Amide Phosphonium Salt Catalyzed Enantioselective Mannich Addition of Isoxazole-based Nucleophiles to β,γ-Alkynyl-α-ketimino Esters

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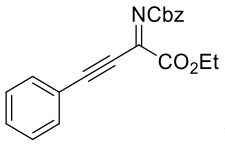
Support information

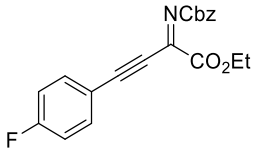
Preparation of β,γ-alkynyl-α-imino ester 1

These substrates were prepared according to literature procedure. [1-2] **1a**, **1b**, **1c**, **1d**, **1e**, **1f**, **1g** and **1j** are Known compounds. New compounds **1h**, **1i**, **1k**, **1l**, **1m**, **1n** and **1o** were prepared according to literature procedures. Fluorinated alkynyl ketimine **1p** was prepared according to literature procedure. [3]



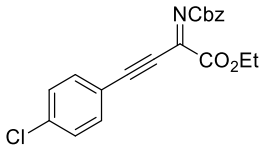
1b

Ethyl-(*E*)-2-(((benzyloxy)carbonyl)imino)-4-phenylbut-3-ynoate (1b): Light yellow oil, 2.4 g, 82% yield, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 – 7.41 (m, 3H), 7.38 – 7.33 (m, 4H), 7.33 – 7.27 (m, 3H), 5.35 (s, 2H), 4.42 (q, J = 7.1 Hz, 2H), 1.40 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.2, 160.9, 146.1, 135.0, 133.1, 131.2, 128.7, 119.6, 102.7, 81.2, 69.0, 63.5, 14.1; HRMS (ESI) m/z: $[M + Na]^+$ calcd for $(C_{20}H_{17}NNaO_4)^+$ 358.1050, found 358.1056.



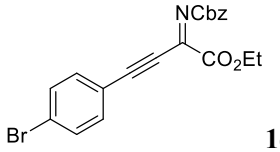
1c

Ethyl-(*E*)-2-(((benzyloxy)carbonyl)imino)-4-(4-fluorophenyl)but-3-ynoate (1c): White solid, 1.2 g, 73% yield, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 – 7.37 (m, 2H), 7.34 – 7.26 (m, 5H), 7.07 – 6.98 (m, 2H), 5.34 (s, 2H), 4.40 (q, J = 7.1 Hz, 2H), 1.39 (t, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 164.3 (d, J = 254.5 Hz), 161.2, 160.8, 146.0, 135.5 (d, J = 9.0 Hz), 135.1, 128.8, 128.7, 116.2 (d, J = 22.4 Hz), 115.8, 101.6, 81.1, 69.0, 63.6, 14.1; HRMS (ESI) m/z: $[M + Na]^+$ calcd for $(C_{20}H_{16}FNNaO_4)^+$ 376.0956, found 376.0963.



1d

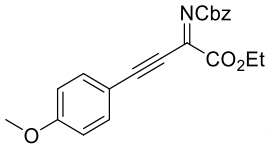
Ethyl-(*E*)-2-(((benzyloxy)carbonyl)imino)-4-(4-chlorophenyl)but-3-ynoate (1d): White solid, 0.9 g, 70% yield, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44 – 7.39 (m, 2H), 7.34 – 7.27 (m, 5H), 7.24 – 7.15 (m, 2H), 5.34 (s, 2H), 4.41 (q, J = 7.1 Hz, 2H), 1.39 (t, J = 7.1 Hz, 3H).; ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.1, 160.8, 145.9, 137.7, 135.0, 134.3, 129.1, 128.8, 128.7, 118.0, 101.2, 81.8, 69.0, 63.6, 14.1; HRMS (ESI) m/z: $[M + Na]^+$ calcd for $(C_{20}H_{16}ClNNaO_4)^+$ 392.0660, found 392.0656.



1e

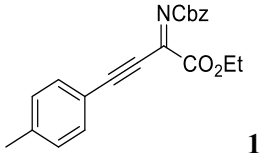
Ethyl-(*E*)-2-(((benzyloxy)carbonyl)imino)-4-(4-bromophenyl)but-3-ynoate (1e): yellow solid, 1.4 g, 74% yield, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 (d, J = 8.0 Hz, 2H), 7.43 – 7.39 (m, 2H), 7.33 – 7.26 (m, 3H), 7.13 (d, J = 8.0 Hz, 2H), 5.33 (s, 2H), 4.40 (q, J = 7.1 Hz, 2H), 1.39 (t, J = 7.1 Hz,

3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.1, 160.7, 145.9, 135.0, 134.3, 132.1, 128.7, 126.1, 118.5, 101.2, 81.9, 69.0, 63.6, 14.1; HRMS (ESI) m/z: $[M + H]^+$ calcd for $(C_{20}H_{17}BrNO_4)^+$ 414.0335, found 414.0349.



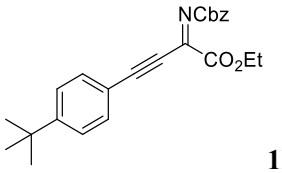
1f

Ethyl-(*E*)-2-(((benzyloxy)carbonyl)imino)-4-(4-methoxyphenyl)but-3-ynoate(1f): Light yellow liquid, 1.5 g, 67% yield, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 – 7.41 (m, 2H), 7.36 – 7.27 (m, 5H), 6.84 (d, J = 8.4 Hz, 2H), 5.35 (s, 2H), 4.40 (q, J = 7.1 Hz, 2H), 3.83 (s, 3H), 1.39 (d, J = 7.1 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 162.1, 161.4, 161.1, 146.2, 135.2, 135.2, 128.7, 128.7, 128.5, 114.4, 111.5, 104.1, 81.4, 68.9, 63.4, 55.6, 14.1; HRMS (ESI) m/z: $[M + Na]^+$ calcd for $(C_{21}H_{19}NNaO_5)^+$ 388.1155, found 388.1160.



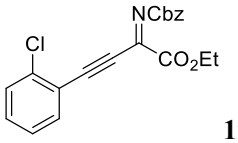
1g

Ethyl-(*E*)-2-(((benzyloxy)carbonyl)imino)-4-(p-tolyl)but-3-ynoate (1g): Light yellow liquid, 1.3 g, 70% yield, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.47 – 7.38 (m, 2H), 7.33 – 7.23 (m, 5H), 7.28 – 7.22 (m, 2H), 7.15 (d, J = 7.3 Hz, 2H), 5.35 (s, 2H), 4.41 (q, J = 7.1 Hz, 2H), 2.39 (s, 3H), 1.40 (d, J = 7.1 Hz, 3H).; ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.3, 161.0, 146.2, 142.1, 135.1, 133.2, 129.5, 128.7, 116.6, 103.5, 81.2, 69.0, 63.5, 21.9, 14.1; HRMS (ESI) m/z: $[M + Na]^+$ calcd for $(C_{21}H_{19}NNaO_4)^+$ 372.1206, found 372.1210.



1h

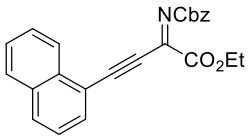
Ethyl-(*E*)-2-(((benzyloxy)carbonyl)imino)-4-(4-(tert-butyl)phenyl)but-3-ynoate (1h): White solid, 2 g, 73% yield, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 – 7.40 (m, 2H), 7.39 – 7.35 (m, 2H), 7.35 – 7.27 (m, 5H), 5.35 (s, 2H), 4.41 (q, J = 7.1 Hz, 2H), 1.40 (d, J = 7.1 Hz, 3H), 1.33 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.3, 161.0, 155.1, 146.3, 135.1, 133.0, 128.7, 128.7, 128.5, 125.8, 116.6, 103.4, 81.1, 69.0, 63.5, 35.2, 31.2, 31.1, 14.1; HRMS (ESI) m/z: $[M + Na]^+$ calcd for $(C_{24}H_{25}NNaO_4)^+$ 414.1676, found 414.1682.



1i

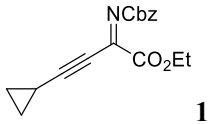
Ethyl-(*E*)-2-(((benzyloxy)carbonyl)imino)-4-(2-chlorophenyl)but-3-ynoate (1i): Light yellow liquid, 1.2 g, 65% yield, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 – 7.38 (m, 4H), 7.37 – 7.28 (m, 4H),

7.25 – 7.21 (m, 1H), 5.34 (s, 2H), 4.42 (q, J = 7.1 Hz, 2H), 1.40 (t, J = 7.1 Hz, 3H).; ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.0, 160.6, 145.8, 137.5, 134.9, 132.3, 129.7, 128.8, 128.7, 126.8, 120.0, 98.4, 85.1, 69.2, 63.6, 14.1; HRMS (ESI) m/z: $[M + Na]^+$ calcd for $(C_{20}H_{16}ClNNaO_4)^+$ 392.0660, found 392.0656.



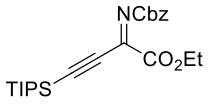
1j

Ethyl-(*E*)-2-(((benzyloxy)carbonyl)imino)-4-(naphthalen-1-yl)but-3-ynoate (1j): White solid, 2.1 g, 80% yield, ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.30 (d, J = 7.6 Hz, 1H), 7.97 (d, J = 8.2 Hz, 1H), 7.89 (d, J = 7.6 Hz, 1H), 7.60 (ddd, J = 16.7, 10.9, 3.9 Hz, 3H), 7.51 – 7.31 (m, 4H), 7.26 – 7.21 (m, 2H), 5.40 (s, 2H), 4.48 (q, J = 7.1 Hz, 2H), 1.47 (t, J = 7.1 Hz, 3H).; ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.5, 160.9, 146.2, 135.0, 133.7, 133.6, 133.1, 132.2, 128.7, 128.7, 128.0, 127.1, 125.8, 125.2, 117.2, 101.3, 86.0, 69.2, 63.6, 14.2; HRMS (ESI) m/z: $[M + Na]^+$ calcd for $(C_{24}H_{19}NNaO_4)^+$ 408.1206, found 408.1202.



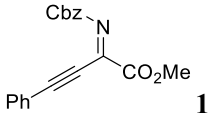
1k

Ethyl-(*E*)-2-(((benzyloxy)carbonyl)imino)-4-cyclopropylbut-3-ynoate (1k): Light yellow liquid, 0.8 g, 76% yield, ^{1}H NMR (400 MHz, $CDCl_3$) δ 1H NMR (400 MHz,) δ 7.40 (d, J = 6.9 Hz, 2H), 7.36 – 7.32 (m, 3H), 5.27 (s, 2H), 4.33 (q, J = 6.8 Hz, 2H), 1.36 – 1.32 (m, 4H), 0.97 – 0.92 (m, 2H), 0.82 – 0.72 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.4, 161.0, 135.1, 128.8, 128.7, 128.7, 128.6, 128.5, 128.4, 128.2, 127.6, 110.8, 69.4, 68.8, 68.7, 66.9, 63.3, 45.2, 14.1, 13.9, 10.4, 10.1; HRMS (ESI) m/z: $[M + Na]^+$ calcd for $(C_{17}H_{17}NNaO_4)^+$ 322.1050, found 322.1055.



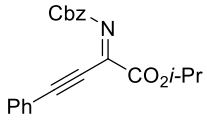
1l

Ethyl-(*E*)-2-(((benzyloxy)carbonyl)imino)-4-(triisopropylsilyl)but-3-ynoate (1l): Light yellow liquid, 2.3 g, 86% yield, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 – 7.32 (m, 5H), 5.26 (s, 2H), 4.35 (q, J = 7.1 Hz, 2H), 1.35 (d, J = 7.1 Hz, 3H), 1.08 (s, 21H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.0, 160.4, 145.7, 134.7, 128.7, 128.7, 109.0, 96.7, 69.2, 63.4, 18.5, 14.0, 11.0; HRMS (ESI) m/z: $[M + Na]^+$ calcd for $(C_{23}H_{33}NNaO_4Si)^+$ 438.2071, found 438.2064.



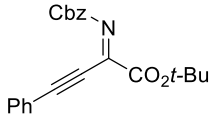
1m

Light yellow liquid, 1.1 g, 70% yield, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.46 – 7.40 (m, 3H), 7.38 – 7.33 (m, 4H), 7.30 (s, 3H), 5.36 (s, 2H), 3.96 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.3, 161.1, 145.8, 135.0, 133.1, 131.3, 128.7, 128.7, 120.5, 119.6, 102.8, 81.1, 69.0, 54.0; HRMS (ESI-TOF) m/z: $[M + Na]^+$ calcd for $(C_{19}H_{15}NNaO_4)^+$ 344.0893, found 344.0899.



1n

Light yellow liquid , 1.6g, 79% yield, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 – 7.40 (m, 3H), 7.37 – 7.33 (m, 4H), 7.32 – 7.27 (m, 3H), 5.35 (s, 2H), 5.27 – 5.18 (m, 1H), 1.39 (d, J = 6.2 Hz, 6H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.1, 159.9, 146.2, 134.9, 133.1, 130.9, 128.7, 119.6, 102.3, 80.9, 71.4, 68.4, 21.7; HRMS (ESI-TOF) m/z: [M + Na]+ calcd for $(C_{21}H_{19}NNaO_4)^+$ 372.1206, found 372.1215.



1o

Light yellow liquid, 0.7g, 68% yield, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.49 – 7.37 (m, 4H), 7.36 – 7.26 (m, 6H), 5.33 (s, 2H), 1.56 (s, 9H); ^{13}C NMR (100 MHz, $CDCl_3$) δ 161.5, 160.1, 147.4, 135.1, 133.8, 133.0, 131.1, 128.9, 128.7, 128.7, 119.8, 102.1, 84.8, 81.4, 80.5, 68.9, 53.6, 27.9; HRMS (ESI-TOF) m/z: $[M + Na]^+$ calcd for $(C_{22}H_{21}NNaO_4)^+$ 386.1363, found 386.1370.

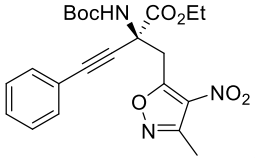
Preparation of Preparation of nitroisoxazole 2

These substrates were prepared according to literature procedure.[4] All of the nitroisoxazole substrates employed in the current study are known compounds.

References:

1. (a) I. Mizota, Y. Matsuda, S. Kamimura, H. Tanaka and M. Shimizu, *Org. Lett*., **2013**, *15*, 4206; (b) M. Guo, D. Li and Z. Zhang, *J. Org. Chem*., **2003**, *68*, 10172.
2. (a) M. Hatano, H. Okamoto, T. Kawakami, K. Toh, H. Nakatsuji, A. Sakakura, and K. Ishihara, *Chem Sci.* **2018,** *9*, 6361; (b) J. X. Yang, Z. Wang, Z. Y He, G. F. Li,. L. Hong,. W. S. Sun, and R. Wang, *Angew.Chem. Int.Ed*. **2020**, *59*,642; (c) K. Ogura, T. Takehara, T. Suzuki, S. Nakamura, *Adv. Synth. Catal.* **2021**, *363*, 4544.
3. B. M. Trost, C.-I. J. Hung, M. J. Scharf, *Angew. Chem. Int. Ed.* **2018***, 57,* 11408
4. X. Xia, Q. Zhu, J. Wang, J. Chen, W. Cao, B. Zhu, X. Wu, *J. Org. Chem.* **2018**, *83*, 14617

^{1}H NMR, ^{13}C NMR and HPLC spectra of isolated compounds



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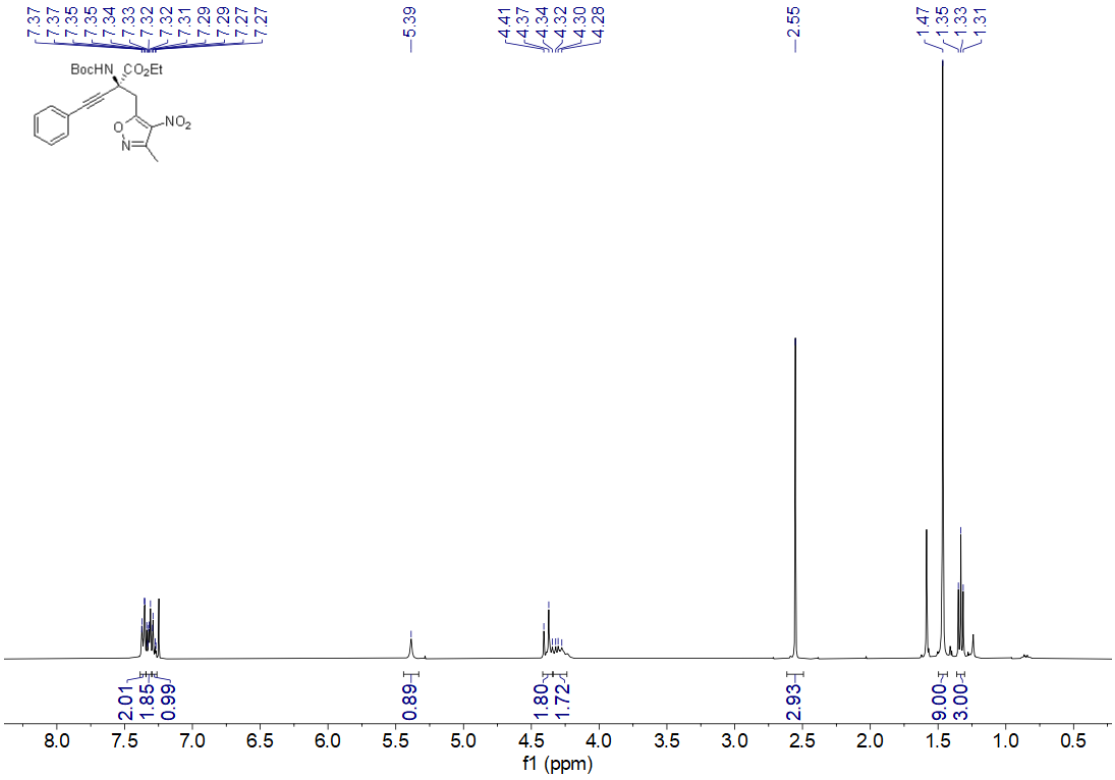

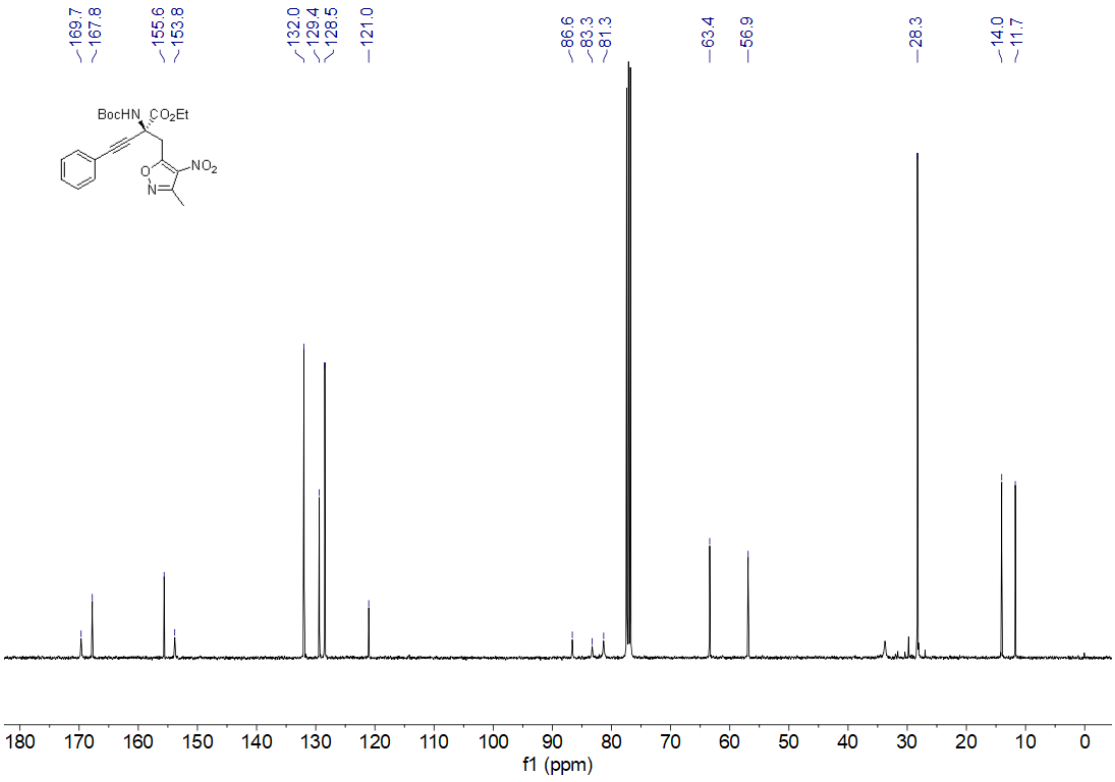

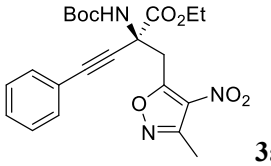

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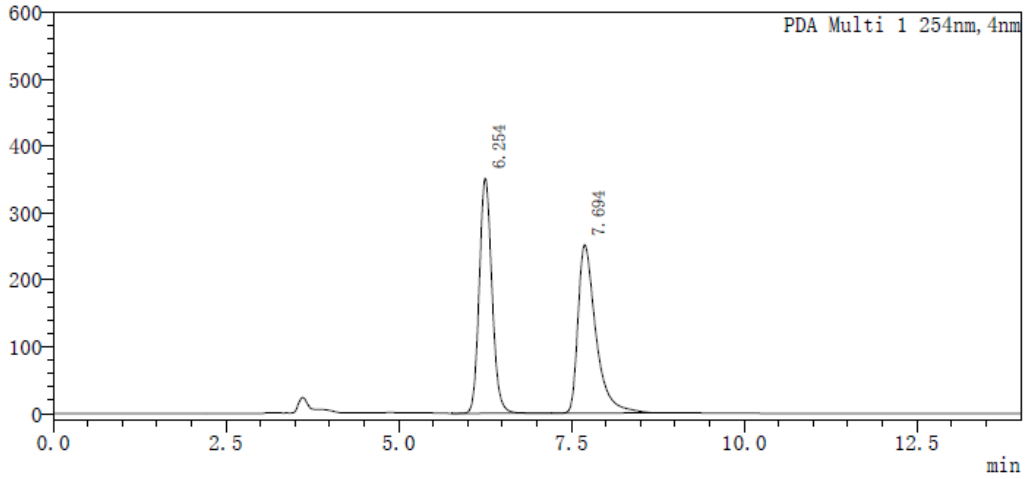

〈Peak table〉

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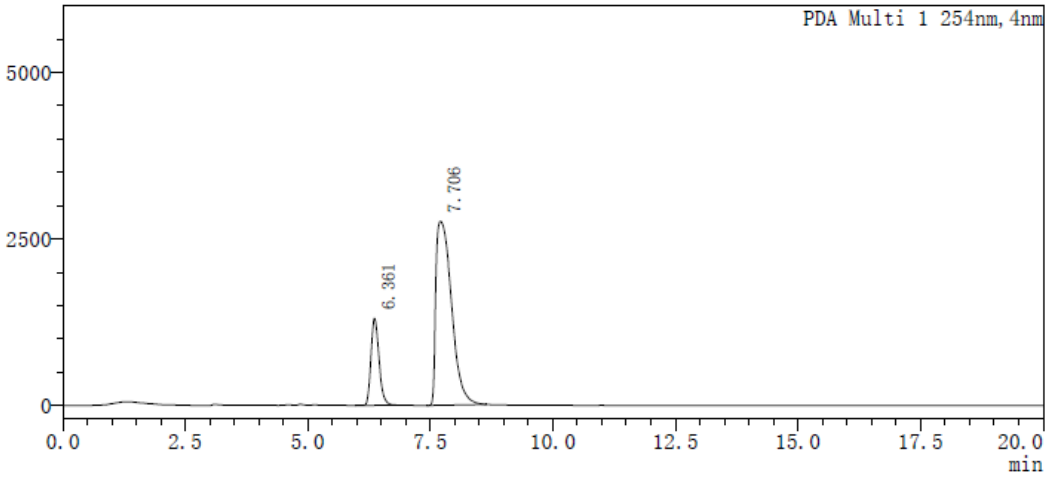

〈Peak table〉

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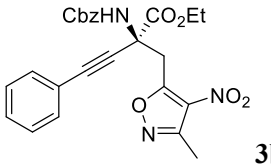
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N

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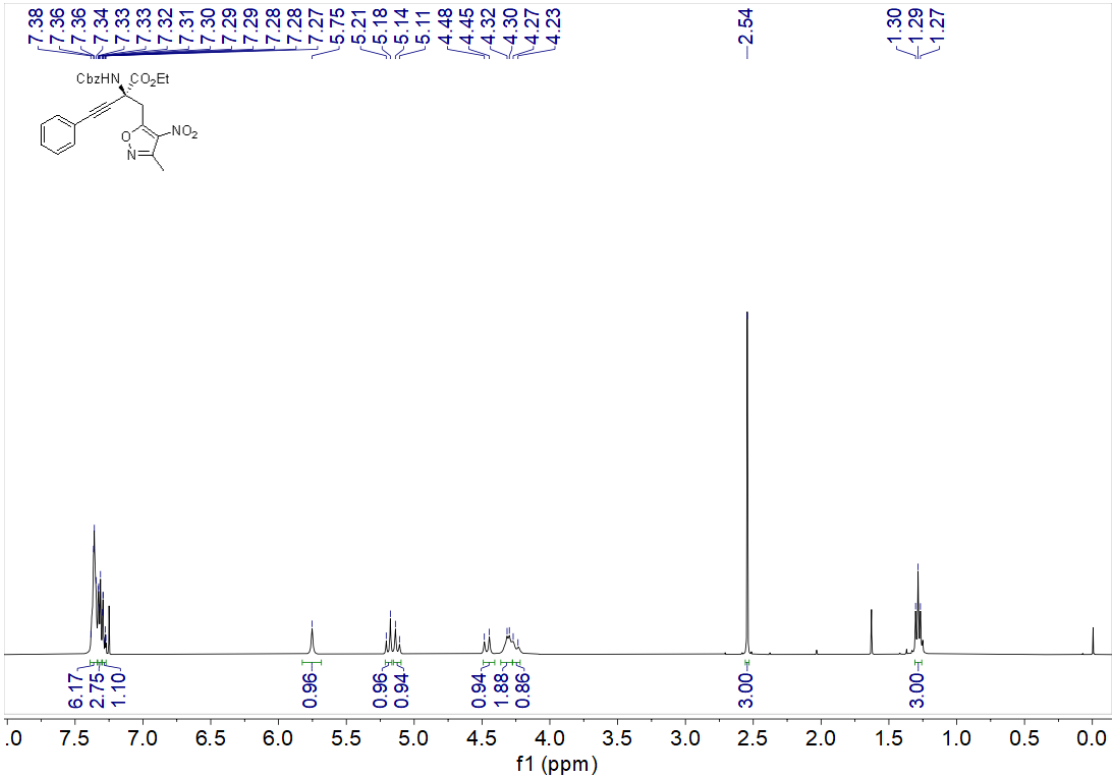
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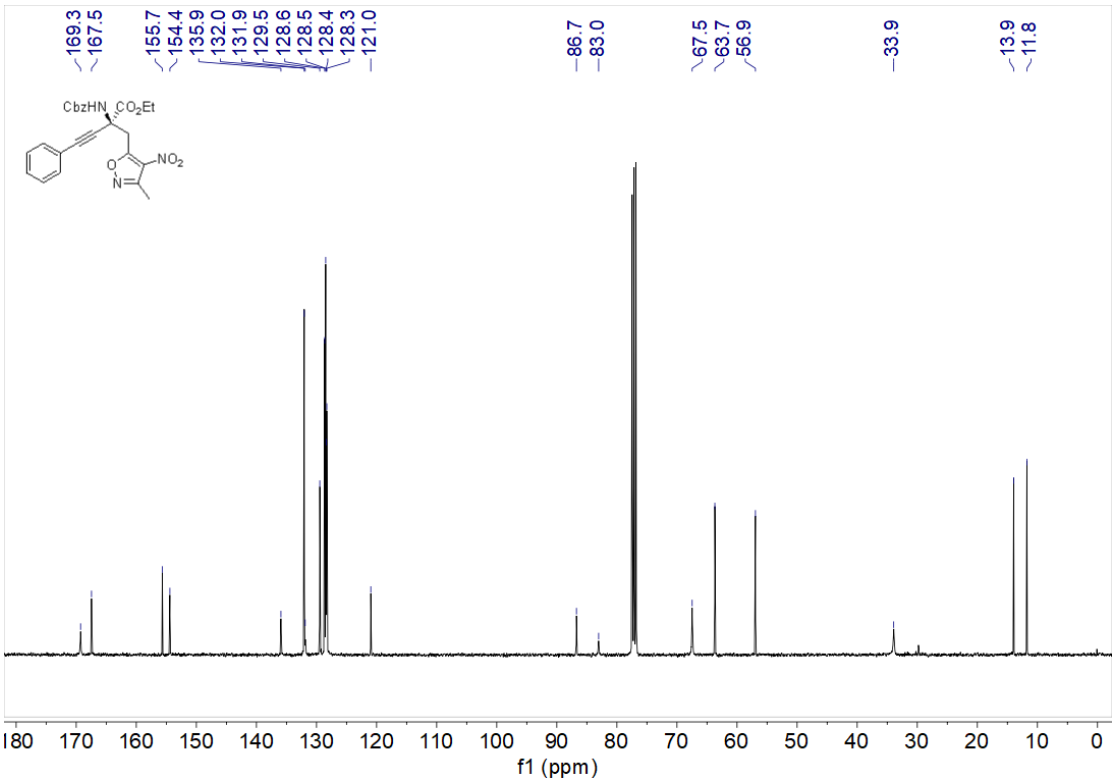
f1 (ppm)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128.5
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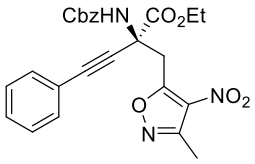
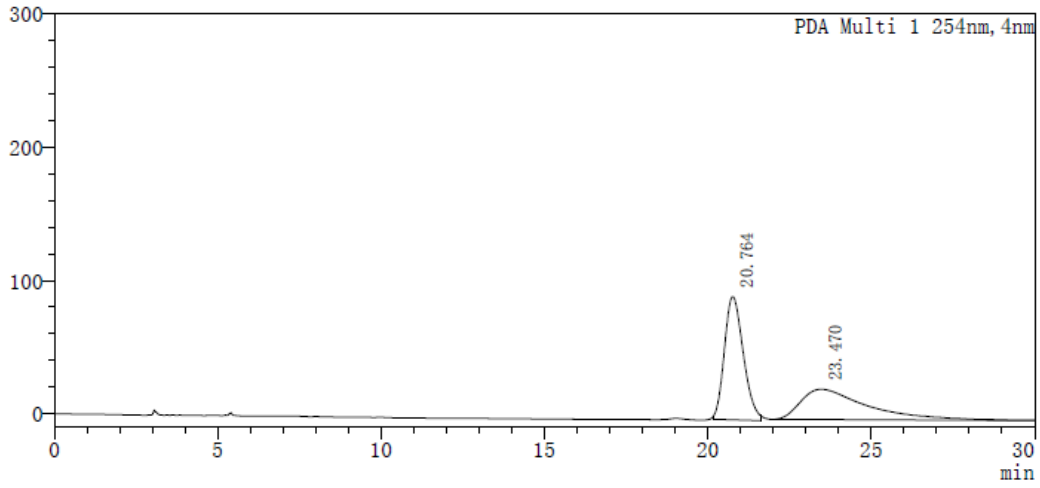
83.0
67.5
63.7
56.9
33.9
13.9
11.8
f1 (ppm)



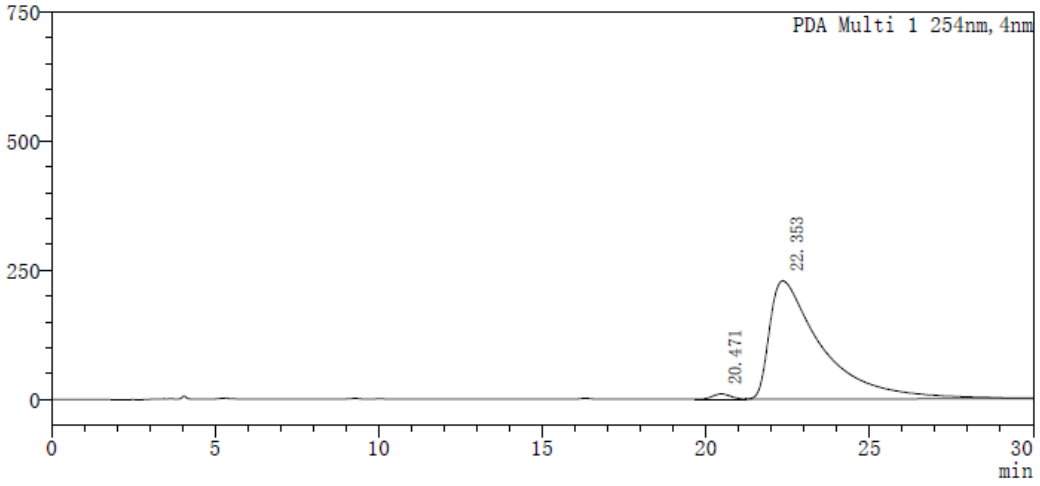
3ba



〈Peak table〉

PDA Ch1 254nm

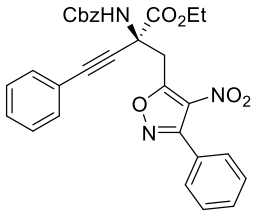
Peak#	Ret. Time	Height	Area	Area%
1	20.764	92538	3710297	53.266
2	23.470	22797	3255315	46.734
Total		115334	6965612	100.000



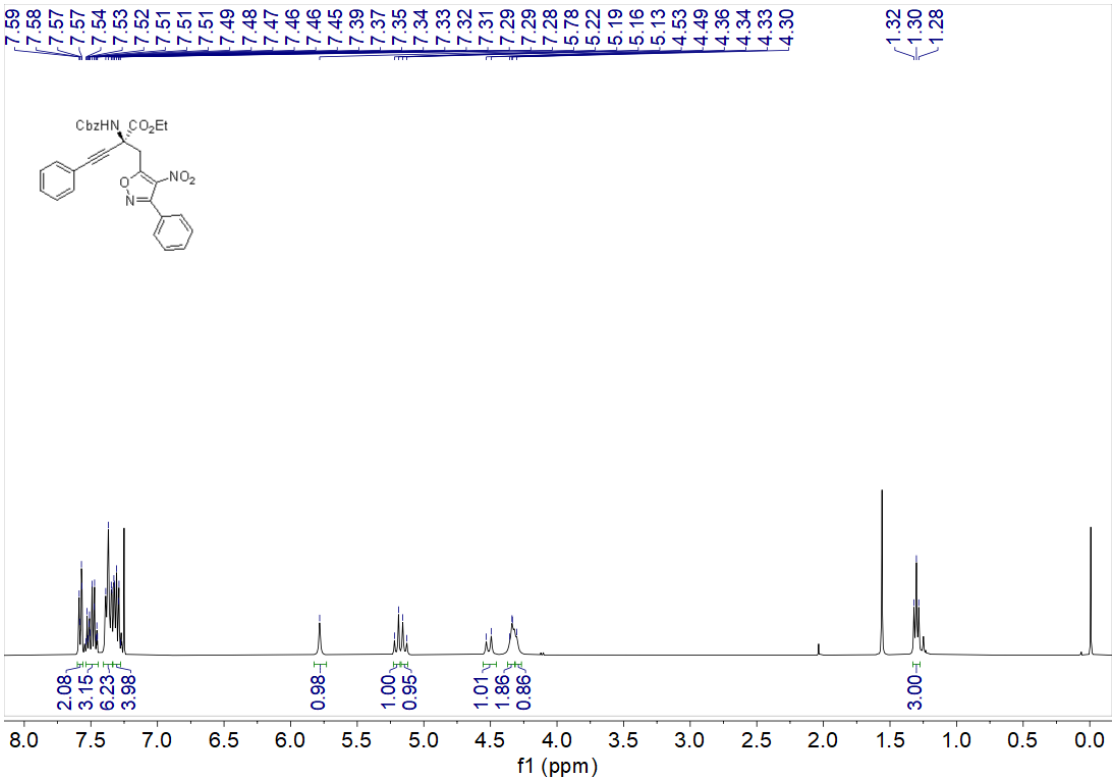
〈Peak table〉

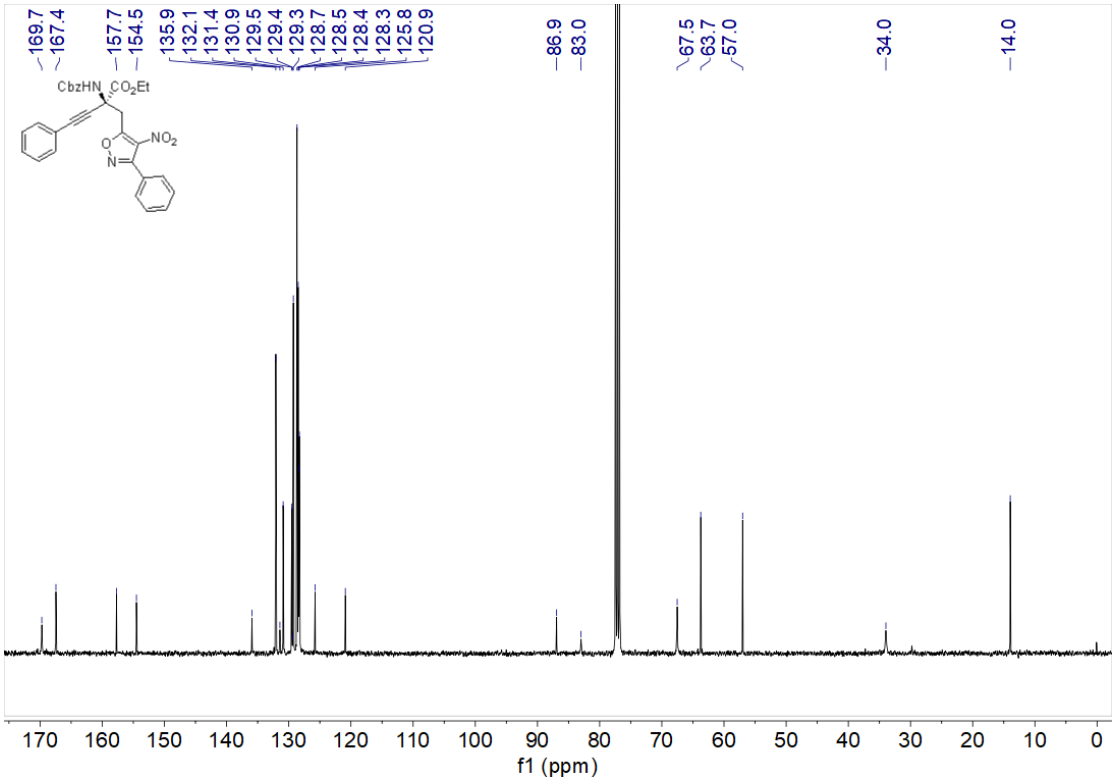
PDA Ch1 254nm

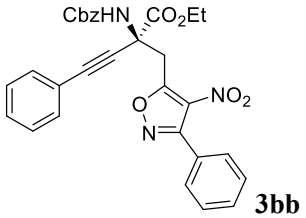
Peak#	Ret. Time	Height	Area	Area%
1	20.471	10038	384636	1.473
2	22.353	229062	25724569	98.527
Total		239099	26109205	100.000


CbzHN
CO2Et
NO2
O
N

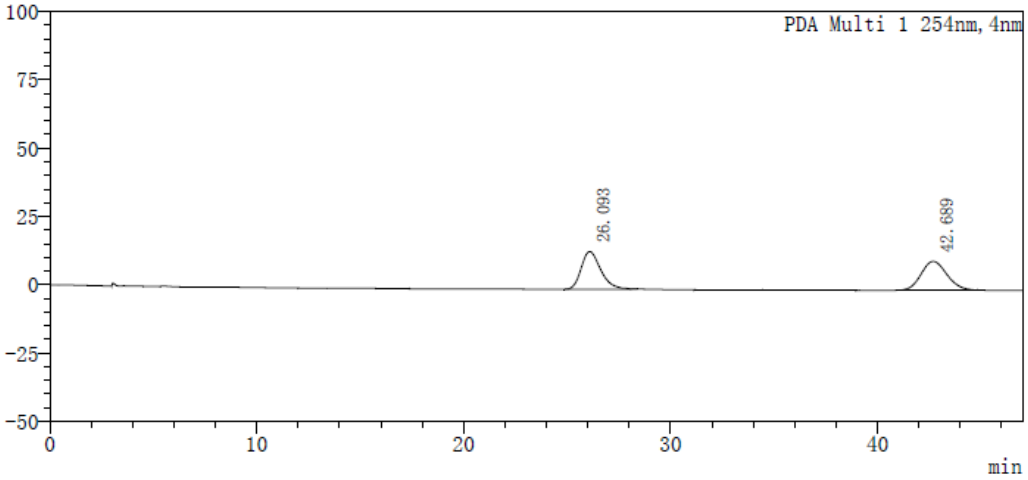
3bb


7.59 7.58 7.57 7.57 7.54 7.53 7.52 7.51 7.51 7.51 7.49 7.48 7.47 7.46 7.46 7.45 7.39 7.37 7.35 7.34 7.33 7.32 7.31 7.29 7.29 7.28 5.78 5.22 5.19 5.16 5.13 4.53 4.49 4.36 4.34 4.33 4.30
1.32 1.30 1.28
2.08 3.15 6.23 3.98 0.98 1.00 0.95 1.01 1.86 0.86 3.00
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


169.7 167.4 157.7 154.5 135.9 132.1 131.4 130.9 129.5 129.4 129.3 128.7 128.5 128.4 128.3 125.8 120.9
86.9 83.0 67.5 63.7 57.0 34.0 14.0
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)



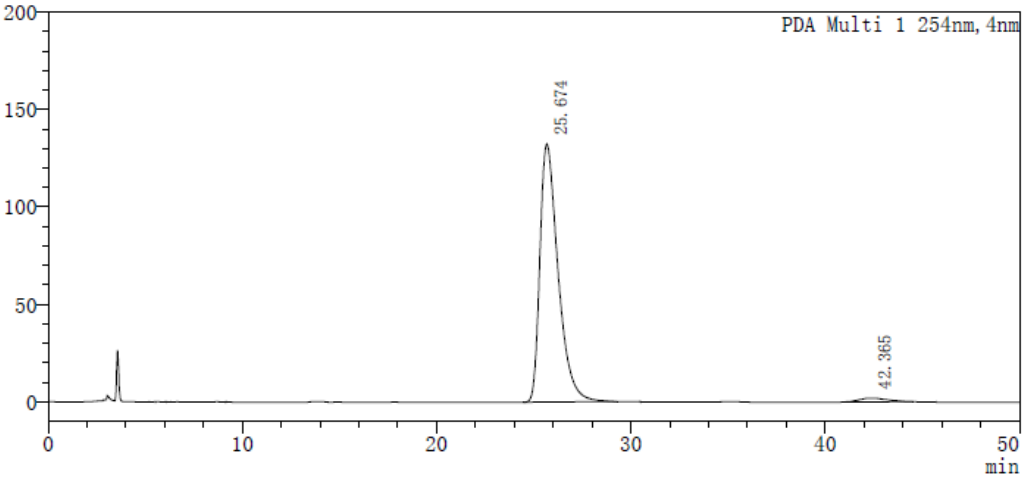
3bb



〈Peak table〉

PDA Ch1 254nm

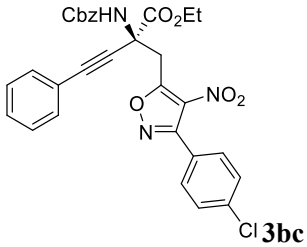
Peak#	Ret. Time	Height	Area	Area%
1	26.093	13805	904714	49.830
2	42.689	10565	910904	50.170
Total		24370	1815617	100.000



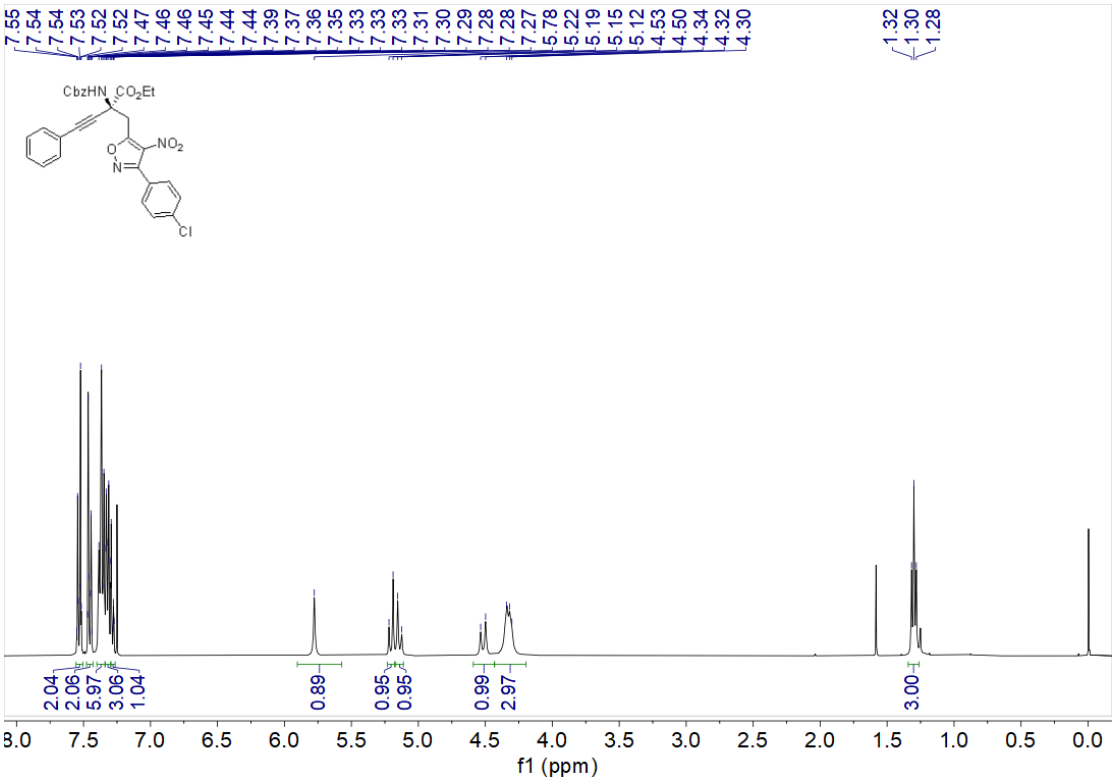
〈Peak table〉

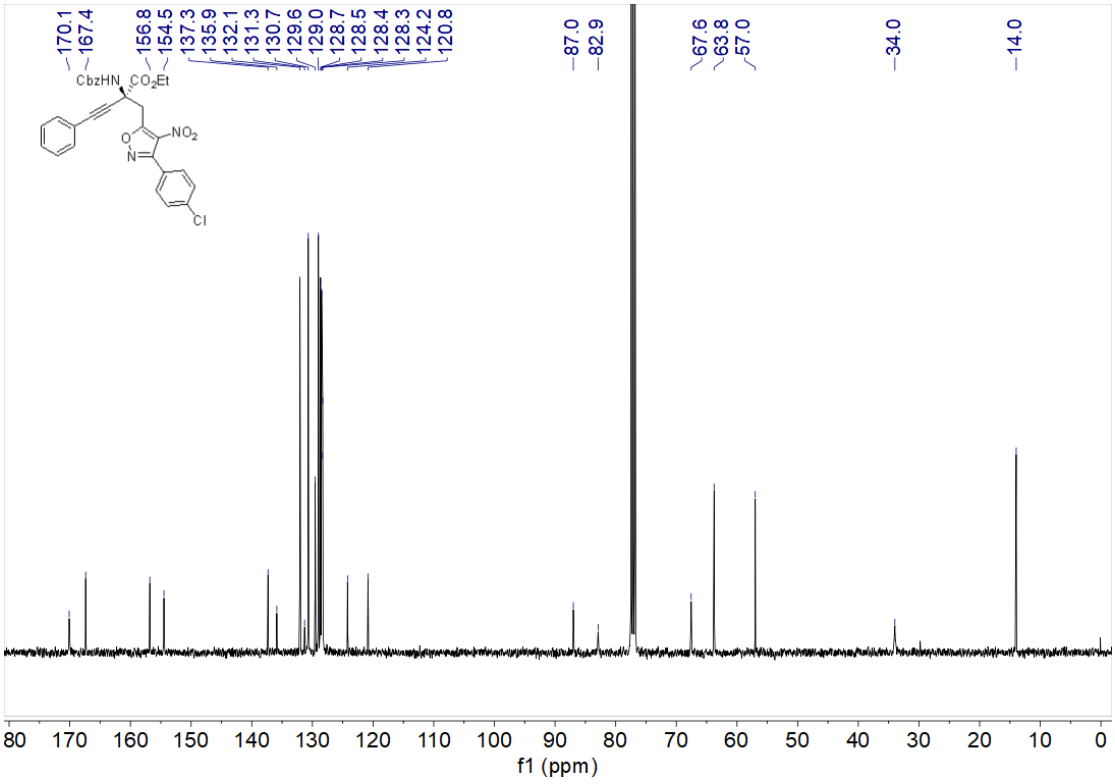
PDA Ch1 254nm

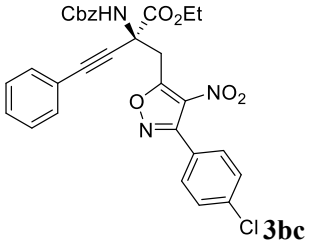
Peak#	Ret. Time	Height	Area	Area%
1	25.674	132408	8615887	97.869
2	42.365	1884	187618	2.131
Total		134292	8803505	100.000


CbzHN
CO2Et
NO2
O
N
Cl

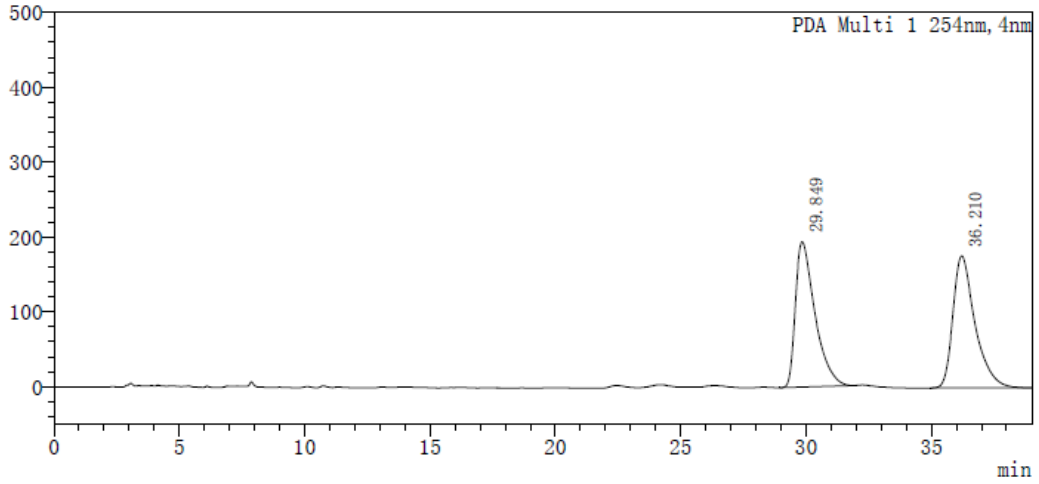
3bc


7.55 7.54 7.54 7.53 7.52 7.52 7.47 7.46 7.46 7.45 7.44 7.44 7.39 7.37 7.36 7.35 7.33 7.33 7.31 7.30 7.29 7.28 7.28 7.27 5.78 5.22 5.19 5.15 5.12 4.53 4.50 4.34 4.32 4.30
1.32 1.30 1.28
2.04 2.06 5.97 3.06 1.04 0.89 0.95 0.95 0.99 2.97 3.00
f1 (ppm)


170.1 167.4 156.8 154.5 137.3 135.9 132.1 131.3 130.7 129.6 129.0 128.7 128.5 128.4 128.3 124.2 120.8
87.0 82.9
67.6 63.8 57.0
34.0
14.0
f1 (ppm)



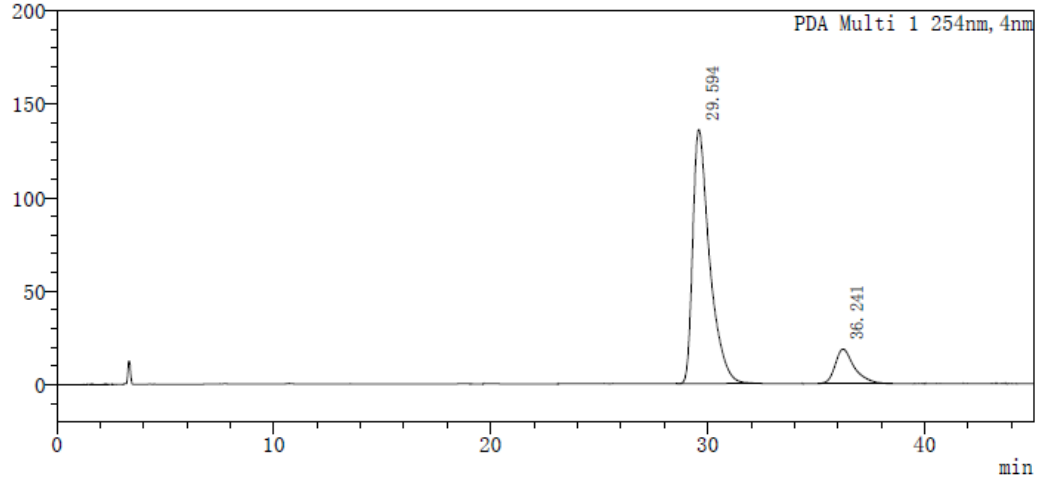
3bc



〈Peak table〉

PDA Ch1 254nm

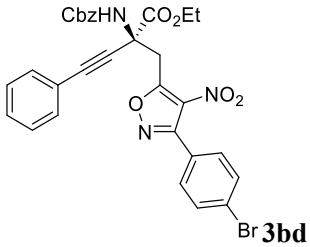
Peak#	Ret. Time	Height	Area	Area%
1	29.849	193817	10498686	49.364
2	36.210	176107	10769201	50.636
Total		369924	21267887	100.000



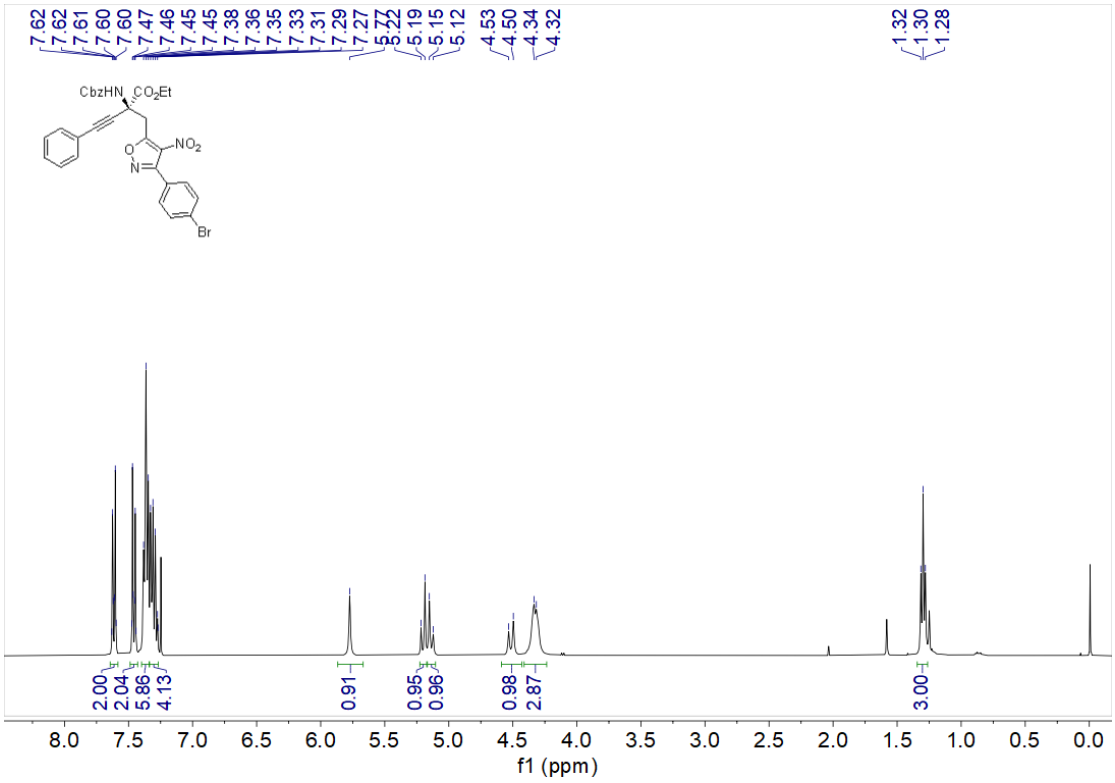
〈Peak table〉

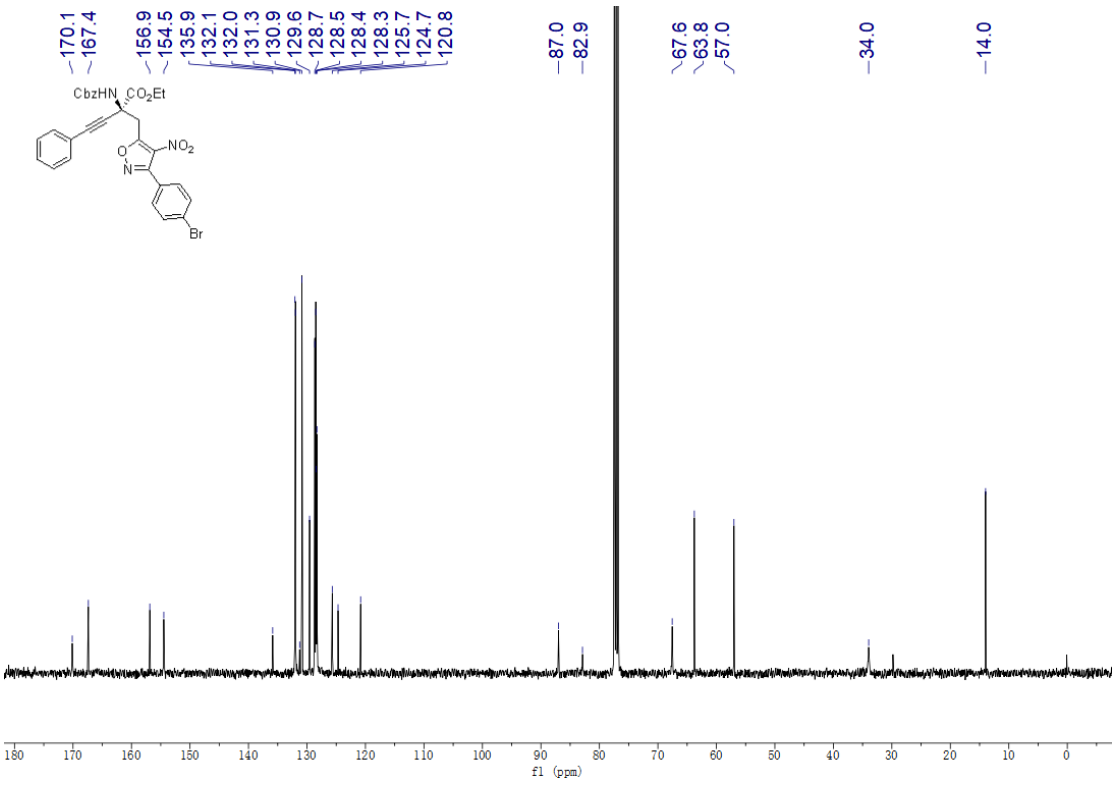
PDA Ch1 254nm

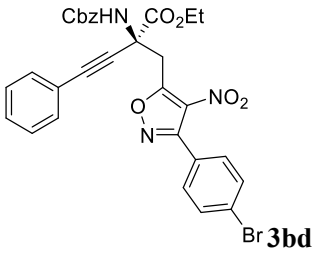
Peak#	Ret. Time	Height	Area	Area%
1	29.594	136111	7352629	86.747
2	36.241	18443	1123352	13.253
Total		154555	8475981	100.000


