Supplementary Information for

Synthesis and Properties of Optically Active Helical Polymers from (*S*)-3-Functional-3′-Vinyl-BINOL Derivatives

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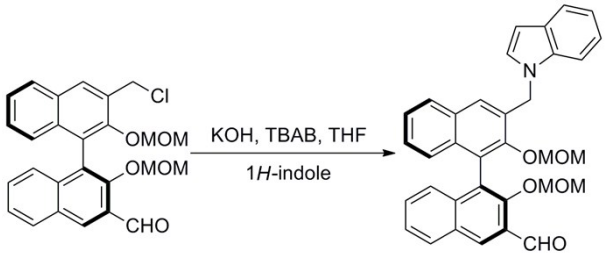
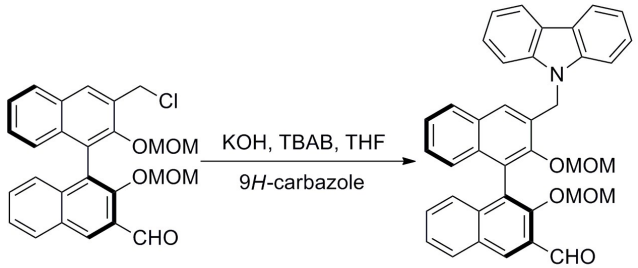
Synthesis of (*S*)-4b, (*S*)-4c, (*S*)-5b, (*S*)-5c, (*S*)-6b and (*S*)-6c.



(*S*)-**3** (*S*)-**4b**

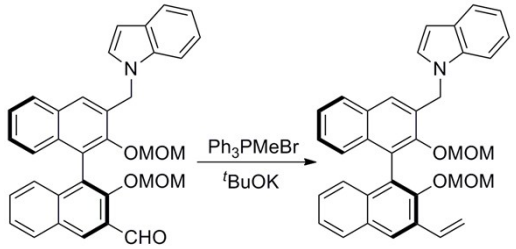
(*S*)-3′-((1H-indol-1-yl)methyl)-2,2′-bis(methoxymethoxy)-[1,1′-binaphthalene]-3-carbaldehyde, ((*S*)-4b), 83 % (1.47 g) as yellow oil: ^{1}H NMR δ 10.59 (s, 1H), 8.62 (s, 1H), 8.08 (d, *J* = 7.6 Hz, 1H), 7.73 (d, *J* = 6.9 Hz, 1H), 7.64 (d, *J* = 7.6 Hz, 1H), 7.52 (d, *J* = 7.1 Hz, 1H), 7.45 (d, *J* = 7.0 Hz, 1H), 7.38 (d, *J* = 7.7 Hz, 1H), 7.32 (s, 2H), 7.28 (s, 1H), 7.22 (d, *J* = 8.1 Hz, 2H), 7.15 (dd, *J* = 18.5, 9.8 Hz, 3H), 6.67 (s, 1H), 5.72 (d, *J* = 23.1 Hz, 2H), 4.64 (s, 2H), 4.56 (s, 2H), 3.10 (s, 3H), 2.90 (s, 3H). ^{13}C NMR δ 190.79, 153.93, 152.40, 136.94, 136.34, 133.24, 131.91, 131.43, 130.77, 130.33, 130.02, 129.61, 129.02, 128.74, 128.62, 126.75, 126.59, 126.18, 125.60, 125.41, 124.39, 121.82, 121.07, 119.65, 109.69, 101.96, 100.46, 99.79, 57.04, 46.00. Elem. Anal. Calcd. for $C_{34}H_{29}NO_5$: C, 76.82; H, 5.50. Found: C, 76.84; H, 5.48.



(*S*)-**3** (*S*)-**4c**

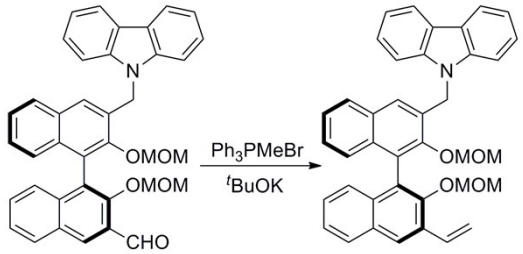
(*S*)-3′-((9H-carbazol-9-yl)methyl)-2,2′-bis(methoxymethoxy)-[1,1′-binaphthalene]-3- carbaldehyde ((*S*)-4c), 84 % (1.63 g) as yellow oil: ^{1}H NMR δ 10.62 (s, 1H), 8.64 (s, 1H), 8.22 (d, *J* = 7.2 Hz, 2H), 8.10 (d, *J* = 7.7 Hz, 1H), 7.53 (d, *J* = 7.7 Hz, 1H), 7.46 (s, 7H), 7.32 (s, 3H), 7.22 – 7.17 (m, 2H), 7.12 (d, *J* = 7.9 Hz, 1H), 5.90 (q, *J* = 17.9 Hz, 2H), 4.68 (s, 4H), 3.20 (s, 3H), 2.91 (s, 3H). ^{13}C NMR δ 190.82, 153.93,

152.73, 140.80, 136.98, 133.17, 132.03, 130.81, 130.56, 130.09, 130.09, 129.69, 129.06, 128.16, 126.68, 126.30, 126.25, 126.04, 125.58, 125.34, 124.45, 123.16, 120.57, 119.43, 108.87, 100.58, 100.03, 57.23, 57.09, 42.63. Elem. Anal. Calcd. for $C_{38}H_{31}NO_5$: C, 78.47; H, 5.37. Found: C, 78.44; H, 5.38.



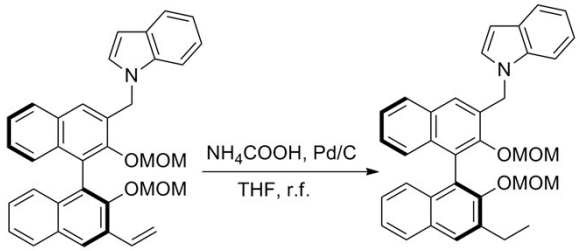
(*S*)-**4b** (*S*)-**5b**

(*S*)-1-((2,2′-bis(methoxymethoxy)-3′-vinyl-[1,1′-binaphthalen]-3-yl)methyl)-1H-indole ((*S*)-5b), 95 % (1.15 g) as a white solid: ^{1}H NMR δ 8.16 (s, 1H), 7.92 (d, *J* = 7.8 Hz, 1H), 7.73 (d, *J* = 7.1 Hz, 1H), 7.59 (d, *J* = 7.7 Hz, 1H), 7.42 (d, *J* = 7.0 Hz, 1H), 7.37 (d, *J* = 7.5 Hz, 1H), 7.29 (d, *J* = 9.8 Hz, 3H), 7.20 (s, 3H), 7.18 (s, 2H), 7.16 (s, 2H), 6.67 (s, 1H), 6.00 (d, *J* = 17.6 Hz, 1H), 5.73 (dd, *J* = 17.1 Hz, 2H), 5.47 (d, *J* = 10.8 Hz, 1H), 4.68 (d, *J* = 4.9 Hz, 1H), 4.58 (s, 1H), 4.55 (s, 2H), 3.15 (s, 3H), 2.56 (s, 3H). ^{13}C NMR δ 152.20, 151.46, 136.40, 133.59, 132.54, 131.78, 131.35, 130.90, 130.72, 128.72, 128.25, 127.91, 126.74, 126.66, 126.33, 125.98, 125.43, 125.18, 121.80, 121.05, 119.62, 116.39, 109.76, 101.89, 99.62, 99.17, 57.08, 56.36, 46.08. Elem. Anal. Calcd. for $C_{35}H_{31}NO_4$: C, 79.37; H, 5.90. Found: C, 79.34; H, 5.92.



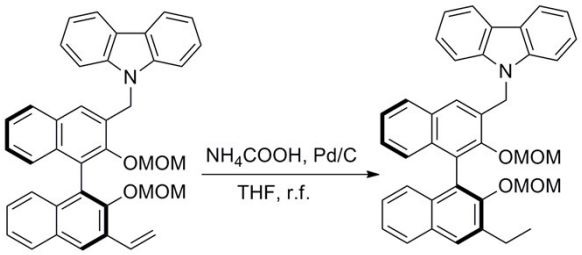
(*S*)-**4c** (*S*)-**5c**

(*S*)-9-((2,2′-bis(methoxymethoxy)-3′-vinyl-[1,1′-binaphthalen]-3-yl)methyl)-9H-carbazole ((*S*)-5c), 96 % (1.27 g) as a white solid: ^{1}H NMR δ 8.22 (d, *J* = 7.5 Hz, 2H), 8.18 (s, 1H), 7.94 (d, *J* = 7.9 Hz, 1H), 7.46 (d, *J* = 8.1 Hz, 6H), 7.31 (t, *J* = 7.0 Hz, 4H), 7.26 – 7.21 (m, 2H), 7.17 (s, 2H), 7.09 (s, 1H), 6.02 (d, *J* = 17.7 Hz, 1H), 5.92 (q, *J* = 18.4 Hz, 2H), 5.49 (d, *J* = 10.9 Hz, 1H), 4.74 (d, *J* = 5.2 Hz, 1H), 4.66 (s, 2H), 4.59 (d, *J* = 5.1 Hz, 1H), 3.25 (s, 3H), 2.58 (s, 3H). ^{13}C NMR δ 152.65, 151.50, 140.93, 133.68, 133.59, 132.64, 131.91, 131.02, 130.80, 130.41, 128.35, 127.98, 126.85, 126.29, 126.14, 126.08, 125.56, 125.50, 125.16, 123.22, 120.59, 119.41, 116.49, 109.00, 99.95, 99.31, 57.36, 56.46, 42.86. Elem. Anal. Calcd. for $C_{39}H_{33}NO_4$: C, 80.81; H, 5.74. Found: C, 80.84; H, 5.78.



