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Supporting Information

Transamidation via C-N Bond Cleavage of Amides and Tertiary Amines

Muhammad Aliyu Idris, Sunwoo Lee*

Department of Chemistry, Chonnam National University, Gwangju, 61186, Republic of Korea

Content

1. General Information

All reagents were purchased and used without further purification. ^{1}H spectra were recorded in $CDCl_3$ on 500 MHz NMR and 400 MHz spectrometers and data are reported as follows: chemical shift, multiplicity (s = singlet, d = doublet, t = triplet, m = multiplet), coupling constants (Hz) and integration. ^{13}C spectra were recorded in $CDCl_3$ on 126 MHz and 101 MHz NMR spectrometers and resonances (δ) are given in ppm.

2. General procedure for the synthesis of product 3 from *N*-acyl glutarimide derivatives

To a 20mL vial equipped with a stir bar added *N*-acyl glutarimide derivatives (1.0 mmol, 1.0 equiv), amine derivatives (3.0 mmol, 3.0 equiv), $PdCl_2$ (3.5 mg, 0.02 mmol, 0.02 equiv), KI (16.6 mg, 0.1 mmol, 0.1 equiv), NH_4Cl (5.4 mg, 0.1 mmol, 0.1 equiv), DTBP (292 mg, 2.0 mmol, 2.0 equiv) and anisole (5.0 mL). The reaction mixture was stirred at 100 °C for 12 h. The resulting mixture was charged to the separating funnel added water extracted with EtOAc. The organic layer was dried over anhydrous Mg_2SO_4, filtered and concentrated under vacuum. The crude product was purified by column chromatography on a silica gel column with *n*-hexane/ethyl acetate as eluent to obtain the desired product.

3. General procedure for the synthesis of 3aa in Table 2

To a 20mL vial equipped with a stir bar added amide derivatives (1.0 mmol, 1.0 equiv), triethylamine (xxx mg, 3.0 mmol, 3.0 equiv), $PdCl_2$ (3.5 mg, 0.02 mmol, 0.02 equiv), KI (16.6 mg, 0.1 mmol, 0.1 equiv), NH_4Cl (5.4 mg, 0.1 mmol, 0.1 equiv), DTBP (292 mg, 2.0 mmol, 2.0 equiv) and anisole (5.0 mL). The reaction mixture was stirred at 100 °C for 12 h. The resulting mixture was charged to the separating funnel added water extracted with EtOAc. The organic layer was dried over anhydrous Mg_2SO_4, filtered and concentrated under vacuum. The crude product was purified by column chromatography on a silica gel column with *n*-hexane/ethyl acetate as eluent to obtain the desired product 3aa.

N-phenyl-*N*-tosylbenzamide (4) (351 mg, 1.0 mmol) afforded 3aa (158 mg, 0.89 mmol, 89%).

tert-butyl benzoyl(phenyl)carbamate (5) (297 mg, 1.0 mmol) afforded 3aa (234 mg, 0.70 mmol, 70%).

2-benzoylbenzo[d]isothiazol-3(2H)-one 1,1-dioxide (6) (287 mg, 1.0 mmol) afforded 3aa (71 mg, 0.40 mmol, 40%).

4. Experiment Data

***N,N*-Diethylbenzamide (3aa)**:[1] 1-Benzoylpiperidine-2,6-dione (217 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethylbenzamide (**3a**) (162.8 mg, 0.92 mmol, 92% yield) as a yellow

oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41 – 7.35 (m, 5H), 3.55 (br s, 2H), 3.26 (br s, 2H), 1.25 (br s, 3H), 1.11 (br s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.3, 137.3, 129.1, 128.4, 126.3, 43.3, 39.2, 14.2, 12.9.

***N,N*-Diethyl-3-methylbenzamide (3ba)**:[1] 1-(3-methylbenzoyl)piperidine-2,6-dione (231 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethyl-3-methylbenzamide (**3ba**) (162 mg, 0.85 mmol, 85% yield) as a yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.26 (d, J = 7.7 Hz, 1H), 7.22 – 7.17 (m, 2H), 7.14 (d, J = 7.5 Hz, 1H), 3.54 (br s, 2H), 3.26 (br s, 2H), 2.37 (br s, 3H), 1.24 (br s, 3H), 1.10 (br s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.6, 138.2, 137.1, 129.8, 128.2, 126.9, 123.2, 43.3, 39.2, 21.4, 14.2, 12.9.

***N,N*-Diethyl-4-methylbenzamide (3ca)**:[1] 1-(4-methylbenzoyl)piperidine-2,6-dione (231 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethyl-4-methylbenzamide (**3ca**) (137.5 mg, 0.72 mmol, 72% yield) as a yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.28 – 7.25 (m, 2H), 7.19 (d, J = 7.8 Hz, 2H), 3.53 (br s, 2H), 3.27 (br s, 2H), 2.37 (br s, 3H), 1.22 (br s, 3H), 1.12 (br s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.5, 139.1, 134.4, 128.9, 126.4, 43.3, 39.2, 21.3, 14.2, 12.9.

4-(*tert*-Butyl)-*N,N*-diethylbenzamide (3ea):[1] 1-(4-(*tert*-butyl)benzoyl)piperidine-2,6-dione (273 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded 4-(*tert*-butyl)-*N,N*-diethylbenzamide (**3ea**) (174.7 mg, 0.75 mmol, 75% yield) as a yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.39 (d, J = 8.5 Hz, 2H), 7.30 (d, J = 8.5 Hz, 2H), 3.53 (br s, 2H), 3.28 (br s, 2H), 1.31 (s, 9H), 1.22 (br s, 3H), 1.13 (br s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 171.5, 152.2, 134.26, 126.1, 125.2, 43.3, 39.2, 34.7, 31.2, 14.3, 12.9.

***N,N*-Diethyl-3-methoxybenzamide (3fa)**:[1] 1-(3-methoxybenzoyl)piperidine-2,6-dione (247 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethyl-3-methoxybenzamide (**3fa**) (147.0 mg, 0.71 mmol, 71% yield) as a yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.30 – 7.27 (m, 1H), 6.94 – 6.88 (m, 3H), 3.81 (s, 3H), 3.53 (br s, 2H), 3.25 (br s, 2H), 1.24 (br s, 3H), 1.10 (br s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 171.0, 159.5, 138.5, 129.5, 118.37, 115.0, 111.6, 55.3, 43.2, 39.2, 14.3, 12.9.

***N,N*-Diethyl-4-methoxybenzamide (3ga)**:[1] 1-(4-methoxybenzoyl)piperidine-2,6-dione (247 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethyl-3-methoxybenzamide (**3ga**) (169.7 mg, 0.82 mmol, 82% yield) as a yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 – 7.31 (m, 2H), 6.94 – 6.85 (m, 2H), 3.82 (s, 3H), 3.42 (br s, 4H), 1.18 (br s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.2, 160.3, 129.6, 128.2, 113.6, 55.3, 43.3, 39.2, 14.1, 13.4.

4-(Chloromethyl)-*N,N*-diethylbenzamide (3ha):[2] 1-(4-(chloromethyl)benzoyl)piperidine-2,6-dione (267 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded 4-(chloromethyl)-*N,N*-diethylbenzamide (**3ha**) (126 mg, 0.56 mmol, 56% yield) as a white solid; ^{1}H NMR (500 MHz, $CDCl_3$)

δ 7.42 (d, *J* = 8.0 Hz, 2H), 7.36 (d, *J* = 8.1 Hz, 2H), 4.59 (s, 2H), 3.54 (br s, 2H), 3.25 (br s, 2H), 1.23 (br s, 3H), 1.12 (br s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.7, 138.3, 137.3, 128.6, 126.7, 45.7, 43.3, 39.3, 14.3, 12.9.

***N,N*-Diethyl-2-fluorobenzamide (3ia)**:[3] 1-(2-fluorobenzoyl)piperidine-2,6-dione (235 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethyl-2-fluorobenzamide (**3ia**) (113 mg, 0.58 mmol, 58% yield) as a light yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.38 – 7.29 (m, 2H), 7.18 (t, *J* = 7.5 Hz, 1H), 7.08 (t, *J* = 8.9 Hz, 1H), 3.57 (dd, *J* = 13.7, 6.7 Hz, 2H), 3.21 (q, *J* = 7.1 Hz, 2H), 1.25 (t, *J* = 7.1 Hz, 3H), 1.07 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 166.13, 158.0 (d, *J* = 247 Hz), 130.6 (d, *J* = 7.8 Hz), 128.4 (d, *J* = 4.0 Hz), 125.4 (d, *J* = 18.5 Hz), 124.4 (d, *J* = 3.5 Hz), 115.8 (d, *J* = 21.4 Hz), 43.01, 39.17, 13.96, 12.87.

***N,N*-Diethyl-3-fluorobenzamide (3ja)**:[4] 1-(3-fluorobenzoyl)piperidine-2,6-dione (235 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethyl-3-fluorobenzamide (**3ja**) (152.0 mg, 0.78 mmol, 78% yield) as a light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 – 7.32 (m, 1H), 7.17 – 7.04 (m, 3H), 3.54 (br s, 2H), 3.25 (br s, 2H), 1.24 (br s, 3H), 1.12 (br s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.73, 162.5 (d, *J* = 248.4 Hz), 139.2 (d, *J* = 6.8 Hz), 130.2 (d, *J* = 8.1 Hz), 121.9 (d, *J* = 3.2 Hz), 116.1 (d, *J* = 21.3 Hz), 113.6 (d, *J* = 22.8 Hz), 43.25, 39.33, 14.18, 12.83.

***N,N*-Diethyl-4-fluorobenzamide (3ka)**:[1] 1-(4-fluorobenzoyl)piperidine-2,6-dione (235 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethyl-4-fluorobenzamide (**3ka**) (169.6 mg, 0.87 mmol, 87% yield) as a yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44 – 7.33 (m, 2H), 7.08 (ddd, *J* = 8.8, 5.8, 2.4 Hz, 2H), 3.53 (br s, 2H), 3.27 (br s, 2H), 1.22 (br s, 3H), 1.16 (br s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 170.38, 163.1 (d, *J* = 249.6 Hz), 133.3 (d, *J* = 3.5 Hz), 128.5 (d, *J* = 8.3 Hz), 115.5 (d, *J* = 21.8 Hz), 43.34, 39.38, 14.20, 12.92.

***N,N*-Diethyl-3,4-difluorobenzamide (3la)**:[5] 1-(3,4-difluorobenzoyl)piperidine-2,6-dione (253 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethyl-3,4-difluorobenzamide (**3la**) (172.5 mg, 0.81 mmol, 81% yield) as a yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.28 – 7.09 (m, 3H), 3.51 (br s, 2H), 3.25 (br s, 2H), 1.21 (br s, 3H), 1.13 (br s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.9, 151.4 (dd, *J* = 251.4, 11.3 Hz), 149.5 (dd, *J* = 250.7, 11.3 Hz), 134.0 (t, *J* = 5.0 Hz), 122.9 (dd, *J* = 6.3, 3.8 Hz), 117.5 (d, *J* = 17.6 Hz), 116.1 (d, *J* = 17.6 Hz), 43.3, 39.5, 14.2, 12.8.

***N,N*-Diethyl-4-(trifluoromethyl)benzamide (3ma)**:[6] 1-(4-(trifluoromethyl)benzoyl)piperidine-2,6-dione (285 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethyl-4-(trifluoromethyl)benzamide (**3ma**) (174.0 mg, 0.71 mmol, 71% yield) as a colorless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.59 (d, *J* = 8.0 Hz, 2H), 7.41 (d, *J* = 7.9 Hz, 2H), 3.49 (d, *J* = 5.6 Hz, 2H), 3.15 (d, *J* = 5.5 Hz, 2H), 1.18 (d, *J* = 6.9 Hz, 3H), 1.04 (br s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.8, 140.7,

131.1 (q, *J* = 32.7 Hz), 126.3 (q, *J* = 272.2 Hz), 126.7, 125.5 (q, *J* = 3.8 Hz), 124.9, 43.3, 39.4, 14.2, 12.9.

***N,N*-Diethyl-3-iodobenzamide (3na)**:[7] 1-(3-iodobenzoyl)piperidine-2,6-dione (343 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethyl-3-iodobenzamide (**3na**) (224.0 mg, 0.74 mmol, 74% yield) as a light yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.72 (dd, *J* = 6.9, 4.5 Hz, 2H), 7.33 (d, *J* = 7.6 Hz, 1H), 7.14 (t, *J* = 7.7 Hz, 1H), 3.53 (br s, 2H), 3.24 (br s, 2H), 1.24 (br s, 3H), 1.12 (br s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.4, 139.2, 138.1, 135.14, 130.1, 125.4, 94.2, 43.3, 39.4, 14.2, 12.9.

4-Bromo-*N,N*-diethylbenzamide (3oa):[8] 1-(4-bromobenzoyl)piperidine-2,6-dione (296 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded 4-bromo-*N,N*-diethylbenzamide (**3oa**) (181.7 mg, 0.71 mmol, 71% yield) as a yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.51 (d, *J* = 8.5 Hz, 2H), 7.24 (d, *J* = 8.5 Hz, 2H), 3.51 (br s, 2H), 3.22 (br s, 2H), 1.20 (s, 3H), 1.10 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.2, 136.0, 131.6, 128.0, 123.3, 43.3, 39.4, 14.2, 12.9.

4-Chloro-*N,N*-diethylbenzamide (3pa):[8] 1-(4-chlorobenzoyl)piperidine-2,6-dione (252 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded 4-chloro-*N,N*-diethylbenzamide (**3pa**) (158.7 mg, 0.75 mmol, 75% yield) as a colorless oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.36 (d, *J* = 8.6 Hz, 2H), 7.31 (d, *J* = 8.6 Hz, 2H), 3.51 (br s, 2H), 3.24 (br s, 2H), 1.18 (s, 3H), 1.15 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.2, 135.6, 135.1, 128.7, 127.8, 43.3, 39.4, 14.1, 12.9

***N,N*-Diethyl-[1,1'-biphenyl]-4-carboxamide (3qa)**:[1] 1-([1,1'-biphenyl]-4-carbonyl)piperidine-2,6-dione (293 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethyl-[1,1'-biphenyl]-4-carboxamide (**3qa**) (152.0 mg, 0.60 mmol, 60% yield) as a yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64 – 7.58 (m, 4H), 7.48 – 7.42 (m, 4H), 7.39 – 7.34 (m, 1H), 3.57 (br s, 2H), 3.32 (br s, 2H), 1.25 (br s, 3H), 1.16 (br s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.2, 142.0, 140.4, 136.10, 128.9, 127.7, 127.1, 126.9, 43.3, 39.3, 14.4, 12.9.

***N,N*-Diethyl-2-naphthamide (3ra)**:[1] 1-(2-naphthoyl)piperidine-2,6-dione (267 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethyl-2-naphthamide (**3ra**) (161.0 mg, 0.71 mmol, 71% yield) as a yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.83 – 7.73 (m, 4H), 7.49 – 7.35 (m, 3H), 3.52 (br s, 2H), 3.23 (br s, 2H), 1.21 (br s, 3H), 1.05 (br s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.4, 134.6, 133.4, 132.8, 128.3, 128.3, 127.8, 126.8, 126.6, 125.8, 123.9, 43.42, 39.4, 14.3, 13.0

***N,N*-Diethyl-1-naphthamide (3sa)**:[9] 1-(1-naphthoyl)piperidine-2,6-dione (267 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethyl-1-naphthamide (**3sa**) (159.0 mg, 0.70 mmol, 70% yield) as a colorless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.87 – 7.84 (m, 2H), 7.82 – 7.78 (m, 1H),

7.54 – 7.46 (m, 3H), 7.40 (dd, *J* = 7.0, 1.2 Hz, 1H), 3.86 (br s, 1H), 3.54 (br s, 1H), 3.15 – 3.06 (m, 2H), 1.38 (t, *J* = 7.1 Hz, 3H), 1.00 (t, *J* = 7.1 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 170.3, 135.2, 133.5, 129.6, 128.8, 128.3, 126.9, 126.4, 125.1, 124.8, 123.2, 43.1, 39.0, 14.3, 13.1.

***N,N*-Diethyl-4-formylbenzamide (3ta)**:[8] 4-(2,6-dioxopiperidine-1-carbonyl)benzaldehyde (245 mg, 1.0 mmol) and trimethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethyl-4-formylbenzamide (**3ta**) (31.0 mg, 0.15 mmol, 15% yield) as a yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 10.04 (s, 1H), 7.93 (d, *J* = 8.2 Hz, 2H), 7.53 (d, *J* = 8.0 Hz, 2H), 3.57 (d, *J* = 6.2 Hz, 2H), 3.22 (d, *J* = 6.1 Hz, 2H), 1.26 (br s, 3H), 1.11 (br s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 191.6, 169.9, 143.0, 136.5, 129.9, 126.9, 43.2, 39.3, 14.2, 12.9.

4-Acetyl-*N,N*-diethylbenzamide (3ua):[1] 1-(4-acetylbenzoyl)piperidine-2,6-dione (259 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded 4-Acetyl-*N,N*-diethylbenzamide (**3ua**) (164.0 mg, 0.75 mmol, 75% yield) as a yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.98 (d, *J* = 8.2 Hz, 2H), 7.46 (d, *J* = 8.2 Hz, 2H), 3.55 (s, 2H), 3.21 (s, 2H), 2.62 (s, 3H), 1.25 (s, 3H), 1.10 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 197.5, 170.2, 141.6, 137.3, 128.5, 126.5, 43.2, 39.3, 26.7, 14.2, 12.9.

4-Cyano-*N,N*-diethylbenzamide (3va):[9] 4-(2,6-dioxopiperidine-1-carbonyl)benzonitrile (242 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded 4-cyano-*N,N*-diethylbenzamide (**3va**) (176.0 mg, 0.87 mmol, 87% yield)) as a colorless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (d, *J* = 8.4 Hz, 2H), 7.48 (d, *J* = 8.4 Hz, 2H), 3.56 (d, *J* = 6.6 Hz, 2H), 3.21 (d, *J* = 6.5 Hz, 2H), 1.26 (br s, 3H), 1.12 (br s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 169.2, 141.6, 132.4, 127.1, 118.2, 113.0, 43.3, 39.5, 14.2, 12.9

***N,N*-Diethyl-4-nitrobenzamide (3wa)**:[9] 1-(4-nitrobenzoyl)piperidine-2,6-dione (262 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethyl-4-nitrobenzamide (**3wa**) (193.0 mg, 0.87 mmol, 87% yield) as a yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 8.26 (d, *J* = 8.8 Hz, 2H), 7.54 (d, *J* = 8.8 Hz, 2H), 3.56 (br s, 2H), 3.20 (br s, 2H), 1.26 (br s, 3H), 1.11 (br s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 168.9, 148.1, 143.4, 127.3, 123.8, 43.3, 39.5, 14.2, 12.8.

***N,N*-Diethylfuran-2-carboxamide (3xa)**:[8] 1-(furan-2-carbonyl)piperidine-2,6-dione (207 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethylfuran-2-carboxamide (**3xa**) (142.0 mg, 0.85 mmol, 85% yield) as a colorless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 (dd, *J* = 1.7, 0.8 Hz, 1H), 6.93 (dd, *J* = 3.5, 0.8 Hz, 1H), 6.39 (dd, *J* = 3.4, 1.8 Hz, 1H), 3.48 (br s, 4H), 1.18 (br s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 158.6, 147.7, 142.5, 114.7, 110.2, 41.5, 40.3, 13.6, 11.5.

***N,N*-Diethylfuran-3-carboxamide (3ya)**:[10] 1-(furan-3-carbonyl)piperidine-2,6-dione (207 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethylfuran-3-carboxamide (**3ya**) (130.0 mg, 0.78 mmol, 78% yield) as a light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.71 (dd, *J* = 1.5, 0.9

Hz, 1H), 7.42 (t, *J* = 1.7 Hz, 1H), 6.59 (dd, *J* = 1.8, 0.8 Hz, 1H), 3.48 (d, *J* = 7.0 Hz, 4H), 1.21 (t, *J* = 7.1 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 164.2, 142.7, 121.8, 110.2, 42.9, 40.1, 14.5, 12.9.

3-Bromo-*N,N*-diethylthiophene-2-carboxamide(3za):[10]1-(3-bromothiophene-2-carbonyl)piperidine-2,6-dione (302 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded 3-Bromo-*N,N*-diethylthiophene-2-carboxamide (**3za**) (183.0 mg, 0.70 mmol, 70% yield) as a light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.31 (d, *J* = 5.2 Hz, 1H), 6.95 (d, *J* = 5.2 Hz, 1H), 3.53 (br s, 2H), 3.35 (br s, 2H), 1.20 (br s, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 162.8, 132.6, 130.0, 126.3, 109.2, 43.4, 39.7, 14.1, 12.9.

***N,N*-Dipropylbenzamide (3ab)**:[9] 1-benzoylpiperidine-2,6-dione (217 mg, 1.0 mmol) and tri-*n*-propylamine (429 mg, 3.0 mmol) afforded *N,N*-dipropylbenzamide (**3ab**) (174.0 mg, 0.85 mmol, 85% yield) as a colorless oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41 – 7.31 (m, 5H), 3.46 (br s, 2H), 3.16 (br s, 2H), 1.69 (d, *J* = 5.9 Hz, 2H), 1.52 (d, *J* = 5.9 Hz, 2H), 0.98 (br s, 3H), 0.74 (br s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.8, 137.4, 129.0, 128.4, 126.5, 50.7, 46.3, 21.9, 20.7, 11.5, 11.0.

3-Methyl-*N,N*-dipropylbenzamide (3bb):[11] 1-(3-methylbenzoyl)piperidine-2,6-dione (231 mg, 1.0 mmol) and tri-*n*-propylamine (429 mg, 3.0 mmol) afforded 3-methyl-*N,N*-dipropylbenzamide (**3bb**) (186.0 mg, 0.85 mmol, 85% yield) as a light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28 – 7.24 (m, 1H), 7.20 – 7.10 (m, 3H), 3.45 (br s, 2H), 3.16 (br s, 2H), 2.36 (s, 3H), 1.69 (d, *J* = 6.5 Hz, 2H), 1.52 (d, *J* = 6.5 Hz, 2H), 0.98 (br s, 3H), 0.75 (br s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 172.1, 138.2, 137.2, 129.7, 128.2, 127.1, 123.4, 50.7, 46.2, 21.9, 21.4, 20.7, 11.5, 11.0.

4-Methyl-*N,N*-dipropylbenzamide (3cb):[12] 1-(4-methylbenzoyl)piperidine-2,6-dione (231 mg, 1.0 mmol) and tri-*n*-propylamine (429 mg, 3.0 mmol) afforded 4-methyl-*N,N*-dipropylbenzamide (**3bb**) (160.0 mg, 0.73 mmol, 73% yield) as a light yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.25 (d, *J* = 8.1 Hz, 2H), 7.18 (d, *J* = 7.9 Hz, 2H), 3.44 (br s, 2H), 3.17 (br s, 2H), 2.37 (s, 3H), 1.67 (br s, 2H), 1.53 (br s, 2H), 0.97 (br s, 3H), 0.75 (br s, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 172.0, 139.0, 134.5, 128.9, 126.5, 50.7, 46.3, 21.9, 21.4, 20.7, 11.4, 11.1.

4-(*tert*-Butyl)-*N,N*-dipropylbenzamide (3eb): 1-(4-(*tert*-butyl)benzoyl)piperidine-2,6-dione (273 mg, 1.0 mmol) and tri-n-propylamine (429 mg, 3.0 mmol) afforded 4-(*tert*-butyl)-*N,N*-dipropylbenzamide (**3eb**) (160.0 mg, 0.73 mmol, 73% yield) as a light yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.38 (d, *J* = 8.3 Hz, 2H), 7.29 – 7.26 (m, 2H), 3.44 (br s, 2H), 3.19 (br s, 2H), 1.67 (br s, 2H), 1.54 (br s, 2H), 1.31 (s, 9H), 0.96 (br s, 3H), 0.76 (br s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 172.0, 152.1, 134.3, 126.3, 125.2, 50.7, 46.2, 34.7, 31.2, 21.9, 20.7, 11.4, 11.1. HRMS (FD) m/z cacld. for $C_{17}H_{27}NO$ $[M+H]^+$: 262.2171, found: 262.2171.

4-Cyano-*N,N*-dipropylbenzamide (3sb):[13] 4-(2,6-dioxopiperidine-1-carbonyl)benzonitrile (242 mg,

1.0 mmol) and tri-n-propylamine (429 mg, 3.0 mmol) afforded 4-cyano-*N,N*-dipropylbenzamide (**3sb**) (195.5 mg, 0.85 mmol, 85% yield) as a light yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.69 (d, *J* = 8.3 Hz, 2H), 7.45 (d, *J* = 8.3 Hz, 2H), 3.50 – 3.41 (m, 2H), 3.13 – 3.04 (m, 2H), 1.68 (dd, *J* = 14.7, 7.4 Hz, 2H), 1.51 (dd, *J* = 14.6, 7.3 Hz, 2H), 0.97 (t, *J* = 7.2 Hz, 3H), 0.74 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.7, 141.6, 132.4, 127.2, 118.2, 112.9, 50.6, 46.41, 2.9, 20.64, 11.4, 11.0.

***N,N*-Dibutylbenzamide (3ac)**:[9] 1-benzoylpiperidine-2,6-dione (217 mg, 1.0 mmol) and tri-n-butylamine (555 mg, 3.0 mmol) afforded *N,N*-dibutylbenzamide (**3ac**) (189.0 mg, 0.81 mmol, 81% yield) as a yellow oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40 – 7.32 (m, 5H), 3.49 (s, 2H), 3.18 (s, 2H), 1.64 (s, 2H), 1.48 (s, 2H), 1.41 (s, 2H), 1.13 (d, *J* = 6.5 Hz, 2H), 1.00 – 0.93 (m, 3H), 0.79 (d, *J* = 6.1 Hz, 3H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.8, 137.2, 129.1, 128.4, 126.5, 48.8, 44.5, 30.8, 29.7, 20.31, 19.7, 13.9, 13.6.

***N,N*-Dibutyl-3-fluorobenzamide (3kc)**: 1-(3-fluorobenzoyl)piperidine-2,6-dione (235 mg, 1.0 mmol) tri-n-butylamine (555 mg, 3.0 mmol) afforded *N,N*-dibutyl-3-fluorobenzamide **(3kc)** (203.5 mg, 0.81 mmol, 81% yield) as a yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.39 – 7.35 (m, 1H), 7.16 – 7.04 (m, 3H), 3.48 (br s, 2H), 3.18 (br s, 2H), 1.64 (br s, 2H), 1.49 (br s, 2H), 1.40 (br s, 2H), 1.15 (d, *J* = 6.8 Hz, 2H), 0.98 (br s, 3H), 0.80 (s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.1, 162.5 (d, *J* = 248.3 Hz), 139.3 (d, *J*= 6.8 Hz), 130.2 (d, *J* = 8.1 Hz), 122.1 (d, *J* = 3.2 Hz), 116.0 (d, *J* = 21.1 Hz), 113.8 (d, *J* = 22.8 Hz), 48.7, 44.5, 30.9, 29.6, 20.3, 19.7, 13.9, 13.6. HRMS (FD) m/z cacld. for $C_{15}H_{22}FNO$ $[M]^+$: 252.1764, found: 252.1763.

***N,N*-Dibutyl-4-fluorobenzamide (3lc)**:[14] 1-(3-fluorobenzoyl)piperidine-2,6-dione (235 mg, 1.0 mmol) tri-n-butylamine (555 mg, 3.0 mmol) afforded *N,N*-diethyl-4-fluorobenzamide (**3lc**) (191.0 mg, 0.76 mmol, 76% yield) as a yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.35 (dd, *J* = 8.6, 5.4 Hz, 2H), 7.06 (t, *J* = 8.7 Hz, 2H), 3.46 (br s, 2H), 3.18 (br s, 2H), 1.62 (br s, 2H), 1.47 (br s, 2H), 1.38 (br s, 2H), 1.13 (br s, 2H), 0.96 (br s, 3H), 0.79 (br s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.7, 162.9 (d, *J* = 249.2 Hz), 133.4 (d, *J* = 3.6 Hz), 128.6 (d, *J* = 8.4 Hz), 115.4 (d, *J* = 21.7), 48.9, 44.6, 30.8, 29.6, 20.3, 19.72, 13.9, 13.6.

***N,N*-Dibutyl-3,4-difluorobenzamide (3mc)**: 1-(3,4-difluorobenzoyl)piperidine-2,6-dione (253 mg, 1.0 mmol) tri-n-butylamine (555 mg, 3.0 mmol) afforded *N,N*-dibutyl-3,4-difluorobenzamide **(3mc)** (204.0 mg, 0.76 mmol, 76% yield) as a yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.22 – 7.15 (m, 2H), 7.11 – 7.07 (m, 1H), 3.45 (br s, 2H), 3.17 (br s, 2H), 1.61 (br s, 2H), 1.47 (br s, 2H), 1.37 (br s, 2H), 1.14 (br s, 2H), 0.96 (br s, 3H), 0.80 (br s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 169.3, 151.4 (dd, *J* = 252.0, 11.3 Hz), 149.4 (dd, *J* = 250.7, 11.3), 134.1 (t, *J* = 5.0 Hz), 123.0 (dd, *J* = 6.3, 3.8 Hz), 117.4 (d, *J* = 17.6 Hz), 116.2 (d, *J* = 18.9 Hz), 48.8, 44.7, 30.8, 29.5, 20.3, 19.7, 13.9, 13.6. HRMS (FD) m/z

cacld. for $C_{15}H_{21}F_2NO$ $[M+H]^+$: 270.1669, found: 270.1669.

***N,N*-Dibutyl-4-(trifluoromethyl)benzamide (3nc)**:[15] 1-(4-(trifluoromethyl)benzoyl)piperidine-2,6-dione (285 mg, 1.0 mmol) tri-n-butylamine (555 mg, 3.0 mmol) afforded *N,N*-dibutyl-4-(trifluoromethyl)benzamide (**3nc**) (235.0 mg, 0.78 mmol, 78% yield) as a yellow oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.65 (d, J = 8.0 Hz, 2H), 7.46 (d, J = 7.9 Hz, 2H), 3.52 – 3.45 (m, 2H), 3.18 – 3.11 (m, 2H), 1.69 – 1.61 (m, 2H), 1.52 – 1.45 (m, 2H), 1.39 (dd, J = 14.8, 7.4 Hz, 2H), 1.13 (dd, J = 14.7, 7.3 Hz, 2H), 0.97 (t, J = 7.2 Hz, 3H), 0.78 (t, J = 7.2 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 170.1, 140.9, 131.0 (q, J = 32.8 Hz), 126.8, 126.0 (q, J = 273.4 Hz), 125.4 (q, J = 3.8 Hz), 48.7, 44.5, 30.8, 29.6, 20.3, 19.7, 13.9, 13.6.

***N,N*-Dioctylbenzamide (3ad)**:[14] 1-benzoylpiperidine-2,6-dione (217 mg, 1.0 mmol) and tri-n-octylamine (1.0g, 3.0 mmol) afforded *N,N*-dioctylbenzamide (**3ad**) (273.0 mg, 0.79 mmol, 79% yield) as a light brown oil; ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 – 7.32 (m, 5H), 3.54 – 3.39 (m, 2H), 3.26 – 3.10 (m, 2H), 1.65 (br s, 2H), 1.48 (br s, 2H), 1.34 – 1.13 (m, 20H), 0.87 (d, J = 6.8 Hz, 6H); ^{13}C NMR (101 MHz, $CDCl_3$) δ 171.6, 137.4, 129.0, 128.3, 126.5, 49.0, 44.7, 31.9, 31.7, 29.5, 29.4, 29.3, 29.1, 28.6, 27.6 27.1, 26.5, 22.7, 22.6, 14.1

3-Methoxy-*N,N*-dioctylbenzamide (3fd): 1-(3-methoxybenzoyl)piperidine-2,6-dione (247 mg, 1.0 mmol) and tri-n-octylamine (1.0g, 3.0 mmol) afforded 3-methoxy-*N,N*-dioctylbenzamide (**3fd**) (233.0 mg, 0.62 mmol, 62% yield) as a light brown oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.30 – 7.26 (m, 1H), 6.93 – 6.87 (m, 3H), 3.81 (s, 3H), 3.46 (br s, 2H), 3.18 (br s, 2H), 1.64 (br s, 2H), 1.49 (br s, 2H), 1.34 – 1.13 (m, 20H), 0.88 (br s, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 171.3, 159.5, 138.5, 129.5, 118.6, 114.9, 111.8, 55.3, 49.0, 44.7, 31.8, 29.4, 29.3, 29.1, 28.6, 27.5, 27.1, 3.5, 22.6, 14.1. HRMS (FD) m/z cacld. for $C_{24}H_{41}NO_2$ $[M+H]^+$: 376.3216, found: 376.3217.

***N,N*-diethylcyclohexanecarboxamide (3'aa)**:[16] 1-(cyclohexanecarbonyl)piperidine-2,6-dione (223 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethylcyclohexanecarboxamide (**3'aa**) (112.0 mg, 0.61 mmol, 61% yield) as a colorless oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 3.28 (br s, 2H), 3.27 (br s, 2H), 2.35 (tt, J = 11.7, 3.5 Hz, 1H), 1.77 – 1.71 (m, 2H), 1.67 – 1.60 (m, 3H), 1.55 – 1.46 (m, 2H), 1.24 – 1.20 (m, 3H), 1.11 (br s, 3H), 1.05 (br s, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 175.3, 41.6, 40.6, 39.9, 29.5, 25.8, 25.7, 14.9, 13.0.