CbzHN
CO2Et
NO2
O
N
Br

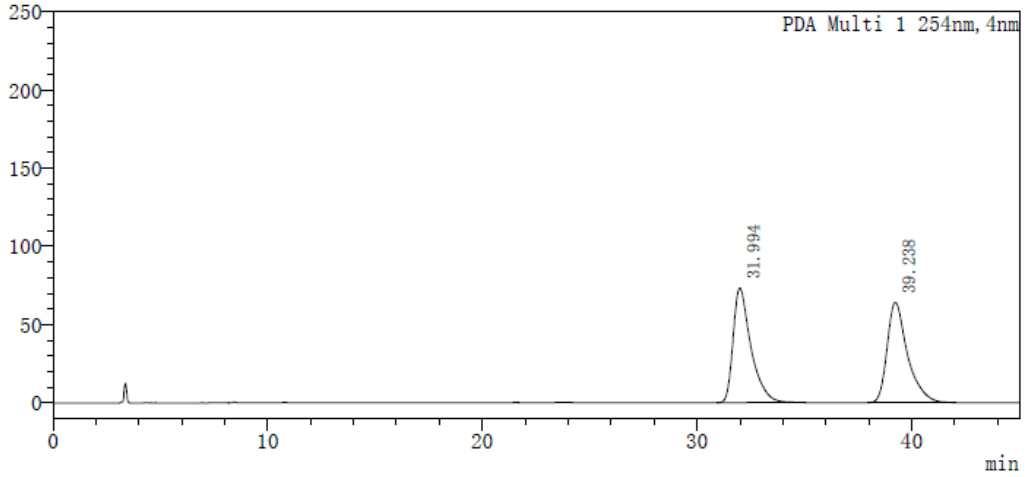
3bd


7.62
7.62
7.61
7.60
7.60
7.47
7.46
7.45
7.45
7.38
7.36
7.35
7.33
7.31
7.29
7.27
5.22
5.19
5.15
5.12
4.53
4.50
4.34
4.32
1.32
1.30
1.28
2.00
2.04
5.86
4.13
0.91
0.95
0.96
0.98
2.87
3.00
f1 (ppm)


170.1
167.4
156.9
154.5
135.9
132.1
132.0
131.3
130.9
129.6
128.7
128.5
128.4
128.3
125.7
124.7
120.8
87.0
82.9
67.6
63.8
57.0
34.0
14.0
f1 (ppm)



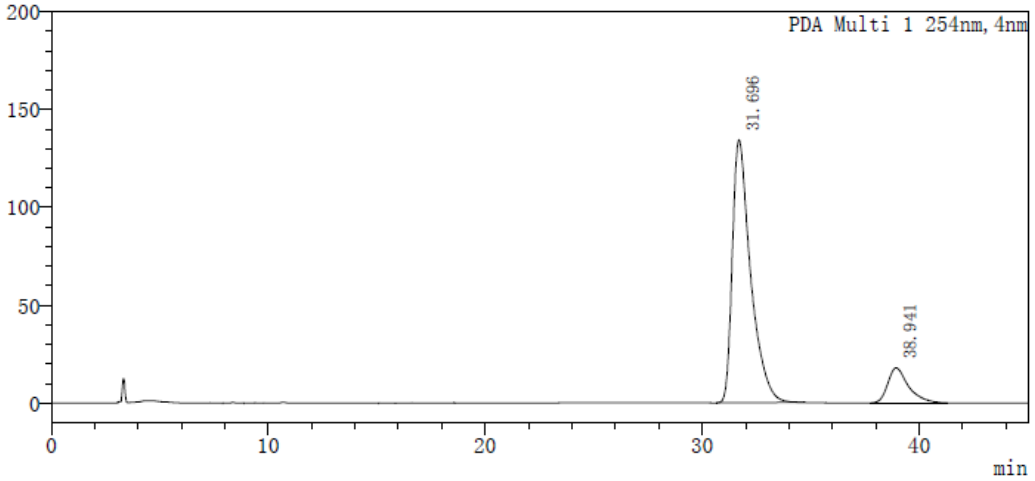
3bd



<Peak table>

PDA Ch1 254nm

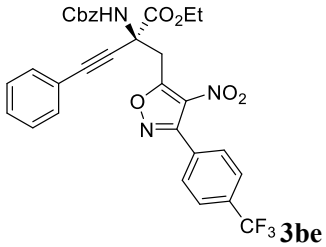
Peak#	Ret. Time	Height	Area	Area%
1	31.994	73159	4212877	49.897
2	39.238	64145	4230330	50.103
Total		137303	8443207	100.000



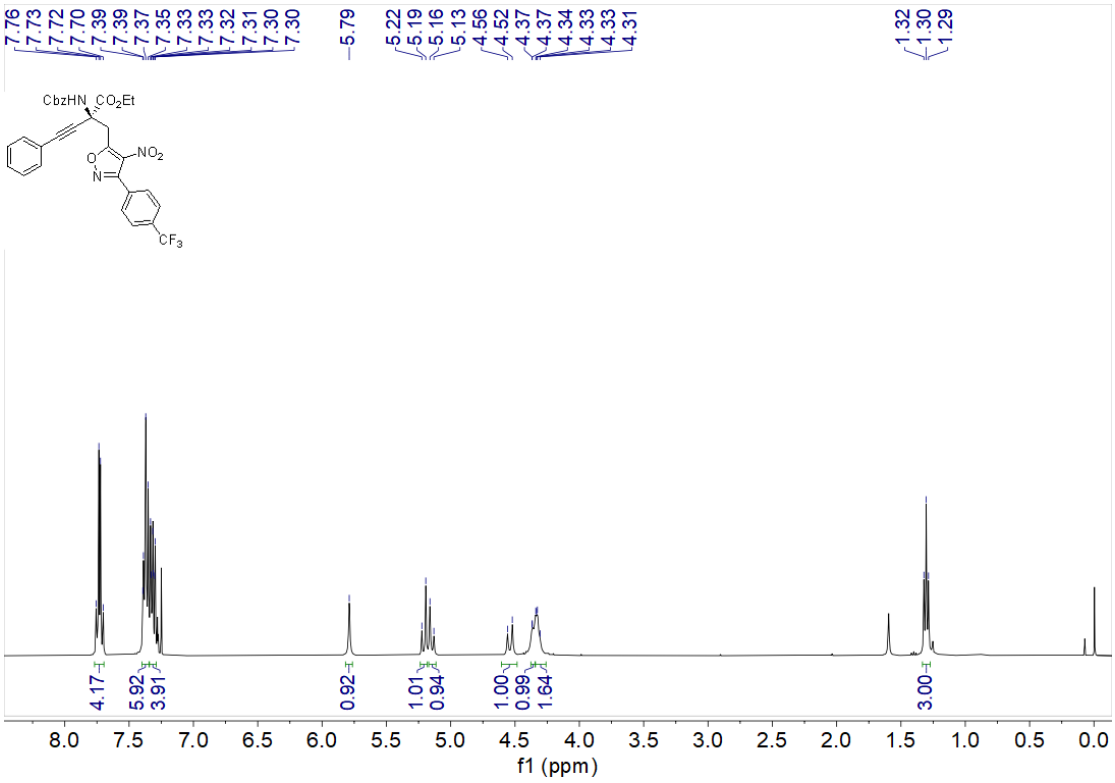
<Peak table>

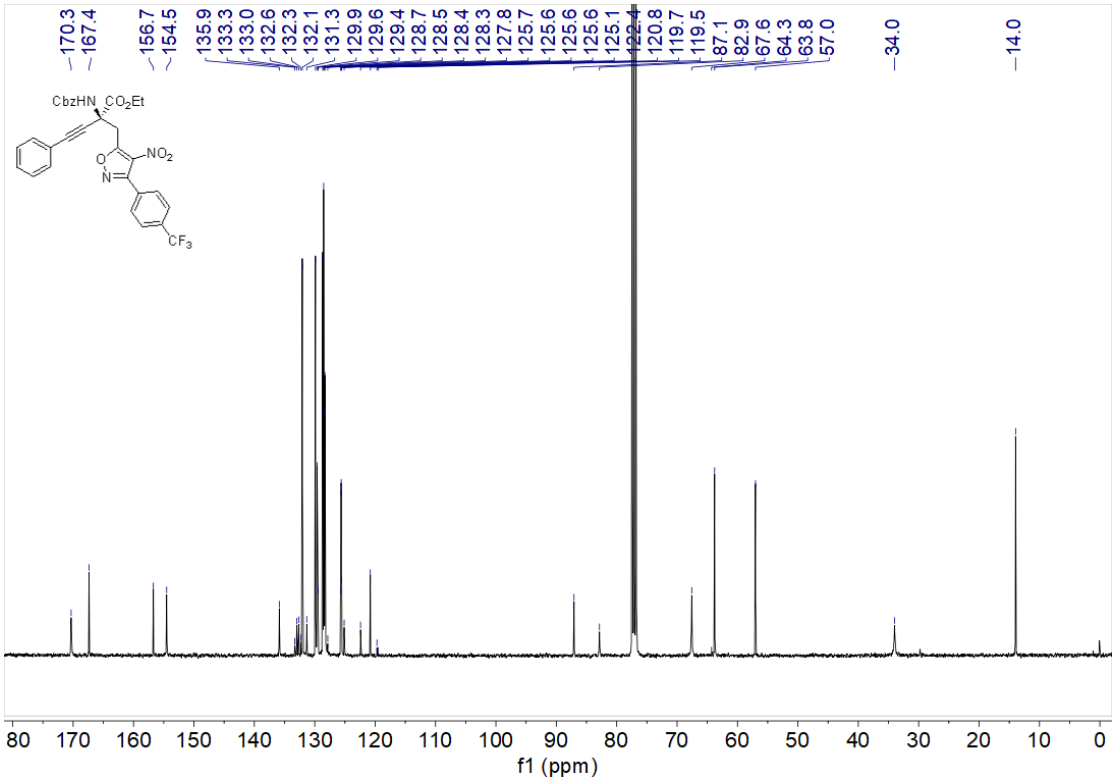
PDA Ch1 254nm

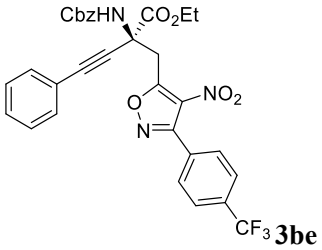
Peak#	Ret. Time	Height	Area	Area%
1	31.696	134263	7863810	87.000
2	38.941	17866	1175093	13.000
Total		152129	9038904	100.000


CbzHN
CO2Et
NO2
O
N
CF3

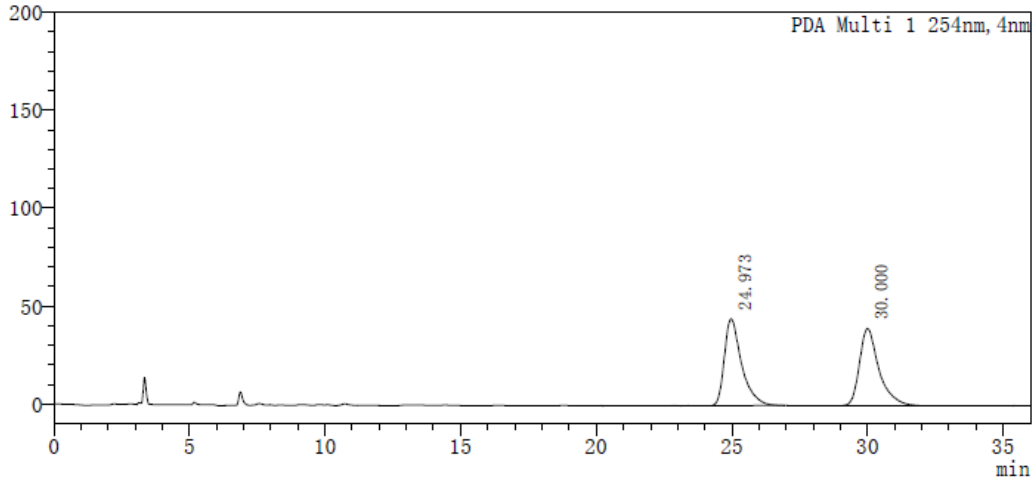
3be


7.76
7.73
7.72
7.70
7.39
7.39
7.37
7.35
7.33
7.33
7.32
7.31
7.30
7.30
5.79
5.22
5.19
5.16
5.13
4.56
4.52
4.37
4.37
4.34
4.33
4.33
4.31
1.32
1.30
1.29
4.17
5.92
3.91
0.92
1.01
0.94
1.00
0.99
1.64
3.00
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


170.3
167.4
156.7
154.5
135.9
133.3
133.0
132.6
132.3
132.1
131.3
129.9
129.6
129.4
128.7
128.5
128.4
128.3
127.8
125.7
125.6
125.6
125.6
125.1
120.8
119.7
119.5
87.1
82.9
67.6
64.3
63.8
57.0
34.0
14.0
80
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)



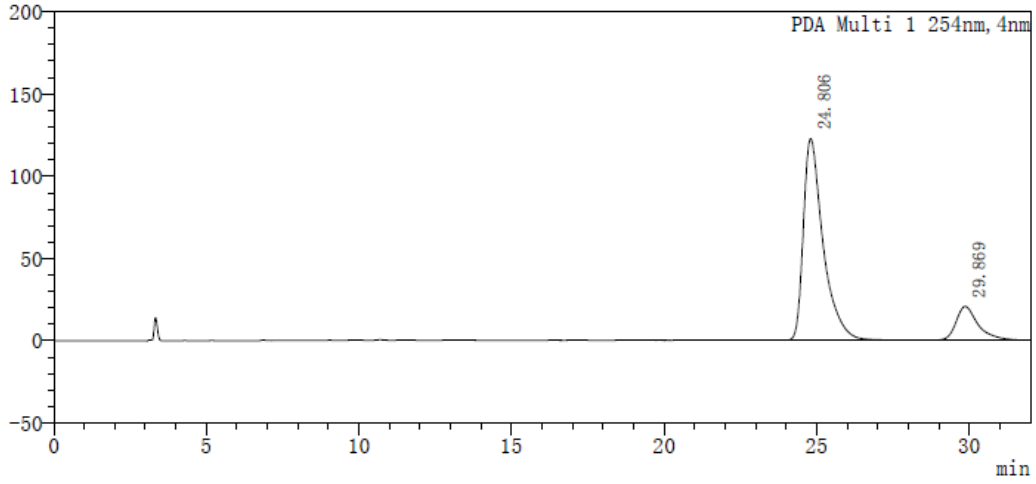
3be



〈Peak table〉

PDA Ch1 254nm

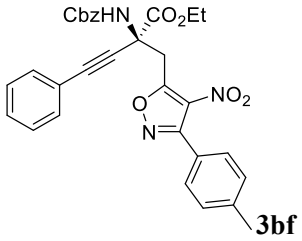
Peak#	Ret. Time	Height	Area	Area%
1	24.973	44337	1959135	50.029
2	30.000	39314	1956882	49.971
Total		83652	3916017	100.000



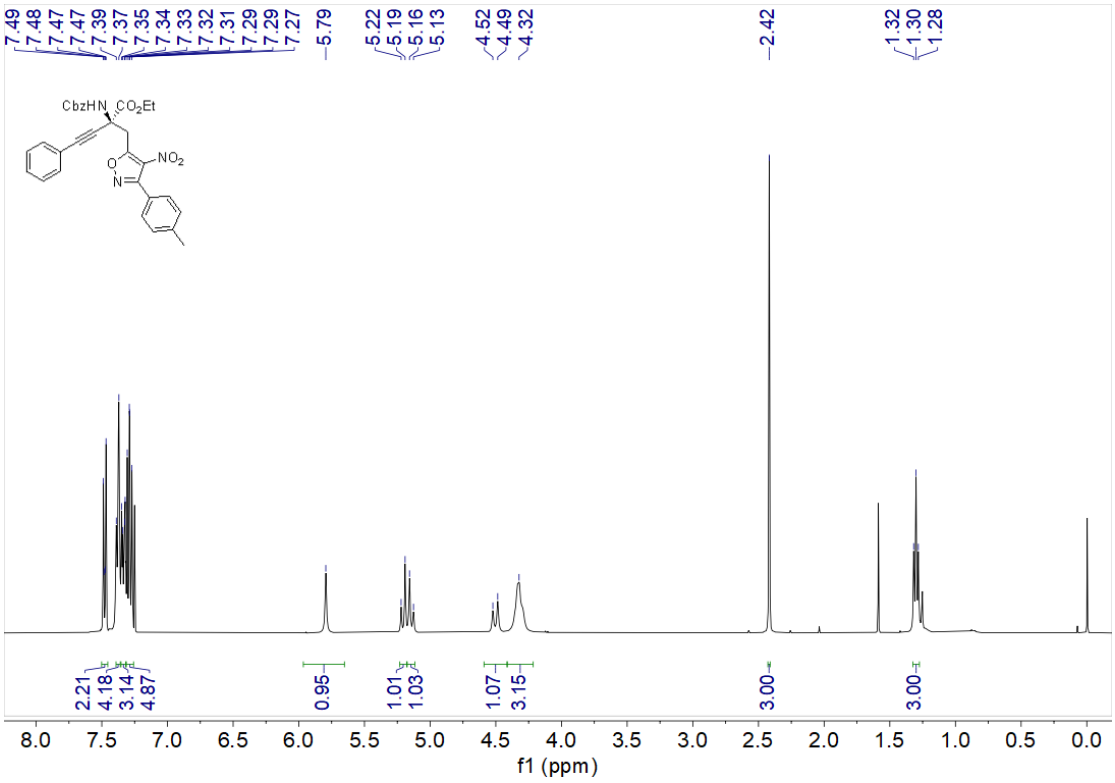
〈Peak table〉

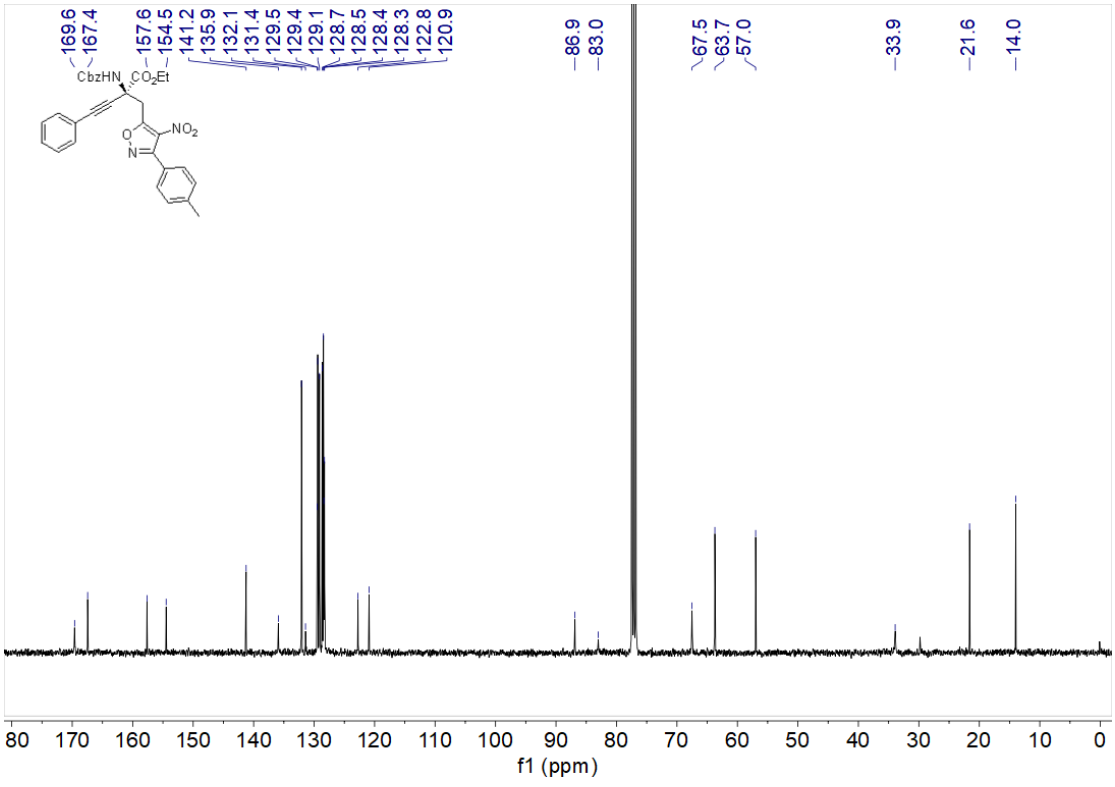
PDA Ch1 254nm

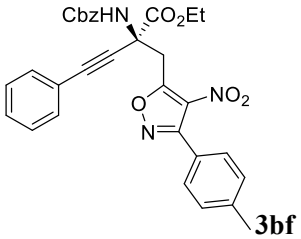
Peak#	Ret. Time	Height	Area	Area%
1	24.806	122443	5501662	84.521
2	29.869	20351	1007574	15.479
Total		142795	6509235	100.000


CbzHN
CO2Et
NO2
O
N

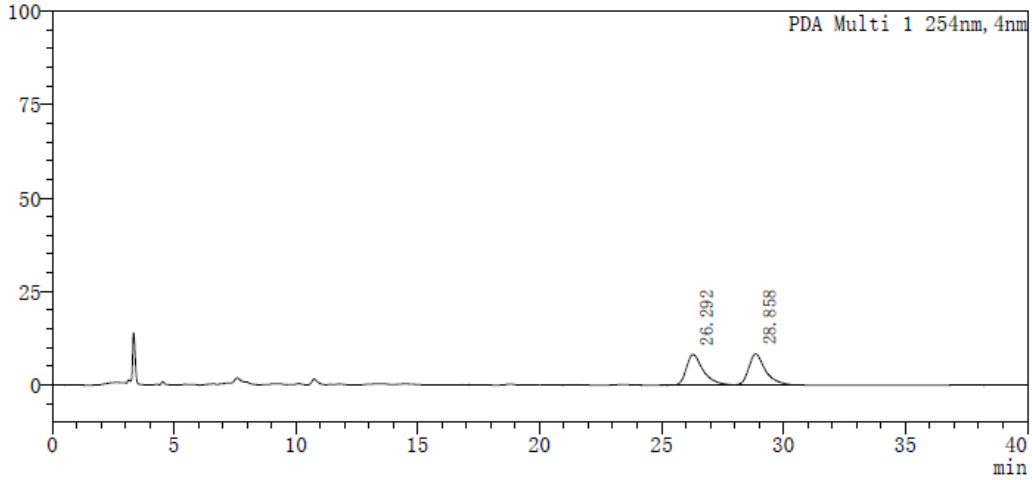
3bf


7.49
7.48
7.47
7.47
7.39
7.37
7.35
7.34
7.33
7.32
7.31
7.29
7.29
7.27
5.79
5.22
5.19
5.16
5.13
4.52
4.49
4.32
2.42
1.32
1.30
1.28
2.21
4.18
3.14
4.87
0.95
1.01
1.03
1.07
3.15
3.00
3.00
f1 (ppm)


169.6
167.4
157.6
154.5
141.2
135.9
132.1
131.4
129.5
129.4
129.1
128.7
128.5
128.4
128.3
122.8
120.9
86.9
83.0
67.5
63.7
57.0
33.9
21.6
14.0
f1 (ppm)



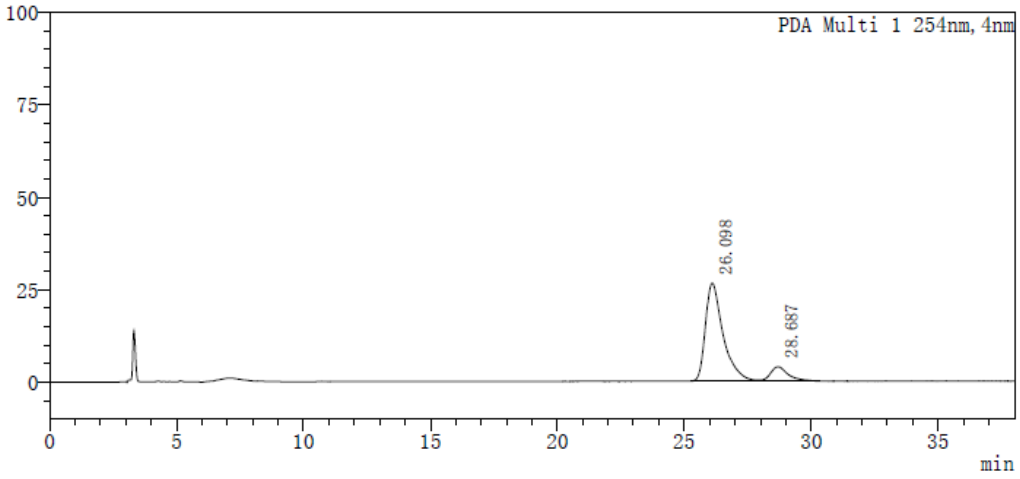
3bf



〈Peak table〉

PDA Ch1 254nm

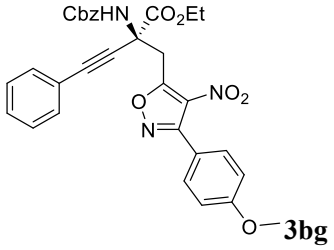
Peak#	Ret. Time	Height	Area	Area%
1	26.292	8158	385988	49.822
2	28.858	8245	388740	50.178
Total		16403	774728	100.000

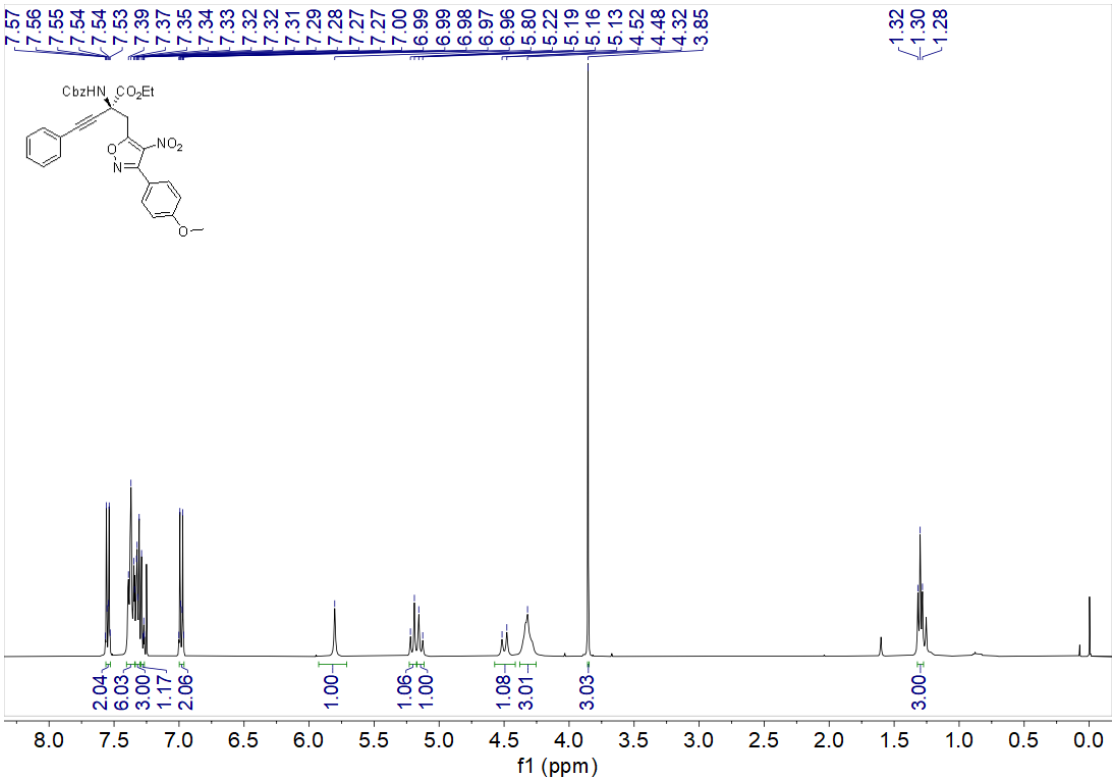


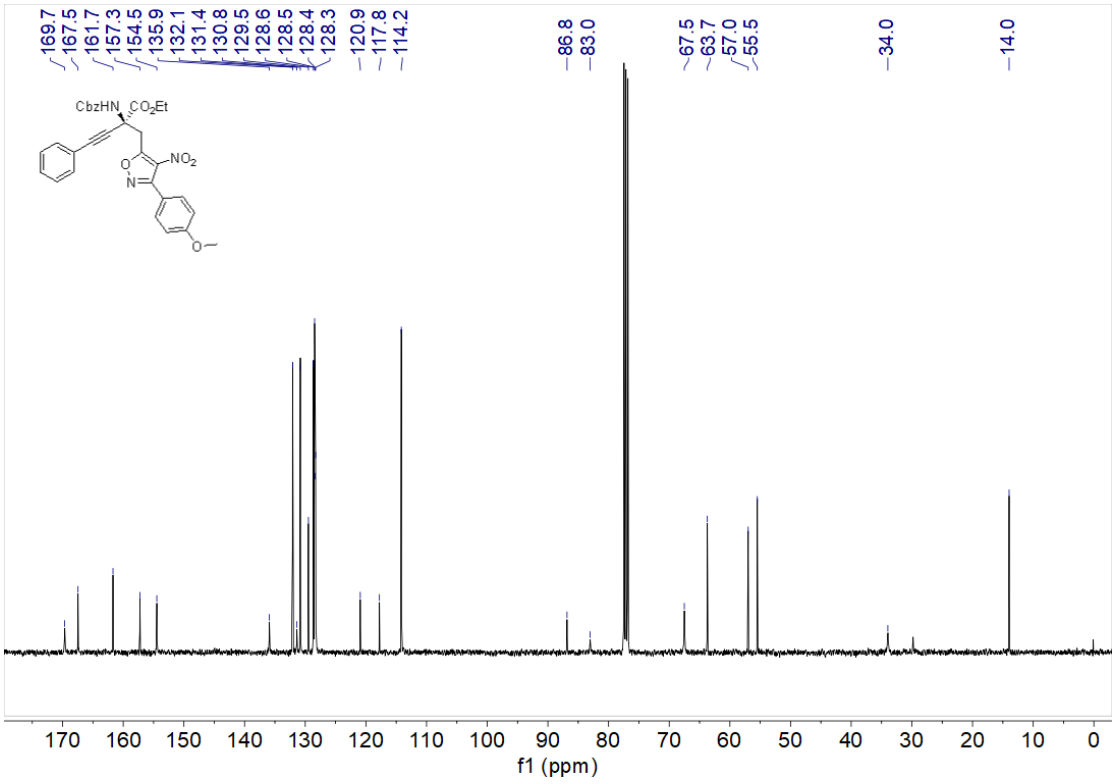
〈Peak table〉

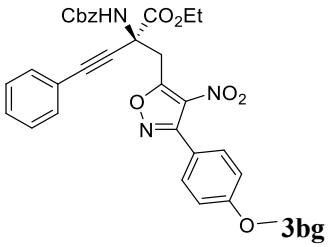
PDA Ch1 254nm

Peak#	Ret. Time	Height	Area	Area%
1	26.098	26499	1281726	87.326
2	28.687	3867	186022	12.674
Total		30365	1467748	100.000

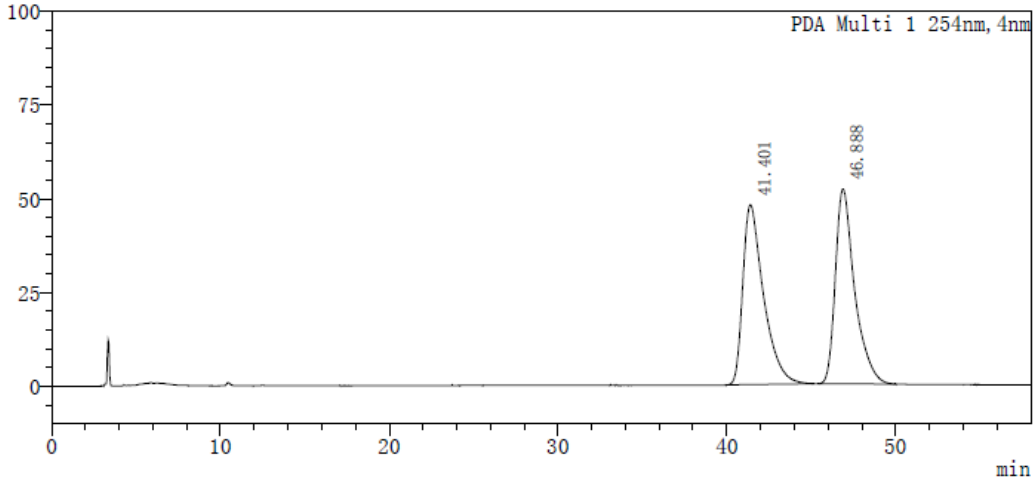

CbzHN
CO2Et
NO2
O
N
O
3bg


7.57 7.56 7.55 7.54 7.54 7.53 7.39 7.37 7.35 7.34 7.33 7.32 7.31 7.29 7.28 7.27 7.27 7.00 6.99 6.99 6.98 6.97 6.96 5.80 5.22 5.19 5.16 5.13 4.52 4.48 4.32 3.85
1.32 1.30 1.28
2.04 6.03 3.00 1.17 2.06 1.00 1.06 1.00 1.08 3.01 3.03 3.00
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


169.7 167.5 161.7 157.3 154.5 135.9 132.1 131.4 130.8 129.5 128.6 128.5 128.4 128.3 120.9 117.8 114.2
86.8 83.0
67.5 63.7 57.0 55.5
34.0
14.0
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)



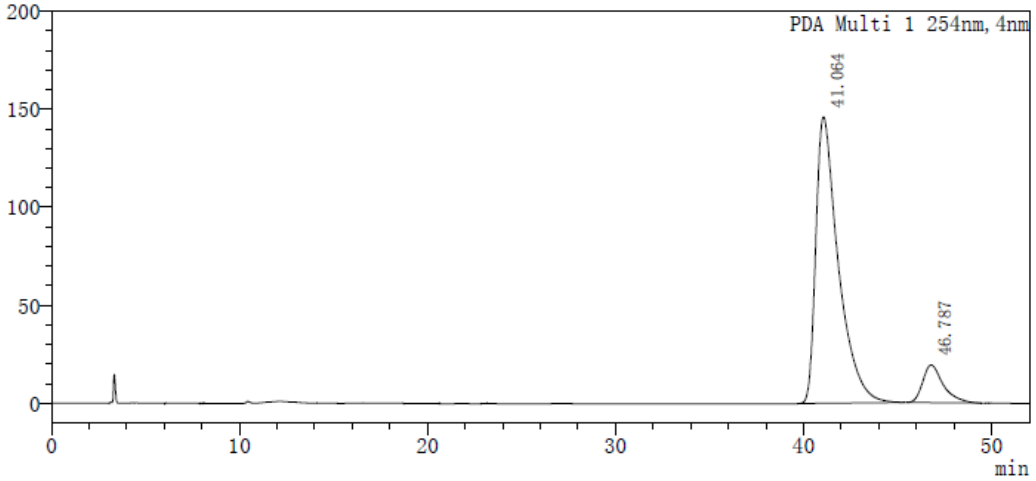
3bg



〈Peak table〉

PDA Ch1 254nm

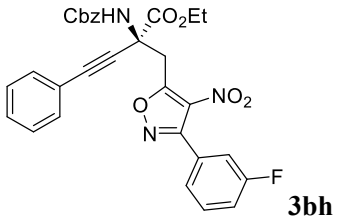
Peak#	Ret. Time	Height	Area	Area%
1	41.401	47961	4094552	49.744
2	46.888	51983	4136767	50.256
Total		99944	8231319	100.000



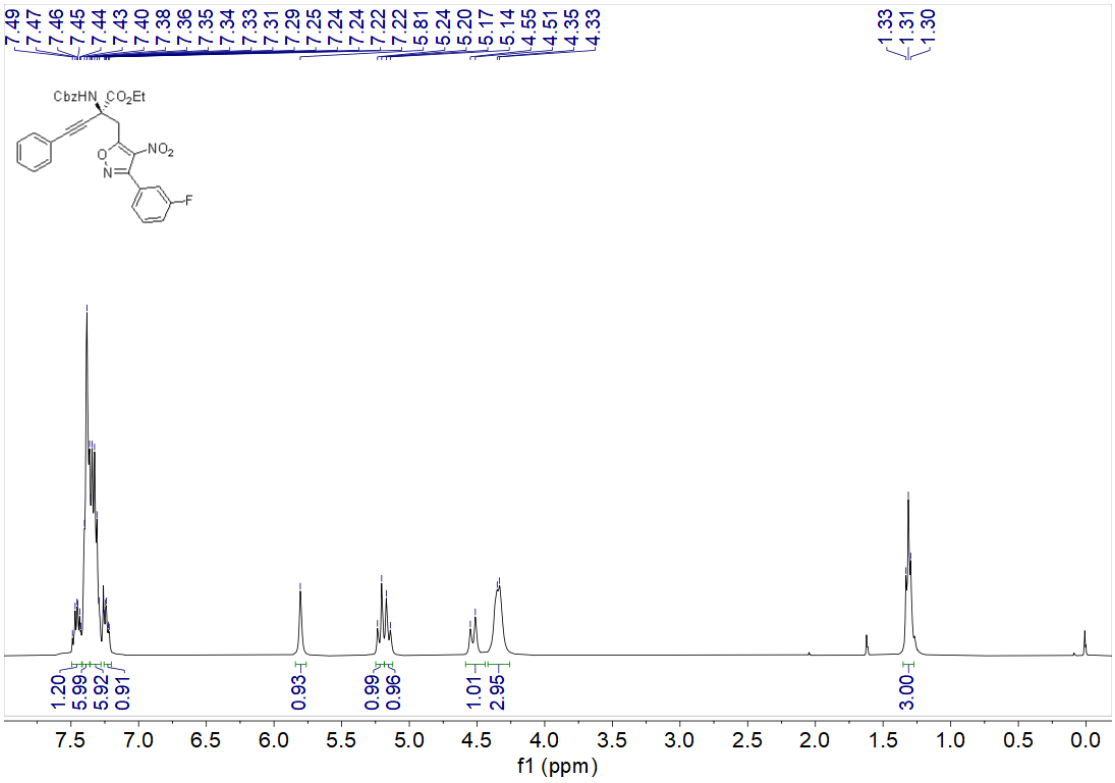
〈Peak table〉

PDA Ch1 254nm

Peak#	Ret. Time	Height	Area	Area%
1	41.064	146194	12179693	89.292
2	46.787	19261	1460576	10.708
Total		165455	13640270	100.000


CbzHN
CO2Et
NO2
O
N
F

3bh


7.49
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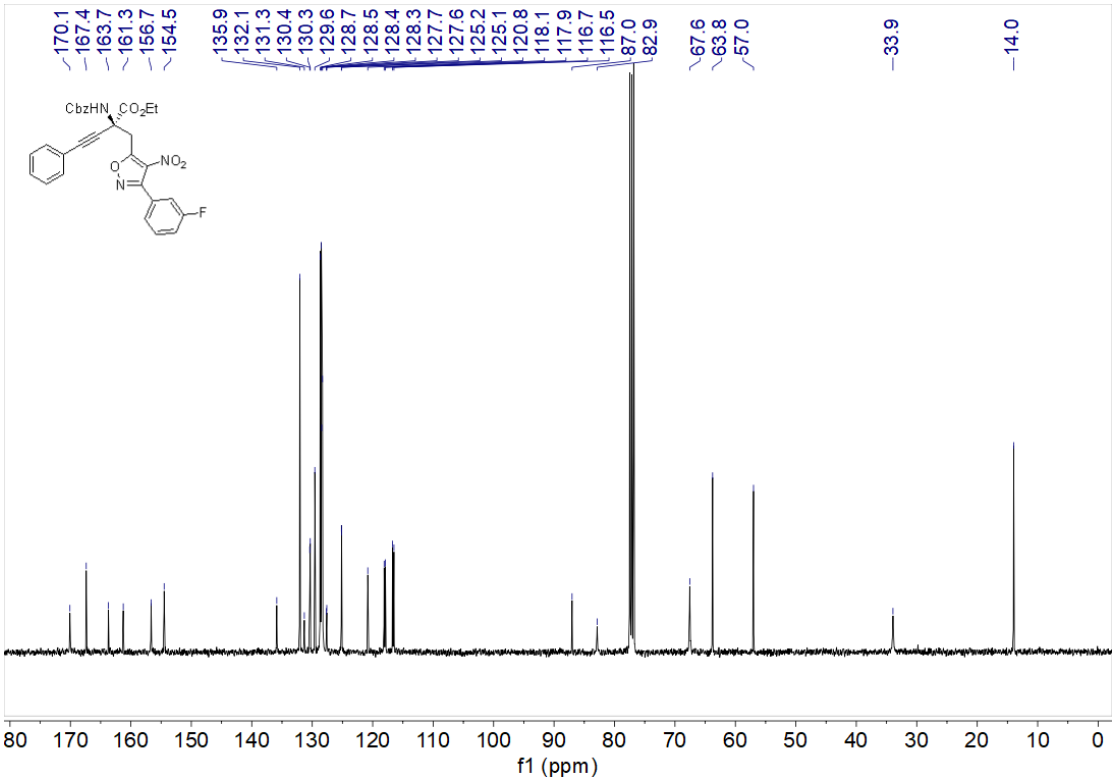
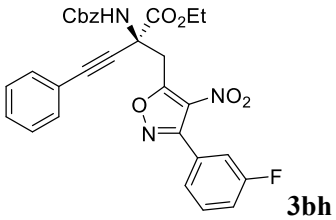
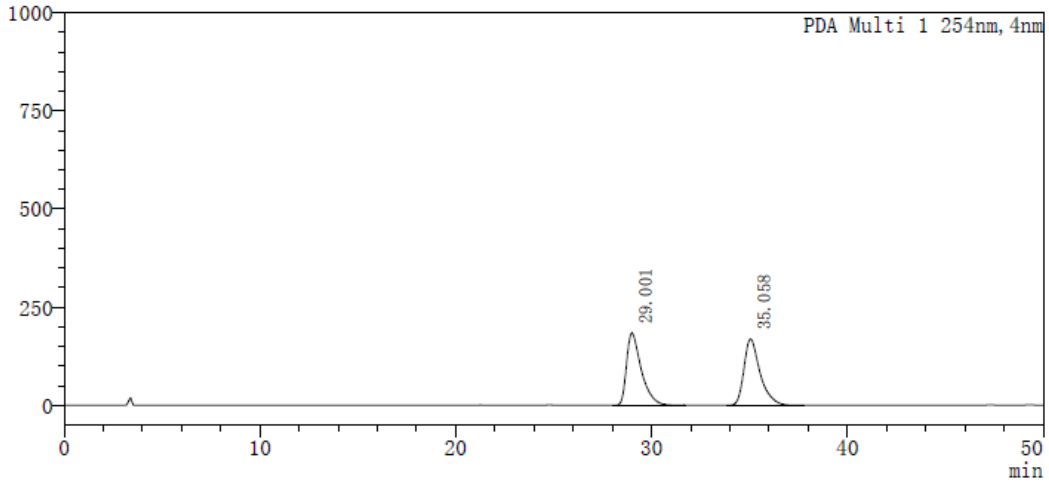
7.46
7.45
7.44
7.43
7.40
7.38
7.36
7.35
7.34
7.33
7.31
7.29
7.25
7.24
7.24
7.22
7.22
5.81
5.24
5.20
5.17
5.14
4.55
4.51
4.35
4.33
1.33
1.31
1.30
1.20
5.99
5.92
0.91
0.93
0.99
0.96
1.01
2.95
3.00
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


170.1
167.4
163.7
161.3
156.7
154.5
135.9
132.1
131.3
130.4
130.3
129.6
128.7
128.5
128.4
128.3
127.7
127.6
125.2
125.1
120.8
118.1
117.9
116.7
116.5
87.0
82.9
67.6
63.8
57.0
33.9
14.0
80
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)



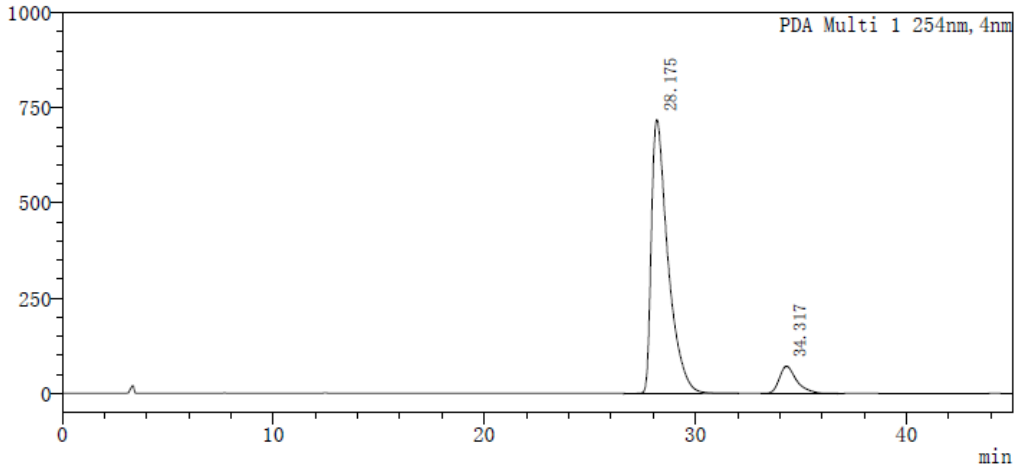
3bh



〈Peak table〉

PDA Ch1 254nm

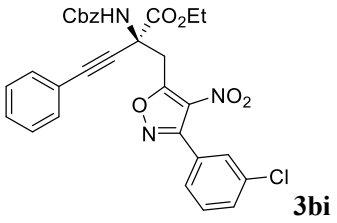
Peak#	Ret. Time	Height	Area	Area%
1	29.001	183837	9634658	49.927
2	35.058	168512	9662693	50.073
Total		352349	19297351	100.000



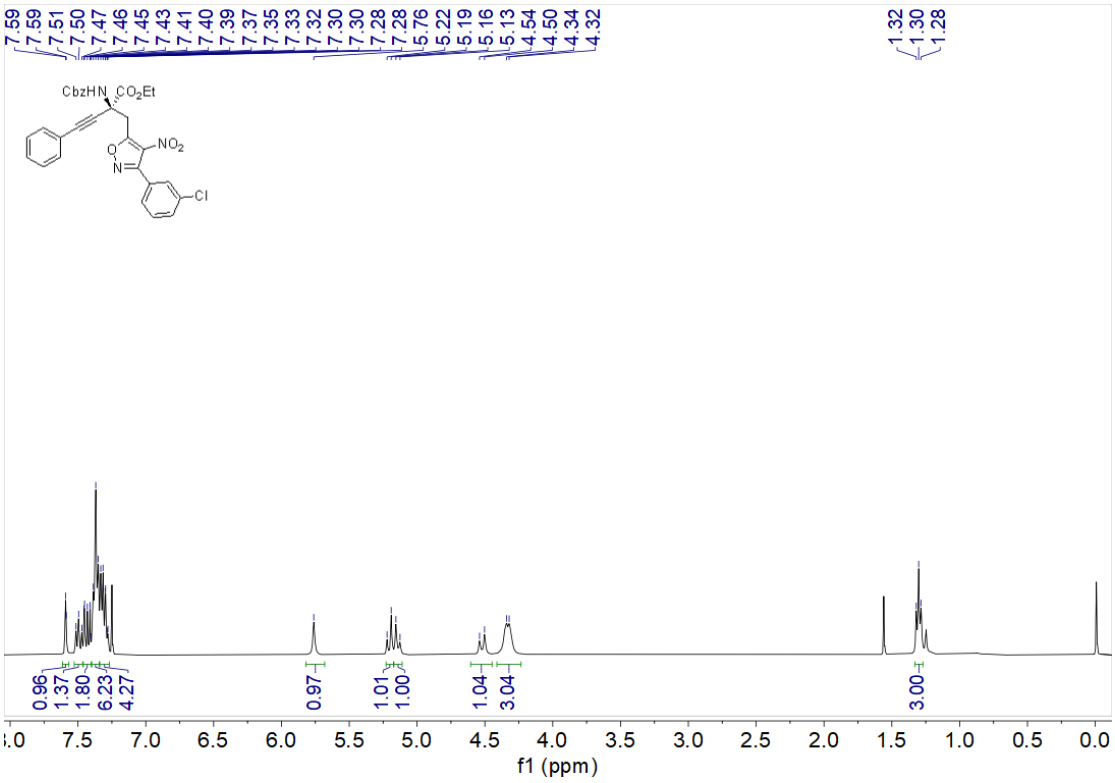
〈Peak table〉

PDA Ch1 254nm

Peak#	Ret. Time	Height	Area	Area%
1	28.175	719152	39389245	90.658
2	34.317	71351	4059005	9.342
Total		790503	43448250	100.000


CbzHN
CO2Et
NO2
O
N
Cl

3bi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7.46
7.45
7.43
7.41
7.40
7.39
7.37
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7.33
7.32
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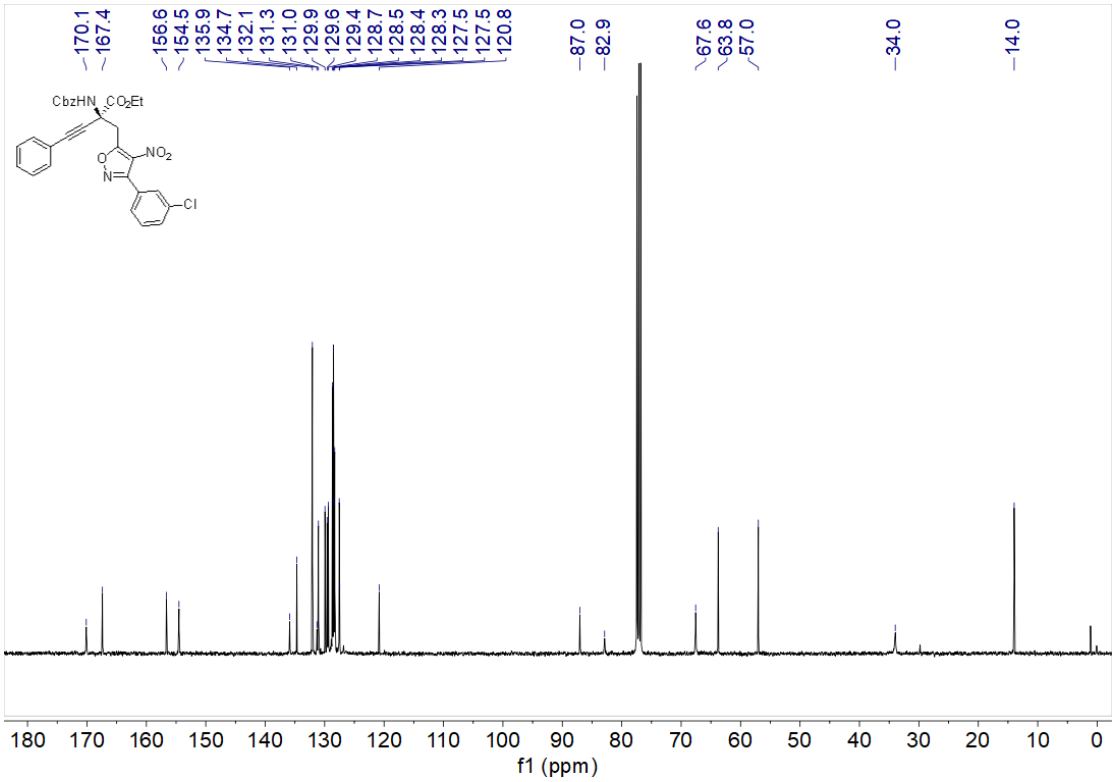
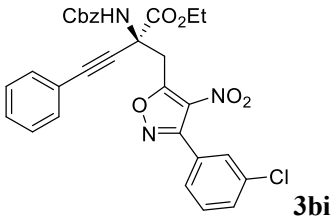
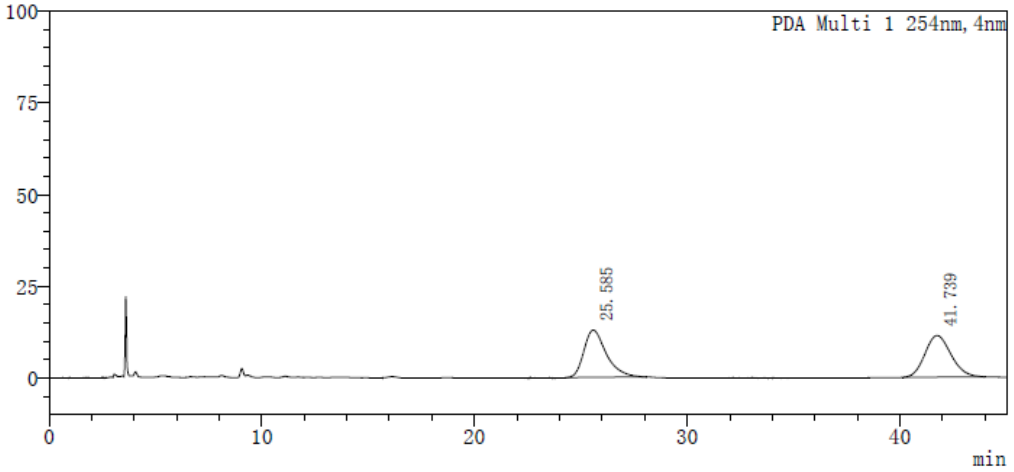
7.30
7.28
7.28
5.76
5.22
5.19
5.16
5.13
4.54
4.50
4.34
4.32
1.32
1.30
1.28
0.96
1.37
1.80
6.23
4.27
0.97
1.01
1.00
1.04
3.04
3.00
f1 (ppm)


170.1
167.4
156.6
154.5
135.9
134.7
132.1
131.3
131.0
129.9
129.6
129.4
128.7
128.5
128.4
128.3
127.5
127.5
120.8
87.0
82.9
67.6
63.8
57.0
34.0
14.0
f1 (ppm)



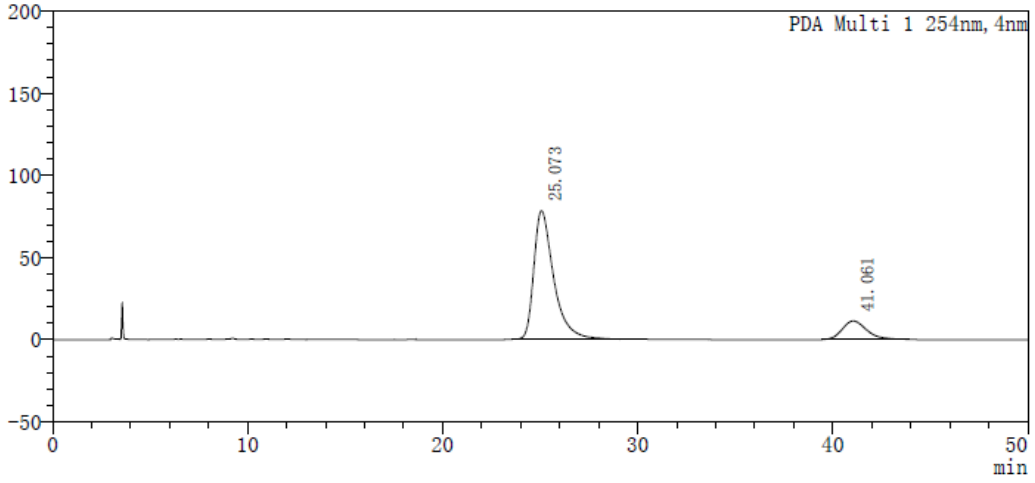
3bi



〈Peak table〉

PDA Ch1 254nm

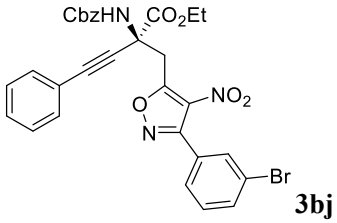
Peak#	Ret. Time	Height	Area	Area%
1	25.585	12921	949904	49.595
2	41.739	11332	965416	50.405
Total		24254	1915320	100.000



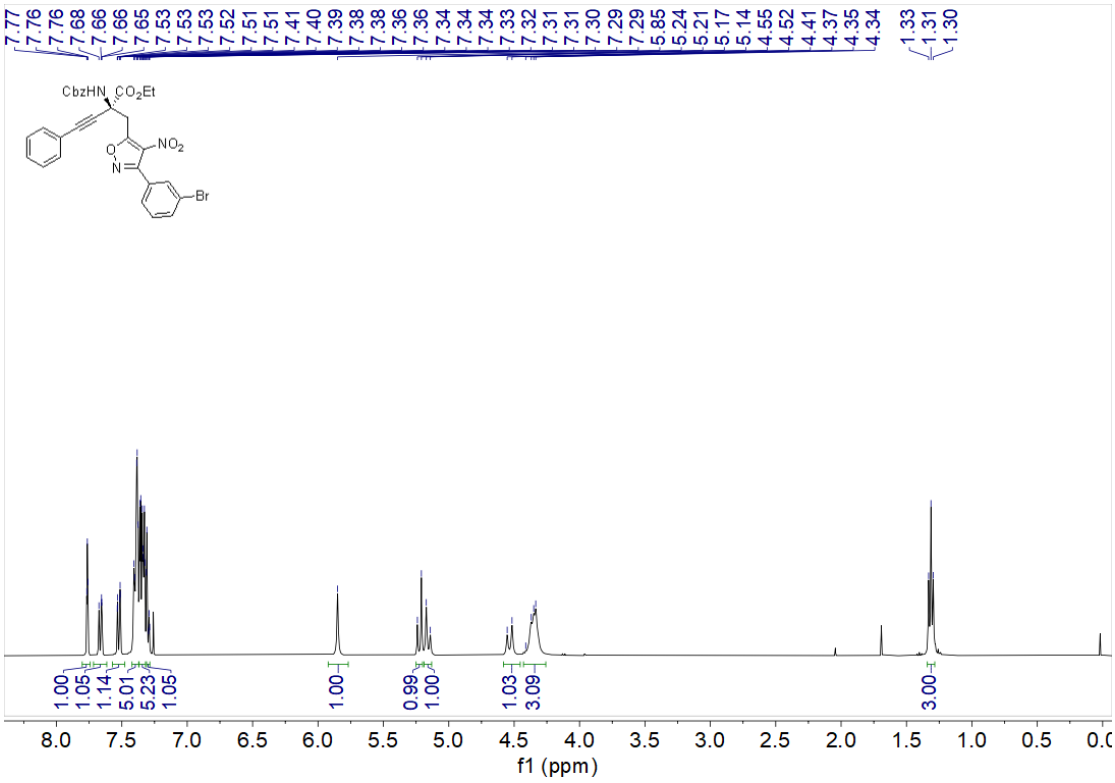
〈Peak table〉

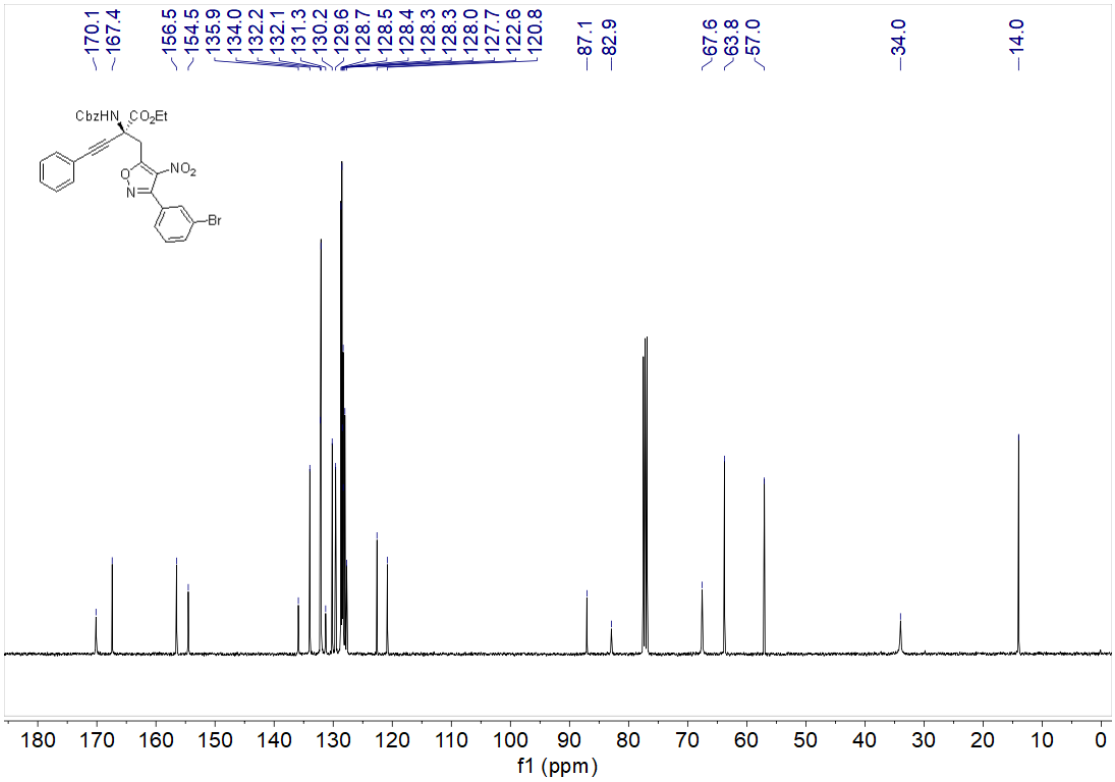
PDA Ch1 254nm

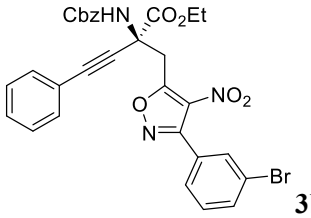
Peak#	Ret. Time	Height	Area	Area%
1	25.073	78177	5514603	84.848
2	41.061	11277	984810	15.152
Total		89454	6499413	100.000


