Supplementary Materials

Immobilized Pd(0) nanoparticles on phosphine-functionalized graphene as highly active catalyst for Heck, Suzuki and *N*-arylation reactions

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Spectral data for synthesized compounds

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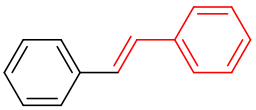
Copy of ^{1}H-NMR and ^{13}C-NMR

&

SEM of recovered catalyst

1. Spectral data for synthesized compounds

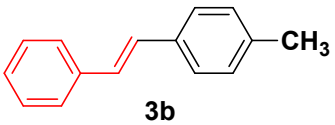
1.1. (*E*)-1,2-diphenylethene (3a)



3a

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 7.13 (s, 2H), 7.25-7.41 (m, 6H), 7.52-7.56 (m, 4H). ^{13}C NMR (62.5 MHz, $CDCl_3$): 126.3, 126.6, 127.7, 128.7, 137.4.

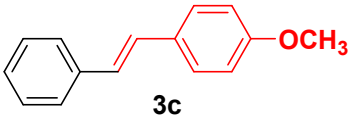
1.2. (E)-1-Methyl-4-styrylbenzene(3b)



3b

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 2.27 (s, 3H), 6.98 (s, 2H), 7.02-7.18 (m, 3H), 7.23-7.29 (m, 2H), 7.32 (d, *J*= 7.5 Hz, 2H), 7.40-7.43 (m, 2H). ^{13}C NMR (62.5 MHz, $CDCl_3$): 21.3, 126.4, 126.5, 127.4, 127.7, 128.6, 128.7, 129.4, 134.6, 137.5.

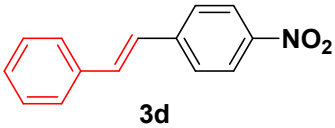
1.3. (E)-1-methoxy-4-styrylbenzene (3c)



3c

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 3.71 (s, 3H), 6.78-6.82 (m, 2H), 6.87 (d, *J* = 15 Hz, 1H), 6.98 (d, *J* = 15 Hz, 1H), 7.11-7.28 (m, 3H), 7.33-7.41 (m, 4H).^{13}C NMR (62.5 MHz, $CDCl_3$): 55.6, 114.2, 126.3, 126.6, 127.2, 127.8, 128.2, 128.7, 128.8, 137.7, 159.2.

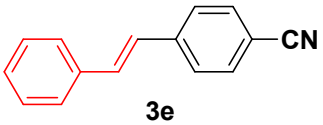
1.4. (E)-1-nitro-4-styrylbenzene (3d)



3d

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 7.06 (d, *J* = 15 Hz, 1H), 7.20 (d, *J* = 15 Hz, 1H), 7.25-7.36 (m, 3H), 7.45-7.50 (m, 2H), 7.54 (d, *J* = 7.5 Hz, 2H), 8.14 (d, *J* = 7.5 Hz, 2H).^{13}C NMR (62.5 MHz, $CDCl_3$): 124.1, 126.3, 126.8, 127.0, 128.8, 128.9, 133.3, 136.2, 142.0, 143.2.

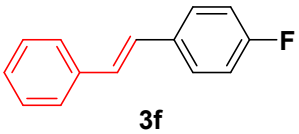
1.5. (E)-4-styrylbenzonitrile (3e)



3e

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 7.05-7.12 (m, 2H), 7.32-7.43 (m, 3H), 7.52-7.66 (m, 6H). ^{13}C NMR (62.5 MHz, $CDCl_3$): 110.5, 126.7, 126.8, 126.9, 128.6, 128.8, 132.4, 132.5, , 136.2.

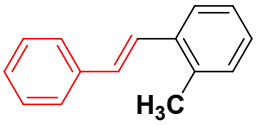
1.6. (E)-1-Fluoro-4-styrylbenzene (3f)



3f

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 6.91-7.02 (m, 4H), 7.20-7.24 (m, 1H), 7.31 (t, *J* = 7.8 Hz, 2H), 7.41–7.44 (m, 4H). ^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 115.5, 115.8, 126.3, 127.4, 127.5, 127.8, 127.9, 128.5, 128.8, 133.5, 137.1, 160.5, 163.8.

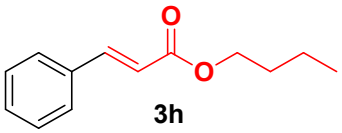
1.7. (E)-1-Methyl-2-styrylbenzene (3g)



3g

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 2.42 (s, 3 H), 7.12-7.33 (m, 11H). ^{13}C NMR (250 MHz, $CDCl_3$): δ (ppm) = 19.8, 125.4, 126.3, 126.5, 127.0, 127.6, 128.8, 130.2, 130.5.

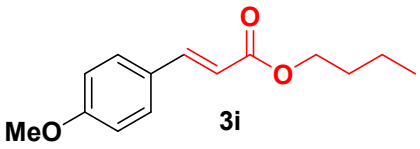
1.8. *n*-Butyl cinnamate (3h)



3h

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 0.86 (t, *J* = 7.5 Hz, 3H), 1.26-1.40 (m, 2H), 1.53-1.64 (m, 2H), 4.10 (t, *J* = 7.5 Hz, 2H), 6.34 (d, *J* = 15 Hz, 1H), 7.24- 7.27 (m, 3H), 7.38- 7.42 (m, 2H), 7.57 (d, *J* = 15 Hz, 1H). ^{13}C NMR (62.5 MHz, $CDCl_3$): 13.7, 19.1, 30.6, 64.7, 113.3, 118.3, 121.8, 128.3, 132.6, 138.7, 142.0, 166.1.

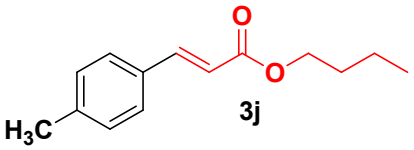
1.9. (E)-butyl 3-(4-methoxyphenyl)acrylate (3i)



3i

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 0.89 (t, *J* = 7.5 Hz, 3H), 1.29-1.44 (m, 2H), 1.56-1.67 (m, 2H), 3.78 (s, 3H), 4.13 (t, *J* = 7.5 Hz, 2H), 6.24 (d, *J* = 15 Hz, 1H), 6.83 (d, *J* = 7.5 Hz, 2H), 7.40 (d, *J* = 7.5 Hz, 2H), 7.57 (d, *J* = 15 Hz, 1H).^{13}C NMR (62.5 MHz, $CDCl_3$): 13.7, 19.2, 30.8, 55.3, 64.2, 114.3, 115.8, 129.7, 144.2..

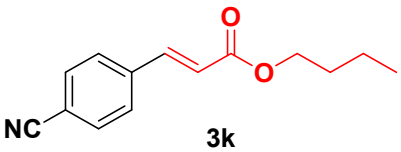
1.10. (E)-Butyl 3-(*p*-tolyl)acrylate (3j)



3j

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 0.96 (t, *J* = 7.5 Hz, 3H), 1.36-1.51 (m, 2H), 1.63-1.74 (m, 2H), 2.36 (s, 3H), 4.14 (d, *J* = 7.5 Hz, 2H), 6.39 (d, *J* = 15 Hz, 1H), 7.17 (d, *J* = 7.5 Hz, 2H), 7.41 (d, *J* = 7.5 Hz, 2H), 7.66 (d, *J* = 15 Hz, 1H). ^{13}C NMR (62.5 MHz, $CDCl_3$): 13.8, 19.2, 21.4, 30.8, 64.3, 117.1, 128.0, 129.6, 131.7, 140.5, 144.5, 167.2.

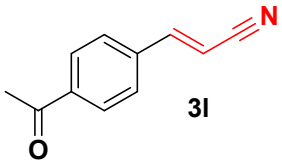
1.11. (E)-butyl 3-(4-cyanophenyl)acrylate (3k)



3k

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 0.97 (t, *J* = 7.5 Hz, 3H), 1.37-1.51 (m, 2H), 1.64-1.75 (m, 2H), 4.23 (t, *J* = 7.5 Hz, 2H), 6. 53 (d, *J* = 17.5 Hz, 1H), 7.61-7.69 (m, 5H). ^{13}C NMR (62.5 MHz, $CDCl_3$): 13.7, 19.1, 30.7, 64.7, 113.3, 118.3, 121.8, 128.3, 132.6, 138.7, 142.0, 166.2.

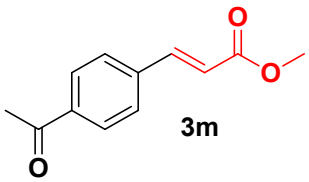
1.12. (E) –methyl 3-(4-acetyl phenyl) acrylonitrile (3l)



3l

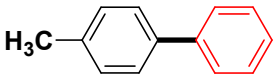
^{1}H-NMR (250MHz, $CDCl_3$/TMS) δ (ppm) = 2.62 (s, 3H), 5.9 (d, *J* = 16.8 Hz, 1H), 7.44 (d, *J* = 16.8 Hz, 1H), 7.54 (d, *J* = 8.2 Hz, 2H), 7.9 (d, *J* = 8.4 Hz, 2H).^{13}C-NMR (62.5 MHz,$CDCl_3$/TMS): δ (ppm) = 26.7, 99.0, 127.5, 129.0, 137.5, 138.8, 147.4, 149.1, 197.0.

1.13. (E)-methyl3-(4-acetylphenyl)acrylate (3m)



^{1}H-NMR (250MHz, $CDCl_3$/TMS) δ (ppm) = 2.60 (s, 3H), 3.80 (s, 3H), 6.5 (d, *J* = 16.0 Hz ,2H), 7.7 (d, *J* = 16.5 Hz, 1H), 7.6 (d, *J* = 8.5 Hz, 1H), 7.9 (d, *J* = 8.3 Hz, 1H).^{13}C-NMR (62.5 MHz, $CDCl_3$/TMS): δ (ppm) = 26.7, 61.9, 120.3, 128.1, 128.8, 138.0, 138.7, 143.3, 166.9, 197.3.

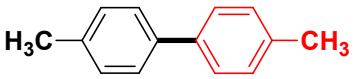
1.14. 4-Methyl-1,1'-biphenyl (5a)



5a

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 2.53 (s, 3H), 7.37-7.47 (m, 2H), 7.51-7.57 (m, 5H), 7.62-7.74 (m, 2H). ^{13}C NMR (62.5 MHz, $CDCl_3$): 21.6, 127.4, 127.5, 127.8, 128.8, 129.4, 130.1, 131.4, 132.1, 138.1.

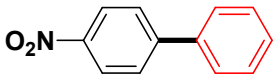
1.15. 4,4'-Dimethyl-1,1'-biphenyl (5c)



5c

^{1}H NMR (250 MHz, $CDCl_3$/TMS): δ (ppm) = 2.33 (s, 6H), 7.12 (d, *J* = 6.2 Hz, 4H), 7.40 (d, *J* = 6.2 Hz, 4H). ^{13}CNMR (62.5 MHz, $CDCl_3$/TMS): δ (ppm) = 21.1, 126.8, 129.4, 136.9, 138.3.

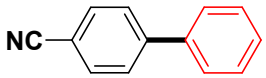
1.16. 4-Nitro-1,1'-biphenyl (5d)



5d

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 7.45-7.76 (m, 7H), 8.31 (d, *J* = 9.0 Hz, 2H). ^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 124.9, 127.6, 127.9, 128.9, 129.5, 129.7, 141.1, 147.8.

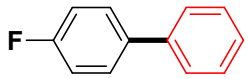
1.17. [1,1'-Biphenyl]-4-carbonitrile (5e)



5e

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 7.41-7.48 (m, 3H), 7.58-7.76 (m, 6H). ^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 110.8, 118.6, 127.3, 127.5, 128.7, 129.3, 132.1, 139.8, 146.2.

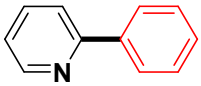
1.18. 2.6. 4-Fluoro-1,1'-biphenyl (5f)



5f

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 7.13 (t, *J* = 9.0 Hz, 2H), 7.34-7.44 (m, 5H) 7.53-7.58 (m, 2H). ^{13}C NMR (62.5 MHz, $CDCl_3$): 115.3, 127.4, 127.5, 128.8, 137.1, 139.9, 161.1, 163.7.

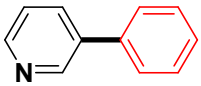
1.19. 2-Phenylpyridine (5g)



5g

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 7.23 (d, *J* = 9.0 Hz, 1H) 7.43-7.99 (m, 7H), 8.71 (s, 1H). ^{13}C NMR (62.5 MHz, $CDCl_3$): 120.3, 122.4, 126.3, 127.7, 137.0, 139.5, 149.3, 157.1.

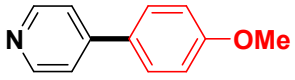
1.20. 3-Phenylpyridine (5h)



5h

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 7.32-7.58 (m, 6H), 7.86-7.88 (m, 1H), 8.59 (d, *J* = 4Hz, 1H), 8.86 (s, 1H). ^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 123.4, 127.1, 128.3, 129.1, 134.5, 136.7, 137.8, 149.3, 149.4.

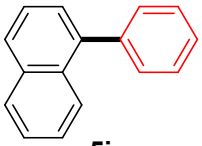
1.21. 4-(4-Methoxyphenyl)pyridine (5i)



5i

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 3.87 (s, 3H), 7.00 (d, *J* = 8.3 Hz, 2H), 7.50 (d, *J* = 5.4 Hz, 2H), 7.62 (d, *J* = 8.3 Hz, 2H), 8.62 (d, *J* = 5.4 Hz, 2H). ^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 55.4, 114.5, 121.2, 128.0, 130.4, 147.8, 150.1, 150.7, 160.8.

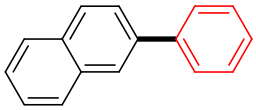
1.22. 1-Phenylnaphthalene (5j)



5j

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 7.24-7.52 (m, 5H), 7.82-7.99 (m, 7H). ^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 125.0, 125.9, 126.0, 126.2, 126.8, 128.4, 128.6, 129.2, 131.2, 133.5, 137.3, 140.6, 141.7.

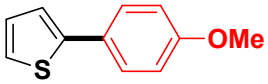
1.23. 2-Phenylnaphthalene (5k)



5k

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 7.34-7.49 (m, 5H), 7.68-8.02 (m, 7H). ^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 125.8, 125.9, 126.9, 127.0, 127.07, 127.11, 128.7, 132.2, 132.9, 133.9, 134.2, 138.6, 141.3.

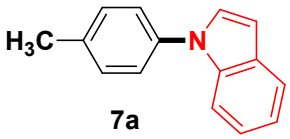
1.24. 2-(4-Methoxyphenyl)thiophene (5l)



5l

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 3.83 (s, 3H), 6.90-7.06 (m, 3H), 7.20-7.26 (m, 2H), 7.53 (d, J = 4.7 Hz, 2H). ^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 55.4, 114.1, 122.0, 123.8, 127.2, 127.4, 127.8, 143.9, 159.1.

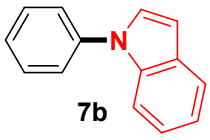
1.25. 1-*p*-Tolyl-*1H*-indole (7a)



7a

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 2.36 (s, 3H), 6.59-6.62 (m, 1H), 7.05- 7.49 (m, 8H), 7.59- 7.64 (m, 1H). ^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 21.0, 103.2, 110.5, 120.2, 121.0, 122.2, 124.3, 128.1, 129.1, 130.1, 136.3, 143.7.

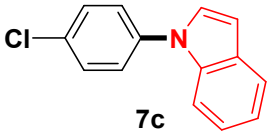
1.26. 1-Phenyl-*1H*-indole (7b)



7b

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 6.59- 6.60 (m, 1H), 7.05- 7.50 (m, 9H), 7.58- 7.62 (m,
1H).^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 103.6, 110.5, 120.4, 121.2, 122.4, 124.4, 126.5, 128.0, 119.3, 129.6, 135.9, 139.8.

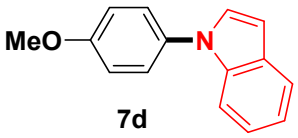
1.27. 1-(4-Chlorophenyl)-*1H*-indole (7c)



7c

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 6.60-6.62 (m, 1H), 7.09- 7.54 (m, 8H), 7.59- 7.63 (m, 1H). ^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 104.0, 110.3, 120.6, 121.3, 122.6, 125.5, 127.7, 129.3, 129.8.

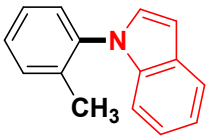
1.28. 1-(4-Methoxyphenyl)-*1H*-indole (7d)



7d

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 3.72 (s, 3H), 6.52- 6.54 (m, 1H), 6.85- 7.36 (m, 8H), 7.56- 7.59 (m, 1H). ^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 55.6, 103.0, 110.5, 114.8, 120.2, 121.1, 122.2, 126.0, 128.4, 129.4, 132.9, 136.4, 158.3.

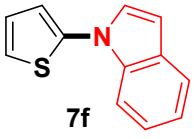
1.29. 1-*o*-Tolyl-*1H*-indole (7e)



7e

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 1.99 (s, 3H), 6.59- 6.61 (m, 1H), 6.95-7.31 (m, 8H), 7.61- 7.64 (m, 1H).^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 17.6, 102.4, 110.5, 119.8, 120.8, 122.0, 126.7, 128.1, 128.2, 128.6, 131.2, -.

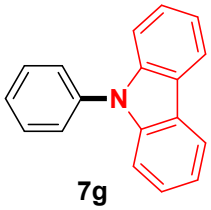
1.30. 1-(Thiophen-2-yl)-*1H*-indole (7f)



7f

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 6.58- 6.60 (m, 1H), 6.96- 7.22 (m, 6H), 7.49- 7.60 (m, 2H). ^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 104.1, 110.6, 120.4, 120.8, 121.0, 121.1, 121.6, 122.78, 122.82, 126.0,129.3.

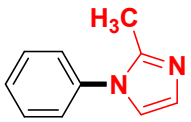
1.31. 9-Phenyl-9H-carbazole (7g)



7g

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 7.17- 7.54 (m, 11H), 8.06- 8.09 (m, 2H).^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 109.7, 119.9, 120.3, 125.9, 127.1, 127.4, 129.9.

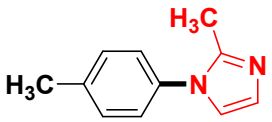
1.32. 2-Methyl-1-phenyl-*1H*-imidazole (7h)



7h

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 2.28 (s, 3H), 6.92- 6.96 (m, 2H), 7.18- 7.44 (m, 5H). ^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 13.6, 115.8, 125.5, 127.4, 128.2, 129.5, 137.9, 144.7.

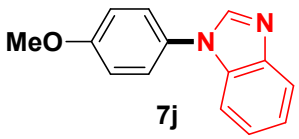
1.33. 2-Methyl-1-*p*-tolyl-1H-imidazole (7i)



7i

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 2.34 (s, 3H), 2.41 (s. 3H), 6.97- 7.01 (m,2H), 7.14-7.28 (m, 4H). ^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 13.6, 21.1, 115.6, 125.3, 127.3, 130.0, 133.9, 138.2, 143.1.

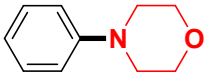
1.34. 1-(4-Methoxyphenyl)-*1H*-benzo[d]imidazole (7j)



7j

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 3.89 (s, 3H), 7.06- 7.11 (m, 2H), 7.24- 7.53 (m, 6H), 7.93 (brs, 1H). ^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 55.5, 107.3, 109.8, 114.6, 115.9, 119.7, 122.2, 136.0, 163.2.

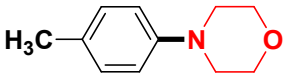
1.35. 4-Phenylmorpholine (7k)



7k

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 3.13-3.16 (m, 4H), 3.83-3.87 (m, 4H), 6.85-6.92 (m, 3H), 7.24-7.29 (m, 2H).^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 49.5, 66.6, 116.2, 119.9, 129.5, 151.0.

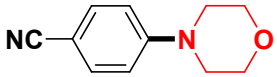
1.36. 4-(*p*-Tolyl)morpholine (7l)



7l

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 2.27 (s, 3H), 3.10-3.13 (m, 4H), 3.85-3.89 (m, 4H), 6.85 (d, *J* = 3.7 Hz, 2H), 7.07 (d, *J* = 4.0 Hz, 2H). ^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 20.3, 49.6, 65.8, 116.0, 129.6, 129.7, 149.0.

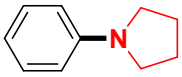
1.37. 4-Morpholinobenzonitrile (7m)



7m

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 3.25-3.29 (m, 4H), 3.82-3.86 (m, 4H), 6.82-6.88 (m, 2H), 7.47-7.53 (m, 2H).^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 47.2, 66.2, 100.7, 114.1, 119.8, 133.6, 153.3.

1.38. 1-Phenylpyrrolidine (7n)

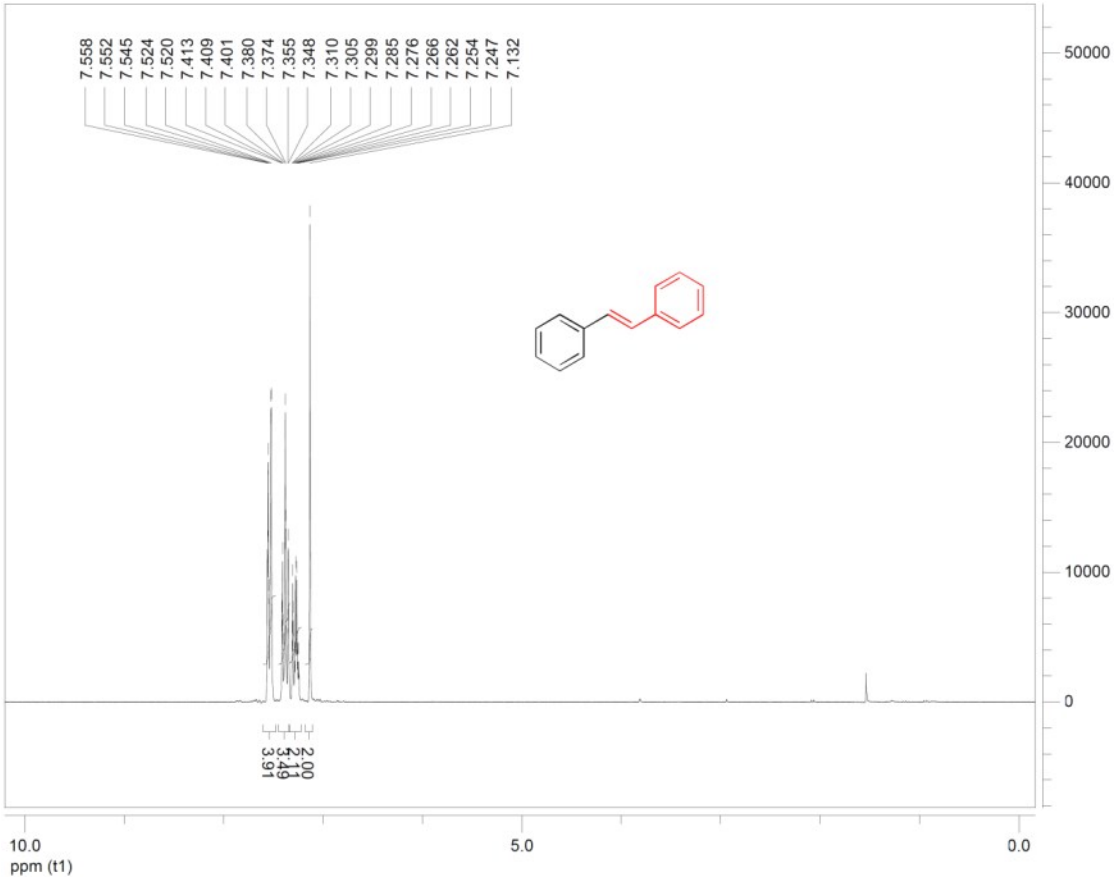


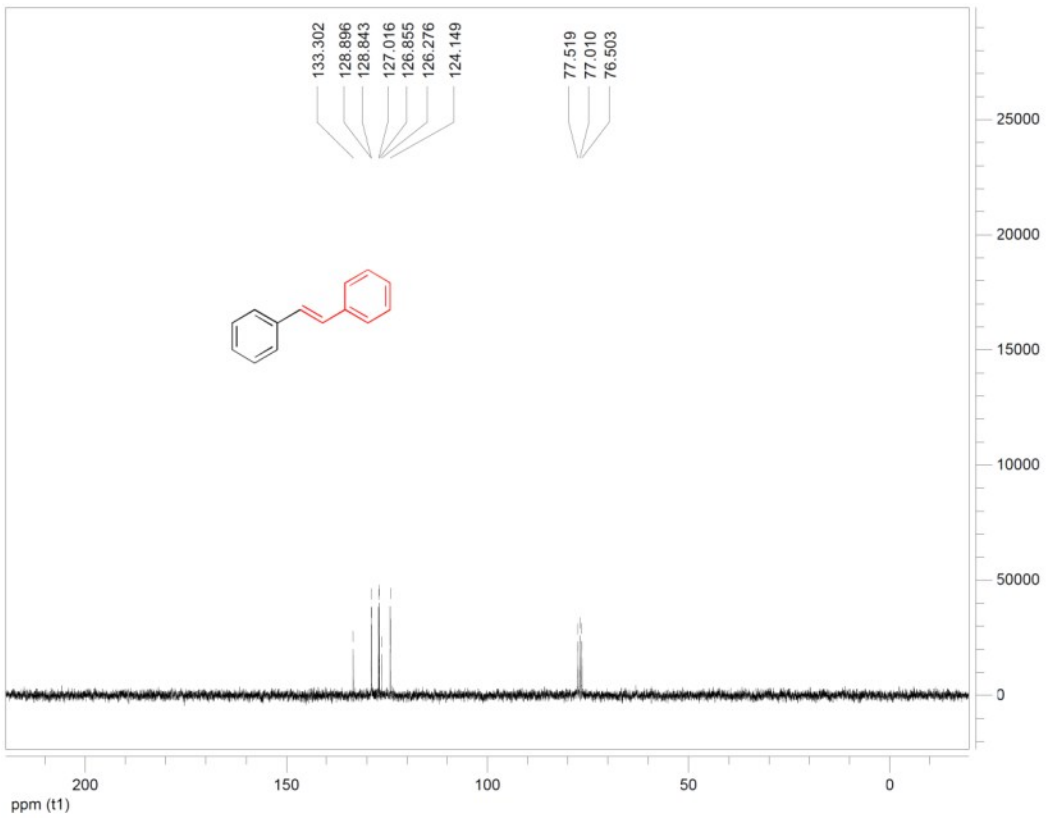
7n

^{1}H NMR (250 MHz, $CDCl_3$): δ (ppm) = 2.02-2.07 (m, 4H), 3.32-3.37 (m, 4H), 6.62-6.72 (m, 3H), 7.26-7.31 (m, 2H).^{13}C NMR (62.5 MHz, $CDCl_3$): δ (ppm) = 25.3, 47.5, 111.5, 115.2, 129.0, 147.8.

