, 200 mmol) were dissolved in DMF (250 mL). The mixture was stirred at 40 ^oC for 24 h. The reaction mixture was dissolved in diethyl ether, which was filtered through a short silica pad to remove residues. The filtrate was washed with water 3 times to remove DMF and the organic phase was dried over $MgSO_4$, filtered, and concentrated under reduced pressure, and could get pure diborylmetahne **2a** as a white solid (19.1 g, 71%). The product was used without purification; **^{1}H NMR** (500 MHz, $CDCl_3$) δ 1.22 (s, 24H), 0.32 (s, 12H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 83.1, 24.9; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[8]

- Synthesis of 1,1-ddiborylethane **2g**: To a 250 mL round bottom flask containing a magnetic stir bar, 1,1-dibromoethane (4 mL, 44 mmol), CuI (8.3 g, 44 mmol), LiOMe (5.0 g, 132 mmol) and B_2pin_2 (20.3 g, 80 mmol) were dissolved in DMF (200 mL). The mixture was stirred at 40 ^oC for 12 h. The reaction mixture was dissolved in diethyl ether, which was filtered through a short silica pad to remove residues. The filtrate was washed with water 3 times to remove DMF and the organic phase was dried over $MgSO_4$, filtered, and concentrated under reduced pressure, and could get pure diborylmetahne **2a** as a colorless liquid (7.3 g, 65%). The product was used without purification. **^{1}H NMR** (300 MHz, $CDCl_3$) δ 1.23 (s, 12H), 1.22 (s, 12H), 1.05 – 1.03 (d, *J* = 7.2 Hz, 3H), 0.75 – 0.68 (q, *J* = 7.2 Hz, 1H). **^{13}C NMR** (75 MHz, $CDCl_3$) 83.0, 24.9, 24.7, 9.2; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[8]

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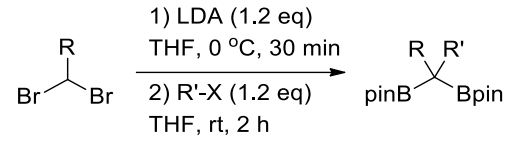
2.1.2. Deprotonative alkylation of diborylmethane and 1,1-diborylethane



R = H, **2a** — **2b, 2c, 2d, 2i**: From **2a**
R = Me, **2g** — **2f**: From **2g**

General procedure: To a round bottom flask containing a magnetic stir bar, **2a** or **2g** (1.0 eq) was dissolved in THF (1 mL/mmol) under nitrogen. The solution was cooled to 0 °C and lithium diisopropylamide (1.0 M in THF/n-hexanes, 1.0 equiv) was added dropwise. The reaction mixture was stirred at 0 °C for 30 min. Than the alkyl halide (1.1 equiv) in THF (1 mL/mmol) solution was added, and the mixture was warmed to rt and stirred for 2 h. The reaction mixture was filtered through a short silica pad and washed with EtOAc. The crude mixture was concentrated under reduced pressure, and was purified by column chromatography on silica gel (*n*-hexanes:EtOAc) to give the desired product.

Synthesis of 1,1-diborylheptane **2b**: The reaction was performed according to the general procedure with **2a** (2.7 g, 10 mmol), 1-bromohexane (1.6 mL, 11 mmol) and LDA (1.0 M in THF/n-hexanes, 10 mL, 10 mmol) in anhydrous THF (10 mL). The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 20:1) to give compound **2b** as a colorless liquid (2.5 g, 72%); **^{1}H NMR** (300 MHz, $CDCl_3$) δ 1.56 – 1.49 (m, 2H), 1.28 – 1.20 (m, 32H), 0.87 – 0.83 (t, *J* = 6.8 Hz, 3H), 0.73 – 0.68 (t, *J* = 7.8 Hz, 1H); **^{13}C NMR** (75 MHz, CDCl3) δ 83.0, 32.7, 31.8, 29.4, 25.8, 25.0, 24.6, 22.7, 14.3; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[9]

Synthesis of **2c**: The reaction was performed according to the general procedure with **2a** (9.7 g, 36 mmol), (2-bromoethyl)benzene (5.4 mL, 39.6 mmol) and LDA (1.0 M in THF/n-hexanes, 36 mL, 36 mmol) in anhydrous THF (36 mL). The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 20:1) to give compound **2c** as a white solid (2.5 g, 63%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.27 – 7.24 (m, 2H), 7.19 – 7.13 (m, 3H), 2.63 – 2.59 (dd, *J* = 15.9, 8.0 Hz, 2H), 1.89 – 1.84 (m, 2H), 1.25 (s, 12H), 1.23 (s, 12H), 0.84 – 0.81 (t, *J* = 7.8 Hz, 2H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 143.1, 128.7, 128.2, 125.6, 83.1, 38.8, 28.1, 25.1, 25.0, 24.6, The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[8]

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Synthesis of **2d**: The reaction was performed according to the general procedure with **2a** (700 mg, 2.6 mmol), 9-(6-bromohexyl)-*9H*-carbazole[10] (950 mg, 2.9 mmol) and LDA (1.0 M in THF/n-hexanes, 2.6 mL, 2.6 mmol) in anhydrous THF (2.6 mL). The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 10:1) to give compound **2d** as a white solid (990 mg, 72%); ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.15 – 8.11 (m, 2H), 7.52 – 7.40 (m, 4H), 7.28 – 7.23 (ddd, *J* = 7.9, 7.0, 1.2 Hz, 2H), 4.31 – 4.26 (t, *J* = 7.3 Hz, 2H), 1.92 – 1.82 (m, 2H), 1.63 – 1.56 (dd, *J* = 14.5, 7.7 Hz, 2H), 1.48 – 1.22 (m, 32H), 0.79 – 0.73 (t, *J* = 7.8 Hz, 1H); **^{13}C NMR** (75 MHz, $CDCl_3$) δ 140.5, 125.6, 122.9, 120.3, 118.7, 108.7, 83.0, 43.1, 32.5, 29.5, 29.0, 27.2, 25.7, 24.9, 24.8, 24.6; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[11]

Synthesis of **2f**: The reaction was performed according to the general procedure with **2g** (2.3 g, 8.0 mmol), iodomethane (0.56 mL, 8.8 mmol) and LDA (1.0 M in THF/n-hexanes, 8.0 mL, 8.0 mmol) in anhydrous THF (8.0 mL). The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 20:1) to give compound **2d** as a white solid (1.7 g, 70%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 1.20 (s, 24H), 1.04 (s, 6H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 83.0, 24.8, 19.9**;** The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[9]

Synthesis of **2i**: The reaction was performed according to the general procedure with **2a** (960 mg, 3.6 mmol), 3-*O*-(4-Bromobutyl)-1,2:5,6-bis-*O*-(1-methylethylidene)-α-D-glucofuranose[12] (1.6 g, 4.0 mmol) and LDA (1.0 M in THF/n-hexanes, 3.6 mL, 3.6 mmol) in anhydrous THF (3.6 mL). The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 5:1) to give compound **2i** as a colorless liquid (1.1 g, 53%); **^{1}H NMR** (300 MHz, $CDCl_3$) δ 5.86 – 5.85 (d, *J* = 3.7 Hz, 1H), 4.52 – 4.50 (d, *J* = 3.7 Hz, 1H), 4.32 – 4.26 (dd, *J* = 13.3, 6.2 Hz, 1H), 4.13 – 4.10 (m, 1H), 4.08 – 4.03 (m, 1H), 3.99 – 3.94 (dd, *J* = 8.5, 6.0 Hz, 1H), 3.83 – 3.82 (d, *J* = 3.0 Hz, 1H), 3.59 – 3.45 (m, 2H), 1.59 – 1.51 (m, *3*H), 1.48 (s, 3H), 1.41 (s, 3H), 1.34 (s, 3H), 1.31 (s, 3H), 1.28 – 1.25 (m, *3*H), 1.22 (s, 12H), 1.21 (s, 12H), 0.73 – 0.68 (t, *J* = 7.7 Hz, 1H); **^{13}C NMR** (75 MHz, $CDCl_3$) δ 109.5, 108.7, 96.5, 83.0, 71.8, 71.2, 70.8, 69.3, 66.7, 32.5, 29.5, 26.2, 26.1, 25.7, 25.1, 25.0, 24.6, 24.6; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[11]

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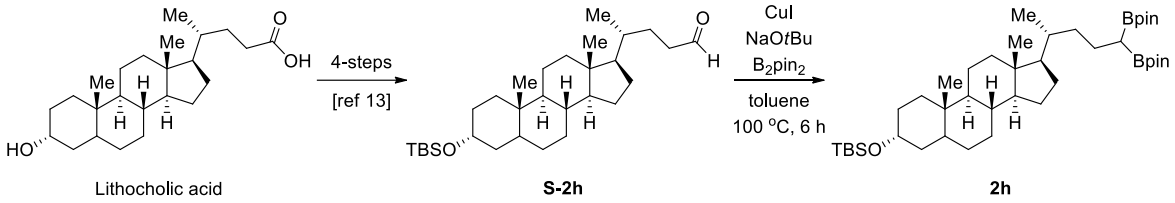
2.1.3. Synthesis of lithocholic acid-containing 1,1-diborylalkane 2h



Lithocholic acid | **S-2h** | **2h**

Lithocholic acid was transformed to *O*-TBS protected aldehyde **S-2h** *via* 4 steps according to a reference.[13]

Synthesis of **2h**: In a nitrogen-filled glove-box, **S-2h** (1.43 mg, 3.0 mmol), CuI (57 mg, 0.30 mmol), NaOtBu (370 g, 3.9 mmol), B_2pin_2 (1.7 g, 6.6 mmol) and toluene (6.0 mL) were added to a 100 mL round bottomed flaks containing a magnetic stirbar. The solution was then heated to 100 °C and stirred for 12 h. The reaction mixture was filtered through short silica pad, and the filterate was concentrated under reduced pressure. The crude mixture was purified by column chromatography on silica gel (nhexane:EtOAc, 30:1) to give the product **2h** as a white solid (1.2 mg, 55%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 3.59 – 3.53 (m, 1H), 1.93 – 1.90 (m, 1H), 1.86 – 1.72 (m, 4H), 1.65 – 1.57 (m, 1H), 1.56 – 1.48 (m, 2H), 1.45 – 1.28 (m, 11H), 1.22 – 1.14 (m, 27H), 1.12 – 1.07 (m, 6H), 0.91 – 0.88 (m, 15H), 0.64 – 0.60 (m, 1H), 0.59 (s, 3H), 0.05 (s, 6H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 82.9, 73.0, 56.5, 56.2, 42.8, 42.5, 40.3, 40.2, 39.3, 37.1, 36.1, 36.0, 35.7, 34.7, 31.2, 28.4, 27.5, 26.6, 26.1, 25.0, 24.6, 24.4, 23.5, 22.4, 20.9, 19.0, 18.5, 12.1, -4.5; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[14]

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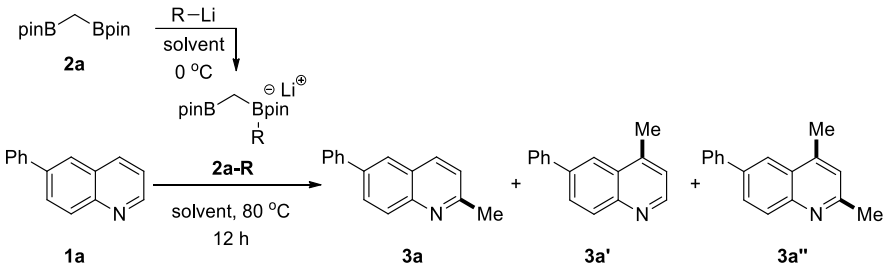
3. General procedure for evaluating reaction conditions

3.1. Optimization study for the C2-methylation of 6-phenylquinoline

In a nitrogen-filled glove-box, diborylmethane **2a** (2.0-2.5 equiv) and anhydrous solvent (1.0 mL) were added to an oven-dried 4-dram vial equipped with a Teflon coated magnetic stirbar. The vial was sealed with assembled screw cap with hole with PTFE/silicone septum and the solution was cooled at 0 °C. Then, organolithium solution (2.0-2.5 equiv) was added dropwise, and reaction mixture was stirred at room temperature for 30 min. The vial was moved inside the glove-box, and 6-phenylquinoline **1a** (21 mg, 0.1 mmol) was added. The vial was removed from the glove-box, and the reaction mixture was stirred at indicated temperature for indicated time. The reaction mixture was quenched with aqueous (10 mL), and the aqueous layer was extracted with EtOAc (10 mL x 3). The combined organics were dried over $MgSO_4$, filtered, and concentrated under reduced pressure. The ^{1}H-NMR yield was determined using 1,1,2,2-tetrachloroethane as an internal standard.

Table S1. Screening table for C2-methylation



entry	R =	Equiv (**2a-R**)	Temp (°C)	Reaction time (h)	solvent	Yield (%)		
						3a	**3a'**	**3a''**
1	Me	2.5	80	12	THF	32	6	16
2	*n*Bu	2.5	80	12	THF	40	12	16
3	*s*Bu	2.5	80	12	THF	60	<1	8
4	*t*Bu	2.5	80	12	THF	74	<1	6
5	Ph	2.5	80	12	THF	40	12	4
7	*t*Bu	2.5	80	12	toluene	12	8	9
8	*t*Bu	2.5	80	12	*n*-hexane	7	5	3
9	*t*Bu	2.5	80	12	1,2-DME	62	<1	2
10	*t*Bu	2.5	80	12	2-MeTHF	64	<1	6
11	*t*Bu	2.0	80	12	THF	78	<1	2
12	***t*Bu**	**2.0**	**80**	**3**	**THF**	**78**	**<1**	**2**
13	*t*Bu	2.0	120	3	THF	78	<1	2

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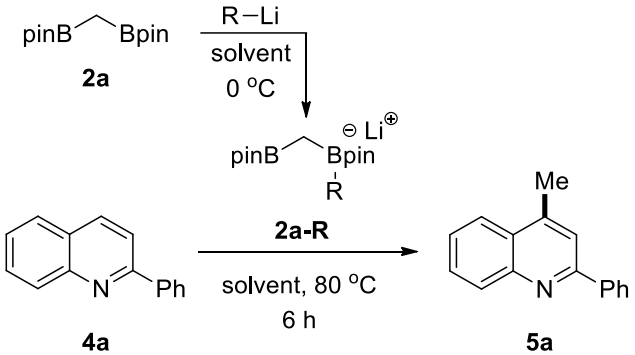
3.2. Optimization study for the C4-methylation of 2-phenylquinoline

In a nitrogen-filled glove-box, diborylmethane **2a** (2.0-2.5 equiv) and anhydrous solvent (1.0 mL) were added to an oven-dried 4-dram vial equipped with a Teflon coated magnetic stirbar. The vial was sealed with assembled screw cap with hole with PTFE/silicone septum and the solution was cooled at 0 °C. Then, organolithium solution (2.0-2.5 equiv) was added dropwise, and reaction mixture was stirred at room temperature for 30 min. The vial was moved inside the glove-box, and 2-phenylquinoline **4a** (21 mg, 0.1 mmol) was added. The vial was removed from the glove-box, and the reaction mixture was stirred at indicated temperature for indicated time. The reaction mixture was quenched with aqueous (10 mL), and the aqueous layer was extracted with EtOAc (10 mL x 3). The combined organics were dried over $MgSO_4$, filtered, and concentrated under reduced pressure. The ^{1}H-NMR yield was determined using 1,1,2,2-tetrachloroethane as an internal standard.

Table S2. Optimization study for the methylation of 2-phenylquinoline



entry	R =	Equiv of **2a-R**	Temp (°C)	Reaction time (h)	solvent	yield (%)
1	Me	2.0	120	6	toluene	72
2	*n*Bu	2.0	120	6	toluene	66
3	*s*Bu	2.0	120	6	toluene	44
4	*t*Bu	2.0	120	6	toluene	58
5	Ph	2.0	120	6	toluene	84
6	Ph	2.0	120	6	THF	57
7	Ph	2.0	120	6	1,2-DME	64
8	Ph	2.0	80	6	toluene	19
9	**Ph**	**2.5**	**120**	**6**	**toluene**	**95**
10	Ph	2.5	120	3	toluene	82

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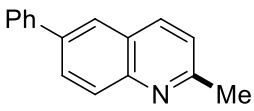
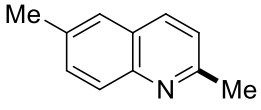
4. General procedure for the C2-alkylation of quinolines

In a nitrogen-filled glove-box, 1,1-diborylalkane **2** (2.0 equiv) and anhydrous tetrahydrofuran (2.0 mL) were added to an oven-dried 4-dram vial equipped with a Teflon coated magnetic stirbar. The vial was sealed with assembled screw cap with hole with PTFE/silicone septum and the solution was cooled at 0 °C. Then, *tert*-butyllithium solution (1.7 M solution in pentane, 2.0 equiv) was added dropwise, and reaction mixture was stirred at room temperature for 30 min. The vial was moved inside the glove-box, and N-heteroarene **1** (0.2 mmol) was added. The vial was removed from the glove-box, and the reaction mixture was stirred at 80 °C for 3 h. The reaction mixture was quenched with aqueous (10 mL), and the aqueous layer was extracted with EtOAc (10 mL x 3). The combined organics were dried over $MgSO_4$, filtered, and concentrated under reduced pressure. The crude reaction mixture was purified by silica gel column chromatography to yield the desired product.

[Note for products **3h–3o**]: The crude mixture of **3h–3o** were treated with sodium perborate to remove unreacted 1,1-diborylalkane by the following procedure: $NaBO_3 \cdot 4H_2O$ (0.6 mmol) and THF/H_2O (3.0 mL, 1:1) were added to the above obtained crude mixture in a 20 mL vial and stirred for 3 h at room temperature. The reaction mixture was quenched with brine (5.0 mL) and extracted with diethylether (10 mL x 3). The crude reaction mixture was purified by silica gel column chromatography to yield the desired product.



2-Methyl-6-phenylquinoline (**3a**): The reaction was performed according to the general procedure for the alkylation with **1a** (41 mg, 0.20 mmol), **2a** (110 mg, 0.40 mmol) and *t*BuLi (1.7 M in pentane, 0.24 mL, 0.40 mmol) in anhydrous THF (2.0 mL) at 80 °C for 3 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 5:1) to give compound **3a** as an brown solid (32 mg, 74%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.12 – 8.07 (dd, J = 12.2, 8.8 Hz, 2H), 7.96 – 7.94 (m, 2H), 7.71 – 7.70 (m, 2H), 7.50 – 7.47 (m, 2H), 7.41 – 7.37 (m, 1H), 7.31 – 7.29 (d, J = 8.4 Hz, 1H), 2.77 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 159.1, 147.2, 140.5, 138.6, 136.6, 129.3, 129.1, 129.0, 127.7, 127.5, 126.8, 125.3, 122.5, 25.4; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[15]



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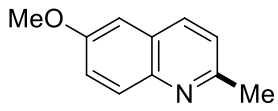
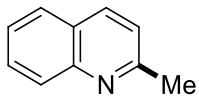
2,6-Dimethylquinoline (**3b**): The reaction was performed according to the general procedure for the alkylation with **1b** (29 mg, 0.20 mmol), **2a** (110 mg, 0.40 mmol) and *t*BuLi (1.7 M in pentane, 0.24 mL, 0.40 mmol) in anhydrous THF (2.0 mL) at 80 °C for 3 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 10:1 with 1% TEA) to give compound **3b** as an orange solid (17 mg, 54%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.97 – 7.95 (d, J = 8.4 Hz, 1H), 7.94 – 7.93 (d, J = 8.4 Hz, 1H), 7.53 – 7.50 (m, 2H), 7.25 – 7.24 (d, J = 8.3 Hz, 1H), 2.73 (s, 3H), 2.51 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 158.1, 146.3, 135.9, 135.7, 131.9, 128.2, 126.6, 126.5, 122.1, 25.2, 21.6; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[15]



6-Methoxy-2-methylquinoline (**3c**): The reaction was performed according to the general procedure for the alkylation with **1c** (32 mg, 0.20 mmol), **2a** (110 mg, 0.40 mmol) and *t*BuLi (1.7 M in pentane, 0.24 mL, 0.40 mmol) in anhydrous THF (2.0 mL) at 80 °C for 3 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 5:1) to give compound **3c** as an white solid (14 mg, 40%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.95 – 7.91 (m, 2H), 7.34 – 7.32 (dd, J = 9.1, 2.8 Hz, 1H), 7.24 – 7.23 (d, J = 8.4 Hz, 1H), 7.04 – 7.03 (d, J = 2.9 Hz, 1H), 3.91 (s, 3H), 2.70 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 157.3, 156.5, 144.0, 135.2, 130.1, 127.5, 122.4, 122.0, 105.4, 55.6, 25.1; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[15]



2-Methylquinoline (**3d**): The reaction was performed according to the general procedure for the alkylation with **1d** (26 mg, 0.20 mmol), **2a** (110 mg, 0.40 mmol) and *t*BuLi (1.7 M in pentane, 0.24 mL, 0.40 mmol) in anhydrous THF (2.0 mL) at 80 °C for 3 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 10:1 with 1% TEA) to give compound **3d** as an light yellow liquid (17 mg, 61%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.07 – 8.05 (m, 2H), 7.79 – 7.77 (dd, J = 8.1, 1.4 Hz, 1H), 7.71 – 7.67 (m, 1H), 7.51 – 7.47 (m, 1H), 7.30 – 7.29 (d, J = 8.5 Hz, 1H), 2.77 (s, 3H); **^{13}C NMR** (126 MHz,

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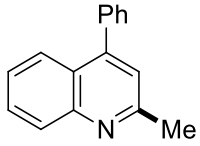
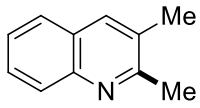
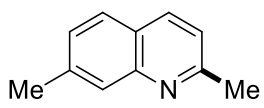
$CDCl_3$) δ 159.1, 147.6, 136.6, 129.8, 128.5, 127.6, 126.6, 126.0, 122.2, 25.3; The obtained ^1H and ^{13}C-NMR were in agreement with the literature.[16]



2-Dimethyl-4-phenylquinoline (**3e**): The reaction was performed according to the general procedure for the alkylation with **1e** (41 mg, 0.20 mmol), **2a** (110 mg, 0.40 mmol) and *t*BuLi (1.7 M in pentane, 0.24 mL, 0.40 mmol) in anhydrous THF (2.0 mL) at 80 °C for 3 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 5:1) to give compound **3e** as an orange oil (20 mg, 45%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.12 – 8.10 (d, J = 8.4 Hz, 1H), 7.87 – 7.85 (dd, J = 8.4, 1.3 Hz, 1H), 7.71 – 7.67 (m, 1H), 7.54 – 7.47 (m, 5H), 7.45 – 7.42 (m, 1H), 7.24 (s, 1H), 2.78 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 158.6, 148.8, 148.4, 138.2, 129.6, 129.5, 129.0, 128.7, 128.5, 125.9, 125.8, 125.2, 122.4, 25.4; The obtained ^1H and ^{13}C-NMR were in agreement with the literature.[16]



2,3-Dimethylquinoline (**3f**): The reaction was performed according to the general procedure for the alkylation with **1f** (29 mg, 0.20 mmol), **2a** (110 mg, 0.40 mmol) and *t*BuLi (1.7 M in pentane, 0.24 mL, 0.40 mmol) in anhydrous THF (2.0 mL) at 80 °C for 3 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 10:1 with 1% TEA) to give compound **3f** as an light yellow liquid (19 mg, 60%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.00 – 7.99 (d, J = 8.4 Hz, 1H), 7.82 (s, 1H), 7.71 – 6.69 (dd, J = 8.1, 1.4 Hz, 1H), 7.62 – 7.59 (m, 1H), 7.46 – 7.43 (m, 1H), 2.68 (s, 3H), 2.44 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 159.1, 146.6, 135.4, 130.2, 128.5, 128.4, 127.6, 126.8, 125.8, 23.7, 19.8; The obtained ^1H and ^{13}C-NMR were in agreement with the literature.[16]



2,7-Dimethylquinoline (**3g**): The reaction was performed according to the general procedure for the alkylation with **1g** (29 mg, 0.20 mmol), **2a** (110 mg, 0.40 mmol) and *t*BuLi

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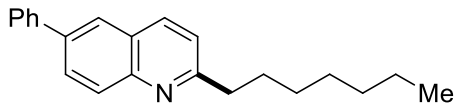
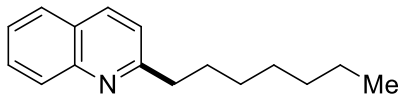
(1.7 M in pentane, 0.24 mL, 0.40 mmol) in anhydrous THF (2.0 mL) at 80 °C for 3 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 10:1 with 1% TEA) to give compound **3g** as an light yellow liquid (18 mg, 56%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.00 – 7.99 (d, J = 8.3 Hz, 1H), 7.82 (s, 1H), 7.66 – 7.65 (d, J = 8.2 Hz, 1H), 7.32 – 7.30 (dd, J = 8.3, 1.6 Hz, 1H), 7.22 – 7.20 (d, J = 8.4 Hz, 1H), 2.73 (s, 3H), 2.54 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 159.0, 148.1, 139.9, 136.2, 128.1, 127.7, 127.2, 124.7, 121.3, 25.4, 22.0; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[15]



2-Heptyl-6-phenylquinoline (**3h**): The reaction was performed according to the general procedure for the alkylation with **1a** (41 mg, 0.20 mmol), **2b** (140 mg, 0.40 mmol) and *t*BuLi (1.7 M in pentane, 0.24 mL, 0.40 mmol) in anhydrous THF (2.0 mL) at 80 °C for 3 h. The obtained crude mixture was treated with sodium perborate to remove the unreacted **2b**. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 5:1) to give compound **3h** as an brown solid (47 mg, 78%); **^{1}H NMR** (300 MHz, $CDCl_3$) δ 8.15 – 8.09 (m, 2H), 7.97 – 7.93 (m, 2H), 7.73 – 7.70 (m, 2H), 7.51 – 7.46 (m, 2H), 7.42 – 7.36 (m, 1H), 7.33 – 7.30 (d, J = 8.4 Hz, 1H), 3.02 – 2.97 (m, 2H), 1.88 – 1.78 (m, 2H), 1.46 – 1.26 (m, 8H), 0.91 – 0.87 (m, 3H); **^{13}C NMR** (75 MHz, $CDCl_3$) δ 163.3, 147.3, 140.6, 138.5, 136.6, 129.3, 129.2, 129.0, 127.7, 127.5, 127.0, 125.3, 121.9, 39.5, 31.9, 30.2, 29.7, 29.3, 22.8, 14.2; HRMS (EI) calc'd for $C_{22}H_{25}N$ (M^+) Exact: 303.1987, Found: 303.1988.



2-Heptylquinoline (**3i**): The reaction was performed according to the general procedure for the alkylation with **1d** (26 mg, 0.20 mmol), **2b** (140 mg, 0.40 mmol) and *t*BuLi (1.7 M in pentane, 0.24 mL, 0.40 mmol) in anhydrous THF (2.0 mL) at 80 °C for 3 h. The obtained crude mixture was treated with sodium perborate to remove the unreacted **2b**. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 10:1) to give compound **3i** as colorless liquid (23 mg, 51%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.07 – 8.04 (m, 2H), 7.78 – 7.77 (d, *J* = 8.0 Hz, 1H), 7.70 – 7.67 (t, *J* = 7.6 Hz, 1H), 7.50 – 7.47 (t, *J* = 7.4 Hz, 1H), 7.31 – 7.29 (d, *J* = 8.4 Hz, 1H), 2.98 – 2.95 (m, 2H), 1.84 – 1.78 (dt, *J* = 15.6, 7.7 Hz, 2H), 1.44 – 1.38 (m, 2H), 1.37 – 1.32 (m, 2H), 1.31 – 1.26 (m, 4H), 0.88 – 0.86

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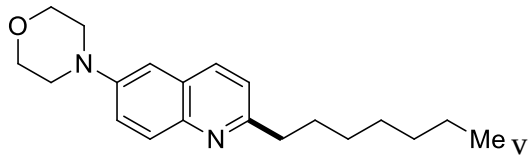
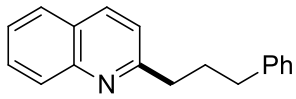
(t, *J* = 6.8 Hz, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 163.3, 148.0, 136.3, 129.5, 129.0, 127.6, 126.9, 125.8, 121.5, 39.6, 31.9, 30.3, 29.9, 29.7, 29.4, 22.8, 14.2; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[17]



4-(2-Heptylquinolin-6-yl)morpholine (**3j**): The reaction was performed according to the general procedure for the alkylation with **1h** (43 mg, 0.20 mmol), **2b** (140 mg, 0.40 mmol) and *t*BuLi (1.7 M in pentane, 0.24 mL, 0.40 mmol) in anhydrous THF (2.0 mL) at 80 ^{o}C for 3 h. The obtained crude mixture was treated with sodium perborate to remove the unreacted **2b**. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 1:1) to give compound **3j** as a brown liquid (39 mg, 63%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.94 – 7.90 (dd, *J* = 11.4, 9.0 Hz, 2H), 7.45 – 7.42 (dd, *J* = 9.2, 2.7 Hz, 1H), 7.23 – 7.21 (d, *J* = 8.4 Hz, 1H), 7.01 – 7.00 (d, *J* = 2.6 Hz, 1H), 3.92 – 3.90 (m, 4H), 3.26 – 3.24 (m, 4H), 2.93 – 2.89 (m, 2H), 1.81 – 1.75 (dt, *J* = 15.4, 7.8 Hz, 2H), 1.41 – 1.31 (m, 4H), 1.29 – 1.25 (m, 4H), 0.88 – 0.85 (t, *J* = 6.8 Hz, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 160.6, 148.9, 143.8, 135.1, 129.7, 127.7, 122.0, 121.8, 109.4, 67.0, 49.8, 39.3, 31.9, 30.3, 29.7, 29.3, 22.8, 14.2; HRMS (ESI) calc'd for $C_{20}H_{29}N_2O$ (M^+) Exact: 313.2275, Found: 313.2281.



2-(3-Phenylpropyl)quinoline (**3k**): The reaction was performed according to the general procedure for the alkylation with **1d** (26 mg, 0.20 mmol), **2c** (150 mg, 0.40 mmol) and *t*BuLi (1.7 M in pentane, 0.24 mL, 0.40 mmol) in anhydrous THF (2.0 mL) at 80 ^{o}C for 3 h. The obtained crude mixture was treated with sodium perborate to remove the unreacted **2c**. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 5:1) to give compound **3k** as an light yellow oil (28 mg, 57%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.09 – 8.06 (m, 2H), 7.79 – 7.77 (d, J = 8.1 Hz, 1H), 7.71 – 7.68 (m, 1H), 7.51 – 7.48 (t, J = 7.5 Hz, 1H), 7.31 – 7.28 (m, 3H), 7.24 – 7.18 (m, 3H), 3.06 – 3.03 (m, 2H), 2.77 – 2.74 (t, J = 7.8 Hz, 2H), 2.21 – 2.16 (m, 2H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.6, 147.9, 142.2,

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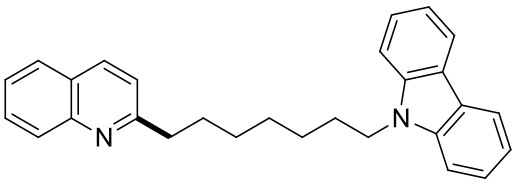
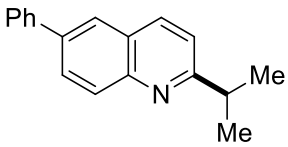
136.5, 129.6, 128.8, 128.6, 128.5, 127.6, 126.9, 125.9, 125.9, 121.5, 38.8, 35.8, 31.7; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[18]



2-(3-Phenylpropyl)quinoline (**3l**): The reaction was performed according to the general procedure for the alkylation with **1d** (26 mg, 0.20 mmol), **2d** (210 mg, 0.40 mmol) and *t*BuLi (1.7 M in pentane, 0.24 mL, 0.40 mmol) in anhydrous THF (2.0 mL) at 80 °C for 3 h. The obtained crude mixture was treated with sodium perborate to remove the unreacted **2d**. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 10:1) to give compound **3l** as an brown solid (49 mg, 62%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.16 – 8.14 (d, J = 7.6 Hz, 2H), 8.11 – 8.07 (m, 2H), 7.82 – 7.79 (m, 1H), 7.74 – 7.71 (m, 1H), 7.54 – 7.49 (m, 3H), 7.45 – 7.42 (m, 2H), 7.30 – 7.25 (m, 3H), 4.34 – 4.30 (m, 2H), 3.01 – 2.97 (m, 2H), 1.92 – 1.89 (t, J = 7.1 Hz, 2H), 1.85 – 1.82 (t, J = 7.6 Hz, 2H), 1.44 – 1.43 (m, 6H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 163.0, 147.9, 140.5, 136.4, 129.5, 128.9, 127.6, 126.8, 125.8, 125.7, 122.9, 121.4, 120.4, 118.8, 108.8, 43.1, 39.3, 30.0, 29.5, 29.4, 29.0, 27.3; HRMS (EI) calc'd for $C_{28}H_{28}N_2$ (M^+) Exact: 392.2252, Found: 392.2257.