CbzHN
CO2Et
NO2
O
N
Br

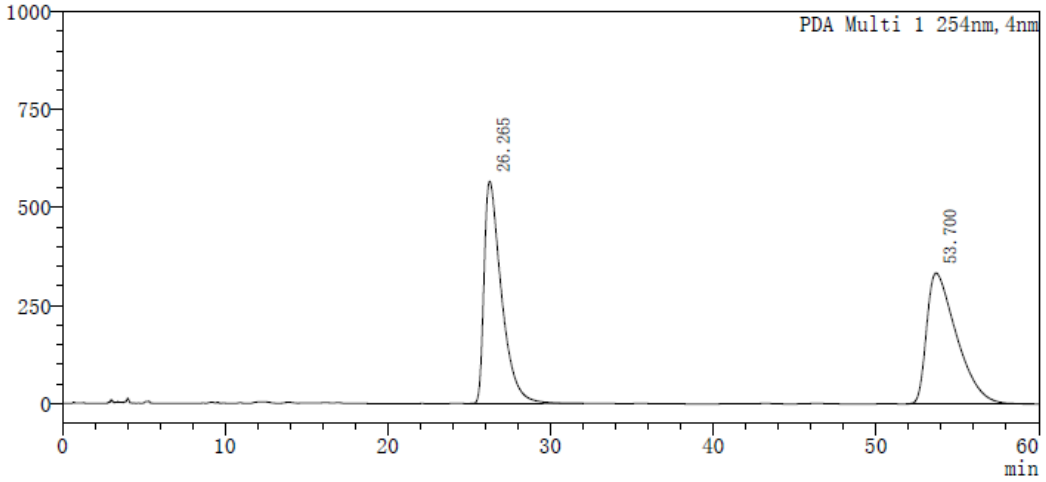
3bj


7.77 7.76 7.76 7.68 7.66 7.66 7.65 7.53 7.53 7.52 7.51 7.51 7.41 7.40 7.39 7.38 7.38 7.36 7.36 7.34 7.34 7.34 7.33 7.32 7.31 7.31 7.30 7.29 7.29 5.85 5.24 5.21 5.17 5.14 4.55 4.52 4.41 4.37 4.35 4.34 1.33 1.31 1.30
CbzHN CO2Et
NO2
O
N
Br
1.00 1.05 1.14 5.01 5.23 1.05 1.00 0.99 1.00 1.03 3.09 3.00
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


170.1 167.4 156.5 154.5 135.9 134.0 132.2 132.1 131.3 130.2 129.6 128.7 128.5 128.4 128.3 128.3 128.0 127.7 122.6 120.8 87.1 82.9 67.6 63.8 57.0 34.0 14.0
CbzHN CO2Et
NO2
O
N
Br
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)



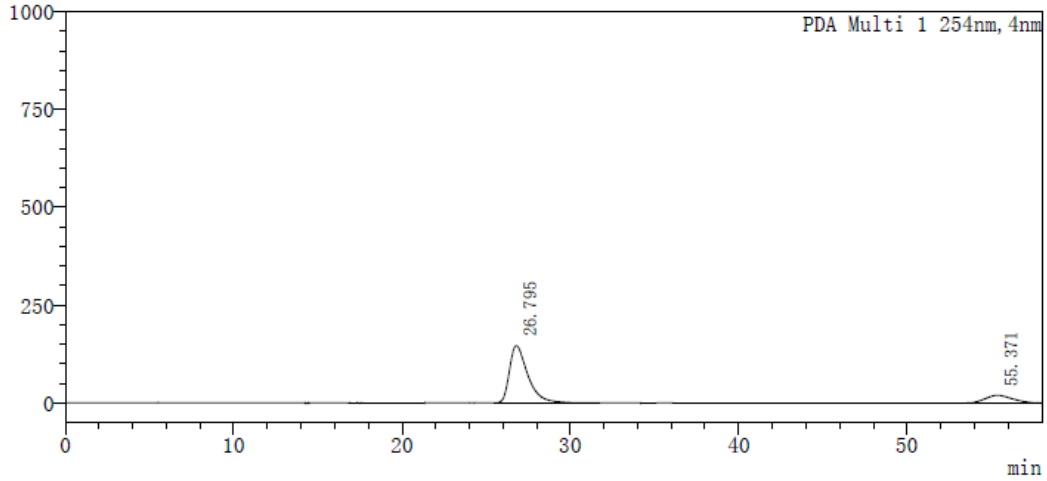
3bj



〈Peak table〉

PDA Ch1 254nm

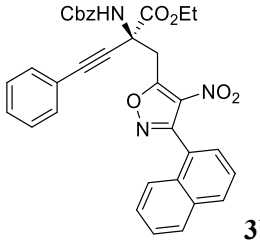
Peak#	Ret. Time	Height	Area	Area%
1	26.265	567895	42301968	49.758
2	53.700	334137	42713073	50.242
Total		902032	85015040	100.000



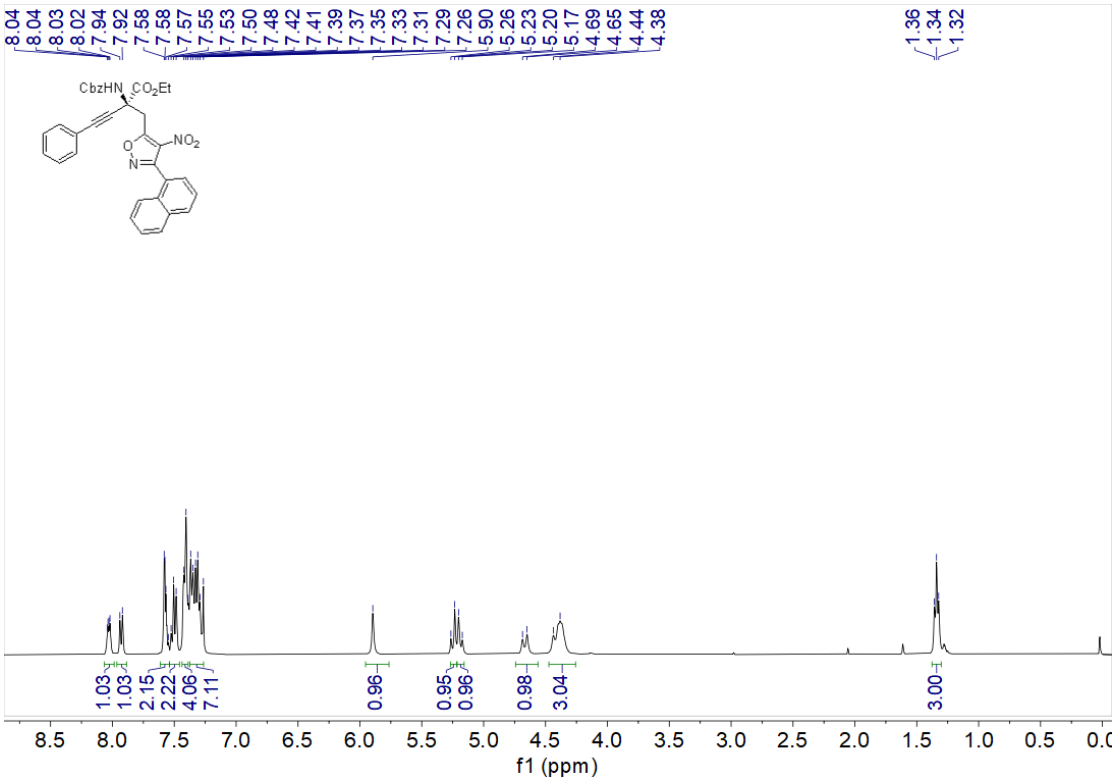
〈Peak table〉

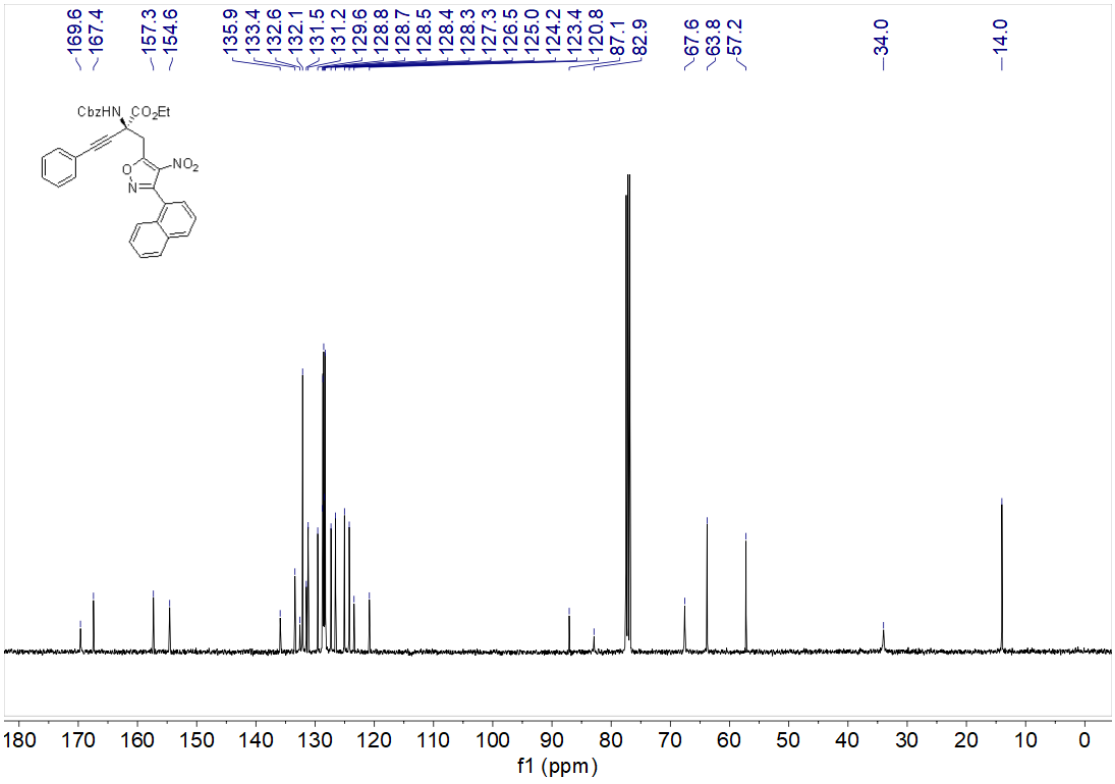
PDA Ch1 254nm

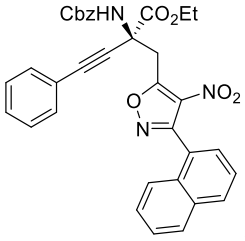
Peak#	Ret. Time	Height	Area	Area%
1	26.795	146222	11061848	82.974
2	55.371	19583	2269885	17.026
Total		165805	13331733	100.000


CbzHN
CO2Et
NO2
O
N

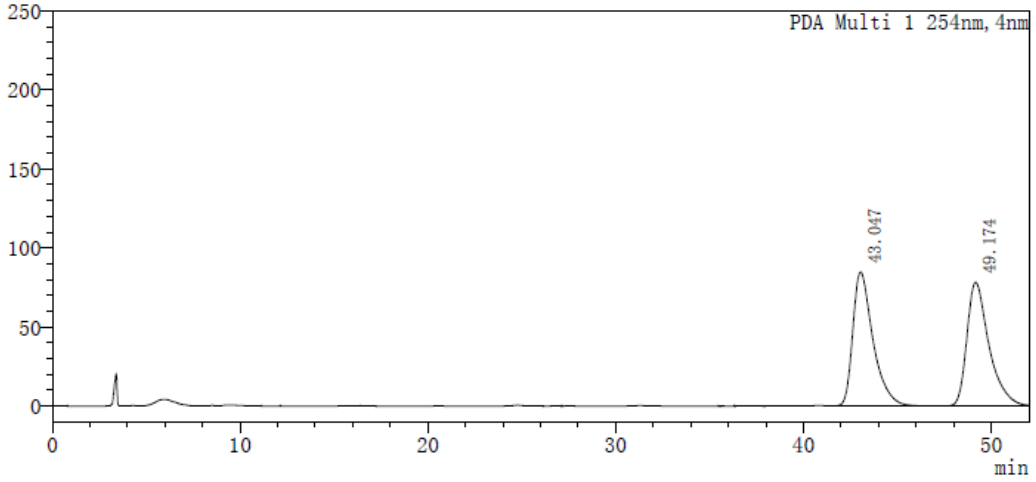
3bk


8.04 8.04 8.03 8.02 7.94 7.92 7.58 7.58 7.57 7.55 7.53 7.50 7.48 7.42 7.41 7.39 7.37 7.35 7.33 7.31 7.29 7.26 5.90 5.26 5.23 5.20 5.17 4.69 4.65 4.44 4.38
1.36 1.34 1.32
1.03 1.03 2.15 2.22 4.06 7.11 0.96 0.95 0.96 0.98 3.04 3.00
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


169.6 167.4 157.3 154.6 135.9 133.4 132.6 132.1 131.5 131.2 129.6 128.8 128.7 128.5 128.4 128.3 127.3 126.5 125.0 124.2 123.4 120.8 87.1 82.9 67.6 63.8 57.2 34.0 14.0
180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)



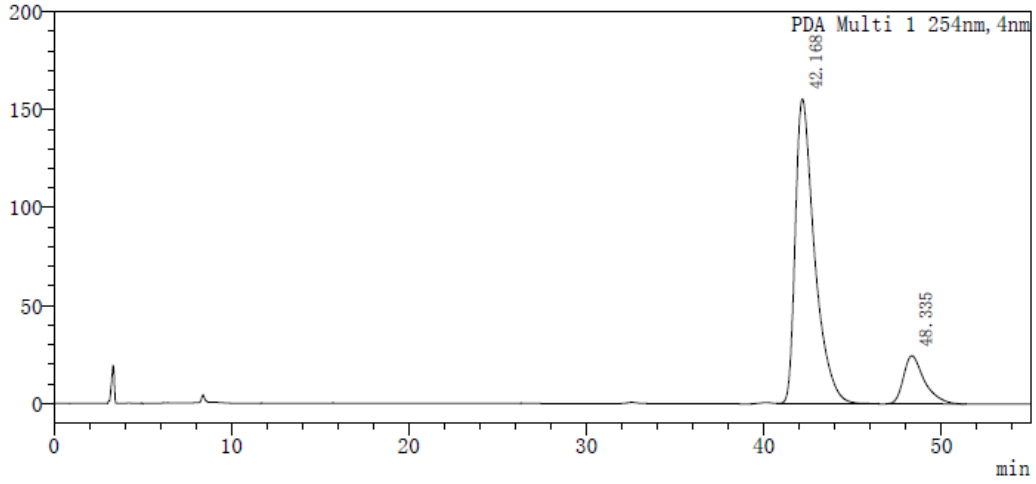
3bk



〈Peak table〉

PDA Ch1 254nm

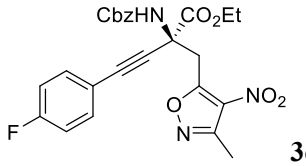
Peak#	Ret. Time	Height	Area	Area%
1	43.047	84683	6293229	49.601
2	49.174	78143	6394471	50.399
Total		162826	12687699	100.000



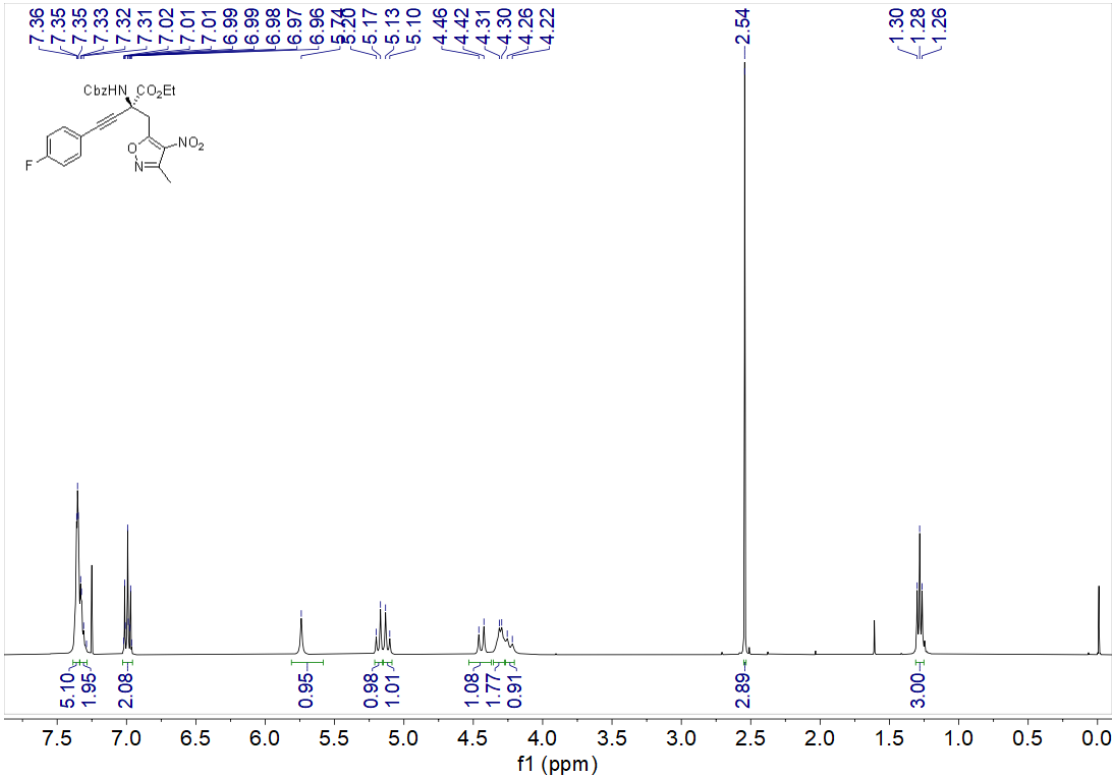
〈Peak table〉

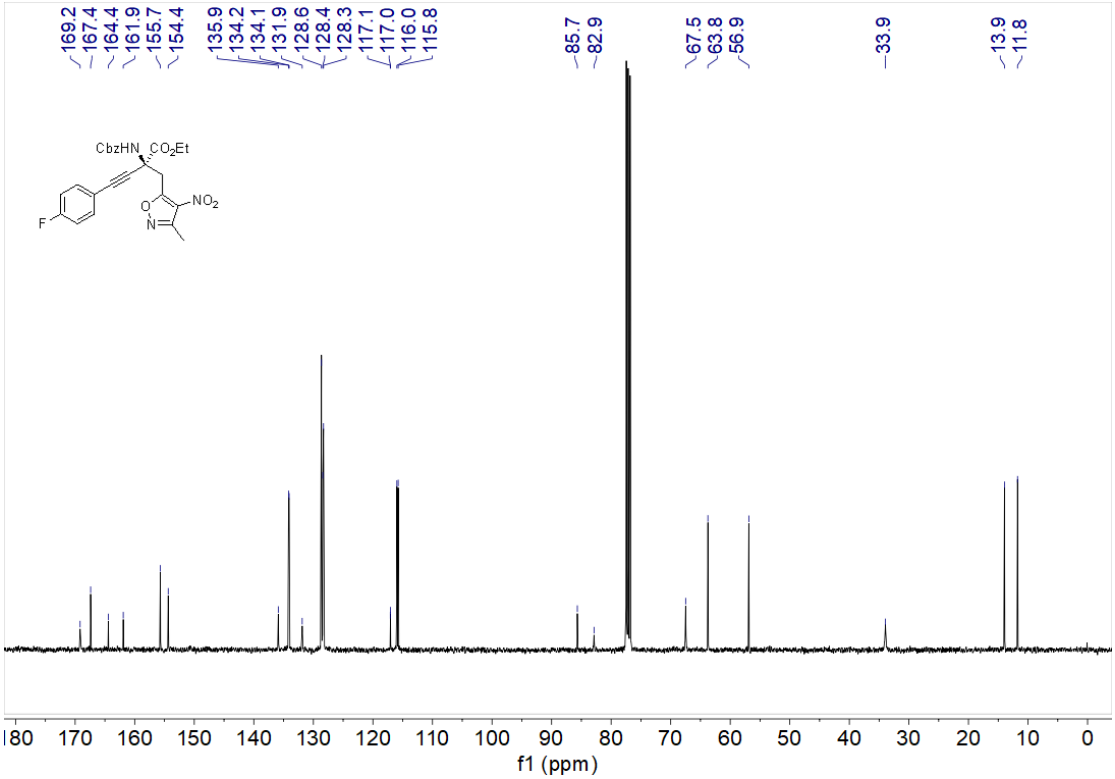
PDA Ch1 254nm

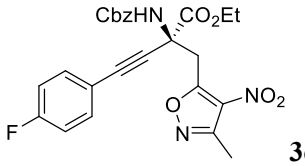
Peak#	Ret. Time	Height	Area	Area%
1	42.168	155689	11757966	85.392
2	48.335	24555	2011415	14.608
Total		180244	13769381	100.000


CbzHN
CO2Et
NO2
O
N
F

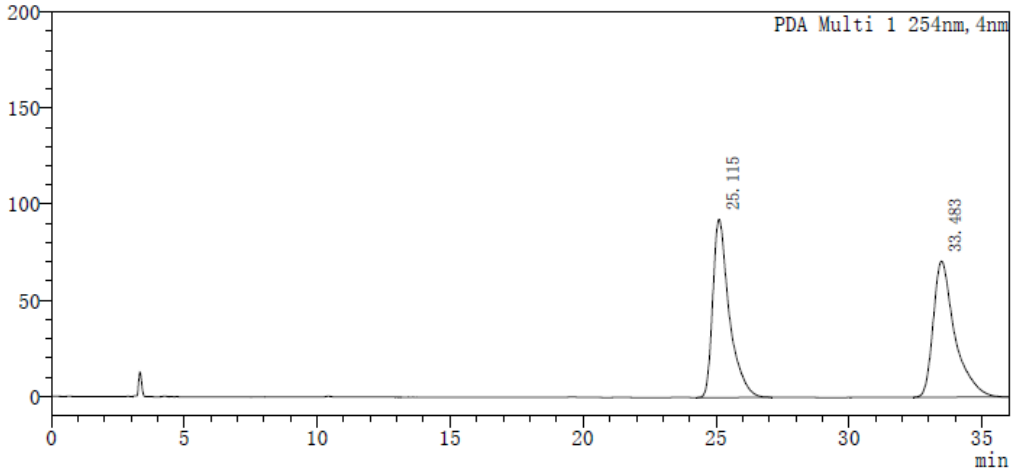
3ca


7.36
7.35
7.35
7.33
7.32
7.31
7.02
7.01
7.01
6.99
6.99
6.98
6.97
6.96
5.20
5.17
5.13
5.10
4.46
4.42
4.31
4.30
4.26
4.22
2.54
1.30
1.28
1.26
5.10
1.95
2.08
0.95
0.98
1.01
1.08
1.77
0.91
2.89
3.00
f1 (ppm)


169.2
167.4
164.4
161.9
155.7
154.4
135.9
134.2
134.1
131.9
128.6
128.4
128.3
117.1
117.0
116.0
115.8
85.7
82.9
67.5
63.8
56.9
33.9
13.9
11.8
f1 (ppm)



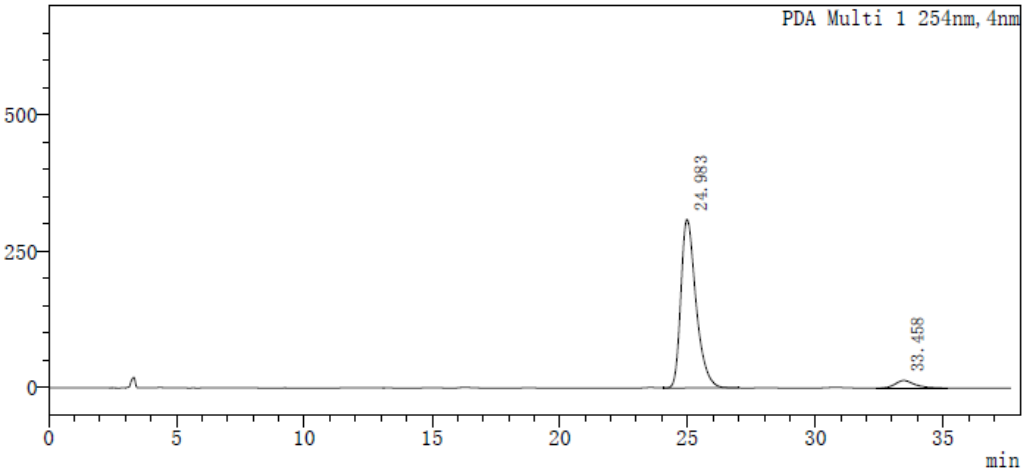
3ca



〈Peak table〉

PDA Ch1 254nm

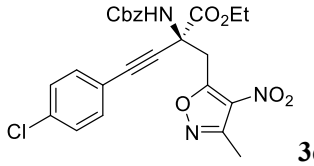
Peak#	Ret. Time	Height	Area	Area%
1	25.115	92712	3999205	49.981
2	33.483	70755	4002208	50.019
Total		163468	8001413	100.000



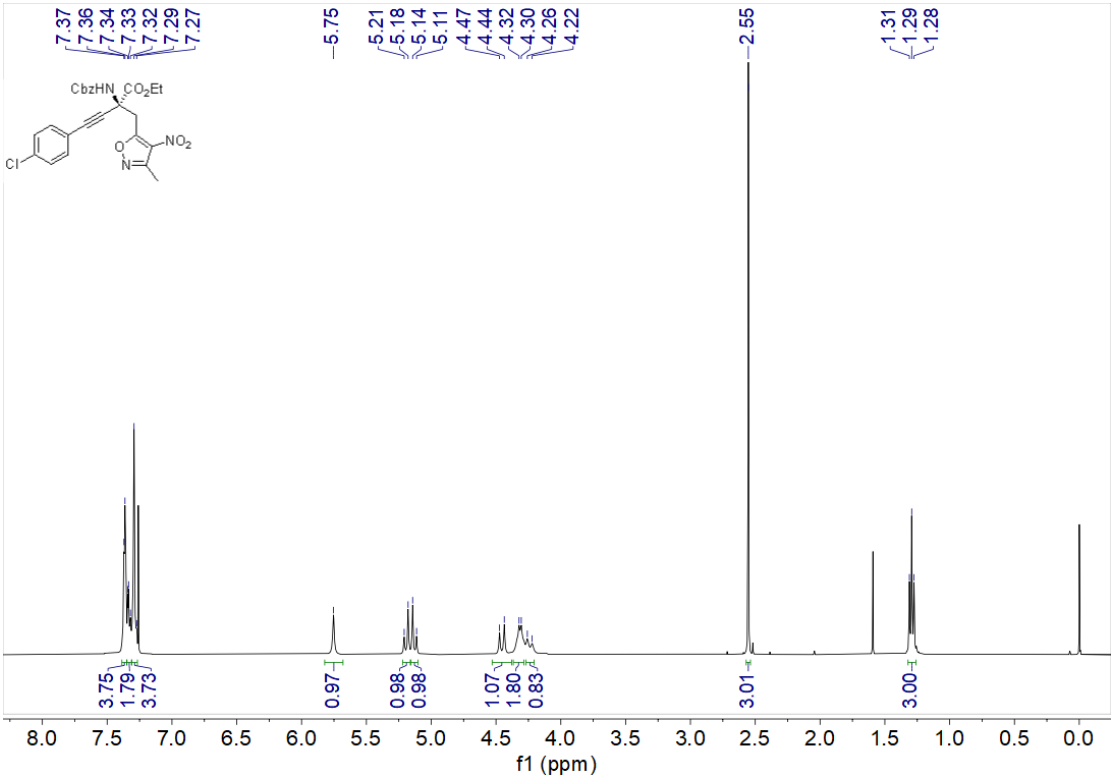
〈Peak table〉

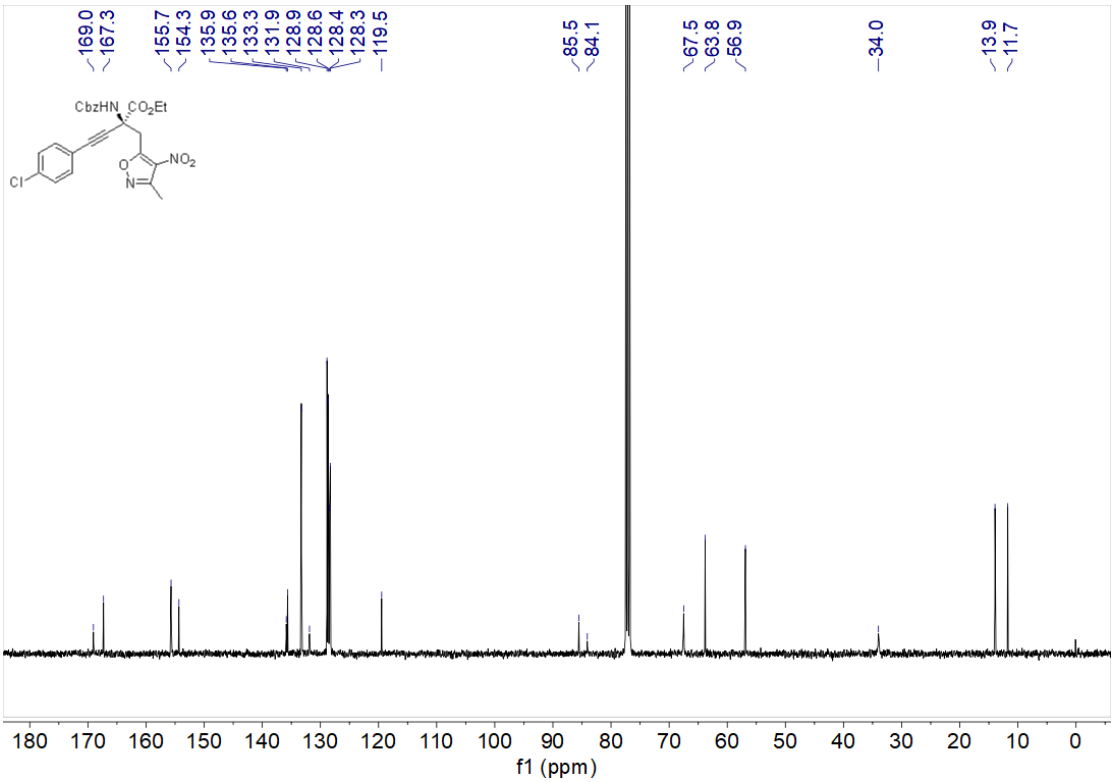
PDA Ch1 254nm

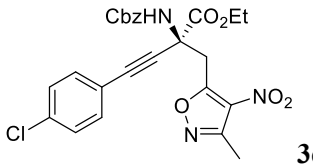
Peak#	Ret. Time	Height	Area	Area%
1	24.983	308748	12700586	94.744
2	33.458	13631	704609	5.256
Total		322378	13405194	100.000


CbzHN
CO2Et
NO2
O
N
Cl

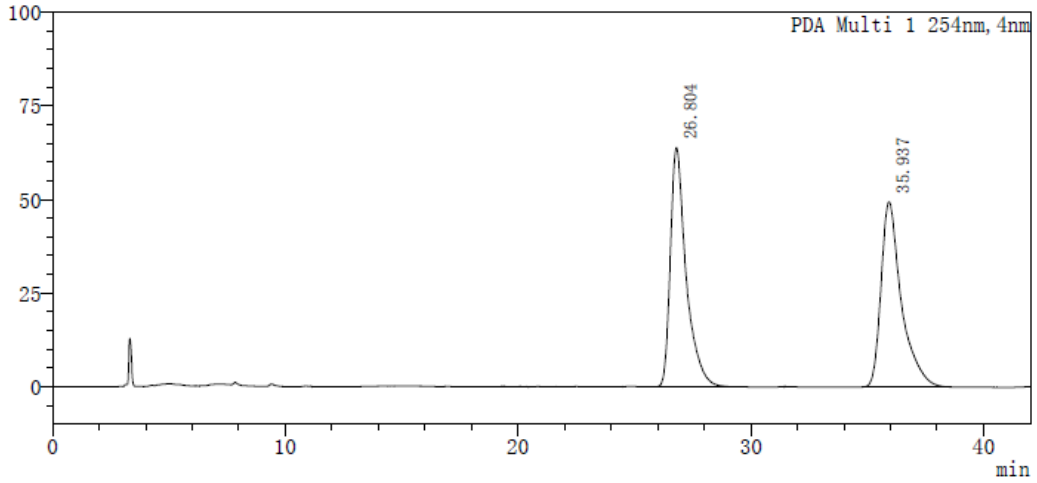
3da


7.37
7.36
7.34
7.33
7.32
7.29
7.27
5.75
5.21
5.18
5.14
5.11
4.47
4.44
4.32
4.30
4.26
4.22
2.55
1.31
1.29
1.28
3.75
1.79
3.73
0.97
0.98
0.98
1.07
1.80
0.83
3.01
3.00
f1 (ppm)


169.0
167.3
155.7
154.3
135.9
135.6
133.3
131.9
128.9
128.6
128.4
128.3
119.5
85.5
84.1
67.5
63.8
56.9
34.0
13.9
11.7
f1 (ppm)



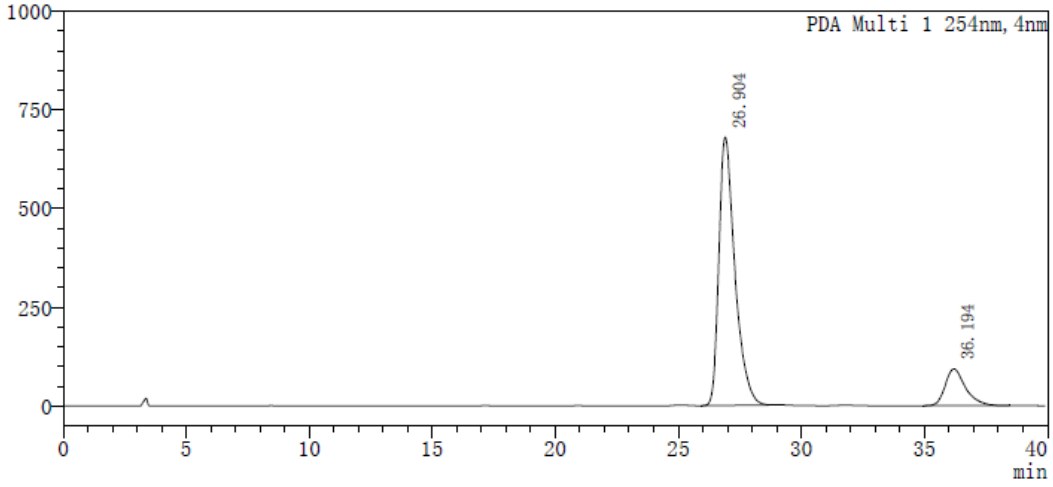
3da



〈Peak table〉

PDA Ch1 254nm

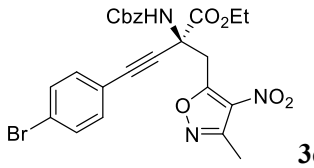
Peak#	Ret. Time	Height	Area	Area%
1	26.804	63902	3006509	50.025
2	35.937	49484	3003561	49.975
Total		113386	6010070	100.000



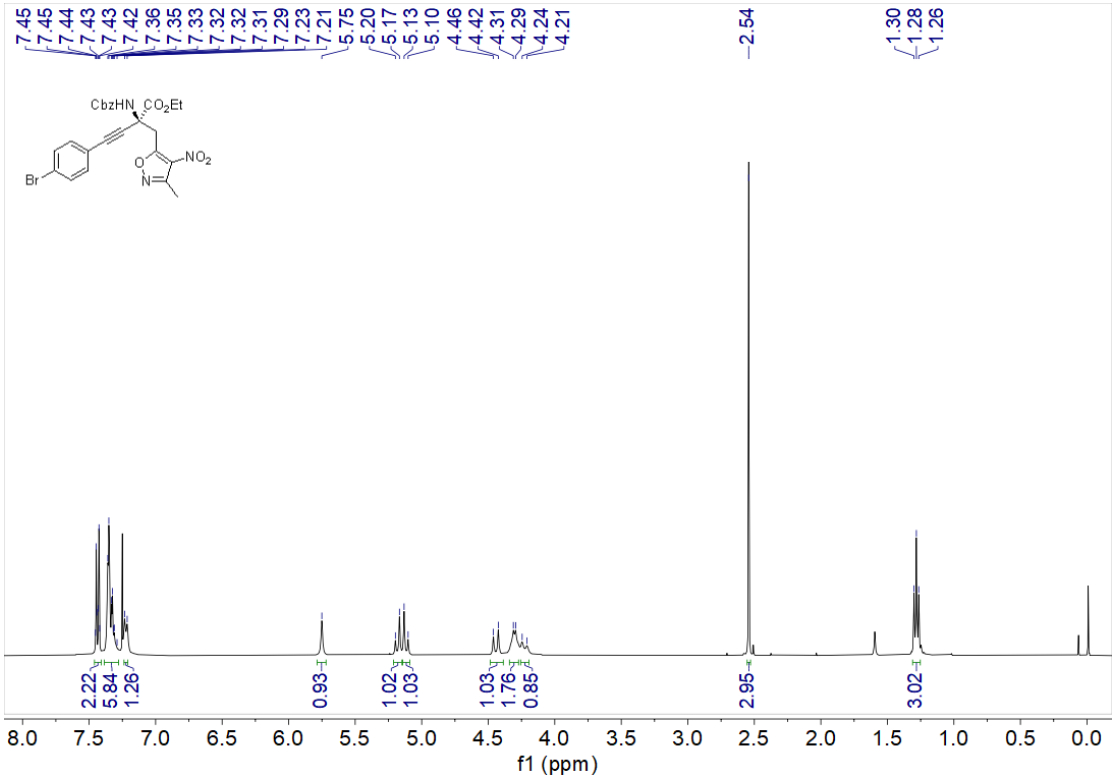
〈Peak table〉

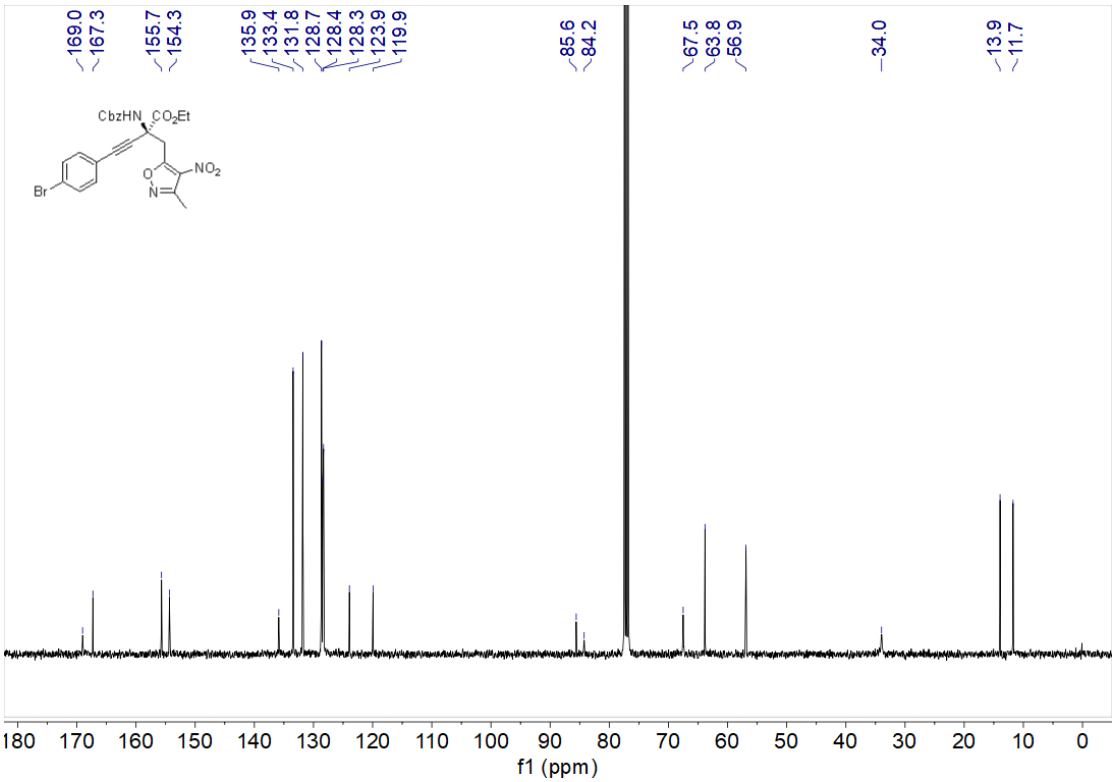
PDA Ch1 254nm

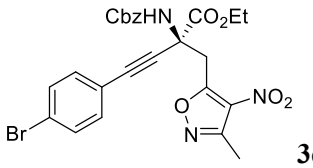
Peak#	Ret. Time	Height	Area	Area%
1	26.904	679352	30761042	85.234
2	36.194	93139	5329081	14.766
Total		772491	36090123	100.000


CbzHN
CO2Et
NO2
O
N
Br

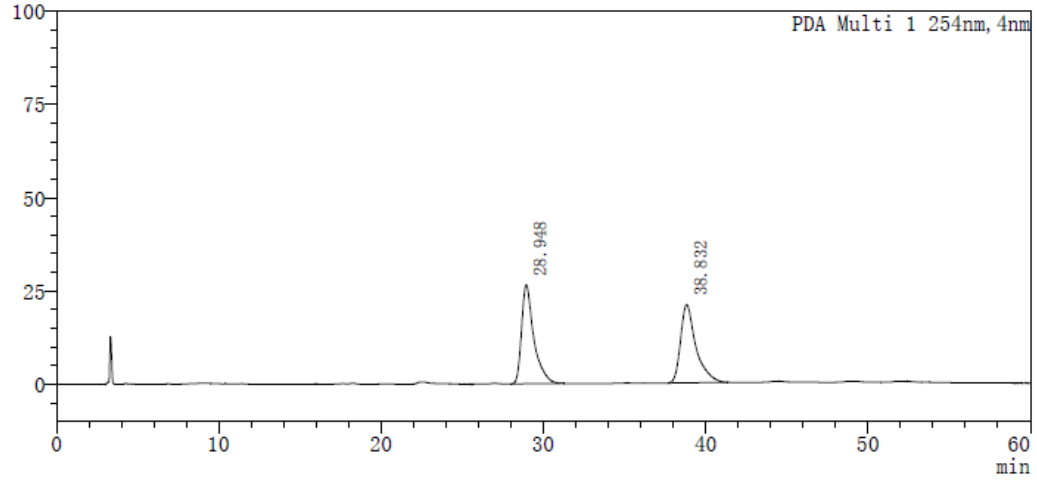
3ea


7.45
7.45
7.44
7.43
7.43
7.42
7.36
7.35
7.33
7.32
7.32
7.31
7.29
7.23
7.21
5.75
5.20
5.17
5.13
5.10
4.46
4.42
4.31
4.29
4.24
4.21
2.54
1.30
1.28
1.26
2.22
5.84
1.26
0.93
1.02
1.03
1.03
1.76
0.85
2.95
3.02
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


169.0
167.3
155.7
154.3
135.9
133.4
131.8
128.7
128.4
128.3
123.9
119.9
85.6
84.2
67.5
63.8
56.9
34.0
13.9
11.7
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)



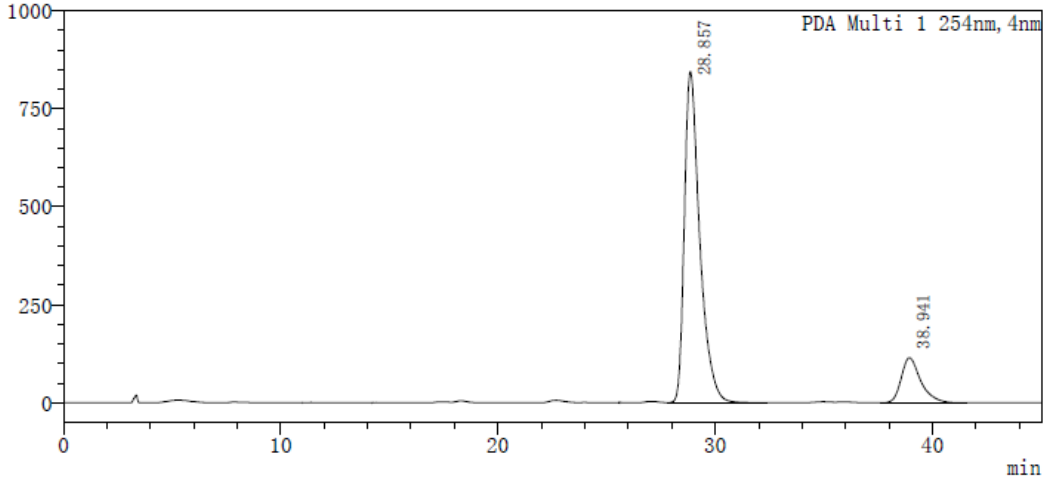
3ea



〈Peak table〉

PDA Ch1 254nm

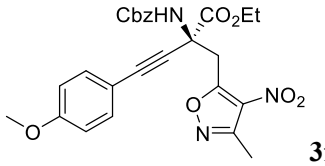
Peak#	Ret. Time	Height	Area	Area%
1	28.948	26537	1390143	50.249
2	38.832	20933	1376353	49.751
Total		47469	2766496	100.000



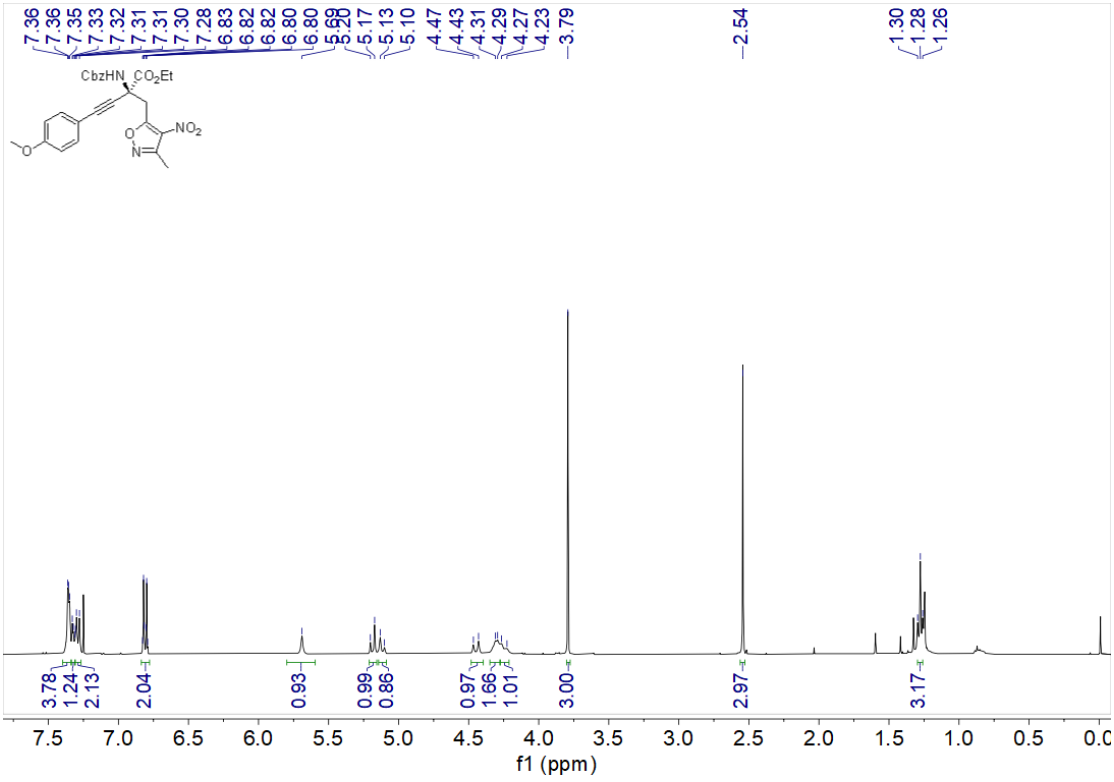
〈Peak table〉

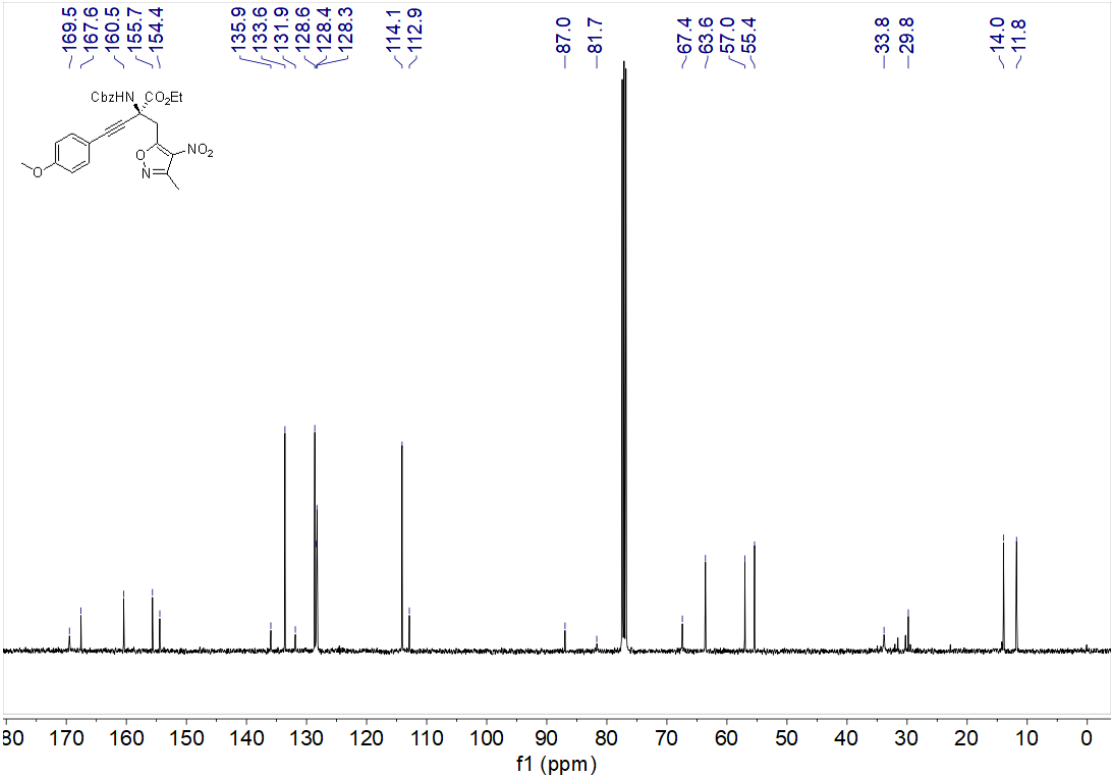
PDA Ch1 254nm

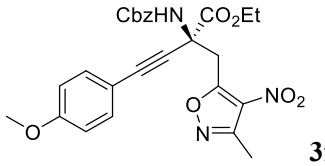
Peak#	Ret. Time	Height	Area	Area%
1	28.857	843629	41548996	85.389
2	38.941	114607	7109375	14.611
Total		958237	48658370	100.000


CbzHN
CO2Et
NO2
O
N
O

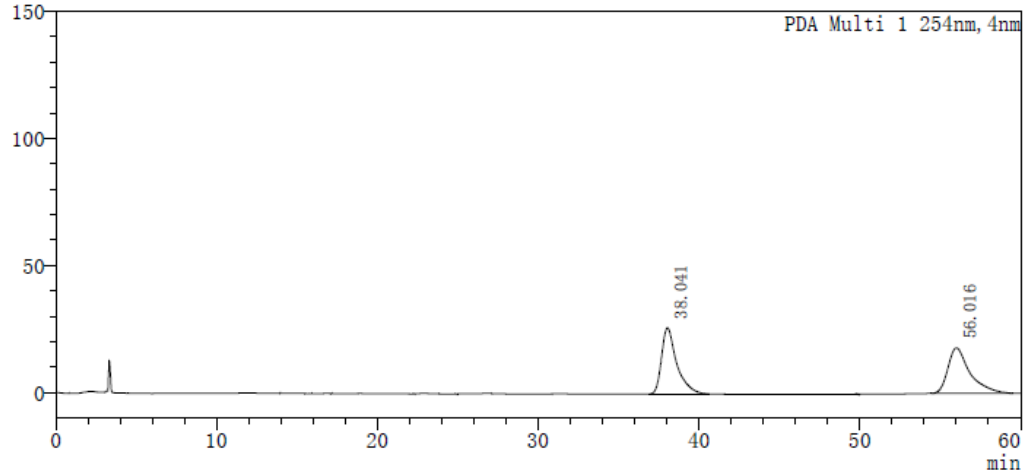
3fa


7.36
7.36
7.35
7.33
7.32
7.31
7.31
7.30
7.28
6.83
6.82
6.82
6.80
6.80
5.69
5.20
5.17
5.13
5.10
4.47
4.43
4.31
4.29
4.27
4.23
3.79
2.54
1.30
1.28
1.26
3.78
1.24
2.13
2.04
0.93
0.99
0.86
0.97
1.66
1.01
3.00
2.97
3.17
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


169.5
167.6
160.5
155.7
154.4
135.9
133.6
131.9
128.6
128.4
128.3
114.1
112.9
87.0
81.7
67.4
63.6
57.0
55.4
33.8
29.8
14.0
11.8
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)



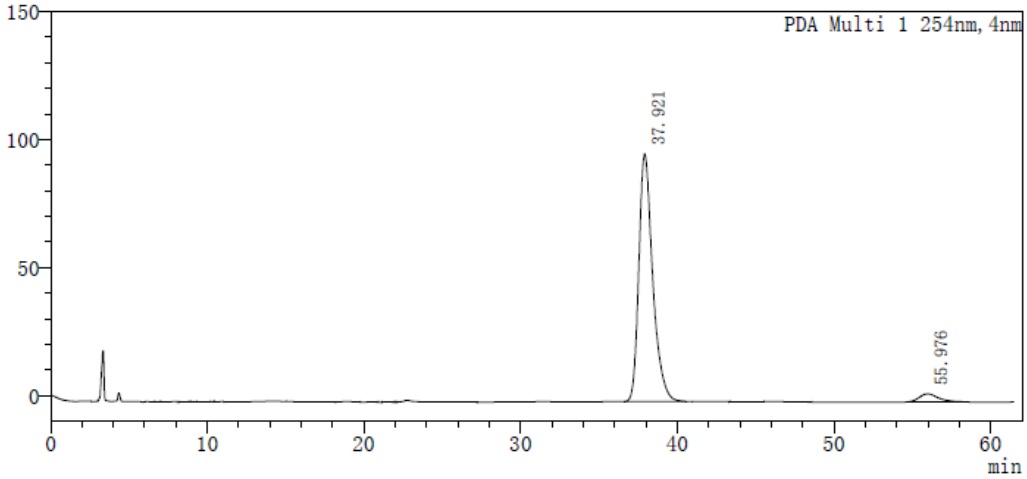
3fa



<Peak table>

PDA Ch1 254nm

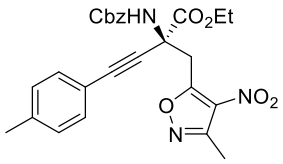
Peak#	Ret. Time	Height	Area	Area%
1	38.041	26025	1702634	50.113
2	56.016	17890	1694976	49.887
Total		43915	3397610	100.000



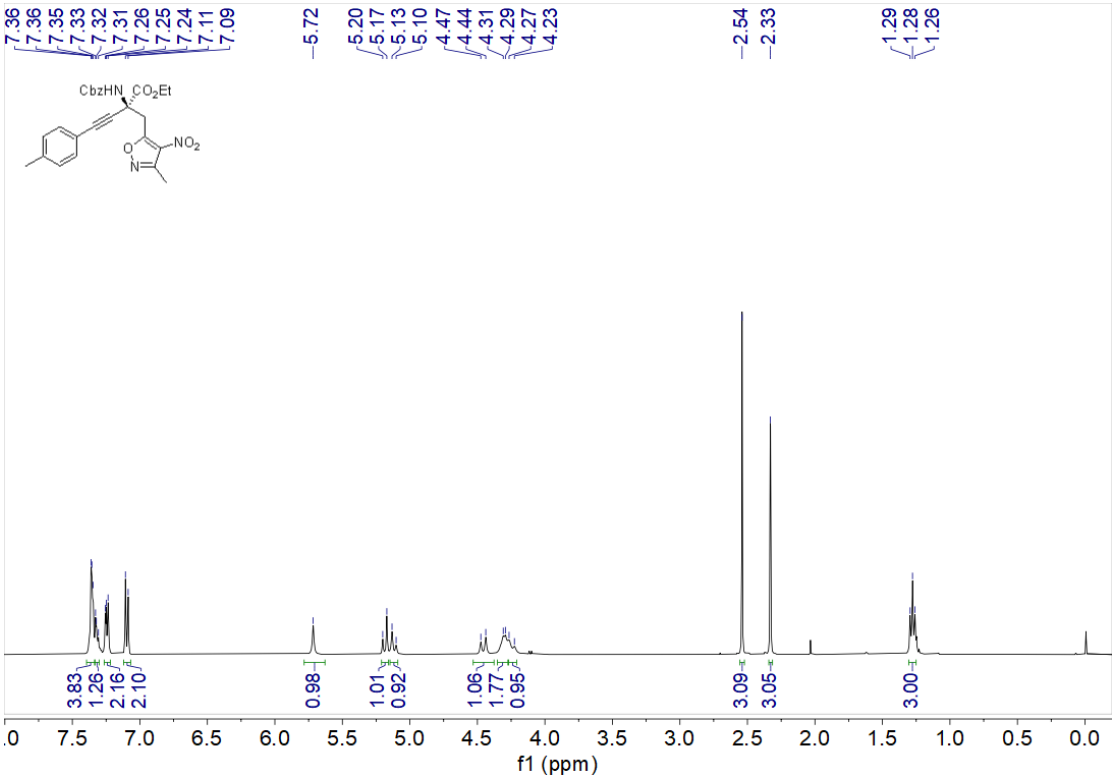
<Peak table>

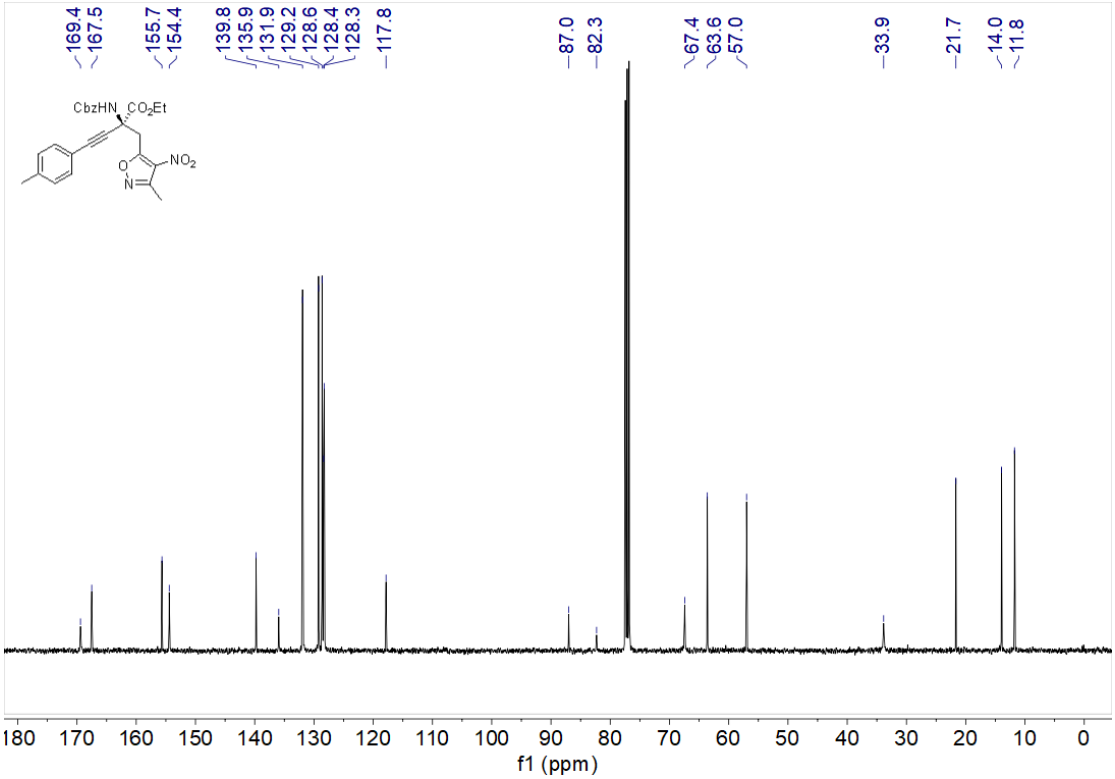
PDA Ch1 254nm

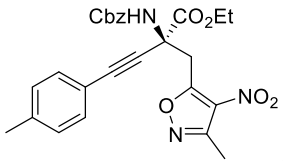
Peak#	Ret. Time	Height	Area	Area%
1	37.921	96699	5938305	95.885
2	55.976	3107	254850	4.115
Total		99806	6193156	100.000