***N,N*-dipropylcyclohexanecarboxamide (3'ab)**:[17] 1-(cyclohexanecarbonyl)piperidine-2,6-dione (223 mg, 1.0 mmol) and tri-*n*-propylamine (429 mg, 3.0 mmol) afforded *N,N*-dipropylcyclohexanecarboxamide (**3'aa**) (116.0 mg, 0.55 mmol, 55% yield) as a colorless oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 3.19 (br s, 2H), 3.14 (br s, 2H), 2.35 (tt, J = 11.6, 3.4 Hz, 1H), 1.78 – 1.70 (m, 2H), 1.63 – 1.60 (m, 3H), 1.53 – 1.45 (m, 6H), 1.25 – 1.14 (m, 3H), 0.86 (br s, 3H), 0.80 (br s, 3H); ^{13}C

NMR (126 MHz, $CDCl_3$) δ 175.8, 49.2, 47.3, 40.7, 29.5, 25.8, 25.7, 22.7, 20.8, 11.1.

***N,N*-diethylcinnamamide (3'ba)**:[18] 1-cinnamoylpiperidine-2,6-dione (243 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethylcinnamamide (**3'ba**) (166.5 mg, 0.82 mmol, 82% yield) as a yellow color oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.65 (d, *J* = 15.4 Hz, 1H), 7.46 (d, *J* = 6.9 Hz, 2H), 7.33 – 7.26 (m, 3H), 6.76 (d, *J* = 15.4 Hz, 1H), 3.42 (q, *J* = 6.9 Hz, 4H), 1.16 (br s, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 165.8, 142.6, 135.4, 129.5, 128.7, 127.8, 117.5, 41.8, 41.4, 14.2, 14.0.

***N,N*-dipropylcinnamamide (3'bb)**:[19] 1-cinnamoylpiperidine-2,6-dione (243 mg, 1.0 mmol) and tri-*n*-propylamine (429 mg, 3.0 mmol) afforded *N,N*-dipropylcinnamamide (**3'bb**) (173.0 mg, 0.75 mmol, 75% yield) as a yellow color oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.63 (d, *J* = 15.3 Hz, 1H), 7.44 (d, *J* = 6.9 Hz, 2H), 7.29 (dd, *J* = 15.6, 8.0 Hz, 3H), 6.76 (d, *J* = 15.4 Hz, 1H), 3.32 (br s, 4H), 1.58 (br s, 4H), 0.88 (br s, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 166.1, 142.2, 135.5, 129.4, 128.7, 127.7, 117.8, 49.9, 48.6, 23.0, 21.1, 11.4, 11.4.

***N,N*-diethyl-3-phenylpropiolamide (3'ca)**:[20] 1-(3-phenylpropioloyl)piperidine-2,6-dione (241 mg, 1.0 mmol) and triethylamine (303 mg, 3.0 mmol) afforded *N,N*-diethyl-3-phenylpropiolamide (**3'ca**) (122.6 mg, 0.61 mmol, 61% yield) as a pale brown color oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.48 – 7.45 (m, 2H), 7.35 – 7.26 (m, 3H), 3.59 (q, *J* = 7.2 Hz, 2H), 3.41 (q, *J* = 7.2 Hz, 2H), 1.21 (t, *J* = 7.2 Hz, 3H), 1.11 (t, *J* = 7.2 Hz, 3H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 153.9, 132.3, 129.8, 128.4, 120.7, 89.0, 81.9, 43.6, 39.3, 14.4, 12.8.

3-phenyl-*N,N*-dipropylpropiolamide (3'cb):[20] 1-(3-phenylpropioloyl)piperidine-2,6-dione (241 mg, 1.0 mmol) and tri-*n*-propylamine (429 mg, 3.0 mmol) afforded 3-phenyl-*N,N*-dipropylpropiolamide (**3'cb**) (130.7 mg, 0.57 mmol, 57% yield) as a pale brown color oil; ^{1}H NMR (500 MHz, $CDCl_3$) δ 7.47 – 7.44 (m, 2H), 7.34 – 7.27 (m, 3H), 3.53 – 3.48 (m, 2H), 3.32 – 3.27 (m, 2H), 1.63 (dd, *J* = 14.9, 7.4 Hz, 2H), 1.54 (ddd, *J* = 9.5, 7.5, 5.8 Hz, 2H), 0.88 (dt, *J* = 24.8, 7.4 Hz, 6H); ^{13}C NMR (126 MHz, $CDCl_3$) δ 154.6, 132.3, 129.9, 128.5, 120.8, 89.3, 82.1, 50.9, 46.5, 22.2, 20.7, 11.4, 11.3.

5. References

[1] X. Qi, R. Zhou, H.-J. Ai and X.-F. Wu, *J. Catal.,* 2020**, 381**, 215.

[2] K. Kisiel, J. Brześkiewicz, R. Loska and M. Mąkosza, *Adv. Synth. Catal*., 2019, **361**, 1641.

[3] X.-Q. Ning, S.-J. Lou, Y.-J. Mao, Z.-Y. Xu and D.-Q. Xu*, Org. Lett.,* 2018, **20,** 2445.

[4] H. Tian, H. Shimakoshi, T. Ono and Y. Hisaeda, *ChemPlusChem,* 2019, **84**, 237.

[5] N. Laidaoui, M. He, D. E. Abed, J.-F. Soule and H. Doucet*, RSC Adv*., 2016, **6**, 62866.

[6] Y. Iyori, K. Takahashi, K. Yamazaki, Y. Ano and N. Chatani, *Chem. Commun*., 2019, **55**, 13610.

[7] W. Li and X.-F. Wu, *Org. Lett.,* 2015, **17**, 1910.

[8] S.-M. Wang, C. Zhao, X. Zhang and H.-L. Qin, *Org. Biomol. Chem*., 2019, **17**, 4087.

[9] R. S. Mane and B. M. Bhanage, *J. Org. Chem*., 2016, **81**, 1223.

[10] N. Schröder, F. Lied and F. Glorius, *J. Am. Chem. Soc.,* 2015, **137**, 1448.

[11] A. Bhattacharya, R. E. Plata, V. Villarreal, S. Muramulla and J. Wu*, Tetrahedron Lett.,* 2006, **47**, 505.

[12] S. Kang, M. T. La and H.-K. Kim, *Tetrahedron Lett.,* 2018, **59**, 3541.

[13] K. S. Goha and C.-H. Tan*, RSC Adv.*, 2012, **2**, 5536.

[14] R. S. Mane and B. M. Bhanage, *Adv. Synth. Catal*., 2017, **359**, 2621.

[15] Y.-Z. Duan and M.-Z. Deng, *Synlett*, 2005, **2**, 355.

[16] S. Y. Chow, M. Y. Stevens, L. Akerbladh, S. Bergman and L. R. Odell, *Chem. Eur. J.*, 2016, **22**, 9155.

[17] A. Cartier, E. Levernier, A.-L. Dhimane, T. Fukuyama, C. Ollivier, I. Ryu,a and L. Fensterbank, *Adv. Synth. Catal*., 2020, **362**, 2254.

[18] M.-M. Wang, G.-H. Sui, X.-C. Cui, H. Wang, J.-P. Qu and Y.-B. Kang, *J. Org. Chem.,* 2019, **84**, 8267−8274.

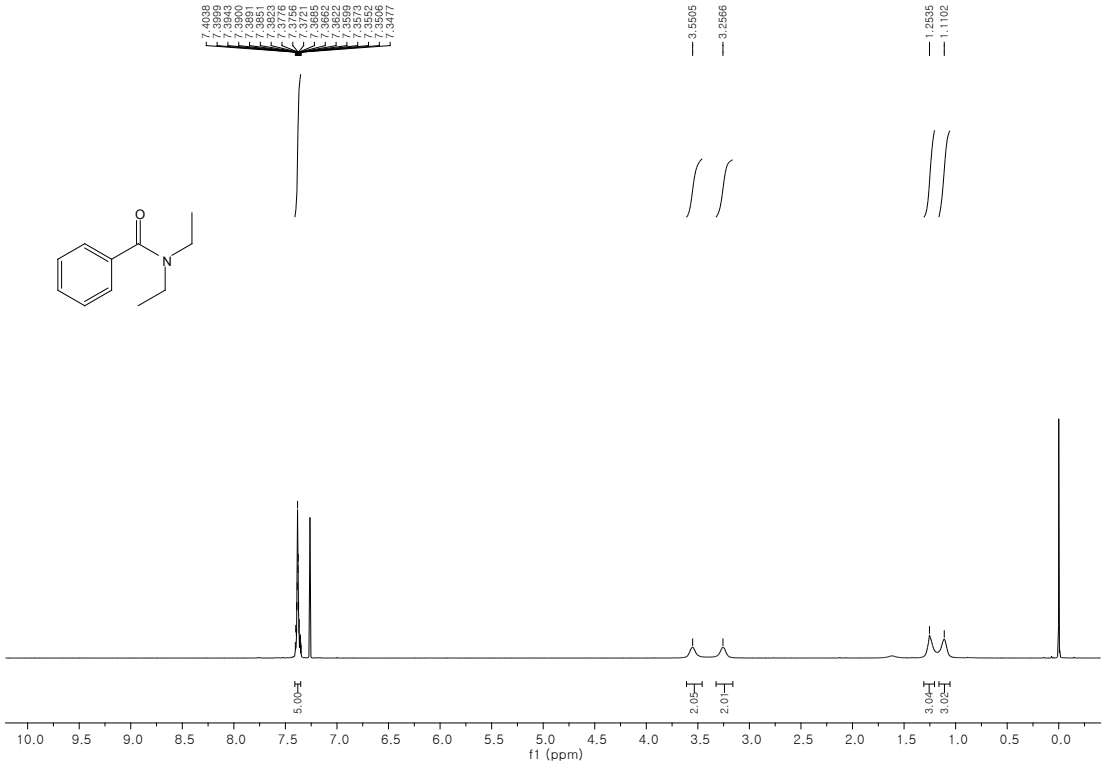
[19] T.-i. Son, H. Yanagihara, F. Ozawa and A. Yamamoto, *Bull. Chem. Soc. Jpn.*, 1988, **61**, 1251-1258.

[20] M. A. Idris, M. Kim, J. G. Kim and S. Lee, *Tetrahedron,* 2019, **75**, 4130-4137.

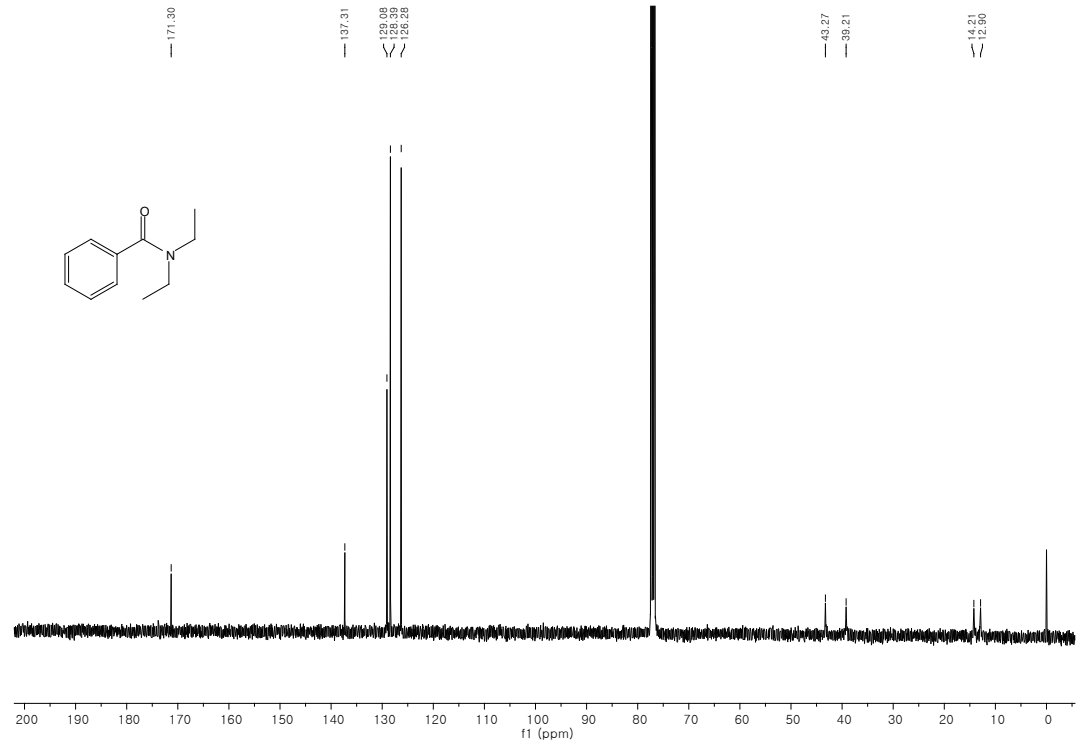
6. Copy of NMR Spectra

***N,N*-Diethylbenzamide (3aa)**:

^{1}H NMR

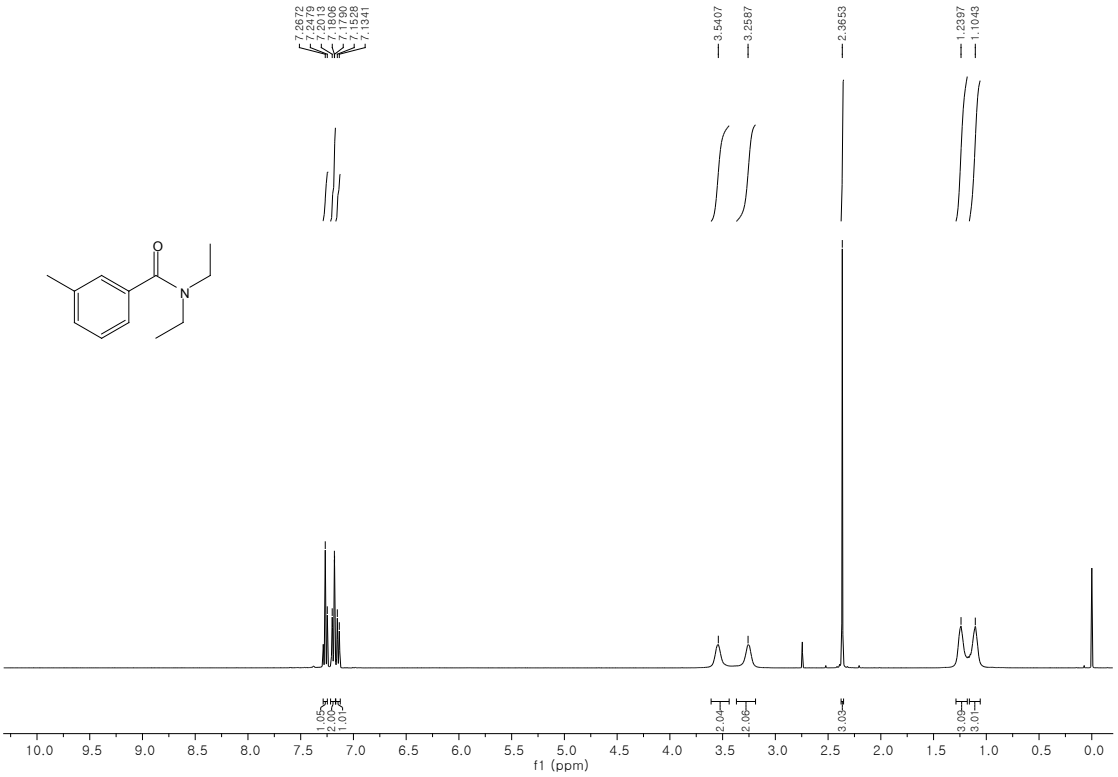


^{13}C NMR

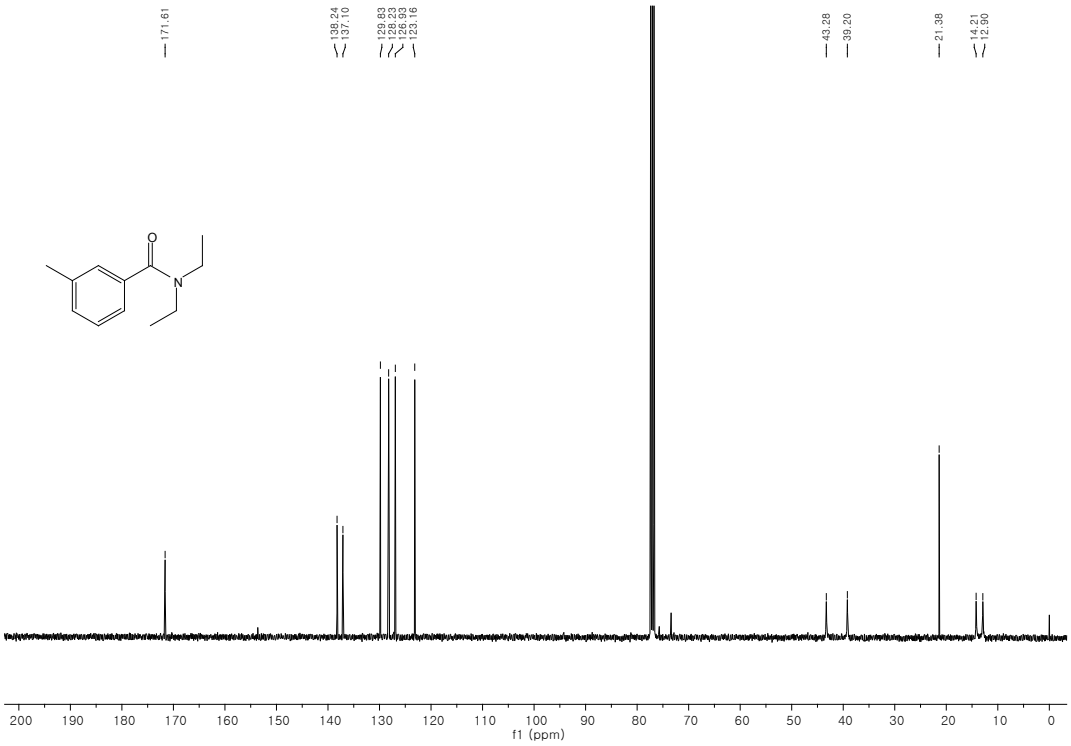


***N,N*-Diethyl-3-methylbenzamide (3ba)**

^{1}H NMR

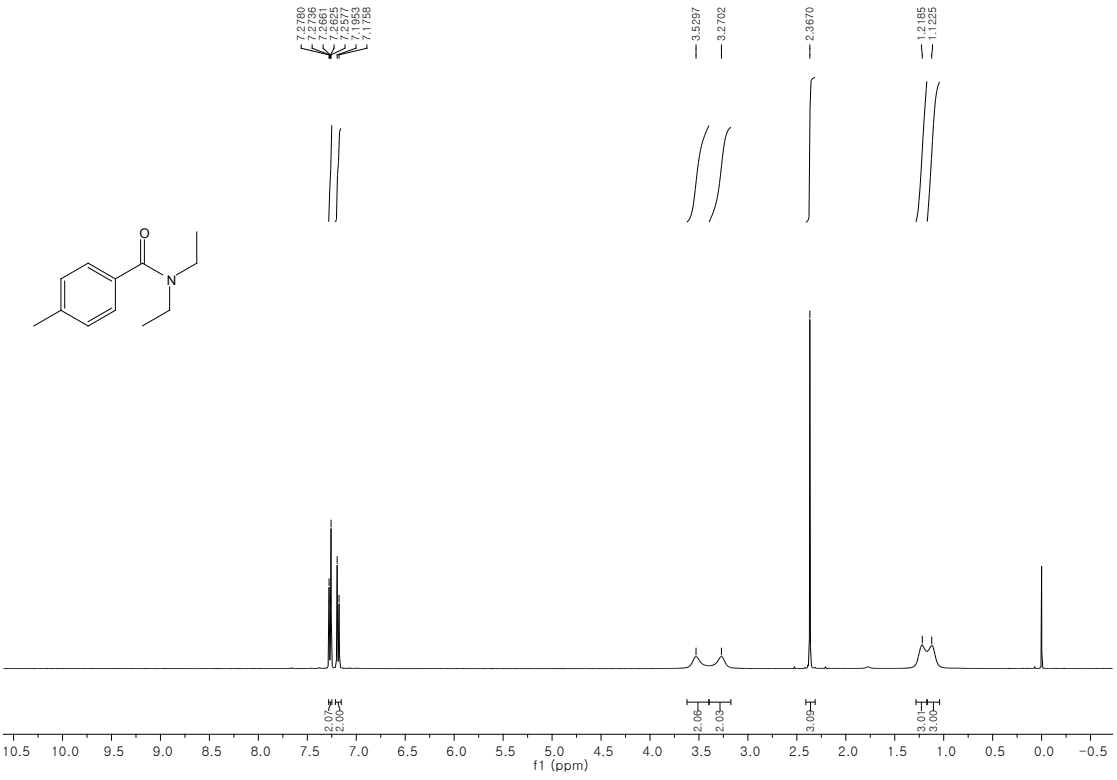


^{13}C NMR

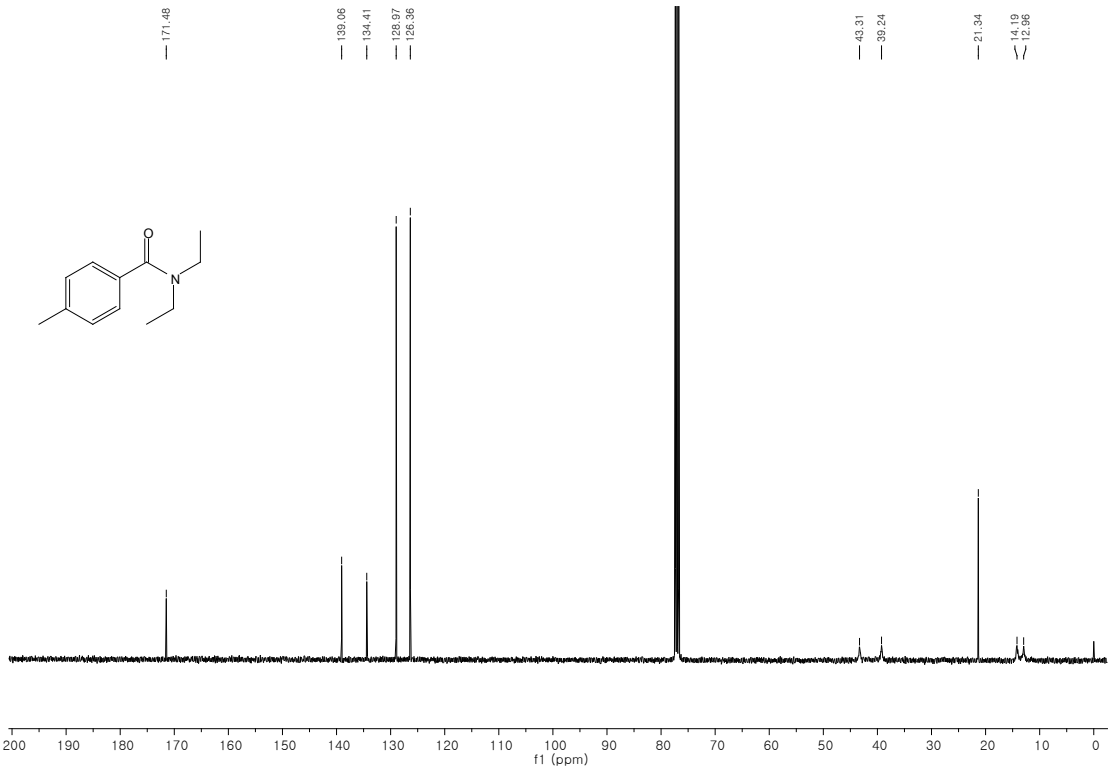


***N,N*-Diethyl-4-methylbenzamide (3ca)**:

^{1}H NMR

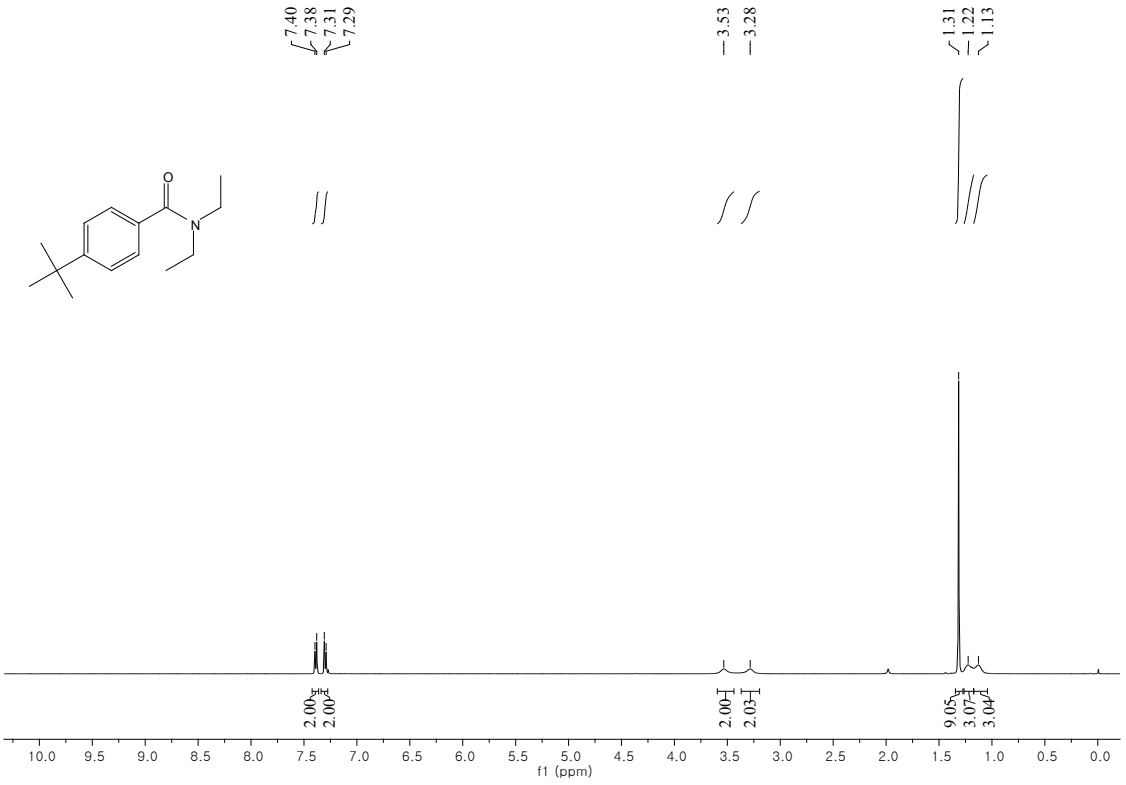


^{13}C NMR

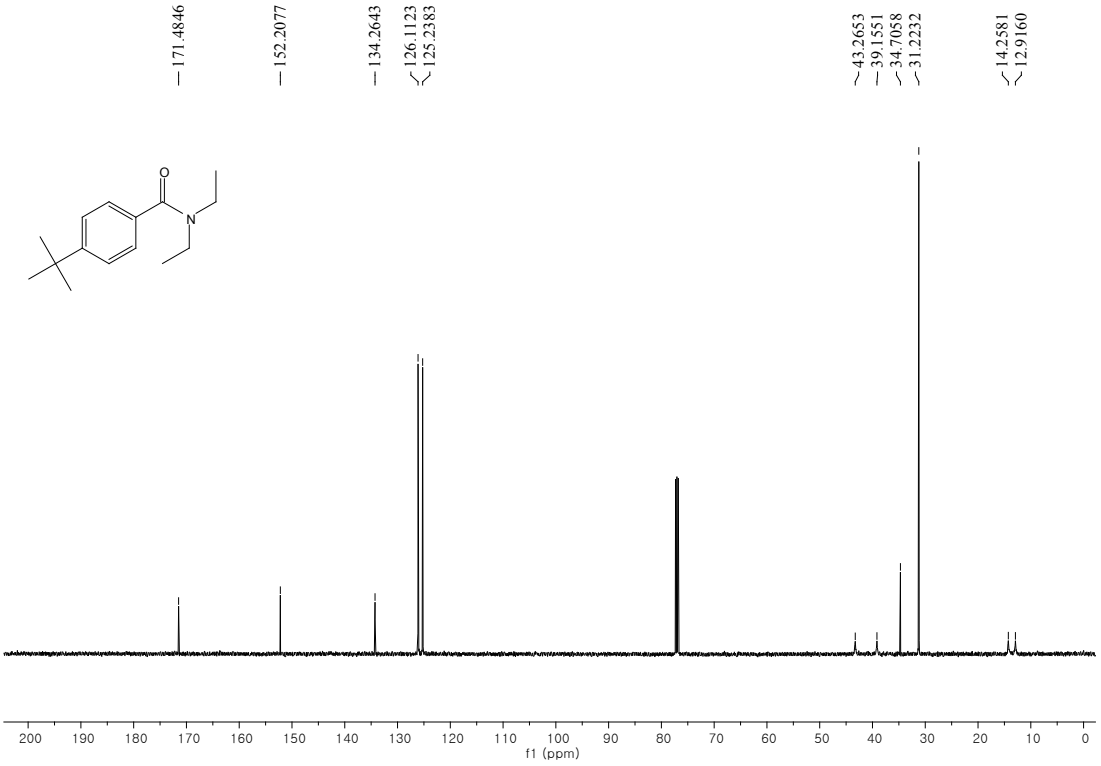


4-(*tert*-butyl)-*N*,*N*-diethylbenzamide (3ea):

