Electronic Supplementary Information (ESI)

Simple and Efficient Nickel-Catalyzed Cross-Coupling Reaction of Alkynylalanes with Benzylic and Aryl Bromides

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I. Reagents and General Techniques

All solvents were dried by refluxing for at least 24 h over P_2O_5 (dichloromethane) or sodium-benzophenone and were freshly distilled prior to use. All synthesis and manipulations were carried out under a dry nitrogen atmosphere.

II. Physical measurements

^1H and ^{13}C NMR spectra were obtained with a Varian Mercury-400 (^1H, 400 MHz; ^{13}C, 100 MHz) spectrometer, and chemical shifts were measured relative to tetramethylsilane (0.00 ppm) as the internal reference. Mass spectroscopy were performed by using Finnigan MAT 95 XL ThermoQuest Mass Spectrometer.

III. General Procedures for the Preparation of the Alkynylalane Reagents

To a cooled (0 ^OC) solution of an alkyne (1.5 mmol) in hexane (3 mL) was added *n*-BuLi (1.5 mmol, 2.5 M in hexane) and stirred for 20 min, followed by an addition of $AlEt_2Cl$ (1.5 mmol, 1 *M* in hexane). The mixture thus obtained had been stirred at 0 ^OC for 20 min and then at room temperature for 2 h. The resulted solution was filtered, followed by an evaporation of hexane under reduced pressures and then added 2 mL of dry diethyl ether to give a alkynylaluminum reagent which was used in the coupling reactions.

IV. General Procedures for the Coupling Reaction of Benzylic Halides with Alkynylalanes Catalyzed by $NiCl_2(PPh_3)_2$

Under a dry nitrogen atmosphere, $NiCl_2(PPh_3)_2$ (0.0262 g, 0.0400 mmol) and alkynylaluminum reagent (1.5 mmol) were mixed in 3 mL dry diethyl ether at room temperature and stirred the mixture for 15 min, followed by an addition of benzylic bromide (1.00 mmol). After stirring for 1 h, the reaction mixture was quenched by aqueous hydrochloric acid (3 *M*). The organic layer was separated, and the aqueous layer was extracted with hexane or ether. The combined organic phase was dried over $MgSO_4$, filtered, and concentrated. The residue was purified by column chromatography to give the products

V. General Procedures for the Coupling Reaction of Aryl Halides with Alkynylalanes Catalyzed by $NiCl_2(PPh_3)_2$

Under a dry nitrogen atmosphere, $NiCl_2(PPh_3)_2$ (0.0262 g, 0.0400 mmol) and alkynylaluminum reagent (1.5 mmol) were mixed in 3 mL dry DME at room temperature and stirred the mixture for 15 min, followed by an addition of Aryl bromide (1.00 mmol). After stirring for 4 h at 80 ^OC, the reaction mixture was allowed to cool down to room temperature and then quenched by aqueous hydrochloric acid (3 *M*). The organic layer was separated, and the aqueous layer was extracted with hexane or ether. The combined organic phase was dried over $MgSO_4$, filtered, and concentrated. The residue was purified by column chromatography

to give the products.

VI. ^{1}H and ^{13}C NMR and High-resolution Mass Spectroscopic Data of Coupling Products

1. **Prop-1-yne-1,3-diyldibenzene** (**2a**)**:** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.47-7.41 (m, 4H), 7.37-7.23 (m, 6H), 3.84 (s, 2H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 136.8, 131.6, 128.5, 128.2, 128.0, 127.8, 126.6, 123.7, 87.5, 82.7, 25.7 ppm. HRMS calculated for $C_{15}H_{12}$ [M^+]: 192.0939, found 192.0943.

2. **1-methyl-2-(3-phenylprop-2-ynyl)benzene (2b):** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.51 (d, J = 6.4 Hz, 1H), 7.46-7.41 (m, 2H), 7.32-7.27 (m, 3H), 7.25-7.17 (m, 3H), 3.75 (s, 2H), 2.38 (s, 3H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 136.0, 135.0, 131.6, 130.1, 128.3, 128.2, 127.7, 126.9, 126.2, 123.7, 87.2, 82.7, 23.9, 19.3 ppm. HRMS calculated for $C_{16}H_{14}$ [M^+]: 206.1096, found 206.1092.

3. **1-methyl-3-(3-phenylprop-2-ynyl)benzene** (**2c**)**:** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.47-7.43 (m, 2H), 7.32-7.28 (m, 3H), 7.26-7.21 (m, 3H), 7.09-7.05 (m, 1H), 3.80 (s, 2H), 2.36 (s, 3H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 138.2, 136.6, 131.6, 128.7, 128.4, 128.2, 127.8, 127.4, 125.0, 123.7, 87.7, 82.5, 25.6, 21.4 ppm. HRMS calculated for $C_{16}H_{14}$ [M^+]: 206.1096, found 206.1088.

4. **1-methyl-4-(3-phenylprop-2-ynyl)benzene (2d):** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.46-7.42 (m, 2H), 7.32-7.26 (m, 5H), 7.14 (d, J = 7.6 Hz, 2H), 3.79 (s, 2H), 2.34 (s, 3H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 136.2, 133.7, 131.6, 129.2, 128.2, 127.8, 127.7, 123.8, 87.8, 82.4, 25.3, 21.0 ppm. HRMS calculated for $C_{16}H_{14}$ [M^+]: 206.1096, found 206.1088.

5. **1-methoxy-3-(3-phenylprop-2-ynyl)benzene (2e):** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.46-7.44 (m, 2H), 7.31-7.25 (m, 4H), 7.01-6.98 (m, 2H), 6.81-6.77 (m, 1H), 3.81 (s, 5H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 159.8, 138.3, 131.6, 129.5, 128.2, 127.8, 123.6, 120.3, 113.7, 112.0, 87.3, 82.7, 55.2, 25.7 ppm. HRMS calculated for $C_{16}H_{14}O$ [M^+]: 222.1045, found 222.1051.

6. **Methyl(4-(3-phenylprop-2-ynyl)phenyl)sulfane (2f):** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.46-7.43 (m, 2H) 7.36-7.32 (m, 2H), 7.31-7.29 (m, 3H), 7.27-7.24 (m, 2H), 3.80 (s, 2H), 2.49 (s, 3H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 136.4, 133.7, 131.6, 128.4, 128.2, 127.8, 127.0, 123.5, 87.3, 82.6, 25.2, 16.1 ppm. HRMS calculated for $C_{16}H_{14}S$ [M^+]: 238.0816, found 238.0824.

7. **1-tert-butyl-4-(3-phenylprop-2-ynyl)benzene (2g):** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.46-7.43 (m, 2H), 7.39-7.33 (m, 4H), 7.31-7.27 (m, 3H), 3.81 (s, 2H) 1.32 (s, 9H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 149.5, 133.7, 131.6, 128.2, 127.7, 127.6, 125.5, 123.7, 87.8, 82.4, 34.4, 31.4, 25.2 ppm. HRMS calculated for $C_{19}H_{20}$ [M^+]: 248.1565, found 248.1570.

8. **2-(3-phenylprop-2-ynyl)biphenyl (2h):** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.71-7.68 (m, 1H), 7.46-7.25 (m, 13H), 3.72 (s, 2H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 141.5, 141.0, 134.3, 131.6, 130.0, 129.2, 129.0, 128.4, 128.24, 128.17, 127.7, 127.1, 126.7, 123.7, 88.2, 82.5, 24.1 ppm. HRMS calculated for $C_{21}H_{16}$ [M^+]: 268.1252, found 268.1262.

9. **3-(3-phenylprop-2-ynyl)biphenyl (2i):** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.65-7.59 (m, 3H), 7.51-7.40 (m, 7H), 7.38-7.28 (m, 4H), 3.91 (s, 2H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 141.5, 141.0, 137.2, 131.6, 129.0, 128.7, 128.2, 127.8, 127.3, 127.2, 126.9, 126.8, 125.5, 123.6, 87.4, 82.8, 25.8 ppm. HRMS calculated for $C_{21}H_{16}$ [M^+]: 268.1252, found 268.1261.

10. **1,3-dimethoxy-5-(3-phenylprop-2-ynyl)benzene (2j):** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.46-7.43 (m, 2H), 7.31-7.28 (m, 3H), 6.60-6.58 (m, 2H), 6.36 (t, J = 2.4 Hz, 1H), 3.80 (s, 6H), 3.78 (s, 2H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 160.8, 139.0, 131.6, 128.2, 127.8, 123.6, 106.0, 98.6, 87.2, 82.7, 55.2, 25.9 ppm. HRMS calculated for $C_{17}H_{16}O_2$ [M^+]: 252.1150, found 252.1153.

11. **1-chloro-4-(3-phenylprop-2-ynyl)benzene (2k):** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.46-7.42 (m, 2H), 7.37-7.28 (m, 7H), 3.80 (s, 2H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 135.2, 132.4, 131.6, 129.3, 128.6, 128.3, 128.0, 123.4, 86.8, 83.0, 25.2 ppm. HRMS calculated for $C_{15}H_{11}Cl$ [M^+]: 226.0549, found 226.0557.

12. **4-(3-phenylprop-2-ynyl)benzonitrile (2l):** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.66-7.63 (m, 2H), 7.56-7.52 (m, 2H), 7.47-7.43 (m, 2H), 7.34-7.30 (m, 3H), 3.90 (s, 2H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 142.3, 132.3, 131.6, 128.7, 128.3, 128.2, 123.0, 118.8, 110.7, 85.5, 83.7, 25.9 ppm. HRMS calculated for $C_{16}H_{11}N$ [M^+]: 217.0891, found 217.0886.

13. **1-(3-phenylprop-2-ynyl)-3,5-bis(trifluoromethyl)benzene (2m):** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.89 (s, 2H), 7.79 (s, 1H), 7.48-7.43 (m, 2H), 7.35-7.32 (m, 3H), 3.97 (s, 3H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 139.3, 132.5, 132.0, 131.7, 128.3 (m), 128.2 (m), 123.3 (q, J = 270 Hz), 122.9, 120.8 (m), 84.9, 84.2, 25.5 ppm. HRMS calculated for

$C_{17}H_{10}F_6$ [M^+]: 328.0687, found 328.0681.

14. 2-(3-phenylprop-2-ynyl)thiophene (2n): ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.47-7.43 (m, 2H), 7.32-7.28 (t, 3H), 7.21-7.18 (m, 1H), 7.04-7.01 (m, 1H), 6.98-6.95 (m, 1H), 3.99 (s, 2H) ppm. $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 139.5, 131.6, 128.2, 128.0, 126.8, 125.0, 124.1, 123.3, 86.7, 82.3, 20.6 ppm. HRMS calculated for $C_{13}H_{10}S$ [M^+]: 198.0503, found 198.0500.

15. Hept-2-ynylbenzene (2o): ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.37-7.28 (m, 4H), 7.27-7.19 (m, 1H), 3.58 (t,*J* = 2.0 Hz, 2H), 2.26-2.20 (m, 2H), 1.57-1.38 (m, 4H), 0.92 (t, *J* = 7.6 Hz, 3H) ppm. $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 137.6, 128.4, 127.8, 126.3, 82.6, 77.4, 31.1, 25.1, 22.0, 18.5, 13.6 ppm.

16. (7-chlorohept-2-ynyl)benzene (2p): ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.35-7.19 (m, 5H), 3.57 (s, 2H), 3.57-3.53 (m, 2H), 2.30-2.23 (m, 2H), 1.94-1.86 (m, 2H), 1.71-1.63 (m, 2H) ppm. $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 137.3, 128.4, 127.8, 126.4, 81.6, 78.2, 44.6, 31.5, 26.1, 25.0, 18.1 ppm. HRMS calculated for $C_{13}H_{15}Cl$ [M^+]: 206.0862, found 206.0855.

17. 1,4-diphenylbut-2-yne (2q): ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.39-7.35 (m, 4H), 7.34-7.29 (m, 4H), 7.25-7.20 (m, 2H), 3.65 (s, 4H) ppm. $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 137.3, 128.4, 127.9, 126.5, 79.9, 25.2 ppm.

18. 4-(3-(trimethylsilyl)prop-2-ynyl)benzonitrile (2r): ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.62 (dt, *J* = 1.6, 8.4 Hz, 2H), 7.48-7.44 (m, 2H), 3.71 (s, 2H), 0.20 (s, 9H) ppm. $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 141.9, 132.3, 128.6, 118.8, 110.6, 102.1, 88.4, 26.3, -0.07 ppm. HRMS calculated for $C_{13}H_{15}SiN$ [M^+]: 213.0974, found 213.0983.

19. 2-methyl-6-(3-(trimethylsilyl)prop-2-ynyl)pyridine (2s): ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.58 (t, *J* = 8 .0 Hz, 1H), 7.37 (d, *J* = 7.6 Hz, 1H), 7.02 (d, *J* = 7.6 Hz, 1H), 3.81 (s, 2H), 2.53 (s, 3H), 0.20 (s, 9H) ppm. $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 157.8, 155.9, 137.0, 121.2, 118.7, 103.1, 87.8, 29.3, 24.4, 0.03 ppm. HRMS calculated for $C_{12}H_{17}NSi$ [M^+]: 203.1130, found 203.1127.

20. 1,2-diphenylethyne (2t): ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.55-7.50 (m, 4H), 7.36-7.30 (m, 6H) ppm. $^{13}C\{^1H\}$ NMR (100 MHz, $CDCl_3$): δ 131.6, 128.3, 128.2, 123.3, 89.4 ppm.

21. 1-methyl-4-(phenylethynyl)benzene (2u): ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.54-7.50 (m,

2H), 7.43 (d, *J* = 8.0 Hz, 2H), 7.37-7.30 (m, 3H), 7.16 (d, *J* = 8.0 Hz, 2H), 2.37 (s, 3H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 138.4, 131.54, 131.49, 129.1, 128.3, 128.1, 123.5, 120.2, 89.5, 88.7, 21.5 ppm.

22. **1,3-dimethyl-5-(phenylethynyl)benzene (2v):** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.54-7.49 (m, 2H), 7.37-7.31 (m, 3H), 7.17 (m, 2H),) 6.97 (s, 1H), 2.31 (s, 6H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 137.9, 131.5, 130.2, 129.3, 128.3, 128.1, 123.4, 122.8, 89.7, 88.7, 21.1 ppm.

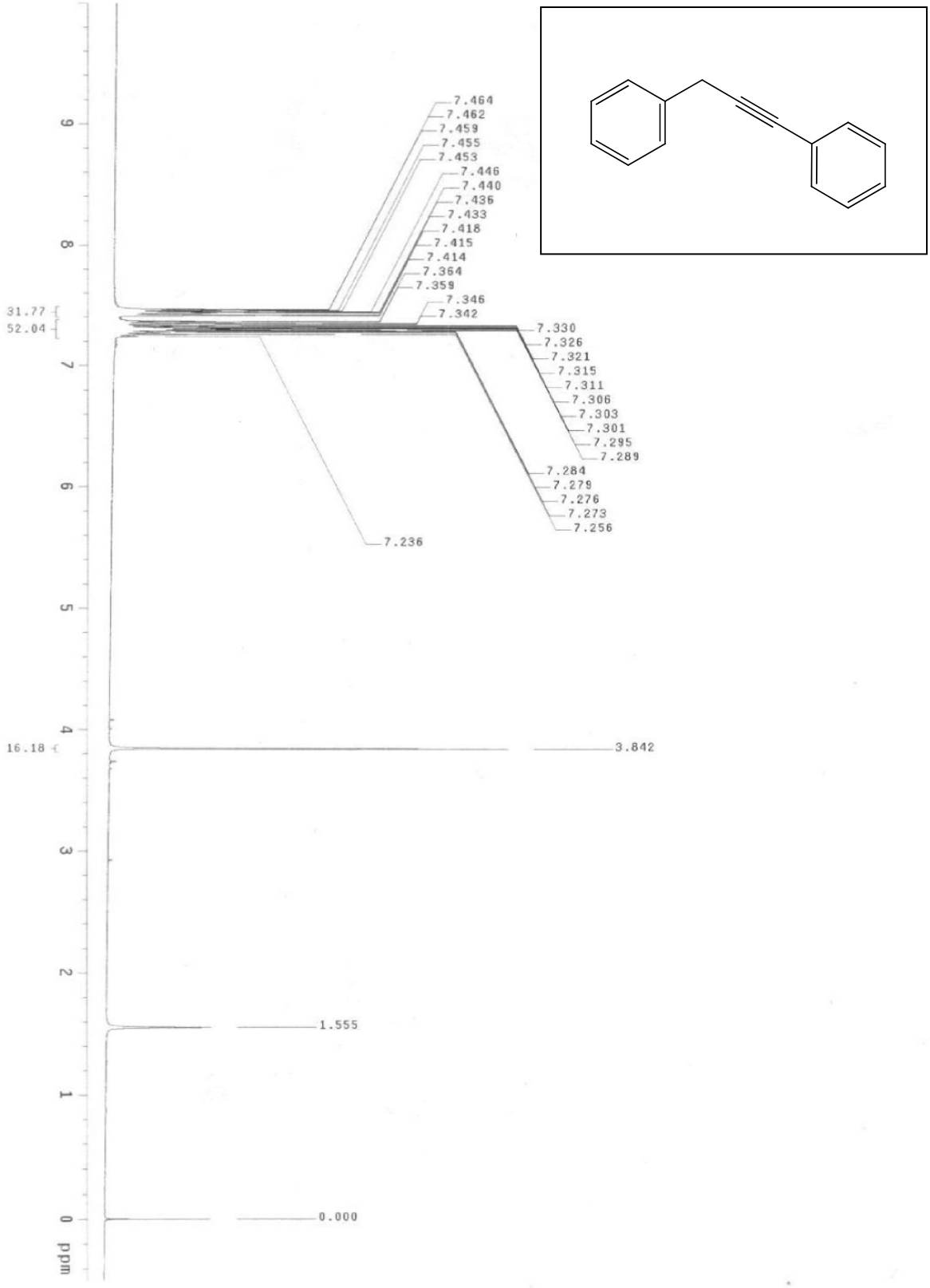
23. **trimethyl(4-(phenylethynyl)phenyl)silane (2w):** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.55-7.52 (m, 2H), 7.50 (s, 4H), 7.37-7.33 (m, 3H), 0.28 (s, 9H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 141.0, 133.2, 131.6, 130.7, 128.3, 128.2, 123.6, 123.3, 89.8, 89.6, -1.2 ppm.

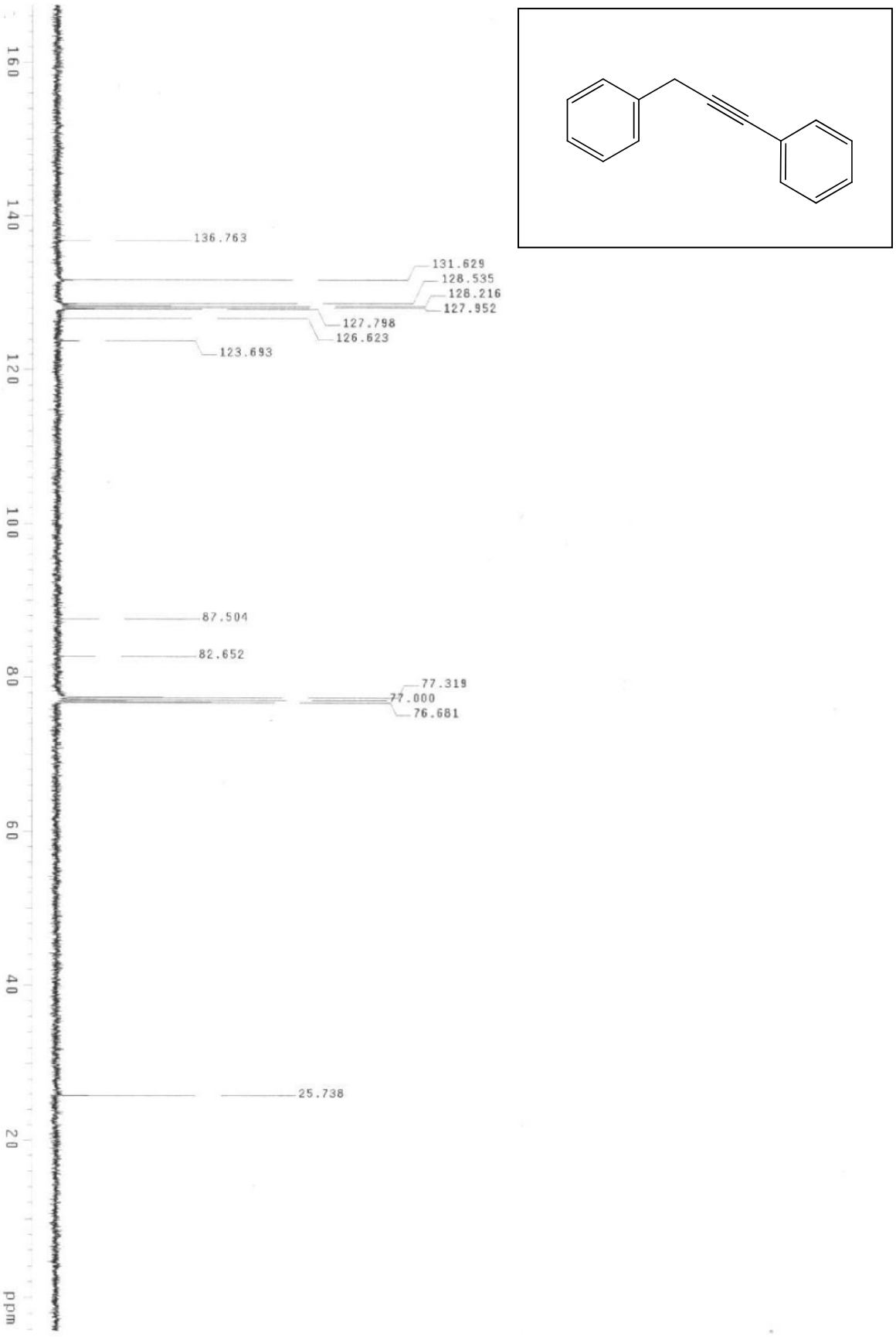
24. **1-fluoro-4-(phenylethynyl)benzene (2x):** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.55-7.48 (m, 4H), 7.38-7.32 (m, 3H), 7.07-7.01 (m, 2H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 162.4 (d, *J* = 248 Hz), 133.4 (d, *J* = 8.6 Hz), 131.5, 128.3 (d, *J* = 3.9 Hz), 123.0, 119.3 (d, *J* = 3.9 Hz), 115.7, 115.5, 89.0 (d, *J* = 1.6 Hz), 88.3 ppm.

25. **4-(phenylethynyl)benzonitrile (2y):** ^{1}H NMR (400 MHz, $CDCl_3$): δ 7.66-7.59 (m, 4H), 7.57-7.53 (m, 2H), 7.41-7.36 (m, 3H) ppm. $^{13}C\{^{1}H\}$ NMR (100 MHz, $CDCl_3$): δ 132.04, 132.02, 131.8, 129.1, 128.5, 128.2, 122.2, 118.5, 111.4, 93.7, 87.7 ppm.