CbzHN
CO2Et
NO2
O
N

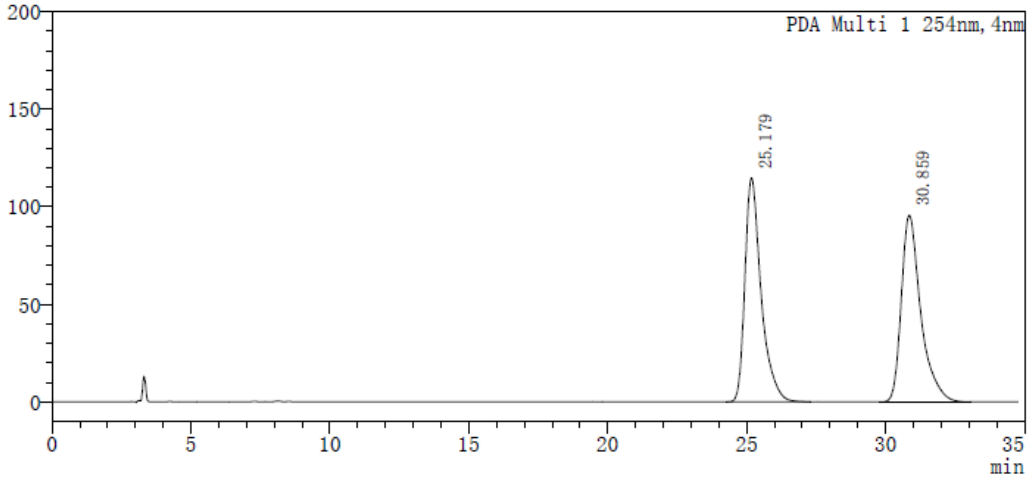
3ga


7.36
7.36
7.35
7.33
7.32
7.31
7.26
7.25
7.24
7.11
7.09
5.72
5.20
5.17
5.13
5.10
4.47
4.44
4.31
4.29
4.27
4.23
2.54
2.33
1.29
1.28
1.26
3.83
1.26
2.16
2.10
0.98
1.01
0.92
1.06
1.77
0.95
3.09
3.05
3.00
f1 (ppm)


169.4
167.5
155.7
154.4
139.8
135.9
131.9
129.2
128.6
128.4
128.3
117.8
87.0
82.3
67.4
63.6
57.0
33.9
21.7
14.0
11.8
f1 (ppm)



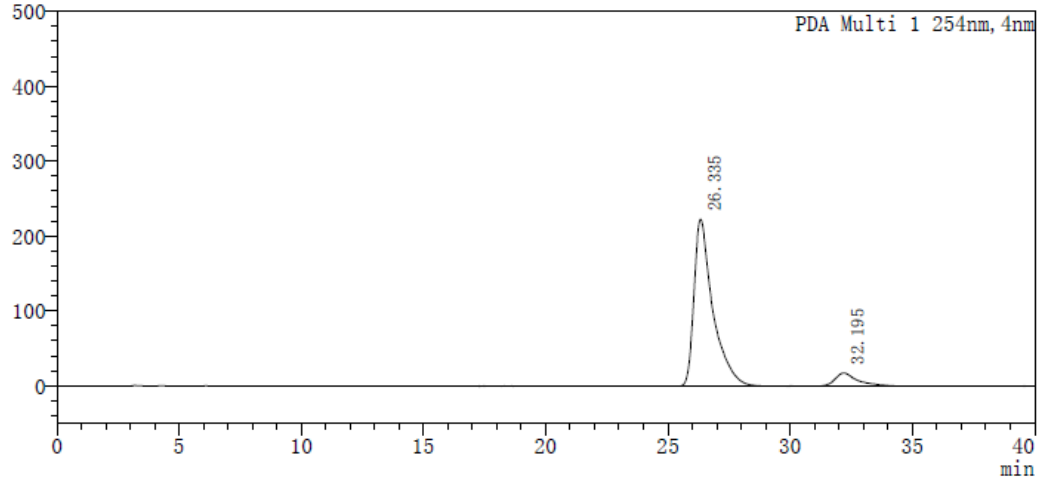
3ga



〈Peak table〉

PDA Ch1 254nm

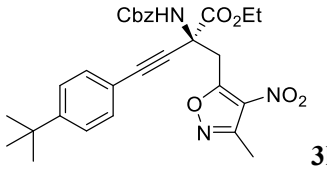
Peak#	Ret. Time	Height	Area	Area%
1	25.179	114616	4656823	50.013
2	30.859	95699	4654384	49.987
Total		210315	9311207	100.000



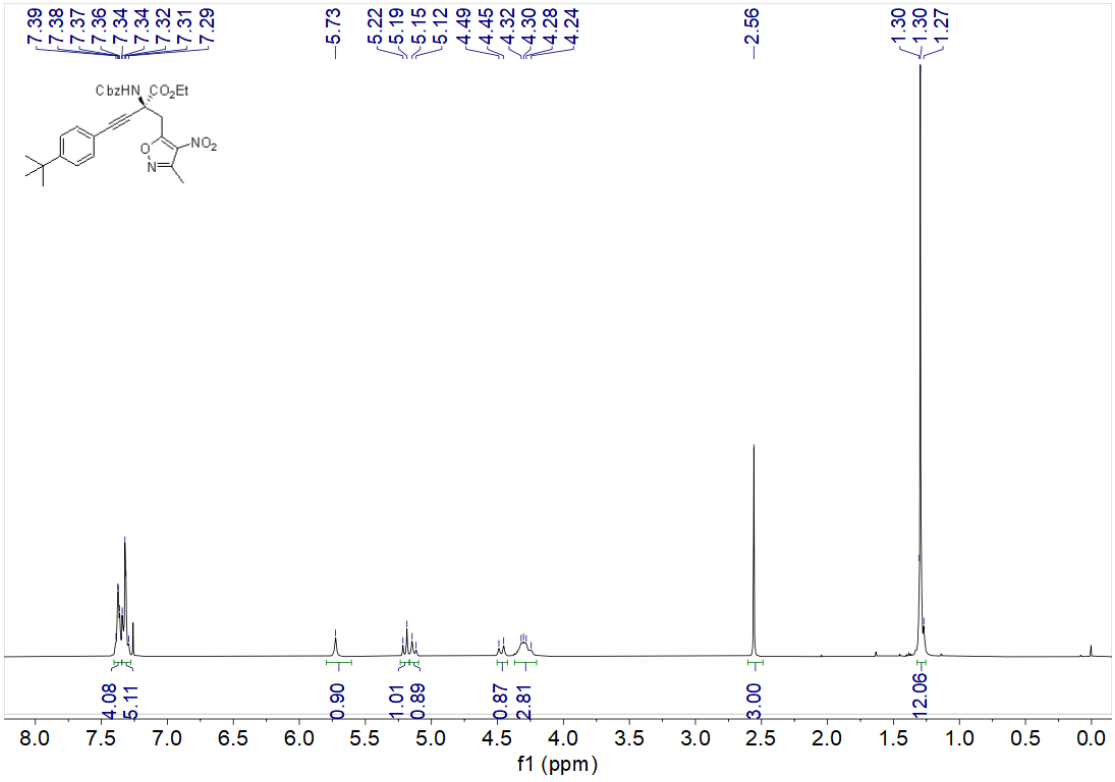
〈Peak table〉

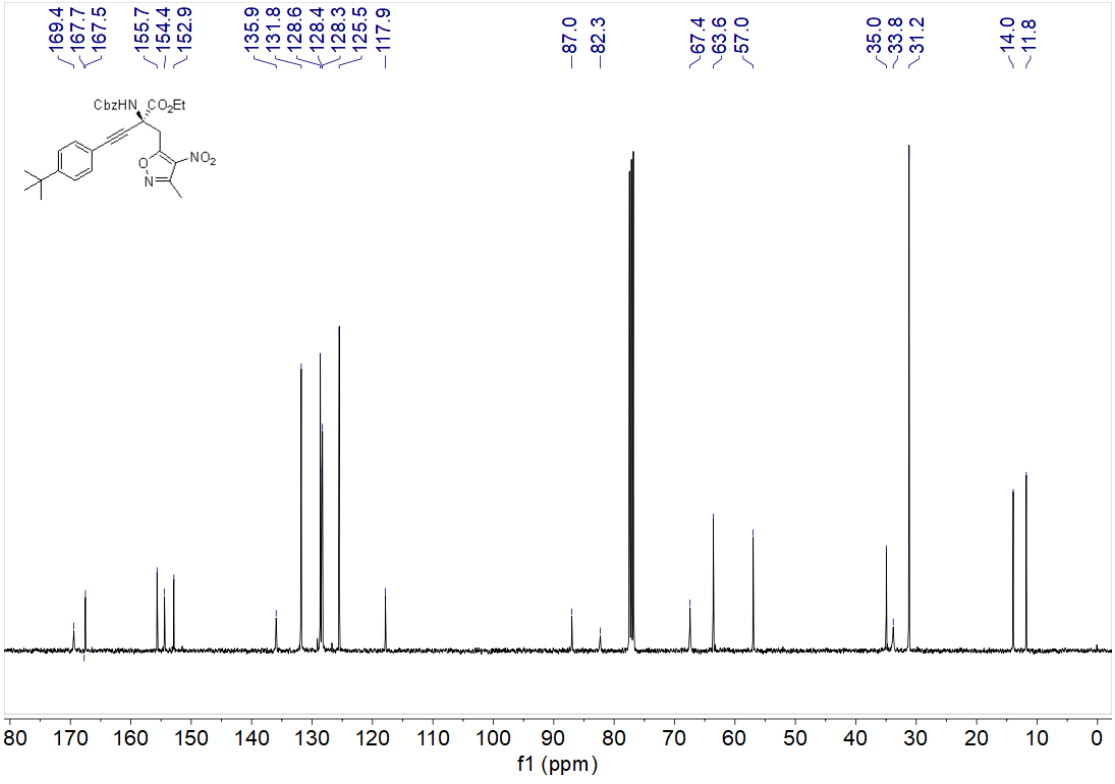
PDA Ch1 254nm

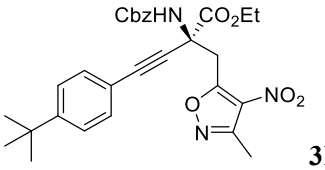
Peak#	Ret. Time	Height	Area	Area%
1	26.335	222633	11910508	91.503
2	32.195	17384	1106025	8.497
Total		240016	13016533	100.000


CbzHN
CO2Et
NO2
O
N

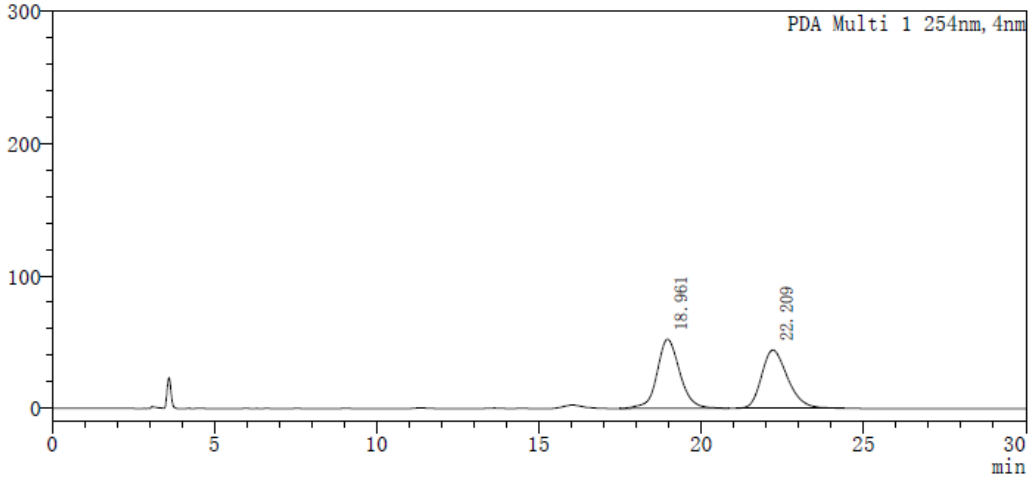
3ha


7.39
7.38
7.37
7.36
7.34
7.34
7.32
7.31
7.29
5.73
5.22
5.19
5.15
5.12
4.49
4.45
4.32
4.30
4.28
4.24
2.56
1.30
1.30
1.27
4.08
5.11
0.90
1.01
0.89
0.87
2.81
3.00
12.06
f1 (ppm)


169.4
167.7
167.5
155.7
154.4
152.9
135.9
131.8
128.6
128.4
128.3
125.5
117.9
87.0
82.3
67.4
63.6
57.0
35.0
33.8
31.2
14.0
11.8
f1 (ppm)



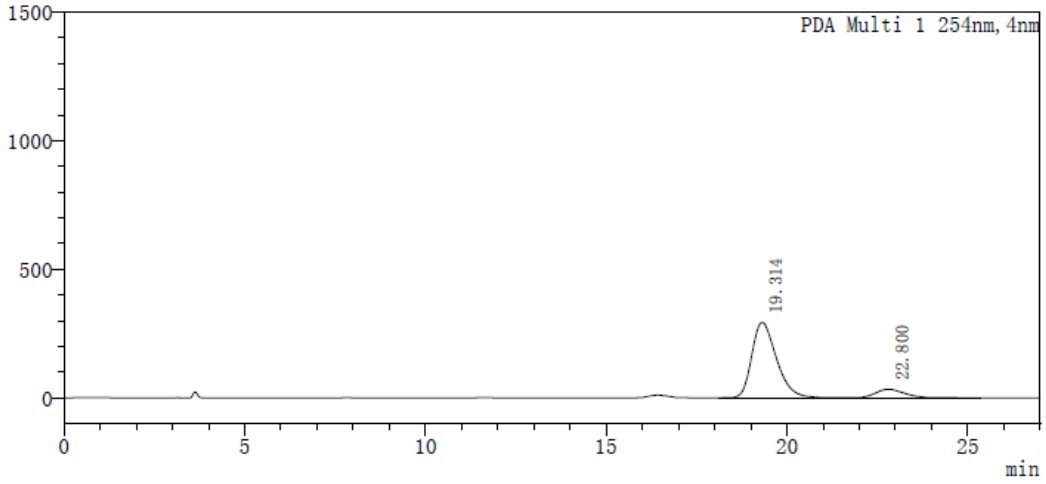
3ha



〈Peak table〉

PDA Ch1 254nm

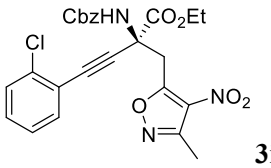
Peak#	Ret. Time	Height	Area	Area%
1	18.961	52294	2536744	50.923
2	22.209	44040	2444759	49.077
Total		96334	4981503	100.000



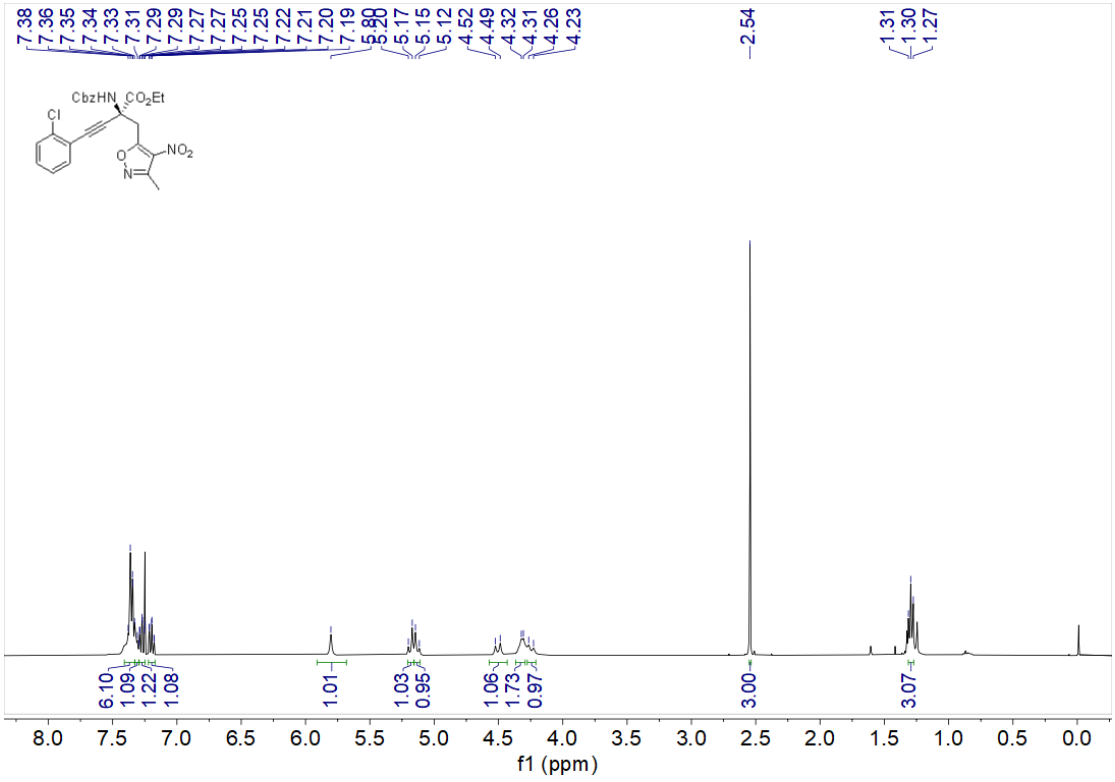
〈Peak table〉

PDA Ch1 254nm

Peak#	Ret. Time	Height	Area	Area%
1	19.314	294401	14001732	87.910
2	22.800	33283	1925664	12.090
Total		327684	15927396	100.000


CbzHN
CO2Et
Cl
NO2
O
N

3ia


7.38
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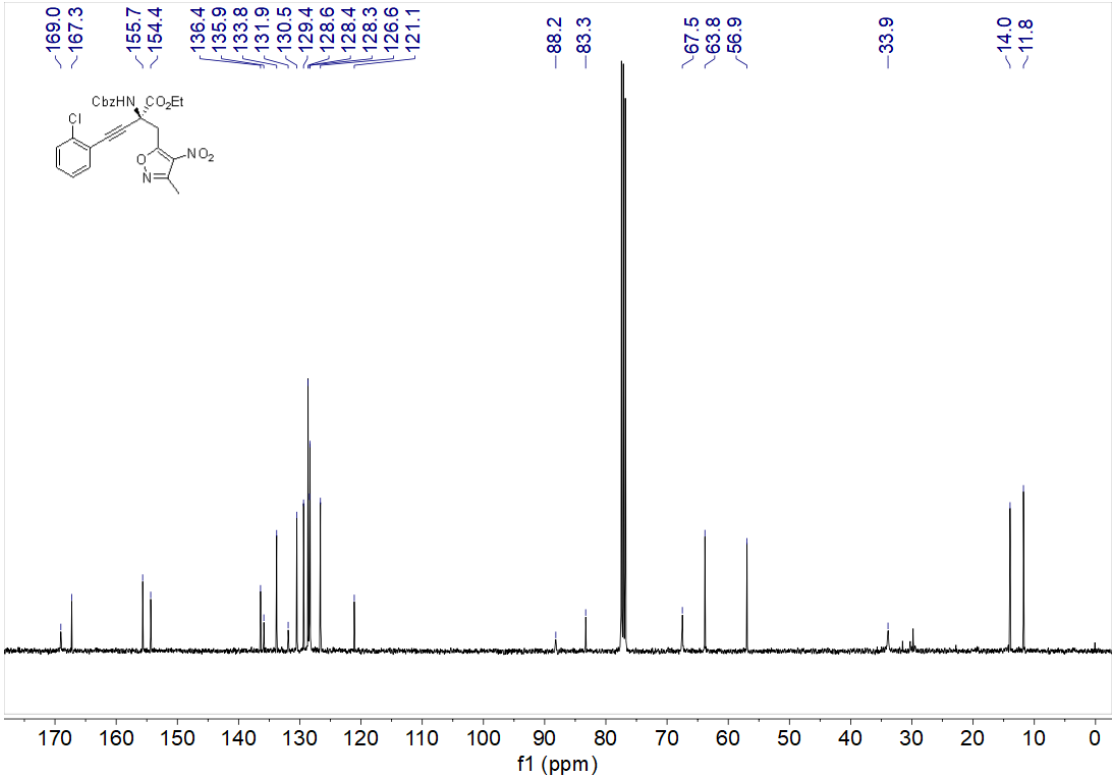
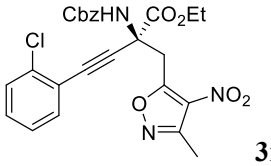
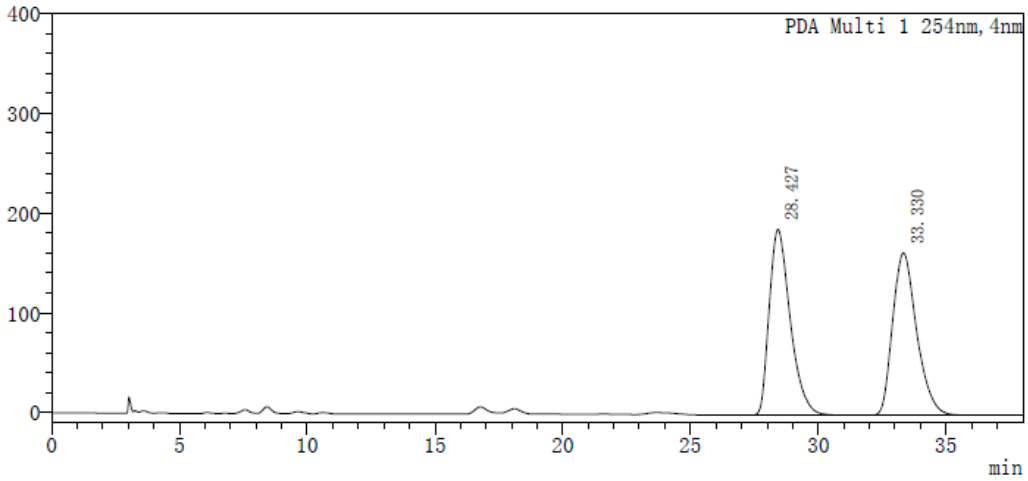
7.35
7.34
7.33
7.31
7.29
7.29
7.27
7.27
7.25
7.25
7.22
7.21
7.20
7.19
5.20
5.17
5.15
5.12
4.52
4.49
4.32
4.31
4.26
4.23
2.54
1.31
1.30
1.27
6.10
1.09
1.22
1.08
1.01
1.03
0.95
1.06
1.73
0.97
3.00
3.07
f1 (ppm)


169.0
167.3
155.7
154.4
136.4
135.9
133.8
131.9
130.5
129.4
128.6
128.4
128.3
126.6
121.1
88.2
83.3
67.5
63.8
56.9
33.9
14.0
11.8
f1 (ppm)



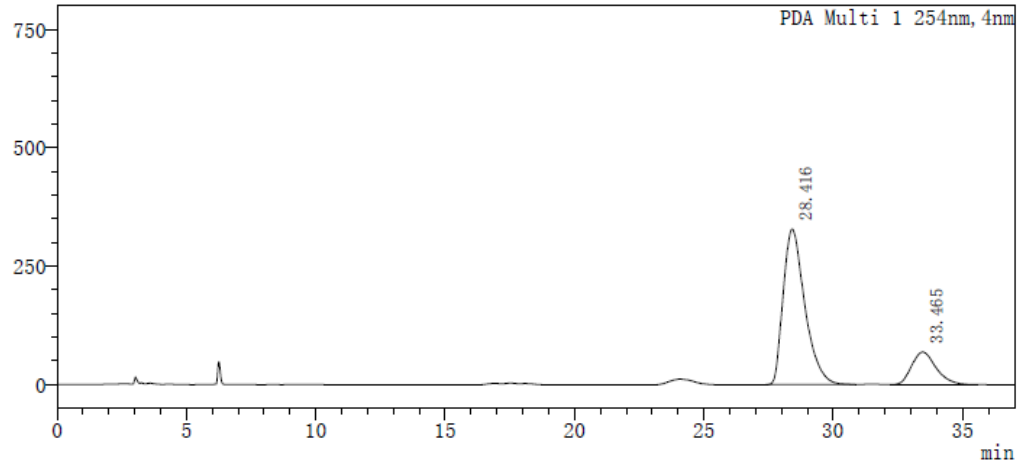
3ia



〈Peak table〉

PDA Ch1 254nm

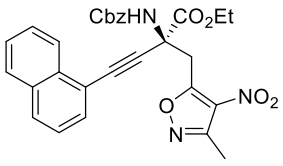
Peak#	Ret. Time	Height	Area	Area%
1	28.427	186069	10608470	50.078
2	33.330	162563	10575578	49.922
Total		348632	21184048	100.000



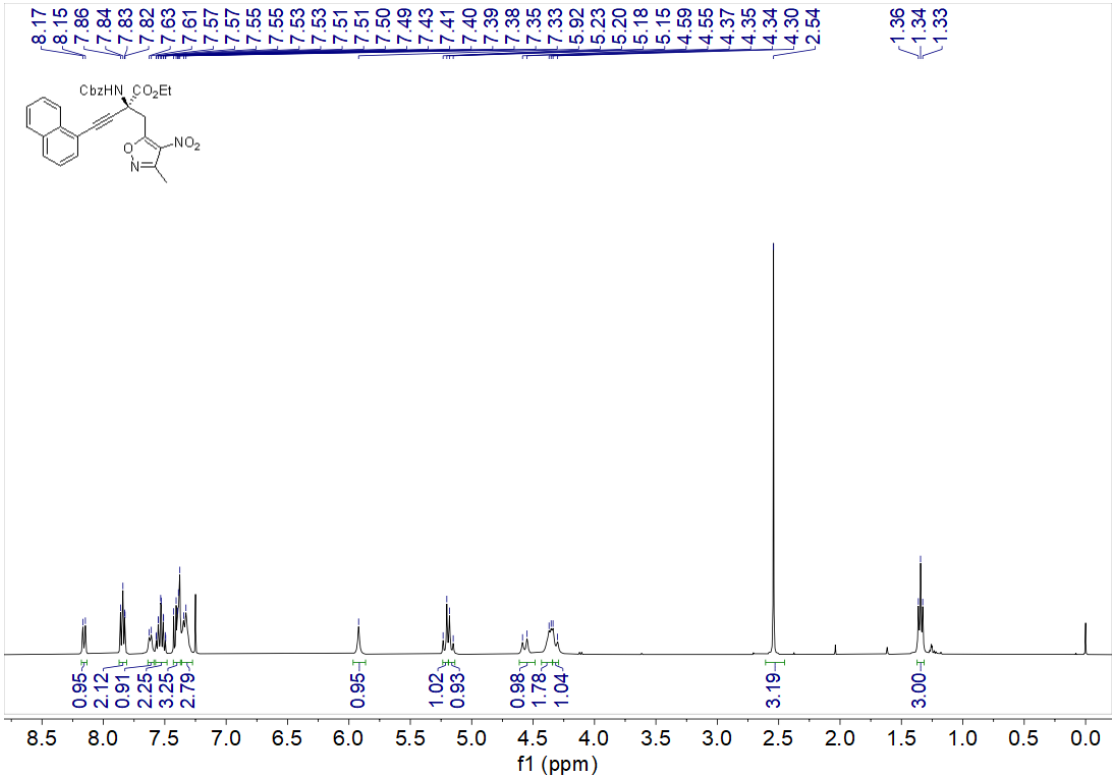
〈Peak table〉

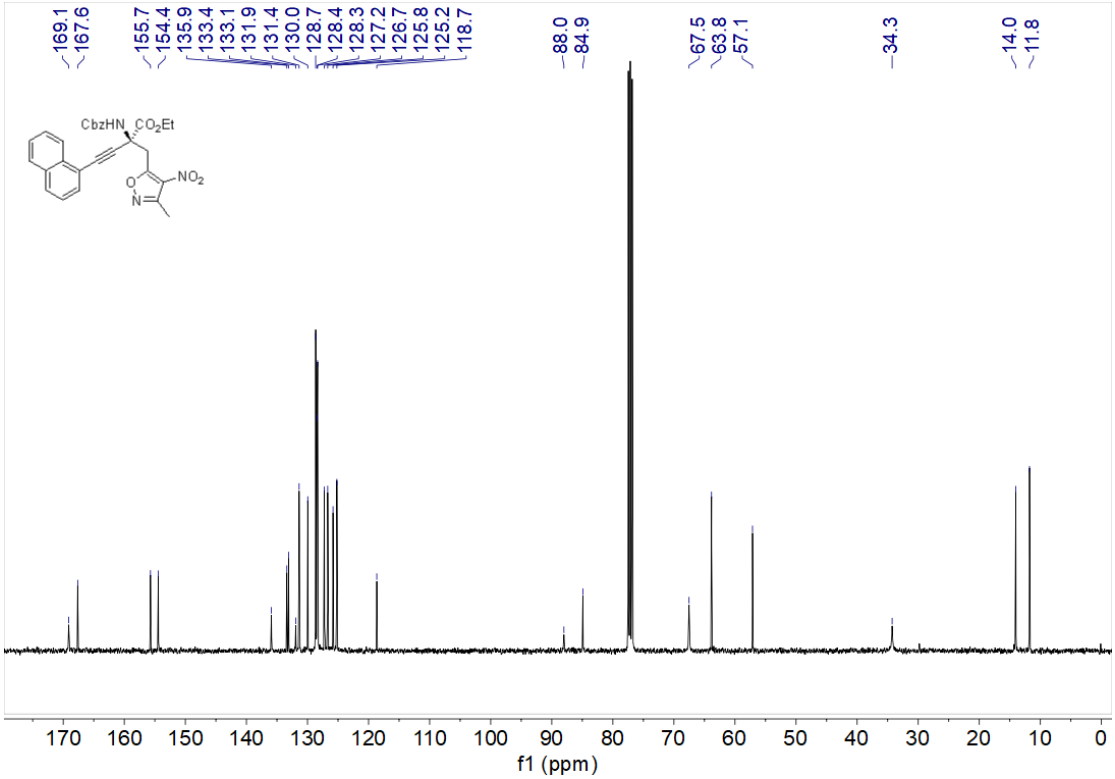
PDA Ch1 254nm

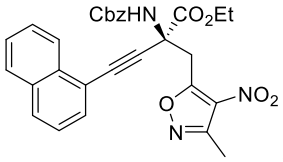
Peak#	Ret. Time	Height	Area	Area%
1	28.416	328332	19077195	81.002
2	33.465	68428	4474346	18.998
Total		396761	23551541	100.000


CbzHN
CO2Et
NO2
O
N

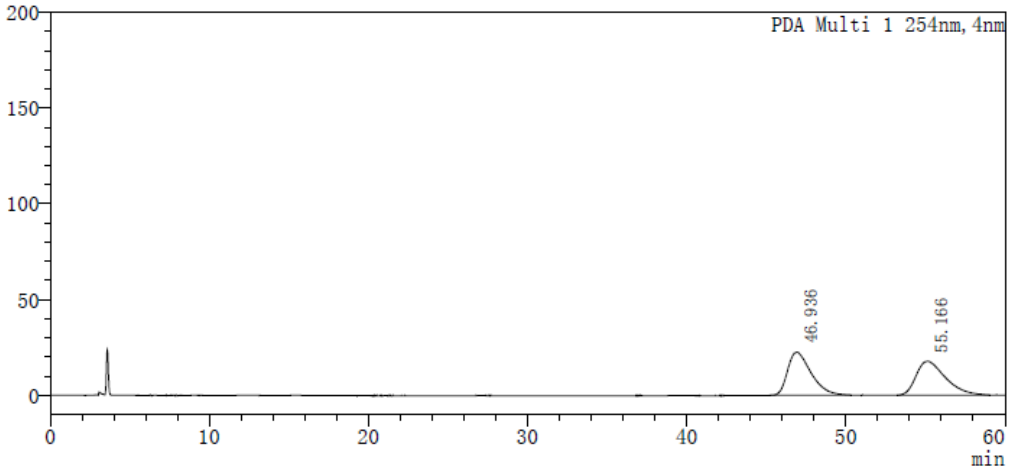
3ja


8.17 8.15 7.86 7.84 7.83 7.82 7.63 7.61 7.57 7.57 7.55 7.55 7.53 7.53 7.51 7.51 7.50 7.49 7.43 7.41 7.40 7.39 7.38 7.35 7.33 5.92 5.23 5.20 5.18 5.15 4.59 4.55 4.37 4.35 4.34 4.30 2.54
1.36 1.34 1.33
0.95 2.12 0.91 2.25 3.25 2.79 0.95 1.02 0.93 0.98 1.78 1.04 3.19 3.00
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


169.1 167.6 155.7 154.4 135.9 133.4 133.1 131.9 131.4 130.0 128.7 128.4 128.3 127.2 126.7 125.8 125.2 118.7
88.0 84.9 67.5 63.8 57.1 34.3 14.0 11.8
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)



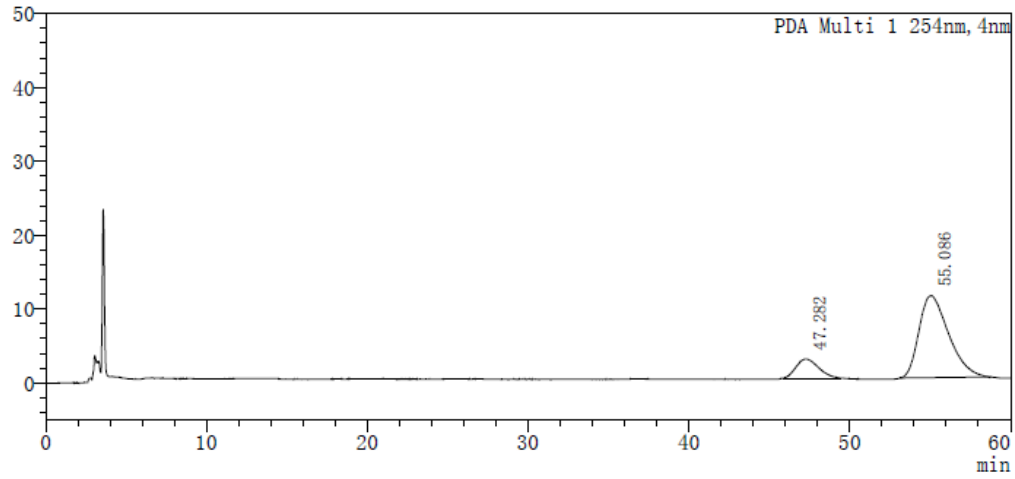
3ja



<Peak table>

PDA Ch1 254nm

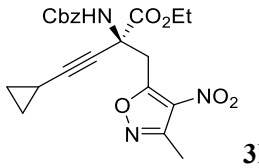
Peak#	Ret. Time	Height	Area	Area%
1	46.936	22395	2283253	50.286
2	55.166	17657	2257256	49.714
Total		40052	4540508	100.000



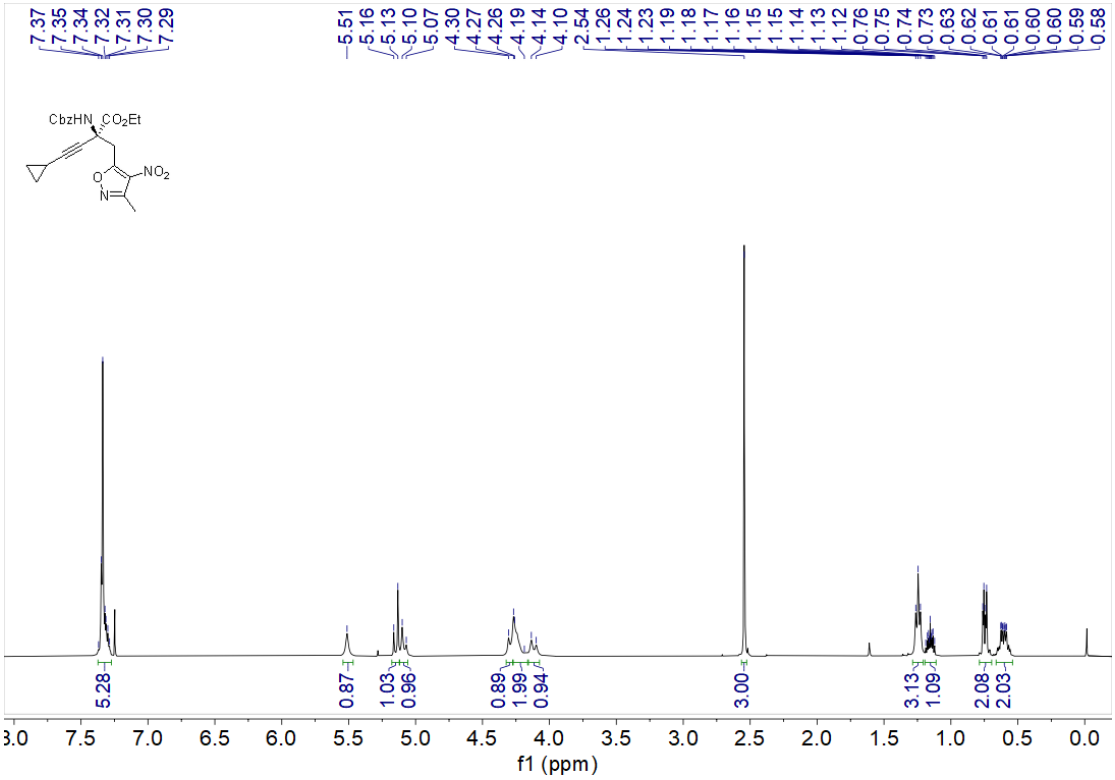
<Peak table>

PDA Ch1 254nm

Peak#	Ret. Time	Height	Area	Area%
1	47.282	2619	253730	15.089
2	55.086	11132	1427843	84.911
Total		13751	1681573	100.000


CbzHN
CO2Et
NO2
O
N

3ka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7.34
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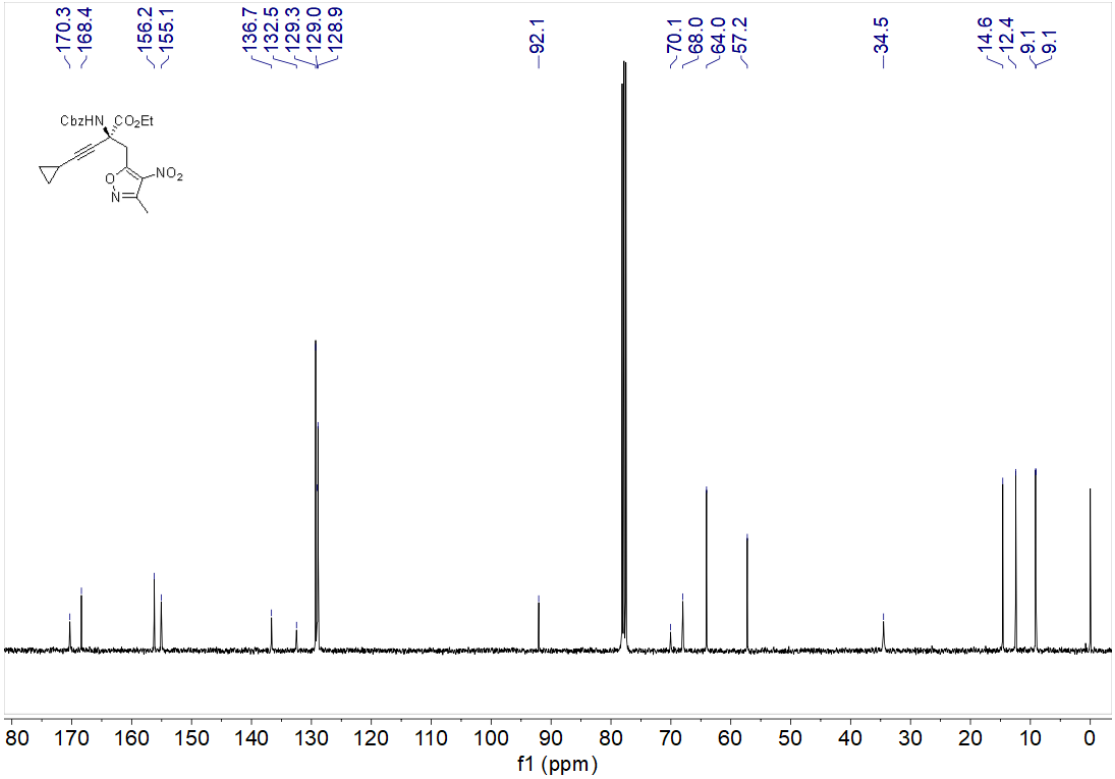
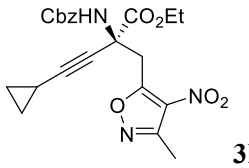
7.31
7.30
7.29
5.51
5.16
5.13
5.10
5.07
4.30
4.27
4.26
4.19
4.14
4.10
2.54
1.26
1.24
1.23
1.19
1.18
1.17
1.16
1.15
1.14
1.13
1.12
0.76
0.75
0.74
0.73
0.63
0.62
0.61
0.61
0.60
0.60
0.59
0.58
5.28
0.87
1.03
0.96
0.89
1.99
0.94
3.00
3.13
1.09
2.08
2.03
f1 (ppm)


170.3
168.4
156.2
155.1
136.7
132.5
129.3
129.0
128.9
92.1
70.1
68.0
64.0
57.2
34.5
14.6
12.4
9.1
9.1
f1 (ppm)



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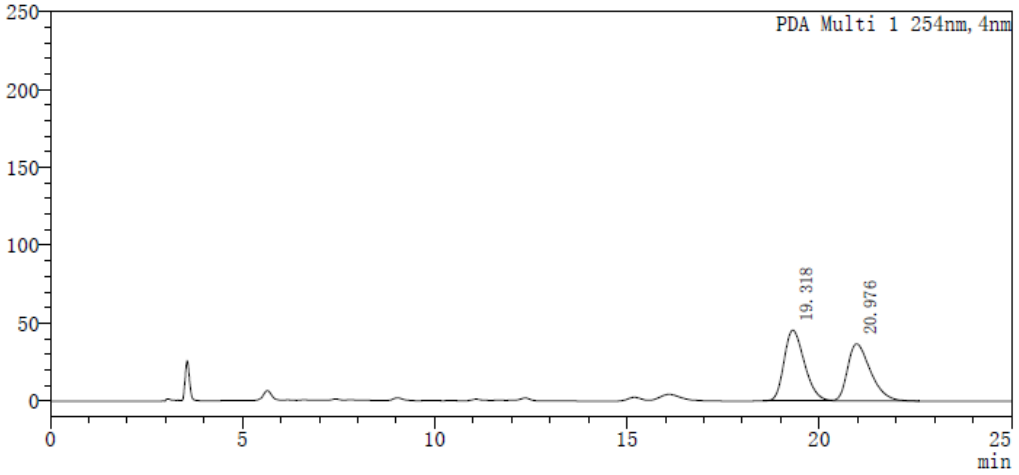
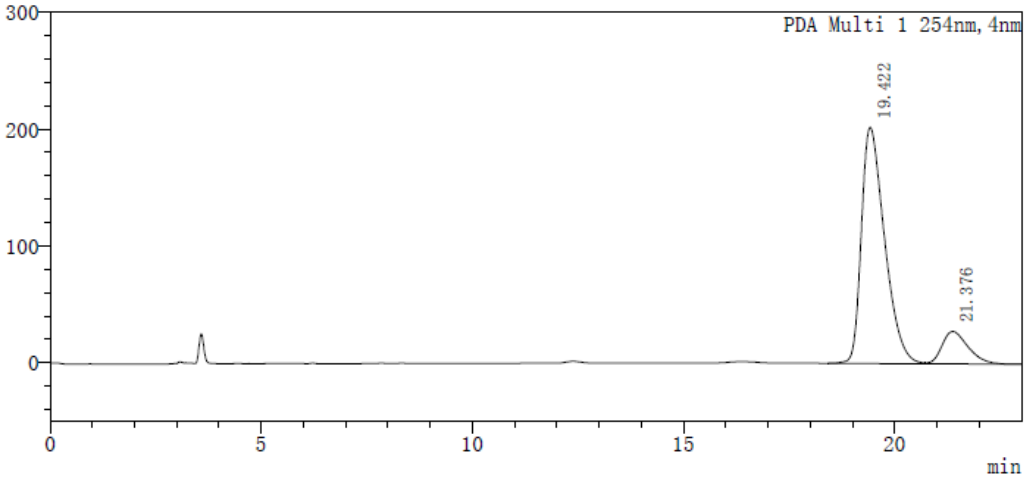


<Peak table>

PDA Ch1 254nm

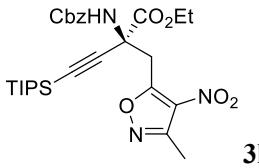
Peak#	Ret. Time	Height	Area	Area%
1	19.318	45322	1671604	52.388
2	20.976	36671	1519189	47.612
Total		81993	3190793	100.000



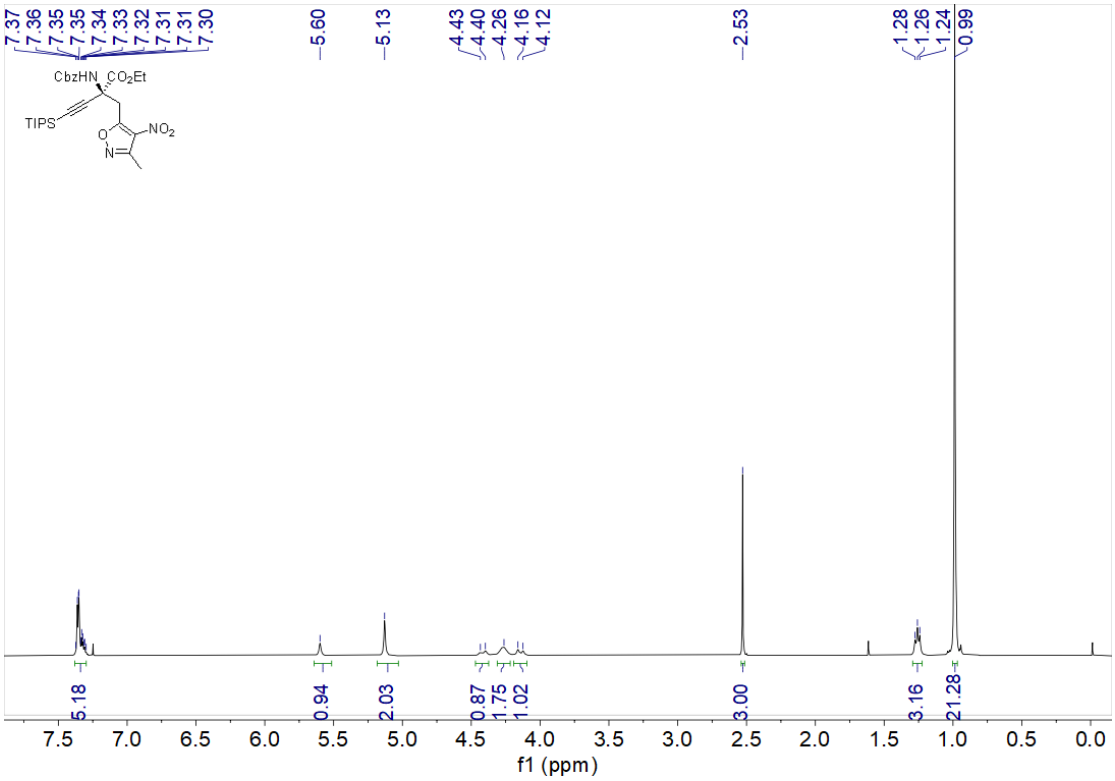
<Peak table>

PDA Ch1 254nm

Peak#	Ret. Time	Height	Area	Area%
1	19.422	201966	7721636	86.605
2	21.376	27805	1194306	13.395
Total		229771	8915942	100.000


CbzHN
CO2Et
TIPS
NO2
O
N

3la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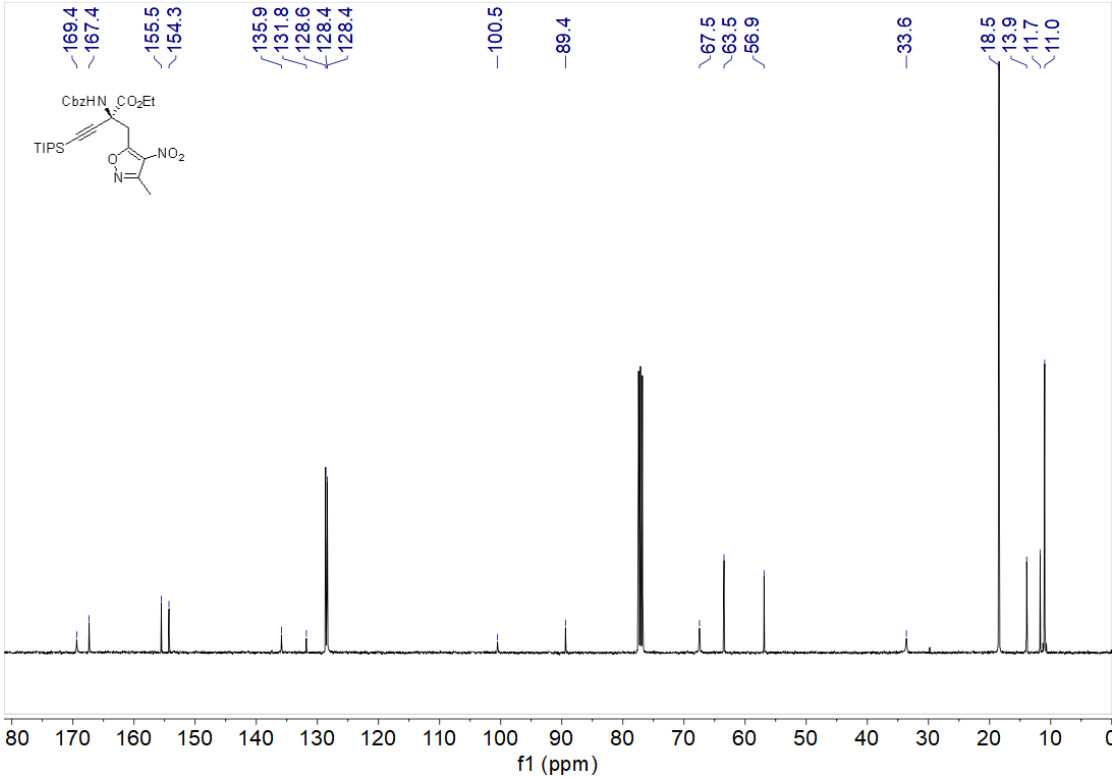
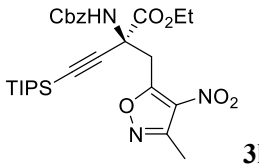
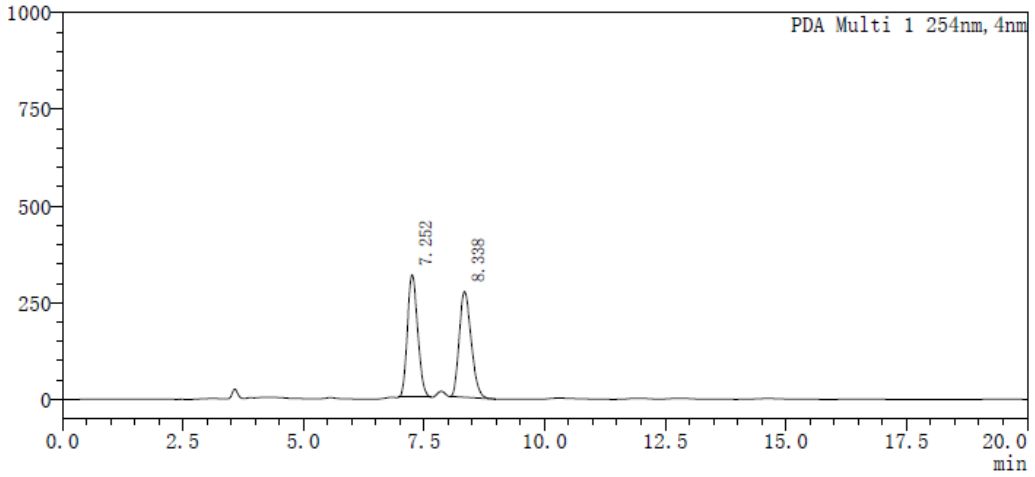
7.31
7.31
7.30
5.60
5.13
4.43
4.40
4.26
4.16
4.12
2.53
1.28
1.26
1.24
0.99
5.18
0.94
2.03
0.87
1.75
1.02
3.00
3.16
21.28
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


169.4
167.4
155.5
154.3
135.9
131.8
128.6
128.4
128.4
100.5
89.4
67.5
63.5
56.9
33.6
18.5
13.9
11.7
11.0
80
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)



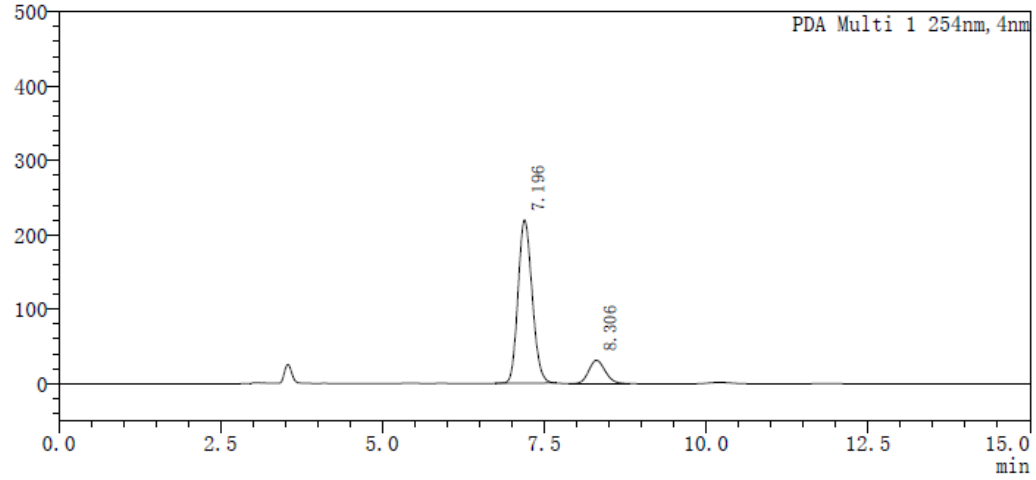
3la



<Peak table>

PDA Ch1 254nm

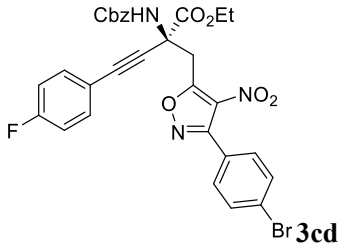
Peak#	Ret. Time	Height	Area	Area%
1	7.252	316464	4703503	49.999
2	8.338	272844	4703708	50.001
Total		589307	9407211	100.000



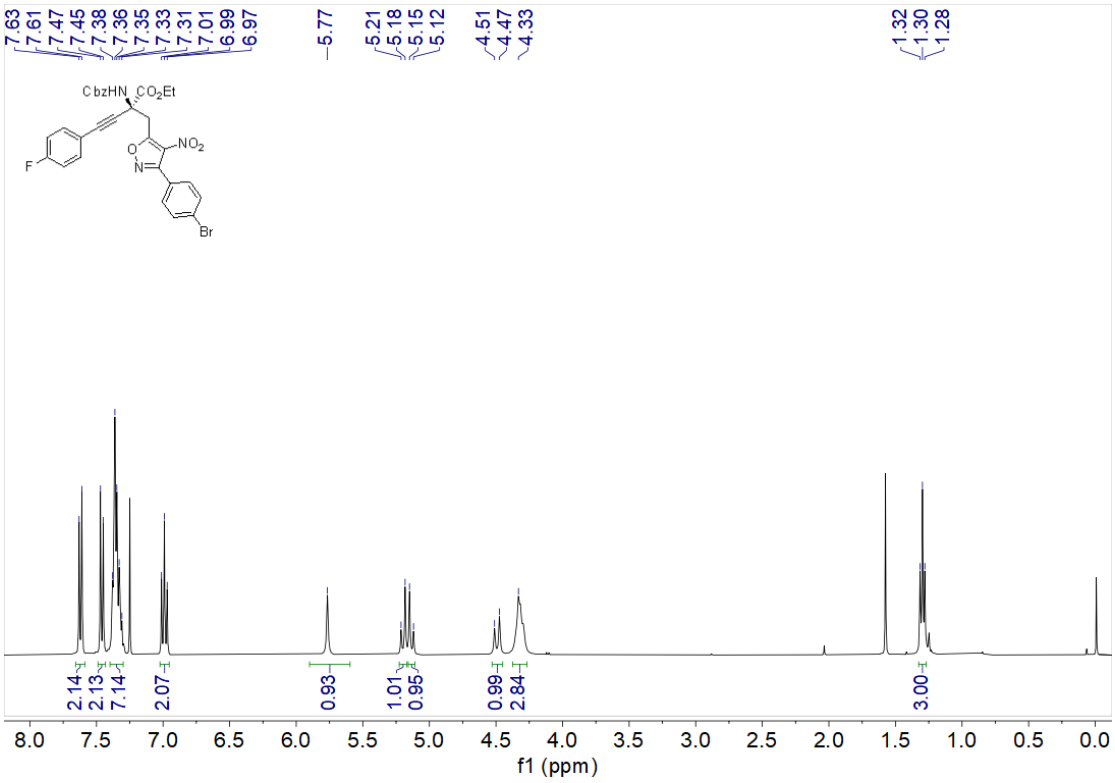
<Peak table>

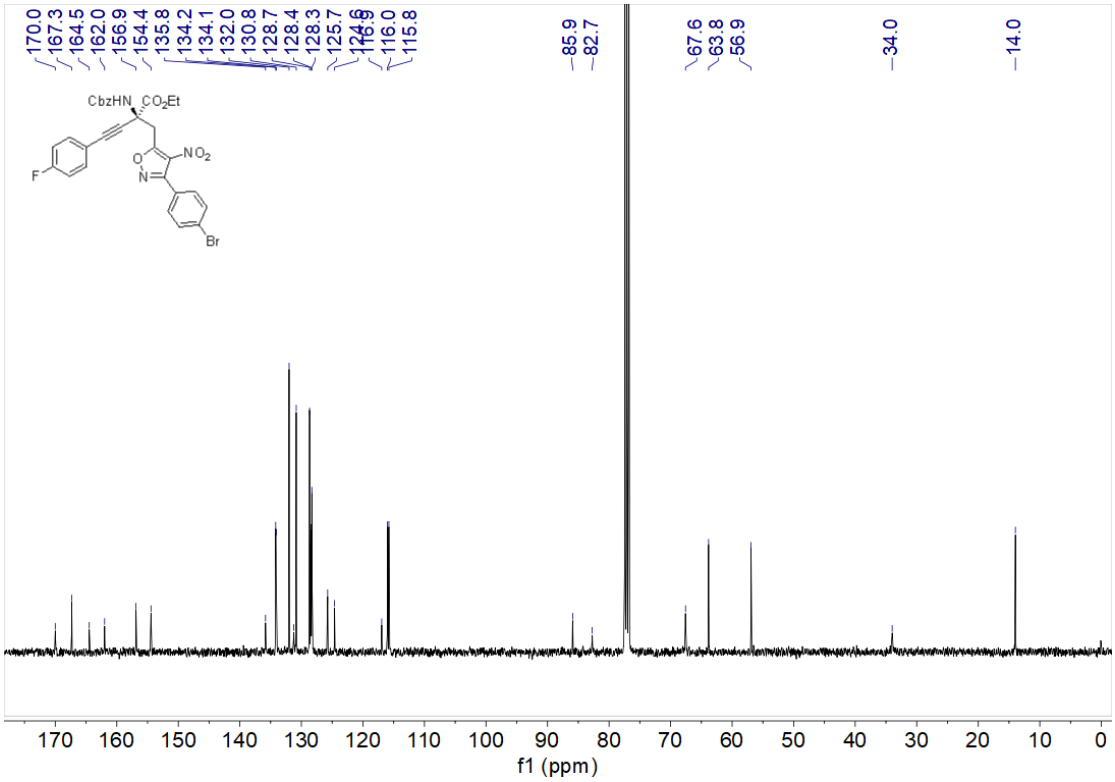
PDA Ch1 254nm

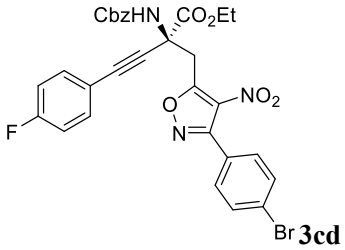
Peak#	Ret. Time	Height	Area	Area%
1	7.196	219243	3334428	85.912
2	8.306	31230	546791	14.088
Total		250473	3881219	100.000