^{1}H NMR

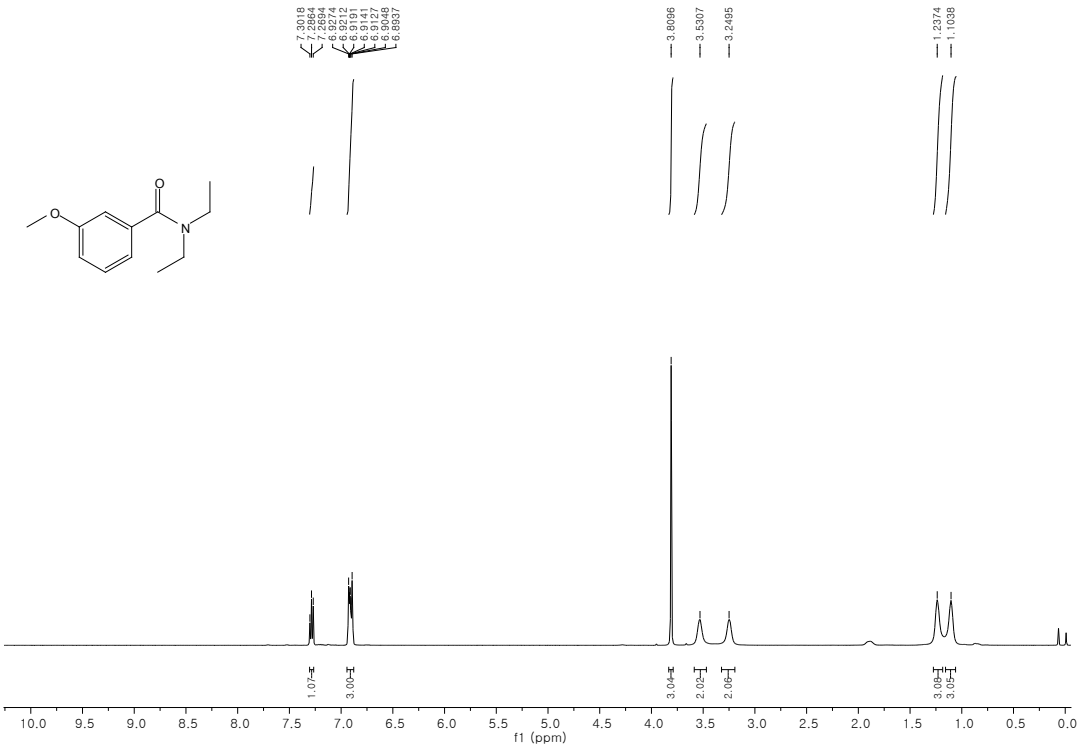


^{13}C NMR

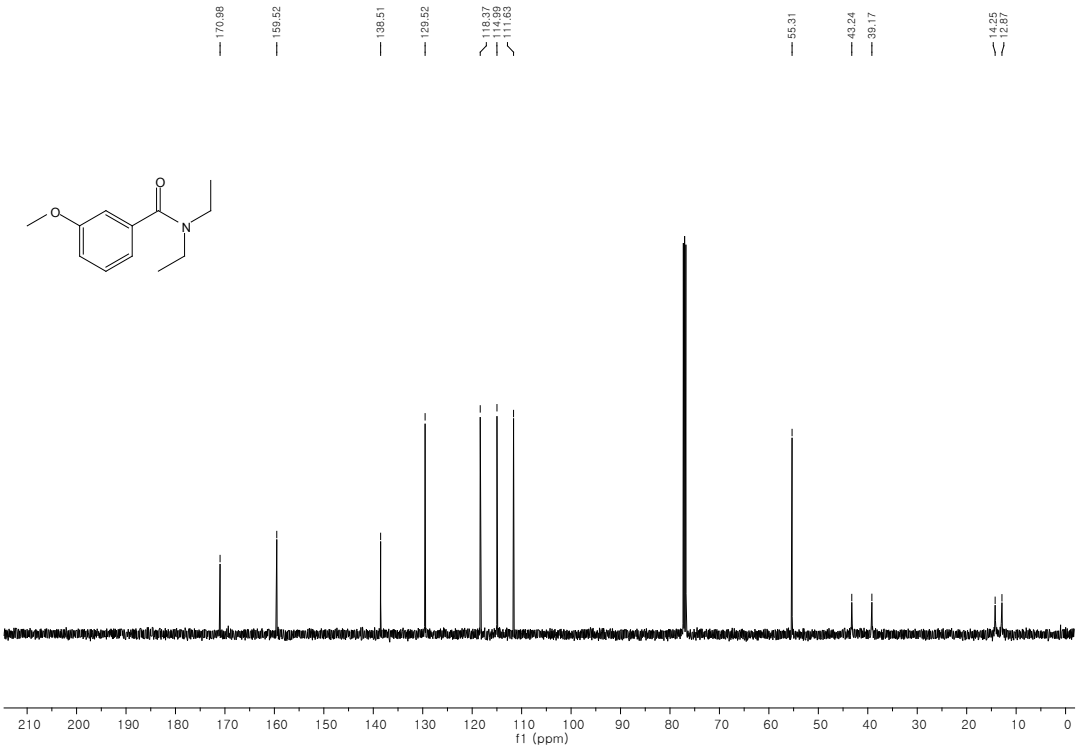


***N,N*-Diethyl-3-methoxybenzamide (3fa)**:

^{1}H NMR

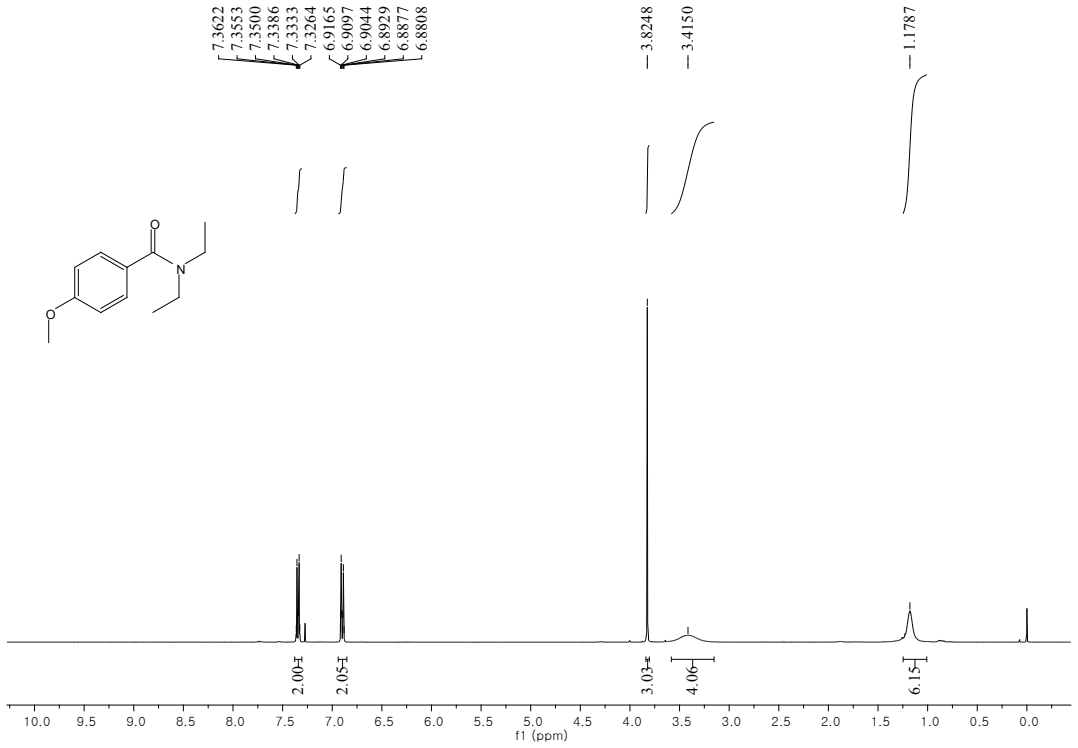


^{13}C NMR

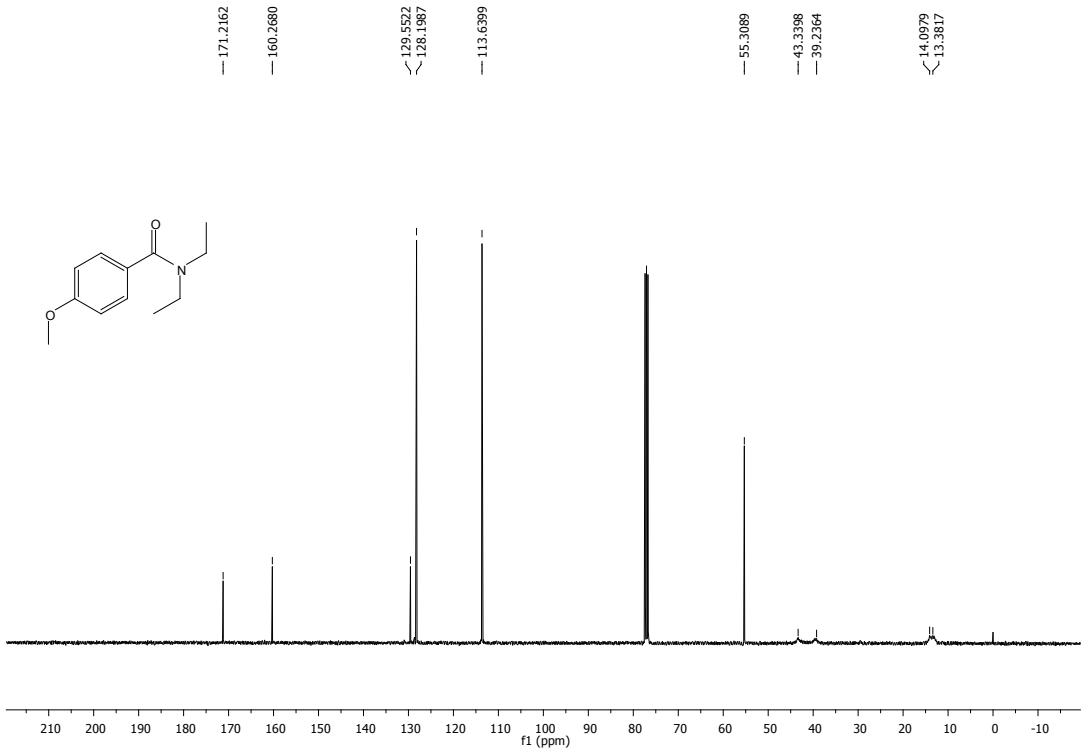


***N,N*-Diethyl-4-methoxybenzamide (3ga)**:

^{1}H NMR

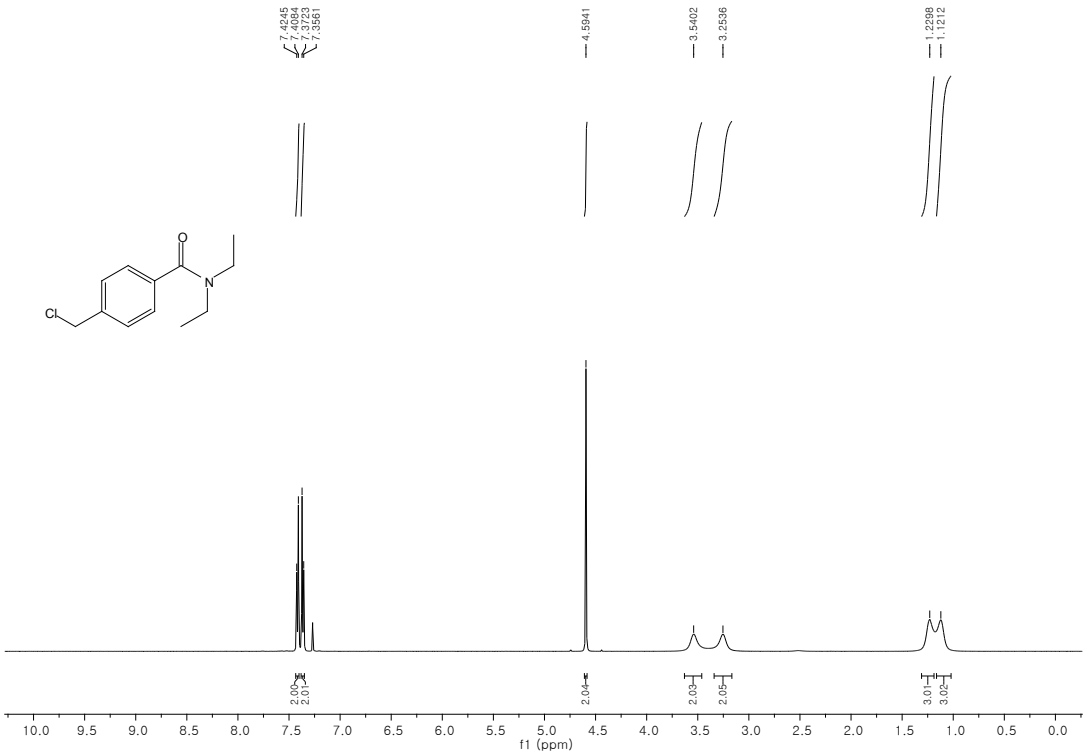


^{13}C NMR

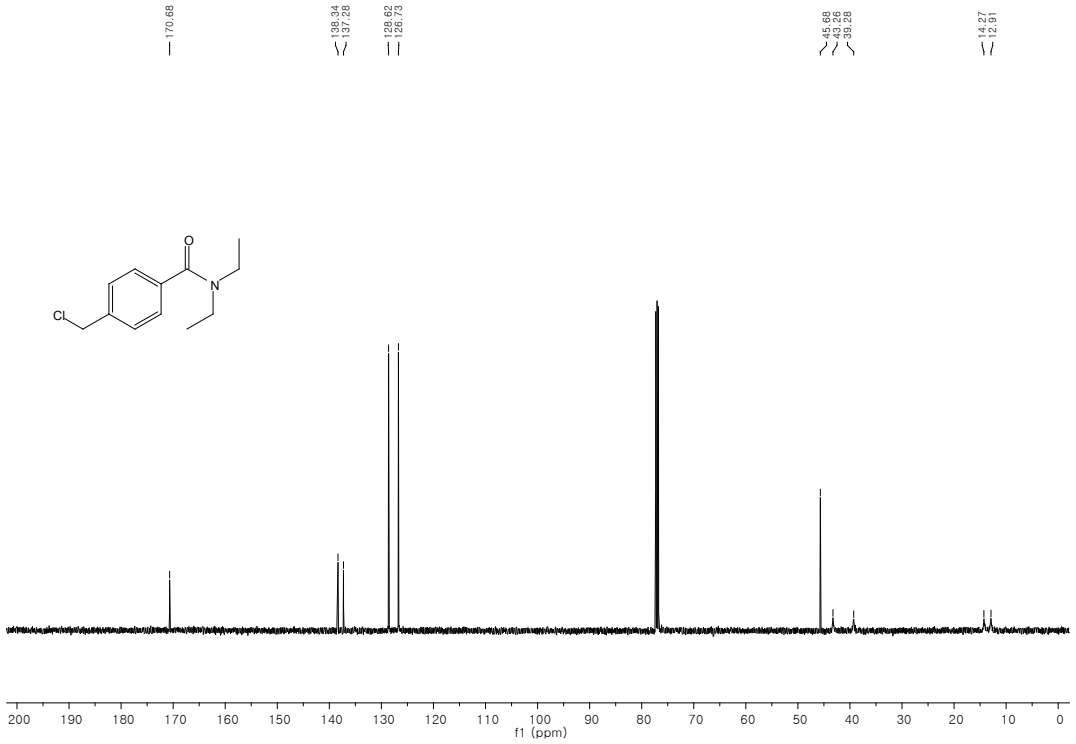


4-(Chloromethyl)-*N*,*N*-diethylbenzamide (3ha):