2-Isopropyl-6-phenylquinoline (**3m**): The reaction was performed according to the general procedure for the alkylation with **1a** (41 mg, 0.20 mmol), **2f** (120 mg, 0.40 mmol) and *t*BuLi (1.7 M in pentane, 0.24 mL, 0.40 mmol) in anhydrous THF (2.0 mL) at 80 °C for 3 h. The obtained crude mixture was treated with sodium perborate to remove the unreacted **2f**. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 10:1) to give compound **3m** as an yellow solid (22 mg, 44%); **^{1}H NMR** (300 MHz, $CDCl_3$) δ 8.16 – 8.12 (m, 2H), 7.97 – 7.94 (m, 2H), 7.74 – 7.70 (m, 2H), 7.52 – 7.47 (m, 2H), 7.42 – 7.36 (m, 2H), 3.37 – 3.23 (hept, J = 6.9 Hz, 1H), 1.43 – 1.41 (d, J = 6.9 Hz, 6H); **^{13}C NMR** (75 MHz, $CDCl_3$) δ 167.9, 147.1, 140.7, 138.6, 136.9, 129.4, 129.2, 129.1, 127.7, 127.5,

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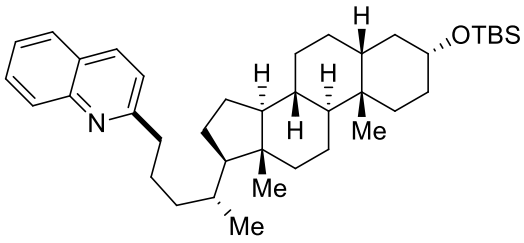
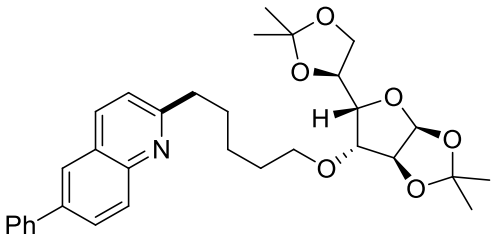
127.2, 125.3, 119.7, 37.4, 22.7; HRMS (EI) calc'd for $C_{18}H_{17}N$ (M^+) Exact: 247.1361, Found: 247.1361.



Product 3n: The reaction was performed according to the general procedure for the alkylation with **1d** (26 mg, 0.20 mmol), **2h** (290 mg, 0.40 mmol) and *t*BuLi (1.7 M in pentane, 0.24 mL, 0.40 mmol) in anhydrous THF (2.0 mL) at 80 ºC for 3 h. The obtained crude mixture was treated with sodium perborate to remove the unreacted **2h**. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 10:1) to give compound **3n** as a white liquid (76 mg, 65%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.05 – 8.04 (m, 2H), 7.77 – 7.75 (dd, J = 8.1, 1.4 Hz, 1H), 7.68 – 7.65 (ddd, J = 8.5, 6.8, 1.5 Hz, 1H), 7.48 – 7.45 (ddd, J = 8.0, 6.8, 1.1 Hz, 1H), 7.30 – 7.28 (d, J = 8.4 Hz, 1H), 3.60 – 3.54 (m, 1H), 2.99 – 2.86 (m, 2H), 1.94 – 1.91 (dt, J = 12.6, 3.3 Hz, 1H), 1.84 – 1.65 (m, 6H), 1.55 – 1.48 (m, 3H), 1.43 – 1.31 (m, 7H), 1.23 – 0.97 (m, 11H), 0.92 – 0.88 (m, 15H), 0.61 (s, 3H), 0.05 (s, 6H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 163.2, 148.0, 136.3, 129.4, 128.9, 127.6, 126.8, 125.7, 121.4, 73.0, 56.5, 56.3, 42.8, 42.4, 40.3, 40.3, 39.9, 37.0, 36.0, 35.8, 35.7, 34.7, 31.1, 28.4, 27.4, 26.9, 26.5, 26.1, 24.4, 23.5, 20.9, 18.8, 18.5, 12.1, -4.5; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[14]



Product (**3o**): The reaction was performed according to the general procedure for the alkylation with **1a** (41 mg, 0.20 mmol), **2i** (230 mg, 0.40 mmol) and *t*BuLi (1.7 M in pentane, 0.24 mL, 0.40 mmol) in anhydrous THF (2.0 mL) at 80 ºC for 3 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 5:1) to give compound **3o** as an orange solid (47 mg, 44%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.14 – 8.12 (d, J = 8.5 Hz, 2H), 7.97 – 7.95 (m, 2H), 7.72 – 7.70 (m, 2H), 7.51 – 7.47 (m, J = 7.6 Hz, 2H), 7.41 –

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7.38 (t, J = 7.4 Hz, 1H), 7.33 – 7.31 (d, J = 8.4 Hz, 1H), 5.86 – 5.85 (d, J = 3.7 Hz, 1H), 4.52 – 4.51 (d, J = 3.8 Hz, 1H), 4.31 – 4.27 (m, 1H), 4.12 – 4.10 (dd, J = 7.6, 3.1 Hz, 1H), 4.08 – 4.05 (dd, J = 8.5, 6.2 Hz, 1H), 4.00 – 3.96 (dd, J = 8.6, 5.7 Hz, 1H), 3.85 – 3.84 (d, J = 3.1 Hz, 1H), 3.65 – 3.57 (m, 1H), 3.55 – 3.48 (m, 1H), 3.02 – 2.98 (t, J = 7.9 Hz, 2H), 1.89 – 1.82 (p, J = 7.8 Hz, 2H), 1.67 – 1.60 (p, J = 6.6 Hz, 2H), 1.52 – 1.47 (m, 5H), 1.41 (s, 3H), 1.33 (s, 3H), 1.30 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 162.8, 147.3, 140.6, 138.8, 136.8, 129.4, 129.1, 127.8, 127.5, 127.1, 125.4, 121.9, 111.9, 109.0, 105.4, 82.7, 82.3, 81.3, 72.7, 70.7, 67.4, 39.2, 29.8, 29.7, 27.0, 26.9, 26.4, 26.1, 25.6; HRMS (EI) calc'd for $C_{32}H_{39}NO_6$ (M^+) Exact: 533.2777, Found: 533.2776.

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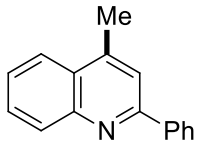
5. General procedure for the C4-alkylation of C2-substituted quinolines

In a nitrogen-filled glove-box, 1,1-diborylalkane **2** (2.0 equiv) and anhydrous toluene (2.0 mL) were added to an oven-dried 4-dram vial equipped with a Teflon coated magnetic stirbar. The vial was sealed with assembled screw cap with hole with PTFE/silicone septum and the solution was cooled at 0 ^{o}C. Then, phenyllithium solution (0.26 mL, 0.5 mmol, 1.9 M solution in dibutyl ether) was added dropwise, and reaction mixture was stirred at room temperature for 30 min. The vial was moved inside the glove-box, and C2-substituted quinolines **4** (0.2 mmol) was added. The vial was removed from the glove-box, and the reaction mixture was stirred at 120 ^{o}C for 6 h. The reaction mixture was quenched with aqueous (10 mL), and the aqueous layer was extracted with EtOAc (10 mL x 3). The combined organics were dried over $MgSO_4$, filtered, and concentrated under reduced pressure.

To remove the side product PhBpin and unreacted 1,1-diborylalkane, $NaBO_3 \cdot 4H_2O$ (93 mg, 0.6 mmol) and THF/H_2O (6.0 mL, 1:1) were added to the above obtained crude mixture and stirred for 3 h at room temperature. Then NaOH 1 M aqueous solution and THF (6.0 mL, 1:1) was added and stirred for additional 30 min. The reaction mixture was quenched with brine (5.0 mL) and extracted with diethylether (10 mL x 3). The combined organic layers were dried over $MgSO_4$, filtered and concentrated under reduced pressure. The crude reaction mixture was purified by silica gel column chromatography to yield the desired product.



4-Methyl-2-phenylquinoline (**5a**): The reaction was performed according to the general procedure for the alkylation with **4a** (41 mg, 0.20 mmol), **2a** (130 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 ^{o}C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:benzene, 1:1) to give compound **5a** as a brown solid (40 mg, 92%); **^{1}H NMR** (300 MHz, $CDCl_3$) δ 8.21 – 8.14 (m, 3H), 8.02 – 7.99 (dt, J = 8.3, 1.0 Hz, 1H), 7.75 – 7.70 (m, 2H), 7.58 – 7.43 (m, 4H), 2.77 (d, J = 1.0 Hz, 3H); **^{13}C NMR** (75 MHz, $CDCl_3$) δ 157.2, 148.2, 145.0, 139.9, 130.4, 129.5, 129.3, 128.9, 127.7, 127.4, 126.2, 123.7, 119.9, 19.2; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[19]

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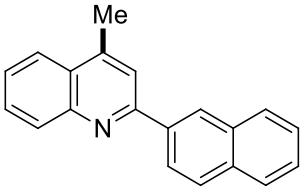
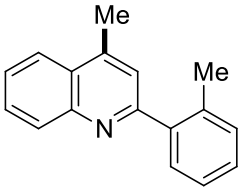


4-Methyl-2-(naphthalen-2-yl)quinoline (**5b**): The reaction was performed according to the general procedure for the alkylation with **4b** (51 mg, 0.20 mmol), **2a** (130 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 ^{o}C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:benzene, 1:1) to give compound **5b** as a yellow-green solid (43 mg, 80%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.62 (d, J = 1.7 Hz, 1H), 8.38 – 8.36 (dd, J = 8.5, 1.8 Hz, 1H), 8.27 – 8.25 (d, J = 8.3 Hz, 1H), 8.02 – 7.99 (m, 3H), 7.91 – 7.89 (m, 1H), 7.87 (s, 1H), 7.77 – 7.73 (m, 1H), 7.58 – 7.52 (m, 3H), 2.79 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 156.9, 148.2, 145.1, 137.1, 134.0, 133.6, 130.3, 129.6, 128.9, 128.6, 127.8, 127.4, 127.2, 126.8, 126.4, 126.3, 125.2, 123.8, 120.0, 19.2; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[20]



4-Methyl-2-(*o*-tolyl)quinoline (**5c**): The reaction was performed according to the general procedure for the alkylation with **4c** (44 mg, 0.20 mmol), **2a** (130 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 ^{o}C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:benzene, 1:1 to benzene 100%) to give compound **5c** as a yellow liquid (43 mg, 92%); **^{1}H NMR** (300 MHz, $CDCl_3$) δ 8.21 – 8.18 (dd, J = 8.1, 1.1 Hz, 1H), 8.06 – 8.02 (dd, J = 8.3, 1.4 Hz, 1H), 7.77 – 7.71 (m, 1H), 7.61 – 7.56 (m, 1H), 7.51 – 7.47 (m, 1H), 7.39 (d, J = 1.1 Hz, 1H), 7.35 – 7.28 (m, 3H), 2.76 (d, J = 1.0 Hz, 3H), 2.42 (s, 3H); **^{13}C NMR** (75 MHz, $CDCl_3$) δ 160.1, 147.7, 144.5, 140.8, 136.1, 130.9, 130.1, 129.7, 129.5, 128.5, 126.9, 126.3, 126.0, 123.7, 123.2, 20.4, 19.0; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[21]

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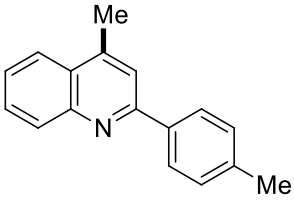
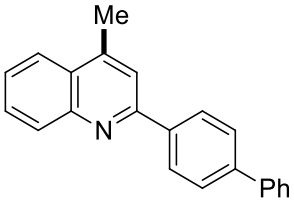


4-Methyl-2-(*p*-tolyl)quinoline (**5d**): The reaction was performed according to the general procedure for the alkylation with **4d** (44 mg, 0.20 mmol), **2a** (130 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 °C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:benzene, 1:1) to give compound **5d** as a white solid (36 mg, 77%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.20 – 8.18 (d, J = 8.4 Hz, 1H), 8.08 – 8.06 (d, J = 7.9 Hz, 2H), 7.99 – 7.97 (dd, J = 8.3, 1.3 Hz, 1H), 7.73 – 7.70 (m, 2H), 7.55 – 7.52 (m, 1H), 7.34 – 7.33 (d, J = 7.9 Hz, 2H), 2.75 (s, 3H), 2.44 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 157.1, 148.2, 144.9, 139.4, 137.0, 130.3, 129.6, 129.4, 127.5, 127.3, 126.0, 123.7, 119.7, 21.5, 19.1; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[22]



2-([1,1'-Biphenyl]-4-yl)-4-methylquinoline (**5e**): The reaction was performed according to the general procedure for the alkylation with **4e** (56 mg, 0.20 mmol), **2a** (130 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 °C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 50:1) to give compound **5e** as a light yellow solid (56 mg, 95%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.28 – 8.23 (m, 3H), 8.01 – 7.99 (dd, J = 8.4, 1.3 Hz, 1H), 7.78 – 7.69 (m, 6H), 7.58 – 7.54 (m, 1H), 7.51 – 7.48 (t, J = 7.6 Hz, 2H), 7.42 – 7.38 (m, 1H), 2.77 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 156.6, 148.2, 145.0, 142.1, 140.7, 138.7, 130.3, 129.5, 128.9, 128.1, 127.7, 127.6, 127.4, 127.2, 126.2, 123.7, 119.7, 19.1; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[20]

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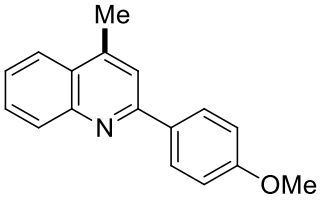
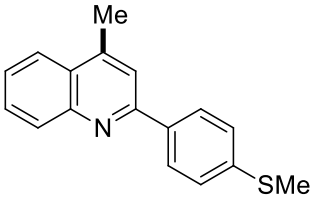


2-(4-Methoxyphenyl)-4-methylquinoline (**5f**): The reaction was performed according to the general procedure for the alkylation with **4f** (47 mg, 0.20 mmol), **2a** (130 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 ^{o}C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:benzene, 1:1 to benzene 100%) to give compound **5f** as a yellow solid (37 mg, 74%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.18 – 8.12 (m, 3H), 7.98 – 7.96 (dd, J = 8.3, 1.4 Hz, 1H), 7.72 – 7.66 (m, 1H), 7.67 – 7.66 (m, 1H), 7.53 – 7.50 (m, 1H), 7.06 – 7.03 (m, 2H), 3.88 (s, 3H), 2.74 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 160.9, 156.7, 148.1, 144.9, 132.3, 130.1, 129.4, 129.0, 127.1, 125.8, 123.7, 119.4, 114.3, 55.5, 19.1; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[23]



4-Methyl-2-(4-(methylthio)phenyl)quinoline (**5g**): The reaction was performed according to the general procedure for the alkylation with **4g** (50 mg, 0.20 mmol), **2a** (130 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 ^{o}C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:benzene, 1:1 to benzene 100%) to give compound **5g** as a yellow solid (28 mg, 53%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.19 – 8.18 (d, J = 8.0 Hz, 1H), 8.12 – 8.09 (m, 2H), 7.99 – 7.97 (dd, J = 8.3, 1.4 Hz, 1H), 7.73 – 7.69 (m, 1H), 7.68 (s, 1H), 7.55 – 7.52 (m, 1H), 7.39 – 7.37 (m, 2H), 2.75 (s, 3H), 2.54 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 156.4, 148.0, 145.2, 140.5, 136.3, 130.1, 129.6, 128.0, 127.3, 126.5, 126.1, 123.7, 119.5, 19.2, 15.7; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[23]

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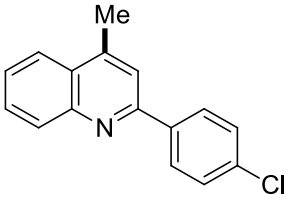
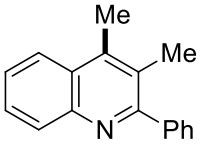
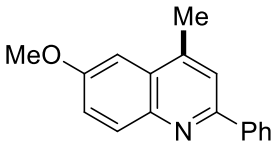


2-(4-Chlorophenyl)-4-methylquinoline (**5h**): The reaction was performed according to the general procedure for the alkylation with **4h** (48 mg, 0.20 mmol), **2a** (130 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 ^{o}C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:benzene, 2:1) to give compound **5h** as a pale yellow solid (23 mg, 45%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.18 – 8.16 (d, J = 8.4 Hz, 1H), 8.11 – 8.10 (m, 2H), 8.00 – 7.98 (dd, J = 8.3, 1.4 Hz, 1H), 7.74 – 7.71 (m, 1H), 7.67 (s, 1H), 7.57 – 7.55 (m, 1H), 7.50 – 7.48 (m, 2H), 2.76 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 155.8, 148.1, 145.3, 138.2, 135.6, 130.3, 129.7, 129.1, 128.9, 127.4, 126.4, 123.8, 119.5, 19.2; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[24]



3,4-Dimethyl-2-phenylquinoline (**5i**): The reaction was performed according to the general procedure for the alkylation with **4i** (44 mg, 0.20 mmol), **2a** (130 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 ^{o}C for 6 h. The crude mixture was purified by column chromatography on silica gel (benzene 100%) to give compound **5i** as a yellow solid (29 mg, 62%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.15 – 8.13 (d, J = 8.4 Hz, 1H), 8.05 – 8.03 (m, 1H), 7.67 – 7.64 (m, 1H), 7.56 – 7.53 (m, 3H), 7.50 – 7.47 (m, 2H), 7.45 – 7.41 (m, 1H), 2.69 (s, 3H), 2.39 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 160.6, 145.9, 142.5, 141.8, 130.1, 129.0, 128.4, 128.3, 128.1, 127.3, 127.2, 126.3, 123.5, 17.6, 14.9; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[25]



6-Methoxy-4-methyl-2-phenylquinoline (**5j**): The reaction was performed according to the general procedure for the alkylation with **4j** (47 mg, 0.20 mmol), **2a** (130 mg, 0.50 mmol)

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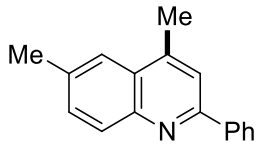
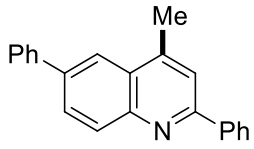
and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 °C for 6 h. The crude mixture was purified by column chromatography on silica gel (Benzene 100%) to give compound **5j** as a white solid (27 mg, 55%); **^{1}H NMR** (300 MHz, $CDCl_3$) δ 8.15 – 8.10 (m, 3H), 7.67 (s, 1H), 7.55 – 7.49 (m, 2H), 7.47 – 7.42 (m, 1H), 7.41 – 7.36 (m, 1H), 7.18 – 7.17 (dd, J = 2.9, 1.3 Hz, 1H), 3.95 (s, 3H), 2.70 (s, 3H); **^{13}C NMR** (75 MHz, $CDCl_3$) δ 157.7, 154.7, 143.6, 139.8, 131.7, 129.0, 128.9, 128.2, 127.4, 121.7, 120.1, 102.0, 55.6, 19.3; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[26]



4,6-Dimethyl-2-phenylquinoline (**5k**): The reaction was performed according to the general procedure for the alkylation with **4k** (48 mg, 0.20 mmol), **2a** (130 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 °C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:benzene, 1:1) to give compound **5k** as a pale yellow solid (34 mg, 73%); **^{1}H NMR** (300 MHz, $CDCl_3$) δ 8.17 – 8.08 (m, 3H), 7.75 – 7.73 (m, 1H), 7.67 (s, 1H), 7.57 – 7.42 (m, 4H), 2.73 (s, 3H), 2.57 (s, 3H); **^{13}C NMR** (75 MHz, $CDCl_3$) δ 156.2, 146.7, 144.2, 140.0, 135.9, 131.6, 130.0, 129.1, 128.8, 127.5, 127.3, 122.7, 119.8, 22.0, 19.1; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[27]



4-Methyl-2,6-diphenylquinoline (**5l**): The reaction was performed according to the general procedure for the alkylation with **4l** (56 mg, 0.20 mmol), **2a** (130 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 °C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 20:1) to give compound **5l** as a yellow solid (58 mg, 98%); **^{1}H NMR** (500 MHz, CD_2Cl_2) δ 8.25 – 8.21 (m, 4H), 8.02 – 8.00 (dd, J = 8.7, 2.2 Hz, 1H), 7.80 – 7.78 (m, 3H), 7.57 – 7.48 (m, 5H), 7.45 – 7.42 (m, 1H), 2.83 (s, 3H); **^{13}C NMR** (126 MHz, CD_2Cl_2) δ 156.9, 147.7, 145.8, 141.2, 139.8, 139.1, 130.9, 129.7, 129.4, 129.4, 129.3, 129.1, 128.1,

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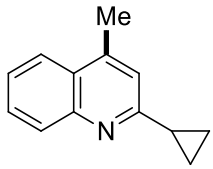
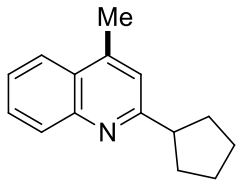
127.9, 127.8, 122.0, 120.2, 19.3; HRMS (EI) calc'd for $C_{22}H_{17}N$ (M^+) 295.1361, found 295.1362.



2-Cyclopropyl-4-methylquinoline (**5m**): The reaction was performed according to the general procedure for the alkylation with **4m** (34 mg, 0.20 mmol), **2a** (130 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 °C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 20:1) to give compound **5m** as a colorless liquid (20 mg, 55%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 7.98 – 7.96 (d, *J* = 8.4 Hz, 1H), 7.92 – 7.90 (d, *J* = 8.2 Hz, 1H), 7.65 – 7.62 (t, *J* = 7.3 Hz, 1H), 7.47 – 7.44 (t, *J* = 7.4 Hz, 1H), 6.99 (s, 1H), 2.65 (s, 3H), 2.24 – 2.18 (m, 1H), 1.15 – 1.12 (m, 2H), 1.10 – 1.05 (m, 2H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 163.1, 147.8, 144.1, 129.2 (2C), 127.0, 125.2, 123.7, 119.9, 18.8, 18.0, 10.1; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[28]



2-Cyclopentyl-4-methylquinoline (**5n**): The reaction was performed according to the general procedure for the alkylation with **4n** (39 mg, 0.20 mmol), **2a** (130 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 °C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 50:1) to give compound **5n** as a yellow liquid (21 mg, 50%); ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.10 – 8.07 (d, *J* = 8.4 Hz, 1H), 7.98 – 7.95 (dd, *J* = 8.3, 1.0 Hz, 1H), 7.72 – 7.66 (ddd, *J* = 8.4, 6.9, 1.4 Hz, 1H), 7.55 – 7.49 (ddd, *J* = 8.2, 6.9, 1.3 Hz, 1H), 7.21 – 7.21 (d, *J* = 0.6 Hz, 1H), 3.44 – 3.33 (m, 1H), 2.71 – 2.70 (d, *J* = 0.9 Hz, 3H), 2.24 – 2.15 (m, 2H), 1.95 – 1.84 (m, 4H), 1.82 – 1.72 (m, 2H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 165.9, 146.7, 145.3, 129.5, 128.9, 127.1, 125.8, 123.7, 120.7, 48.4, 33.8, 26.2, 19.0; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[28]

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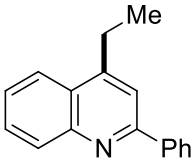
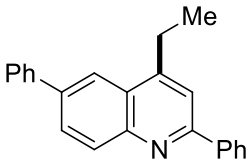
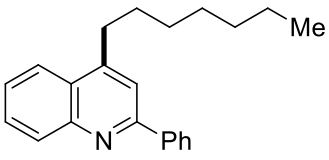


4-Ethyl-2-phenylquinoline (**5o**): The reaction was performed according to the general procedure for the alkylation with **4a** (41 mg, 0.20 mmol), **2g** (140 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 °C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:benzene, 1:1) to give compound **5o** as a yellow liquid (33 mg, 71%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.24 – 8.22 (d, J = 8.4 Hz, 1H), 8.18 – 8.16 (m, 2H), 8.06 – 8.04 (dd, J = 8.3, 1.4 Hz, 1H), 7.74 – 7.70 (m, 2H), 7.56 – 7.52 (m, 3H), 7.49 – 7.45 (m, 1H), 3.21 – 3.16 (q, J = 7.7 Hz, 2H), 1.47 – 1.44 (t, J = 7.6 Hz, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 157.4, 150.8, 148.3, 140.0, 130.5, 129.4, 129.4, 128.9, 127.8, 126.5, 126.2, 123.4, 118.0, 25.6, 14.4; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[20]



4-Ethyl-2,6-diphenylquinoline (**5p**): The reaction was performed according to the general procedure for the alkylation with **4l** (56 mg, 0.20 mmol), **2g** (140 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 °C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 50:1) to give compound **5p** as a yellow solid (39 mg, 63%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.30 – 8.28 (d, J = 8.7 Hz, 1H), 8.22 – 8.19 (m, 3H), 8.00 – 7.98 (dd, J = 8.7, 2.1 Hz, 1H), 7.77 – 7.75 (m, 3H), 7.57 – 7.47 (m, 5H), 7.45 – 7.41 (m, 1H), 3.25 – 3.21 (q, J = 7.5 Hz, 2H), 1.51 – 1.48 (t, J = 7.6 Hz, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 157.2, 150.7, 147.8, 141.1, 140.0, 138.9, 131.0, 129.3, 129.1, 128.9, 127.7, 127.7, 127.6, 126.7, 121.3, 118.2, 25.6, 14.4; HRMS (EI) calc'd for $C_{23}H_{19}N$ (M^+) 309.1517, found 309.1520.



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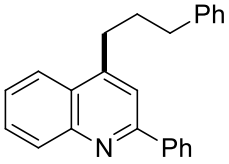
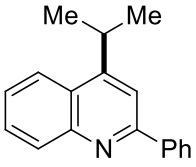
4-Hepthyl-2-phenylquinoline (**5q**): The reaction was performed according to the general procedure for the alkylation with **4a** (41 mg, 0.20 mmol), **2b** (180 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 °C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 50:1) to give compound **5q** as a yellow liquid (43 mg, 71%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.23 – 8.21 (dd, J = 8.5, 1.2 Hz, 1H), 8.18 – 8.16 (m, 2H), 8.05 – 8.04 (dd, J = 8.5, 1.3 Hz, 1H), 7.73 – 7.70 (m, 2H), 7.56 – 7.52 (m, 3H), 7.49 – 7.45 (m, 1H), 3.14 – 3.11 (m, 2H), 1.84 – 1.79 (q, J = 7.8, 6.7 Hz, 2H), 1.51 – 1.49 (m, 2H), 1.42 – 1.26 (m, 8H), 0.92 – 0.89 (t, J = 6.8 Hz, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 157.2, 149.6, 148.5, 140.0, 130.5, 129.3, 129.3, 128.9, 127.7, 126.7, 126.1, 123.5, 118.8, 32.7, 31.9, 30.4, 29.9, 29.3, 22.8, 14.2; HRMS (EI) calc'd for $C_{22}H_{25}N$ (M^+) 303.1987, found 303.1987.



4-Hepthyl-2-phenylquinoline (**5r**): The reaction was performed according to the general procedure for the alkylation with **4a** (41 mg, 0.20 mmol), **2c** (190 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 °C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:benzene, 1:1) to give compound **5r** as a white solid (34 mg, 47%); **^{1}H NMR** (300 MHz, $CDCl_3$) δ 8.25 – 8.17 (m, 3H), 7.99 – 7.97 (m, 1H), 7.77 – 7.71 (m, 2H), 7.60 – 7.47 (m, 4H), 7.39 – 7.34 (m, 2H), 7.28 – 7.24 (m, 3H), 3.22 – 3.16 (m, 2H), 2.86 – 2.81 (t, *J* = 7.6 Hz, 2H), 2.25 – 2.15 (m, 2H); **^{13}C NMR** (75 MHz, $CDCl_3$) δ 157.2, 148.9, 148.6, 141.7, 140.0, 130.6, 129.4, 129.3, 128.9, 128.6, 128.6, 127.7, 126.6, 126.2, 126.2, 123.4, 118.8, 35.9, 32.1, 31.7; HRMS (EI) calc'd for $C_{24}H_{21}N$ (M^+) 323.1674, found 323.1677.



4-Isopropyl-2-phenylquinoline (**5s**): The reaction was performed according to the general procedure for the alkylation with **4a** (41 mg, 0.20 mmol), **2f** (150 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 °C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-

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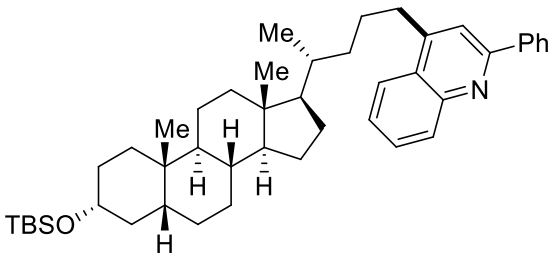
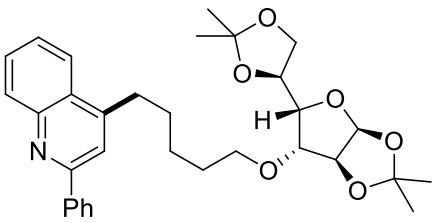
hexanes:benzene, 2:1 to 1:1) to give compound **5s** as a yellow liquid (30 mg, 61%); **^{1}H NMR** (300 MHz, $CDCl_3$) δ 8.24 – 8.21 (d, *J* = 8.4 Hz, 1H), 8.19 – 8.16 (m, 2H), 8.12 – 8.10 (d, *J* = 8.3 Hz, 1H), 7.79 (s, 1H), 7.75 – 7.69 (m, 1H), 7.58 – 7.52 (m, 3H), 7.50 – 7.45 (m, 1H), 3.87 – 3.73 (hept, *J* = 6.8 Hz, 1H), 1.49 – 1.47 (d, *J* = 6.9 Hz, 6H); **^{13}C NMR** (75 MHz, $CDCl_3$) δ 157.5, 155.0, 148.7, 140.4, 130.8, 129.3, 129.2, 128.9, 127.7, 126.1, 126.0, 123.0, 115.1, 28.7, 23.1; The obtained ^{1}H and ^{13}C-NMR were in agreement with the literature.[29]



Product 5t: The reaction was performed according to the general procedure for the alkylation with **4a** (41 mg, 0.20 mmol), **2h** (360 mg, 0.50 mmol) and PhLi (1.9 M in dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 °C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 150:1) to give compound **5t** as a white solid (82 mg, 62%); **^{1}H NMR** (500 MHz, $CDCl_3$) δ 8.22 – 8.21 (d, J = 8.5 Hz, 1H), 8.18 – 8.16 (dd, J = 7.3, 1.7 Hz, 2H), 8.05 – 8.03 (dd, J = 8.4, 1.3 Hz, 1H), 7.74 – 7.70 (m, 2H), 7.56 – 7.52 (m, 3H), 7.48 – 7.47 (m, 1H), 3.62 – 3.57 (m, 1H), 3.15 – 3.02 (m, 2H), 1.97 – 1.93 (dt, J = 12.2, 3.1 Hz, 1H), 1.90 – 1.70 (m, 6H), 1.62 – 1.53 (m, 3H), 1.47 – 1.33 (m, 7H), 1.30 – 1.01 (m, 11H), 0.97 – 0.90 (m, 15H), 0.65 (s, 3H), 0.07 (s, 6H); **^{13}C NMR** (126 MHz, CDCl3) δ 157.2, 149.7, 148.5, 140.0, 130.6, 129.3, 128.9, 128.4, 127.7, 126.7, 126.1, 123.5, 118.8, 73.0, 56.6, 56.4, 42.9, 42.5, 40.4, 40.3, 37.1, 36.3, 36.0, 35.8, 35.7, 34.7, 33.2, 31.2, 28.5, 27.5, 27.0, 26.6, 26.1, 24.4, 23.5, 21.0, 18.8, 18.5, 12.2, -4.4; HRMS (EI) calc'd for $C_{45}H_{65}NOSi$ (M^+) Exact: 663.4835, Found: 663.4835



Product 5u: The reaction was performed according to the general procedure for the alkylation with **4a** (41 mg, 0.20 mmol), **2i** (290 mg, 0.50 mmol) and PhLi (1.9 M in

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dibutylether, 0.26 mL, 0.50 mmol) in anhydrous toluene (2.0 mL) at 120 °C for 6 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 5:1) to give compound **5u** as a colorless liquid (73 mg, 68%);

^{1}H NMR (500 MHz, $CDCl_3$) δ 8.20 – 8.18 (d, *J* = 8.4 Hz, 1H), 8.16 – 8.14 (d, *J* = 7.3 Hz, 2H), 8.3 – 8.01 (d, *J* = 8.3 Hz, 1H), 7.74 – 7.69 (m, 2H), 7.55 – 7.51 (m, 3H), 7.47 – 7.44 (m, 1H), 5.86 – 5.85 (d, *J* = 3.6 Hz, 1H), 4.51 – 4.50 (d, *J* = 3.6 Hz, 1H), 4.32 – 4.28 (dd, *J* = 13.6, 6.1 Hz, 1H), 4.12 – 4.10 (dd, *J* = 7.7, 2.9 Hz, 1H), 4.09 – 4.06 (dd, *J* = 8.4, 6.3 Hz, 1H), 4.00 – 3.97 (dd, *J* = 8.5, 5.9 Hz, 1H), 3.86 – 3.85 (d, *J* = 2.8 Hz, 1H), 3.65 – 3.60 (m, 1H), 3.57 – 3.53 (m, 1H), 3.15 – 3.12 (m, 2H), 1.87 – 1.81 (p, *J* = 7.6 Hz, 2H), 1.69 – 1.64 (m, 2H), 1.58 – 1.53 (m, 2H), 1.49 (s, 3H), 1.42 (s, 3H), 1.32 (s, 3H), 1.30 (s, 3H); **^{13}C NMR** (126 MHz, $CDCl_3$) δ 157.2, 149.1, 148.7, 140.0, 130.7, 129.4, 128.9, 127.7, 126.6, 126.1, 123.4, 118.8, 111.9, 109.1, 105.4, 82.7, 82.3, 81.3, 72.6, 70.6, 67.4, 32.7, 30.2, 29.7, 27.0, 26.9, 26.4, 26.4, 25.6; HRMS (EI) calc'd for $C_{32}H_{39}NO_6$ (M^+) Exact: 533.2777, Found: 533.2776.