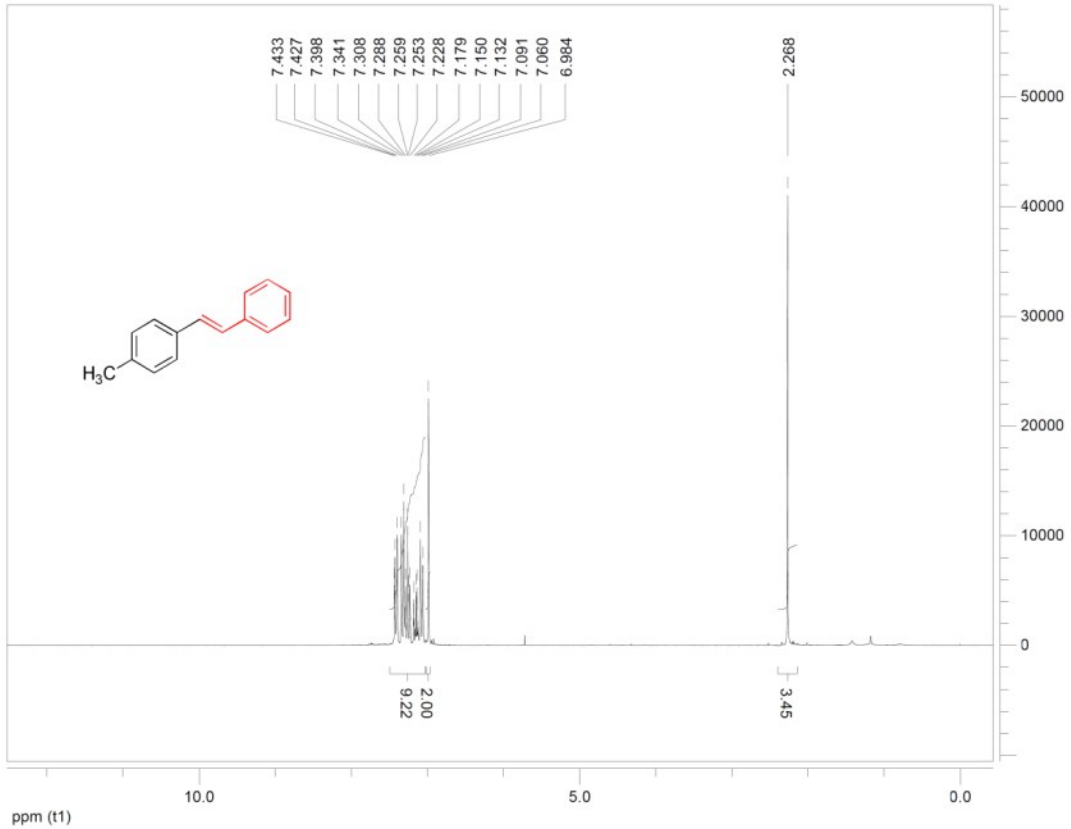
2. Copy of ^{1}HNMR & ^{13}C NMR

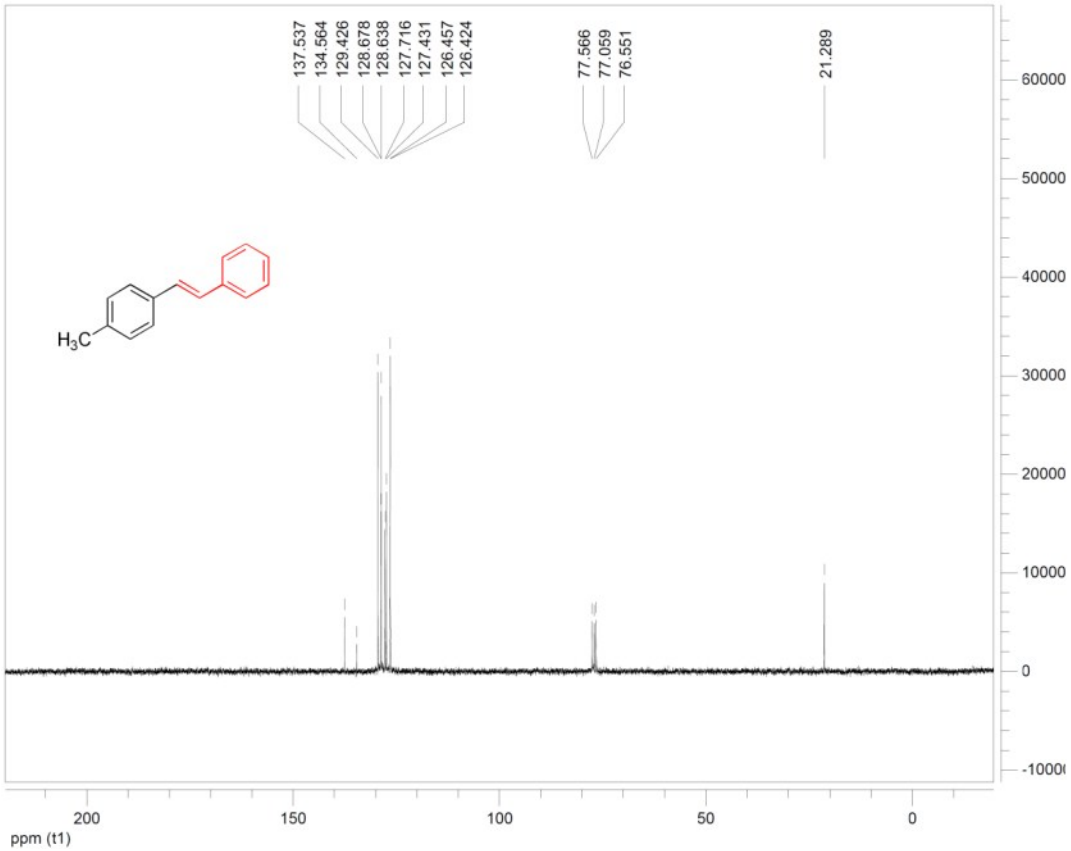
2.1. (*E*)-1,2-diphenylethene (3a)



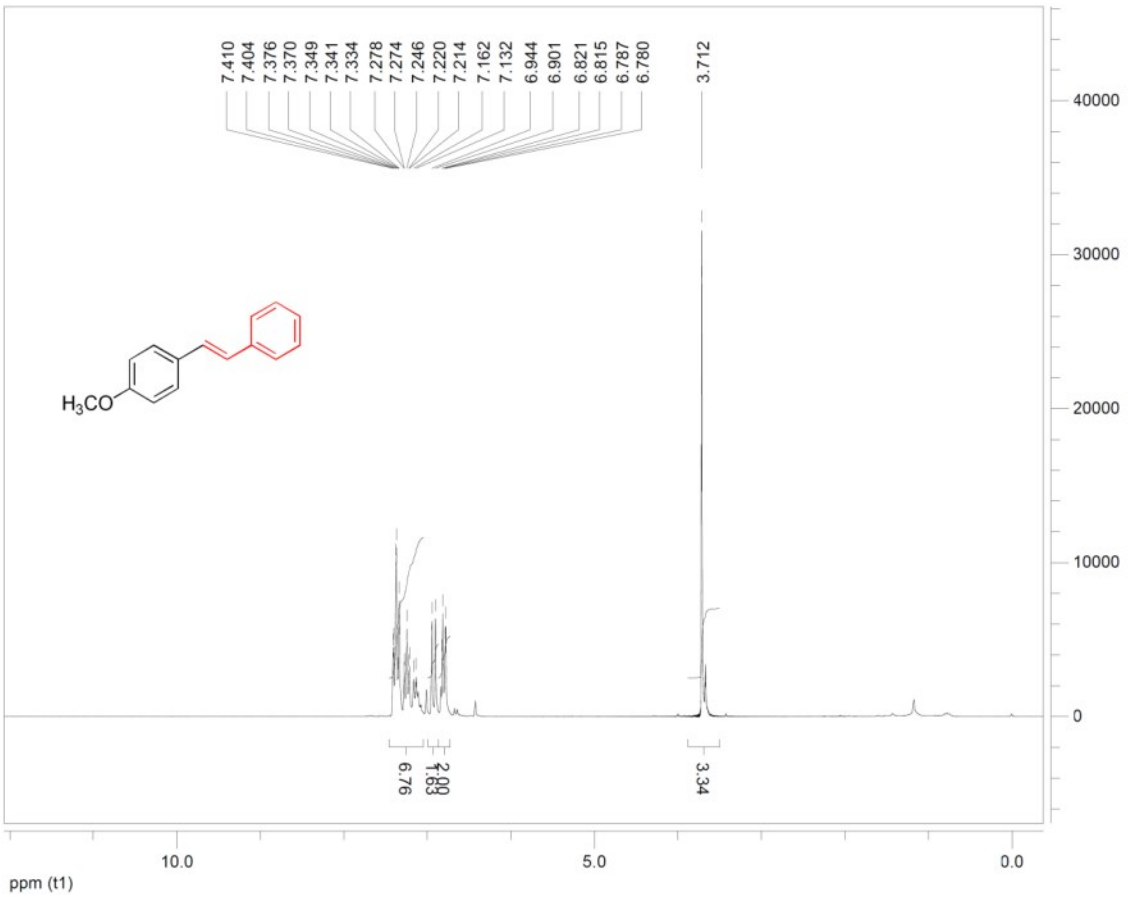


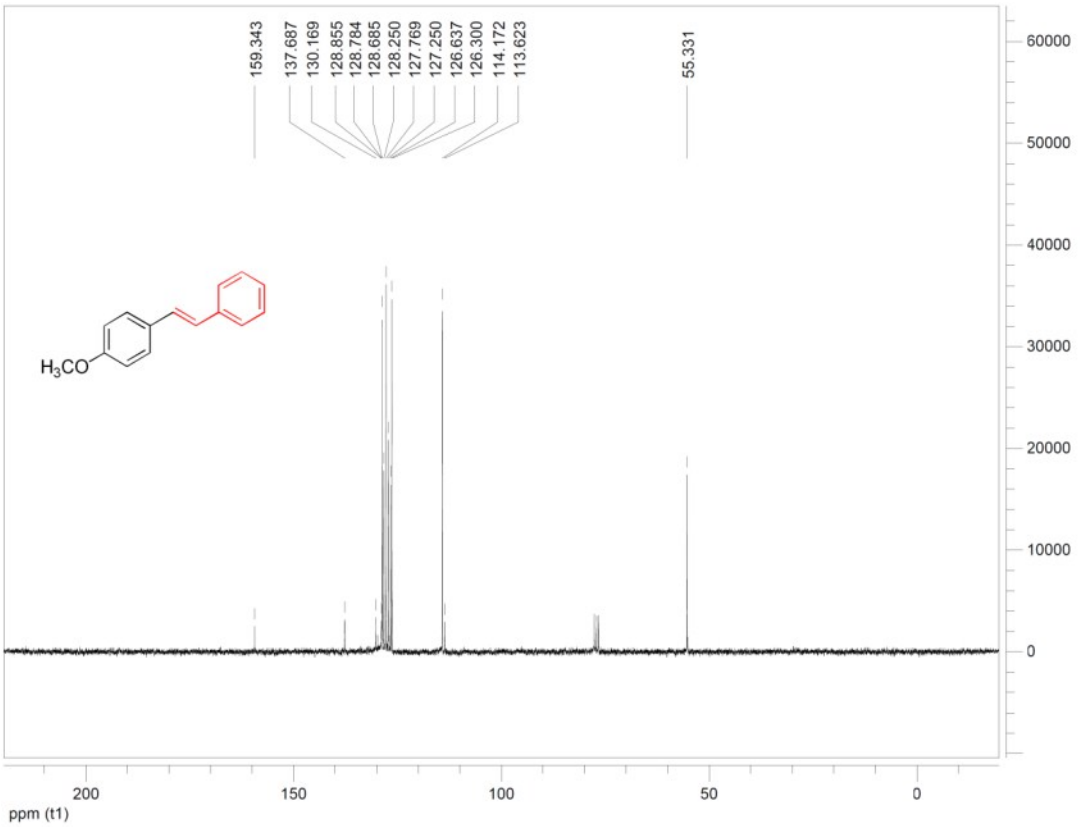
2.2. (E)-1-Methyl-4-styrylbenzene (3b)



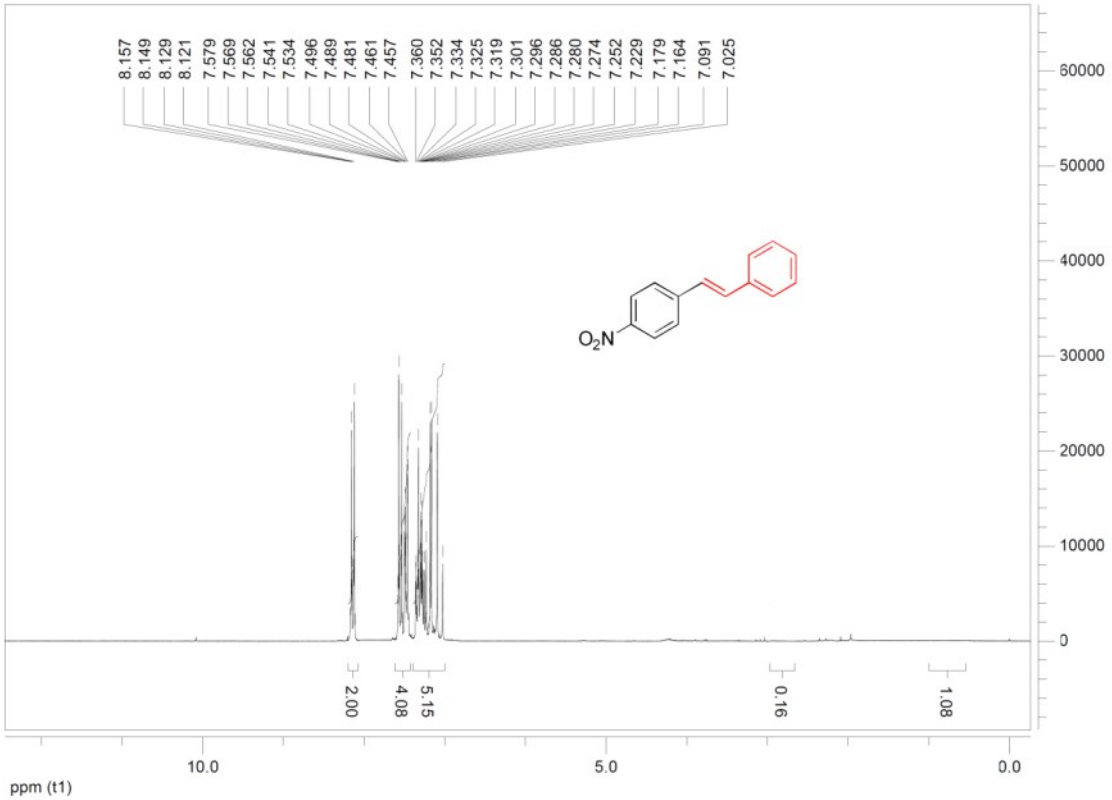


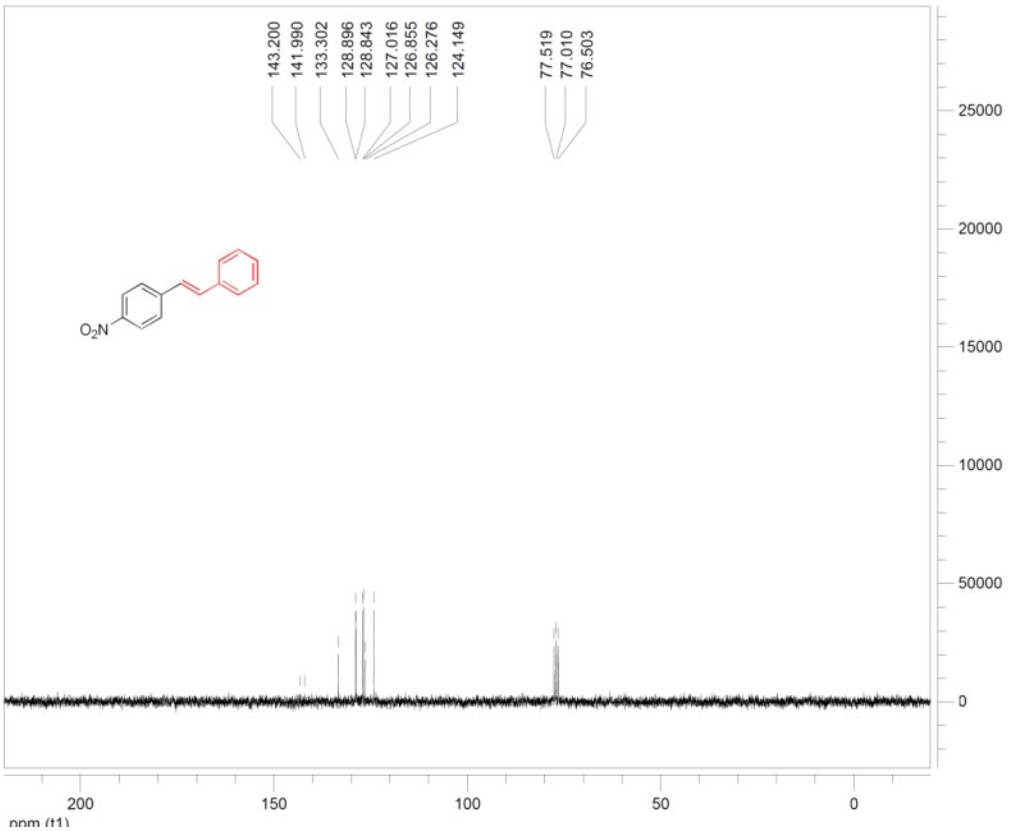
2.3. (E)-1-Methoxy-4-styrylbenzene (3c)



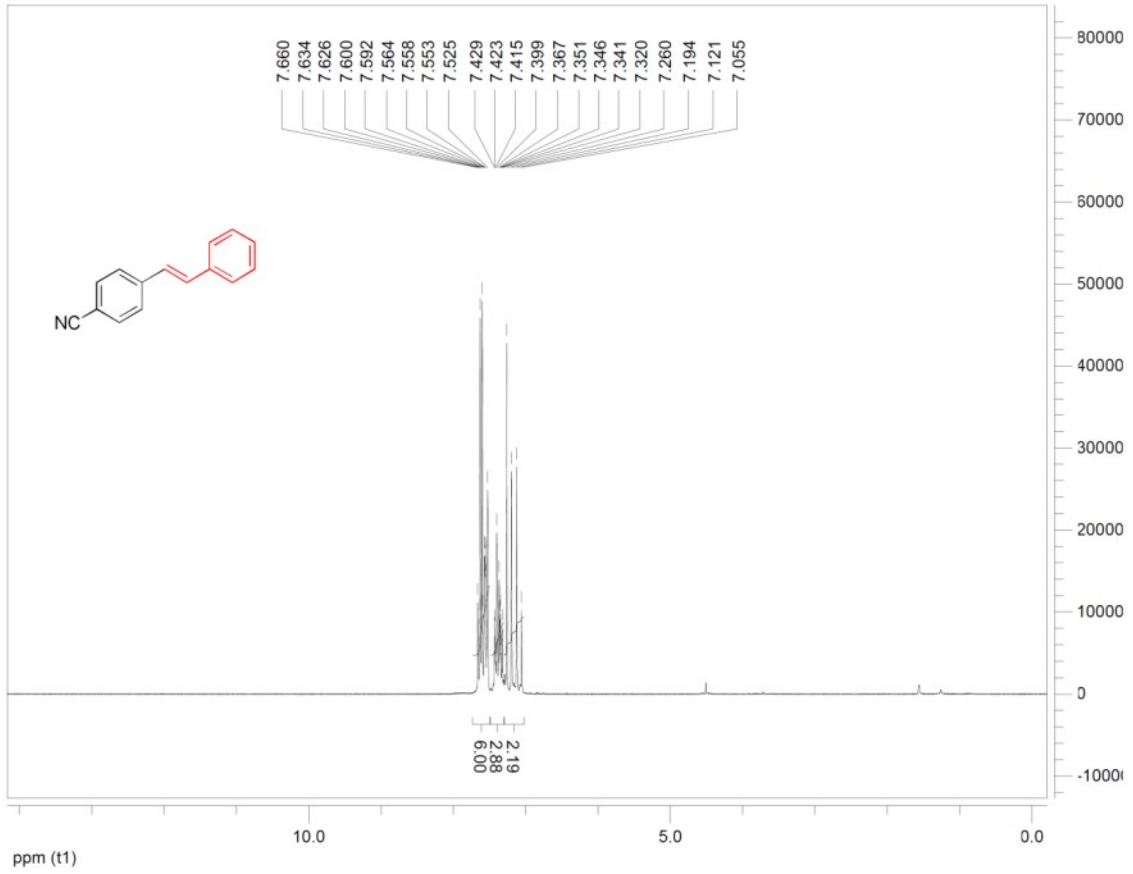


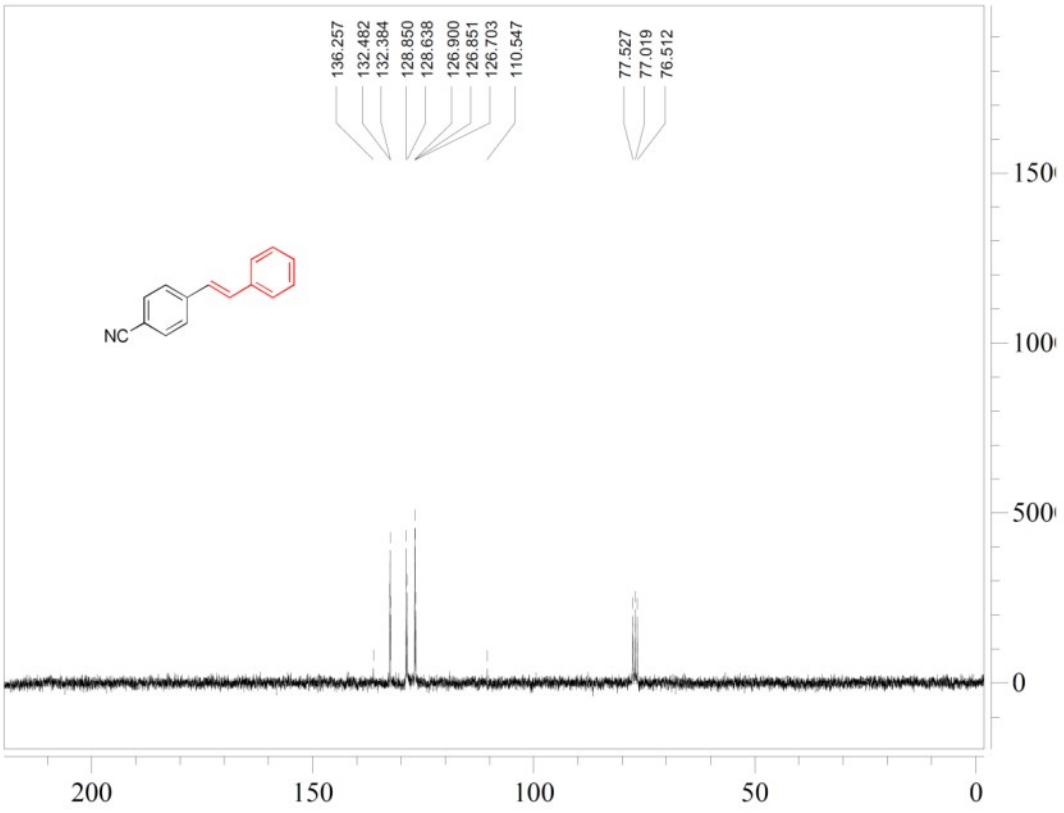
2.4. (E)-1-nitro-4-styrylbenzene (3d)



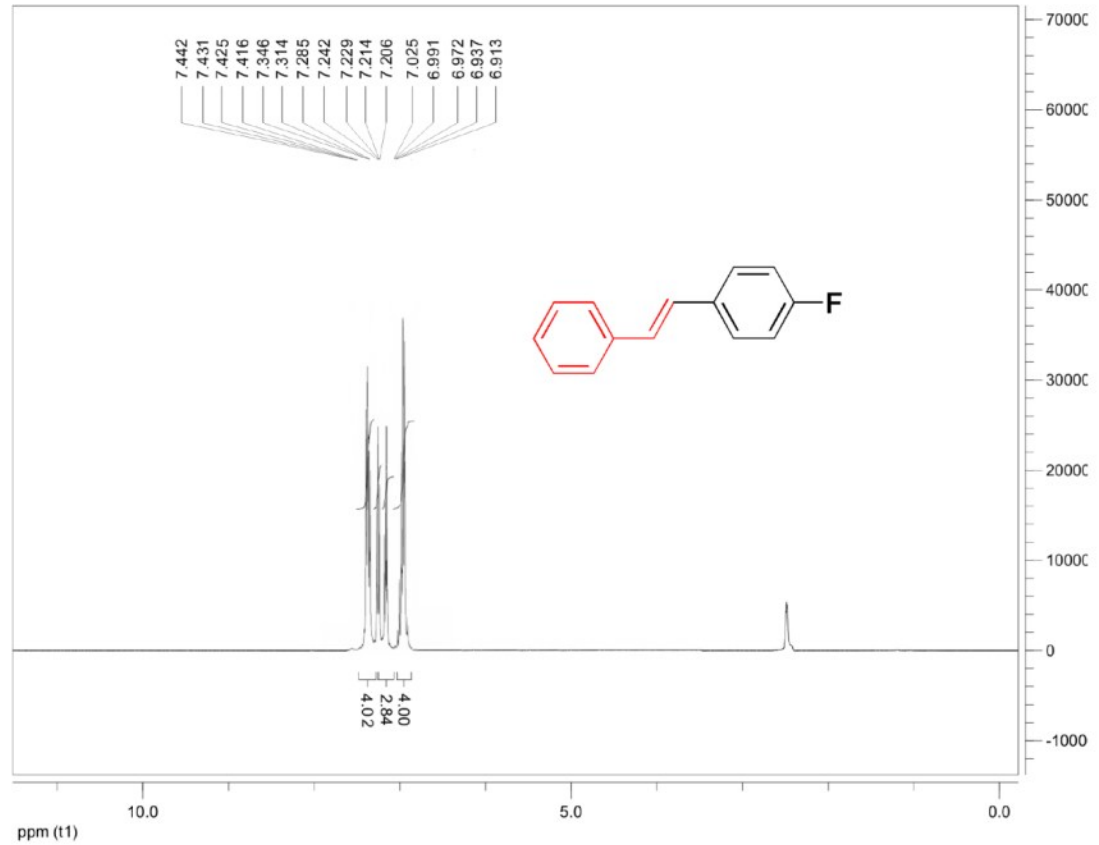


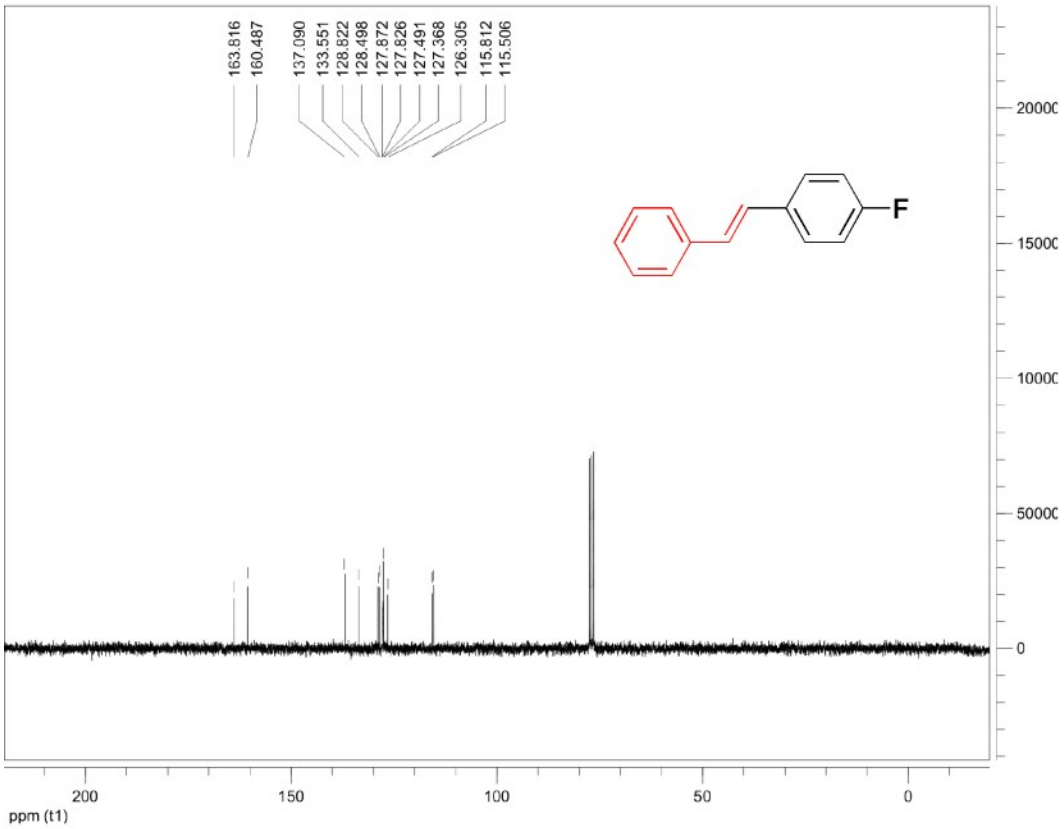
2.5. (E)-4-styrylbenzonitrile (3e)



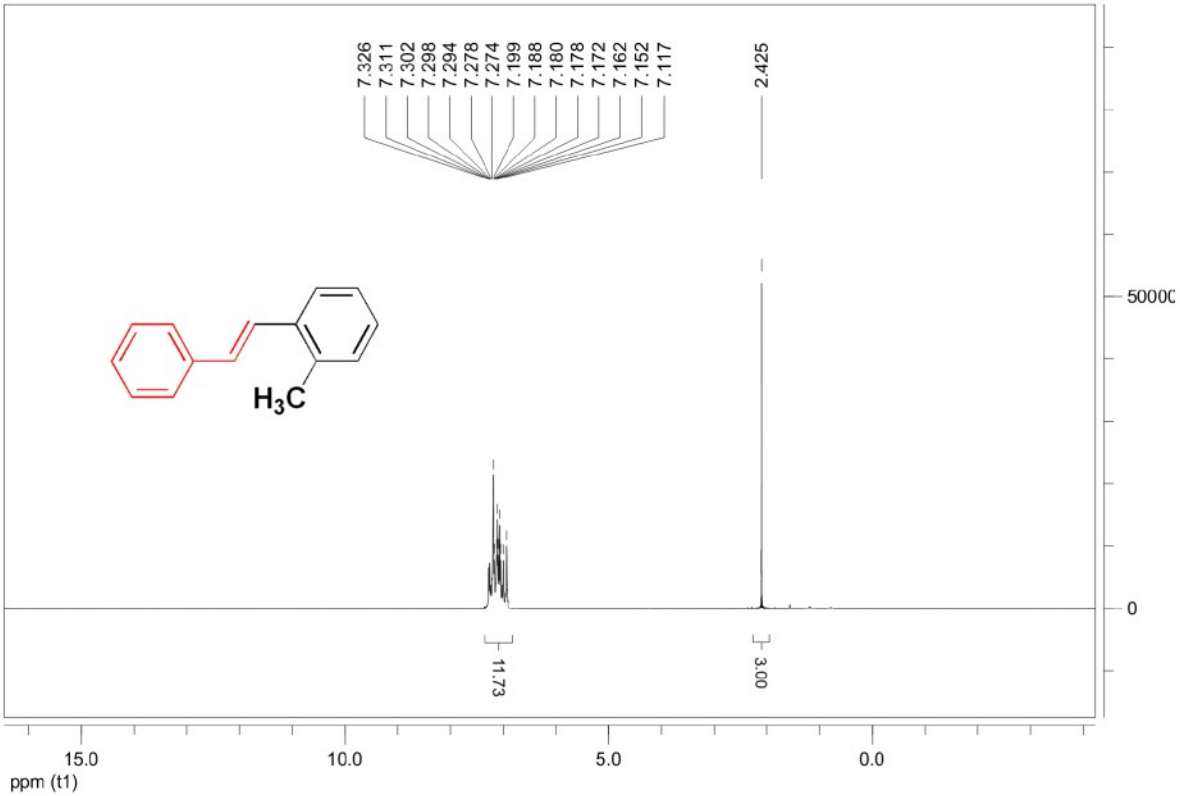


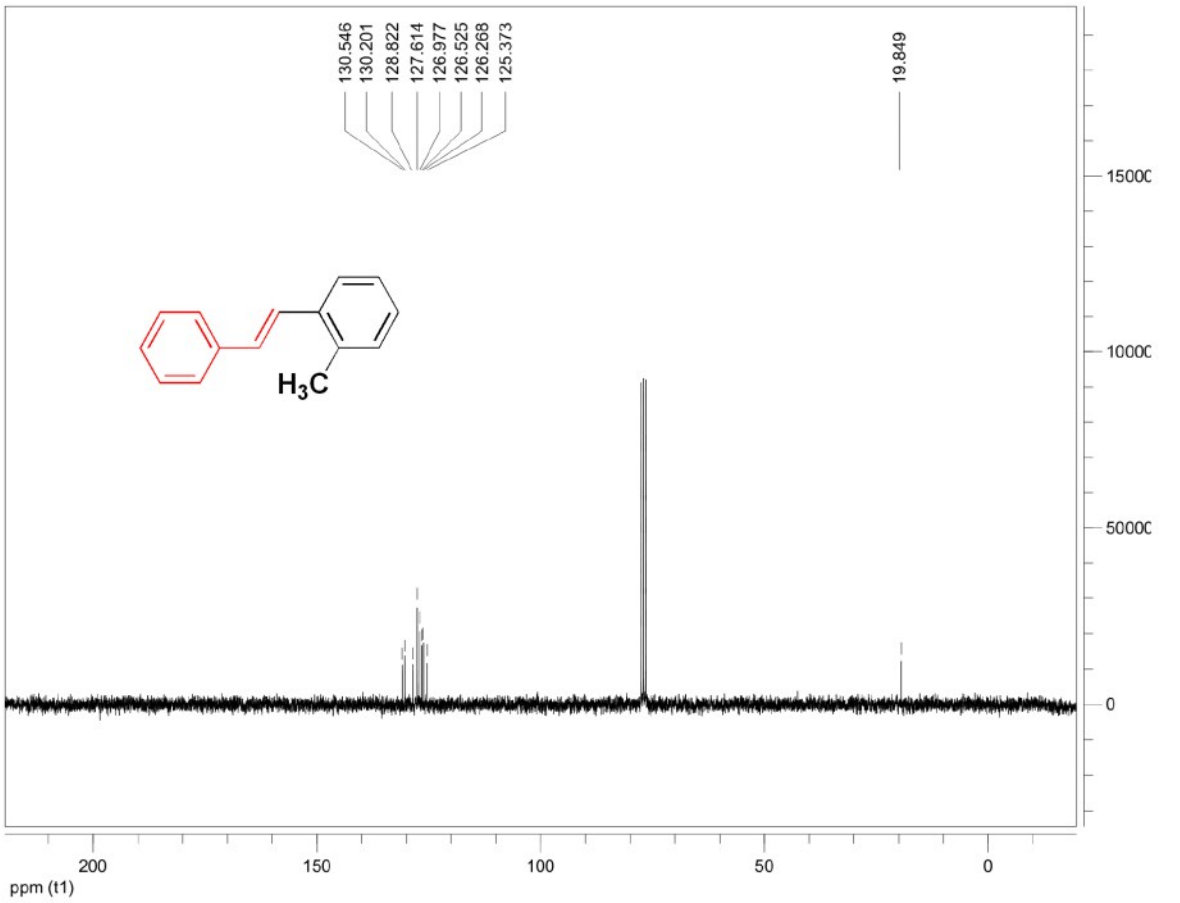
2.6. (E)-1-Fluoro-4-styrylbenzene (3f)