^{1}H NMR

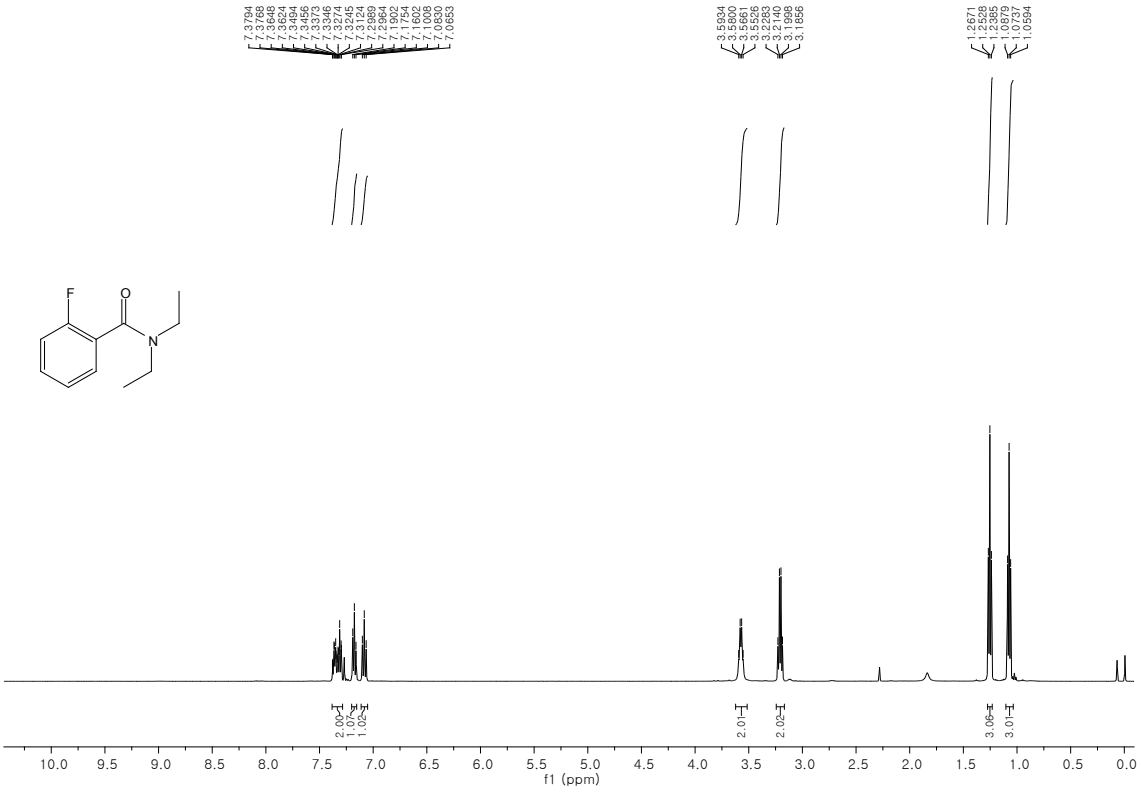


^{13}C NMR

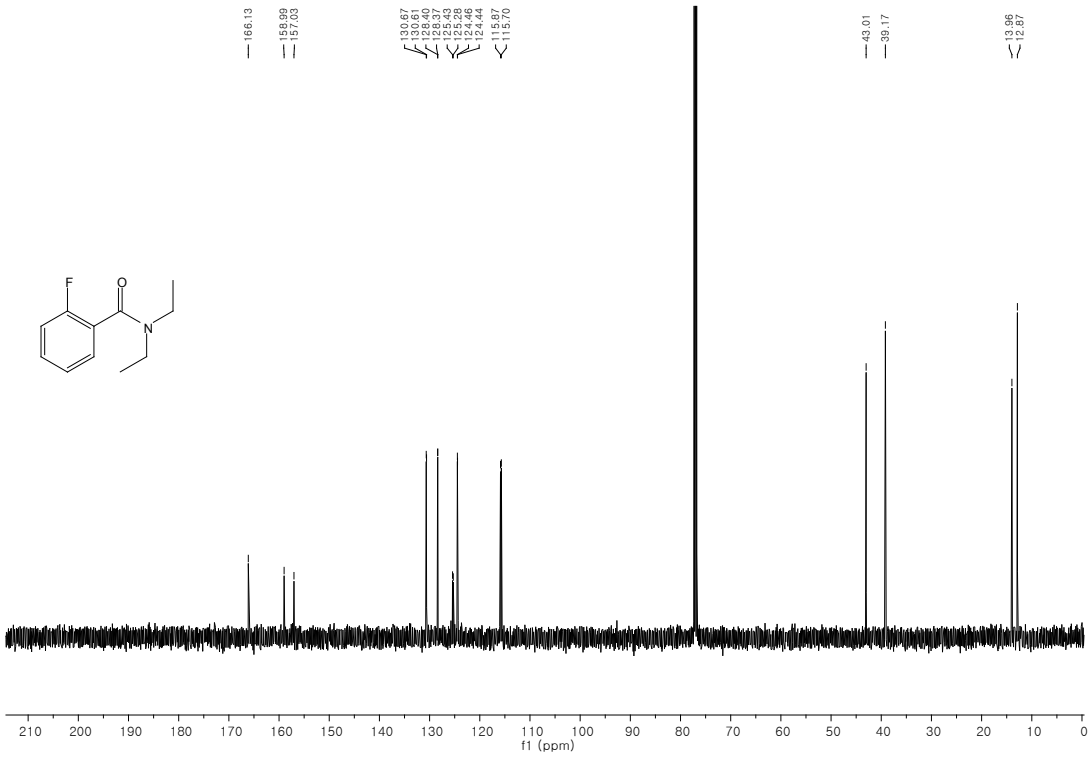


***N,N*-Diethyl-2-fluorobenzamide (3ia)**:

^{1}H NMR

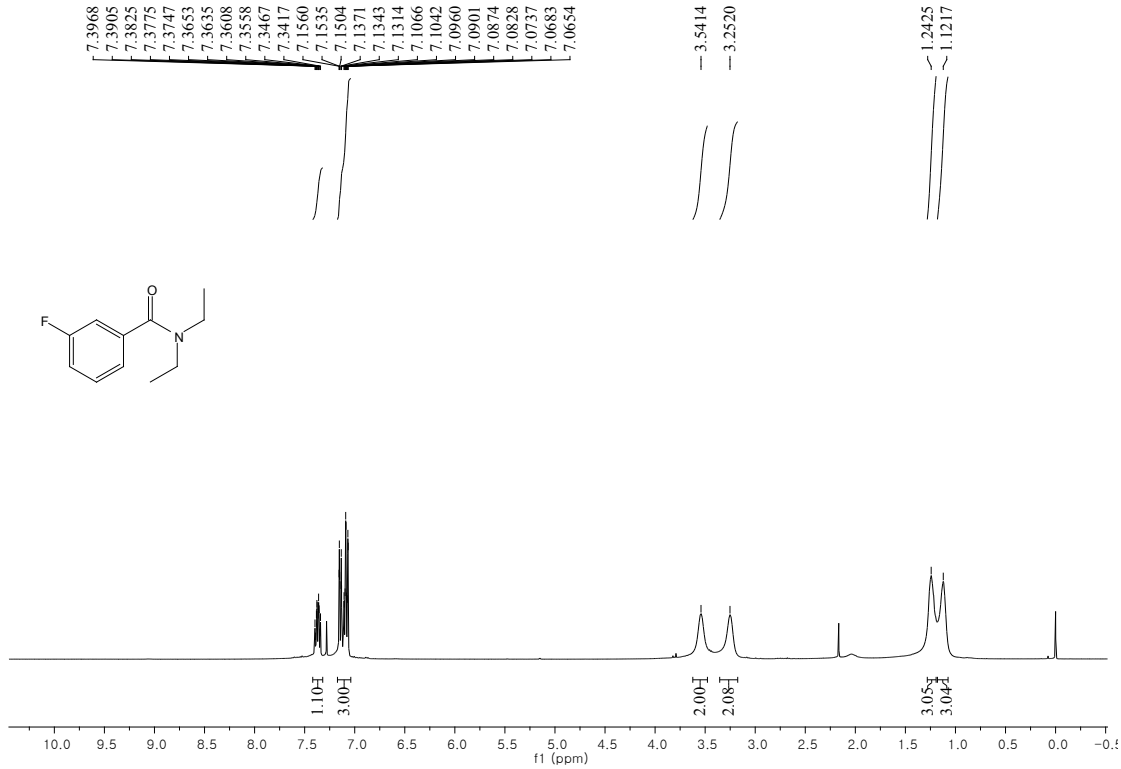


^{13}C NMR

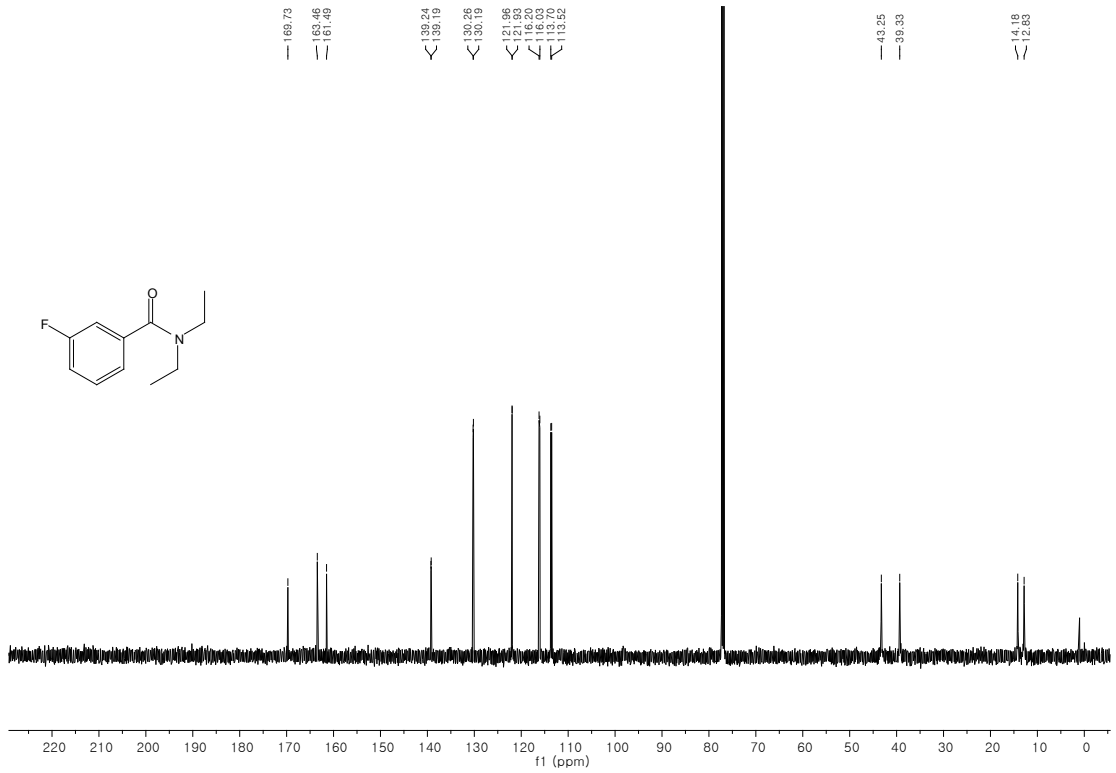


***N*,*N*-Diethyl-3-fluorobenzamide (3ja)**:

^{1}H NMR

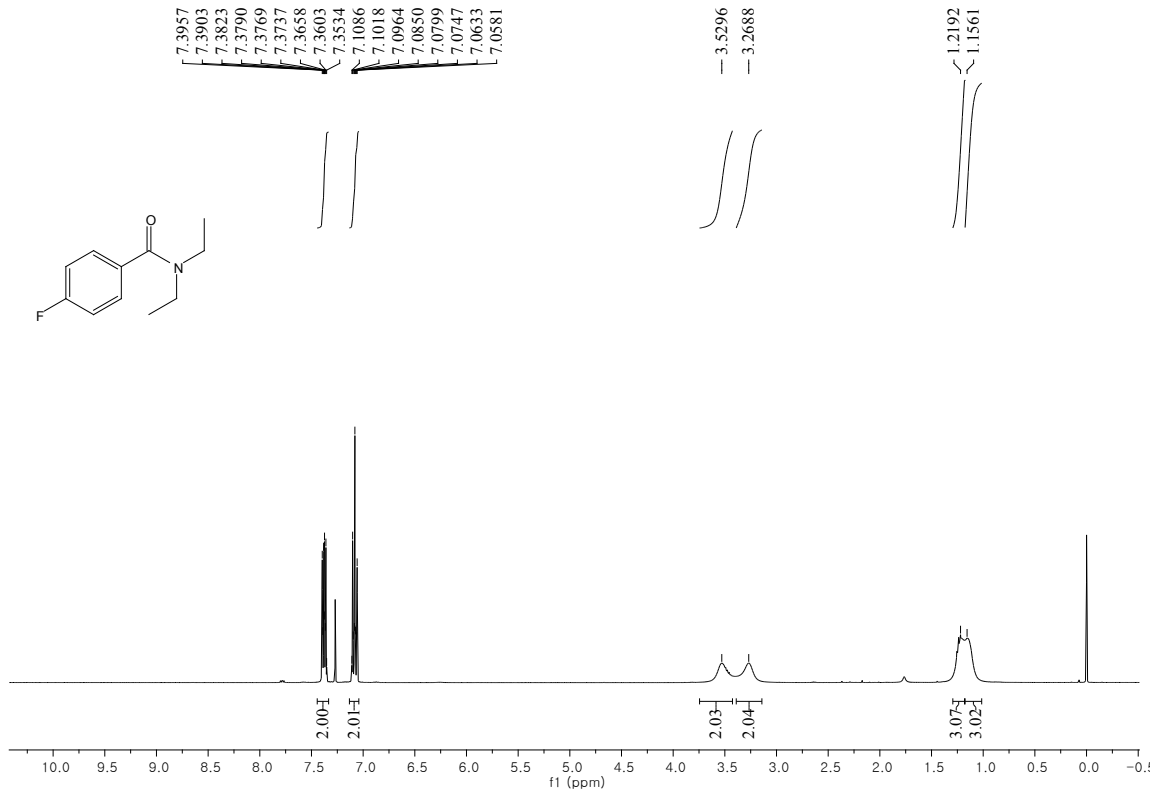


^{13}C NMR

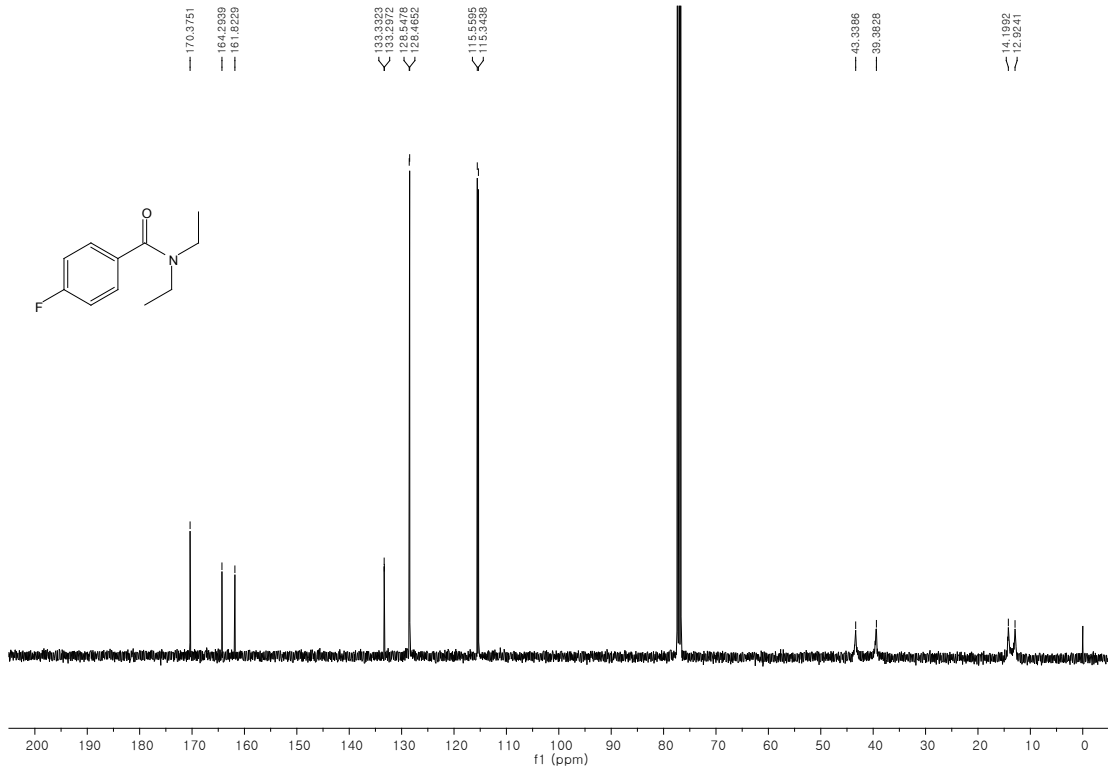


***N,N*-Diethyl-4-fluorobenzamide (3ka)**:

^{1}H NMR

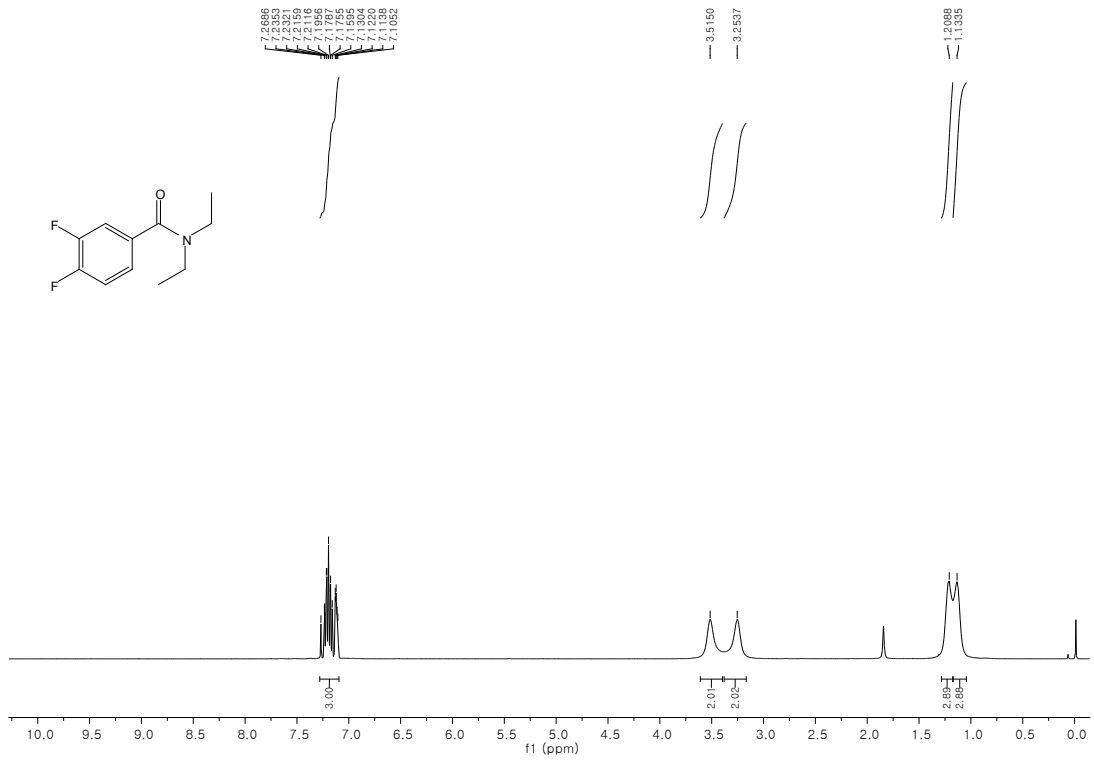


^{13}C NMR

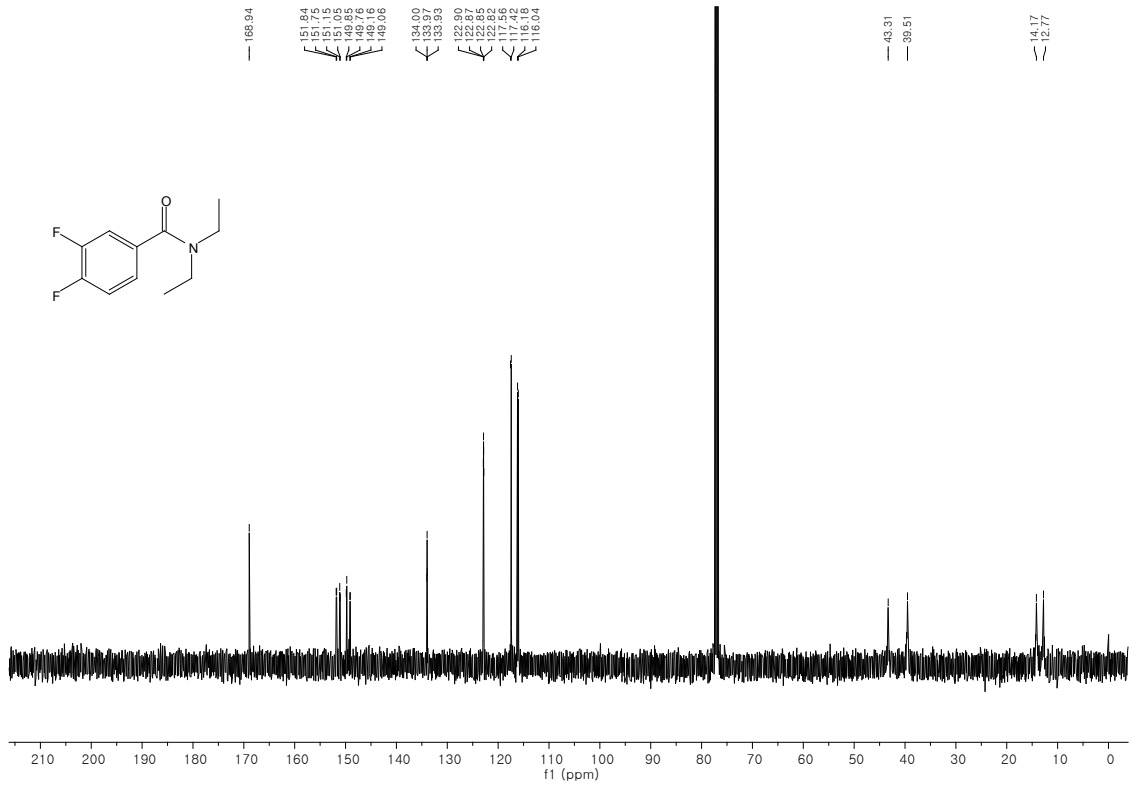


***N,N*-Diethyl-3,4-difluorobenzamide (3la)**:

^{1}H NMR

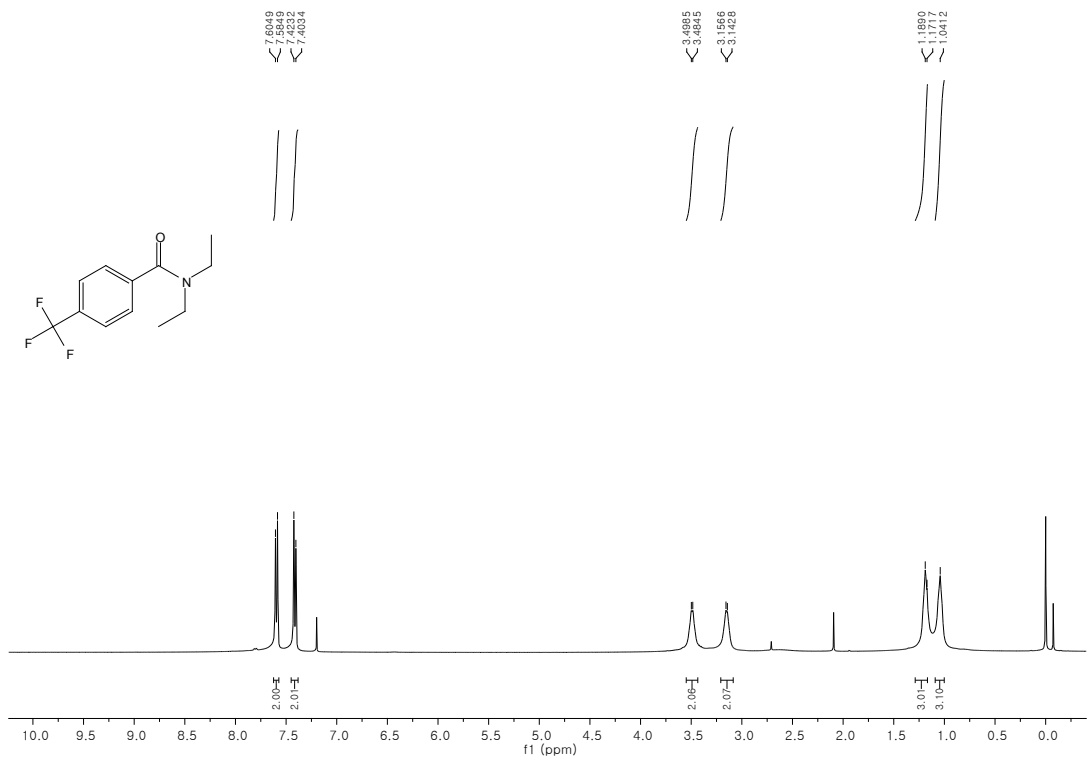


^{13}C NMR

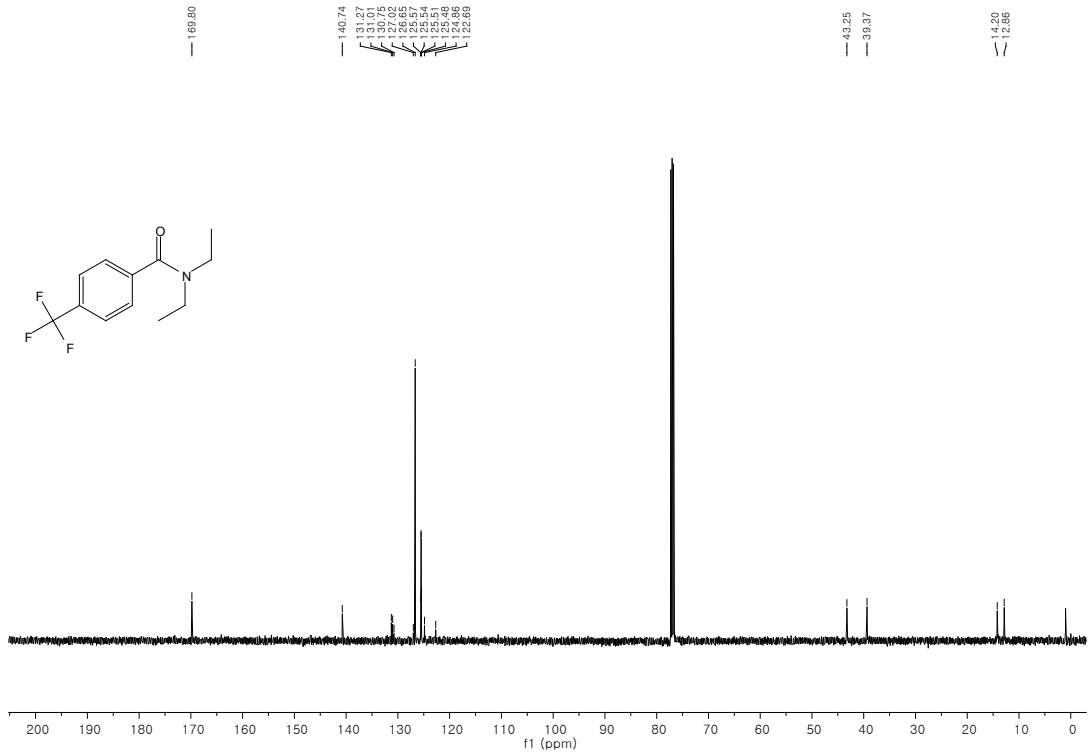


***N,N*-Diethyl-4-(trifluoromethyl)benzamide (3ma)**:

^{1}H NMR

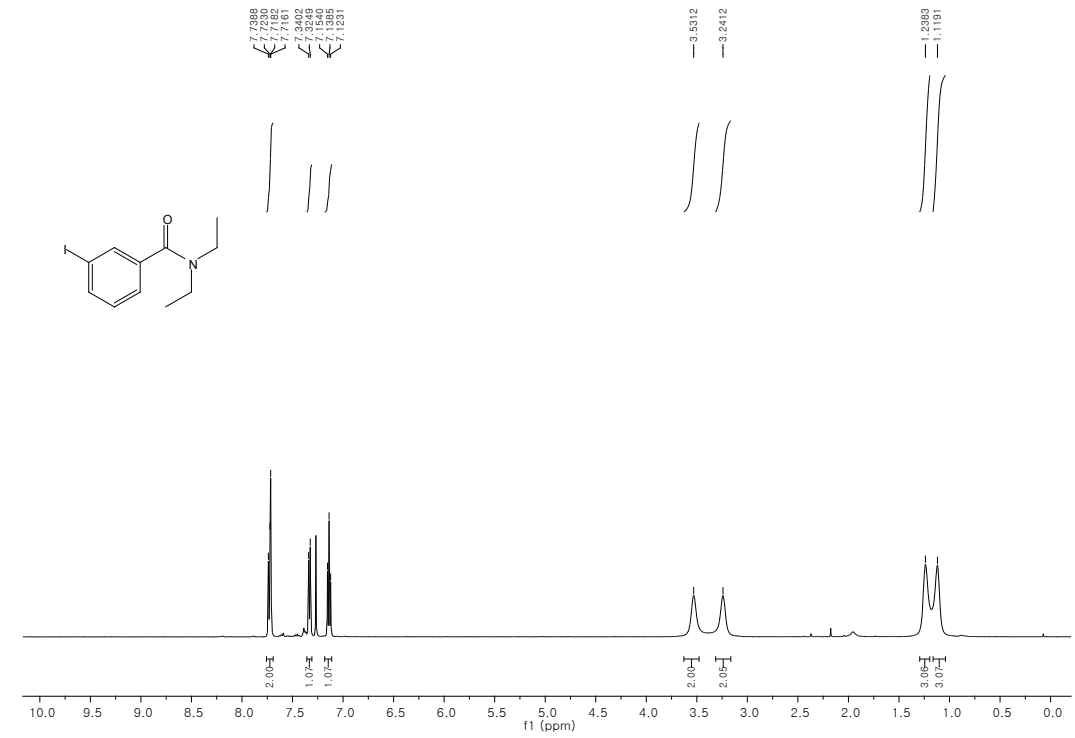


^{13}C NMR

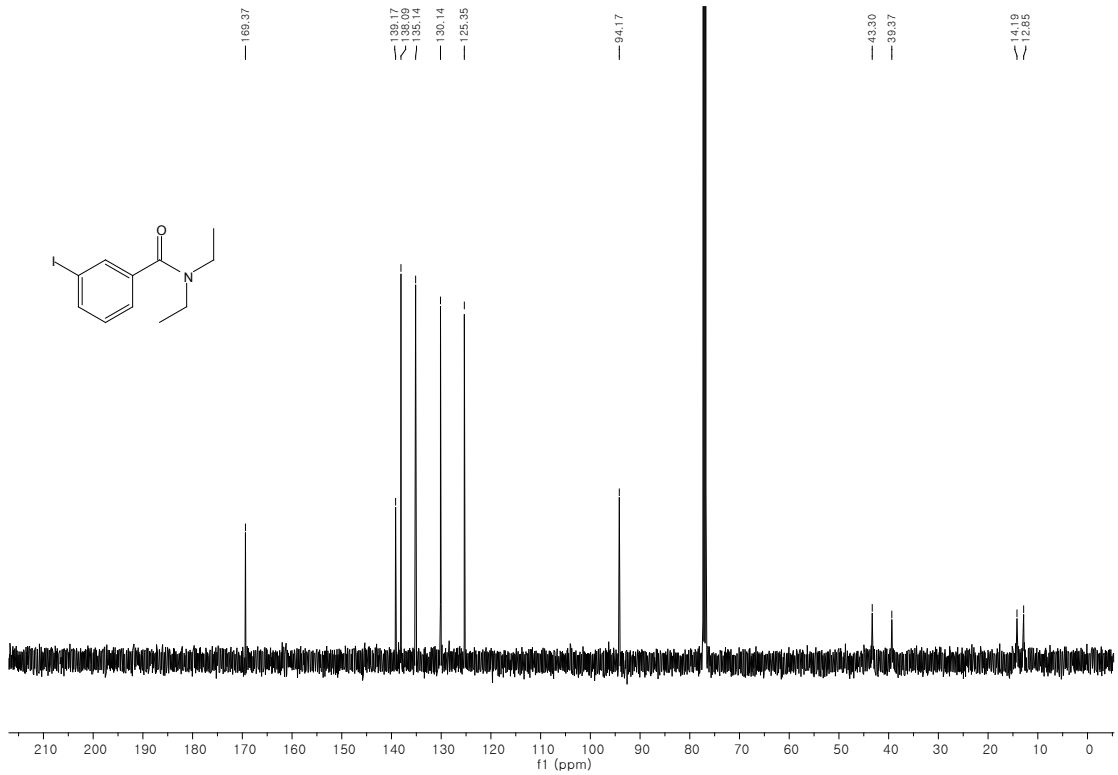


***N,N*-Diethyl-3-iodobenzamide (3na)**:

^{1}H NMR

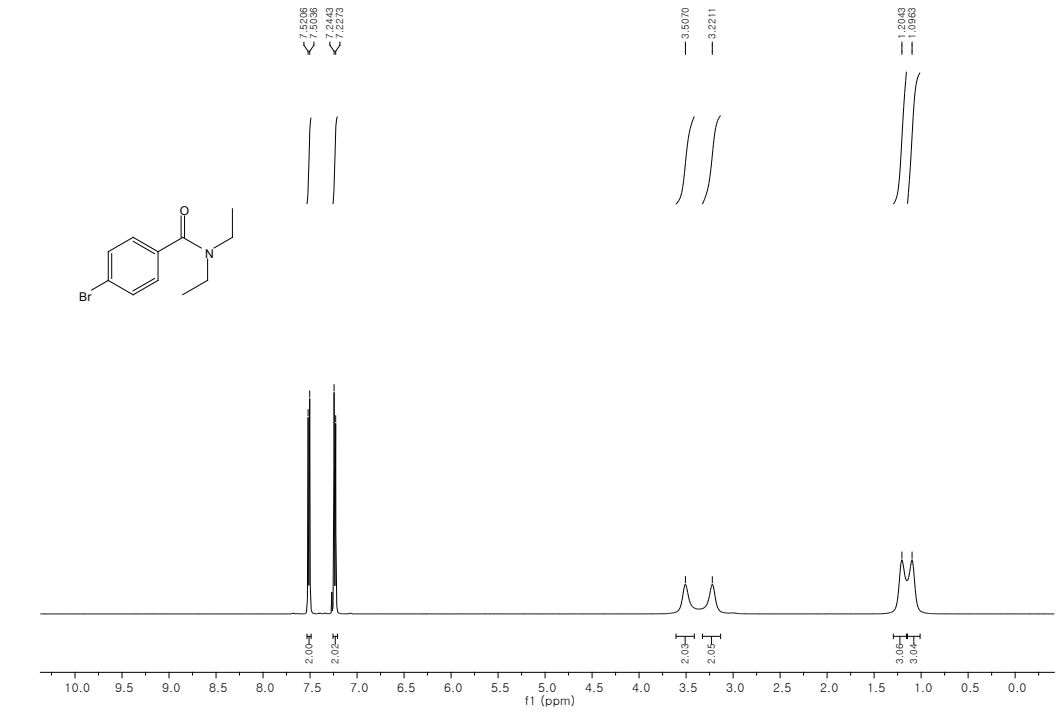


^{13}C NMR

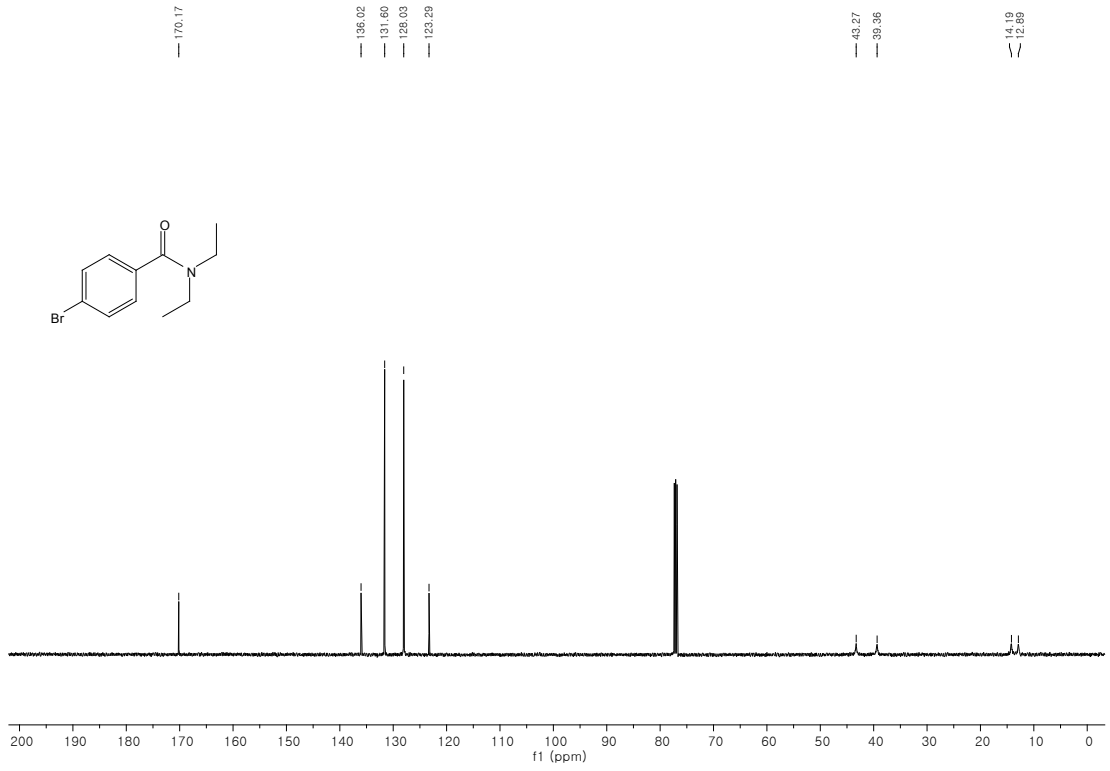


4-Bromo-*N*,*N*-diethylbenzamide (3oa):

^{1}H NMR

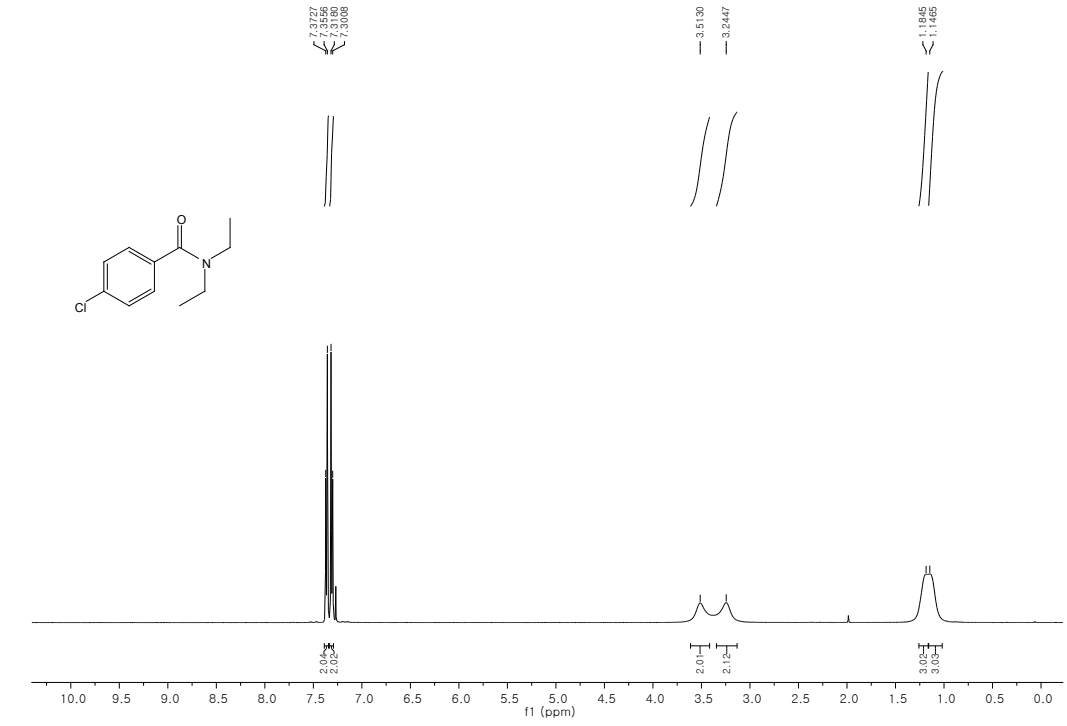


^{13}C NMR

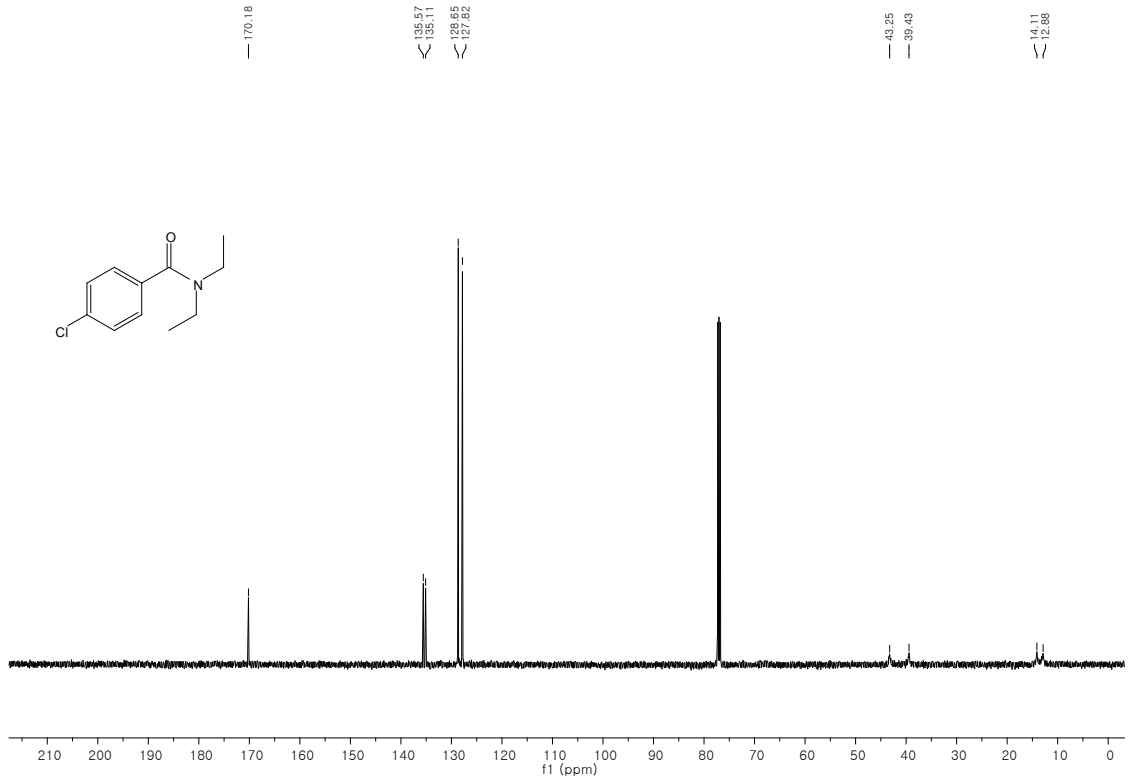


4-Chloro-*N*,*N*-diethylbenzamide (3pa):