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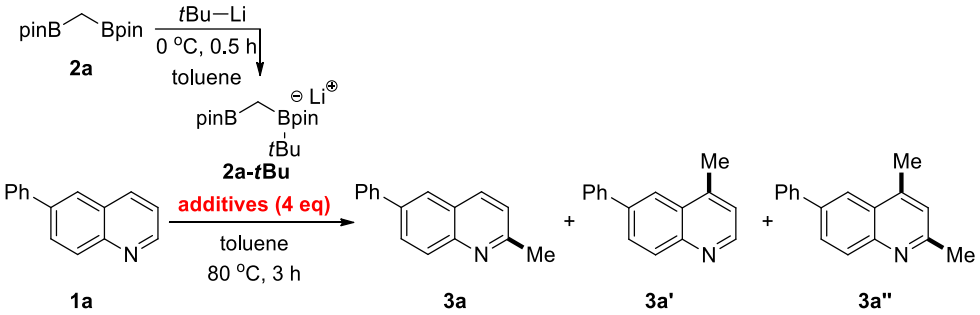
6. Experimental procedure for mechanistic studies

6.1. Selectivity control experiments with lithium-coordinating additives

In a nitrogen-filled glove-box, diborylmethane **2a** (2.0 equiv) and anhydrous toluene (1.0 mL) were added to an oven-dried 4-dram vial equipped with a Teflon coated magnetic stirbar. The vial was sealed with assembled screw cap with hole with PTFE/silicone septum and the solution was cooled at 0 °C. Then, *tert*-butyllithium solution (1.7 M solution in pentane, 2.0 equiv) was added dropwise, and reaction mixture was stirred at room temperature for 30 min. The vial was moved inside the glove-box, and 6-phenylquinoline **1a** (21 mg, 0.1 mmol) and lithium-coordinating additive (4 equiv, 0.4 mmol) were added. The vial was removed from the glove-box, and the reaction mixture was stirred at 80 °C for 3 h. The reaction mixture was quenched with aqueous (10 mL), and the aqueous layer was extracted with EtOAc (10 mL x 3). The combined organics were dried over $MgSO_4$, filtered, and concentrated under reduced pressure. The ^{1}H-NMR yield was determined using 1,1,2,2-tetrachloroethane as an internal standard.

Table S3. Selectivity control experiments in toluene solvent with lithium-coordinating additives



entry	Additive (4 equiv)	solvent	Yield (%)		
			3a	**3a'**	**3a''**
1	-	toluene	12	8	9
2	**HPMA**	**toluene**	**72**	**6**	**<1**
3	**DMPU**	**toluene**	**66**	**6**	**<1**

HMPA: Hexamethylphosphoramide

DMPU: *N*,*N*′-Dimethylpropyleneurea

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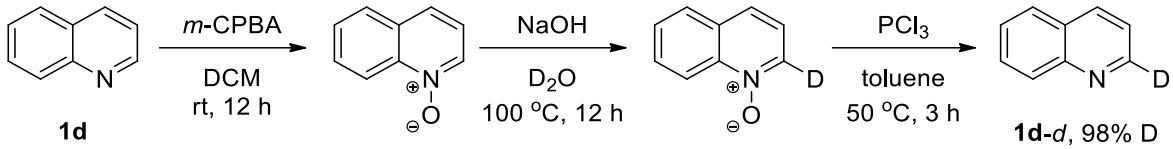
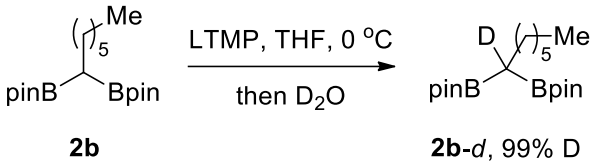
6.2 Deuterium-labeling experiments

6.2.1 Procedure for the synthesis of deuterated 1,1-diborylheptane and quinoline

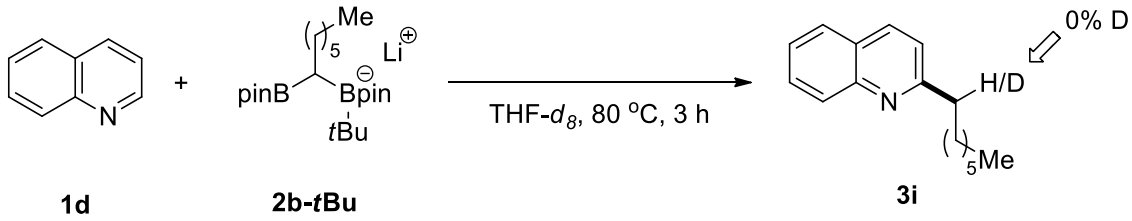


C2-deuterated quinoline **1d**-*d* were synthesized according to a literature procedure.[14]



α-C-H deuterated 1,1-diboryheptane **2b**-*d* were synthesized according to a literature procedure.[14]

6.2.2 Procedure for the C2-alkylation of quinoline in THF-d_8



The reaction was performed according to the general procedure for the C2-alkylation with **1d** (13 mg, 0.10 mmol), **2b** (70 mg, 0.20 mmol) and *t*BuLi (1.7 M in pentane, 0.12 mL, 0.20 mmol) in anhydrous THF-d_8 (1.0 mL) at 80 °C for 3 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 10:1) to give the compound **3i** as a yellow liquid. The isolated ^{1}H-NMR spectrum indicated that deuterium incorporation in **3i**-*d* was not detected by ^{1}H-NMR in $CDCl_3$.

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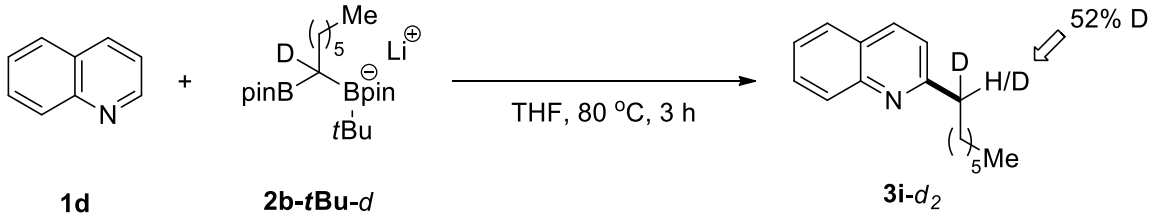
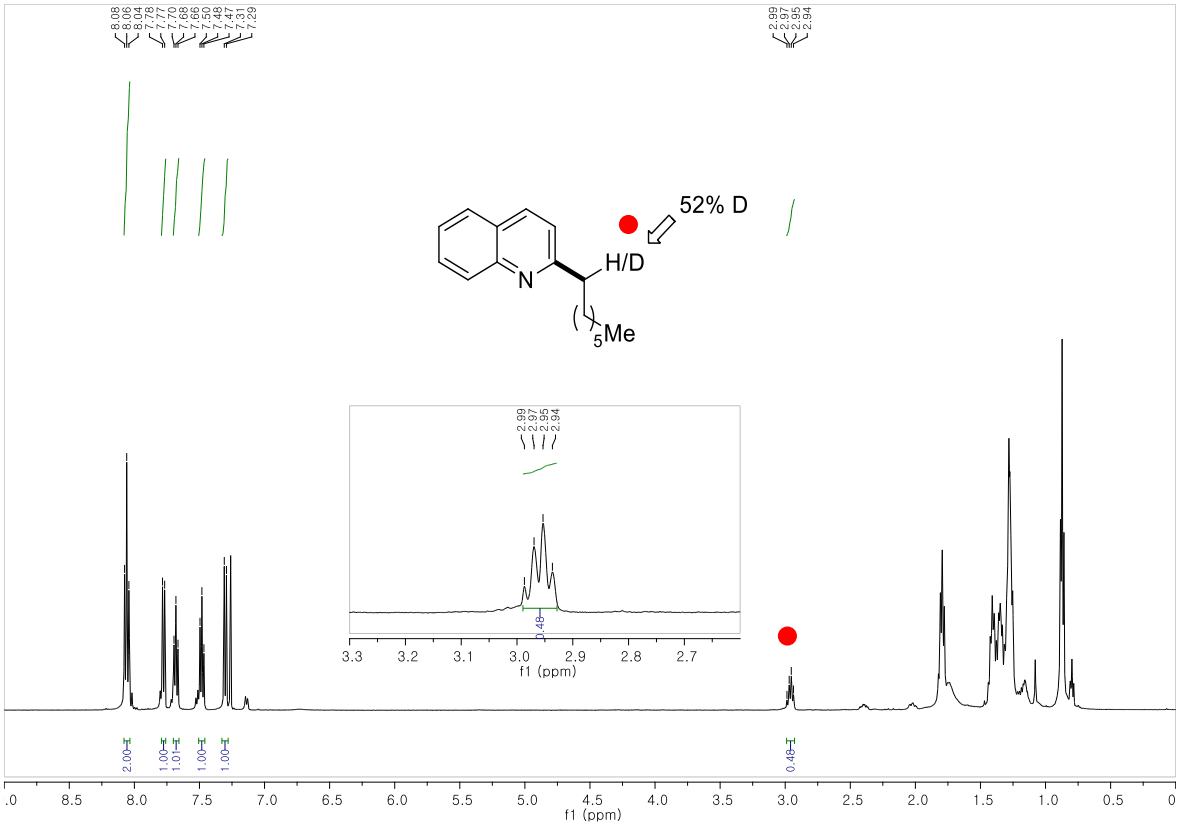
6.2.3 Procedure for the C2-alkylation of quinoline with 2b-*d*



1d **2b-*t*Bu-*d*** **3i-d_2**

The reaction was performed according to the general procedure for the C2-alkylation with **1d** (13 mg, 0.10 mmol), **2b**-*d* (71 mg, 0.20 mmol) and *t*BuLi (1.7 M in pentane, 0.12 mL, 0.20 mmol) in anhydrous THF (1.0 mL) at 80 °C for 3 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 10:1) to give the compound **3i** as a yellow liquid. The isolated ^{1}H-NMR spectrum indicated that deuterium incorporation in **3i**-d_2 was detected to be 52% by ^{1}H-NMR in $CDCl_3$.

Chart S1. Isolated ^{1}H-NMR spectra of the C2-heptylation of 1d with 2b-*d*



In **3i**-d_2, deuterium incorporation was detected to be 52% by ^{1}H-NMR in $CDCl_3$.

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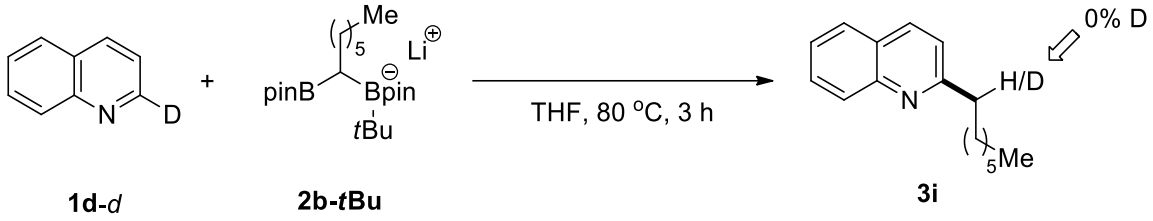
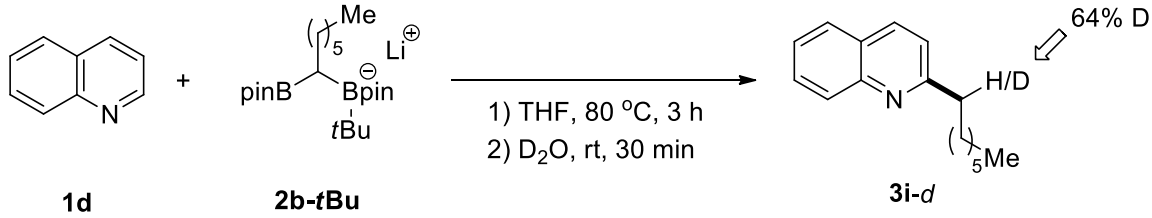
6.2.4 Procedure for the C2-alkylation of deuterated quinoline with 2b



1d-*d* **2b**-*t***Bu** **3i**

The reaction was performed according to the general procedure for the C2-alkylation with **1d**-*d* (13 mg, 0.10 mmol), **2b** (70 mg, 0.20 mmol) and *t*BuLi (1.7 M in pentane, 0.12 mL, 0.20 mmol) in anhydrous THF (1.0 mL) at 80 °C for 3 h. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 10:1) to give the compound **3i** as a yellow liquid. The isolated ^{1}H-NMR spectrum indicated that deuterium incorporation in **3i**-*d* was not detected by ^{1}H-NMR in $CDCl_3$.

6.2.5 Procedure for the C4-alkylation of quinoline with 2b and D_2O quenching experiment



1d **2b**-*t***Bu** **3i**-*d*

The reaction was performed according to the general procedure for the C2-alkylation with **1d** (13 mg, 0.10 mmol), **2b** (70 mg, 0.20 mmol) and *t*BuLi (1.7 M in pentane, 0.12 mL, 0.20 mmol) in anhydrous THF (1.0 mL) at 80 °C for 3 h. The reaction mixture was diluted with D_2O (10 mL) and extracted with EtOAc (10 mL x 3). The combined organic layers were dried over $MgSO_4$, filtered, and concentrated under reduced pressure. The crude mixture was purified by column chromatography on silica gel (*n*-hexanes:EtOAc, 10:1) to give the compound **3i**-*d* as a yellow liquid. The isolated ^{1}H-NMR spectrum indicated that deuterium incorporation in **3i**-*d* was detected to be 64% by ^{1}H-NMR in $CDCl_3$.

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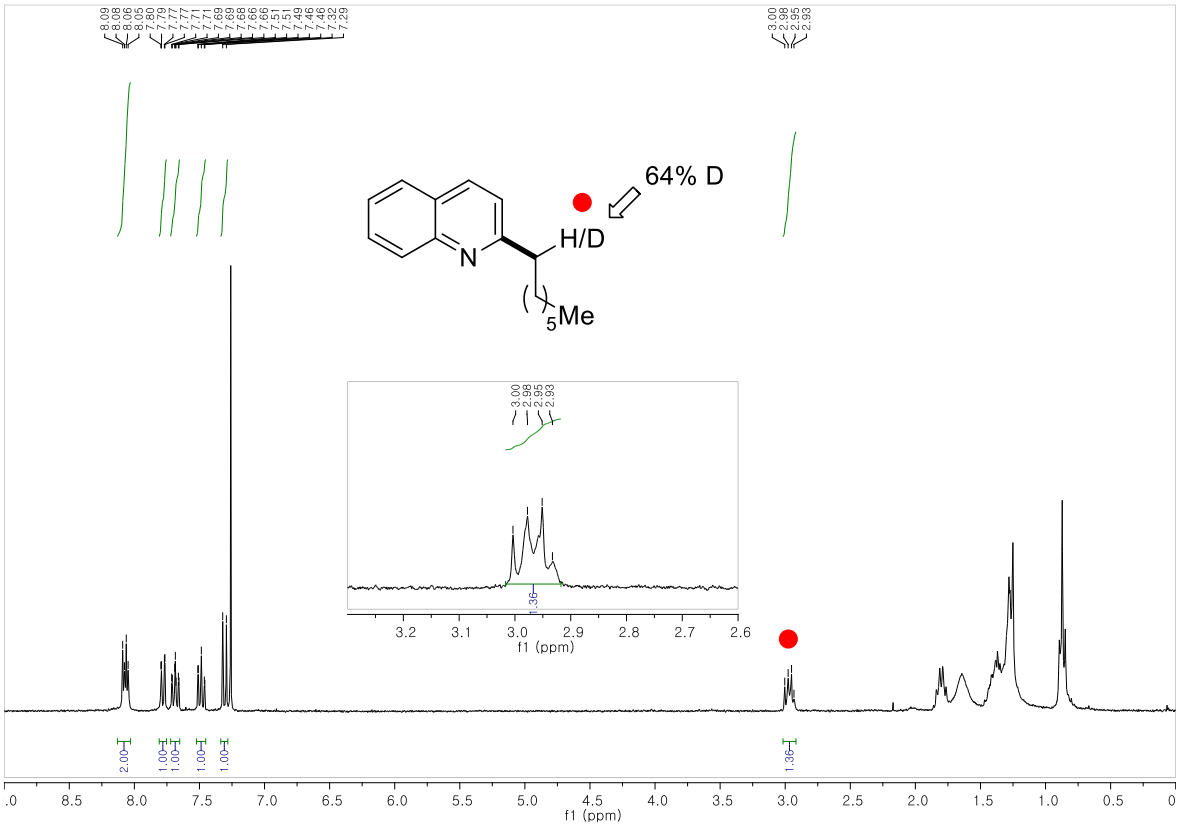
Chart S2. Isolated ^{1}H-NMR spectra of the C2-alkylation after D_2O quenching



In **3i**-*d*, deuterium incorporation was detected to be 64% by ^{1}H-NMR in $CDCl_3$.

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Appendix I

Spectral Copies of ^{1}H and ^{13}C NMR Data Obtained in this Study

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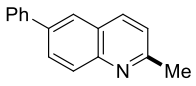
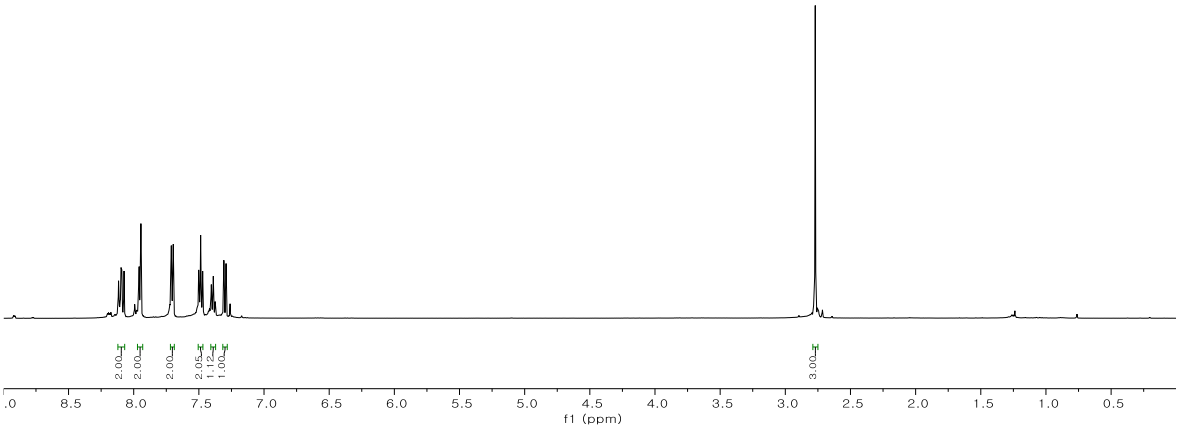
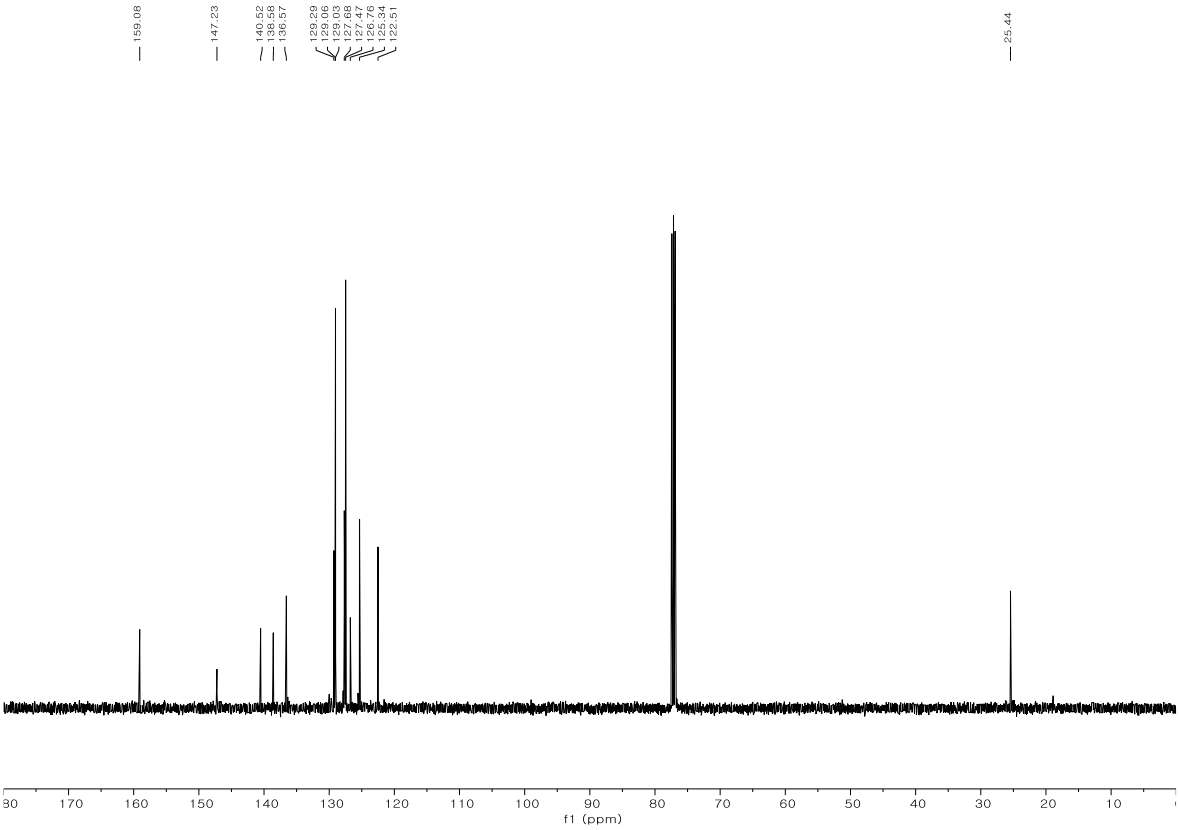
2-Methyl-6-phenylquionline (3a)







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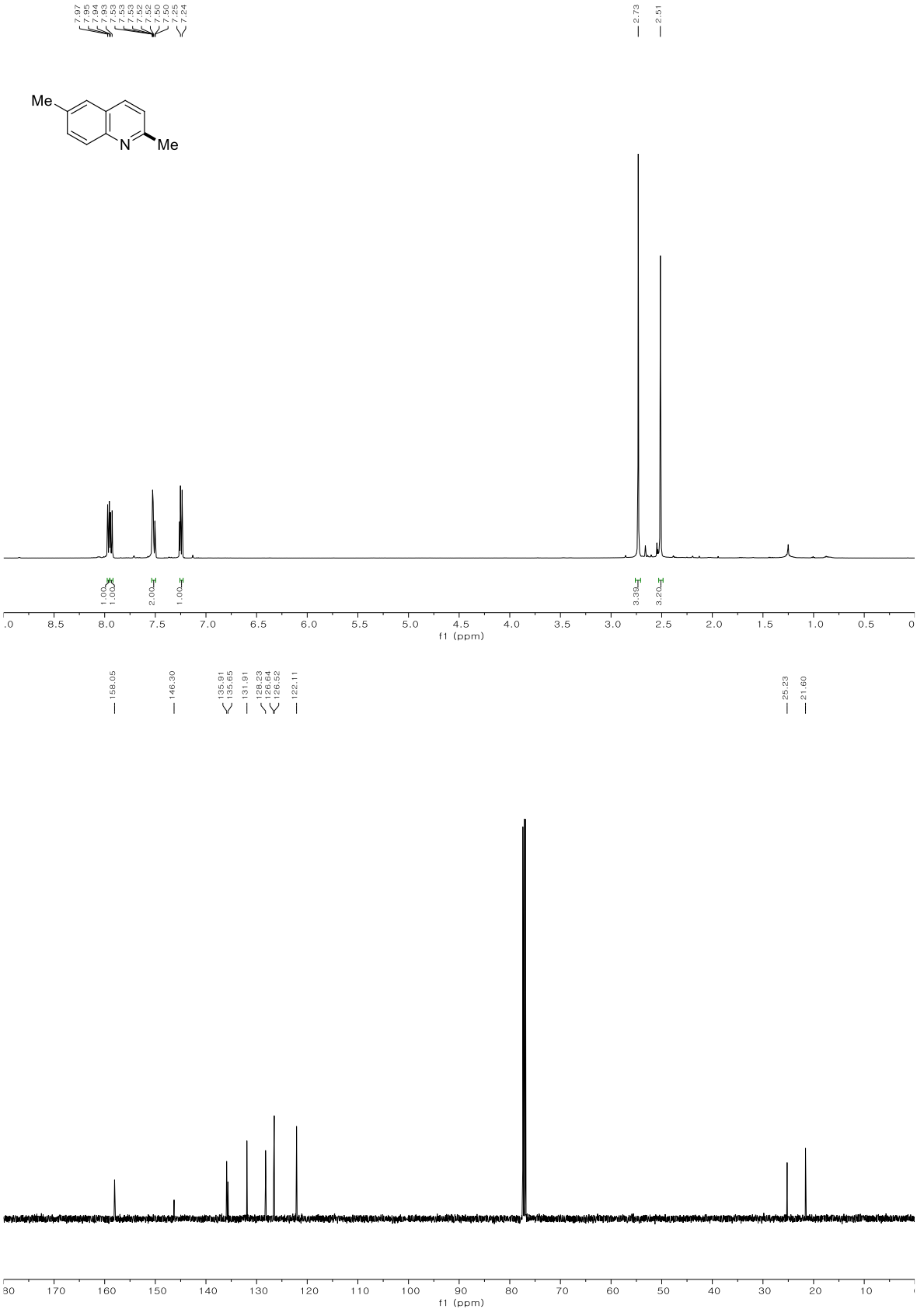

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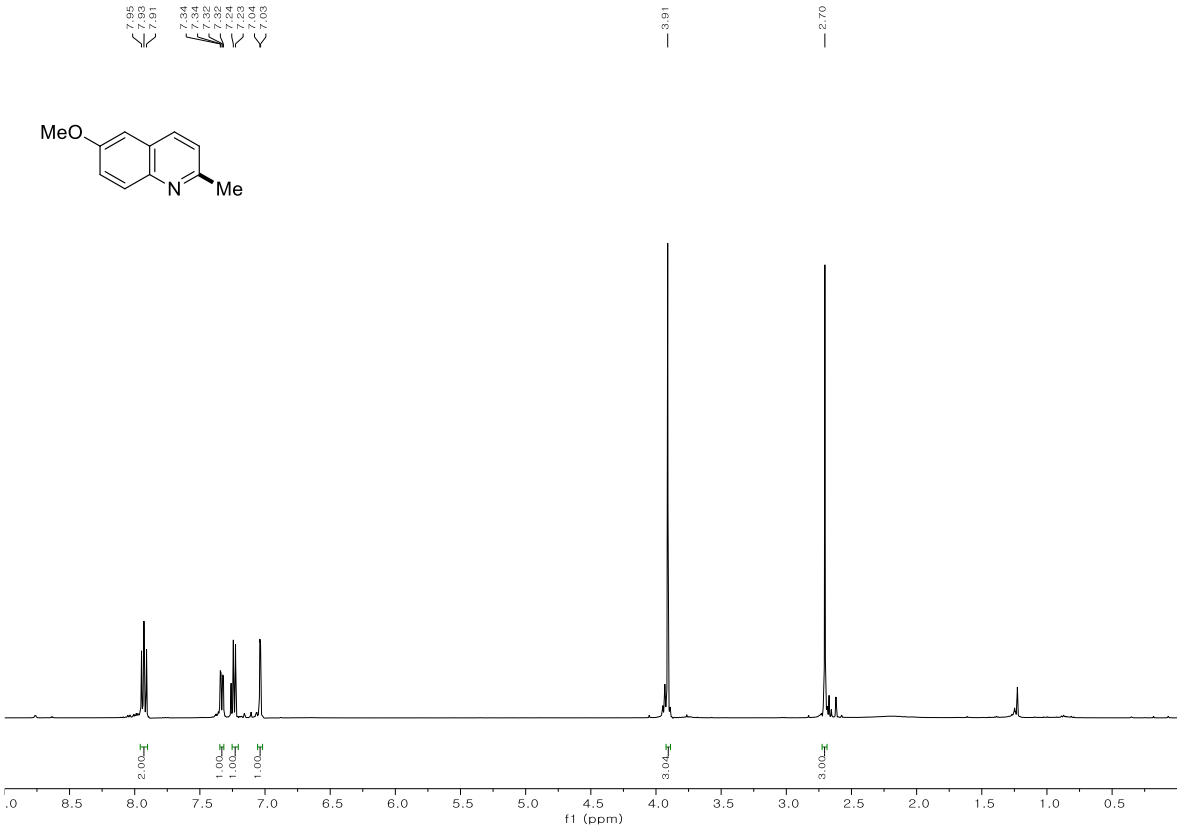

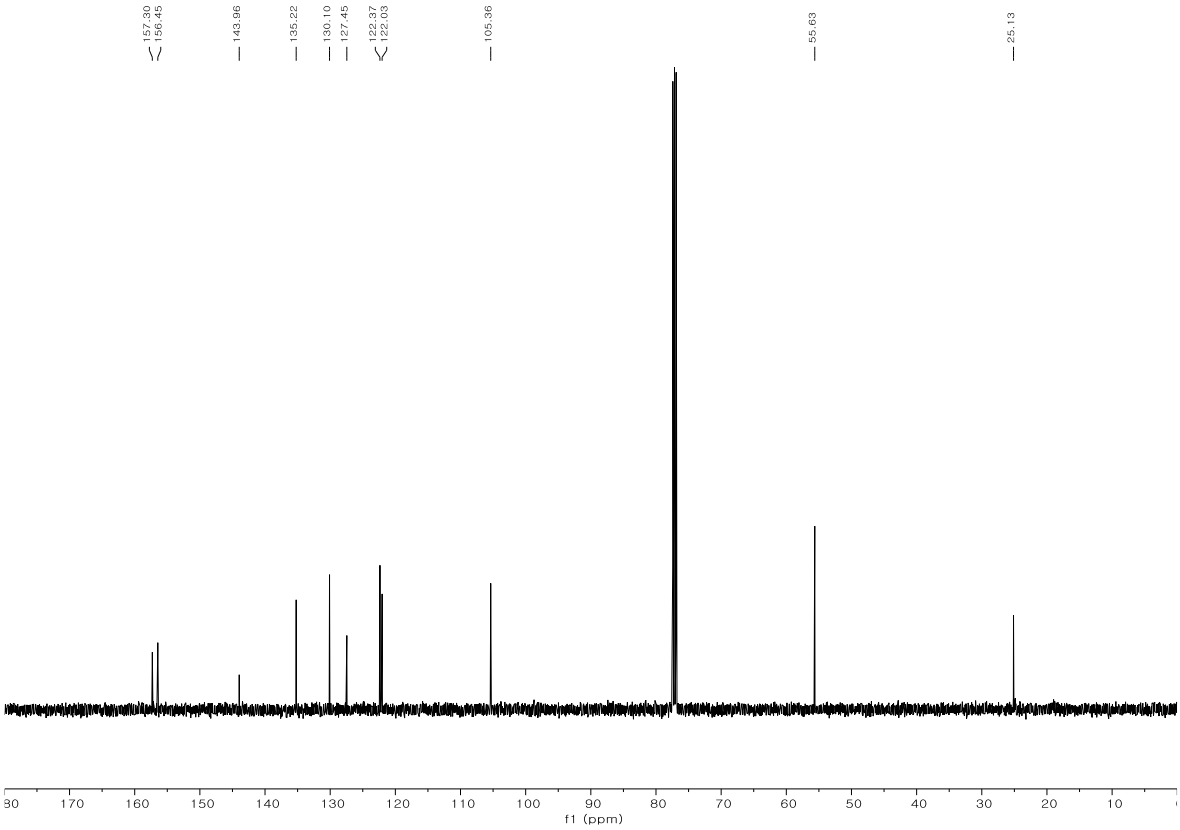

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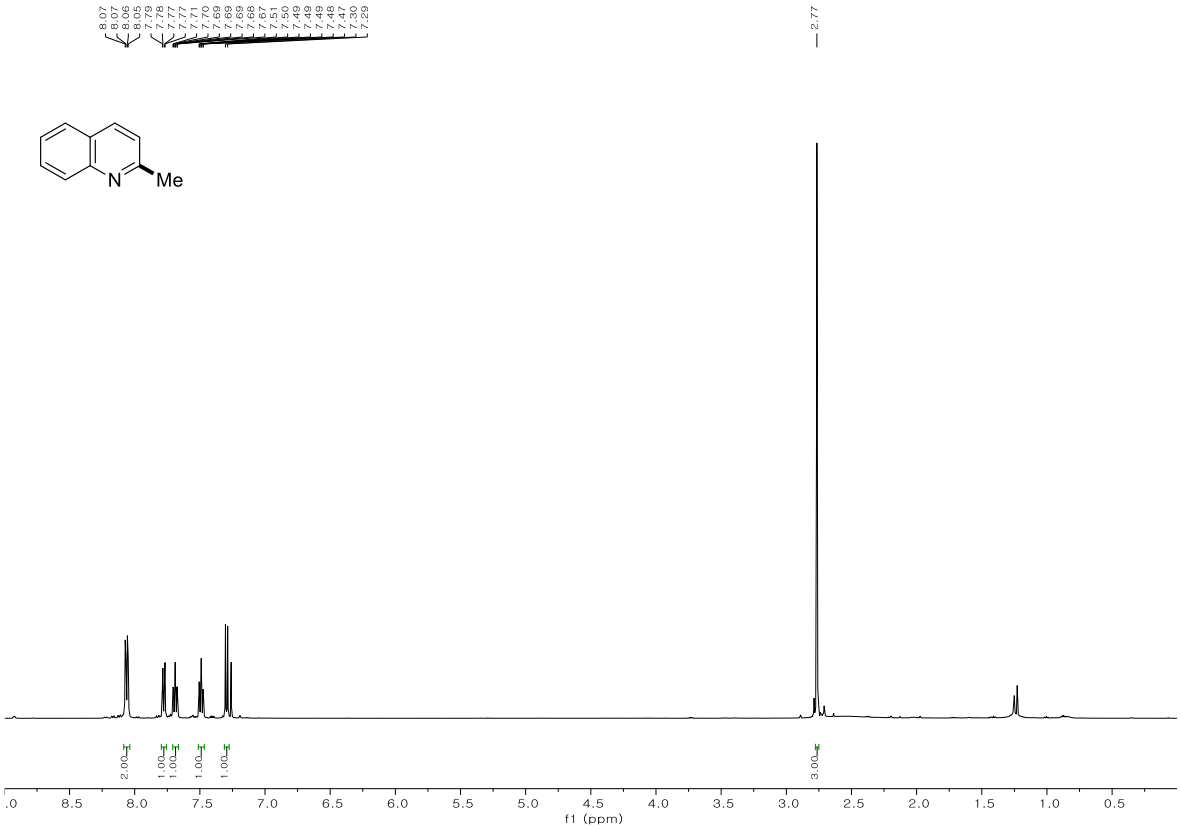