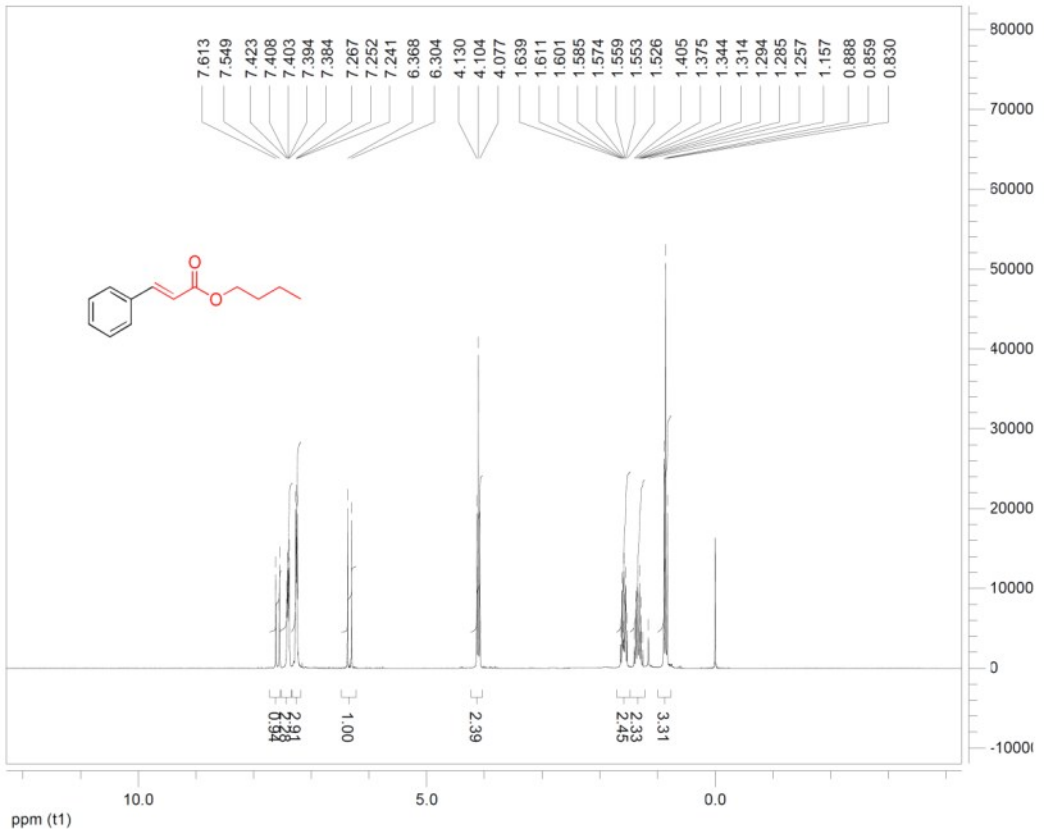


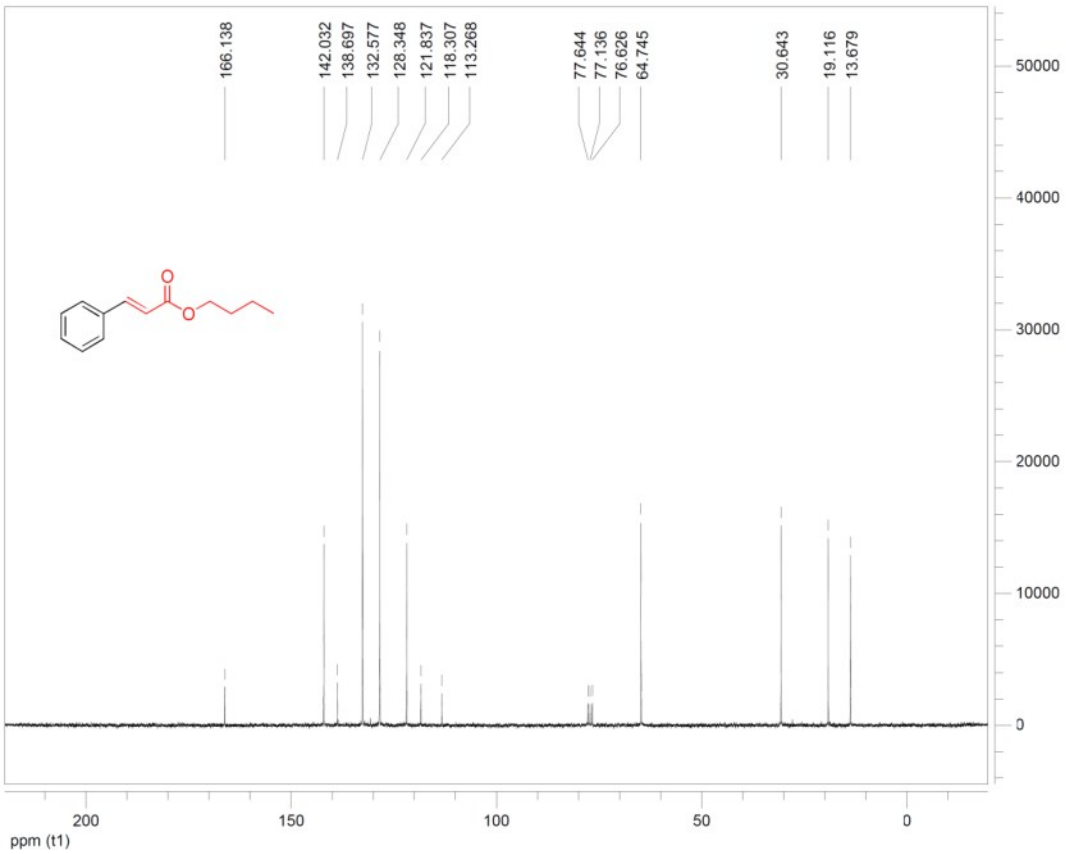
2.7. (E)-1-Methyl-2-styrylbenzene (3g)



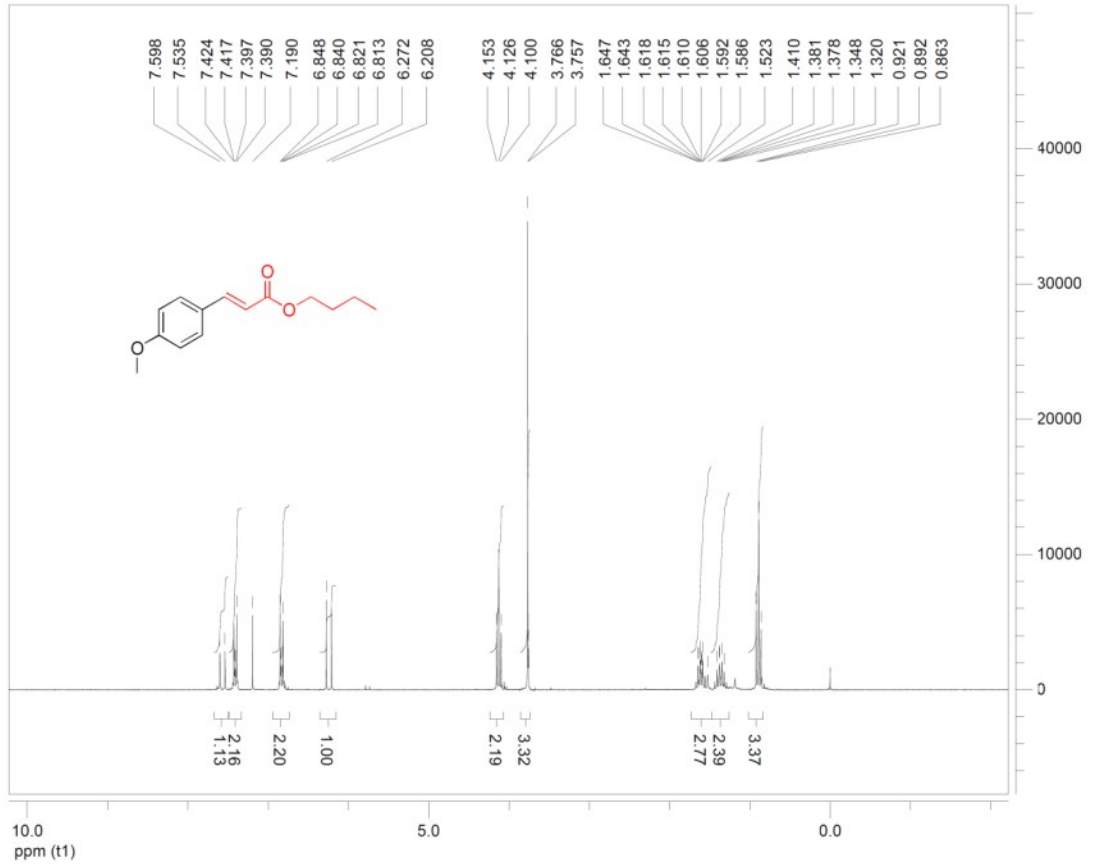


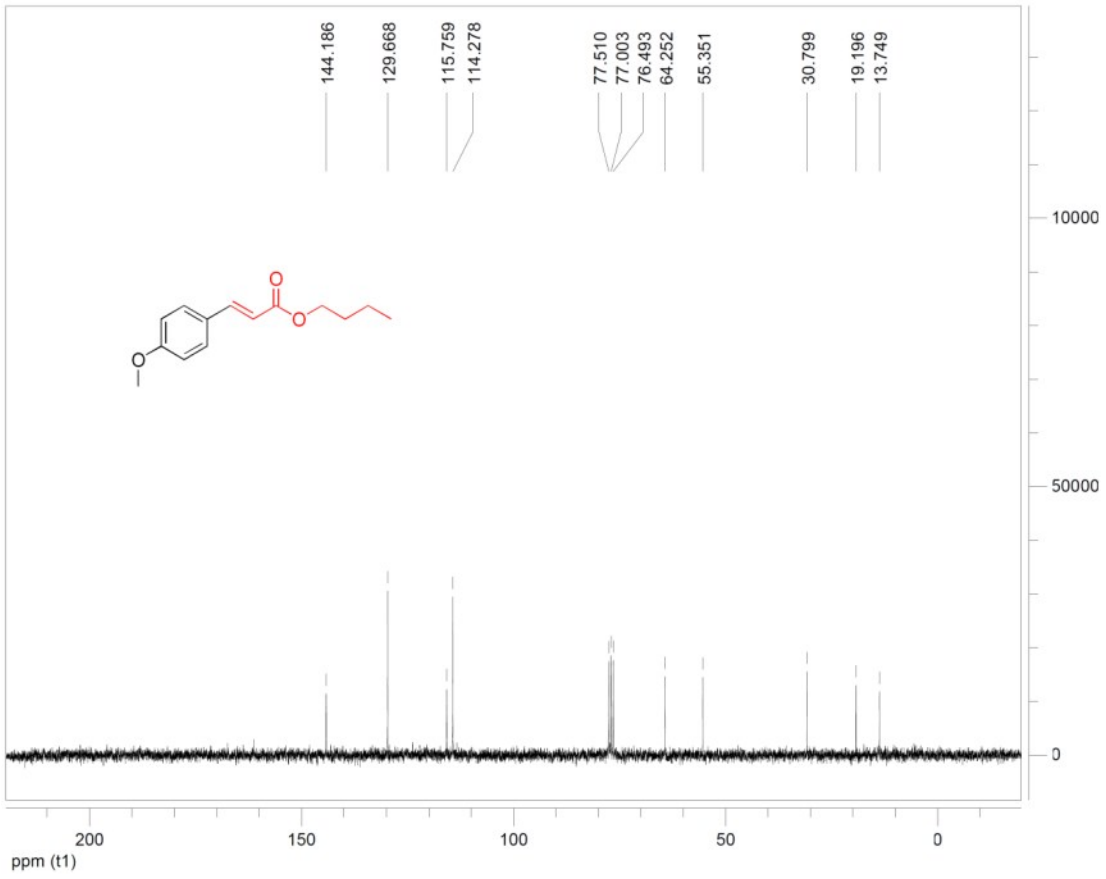
2.8. *n*-Butyl cinnamate (3h)



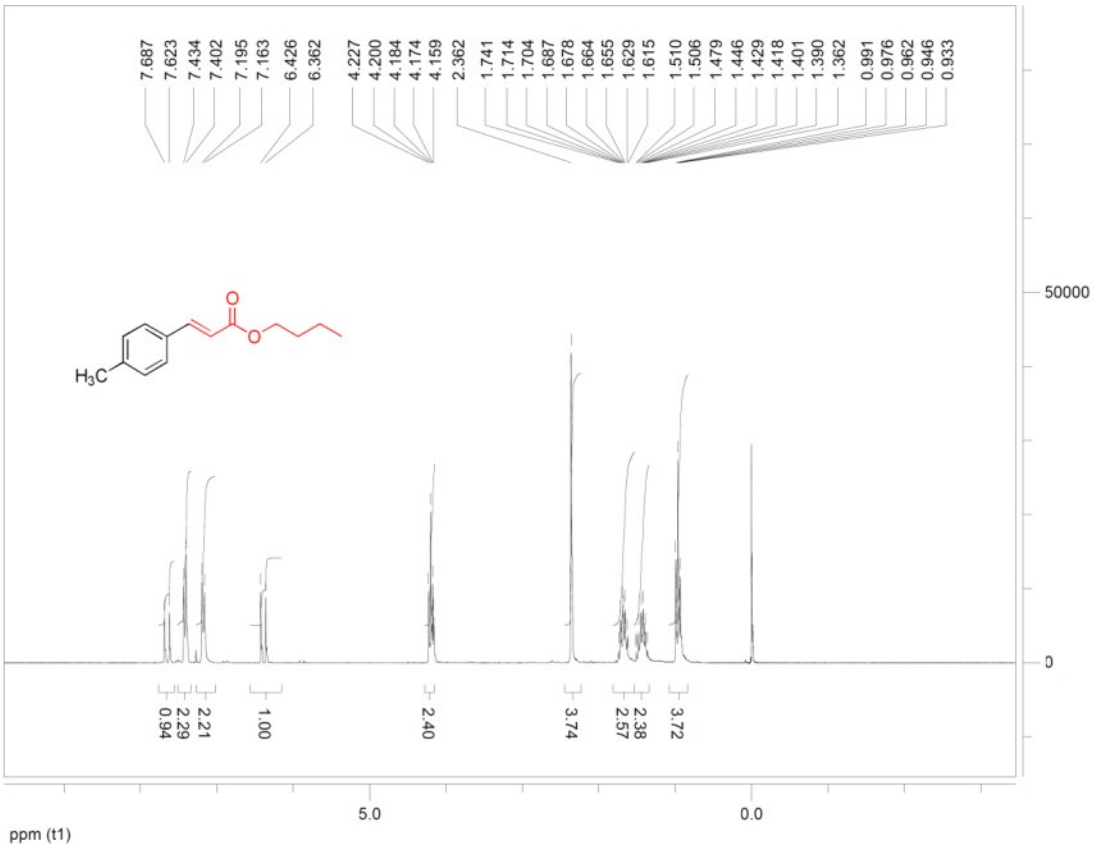


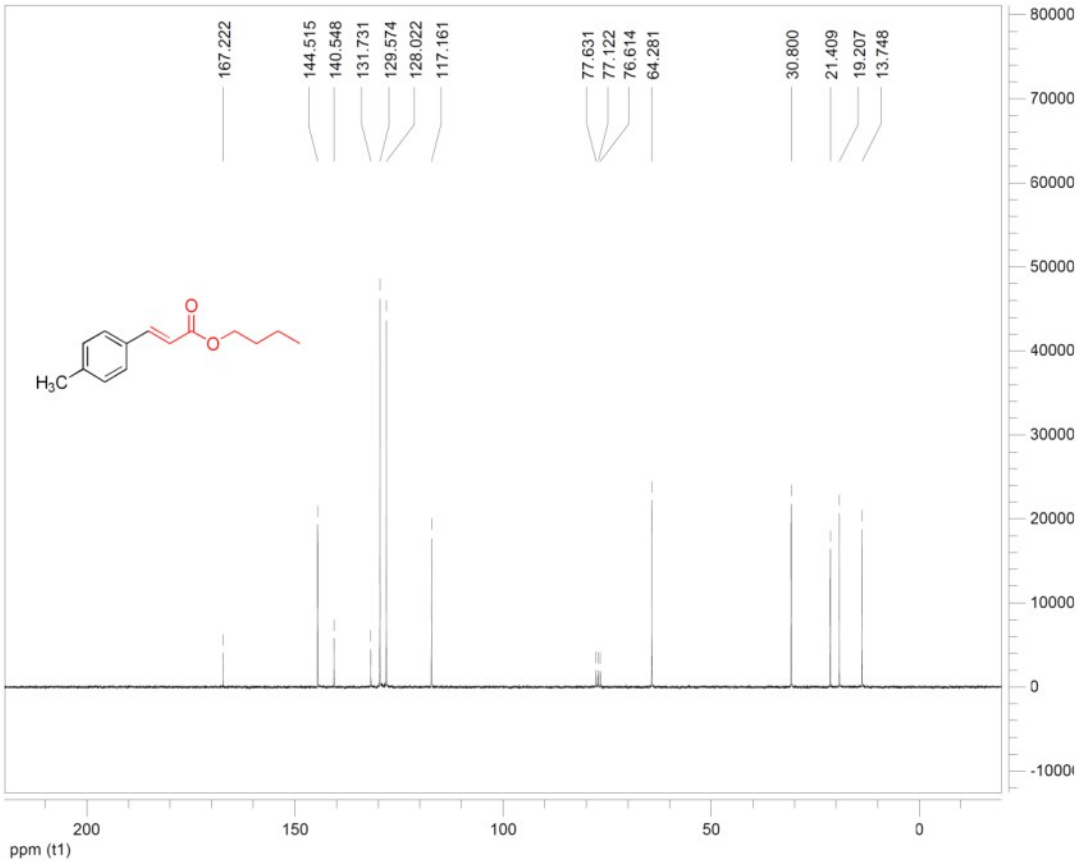
2.9. (E)-butyl 3-(4-methoxyphenyl)acrylate (3i)



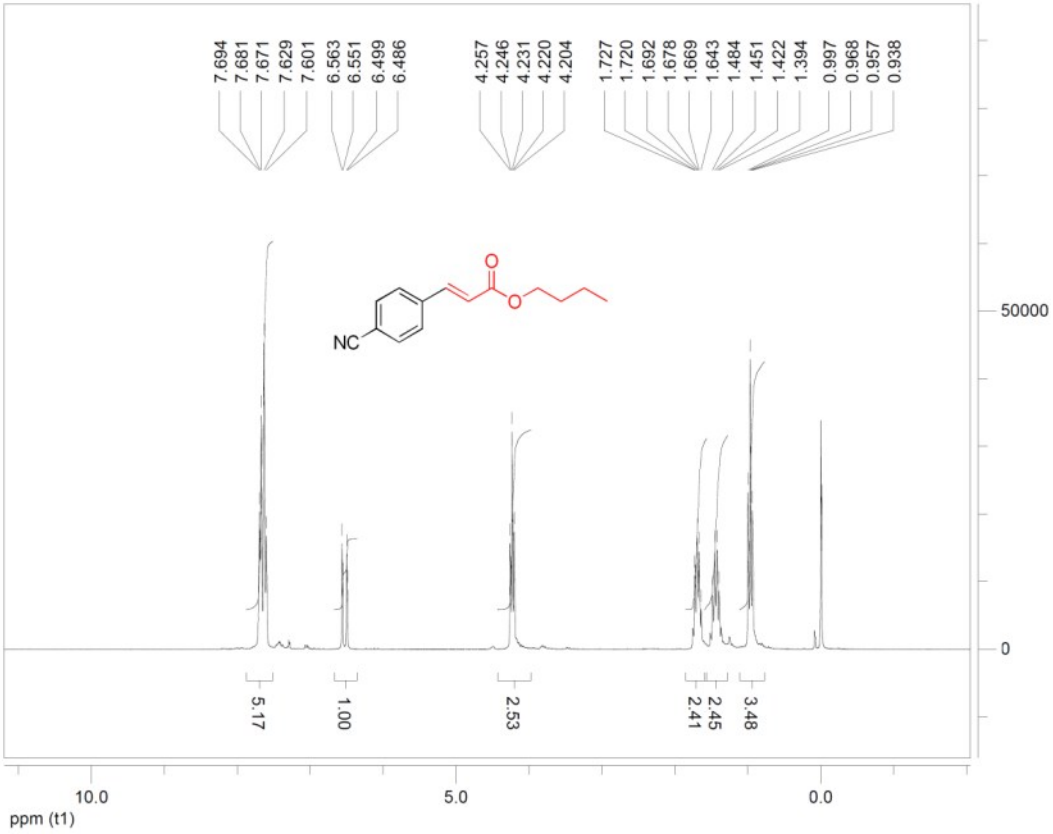


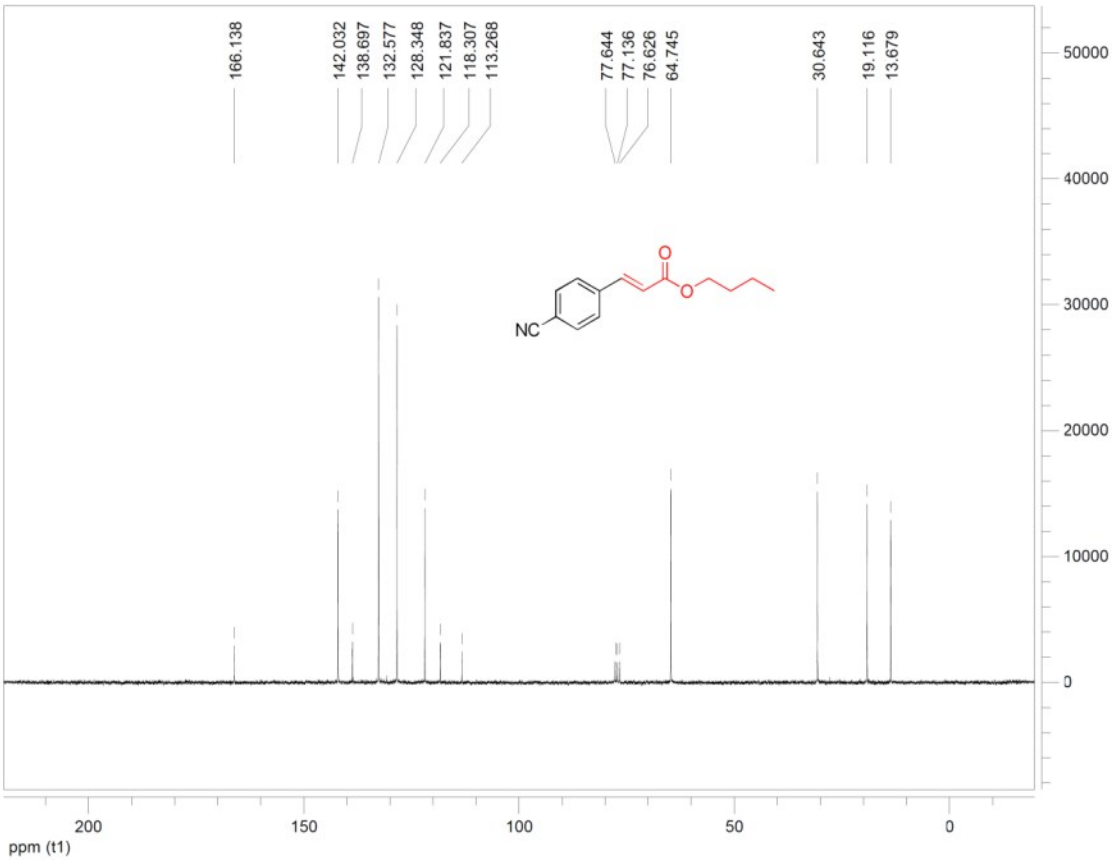
2.10. (E)-Butyl 3-(*p*-tolyl)acrylate (3j)



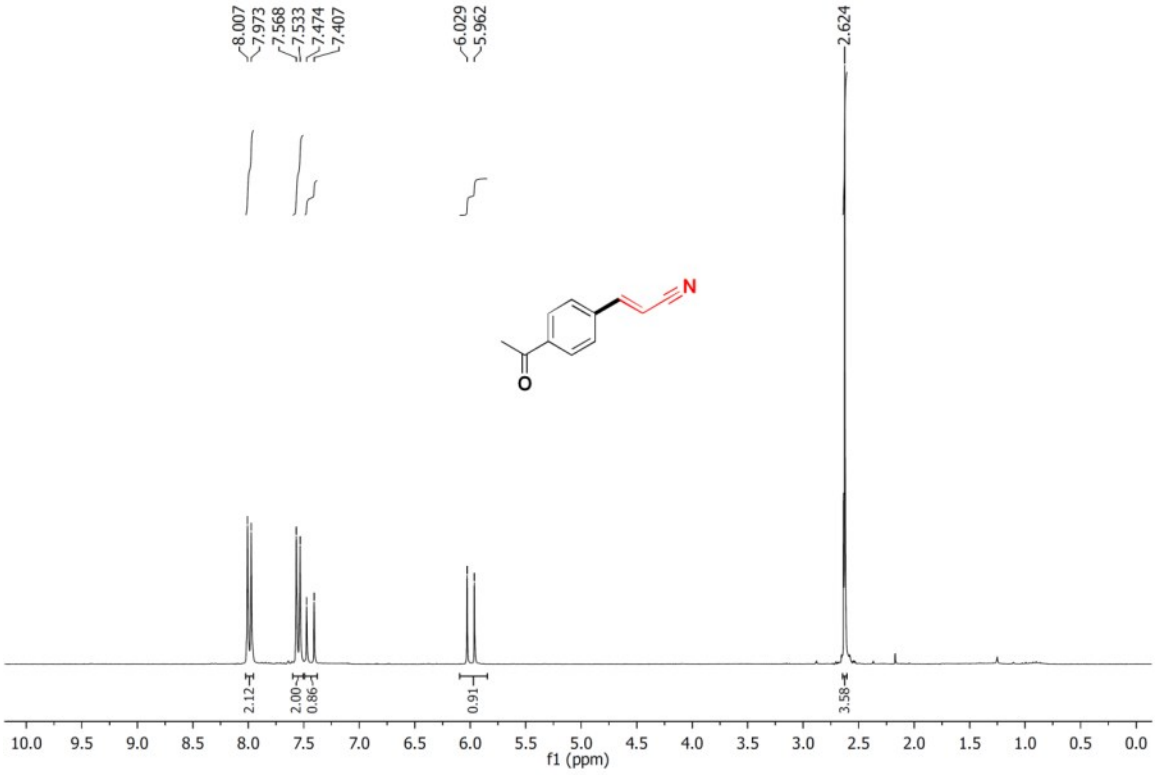


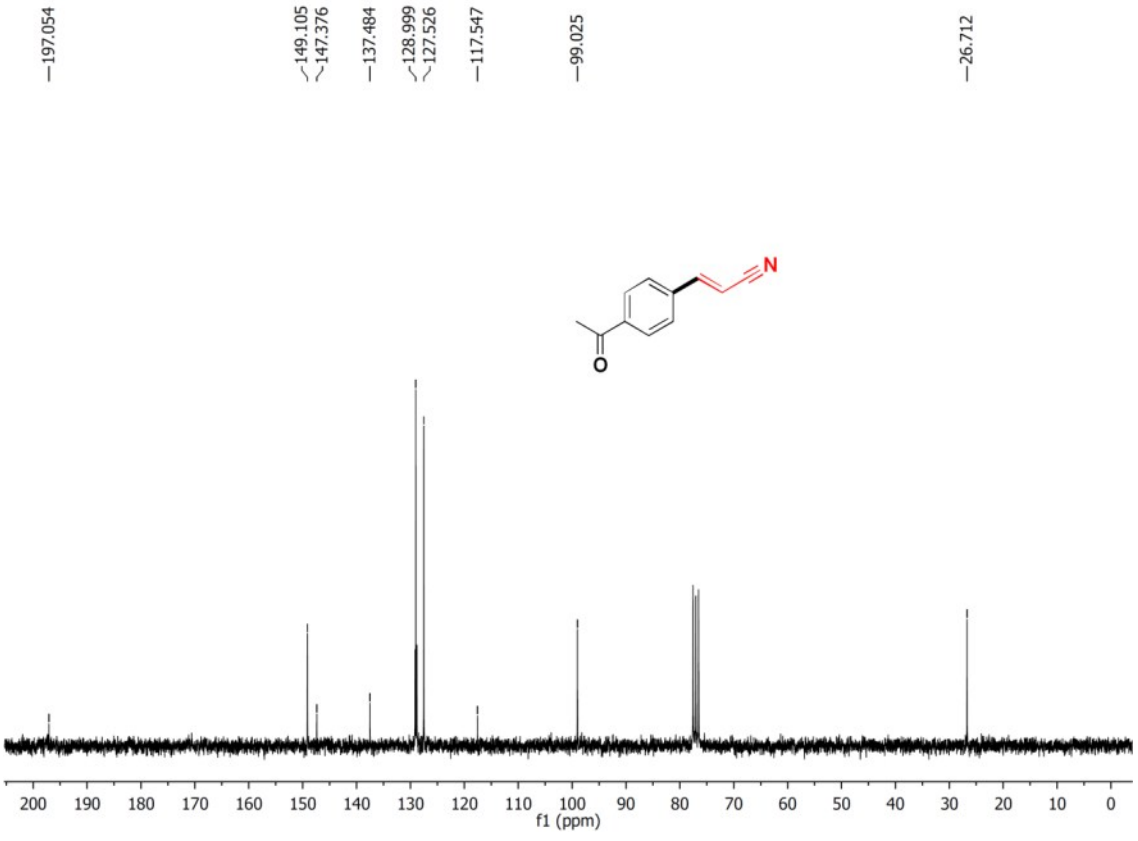
2.11. (E)-butyl 3-(4-cyanophenyl)acrylate (3k)