VII. ^{1}H and ^{13} C NMR Spectra of Coupling Products

1. Prop-1-yne-1,3-diyldibenzene (**2a**)

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80
60
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20
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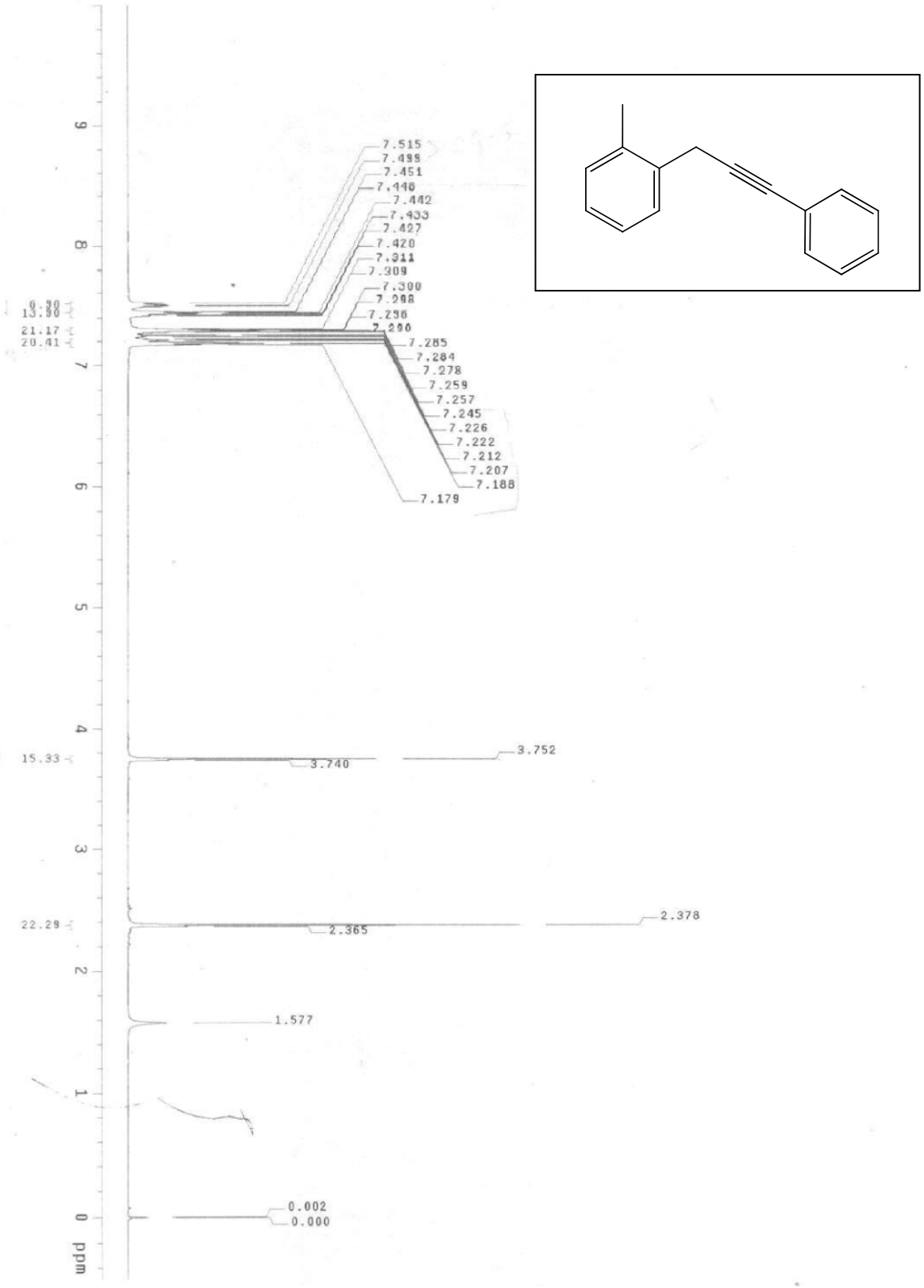
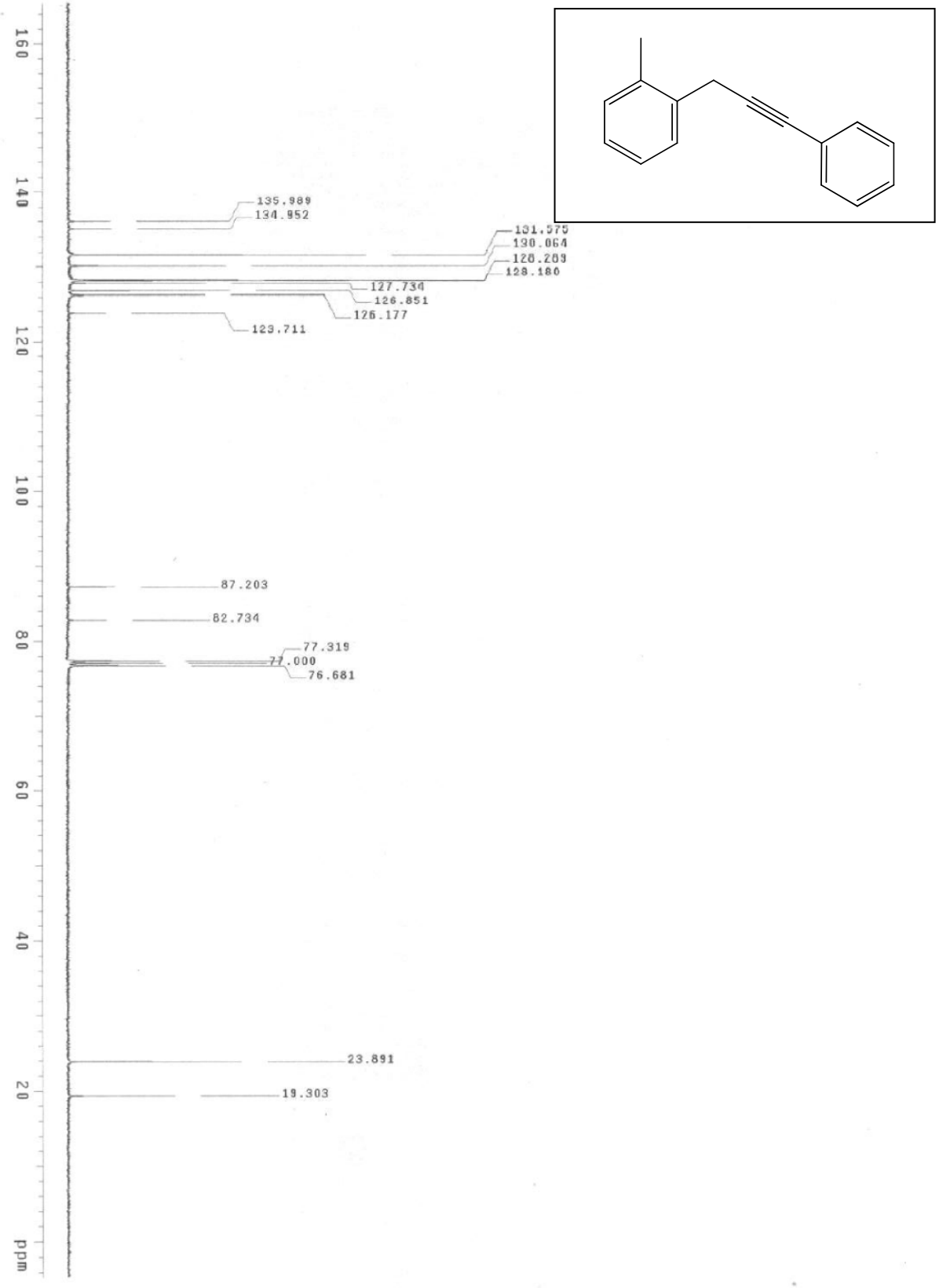
77.000
76.681
25.738

2. 1-methyl-2-(3-phenylprop-2-ynyl)benzene (**2b**)

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140
120
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126.851
126.177
123.711
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77.000
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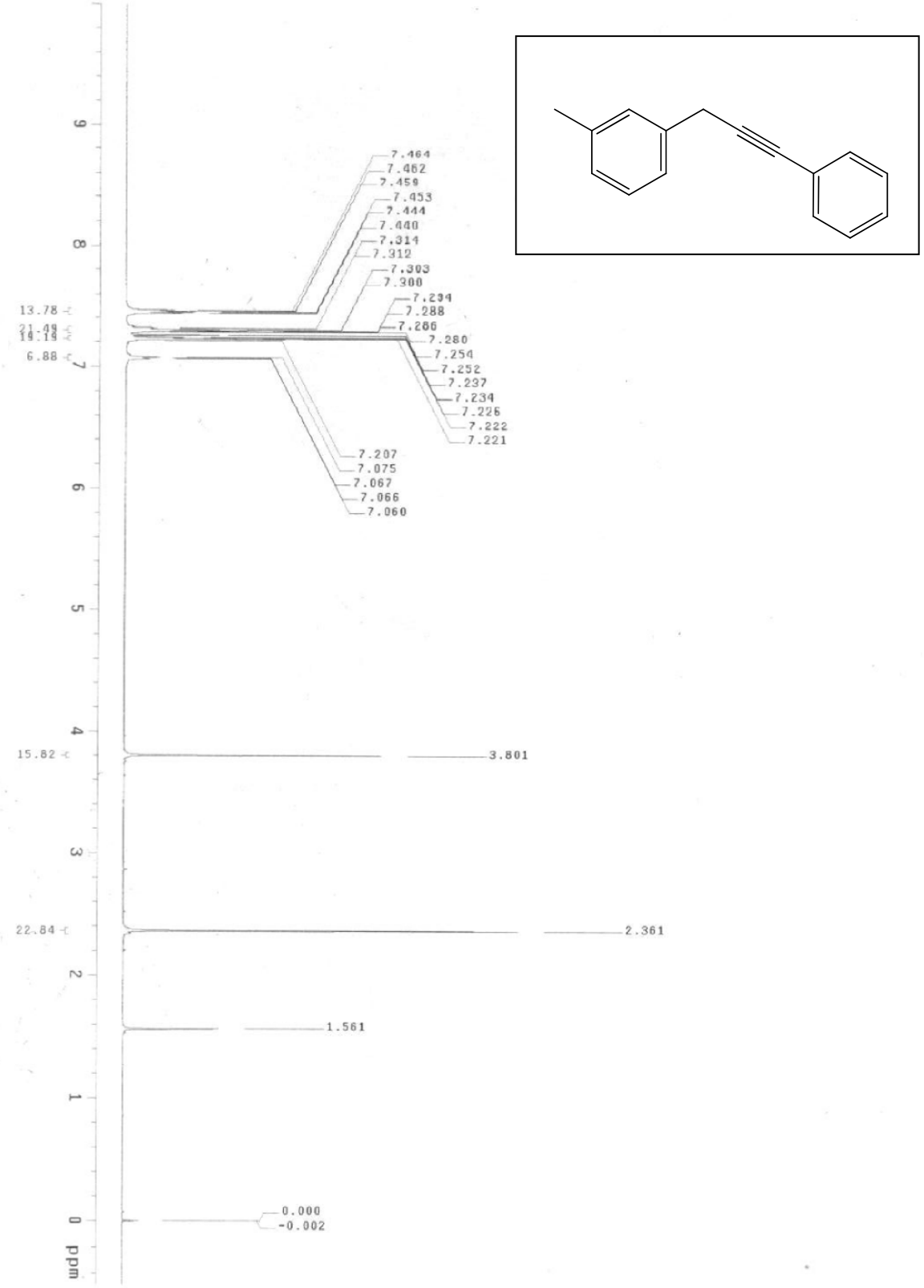
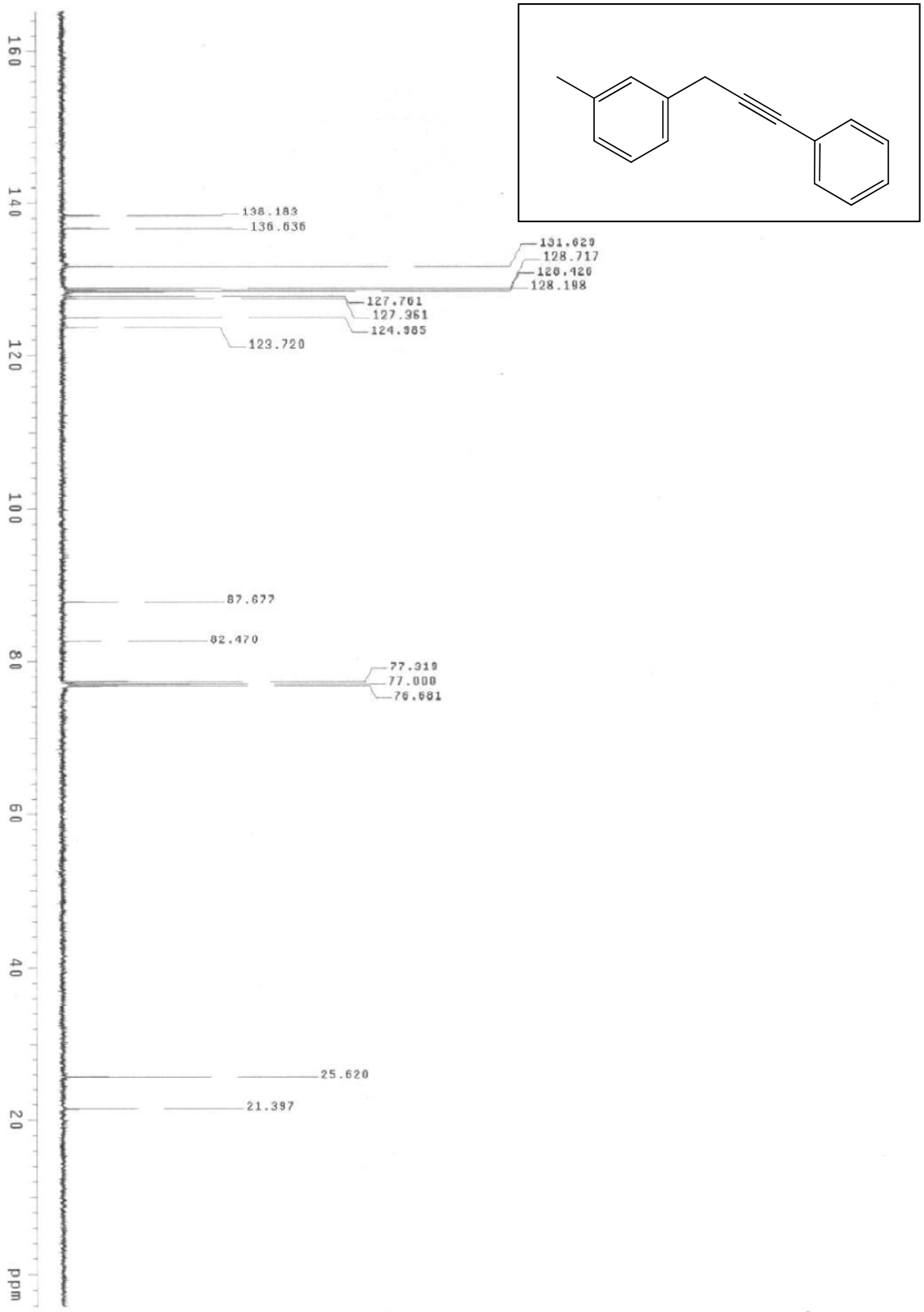
23.891
19.303

3. 1-methyl-3-(3-phenylprop-2-ynyl)benzene (**2c**)

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127.701
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82.470
77.319
77.000
76.681
25.620
21.397
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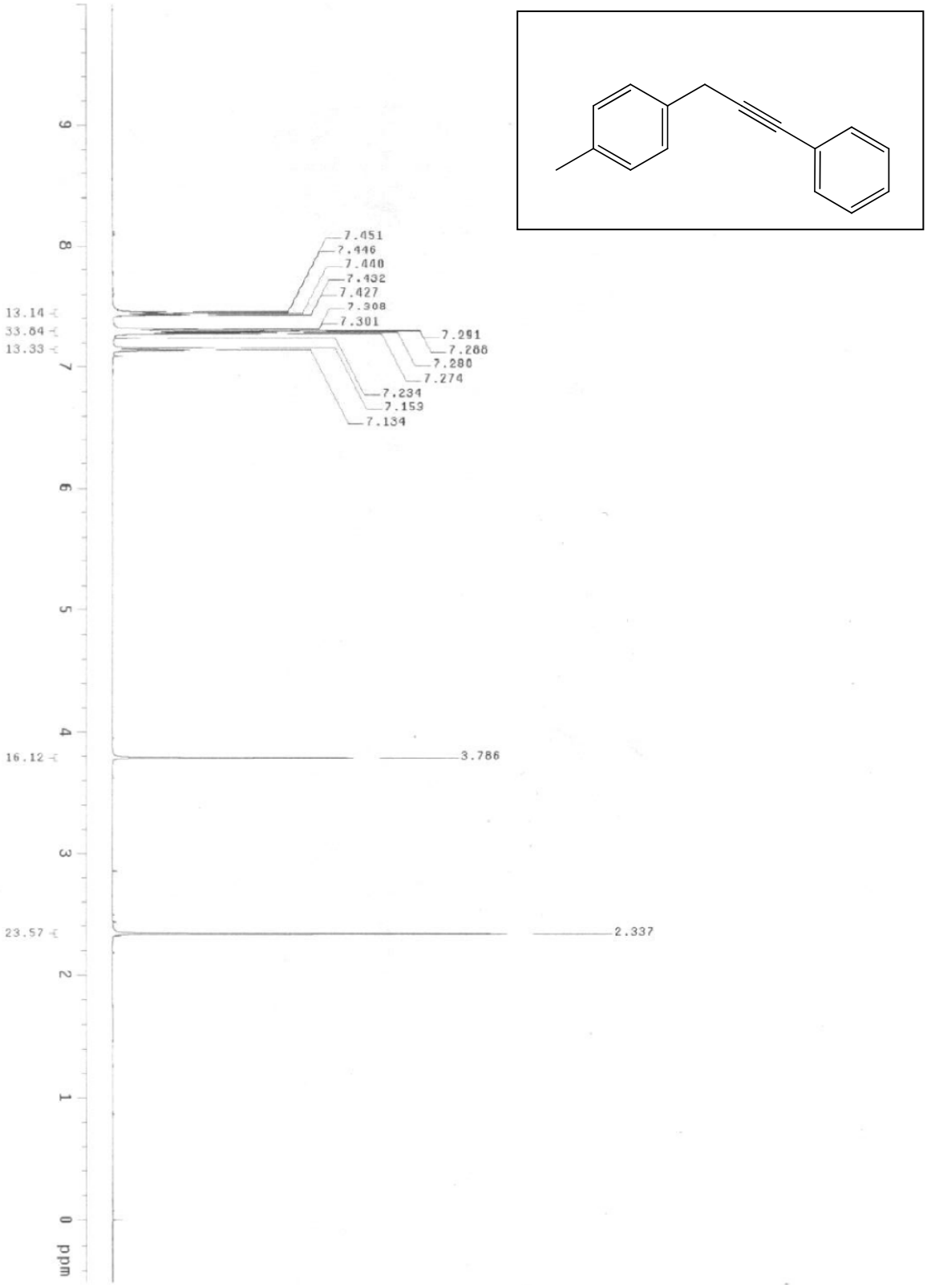
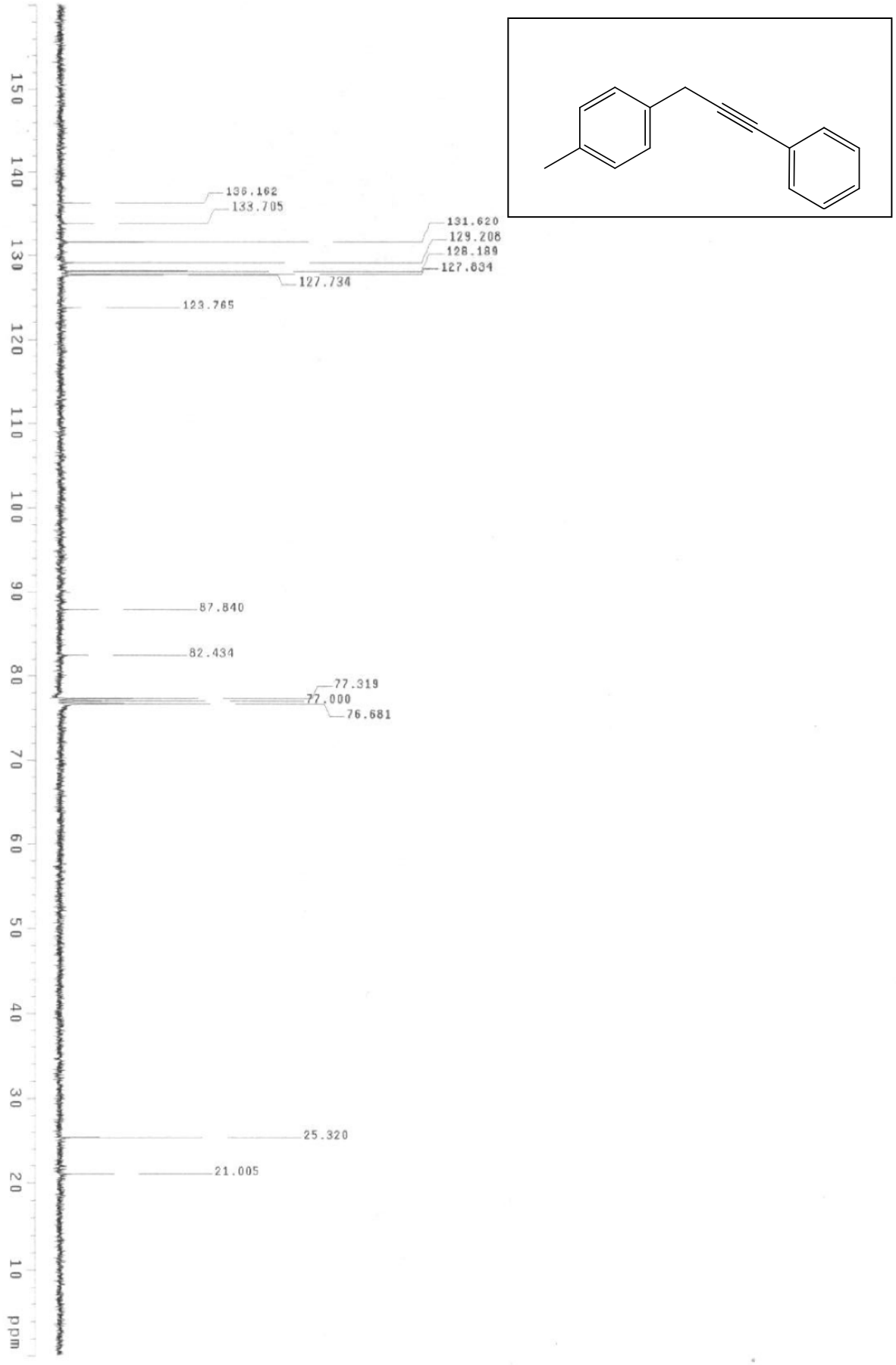
120
100
80
60
40
20
ppm

4. 1-methyl-4-(3-phenylprop-2-ynyl)benzene (**2d**)

