Electronic Supplementary Information

Solvent-promoted Catalyst-free *N*-Formylation of Amines Using Carbon Dioxide under Ambient Conditions

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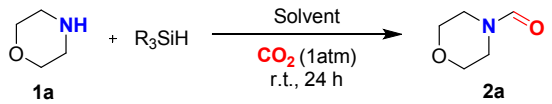
Electronic Supplementary Information Contents:

1) General Information

All substrates were purchased and used as received without further purification. All solvents were purchased from commercial suppliers. Among these solvents, THF and dioxane were distilled by Na, DMSO and DMF were distilled by CaH_2, others were dried over 4 Å molecular sieves prior to use, and all solvents were kept in glove box. 4 Å molecular sieves were dried under dynamic vacuum at 400°C for 24 h prior to use. NMR spectra of the products were recorded using a Bruker Advance TM spectrometer operating at 400 MHz for ^1H and 100 MHz for ^{13}C in $CDCl_3$ unless otherwise noted. Isolated yield was obtained by preparative thin-layer chromatography, and ethyl acetate/petroleum ether was used as the eluent.

2) Experimental Procedure for *N*-formylation of amine.

Table S1. Optimization of the formylation of morpholine.[a]



1a 2a

Entry	Solvent	Hydrosilane	Yield (%)[b]
1	n-Hexane	$PhSiH_3$	n.r.
2	Benzene	$PhSiH_3$	n.r.
3	Toluene	$PhSiH_3$	trace
4	THF	$PhSiH_3$	trace
5	1,4-dioxane	$PhSiH_3$	trace
6	$CHCl_3$	$PhSiH_3$	n.r.
7	CH_3CN	$PhSiH_3$	12
8	DMF	$PhSiH_3$	>99
9	DMSO	$PhSiH_3$	>99
10	2 equiv. DMSO in THF	$PhSiH_3$	19
11	4 equiv. DMSO in THF	$PhSiH_3$	32
12	6 equiv. DMSO in THF	$PhSiH_3$	35
13	8 equiv. DMSO in THF	$PhSiH_3$	62
14	10 equiv. DMSO in THF	$PhSiH_3$	90
15[c]	DMSO	Et_3SiH	>99
16[d]	DMSO	$(EtO)_3SiH$	>99

[a] Reaction conditions: morpholine (0.5 mmol), R_3SiH (0.75 mmol), CO_2 (1 atm), solvent (2 mL), room temperature, 24 h. [b] The yield was determined by GC, calibrated using n-hexadecane as the internal standard. [c] Et_3SiH (2.25 mmol). [d] $(EtO)_3SiH$ (2.25 mmol).

Experimental procedure of Table S1, entry 9: A 50 mL Schlenk tube with a magnetic bar was charged with morpholine (0.5 mmol), $PhSiH_3$ (0.75 mmol), and DMSO (2 mL). Then the tube was sealed and pressurized with 1.0 atm CO_2 after it was vacuumed and flushed with CO_2 three times. After that, it was stirred at room temperature for 24 h. After the reaction was completed, the yield was determined by GC, calibrated using n-hexadecane as the internal standard.

3) Different chemical shifts of morpholine in different deuterated solvents.

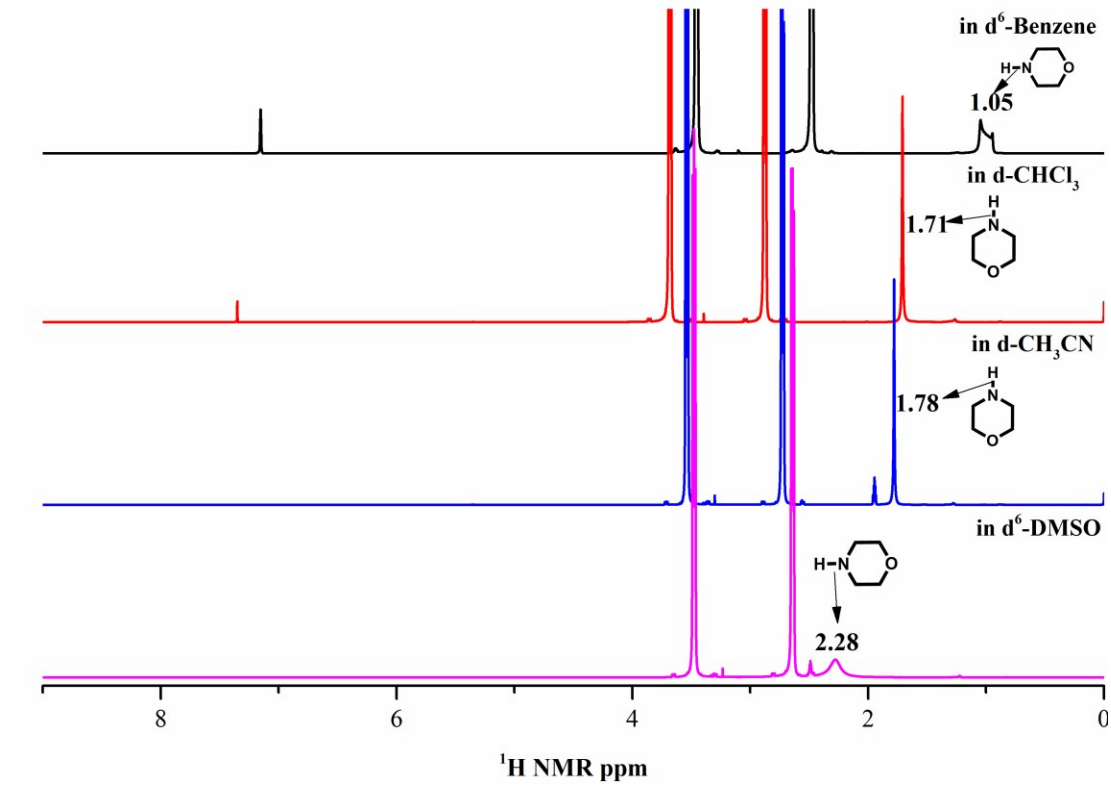


Figure S1. ^{1}H NMR spectra of morpholine in different deuterated solvents. Solvents (0.5 mL), morpholine (0.5 mmol). **It's found that the ^{1}H signals for N-H proton of morpholine in different solvents followed the order: d^6-DMSO (2.28 ppm)> CD_3CN(1.78 ppm)> $CDCl_3$(1.71 ppm)> d^6-benzene(1.05 ppm), which is in agreement with the polarity order of these solvents. This result confirmed the influence of solvents polarity on the property of amine.**

4) In-situ ^{29}Si spectra for the formylation of morpholine.

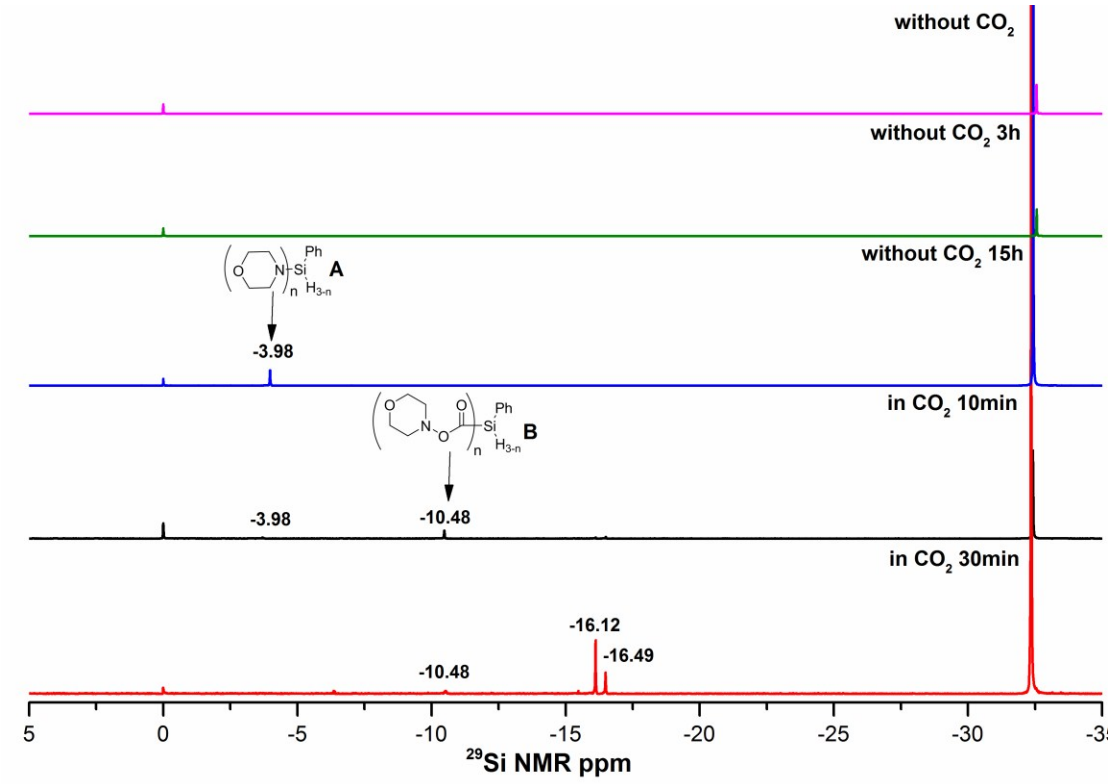


Figure S2. *In-situ* ^{29}Si spectra of morpholine (0.25 mmol) and $PhSiH_3$ (0.375 mmol) exposed to CO_2 (1 atm) at room temperature (0.5 mL d^6-DMSO, with TMSA as internal standard).The mixture was stirred throughout the whole course. (TMSA: Trimethyl silyl acetylene)

5) In-situ ^{1}H NMR spectra for the reaction of morpholine with $PhSiH_3$ in d^6-DMSO.

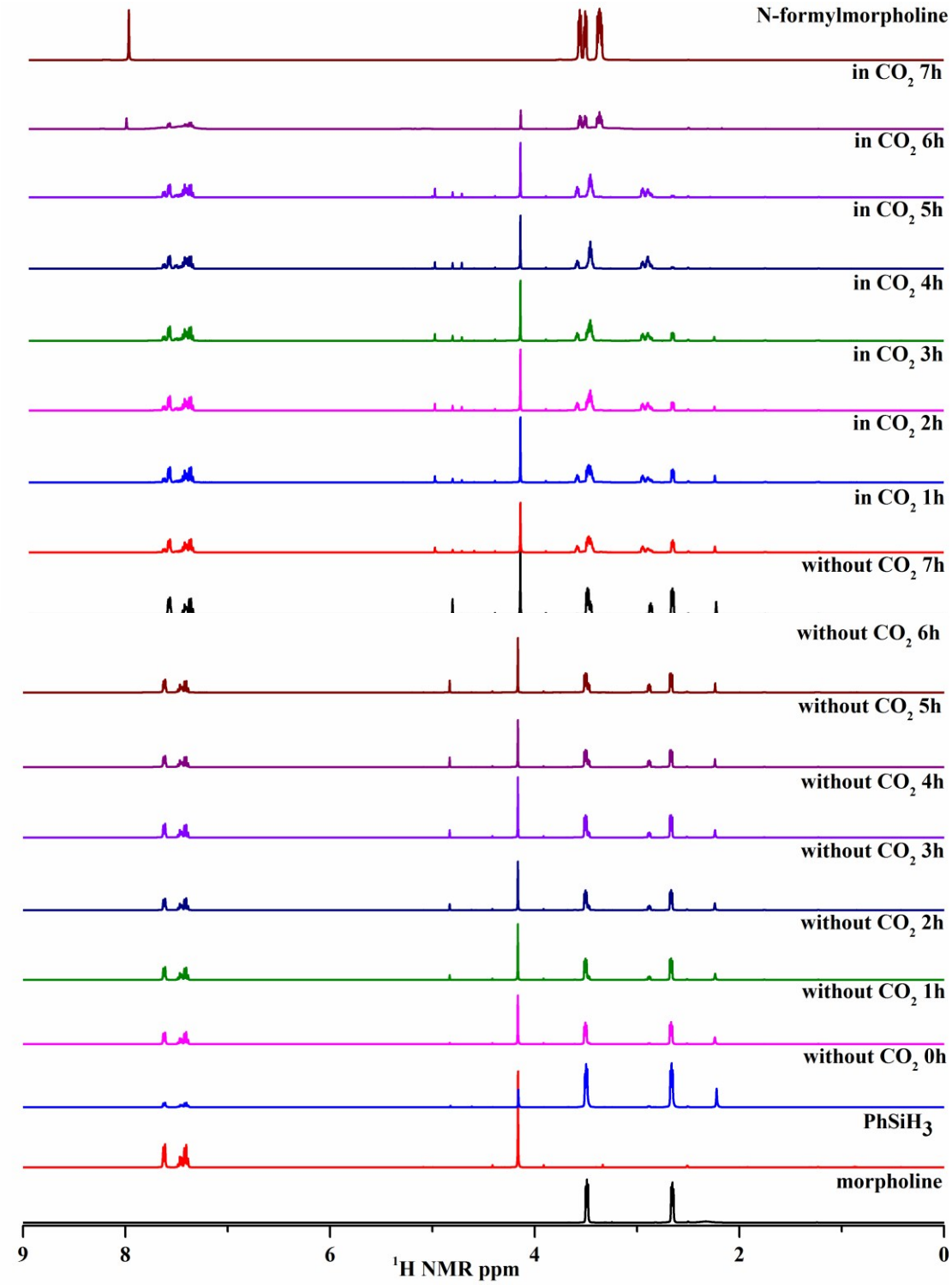


Figure S3. *In-situ* ^{1}H NMR spectra of morpholine (0.25 mmol) and $PhSiH_3$ (0.375 mmol) in d^6-DMSO. CO_2 (1 atm), room temperature. The mixture was shaked from 1 to 6 hours and stirred from 6 to 7 hour. (TMS as internal standard).

6) In-situ ^{13}C NMR spectra for the reaction of morpholine with $PhSiH_3$ in d^6-DMSO.[1]

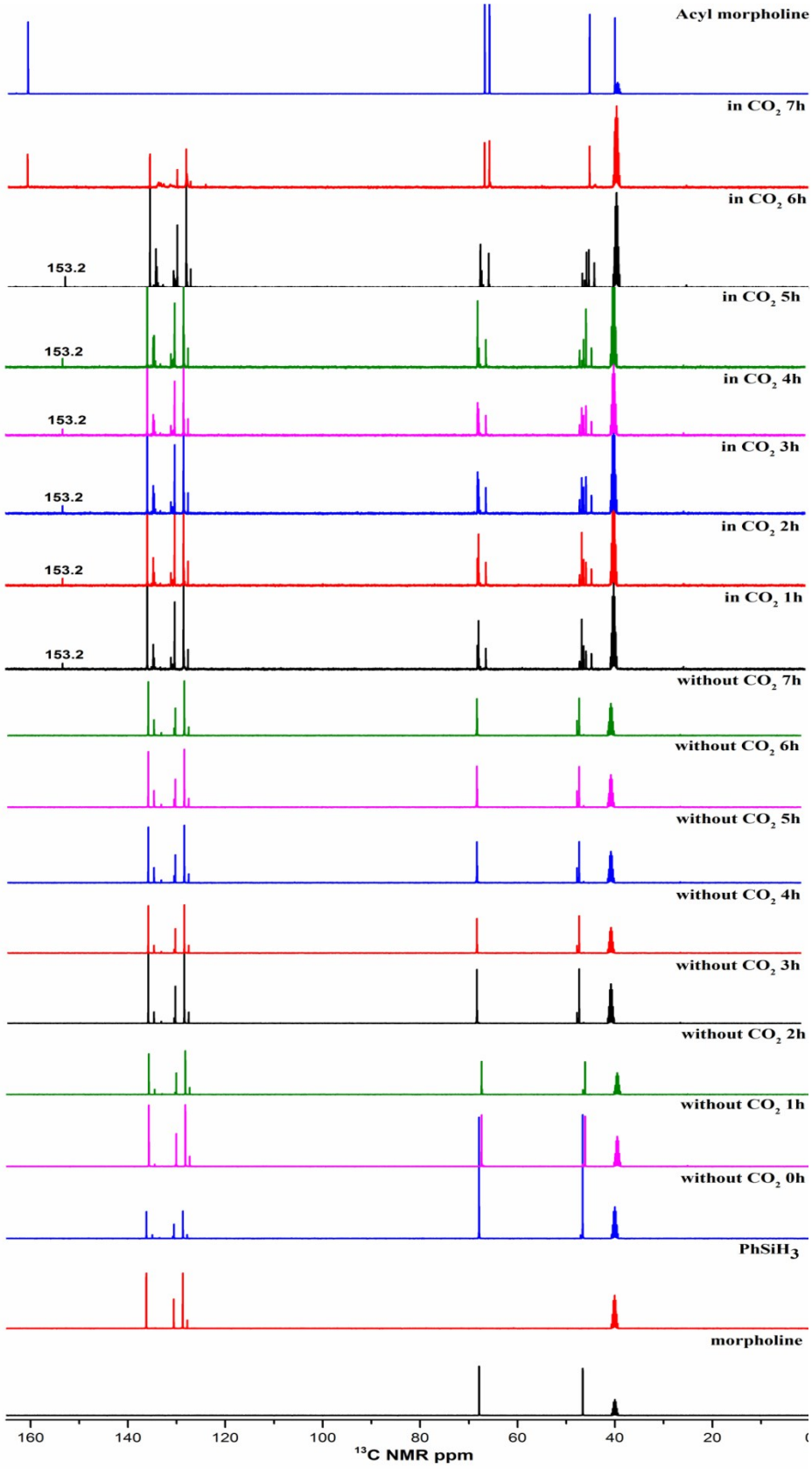


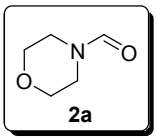
Figure S4. *In-situ* ^{13}C NMR spectra of morpholine (0.25mmol) and $PhSiH_3$

(0.375mmol) in d^6-DMSO. CO_2 (1 atm), room temperature. The mixture was shaked from 1 to 6 hours and stirred from 6 to 7 hour. (TMS as internal standard).

7) The formylation of various amines (1a to 1t) (Table 2)

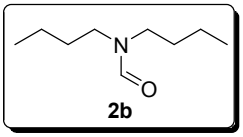
A mixture of amines **1** (0.5 mmol), $PhSiH_3$ (0.75 mmol), and DMSO (2 mL) was added into a 50 mL Schlenk tube with a magnetic bar in the glove box. Then the tube was sealed and pressurized with 1.0 atm CO_2 after it was vacuumed and flushed with CO_2 three times. After that, it was stirred at room temperature for 24 h. After the reaction was completed, the yield was determined by GC, calibrated using n-hexadecane as the internal standard. The spectroscopic data of all the products are presented below.