^{1}H NMR

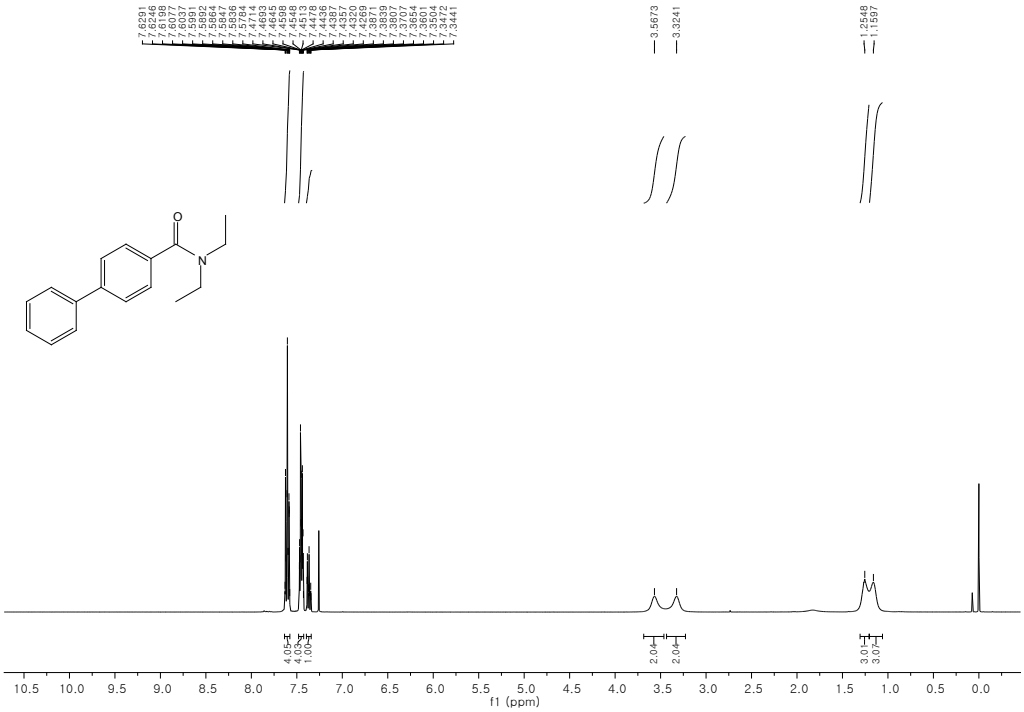


^{13}C NMR

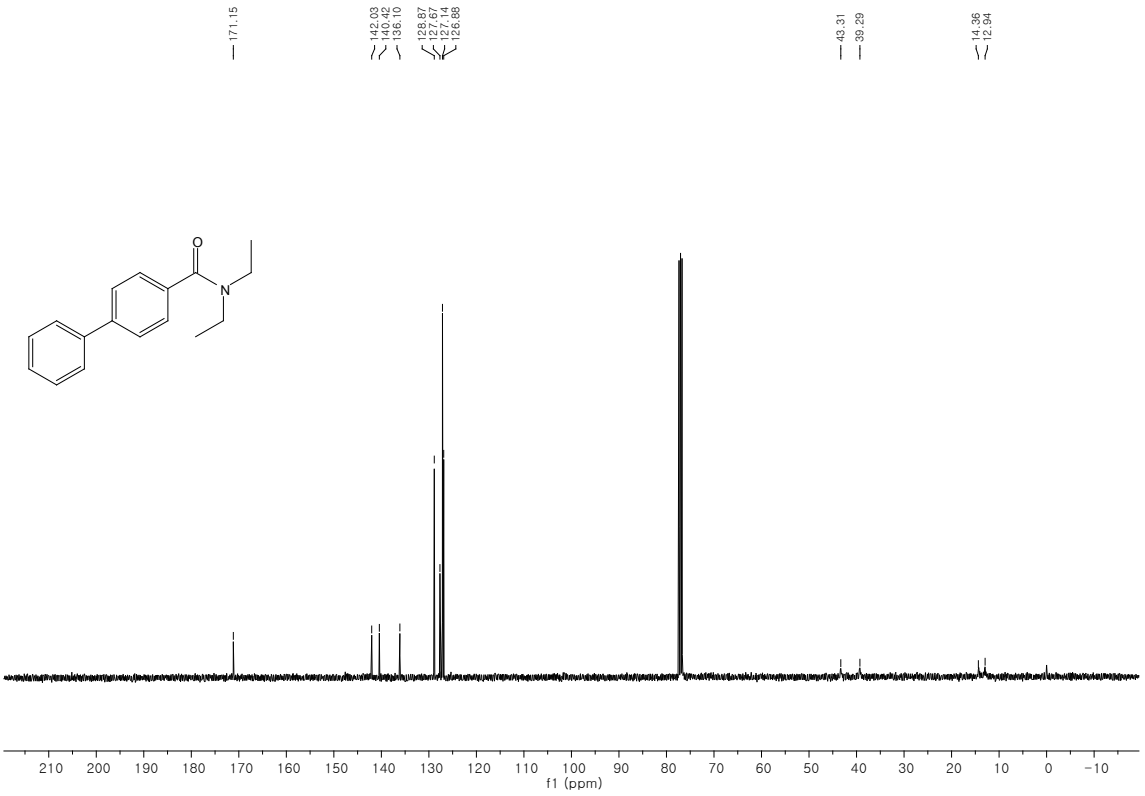


***N,N*-Diethyl-[1,1'-biphenyl]-4-carboxamide (3qa)**:

^{1}H NMR

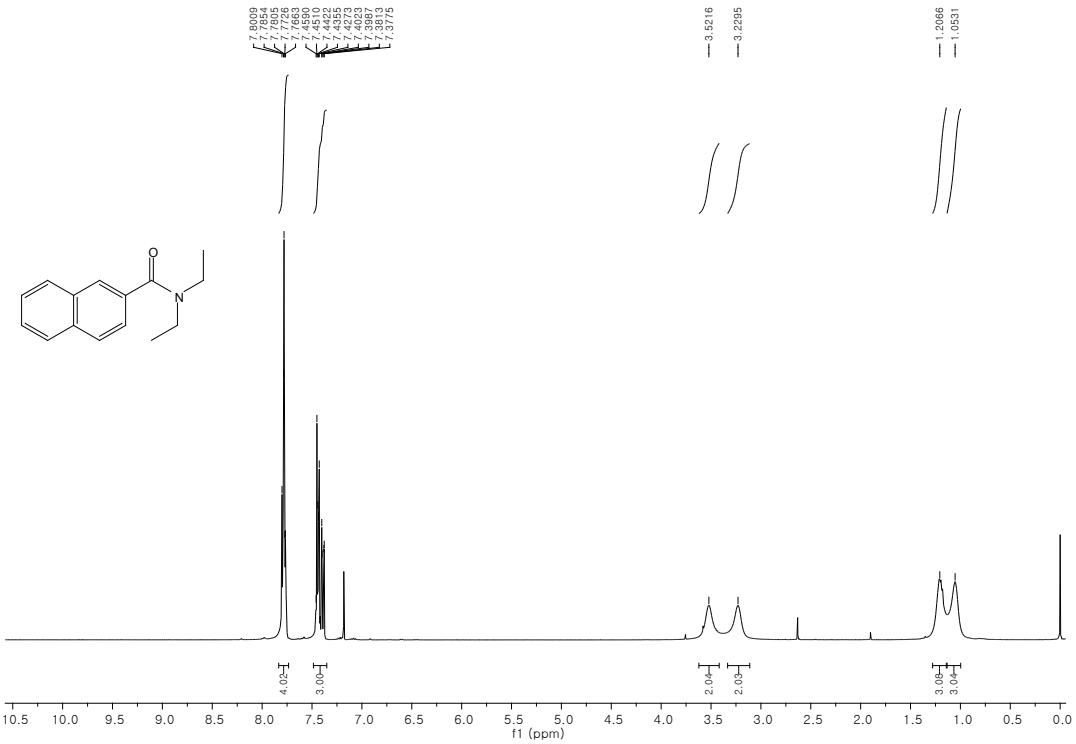


^{13}C NMR

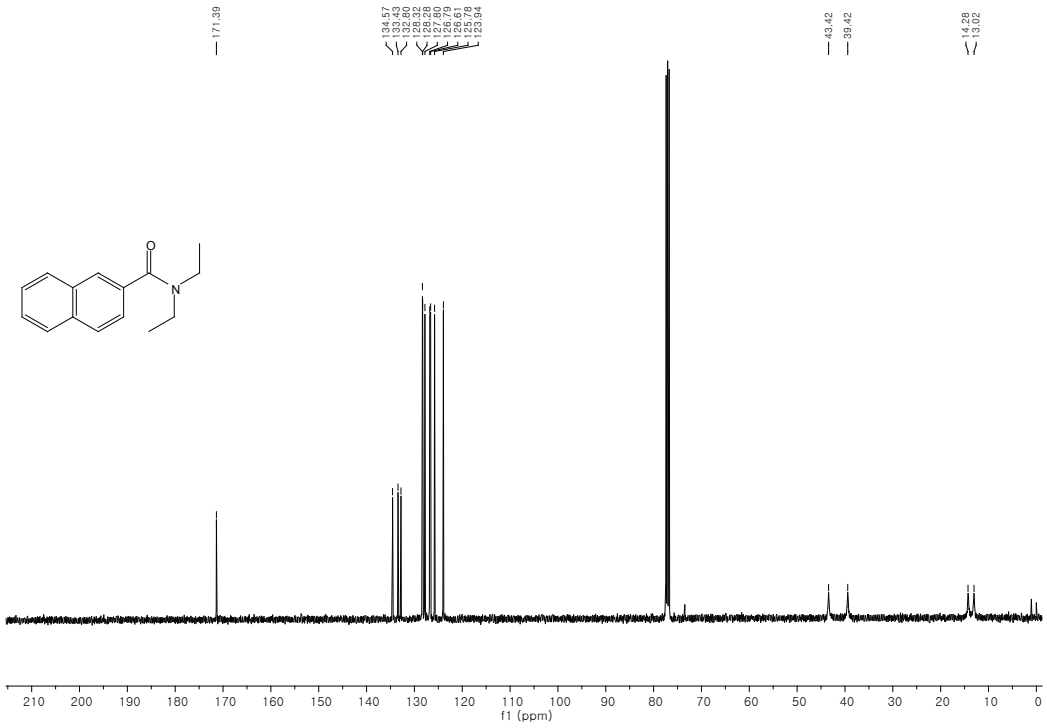


***N,N*-Diethyl-2-naphthamide (3ra)**:

^{1}H NMR

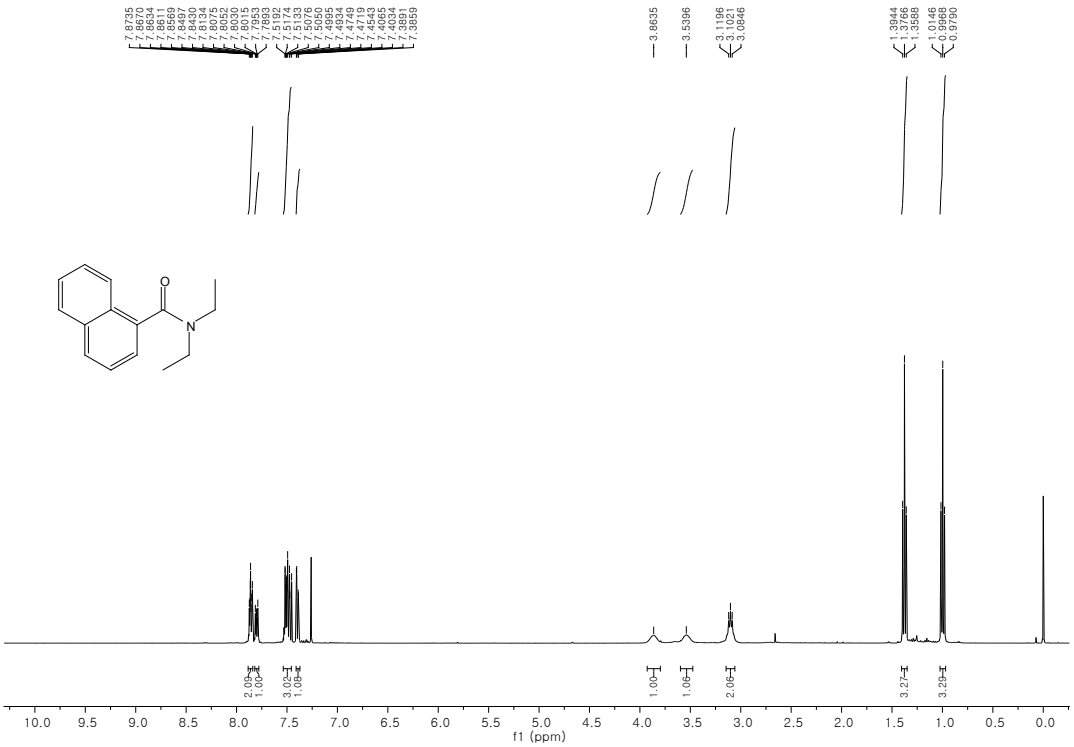


^{13}C NMR

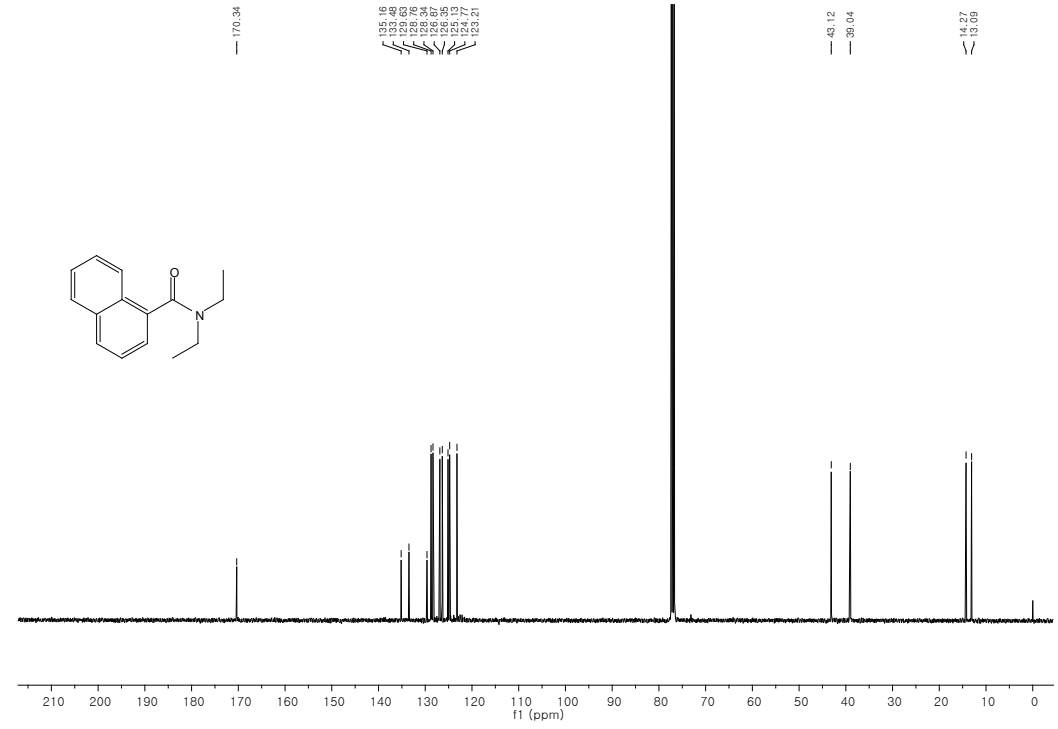


***N,N*-Diethyl-1-naphthamide (3sa)**:

^{1}H NMR

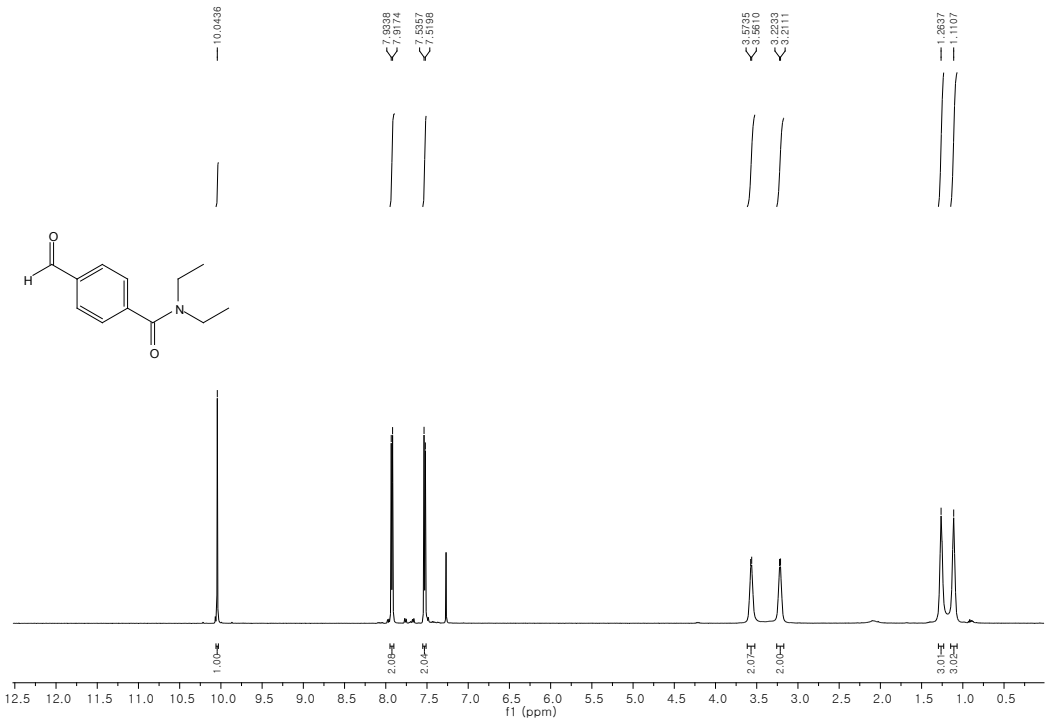


^{13}C NMR

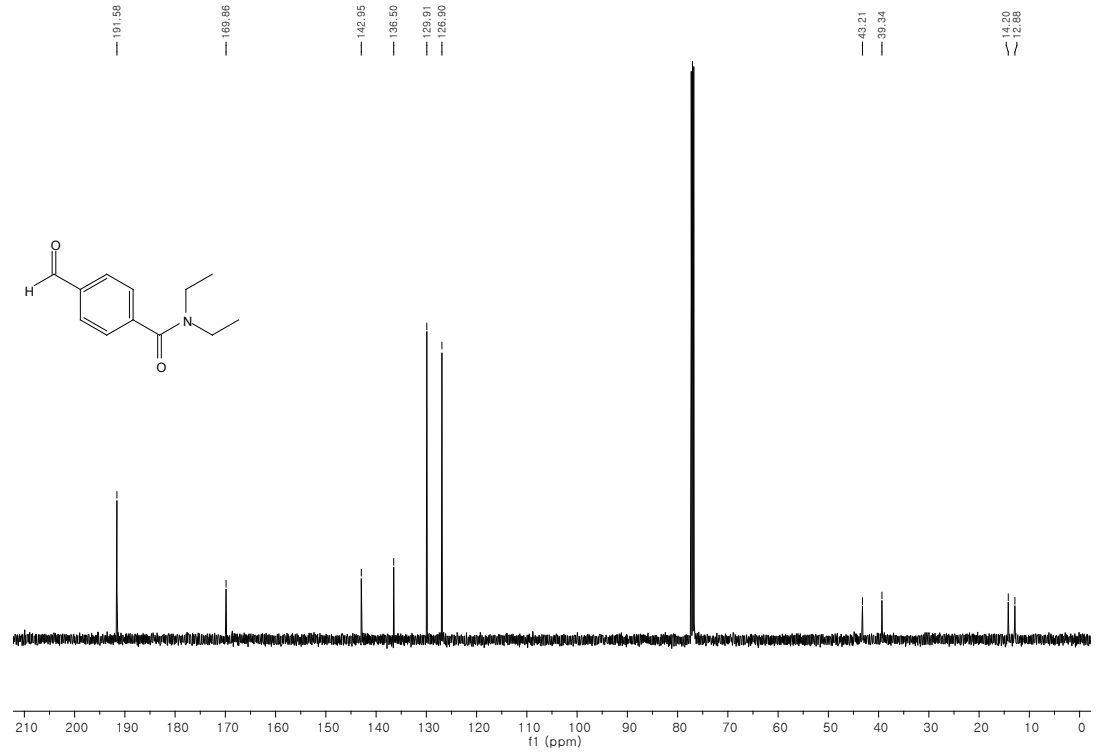


***N,N*-Diethyl-4-formylbenzamide (3ta)**:

^{1}H NMR

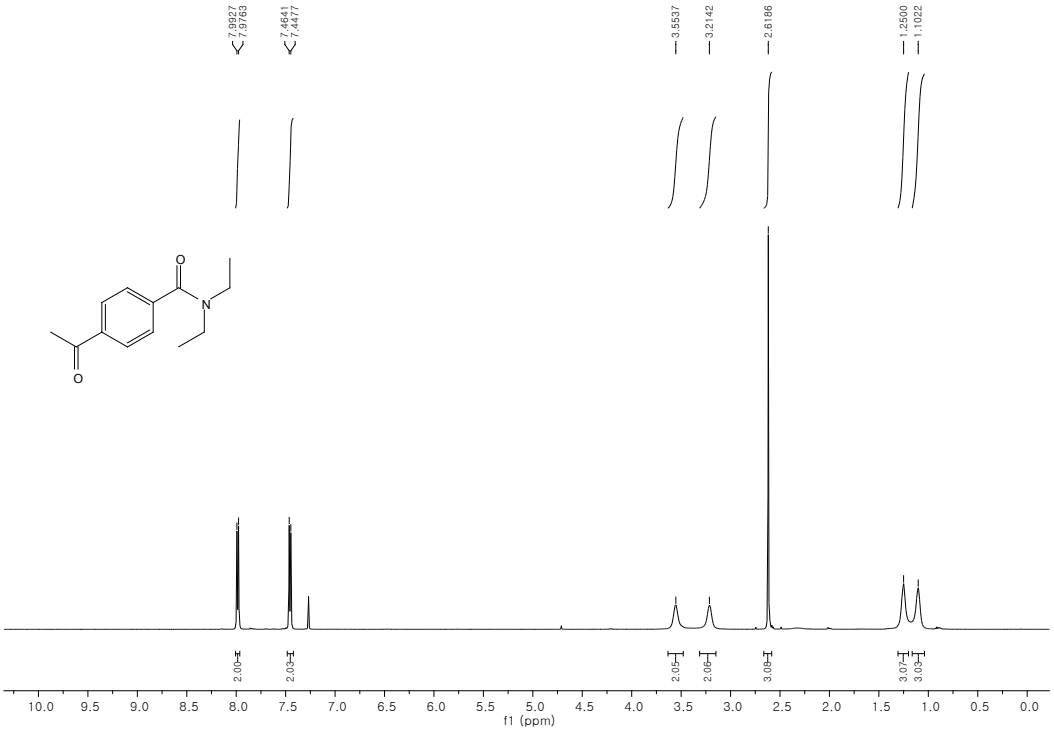


^{13}C NMR

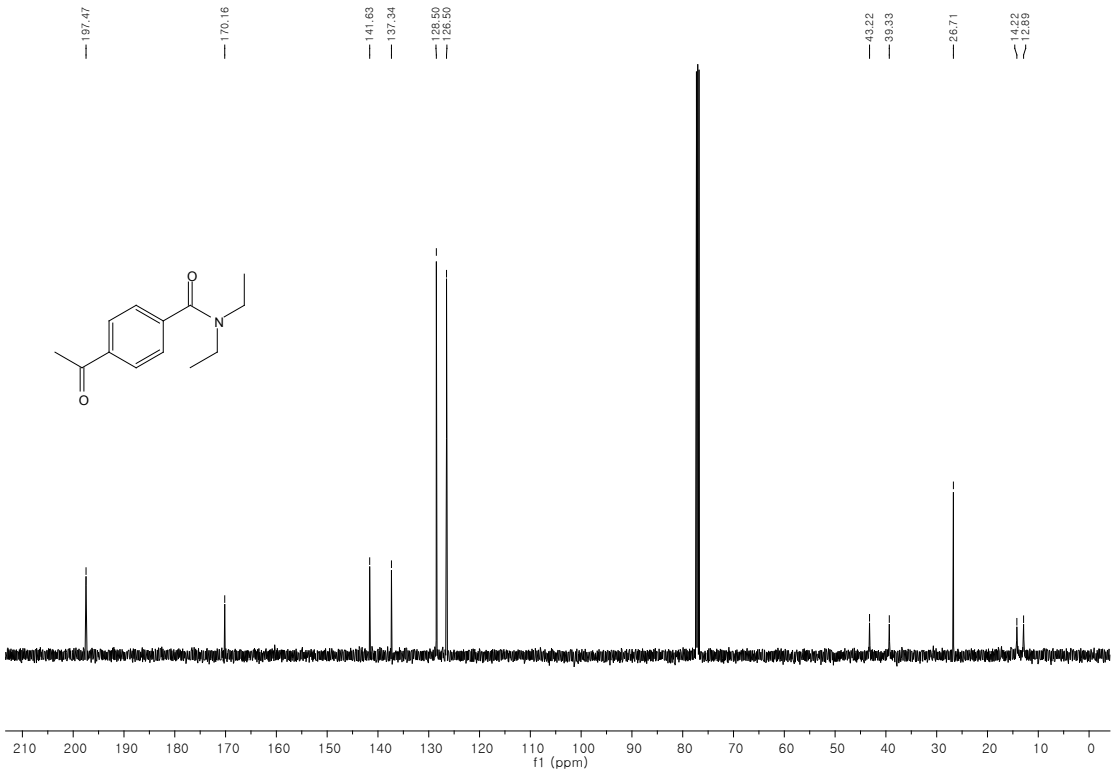


4-Acetyl-*N*,*N*-diethylbenzamide (3ua):

^{1}H NMR

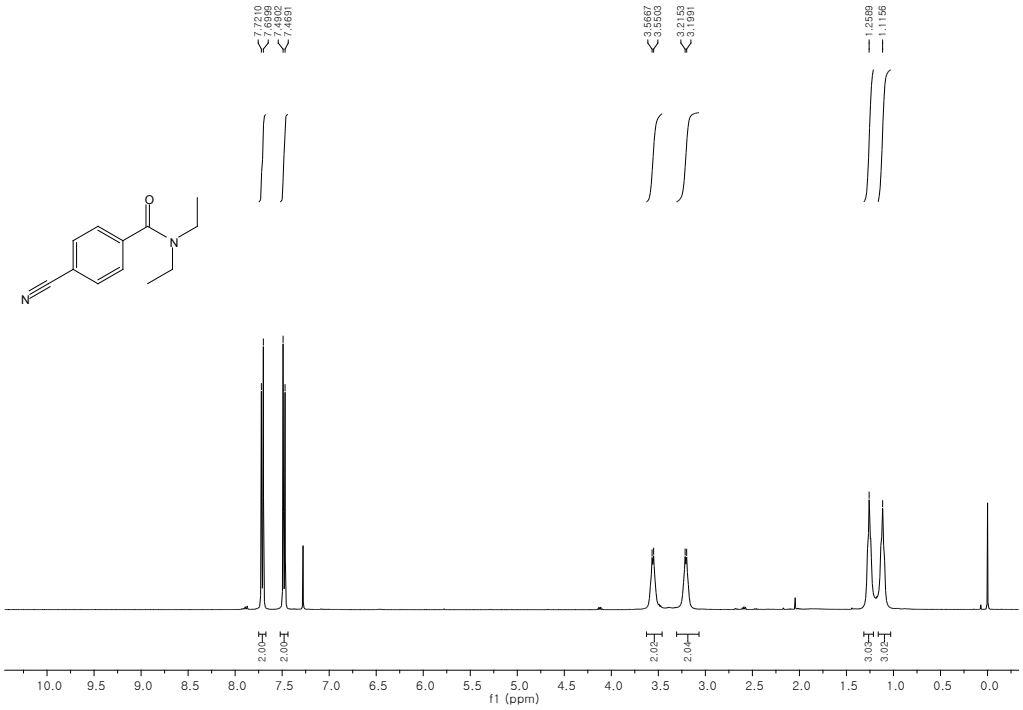


^{13}C NMR

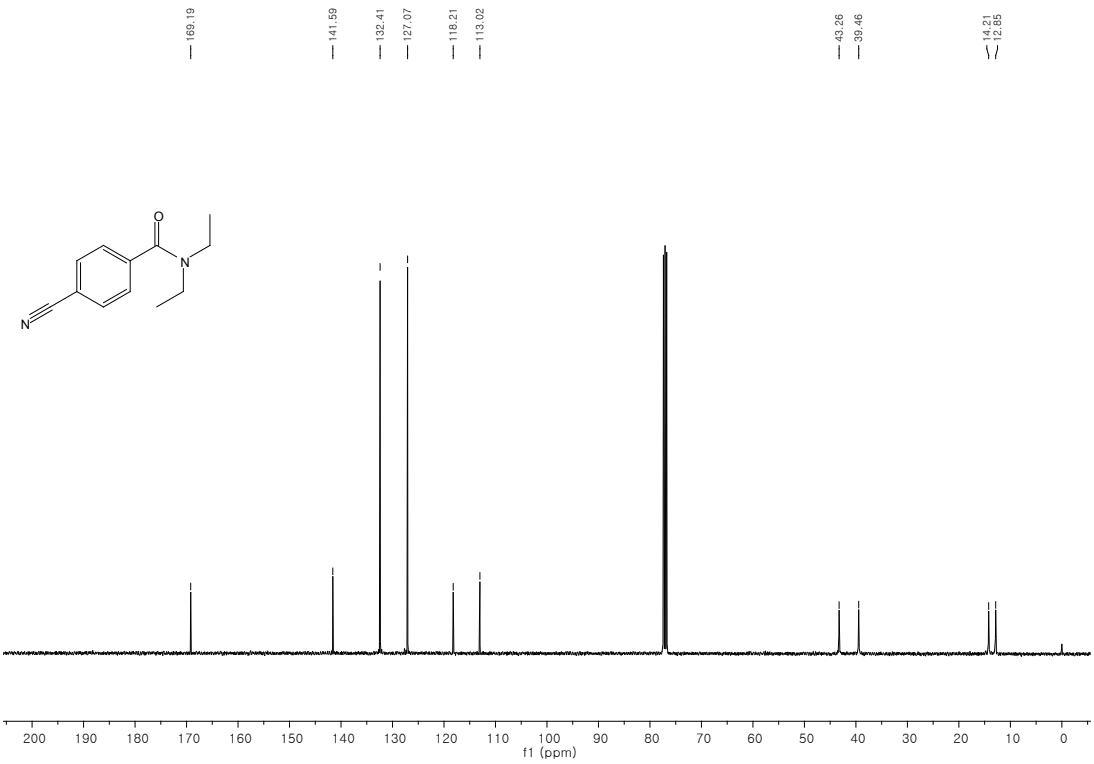


4-Cyano-*N,N*-diethylbenzamide (3va):