(*S*)-**5b** (*S*)-**6b**

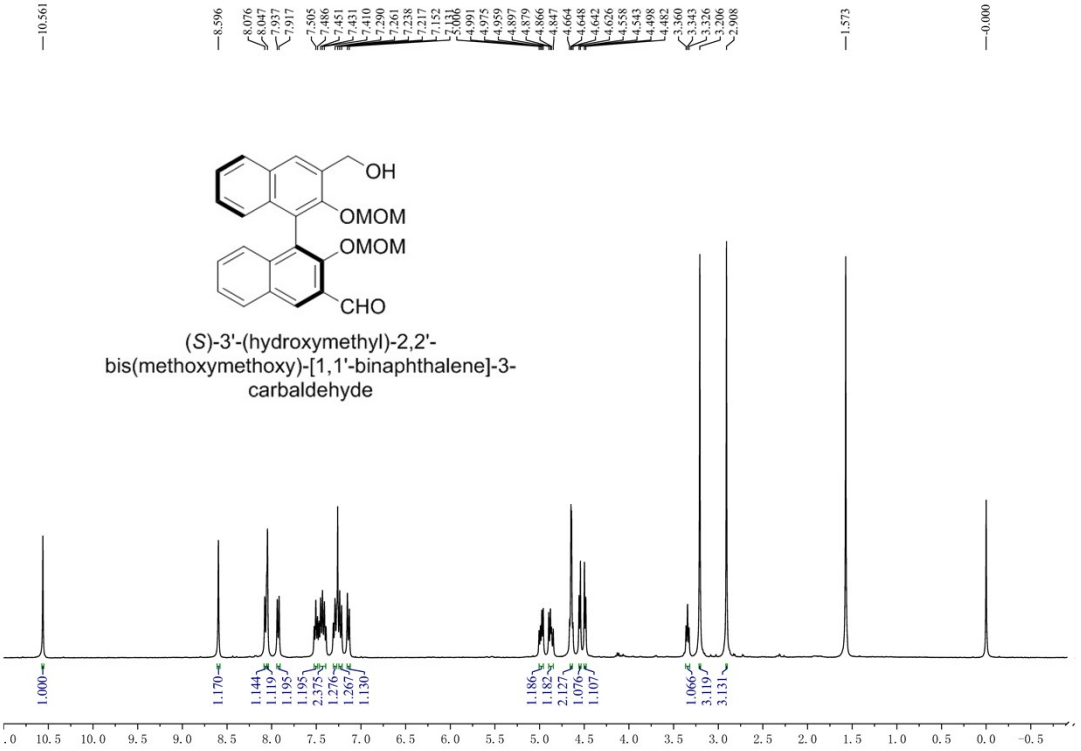
(*S*)-1-((3'-ethyl-2,2'-bis(methoxymethoxy)-[1,1'-binaphthalen]-3-yl)methyl)-1H-indole ((*S*)-6b), 83 % (0.83 g) as colorless oil: ^{1}H NMR δ 7.87 (d, *J* = 8.6 Hz, 1H), 7.85 (s, 1H), 7.73 (d, *J* = 7.2 Hz, 1H), 7.59 (d, *J* = 8.2 Hz, 1H), 7.43 – 7.35 (m, 2H), 7.30 (td, *J* = 6.3, 2.5 Hz, 2H), 7.23 (d, *J* = 7.1 Hz, 1H), 7.21 – 7.14 (m, 6H), 6.67 (d, *J* = 3.1 Hz, 1H), 5.72 (dd, *J* = 44.6, 17.4 Hz, 2H), 4.60 (d, *J* = 5.8 Hz, 1H), 4.50 (dd, *J* = 13.0, 6.1 Hz, 2H), 4.43 (d, *J* = 5.8 Hz, 1H), 3.14 (s, 3H), 3.04 (dt, *J* = 15.0, 7.5 Hz, 1H), 2.97 – 2.87 (m, 1H), 2.84 (s, 3H), 1.43 (t, *J* = 7.5 Hz, 3H). ^{13}C NMR δ 153.09, 152.04, 137.58, 136.39, 133.67, 132.67, 131.44, 131.08, 130.66, 129.45, 128.71, 128.68, 128.32, 127.96, 127.57, 126.87, 126.43, 125.99, 125.94, 125.80, 125.67, 125.13, 125.03, 124.67, 121.78, 121.02, 119.59, 115.21, 109.74, 101.86, 99.43, 99.04, 57.01, 56.48, 46.06, 23.74, 14.54. Elem. Anal. Calcd. for $C_{35}H_{33}NO_4$: C, 79.07; H, 6.26. Found: C, 79.04; H, 6.28.

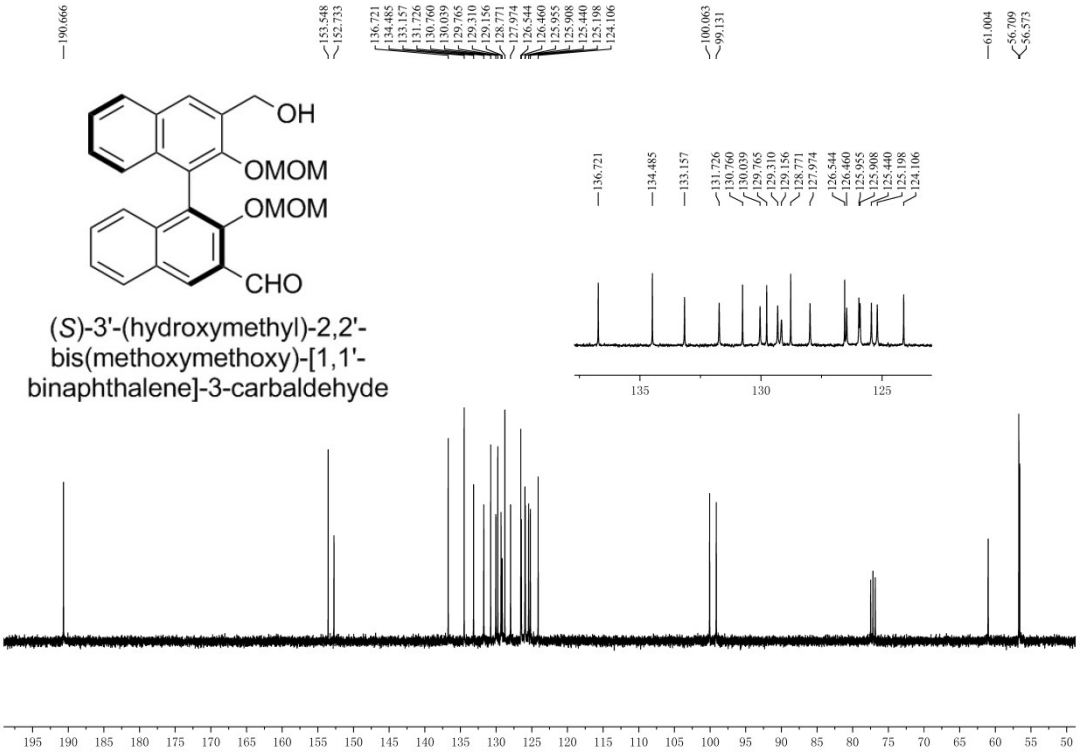


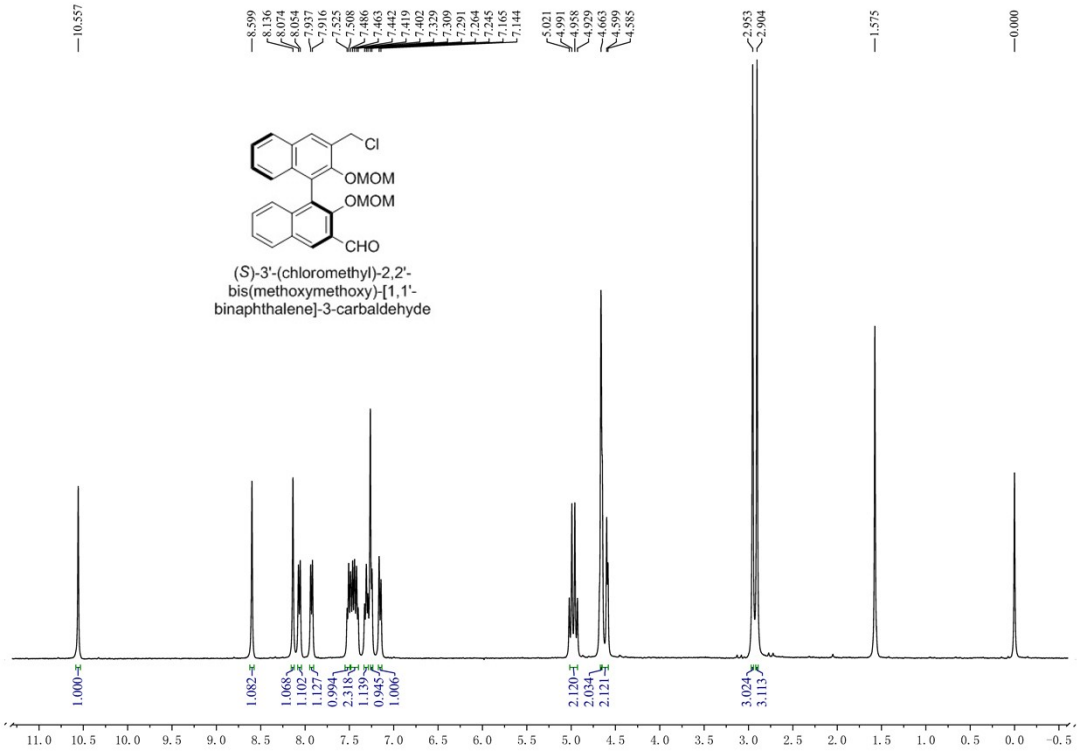
(*S*)-**5c** (*S*)-**6c**

(*S*)-9-((3'-ethyl-2,2'-bis(methoxymethoxy)-[1,1'-binaphthalen]-3-yl)methyl)-9H-carbazole ((*S*)-6c), 85 % (0.85 g) as colorless oil: ^{1}H NMR δ 8.22 (d, *J* = 7.7 Hz, 2H), 7.88 (d, *J* = 9.5 Hz, 2H), 7.50 – 7.39 (m, 6H), 7.34 – 7.29 (m, 2H), 7.27 (d, *J* = 1.2 Hz, 1H), 7.22 (dd, *J* = 8.3, 3.6 Hz, 2H), 7.17 (d, *J* = 3.5 Hz, 2H), 7.08 (s, 1H), 5.91 (q, *J* = 18.7 Hz, 2H), 4.65 (d, *J* = 5.8 Hz, 1H), 4.64 – 4.60 (m, 2H), 4.46 (d, *J* = 5.8 Hz, 1H), 3.25 (s, 3H), 3.07 (dt, *J* = 15.0, 7.5 Hz, 1H), 2.94 (dq, *J* = 15.1, 7.4 Hz, 1H), 2.86 (s, 3H), 1.46 (t, *J* = 7.5 Hz, 3H). ^{13}C NMR δ 153.06, 152.46, 140.87, 137.65, 133.63, 132.71, 131.15, 130.70, 130.48, 128.36, 127.97, 127.63, 126.34, 126.02, 125.92, 125.78, 125.09, 124.76, 123.15, 120.53, 119.36, 108.95, 99.72, 99.14, 57.24, 56.55, 42.80, 23.73, 14.57. Elem. Anal. Calcd. for $C_{39}H_{35}NO_4$: C, 80.53; H, 6.06. Found: C, 80.55; H, 6.08.