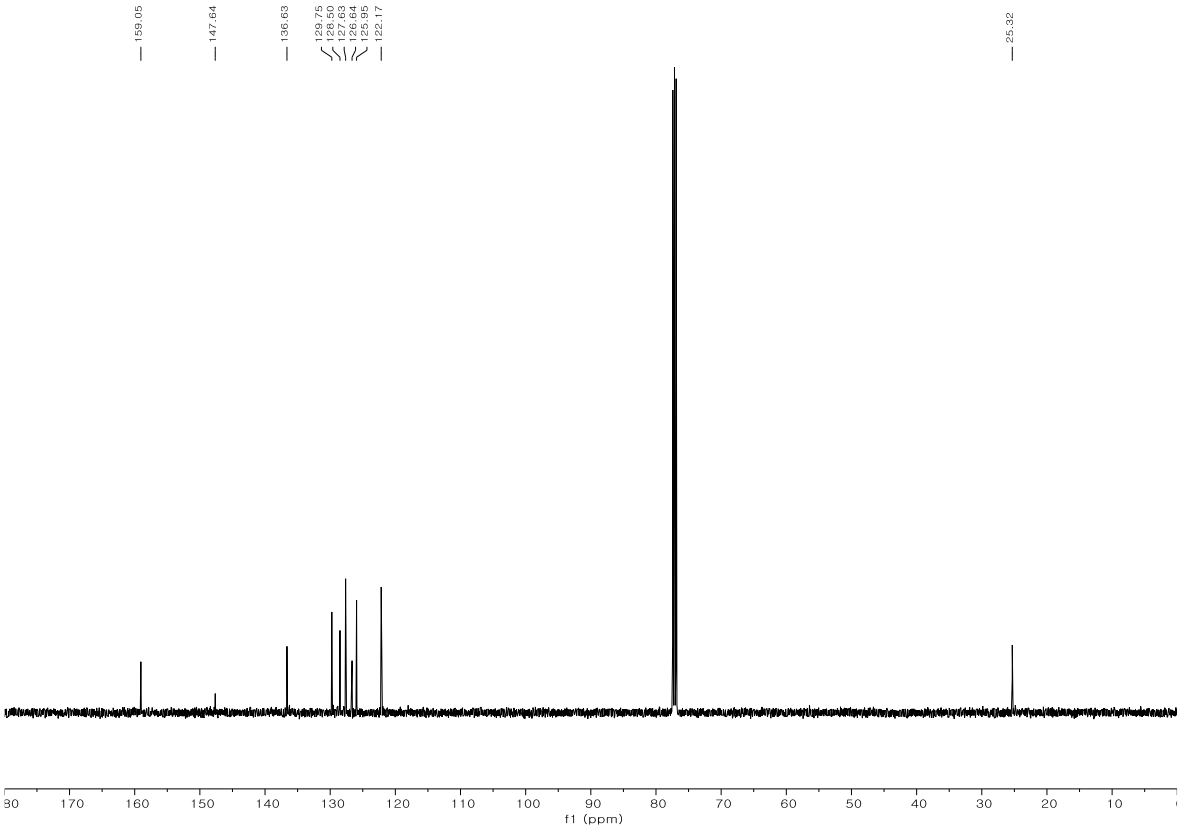

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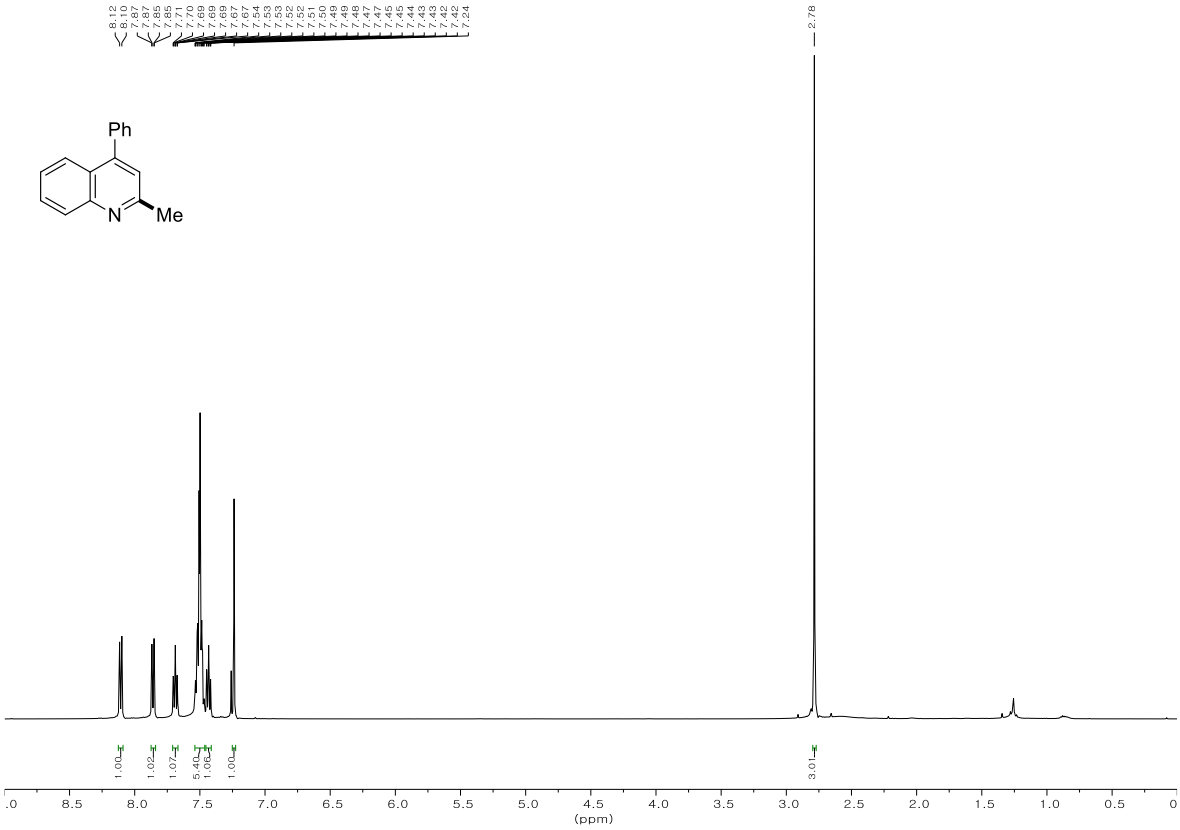

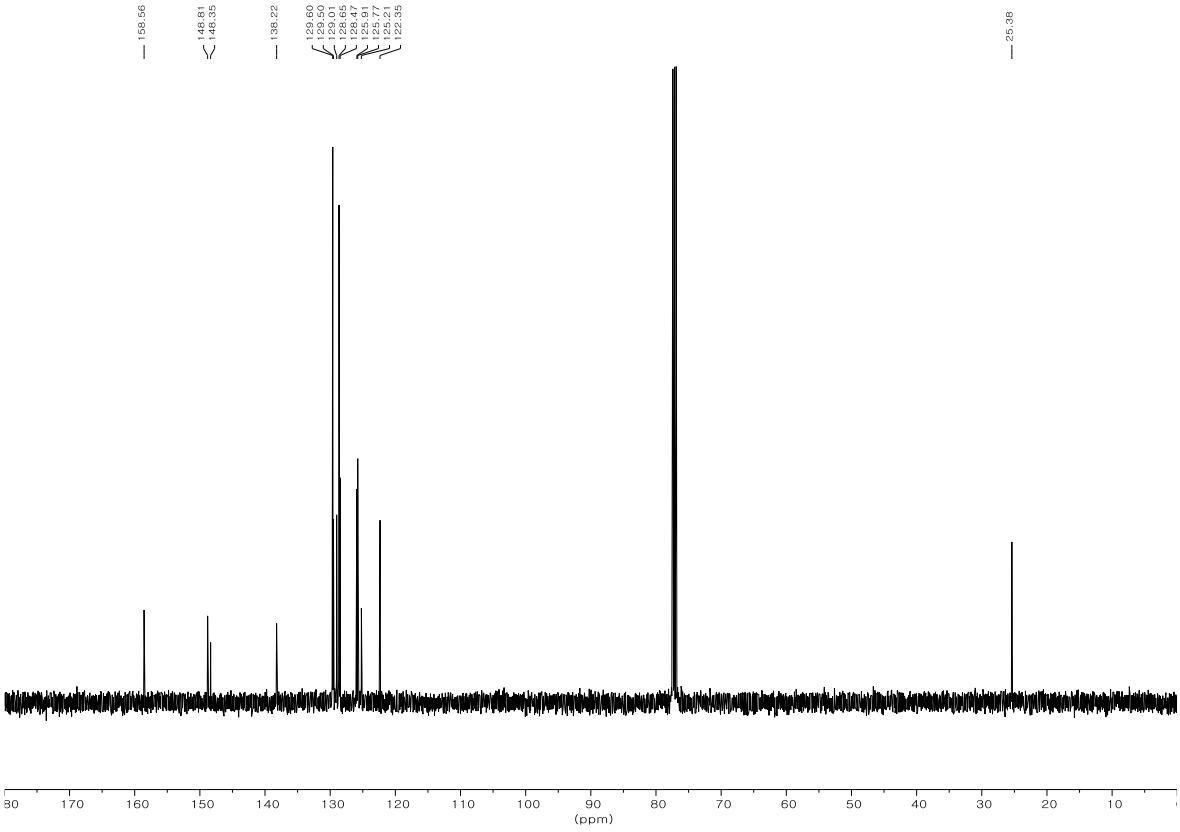

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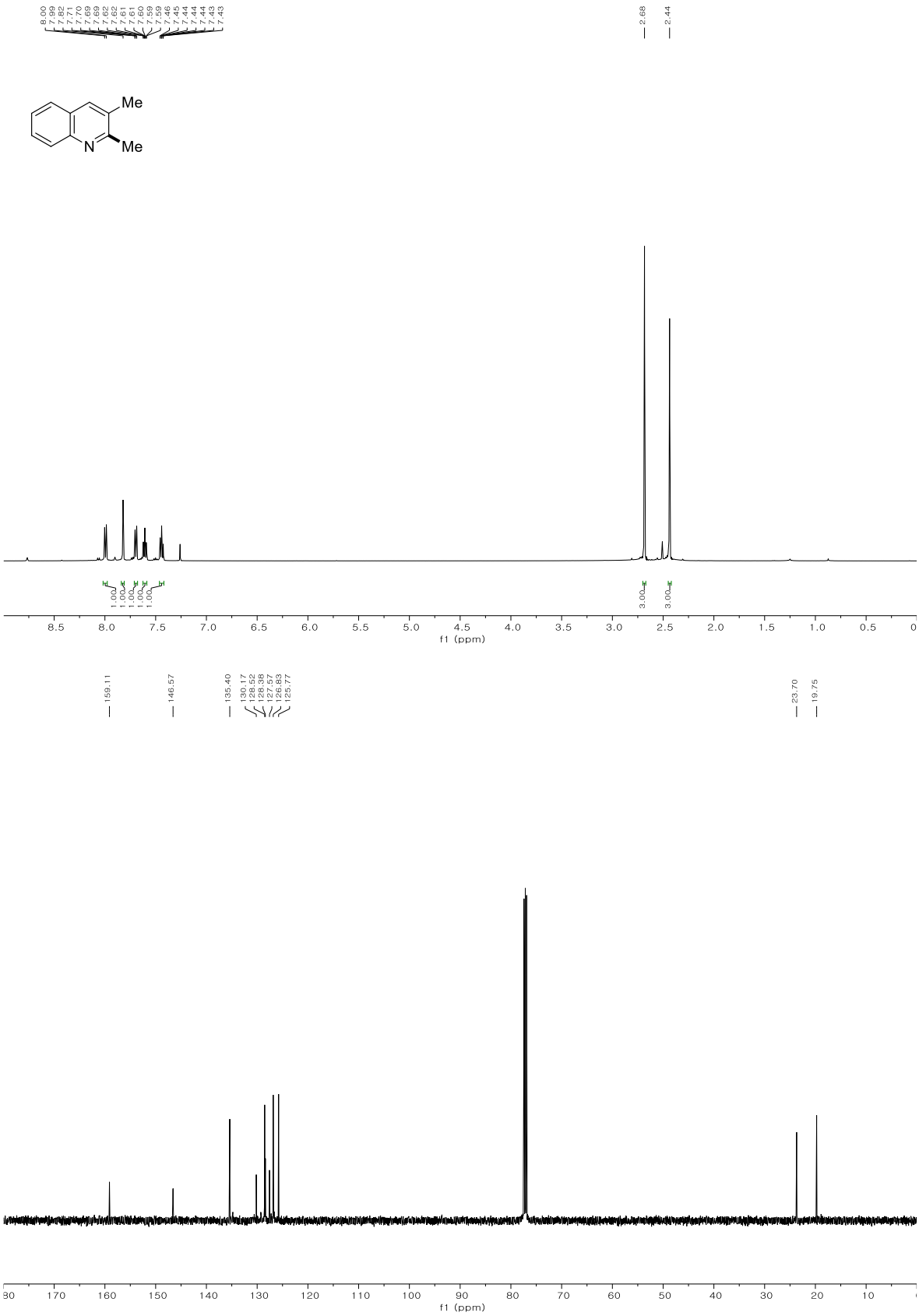

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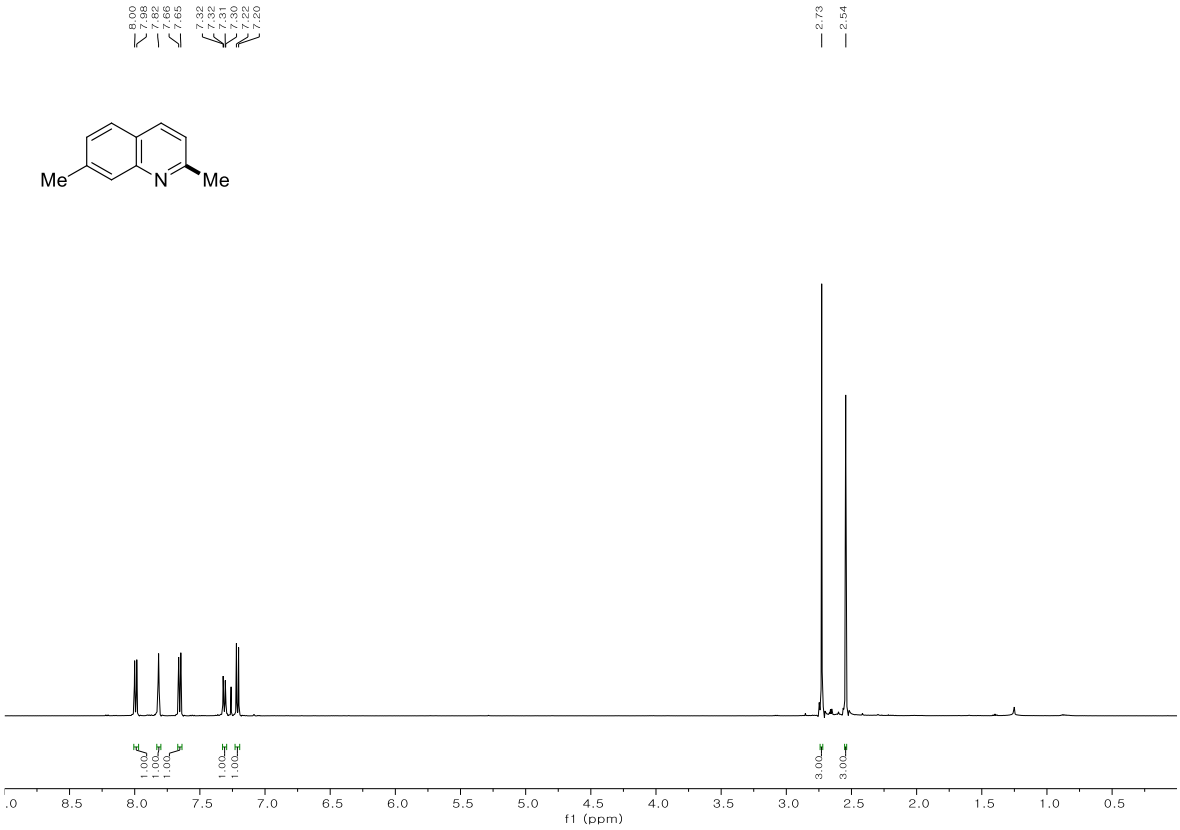

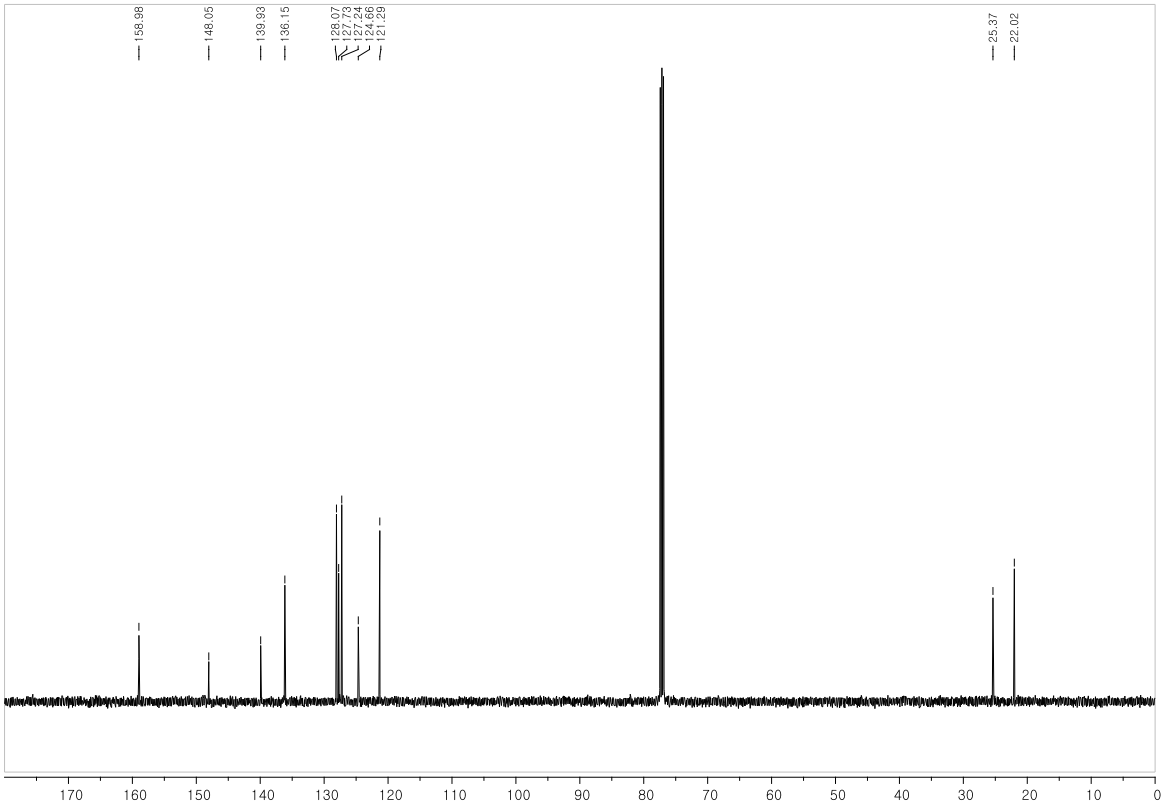

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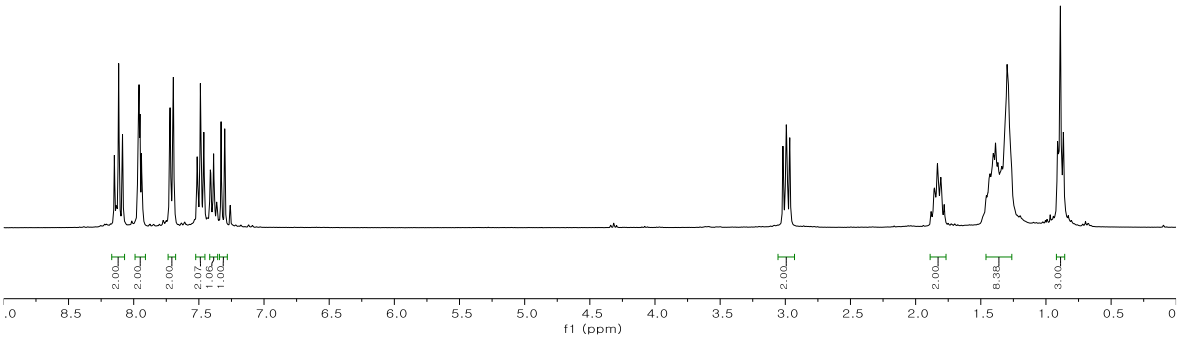
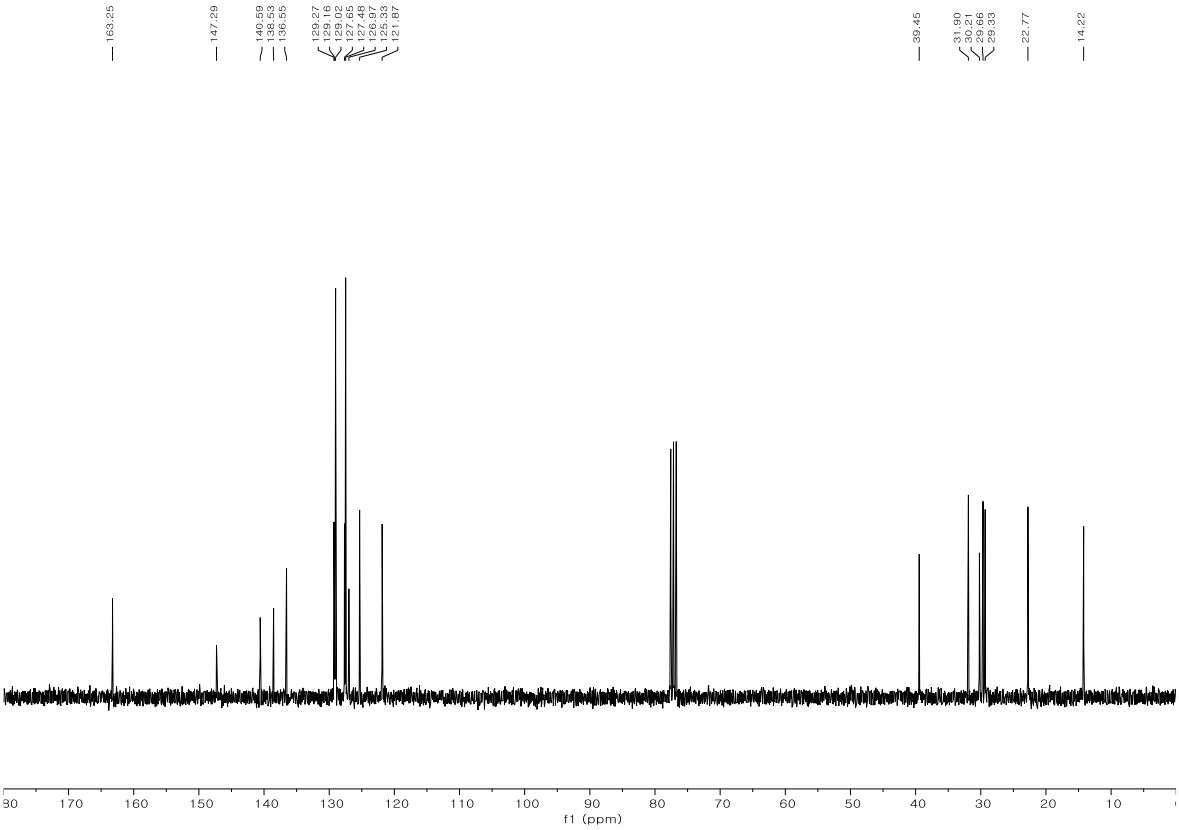
2-Heptyl-6-phenylquinoline (3h)





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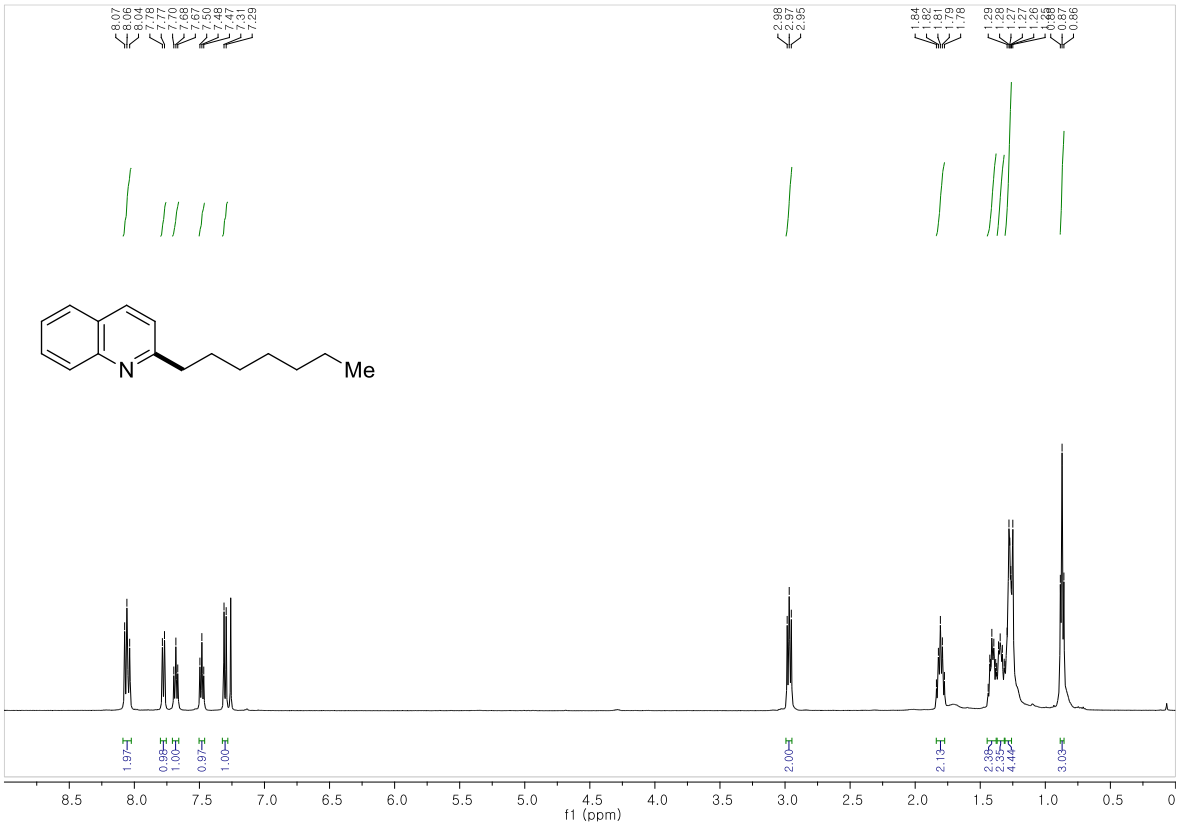

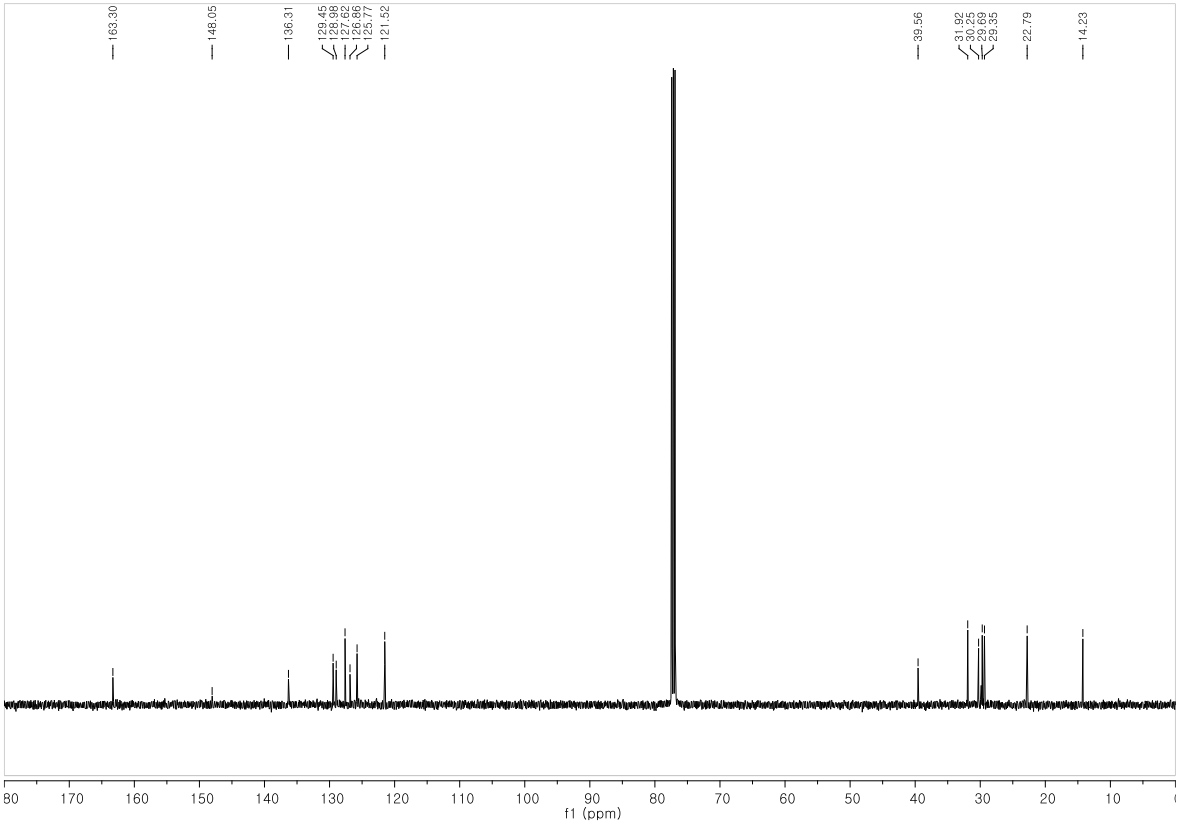

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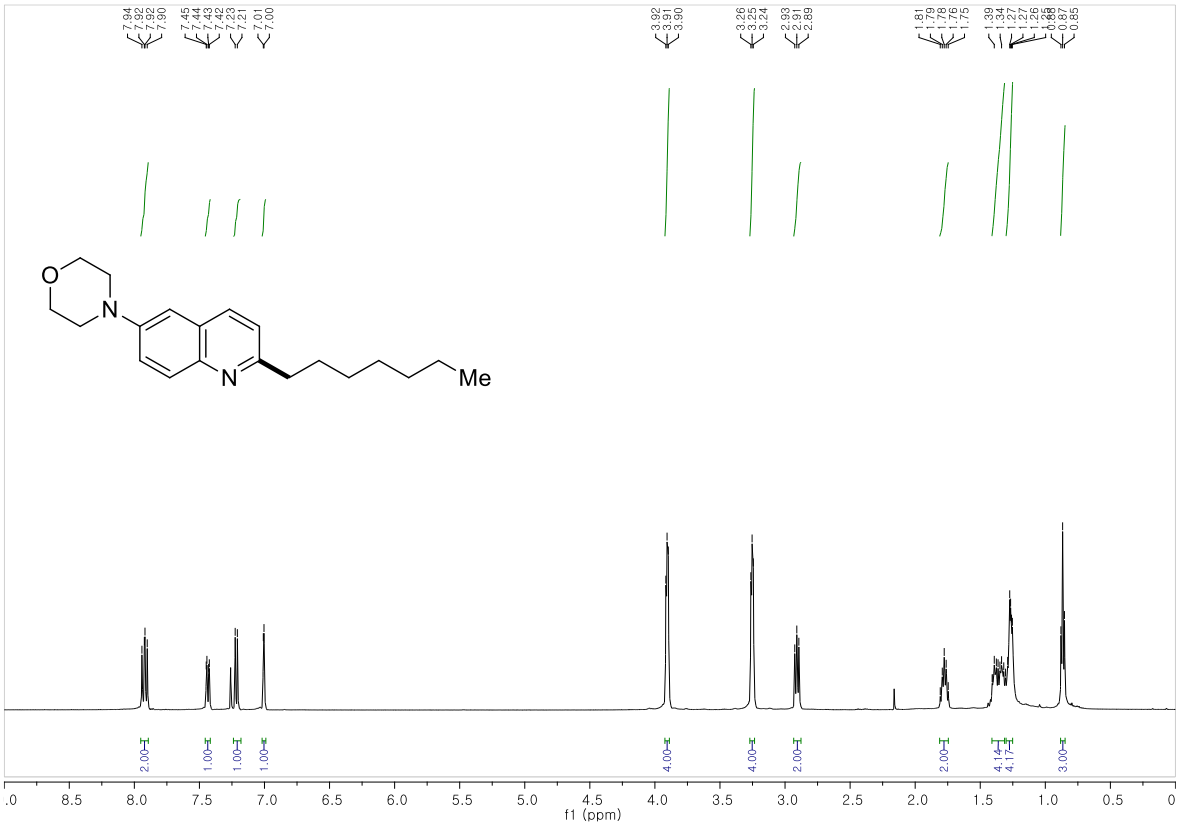
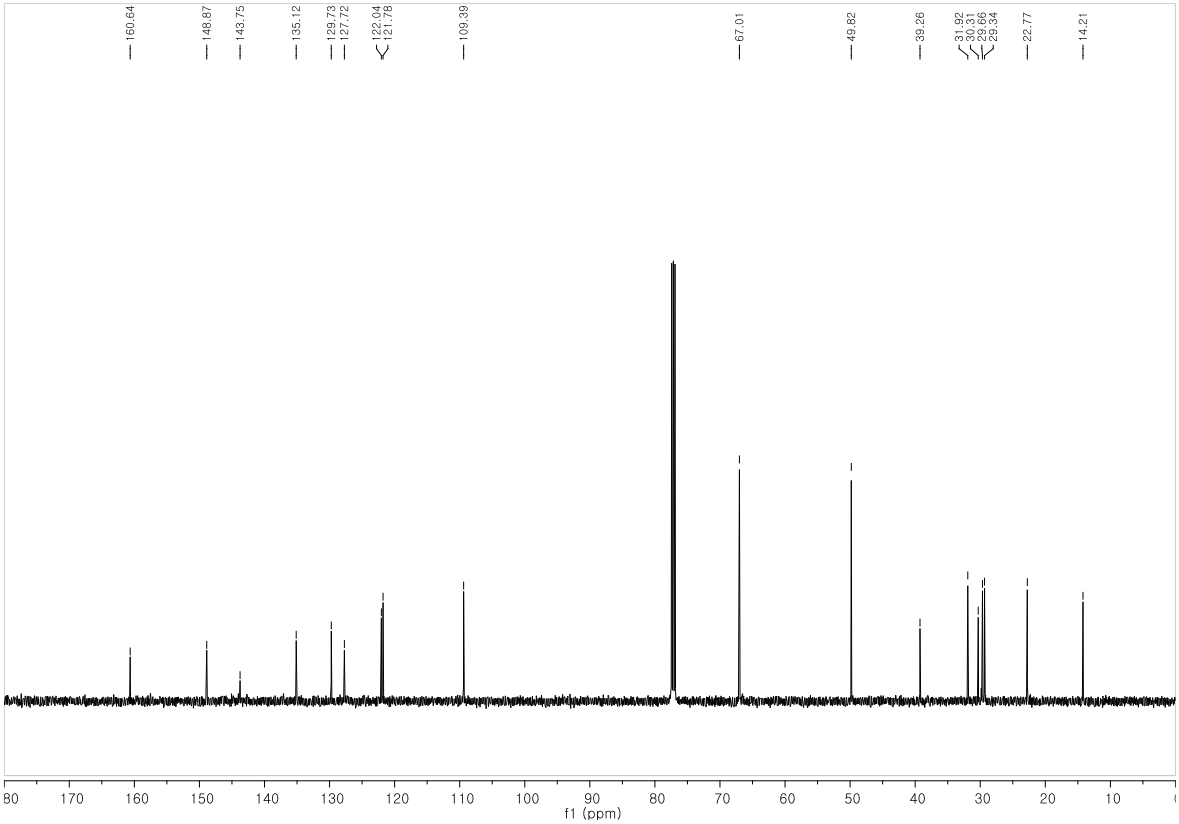
4-(2-Heptylquinolin-6-yl)morpholine (3j)