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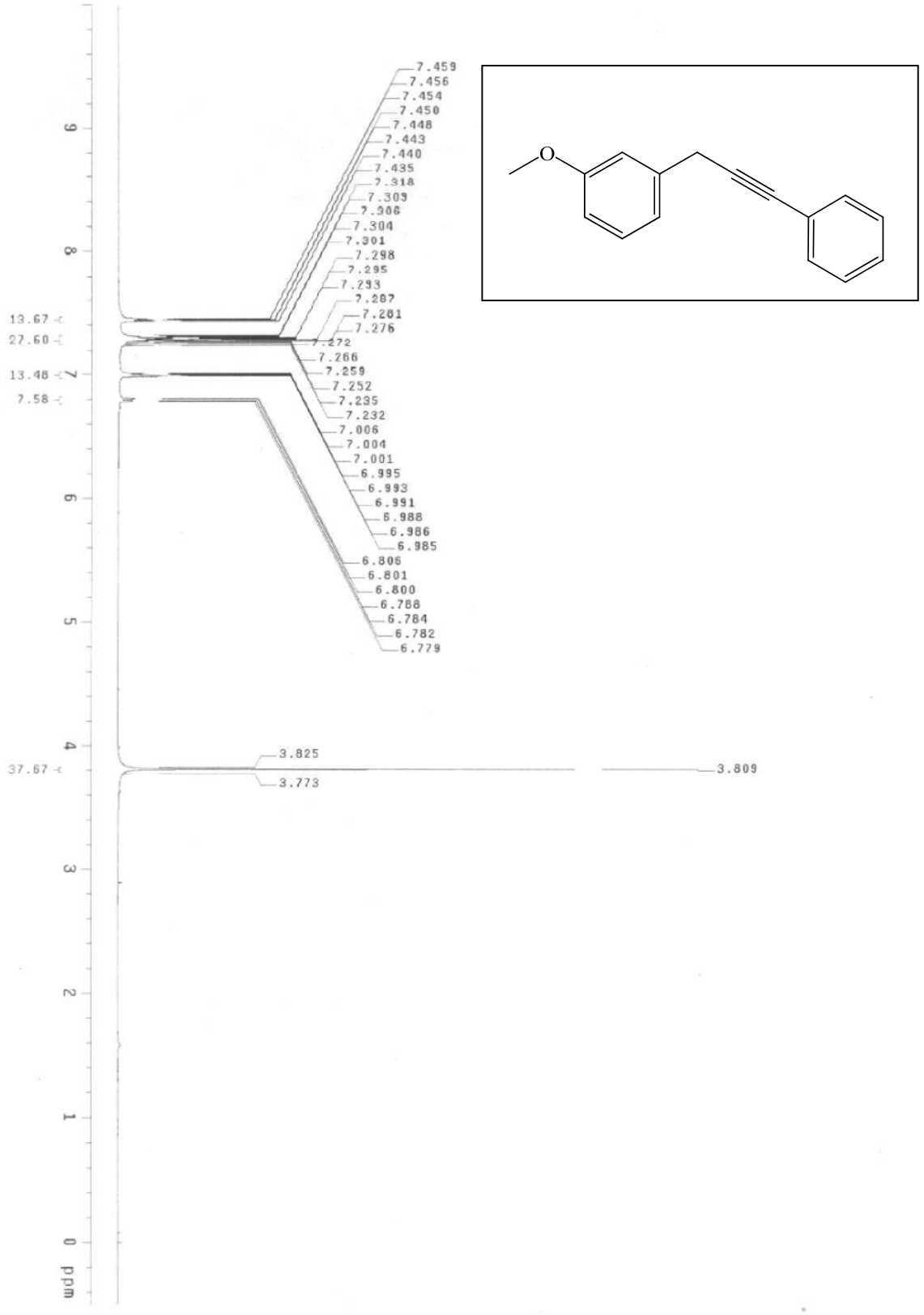
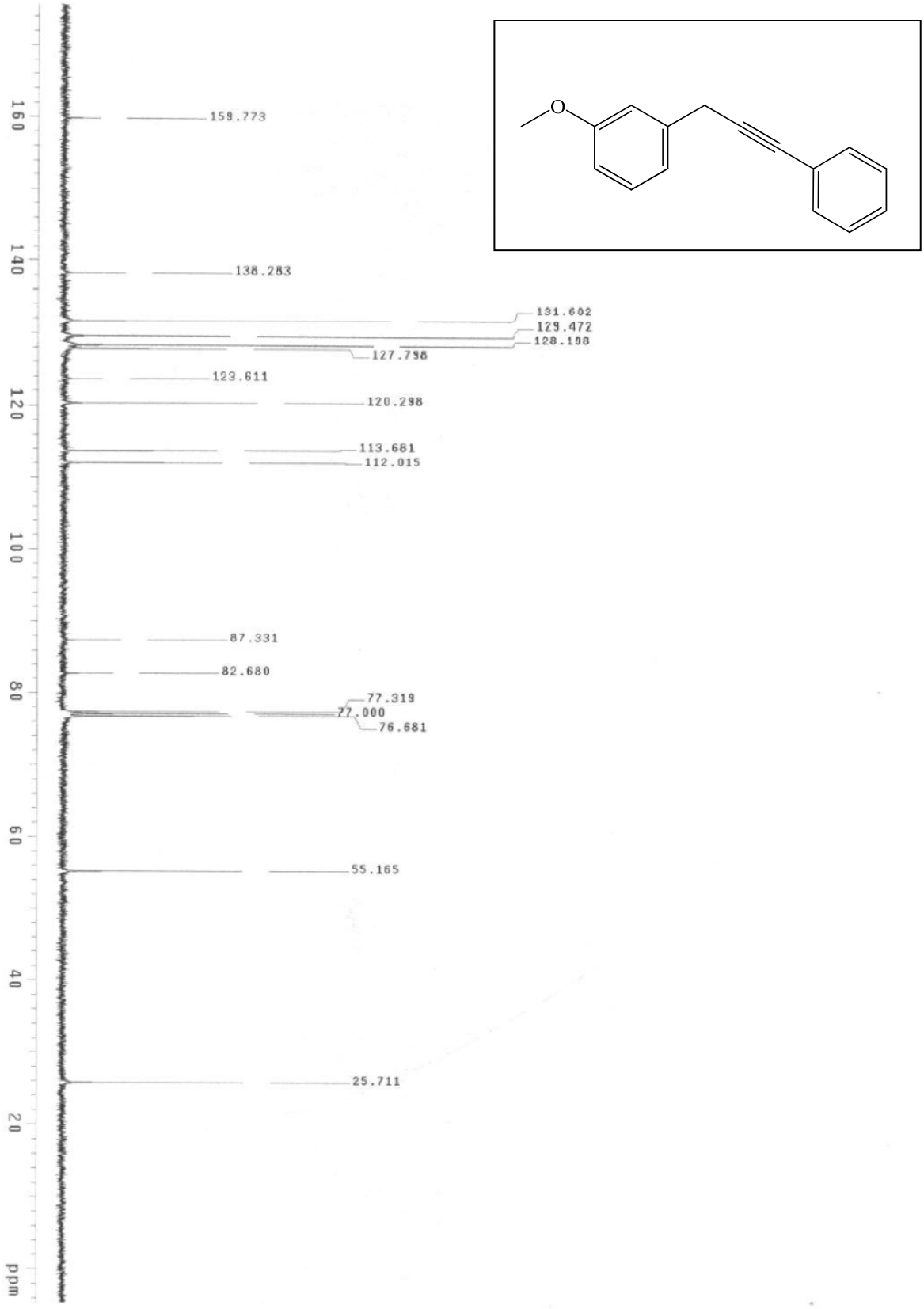
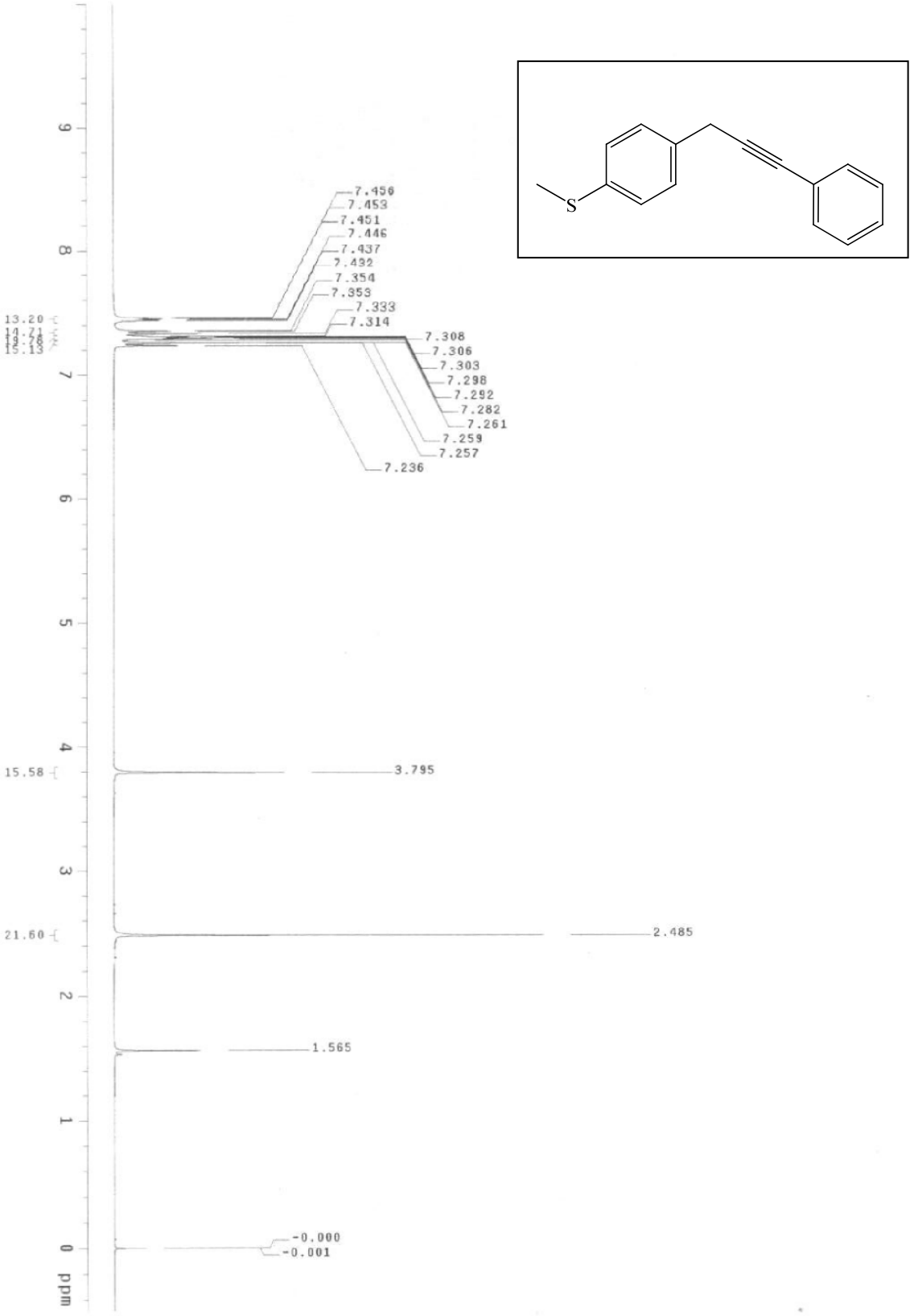
76.681
25.320
21.005
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
ppm

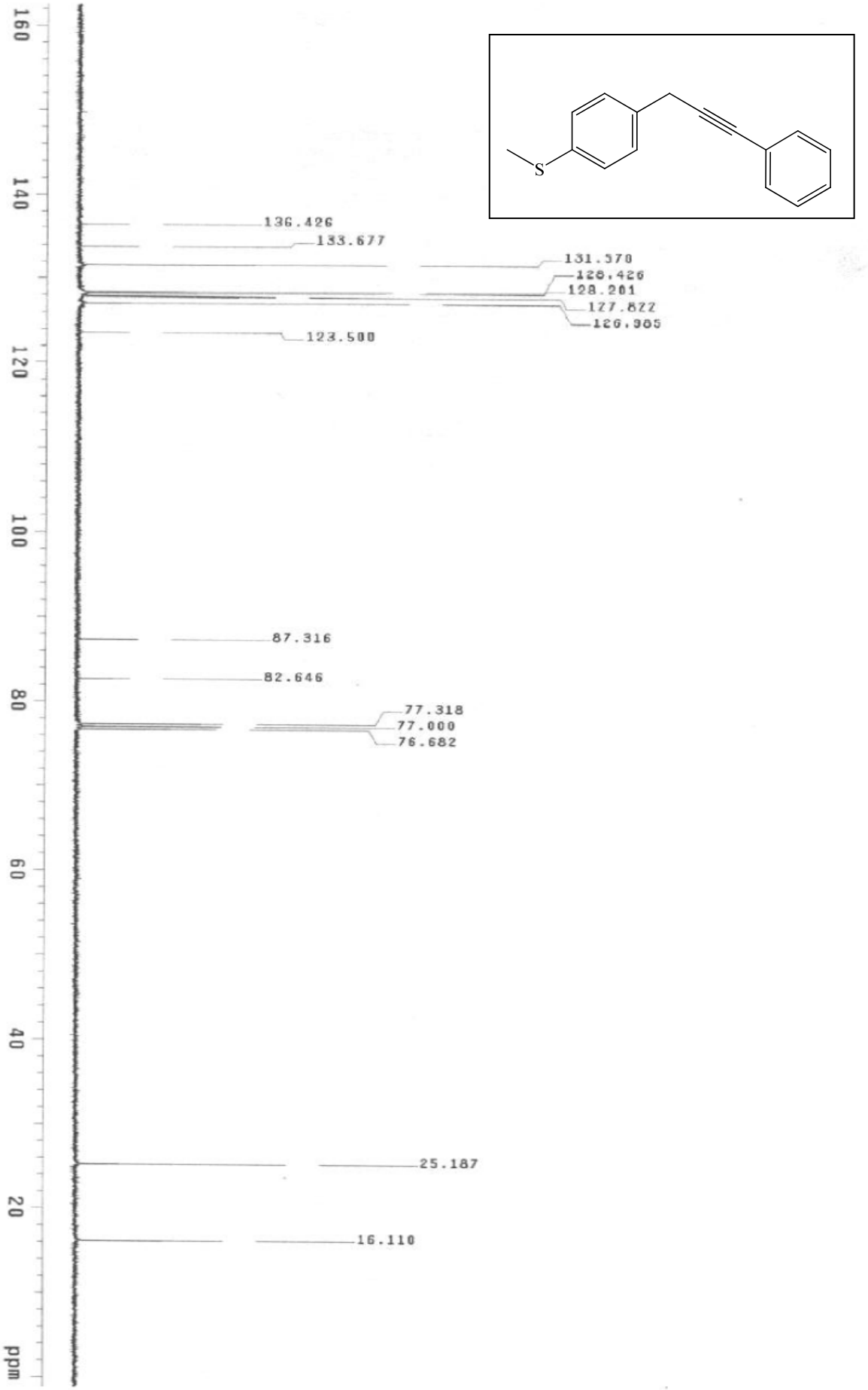
5. 1-methoxy-3-(3-phenylprop-2-ynyl)benzene (**2e**)





6. Methyl(4-(3-phenylprop-2-ynyl)phenyl)sulfane (**2f**)

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140
120
100
80
60
40
20
ppm
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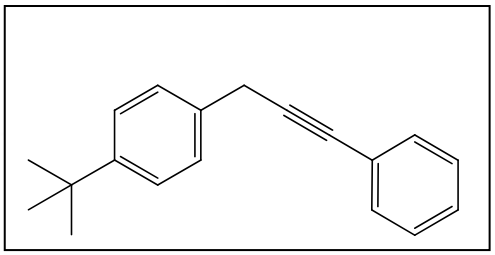
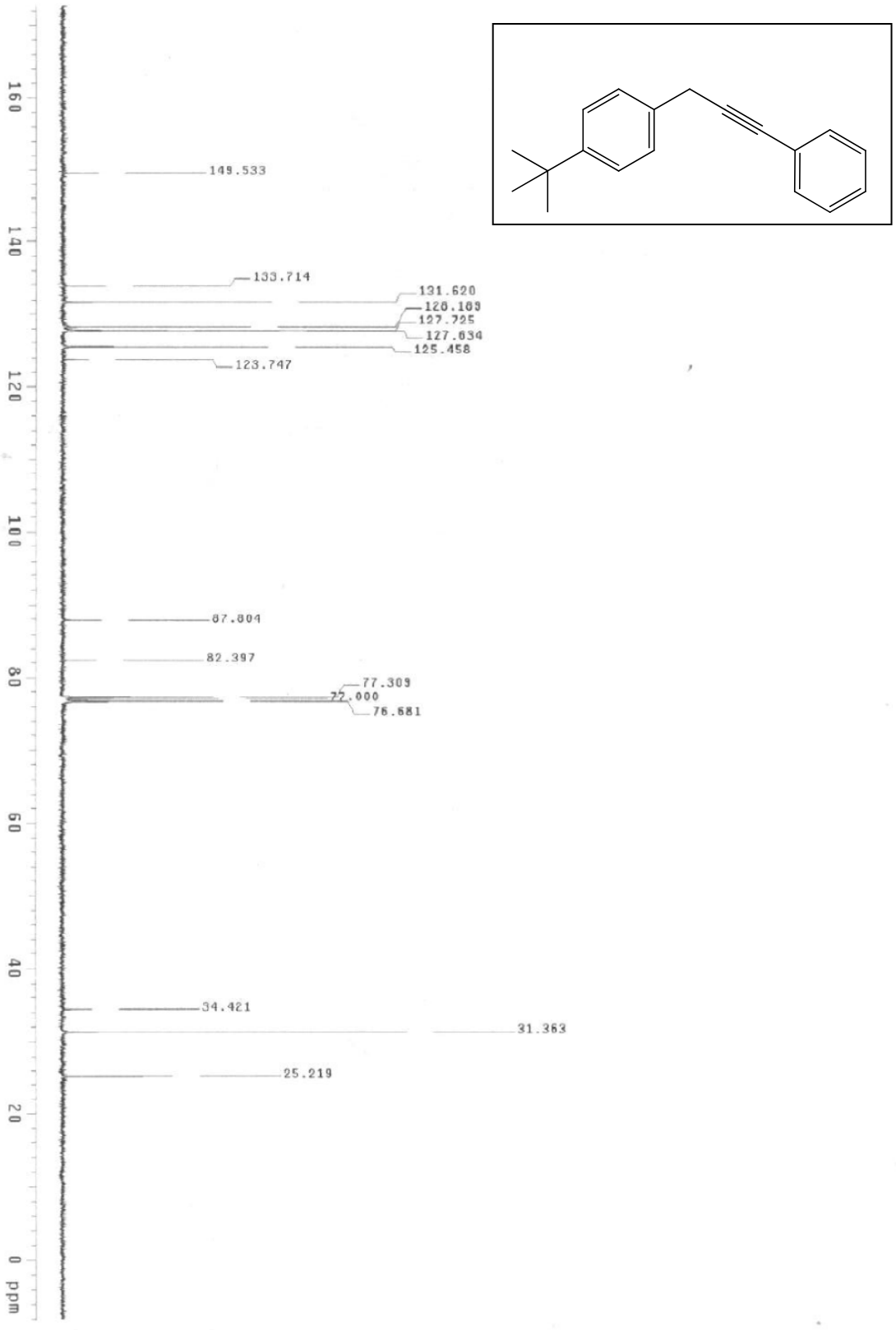
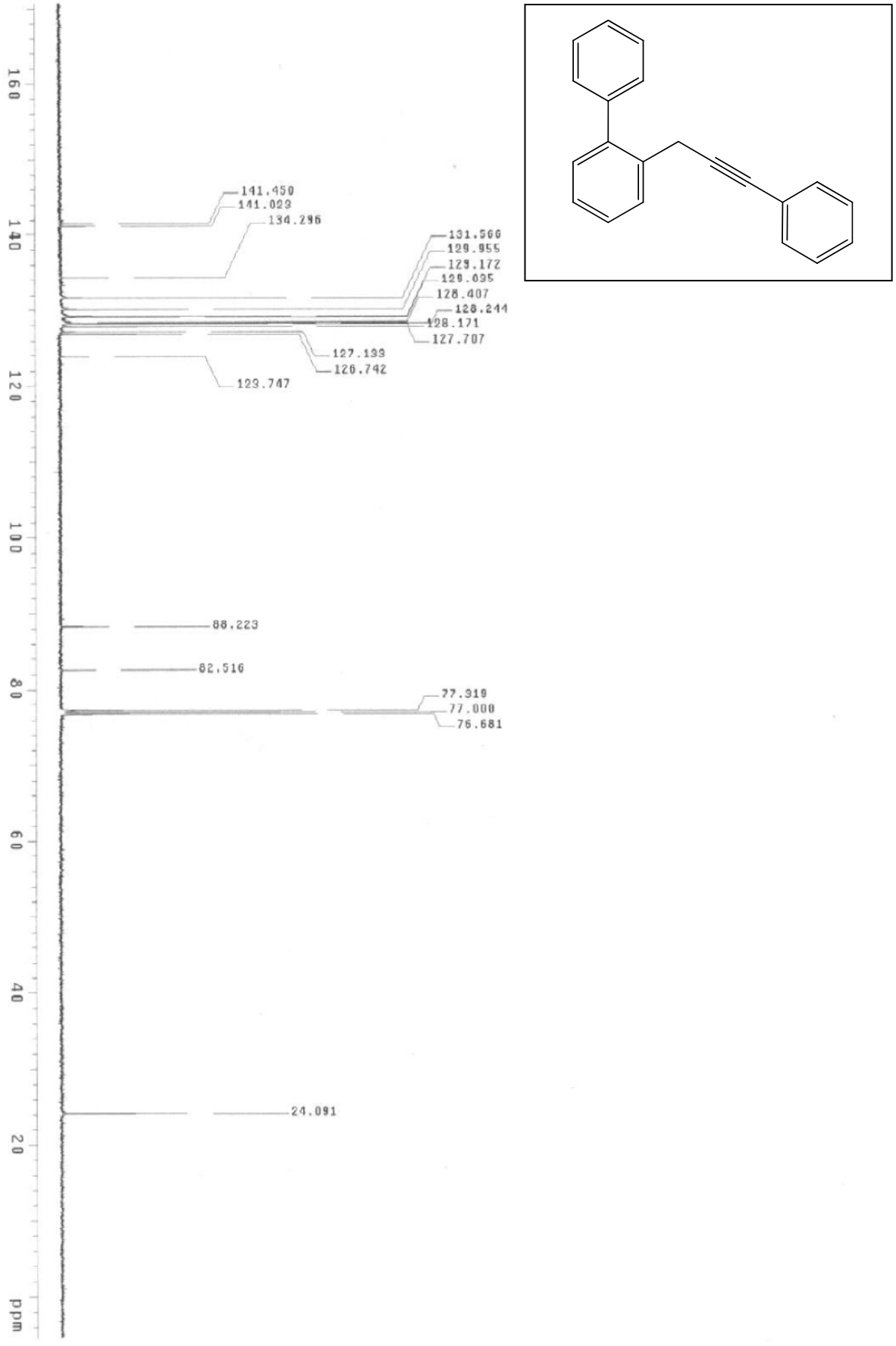
131.570
128.426
128.201
127.822
126.905
123.500
87.316
82.646
77.318
77.000
76.682
25.187
16.110
S

7. 1-tert-butyl-4-(3-phenylprop-2-ynyl)benzene (**2g**)

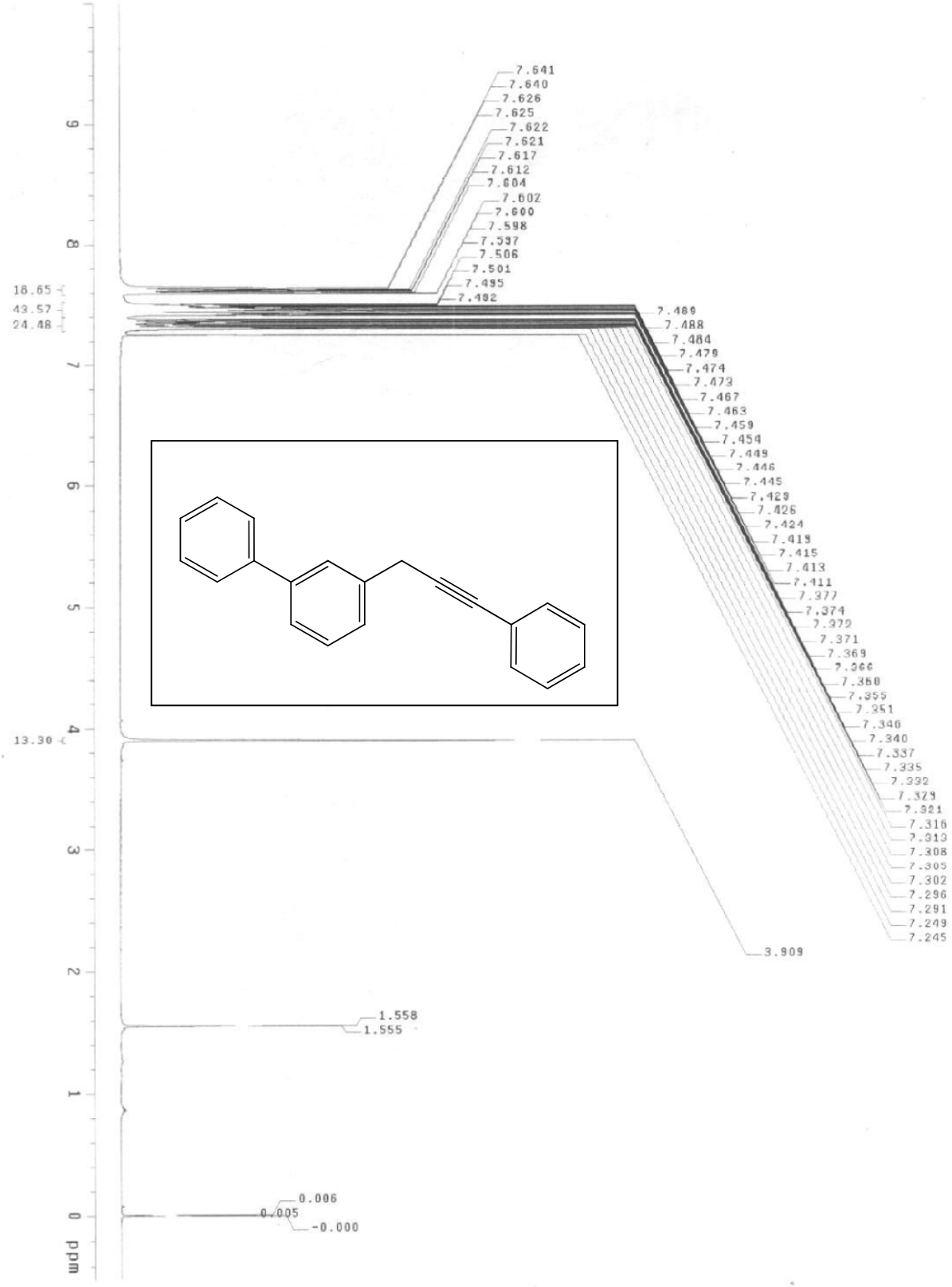


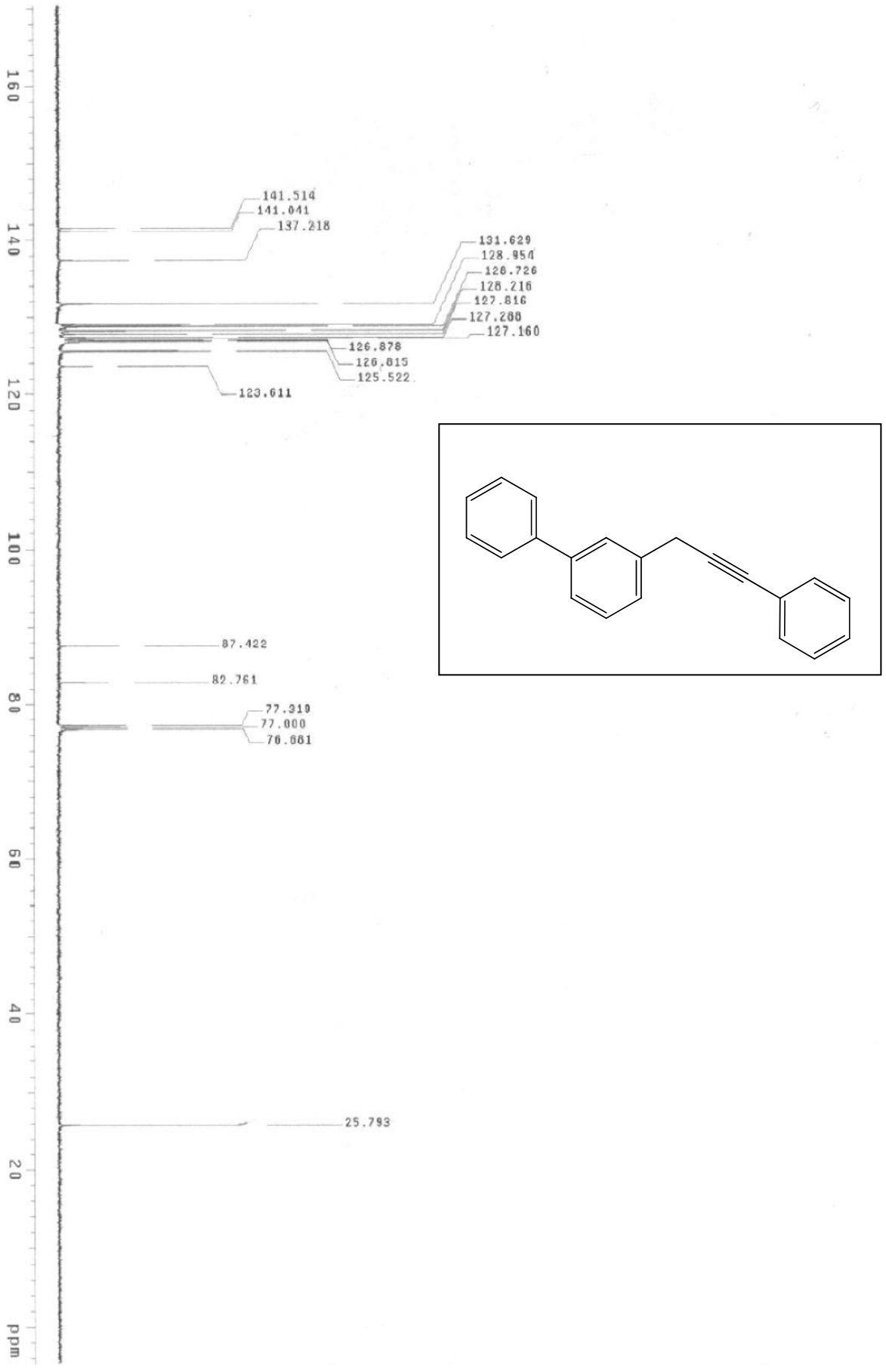

149.533
133.714
131.620
128.103
127.725
127.634
125.458
123.747
87.804
82.397
77.309
77.000
76.681
34.421
31.363
25.219
160
140
120
100
80
60
40
20
0
ppm