^{1}H NMR and ^{13}C NMR Spectra of all Compounds



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7.402
7.329
7.309
7.291
7.264
7.245
7.165
7.144
5.021
4.991
4.958
4.929
4.663
4.599
4.585
2.953
2.904
1.575
0.000
Cl
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OMOM
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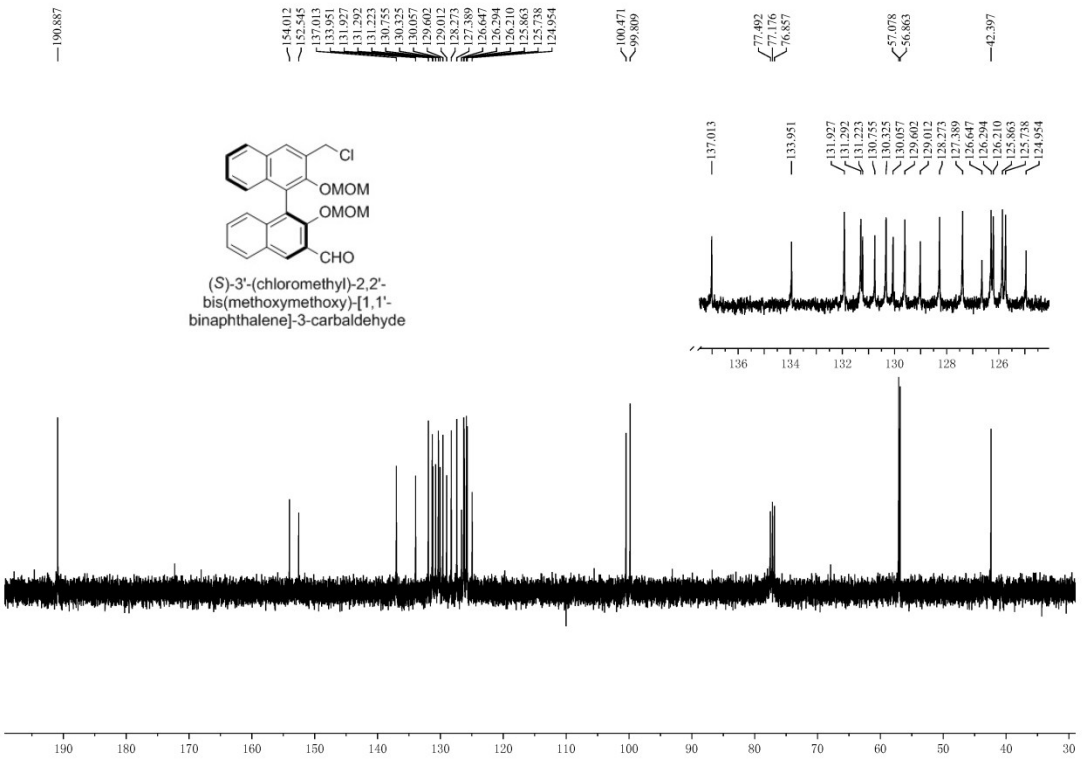
1.068
1.102
1.127
0.994
2.318
1.139
0.945
1.006
2.120
2.034
2.121
3.024
3.113
11.0 10.5 10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0 -0.5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133.951
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128.273
127.389
126.647
126.294
126.210
125.863
125.738
124.954
100.471
99.809
77.492
77.176
76.857
57.078
56.863
42.397
Cl
OMOM
OMOM
CHO
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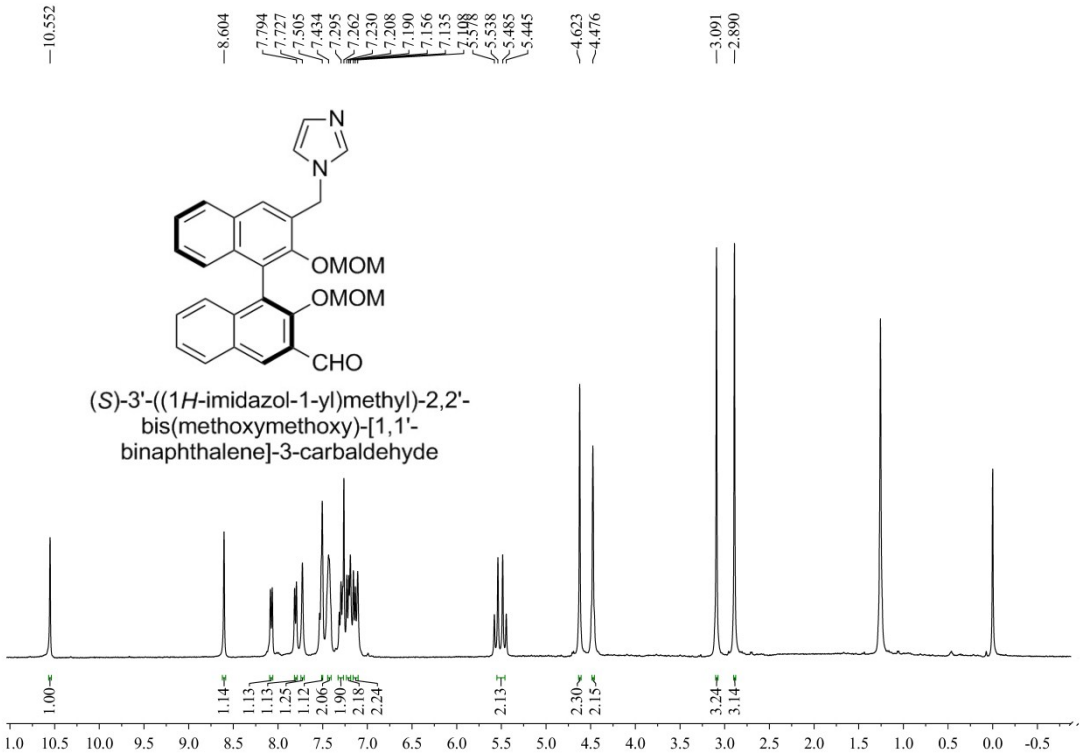
137.013
133.951
131.927
131.292
131.223
130.755
130.325
130.057
129.602
129.012
128.273
127.389
126.647
126.294
126.210
125.863
125.738
124.954
136 134 132 130 128 126
190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30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7.295
7.262
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7.190
7.156
7.135
5.538
5.485
5.445
4.623
4.476
3.091
2.890
OMOM
OMOM
CHO
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1.00
1.14
1.13
1.13
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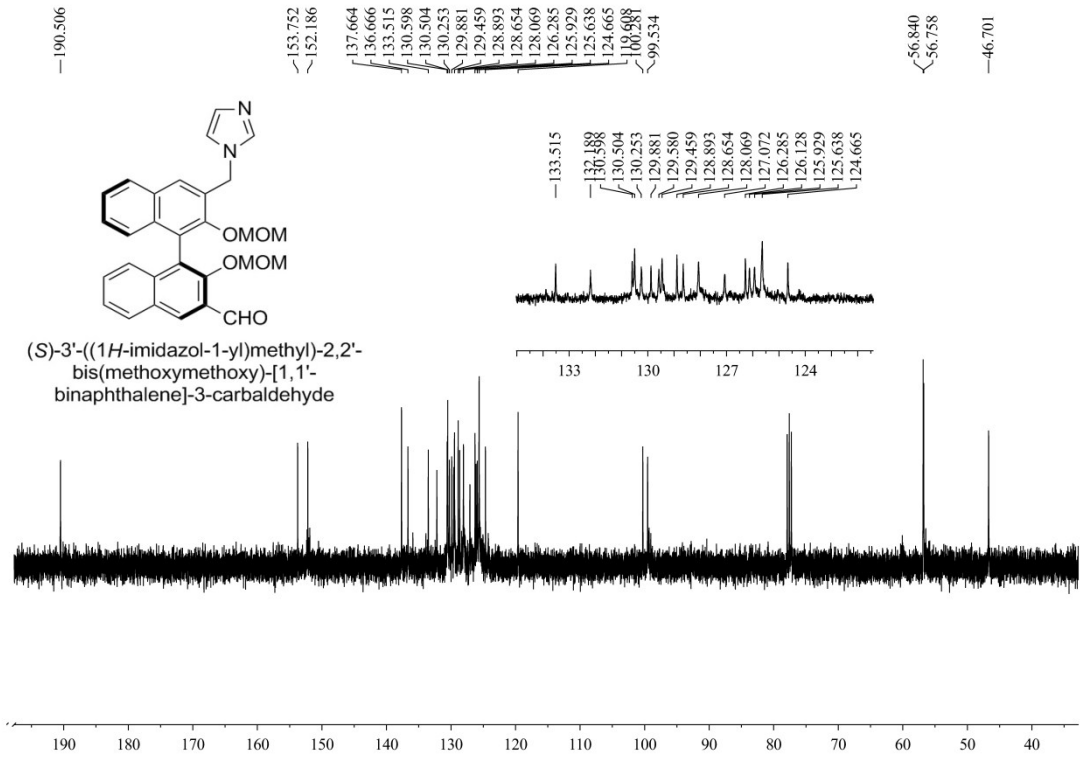
2.13
2.30
2.15
3.24
3.14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128.069
126.285
125.929
125.638
124.665
119.608
100.281
99.534
56.840
56.758
46.701
OMOM
OMOM
CHO
(S)-3'-((1H-imidazol-1-yl)methyl)-2,2'-bis(methoxymethoxy)-[1,1'-binaphthalene]-3-carbaldehyde
133.515
132.188
130.598
130.504
130.253
129.881
129.580
129.459
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133
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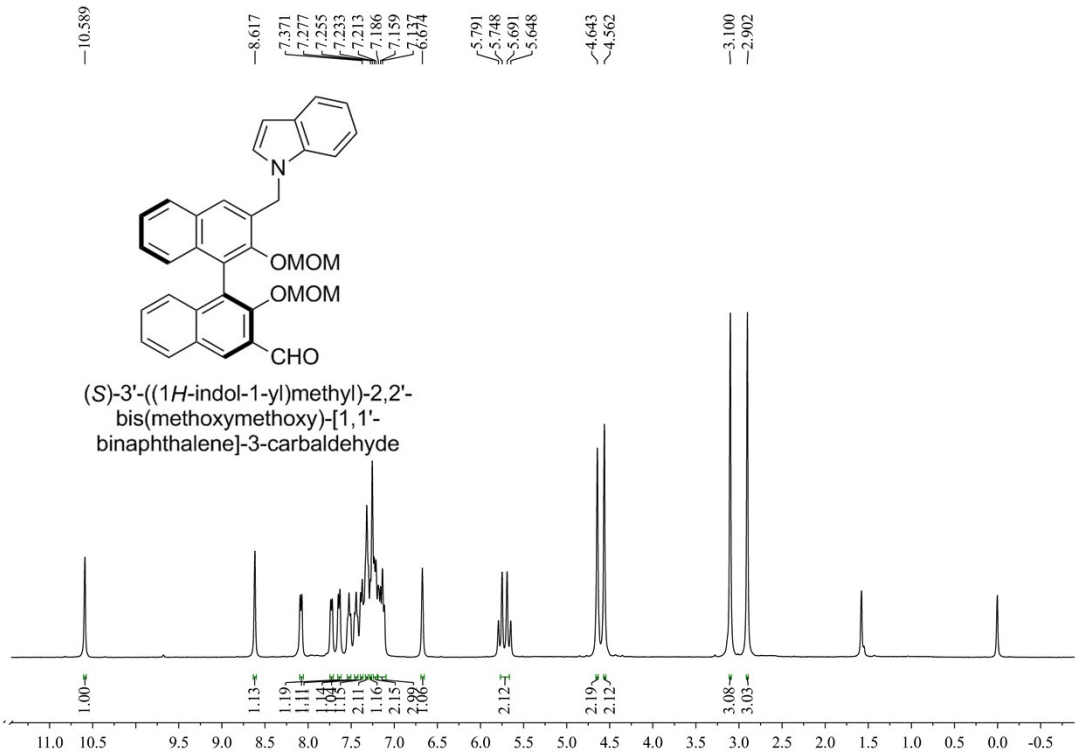
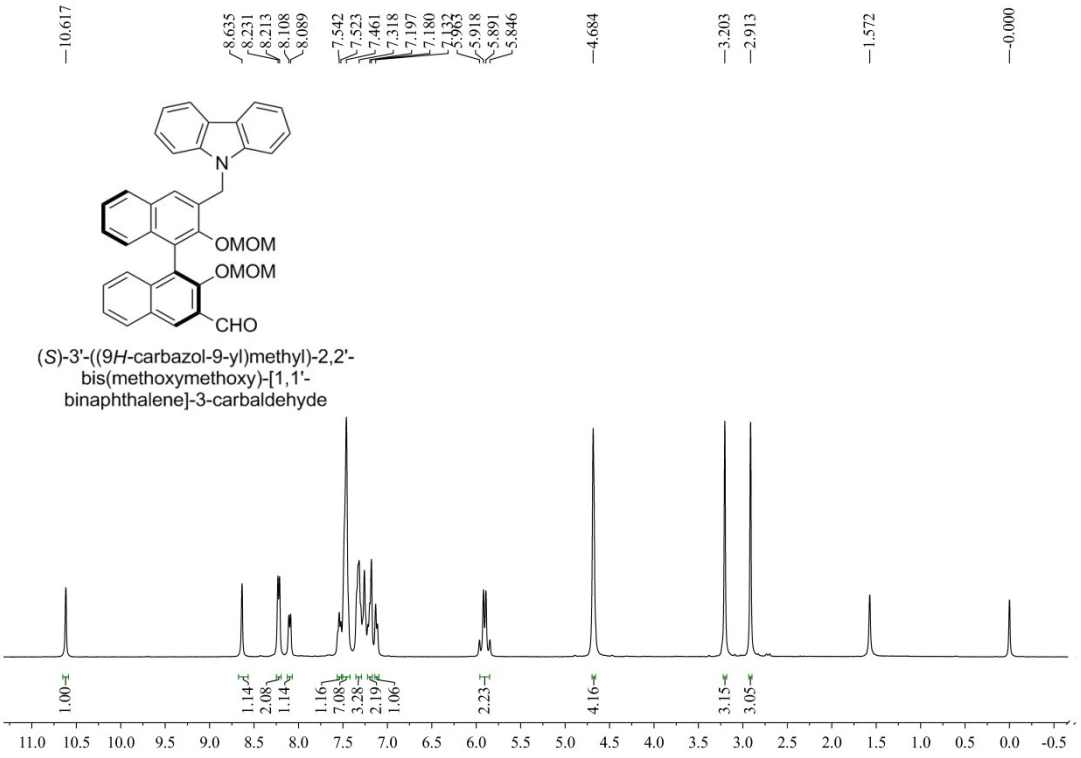
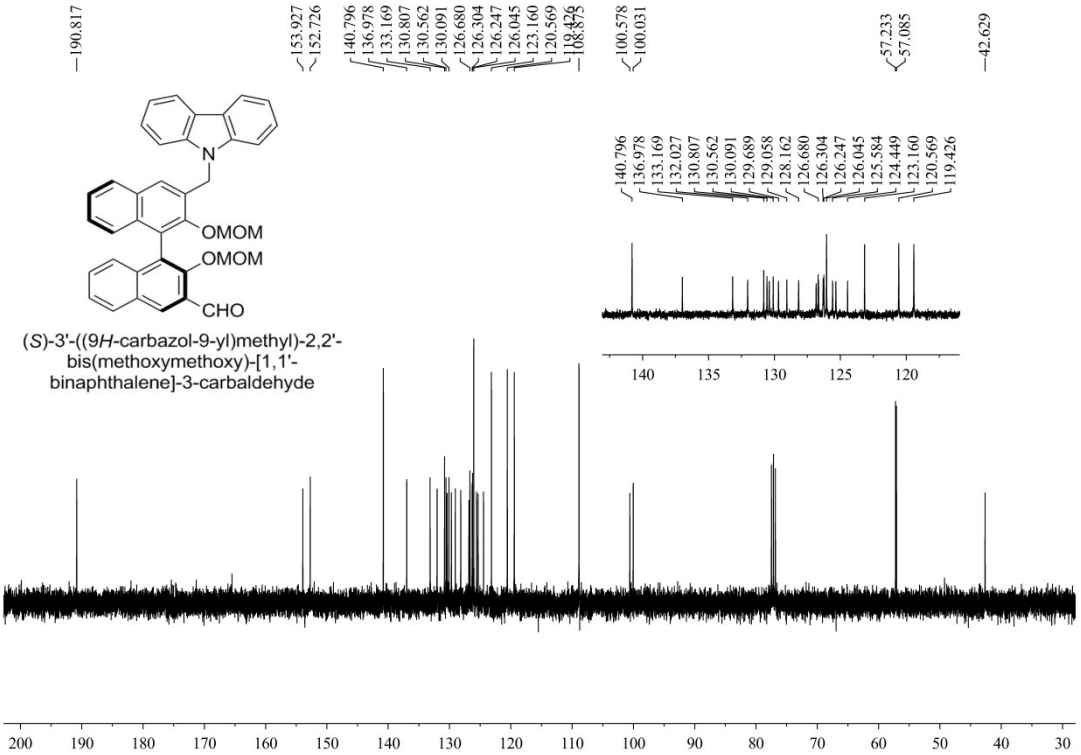
127
124