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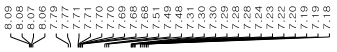

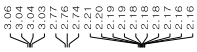

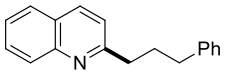

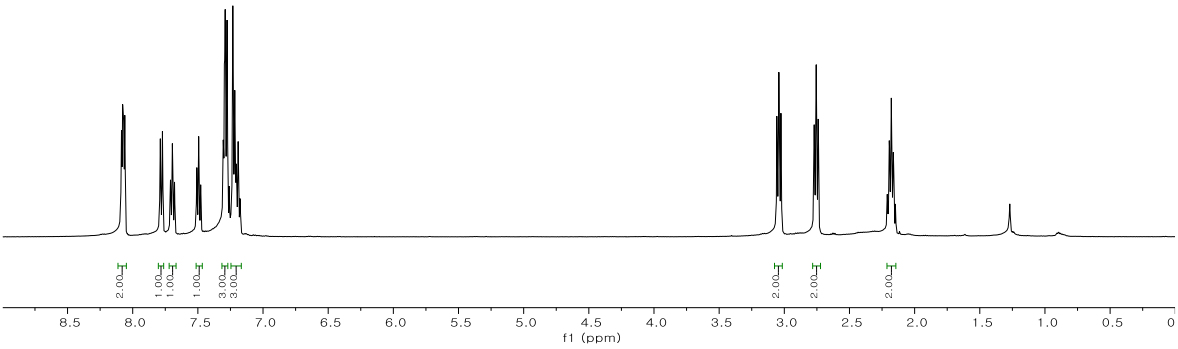

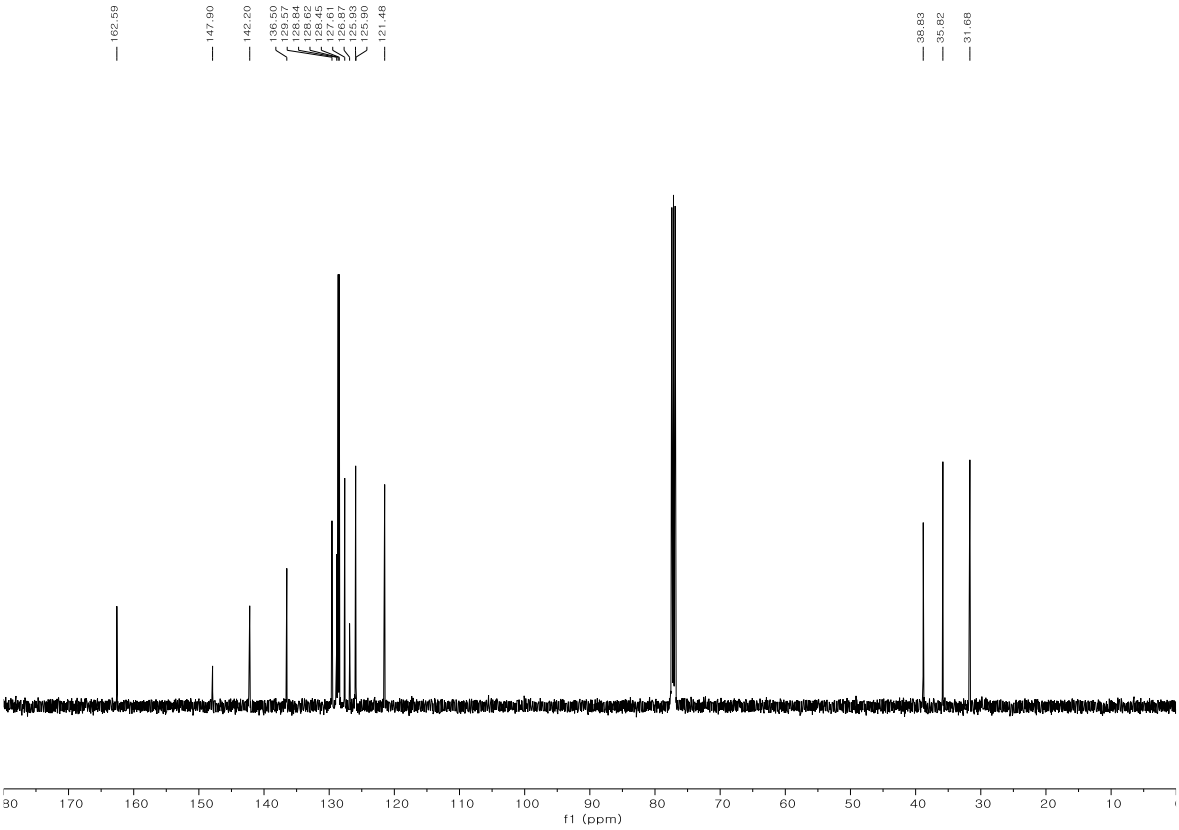

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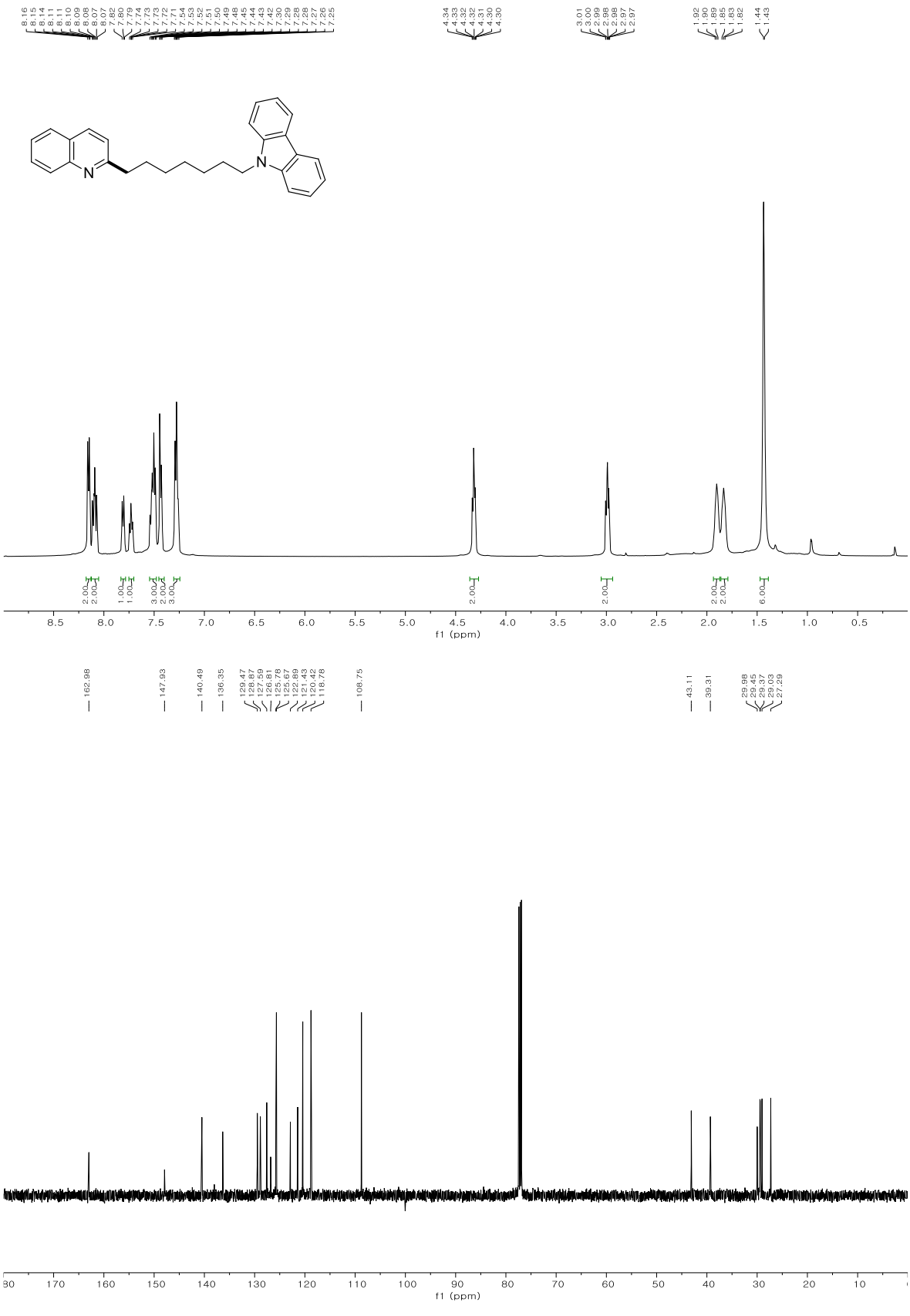
9-(7-(quinolin-2-yl)heptyl)-*9H*-carbazole (3l)



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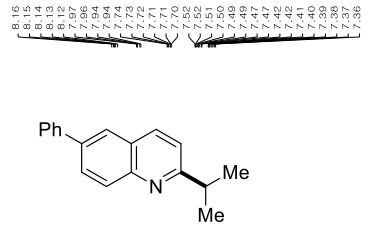

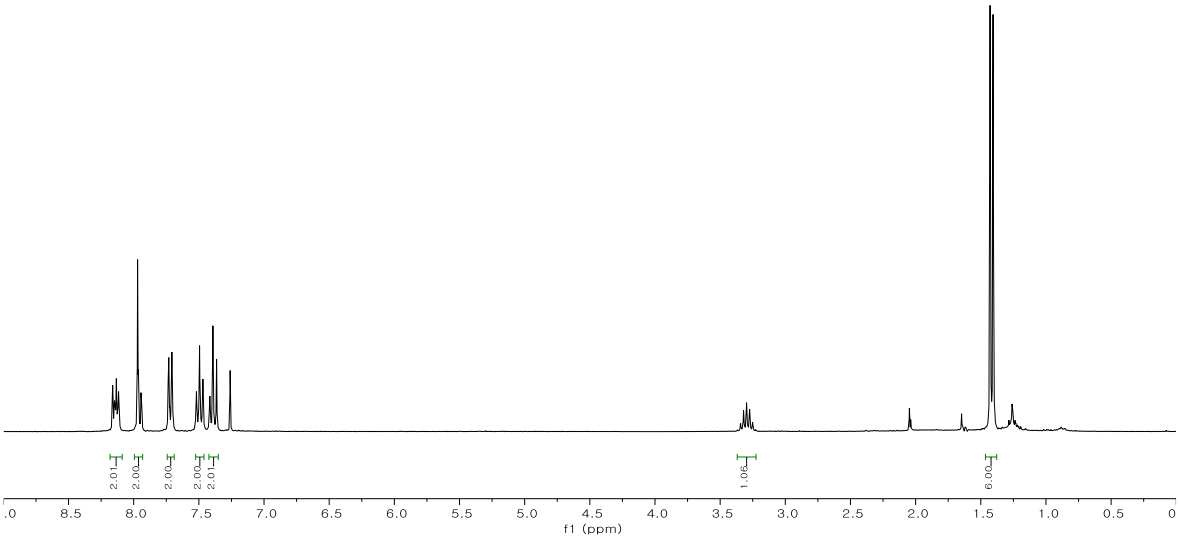

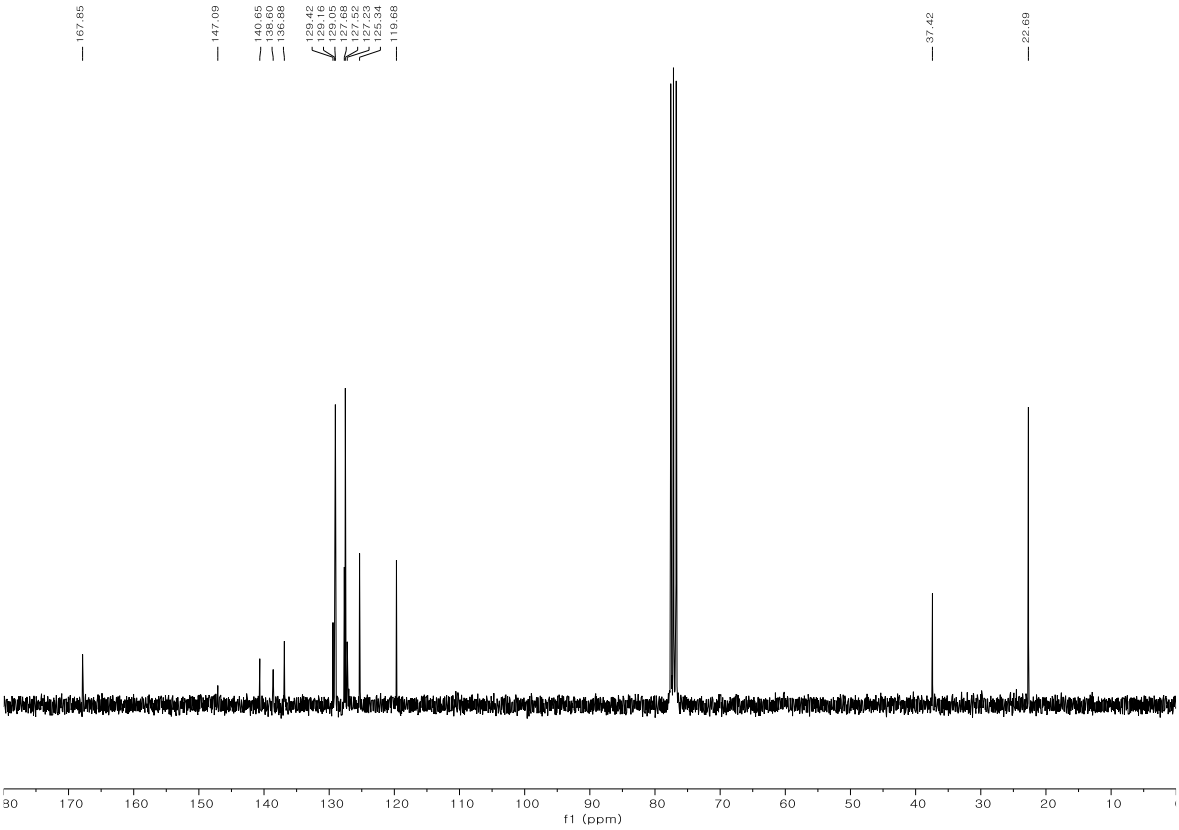

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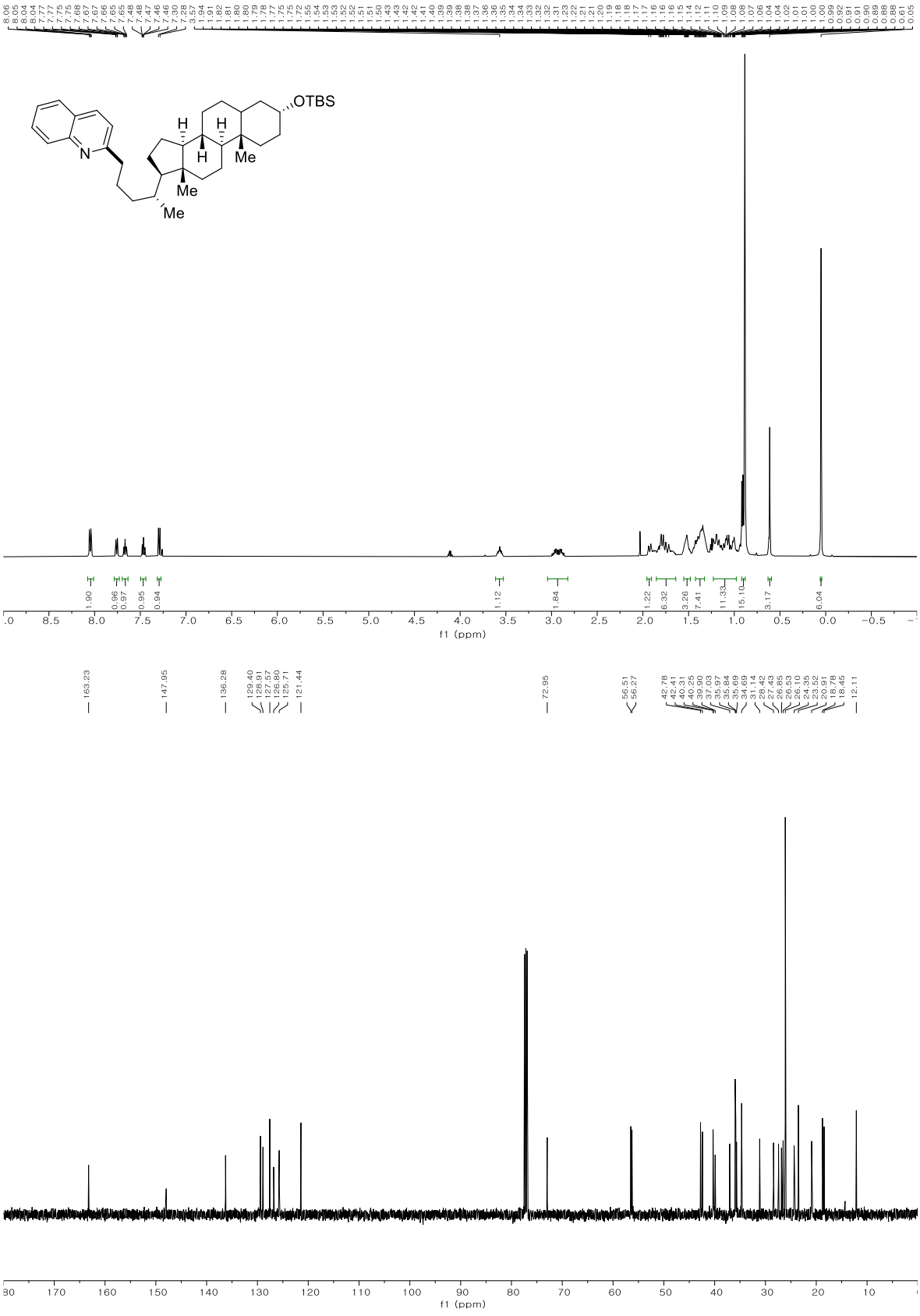

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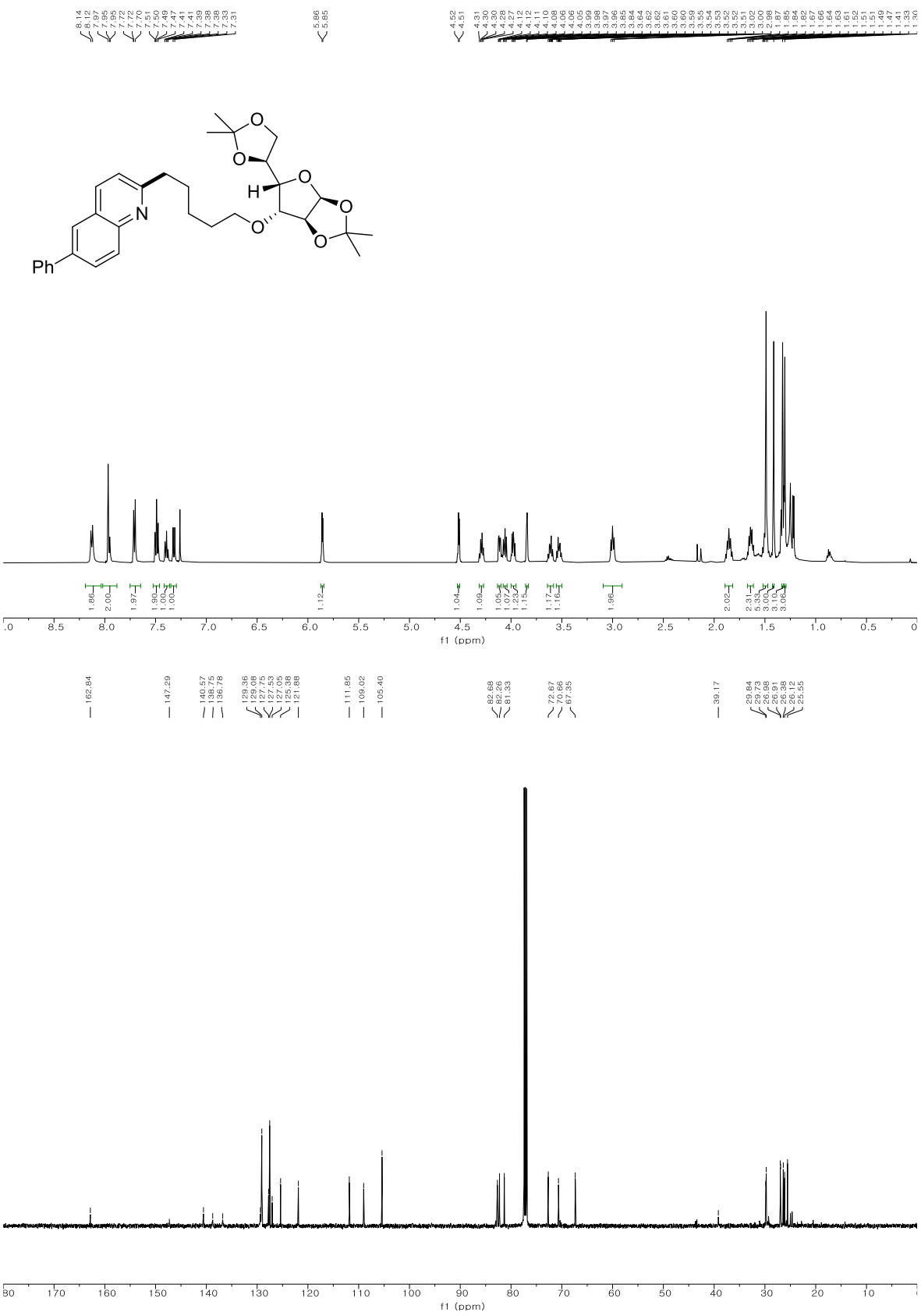

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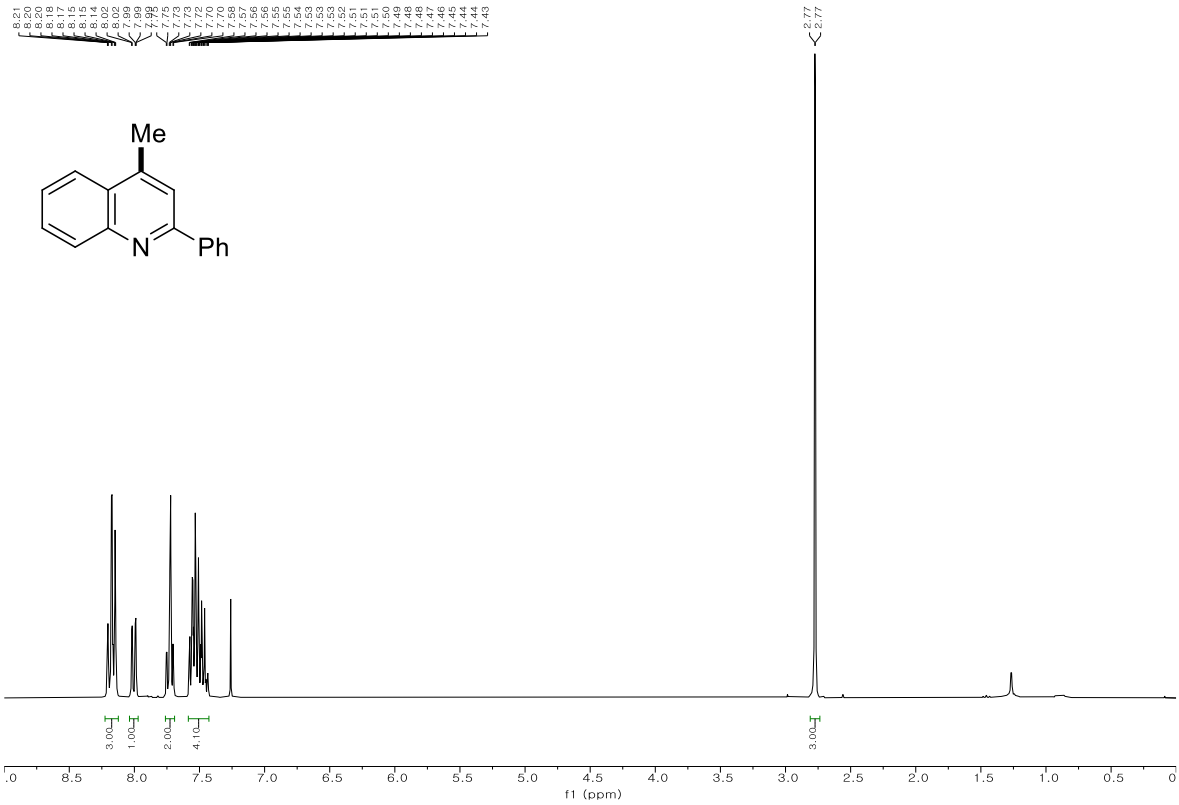
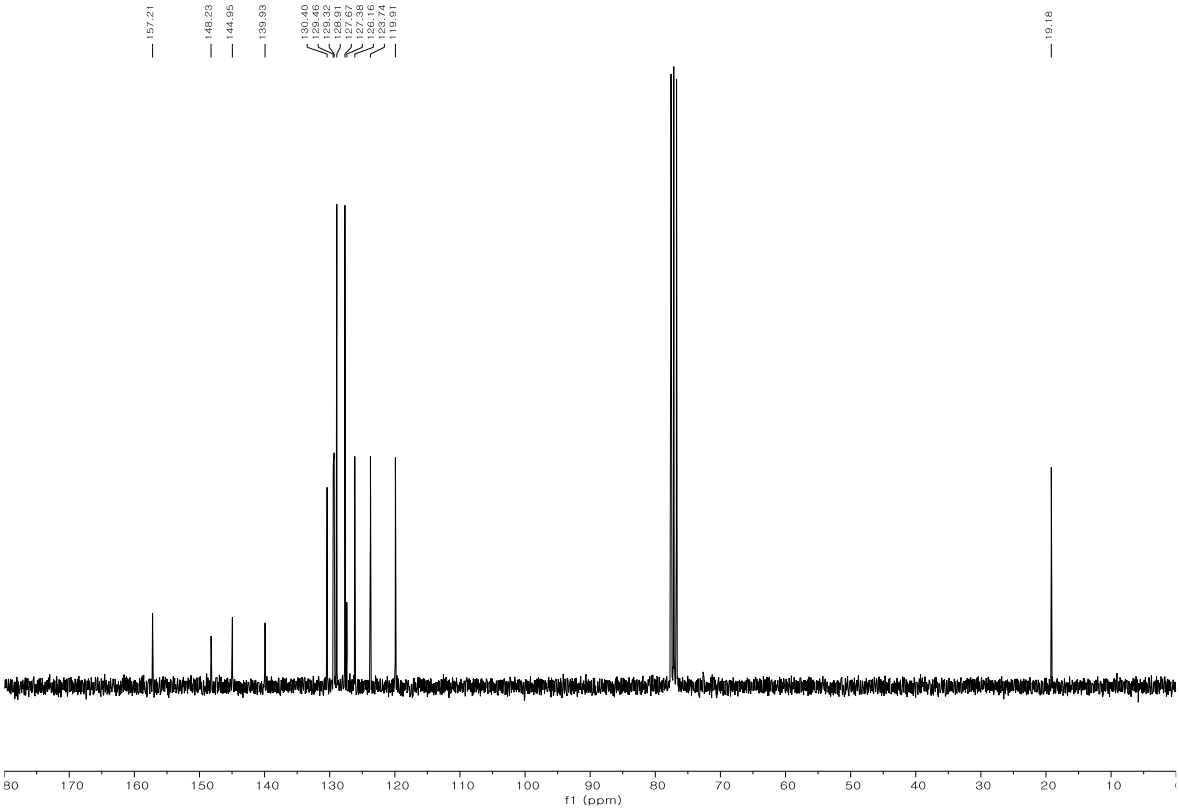
4-Methyl-2-phenylquinoline (5a)