N-formylmorpholine(2a)[2]



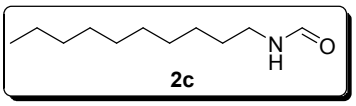
99% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.68 (s, 1H), 3.35 – 3.29 (m, 2H), 3.29 – 3.23 (m, 2H), 3.20 – 3.13 (m, 2H), 3.09 – 3.02 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 160.7, 66.9, 66.0, 45.4, 40.2.

N,N-dibutylformamide (2b)



99% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.04 (s, 1H), 3.25 (dt, *J* = 14.3, 7.4 Hz, 4H), 1.57 – 1.45 (m, 4H), 1.37 – 1.25 (m, 4H), 0.94 (td, *J* = 7.3, 2.8 Hz, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.7, 47.2, 41.9, 30.7, 29.4, 20.1, 19.6, 13.8, 13.7.

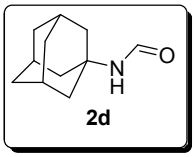
N-decylformamide (2c)



99% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 (s, 1H), 6.21 (s, 1H), 3.16 (ddd, *J* = 27.7, 13.5, 6.8 Hz, 2H), 1.51 – 1.39 (m, 2H), 1.20 (d, *J* = 14.3 Hz, 14H), 0.81 (t, *J* = 6.8 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.4, 41.8, 38.2, 31.8, 31.2, 29.6 – 29.0, 26.8, 26.4, 22.6, 14.1.

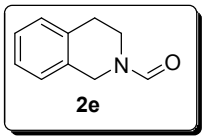
A mixture of amines **1** (0.5 mmol), $PhSiH_3$ (0.75 mmol), and DMSO (2 mL) was added into a 50 mL Schlenk tube with a magnetic bar in the glove box. Then the tube was sealed and pressurized with 1.0 atm CO_2 after it was vacuumed and flushed with CO_2 three times. After that, it was stirred at room temperature for 24 h. After the reaction was completed, the reaction mixture was purified by column chromatography on silica gel using petroleum ether/ethyl acetate (10:1 then 2:1) as the eluent to give products.

N-(1-Adamantyl)formamide (2d)[5]



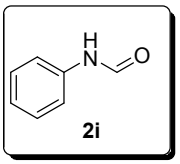
99% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.20 (d, *J* = 12.3 Hz, 0.67H), 7.96 (d, *J* = 1.7 Hz,0.33H), 6.25 (s, 0.65H), 5.25 (s, 0.35H), 2.04 (d, *J* = 18.6 Hz, 3H), 1.96 (d, *J* = 2.4 Hz, 2H), 1.77 (d, *J* = 2.2 Hz, 4H), 1.68 – 1.56 (m, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.3, 160.3, 52.1, 50.7, 44.1, 41.8, 36.2, 35.9, 29.4, 29.3.

3,4-dihydroisoquinoline-2(1H)-carbaldehyde (2e)[2]



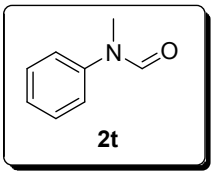
89% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.11 (d, *J* = 16.1 Hz, 1H), 7.20 – 6.93 (m, 4H), 4.47 (d, *J* = 66.5 Hz, 2H), 3.57 (dt, *J* = 59.3, 6.0 Hz, 2H), 2.81 – 2.64 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.5, 161, 134.2, 133.6, 132.4, 131.7, 128.9, 126.8, 126.4, 125.8, 46.9, 42.9, 42, 37.7, 29.5, 27.7.

N-phenylformamide (2i)



97% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.87 (s, 0.5H), 8.50 (dd, *J* = 146.1, 6.5 Hz, 1H), 8.00 (s, 0.43H), 7.54 (d, *J* = 7.8 Hz, 1H), 7.32 (dt, *J* = 13.4, 8.0 Hz, 2H), 7.20 – 7.07 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 163, 159.5, 136.9, 129.8, 129.1, 125.3, 124.8, 120.1, 118.8.

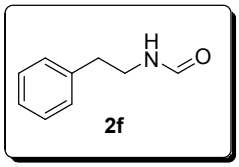
N-methyl-N-phenylformamide (2t)[3]



95% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.39 (s, 1H), 7.33 (t, *J* = 7.7 Hz, 2H), 7.20 (t, *J* = 7.3 Hz, 1H), 7.09 (d, *J* = 7.7 Hz, 2H), 3.24 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.4, 142.2, 129.6, 126.4, 122.4, 32.1.

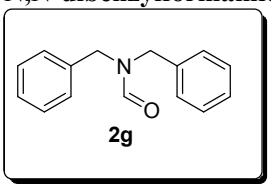
A mixture of amines **1** (0.5 mmol), $PhSiH_3$ (0.75 mmol), and DMSO (2 mL) was added into a 50 mL Schlenk tube with a magnetic bar in the glove box. Then the tube was sealed and pressurized with 1.0 atm CO_2 after it was vacuumed and flushed with CO_2 three times. After that, it was stirred at room temperature for 24 h. After the reaction was completed, the reaction mixture was purified by preparative thin-layer chromatography silica gel using n-hexane/ethyl acetate (2:1 or 1:1) as the eluent to give products.

N-phenethylformamide (2f)



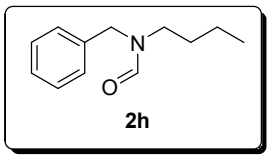
80% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.97 (s, 1H), 7.22 (dd, *J* = 9.9, 4.6 Hz, 2H), 7.13 (dd, *J* = 15.8, 7.2 Hz, 3H), 6.04 (s, 1H), 3.45 (dd, *J* = 13.3, 6.8 Hz, 2H), 2.73 (dd, *J* = 12.7, 5.7 Hz, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.6, 161.4, 138.6, 137.7, 128.8, 126.9, 126.6, 43.2, 39.2, 37.7, 35.5.

N,N-dibenzylformamide (2g)[4]



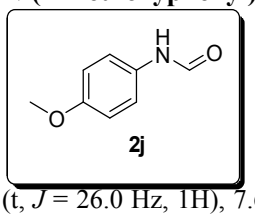
82% yield. ^{1}H NMR (400 MHz, CDCl3) δ 8.41 (s, 1H), 7.40 – 7.27 (m, 6H), 7.21 – 7.15 (m, 4H), 4.41 (s, 2H), 4.25 (s, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.9, 136.0, 135.7, 129, 128.7, 128.6, 128.2, 127.7, 50.3, 44.7.

N-benzyl-N-butylformamide (2h)



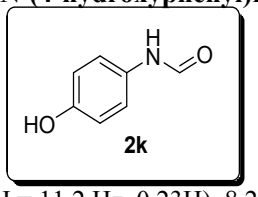
82% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.15 (d, *J* = 33.0 Hz, 1H), 7.21 (ddt, *J* = 24.8, 17.0, 6.9 Hz, 5H), 4.38 (d, *J* = 60.6 Hz, 2H), 3.09 (dt, *J* = 14.2, 7.3 Hz, 2H), 1.47 – 1.32 (m, 2H), 1.19 (ddd, *J* = 9.3, 8.0, 2.5 Hz, 2H), 0.81 (td, *J* = 7.3, 3.7 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.8, 136.6, 136.3, 128.8, 128.6, 128.1, 127.5, 51.2, 46.5, 45.2, 41.7, 30.2, 29, 20.1, 19.6, 13.7, 13.6.

N-(4-methoxyphenyl)formamide (2j)[3]



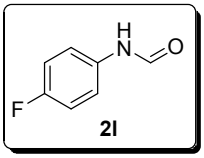
95% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.52 (d, *J* = 11.4 Hz, 0.49H), 8.34 (t, *J* = 26.0 Hz, 1H), 7.69 (s, 0.49H), 7.45 (d, *J* = 8.9 Hz, 1H), 7.04 (d, *J* = 8.8 Hz, 1H), 6.87 (dd, *J* = 13.0, 8.9 Hz, 2H), 3.79 (d, *J* = 6.6 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 163.3, 159.1, 157.6, 156.7, 130.0, 129.6, 121.9, 121.6, 114.9, 114.2, 55.5.

N-(4-hydroxyphenyl)formamide(2k)



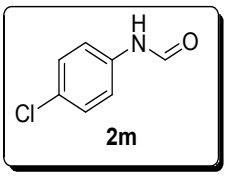
70% yield. ^{1}H NMR (400 MHz, DMSO) δ 9.92 (s, 1H), 9.28 (s, 1H), 8.53 (d, J = 11.2 Hz, 0.23H), 8.20 (d, J = 1.7 Hz, 0.78H), 7.42 (d, J = 8.8 Hz, 2H), 6.75 (dd, J = 9.0, 2.4 Hz, 2H). ^{13}C NMR (100 MHz, DMSO) δ 162.6, 158.9, 154.2, 153.5, 129.9, 129.6, 120.8, 120.2, 115.8, 115.2.

N-(4-fluorophenyl)formamide (2l)



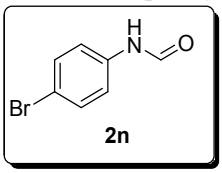
82% yield. ^{1}H NMR (400 MHz, DMSO) δ 10.30 – 10.12 (m, 1H), 8.27 (d, *J* = 1.8 Hz, 1H), 7.69 – 7.55 (m, 2H), 7.18 – 7.12 (m, 2H). ^{13}C NMR (100 MHz, DMSO) δ 162.6, 159.4, 156.9, 134.6, 120.9, 119.5, 116.0, 115.8, 115.5, 115.3.

N-(4-chlorophenyl)formamide (2m)



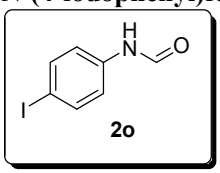
79% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.85 (d, *J* = 9.8 Hz,0.47H), 8.66 (d, *J* = 11.3 Hz, 0.5H), 8.35 (d, *J* = 1.5 Hz, 0.58H), 7.92 (s, 0.55H), 7.50 (d, *J* = 8.8 Hz, 1H), 7.34 – 7.26 (m, 2H), 7.04 (d, *J* = 8.7 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.8, 159.3, 135.4, 130.7, 129.8, 129.1, 121.3, 120.1.

N-(4-bromophenyl)formamide (2n)



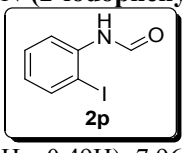
96% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.67 (d, *J* = 11.2 Hz, 0.41H), 8.38 (d, *J* = 1.2 Hz, 0.68H), 7.50 – 7.44 (m, 4H), 6.99 (d, *J* = 8.7 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.3, 158.9, 135.9, 132.8, 132.1, 121.5, 120.4, 118.3, 117.5.

N-(4-iodophenyl)formamide (2o)



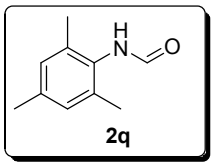
96% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.66 (d, J = 11.3 Hz, 0.51H), 8.49 (d, J = 9.9 Hz, 0.46H), 8.37 (d, J = 1.3 Hz, 1H), 7.64 (dd, J = 11.8, 8.7 Hz, 2H), 7.32 (d, J = 8.7 Hz, 1H), 6.86 (d, J = 8.6 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.3, 159.0, 138.7, 138.1, 136.6, 121.8, 120.5, 88.7, 88.2.

N-(2-iodophenyl)formamide (2p)



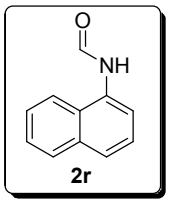
57% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.66 (t, J = 17.2 Hz, 1H), 8.36 (d, J = 1.4 Hz, 0.49H), 7.96 (s, 0.49H), 7.53 – 7.46 (m, 2H), 7.12 – 7.01 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.4, 159.1, 138, 134.3, 133.9, 131.2, 130.6, 128.7, 127.5, 119.2, 117.9, 94.8, 94.2.

N-mesitylformamide (2q)



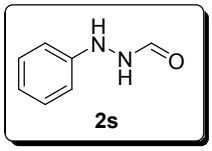
84% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.34 (d, *J* = 1.2 Hz, 0.5H), 8.04 (d, *J* = 11.9 Hz, 0.5H), 7.17 (d, *J* = 9.7 Hz, 1H), 6.93 (s, 1H), 6.89 (s, 1H), 2.27 (d, *J* = 14.2 Hz, 6H), 2.19 (s, 3H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 165.2, 159.7, 137.6, 135.2, 135, 130.5, 129.8, 129.3, 129, 21.0, 20.9, 18.6, 18.4.

N-(naphthalen-1-yl)formamide (2r)



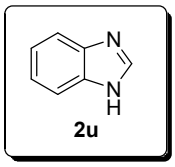
94% yield. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.63 (d, *J* = 10.8 Hz, 1H), 8.47 – 8.21 (m, 1H), 8.01 (dd, *J* = 13.0, 7.9 Hz, 1H), 7.89 (dd, *J* = 16.0, 8.0 Hz, 1H), 7.77 (dd, *J* = 26.4, 8.2 Hz, 1H), 7.63 – 7.45 (m, 3H), 7.33 (d, *J* = 7.2 Hz, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 163.9, 134.3, 128.9, 128.6, 127.8, 127.3 – 127.1, 127.1, 126.7, 126.2, 125.6, 121.2, 120.9, 120.3, 119.2,100.0.

N'-phenylformohydrazide (2s)



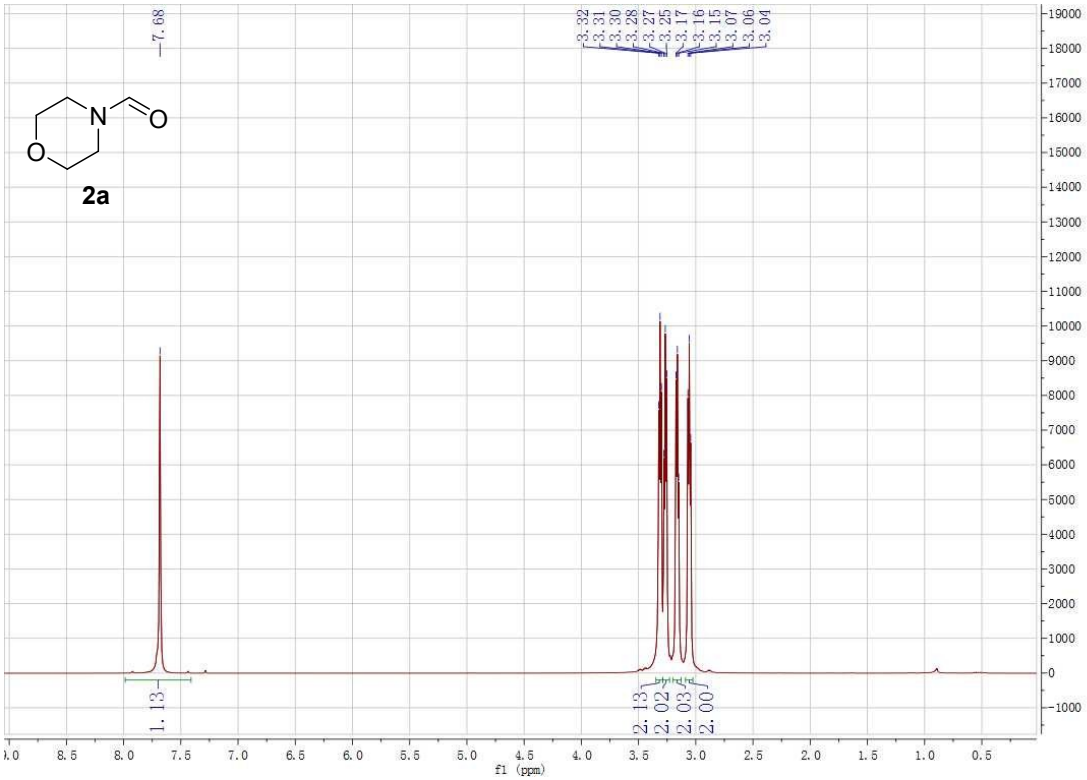
59% yield. ^{1}H NMR (400 MHz, DMSO) δ 9.86 – 9.33 (m, 1H), 8.16 – 7.98 (m, 1H), 7.79 (s, 1H), 7.17 (dd, *J* = 13.2, 7.7 Hz, 2H), 6.74 (dd, *J* = 18.8, 10.0 Hz, 3H). ^{13}C NMR (100 MHz, DMSO) δ 167.7, 160.5, 149.4, 148.7, 128.9, 128.7, 119.4, 118.6, 112.3, 112.1.

Benzimidazole (2u)



51% yield, separation by preparative HPLC using CH_3OH/H_2O (3:2) as the eluent. ^{1}H NMR (400 MHz, DMSO) δ 12.51 (s, 1H), 8.25 (s, 1H), 7.62 (s, 2H), 7.29 – 7.15 (m, 2H). ^{13}C NMR (100 MHz, DMSO) δ 141.9, 121.7.