8. 2-(3-phenylprop-2-ynyl)biphenyl (**2h**)

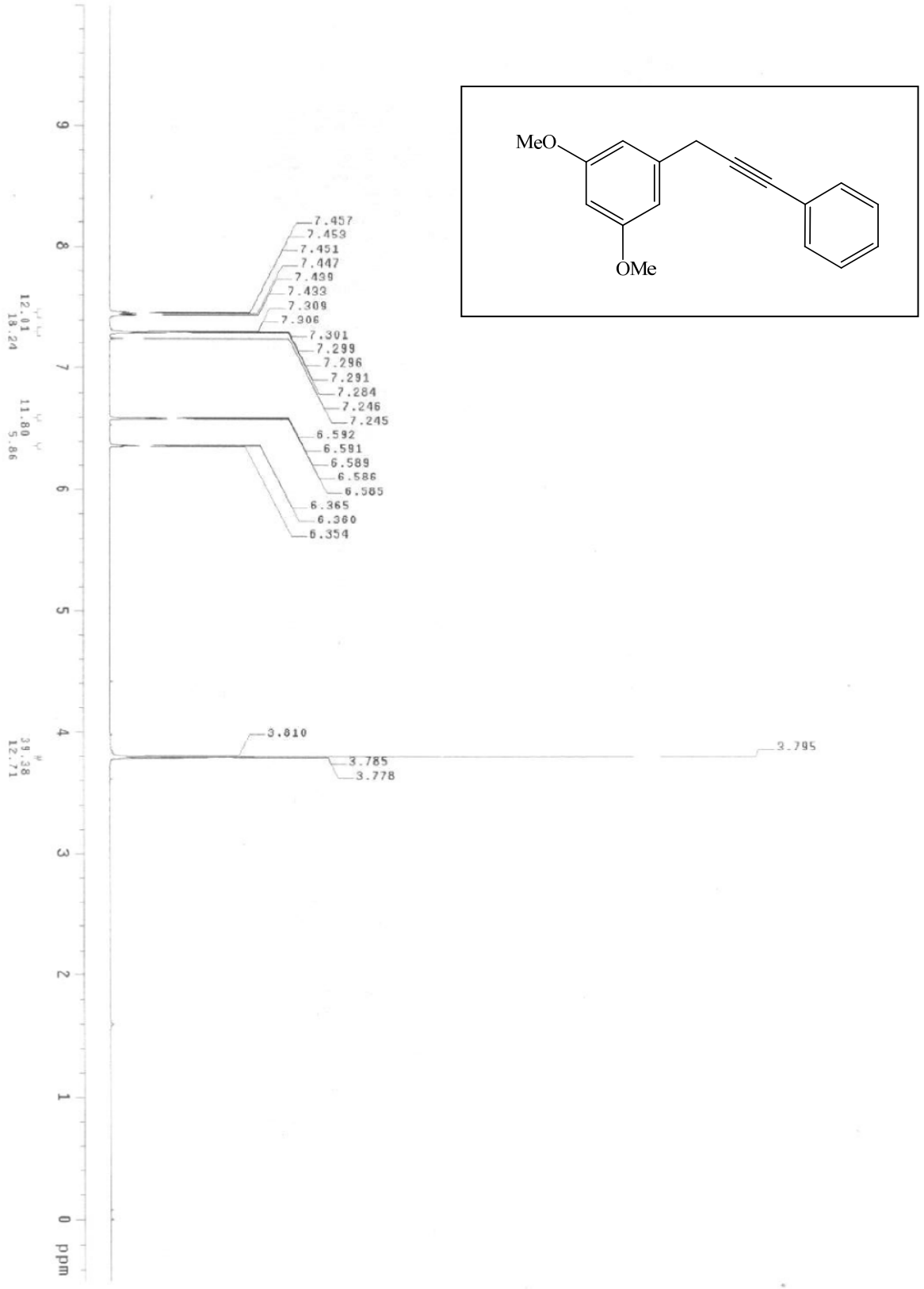

141.450
141.029
134.296
131.560
129.955
129.172
129.035
128.407
128.244
128.171
127.707
127.199
126.742
123.747
88.223
82.516
77.319
77.000
76.681
24.091
160
140
120
100
80
60
40
20
ppm

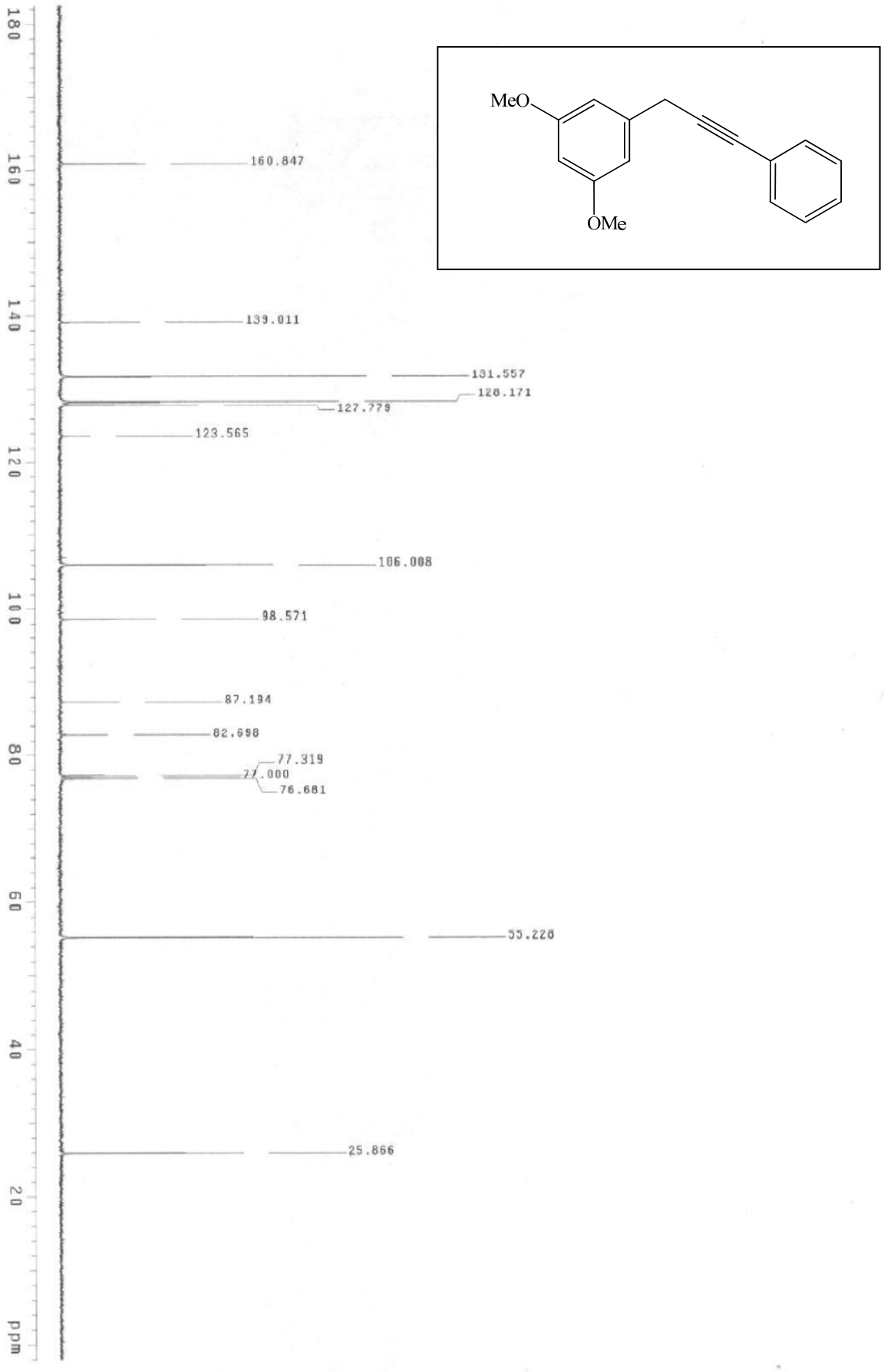
9. 3-(3-phenylprop-2-ynyl)biphenyl (**2i**)



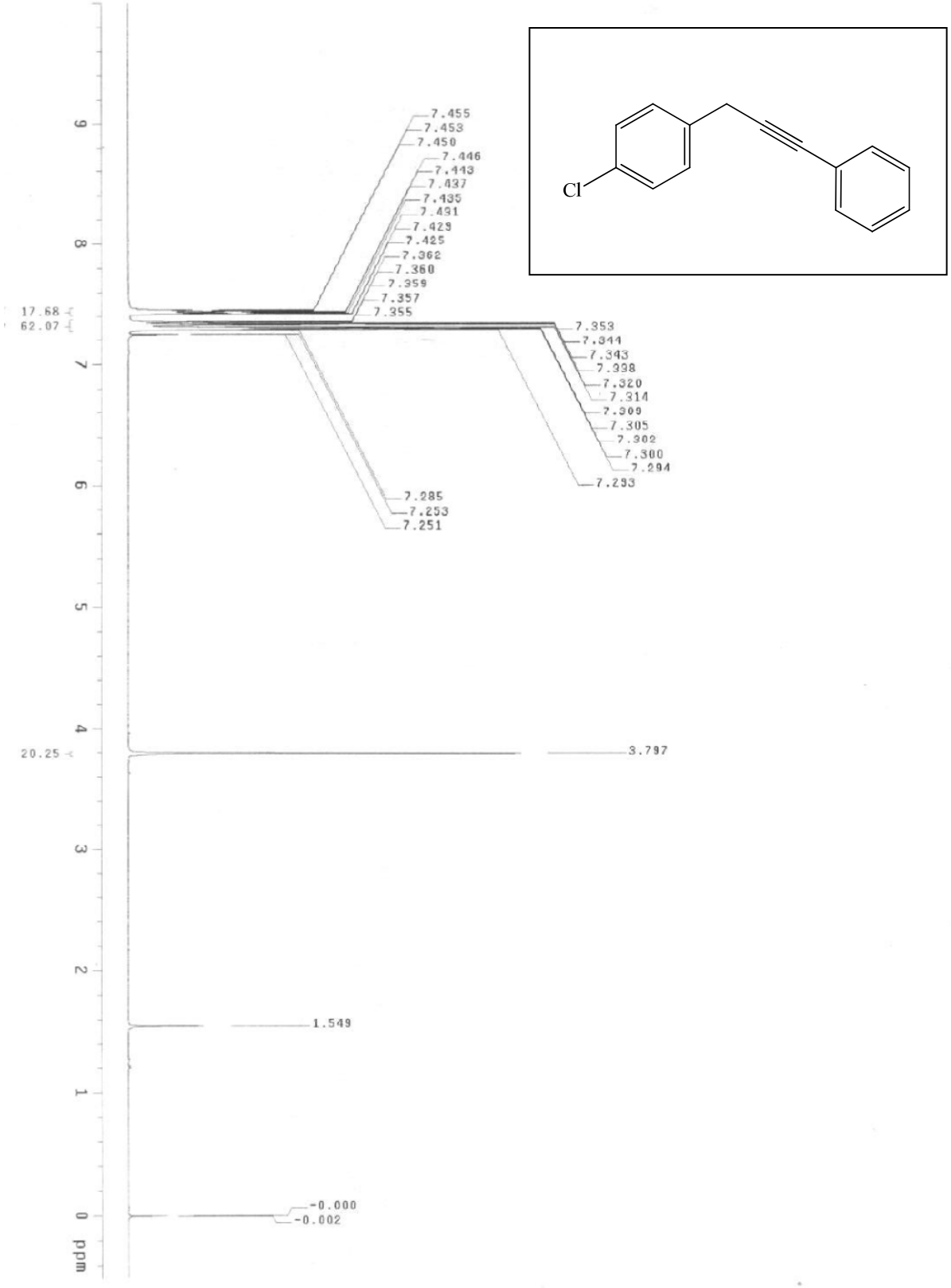

141.514
141.041
137.218
131.629
128.954
128.726
128.216
127.816
127.288
127.160
126.878
126.615
125.522
123.611
87.422
82.761
77.319
77.000
76.681
25.793
160
140
120
100
80
60
40
20
ppm

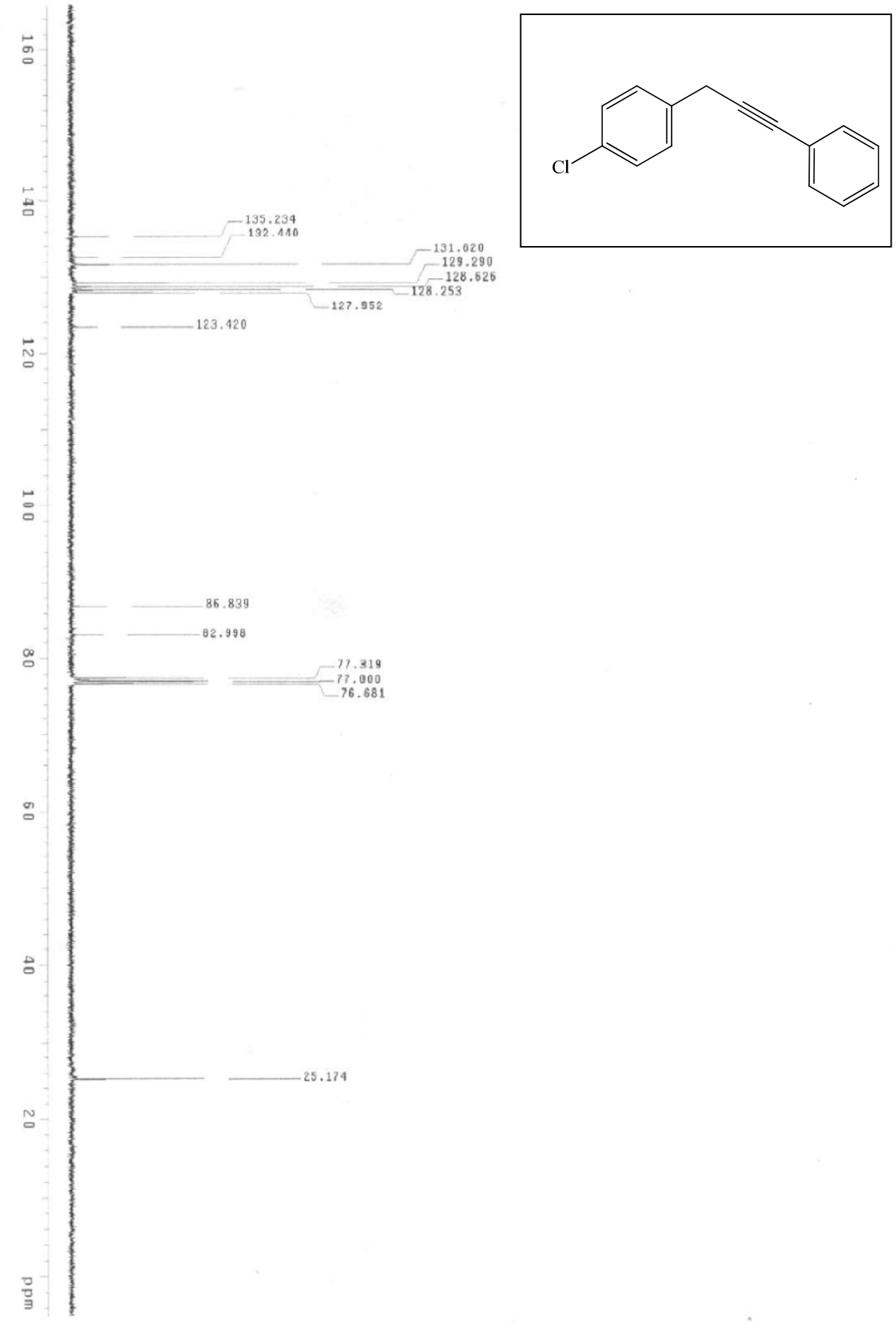
10. 1,3-dimethoxy-5-(3-phenylprop-2-ynyl)benzene (**2j**)



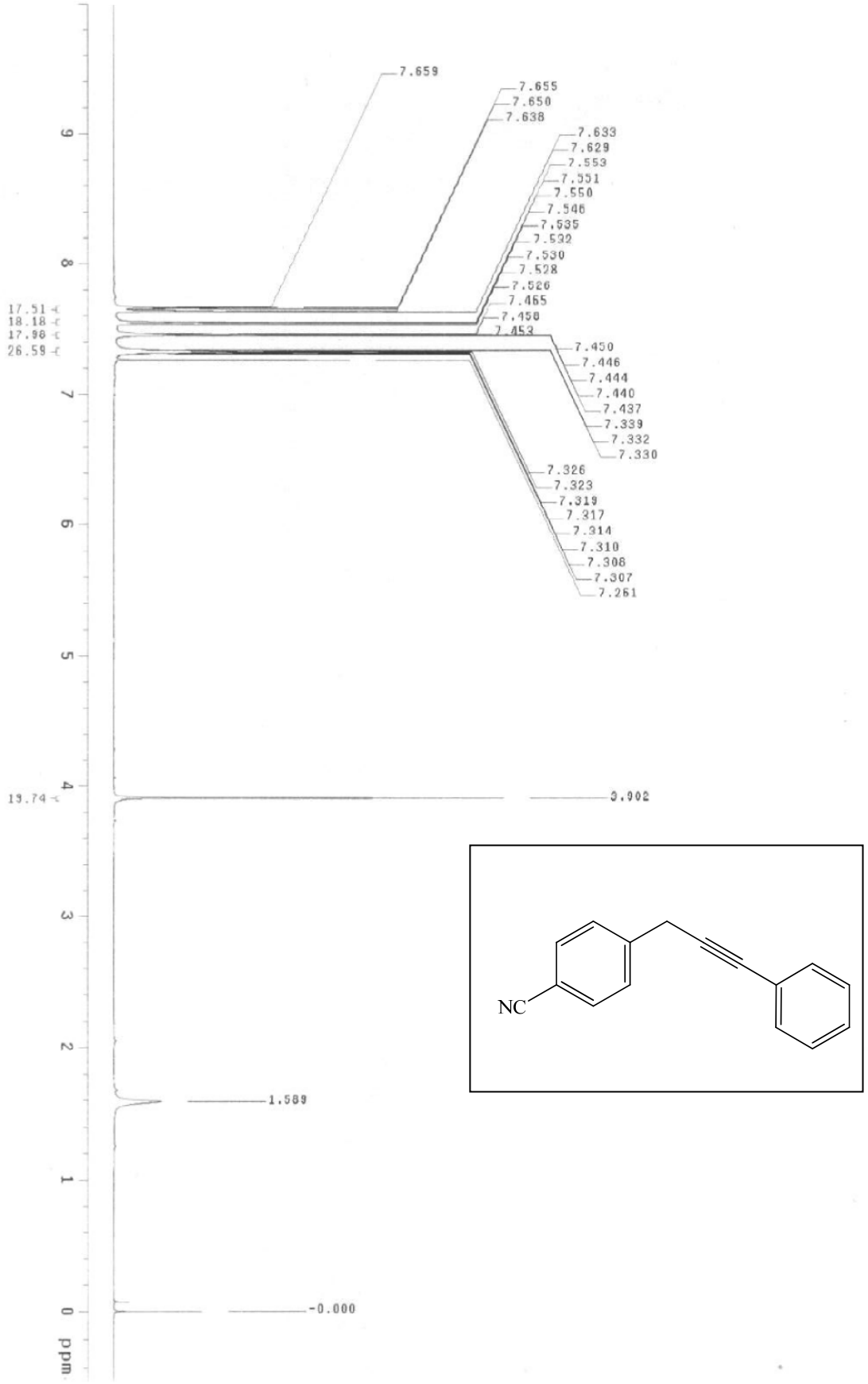

MeO
OMe
160.847
139.011
131.557
128.171
127.779
123.565
106.008
98.571
87.194
82.698
77.319
77.000
76.681
55.226
25.866
180
160
140
120
100
80
60
40
20
ppm

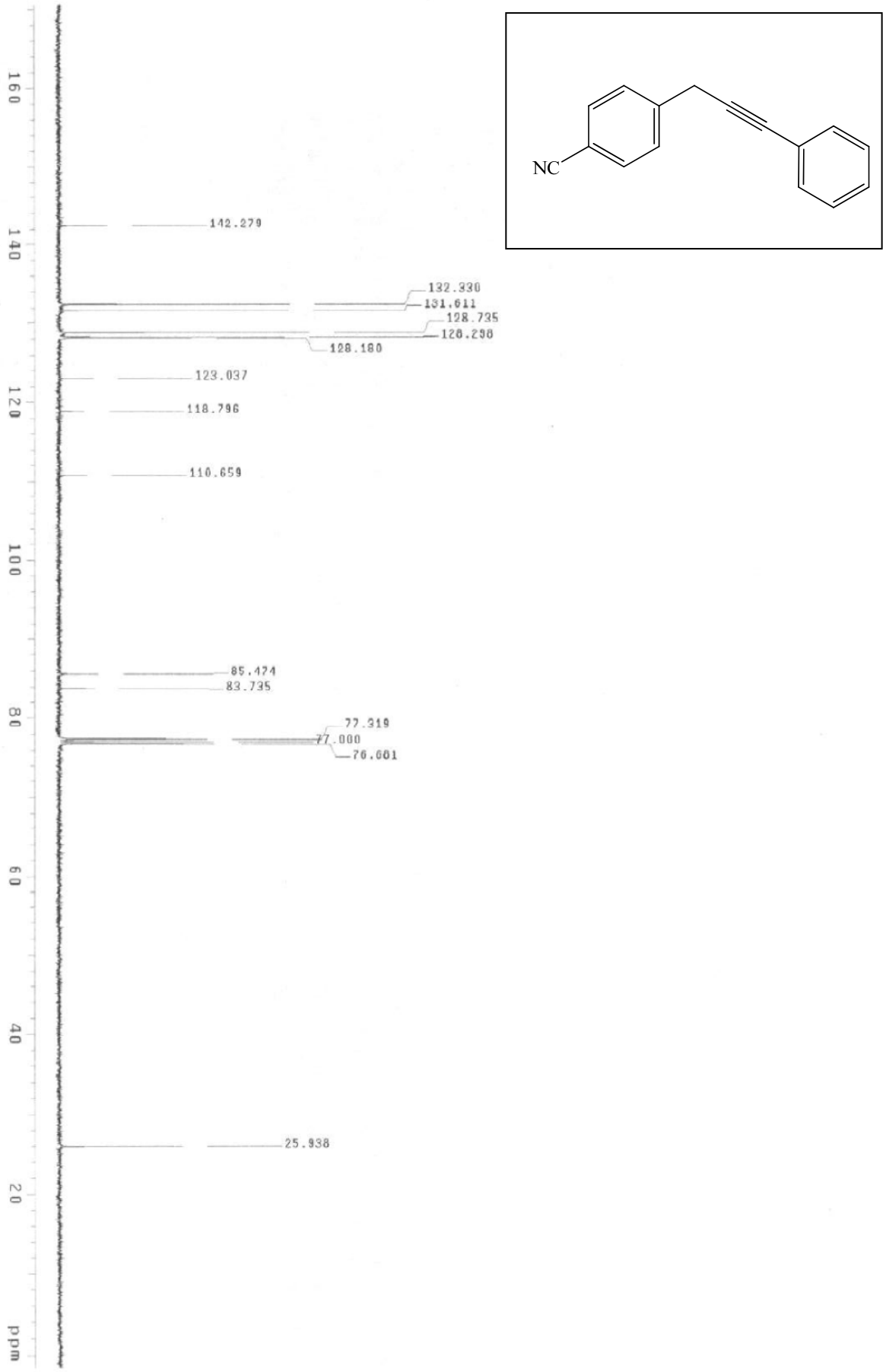
11. 1-chloro-4-(3-phenylprop-2-ynyl)benzene (**2k**)