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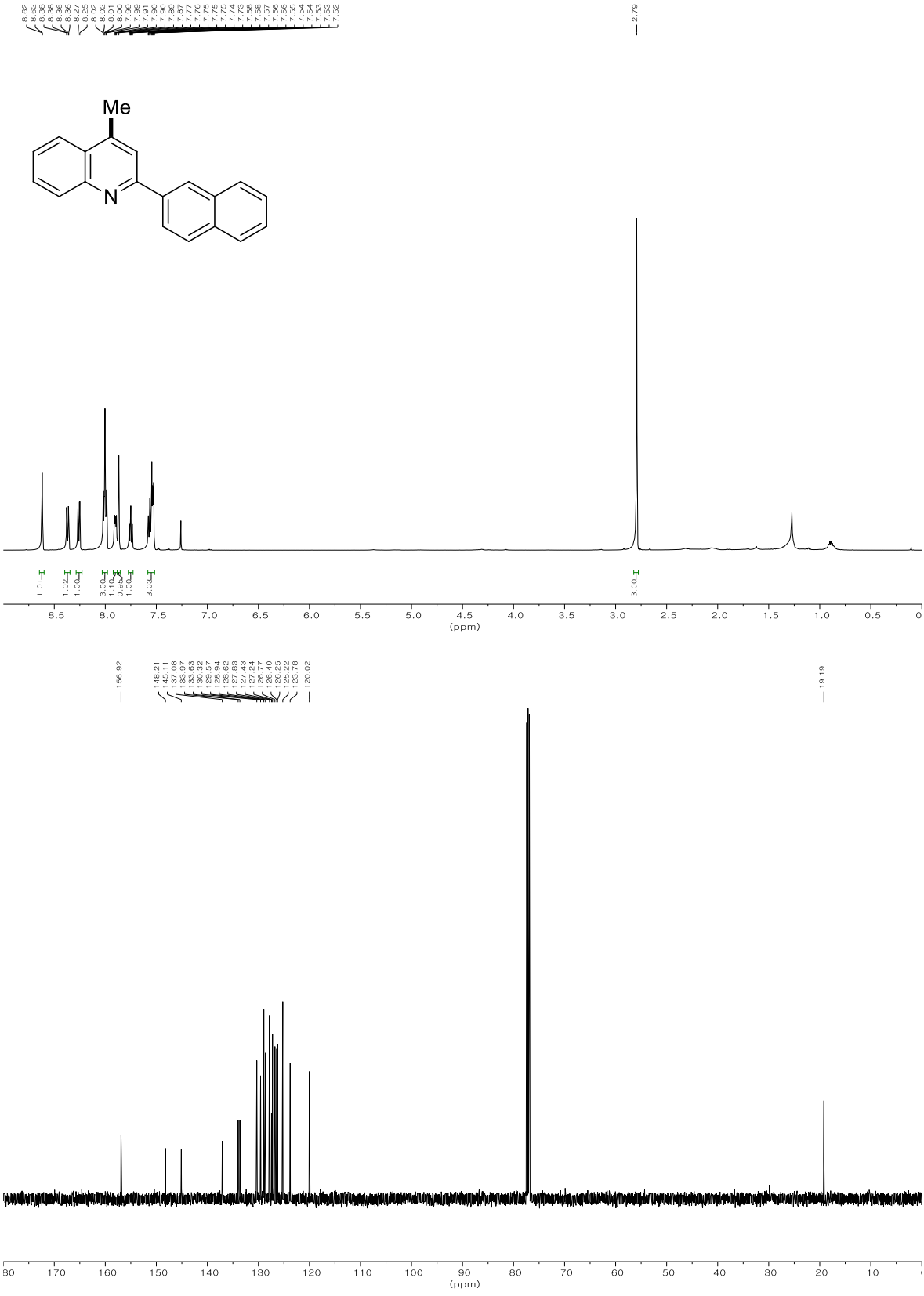
4-Methyl-2-(naphthalen-2-yl)quinoline (5b)



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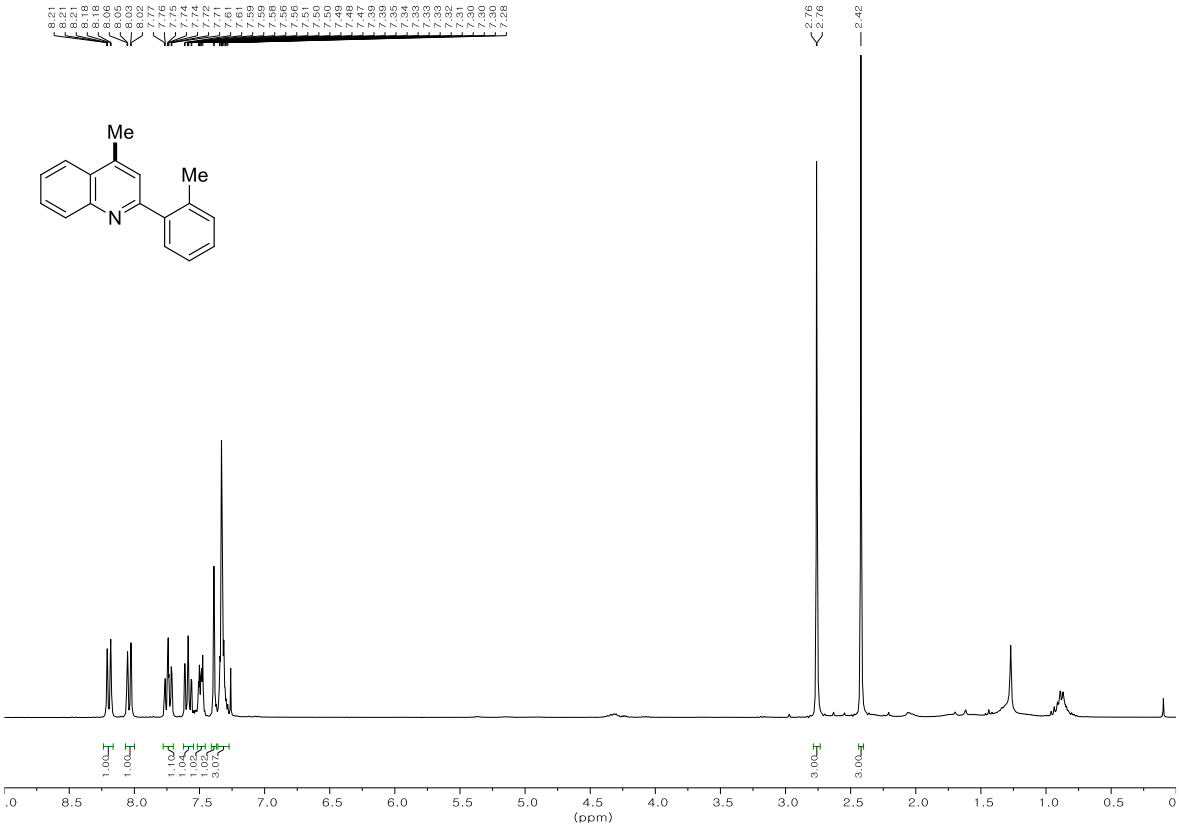
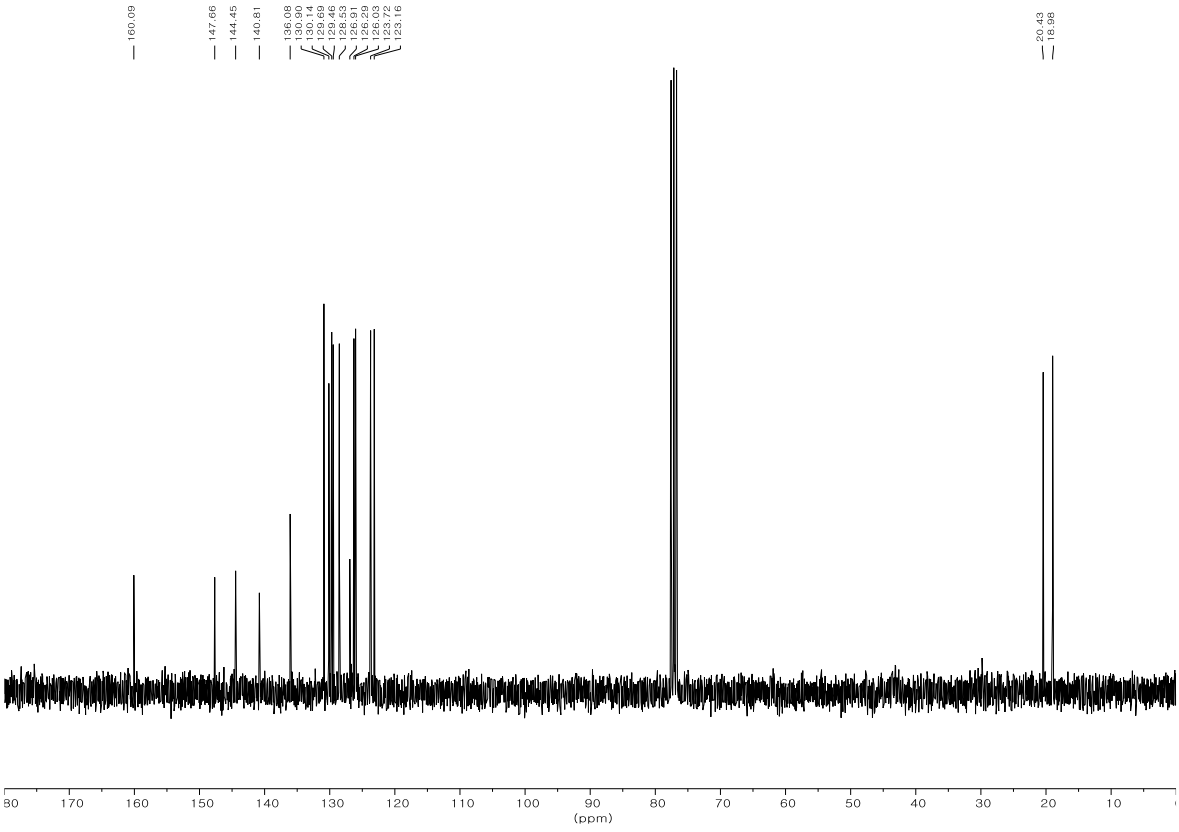
4-Methyl-2-(*o*-tolyl)quinoline (5c)





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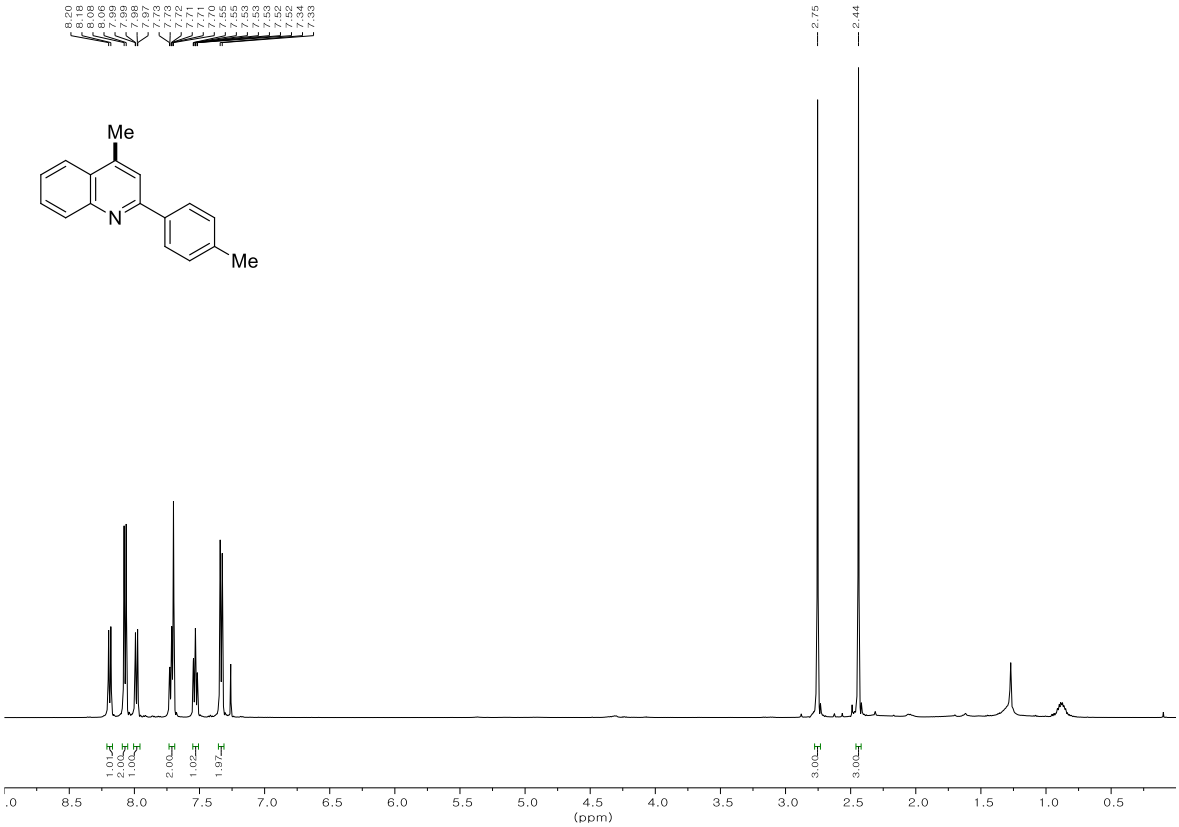
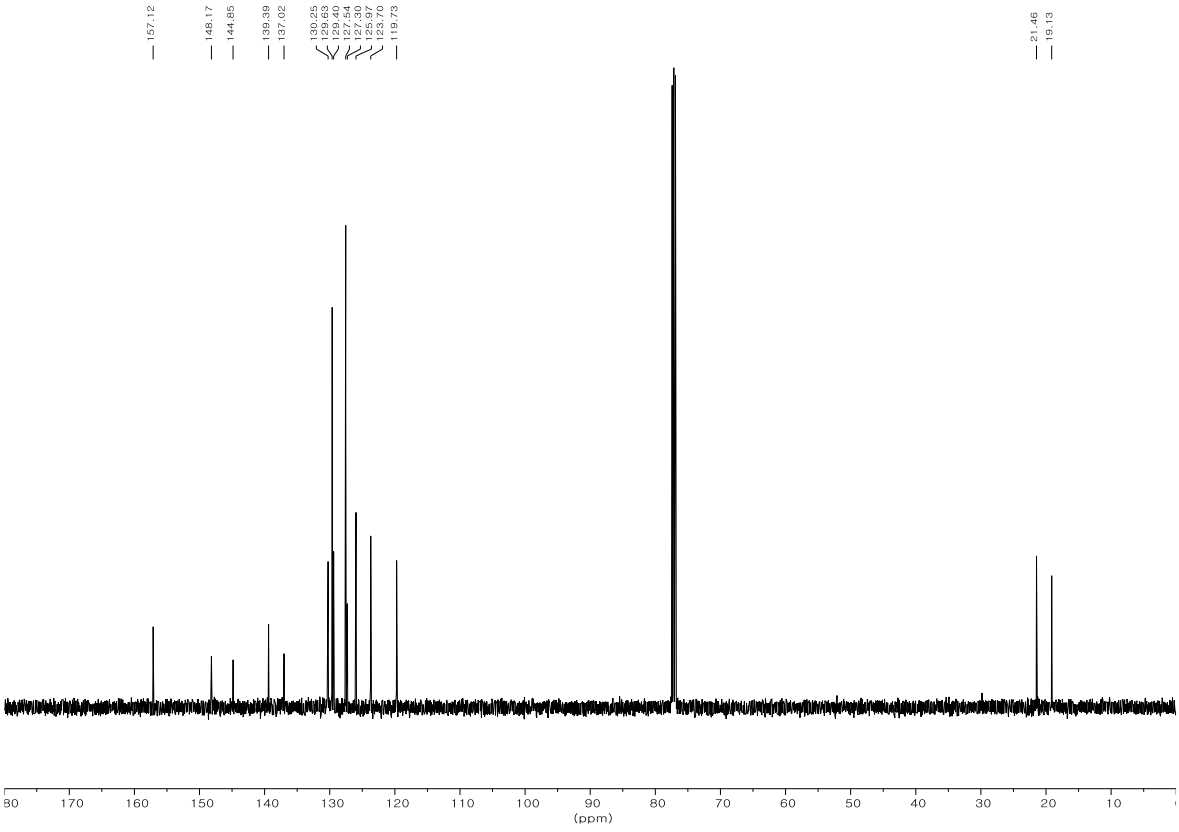
4-Methyl-2-(*p*-tolyl)quinoline (5d)





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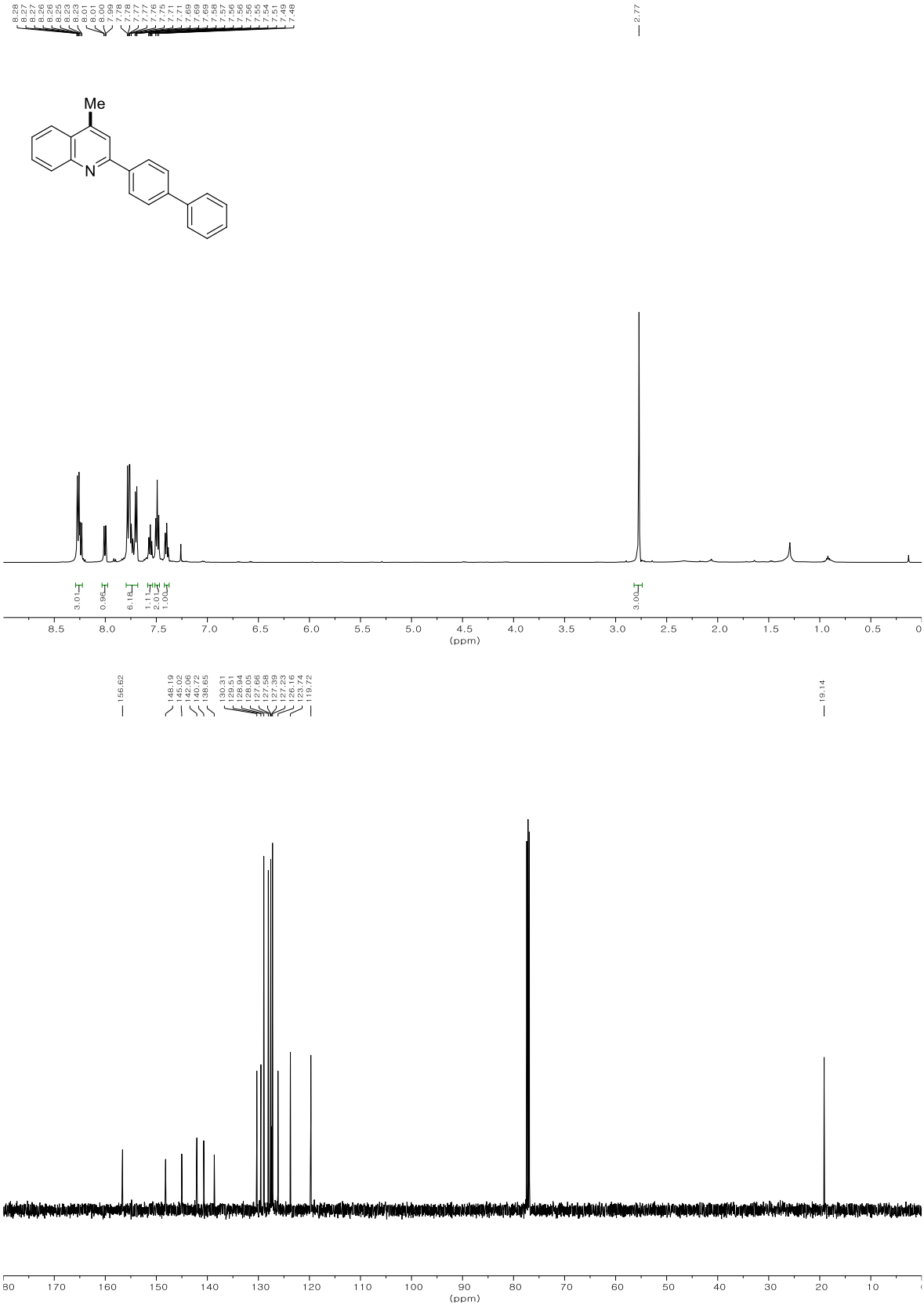
2-([1,1'-Biphenyl]-4-yl)-4-methylquinoline (5e)



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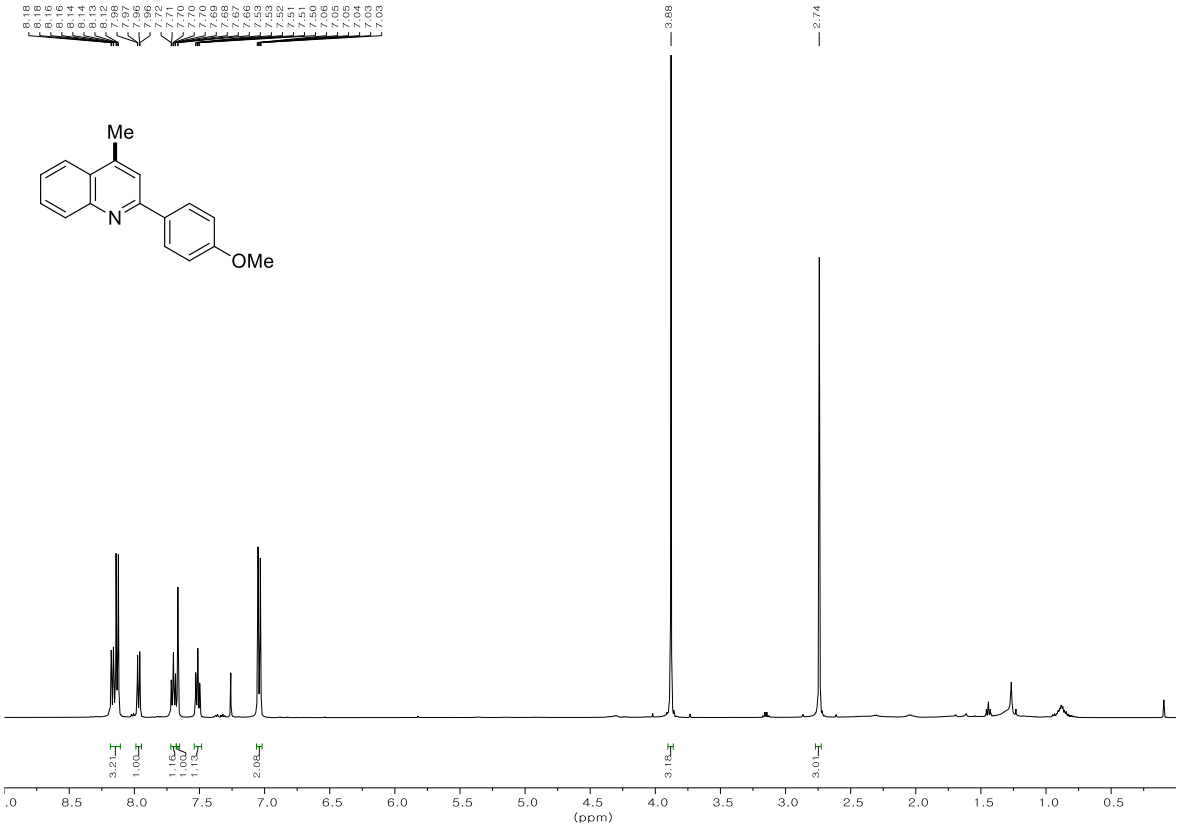

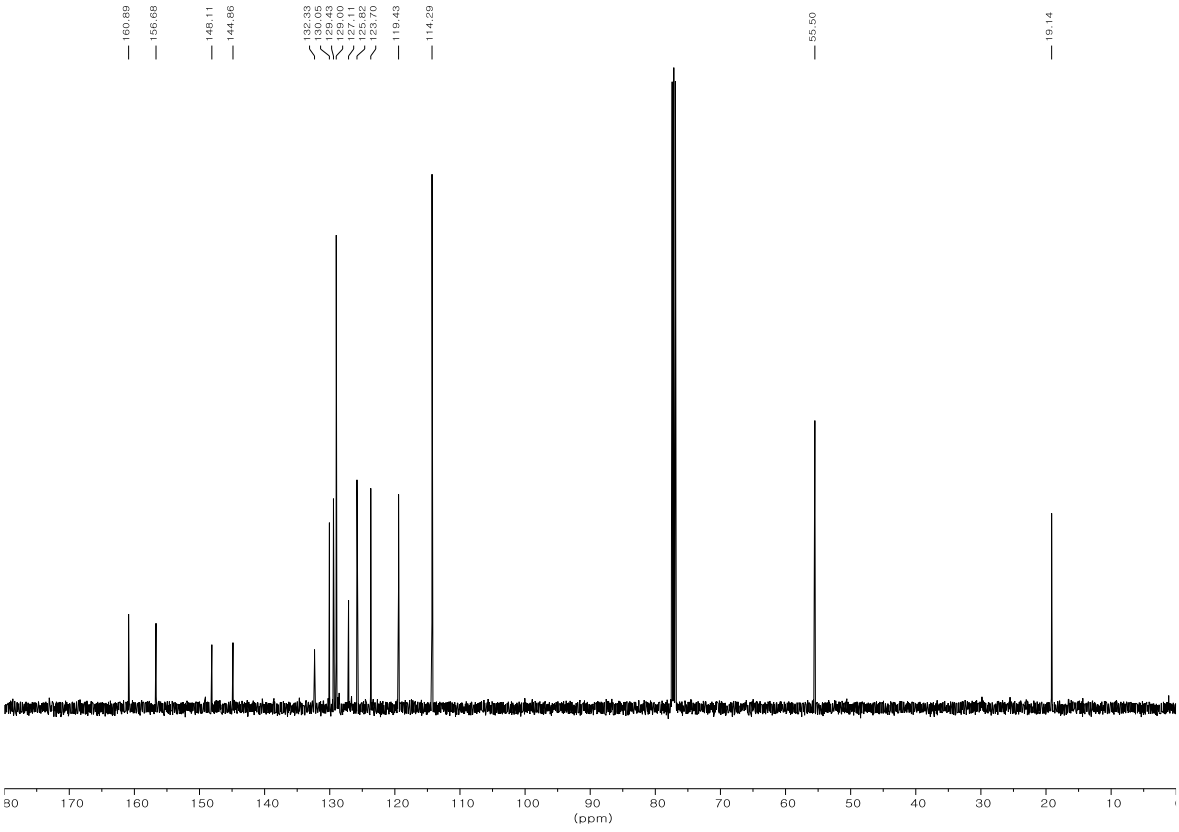

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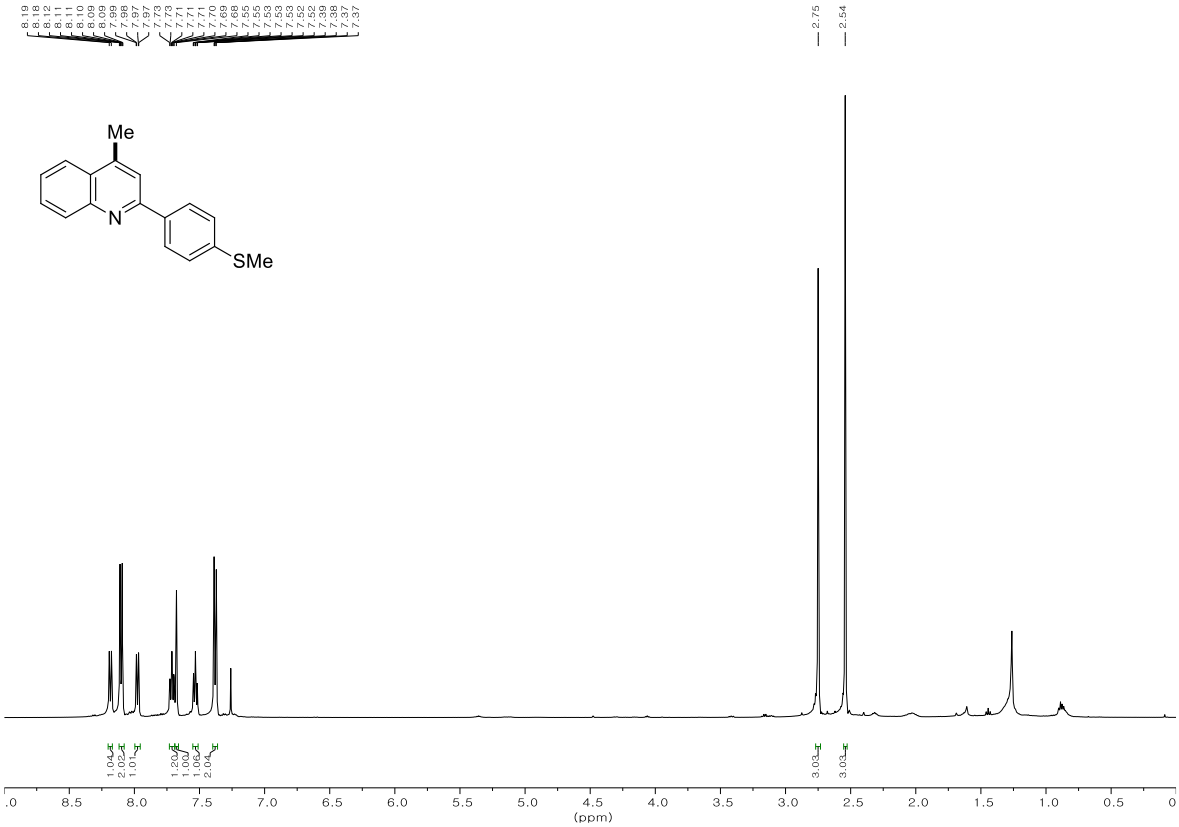
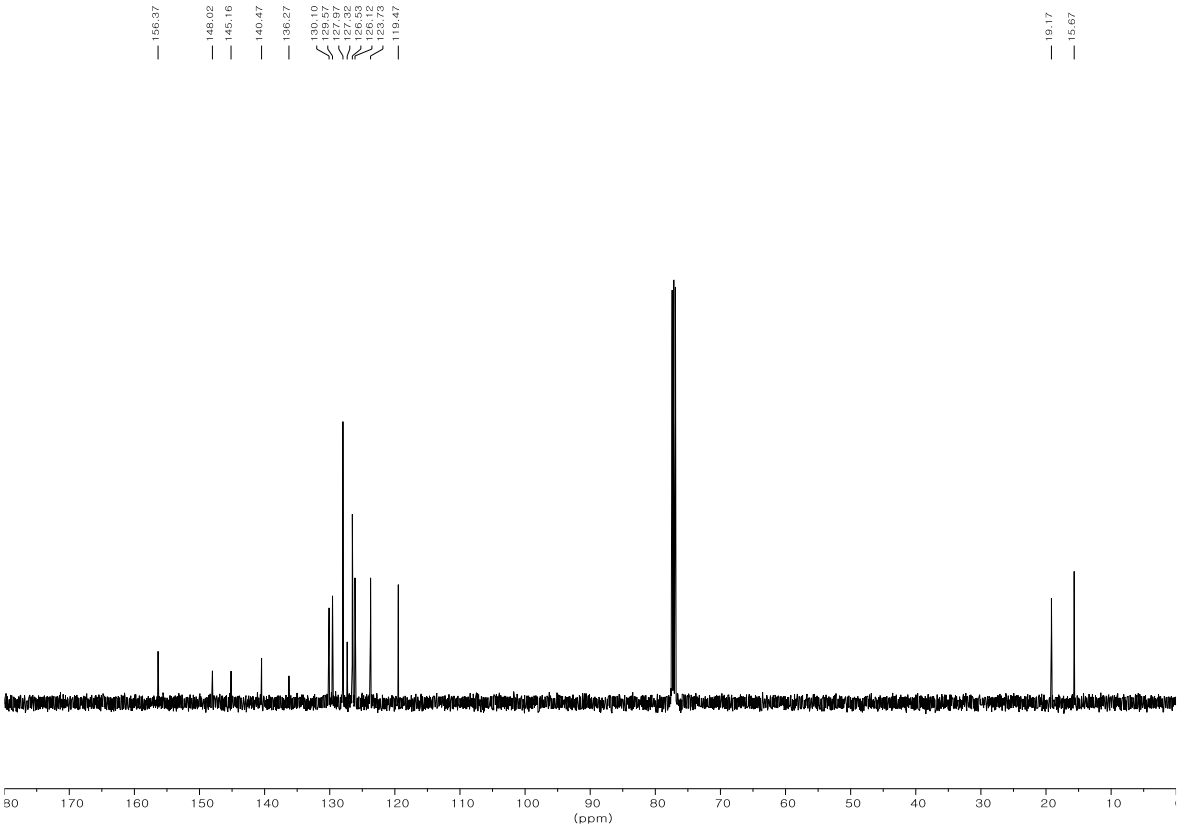
4-Methyl-2-(4-(methylthio)phenyl)quinoline (5g)





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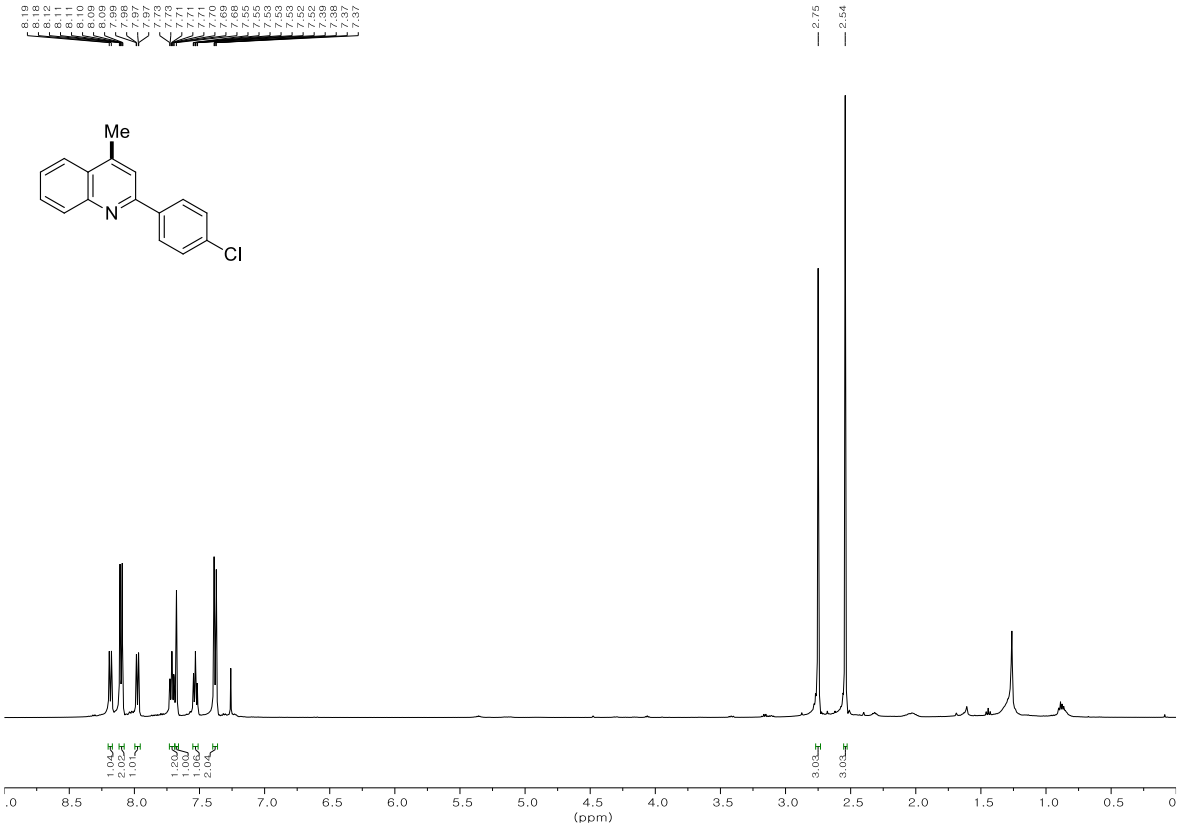