8) ^{1}H NMR and ^{13}C NMR Copies of Products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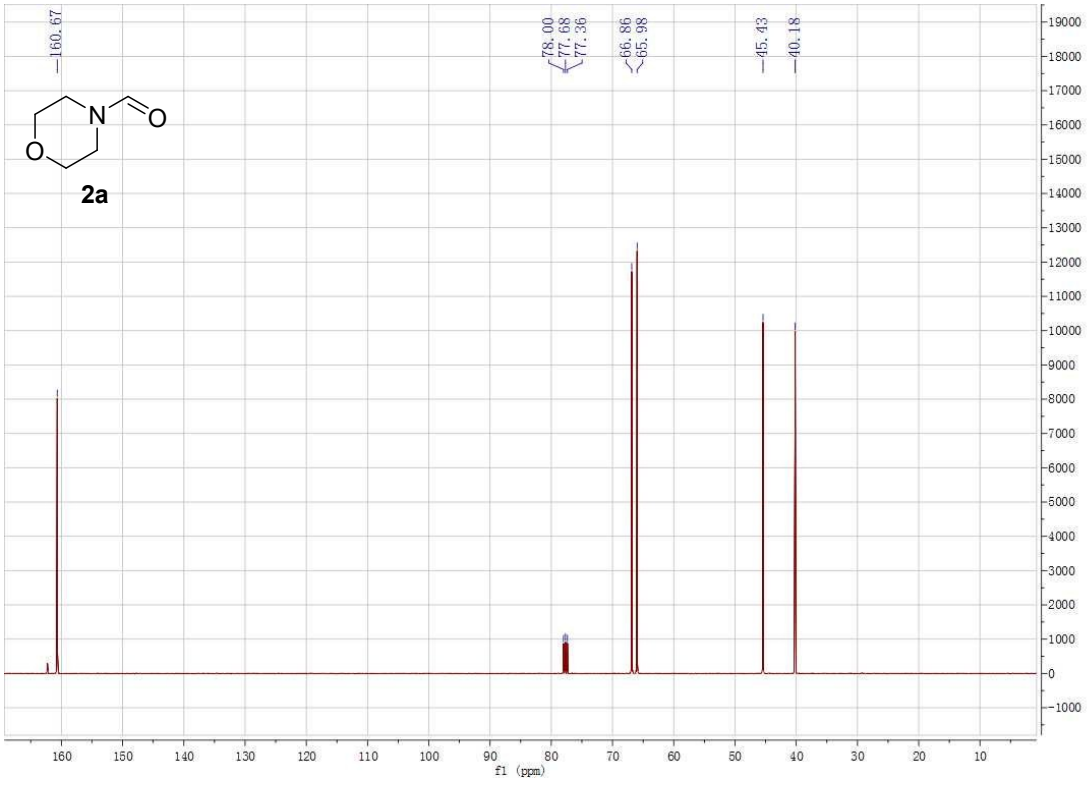
3.06
3.04
1.13
2.13
2.02
2.03
2.00
f1 (ppm)
2a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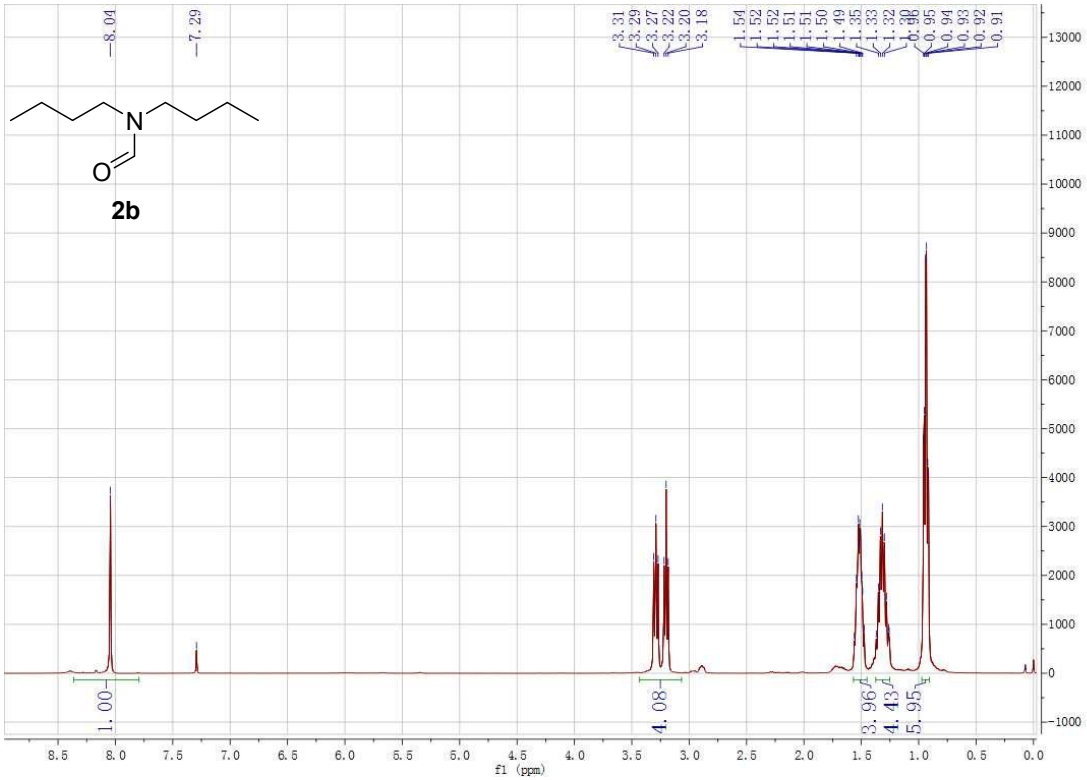
2a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1.50
1.49
1.35
1.33
1.32
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0.95
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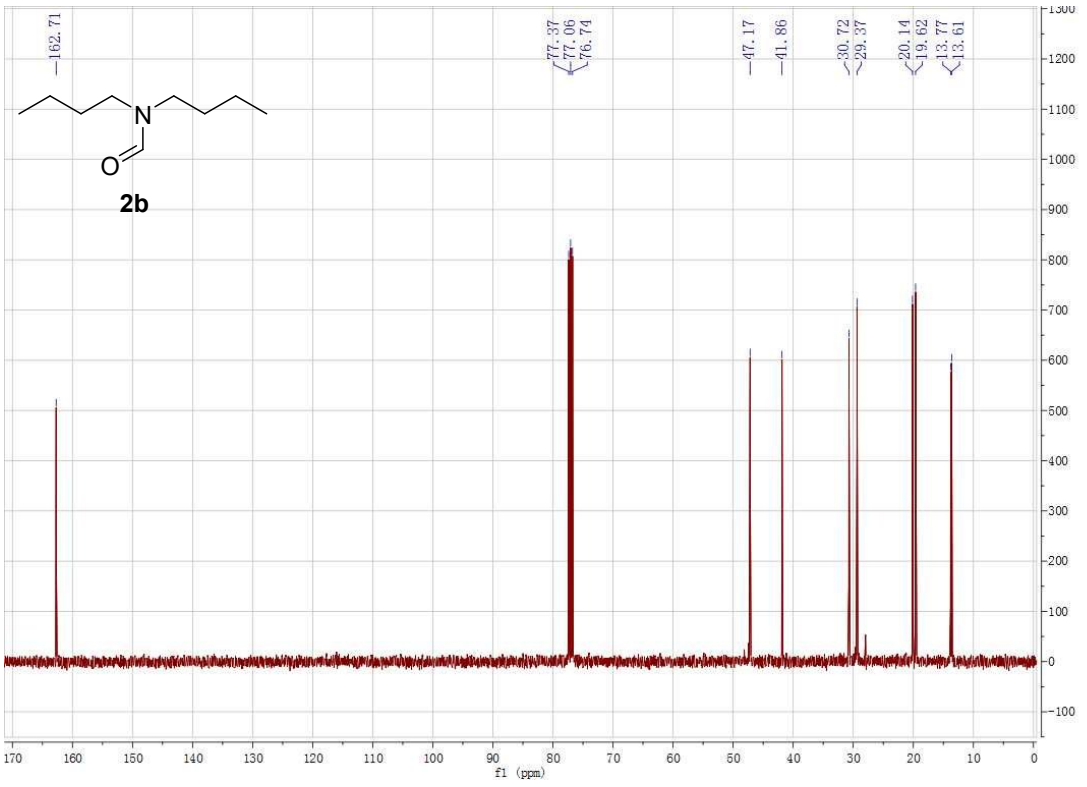
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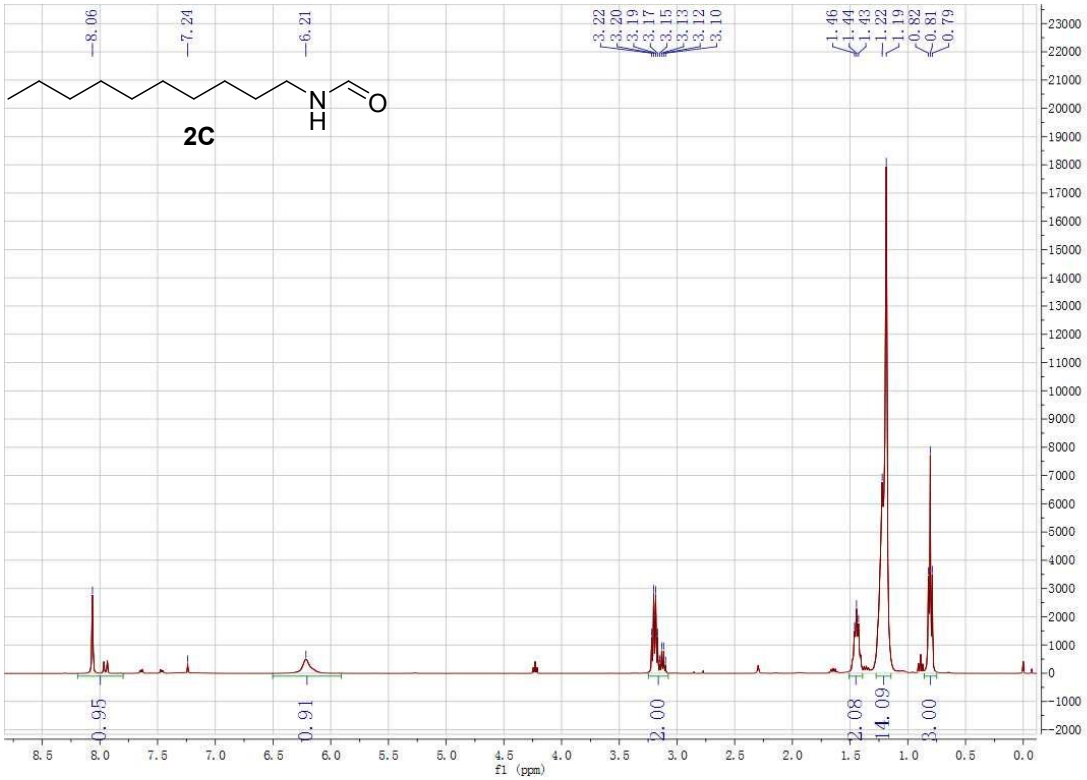
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1.44
1.43
1.22
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14.09
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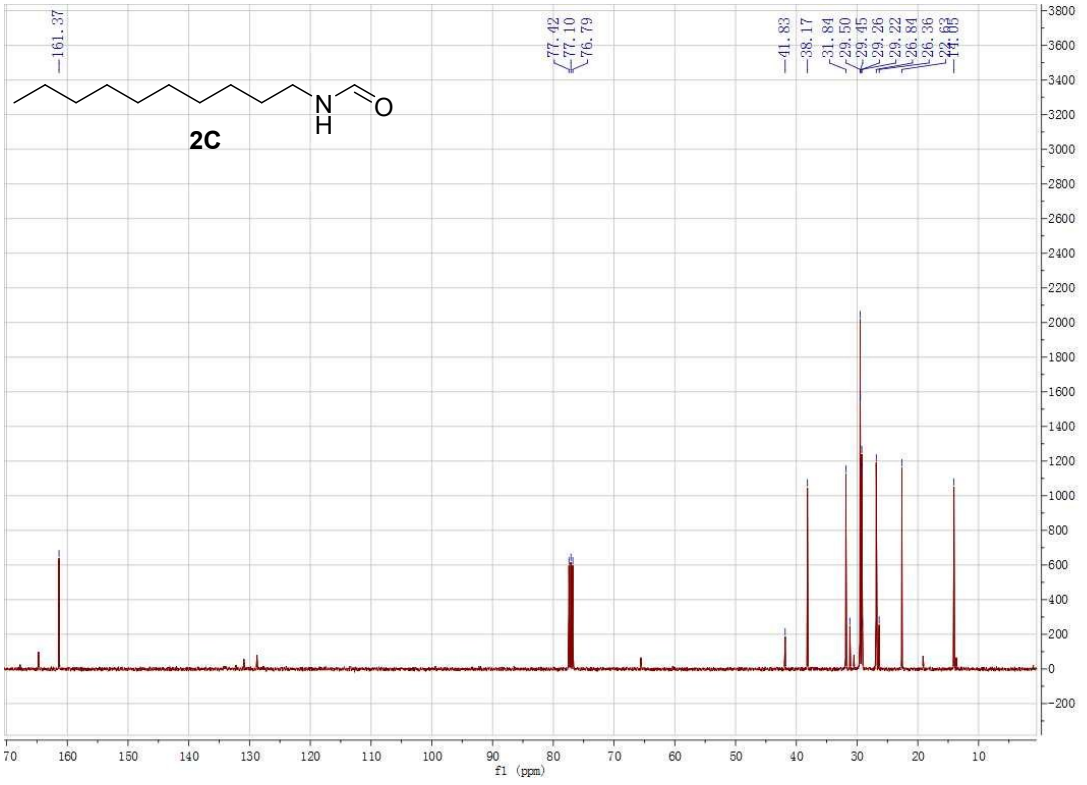
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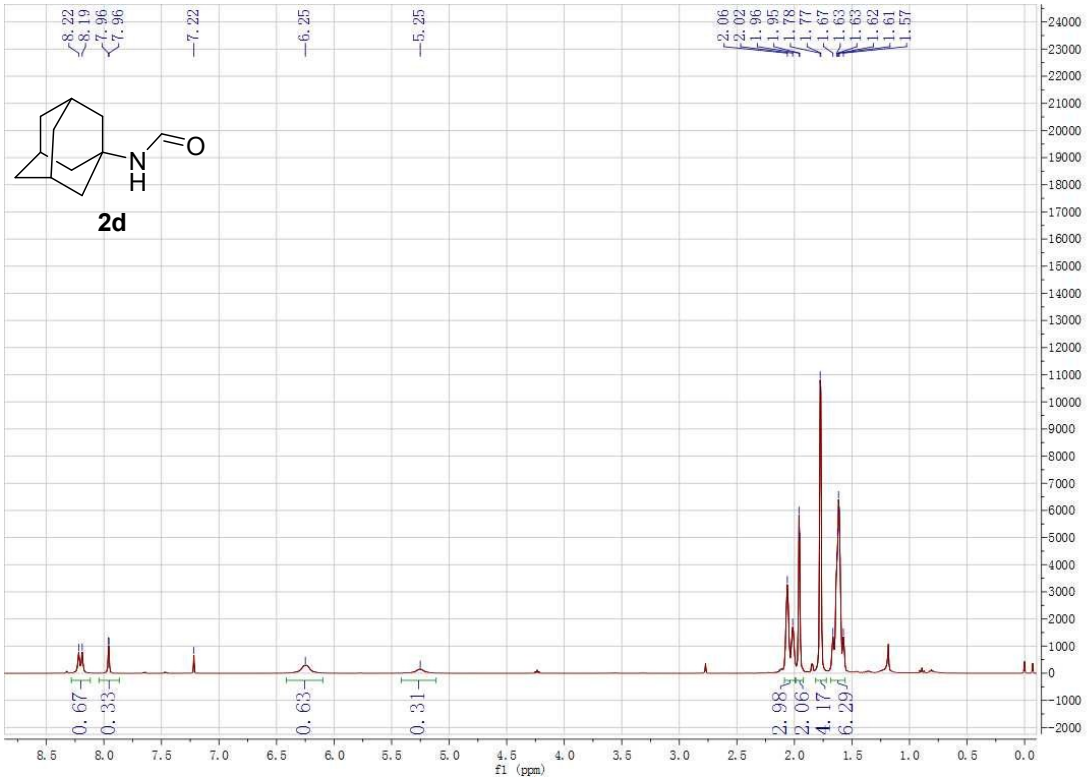
2C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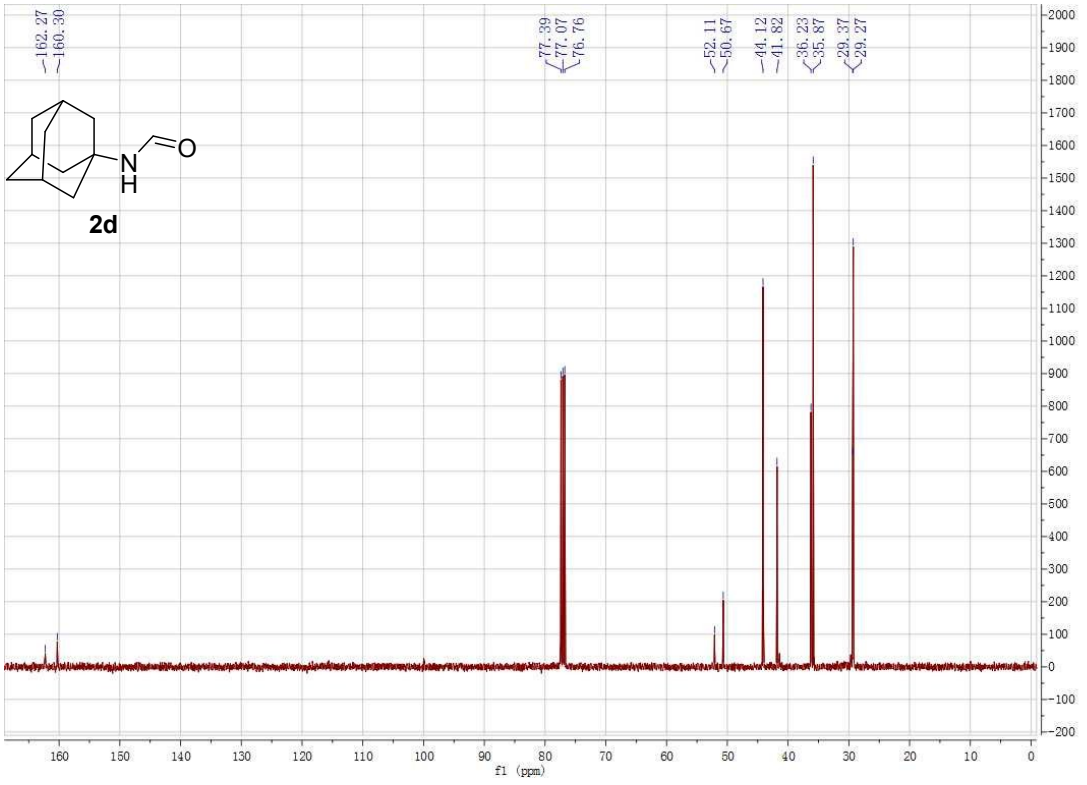
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N
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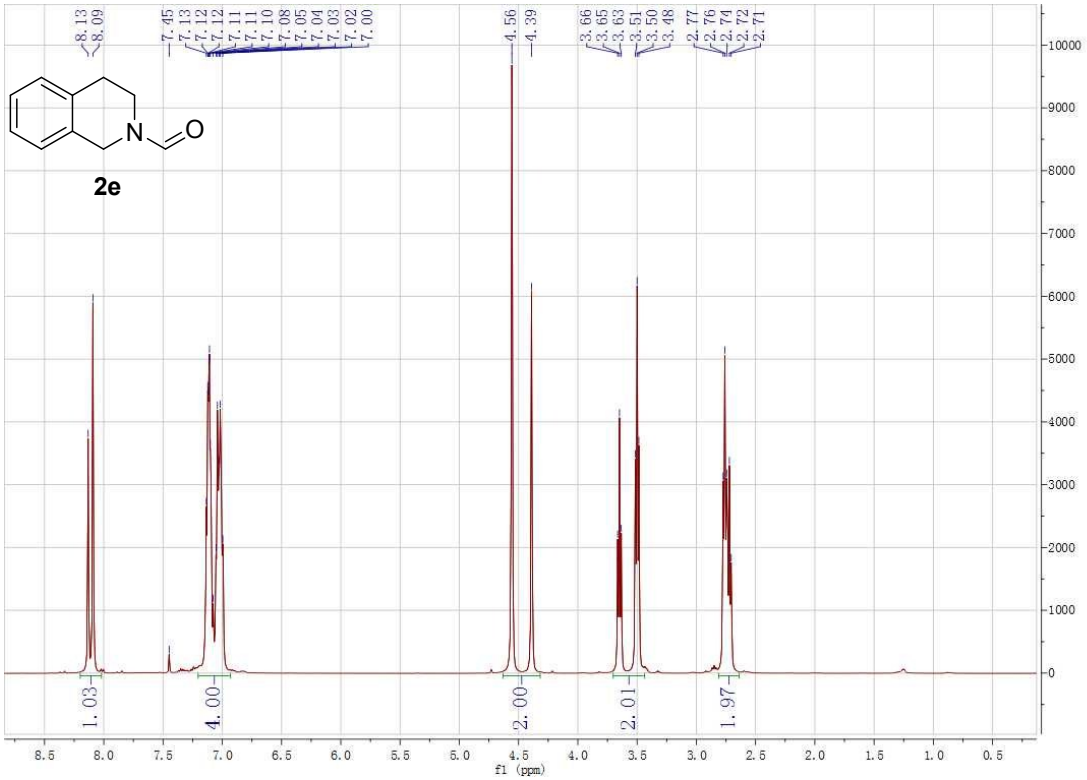
O
2d
f1 (ppm)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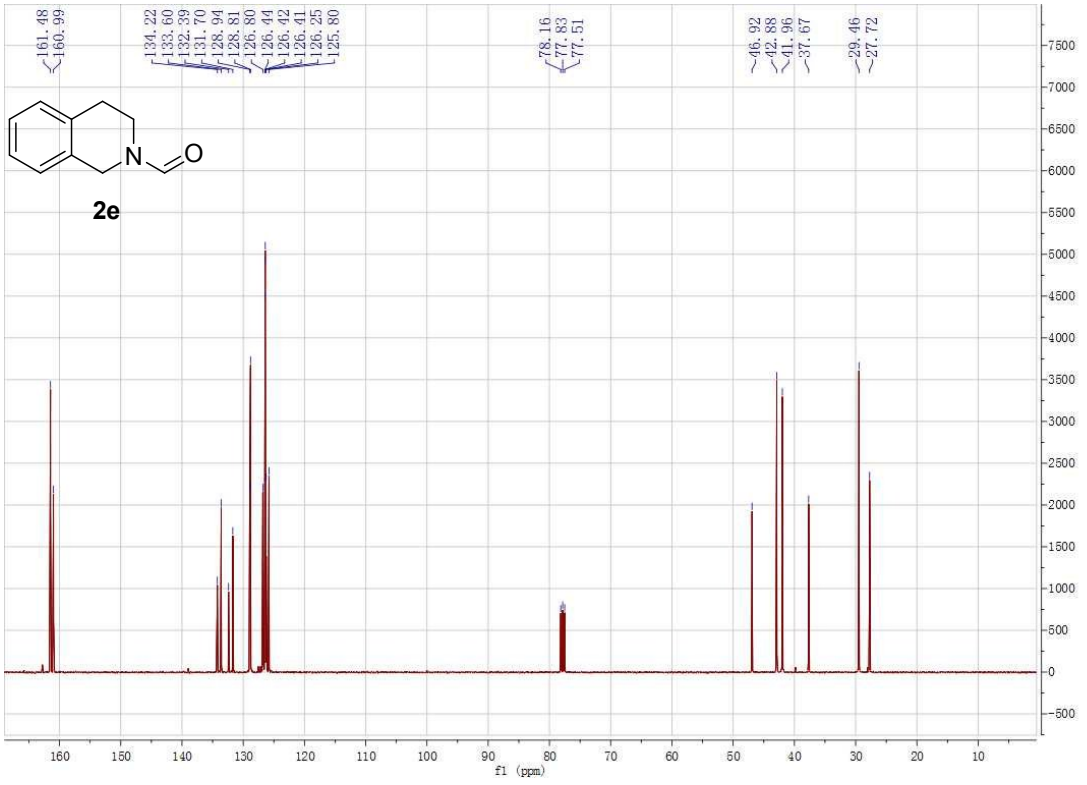
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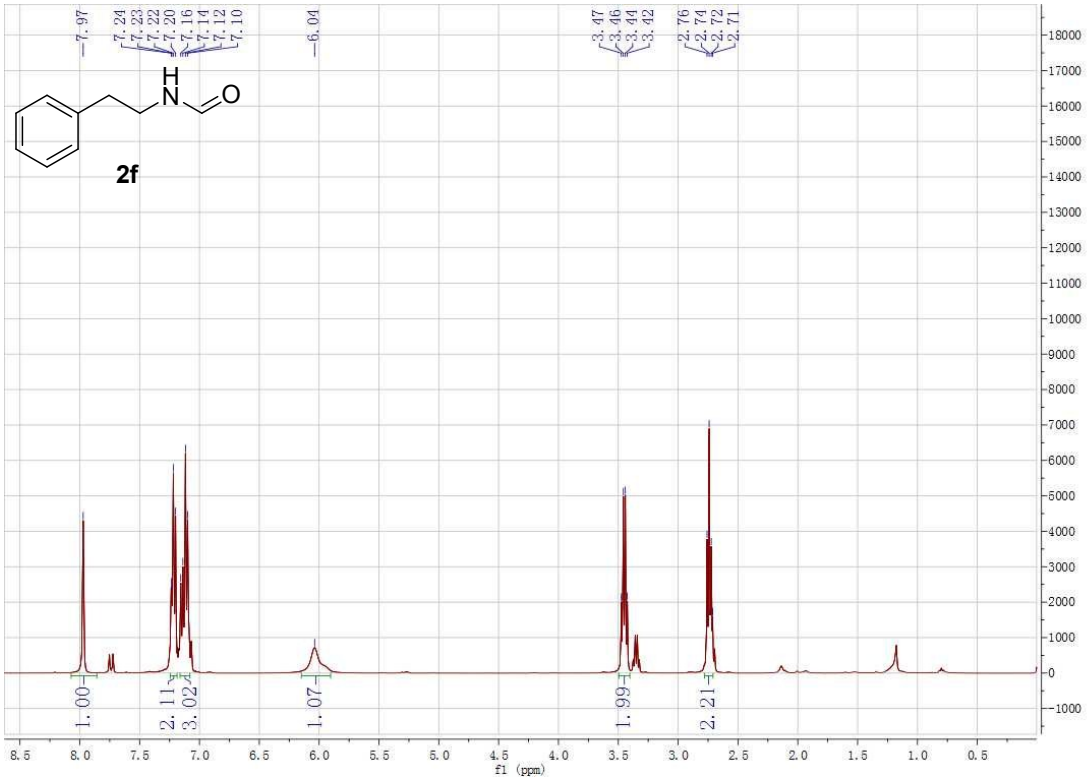
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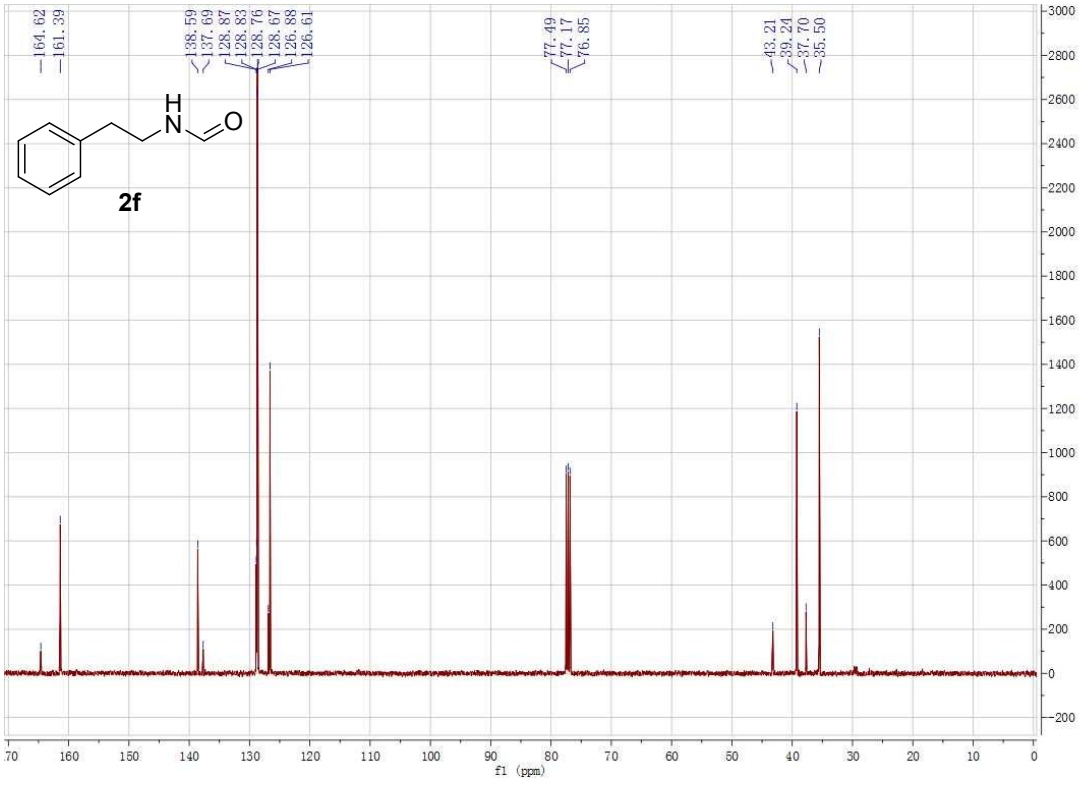
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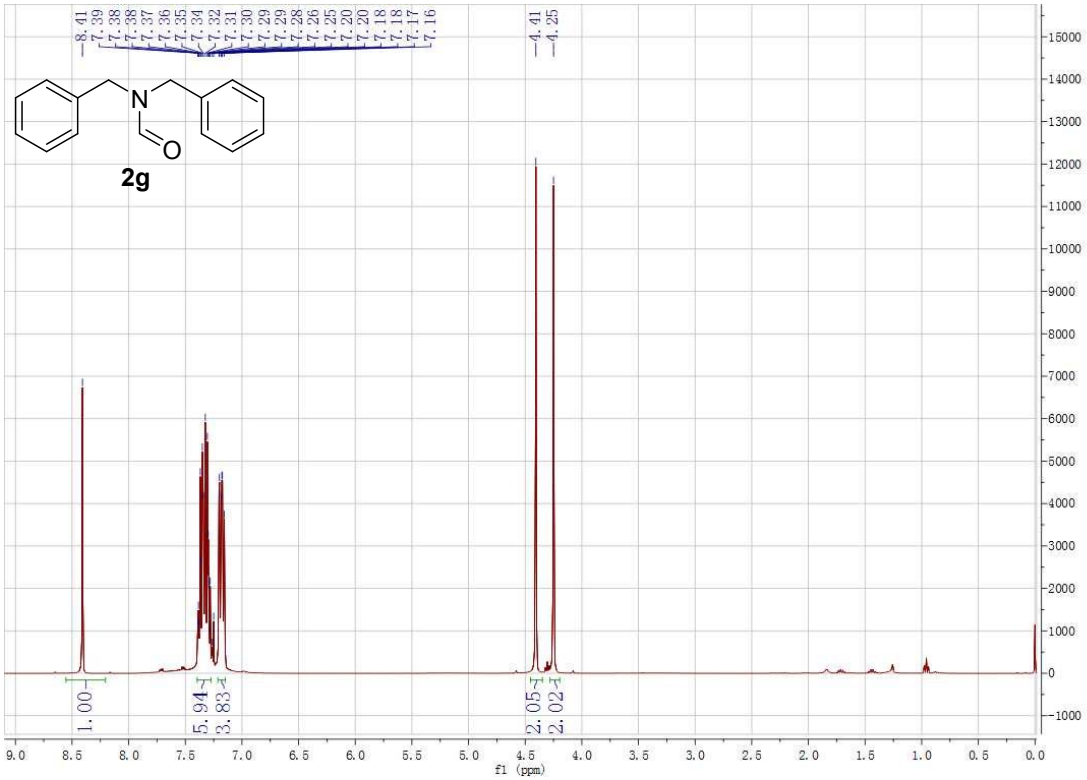
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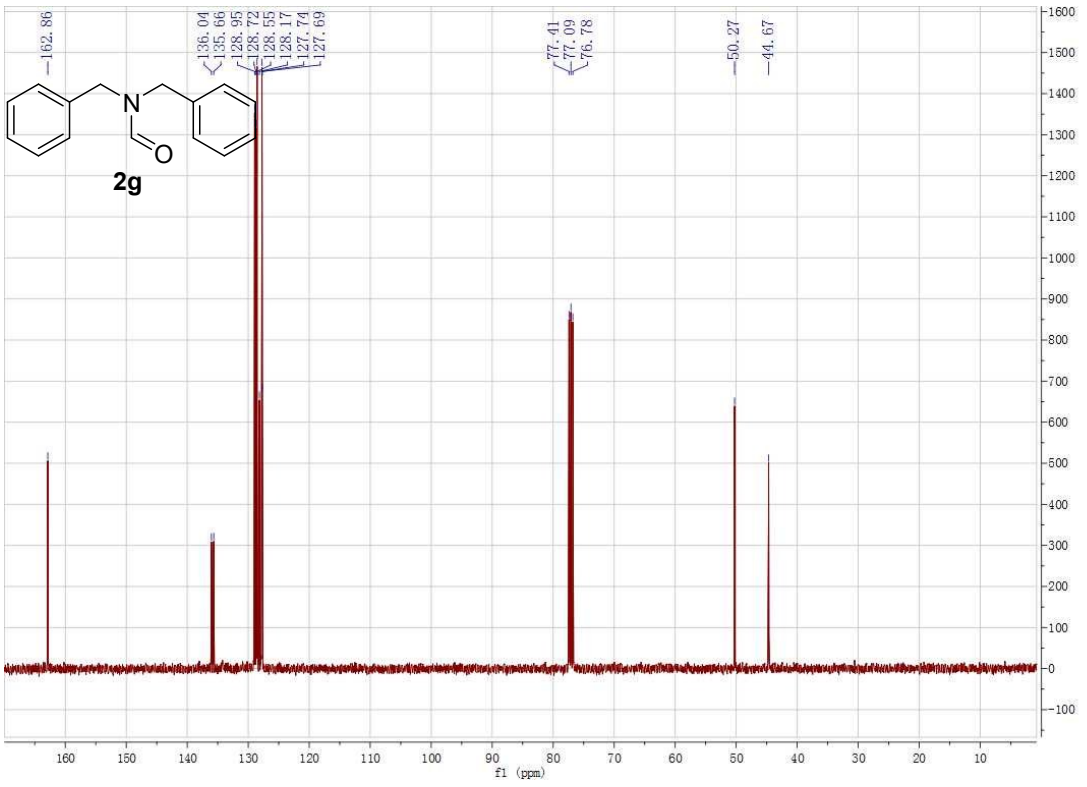
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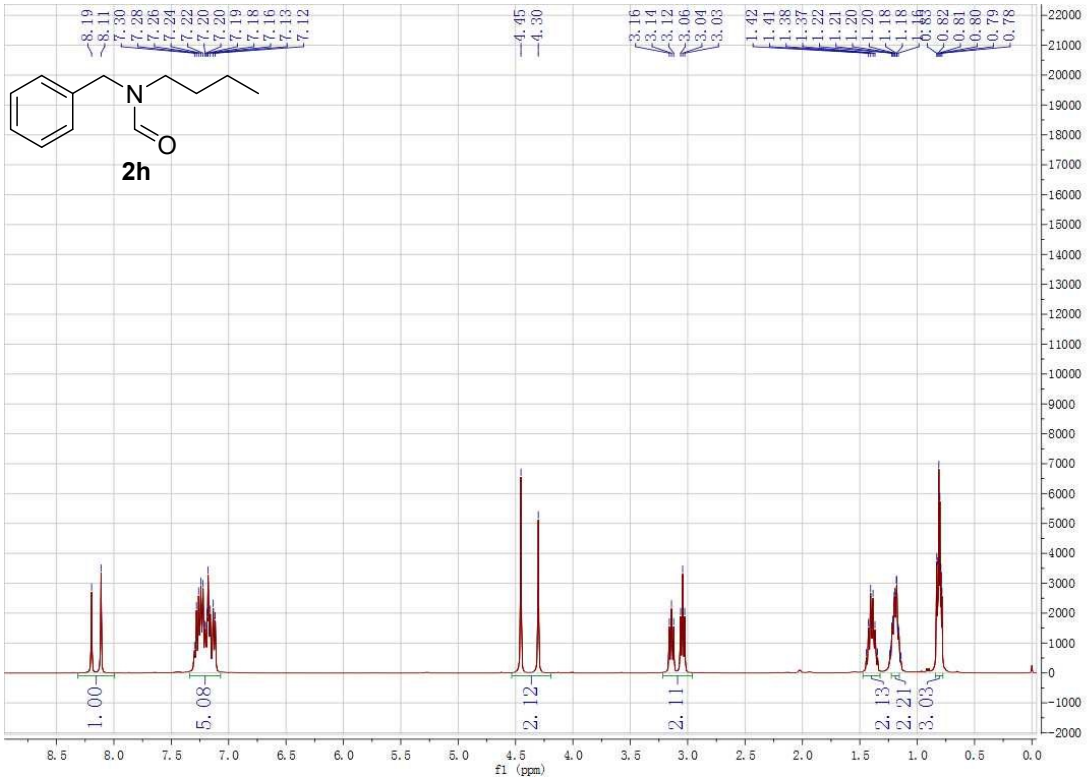
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3.04
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1.37
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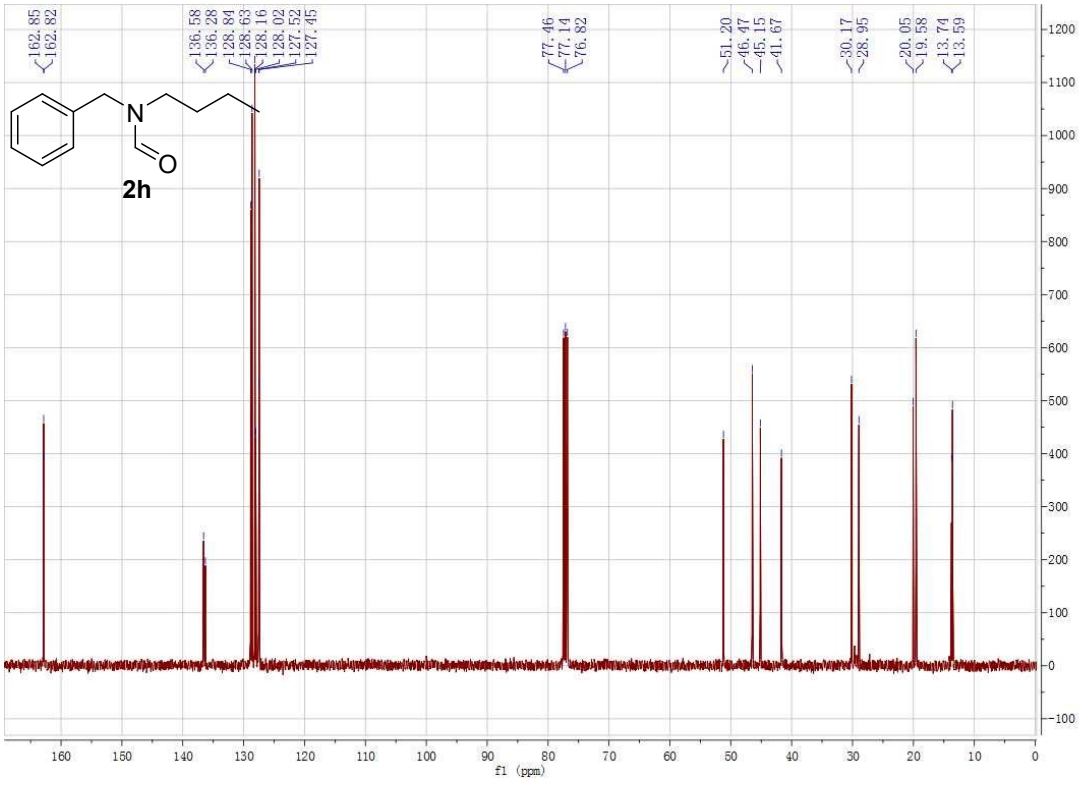
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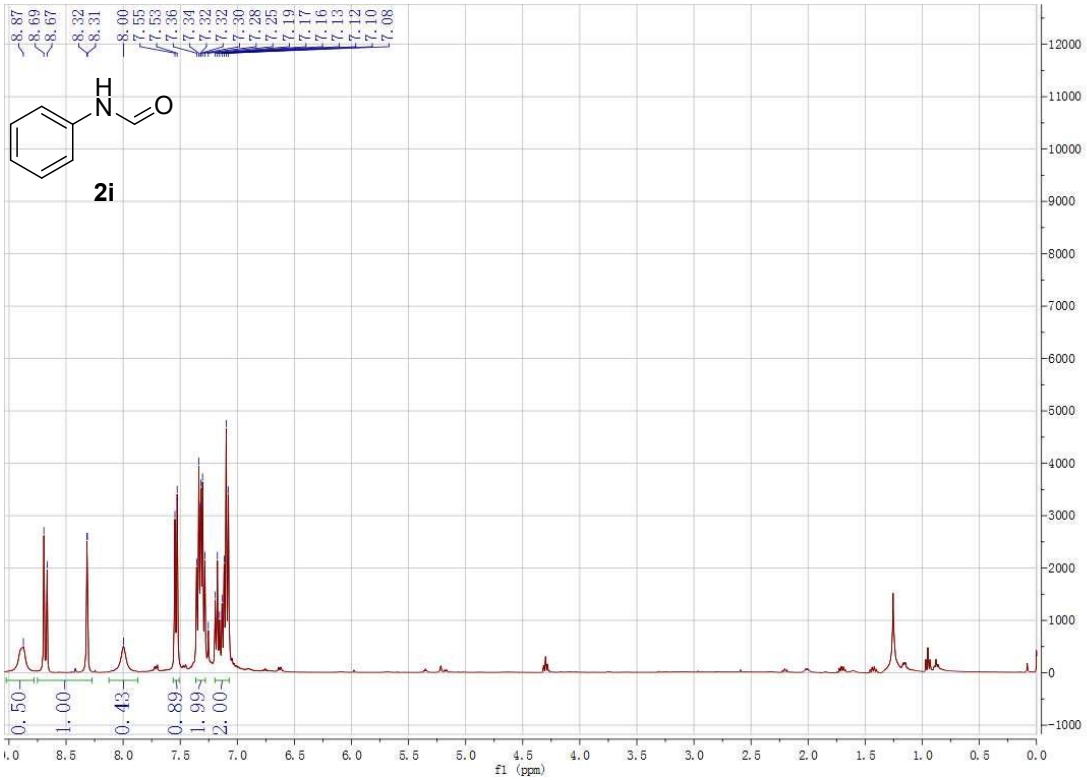