^{1}H NMR

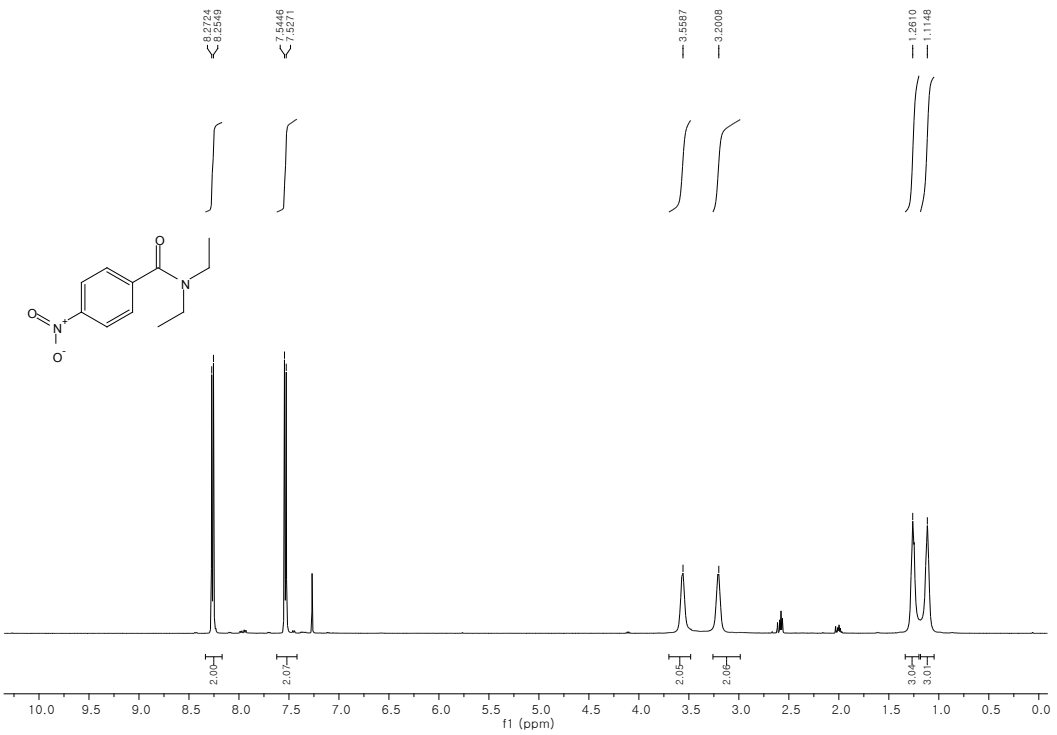


^{13}C NMR

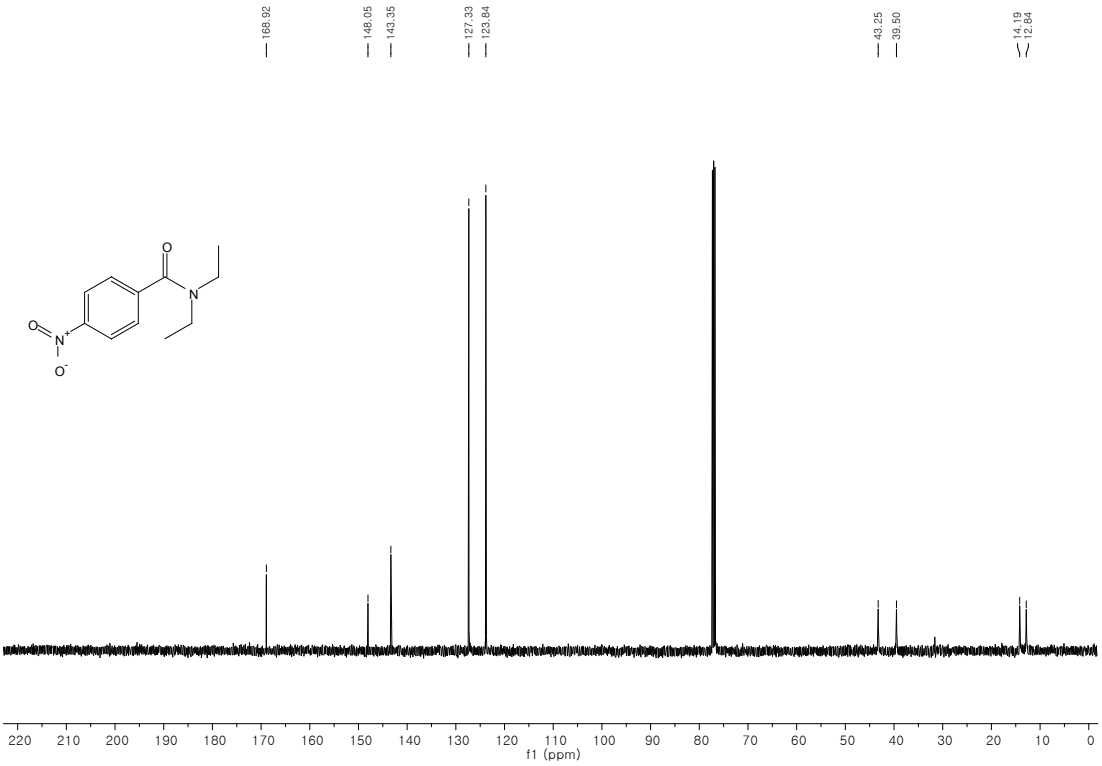


***N,N*-Diethyl-4-nitrobenzamide (3wa)**:

^{1}H NMR

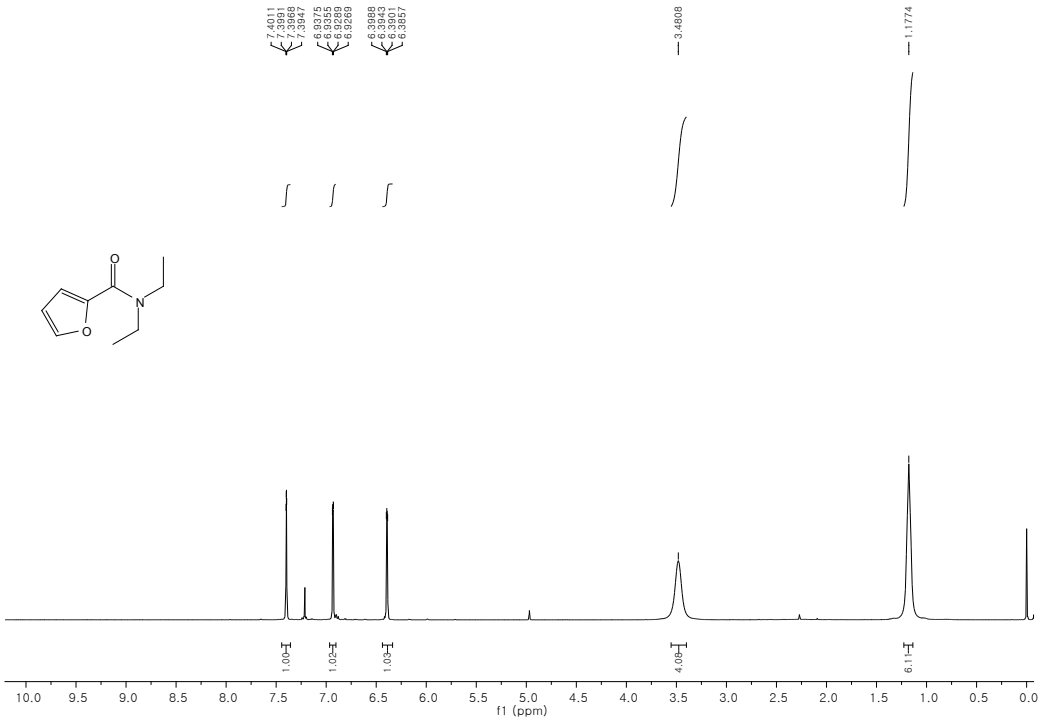


^{13}C NMR

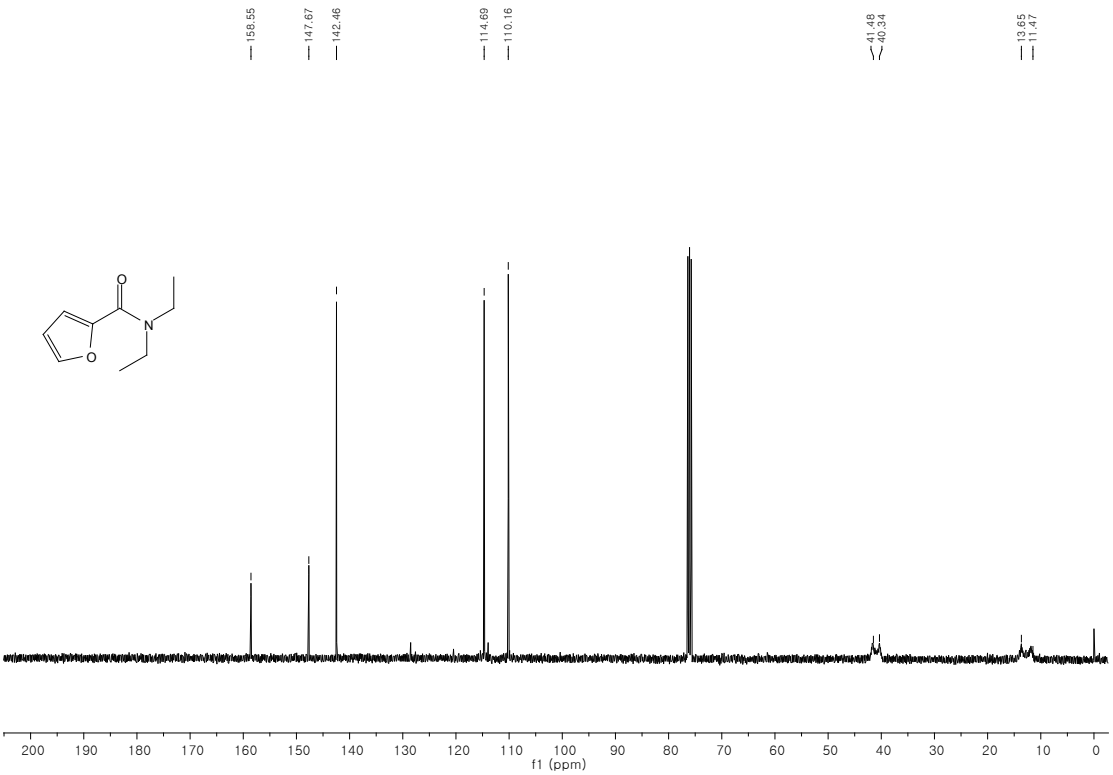


***N,N*-Diethylfuran-2-carboxamide (3xa)**:

^{1}H NMR

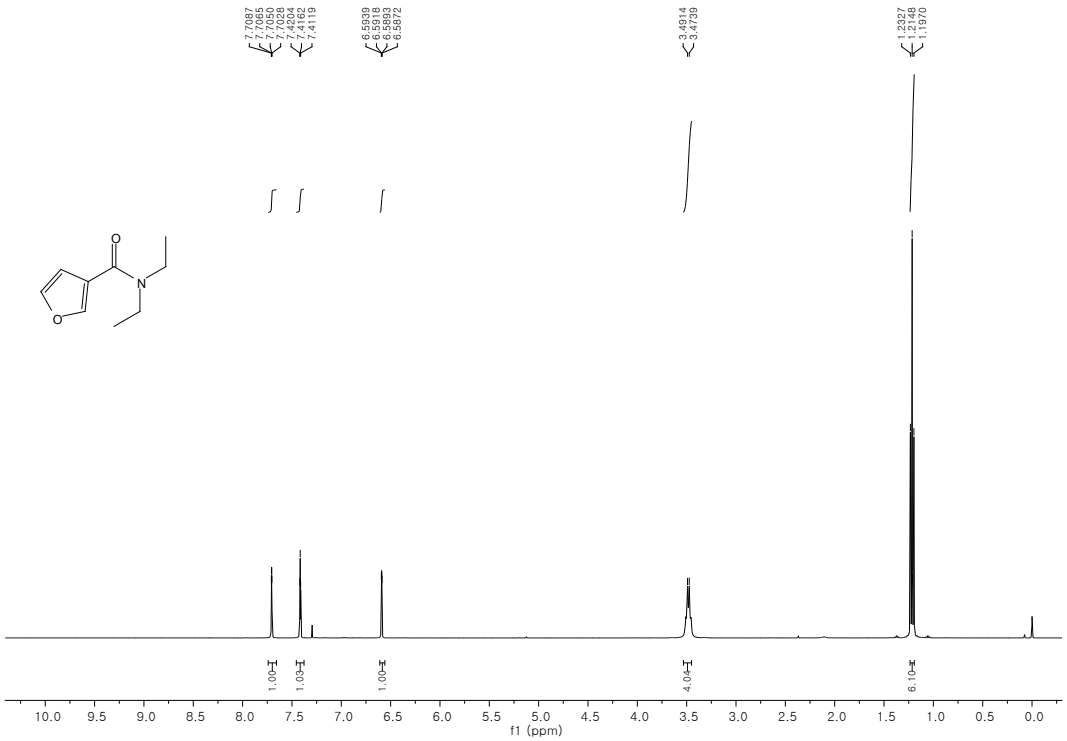


^{13}C NMR

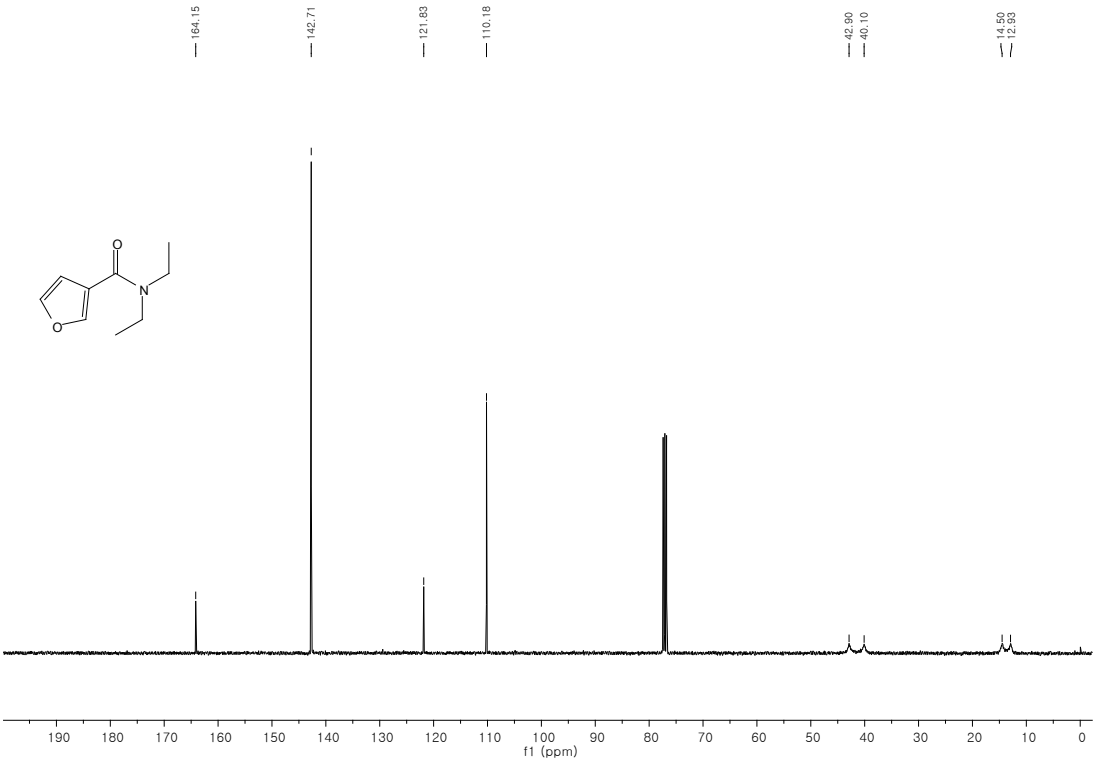


***N,N*-Diethylfuran-3-carboxamide (3ya)**:

^{1}H NMR

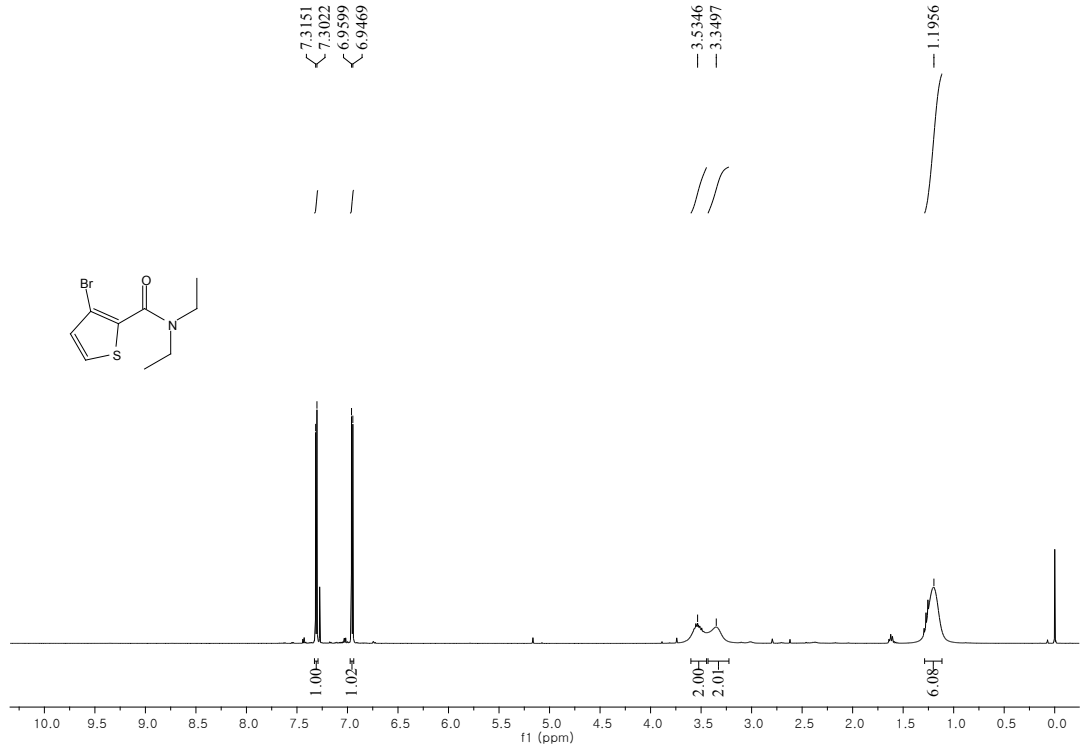


^{13}C NMR

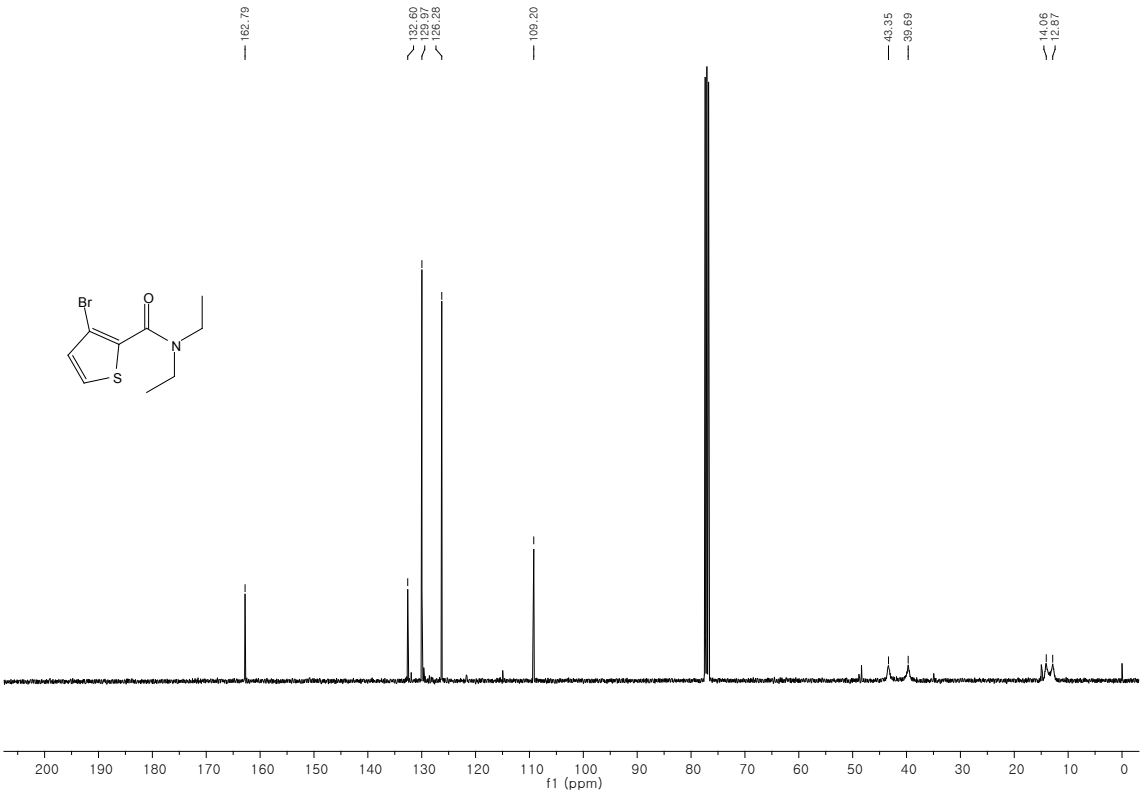


3-Bromo-*N*,*N*-diethylthiophene-2-carboxamide (3za):

^{1}H NMR

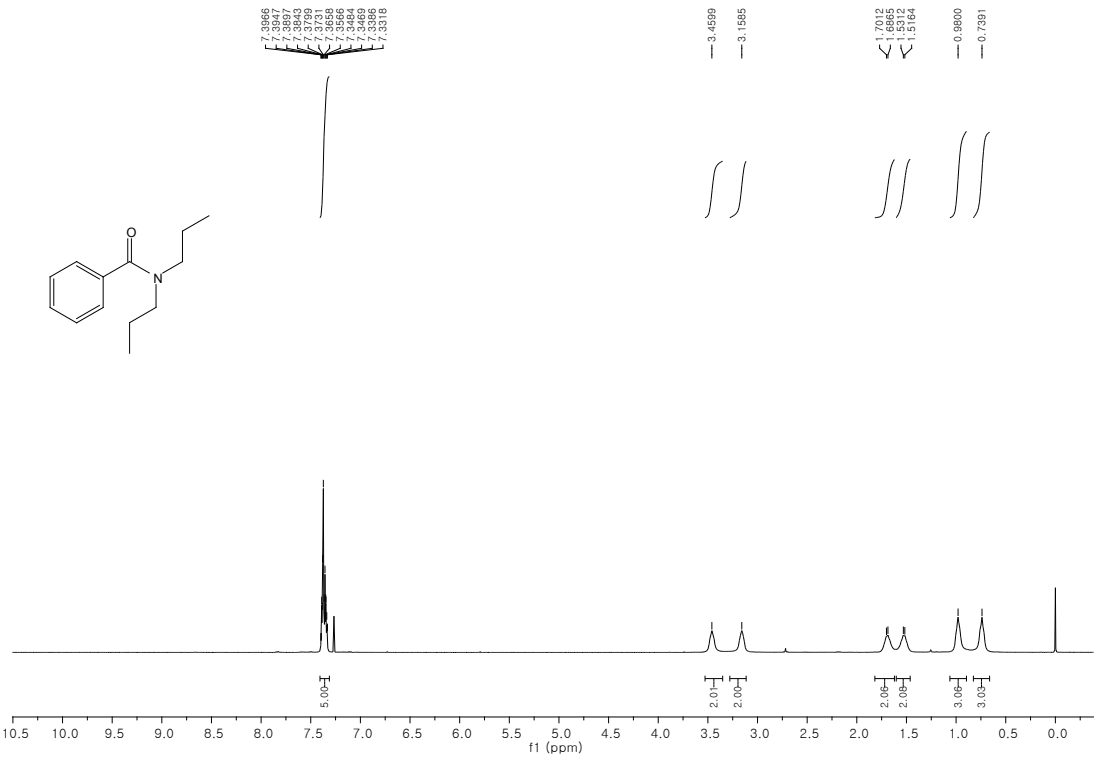


^{13}C NMR

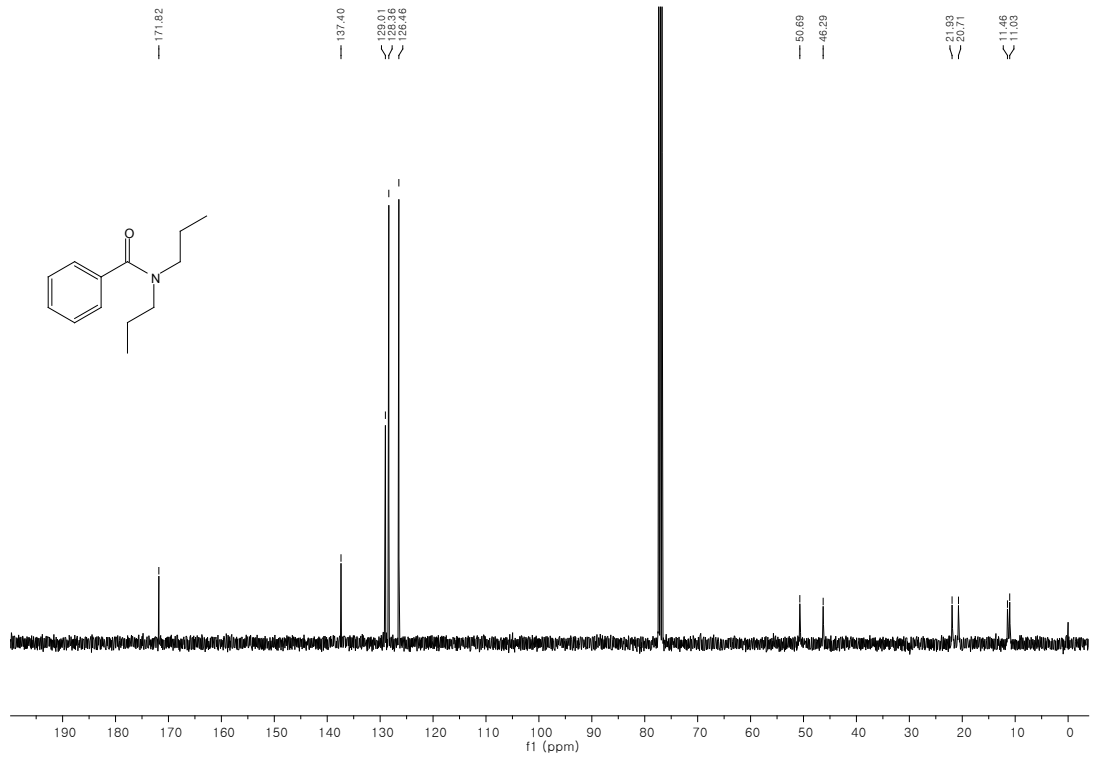


***N,N*-Dipropylbenzamide (3ab)**:

^{1}H NMR

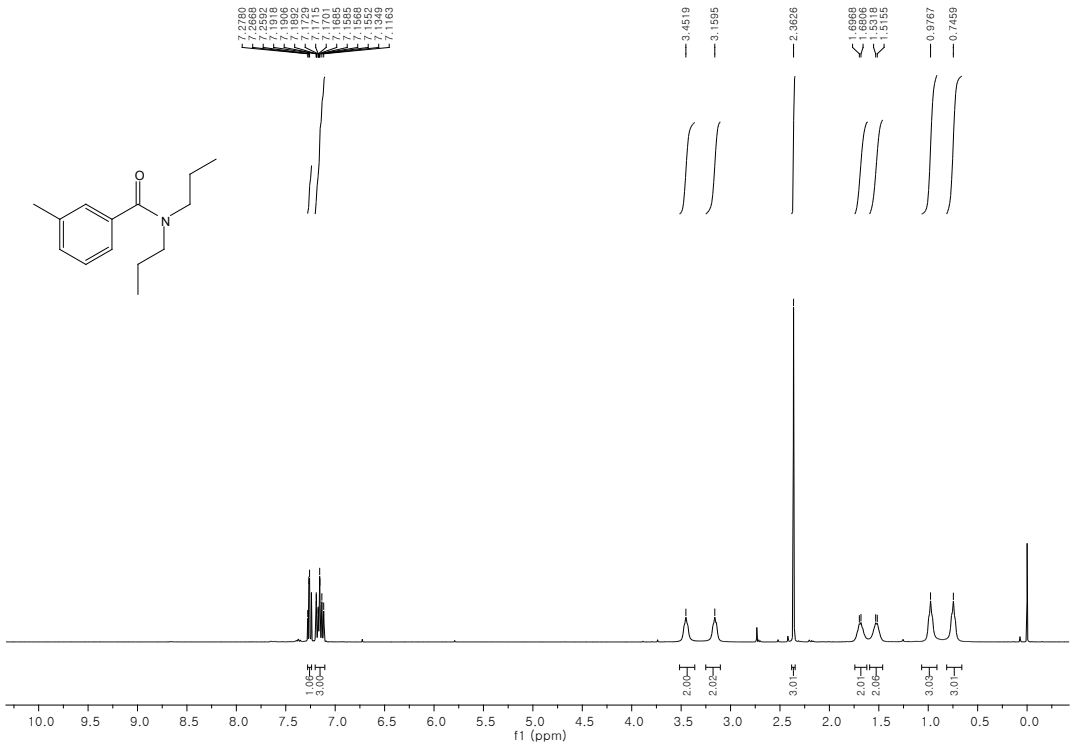


^{13}C NMR

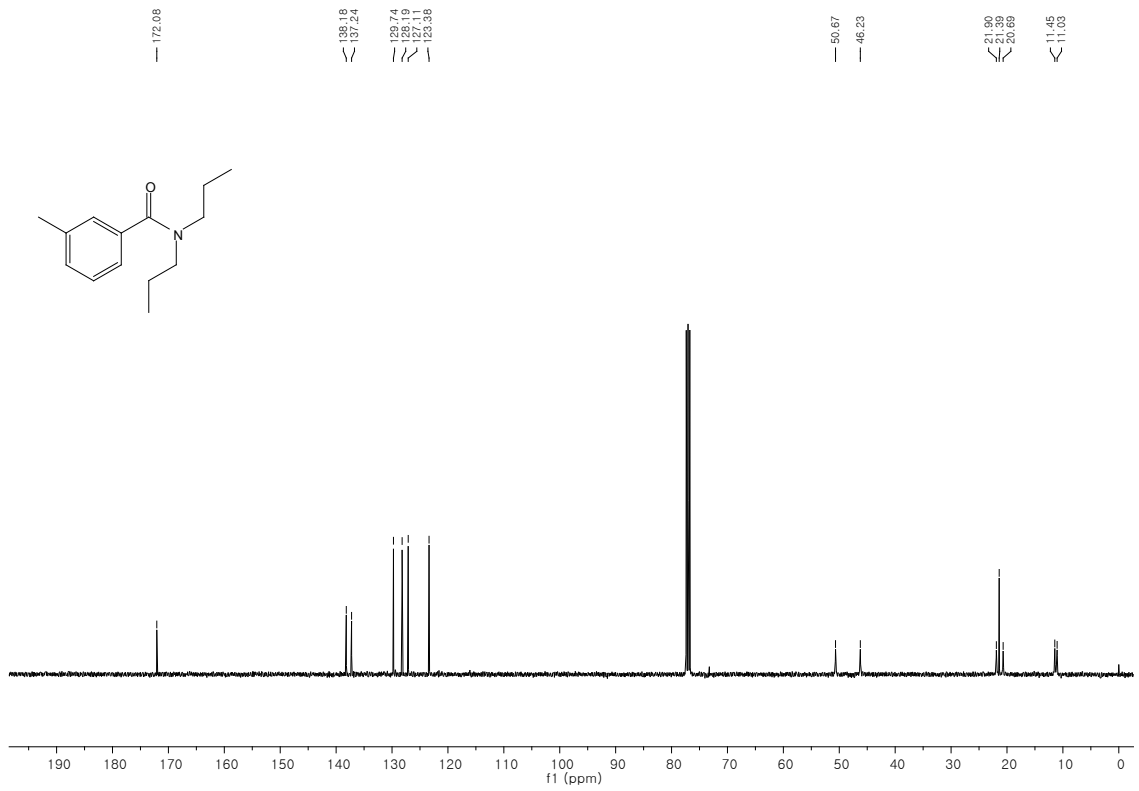


3-Methyl-*N,N*-dipropylbenzamide (3bb):

^{1}H NMR

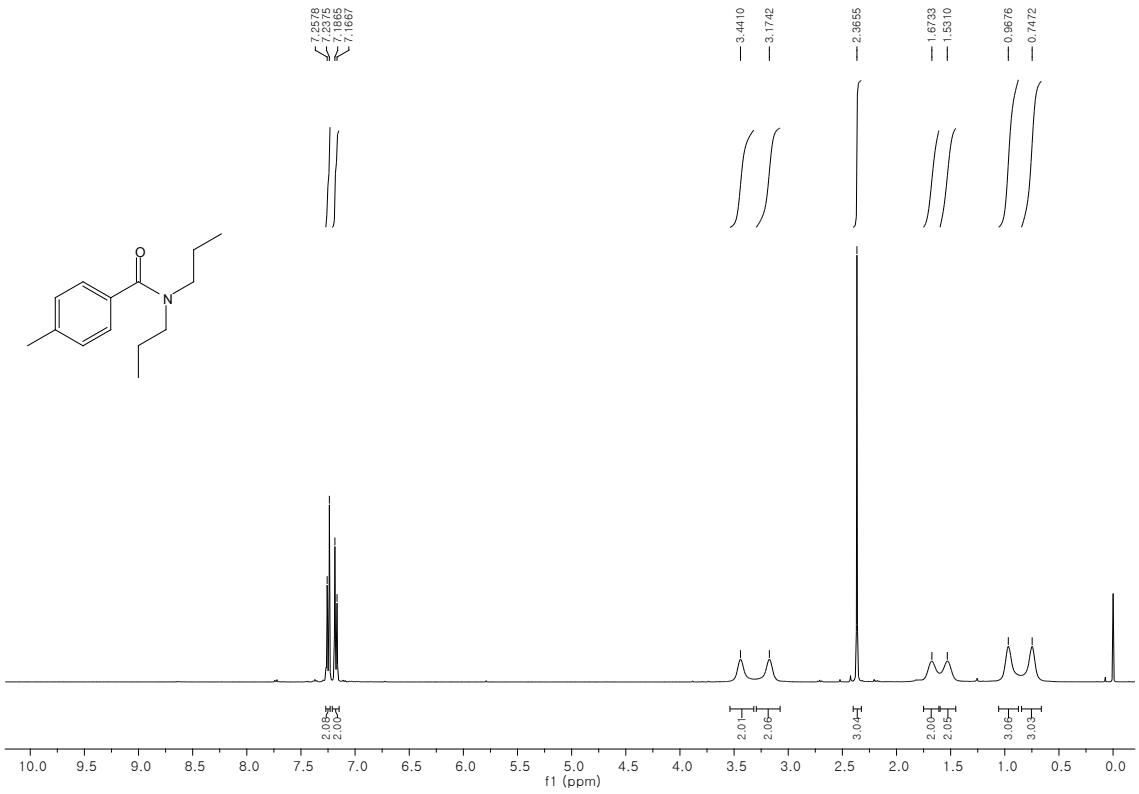


^{13}C NMR

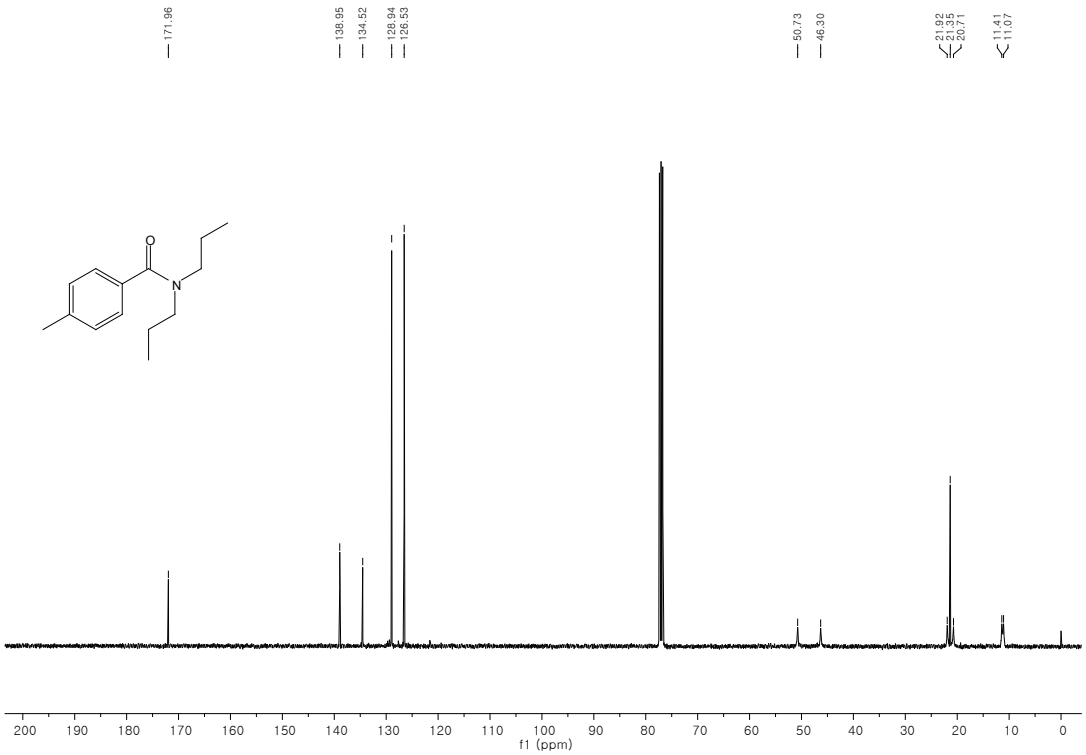


4-Methyl-*N*,*N*-dipropylbenzamide (3cb):

^{1}H NMR

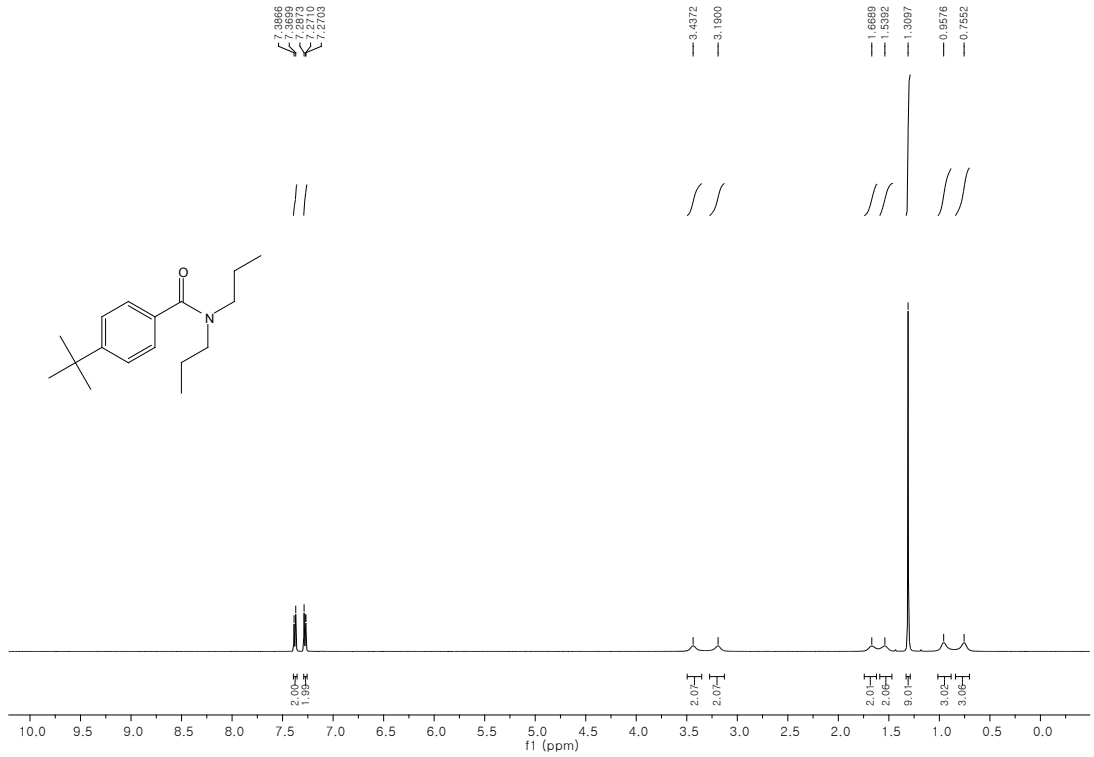


^{13}C NMR

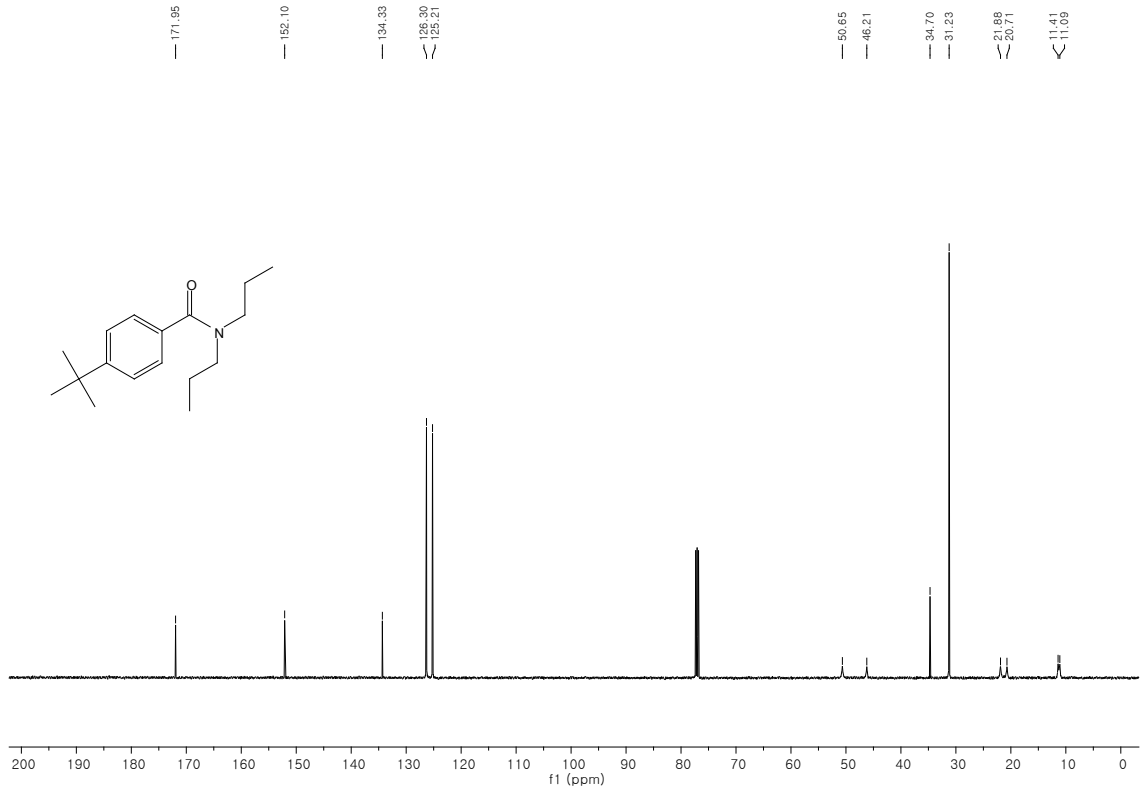


4-(tert-butyl)-*N*,*N*-dipropylbenzamide (3eb):

^{1}H NMR

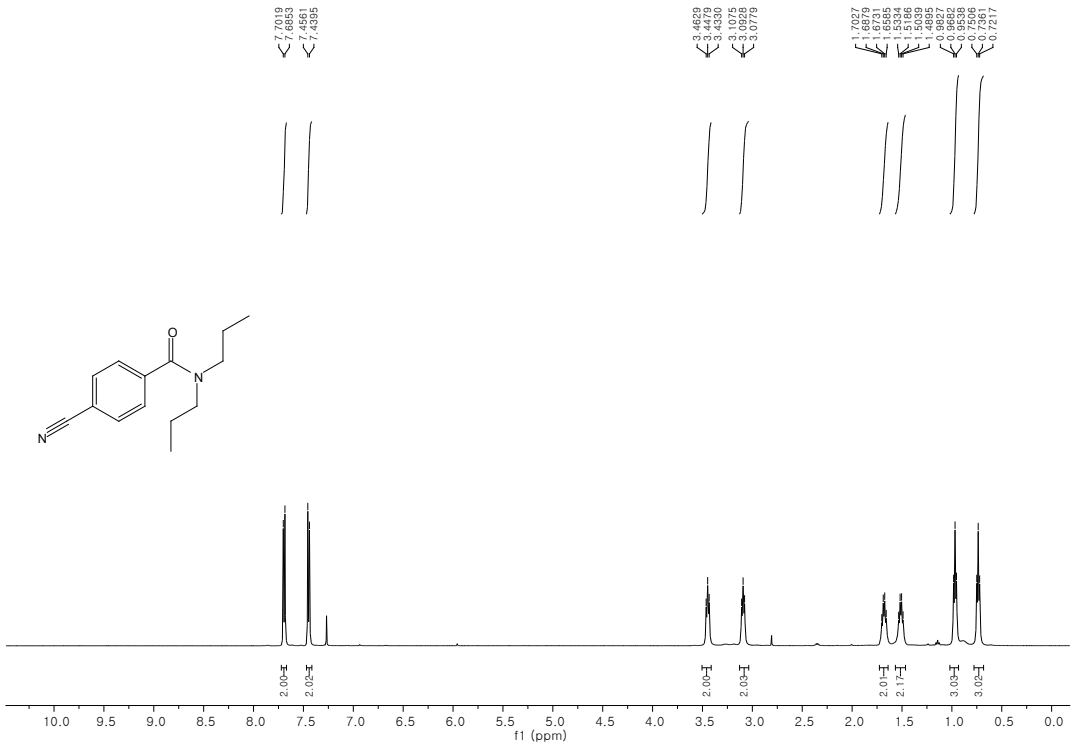


^{13}C NMR

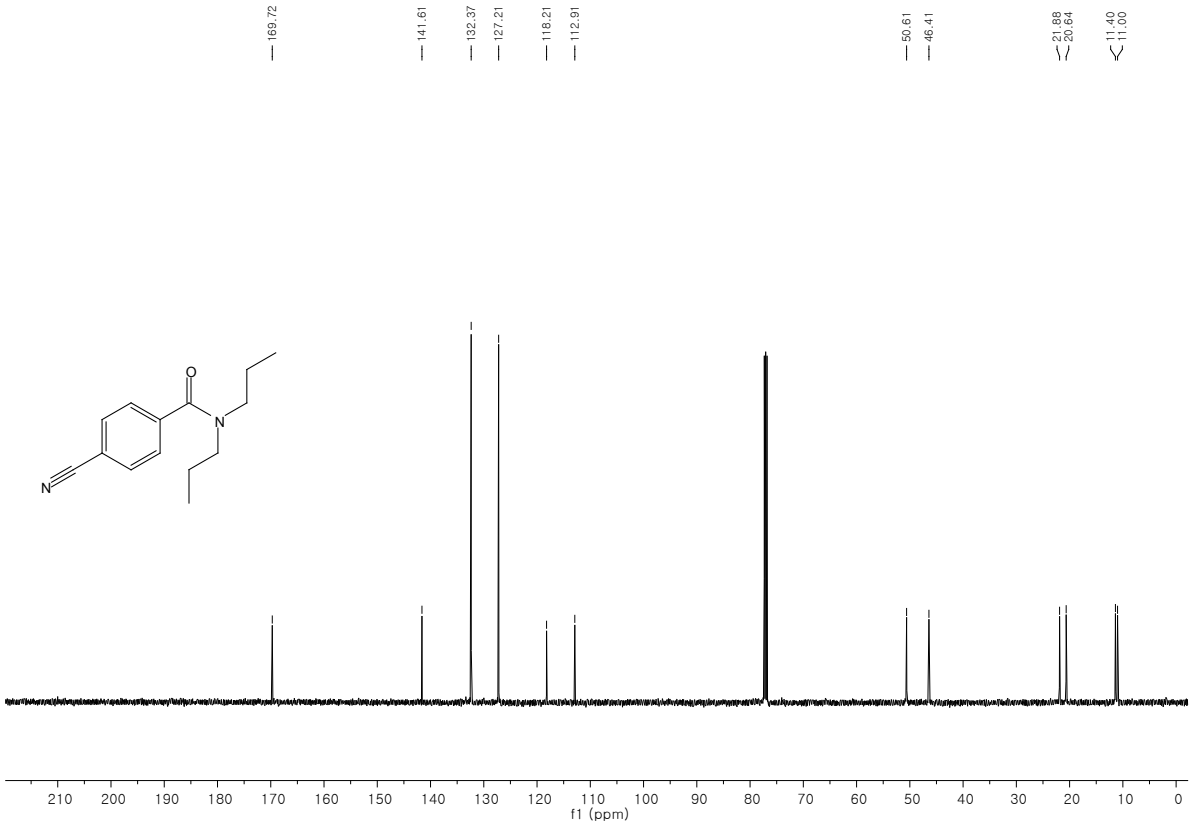


4-Cyano-*N,N*-dipropylbenzamide (3sb):