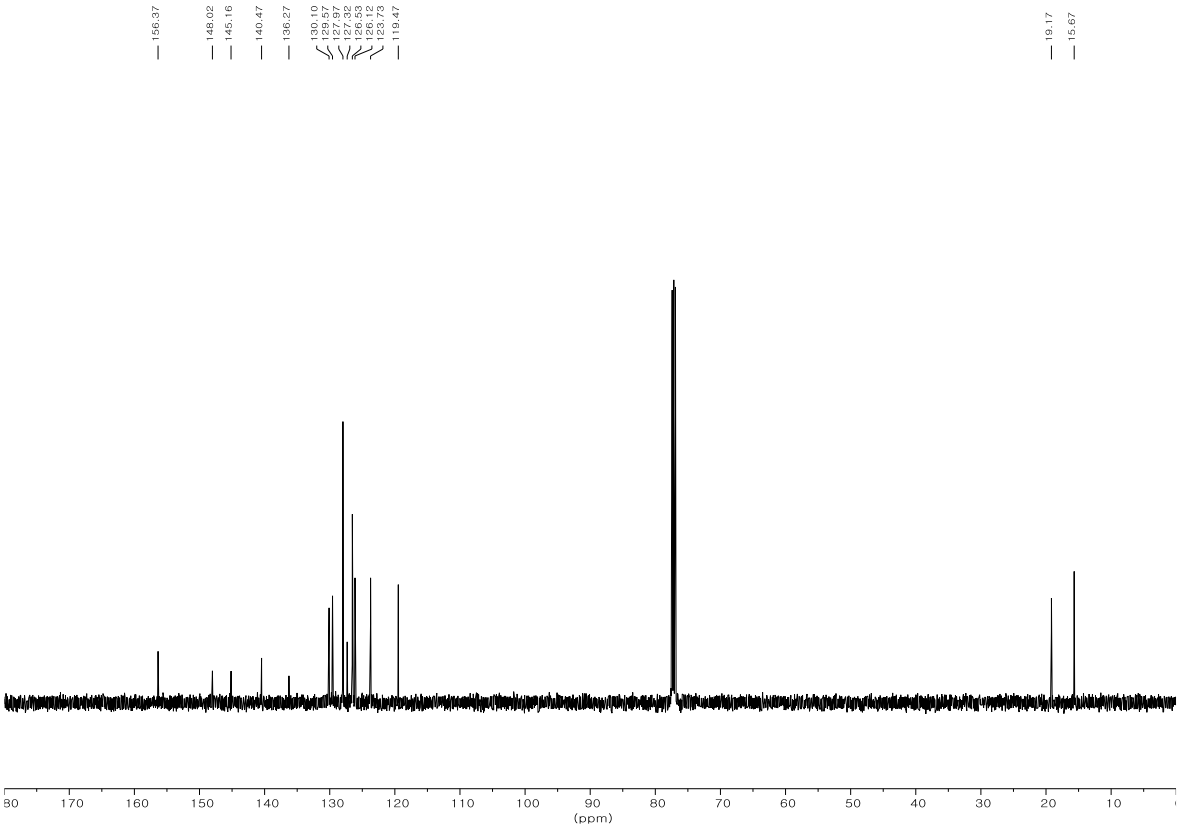

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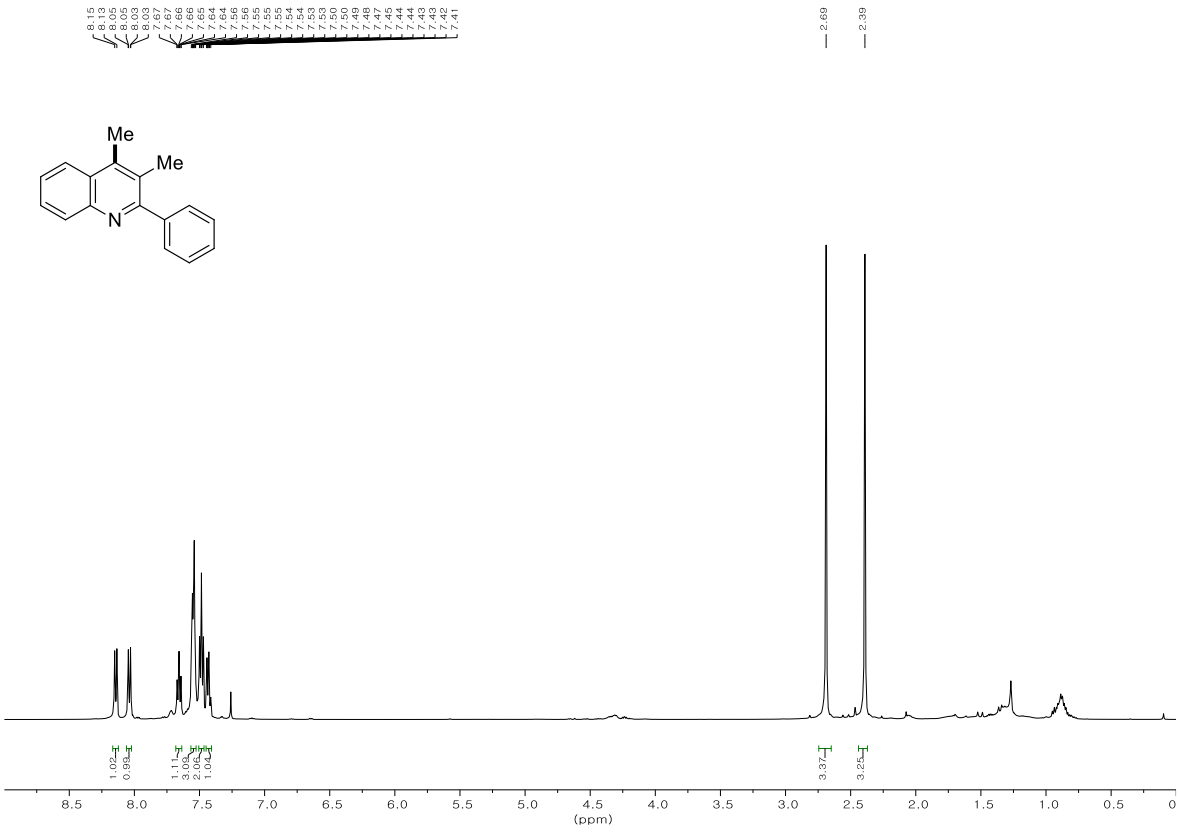
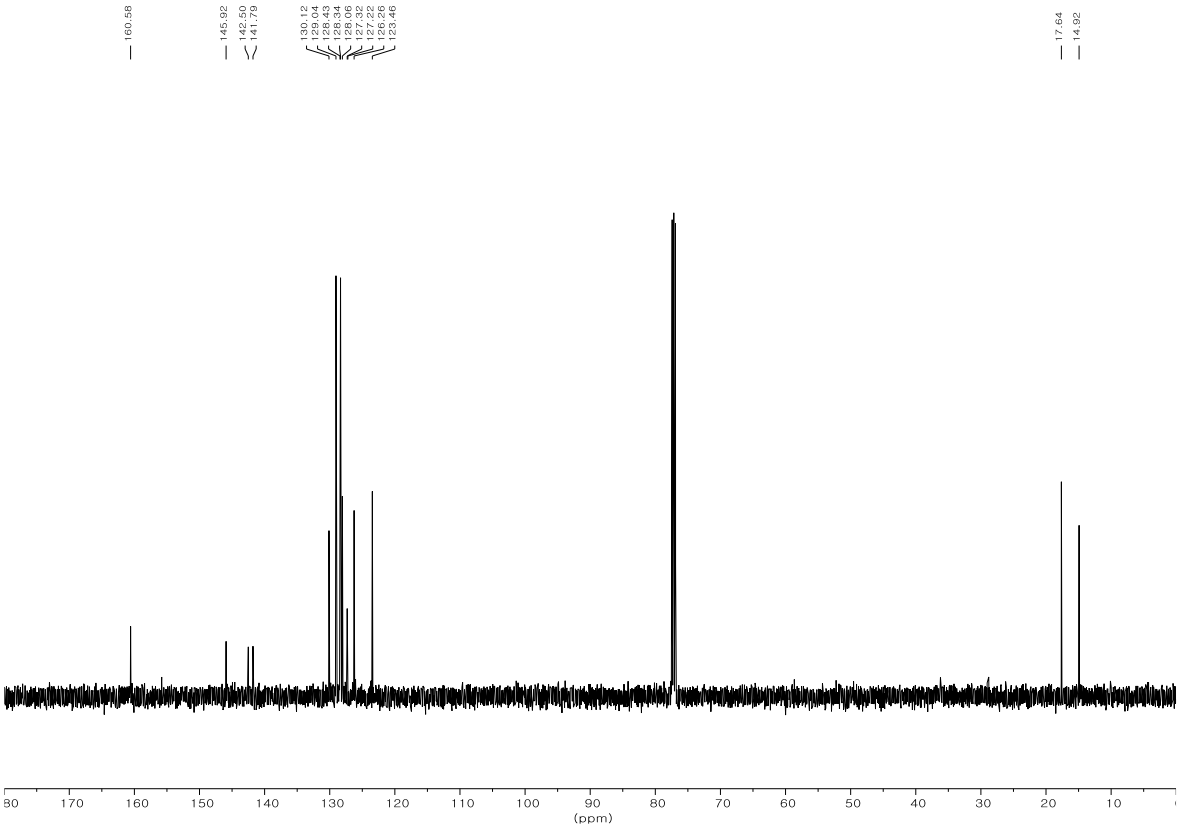
3,4-Dimethyl-2-phenylquinoline (5i)





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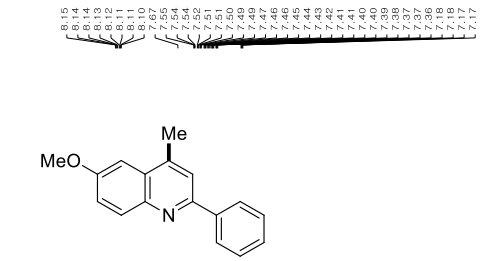

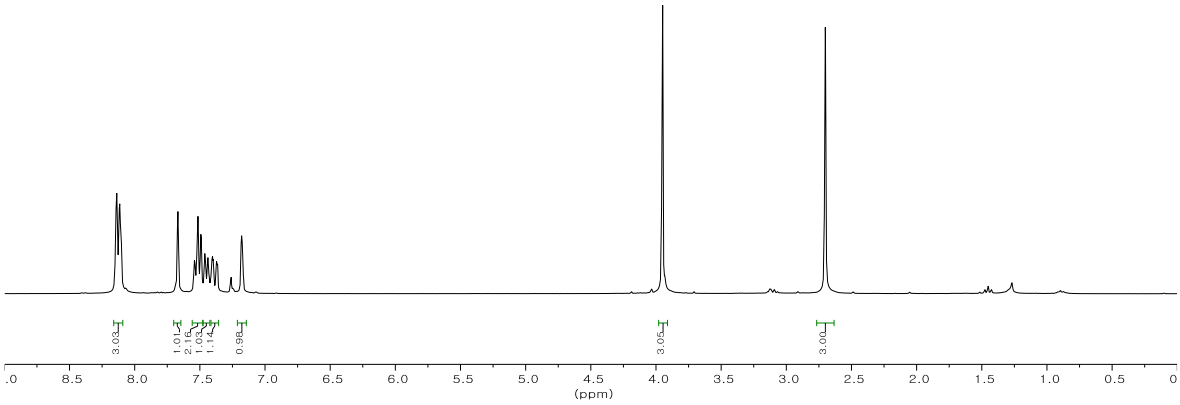

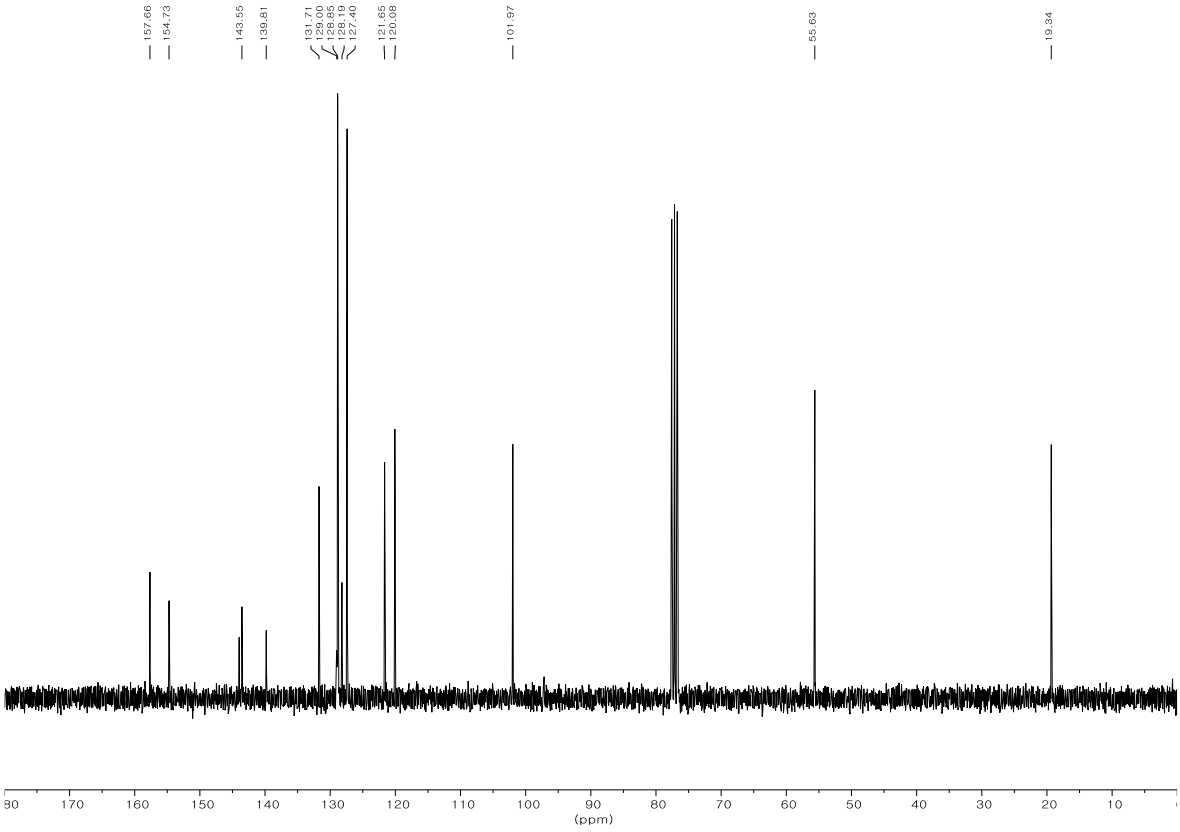

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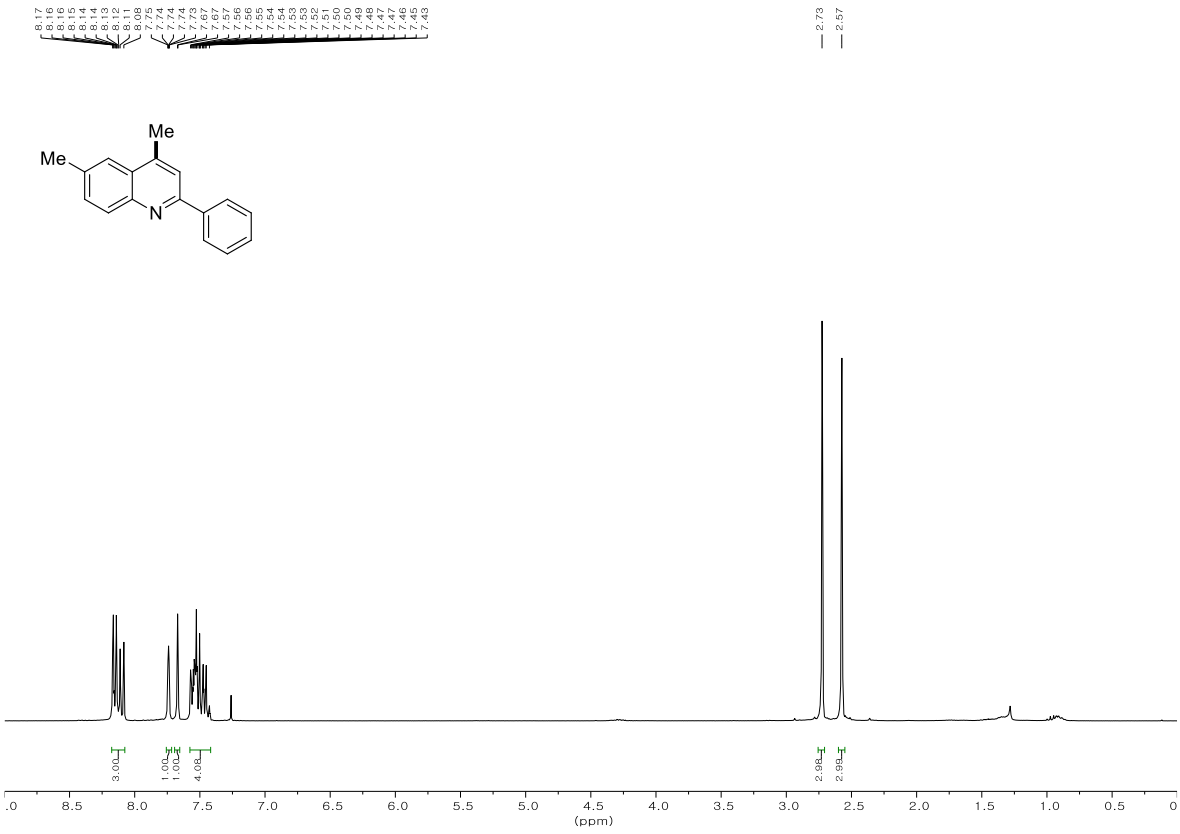
4,6-Dimethyl-2-phenylquinoline (5k)



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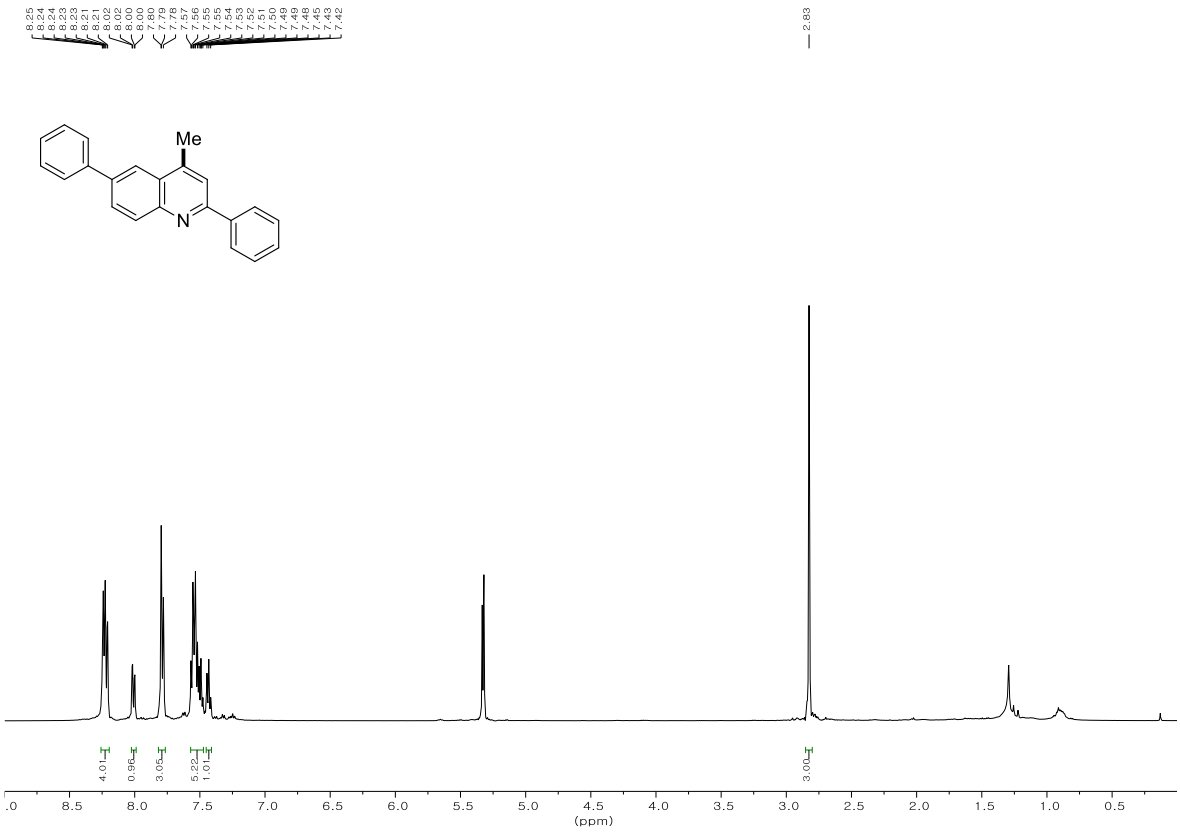
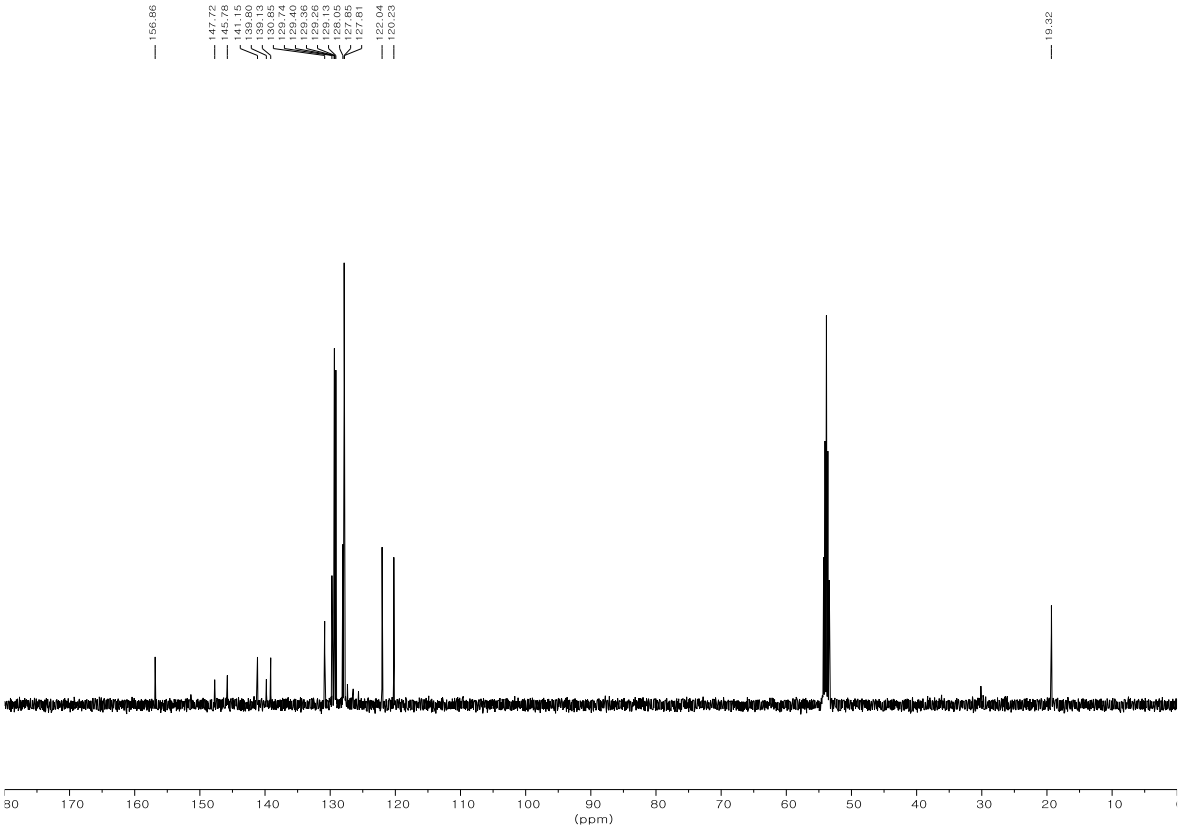
4-Methyl-2,6-diphenylquinoline (5l)





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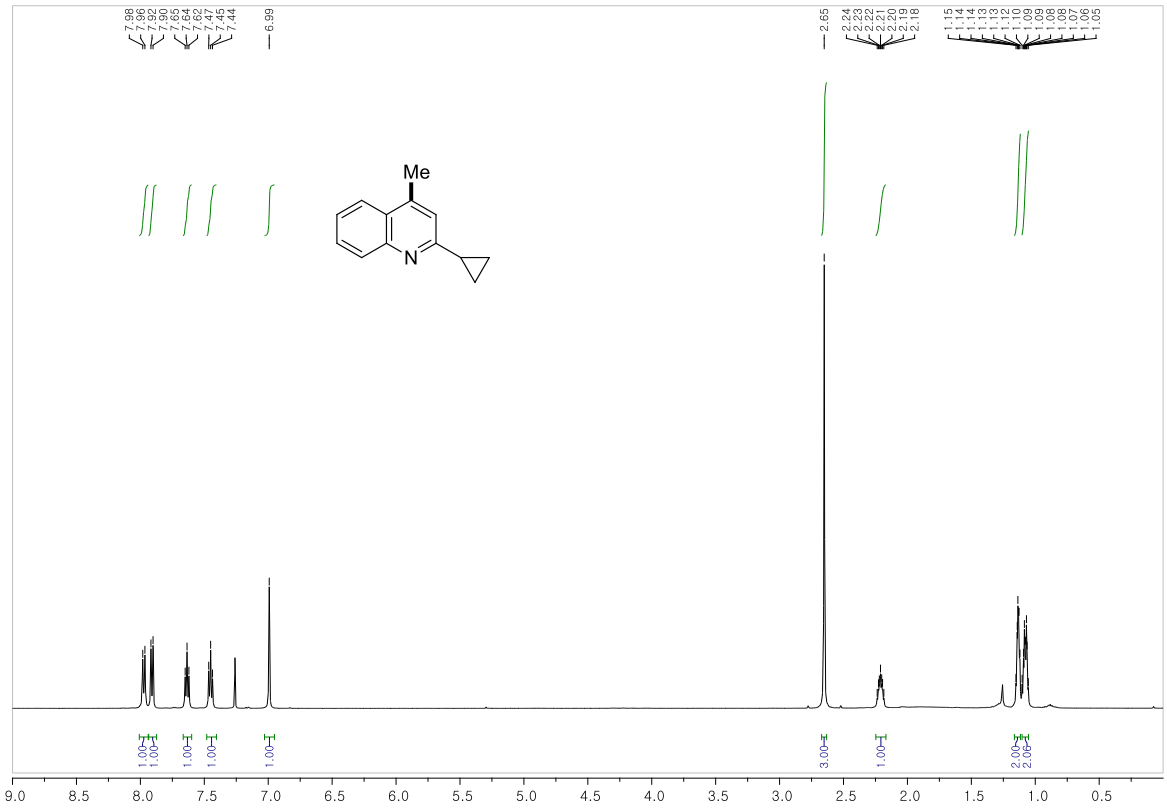
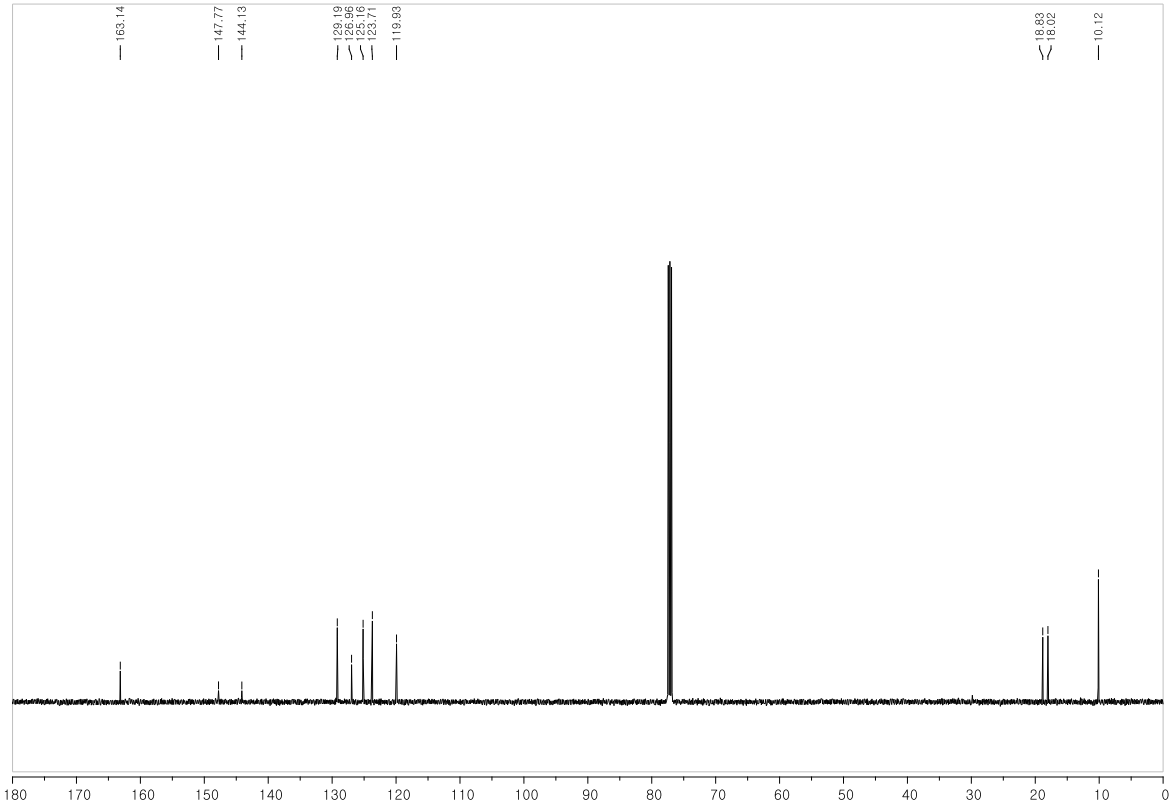
2-Cyclopropyl-4-methylquinoline (5m)