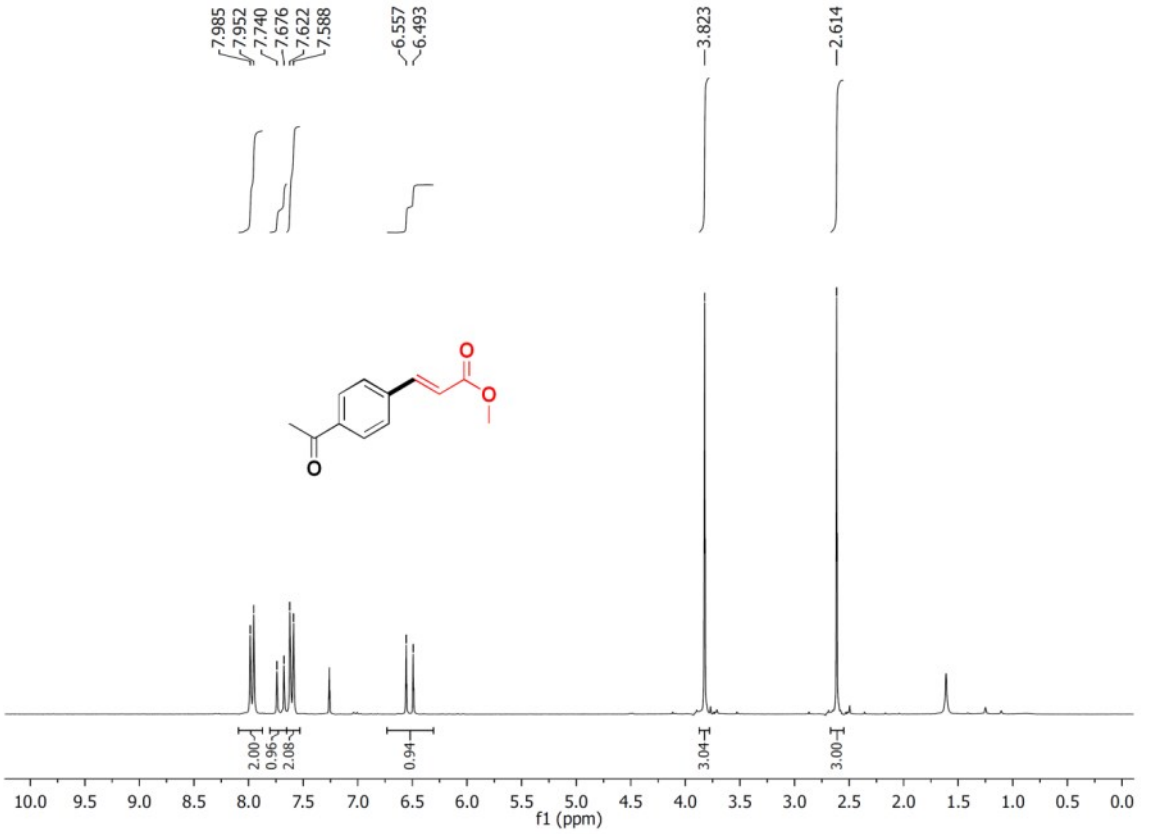


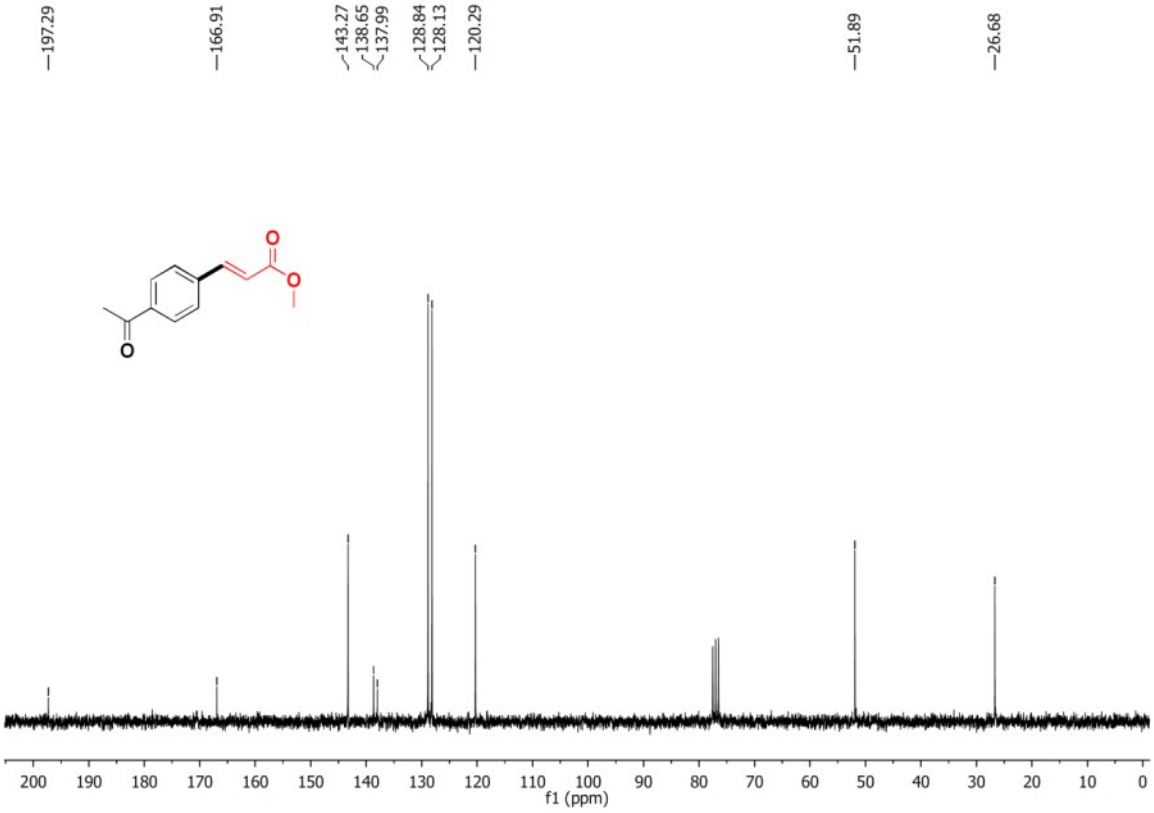
2.12. (E) –methyl 3-(4-acetyl phenyl) acrylonitrile (3l)



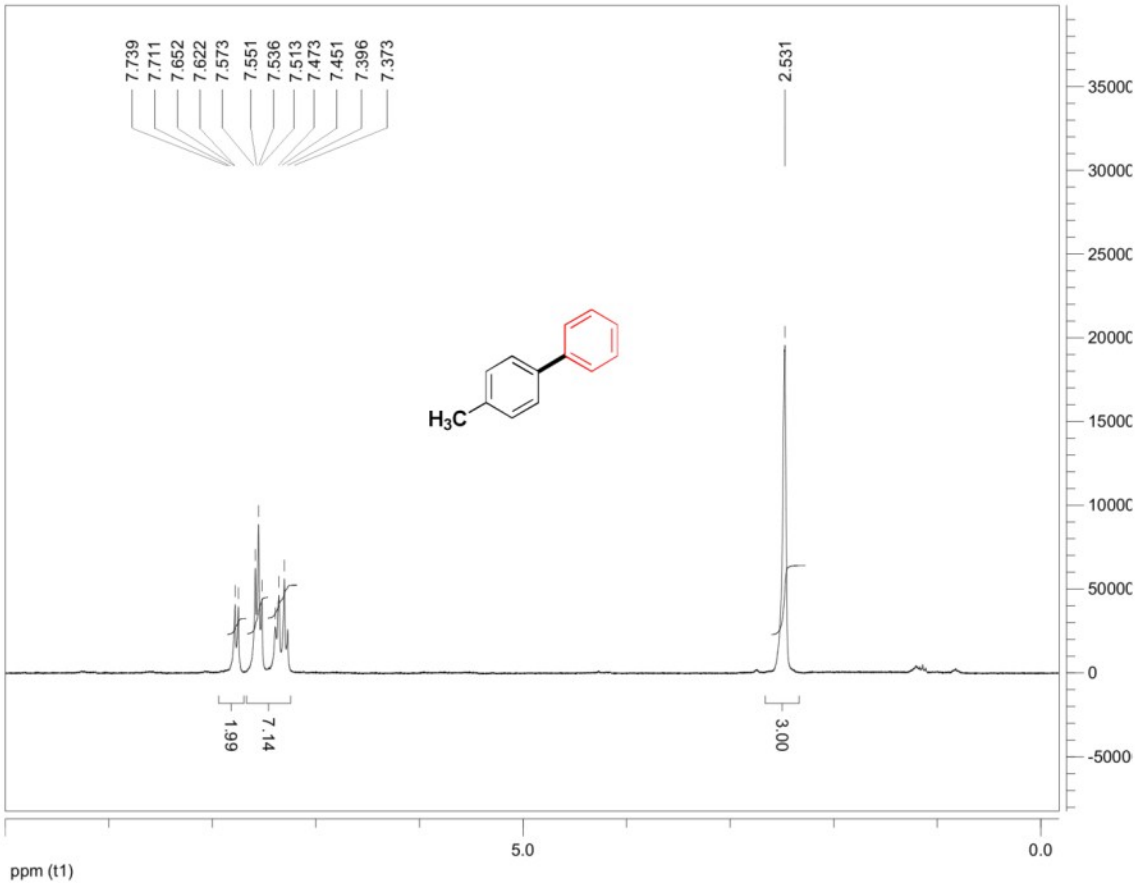


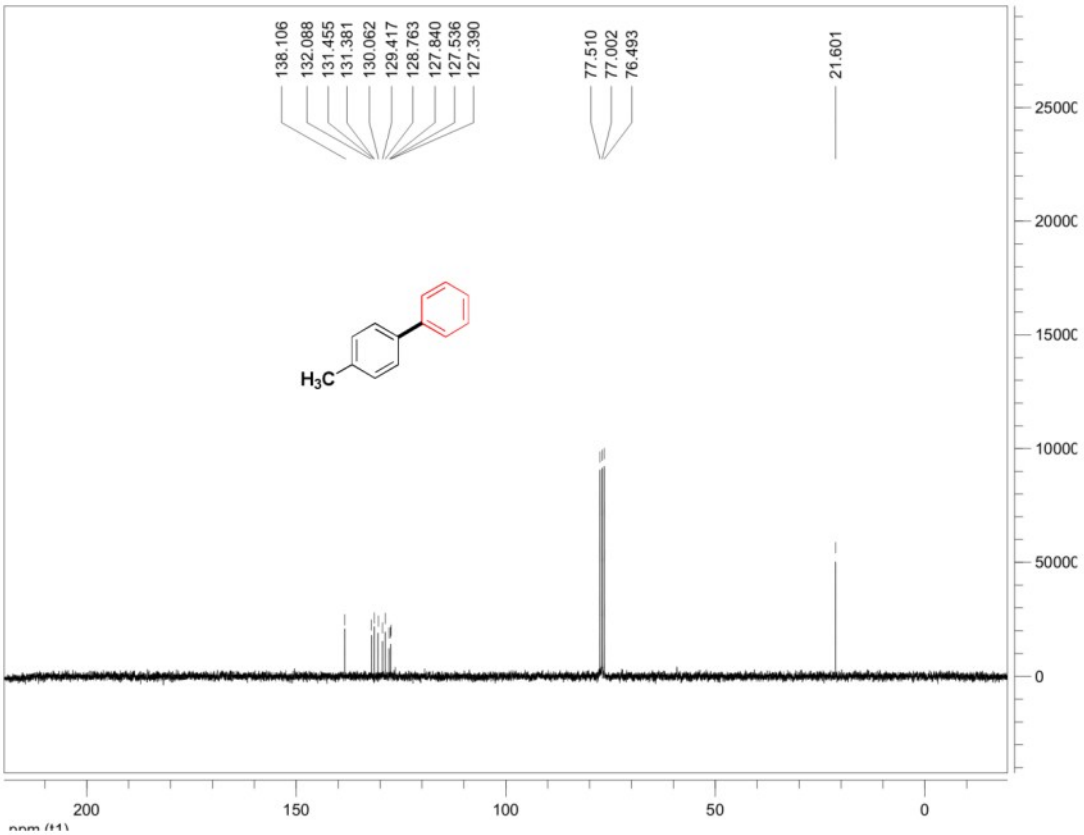
2.13. (E)-methyl3-(4-acetylphenyl)acrylate (3m)



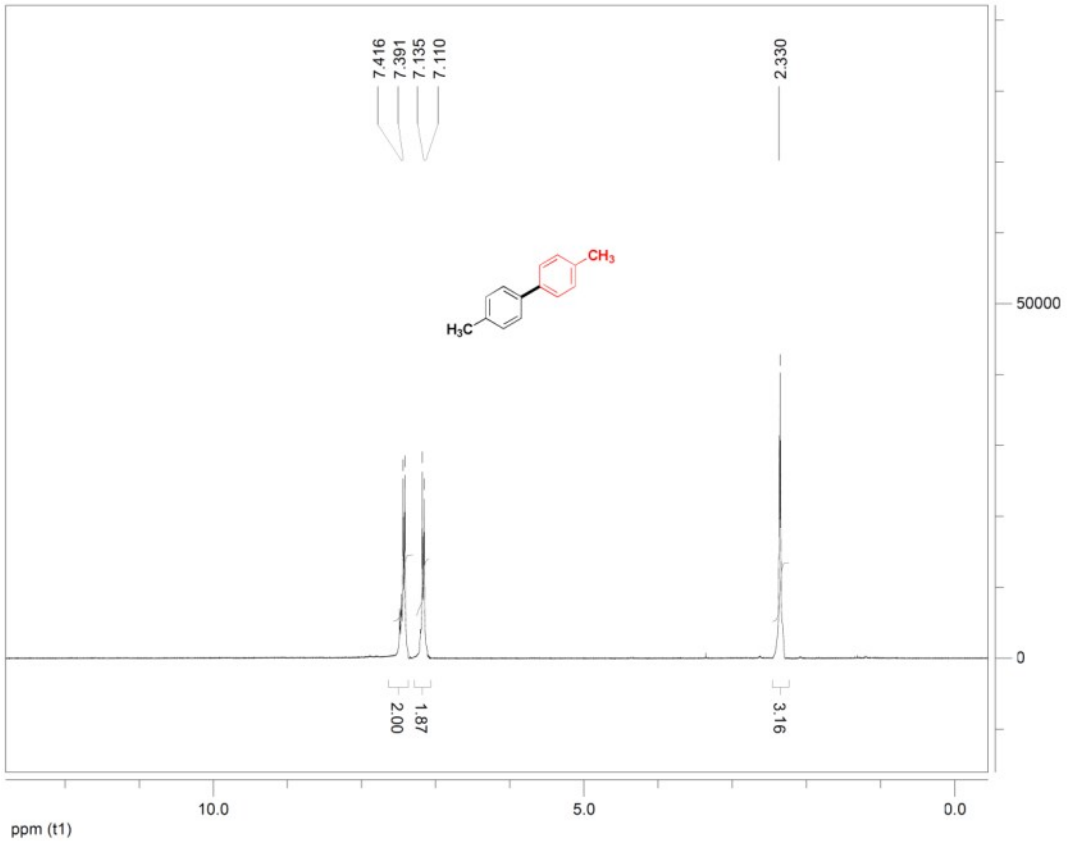


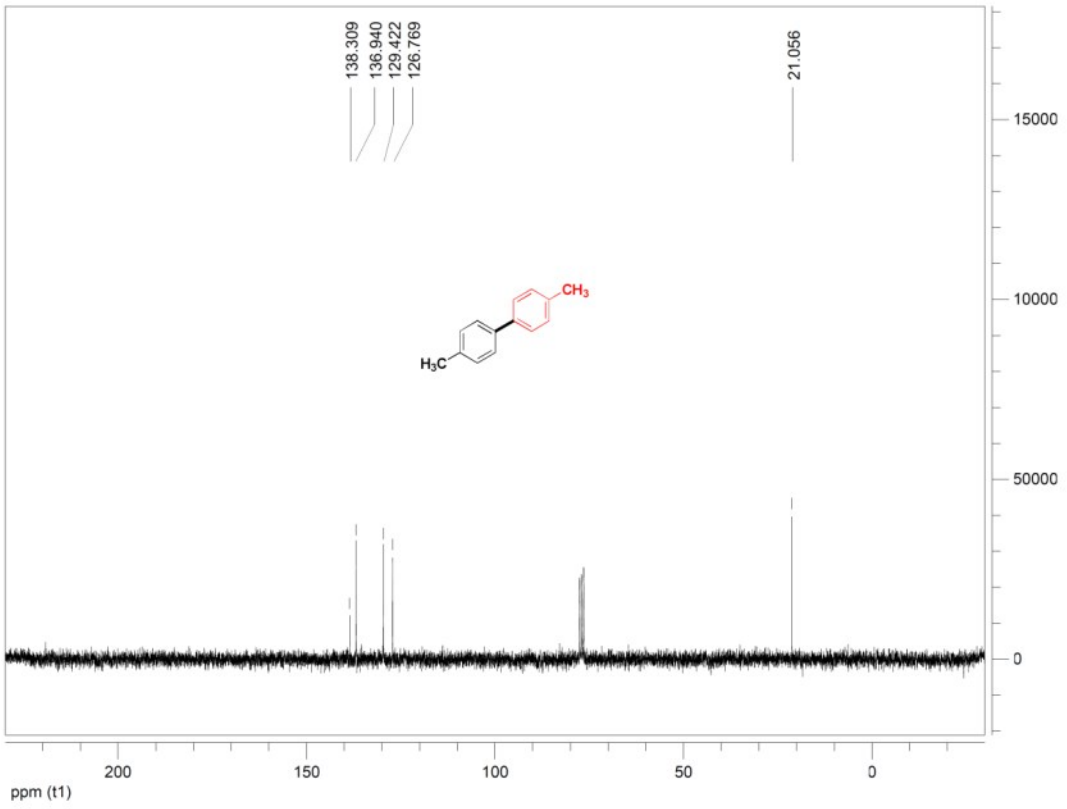
2.14. 4-Methyl-1,1'-biphenyl (5a)



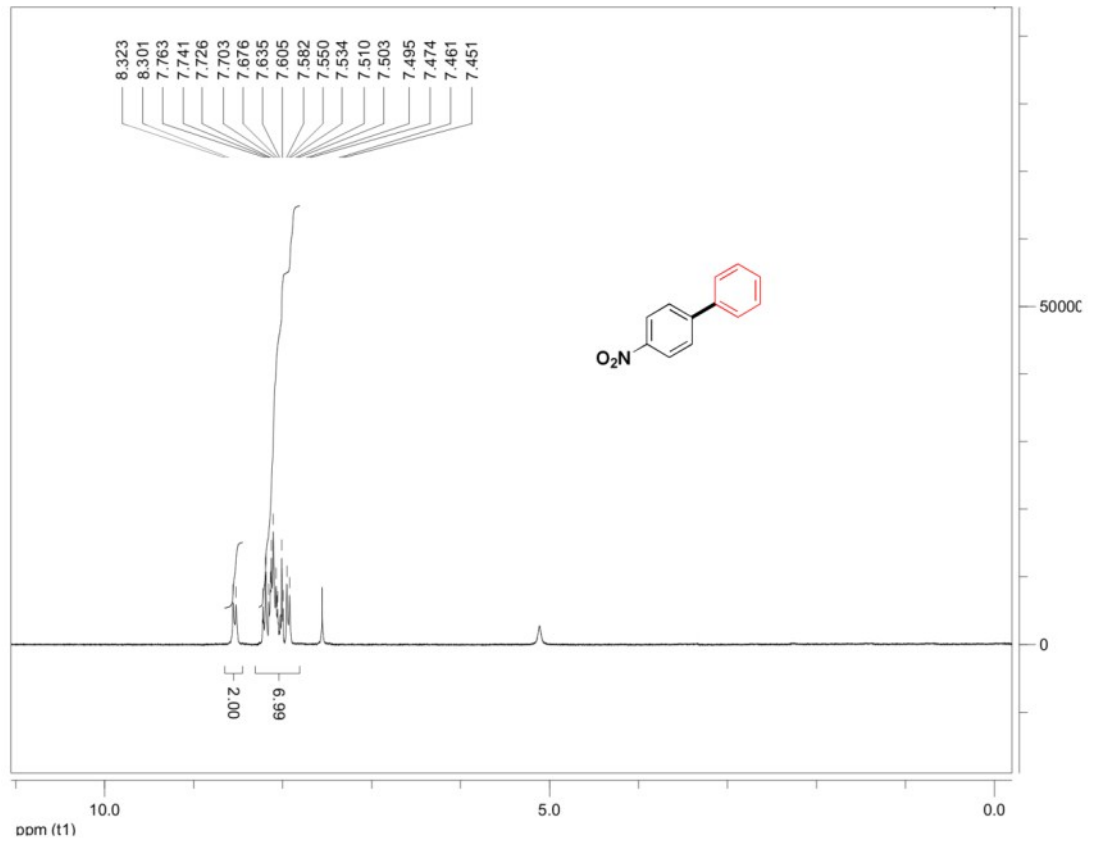


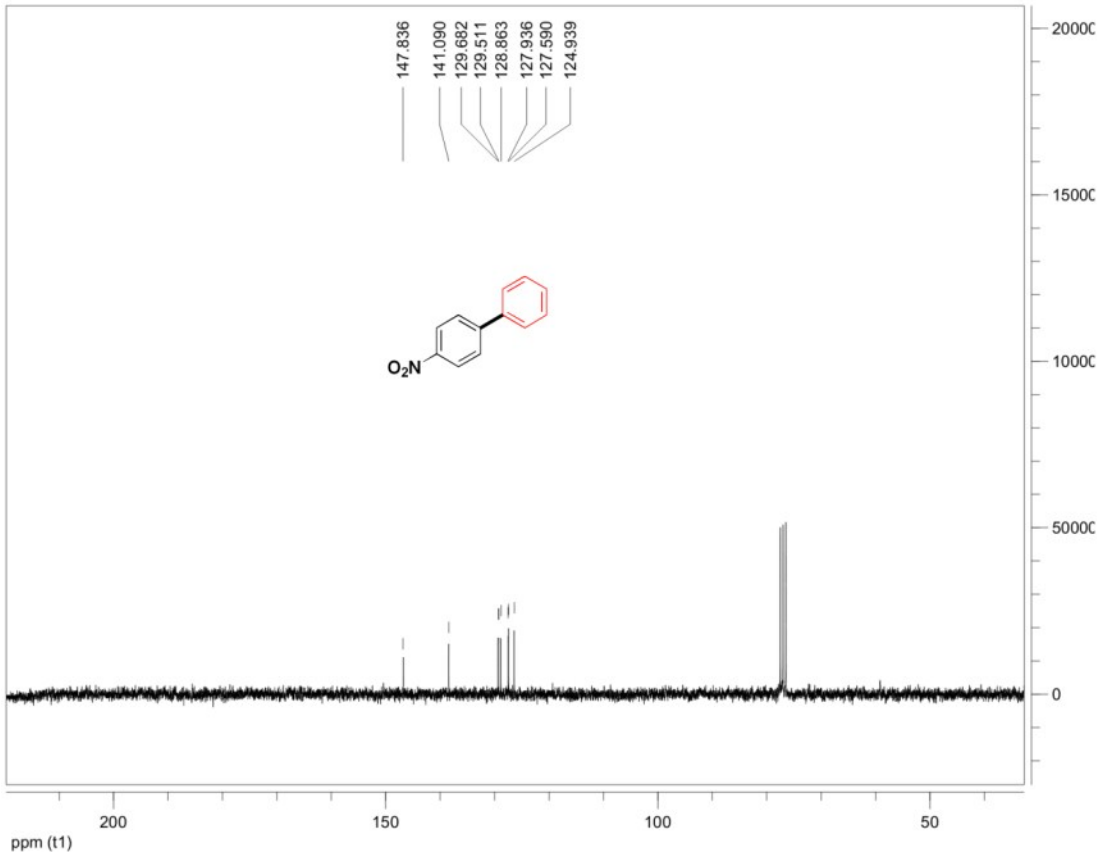
2.15. 4,4'-Dimethyl-1,1'-biphenyl (5c)



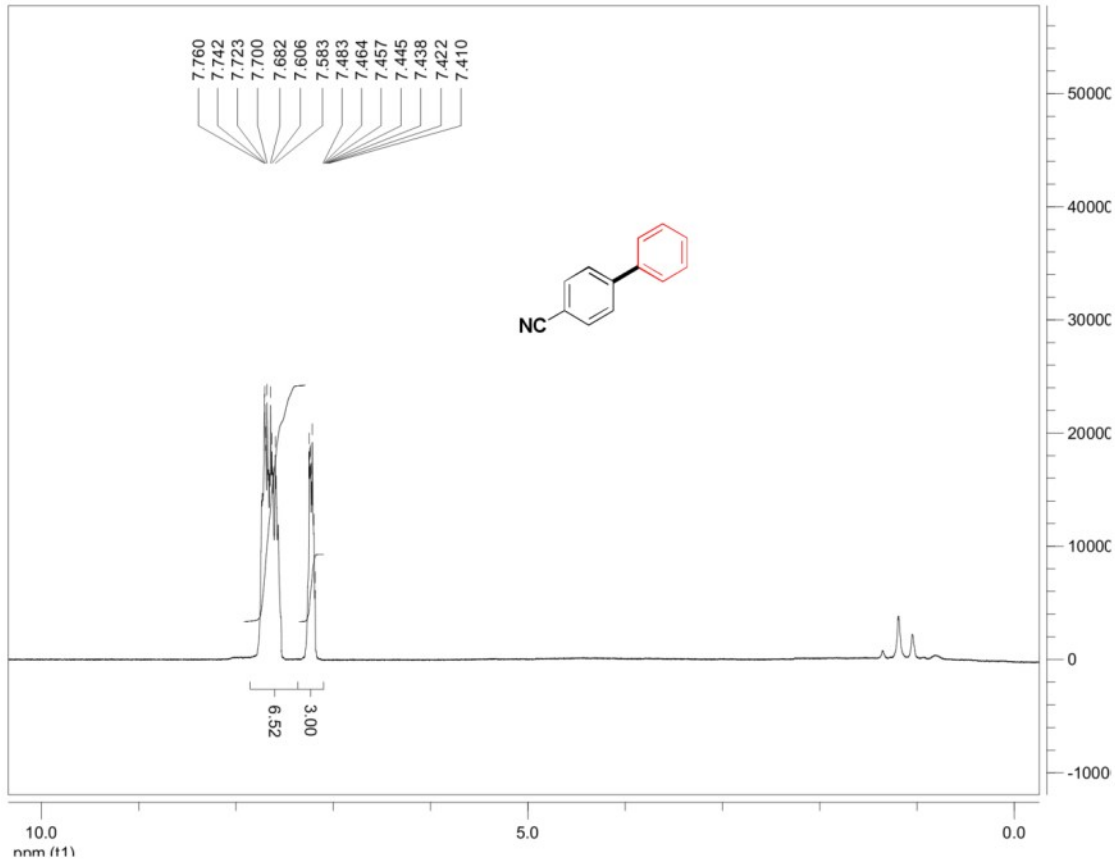


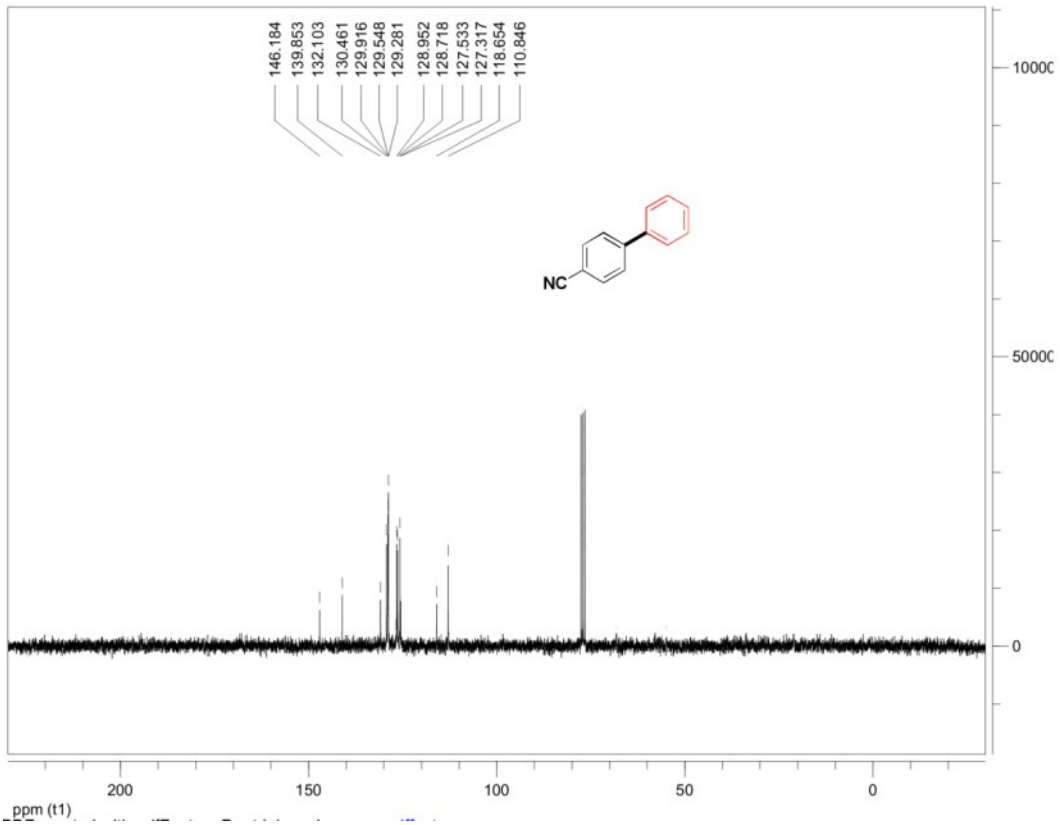
2.16. 4-Nitro-1,1'-biphenyl (5d)