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7.12
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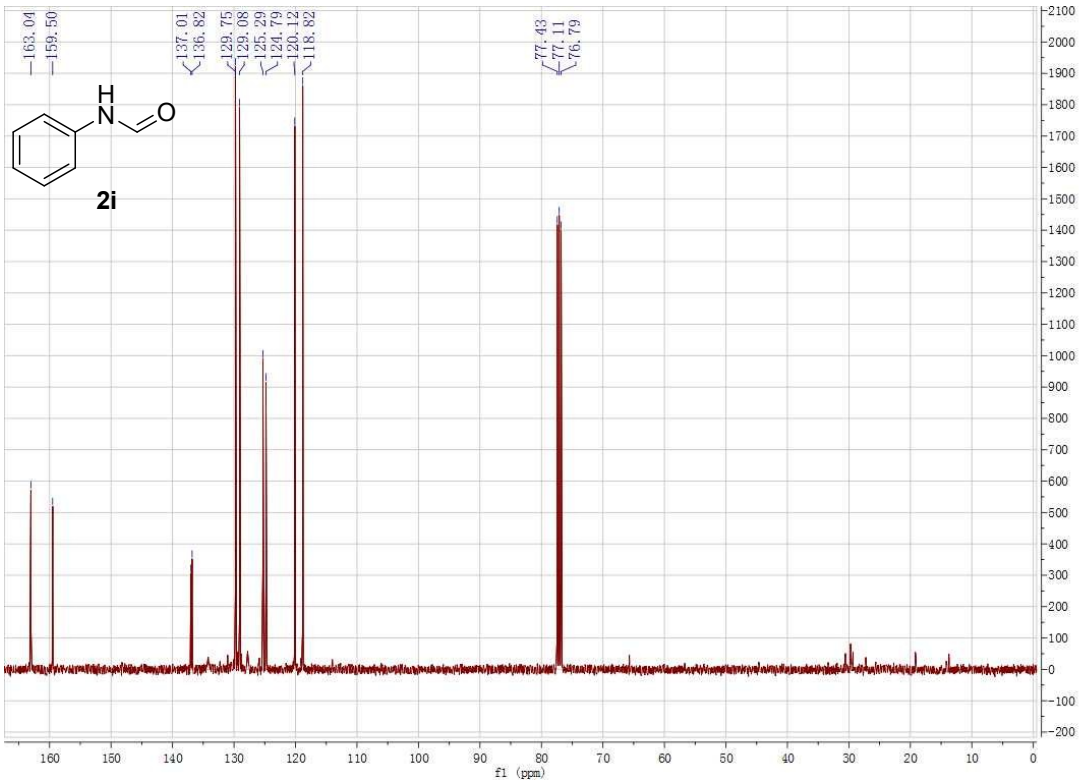
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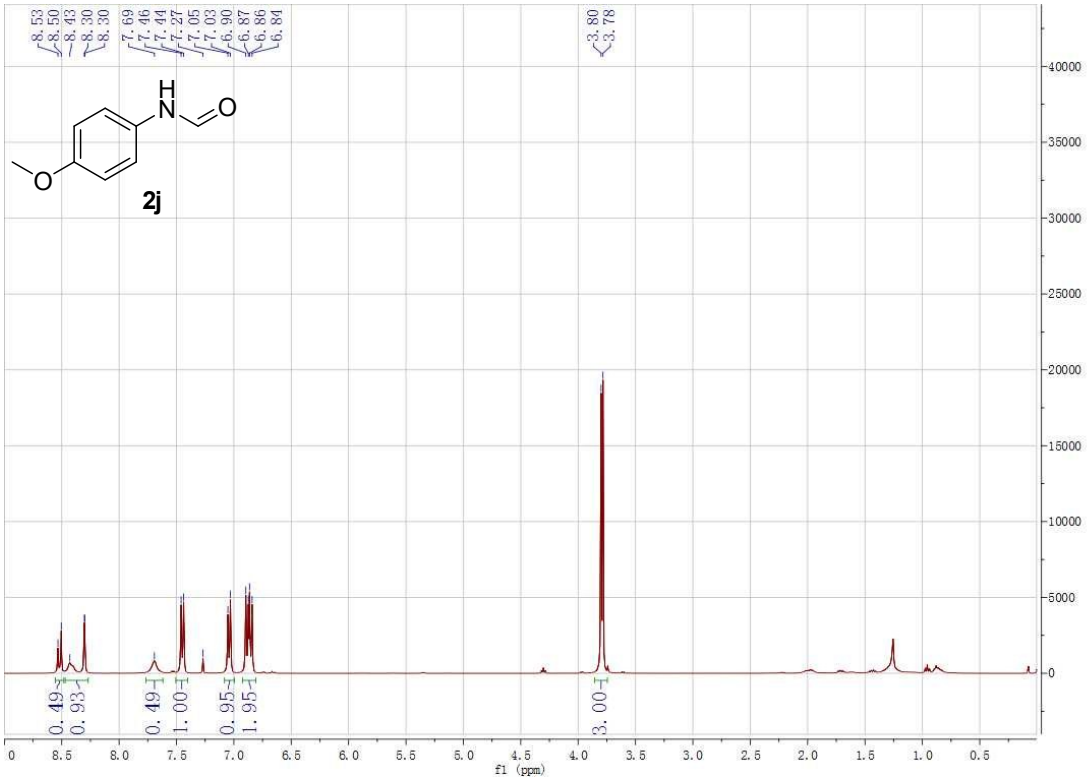
O
2i
f1 (ppm)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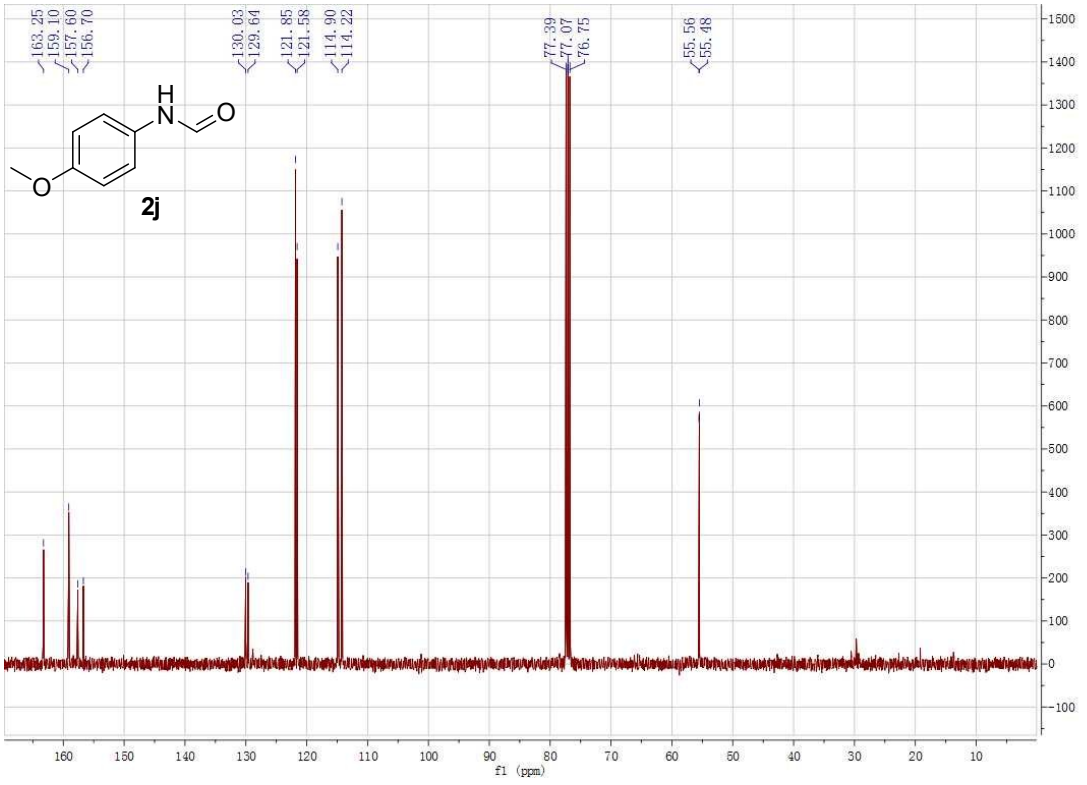
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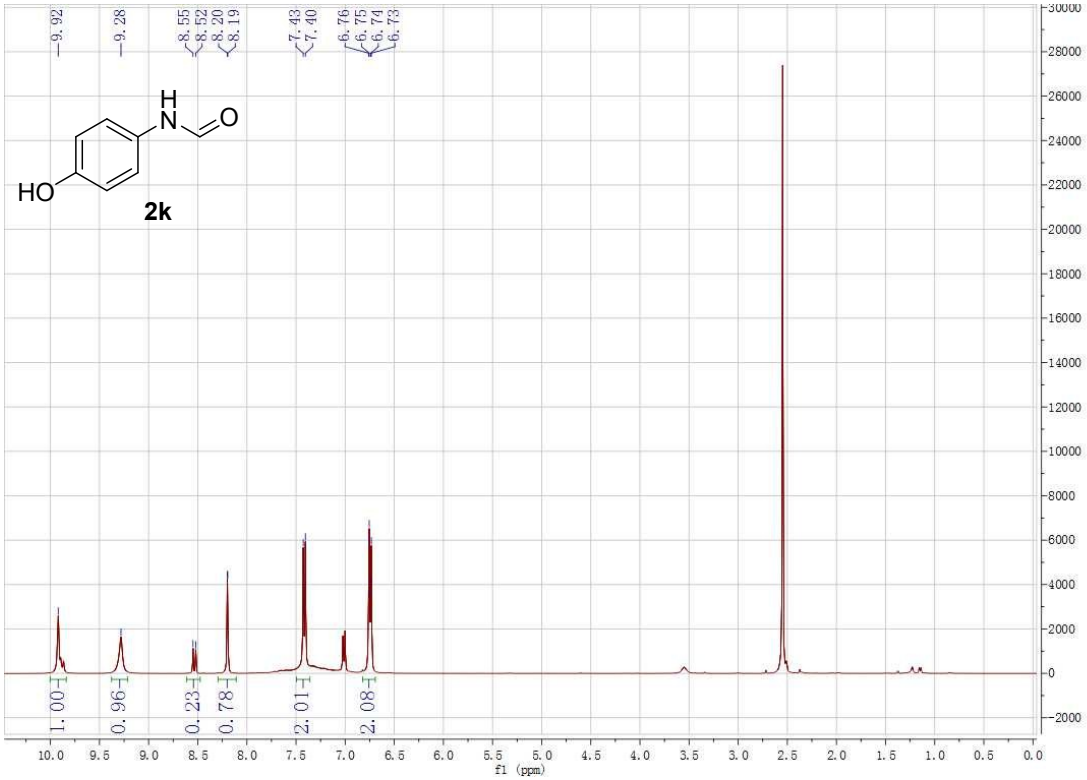
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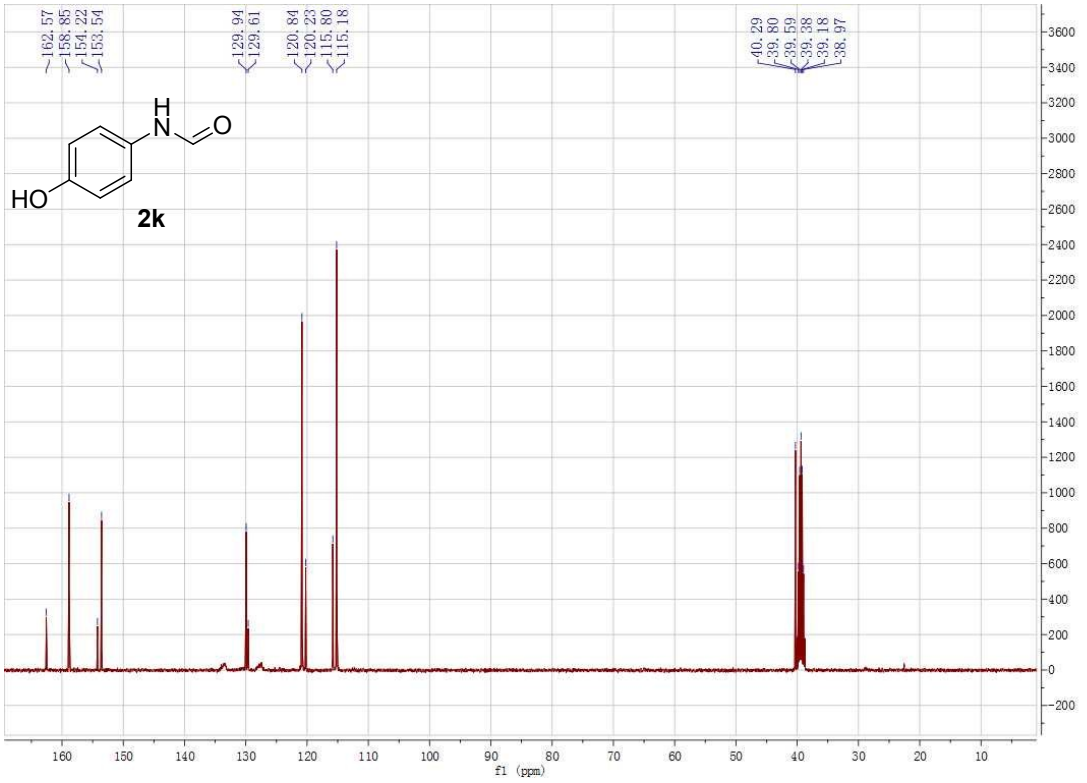
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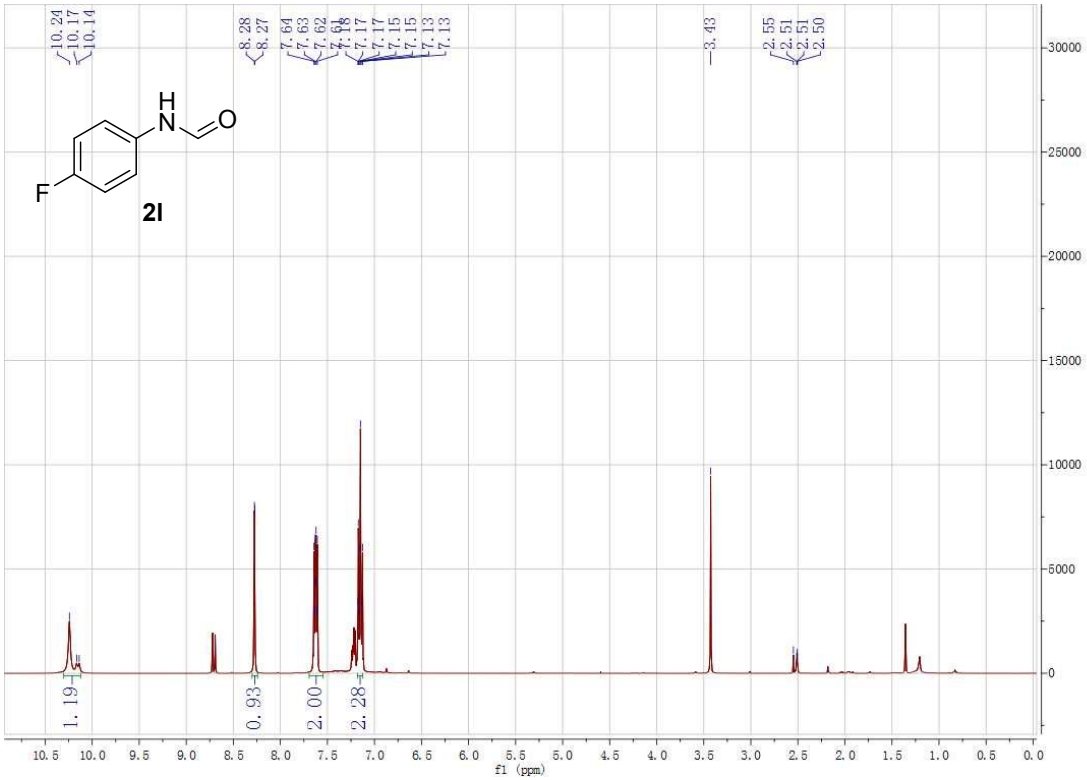
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7.13
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O
F
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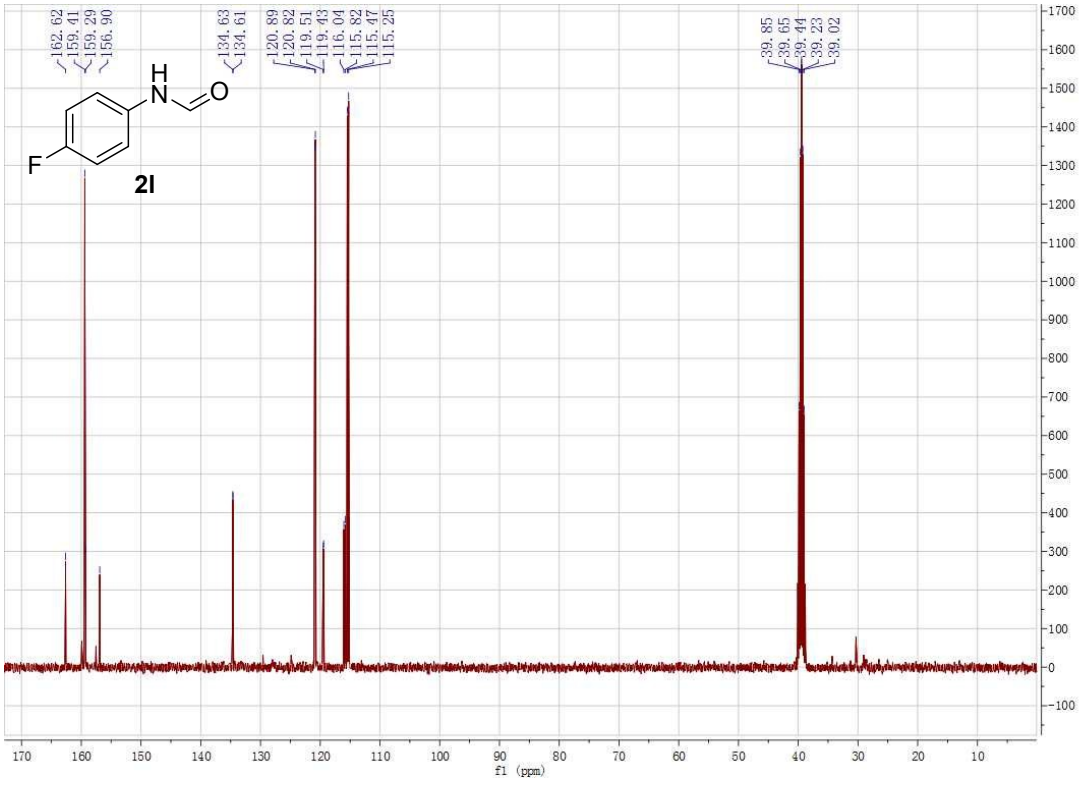
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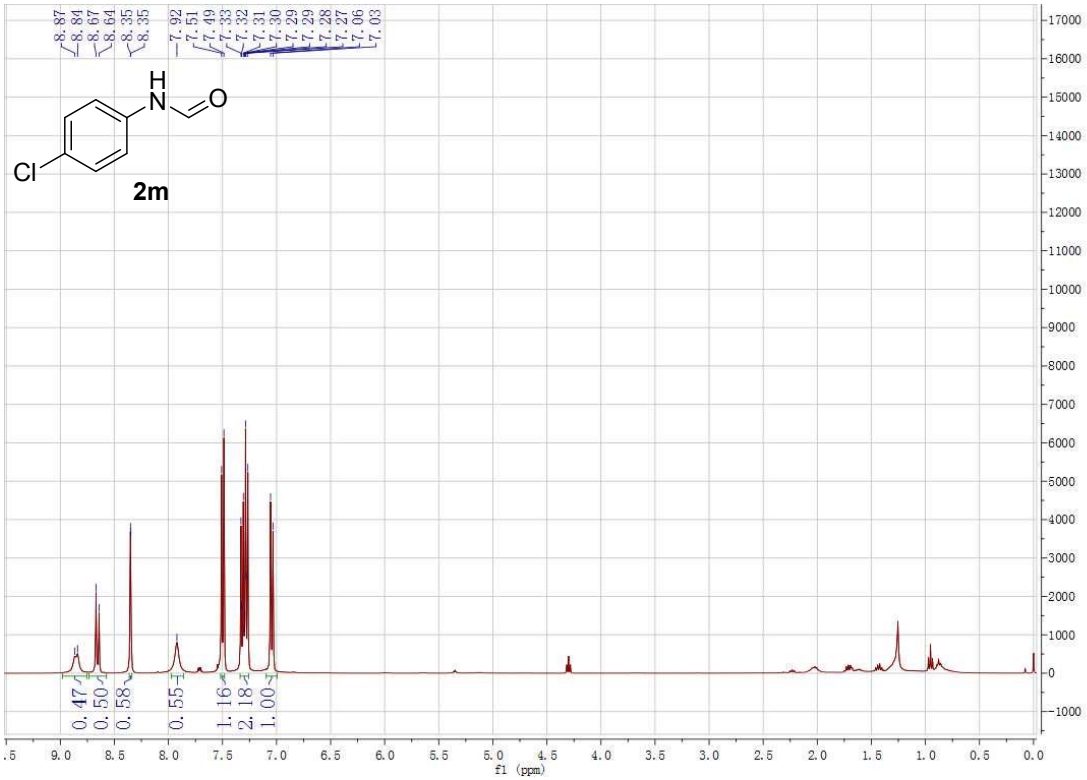
N
O
F
2l
f1 (ppm)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7.28
7.27
7.06
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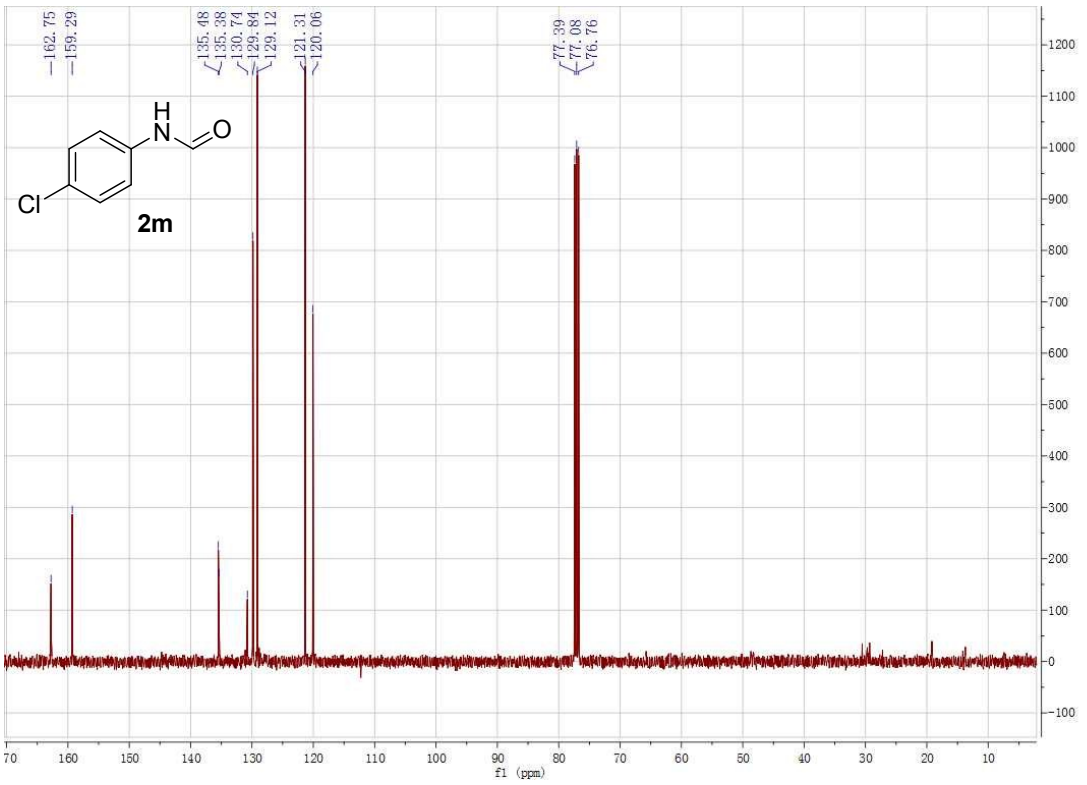
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Cl
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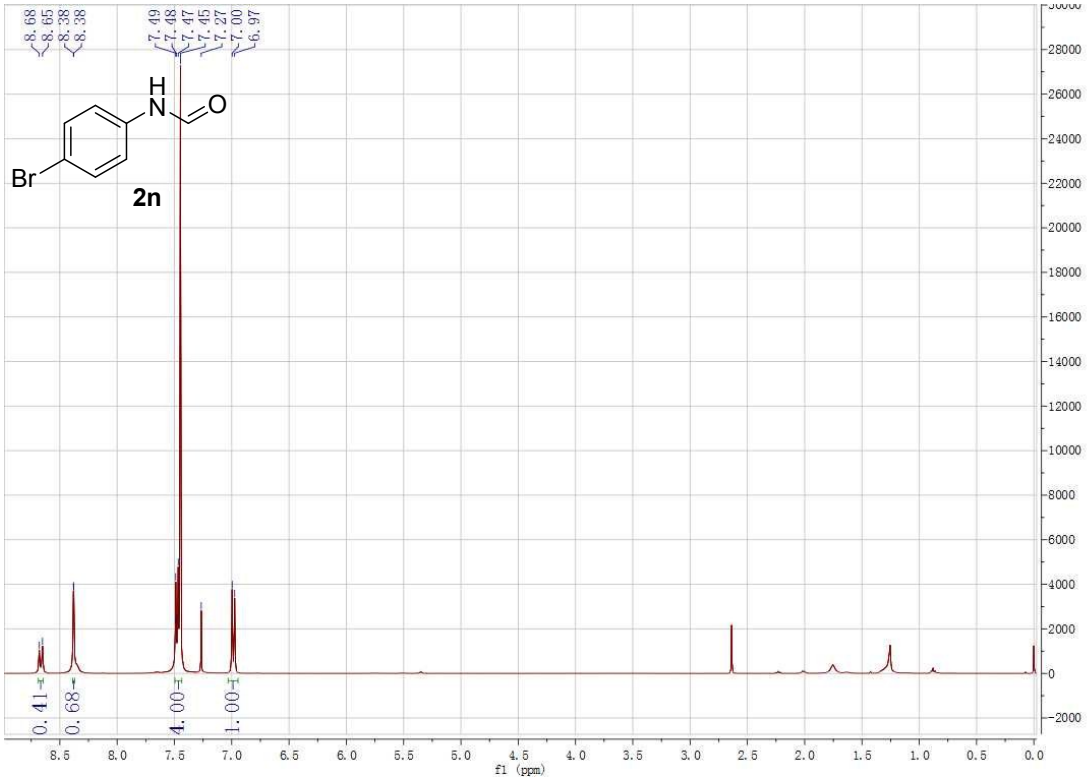
f1 (ppm)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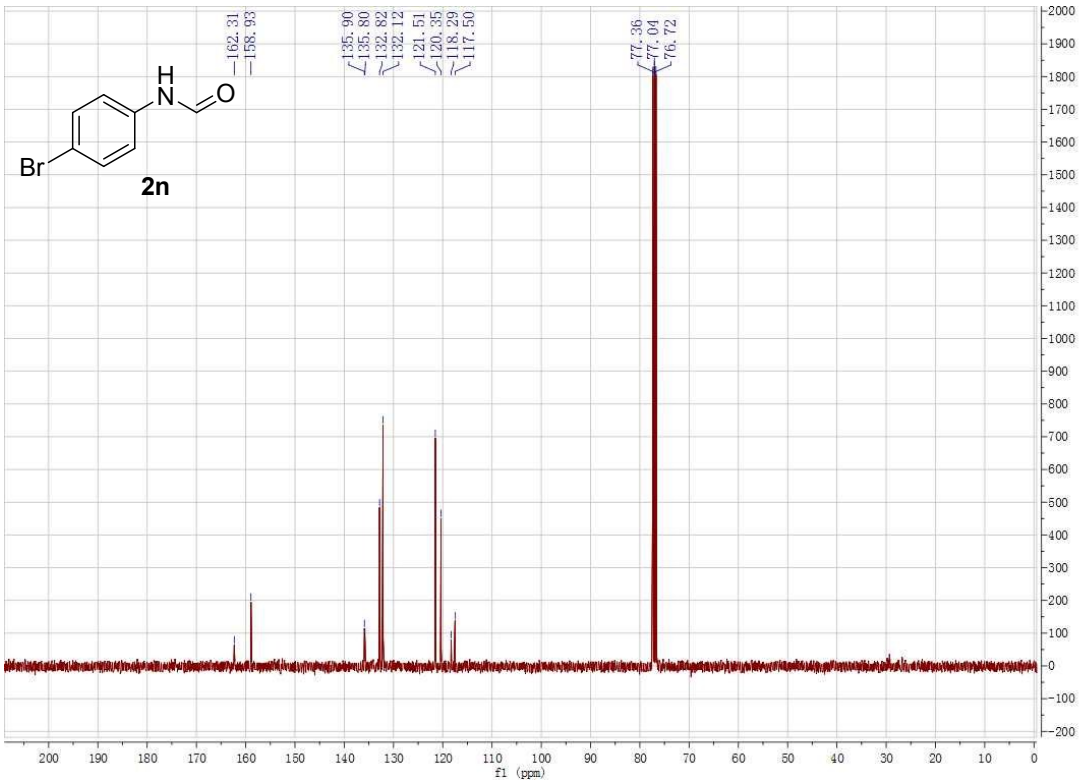
6.97
H
N
O
Br
2n
0.41
0.68
4.00
1.00
f1 (ppm)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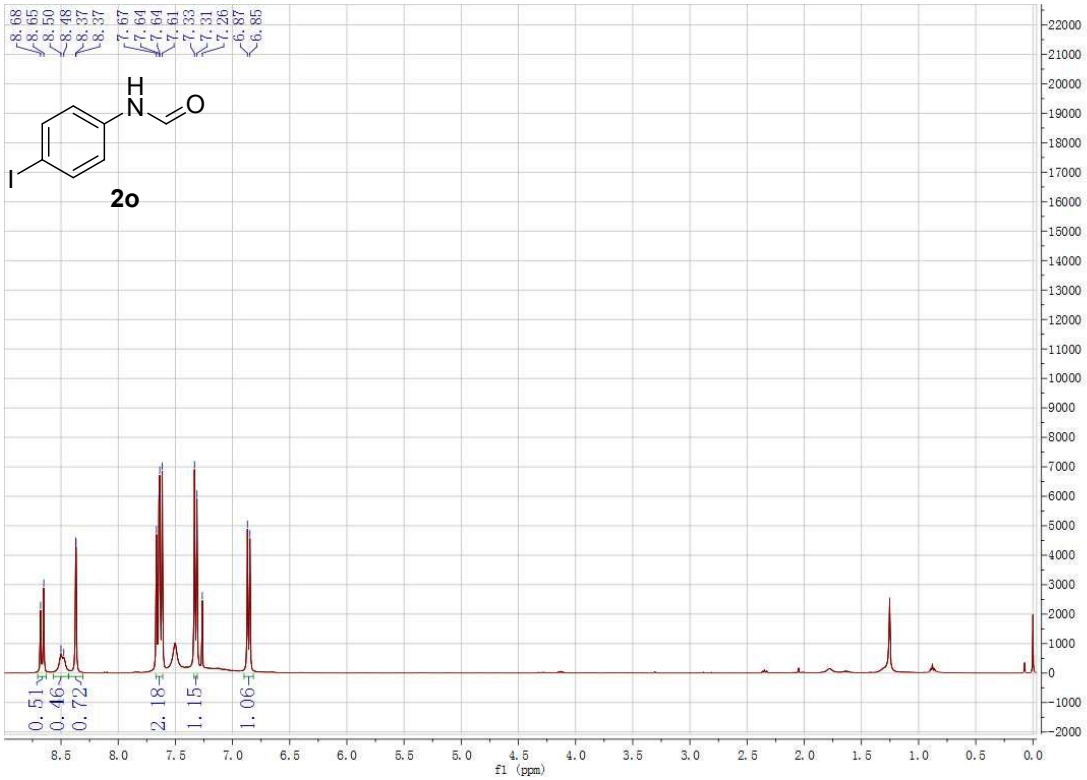
158.93
135.90
135.80
132.82
132.12
121.51
120.35
118.29
117.50
77.36
77.04
76.72
H
N
O
Br
2n
f1 (ppm)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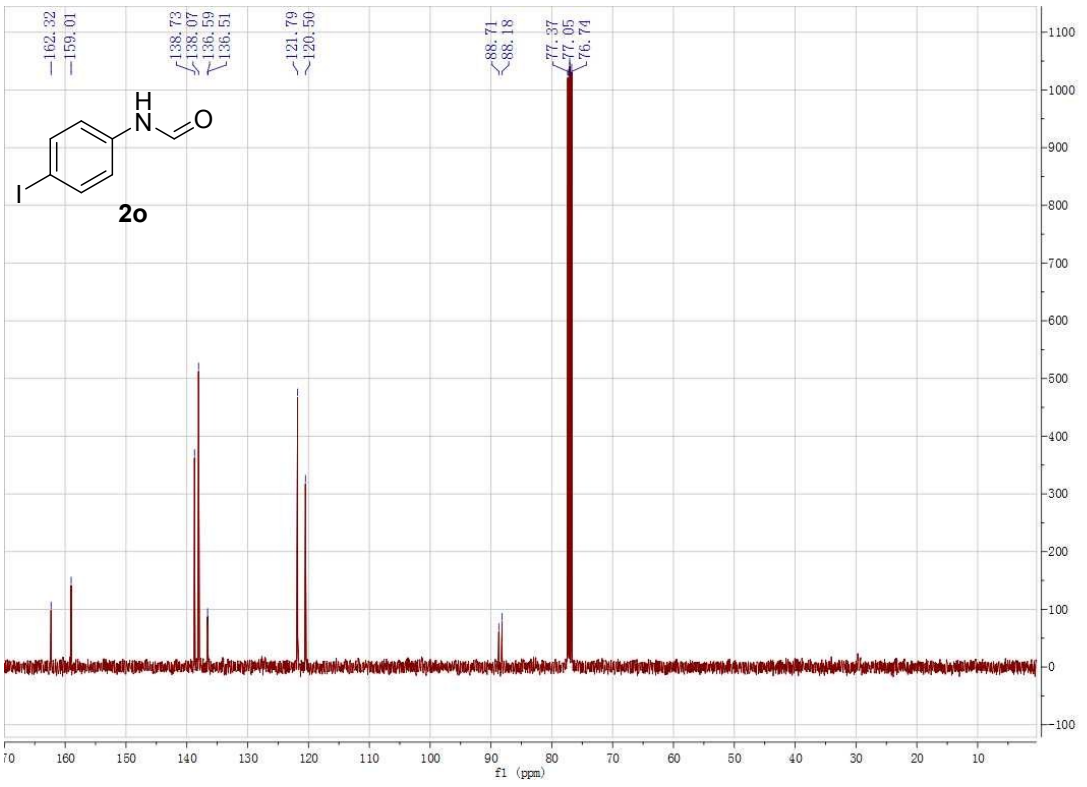
8.65
8.50
8.48
8.37
8.37
7.67
7.64
7.64
7.61
7.33
7.31
7.26
6.87
6.85
H
N
O
I
2o
0.51
0.46
0.72
2.18
1.15
1.06
f1 (ppm)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159.01
138.73
138.07
136.59
136.51
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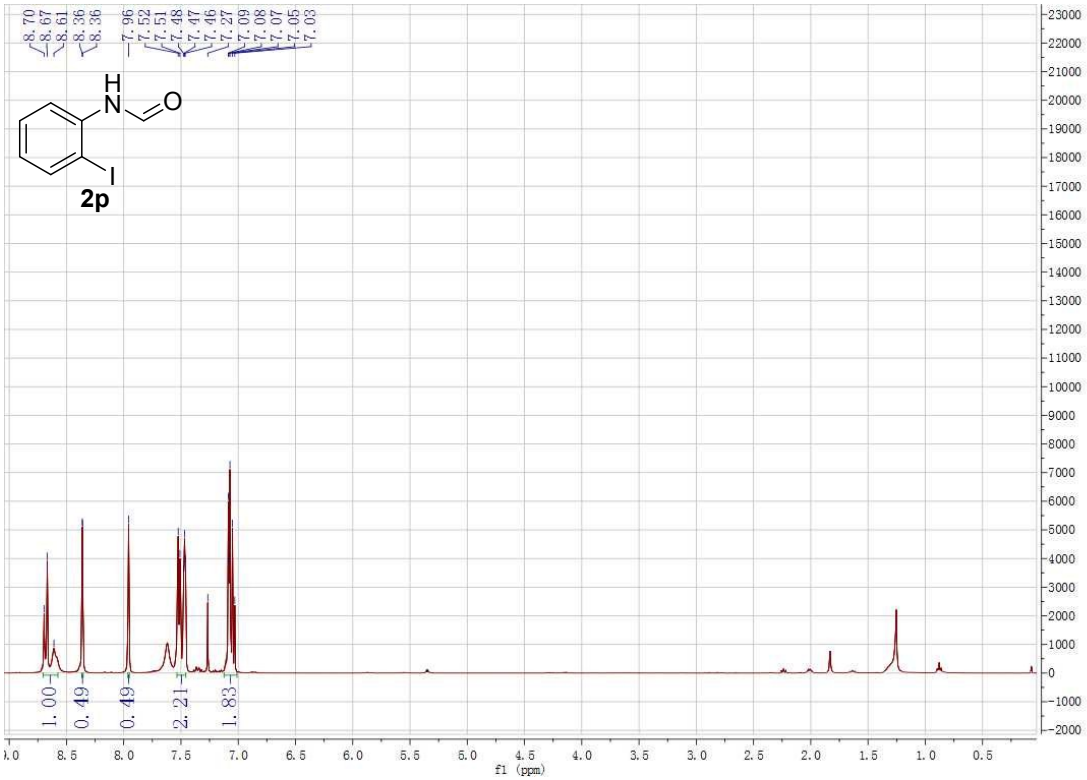
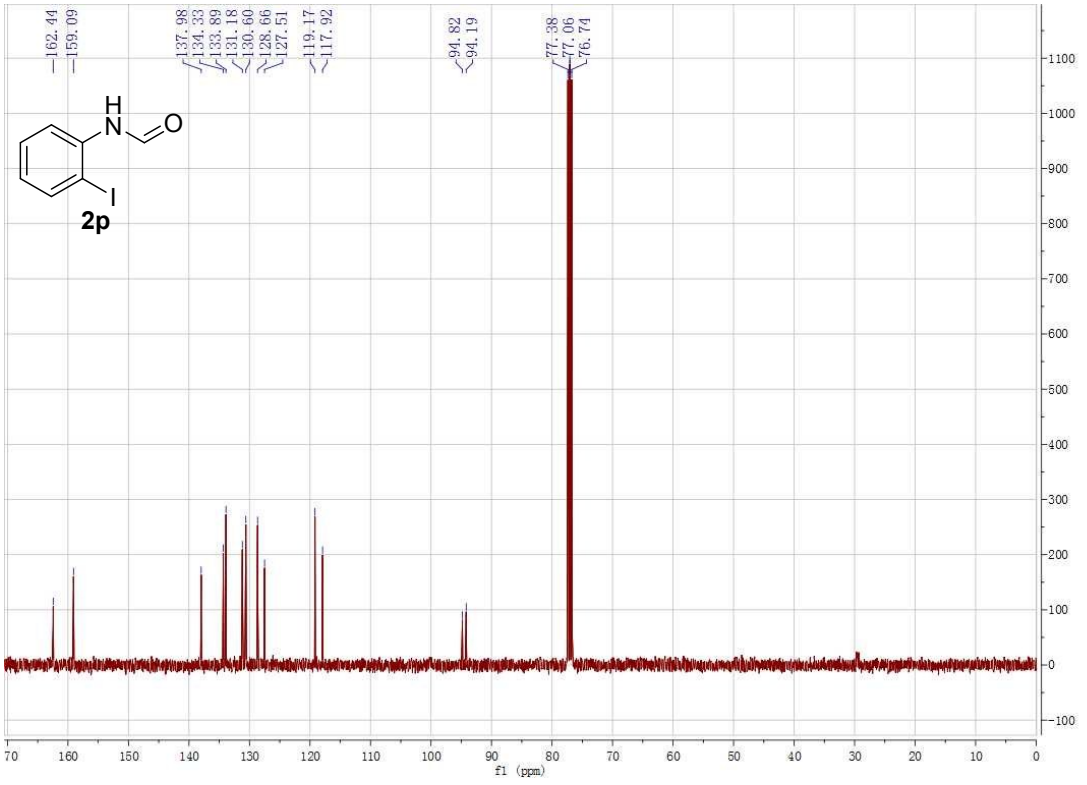
120.50
88.71
88.18
77.37
77.05
76.74
H
N
O
I
2o
f1 (ppm)