(*S*)-3'-((1*H*-indol-1-yl)methyl)-2,2'-bis(methoxymethoxy)-[1,1'-binaphthalene]-3-carbaldehyde



(*S*)-3'-((9*H*-carbazol-9-yl)methyl)-2,2'-bis(methoxymethoxy)-[1,1'-binaphthalene]-3-carbaldehyde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126.045
123.160
120.569
119.426
108.875
100.578
100.031
57.233
57.085
42.629
OMOM
OMOM
CHO
(S)-3'-((9H-carbazol-9-yl)methyl)-2,2'-bis(methoxymethoxy)-[1,1'-binaphthalene]-3-carbaldehyde
140.796
136.978
133.169
132.027
130.807
130.562
130.091
129.689
129.058
128.162
126.680
126.304
126.247
126.045
125.584
124.449
123.160
120.569
119.426
140
135
130
125
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140
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100
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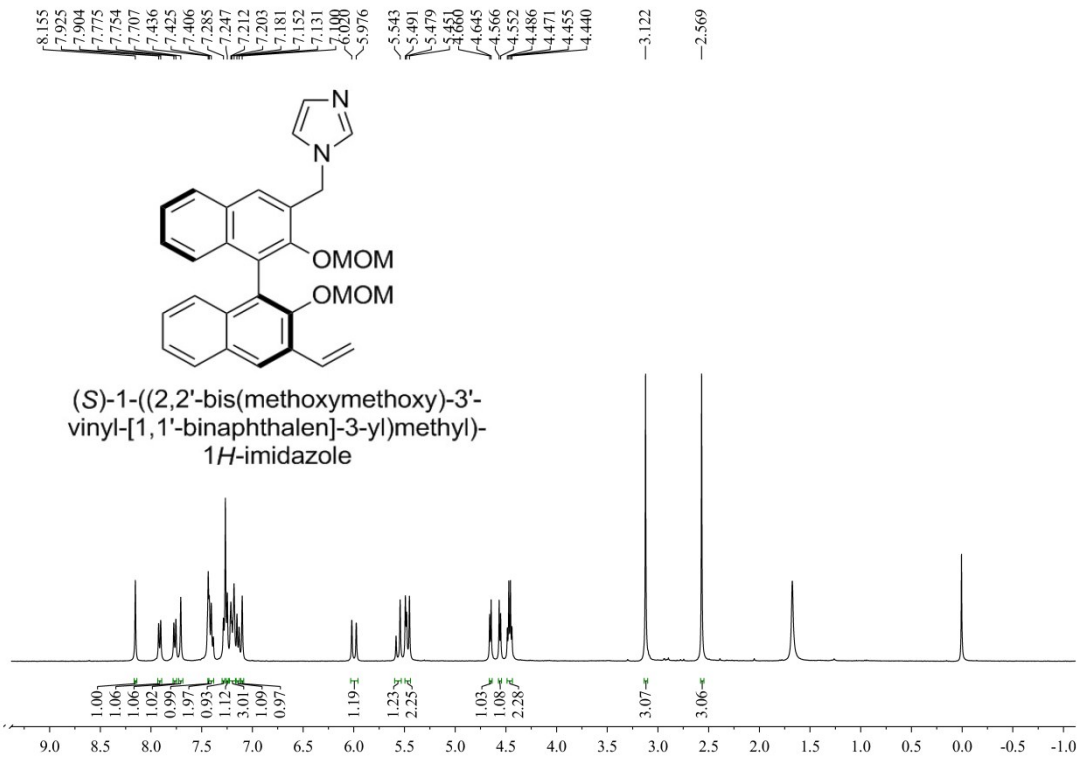
30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7.203
7.181
7.152
7.131
6.020
5.976
5.543
5.491
5.479
4.645
4.566
4.552
4.486
4.471
4.455
4.440
3.122
2.569
N
N
OMOM
OMOM
(S)-1-((2,2'-bis(methoxymethoxy)-3'-vinyl-[1,1'-binaphthalen]-3-yl)methyl)-1H-imidazole
1.00
1.06
1.06
1.02
0.99
1.97
0.93
1.12
3.01
1.09
0.97
1.19
1.23
2.25
1.03
1.08
2.28
3.07
3.06
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
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3.0
2.5
2.0
1.5
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0.5
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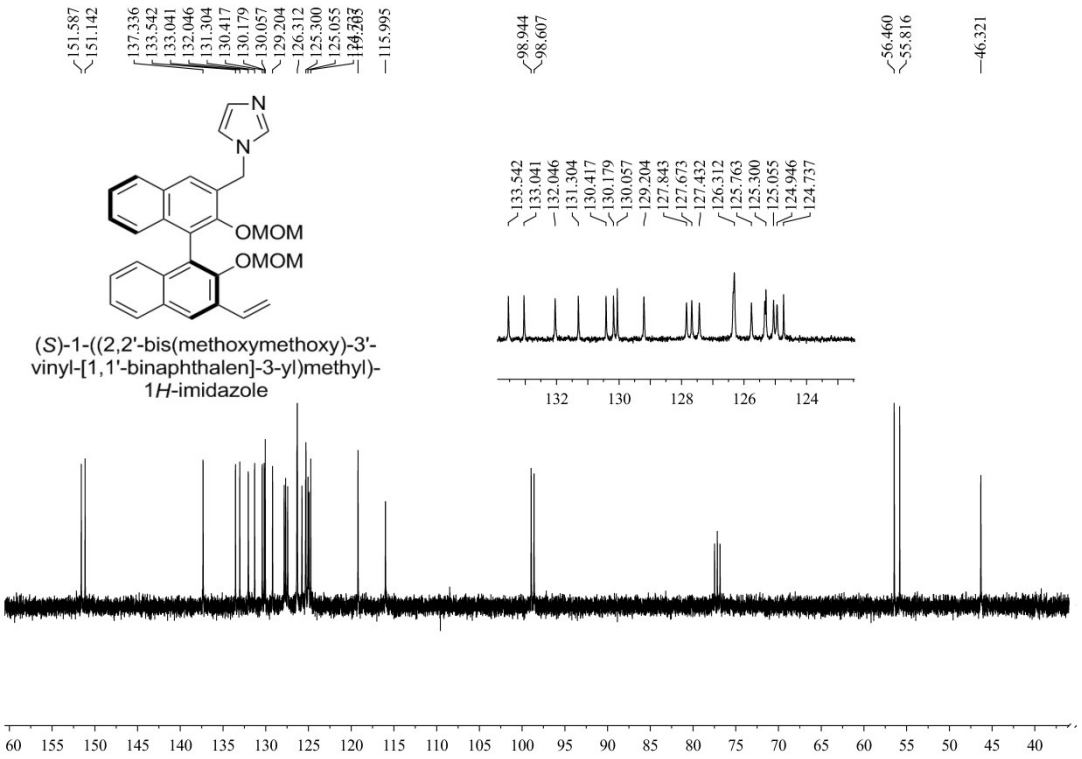
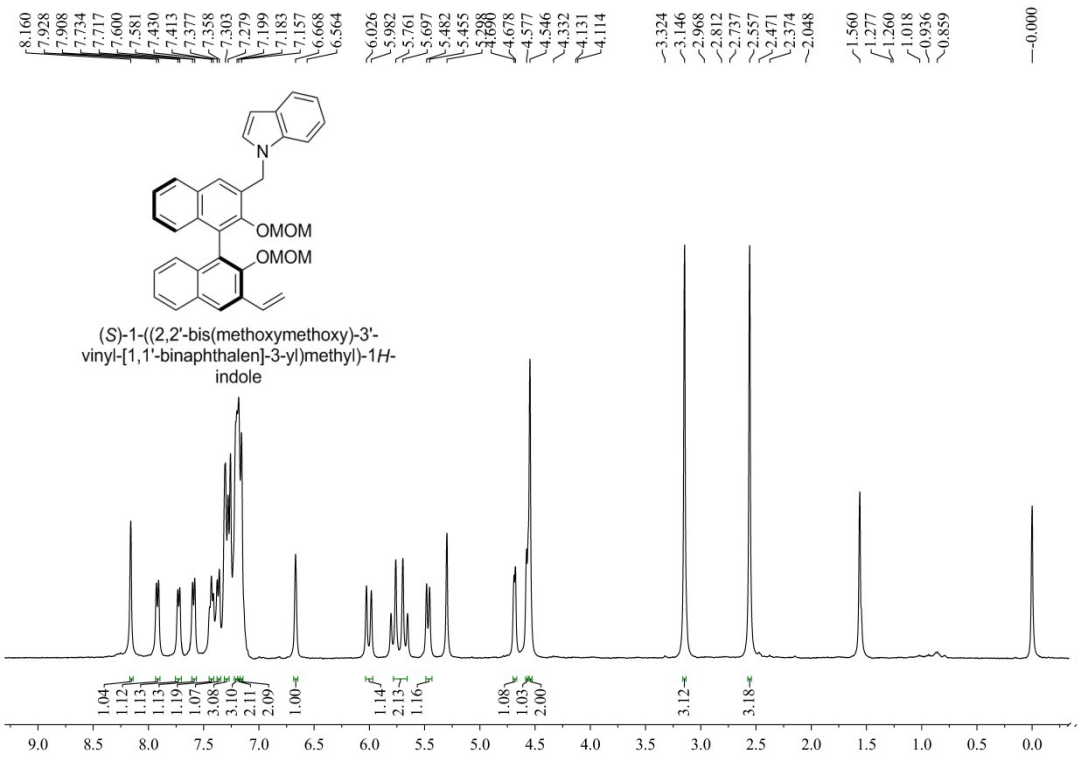
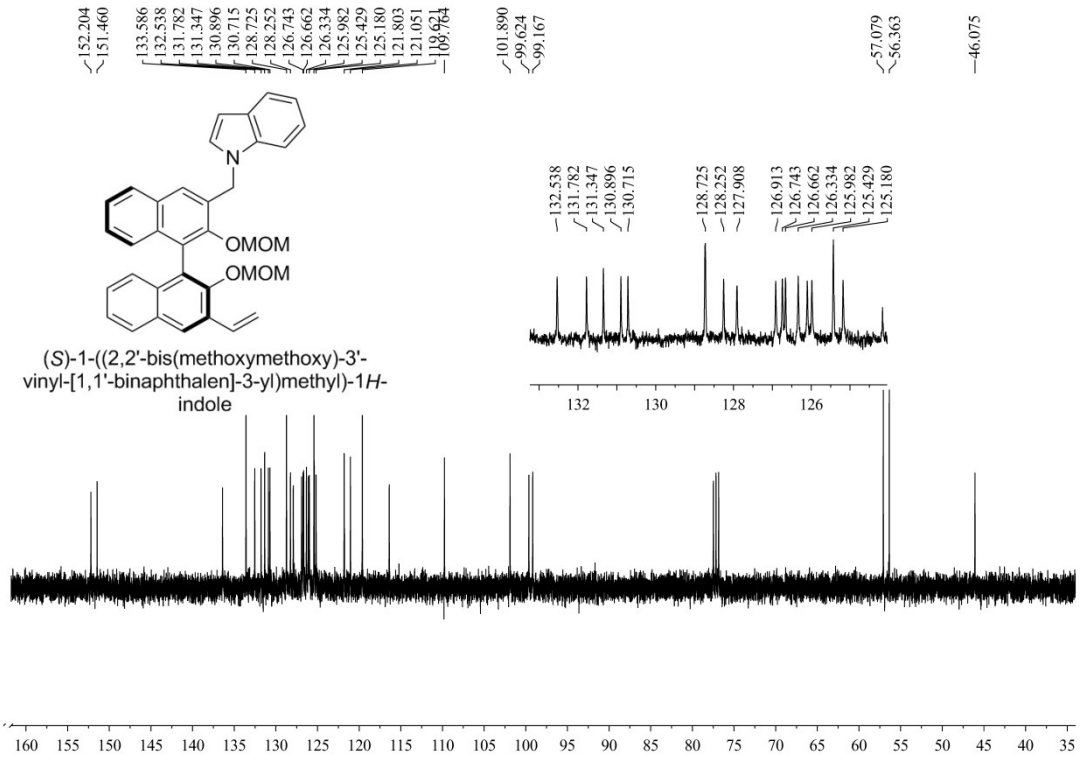
-0.5
-1.0