CbzHN
CO2Et
NO2
O
N
F
Br

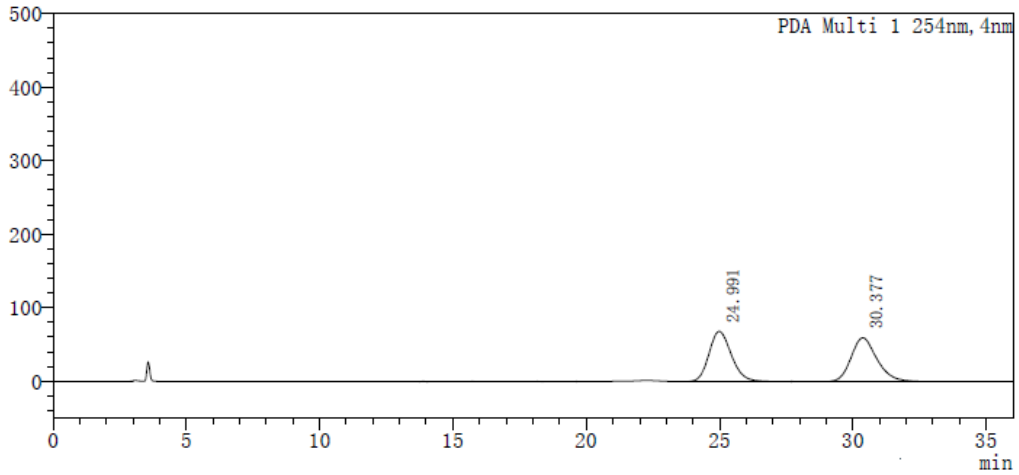
3cd


7.63
7.61
7.47
7.45
7.38
7.36
7.35
7.33
7.31
7.01
6.99
6.97
5.77
5.21
5.18
5.15
5.12
4.51
4.47
4.33
1.32
1.30
1.28
2.14
2.13
7.14
2.07
0.93
1.01
0.95
0.99
2.84
3.00
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


170.0
167.3
164.5
162.0
156.9
154.4
135.8
134.2
134.1
132.0
130.8
128.7
128.4
128.3
125.7
116.9
116.0
115.8
85.9
82.7
67.6
63.8
56.9
34.0
14.0
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)



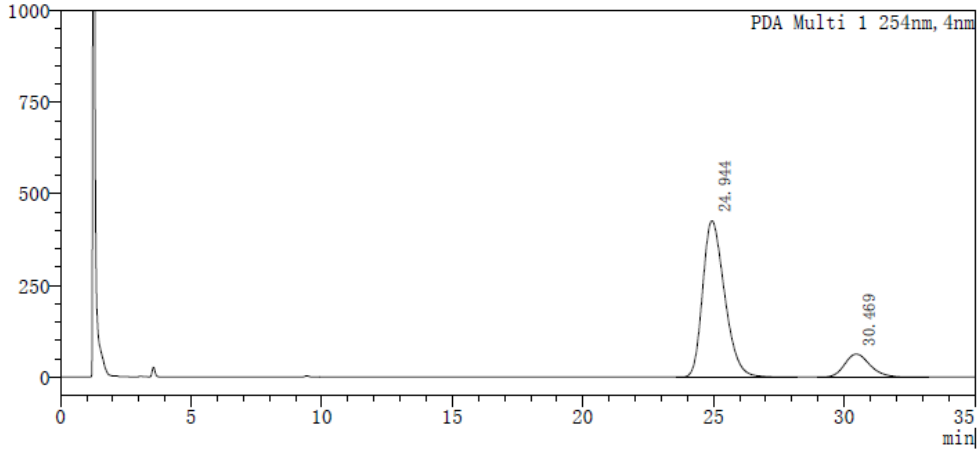
3cd



<Peak table>

PDA Ch1 254nm

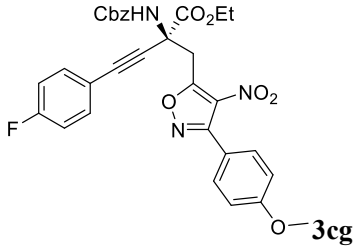
Peak#	Ret. Time	Height	Area	Area%
1	24.991	68034	3964778	49.708
2	30.377	59459	4011402	50.292
Total		127494	7976180	100.000



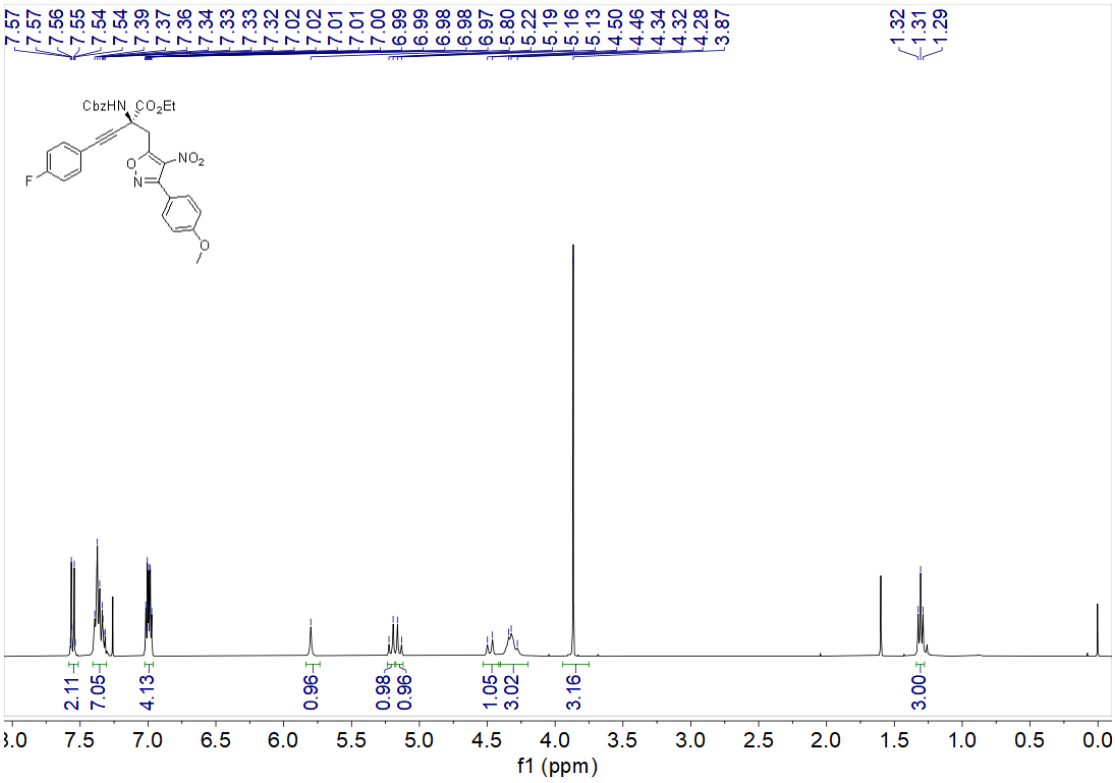
<Peak table>

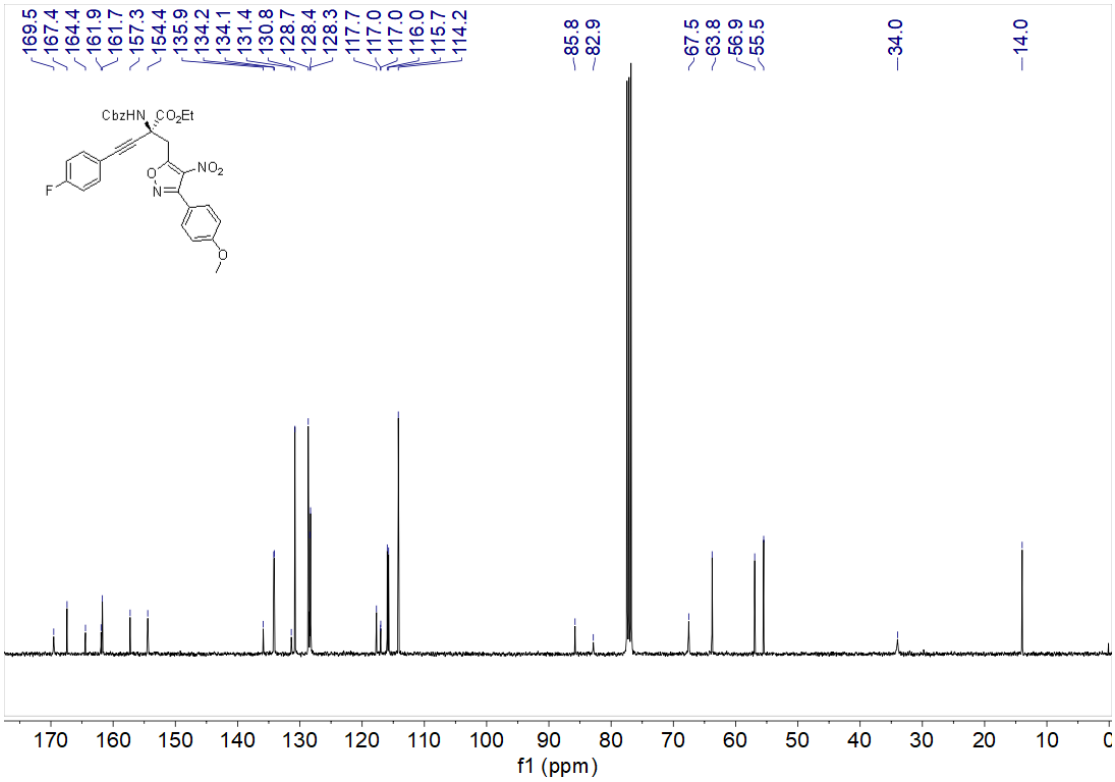
PDA Ch1 254nm

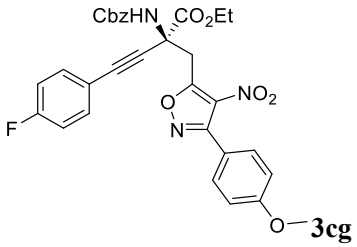
Peak#	Ret. Time	Height	Area	Area%
1	24.944	426702	24963984	85.487
2	30.469	62512	4238173	14.513
Total		489215	29202158	100.000

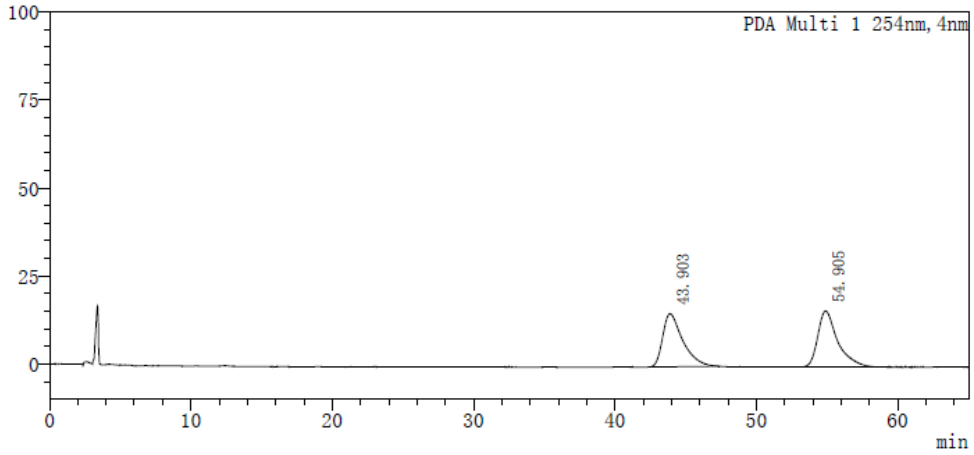

CbzHN
CO2Et
NO2
F
O
N
O

3cg


7.57 7.57 7.56 7.55 7.54 7.54 7.39 7.37 7.36 7.34 7.33 7.33 7.32 7.02 7.02 7.01 7.01 7.00 6.99 6.99 6.98 6.98 6.97 5.80 5.22 5.19 5.16 5.13 4.50 4.46 4.34 4.32 4.28 3.87
1.32 1.31 1.29
2.11 7.05 4.13 0.96 0.98 0.96 1.05 3.02 3.16 3.00
f1 (ppm)


169.5 167.4 164.4 161.9 161.7 157.3 154.4 135.9 134.2 134.1 131.4 130.8 128.7 128.4 128.3 117.7 117.0 117.0 116.0 115.7 114.2
85.8 82.9
67.5 63.8 56.9 55.5
34.0
14.0
f1 (ppm)

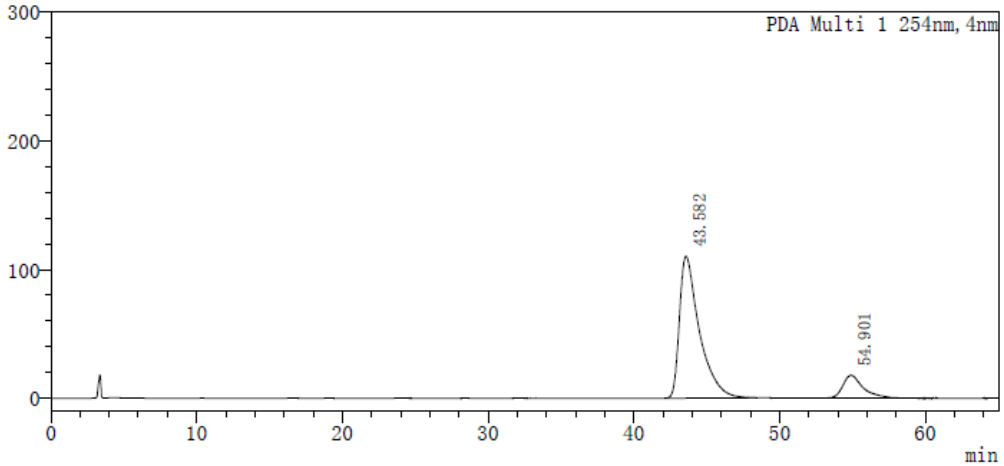




<Peak table>

PDA Ch1 254nm

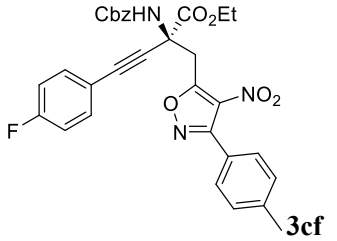
Peak#	Ret. Time	Height	Area	Area%
1	43.903	15095	1488388	49.249
2	54.905	15861	1533801	50.751
Total		30957	3022189	100.000



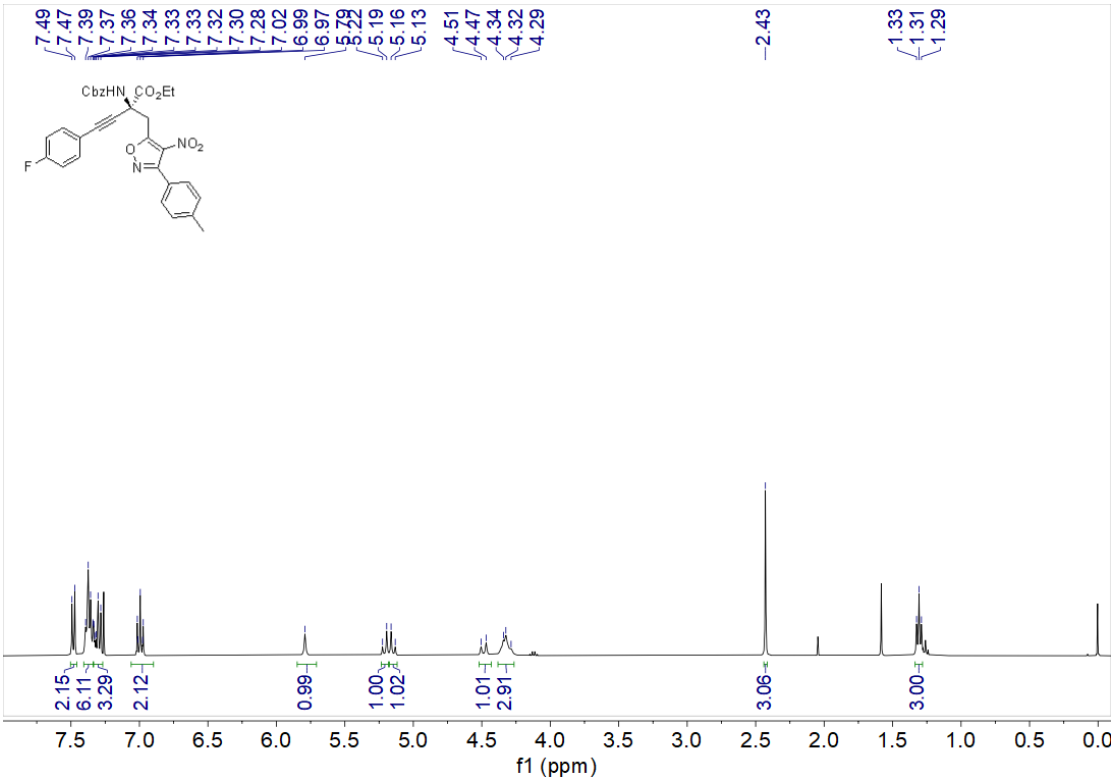
<Peak table>

PDA Ch1 254nm

Peak#	Ret. Time	Height	Area	Area%
1	43.582	110173	10445294	86.092
2	54.901	17645	1687474	13.908
Total		127819	12132768	100.000


CbzHN
CO2Et
NO2
O
N
F

3cf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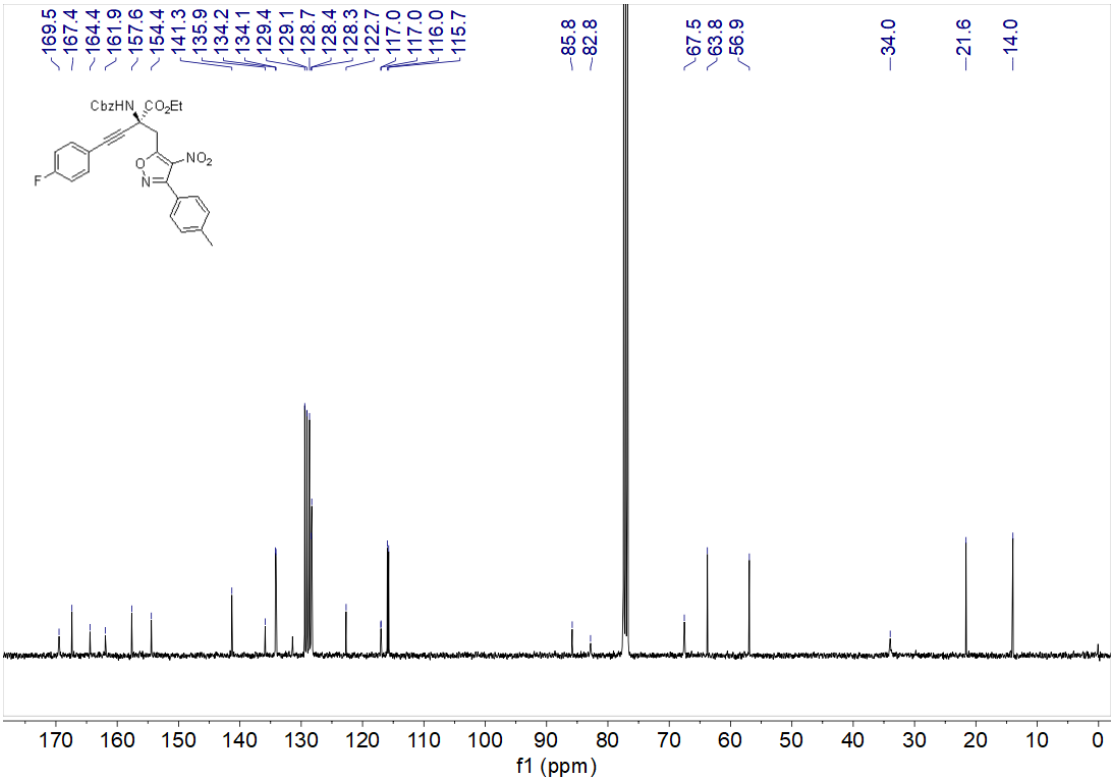
7.34
7.33
7.33
7.32
7.30
7.28
7.02
6.99
6.97
5.22
5.19
5.16
5.13
4.51
4.47
4.34
4.32
4.29
2.43
1.33
1.31
1.29
2.15
6.11
3.29
2.12
0.99
1.00
1.02
1.01
2.91
3.06
3.00
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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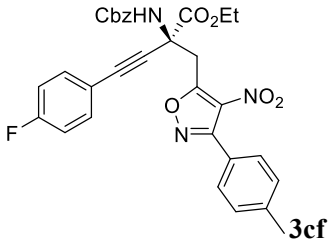
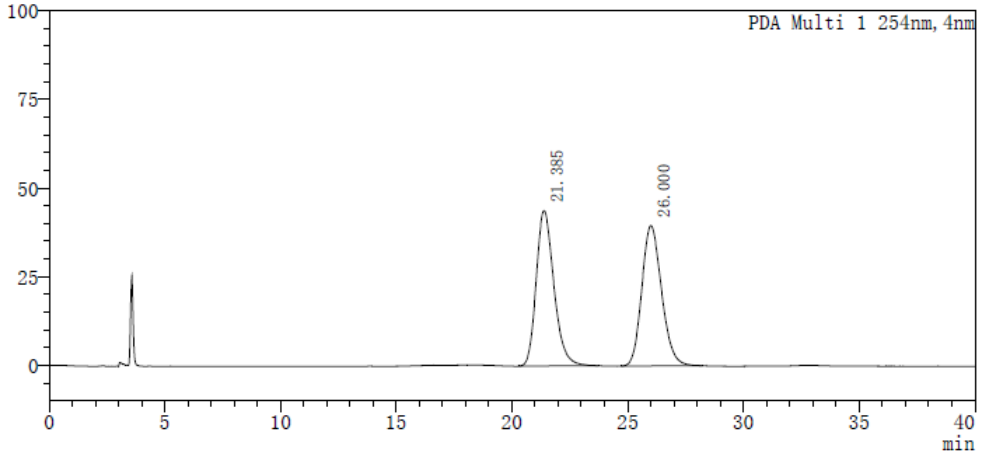
167.4
164.4
161.9
157.6
154.4
141.3
135.9
134.2
134.1
129.4
129.1
128.7
128.4
128.3
122.7
117.0
117.0
116.0
115.7
85.8
82.8
67.5
63.8
56.9
34.0
21.6
14.0
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)



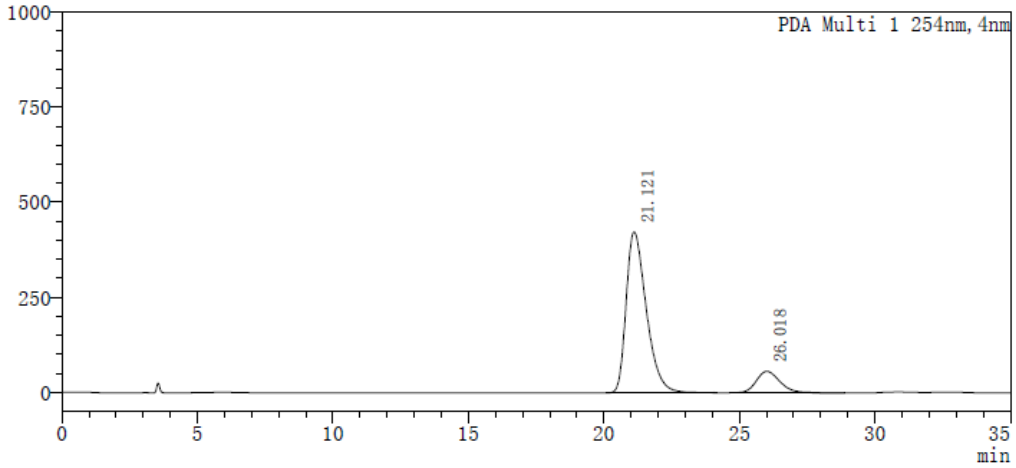
3cf



〈Peak table〉

PDA Ch1 254nm

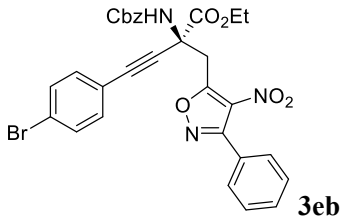
Peak#	Ret. Time	Height	Area	Area%
1	21.385	43835	2331217	49.761
2	26.000	39572	2353641	50.239
Total		83408	4684858	100.000



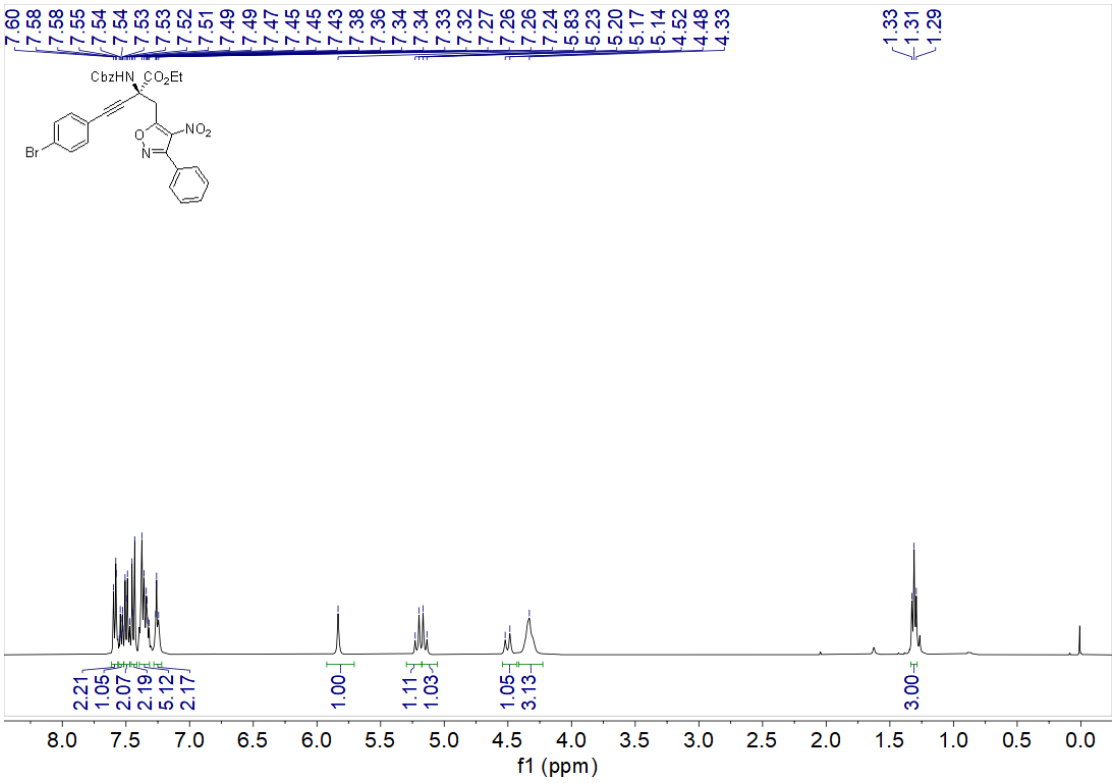
〈Peak table〉

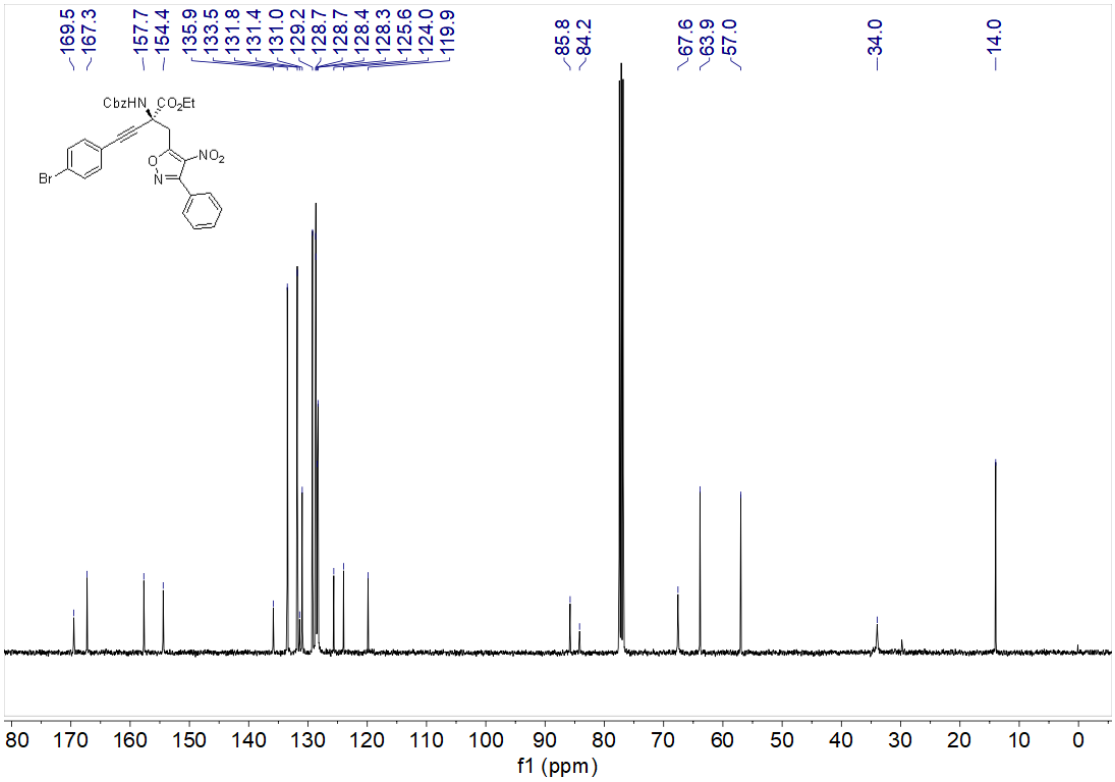
PDA Ch1 254nm

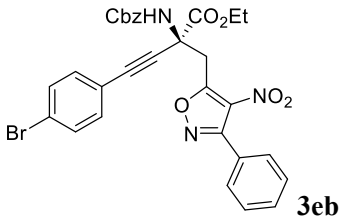
Peak#	Ret. Time	Height	Area	Area%
1	21.121	423504	21942707	86.484
2	26.018	56457	3429321	13.516
Total		479961	25372028	100.000


CbzHN
CO2Et
NO2
O
N
Br

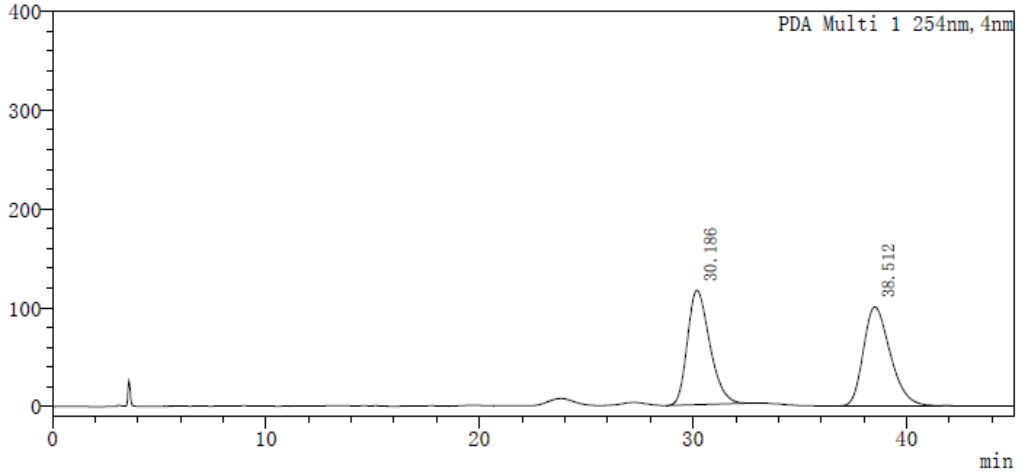
3eb


7.60
7.58
7.58
7.55
7.54
7.54
7.53
7.53
7.52
7.51
7.49
7.49
7.47
7.45
7.45
7.43
7.38
7.36
7.34
7.34
7.33
7.32
7.27
7.26
7.26
7.24
5.83
5.23
5.20
5.17
5.14
4.52
4.48
4.33
1.33
1.31
1.29
2.21
1.05
2.07
2.19
5.12
2.17
1.00
1.11
1.03
1.05
3.13
3.00
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)


169.5
167.3
157.7
154.4
135.9
133.5
131.8
131.4
131.0
129.2
128.7
128.7
128.4
128.3
125.6
124.0
119.9
85.8
84.2
67.6
63.9
57.0
34.0
14.0
80
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)



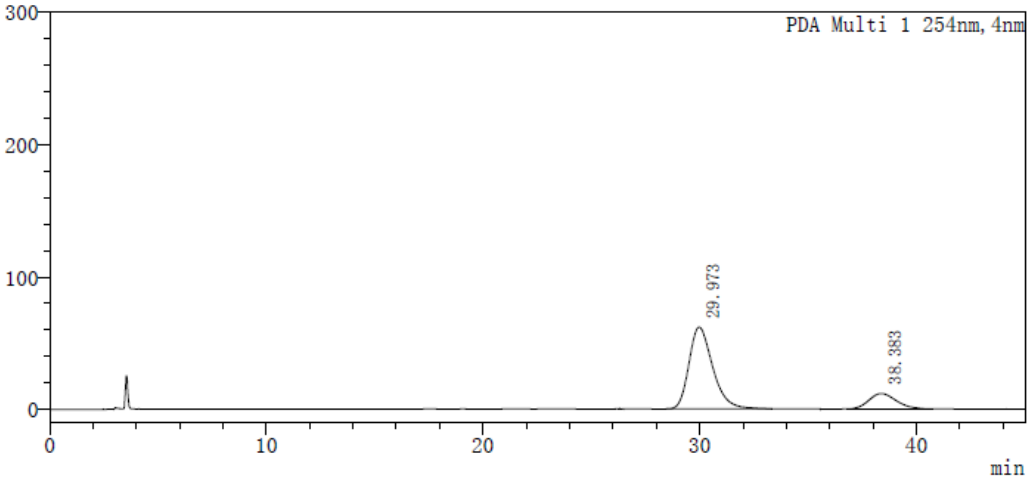
3eb



〈Peak table〉

PDA Ch1 254nm

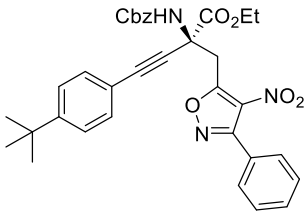
Peak#	Ret. Time	Height	Area	Area%
1	30.186	115858	8442854	48.945
2	38.512	100324	8806763	51.055
Total		216182	17249617	100.000



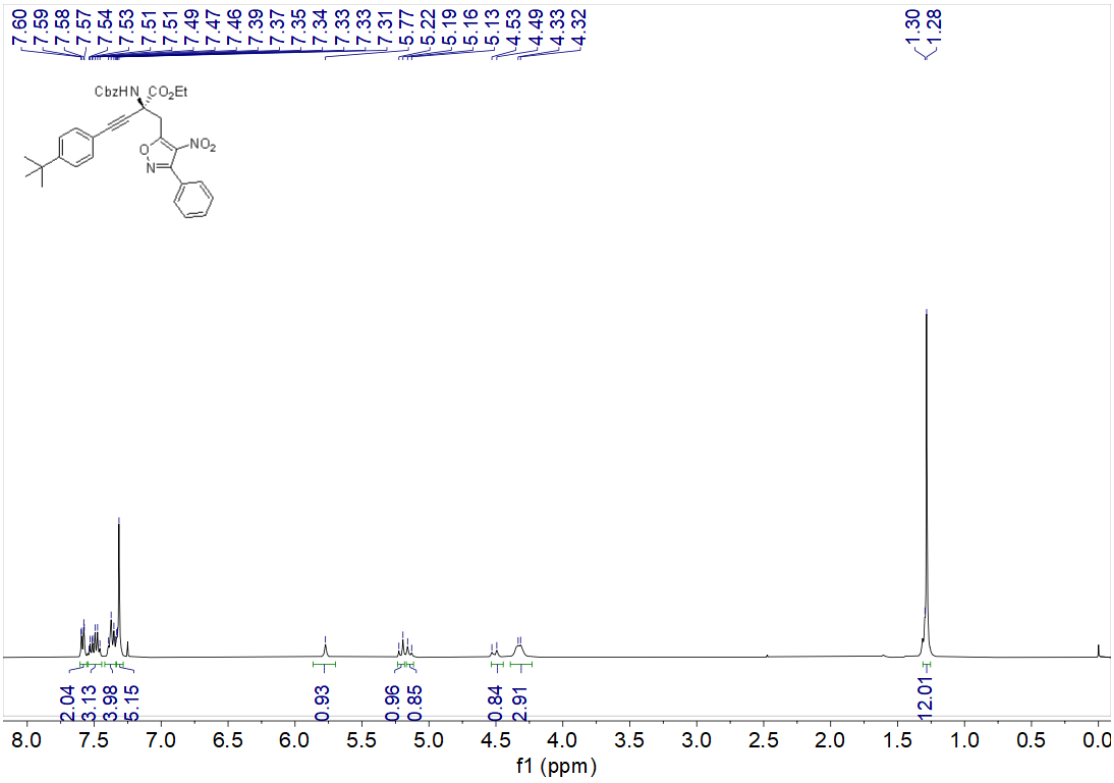
〈Peak table〉

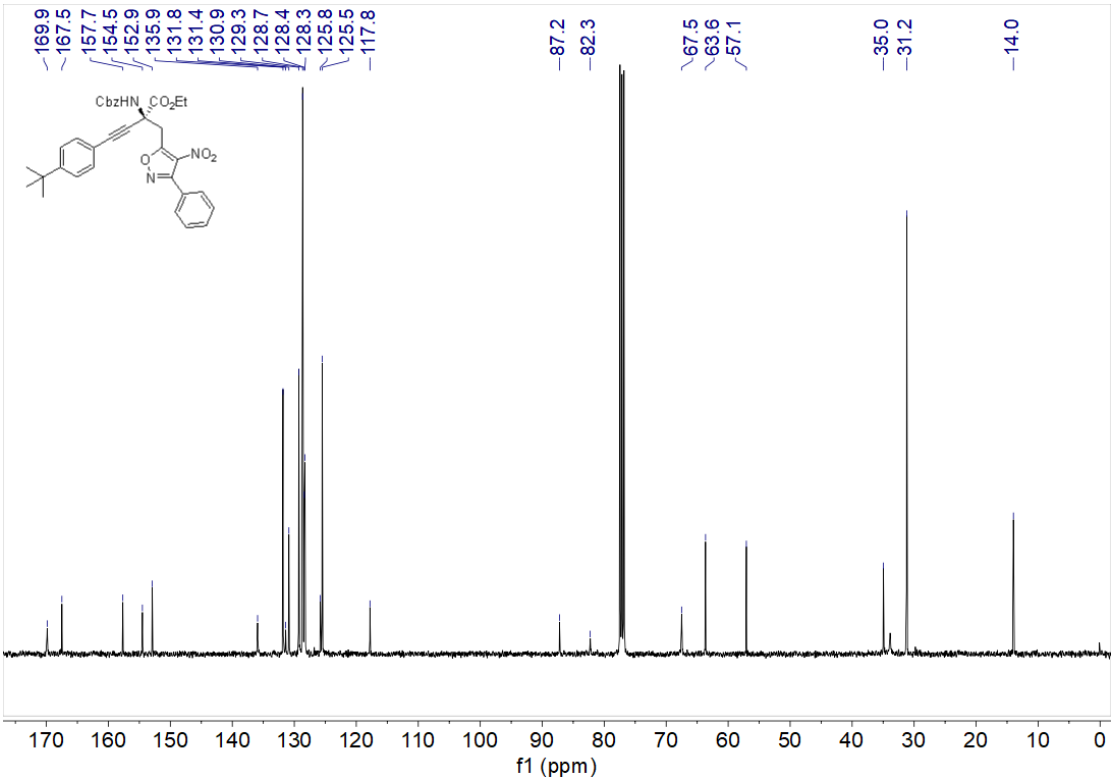
PDA Ch1 254nm

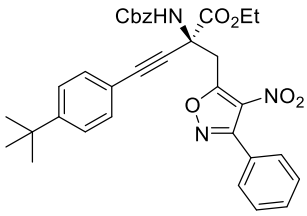
Peak#	Ret. Time	Height	Area	Area%
1	29.973	61778	4701722	82.130
2	38.383	11644	1022995	17.870
Total		73422	5724717	100.000


CbzHN
CO2Et
NO2
O
N

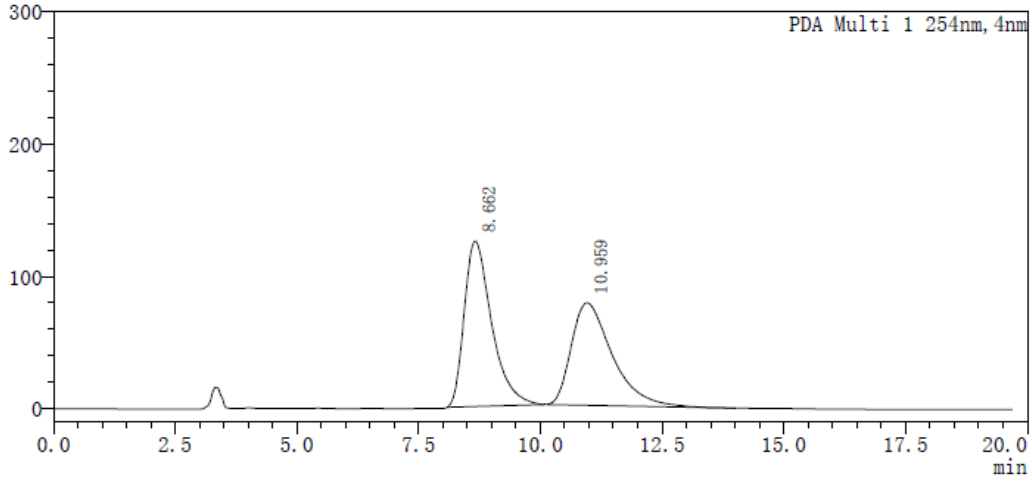
3hb


7.60
7.59
7.58
7.57
7.54
7.53
7.51
7.51
7.49
7.47
7.46
7.39
7.37
7.35
7.34
7.33
7.33
7.31
5.77
5.22
5.19
5.16
5.13
4.53
4.49
4.33
4.32
1.30
1.28
2.04
3.13
3.98
5.15
0.93
0.96
0.85
0.84
2.91
12.01
f1 (ppm)


169.9
167.5
157.7
154.5
152.9
135.9
131.8
131.4
130.9
129.3
128.7
128.4
128.3
125.8
125.5
117.8
87.2
82.3
67.5
63.6
57.1
35.0
31.2
14.0
f1 (ppm)



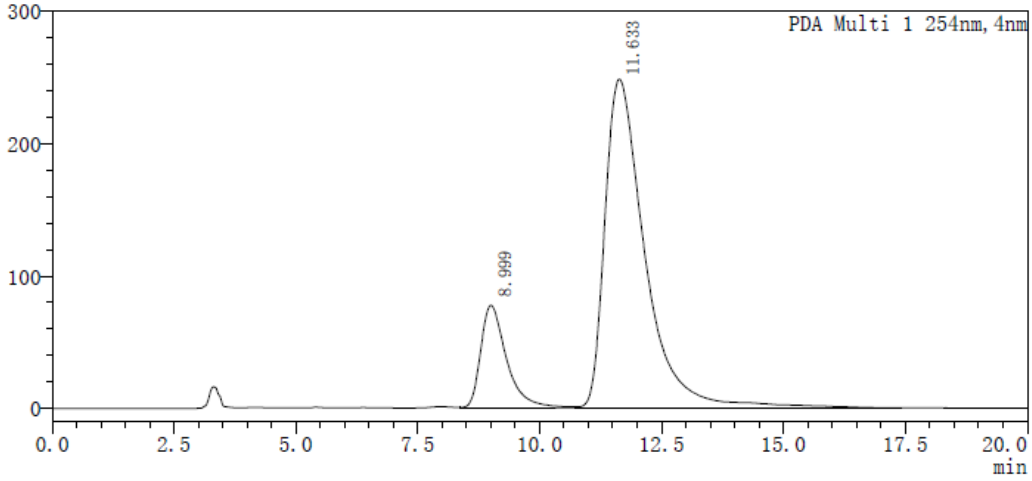
3hb



<Peak table>

PDA Ch1 254nm

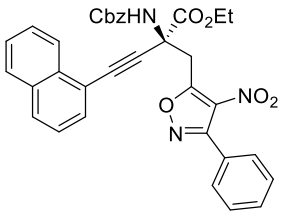
Peak#	Ret. Time	Height	Area	Area%
1	8.662	125038	4896151	51.968
2	10.959	77334	4525348	48.032
Total		202373	9421499	100.000



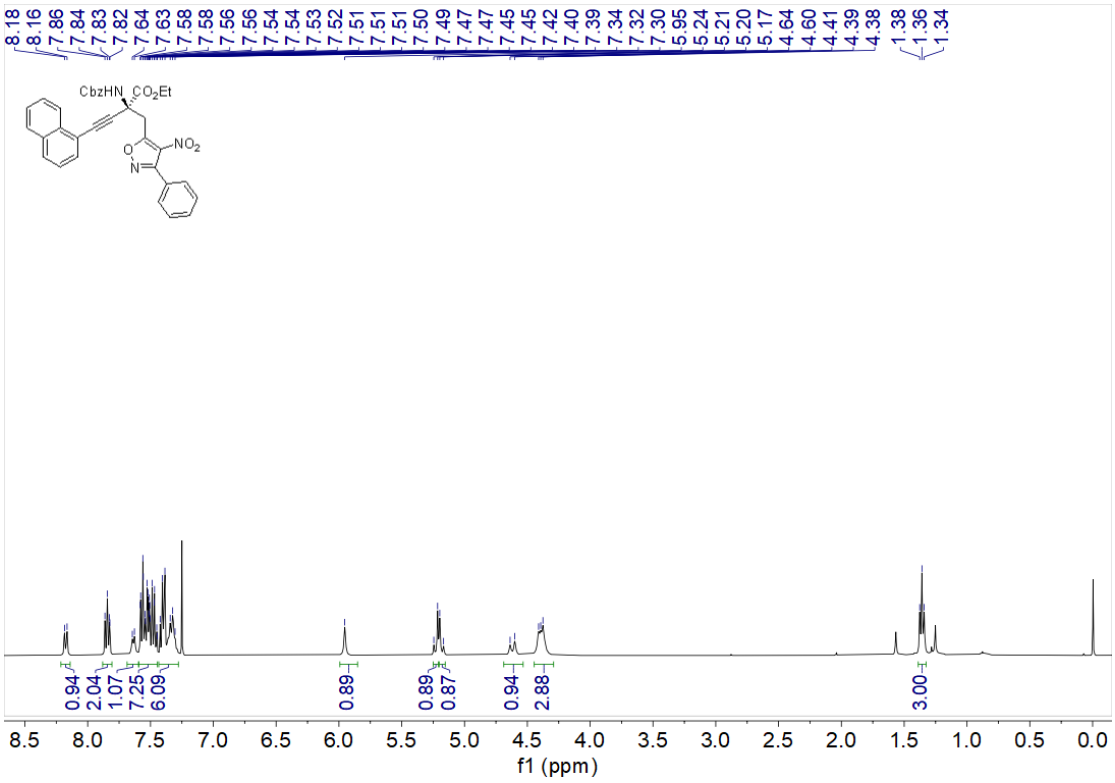
<Peak table>

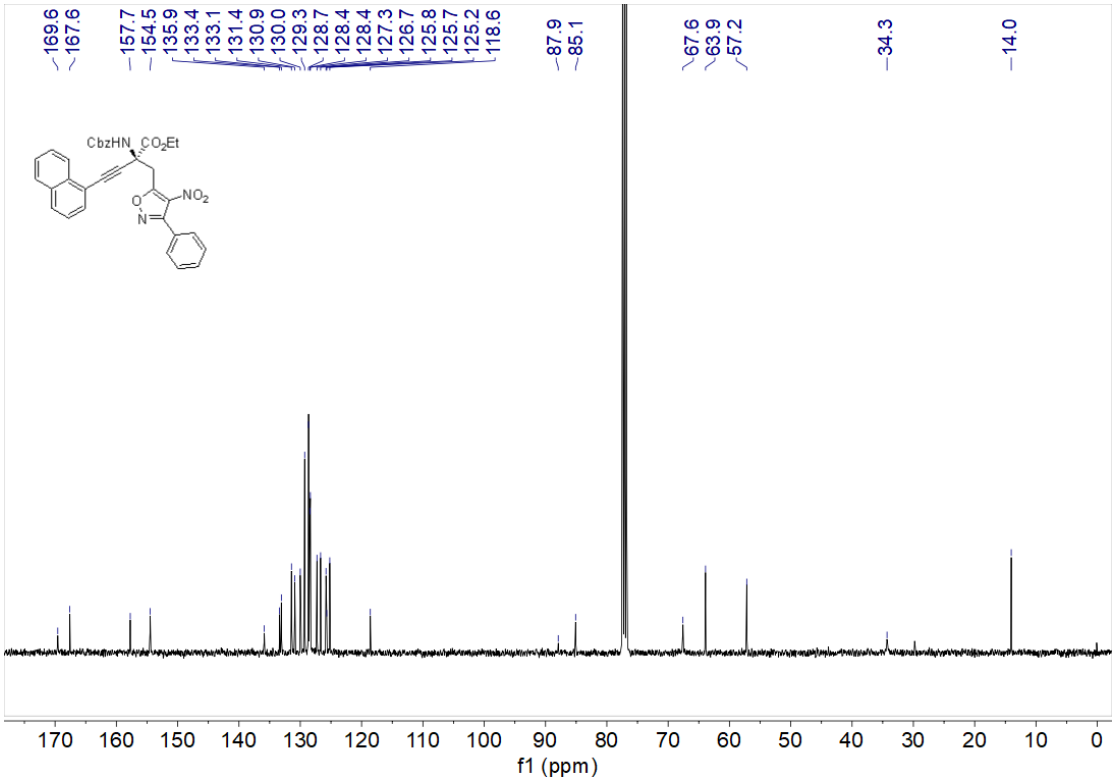
PDA Ch1 254nm

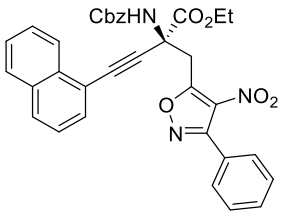
Peak#	Ret. Time	Height	Area	Area%
1	8.999	77597	2886112	16.845
2	11.633	248346	14246829	83.155
Total		325943	17132942	100.000


CbzHN
CO2Et
NO2
O
N

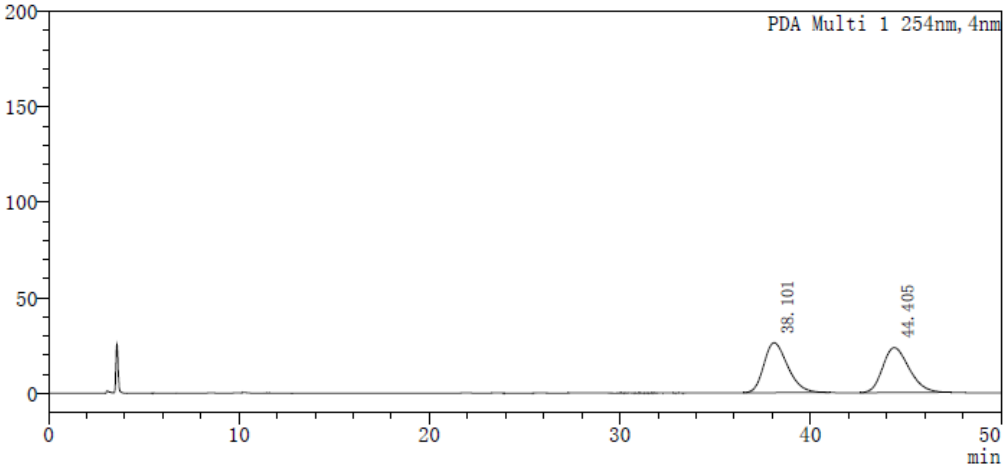
3jb


8.18 8.16 7.86 7.84 7.83 7.82 7.64 7.63 7.58 7.58 7.56 7.56 7.54 7.54 7.53 7.52 7.51 7.51 7.51 7.50 7.49 7.47 7.47 7.45 7.45 7.42 7.40 7.39 7.34 7.32 7.30 5.95 5.24 5.21 5.20 5.17 4.64 4.60 4.41 4.39 4.38 1.38 1.36 1.34
CbzHN CO2Et
NO2
0.94 2.04 1.07 7.25 6.09 0.89 0.89 0.87 0.94 2.88 3.00
8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


169.6 167.6 157.7 154.5 135.9 133.4 133.1 131.4 130.9 130.0 129.3 128.7 128.4 128.4 127.3 126.7 125.8 125.7 125.2 118.6 87.9 85.1 67.6 63.9 57.2 34.3 14.0
CbzHN CO2Et
NO2
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)



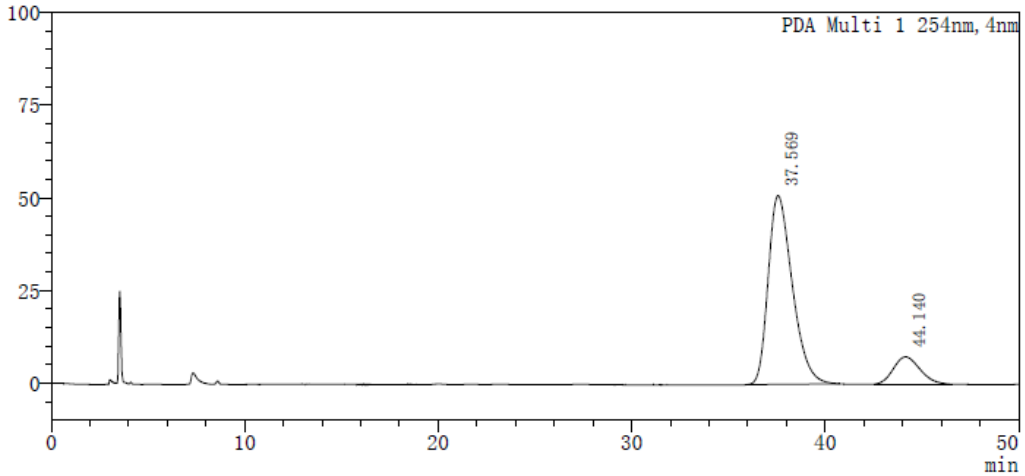
3jb



〈Peak table〉

PDA Ch1 254nm

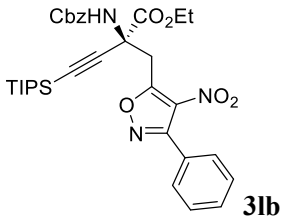
Peak#	Ret. Time	Height	Area	Area%
1	38.101	26106	2271682	49.999
2	44.405	23495	2271753	50.001
Total		49601	4543435	100.000



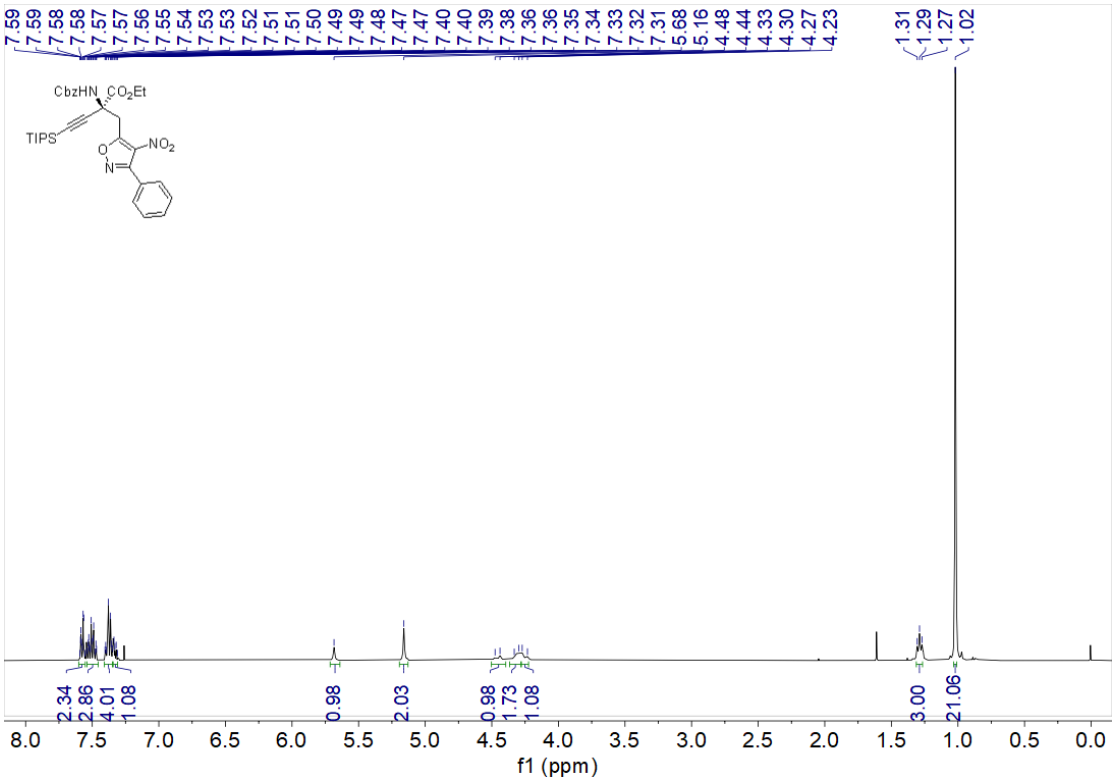
〈Peak table〉

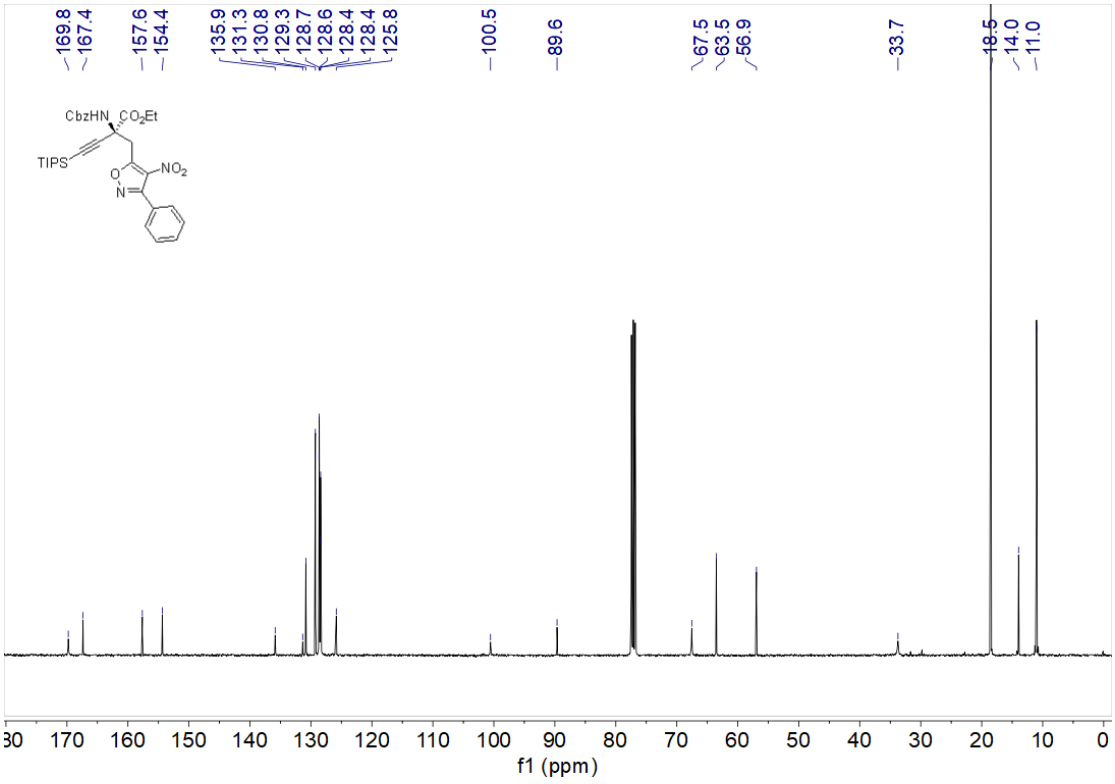
PDA Ch1 254nm

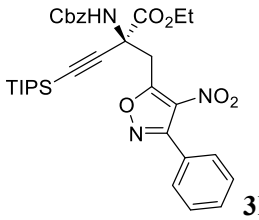
Peak#	Ret. Time	Height	Area	Area%
1	37.569	50930	4418331	86.364
2	44.140	7333	697602	13.636
Total		58263	5115933	100.000