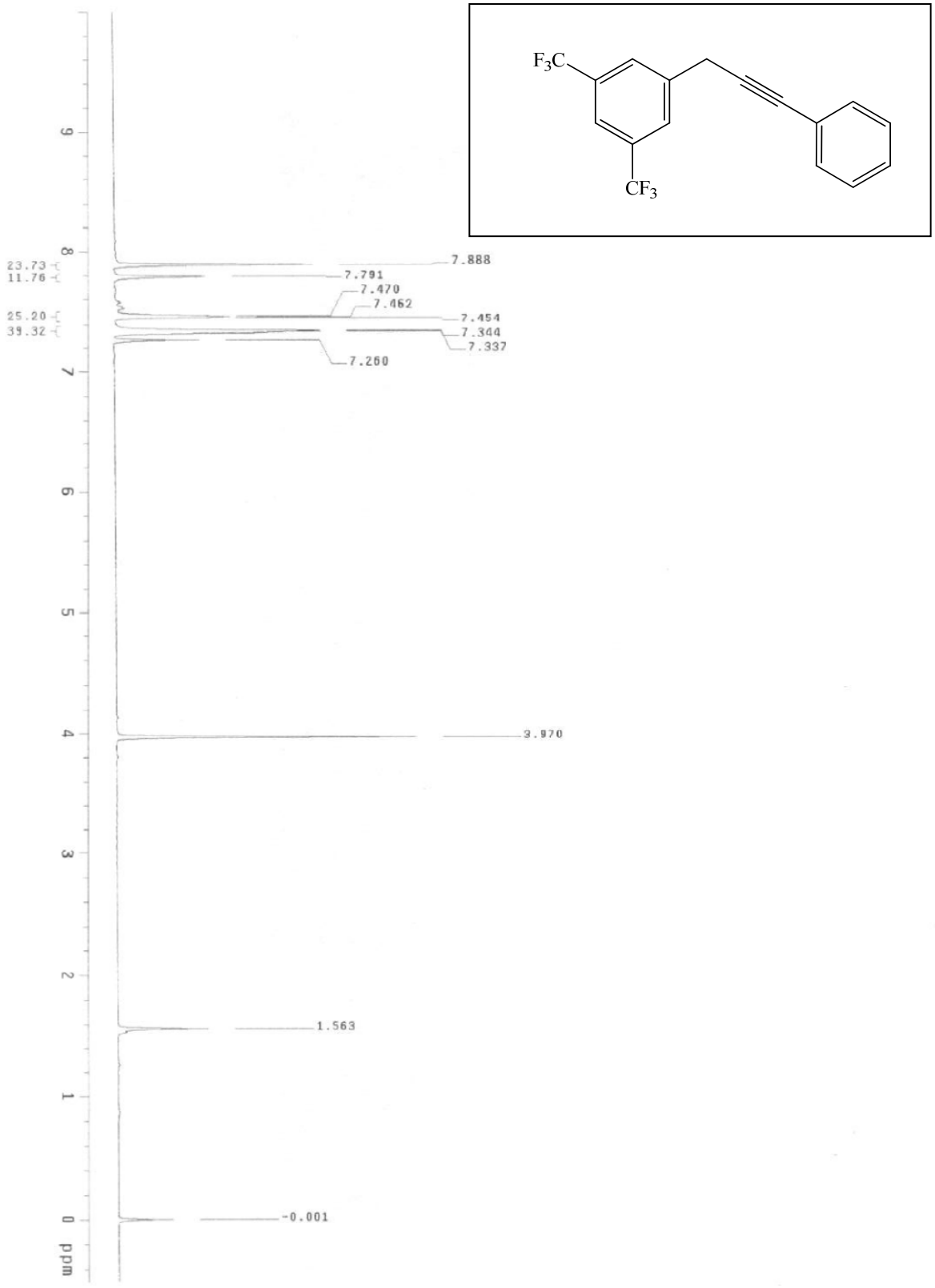

160
140
120
100
80
60
40
20
ppm
135.234
132.440
131.020
129.290
128.626
128.253
127.952
123.420
86.839
82.998
77.819
77.000
76.681
25.174
Cl

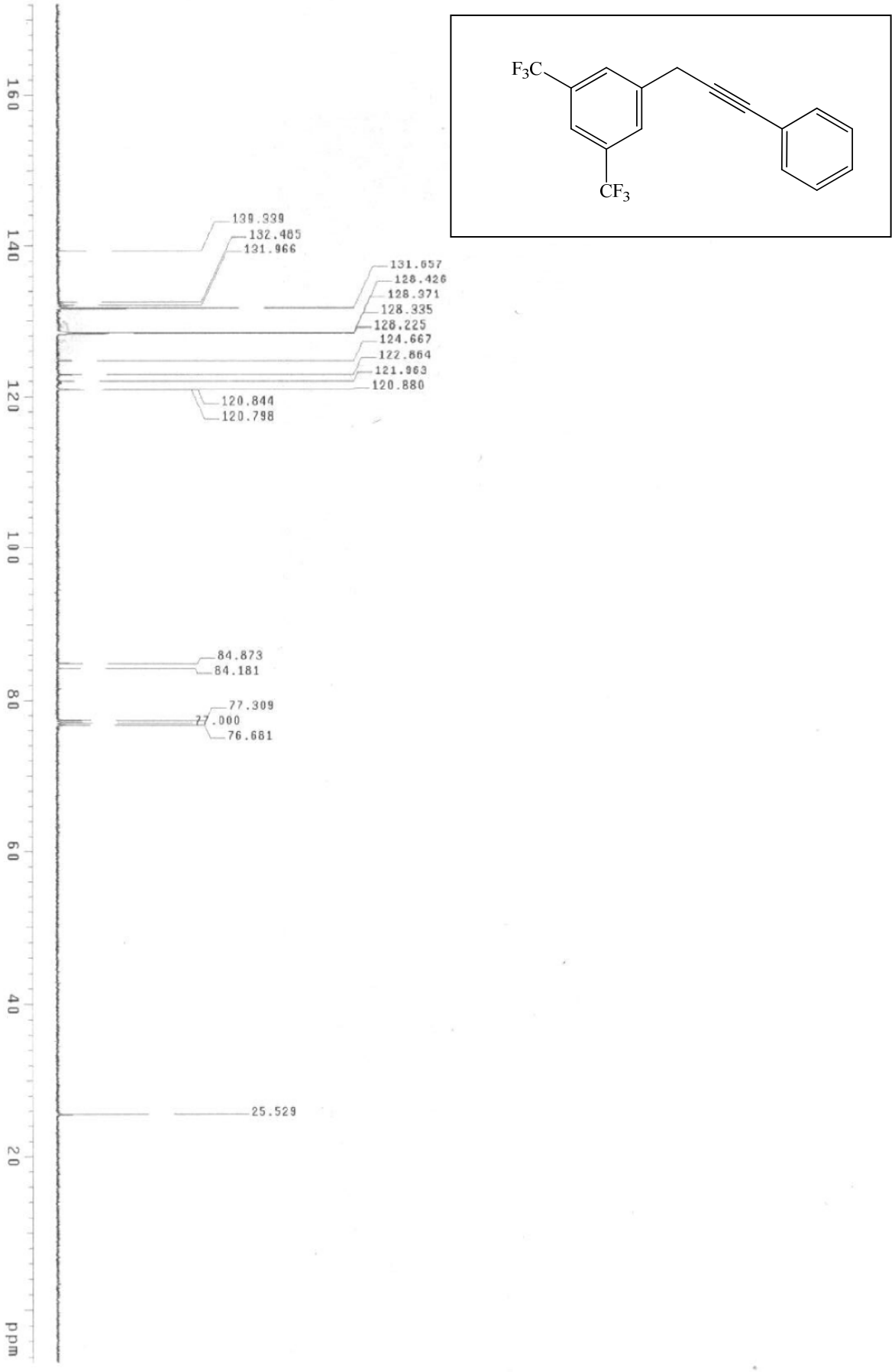
12. 4-(3-phenylprop-2-ynyl)benzonitrile (**2l**)



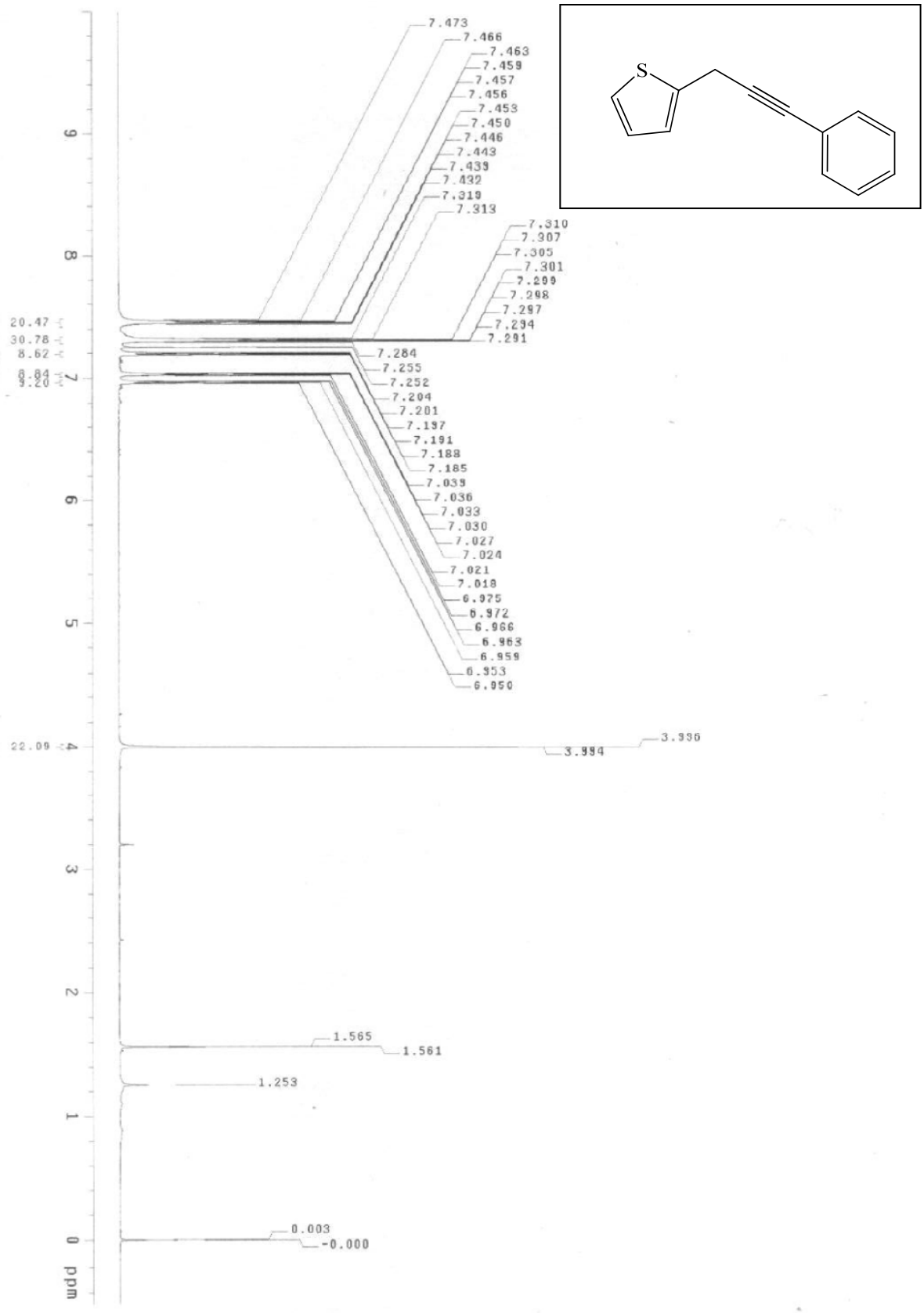

NC
142.279
132.330
131.611
128.735
128.290
128.180
123.037
118.796
110.659
85.474
83.735
77.319
77.000
76.681
25.938
160
140
120
100
80
60
40
20
ppm

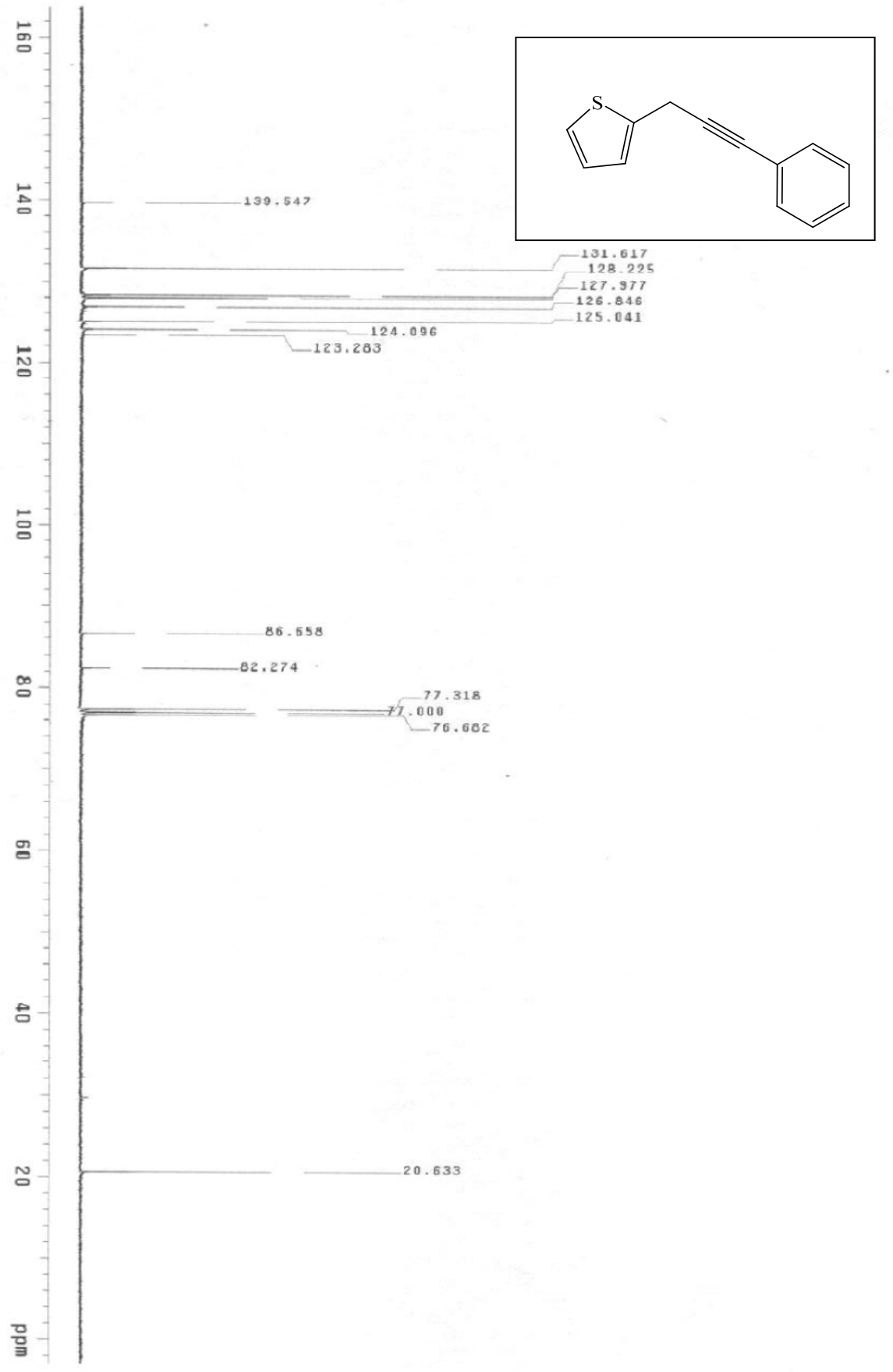
13. 1-(3-phenylprop-2-ynyl)-3,5-bis(trifluoromethyl)benzene (**2m**)



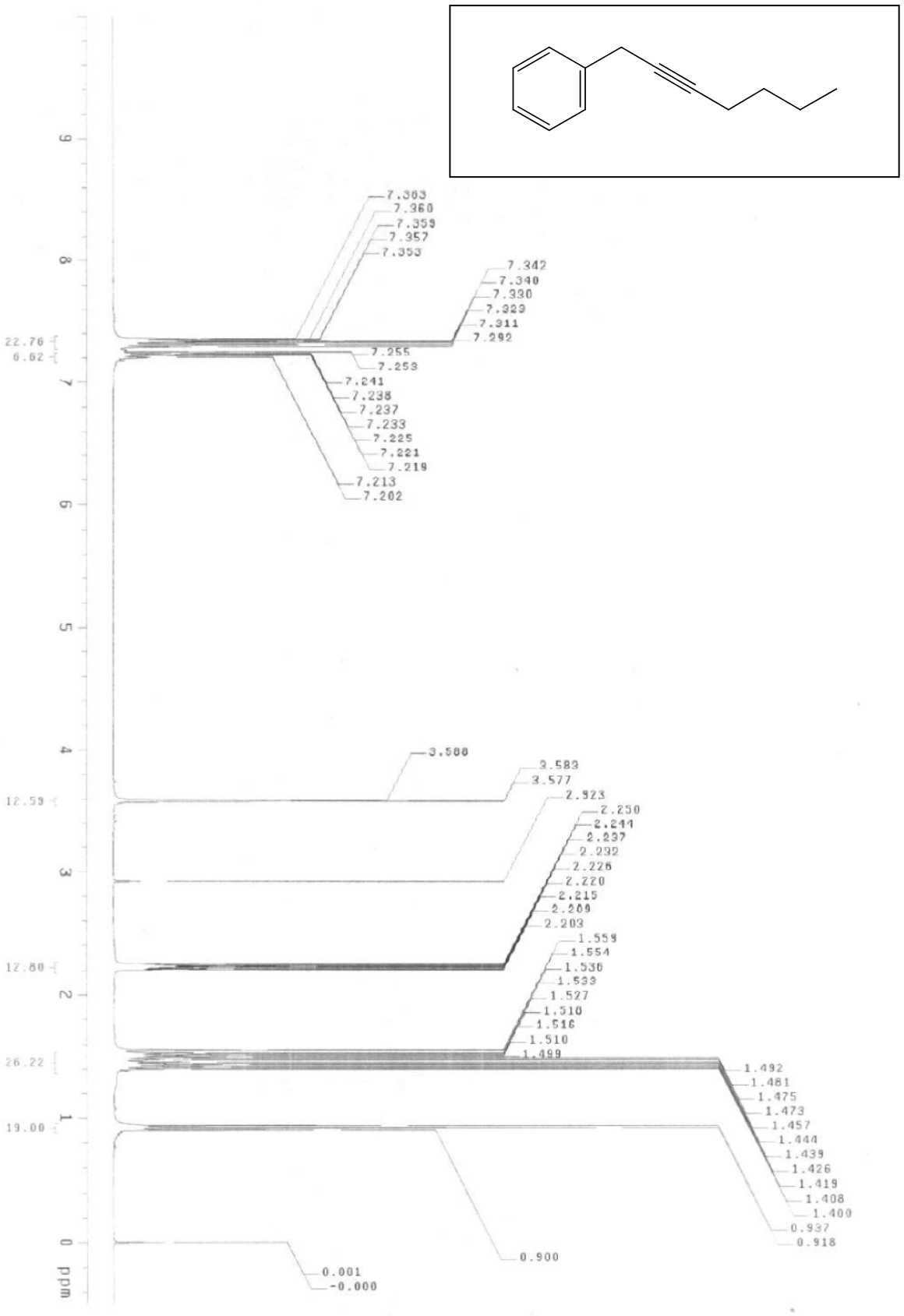

F3C
CF3
139.339
132.485
131.966
131.657
128.426
128.371
128.335
128.225
124.667
122.864
121.963
120.880
120.844
120.798
84.873
84.181
77.309
77.000
76.681
25.529
160
140
120
100
80
60
40
20
ppm

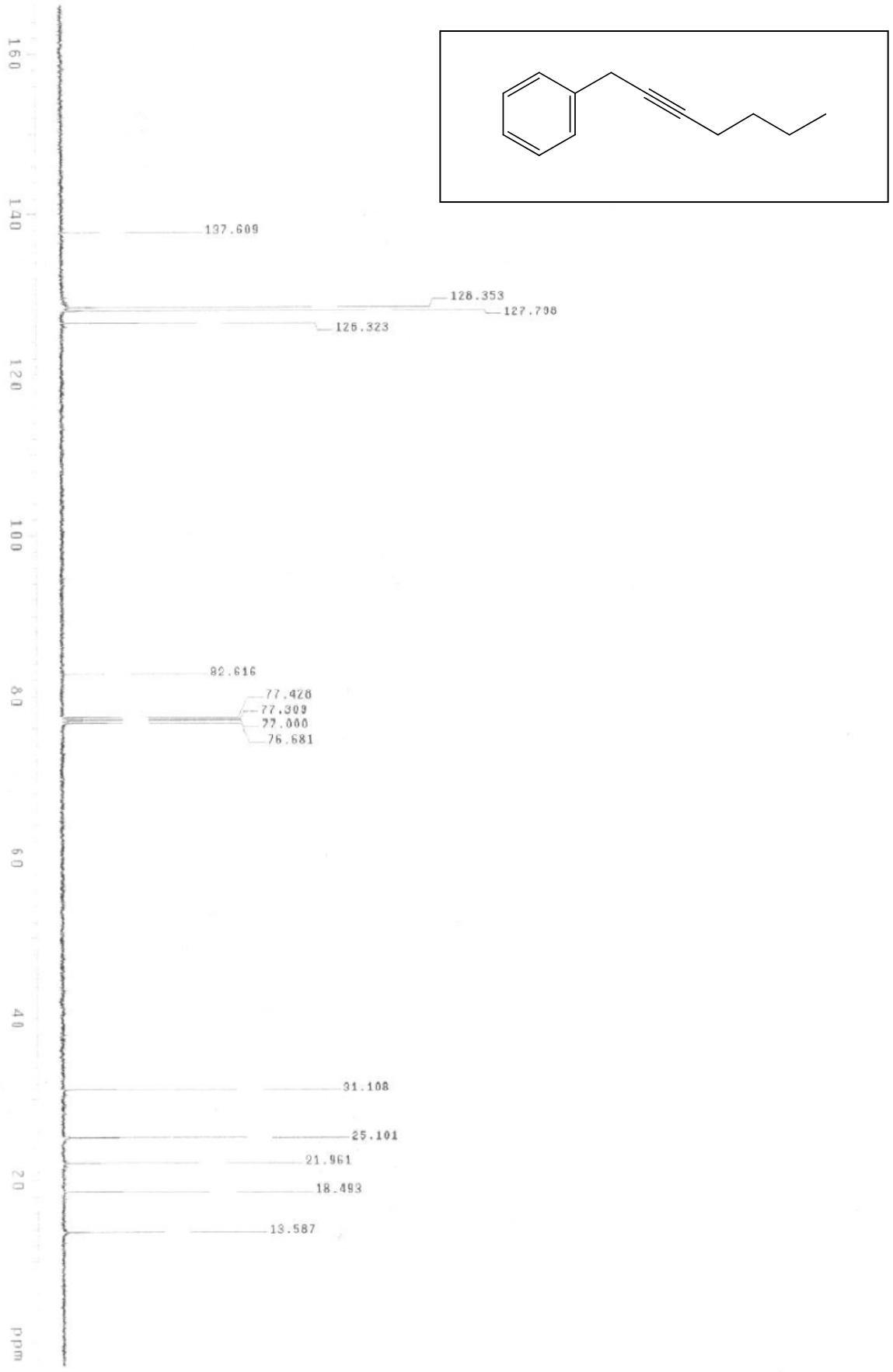
14. 2-(3-phenylprop-2-ynyl)thiophene (**2n**)