8.70
8.67
8.61
8.36
8.36
7.96
7.52
7.51
7.48
7.47
7.46
7.27
7.09
7.08
7.07
7.05
7.03
2p
1.00
0.49
0.49
2.21
1.83
f1 (ppm)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159.09
137.98
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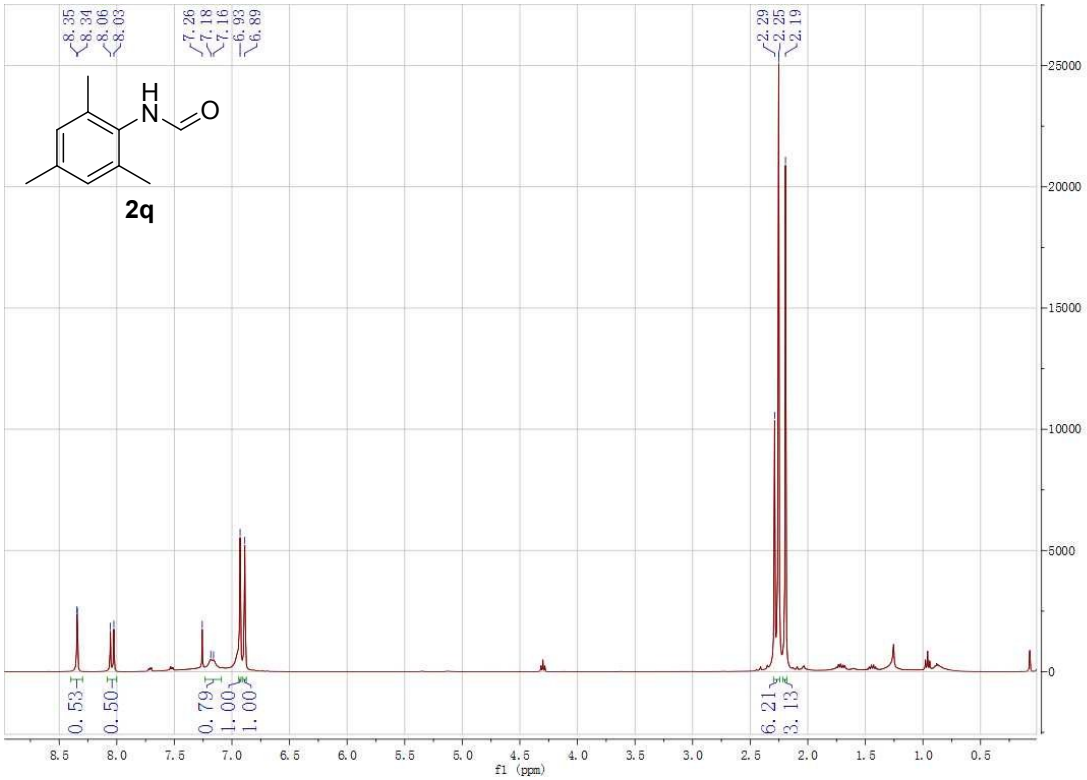
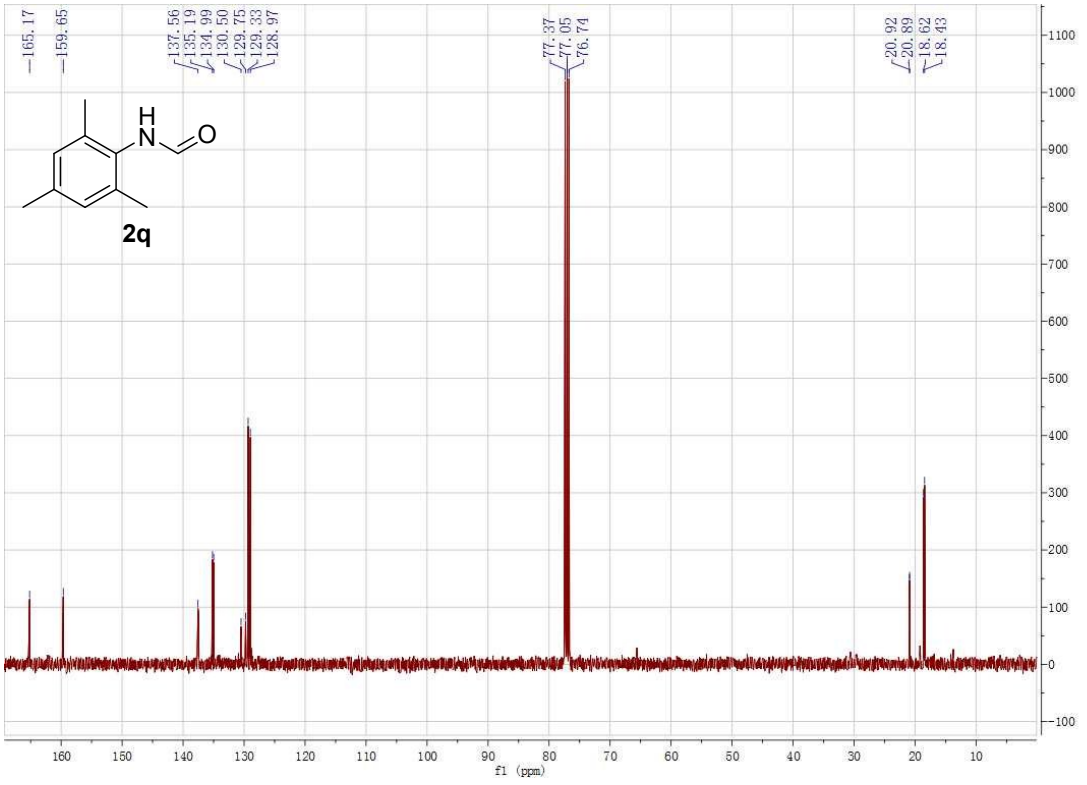
133.89
131.18
130.60
128.66
127.51
119.17
117.92
94.82
94.19
77.38
77.06
76.74
2p
f1 (ppm)