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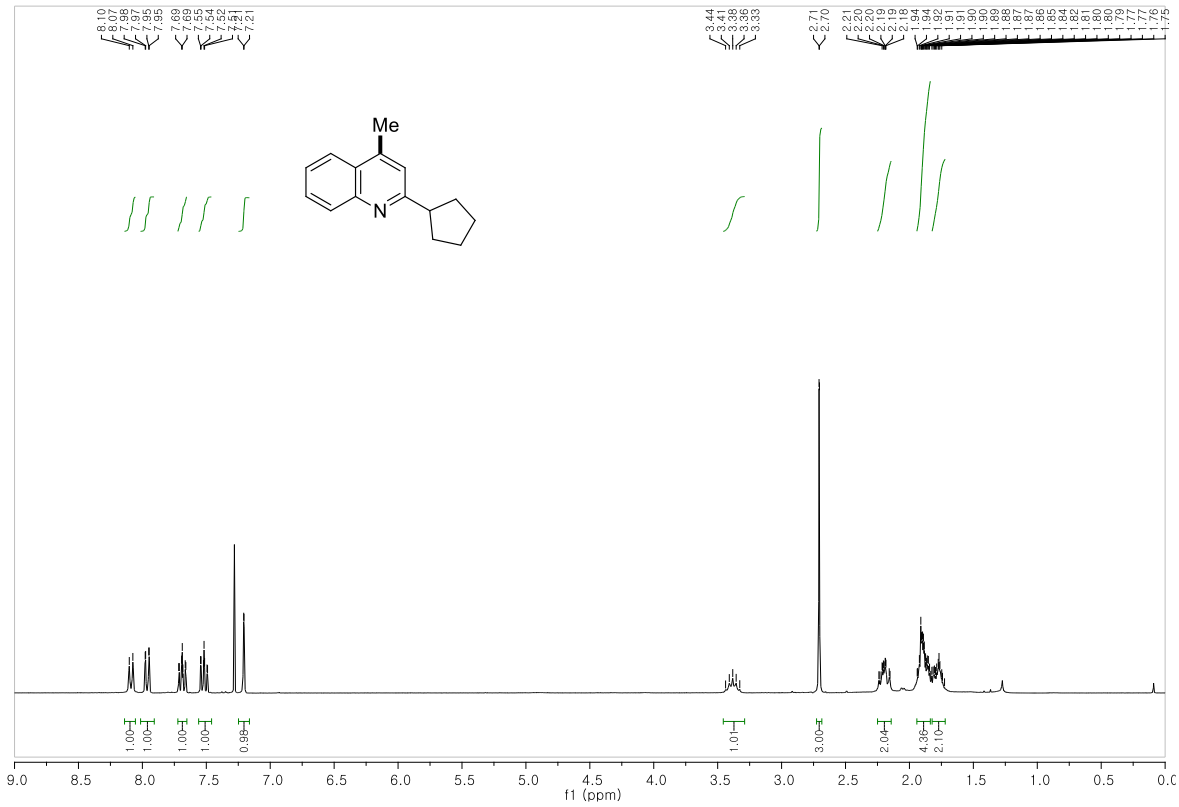
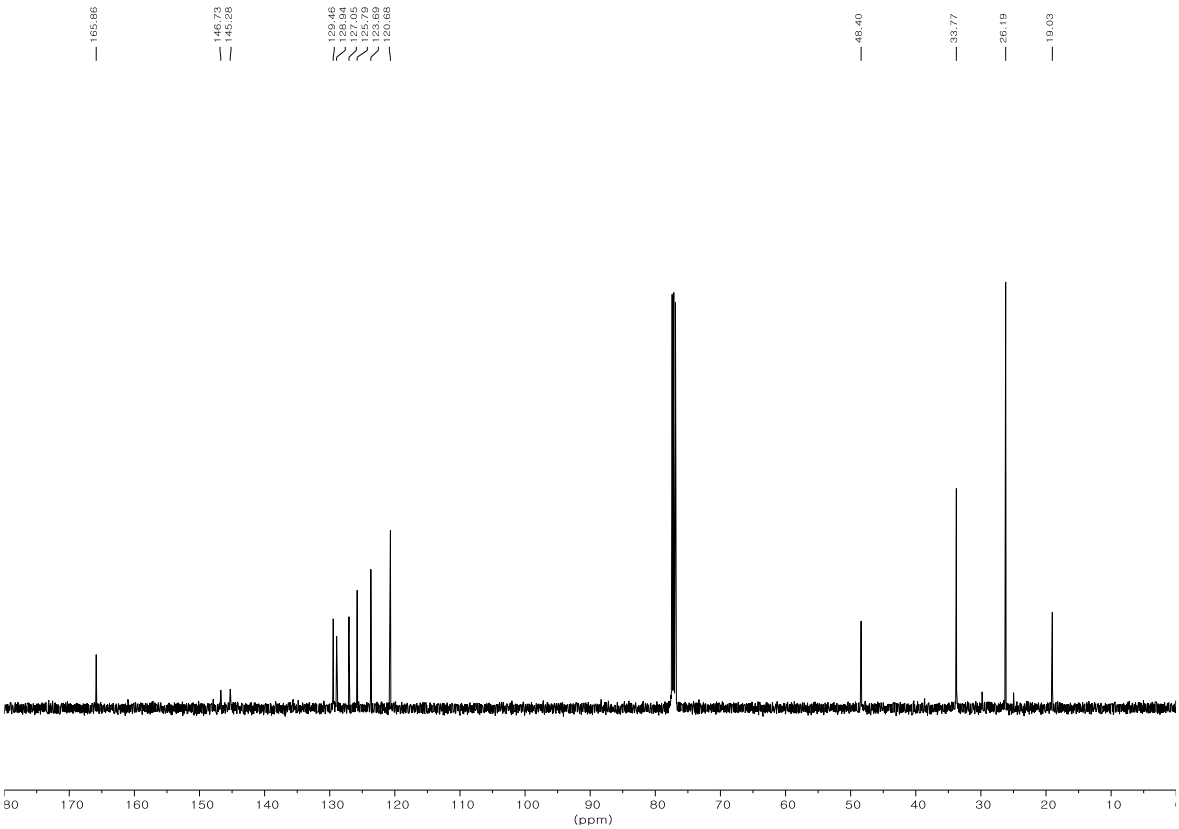
2-Cyclopentyl-4-methylquinoline (5n)





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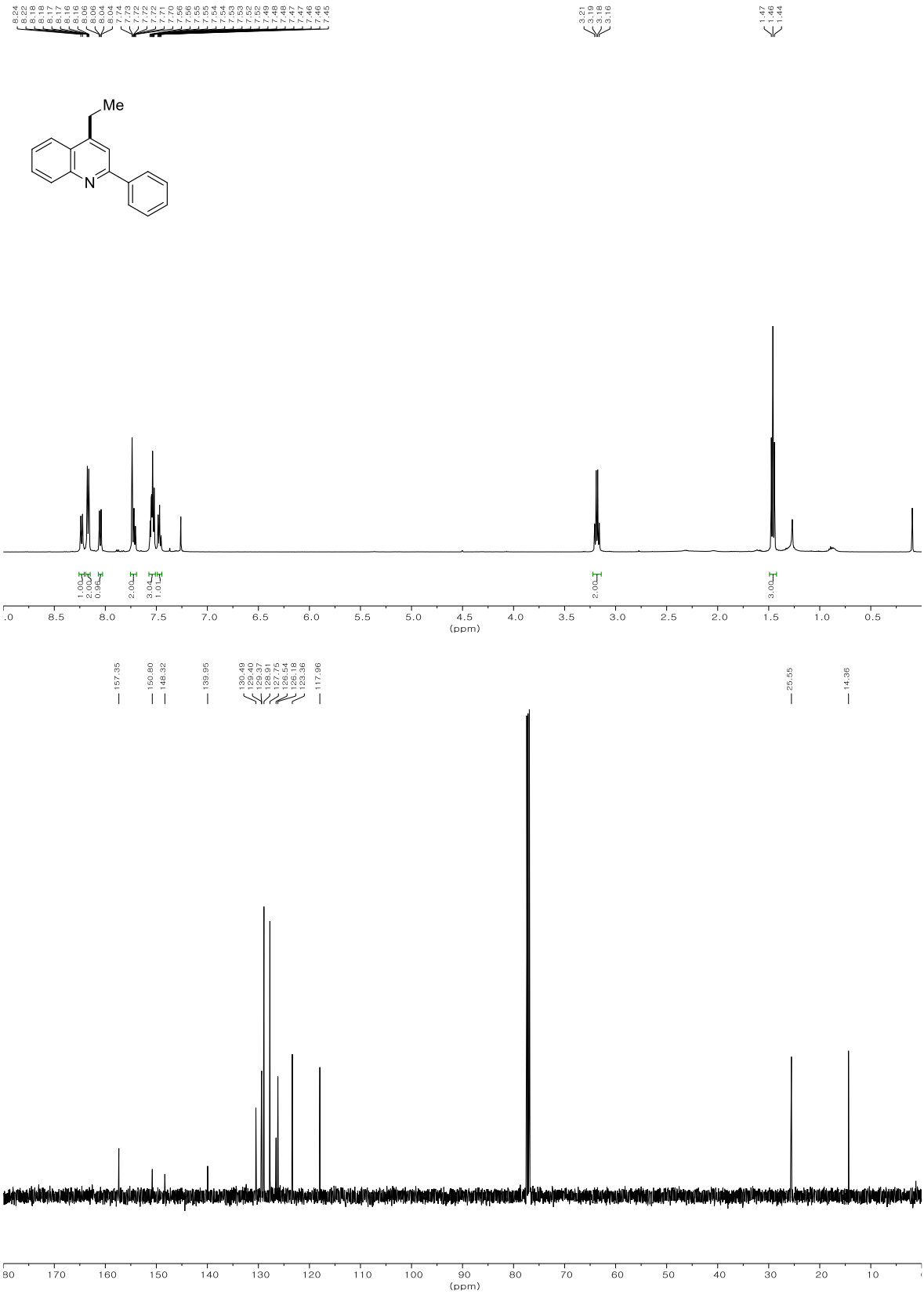
4-Ethyl-2-phenylquinoline (5o)



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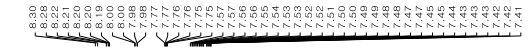
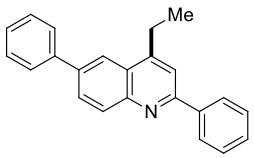
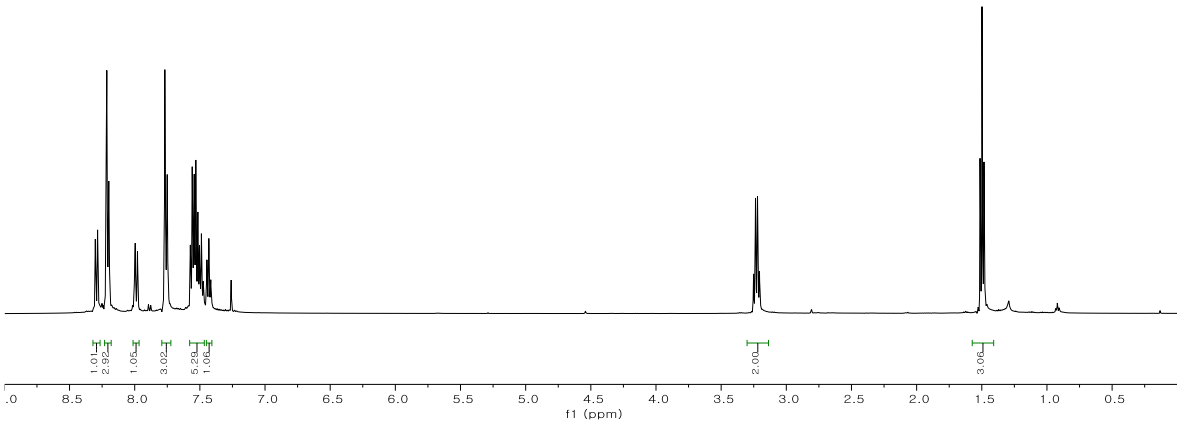
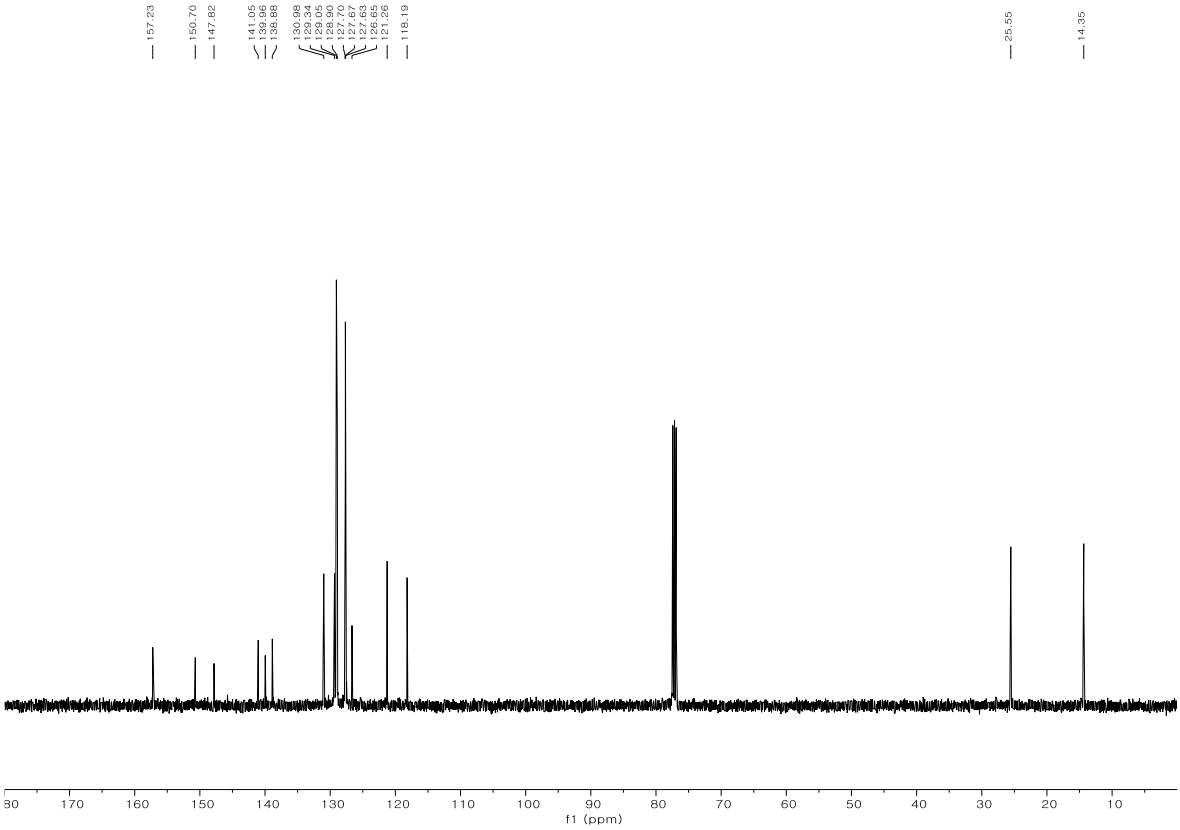
4-Ethyl-2,6-diphenylquinoline (5p)









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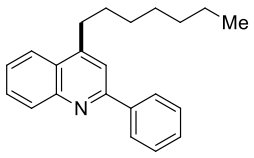
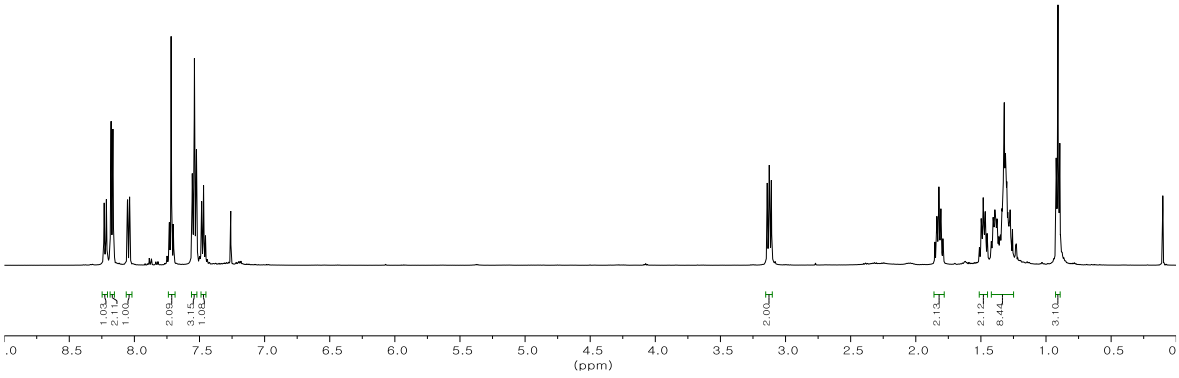
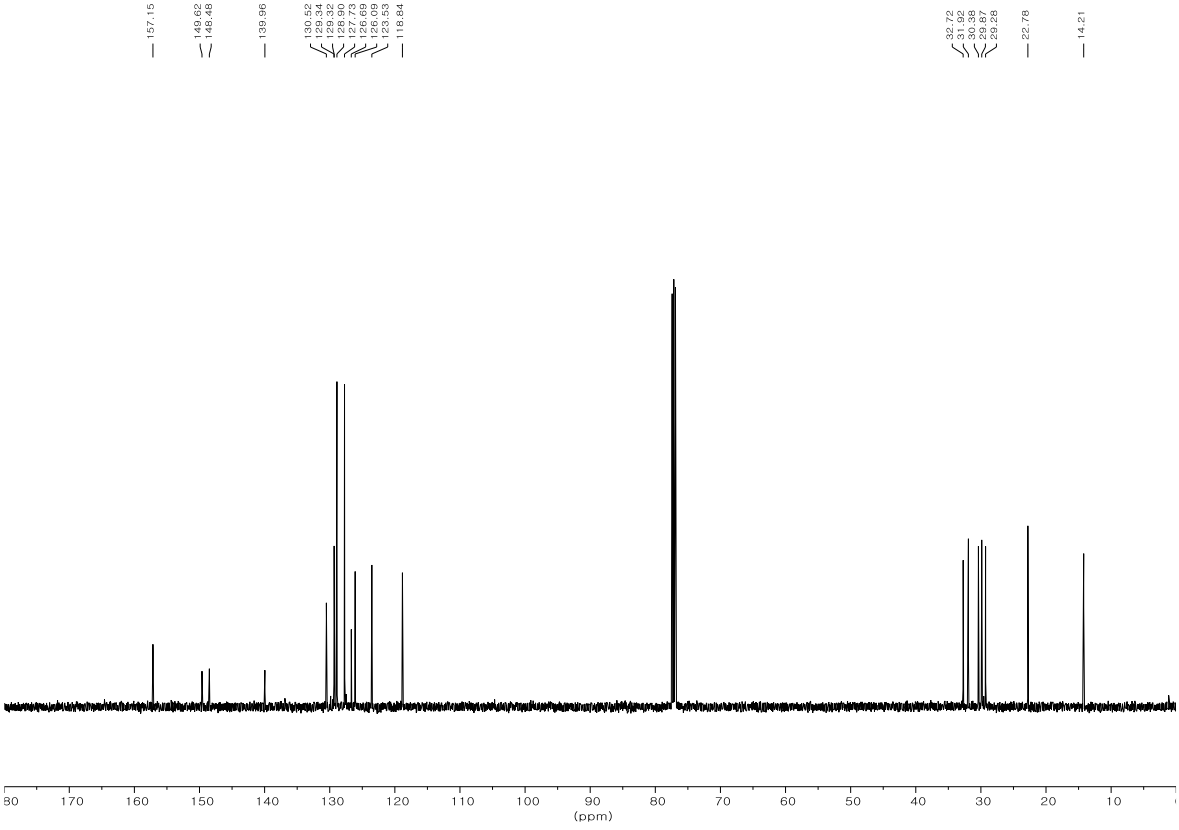
4-Hepthyl-2-phenylquinoline (5q)







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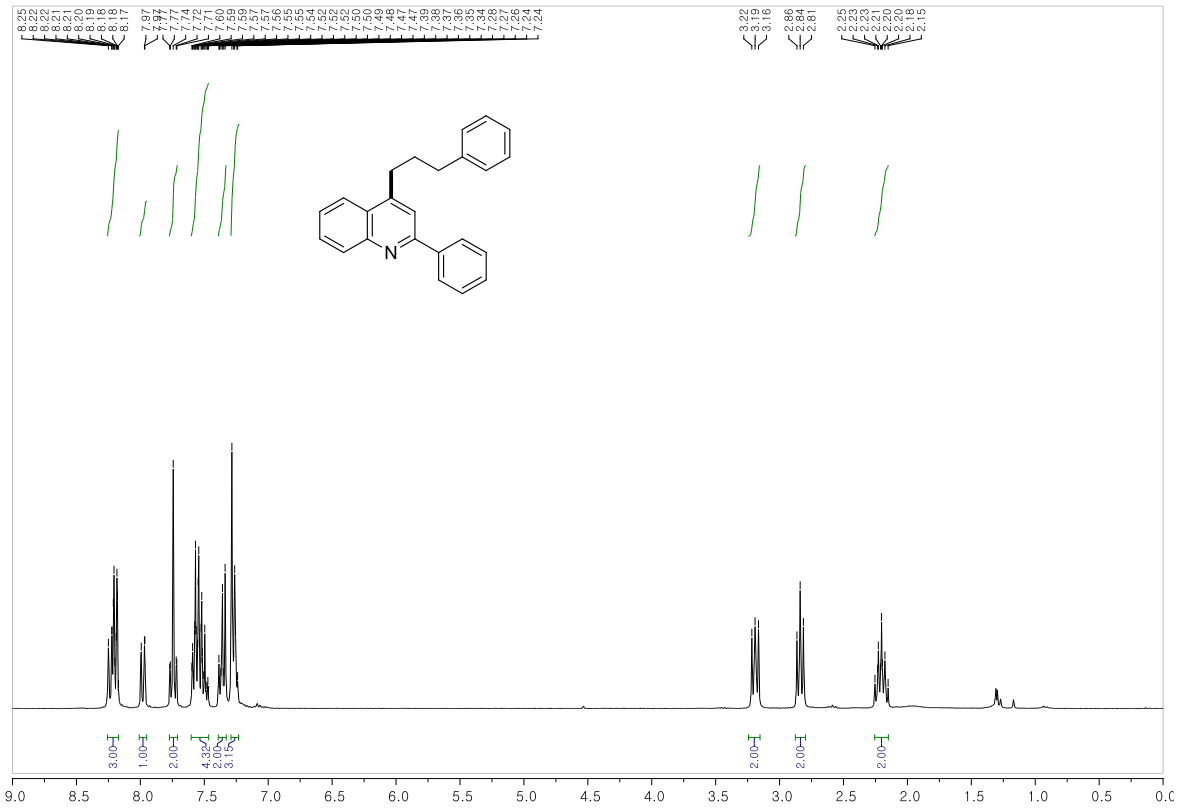
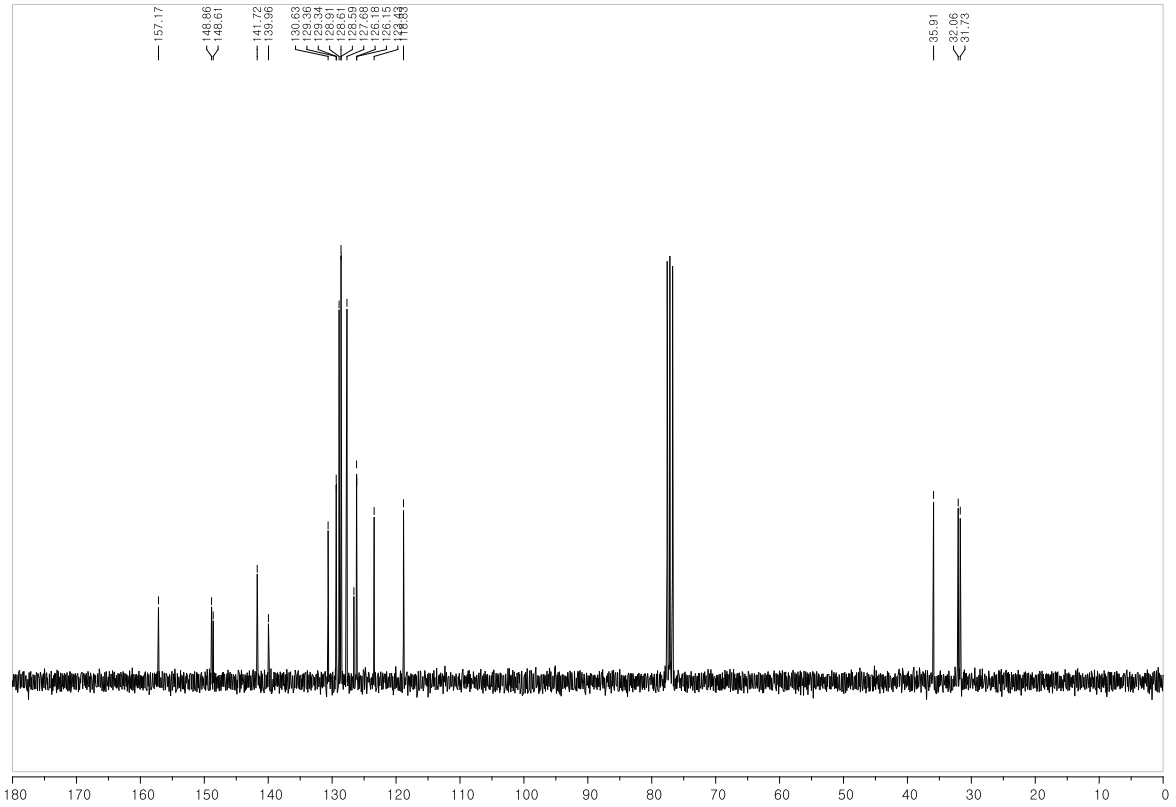
2-Phenyl-4-(3-phenylpropyl)quinoline (5r)





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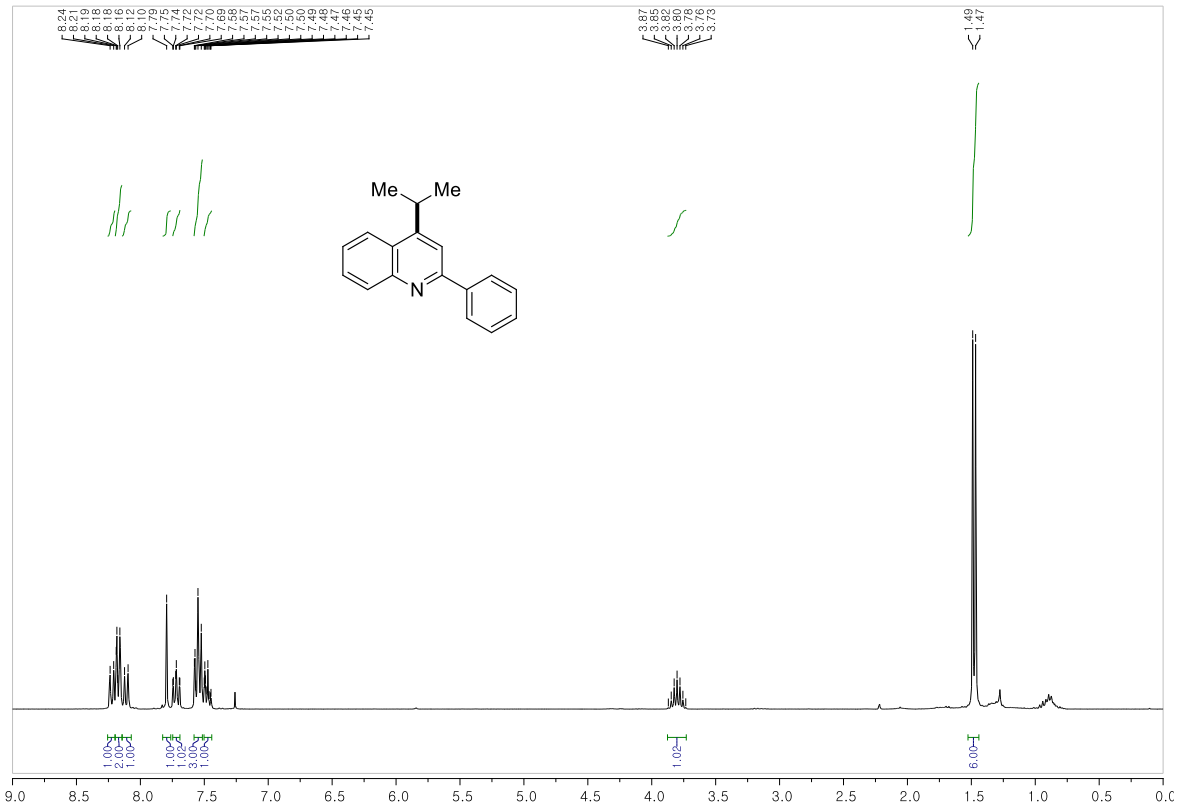
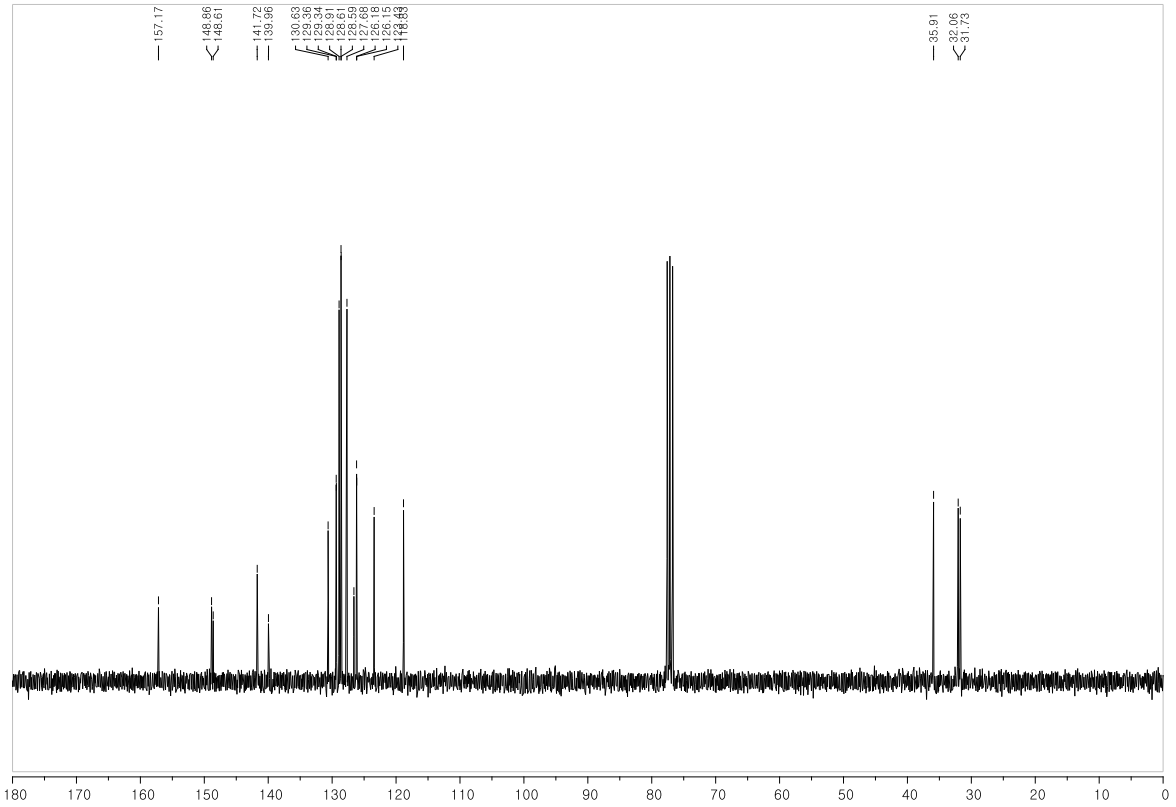
4-Isopropyl-2-phenylquinoline (5s)





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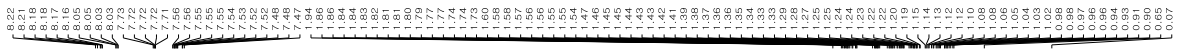

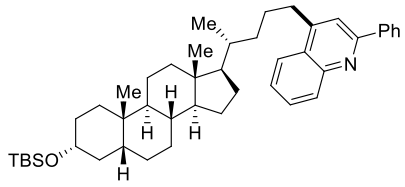

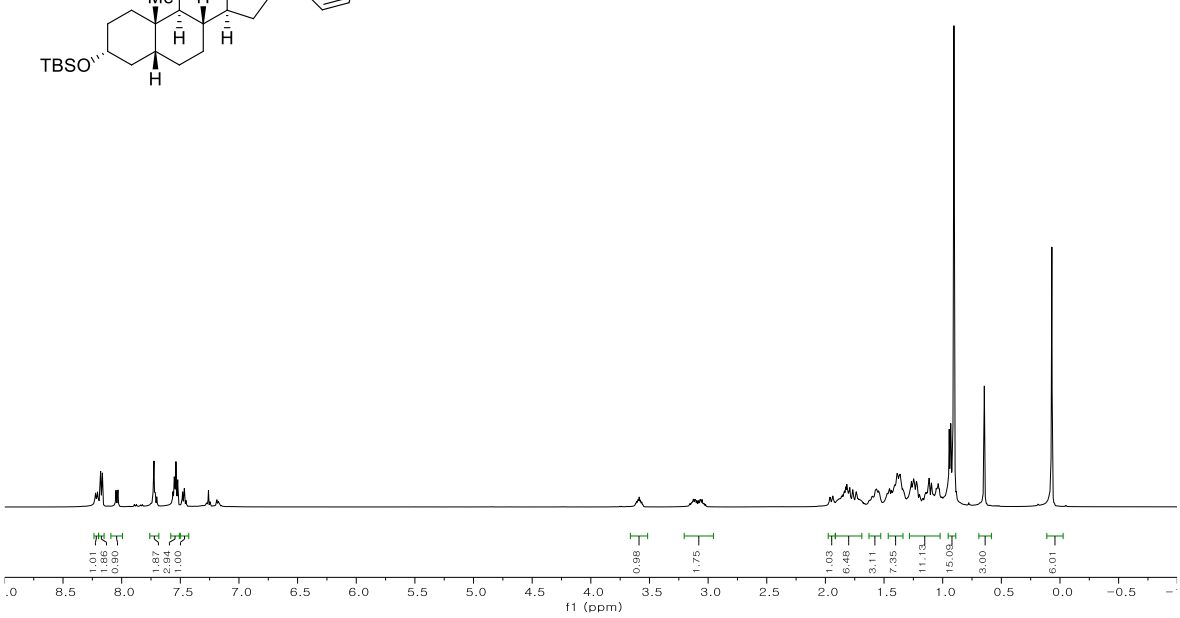

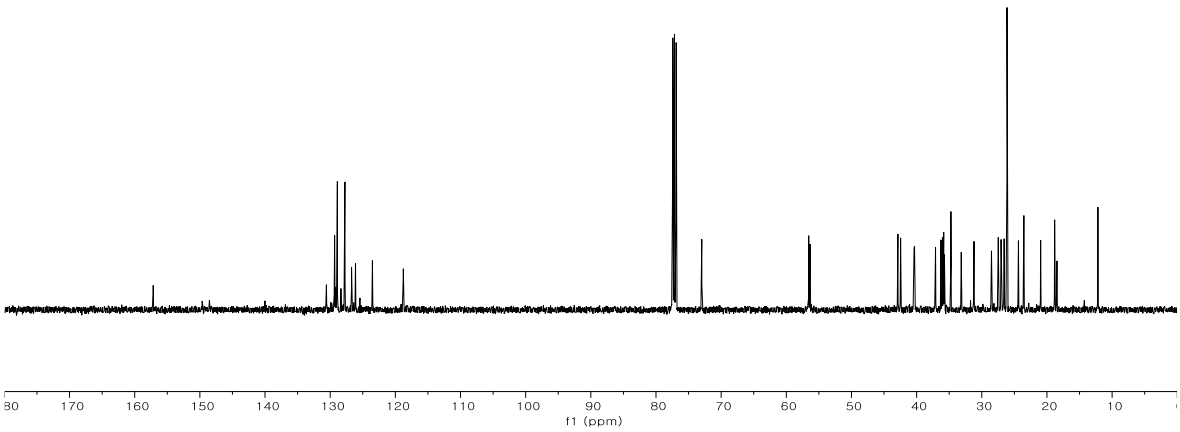

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