CbzHN
CO2Et
TIPS
NO2
O
N

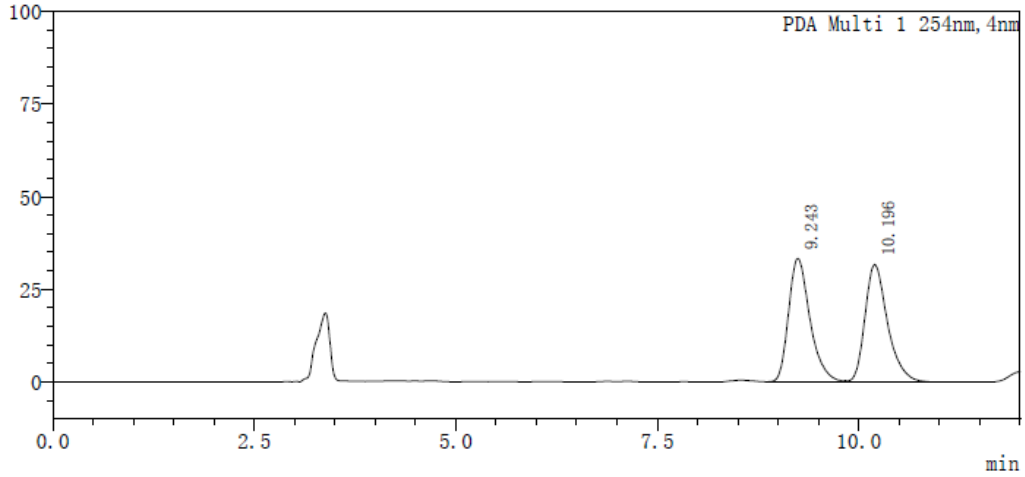
3lb


7.59 7.59 7.58 7.58 7.57 7.57 7.56 7.55 7.54 7.53 7.53 7.52 7.51 7.51 7.50 7.49 7.49 7.48 7.47 7.47 7.40 7.40 7.39 7.38 7.36 7.36 7.35 7.34 7.33 7.32 7.31 5.68 5.16 4.48 4.44 4.33 4.30 4.27 4.23
1.31 1.29 1.27 1.02
2.34 2.86 4.01 1.08 0.98 2.03 0.98 1.73 1.08 3.00 21.06
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


169.8 167.4 157.6 154.4 135.9 131.3 130.8 129.3 128.7 128.6 128.4 128.4 125.8 100.5 89.6 67.5 63.5 56.9 33.7 18.5 14.0 11.0
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)



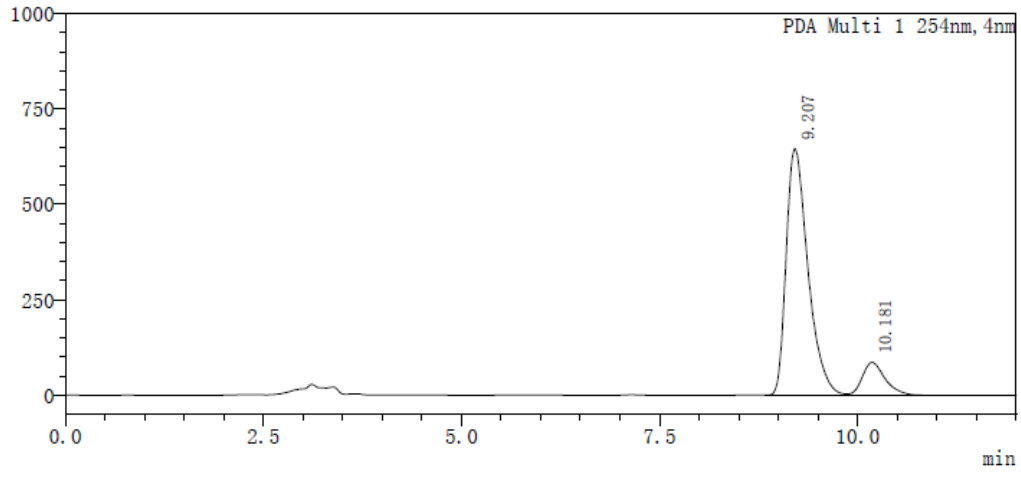
3lb



<Peak table>

PDA Ch1 254nm

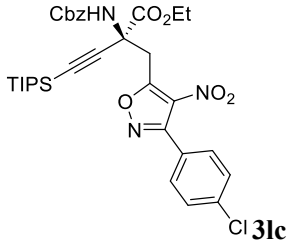
Peak#	Ret. Time	Height	Area	Area%
1	9.243	33320	618324	50.030
2	10.196	31720	617572	49.970
Total		65040	1235895	100.000



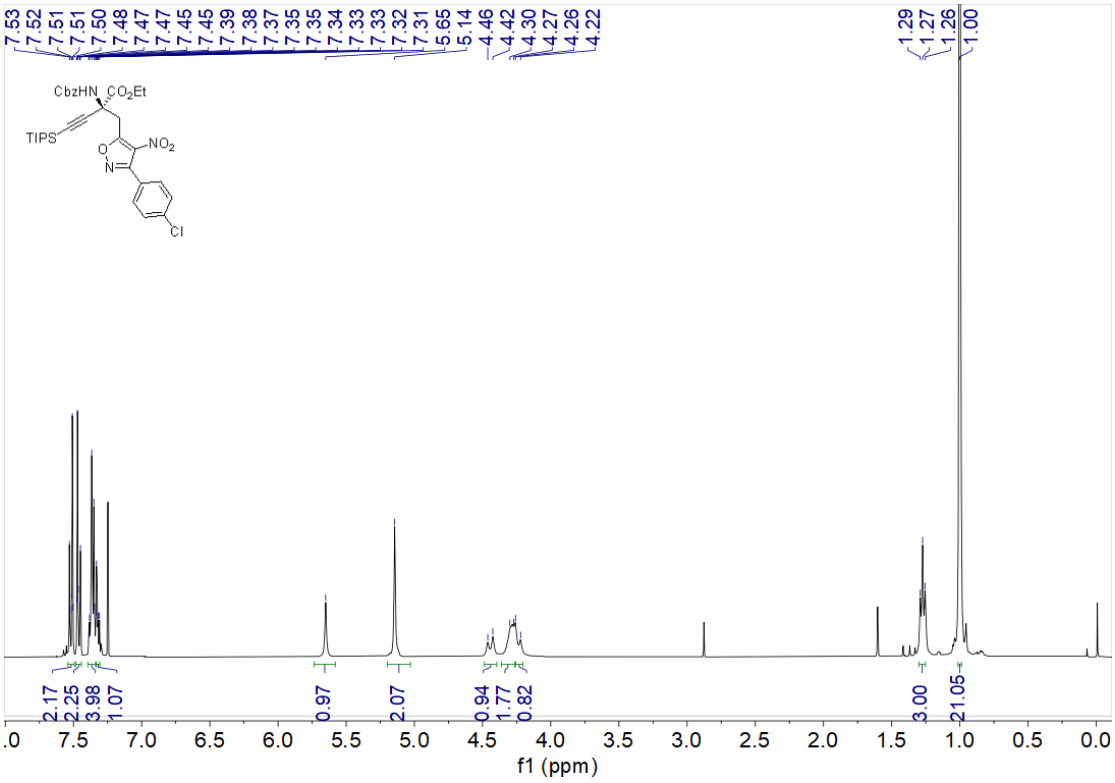
<Peak table>

PDA Ch1 254nm

Peak#	Ret. Time	Height	Area	Area%
1	9.207	646697	12396592	87.631
2	10.181	86501	1749697	12.369
Total		733198	14146289	100.000


CbzHN
CO2Et
TIPS
NO2
O
N
Cl

3lc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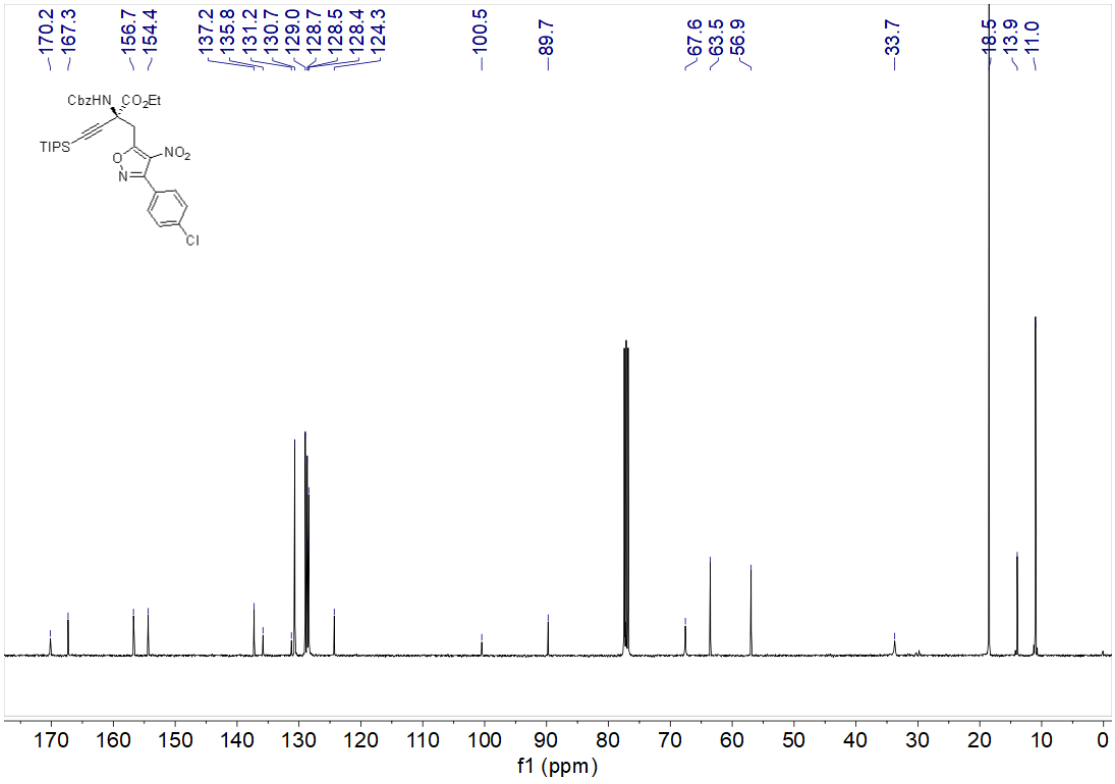
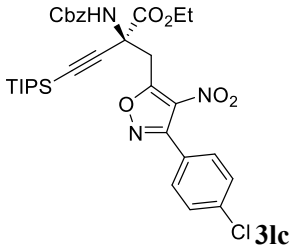
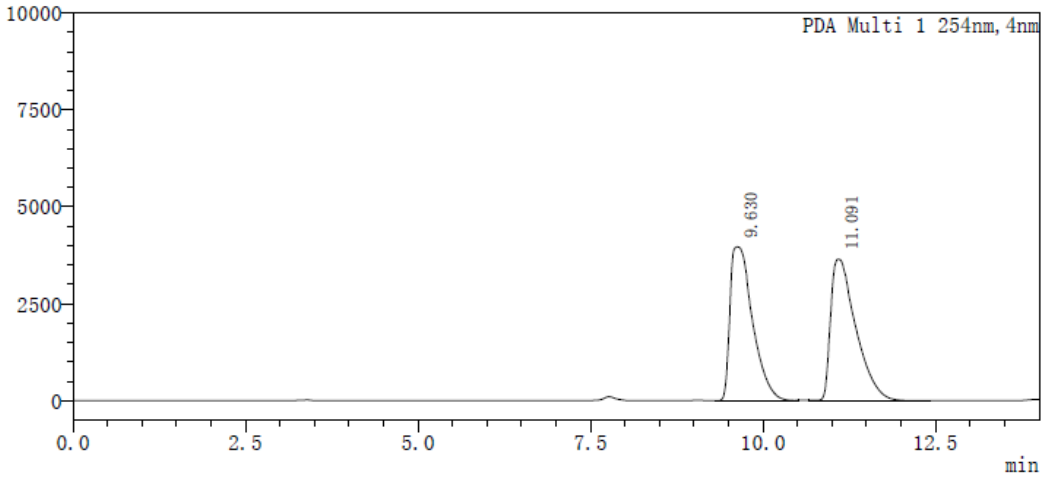
7.51
7.51
7.50
7.48
7.47
7.47
7.45
7.45
7.39
7.38
7.37
7.35
7.35
7.34
7.33
7.33
7.32
7.31
5.65
5.14
4.46
4.42
4.30
4.27
4.26
4.22
1.29
1.27
1.26
1.00
2.17
2.25
3.98
1.07
0.97
2.07
0.94
1.77
0.82
3.00
21.05
f1 (ppm)


170.2
167.3
156.7
154.4
137.2
135.8
131.2
130.7
129.0
128.7
128.5
128.4
124.3
100.5
89.7
67.6
63.5
56.9
33.7
18.5
13.9
11.0
f1 (ppm)



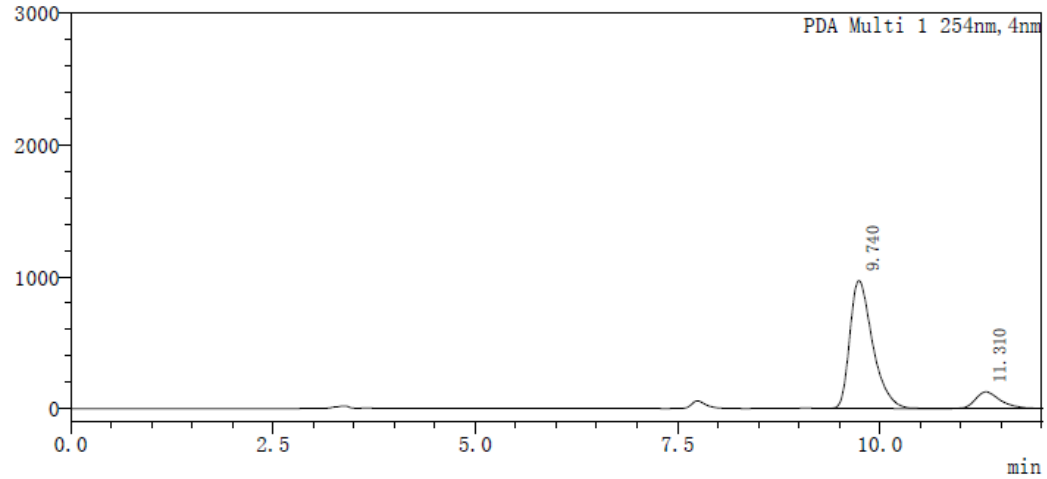
3lc



<Peak table>

PDA Ch1 254nm

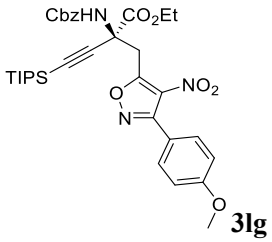
Peak#	Ret. Time	Height	Area	Area%
1	9.630	3964133	89750260	49.369
2	11.091	3641473	92045428	50.631
Total		7605606	181795688	100.000



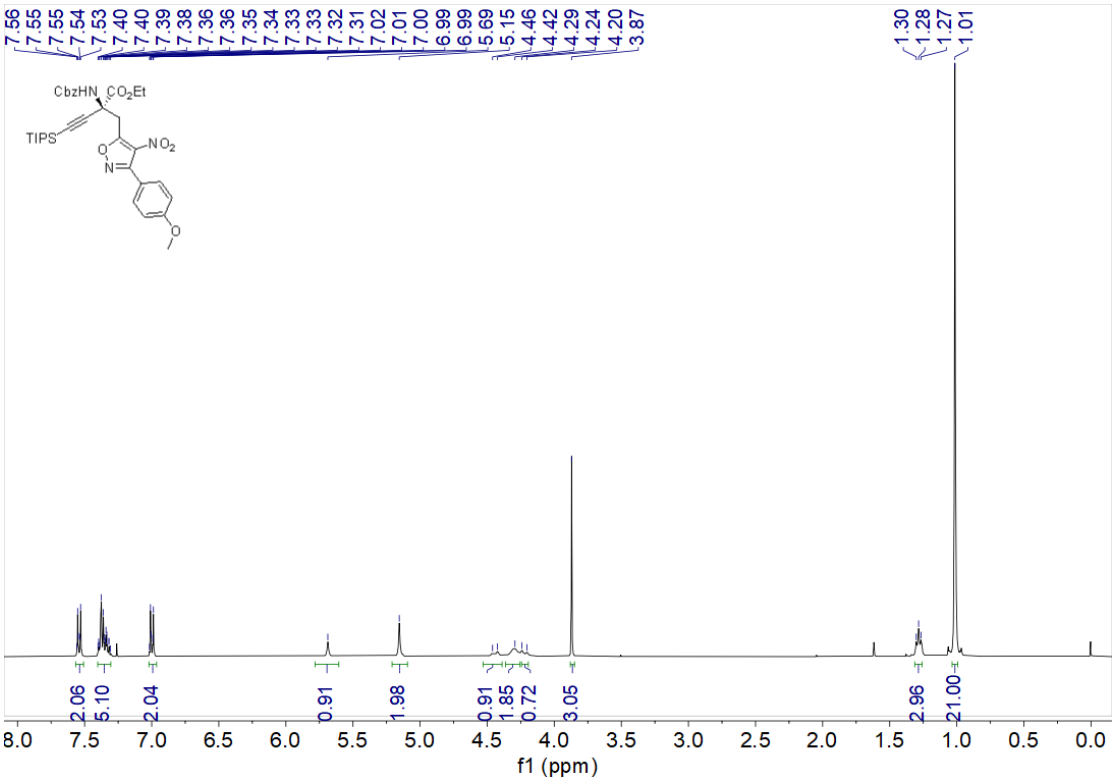
<Peak table>

PDA Ch1 254nm

Peak#	Ret. Time	Height	Area	Area%
1	9.740	970245	19084562	87.555
2	11.310	125987	2712659	12.445
Total		1096232	21797221	100.000


CbzHN
CO2Et
TIPS
NO2
O
N
O

3lg


7.56
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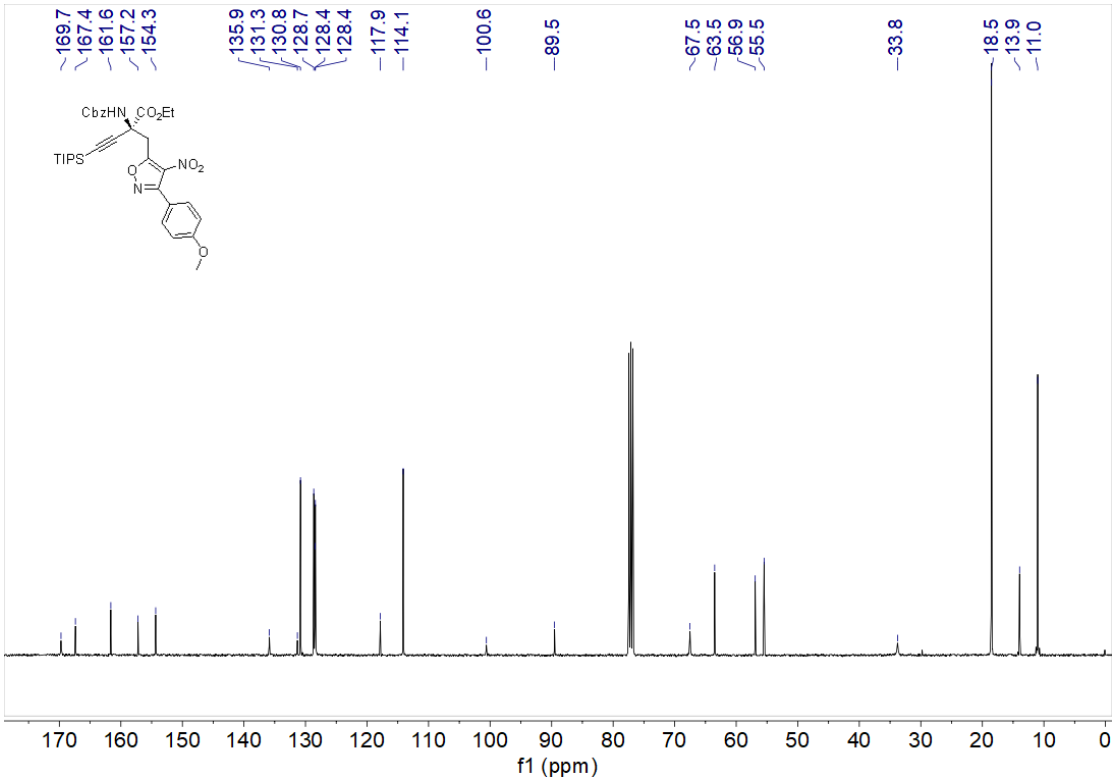
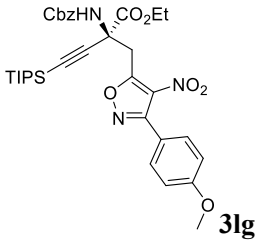
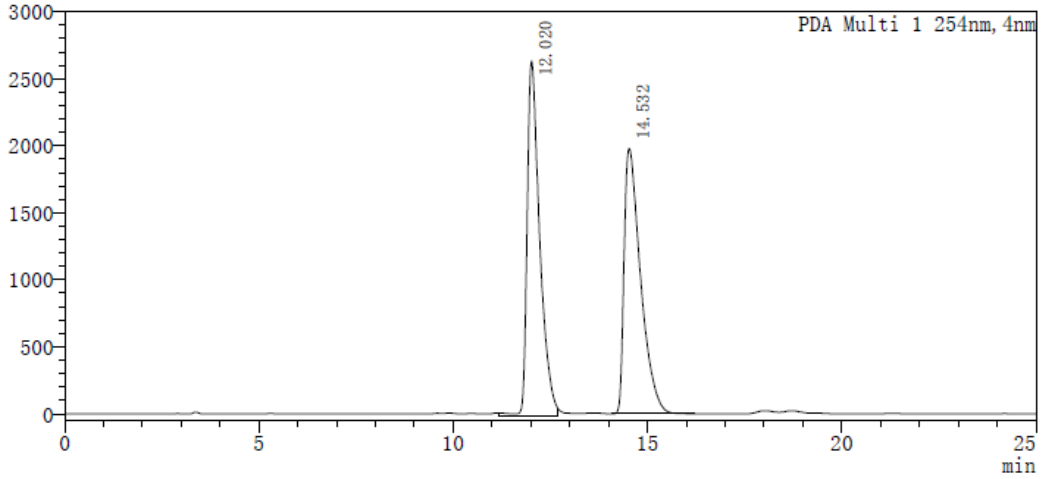
7.55
7.54
7.53
7.40
7.40
7.39
7.38
7.36
7.36
7.35
7.34
7.33
7.33
7.32
7.31
7.02
7.01
7.00
6.99
6.99
5.69
5.15
4.46
4.42
4.29
4.24
4.20
3.87
1.30
1.28
1.27
1.01
2.06
5.10
2.04
0.91
1.98
0.91
1.85
0.72
3.05
2.96
21.00
f1 (ppm)


169.7
167.4
161.6
157.2
154.3
135.9
131.3
130.8
128.7
128.4
128.4
117.9
114.1
100.6
89.5
67.5
63.5
56.9
55.5
33.8
18.5
13.9
11.0
f1 (ppm)



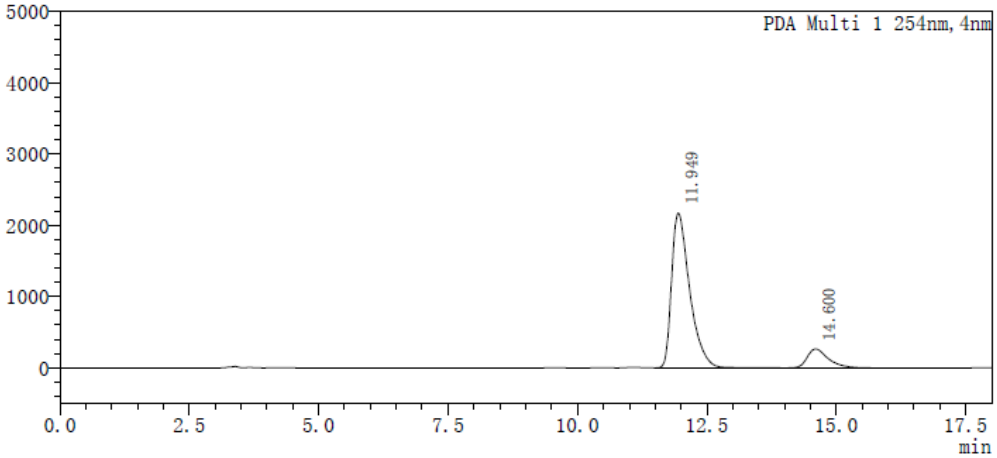
3lg



〈Peak table〉

PDA Ch1 254nm

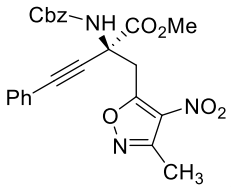
Peak#	Ret. Time	Height	Area	Area%
1	12.020	2641783	59485338	50.493
2	14.532	1978158	58322633	49.507
Total		4619941	117807972	100.000



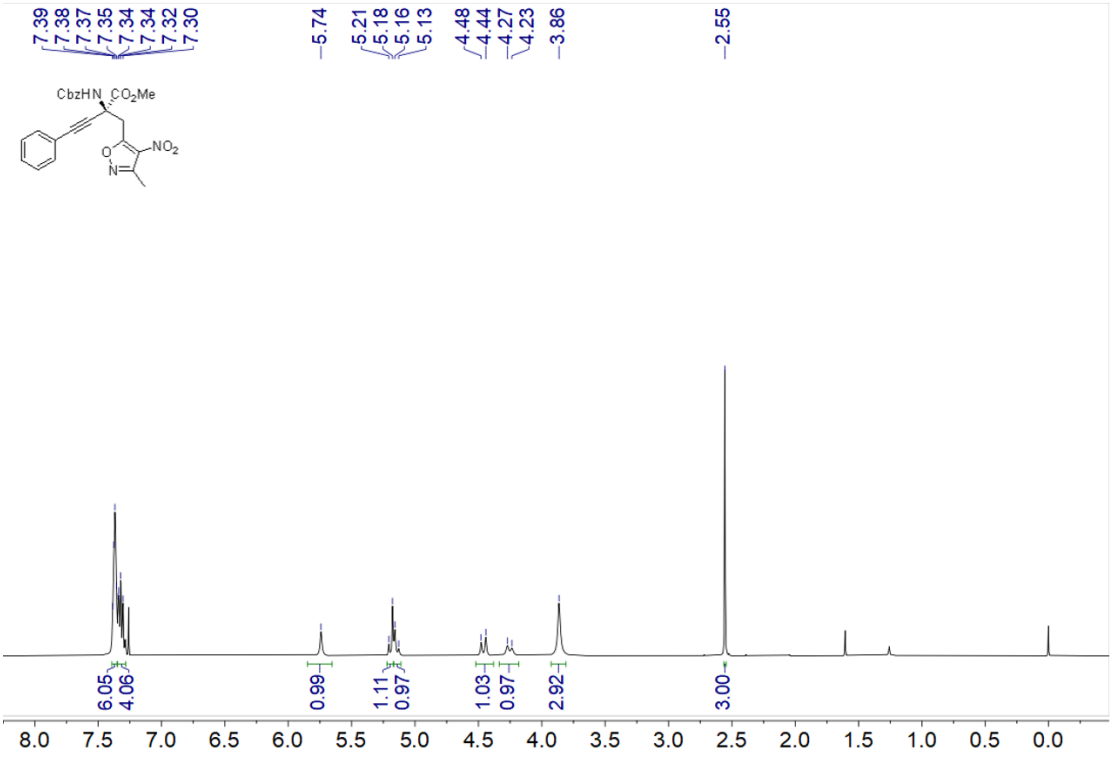
〈Peak table〉

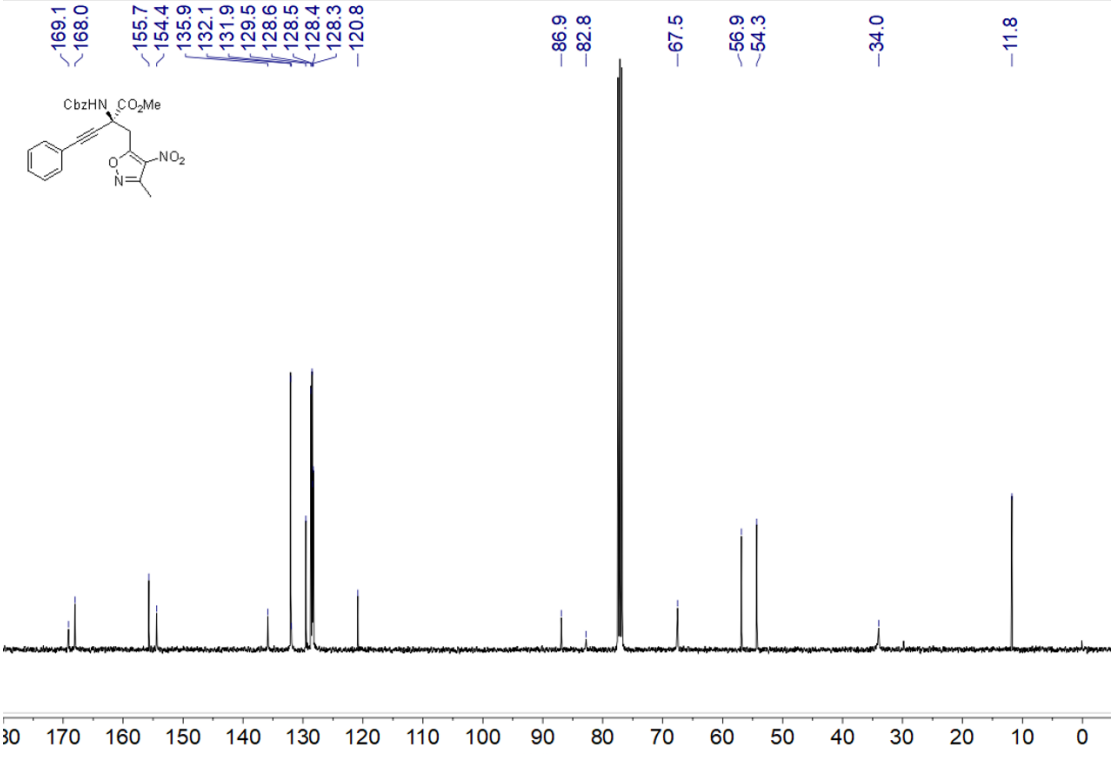
PDA Ch1 254nm

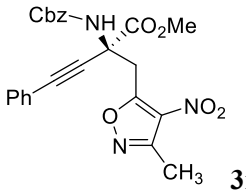
Peak#	Ret. Time	Height	Area	Area%
1	11.949	2170280	52798384	87.621
2	14.600	265207	7459140	12.379
Total		2435487	60257524	100.000


Cbz
NH
CO2Me
Ph
NO2
O
N
CH3

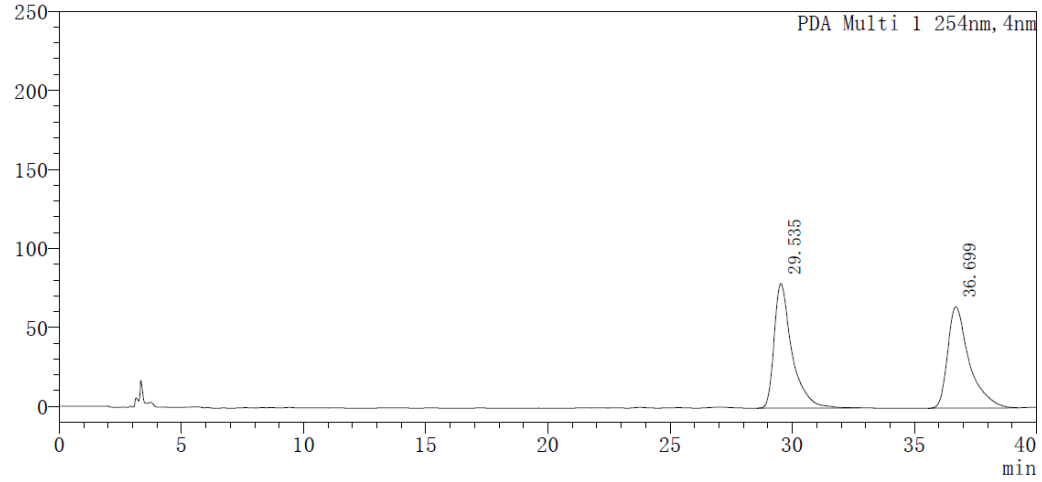
3ma


7.39
7.38
7.37
7.35
7.34
7.34
7.32
7.30
5.74
5.21
5.18
5.16
5.13
4.48
4.44
4.27
4.23
3.86
2.55
CbzHN
CO2Me
NO2
O
N
6.05
4.06
0.99
1.11
0.97
1.03
0.97
2.92
3.00
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0


169.1
168.0
155.7
154.4
135.9
132.1
131.9
129.5
128.6
128.5
128.4
128.3
120.8
86.9
82.8
67.5
56.9
54.3
34.0
11.8
CbzHN
CO2Me
NO2
O
N
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0



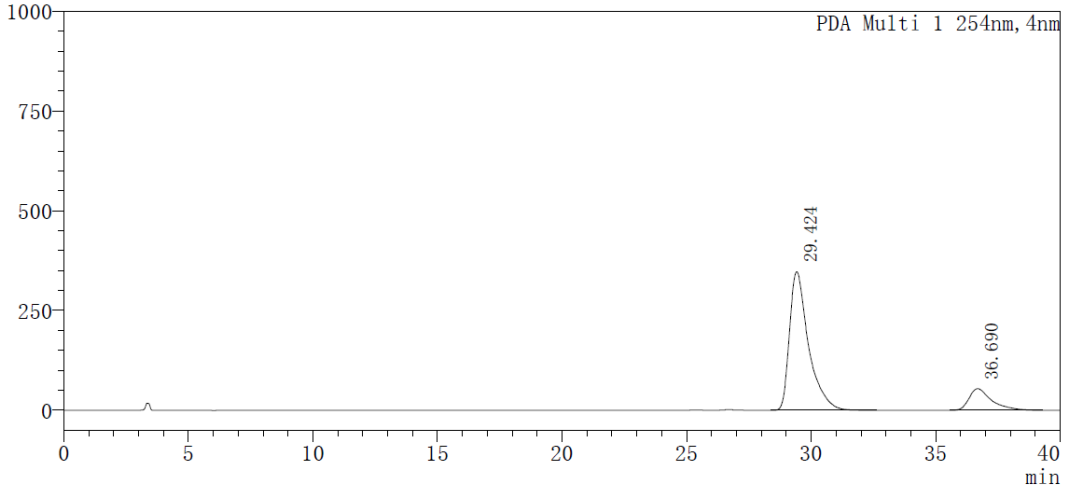
3ma



<Peak table>

PDA Ch1 254nm

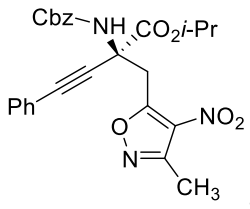
Peak#	Ret. Time	Height	Area	Area%
1	29.535	78922	3986040	50.395
2	36.699	64184	3923582	49.605
total		143106	7909622	100.000



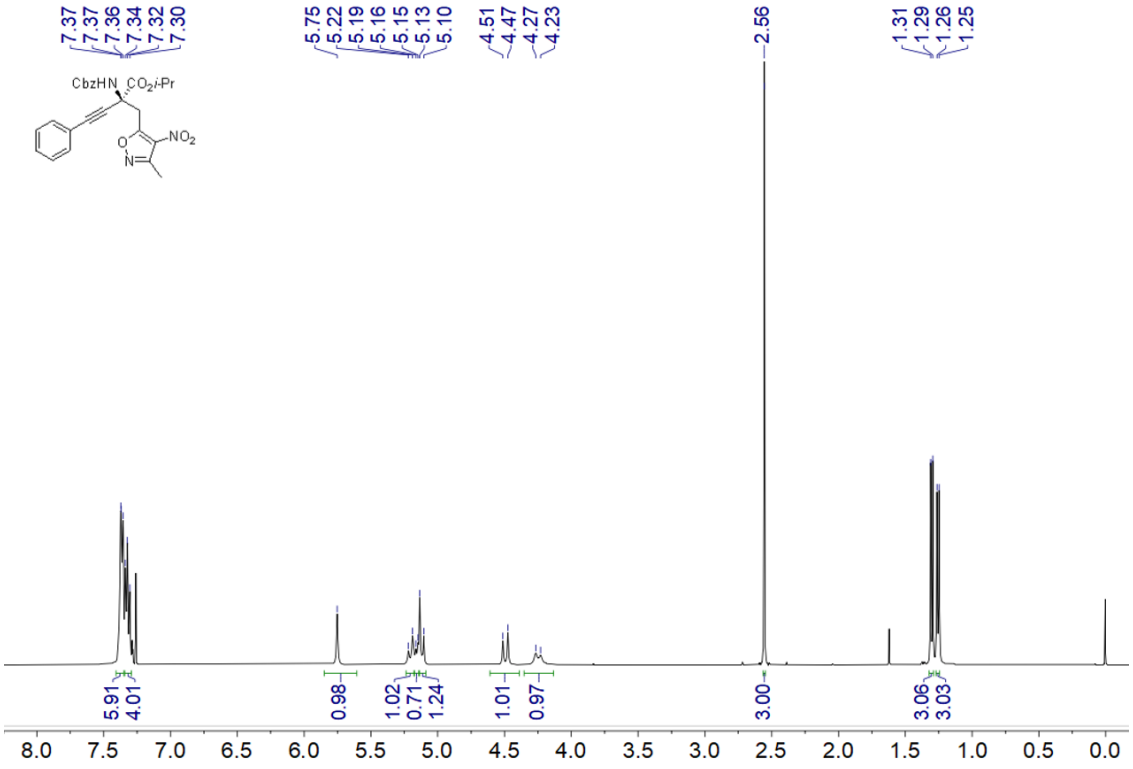
<Peak table>

PDA Ch1 254nm

Peak#	Ret. Time	Height	Area	Area%
1	29.424	347178	18427080	84.365
2	36.690	54115	3414941	15.635
total		401293	21842021	100.000


Cbz
NH
CO2i-Pr
Ph
O
N
NO2
CH3

3na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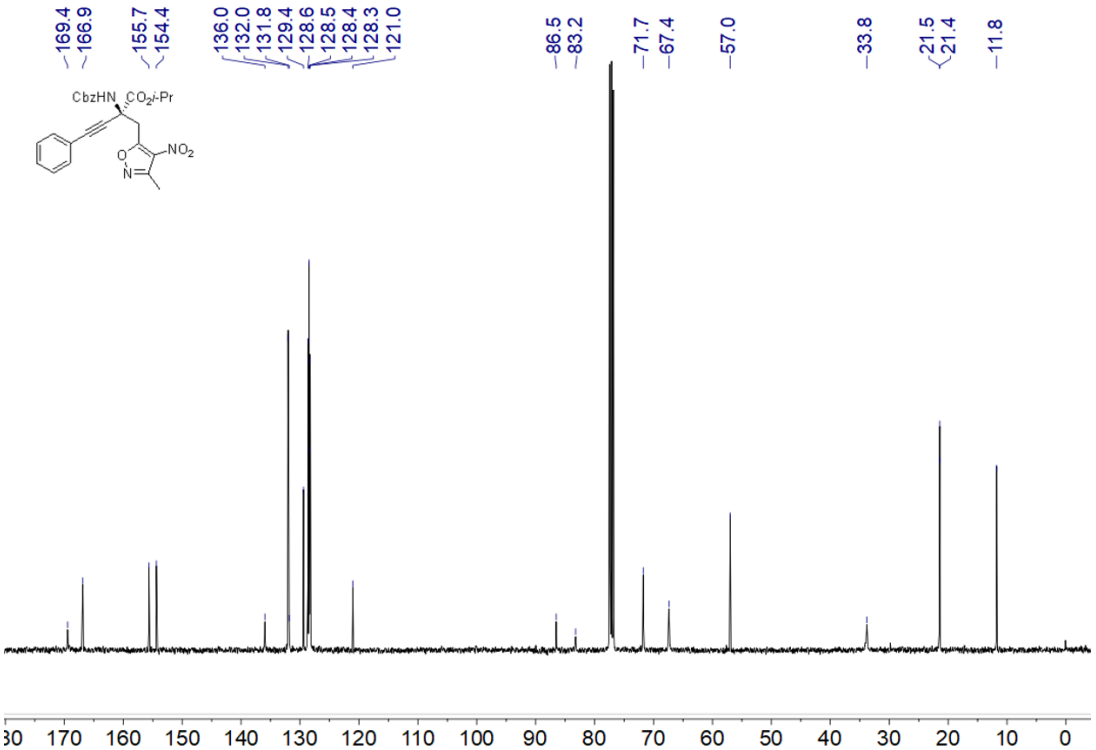
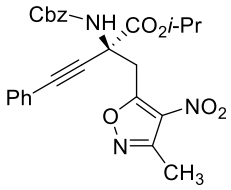
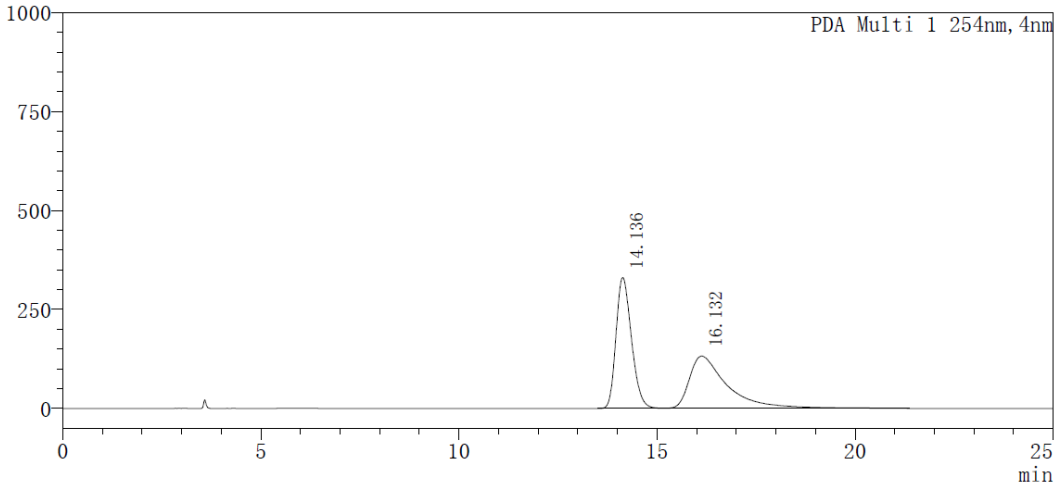
7.37
7.36
7.34
7.32
7.30
5.75
5.22
5.19
5.16
5.15
5.13
5.10
4.51
4.47
4.27
4.23
2.56
1.31
1.29
1.26
1.25
CbzHN
CO2i-Pr
NO2
5.91
4.01
0.98
1.02
0.71
1.24
1.01
0.97
3.00
3.06
3.03
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0


169.4
166.9
155.7
154.4
136.0
132.0
131.8
129.4
128.6
128.5
128.4
128.3
121.0
86.5
83.2
71.7
67.4
57.0
33.8
21.5
21.4
11.8
CbzHN
CO2i-Pr
NO2
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0



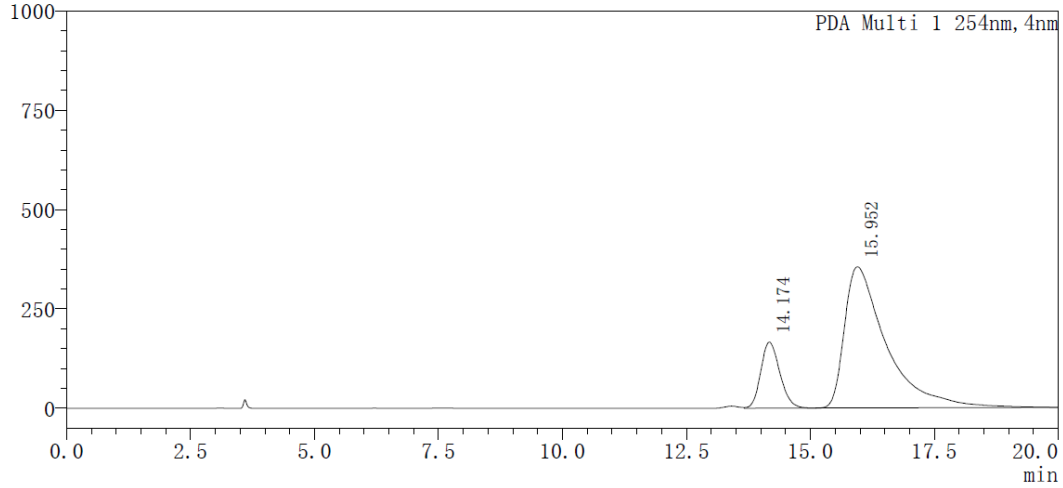
3na



<Peak table>

PDA Ch1 254nm

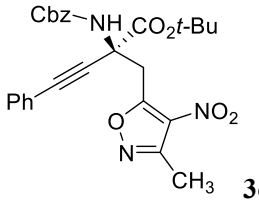
Peak#	Ret. Time	Height	Area	Area%
1	14.136	330757	8977411	50.453
2	16.132	132241	8816367	49.547
total		462998	17793778	100.000



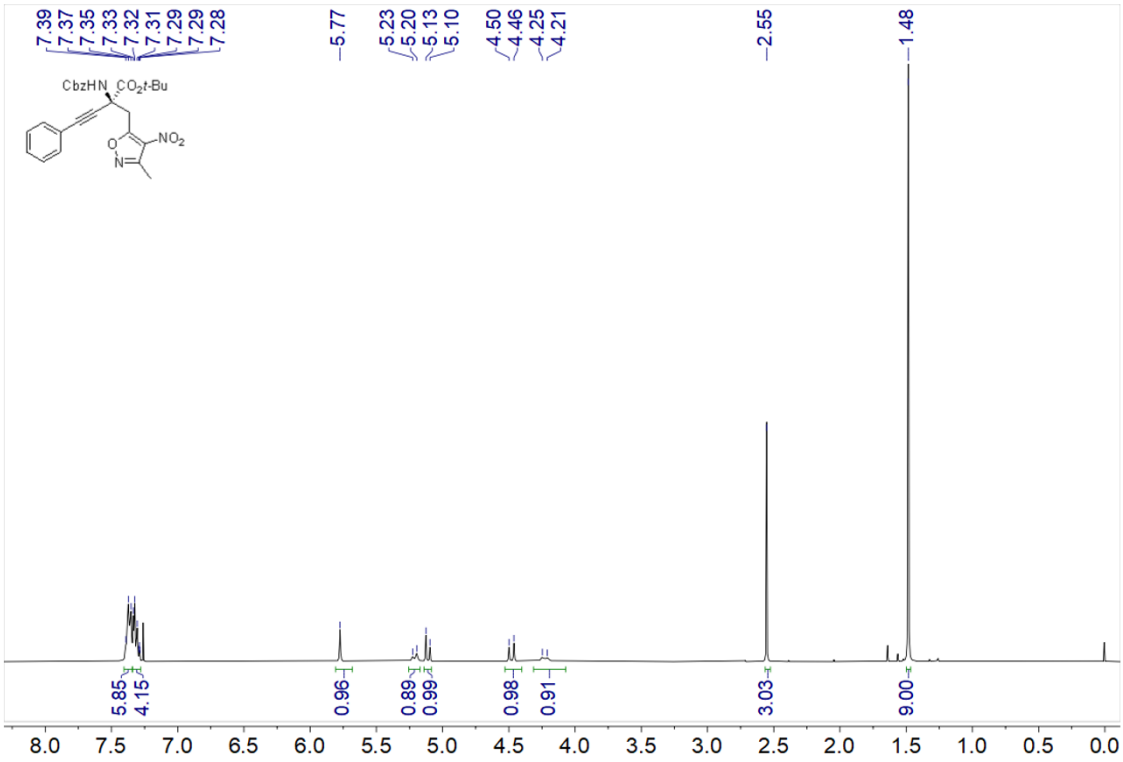
<Peak table>

PDA Ch1 254nm

Peak#	Ret. Time	Height	Area	Area%
1	14.174	166183	4450173	17.484
2	15.952	355186	21002547	82.516
total		521369	25452720	100.000


Cbz
NH
CO2t-Bu
Ph
NO2
O
N
CH3

3oa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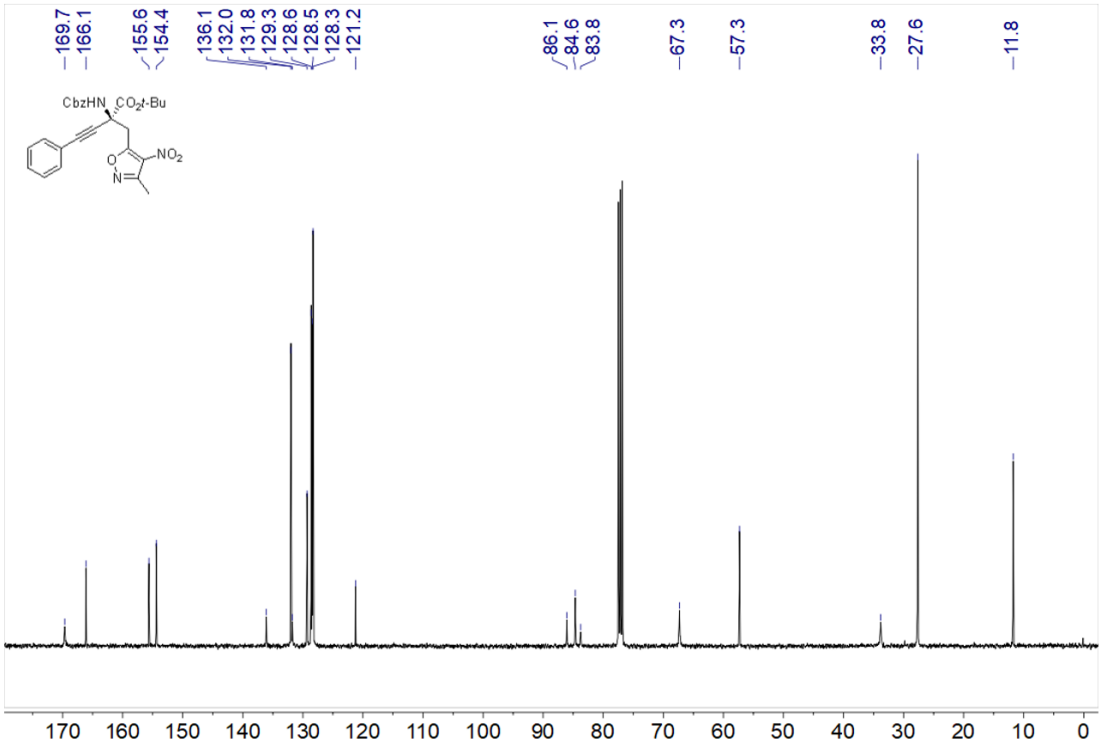
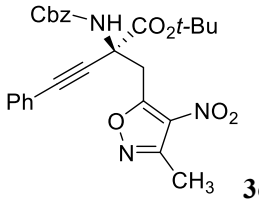
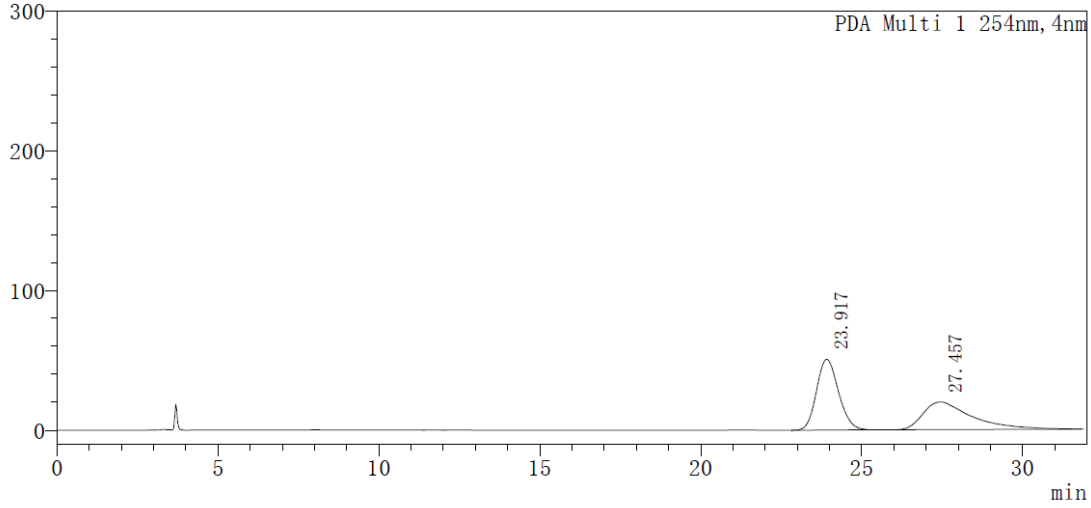
7.37
7.35
7.33
7.32
7.31
7.29
7.29
7.28
5.77
5.23
5.20
5.13
5.10
4.50
4.46
4.25
4.21
2.55
1.48
CbzHN
CO2t-Bu
NO2
5.85
4.15
0.96
0.89
0.99
0.98
0.91
3.03
9.00
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0


169.7
166.1
155.6
154.4
136.1
132.0
131.8
129.3
128.6
128.5
128.3
121.2
86.1
84.6
83.8
67.3
57.3
33.8
27.6
11.8
CbzHN
CO2t-Bu
NO2
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0



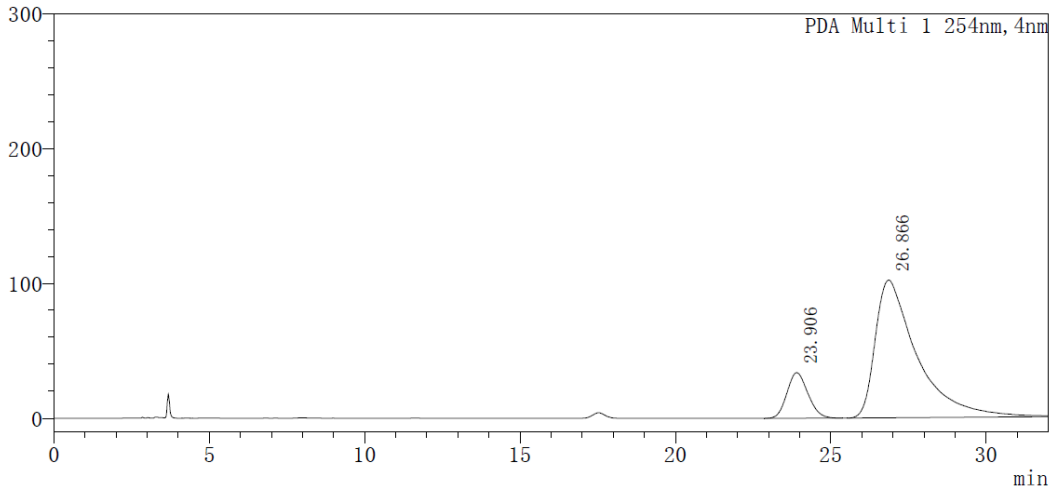
3oa



<Peak table>

PDA Ch1 254nm

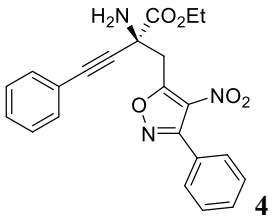
Peak#	Ret. Time	Height	Area	Area%
1	23.917	50565	2402672	53.415
2	27.457	19757	2095459	46.585
total		70322	4498131	100.000



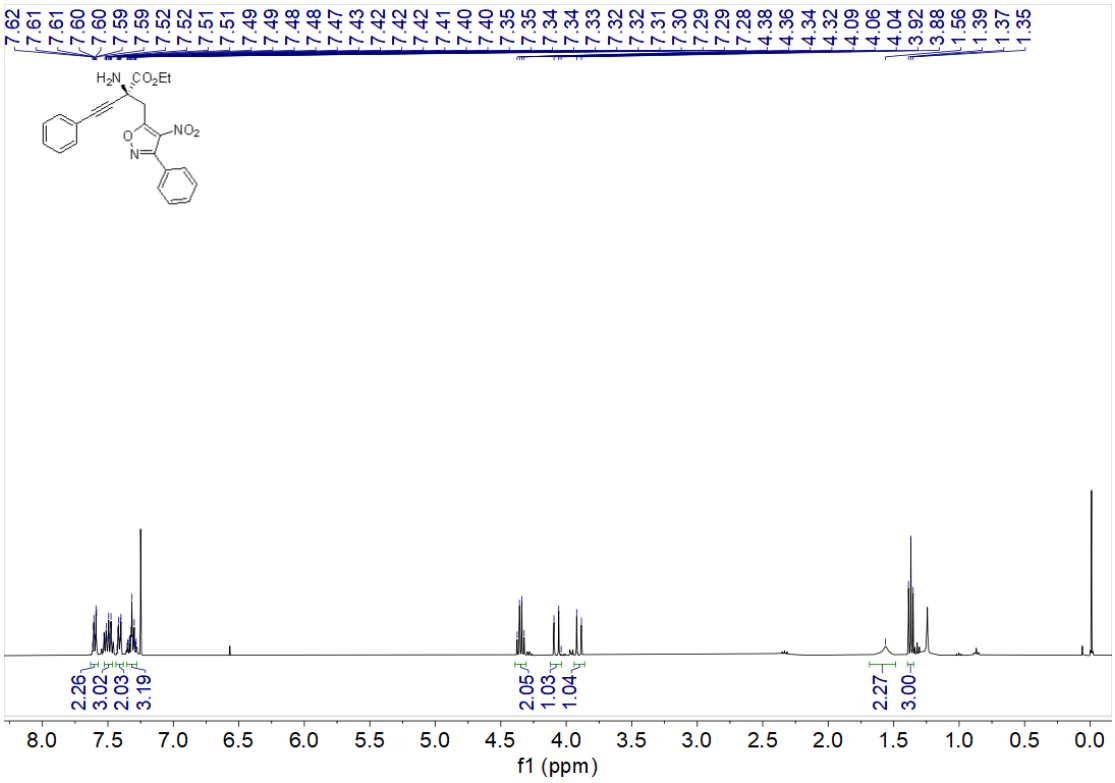
<Peak table>

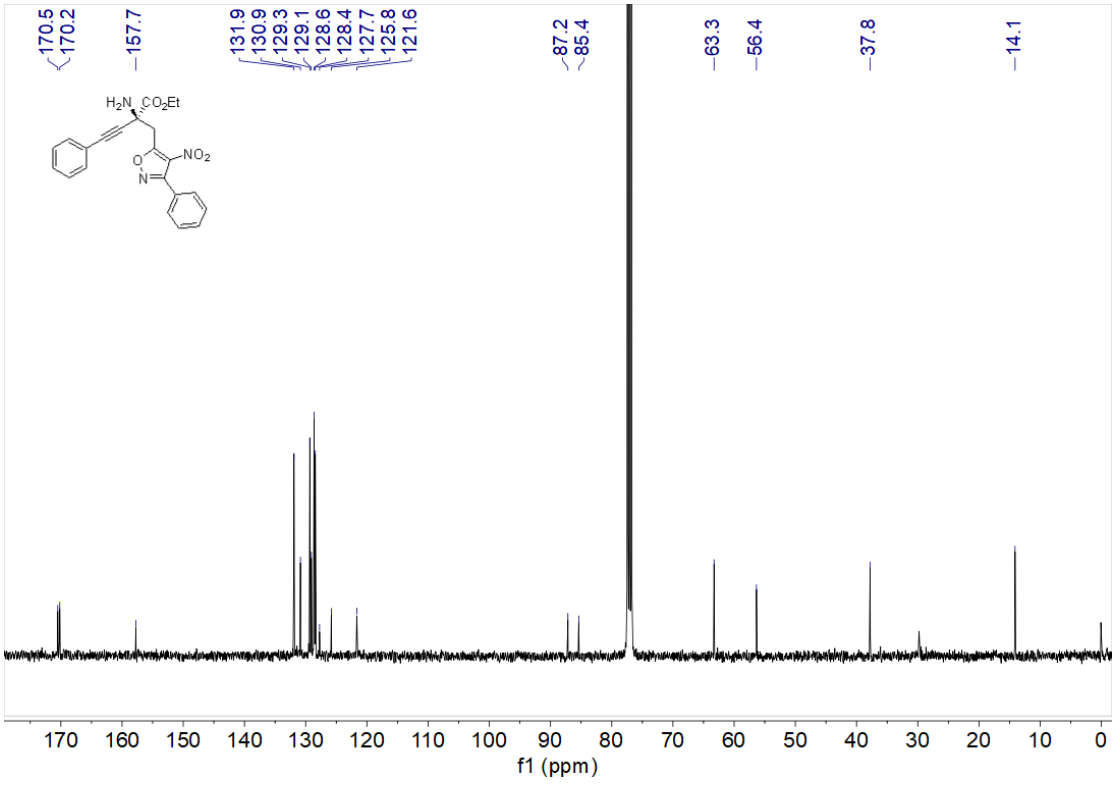
PDA Ch1 254nm

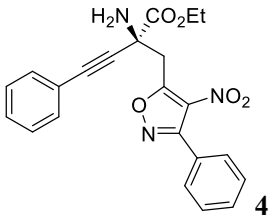
Peak#	Ret. Time	Height	Area	Area%
1	23.906	33801	1587956	14.158
2	26.866	102119	9628281	85.842
total		135920	11216237	100.000