8.35
8.34
8.06
8.03
7.26
7.18
7.16
6.93
6.89
2.29
2.25
2.19
H
N
O
2q
0.53
0.50
0.79
1.00
1.00
6.21
3.13
f1 (ppm)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159.65
137.56
135.19
134.99
130.50
129.75
129.33
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77.05
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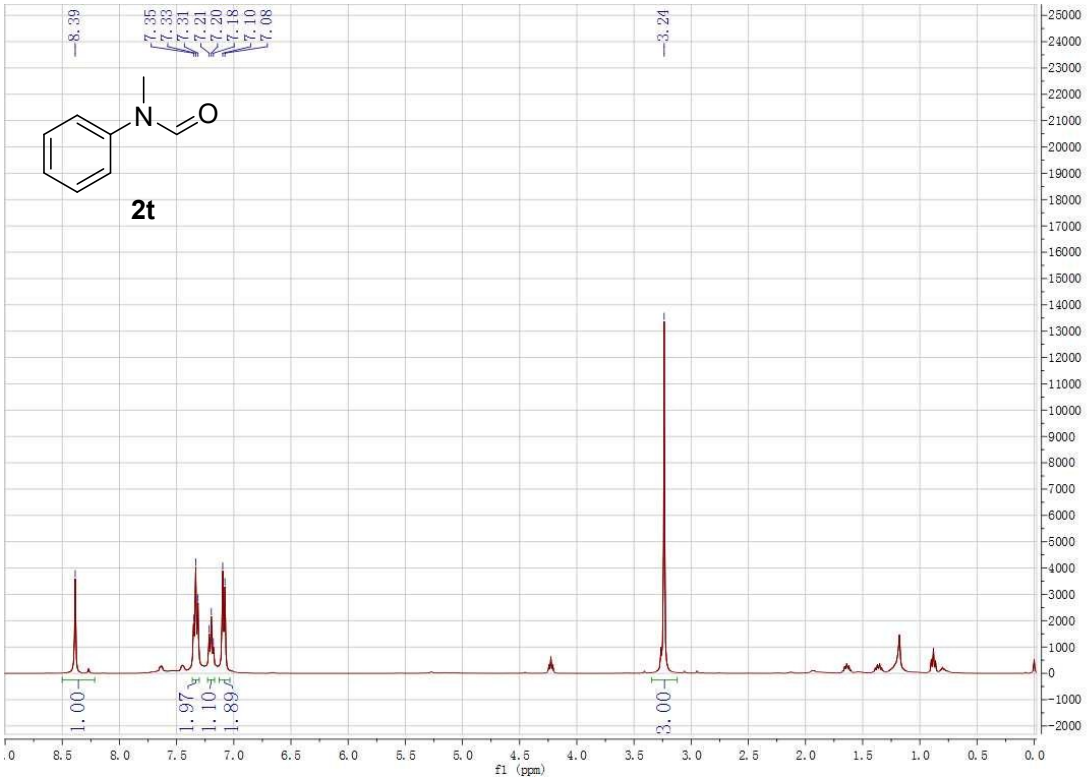
20.92
20.89
18.62
18.43
H
N
O
2q
f1 (ppm)