^{1}H NMR

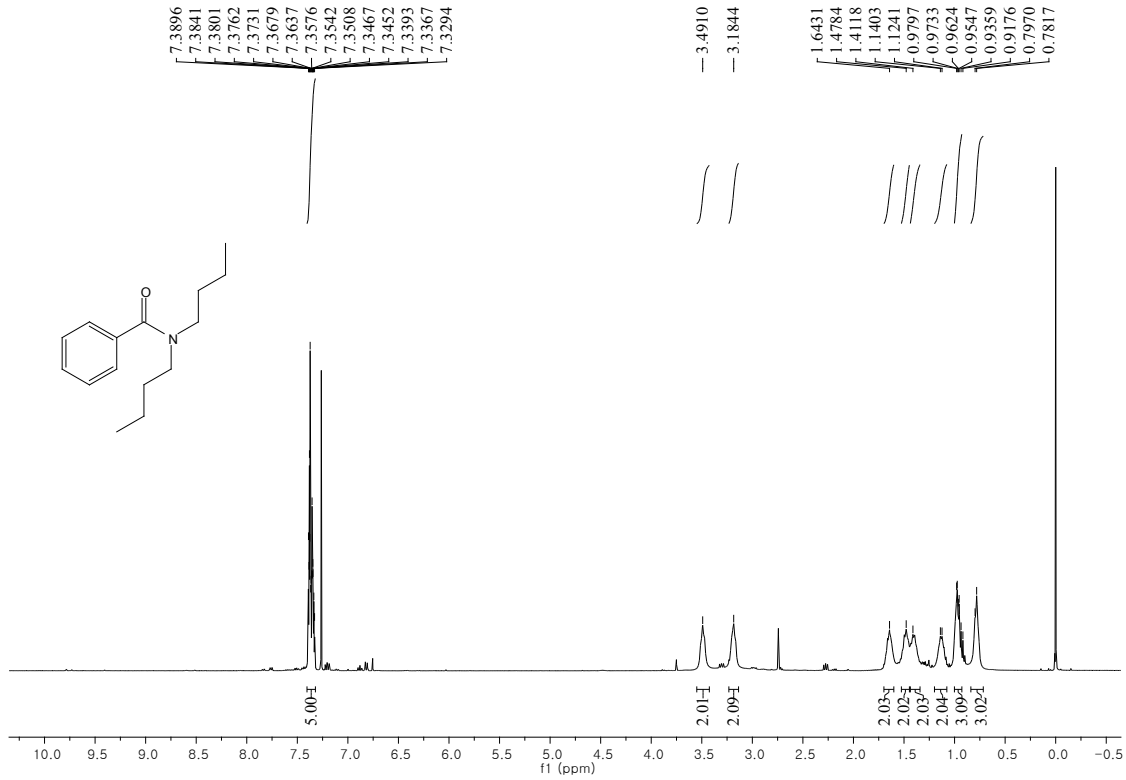


^{13}C NMR

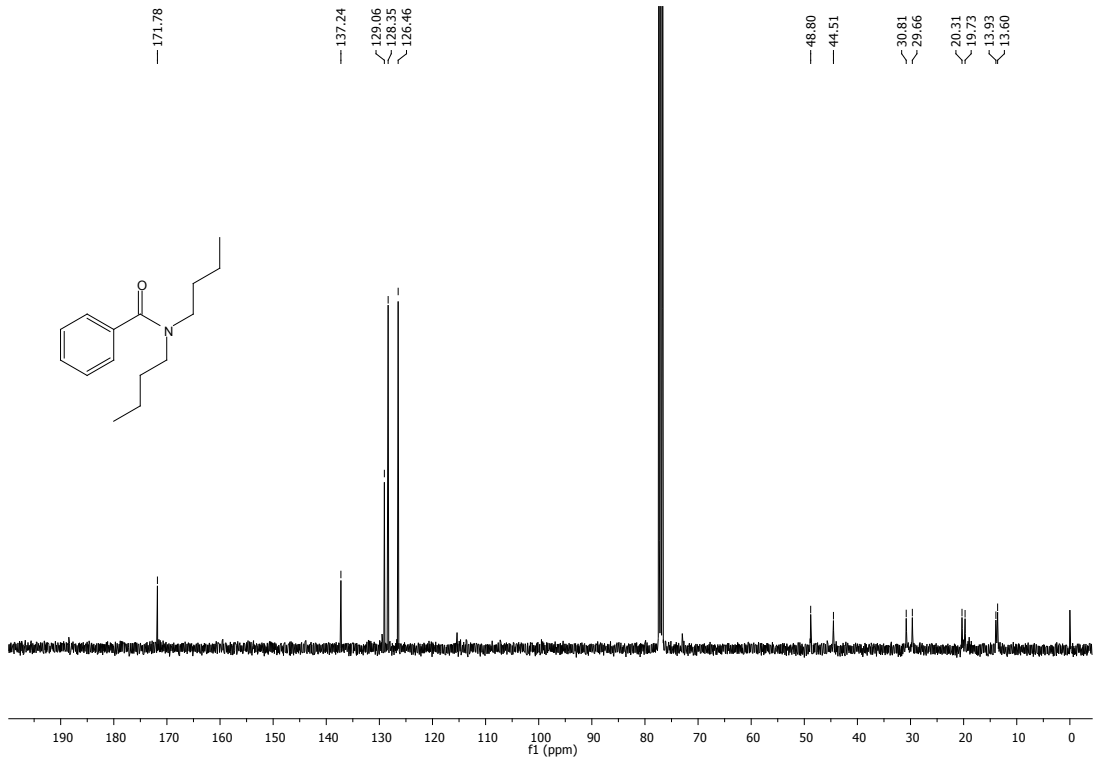


***N,N*-Dibutylbenzamide (3ac)**:

^{1}H NMR

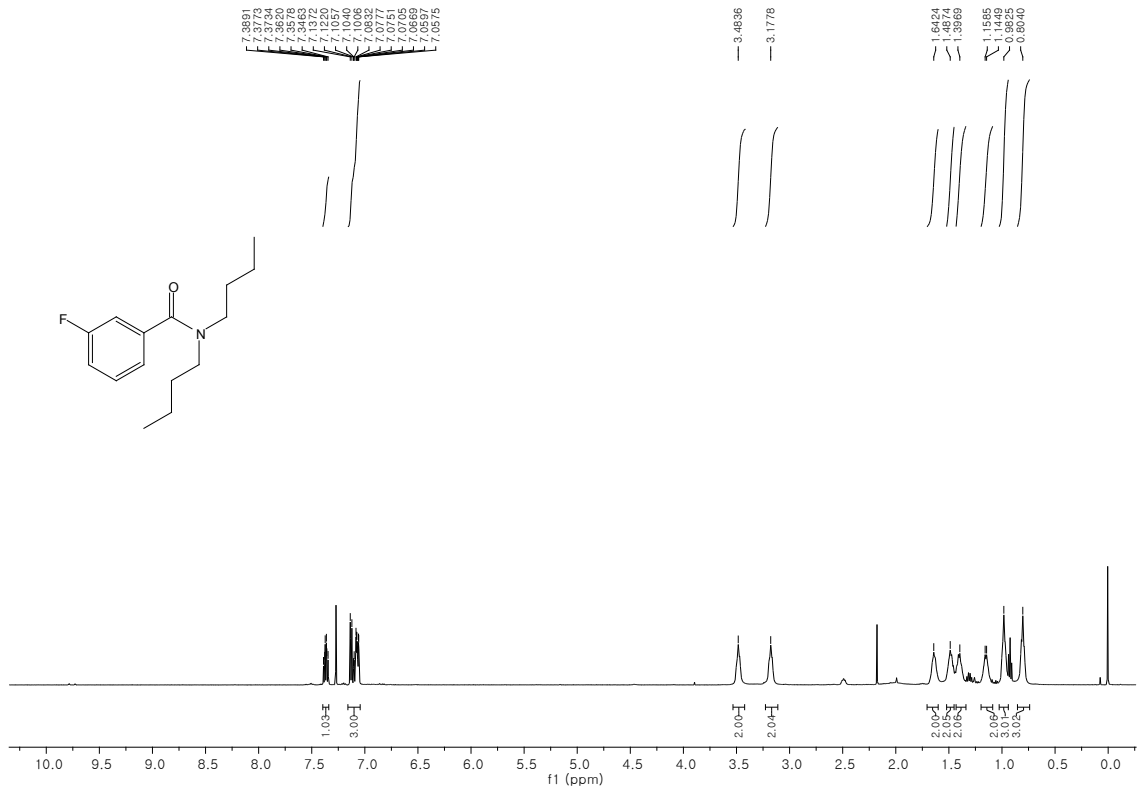


^{13}C NMR

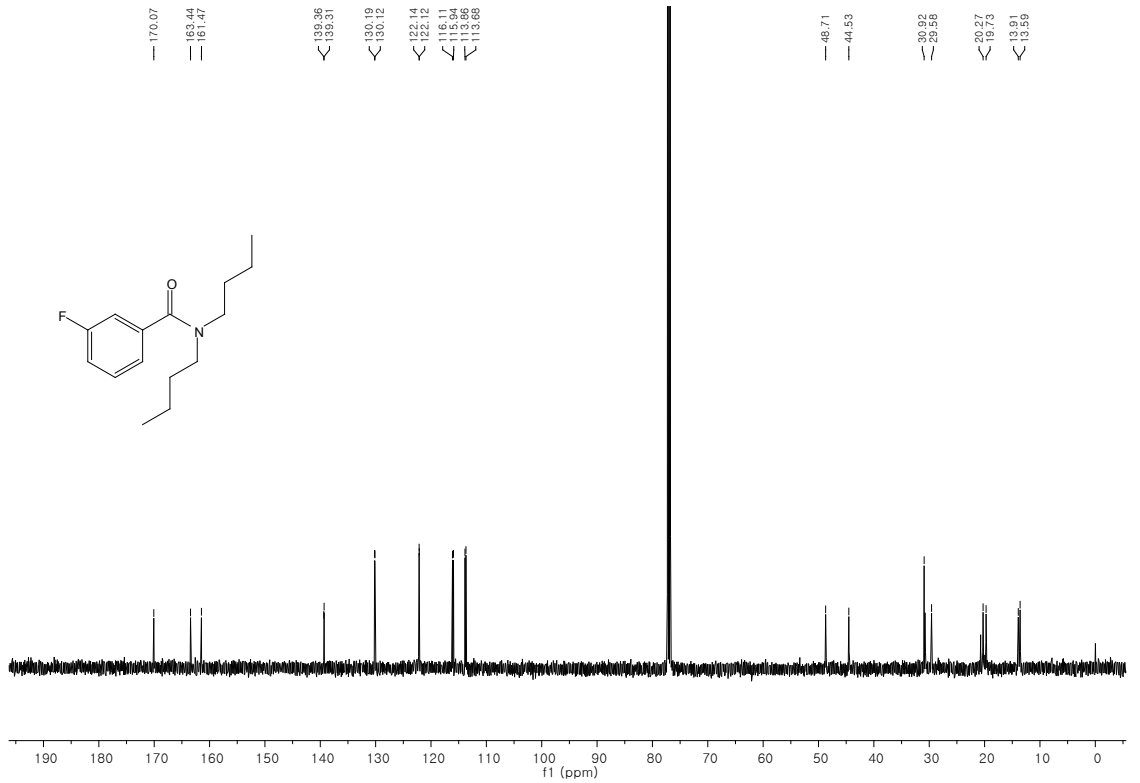


***N,N*-Dibutyl-3-fluorobenzamide (3kc)**:

^{1}H NMR

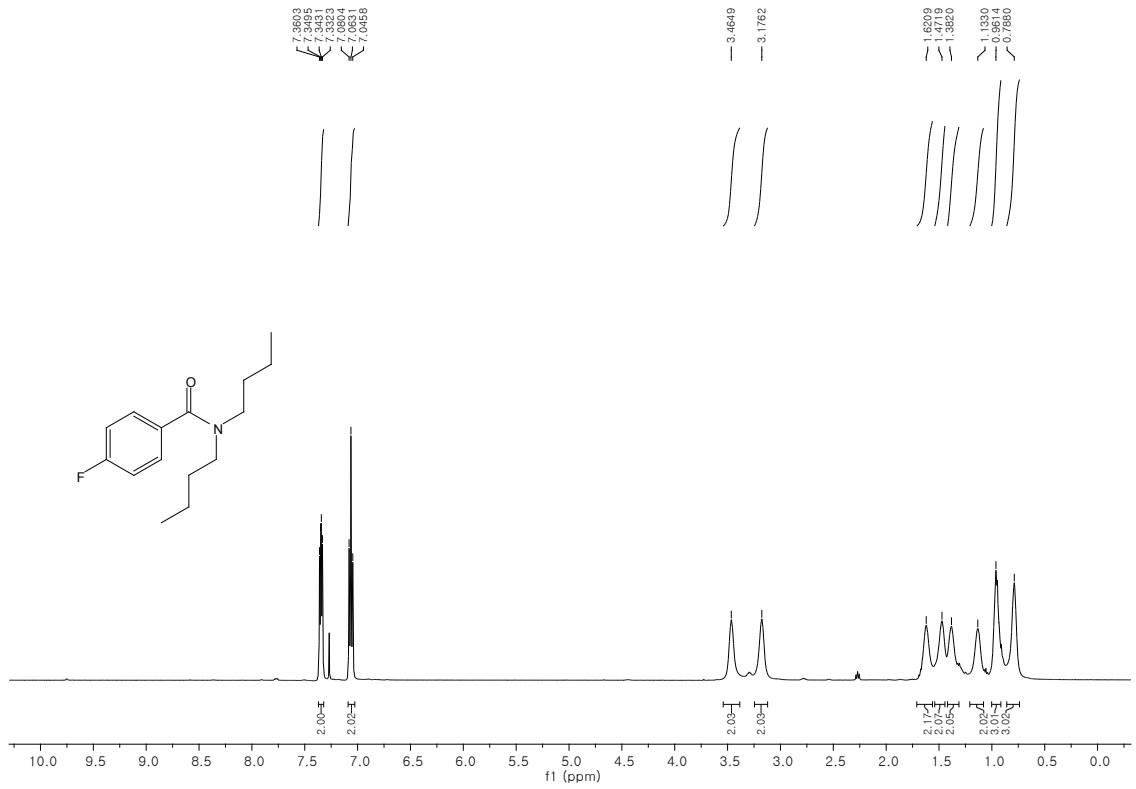


^{13}C NMR

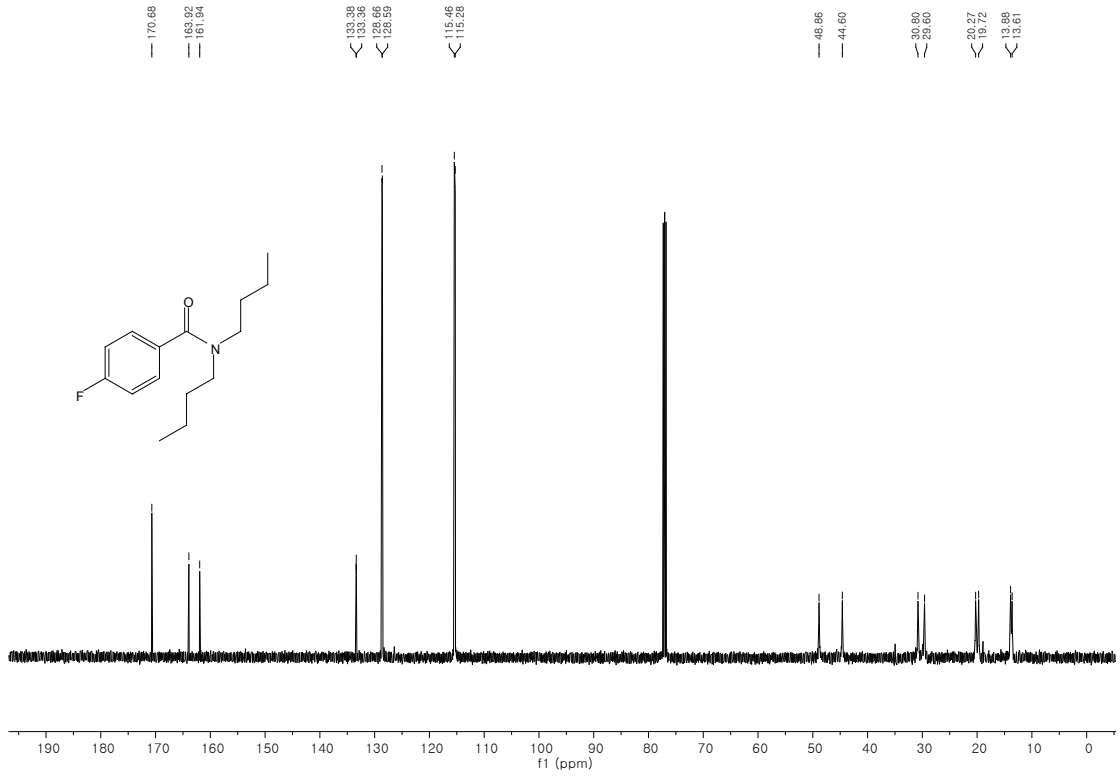


***N,N*-Dibutyl-4-fluorobenzamide (3lc)**:

^{1}H NMR

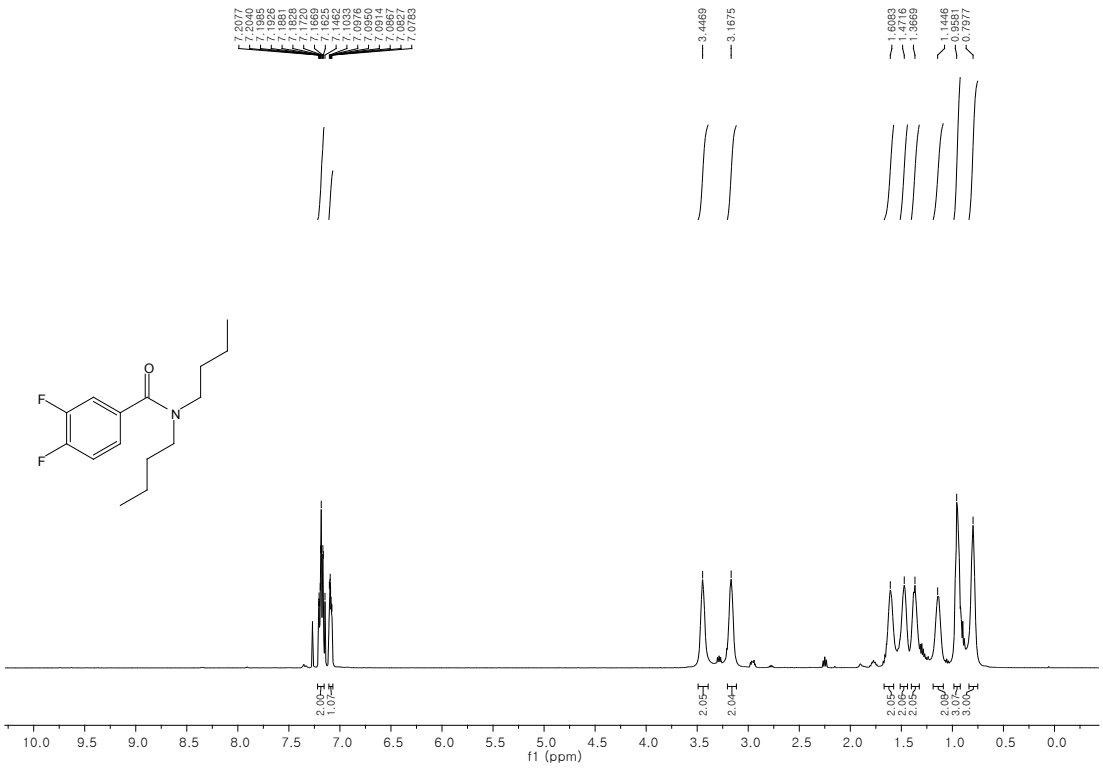


^{13}C NMR

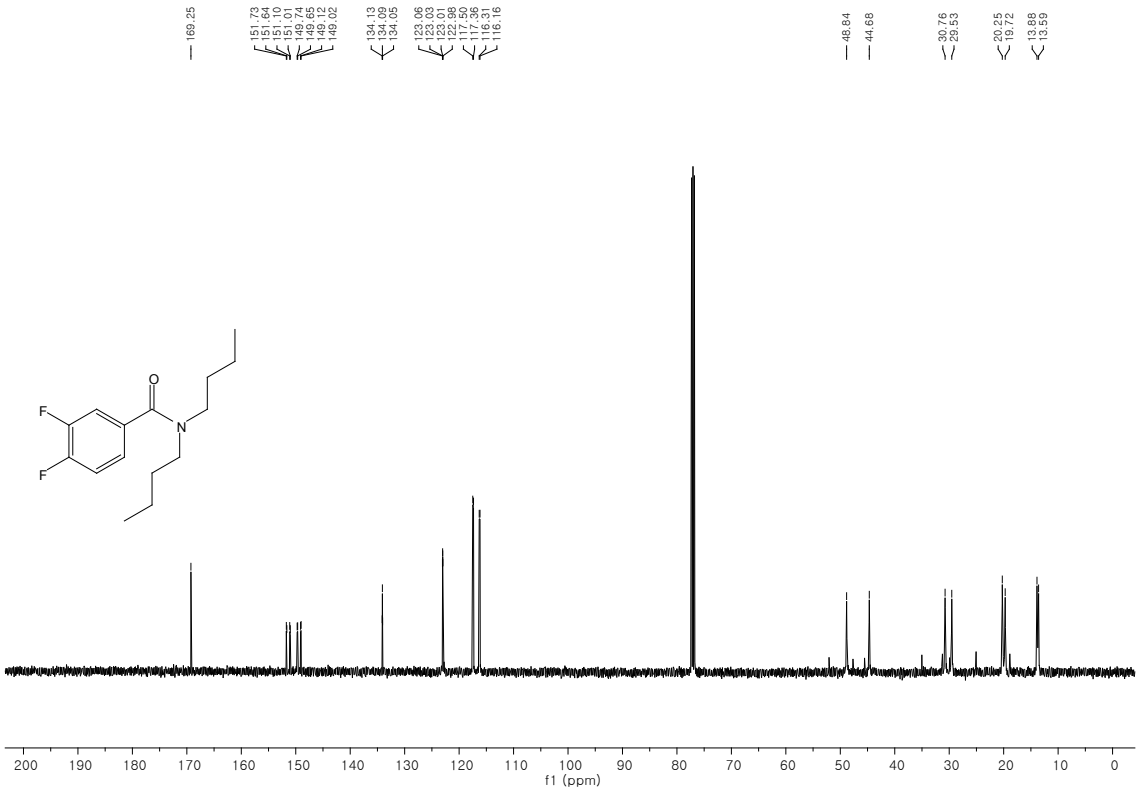


***N,N*-Dibutyl-3,4-difluorobenzamide (3mc)**:

^{1}H NMR

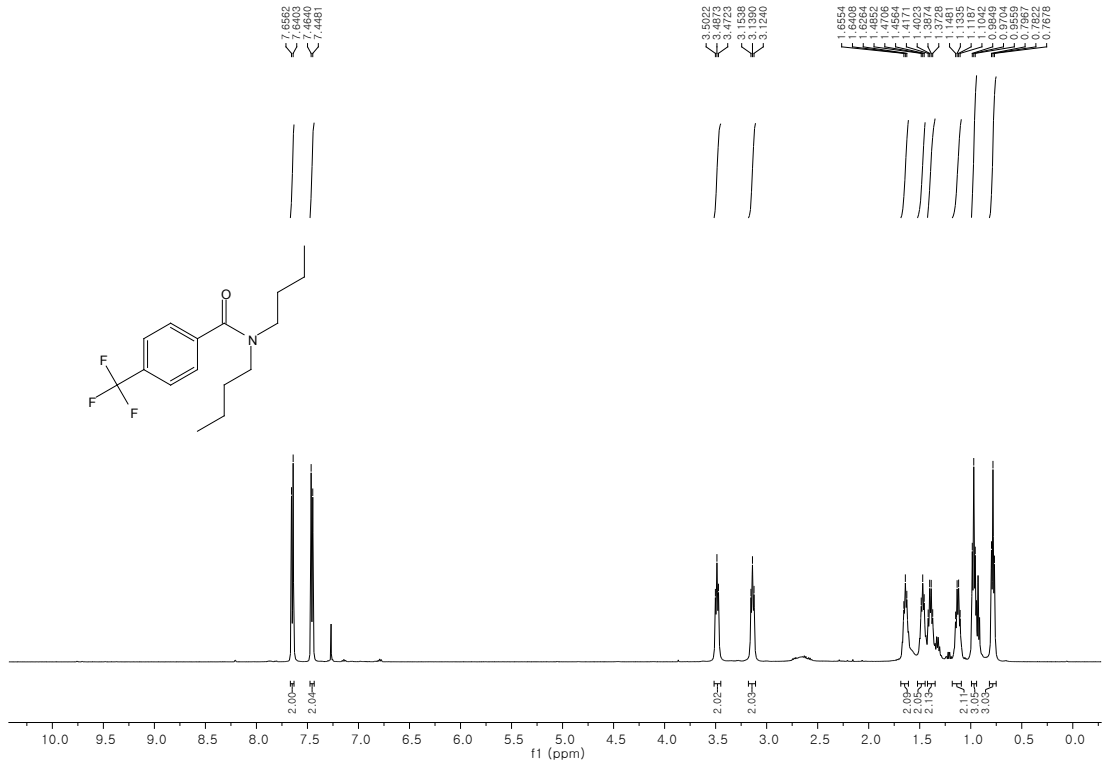


^{13}C NMR

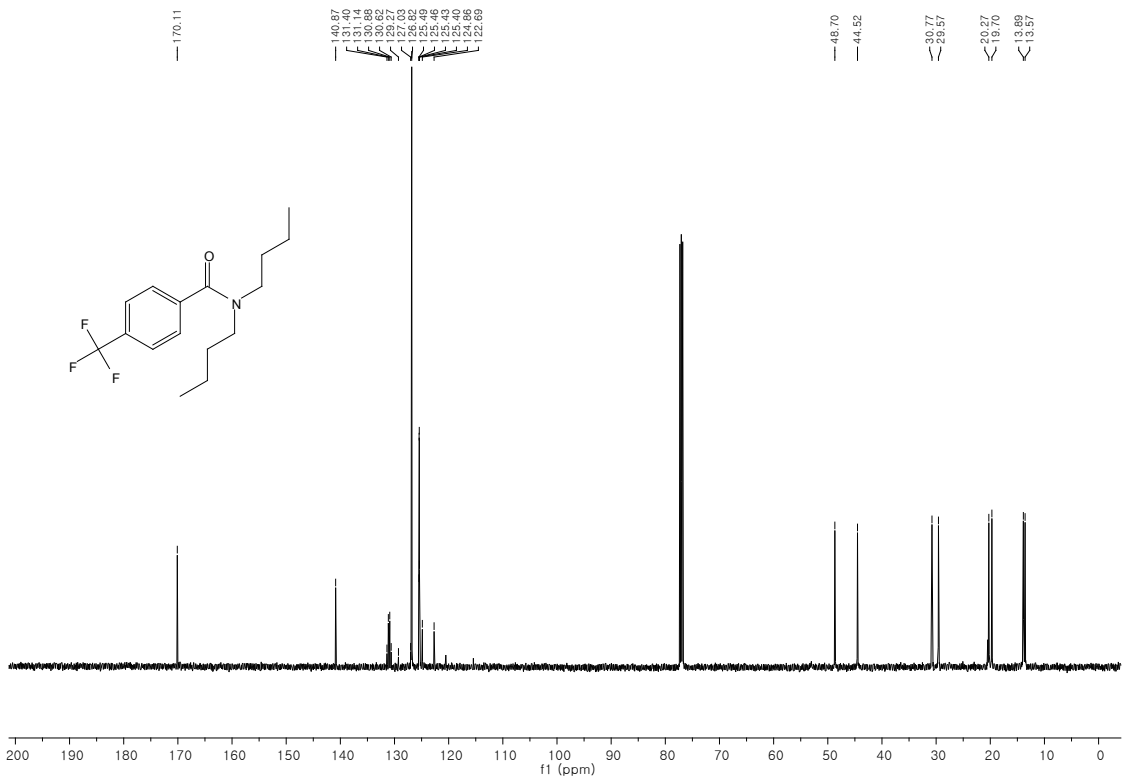


***N,N*-Dibutyl-4-(trifluoromethyl)benzamide (3nc)**:

^{1}H NMR

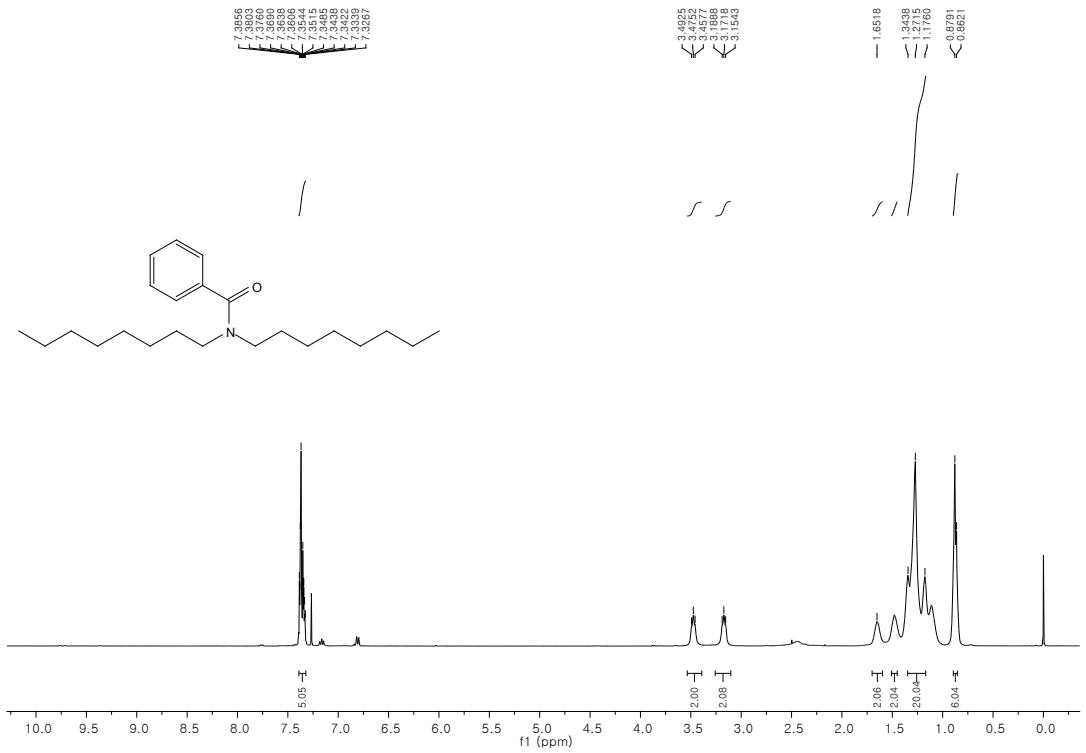


^{13}C NMR

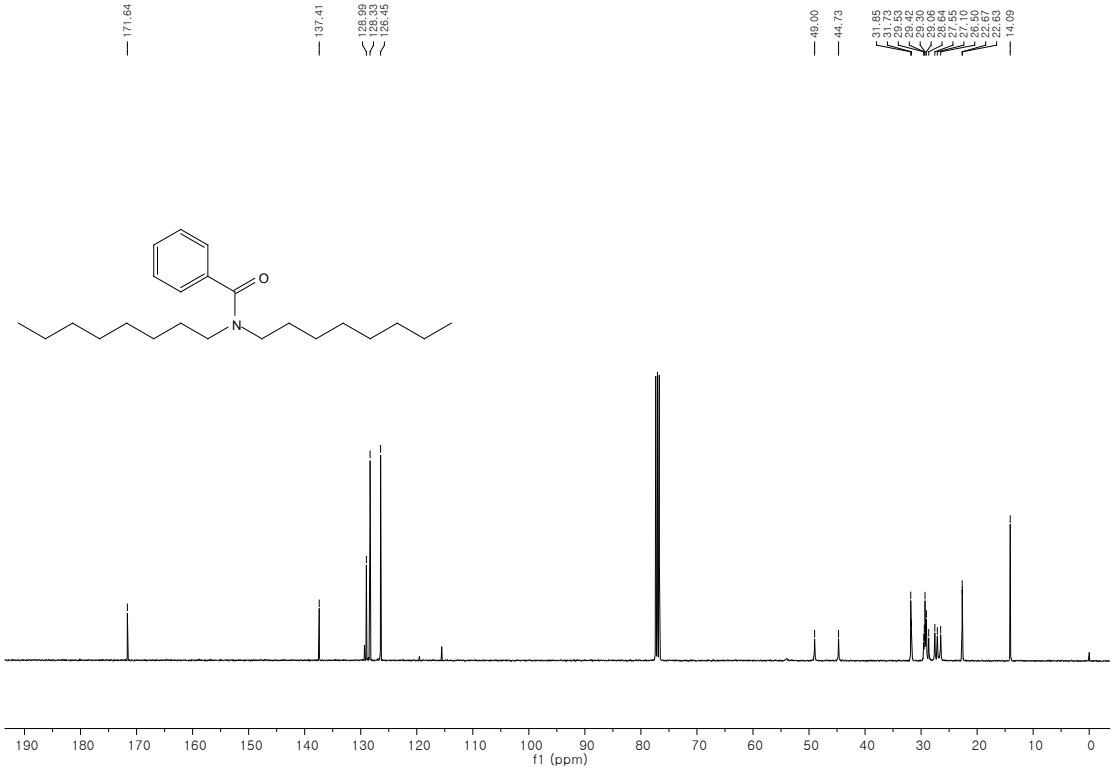


***N,N*-Dioctylbenzamide (3ad)**:

^{1}H NMR



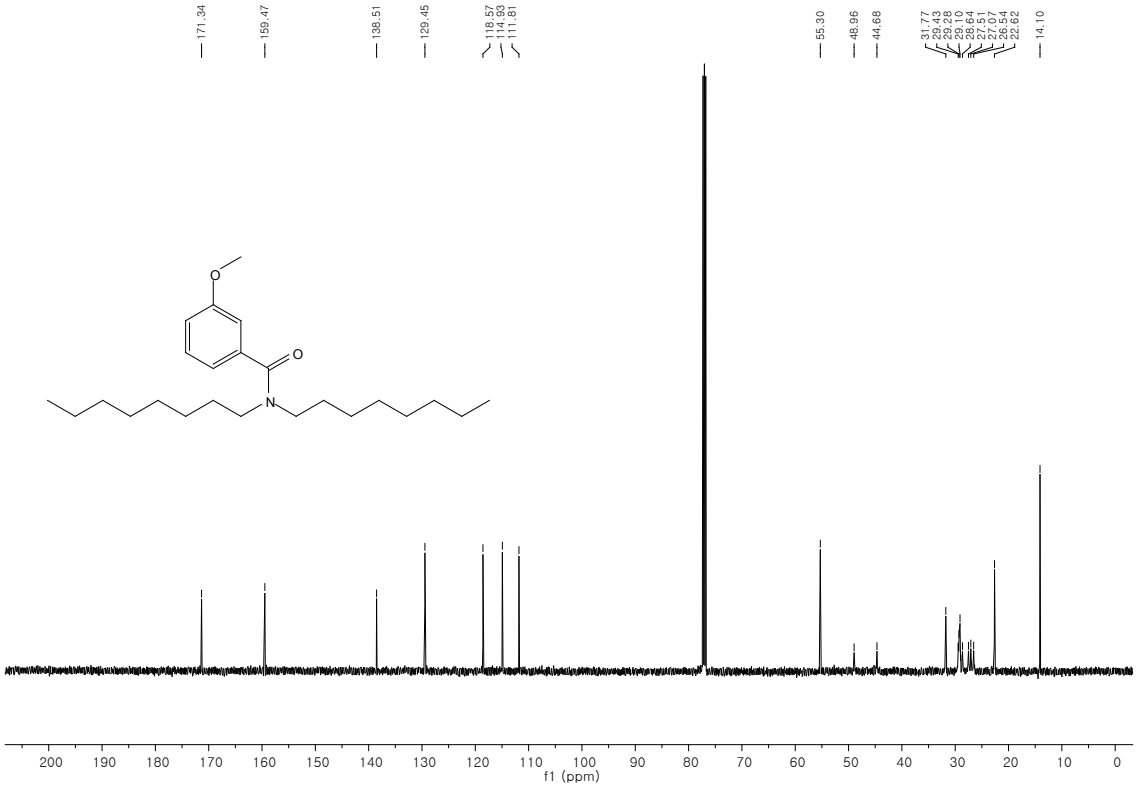
^{13}C NMR



3-Methoxy-*N,N*-dioctylbenzamide (3fd):