(*S*)-1-((2,2'-bis(methoxymethoxy)-3'-vinyl-[1,1'-binaphthalen]-3-yl)methyl)-1*H*-imidazole



(*S*)-1-((2,2'-bis(methoxymethoxy)-3'-vinyl-[1,1'-binaphthalen]-3-yl)methyl)-1*H*-indole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131.347
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128.252
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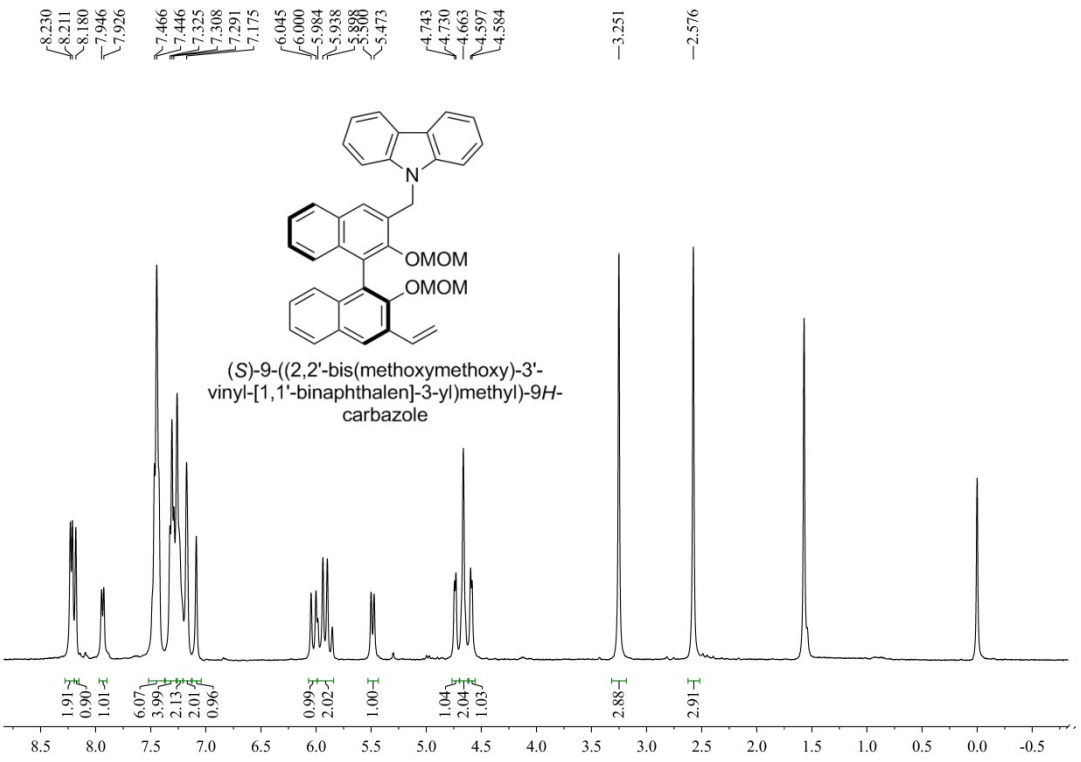
121.803
121.051
101.890
99.624
99.167
57.079
56.363
46.075
OMOM
OMOM
(S)-1-((2,2'-bis(methoxymethoxy)-3'-vinyl-[1,1'-binaphthalen]-3-yl)methyl)-1H-indole
132.538
131.782
131.347
130.896
130.715
128.725
128.252
127.908
126.913
126.743
126.662
126.334
125.982
125.429
125.180
132
130
128
126
160 155 150 145 140 135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50 45 40 35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5.984
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4.663
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4.584
3.251
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OMOM
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0.90
1.01
6.07
3.99
2.13
2.01
0.96
0.99
2.02
1.00
1.04
2.04
1.03
2.88
2.91
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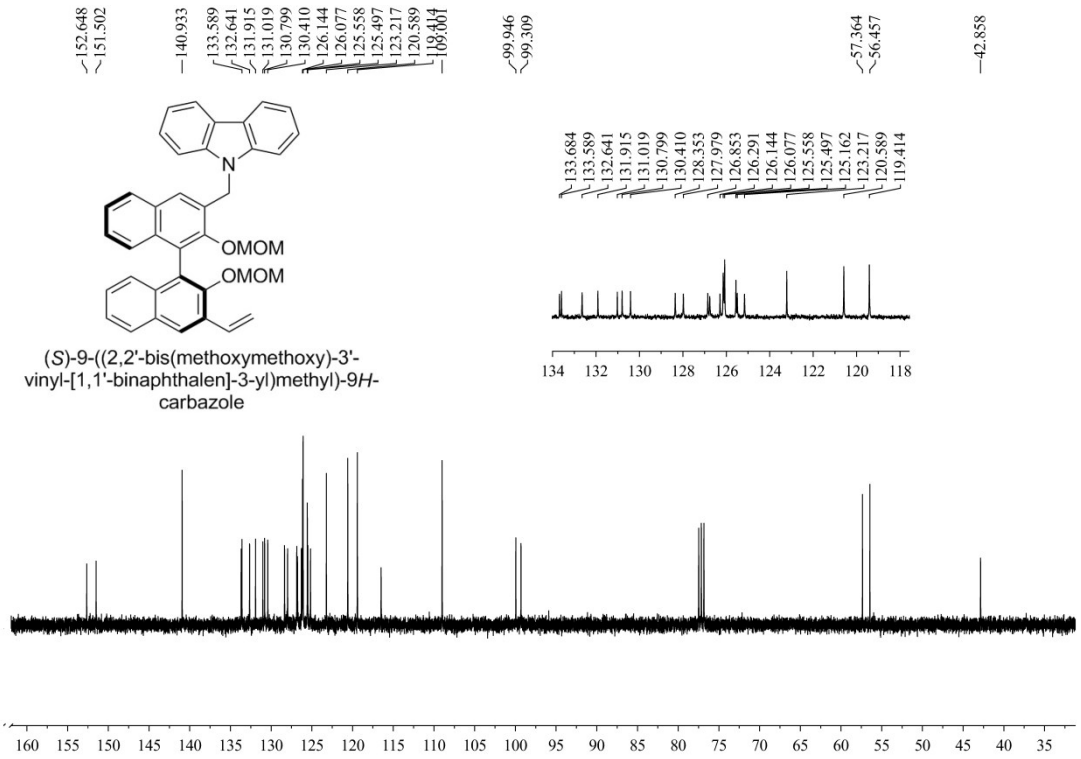
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109.001