8.39
7.35
7.33
7.31
7.21
7.20
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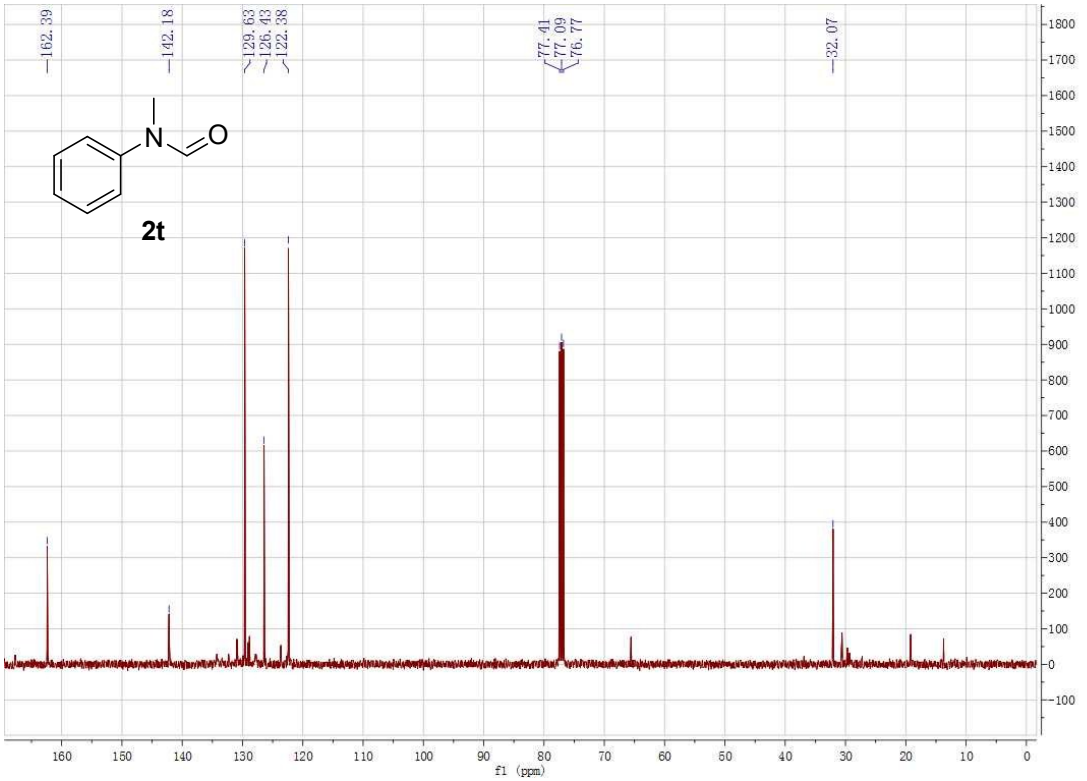
7.10
7.08
3.24
2t
1.00
1.97
1.10
1.89
3.00
f1 (ppm)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129.63
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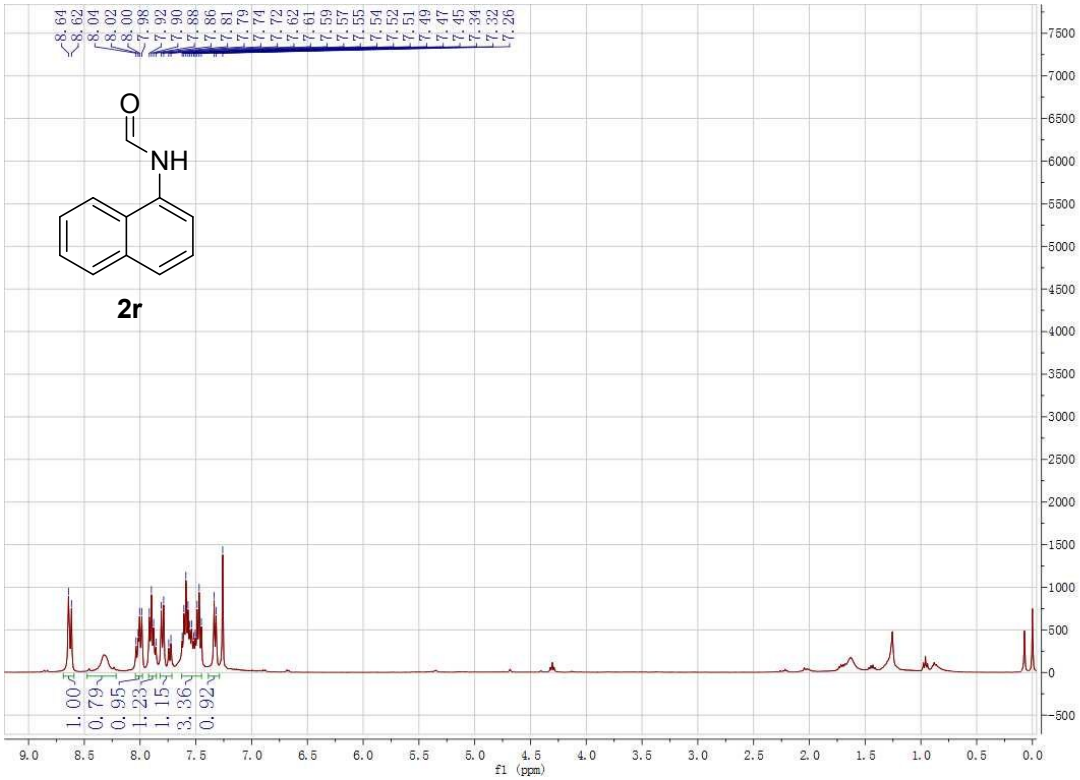
122.38
77.41
77.09
76.77
32.07
2t
f1 (ppm)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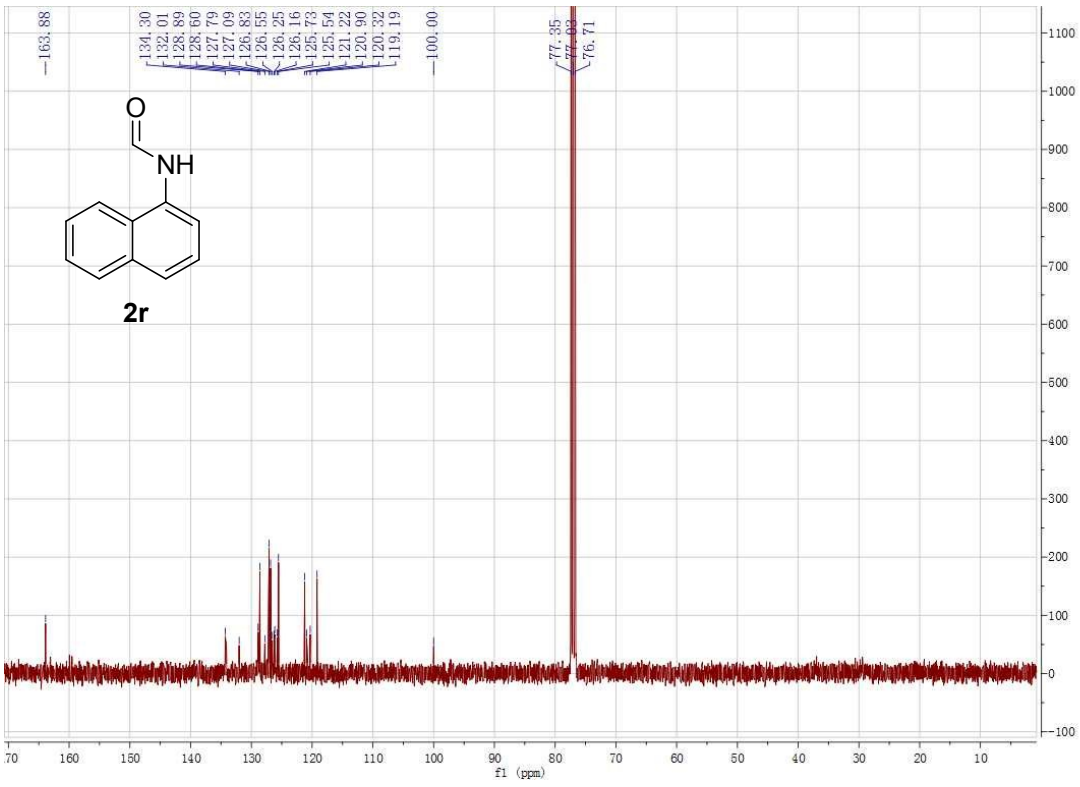
8.62
8.04
8.02
8.00
7.98
7.92
7.90
7.88
7.86
7.81
7.79
7.74
7.72
7.62
7.61
7.59
7.57
7.55
7.54
7.52
7.51
7.49
7.47
7.45
7.34
7.32
7.26
O
NH
2r
1.00
0.79
0.95
1.23
1.15
3.36
0.92
f1 (ppm)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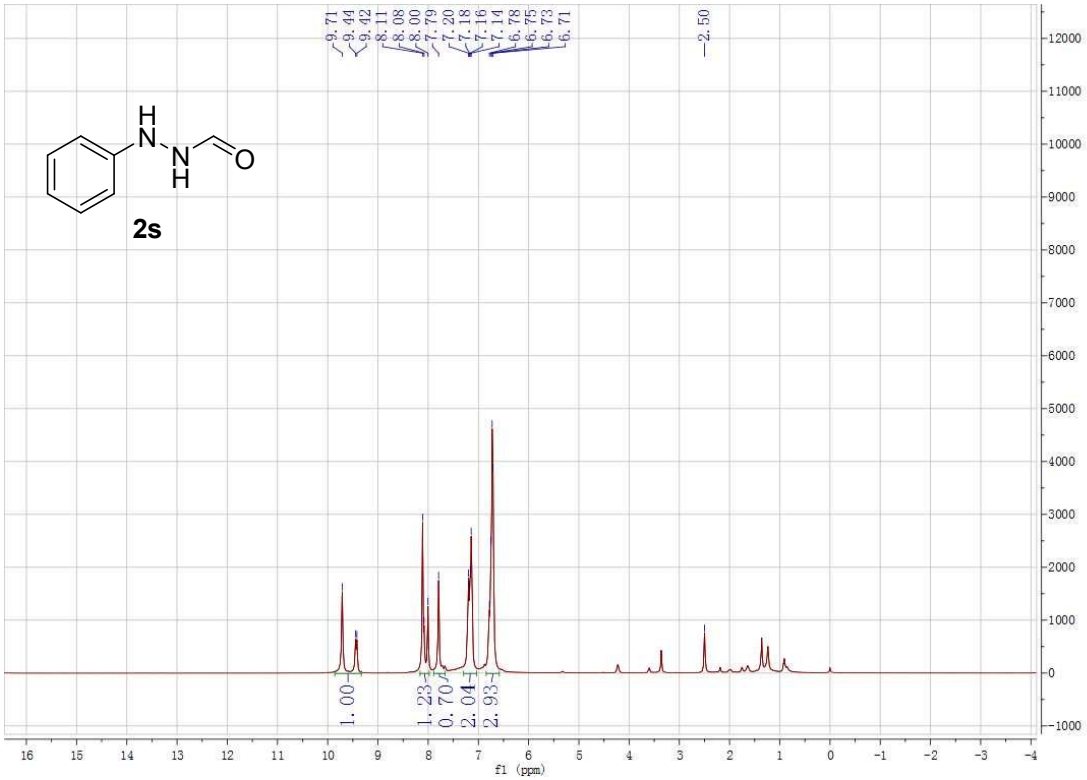
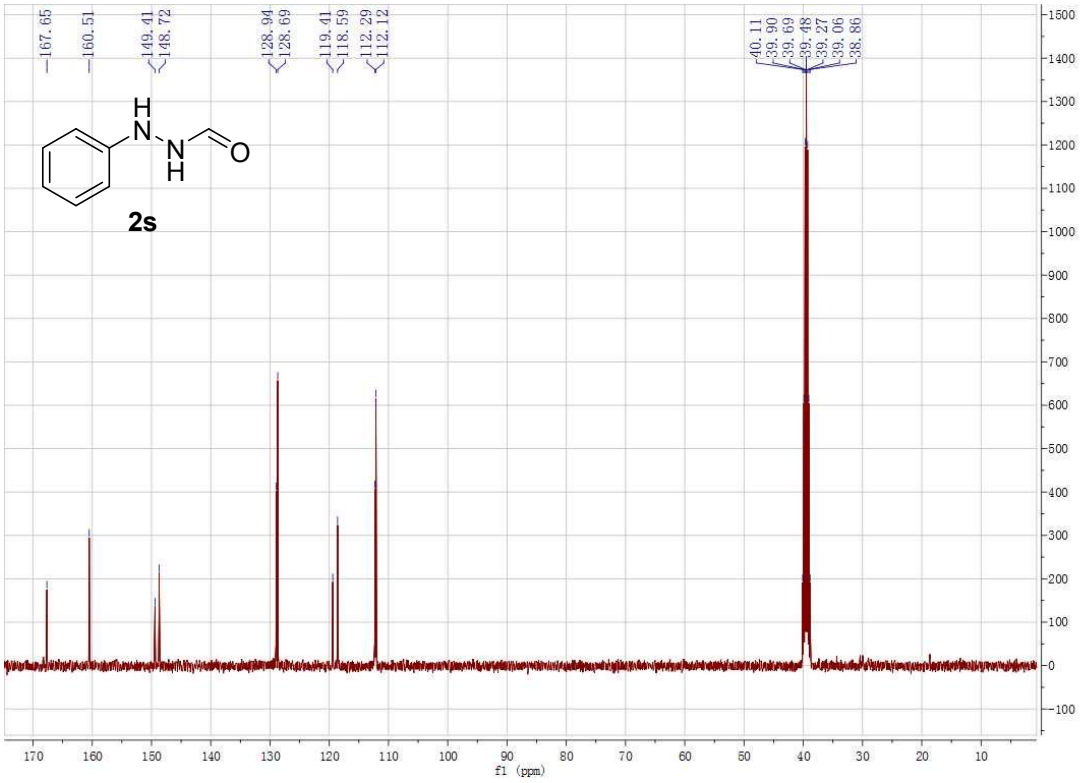
134.30
132.01
128.89
128.60
127.79
127.09
126.83
126.55
126.25
126.16
125.73
125.54
121.22
120.90
120.32
119.19
100.00
77.35
77.03
76.71
O
NH
2r
f1 (ppm)