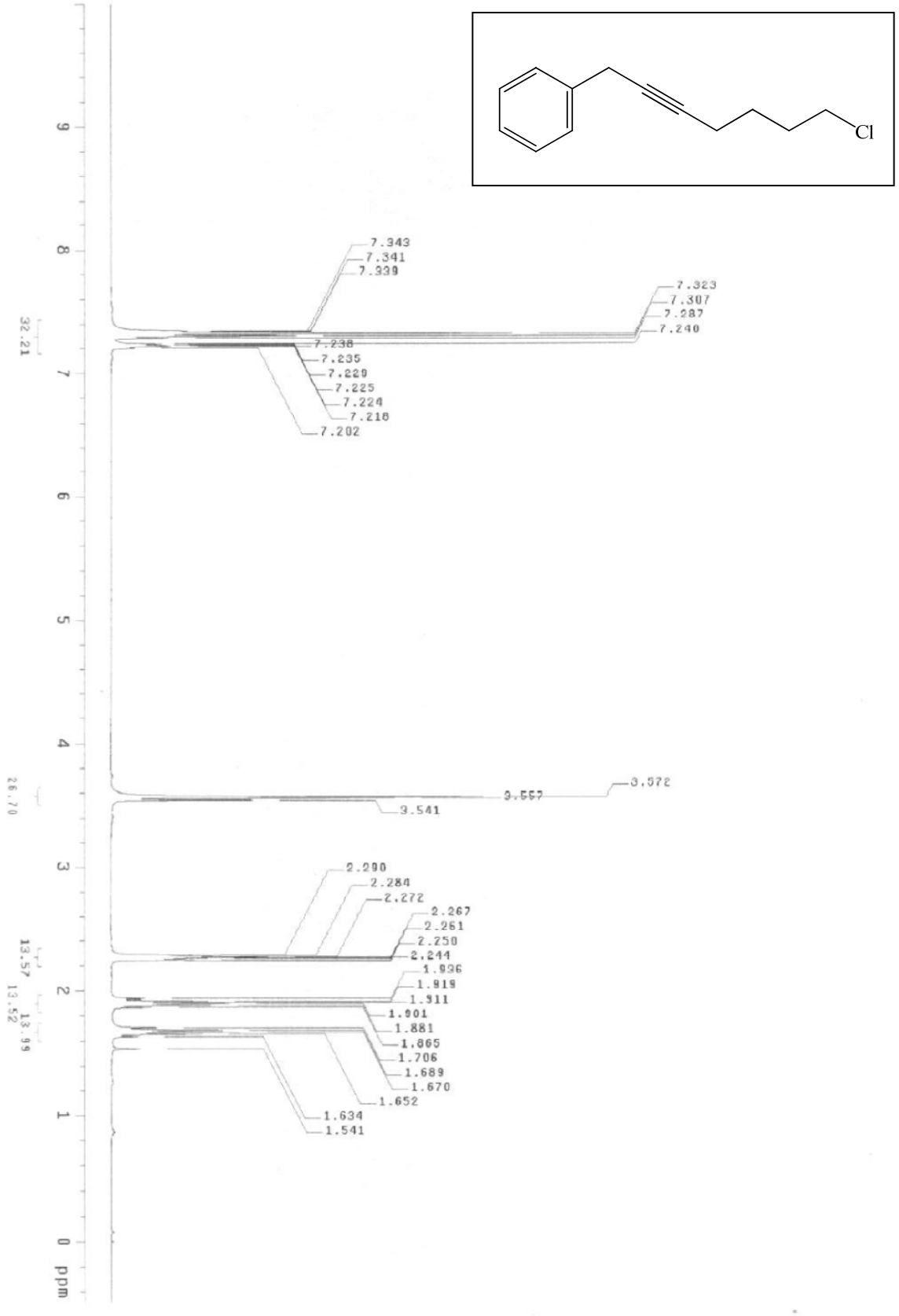

160
140
120
100
80
60
40
20
ppm
139.547
131.617
128.225
127.977
126.846
125.041
124.096
123.283
86.658
82.274
77.318
77.000
76.682
20.633
S

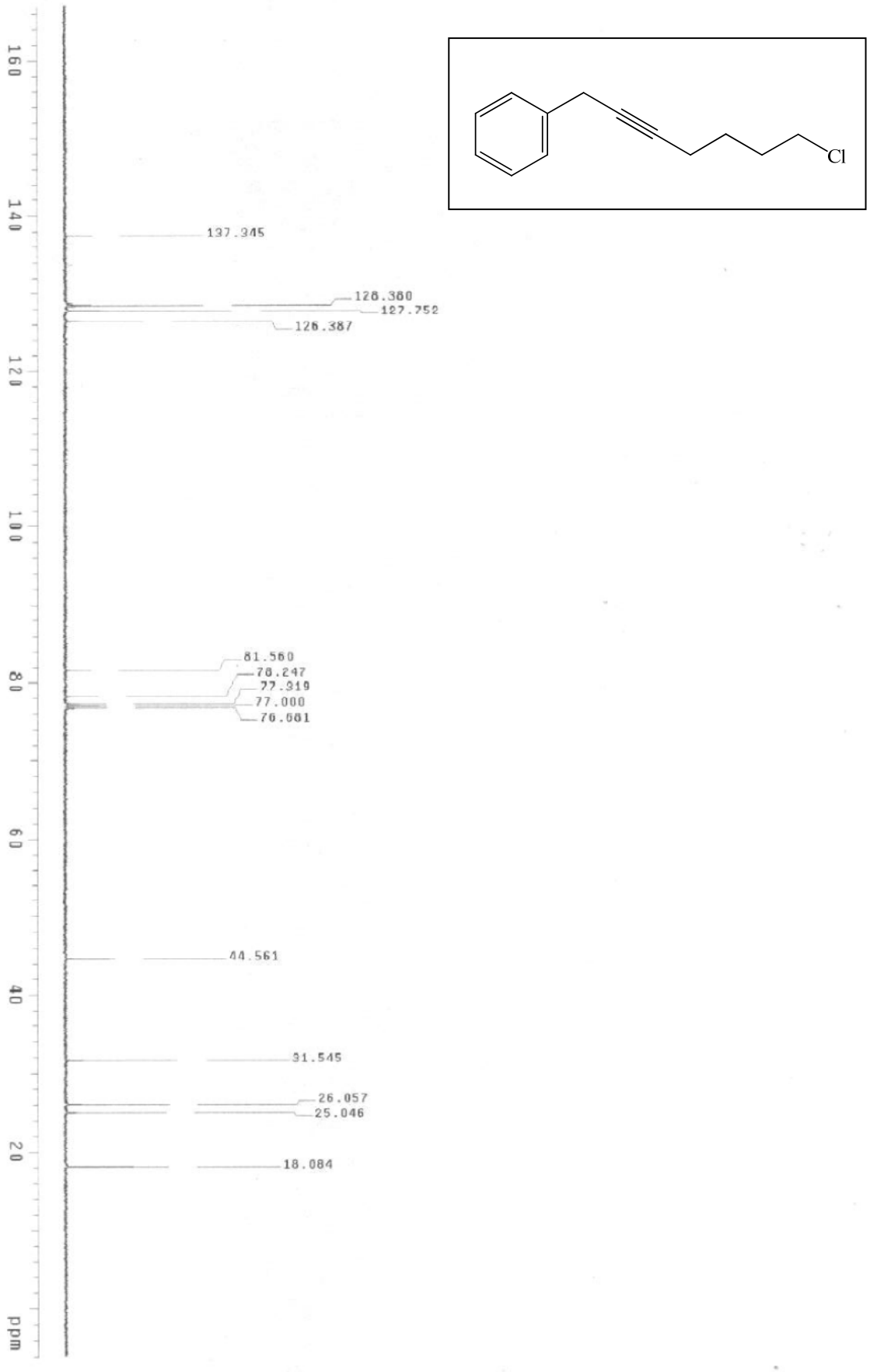
15. Hept-2-ynylbenzene (**2o**)



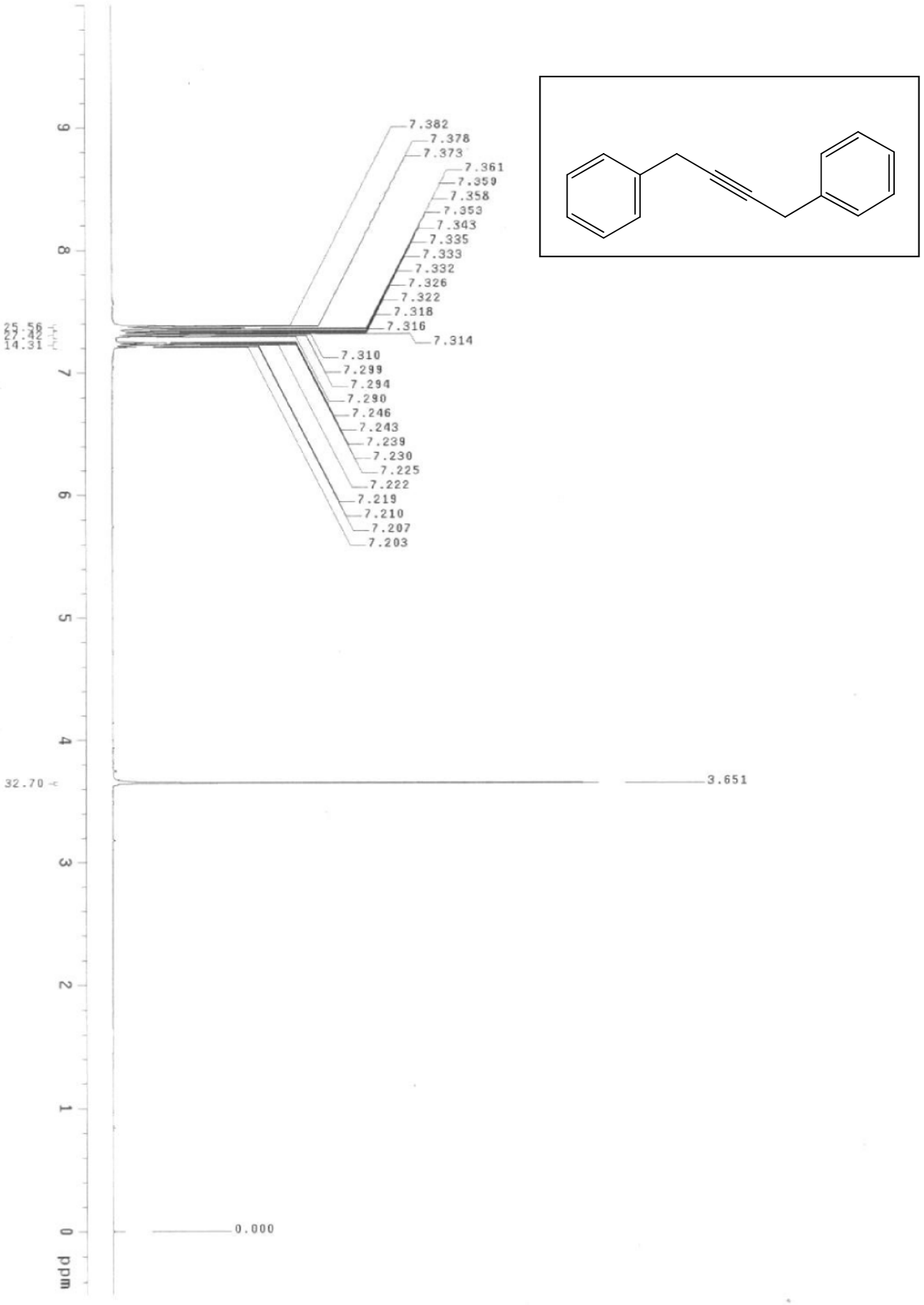

160
140
120
100
80
60
40
20
ppm
137.609
128.353
127.798
125.323
82.616
77.428
77.309
77.060
76.681
31.108
25.101
21.961
18.493
13.587

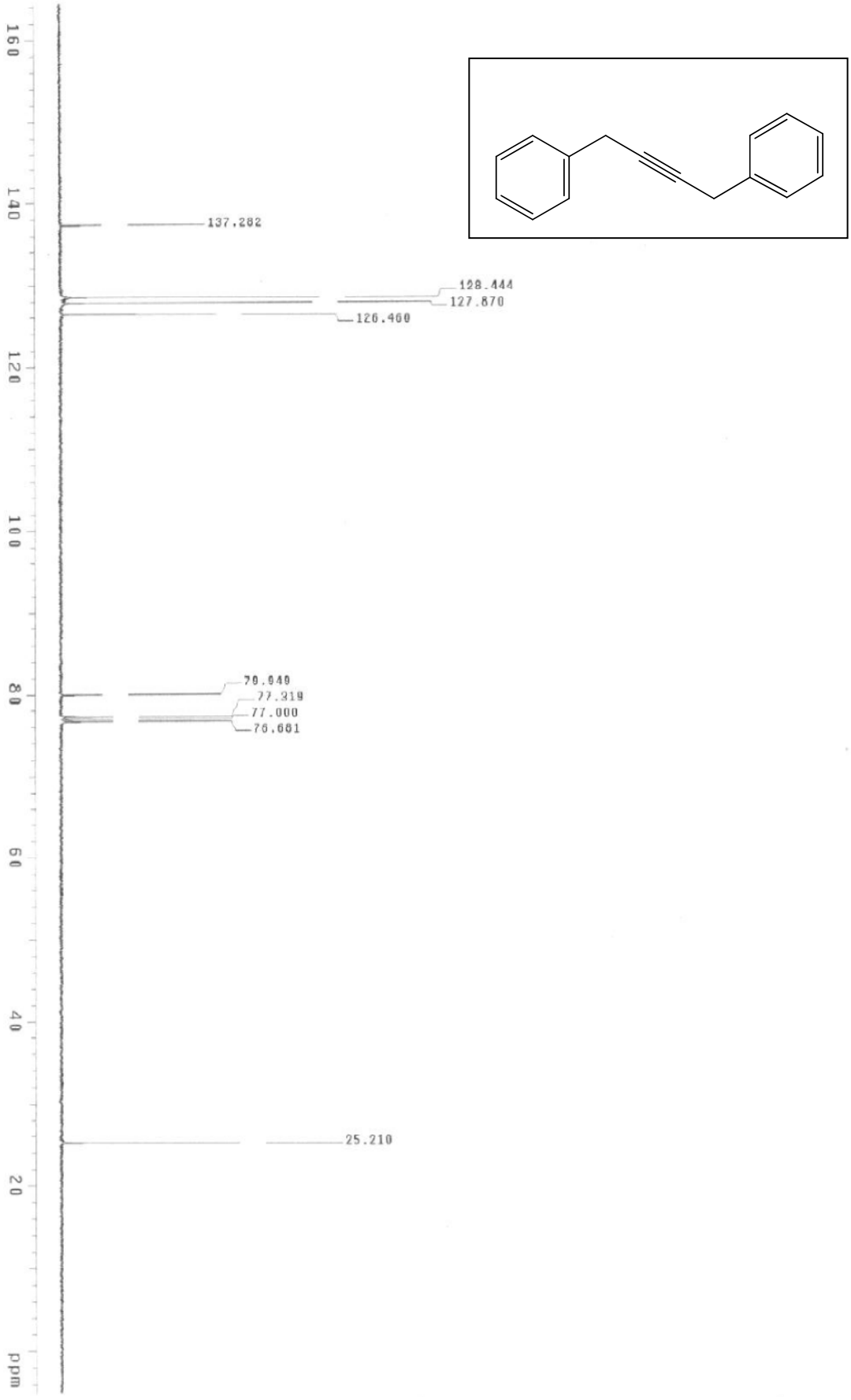
16. (7-chlorohept-2-ynyl)benzene (**2p**)



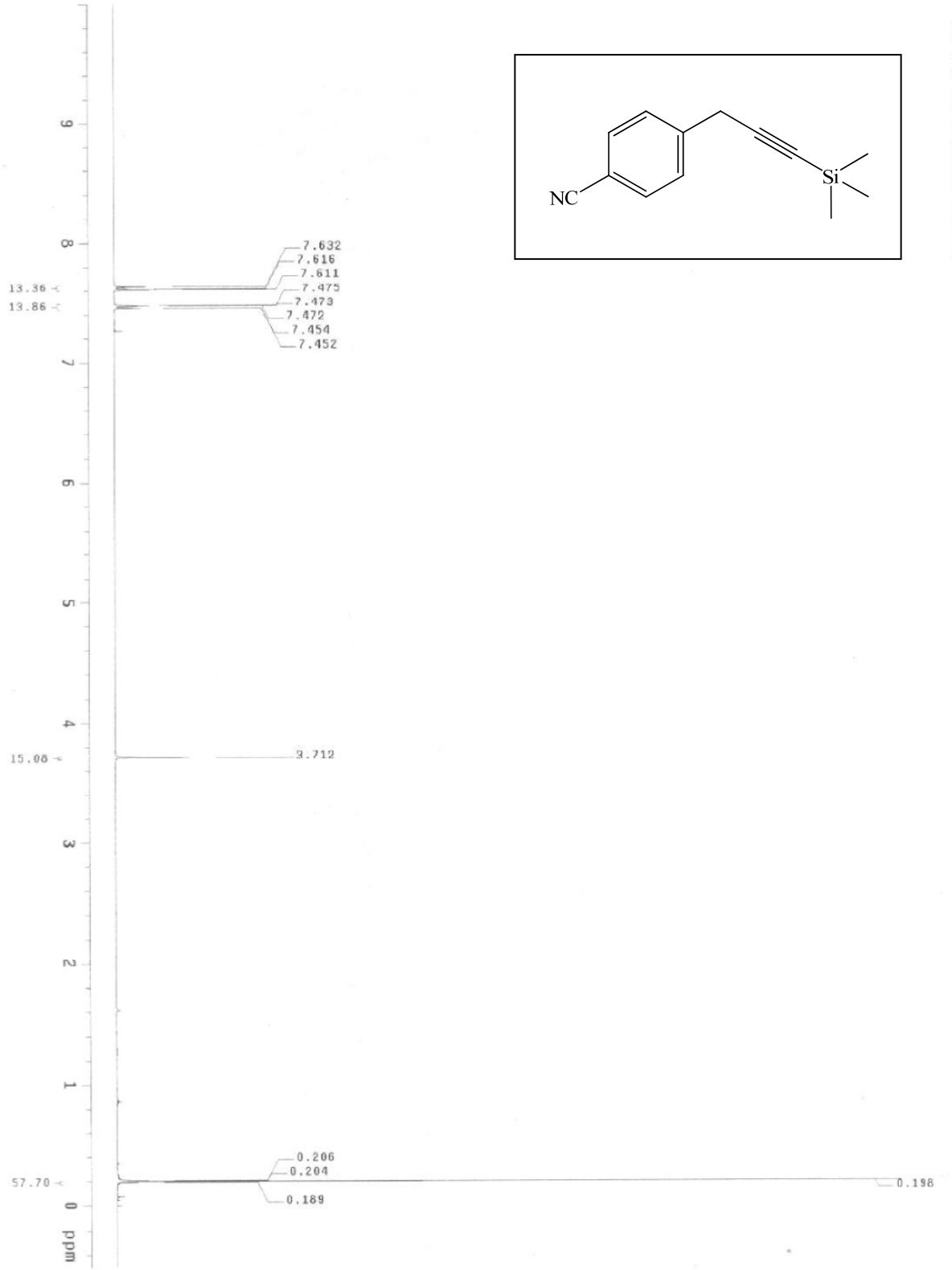

Cl
137.345
128.380
127.752
126.387
81.560
78.247
77.319
77.000
76.681
44.561
31.545
26.057
25.046
18.084
160
140
120
100
80
60
40
20
ppm

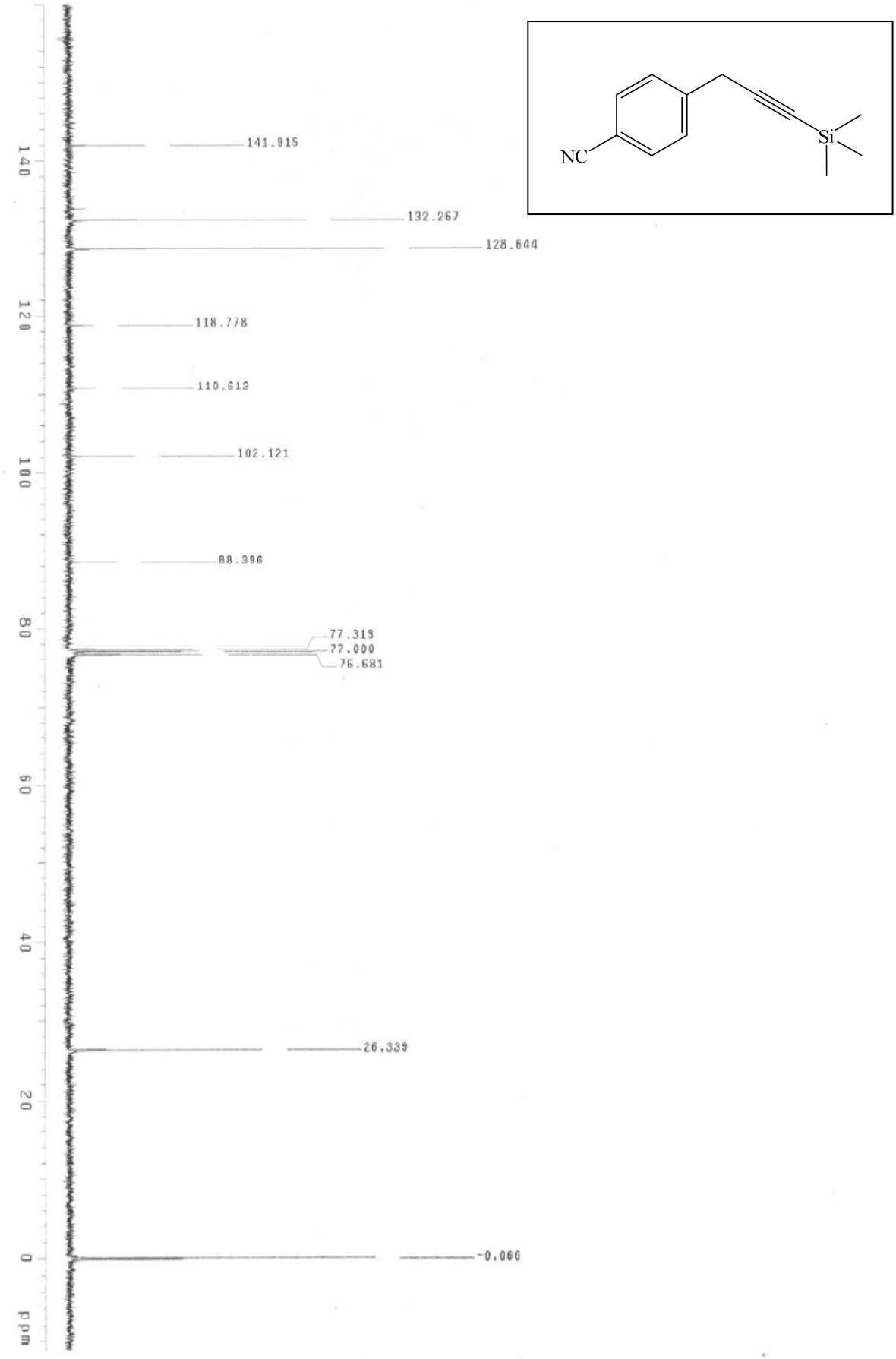
17. 1,4-diphenylbut-2-yne (**2q**)



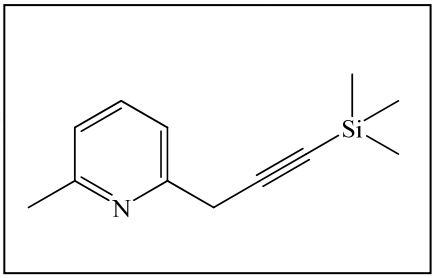

160
140
120
100
80
60
40
20
ppm
137.282
128.444
127.870
126.460
78.040
77.319
77.000
76.681
25.210