99.946
99.309
57.364
56.457
42.858
N
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133.589
132.641
131.915
131.019
130.799
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128.353
127.979
126.853
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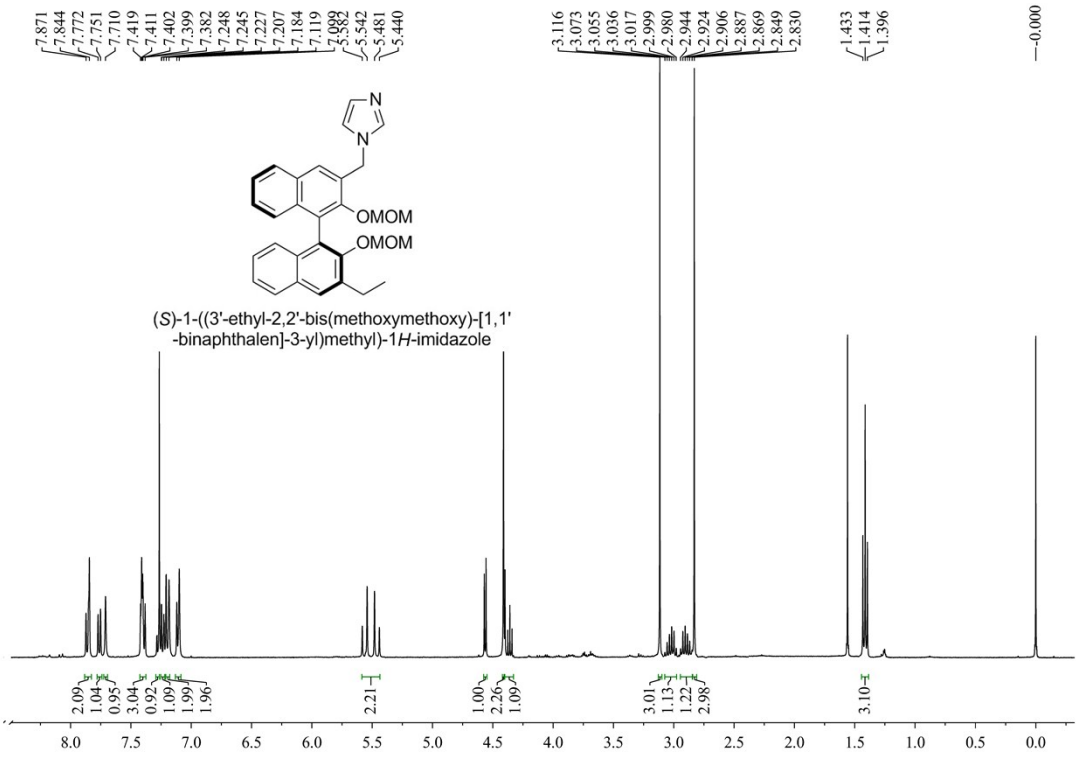
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7.207
7.184
7.119
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5.542
5.481
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3.116
3.073
3.055
3.036
3.017
2.999
2.980
2.944
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2.830
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1.396
0.000
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N
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0.95
3.04
0.92
1.09
1.99
1.96
2.21
1.00
2.26
1.09
3.01
1.13
1.22
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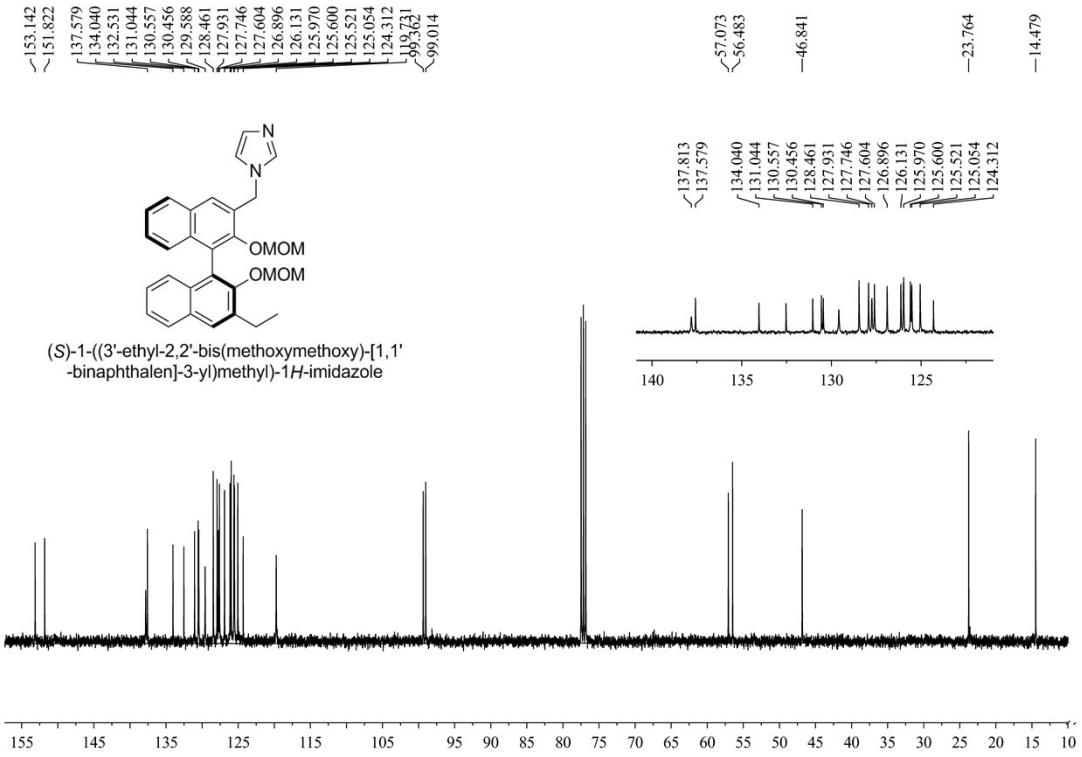
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126.896
126.131
125.970
125.600
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57.073
56.483
46.841
23.764
14.479
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N
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OMOM
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137.579