H2N
CO2Et
NO2
O
N

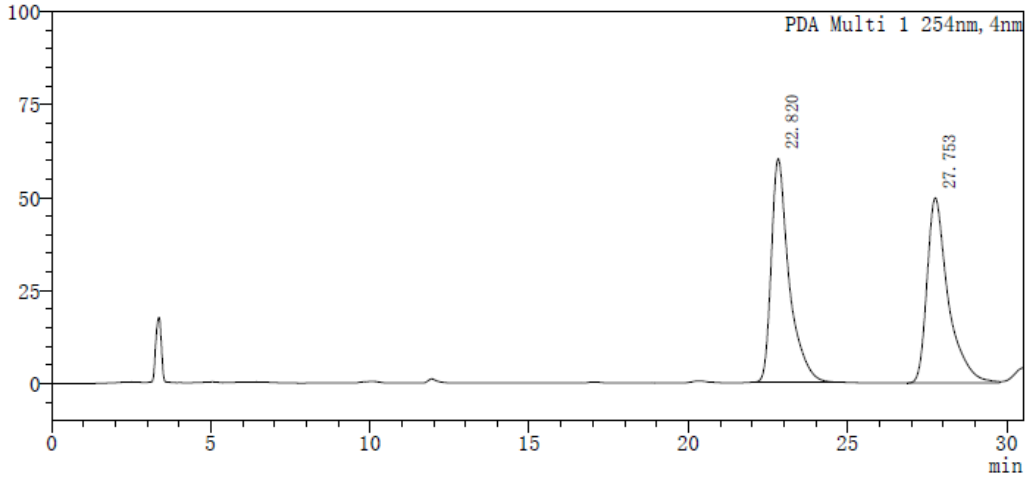
4


7.62 7.61 7.61 7.60 7.60 7.59 7.59 7.52 7.52 7.51 7.51 7.49 7.49 7.48 7.48 7.47 7.43 7.42 7.42 7.42 7.41 7.40 7.40 7.35 7.35 7.34 7.34 7.33 7.32 7.32 7.31 7.30 7.29 7.29 7.28 4.38 4.36 4.34 4.32 4.09 4.06 4.04 3.92 3.88 1.56 1.39 1.37 1.35
2.26 3.02 2.03 3.19 2.05 1.03 1.04 2.27 3.00
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)


170.5 170.2 157.7 131.9 130.9 129.3 129.1 128.6 128.4 127.7 125.8 121.6 87.2 85.4 63.3 56.4 37.8 14.1
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)



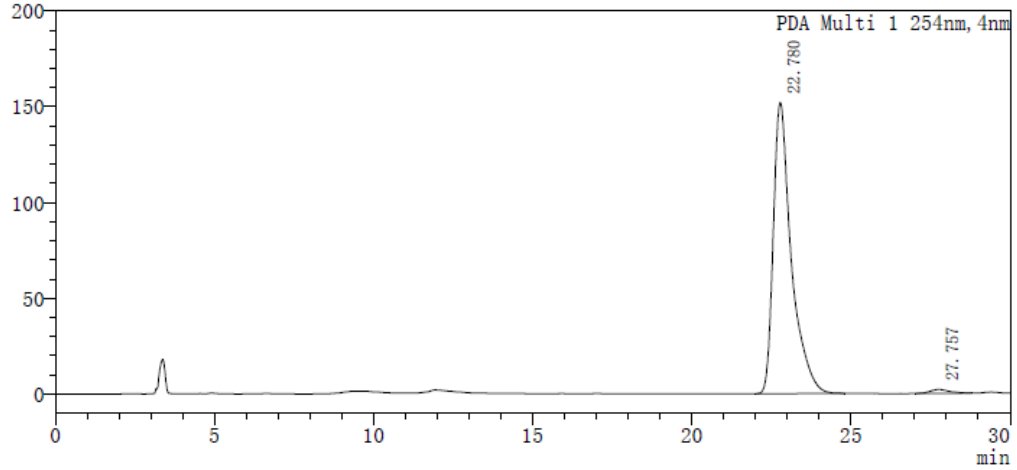
4



〈Peak table〉

PDA Ch1 254nm

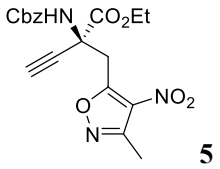
Peak#	Ret. Time	Height	Area	Area%
1	22.820	60116	2333860	50.295
2	27.753	49770	2306443	49.705
Total		109886	4640302	100.000



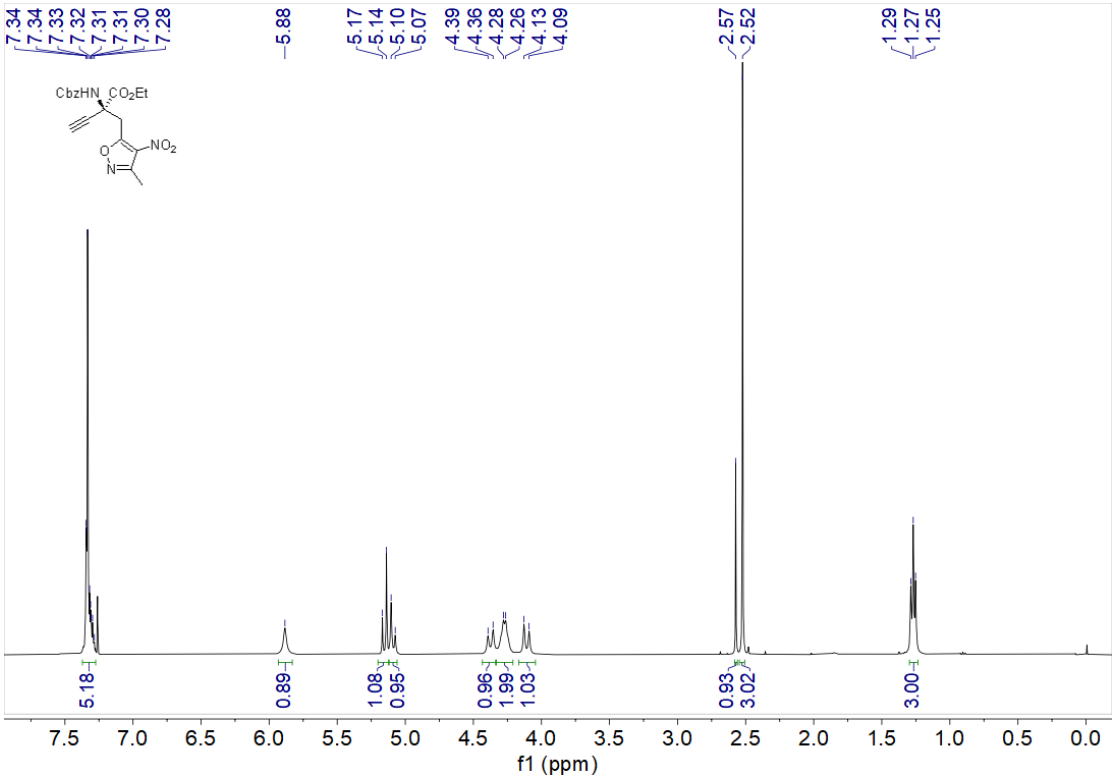
〈Peak table〉

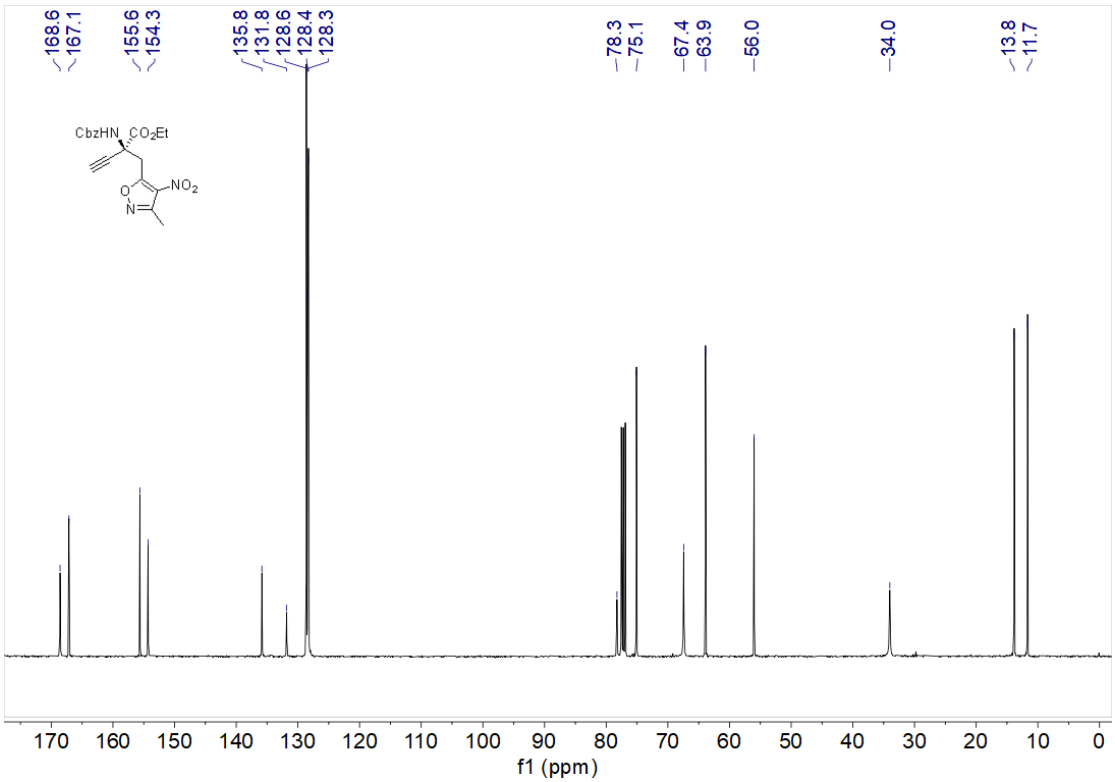
PDA Ch1 254nm

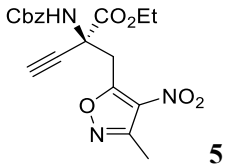
Peak#	Ret. Time	Height	Area	Area%
1	22.780	151904	5979825	98.538
2	27.757	2063	88695	1.462
Total		153967	6068521	100.000


CbzHN
CO2Et
NO2
O
N

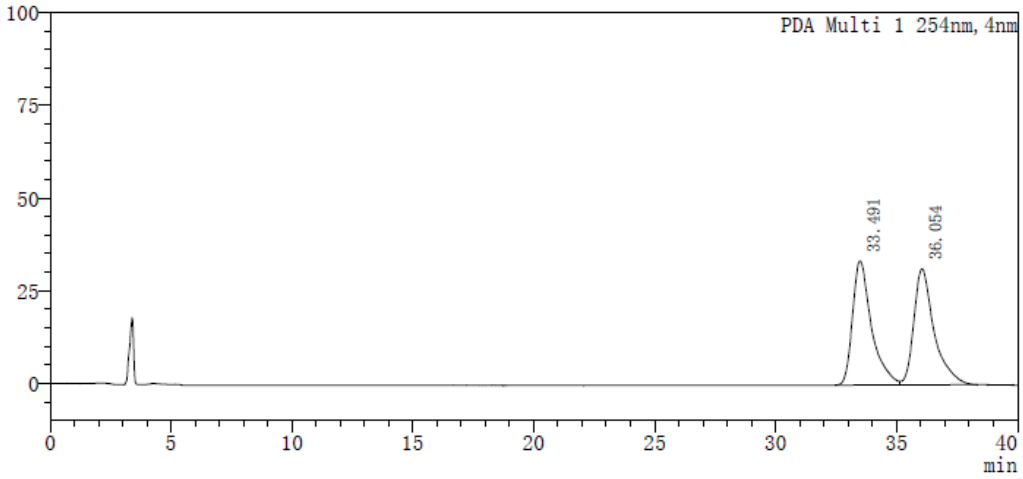
5


7.34
7.34
7.33
7.32
7.31
7.31
7.30
7.28
5.88
5.17
5.14
5.10
5.07
4.39
4.36
4.28
4.26
4.13
4.09
2.57
2.52
1.29
1.27
1.25
5.18
0.89
1.08
0.95
0.96
1.99
1.03
0.93
3.02
3.00
f1 (ppm)


168.6
167.1
155.6
154.3
135.8
131.8
128.6
128.4
128.3
78.3
75.1
67.4
63.9
56.0
34.0
13.8
11.7
f1 (ppm)



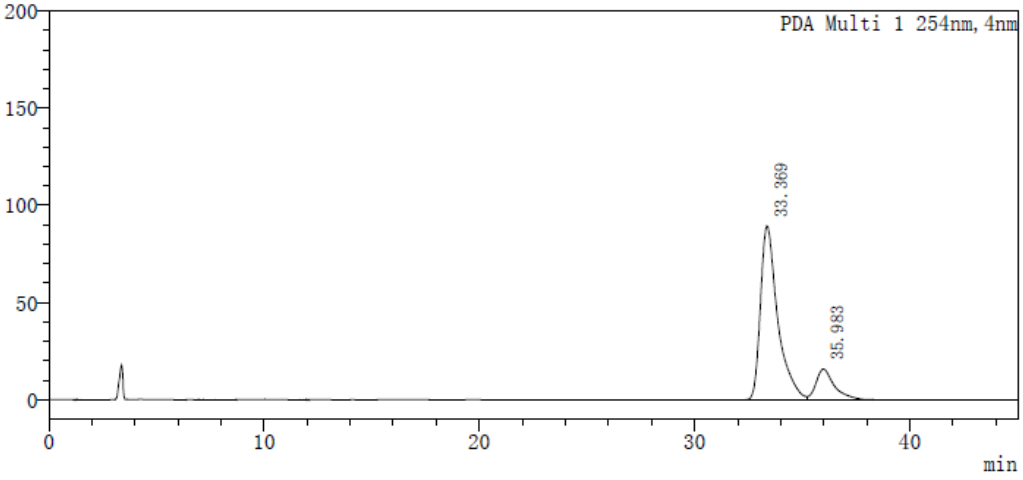
5



〈Peak table〉

PDA Ch1 254nm

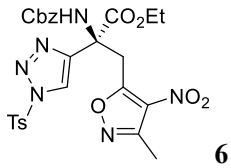
Peak#	Ret. Time	Height	Area	Area%
1	33.491	33497	1830468	49.980
2	36.054	31301	1831902	50.020
Total		64798	3662370	100.000



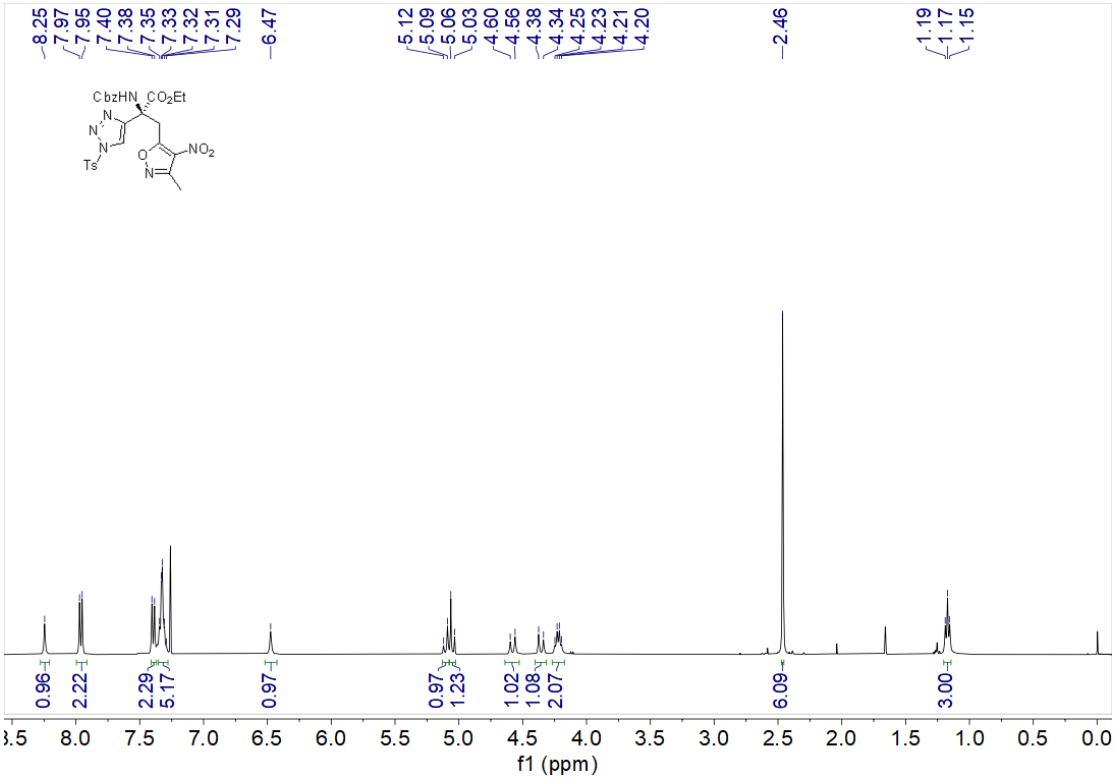
〈Peak table〉

PDA Ch1 254nm

Peak#	Ret. Time	Height	Area	Area%
1	33.369	89374	4983095	84.080
2	35.983	15835	943508	15.920
Total		105209	5926603	100.000


CbzHN
CO2Et
N
N
N
Ts
O
N
NO2

6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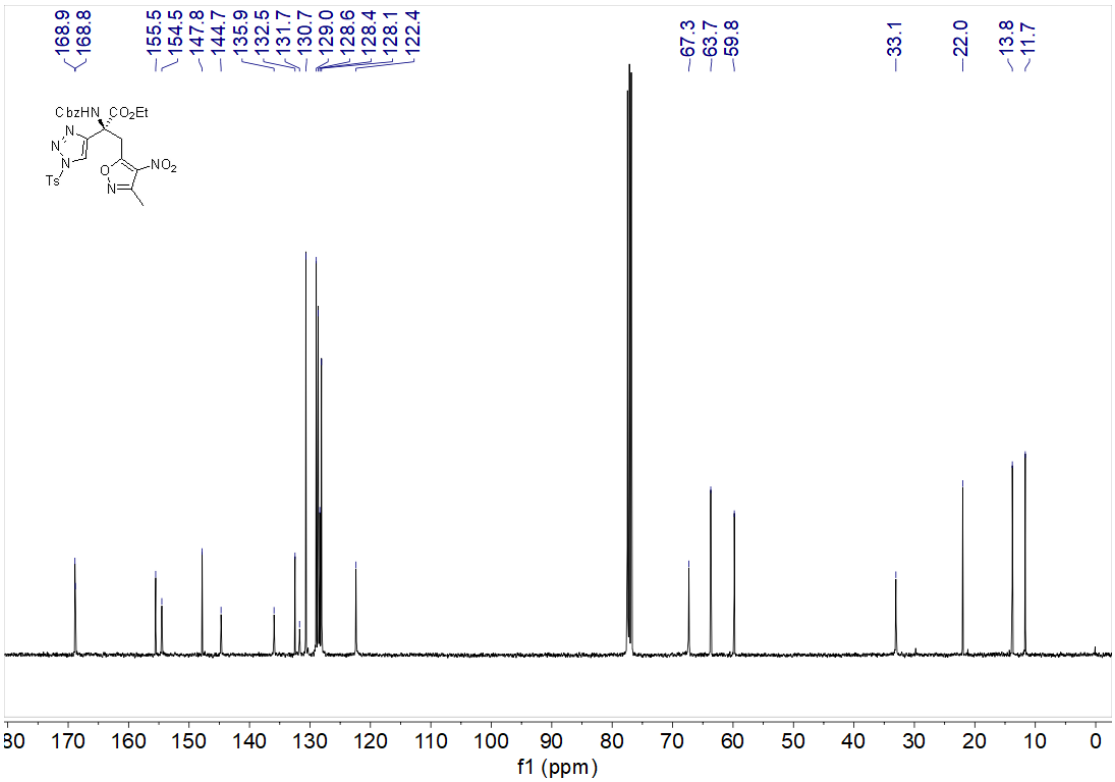
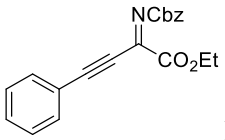
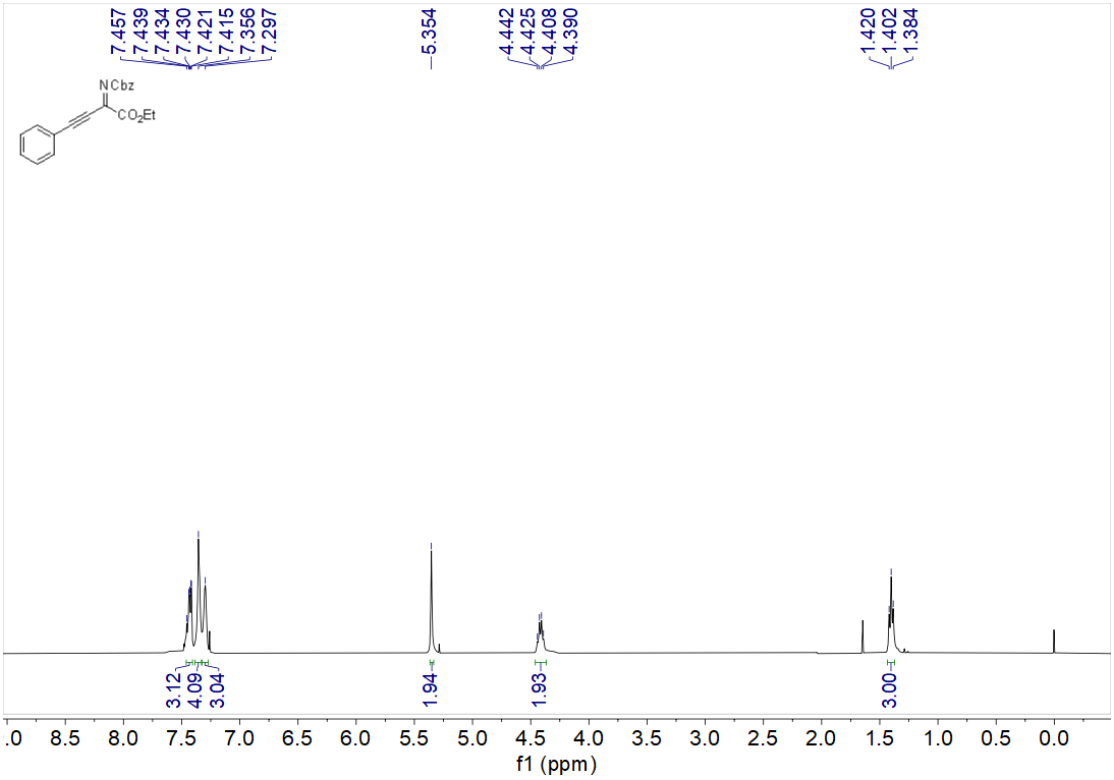
7.40
7.38
7.35
7.33
7.32
7.31
7.29
6.47
5.12
5.09
5.06
5.03
4.60
4.56
4.38
4.34
4.25
4.23
4.21
4.20
2.46
1.19
1.17
1.15
0.96
2.22
2.29
5.17
0.97
0.97
1.23
1.02
1.08
2.07
6.09
3.00
f1 (ppm)

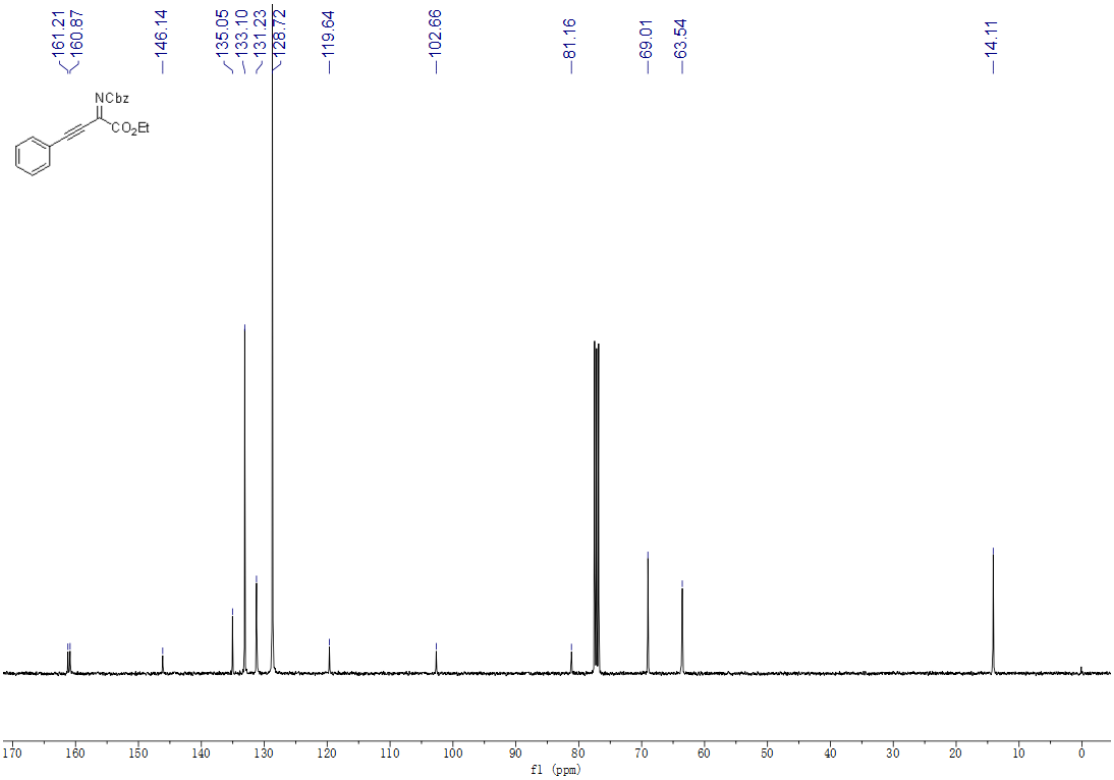

168.9
168.8
155.5
154.5
147.8
144.7
135.9
132.5
131.7
130.7
129.0
128.6
128.4
128.1
122.4
67.3
63.7
59.8
33.1
22.0
13.8
11.7
f1 (ppm)

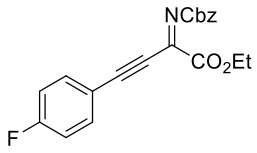
^{1}H NMR, ^{13}C NMR spectra of β,γ-Alkynyl-α-ketimino Esters



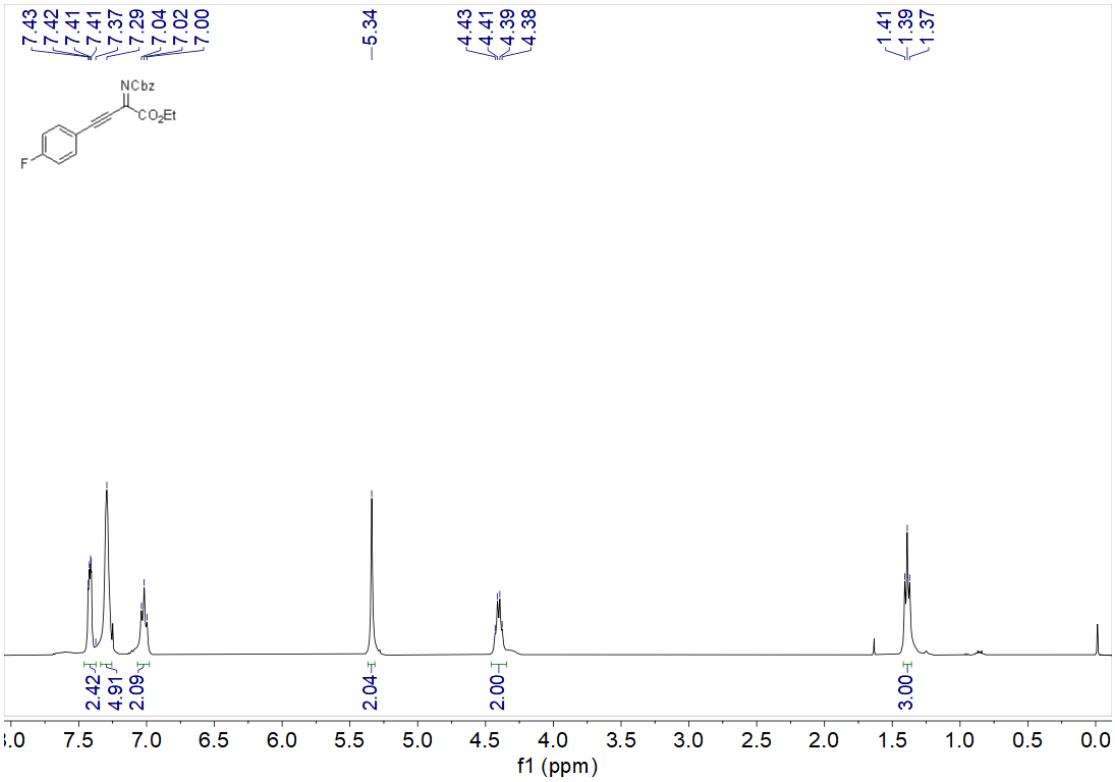
1b






NCbz
CO2Et
F

1c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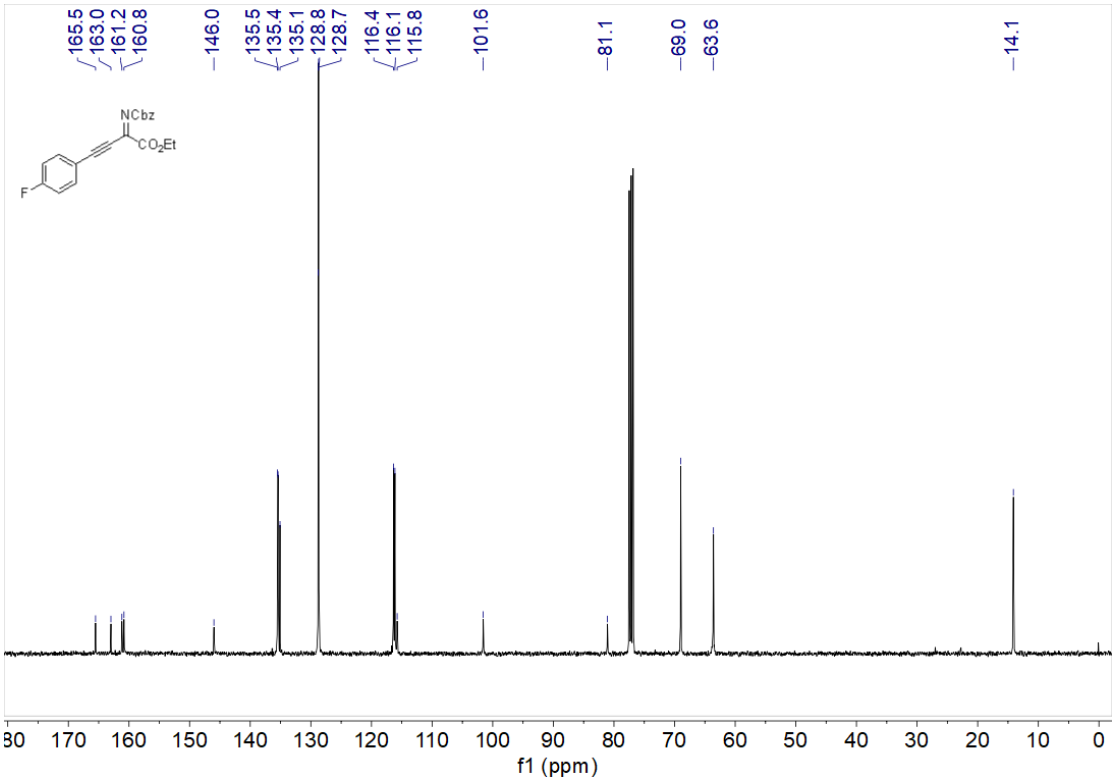
7.42
7.41
7.41
7.37
7.29
7.04
7.02
7.00
5.34
4.43
4.41
4.39
4.38
1.41
1.39
1.37
NCbz
CO2Et
F
2.42
4.91
2.09
2.04
2.00
3.00
f1 (ppm)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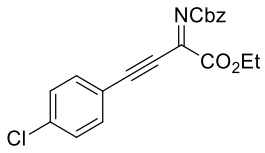
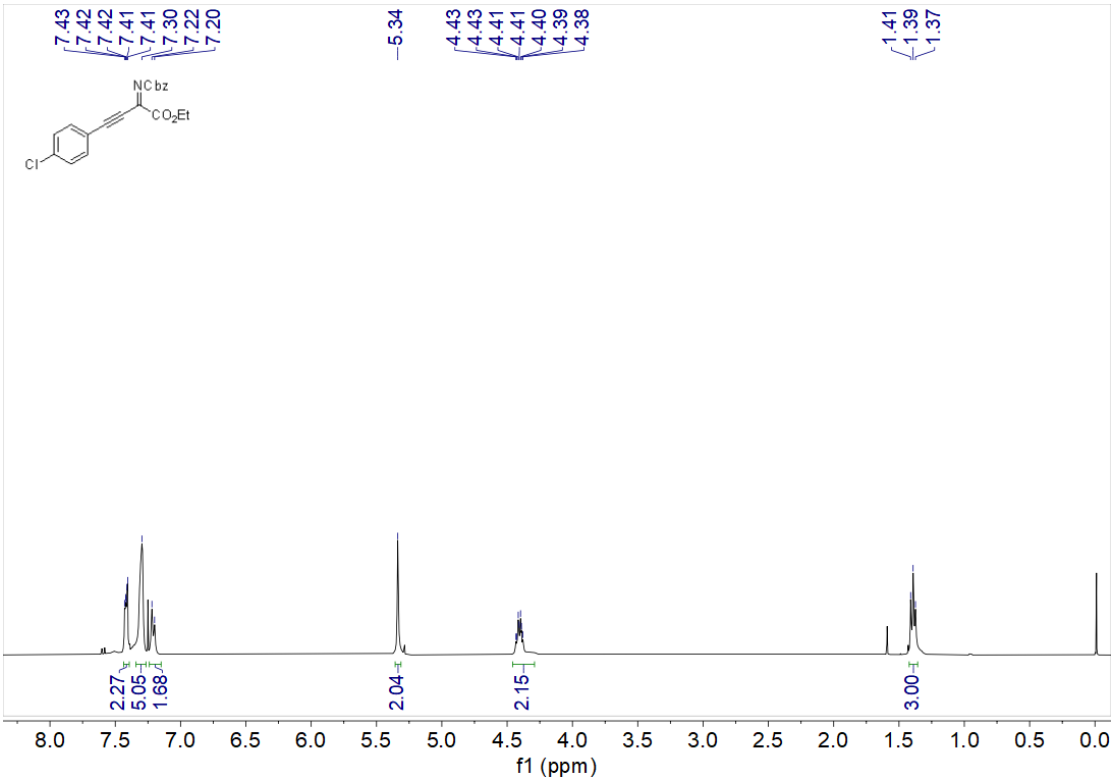
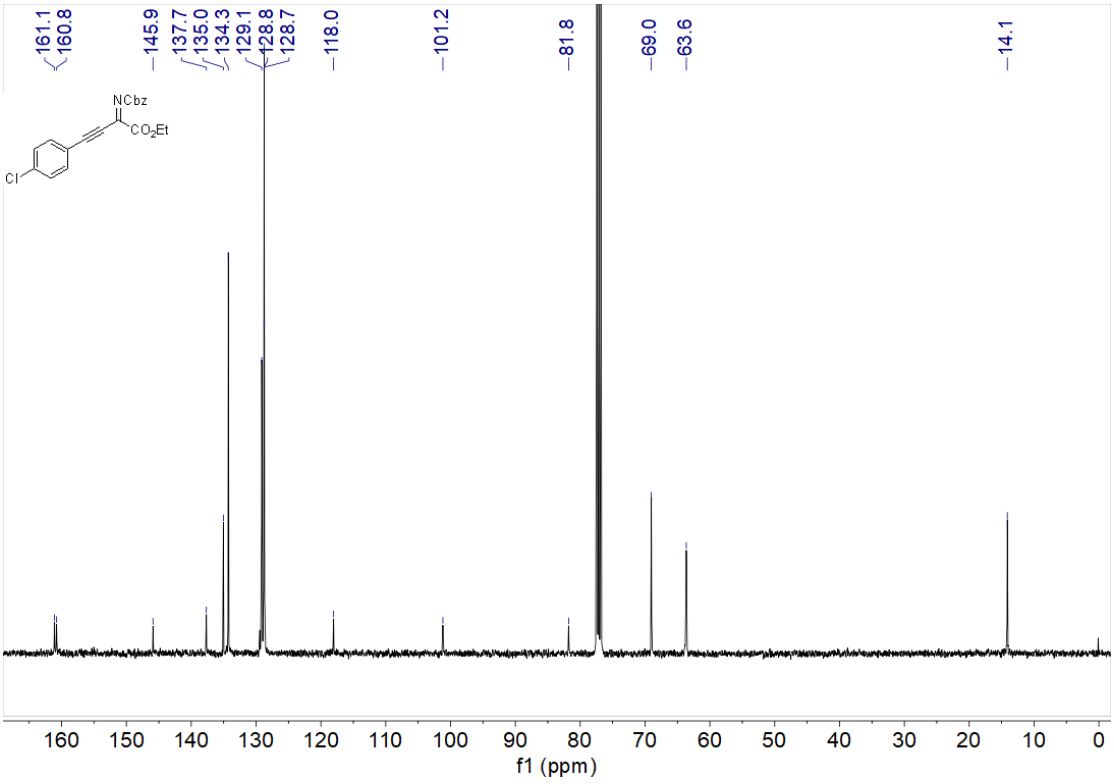
161.2
160.8
146.0
135.5
135.4
135.1
128.8
128.7
116.4
116.1
115.8
101.6
81.1
69.0
63.6
14.1
NCbz
CO2Et
F
f1 (ppm)


NCbz
CO2Et
Cl

1d


7.43
7.42
7.42
7.41
7.41
7.30
7.22
7.20
5.34
4.43
4.43
4.41
4.41
4.40
4.39
4.38
1.41
1.39
1.37
NCbz
CO2Et
Cl
2.27
5.05
1.68
2.04
2.15
3.00
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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134.3
129.1
128.8
128.7
118.0
101.2
81.8
69.0
63.6
14.1
NCbz
CO2Et
Cl
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130
120
110
100
90
80
70
60
50
40
30
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10
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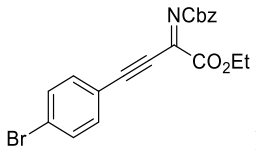
f1 (ppm)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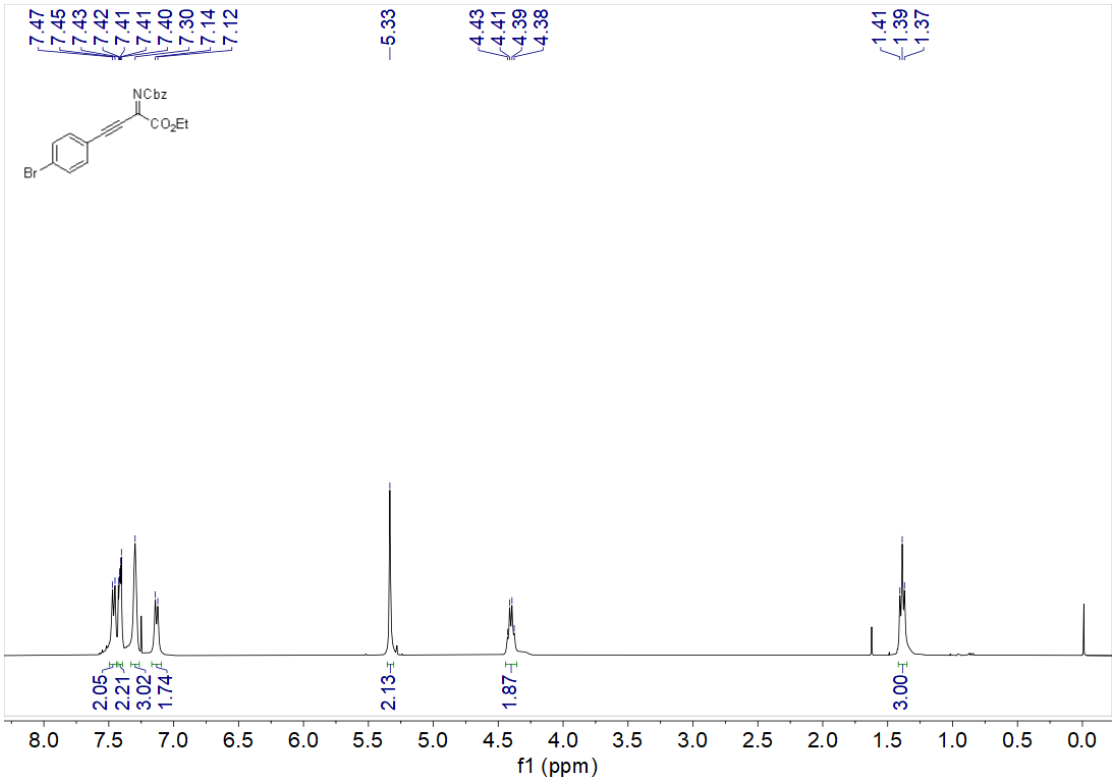
CO2Et
Br

1e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4.43
4.41
4.39
4.38
1.41
1.39
1.37
NCbz
CO2Et
Br
2.05
2.21
3.02
1.74
2.13
1.87
3.00
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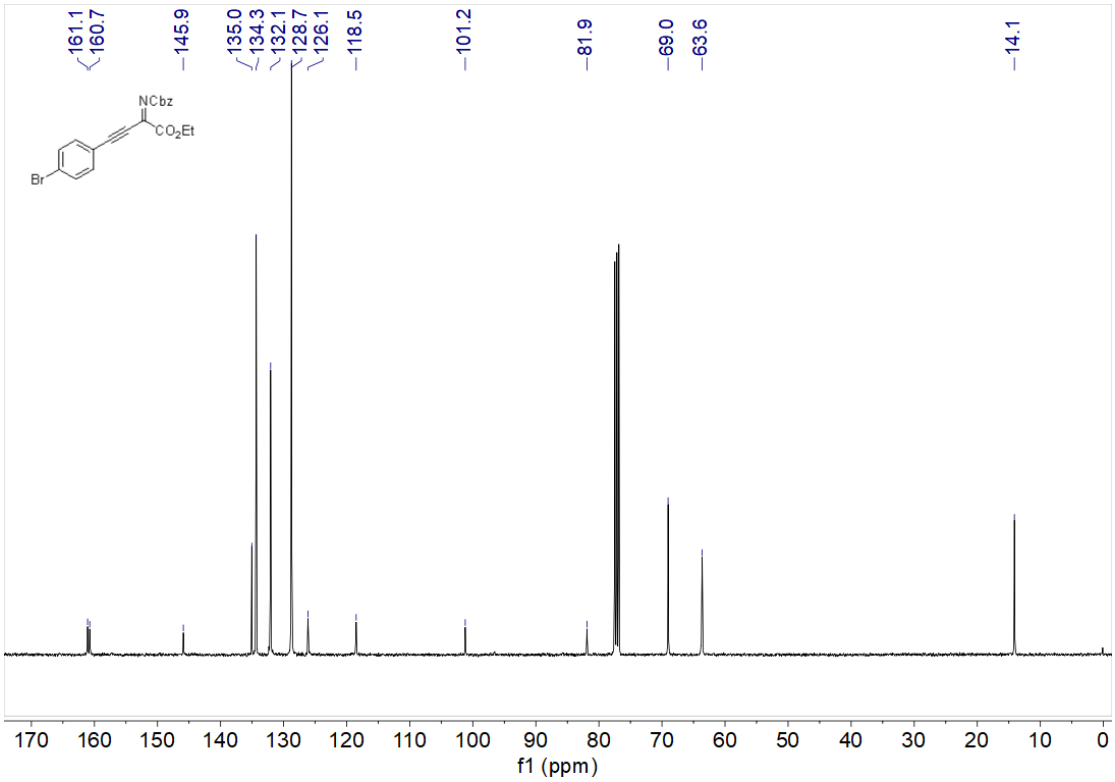
f1 (ppm)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126.1
118.5
101.2
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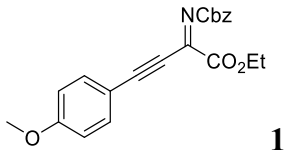
63.6
14.1
NCbz
CO2Et
Br
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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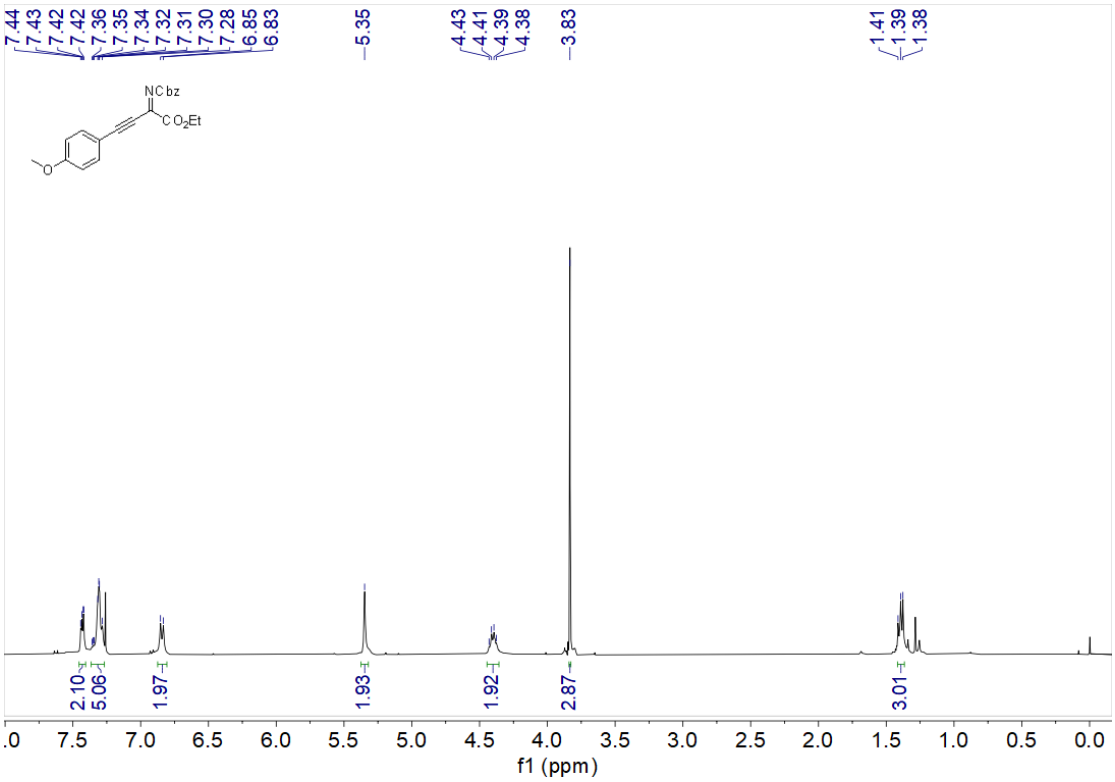
CO2Et
O

1f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6.85
6.83
5.35
4.43
4.41
4.39
4.38
3.83
1.41
1.39
1.38
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CO2Et
O
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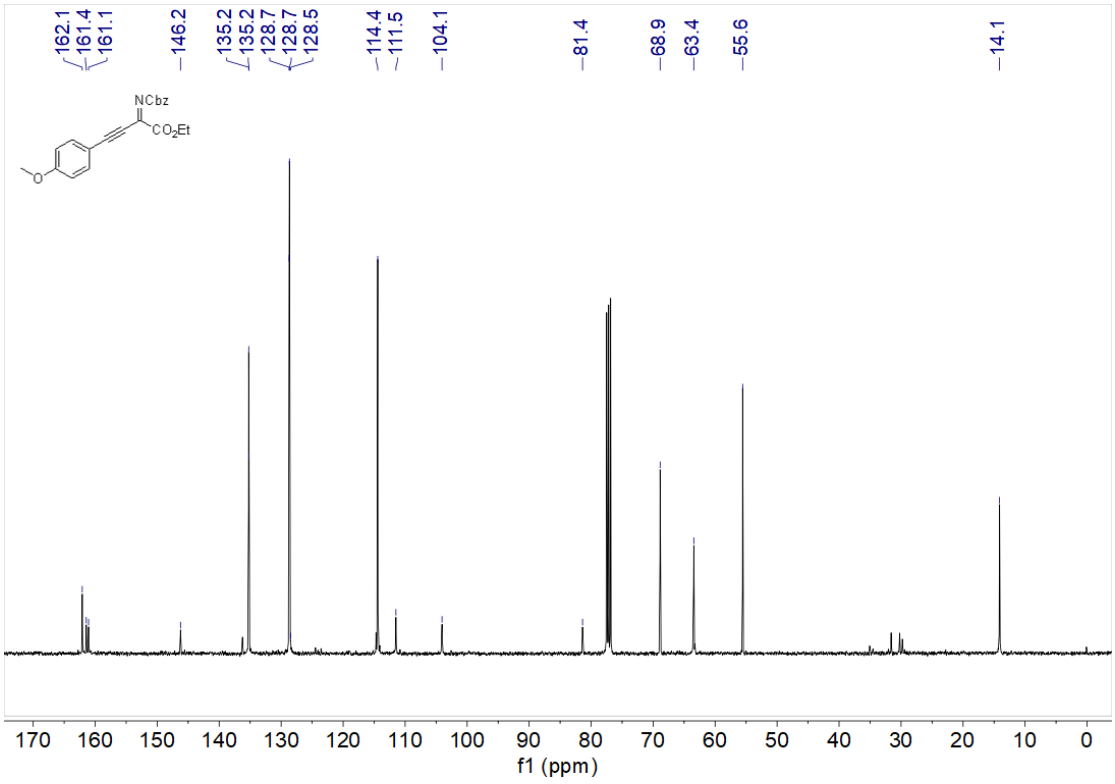
5.06
1.97
1.93
1.92
2.87
3.01
f1 (ppm)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135.2
128.7
128.7
128.5
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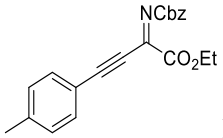
104.1
81.4
68.9
63.4
55.6
14.1
NCbz
CO2Et
O
f1 (ppm)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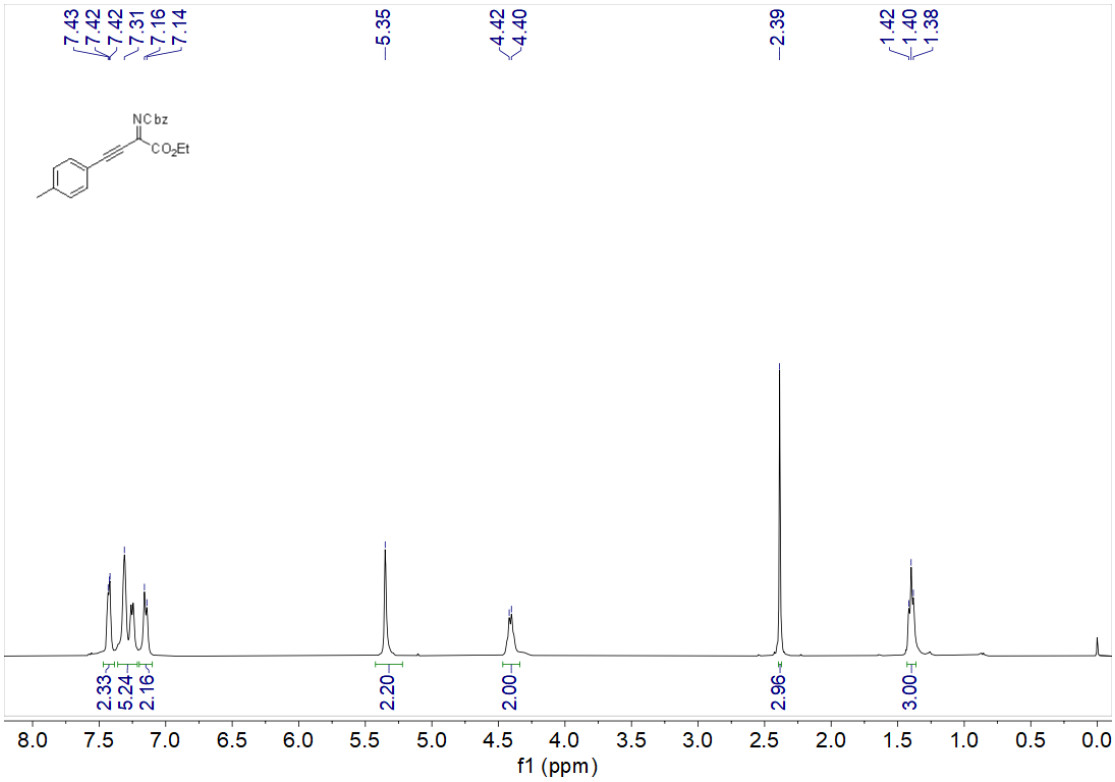
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7.14
5.35
4.42
4.40
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1.42
1.40
1.38
NCbz
CO2Et
2.33
5.24
2.16
2.20
2.00
2.96
3.00
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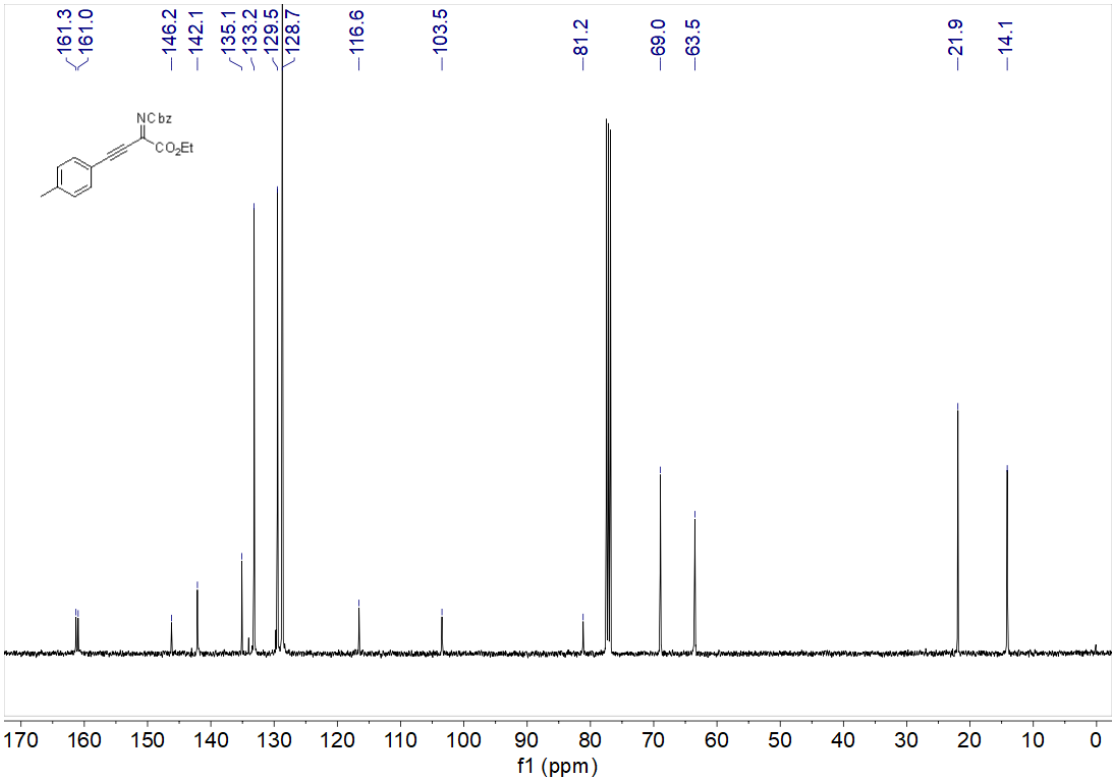
f1 (ppm)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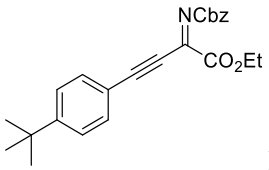
133.2
129.5
128.7
116.6
103.5
81.2
69.0
63.5
21.9
14.1
NCbz
CO2Et
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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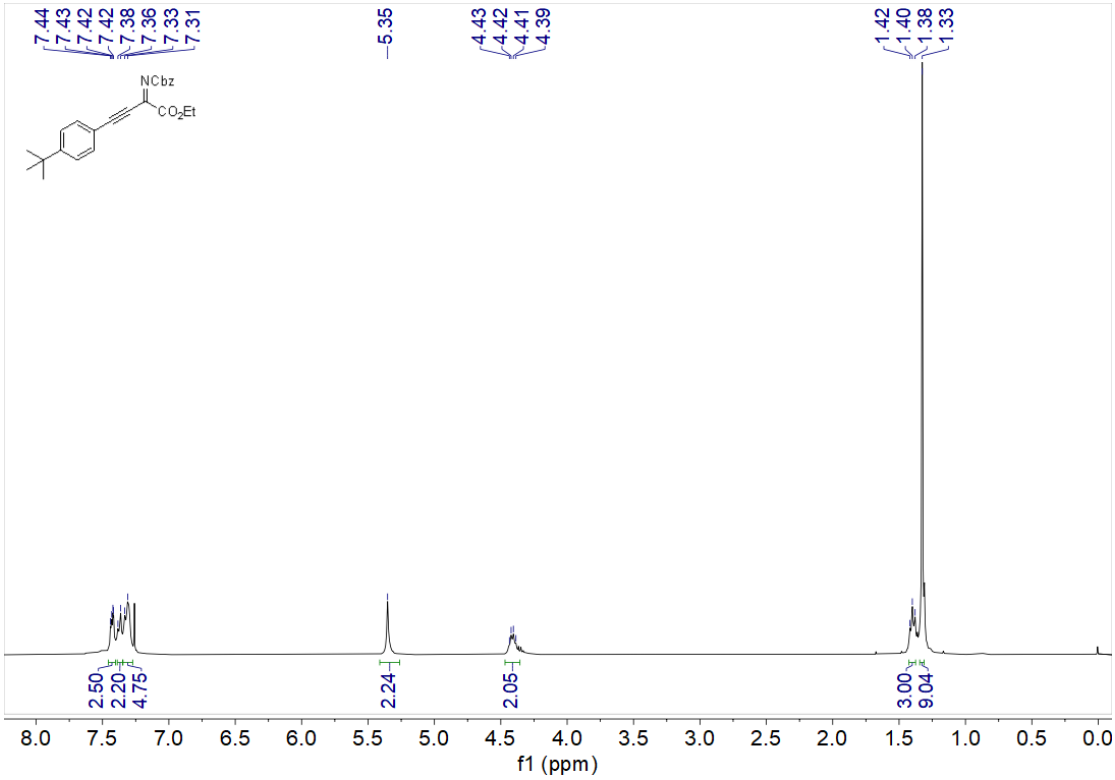
CO2Et