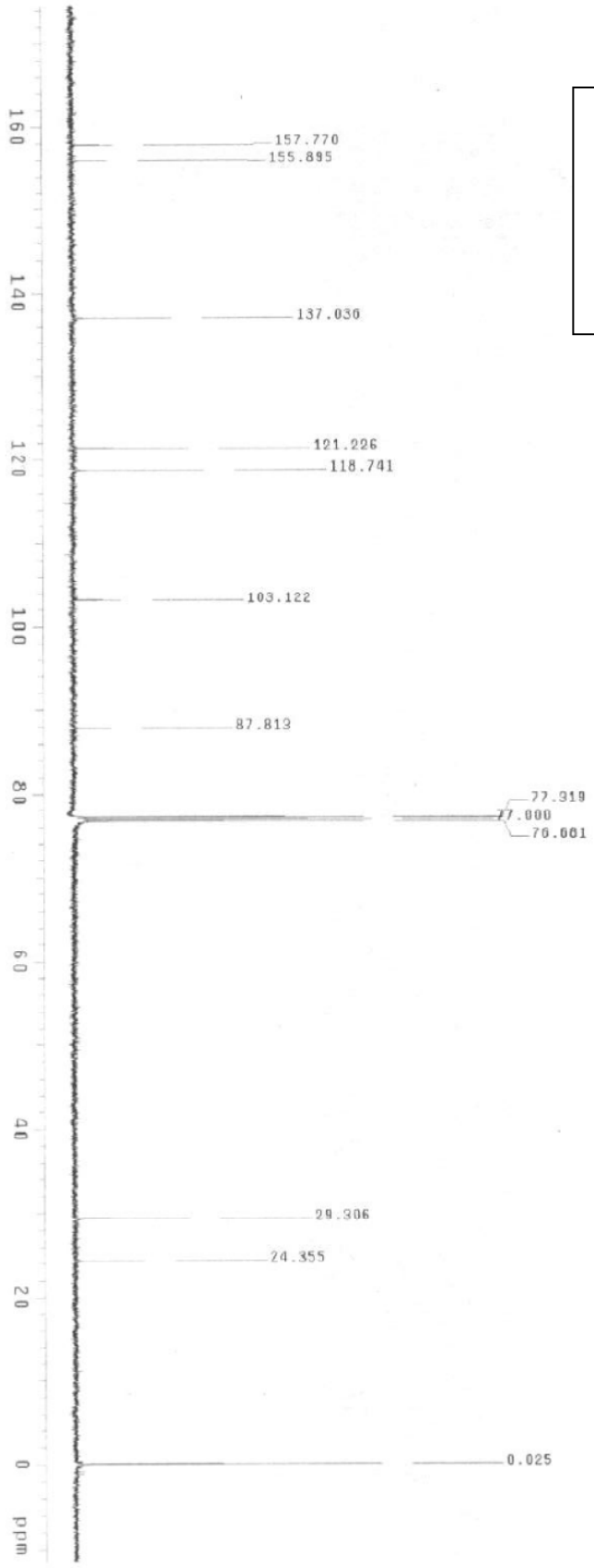
18. 4-(3-(trimethylsilyl)prop-2-ynyl)benzonitrile (**2r**)

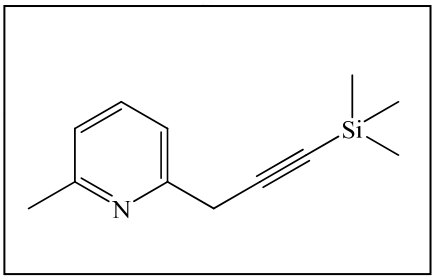



NC
Si
141.915
132.267
128.644
118.778
110.619
102.121
88.396
77.319
77.000
76.681
26.339
-0.066
140
120
100
80
60
40
20
0
ppm

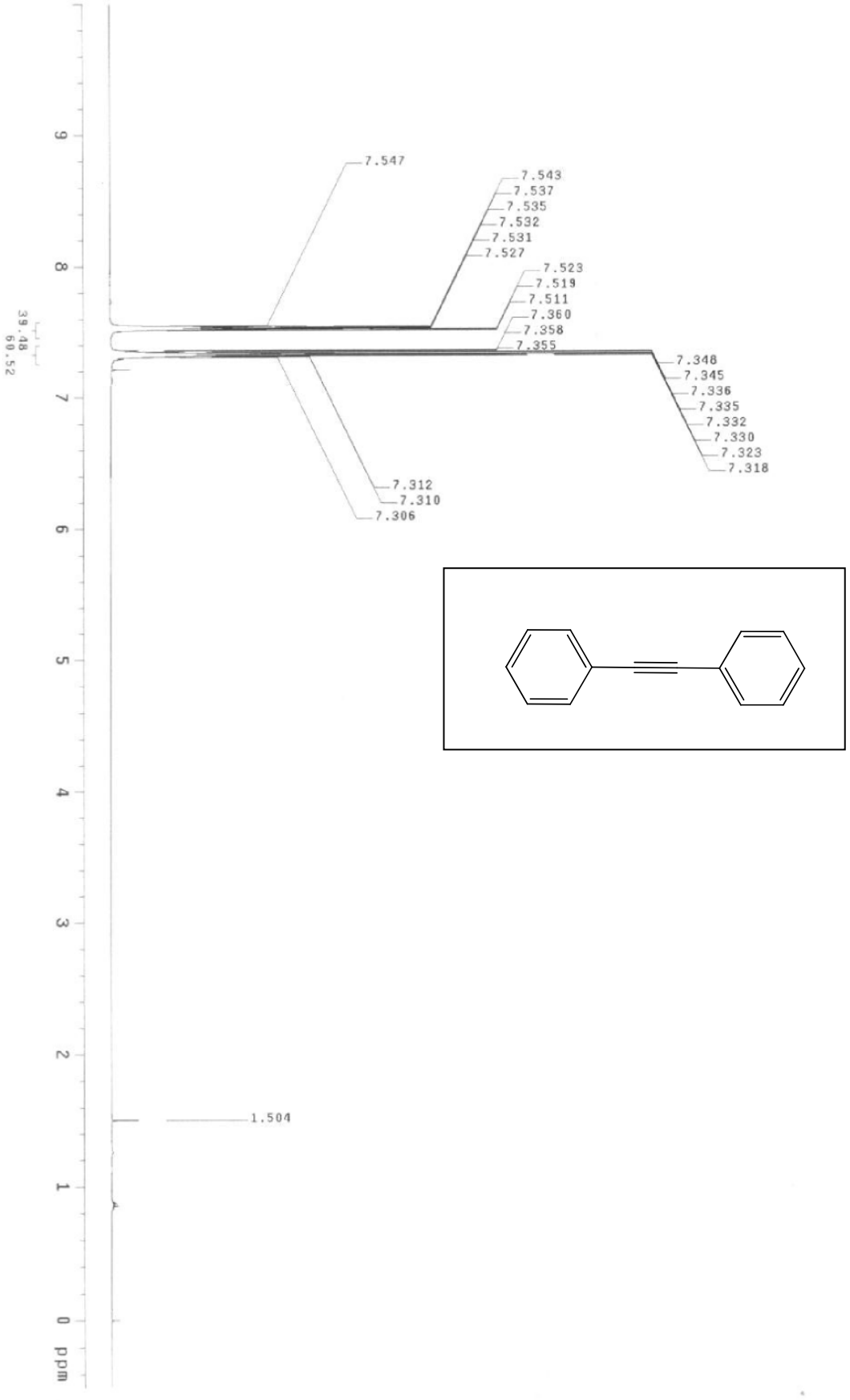
19. 2-methyl-6-(3-(trimethylsilyl)prop-2-ynyl)pyridine (**2s**)

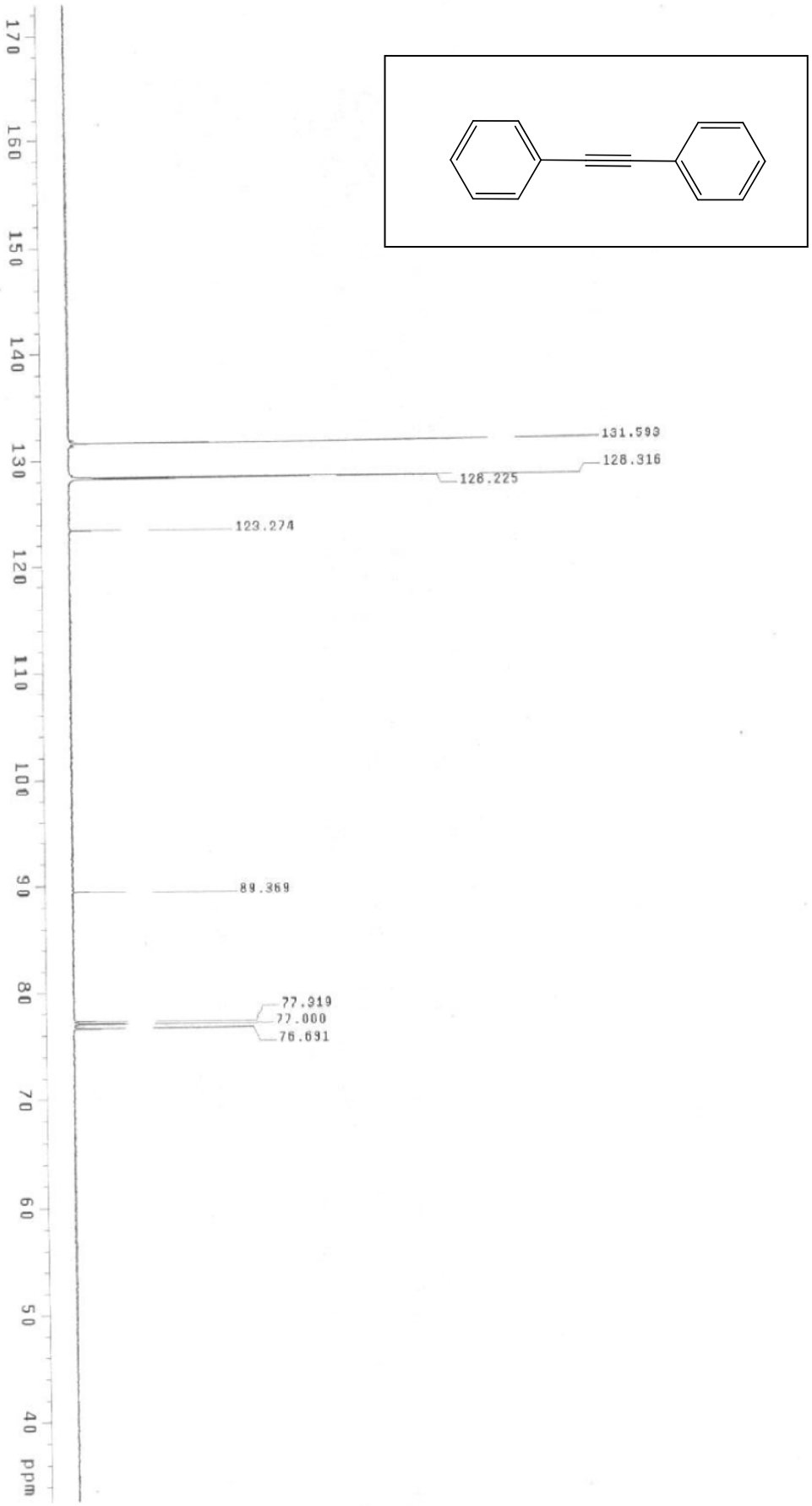




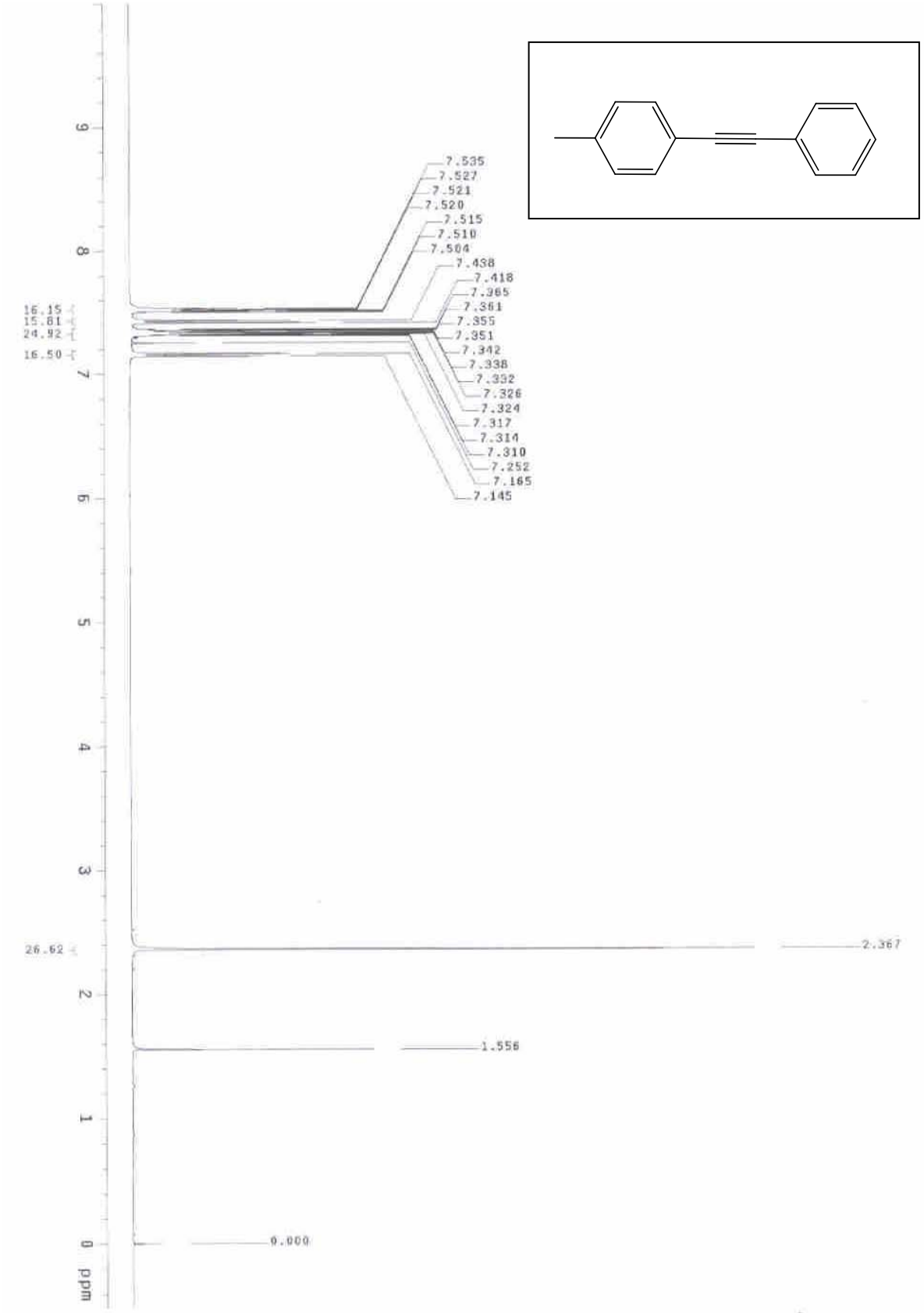


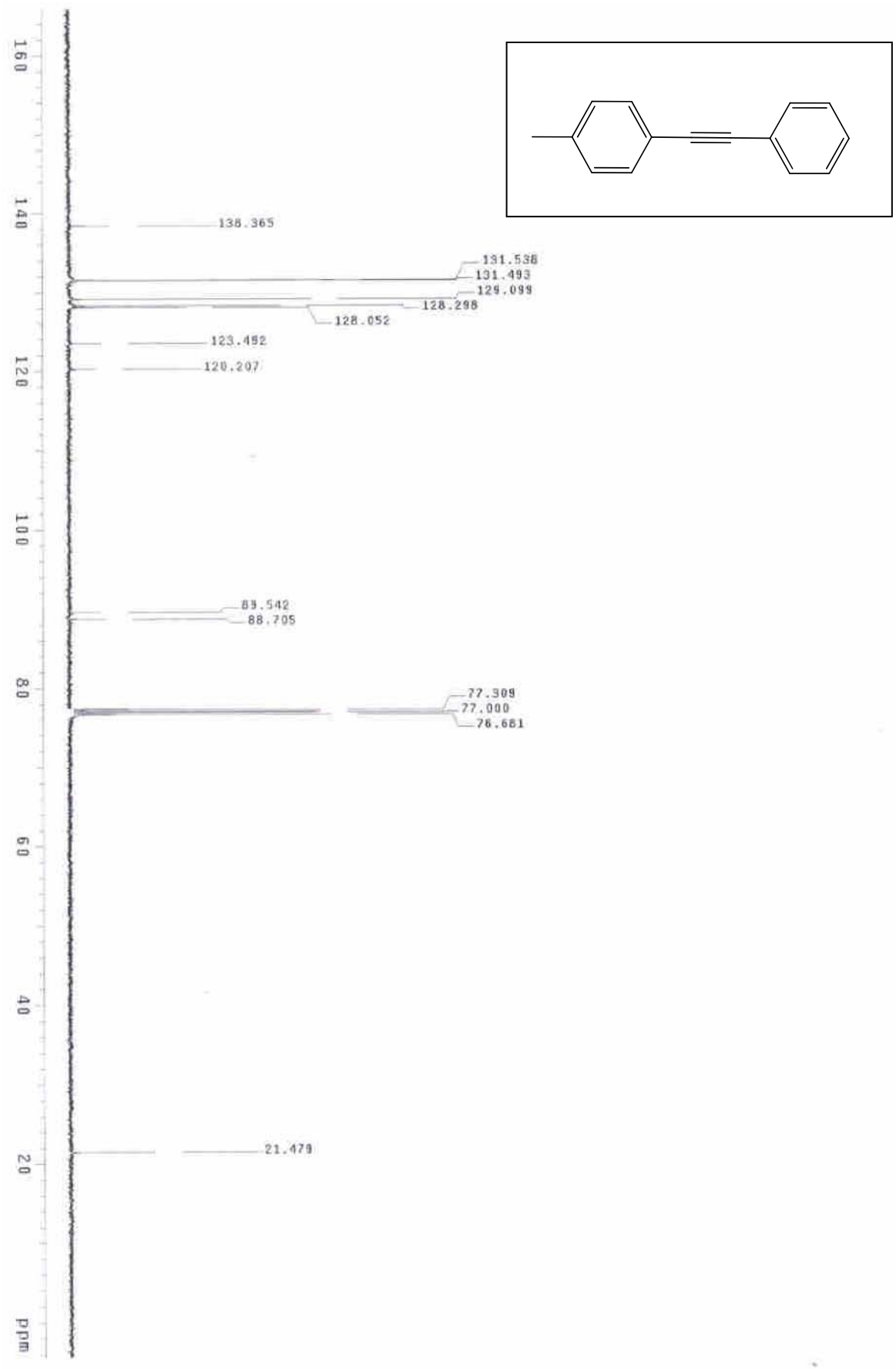
20. 1,2-diphenylethyne (**2t**)



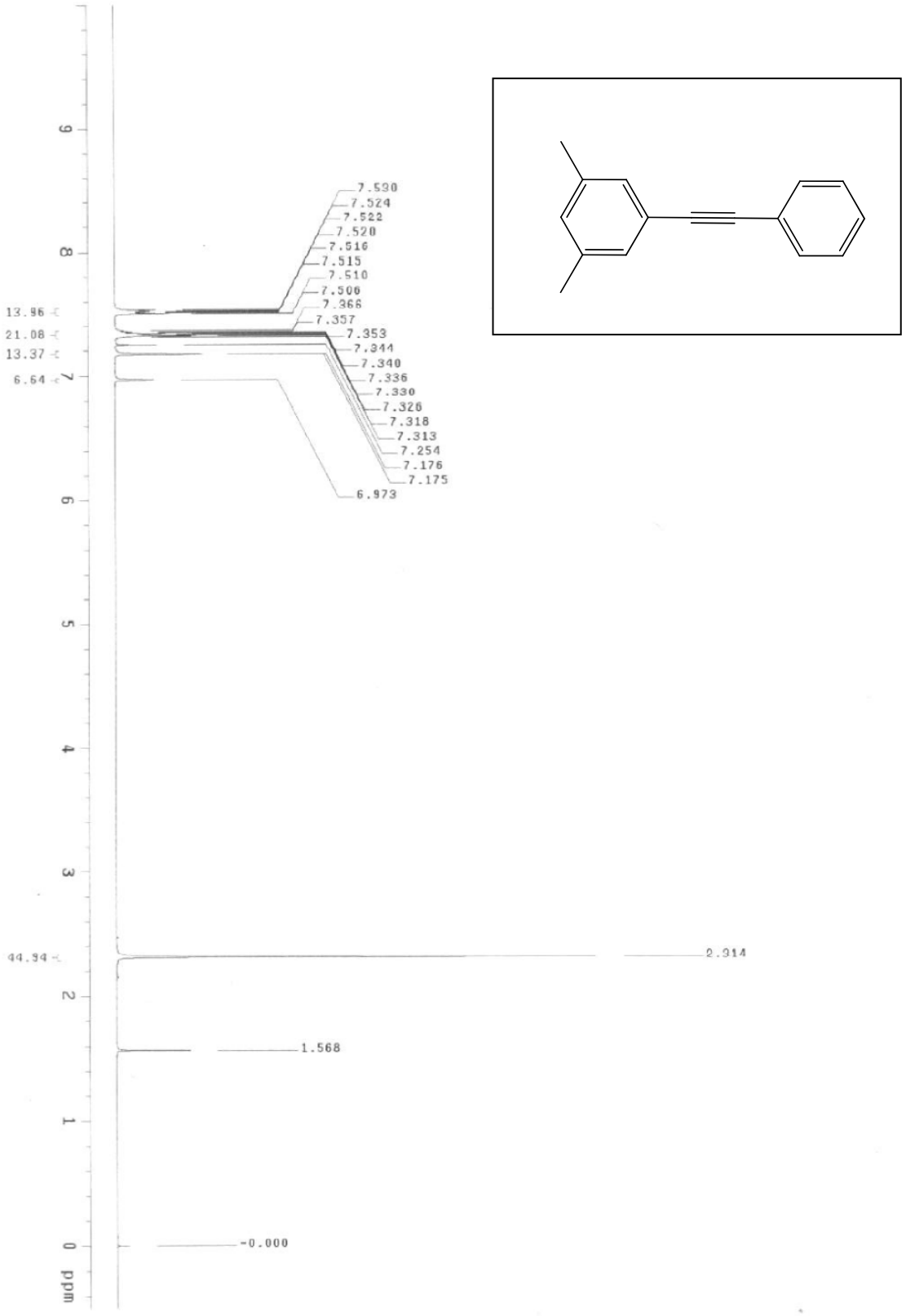

170
160
150
140
130
120
110
100
90
80
70
60
50
40
ppm
131.593
128.316
128.225
123.274
89.369
77.919
77.000
76.691

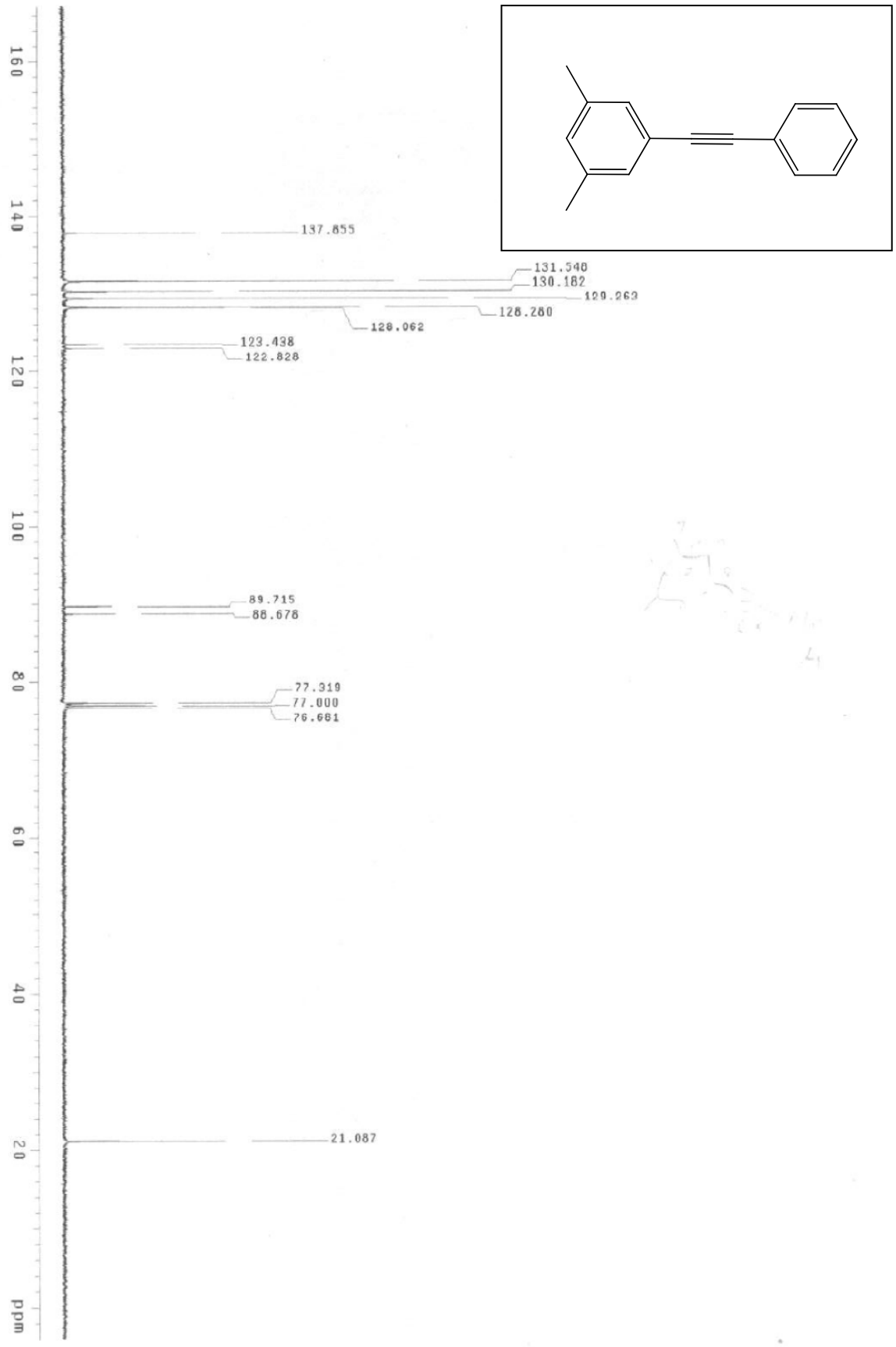
21. 1-methyl-4-(phenylethynyl)benzene (**2u**)