134.040
131.044
130.557
130.456
128.461
127.931
127.746
127.604
126.896
126.131
125.970
125.600
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140
135
130
125
155
145
135
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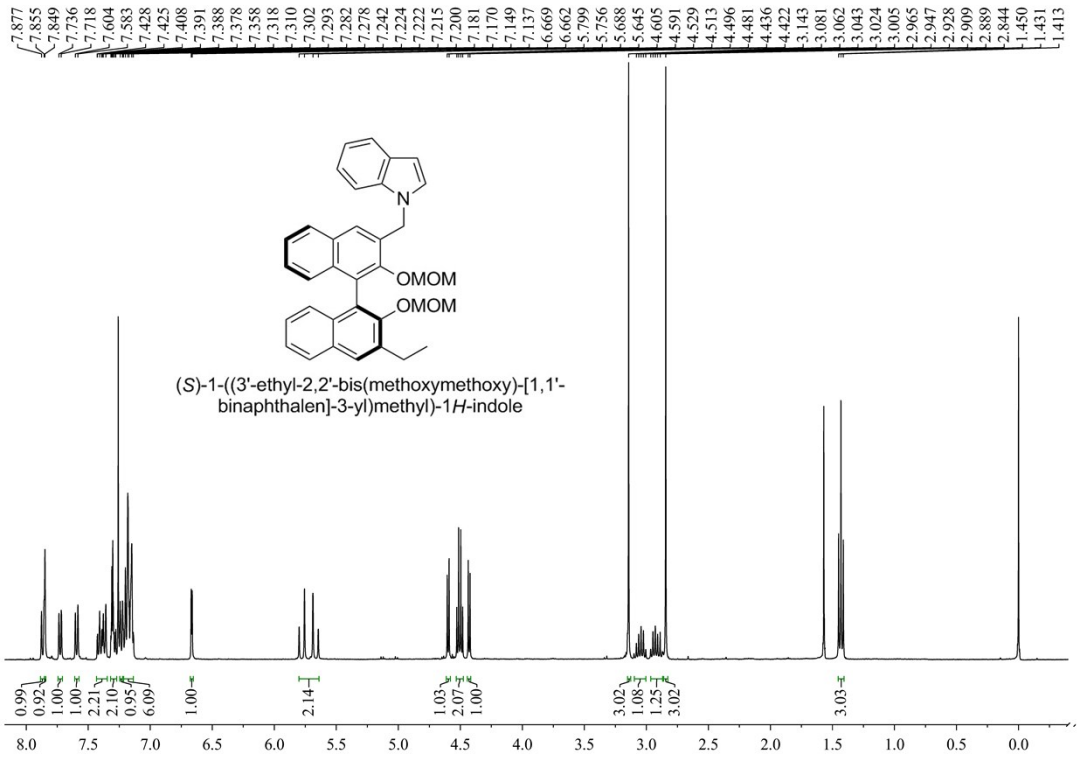
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7.318
7.310
7.302
7.293
7.282
7.278
7.242
7.224
7.222
7.215
7.200
7.181
7.170
7.149
7.137
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6.662
5.799
5.756
5.688
5.645
4.605
4.591
4.529
4.513
4.496
4.481
4.436
4.422
3.143
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3.062
3.043
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2.889
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1.431
1.413
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1.00
2.21
2.10
0.95
6.09
1.00
2.14
1.03
2.07
1.00
3.02
1.08
1.25
3.02
3.03
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7.5
7.0
6.5
6.0
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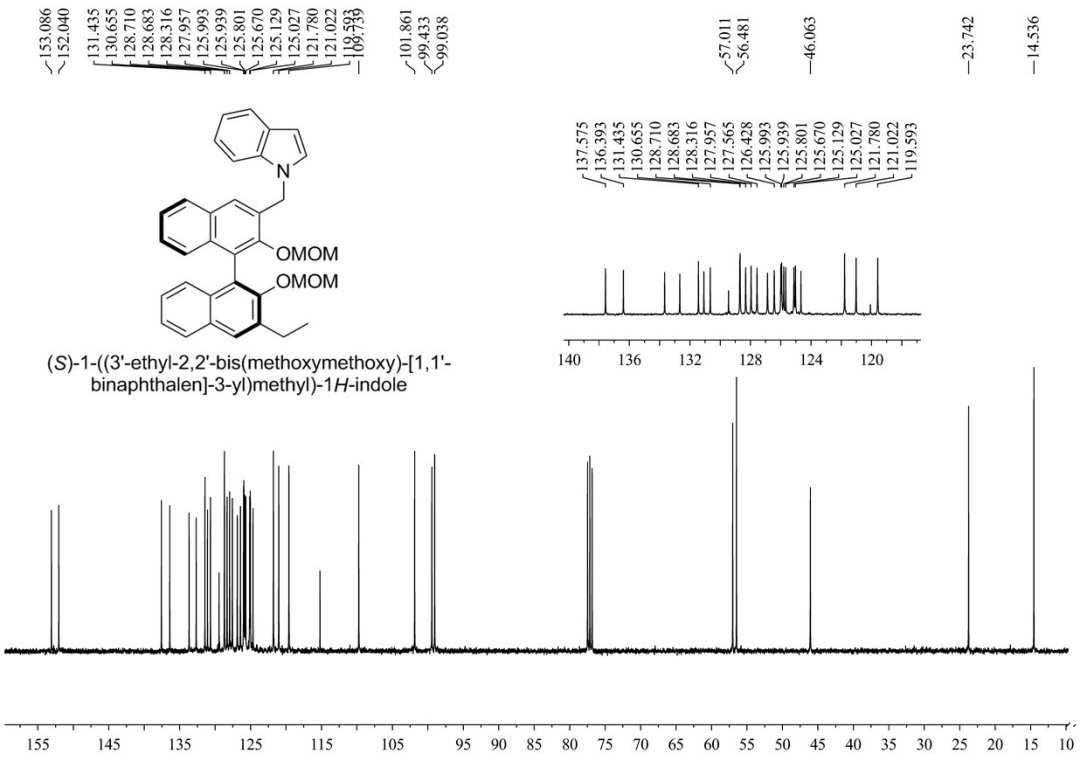
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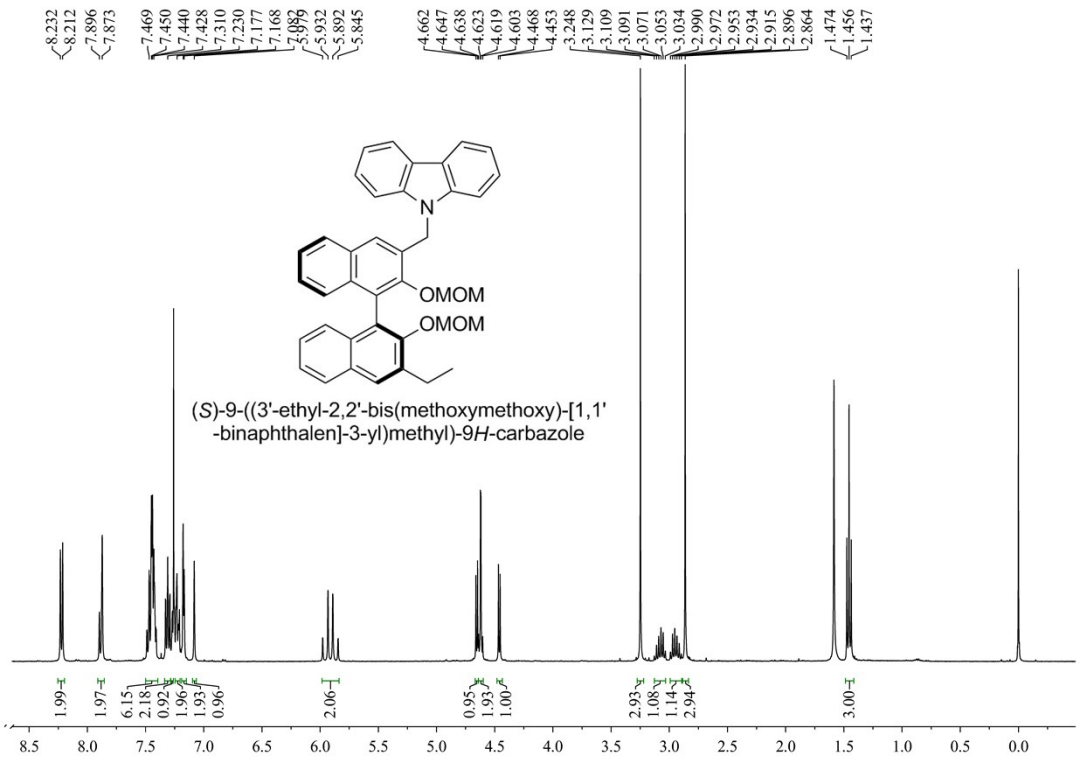
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5.845
4.662
4.647
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4.603
4.468
4.453
3.248
3.129
3.109