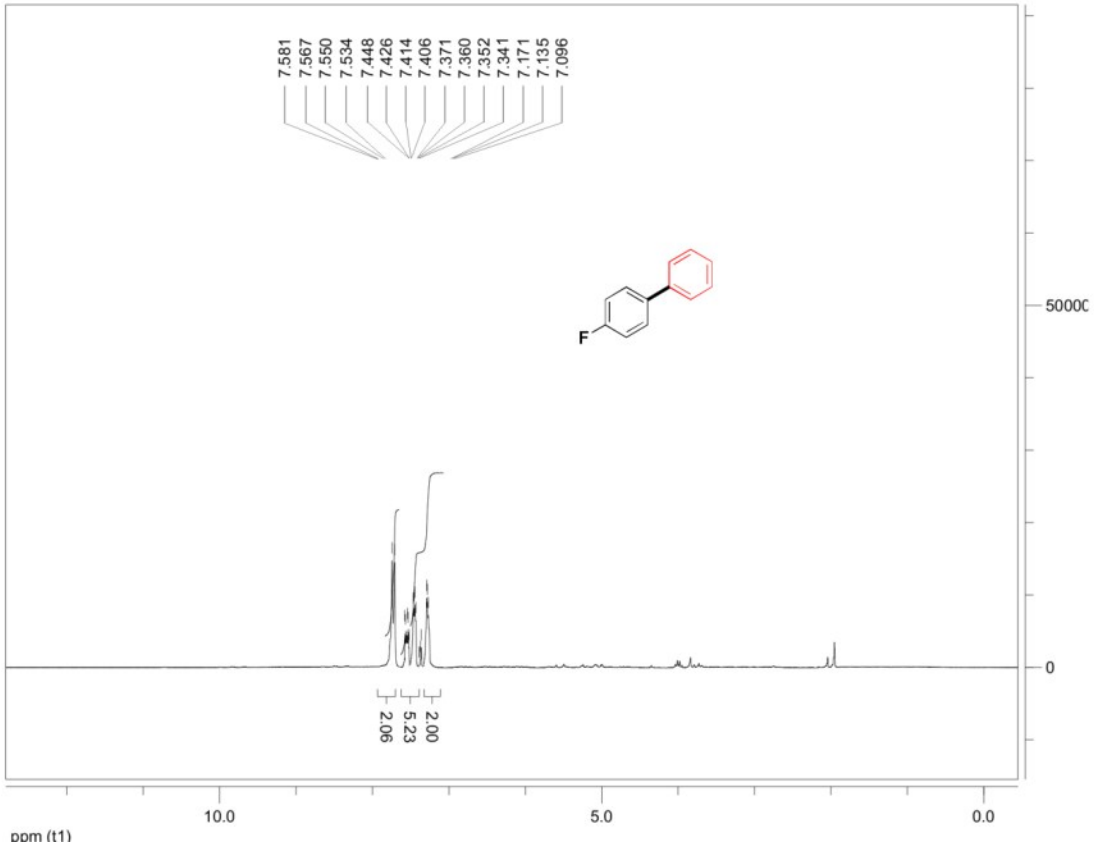


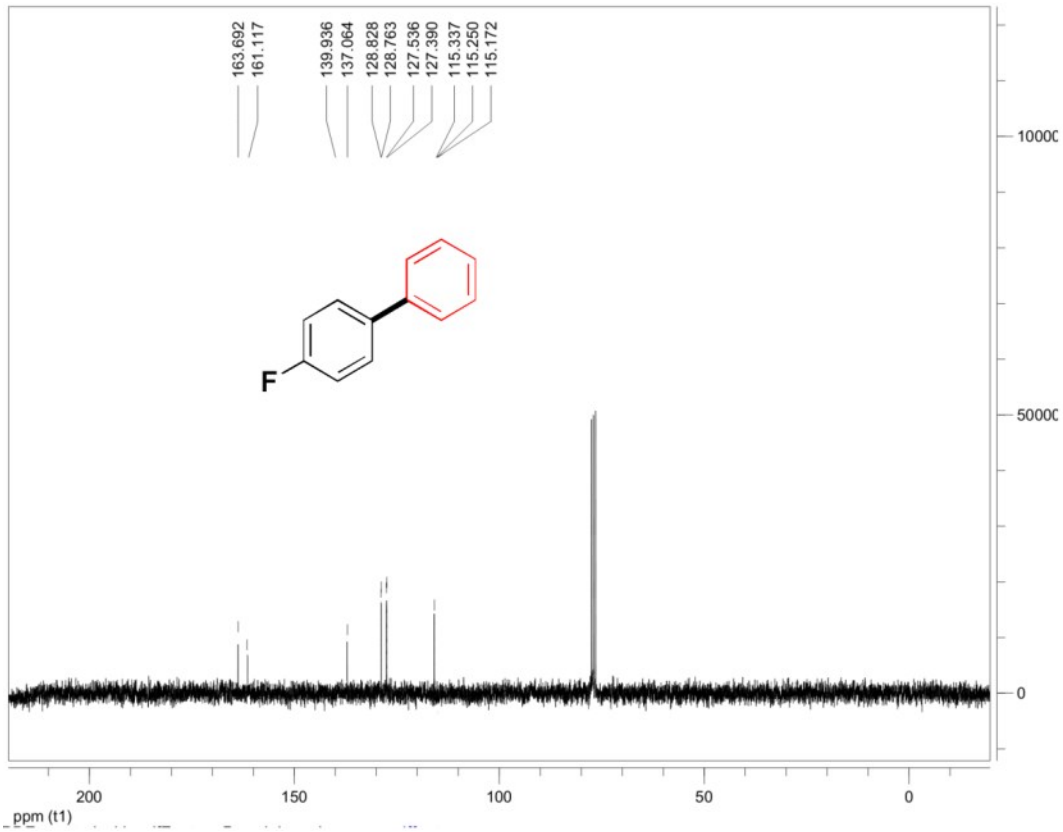
2.17. [1,1'-Biphenyl]-4-carbonitrile (5e)



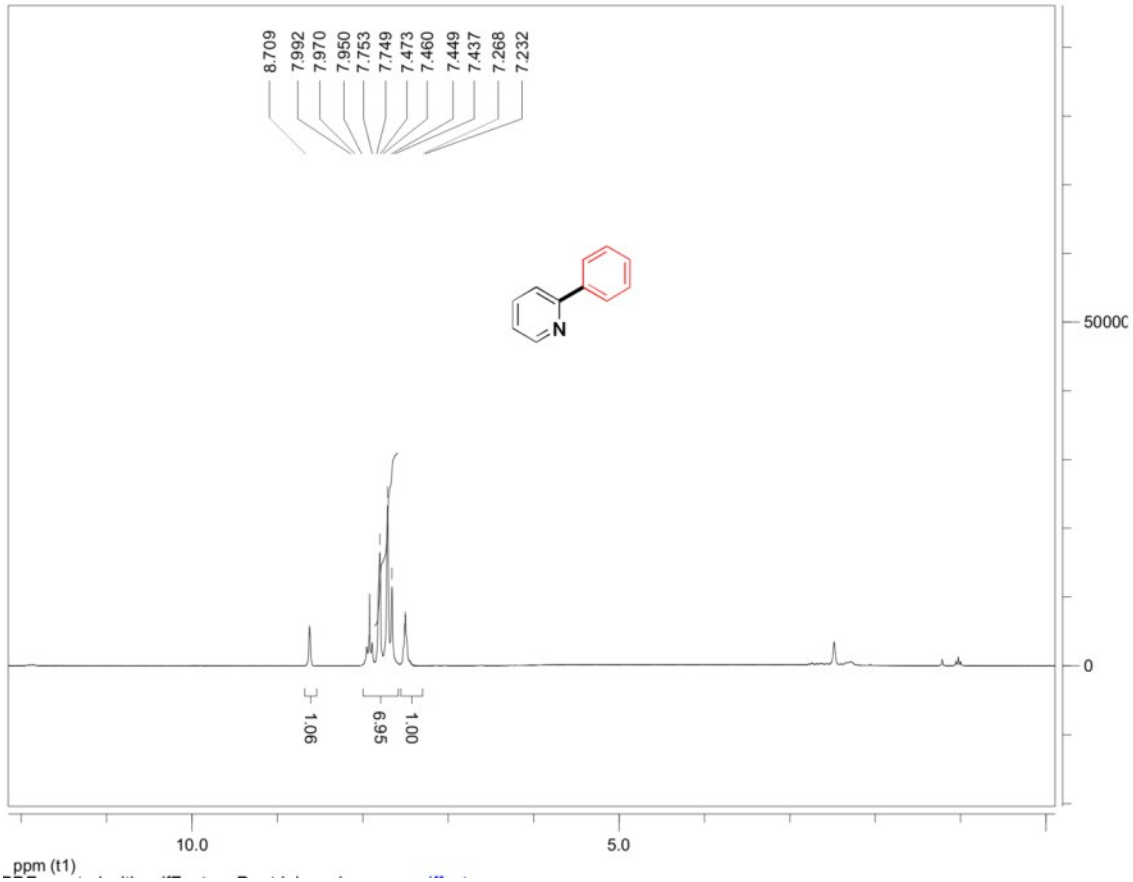


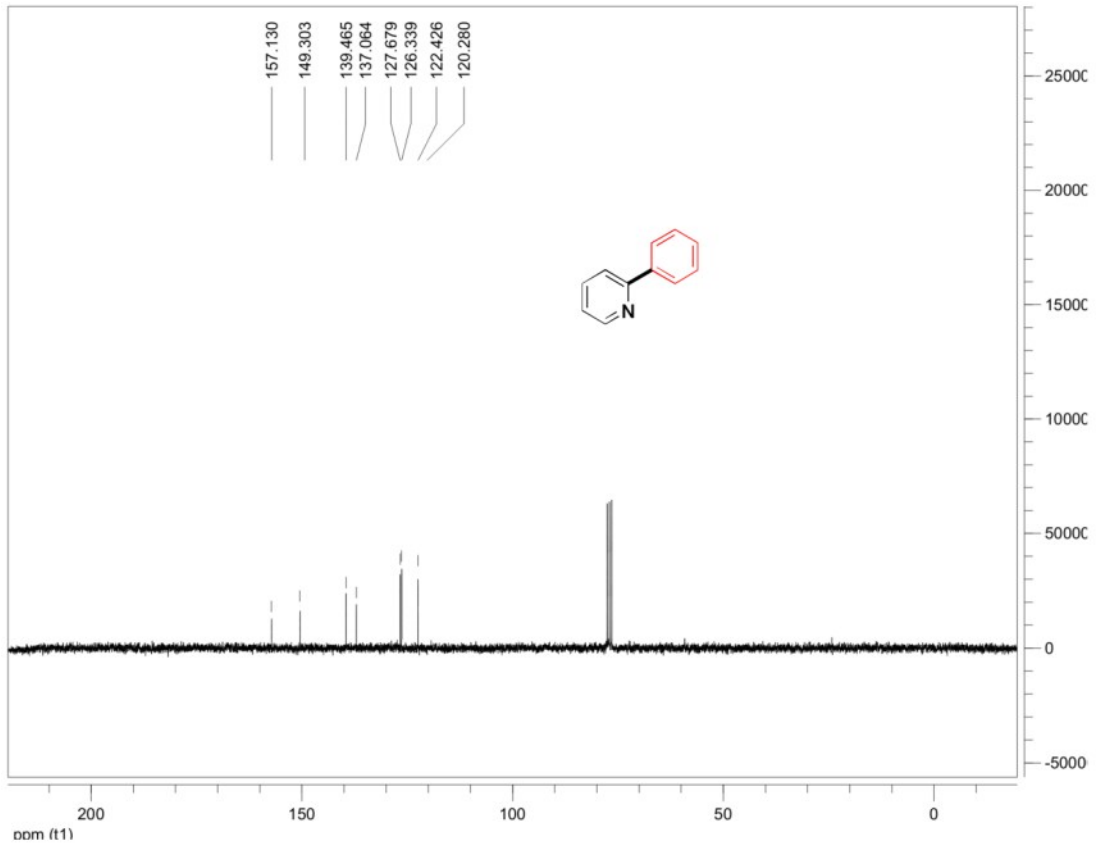
2.18. 2.6. 4-Fluoro-1,1'-biphenyl (5f)



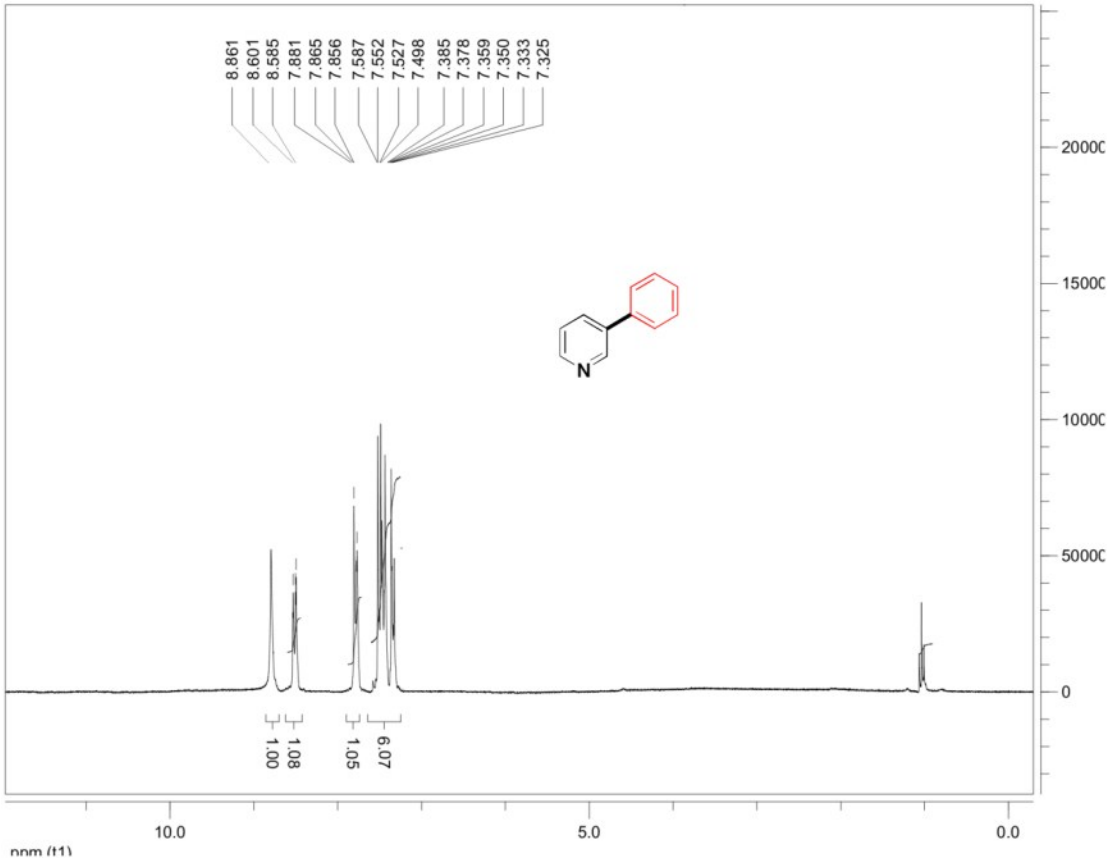


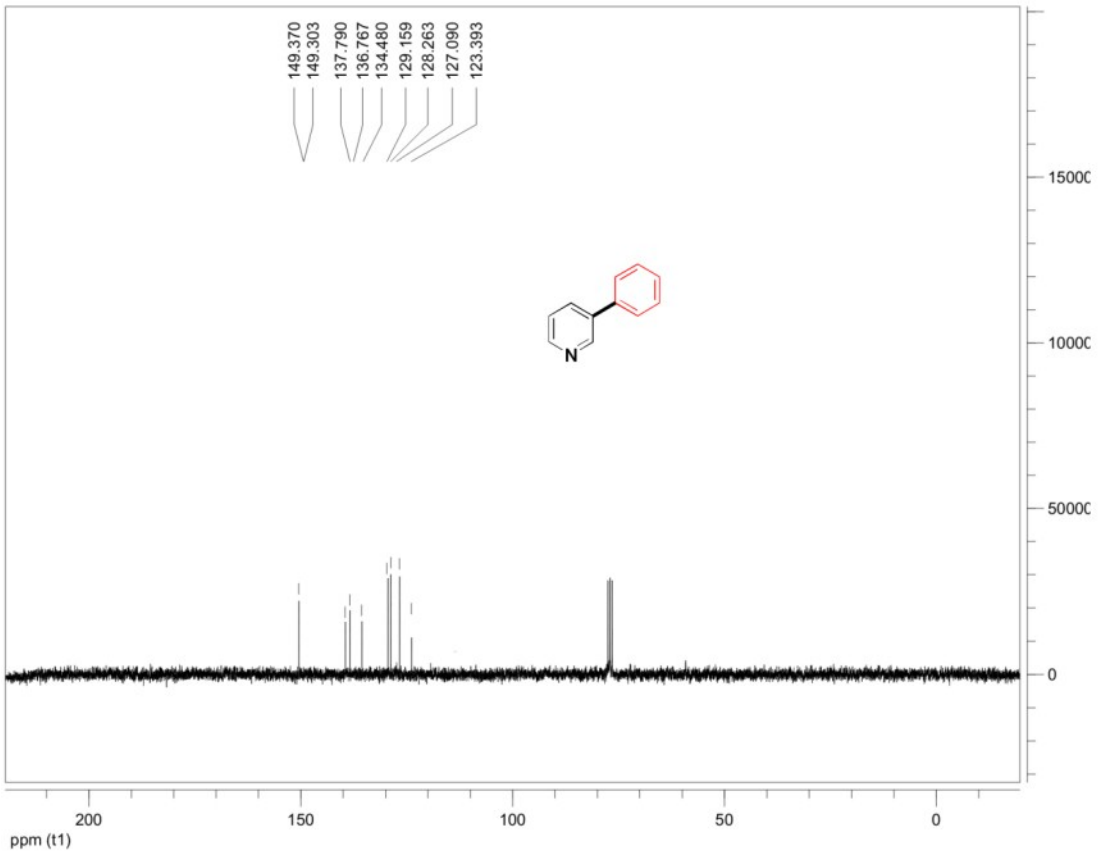
2.19. 2-Phenylpyridine (5g)



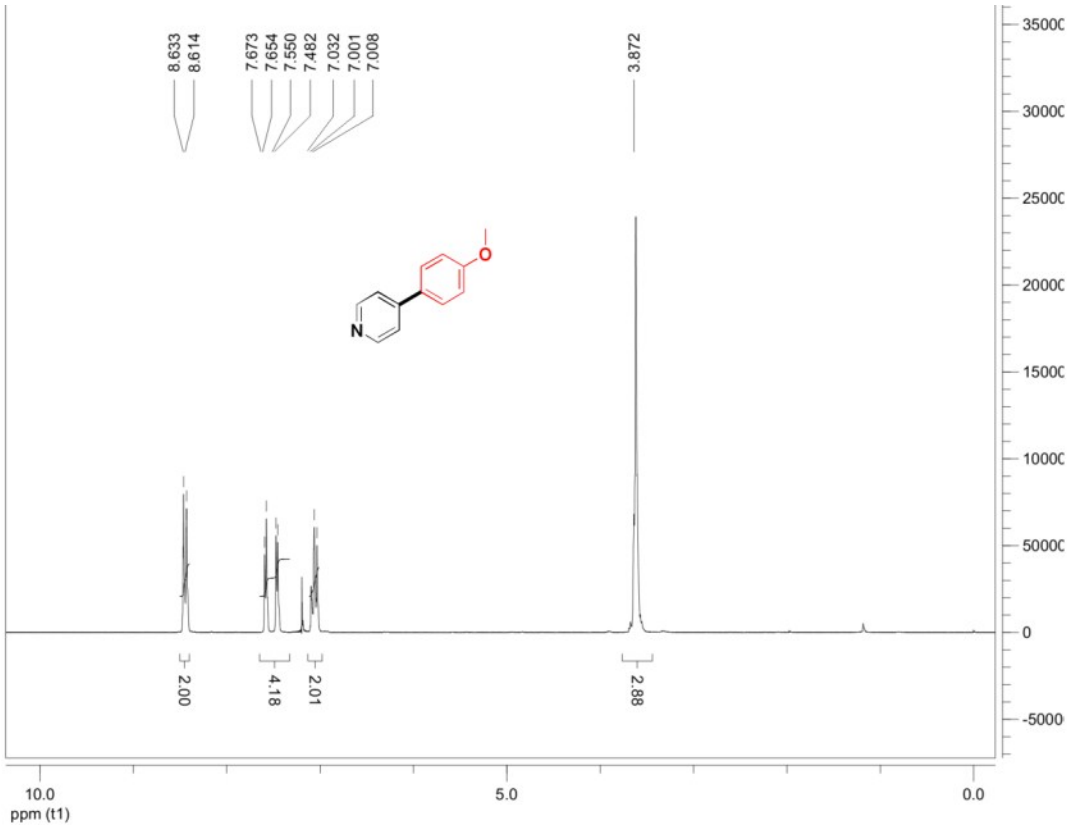


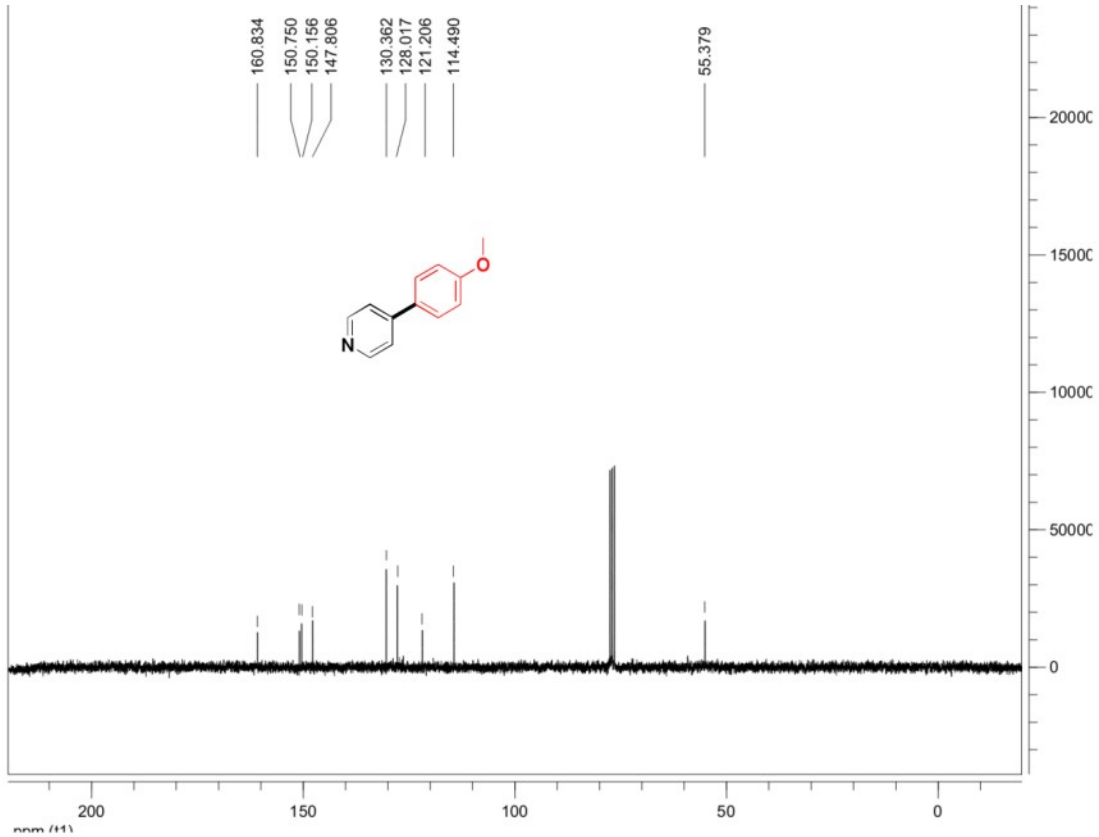
2.20. 3-Phenylpyridine (5h)



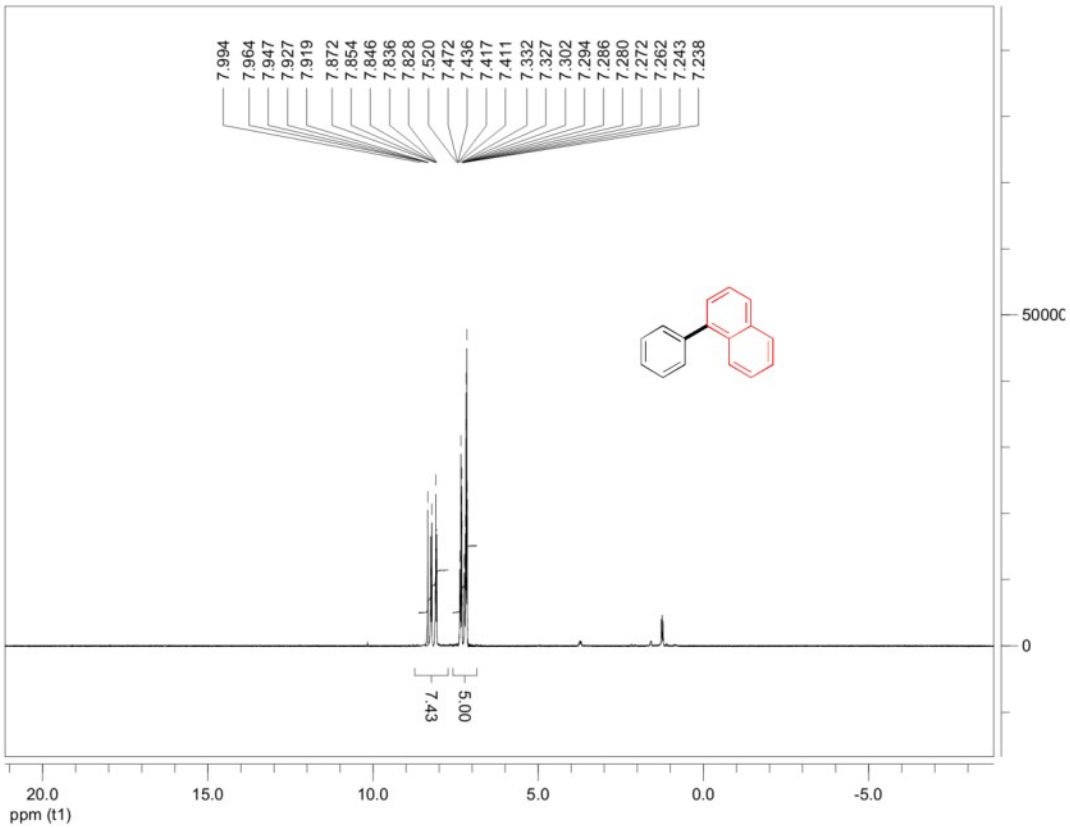


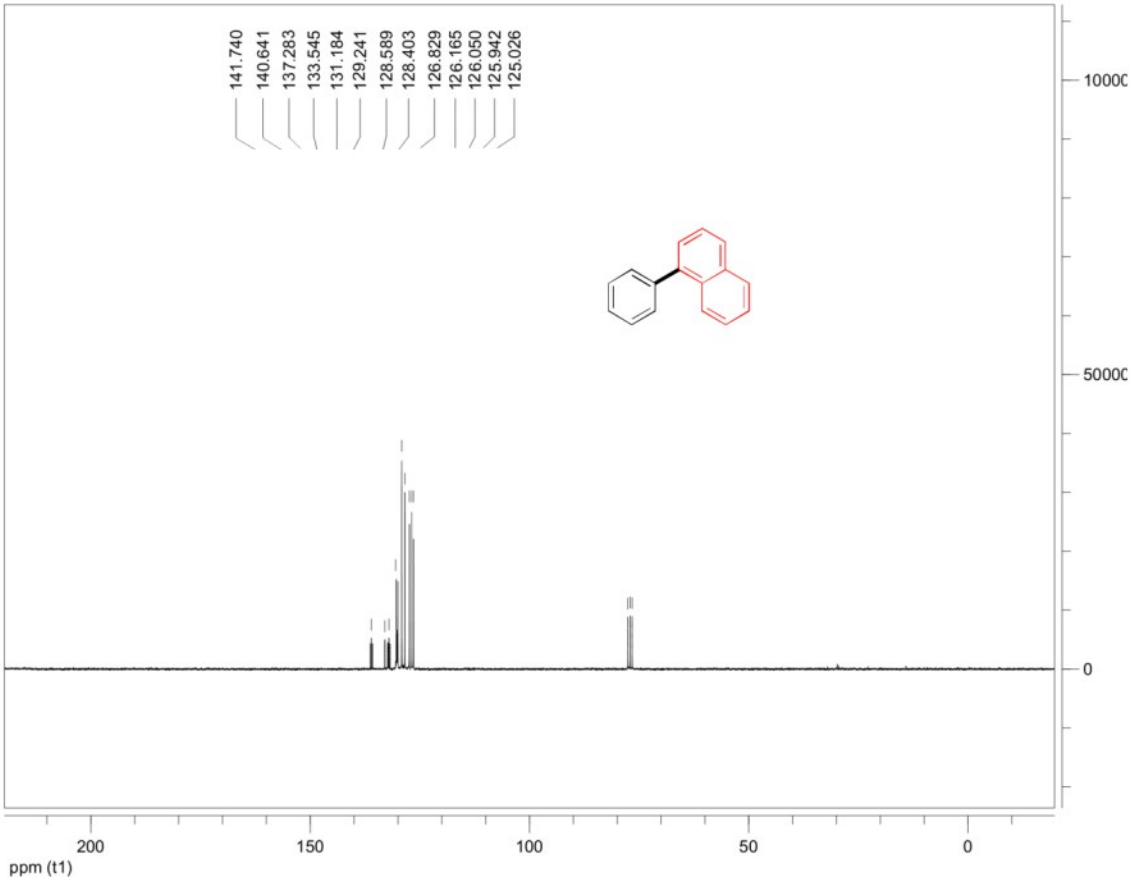
2.21. 4-(4-Methoxyphenyl)pyridine (5i)