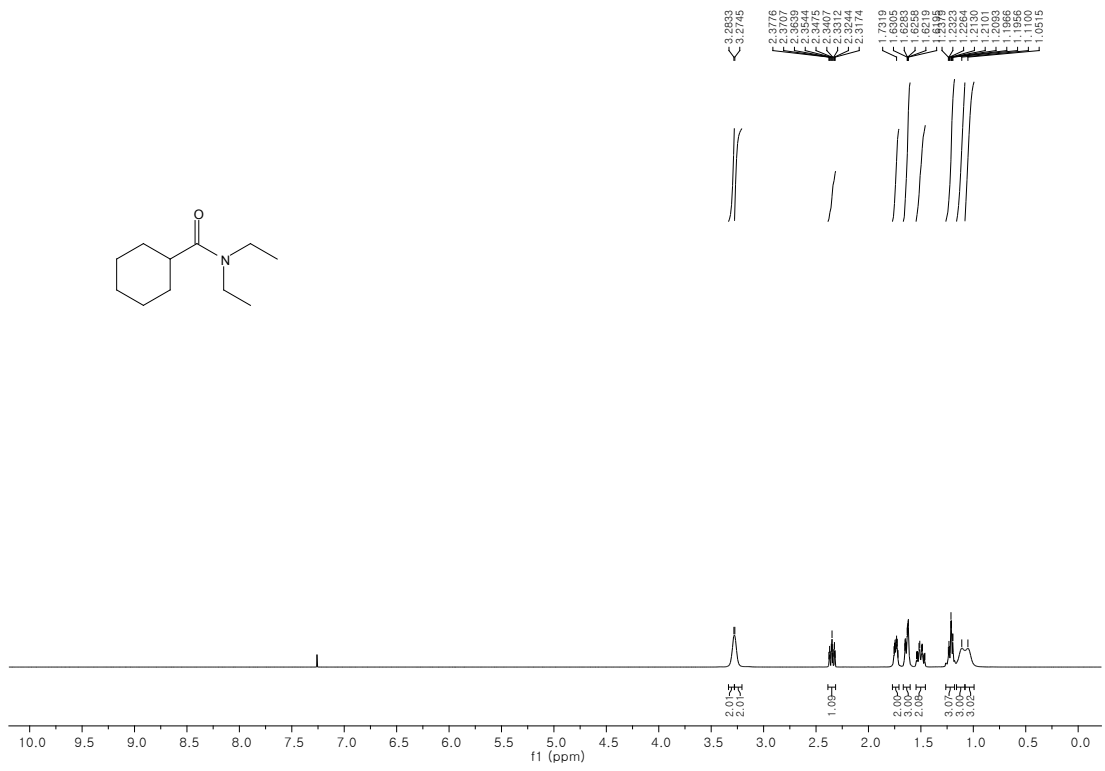
^{1}H NMR

^{13}C NMR

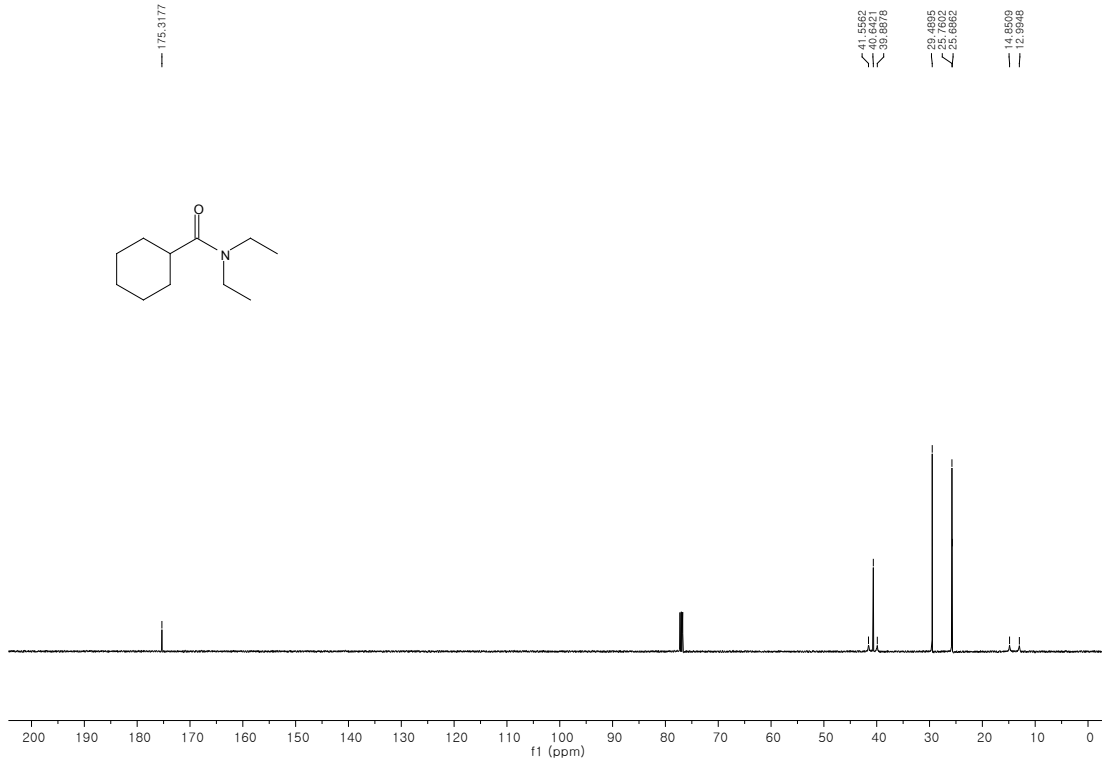


***N,N*-diethylcyclohexanecarboxamide (3'aa)**:

^{1}H NMR

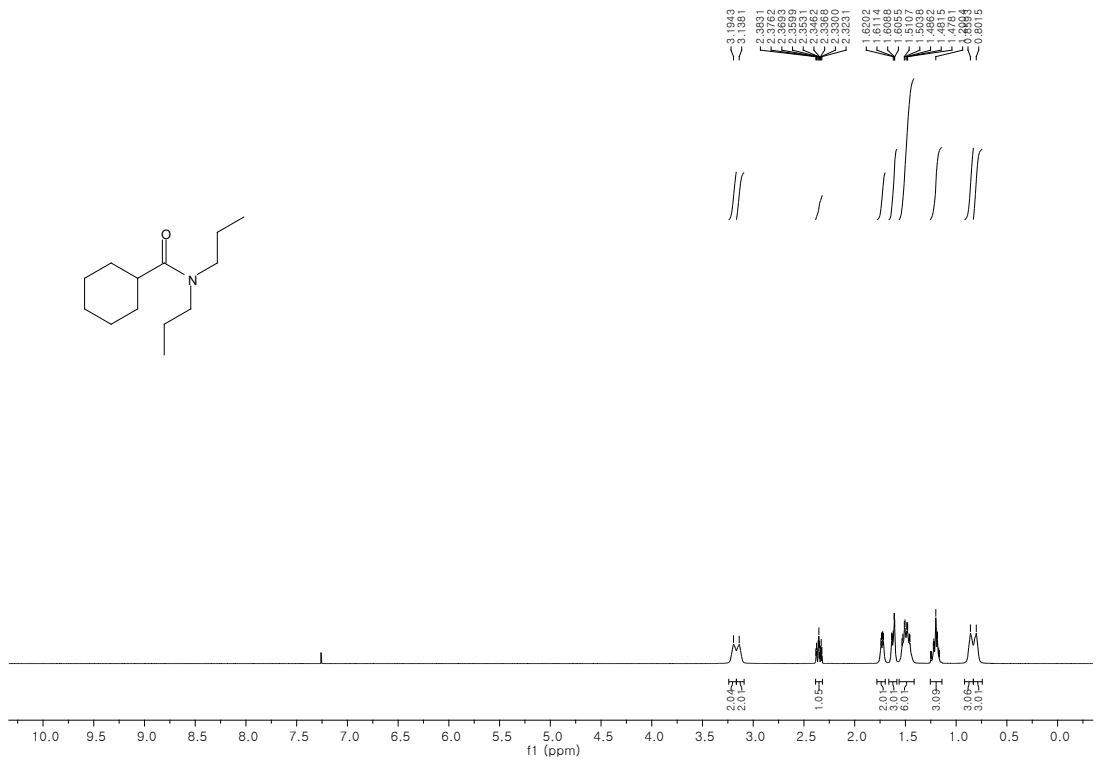


^{13}C NMR

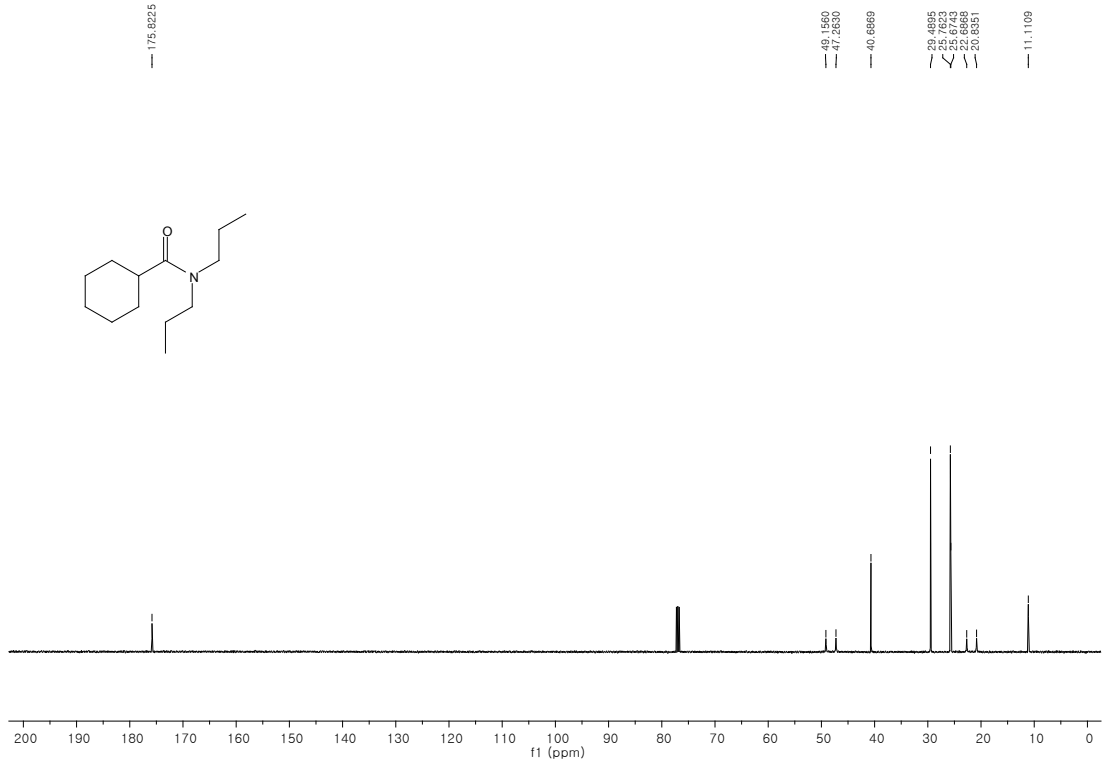


***N,N*-dipropylcyclohexanecarboxamide (3'ab)**:

^{1}H NMR

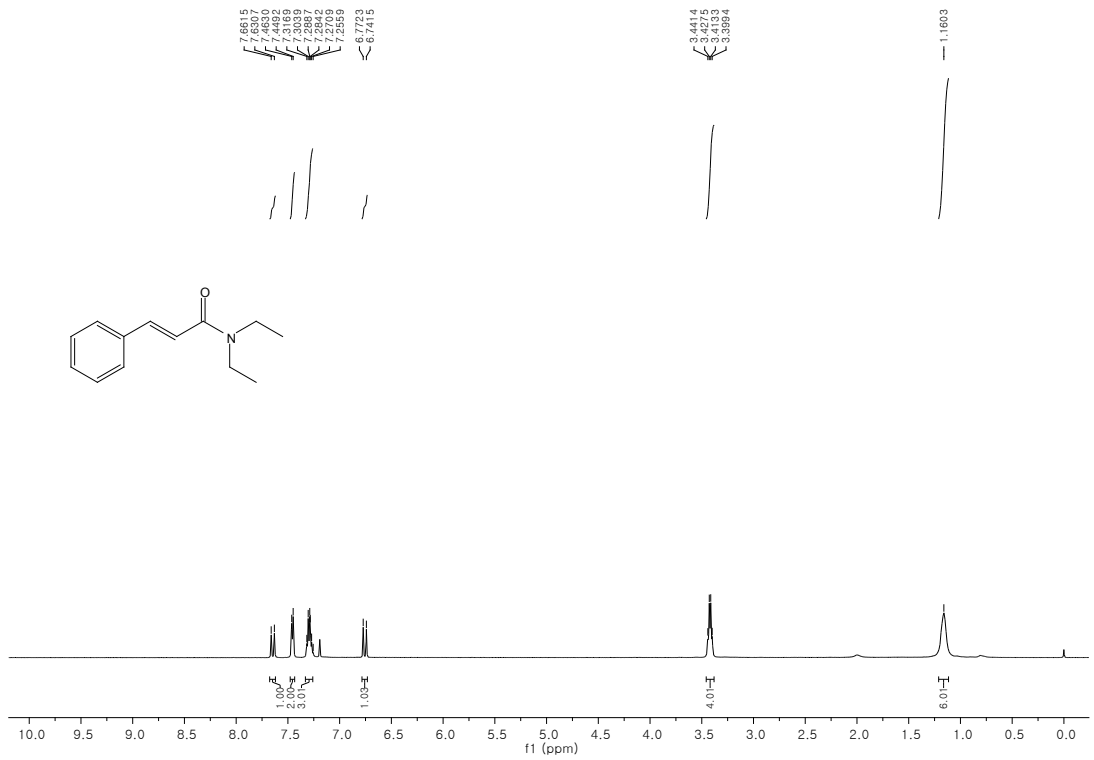


^{13}C NMR

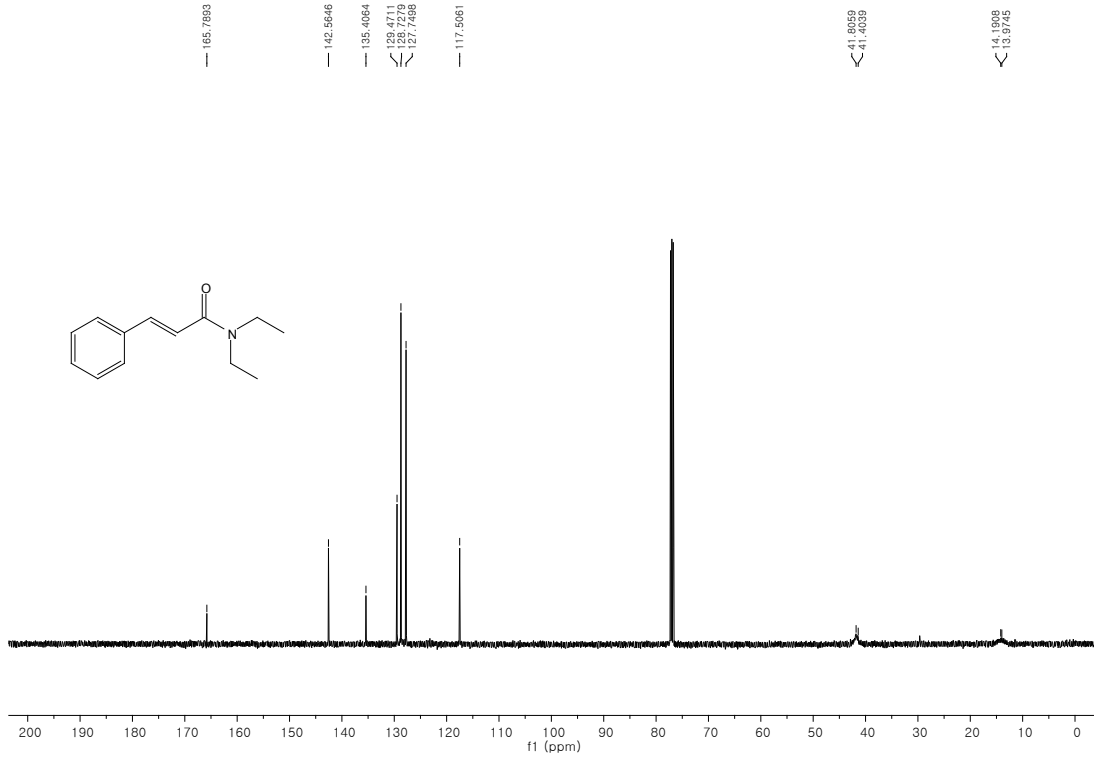


***N,N*-diethylcinnamamide (3'ba)**:

^{1}H NMR

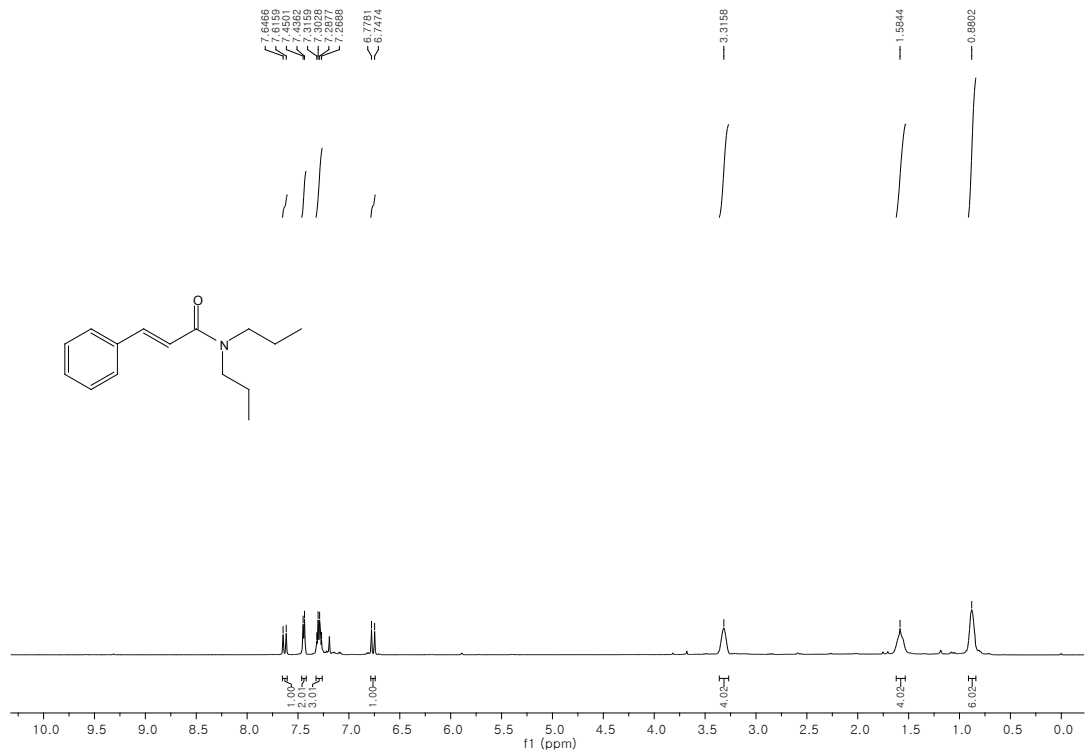


^{13}C NMR

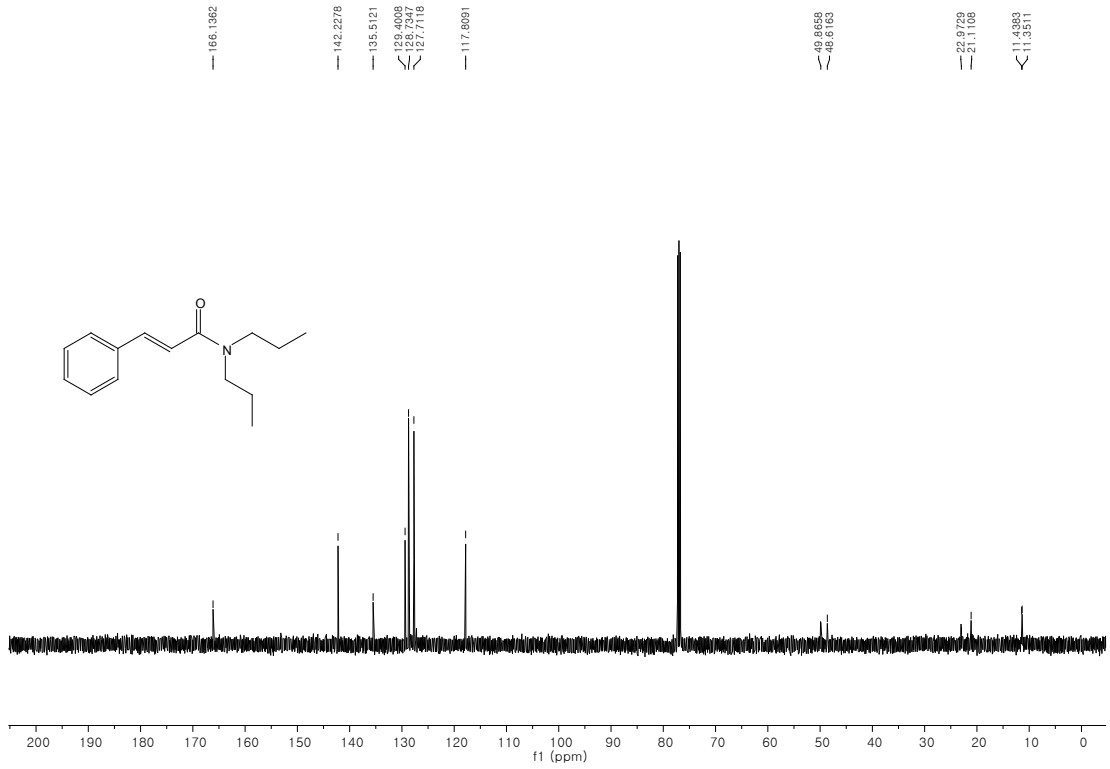


***N,N*-dipropylcinnamamide (3'bb)**:

^{1}H NMR

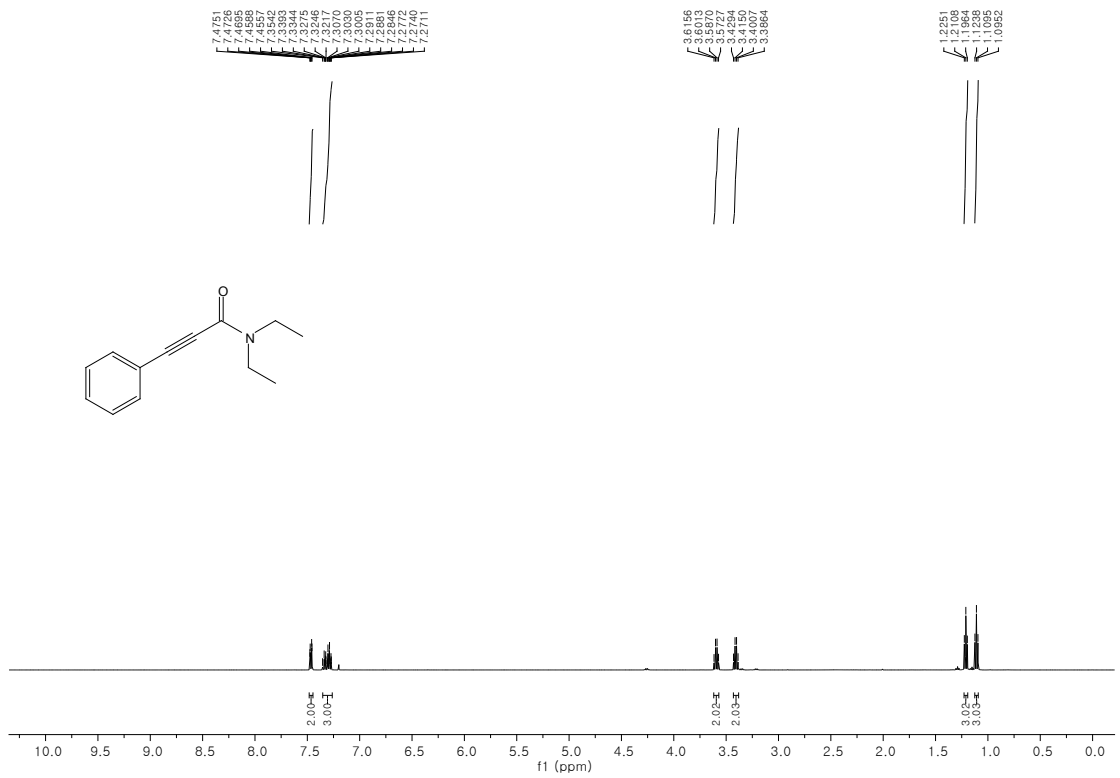


^{13}C NMR

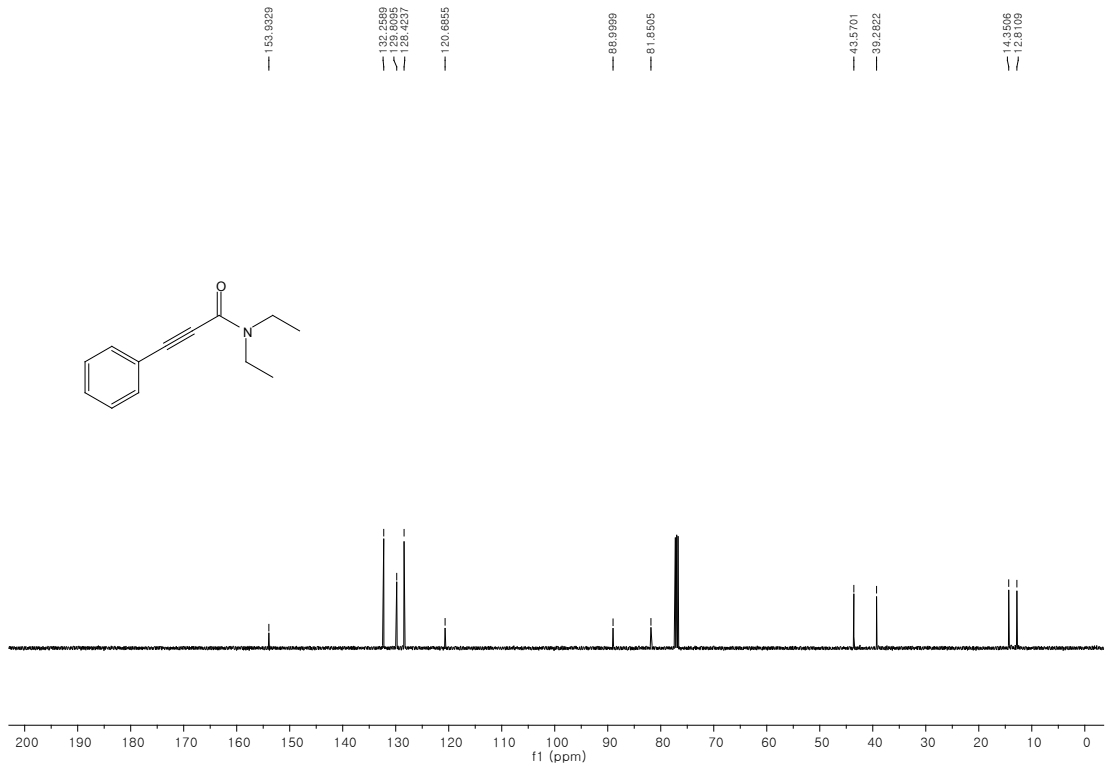


***N,N*-diethyl-3-phenylpropiolamide (3'ca)**:

^{1}H NMR

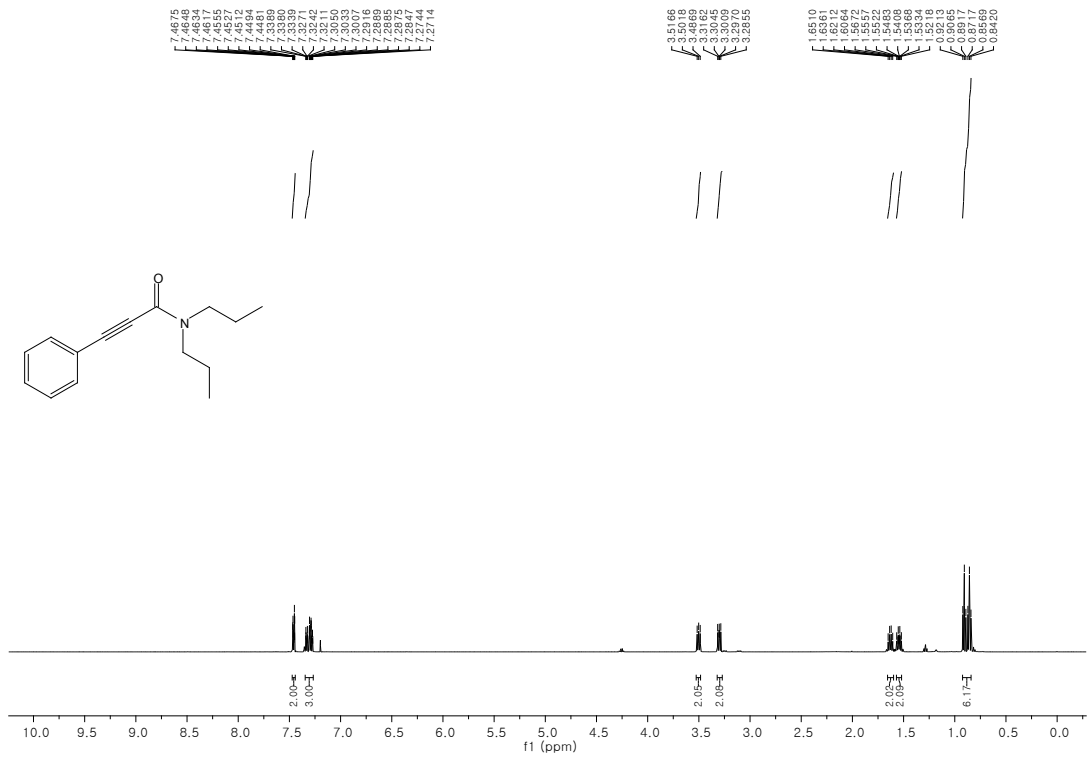


^{13}C NMR



3-phenyl-*N*,*N*-dipropylpropiolamide (3'cb):

^{1}H NMR



^{13}C NMR