3.091
3.071
3.053
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2.990
2.972
2.953
2.934
2.915
2.896
2.864
1.474
1.456
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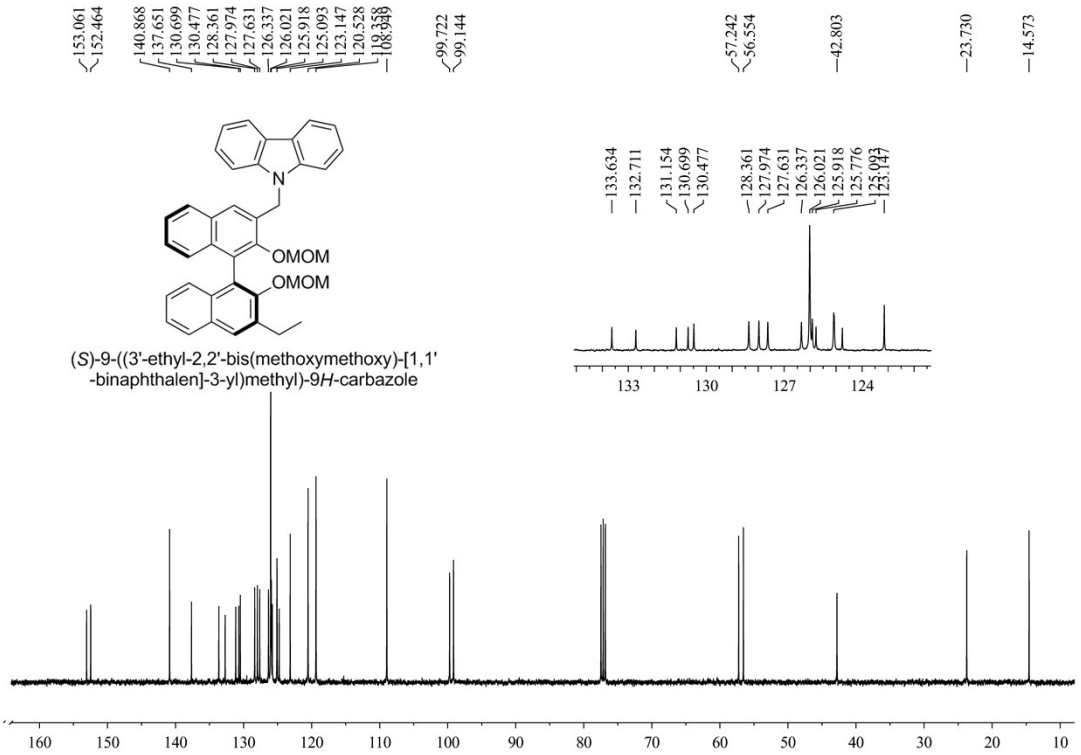
(S)-9-((3'-ethyl-2,2'-bis(methoxymethoxy)-[1,1'-binaphthalen]-3-yl)methyl)-9H-carbazole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-binaphthalen]-3-yl)methyl)-9H-carbazole
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132.711
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126.021
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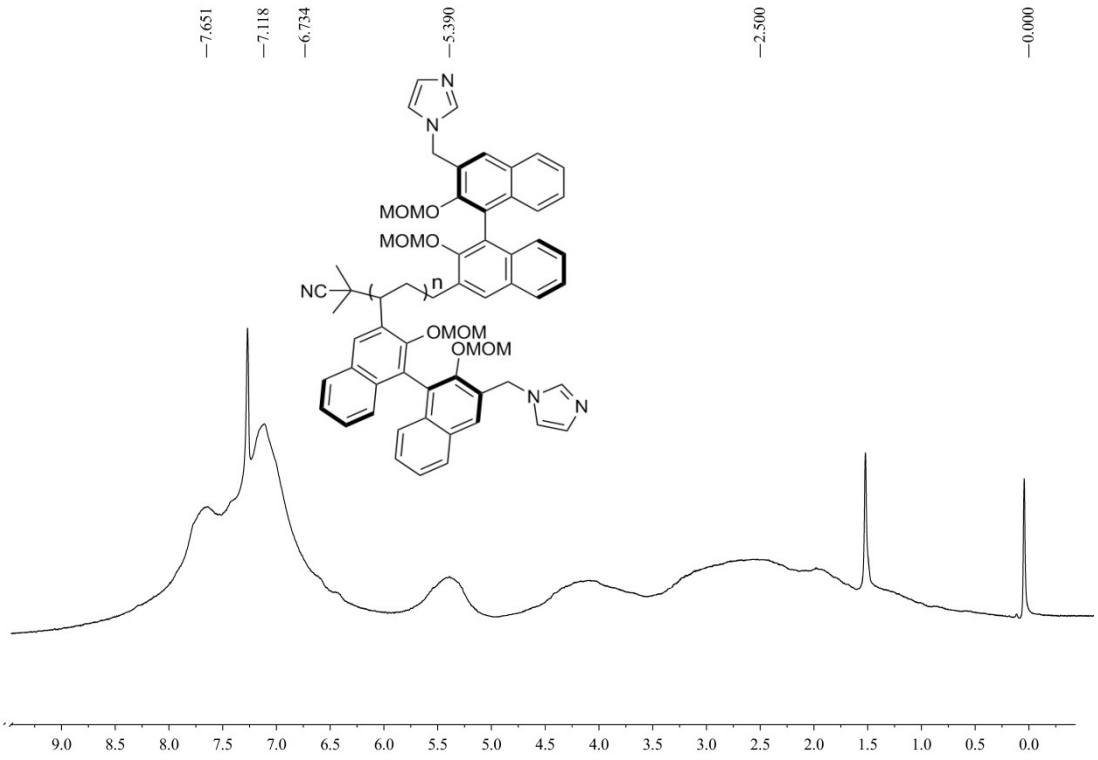
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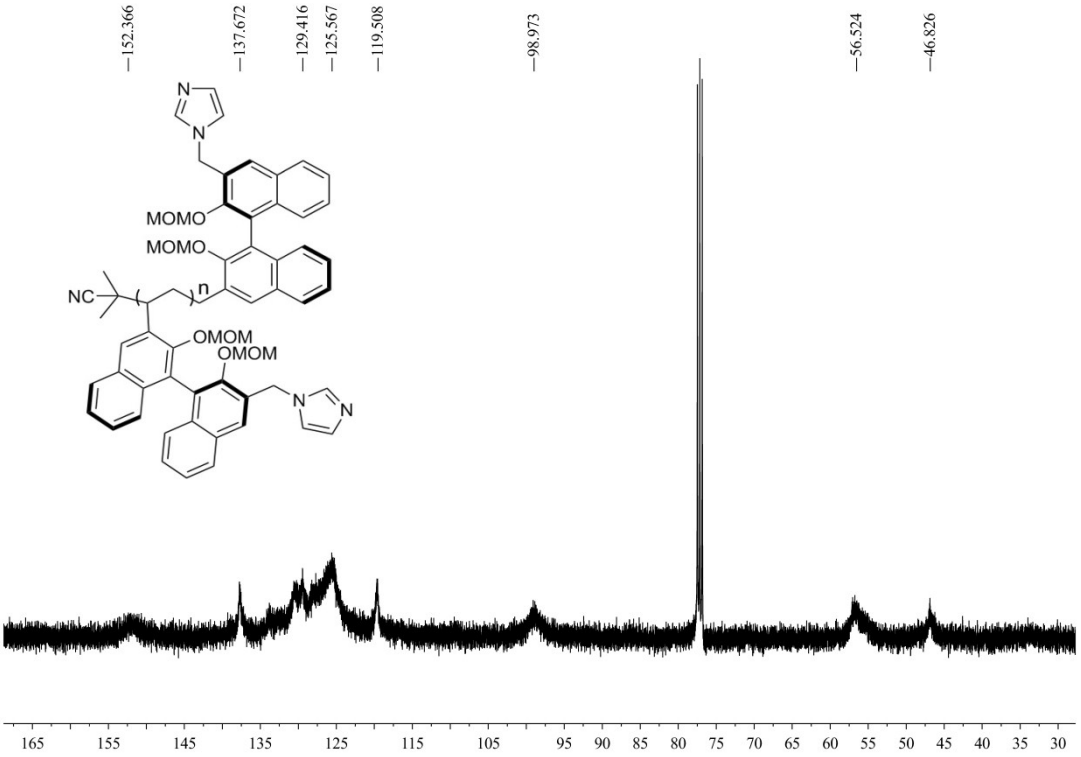
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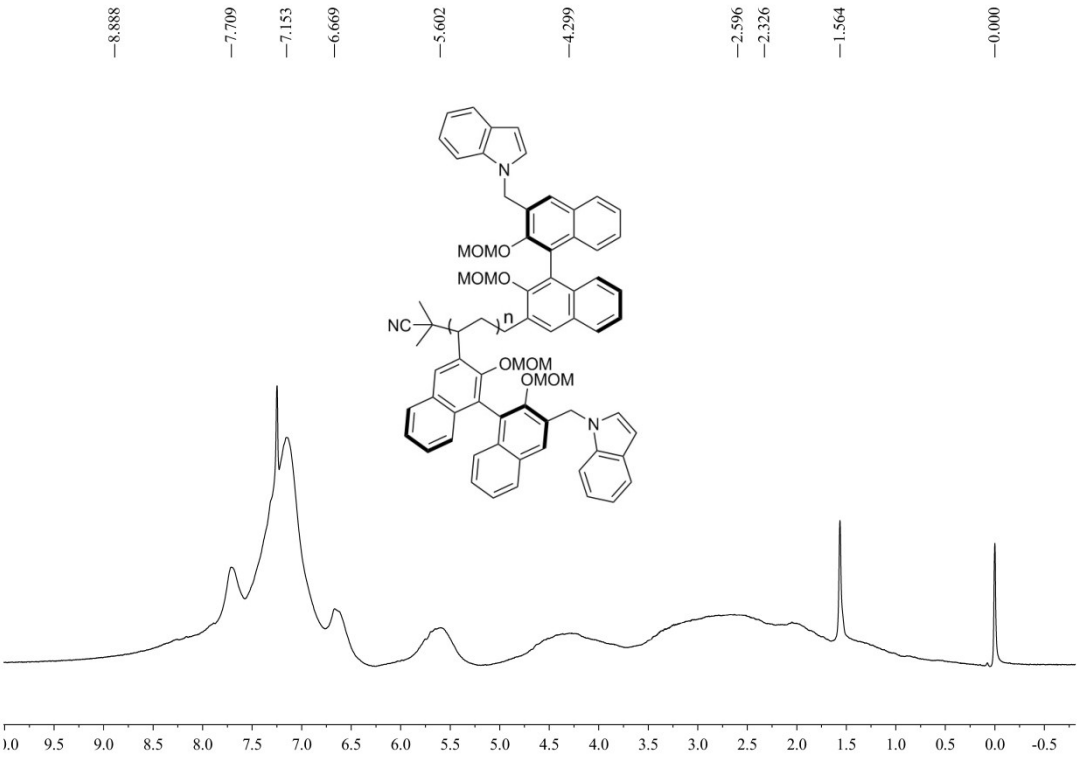
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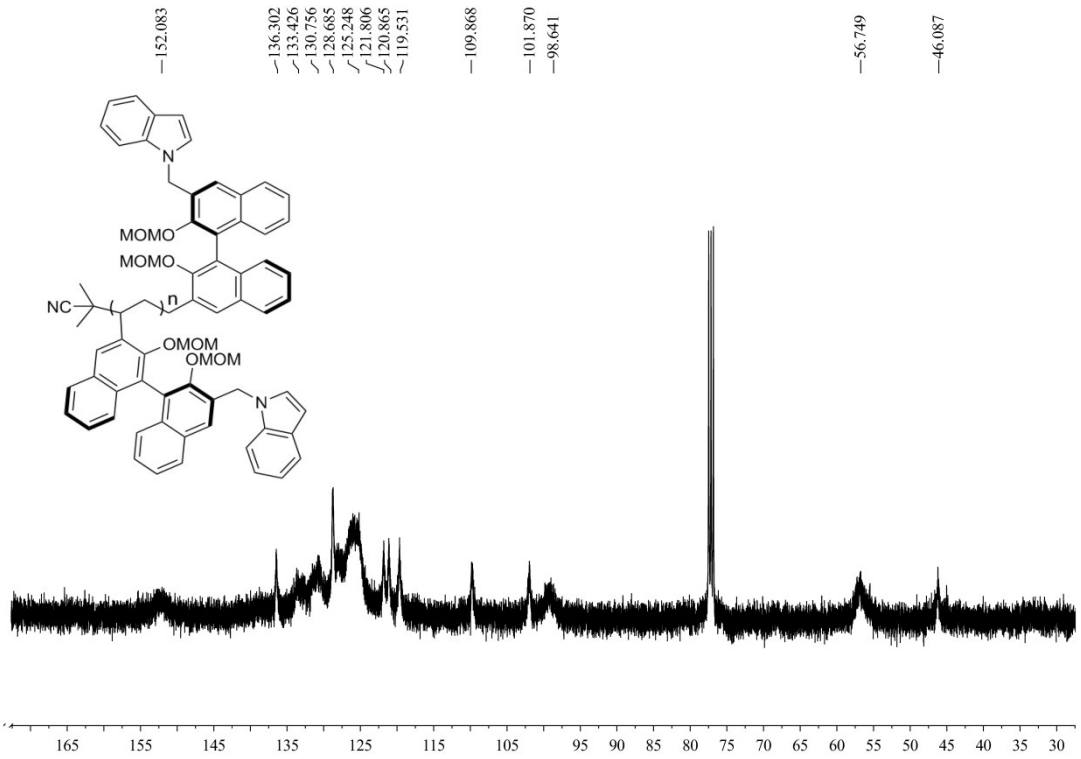
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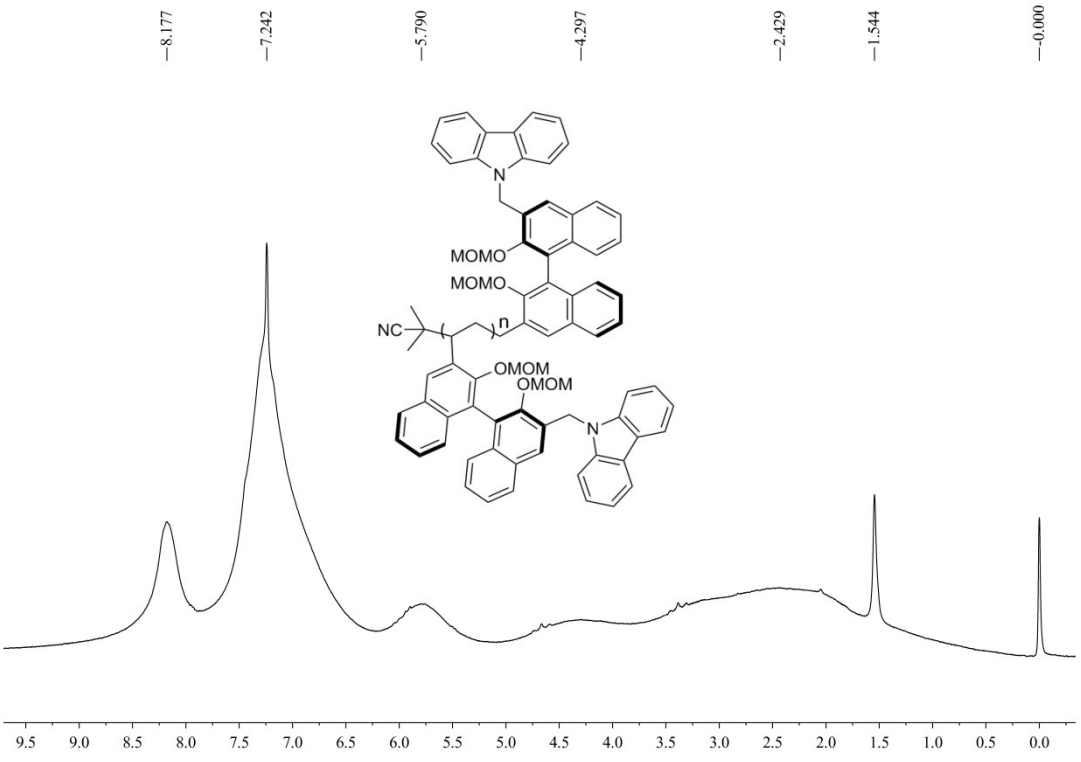
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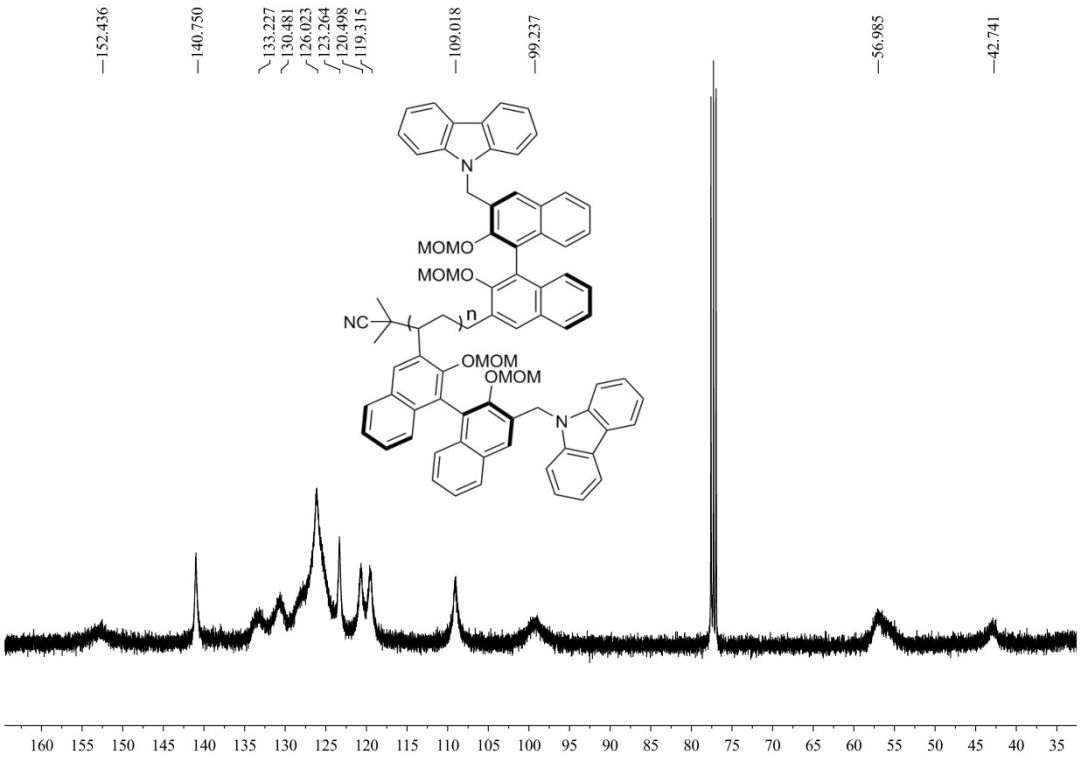
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n
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N
N
160 155 150 145 140 135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50 45 40 35