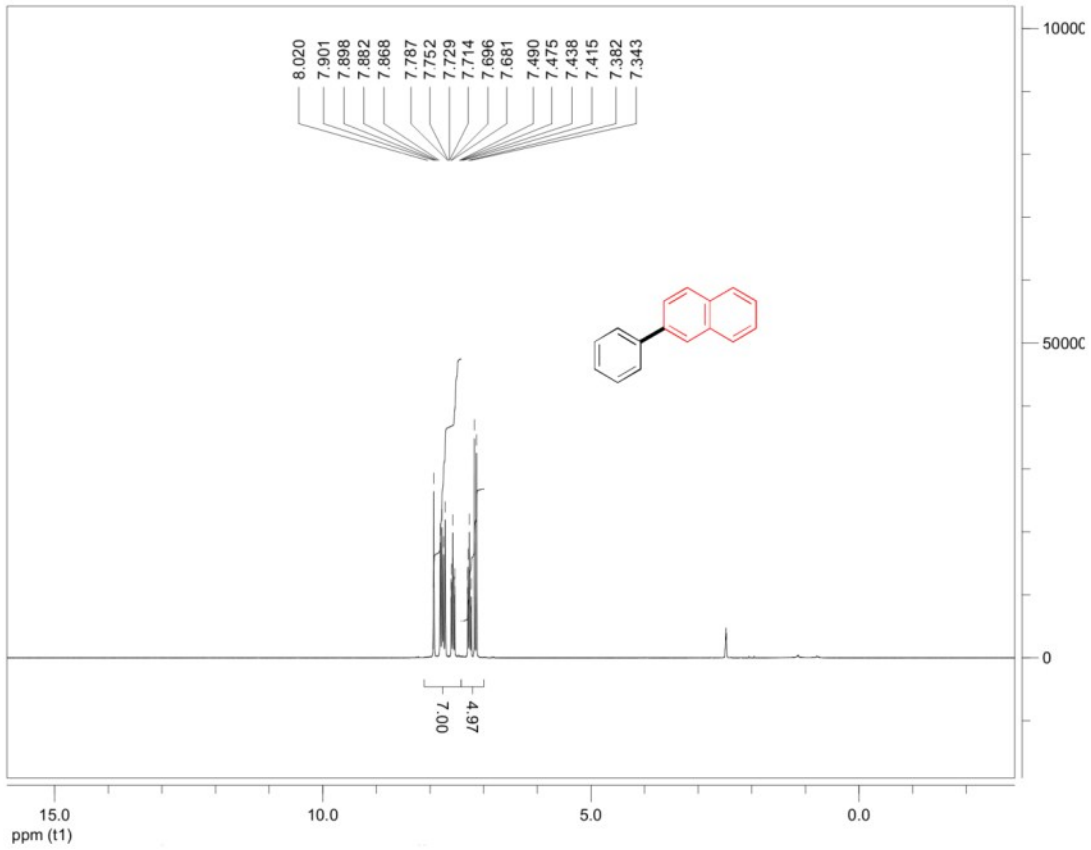


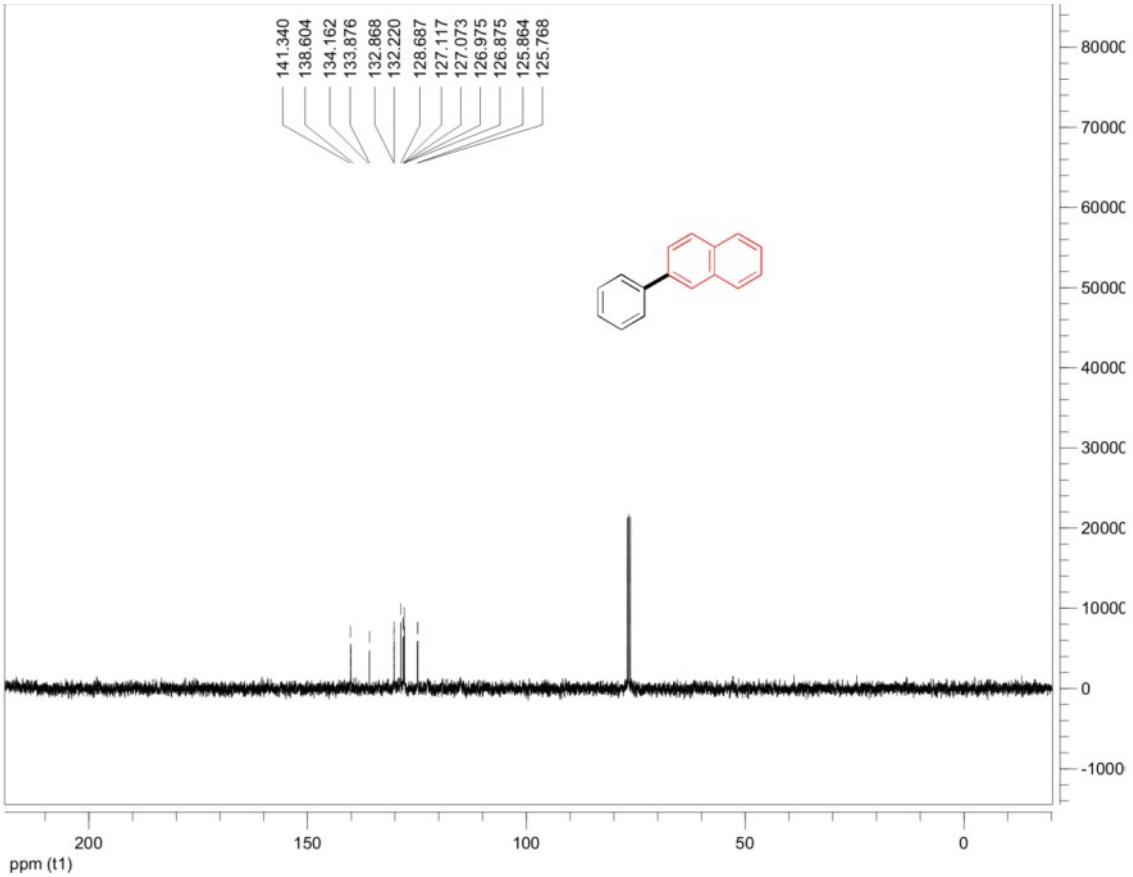
2.22. 1-Phenylnaphthalene (5j)



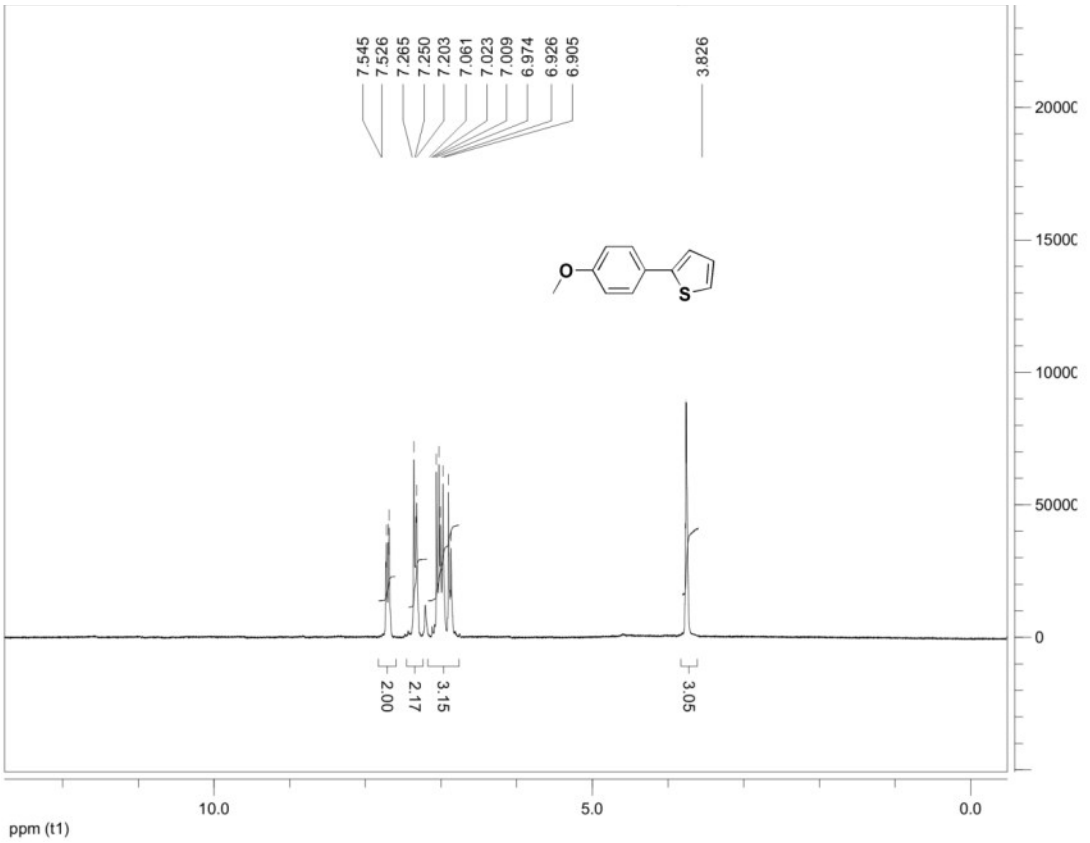


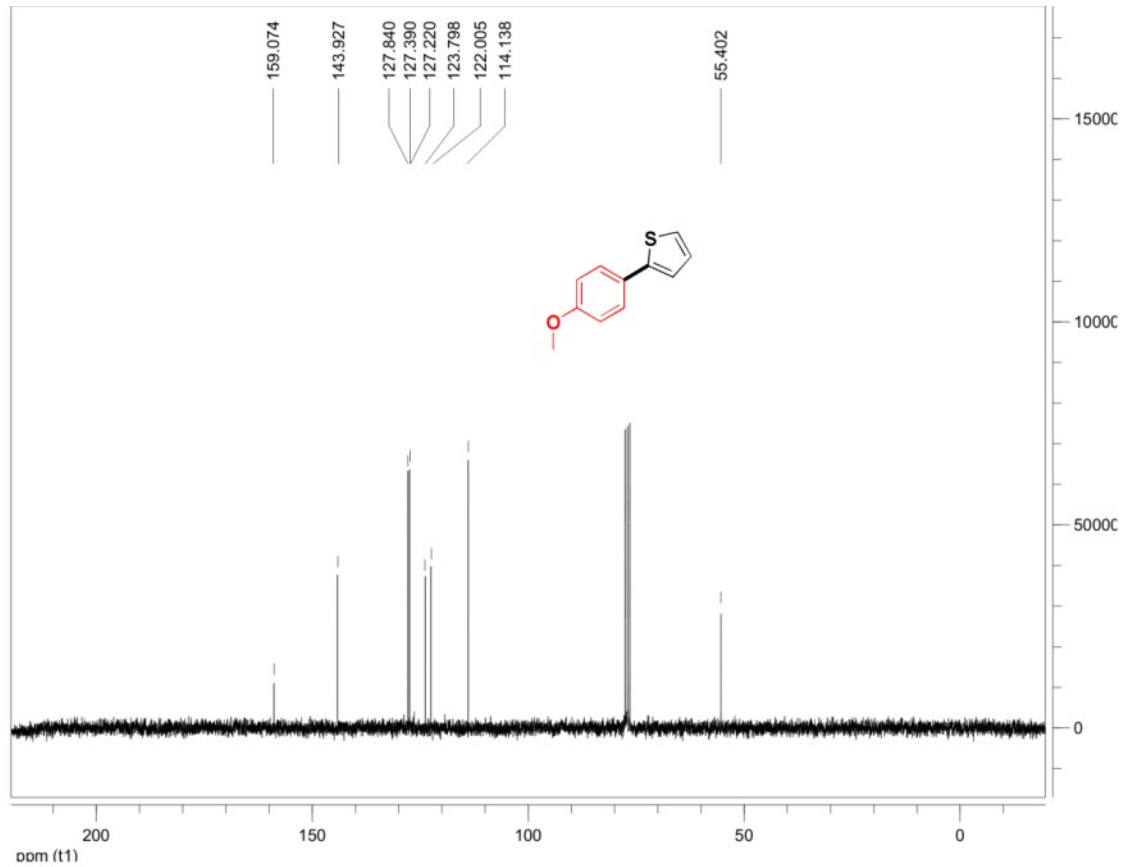
2.23. 2-Phenylnaphthalene (5k)



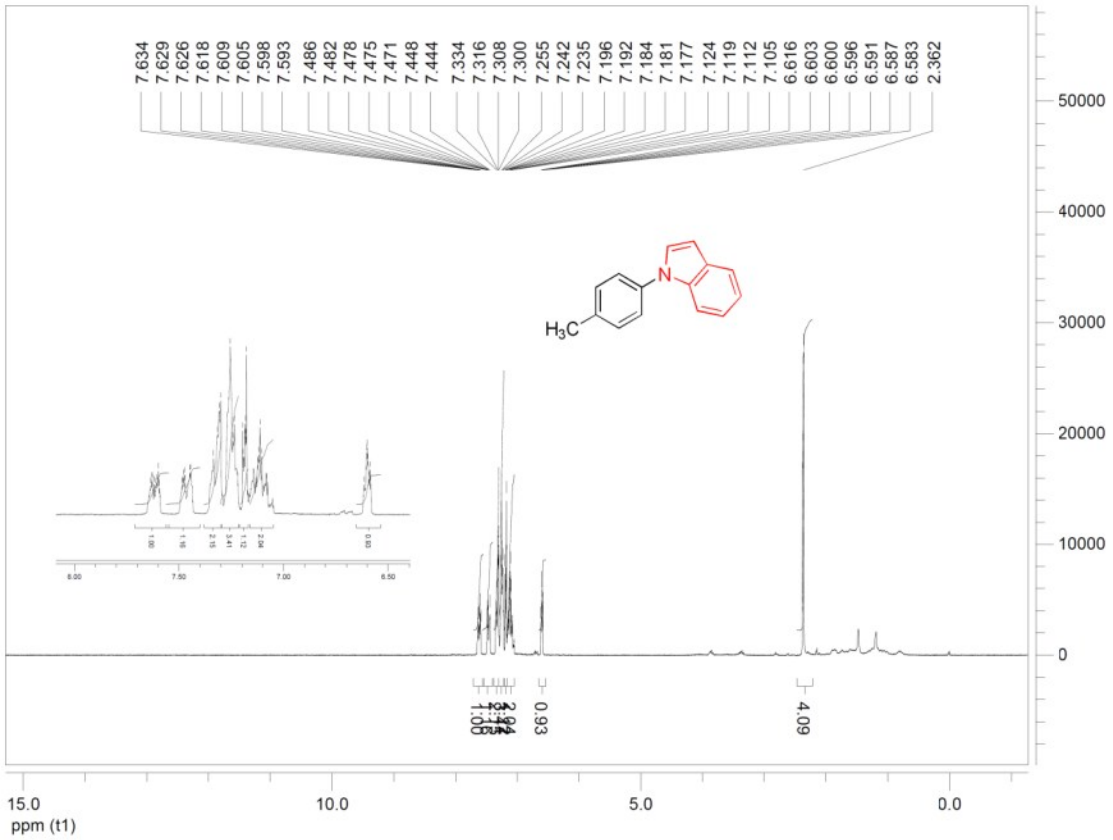


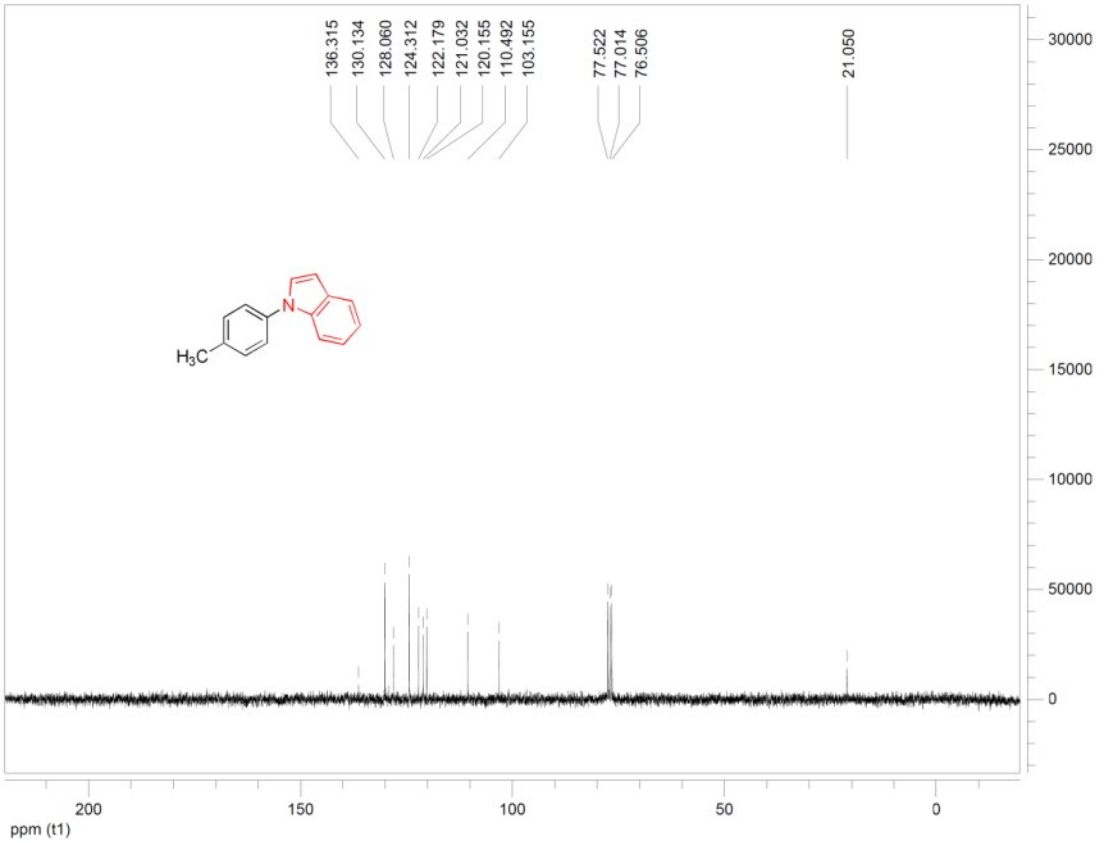
2.24. 2-(4-Methoxyphenyl)thiophene (5l)



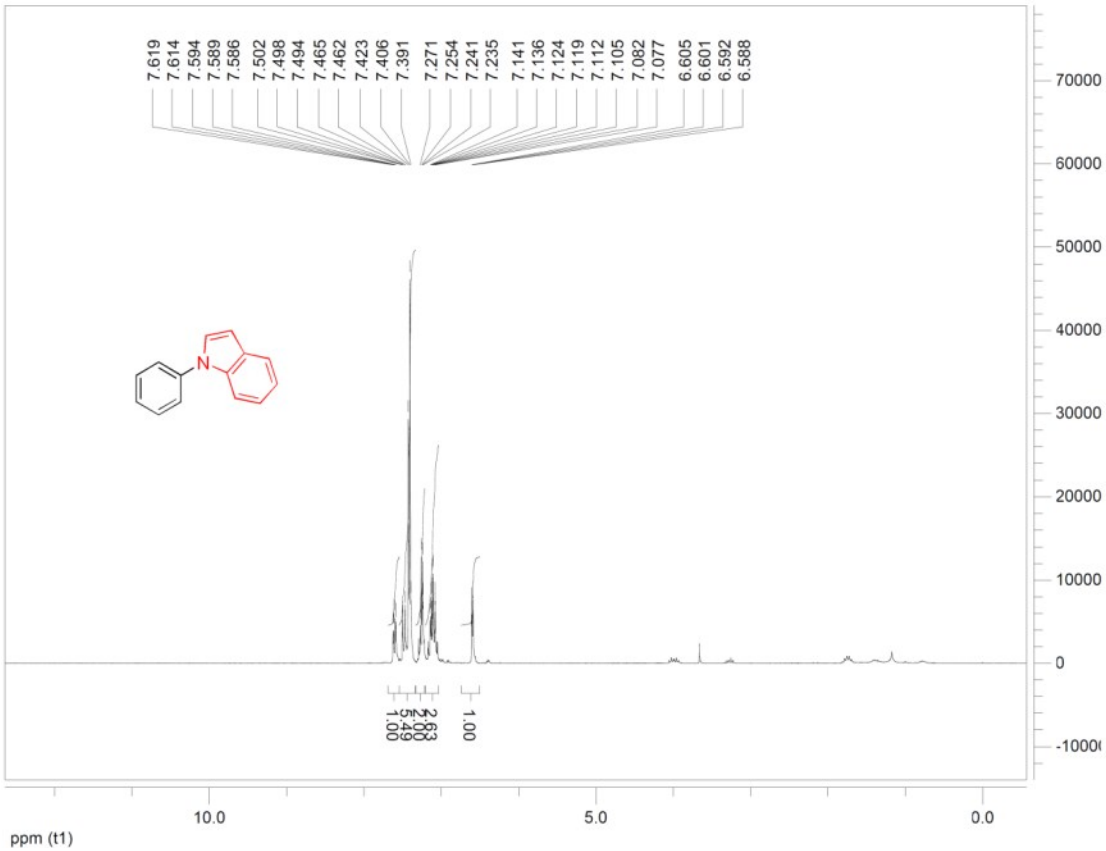


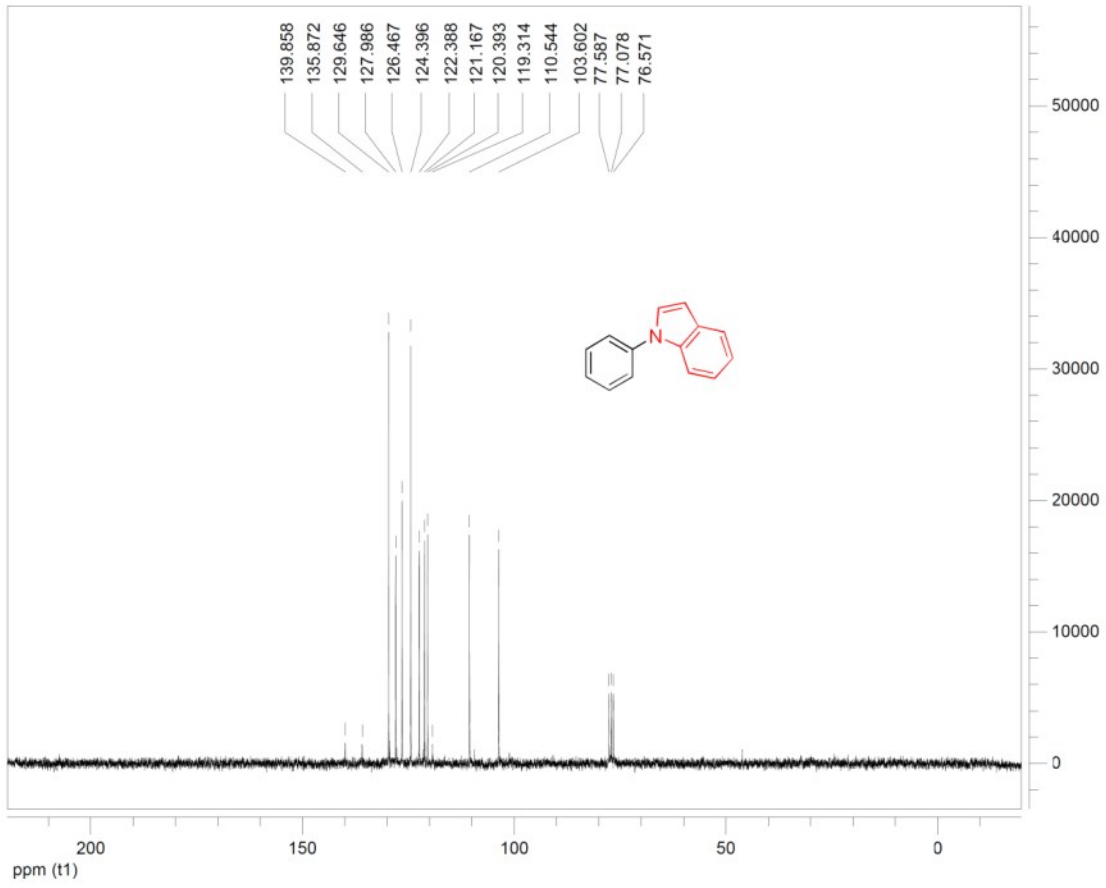
2.25. 1-*p*-Tolyl-*1H*-indole (7a)



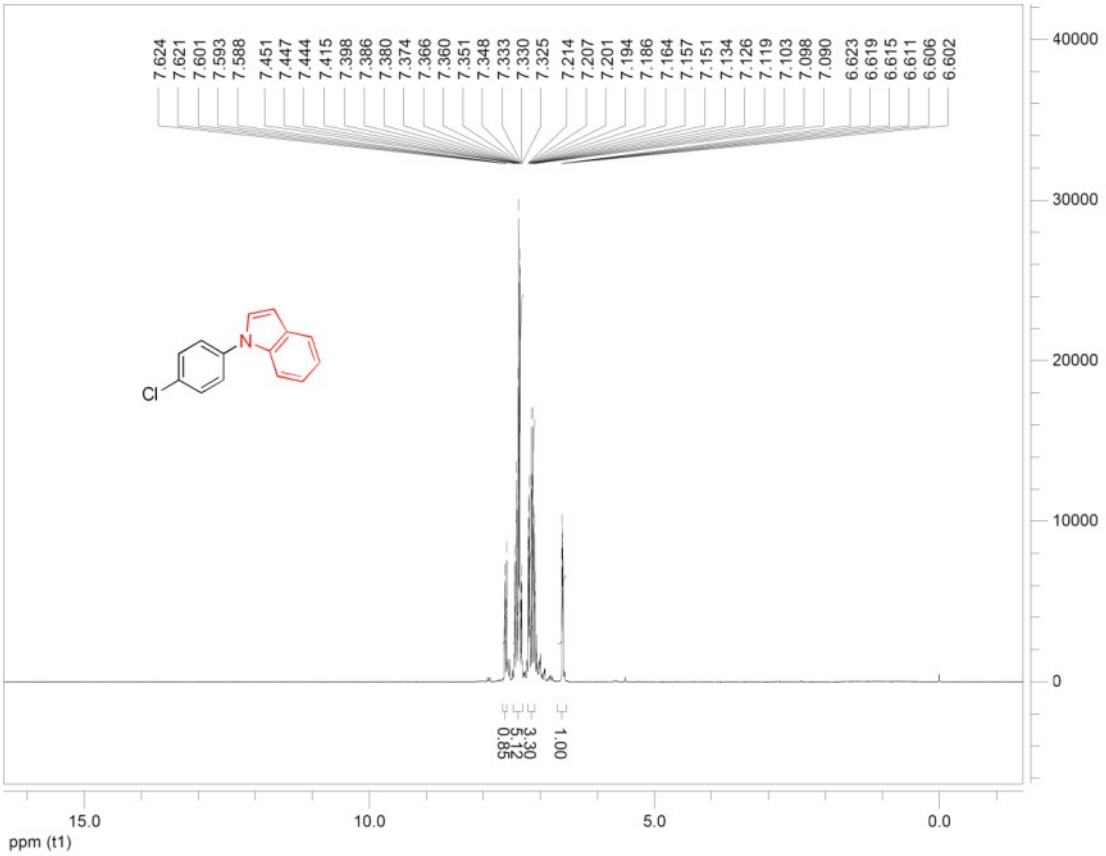


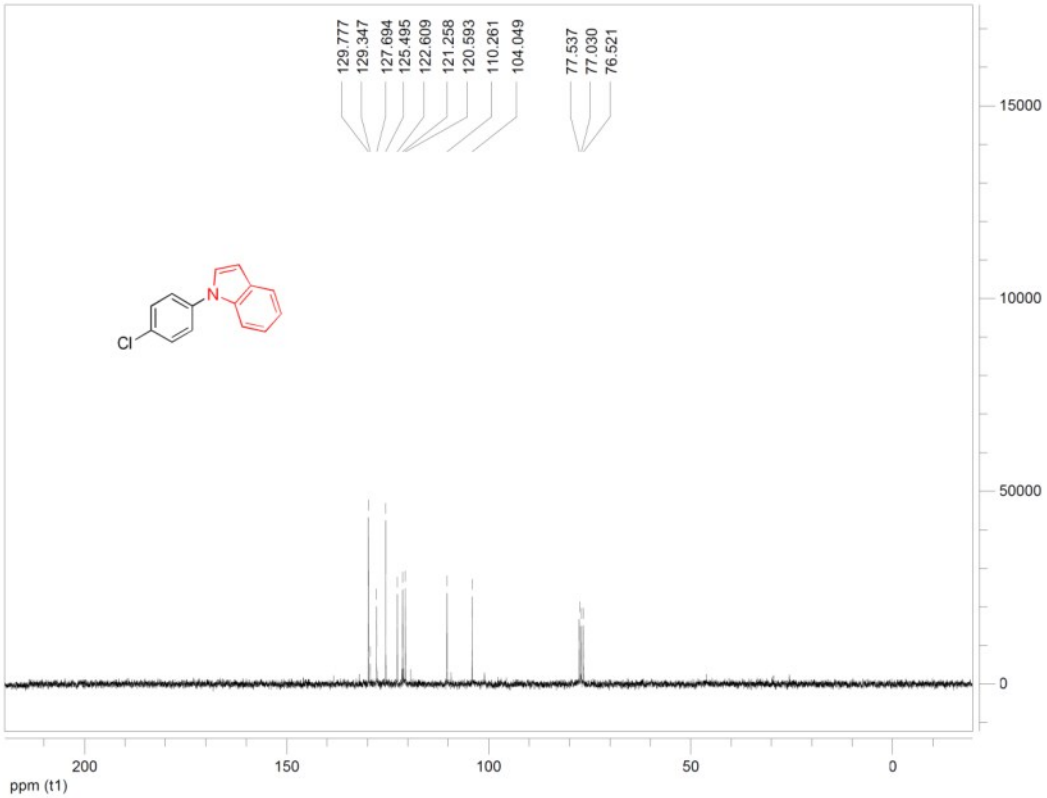
2.26. 1-Phenyl-*1H*-indole (7b)