1h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7.42
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7.36
7.33
7.31
5.35
4.43
4.42
4.41
4.39
1.42
1.40
1.38
1.33
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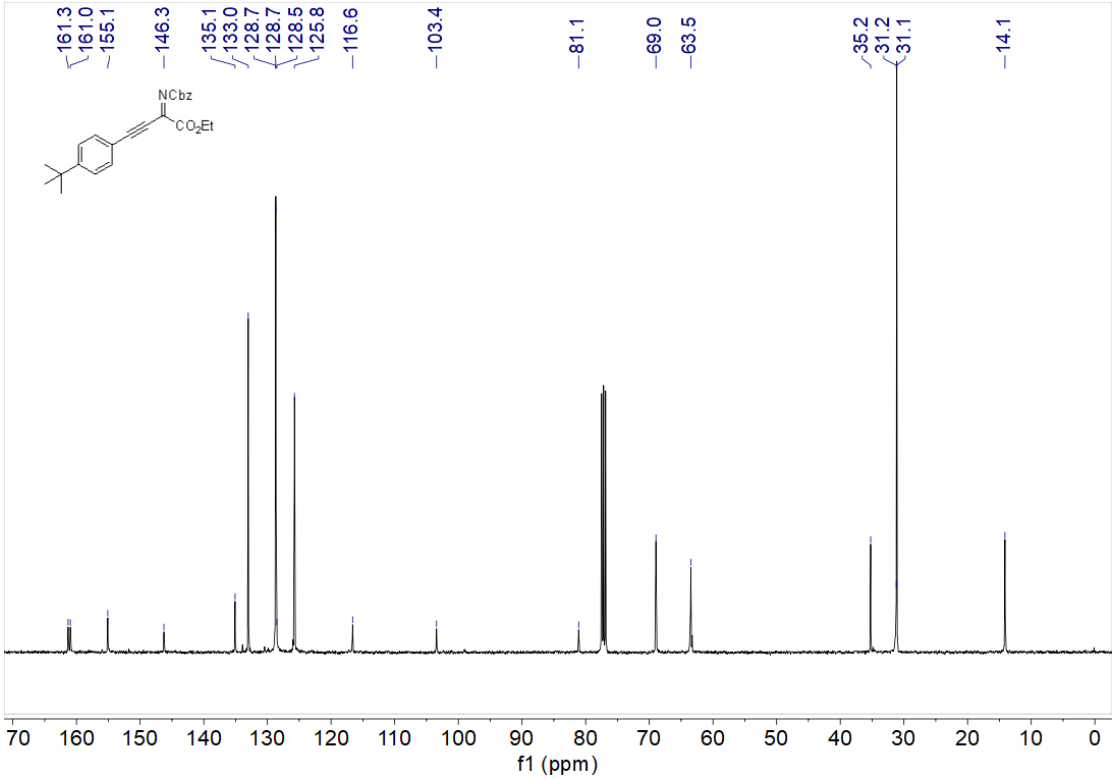
CO2Et
2.50
2.20
4.75
2.24
2.05
3.00
9.04
f1 (ppm)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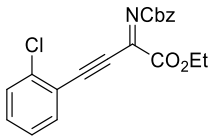
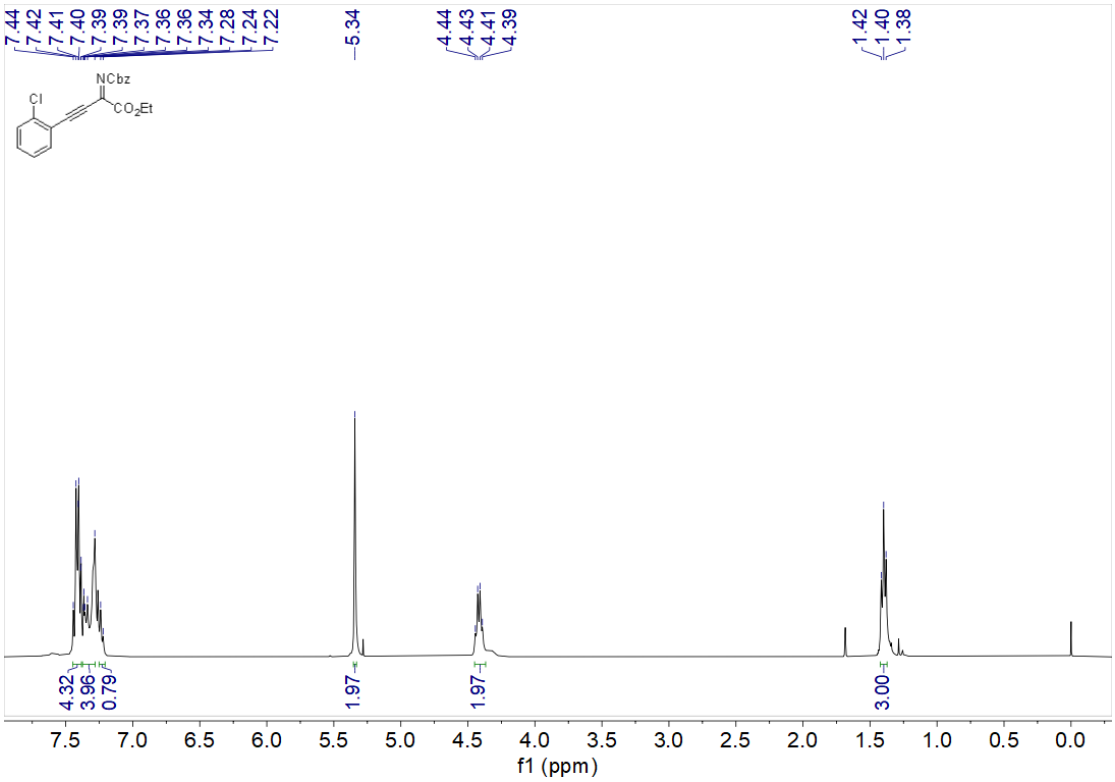
161.0
155.1
146.3
135.1
133.0
128.7
128.7
128.5
125.8
116.6
103.4
81.1
69.0
63.5
35.2
31.2
31.1
14.1
NCbz
CO2Et
f1 (ppm)


NCbz
Cl
CO2Et

1i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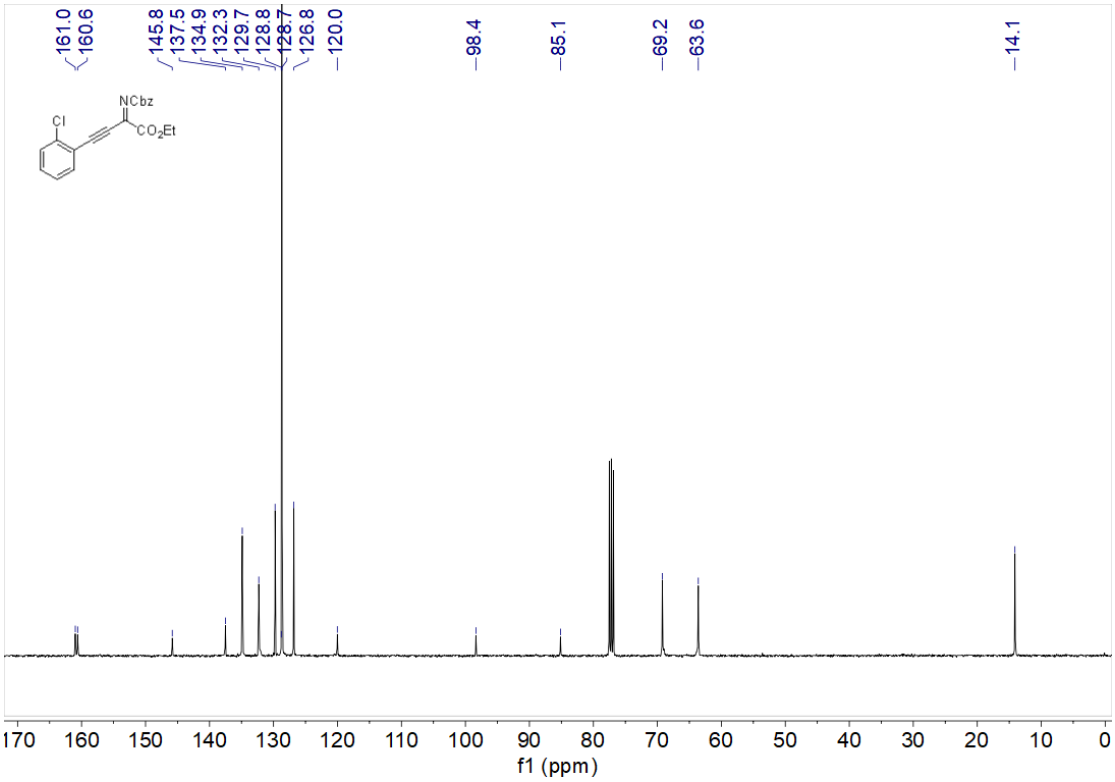
7.39
7.39
7.37
7.36
7.36
7.34
7.28
7.24
7.22
5.34
4.44
4.43
4.41
4.39
1.42
1.40
1.38
NCbz
Cl
CO2Et
4.32
3.96
0.79
1.97
1.97
3.00
7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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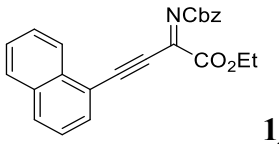
134.9
132.3
129.7
128.8
128.7
126.8
120.0
98.4
85.1
69.2
63.6
14.1
NCbz
Cl
CO2Et
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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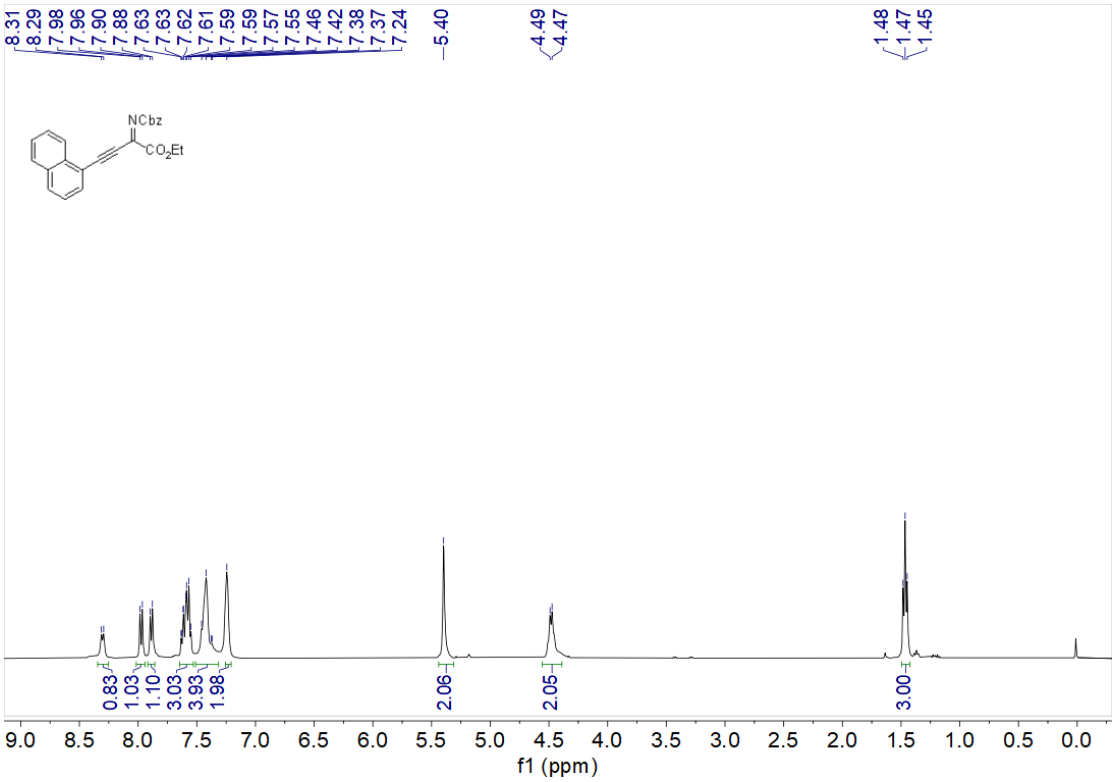
CO2Et

1j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7.62
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7.59
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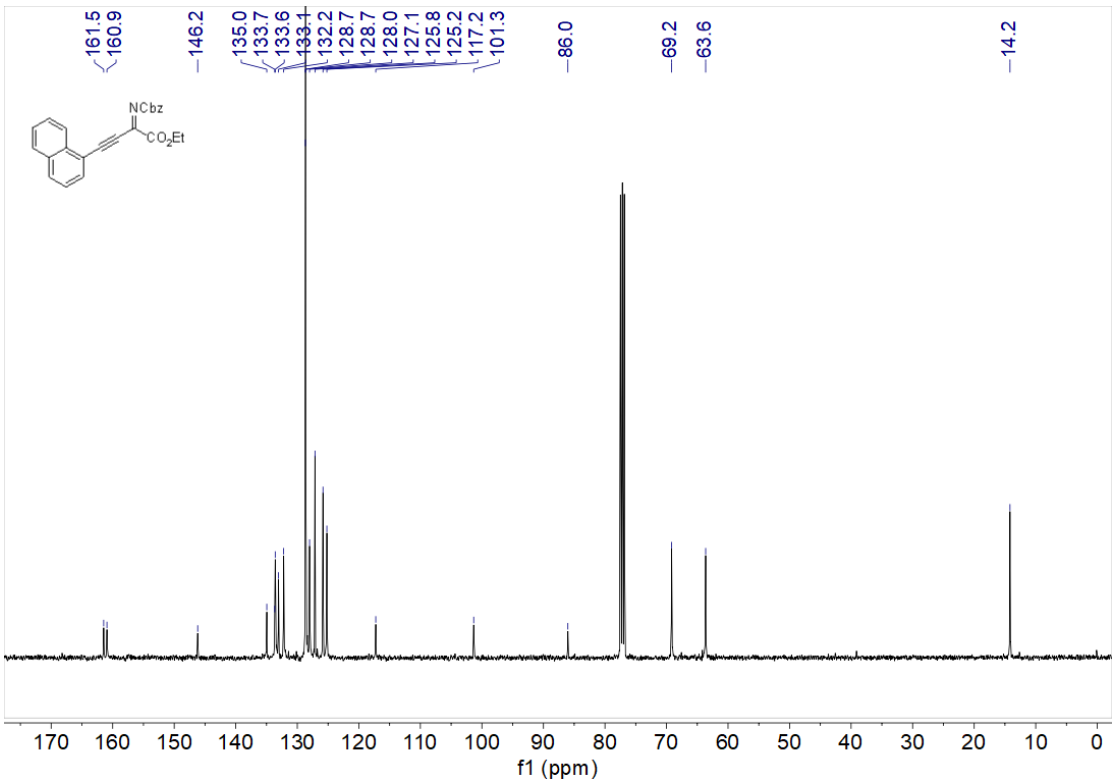
7.57
7.55
7.46
7.42
7.38
7.37
7.24
5.40
4.49
4.47
1.48
1.47
1.45
NCbz
CO2Et
0.83
1.03
1.10
3.03
3.93
1.98
2.06
2.05
3.00
9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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133.6
133.1
132.2
128.7
128.7
128.0
127.1
125.8
125.2
117.2
101.3
86.0
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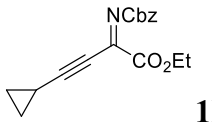
63.6
14.2
NCbz
CO2Et
170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)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CO2Et

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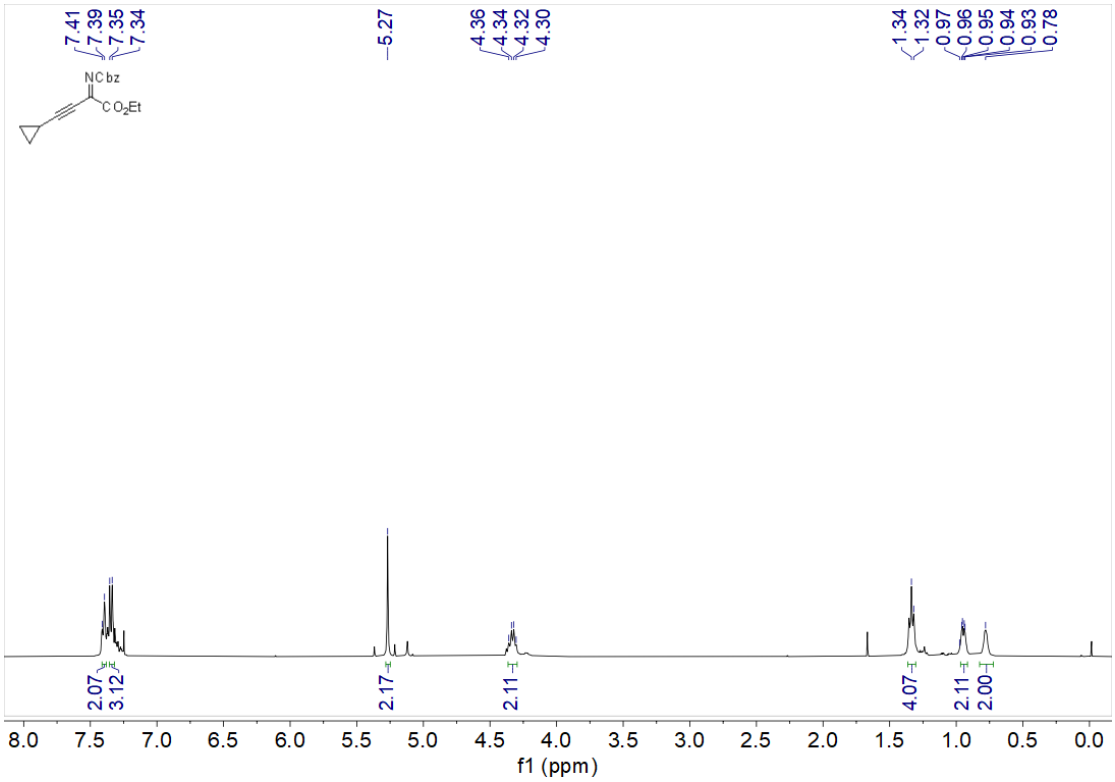
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7.34
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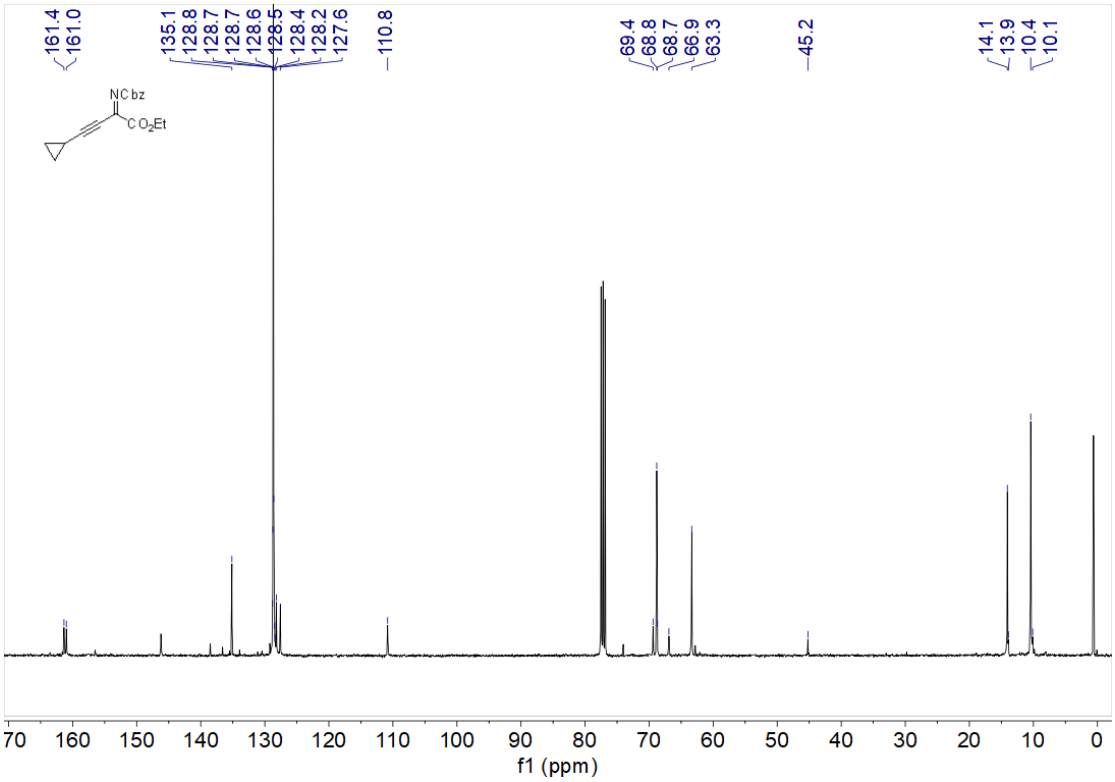
4.34
4.32
4.30
1.34
1.32
0.97
0.96
0.95
0.94
0.93
0.78
NCbz
CO2Et
2.07
3.12
2.17
2.11
4.07
2.11
2.00
8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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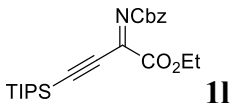
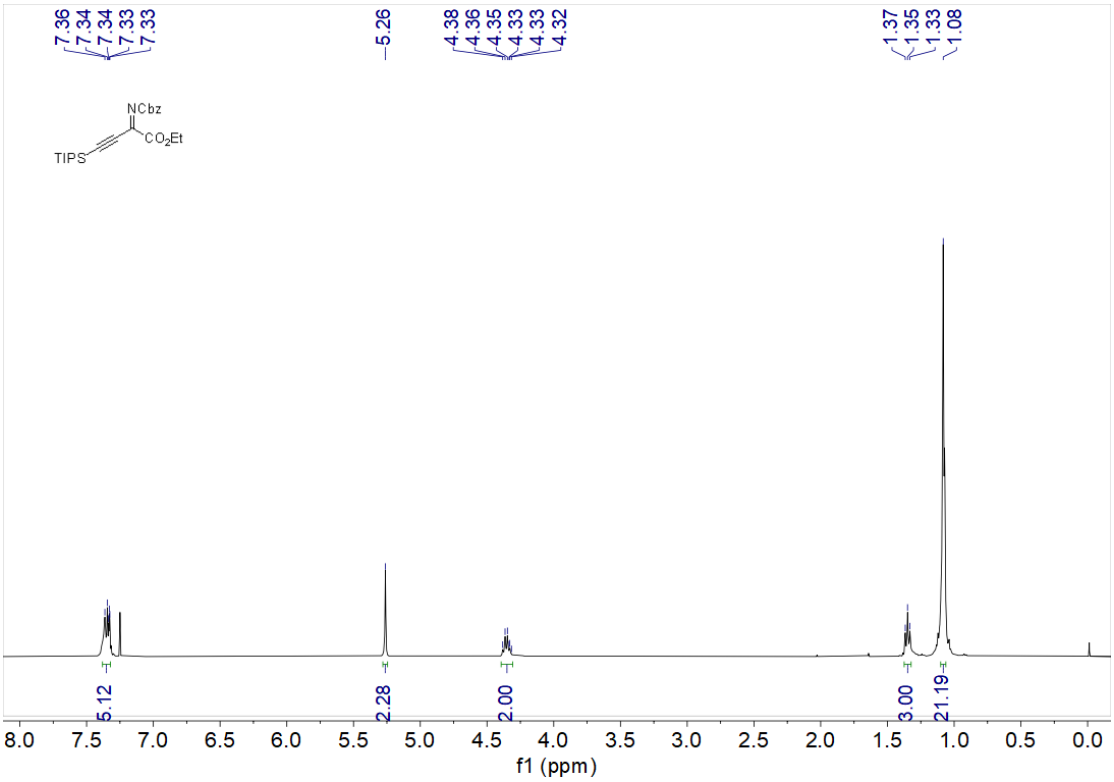
128.7
128.6
128.5
128.4
128.2
127.6
110.8
69.4
68.8
68.7
66.9
63.3
45.2
14.1
13.9
10.4
10.1
NCbz
CO2Et
70 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


NCbz
CO2Et
TIPS

1l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4.33
4.33
4.32
1.37
1.35
1.33
1.08
NCbz
CO2Et
TIPS
5.12
2.28
2.00
3.00
21.19
8.0
7.5
7.0
6.5
6.0
5.5
5.0
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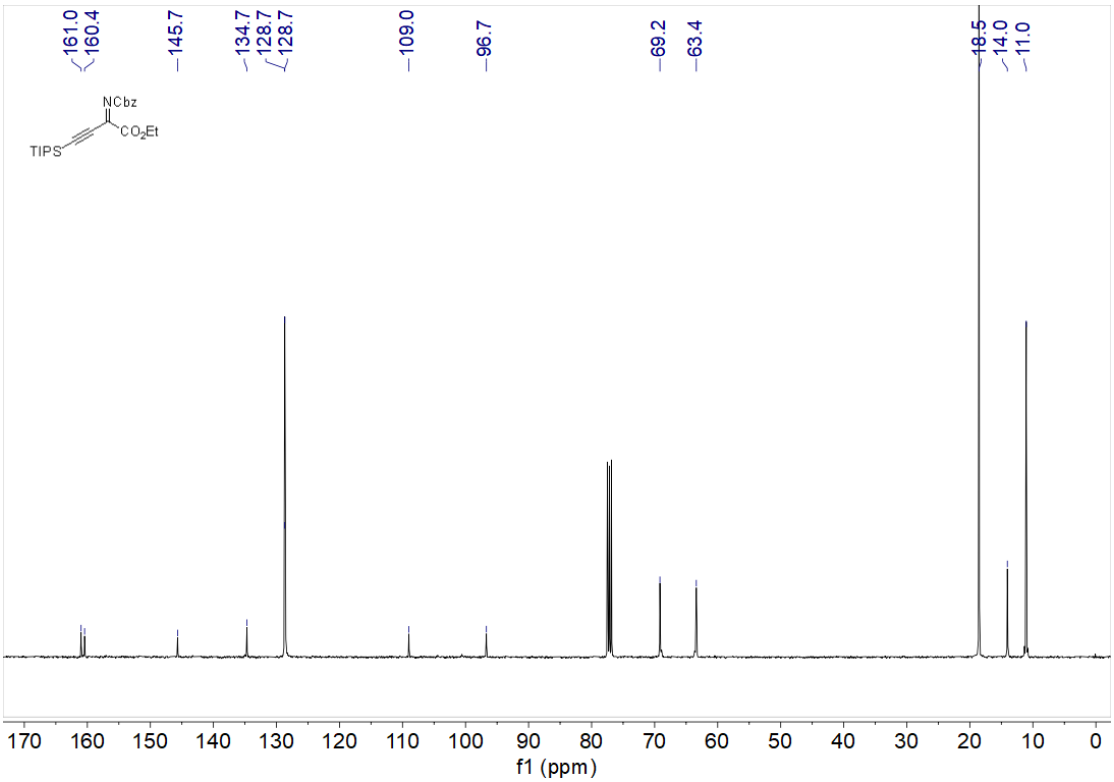
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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128.7
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96.7
69.2
63.4
18.5
14.0
11.0
NCbz
CO2Et
TIPS
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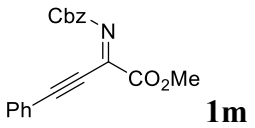
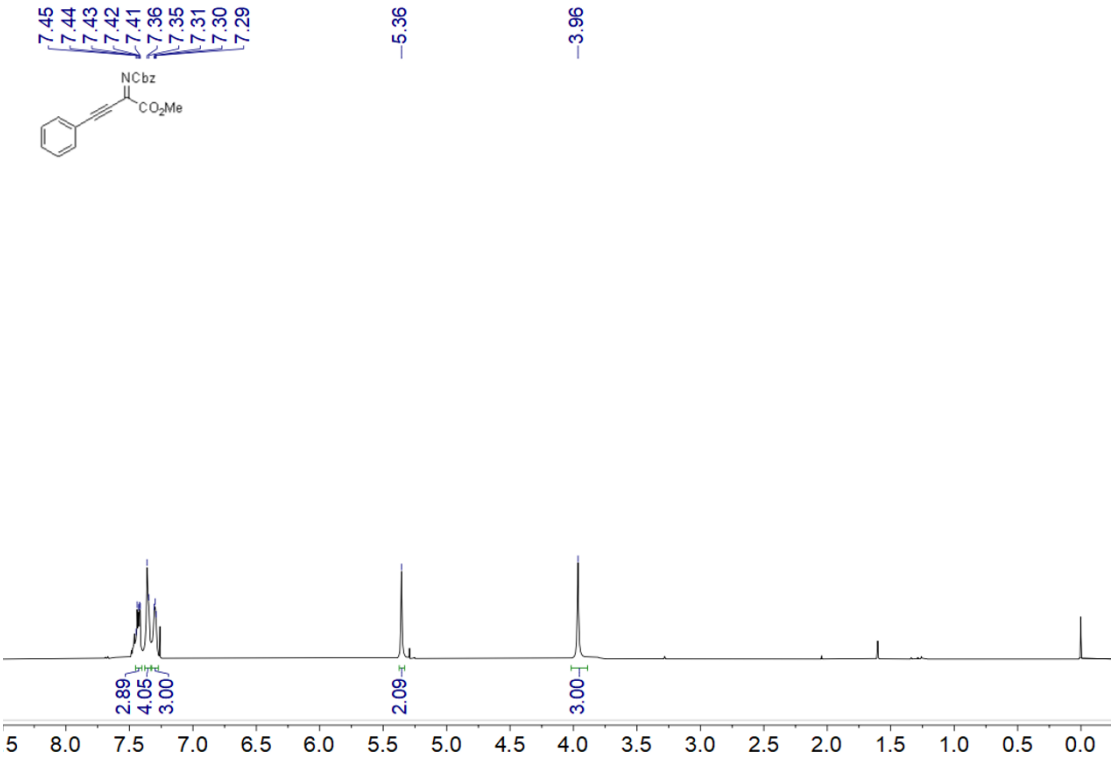
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)


Cbz
N
CO2Me
Ph

1m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5.36
3.96
NCbz
CO2Me
2.89
4.05
3.00
2.09
3.00
5
8.0
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7.0
6.5
6.0
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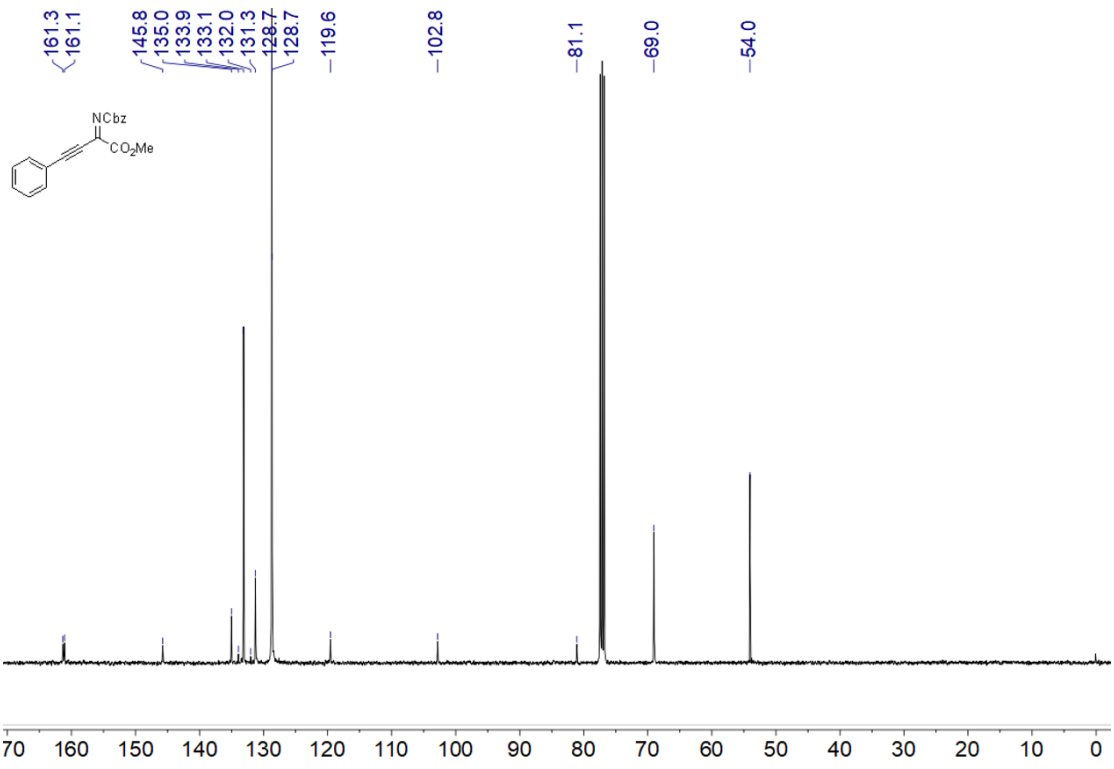
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133.1
132.0
131.3
128.7
128.7
119.6
102.8
81.1
69.0
54.0
NCbz
CO2Me
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110
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90
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70
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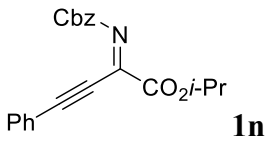
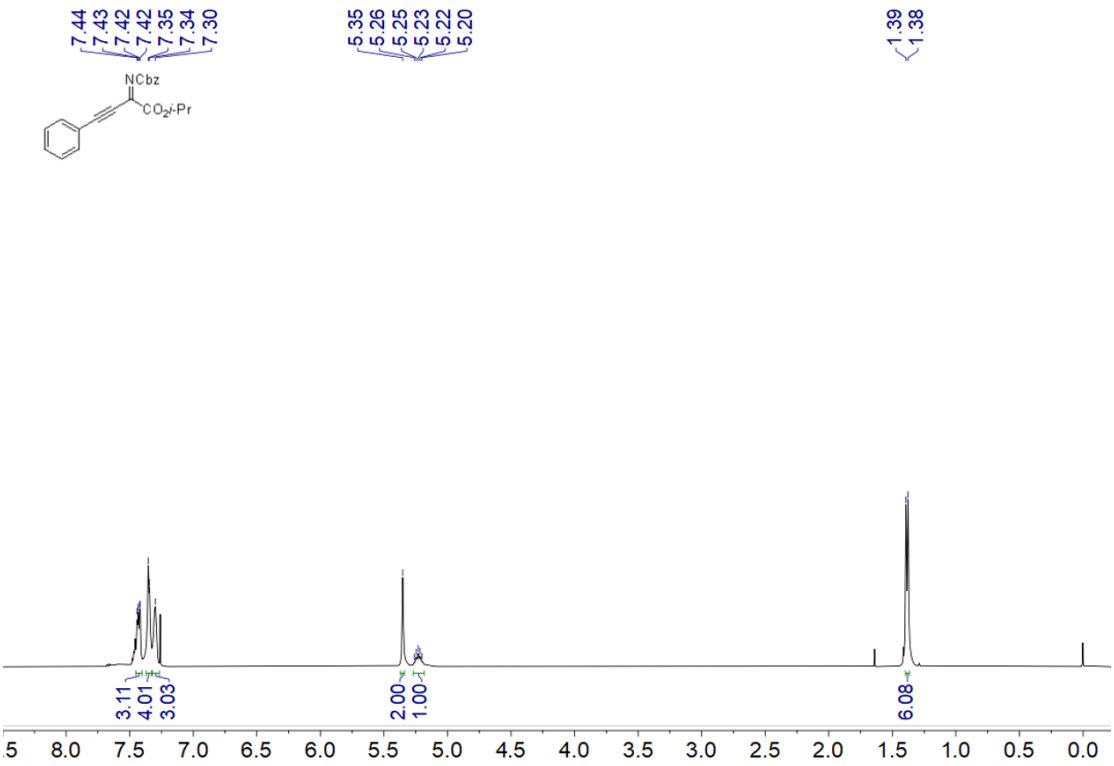
30
20
10
0


Cbz
N
CO2i-Pr
Ph

1n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5.25
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5.22
5.20
1.39
1.38
NCbz
CO2i-Pr
3.11
4.01
3.03
2.00
1.00
6.08
8.0
7.5
7.0
6.5
6.0
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3.0
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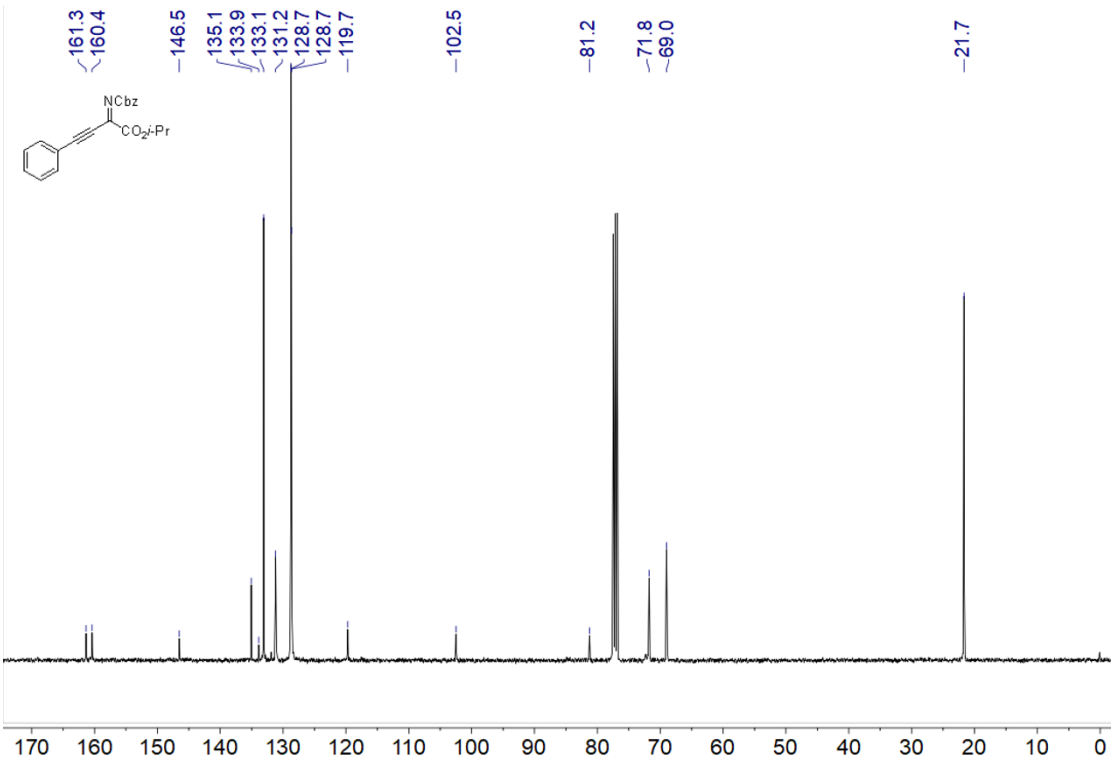
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146.5
135.1
133.9
133.1
131.2
128.7
128.7
119.7
102.5
81.2
71.8
69.0
21.7
NCbz
CO2i-Pr
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140
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110
100
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30
20
10
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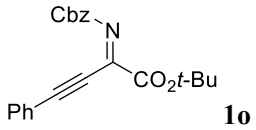
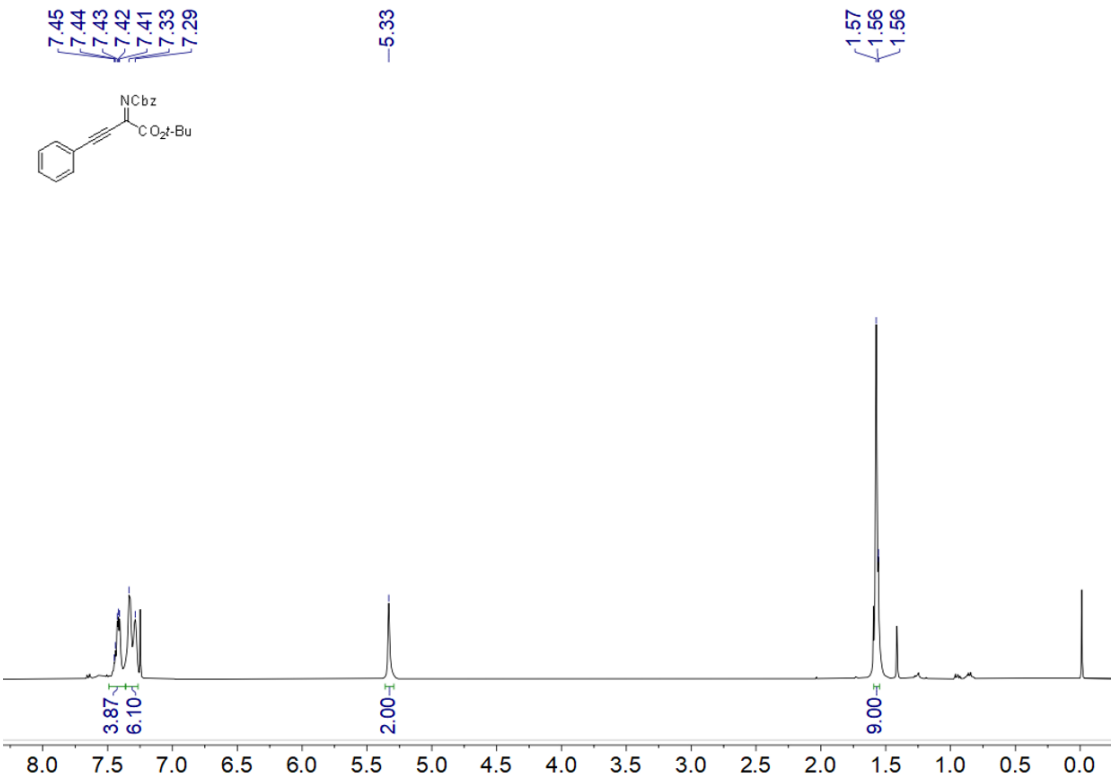

Cbz
N
CO2t-Bu
Ph

1o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1.56
1.56
NCbz
CO2t-Bu
3.87
6.10
2.00
9.00
8.0
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7.0
6.5
6.0
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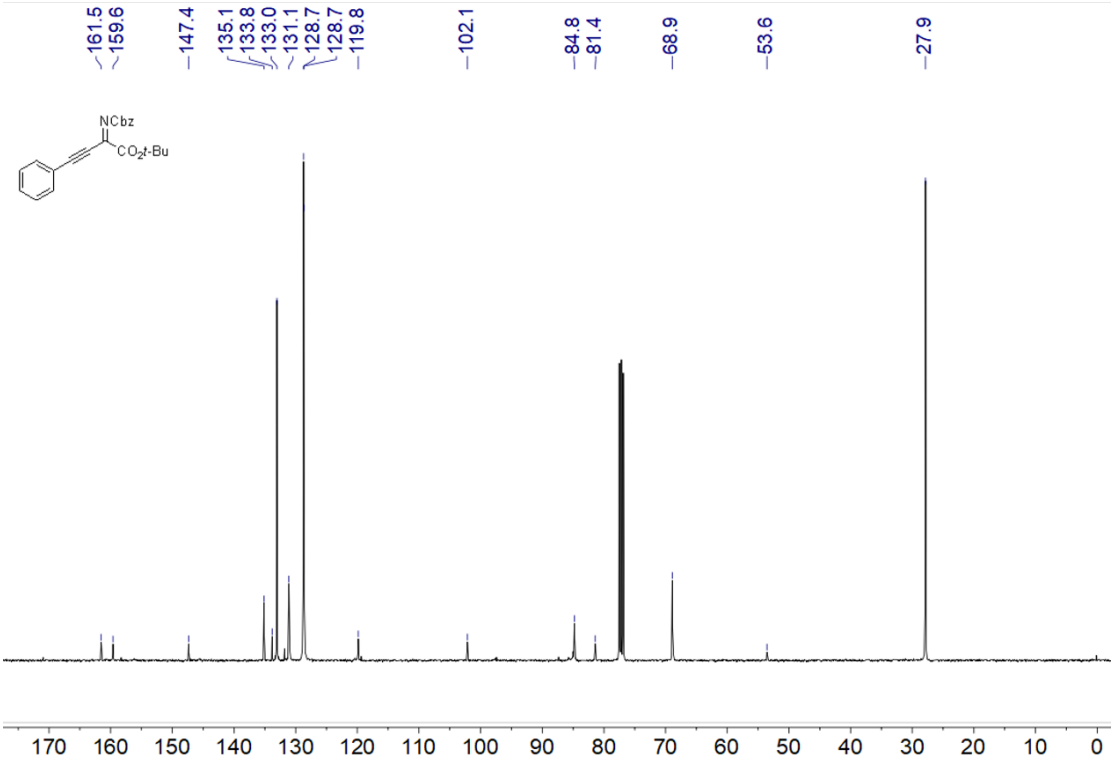
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68.9
53.6
27.9
NCbz
CO2t-Bu
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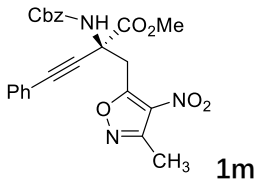
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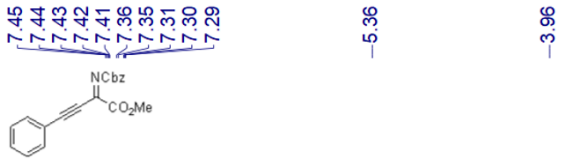
Ph
O
N
NO2
CH3

1m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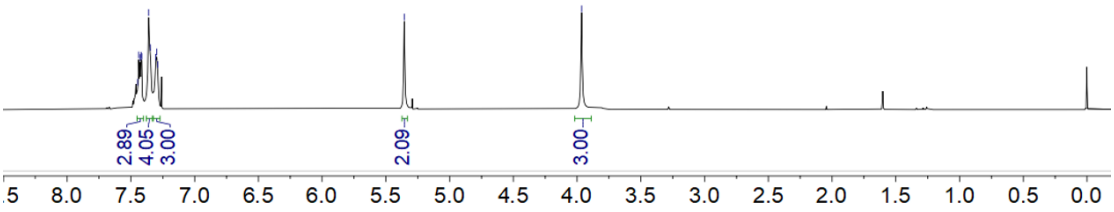
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2.09
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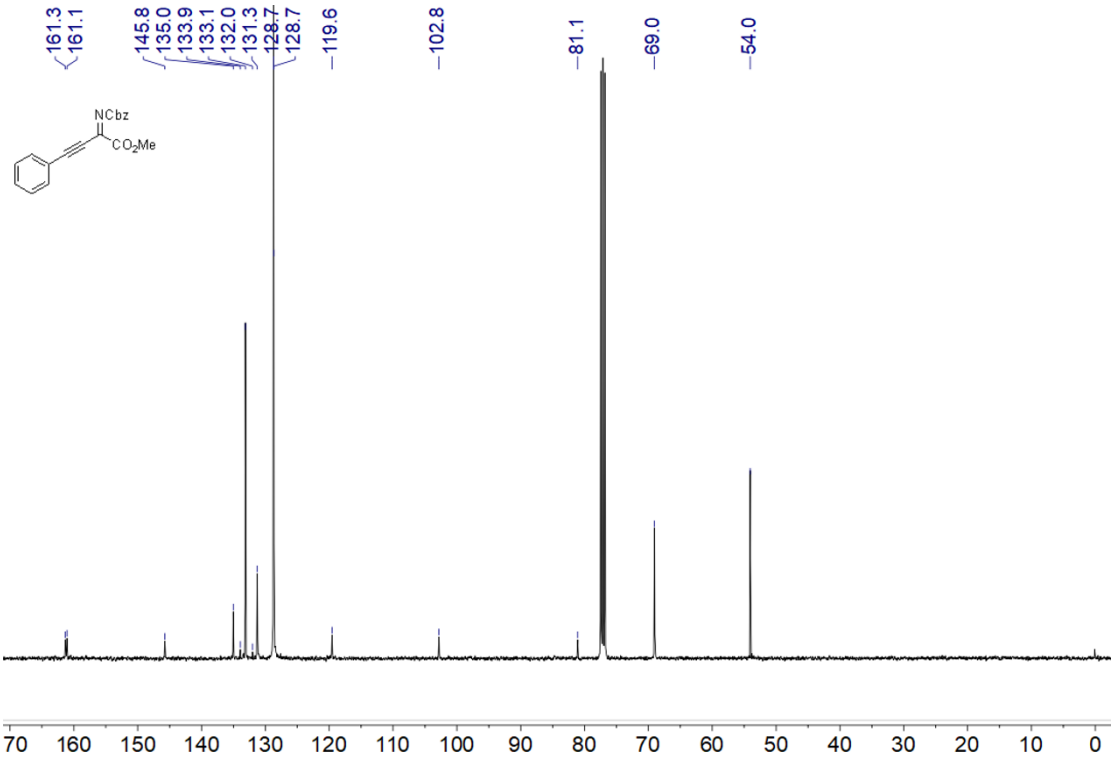
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133.9
133.1
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131.3
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128.7
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81.1
69.0
54.0
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CO2Me
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150
140
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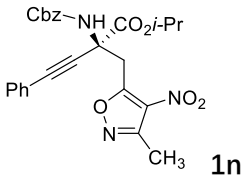
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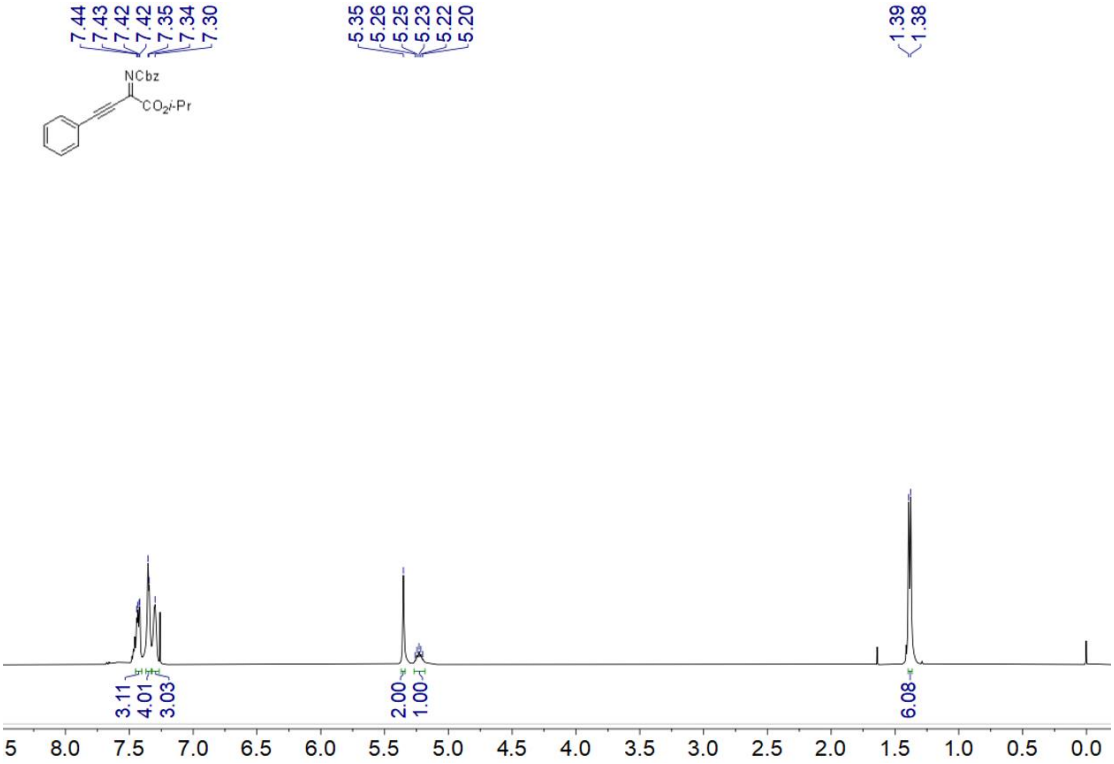
CO2i-Pr
Ph
NO2
O
N
CH3

1n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5.35
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5.25
5.23
5.22
5.20
1.39
1.38
NCbz
CO2i-Pr
3.11
4.01
3.03
2.00
1.00
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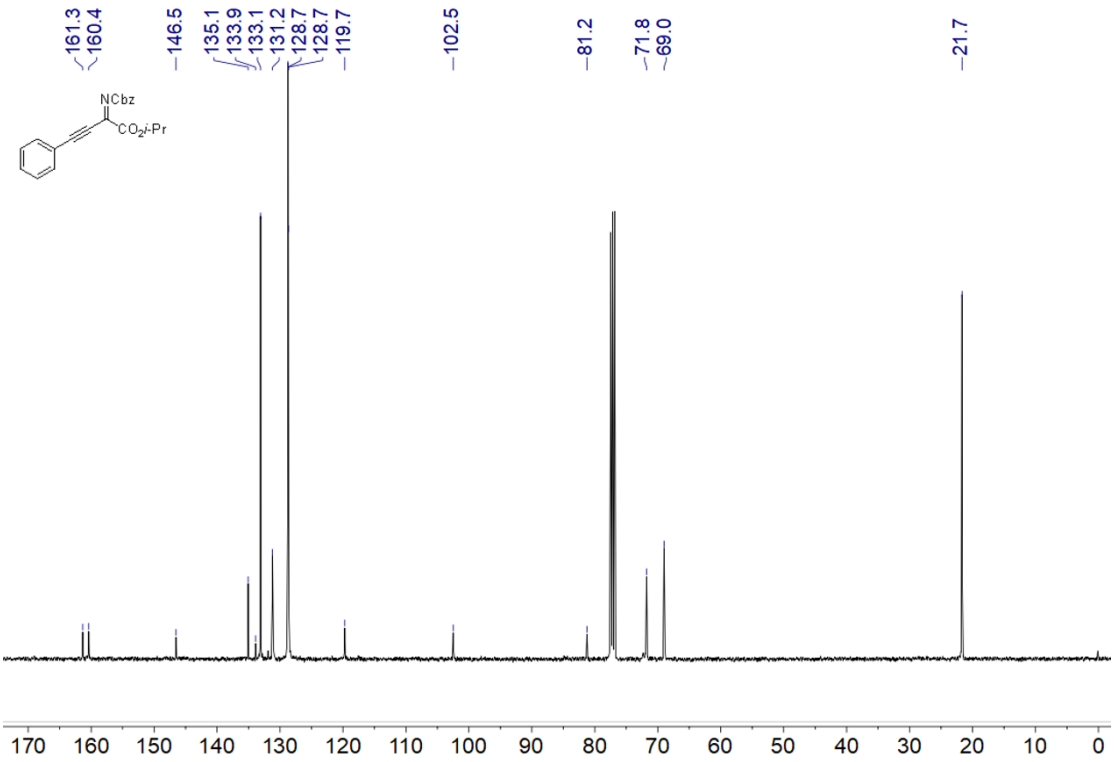
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NCbz
CO2i-Pr
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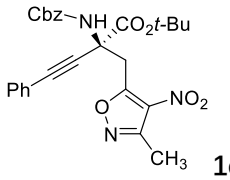
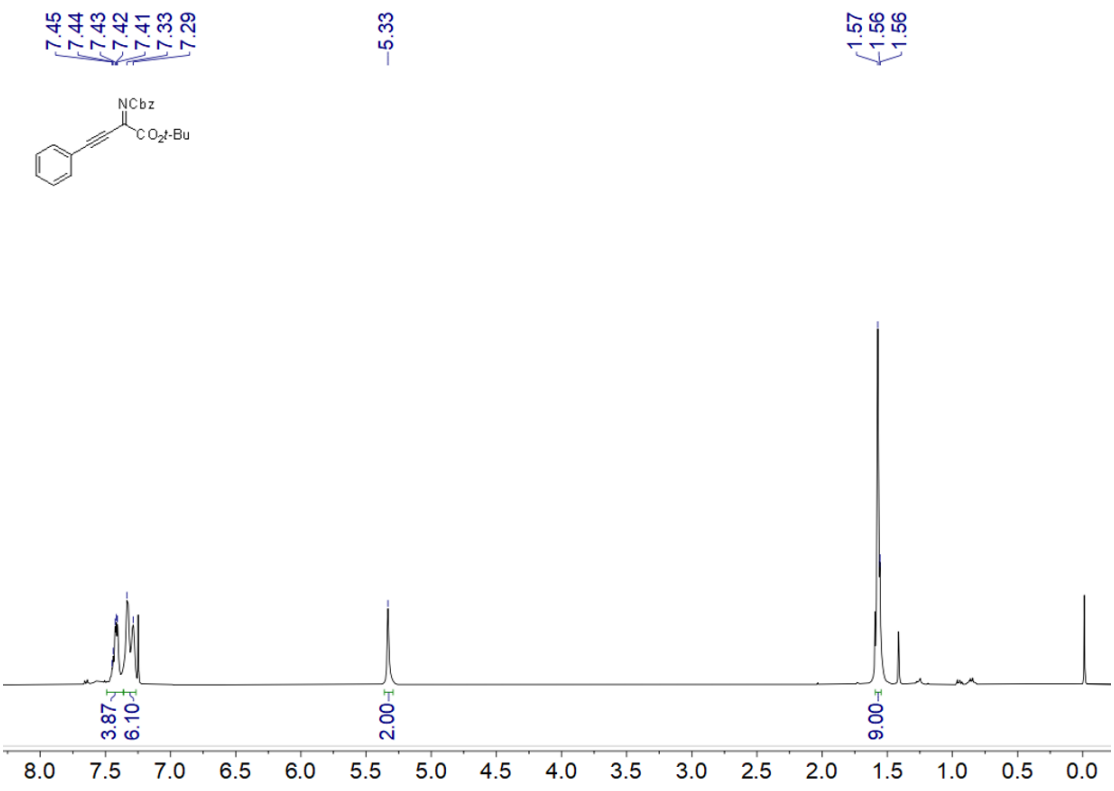

Cbz
NH
CO2t-Bu
Ph
NO2
O
N
CH3

1o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7.42
7.41
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5.33
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1.56
1.56
NCbz
CO2t-Bu
3.87
6.10
2.00
9.00
8.0
7.5
7.0
6.5
6.0
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4.5
4.0
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3.0
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2.0
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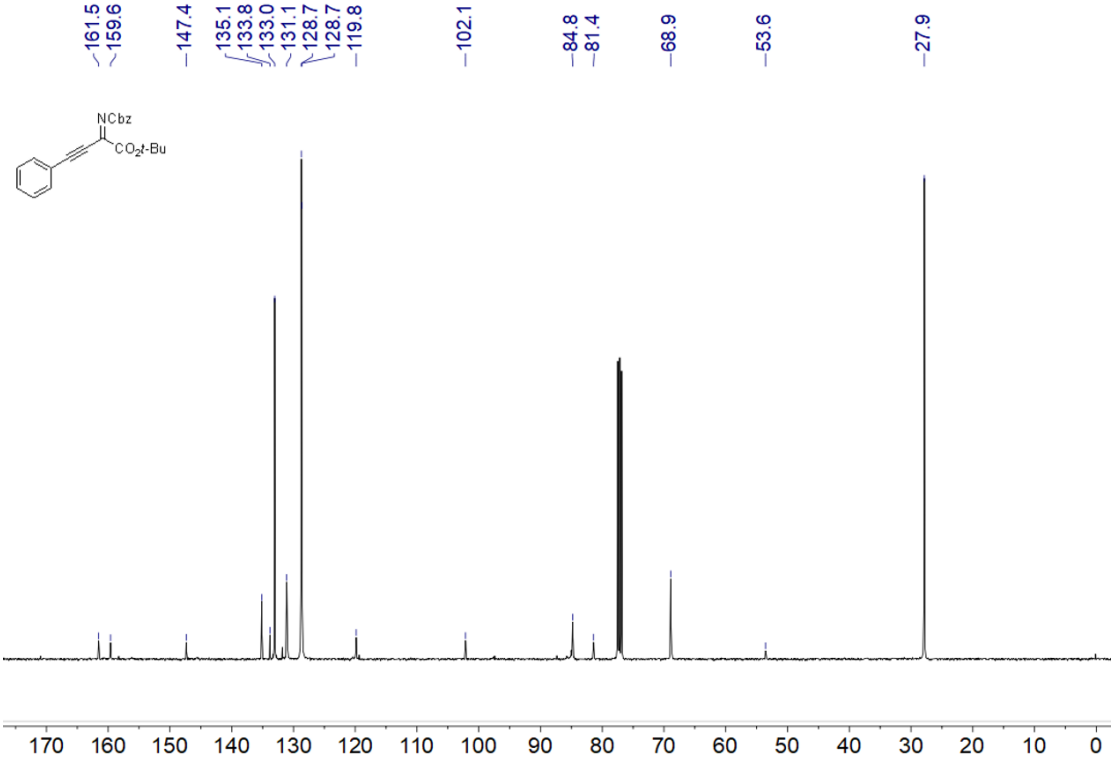
161.5
159.6
147.4
135.1
133.8
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102.1
84.8
81.4
68.9
53.6
27.9
NCbz
CO2t-Bu
170
160
150
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100
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