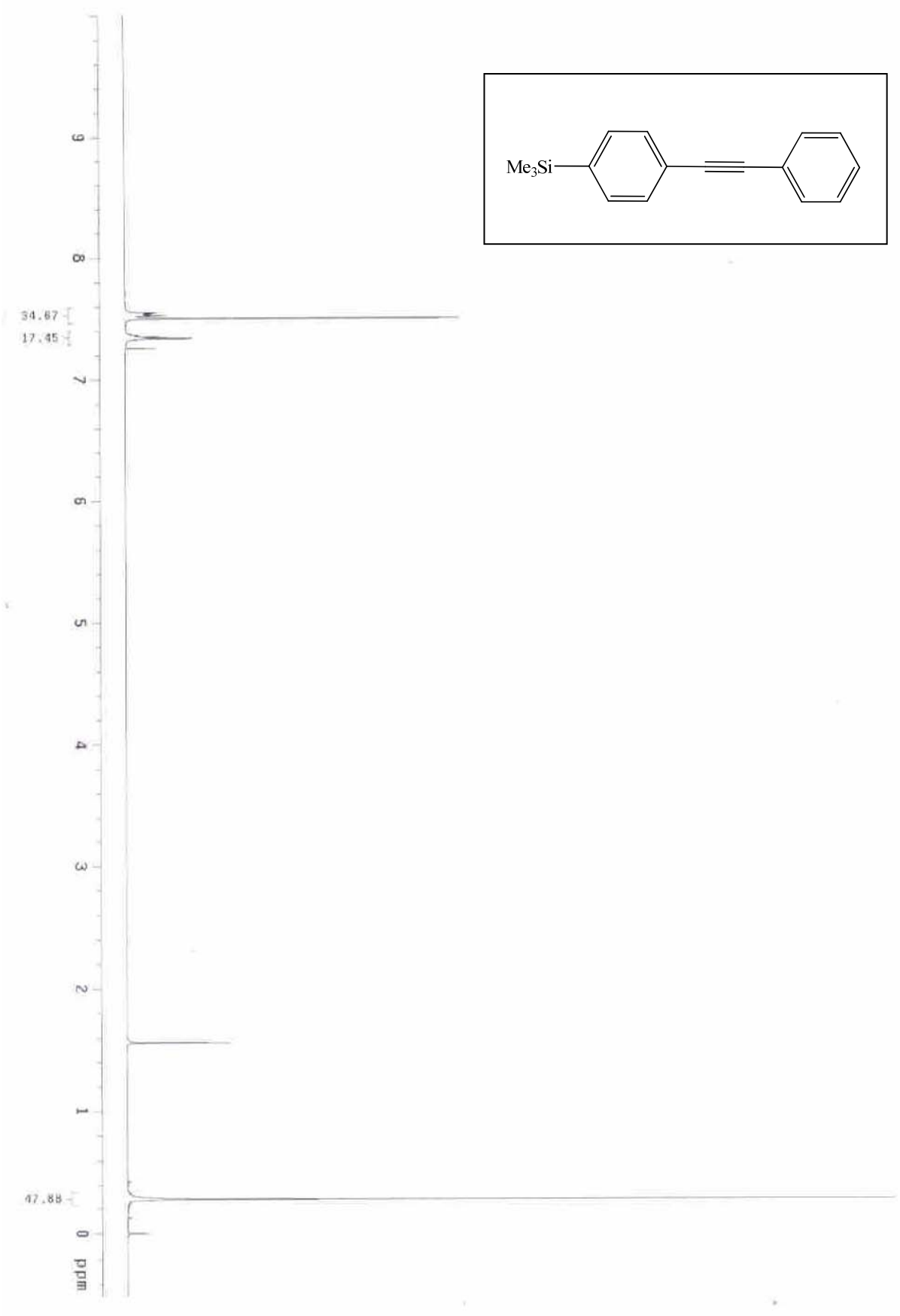

160
140
120
100
80
60
40
20
ppm
138.365
131.538
131.493
129.099
128.298
128.052
123.492
120.207
89.542
88.705
77.309
77.000
76.681
21.479

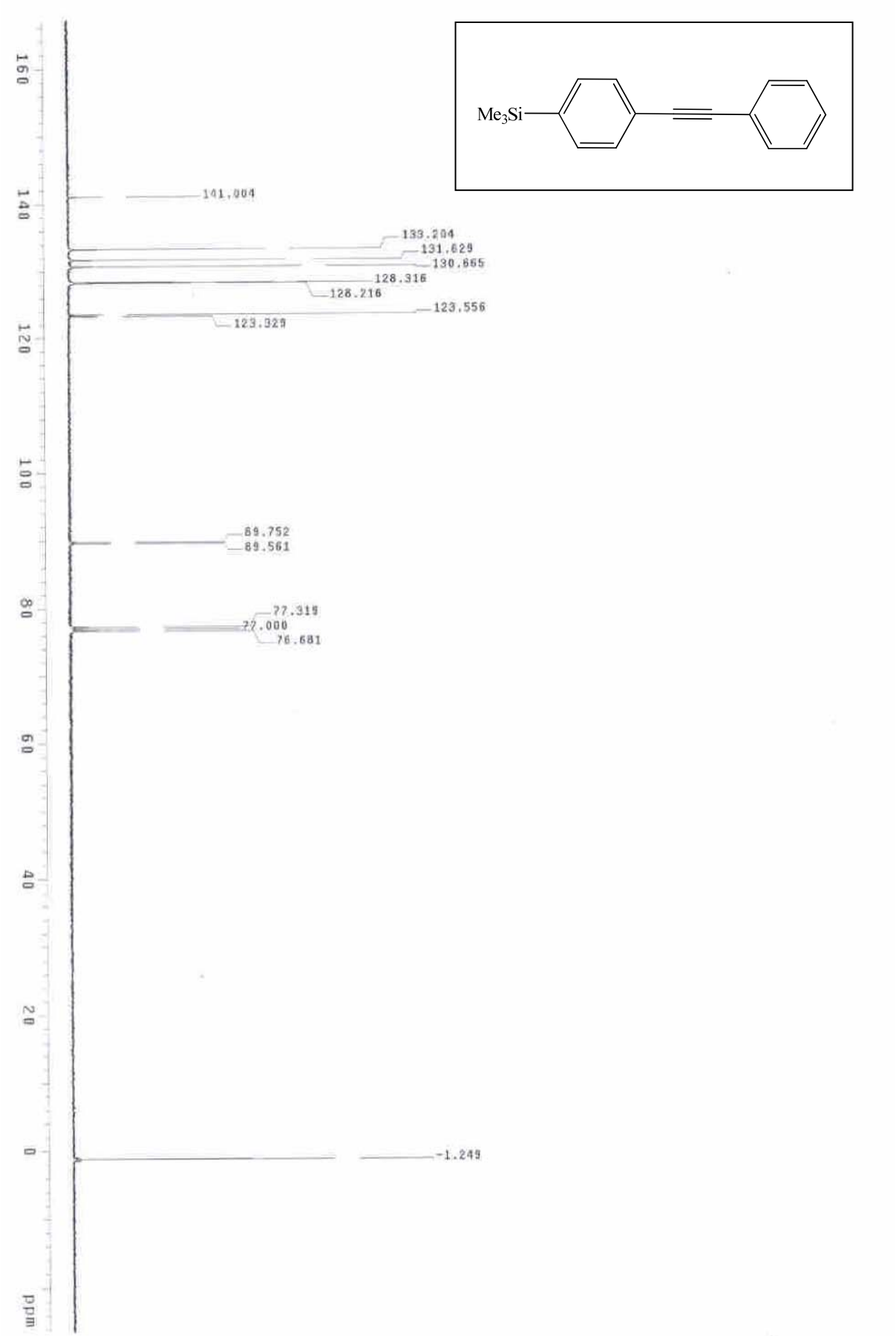
22. 1,3-dimethyl-5-(phenylethynyl)benzene (**2v**)



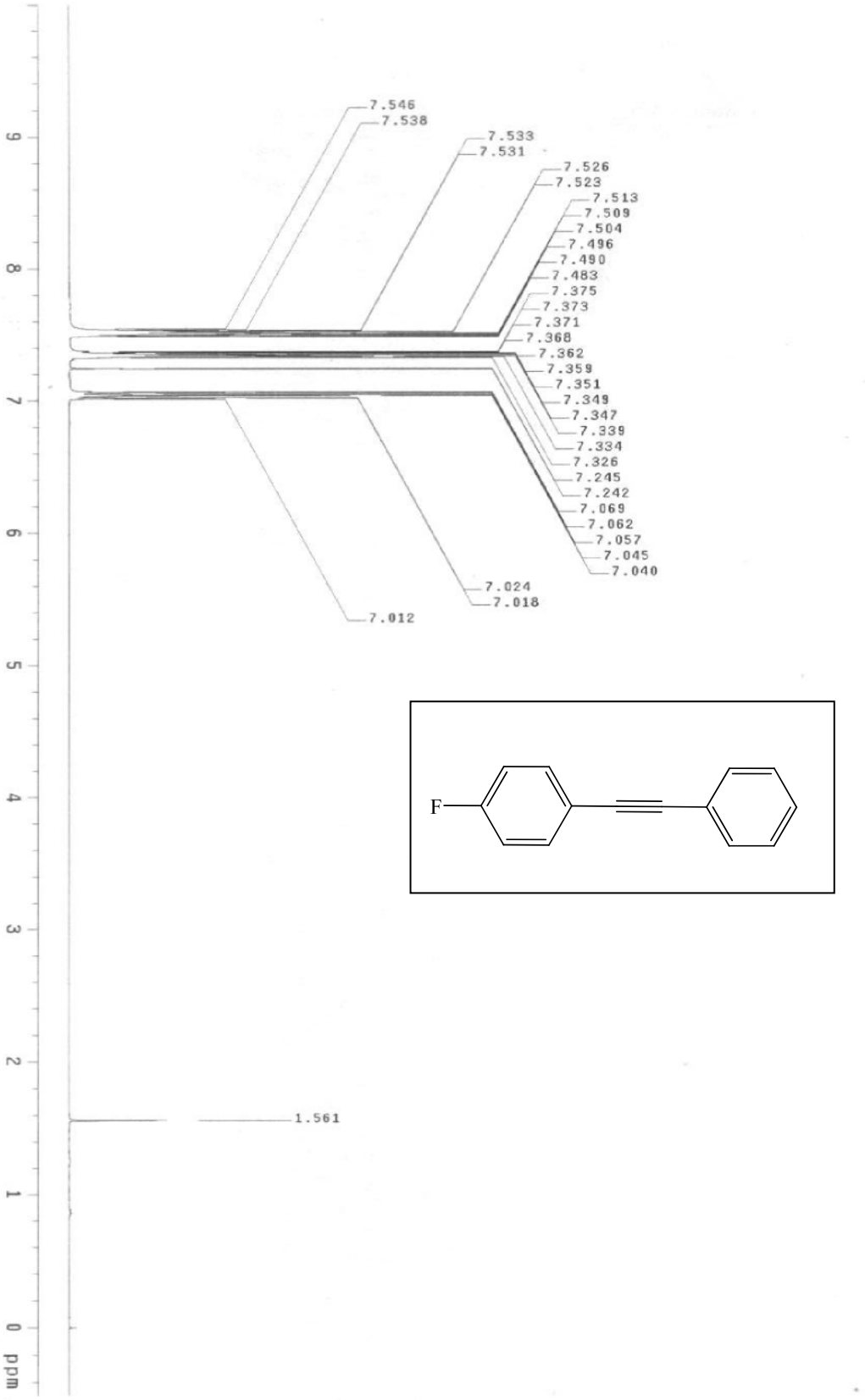

137.855
131.540
130.182
129.263
128.280
128.062
123.438
122.828
89.715
88.678
77.319
77.000
76.681
21.087
160
140
120
100
80
60
40
20
ppm

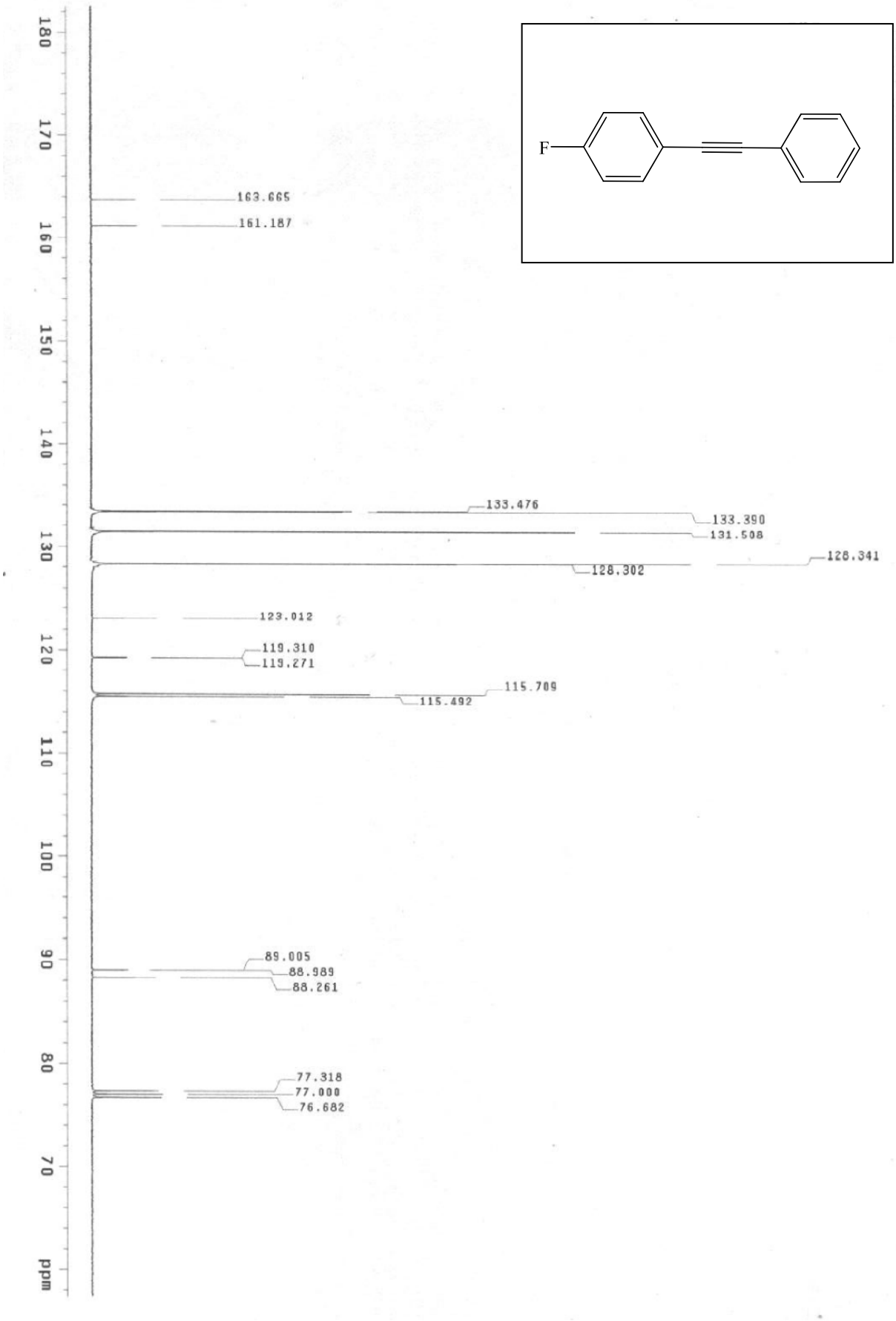
23. trimethyl(4-(phenylethynyl)phenyl)silane (**2w**)



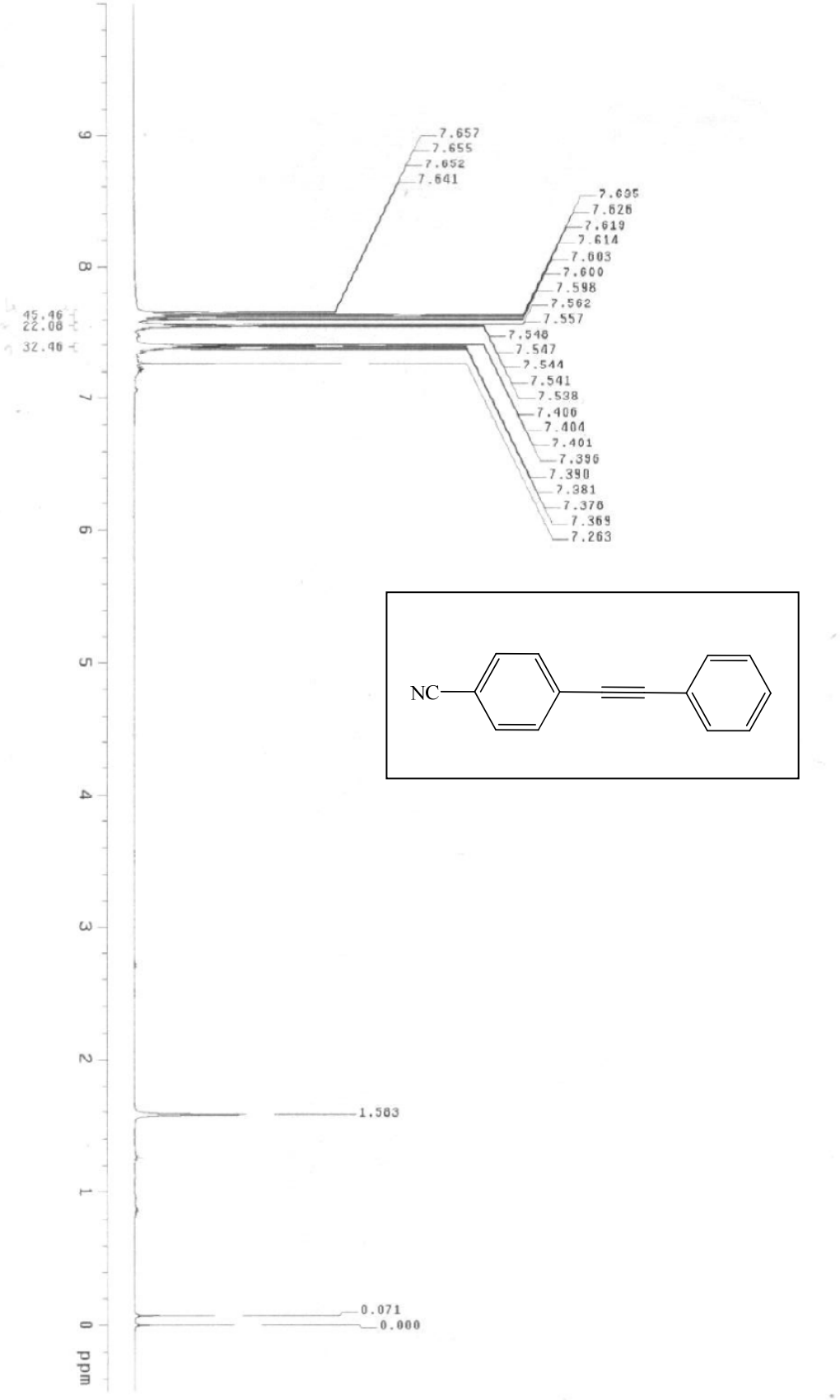

Me3Si
141.004
133.204
131.629
130.665
128.316
128.216
123.556
123.329
89.752
89.561
77.319
77.000
76.681
-1.249
160
140
120
100
80
60
40
20
0
ppm

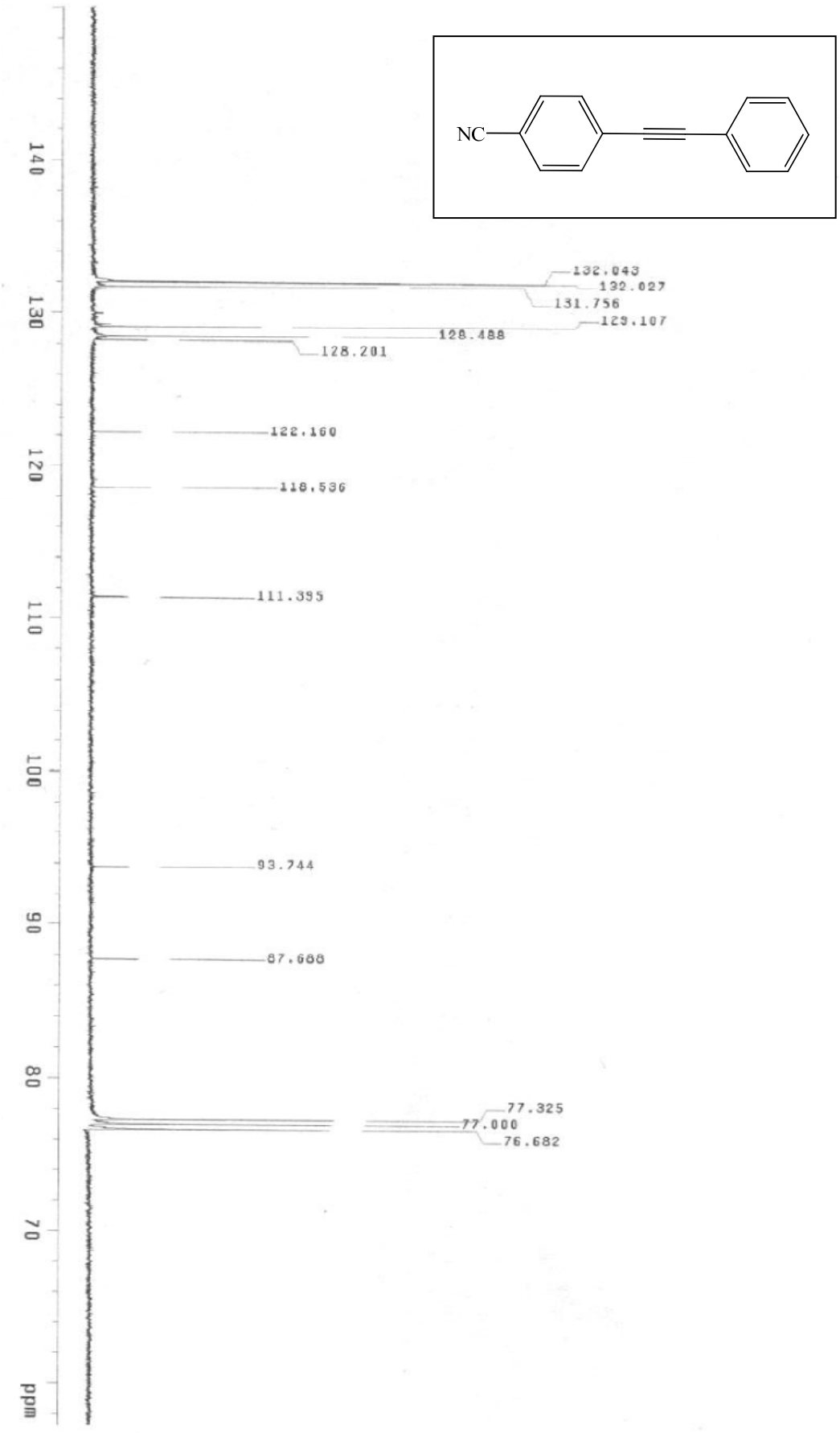
24. 1-fluoro-4-(phenylethynyl)benzene (**2x**)




F
163.665
161.187
133.476
133.390
131.508
128.341
128.302
123.012
119.310
119.271
115.709
115.492
89.005
88.989
88.261
77.318
77.000
76.682
180
170
160
150
140
130
120
110
100
90
80
70
ppm

25. 4-(phenylethynyl)benzonitrile (**2y**)




NC
132.043
132.027
131.756
129.107
128.488
128.201
122.160
118.536
111.395
93.744
87.688
77.325
77.000
76.682
140
130
120
110
100
90
80
70
ppm