9.71
9.44
9.42
8.11
8.08
8.00
7.79
7.20
7.18
7.16
7.14
6.78
6.75
6.73
6.71
2.50
1.00
1.23
0.70
2.04
2.93
f1 (ppm)

2s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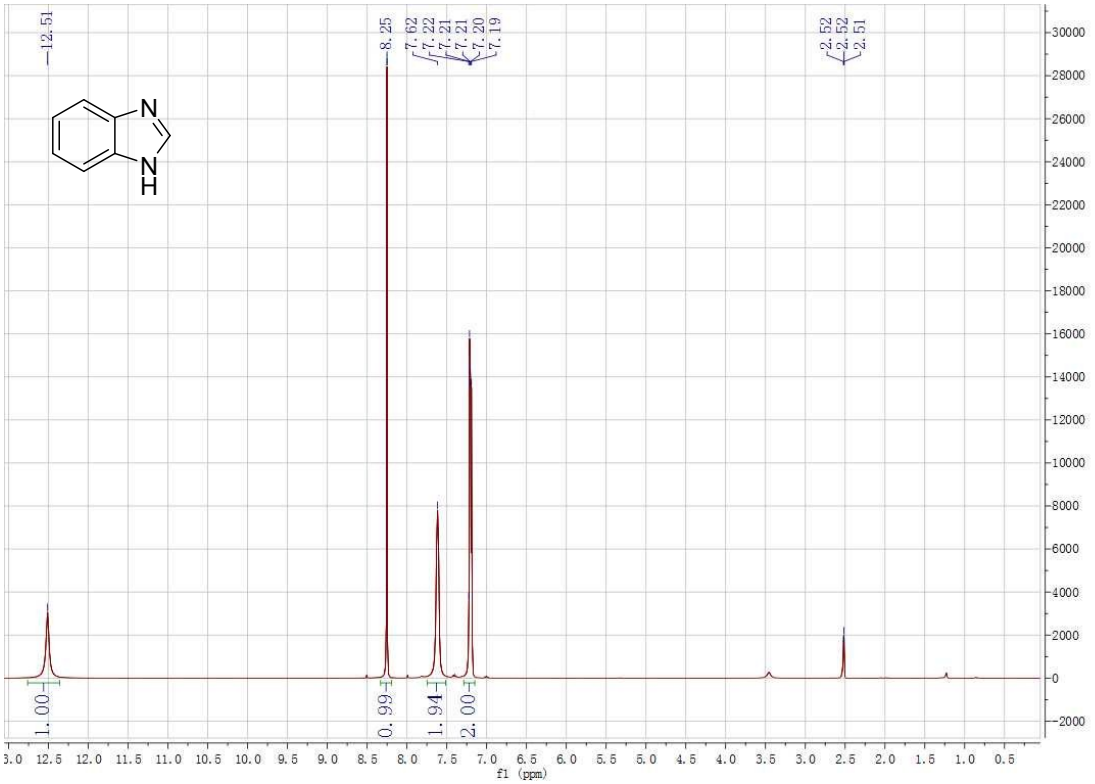
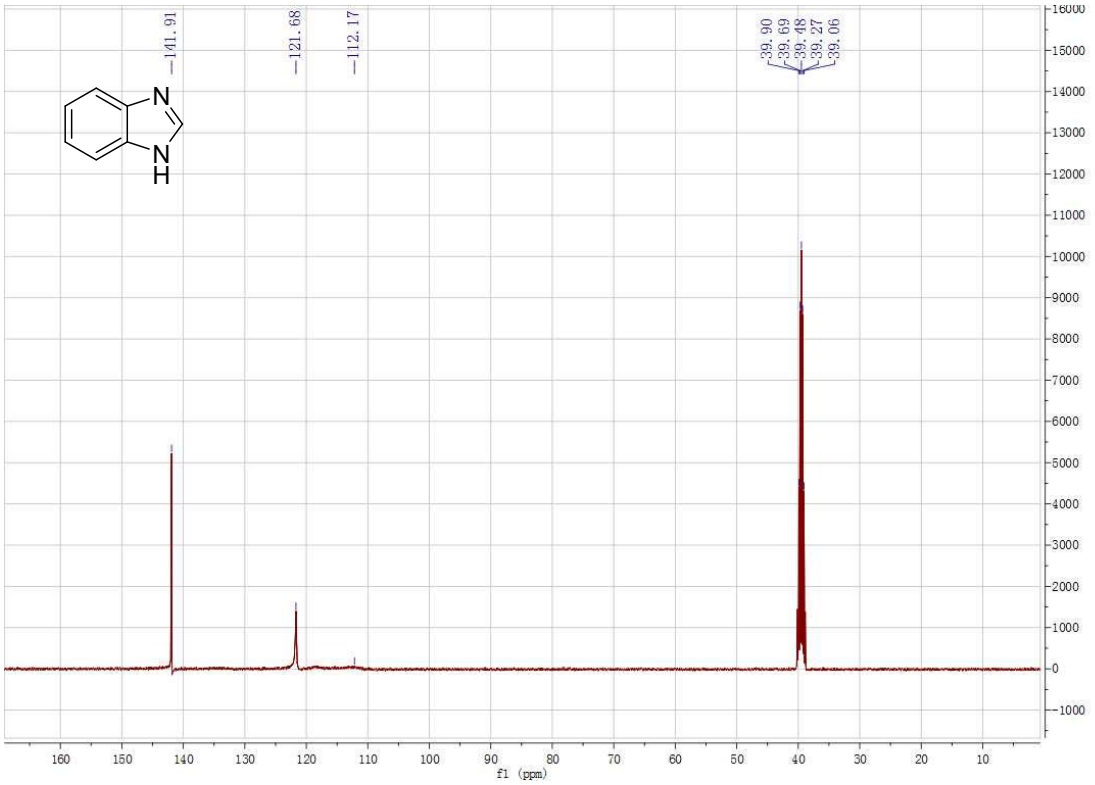
160.51
149.41
148.72
128.94
128.69
119.41
118.59
112.29
112.12
40.11
39.90
39.69
39.48
39.27
39.06
38.86
f1 (ppm)

2s


12.51
8.25
7.62
7.22
7.21
7.21
7.20
7.19
2.52
2.52
2.51
1.00
0.99
1.94
2.00
f1 (ppm)


141.91
121.68
112.17
39.90
39.69
39.48
39.27
39.06
f1 (ppm)

9) References

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