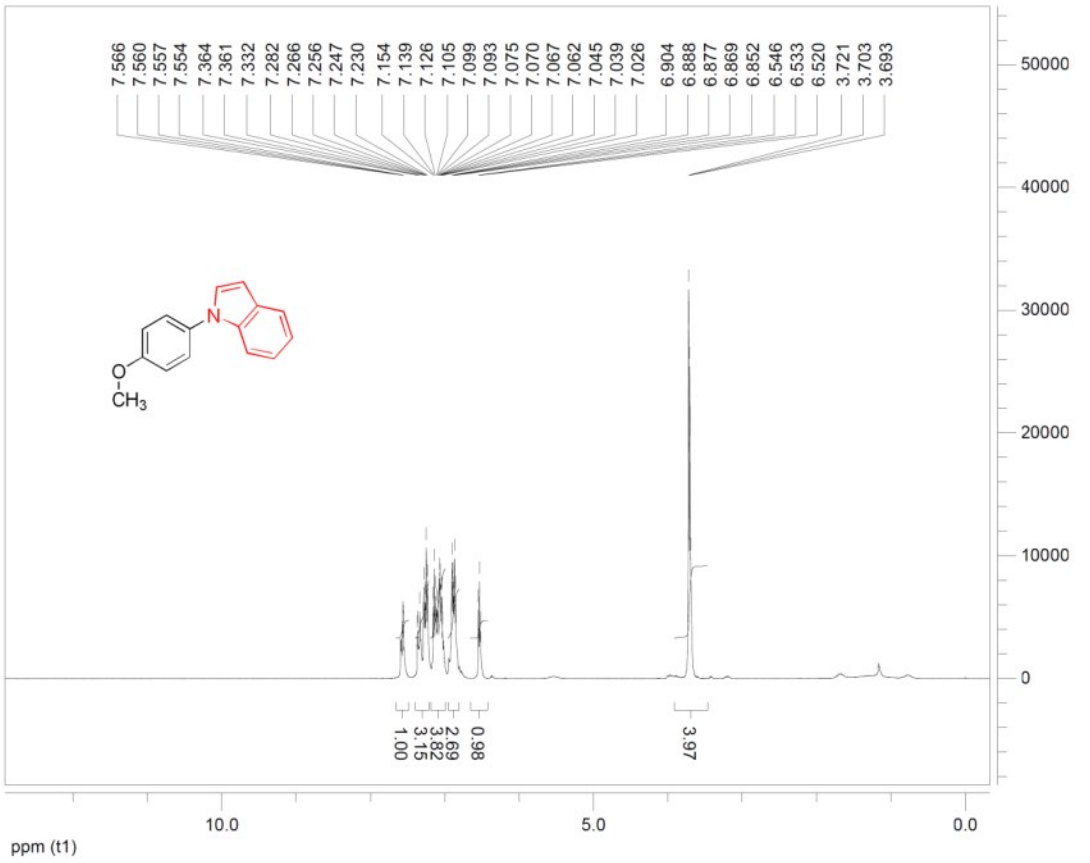


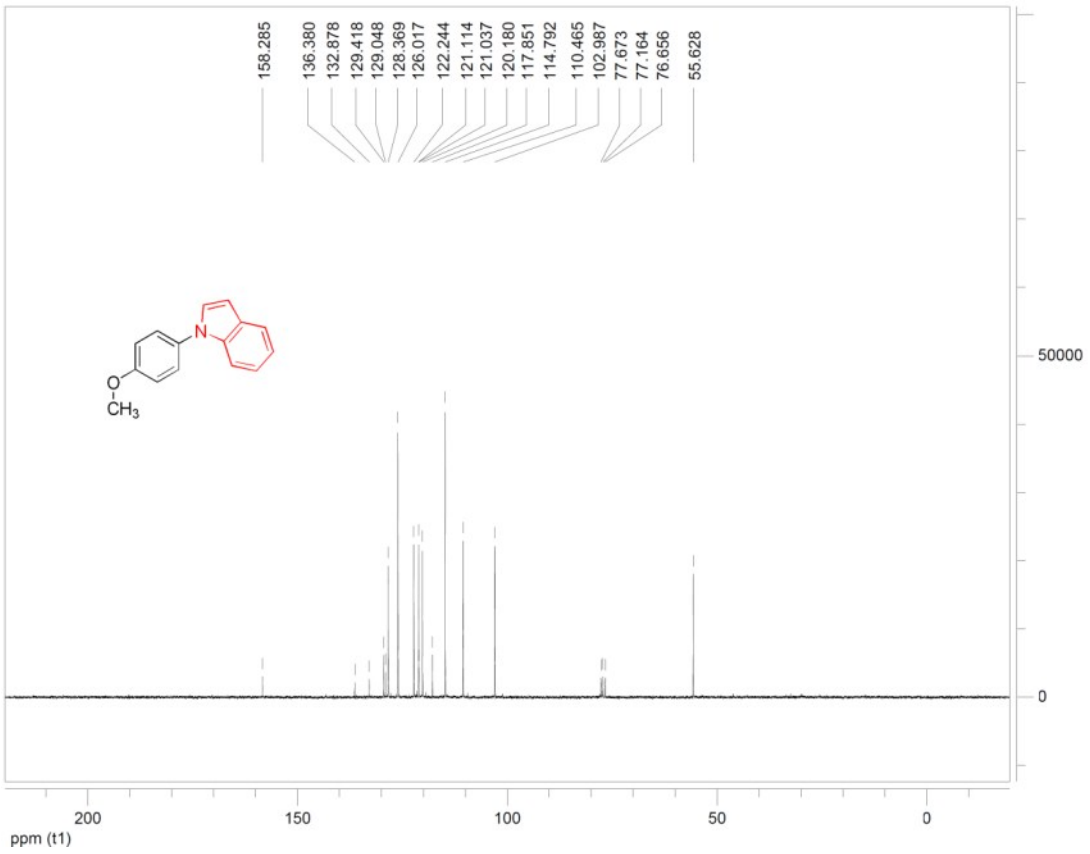
2.27. 1-(4-Chlorophenyl)-*1H*-indole (7c)



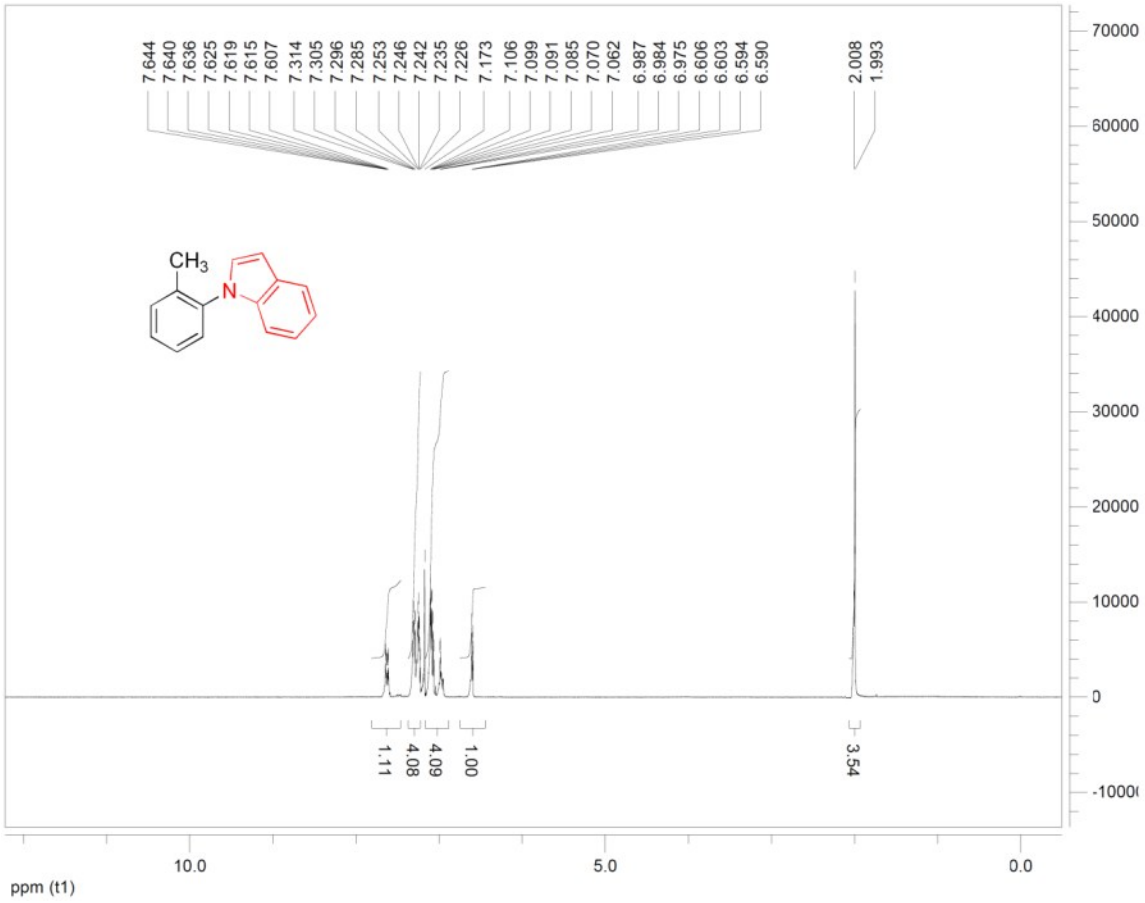


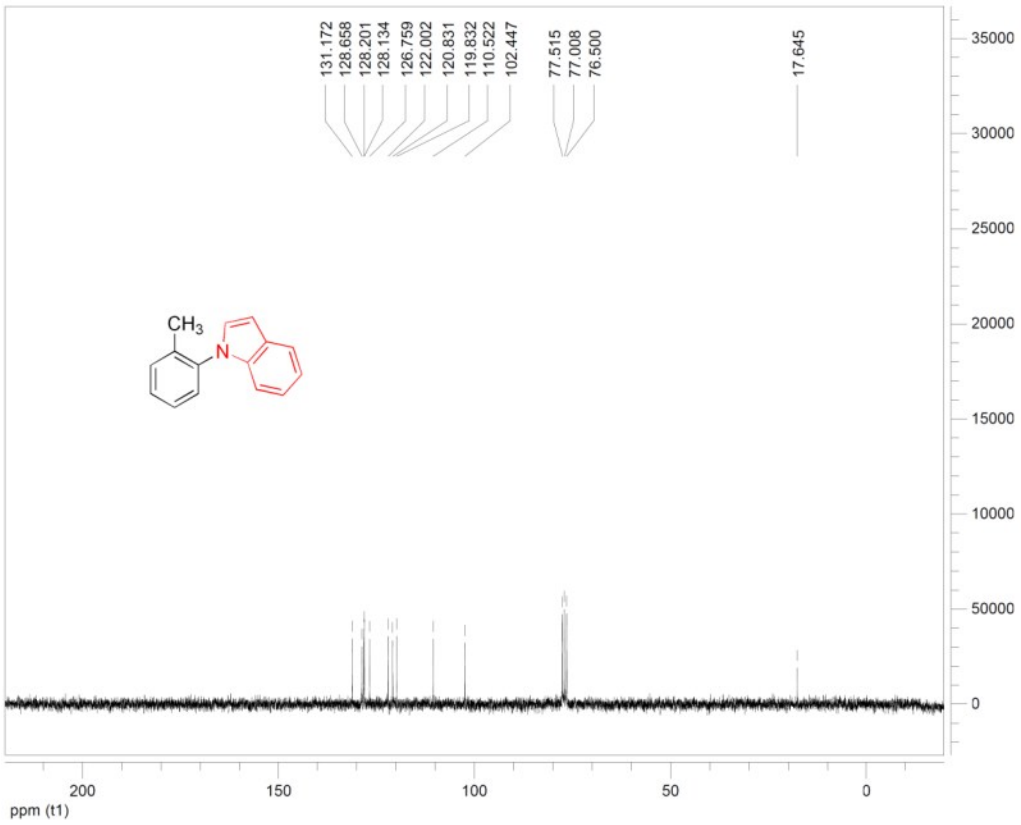
2.28. 1-(4-Methoxyphenyl)-*1H*-indole (7d)



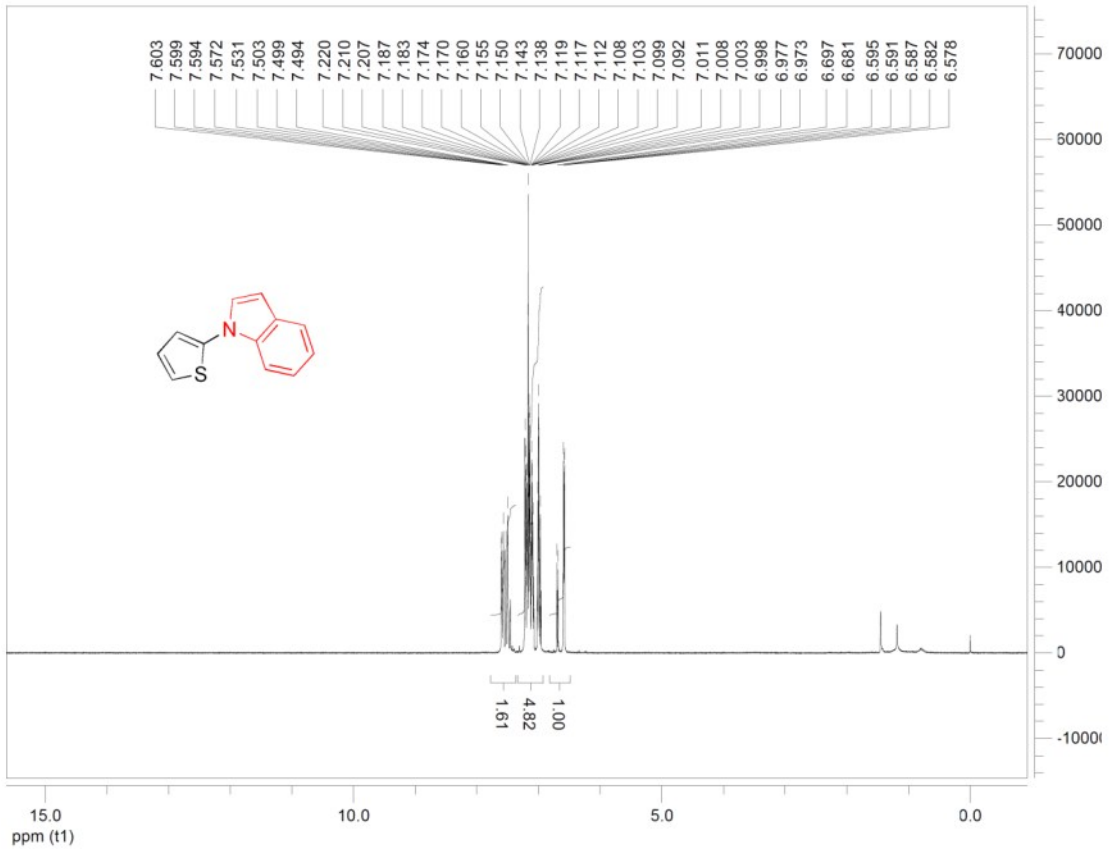


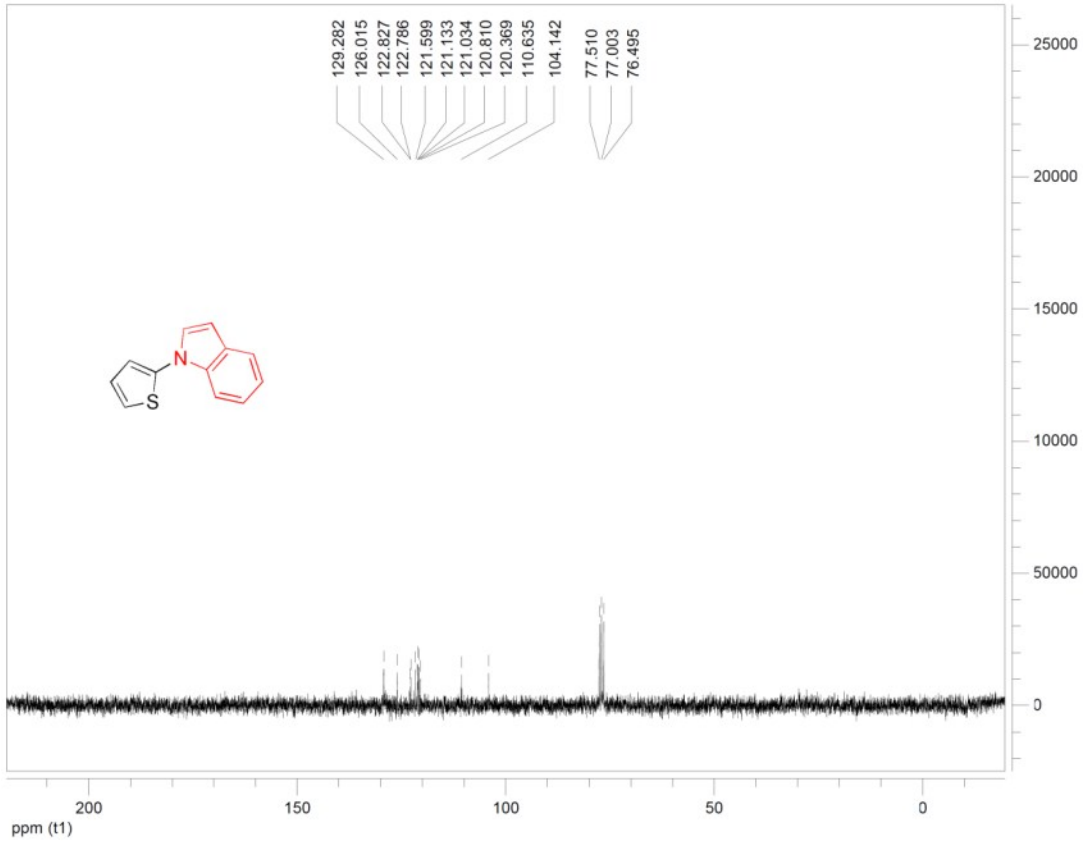
2.29. 1-*o*-Tolyl-*1H*-indole (7e)



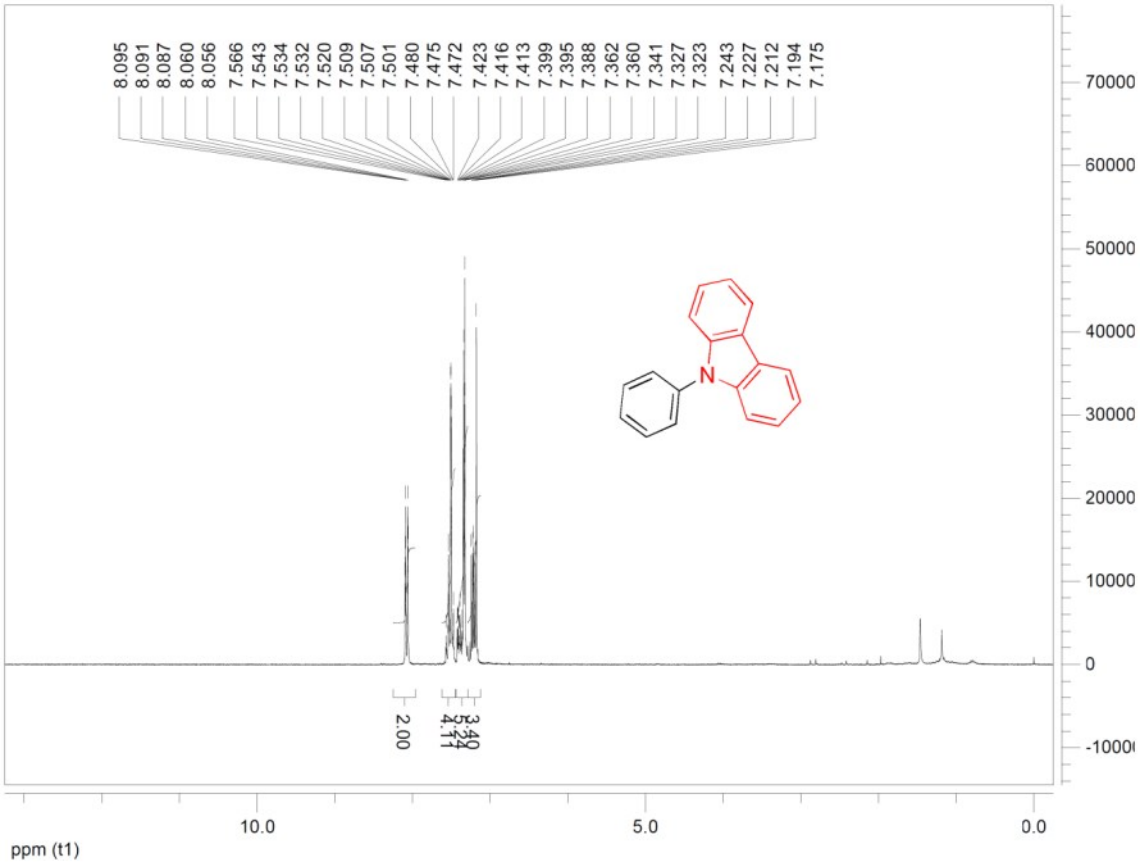


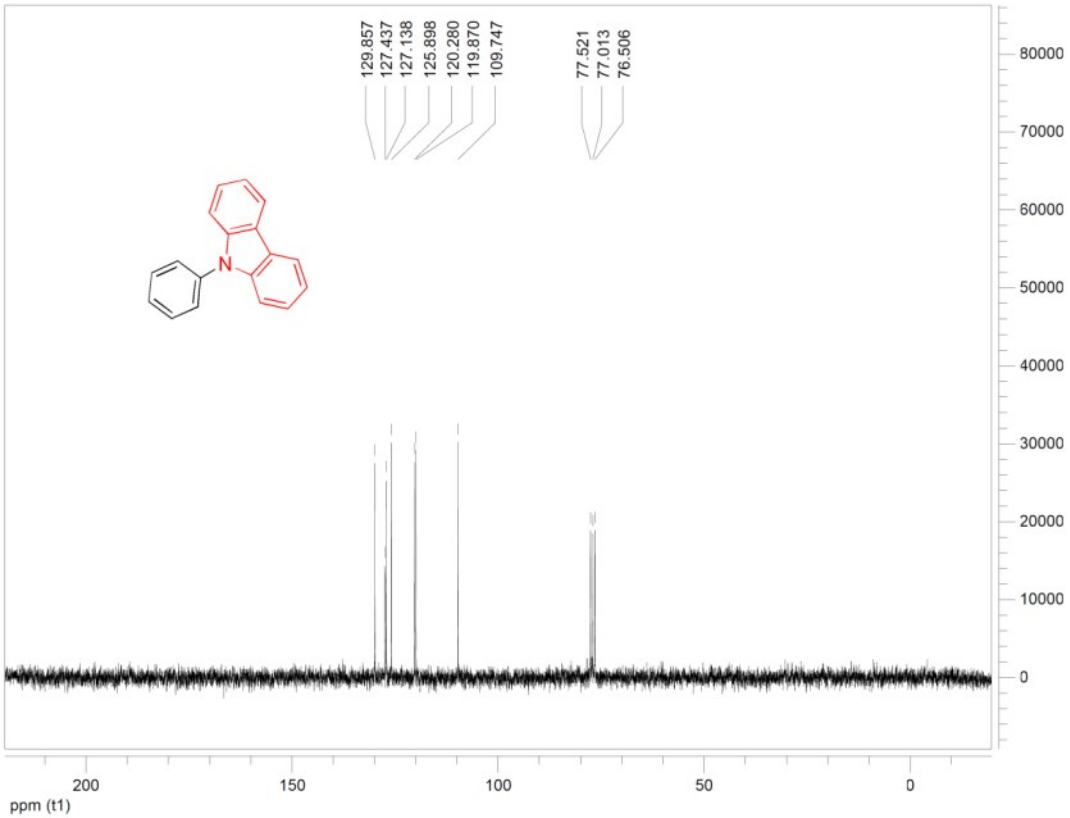
2.30. 1-(Thiophen-2-yl)-*1H*-indole (7f)



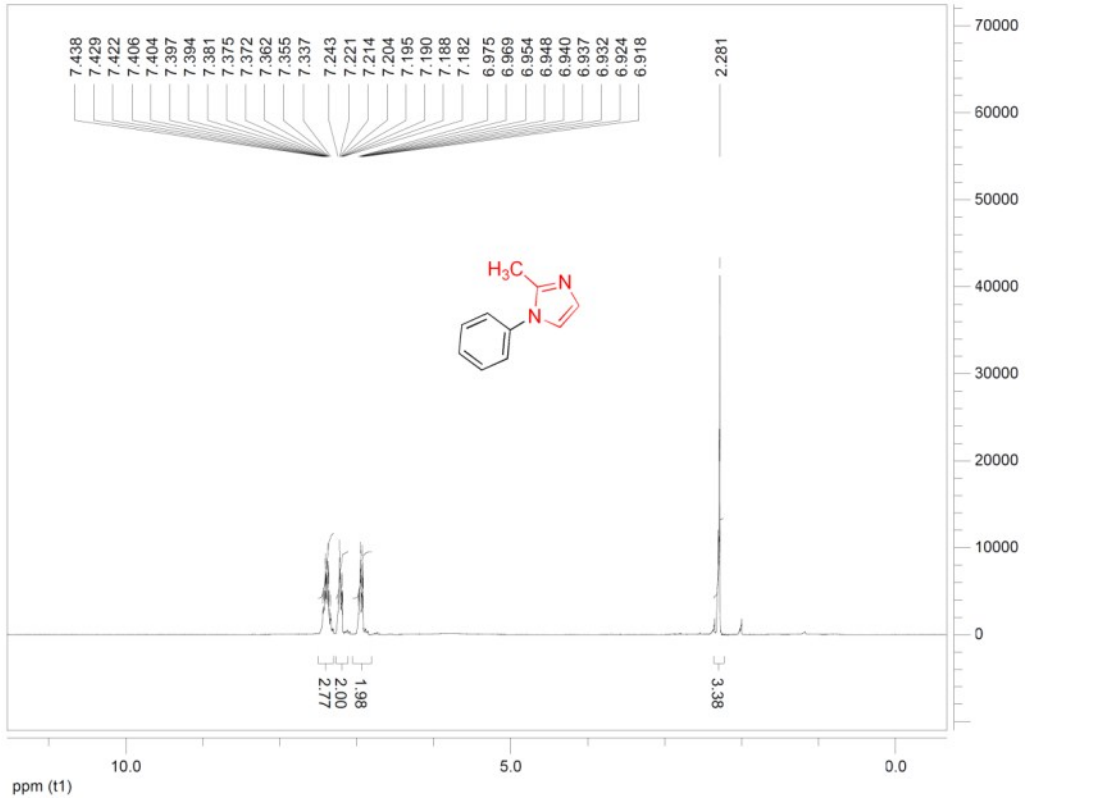


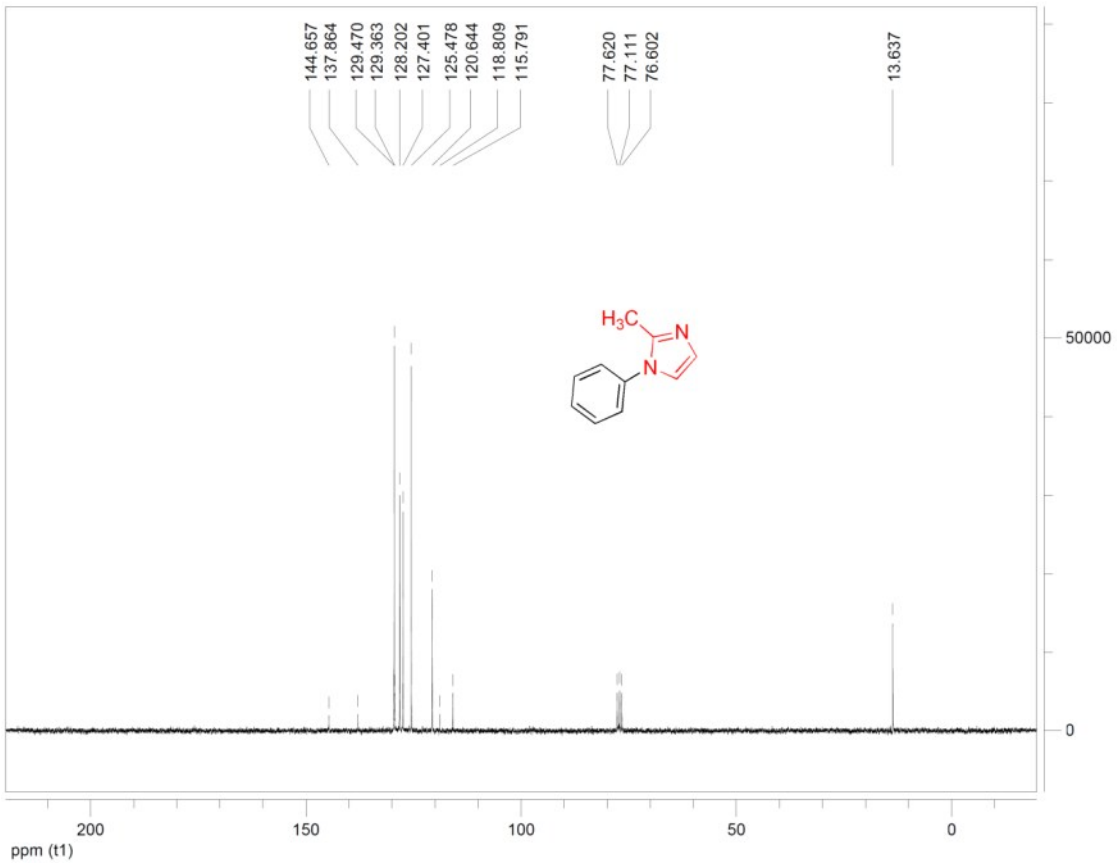
2.31. 9-Phenyl-9H-carbazole (7g)



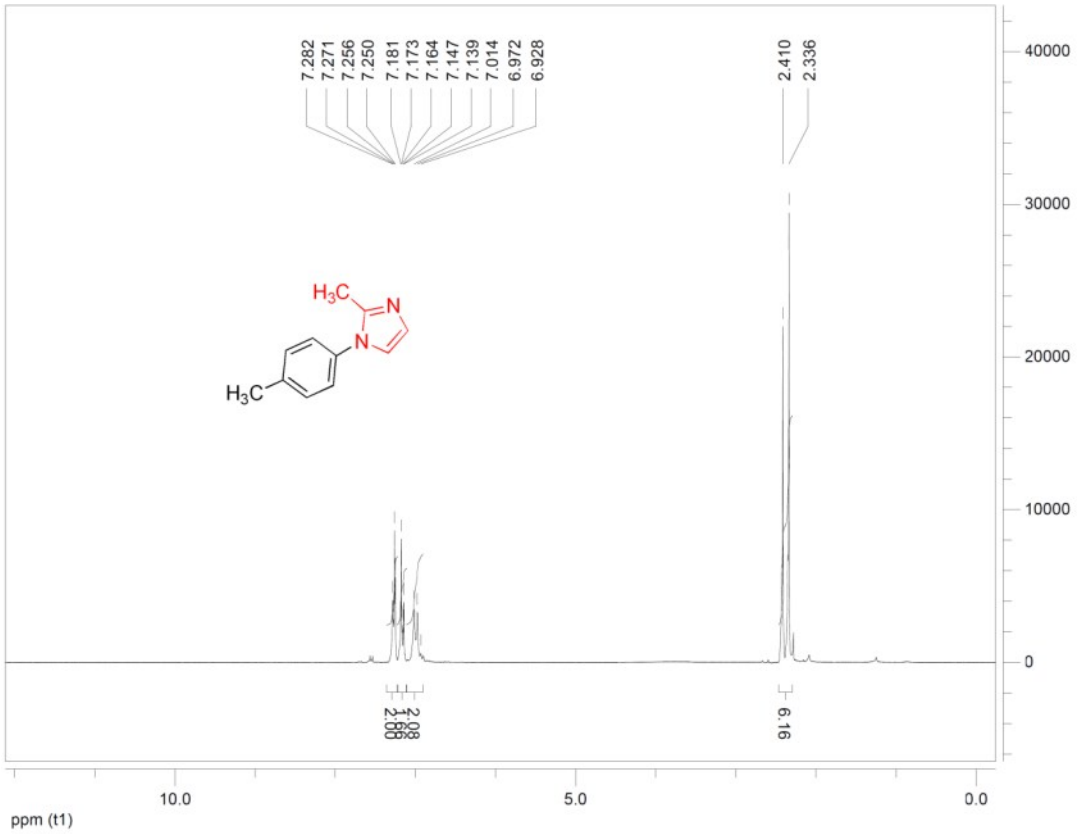


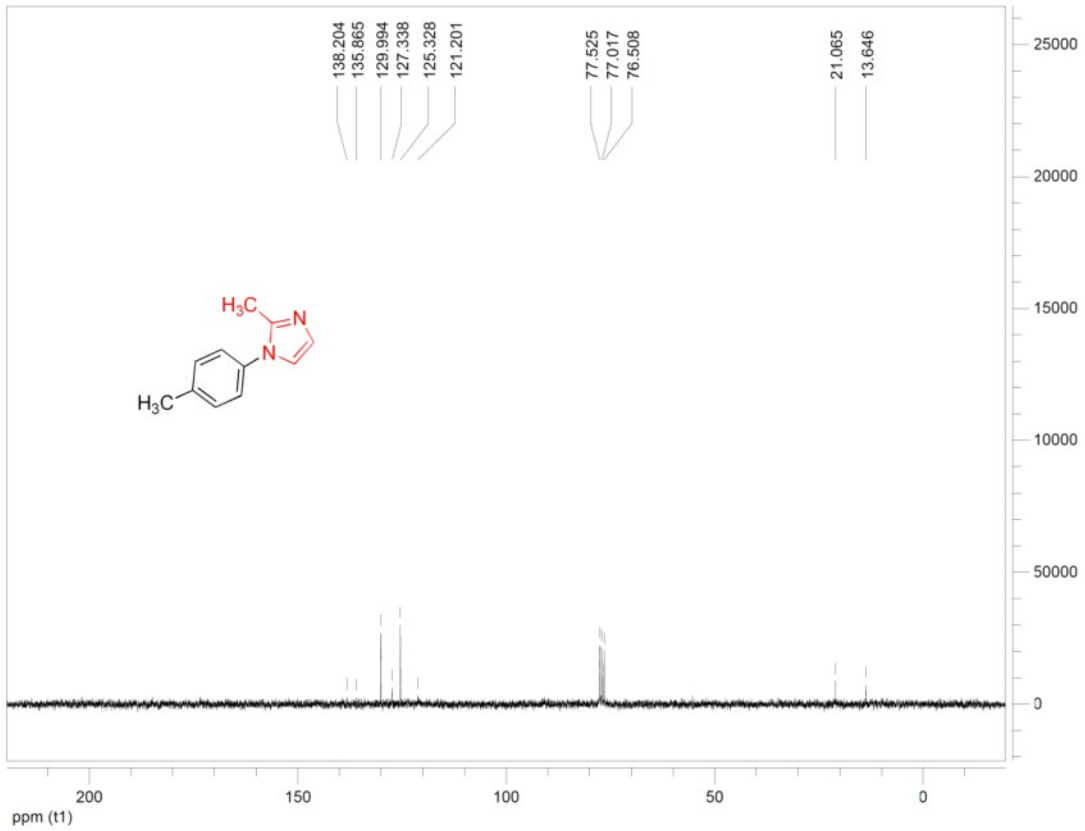
2.32. 2-Methyl-1-phenyl-*1H*-imidazole (7h)



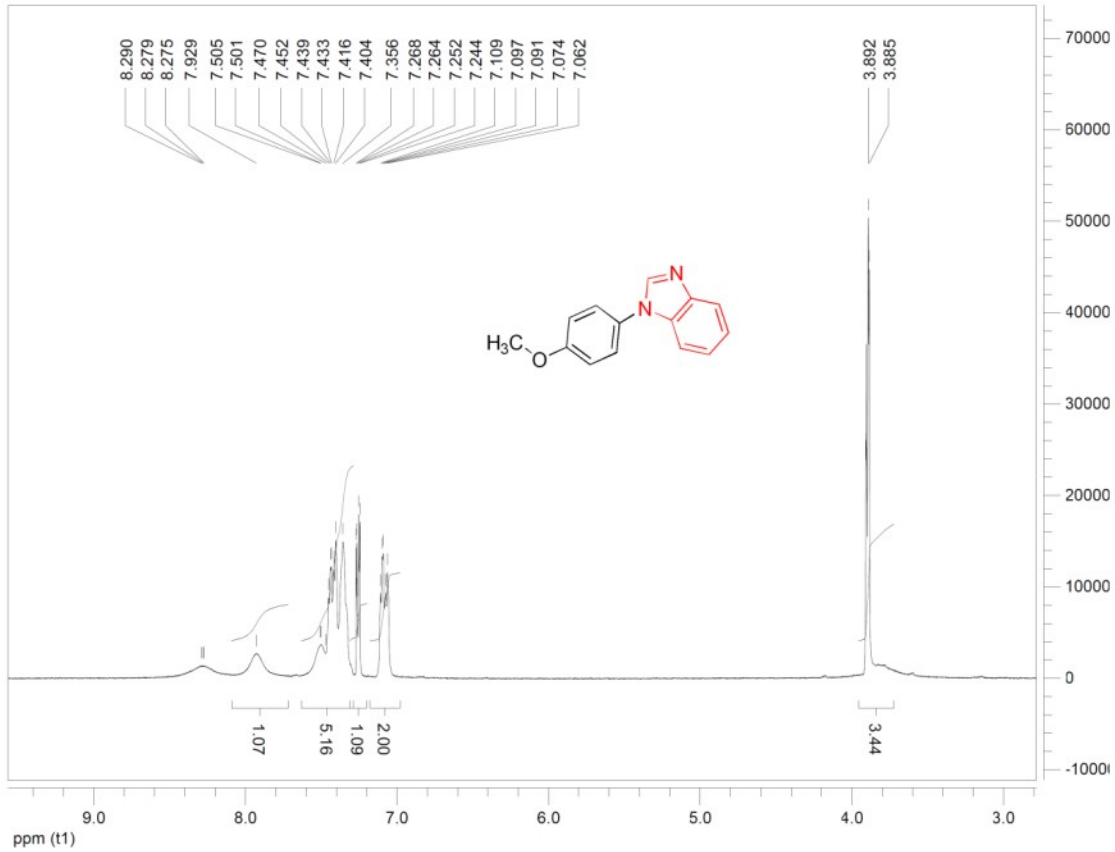


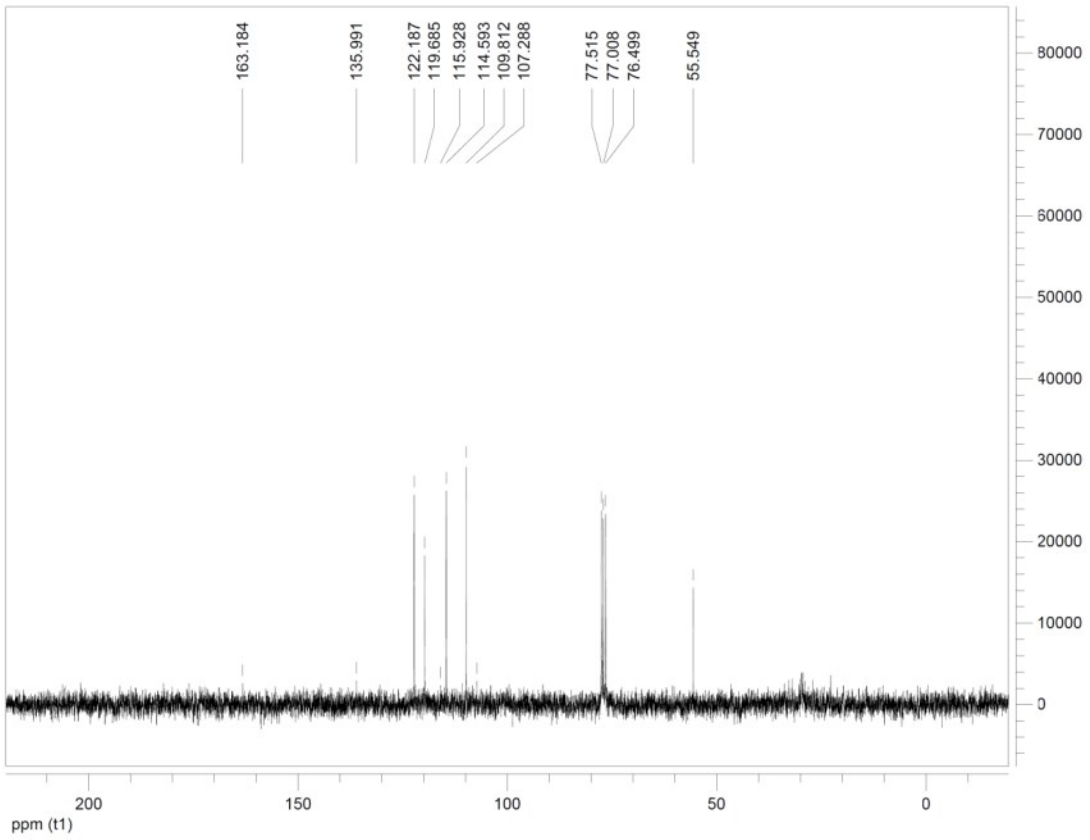
2.33. 2-Methyl-1-*p*-tolyl-1H-imidazole (7i)



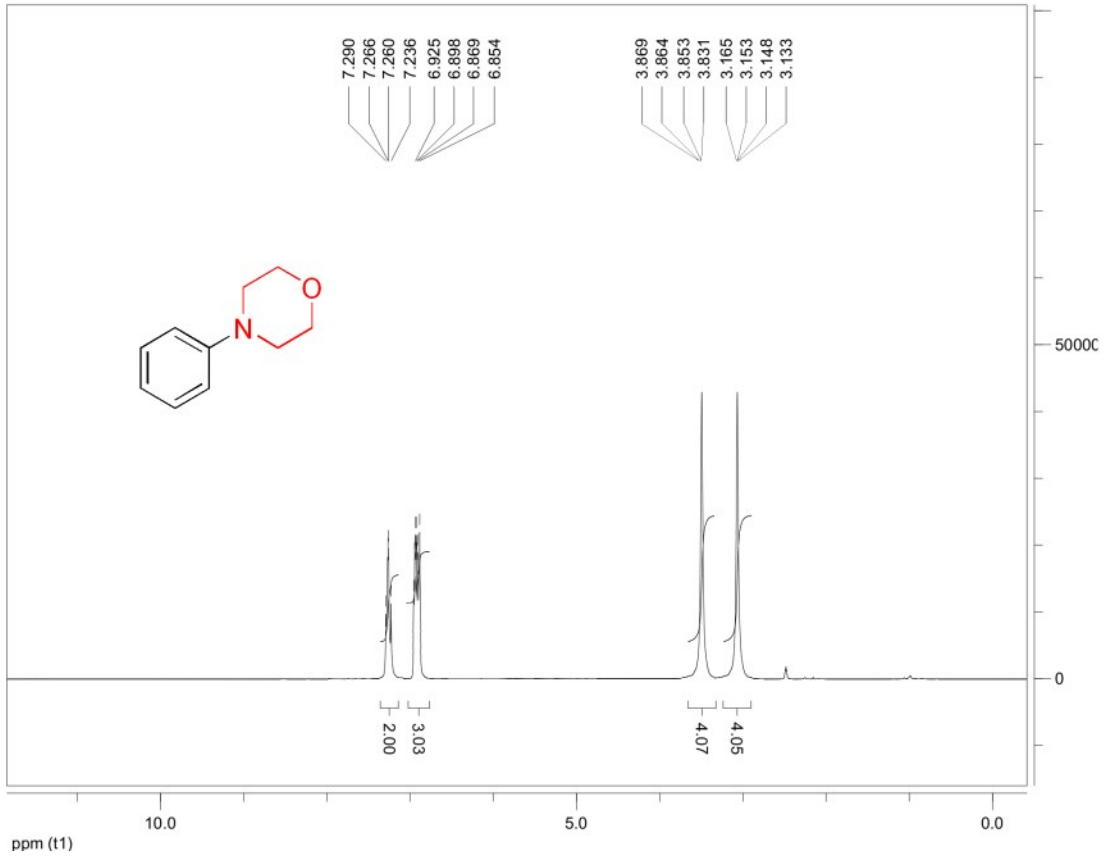


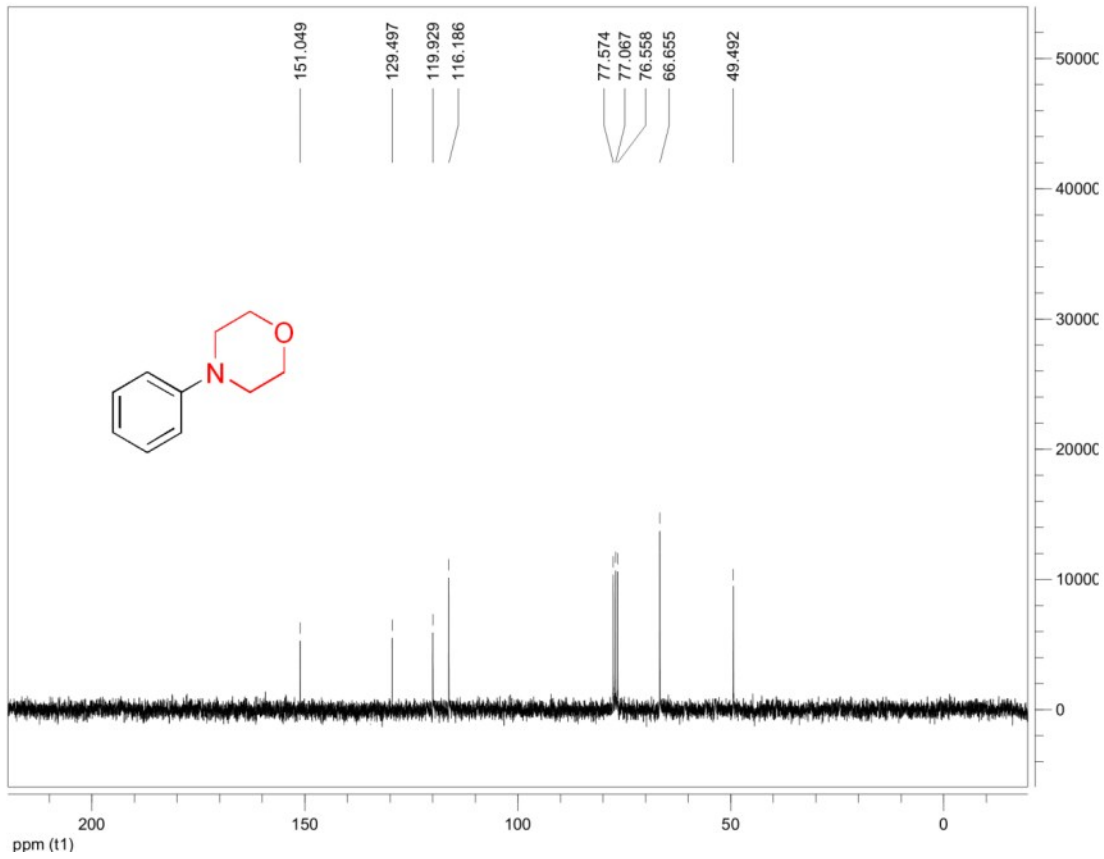
2.34. 1-(4-Methoxyphenyl)-*1H*-benzo[d]imidazole (7j)



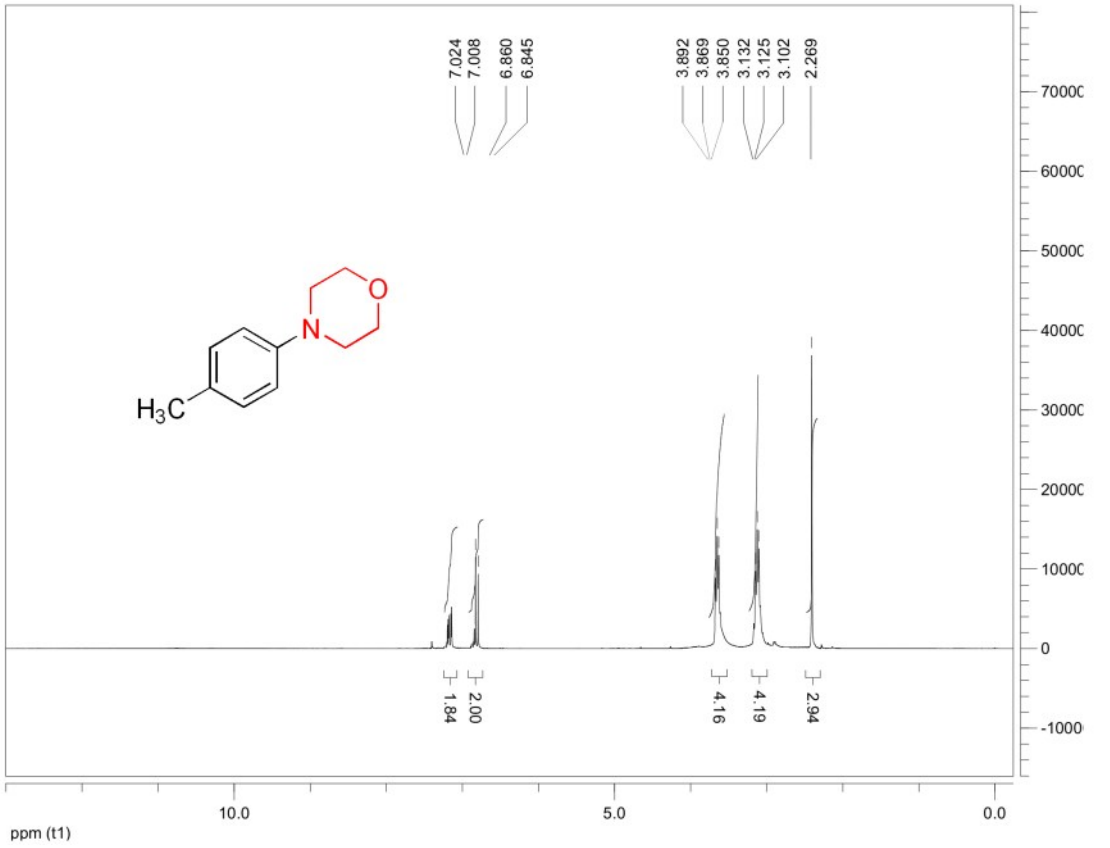


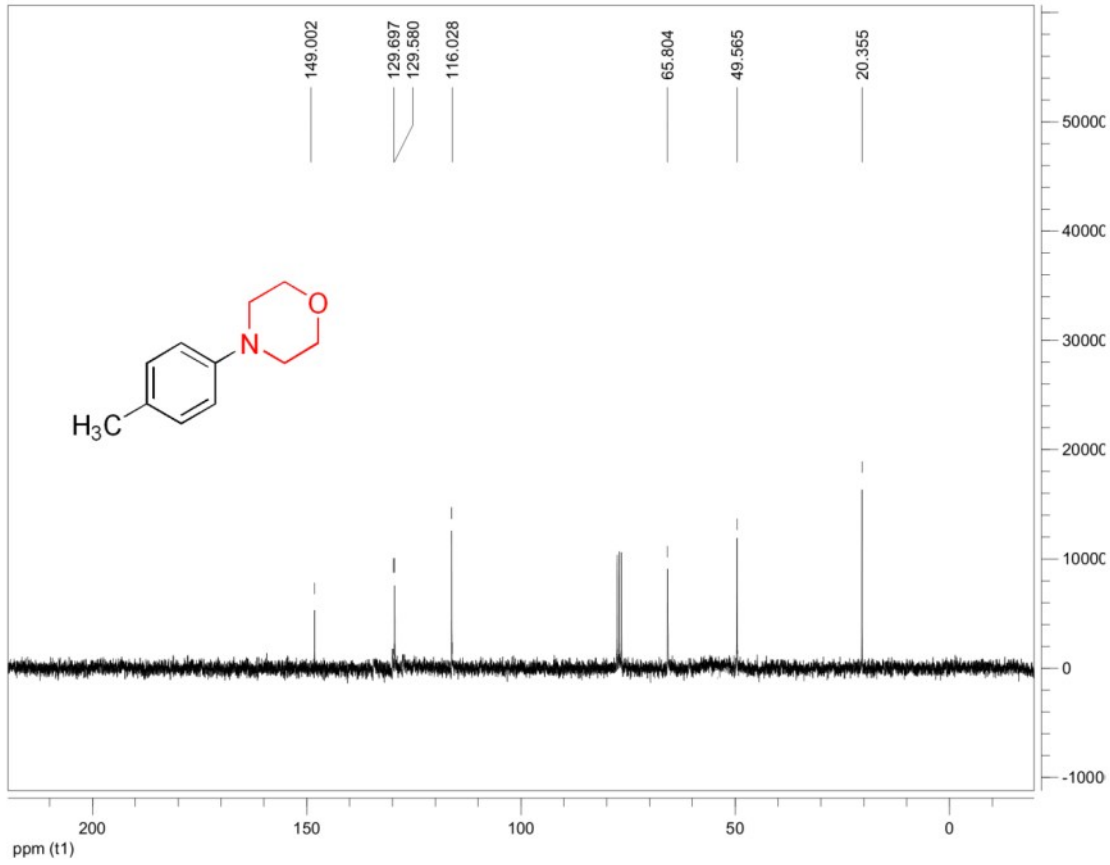
2.35. 4-Phenylmorpholine (7k)



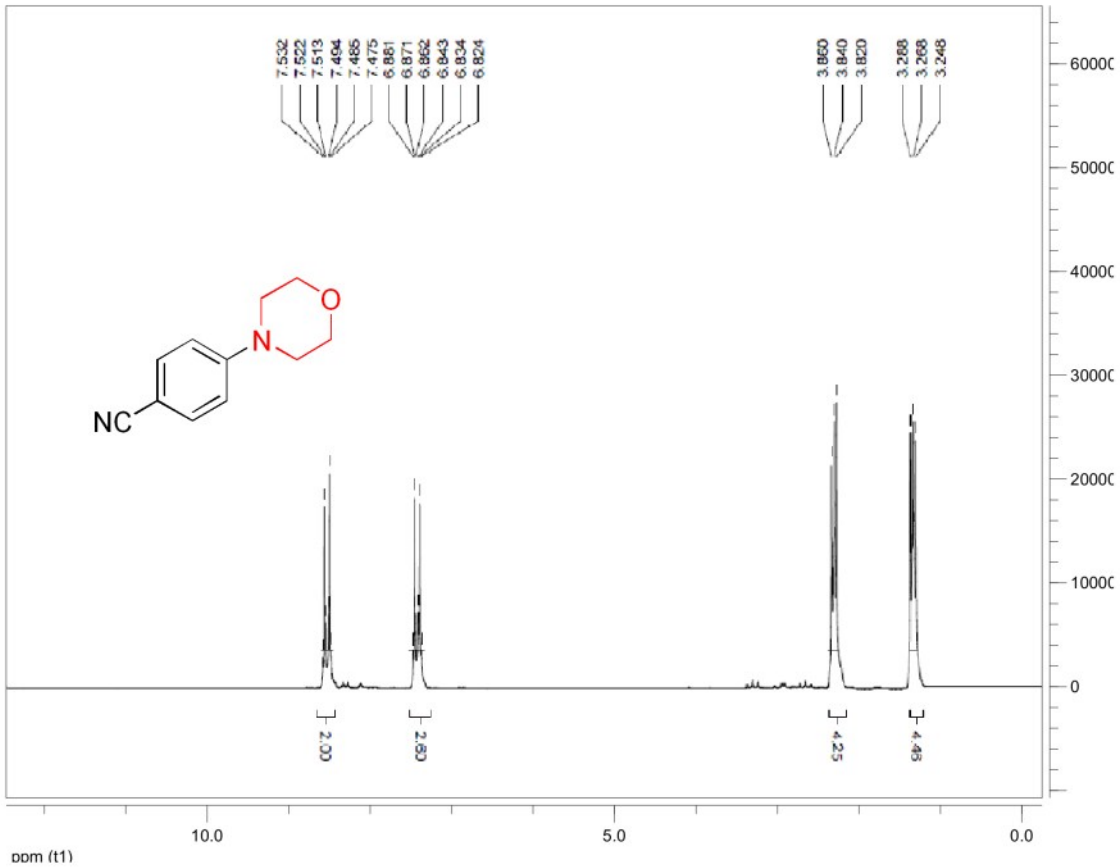


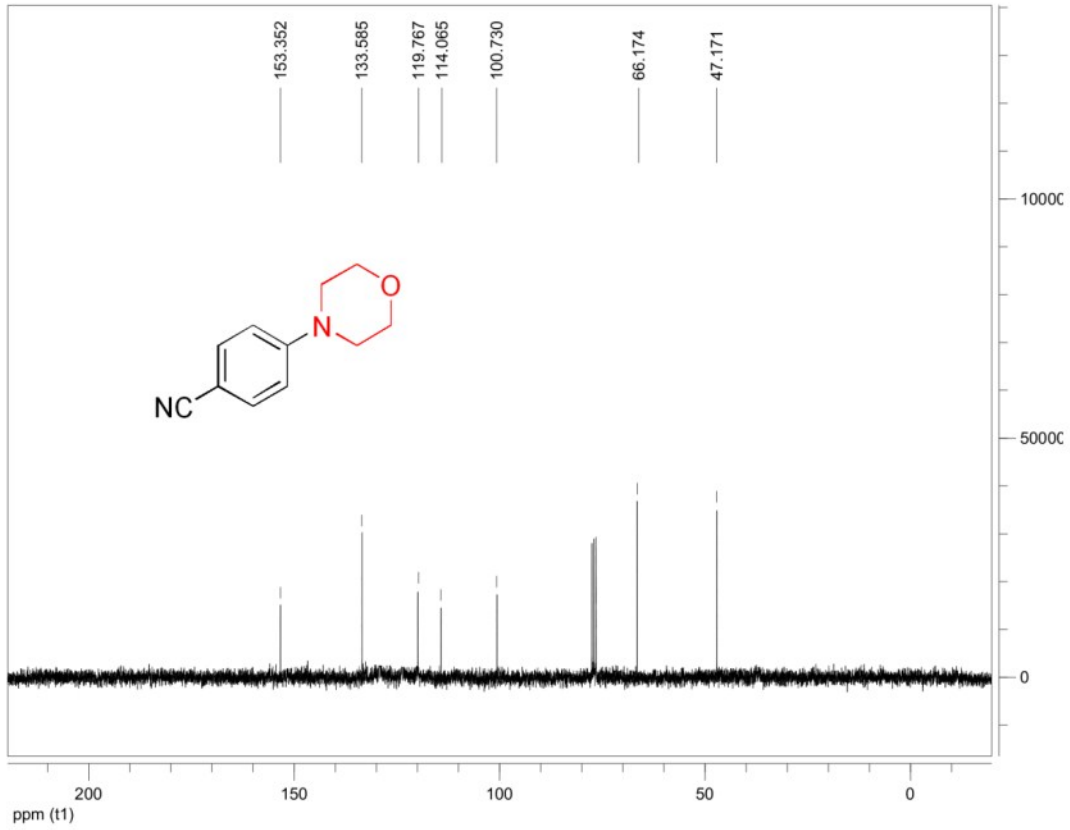
2.36. 4-(*p*-Tolyl)morpholine (7l)



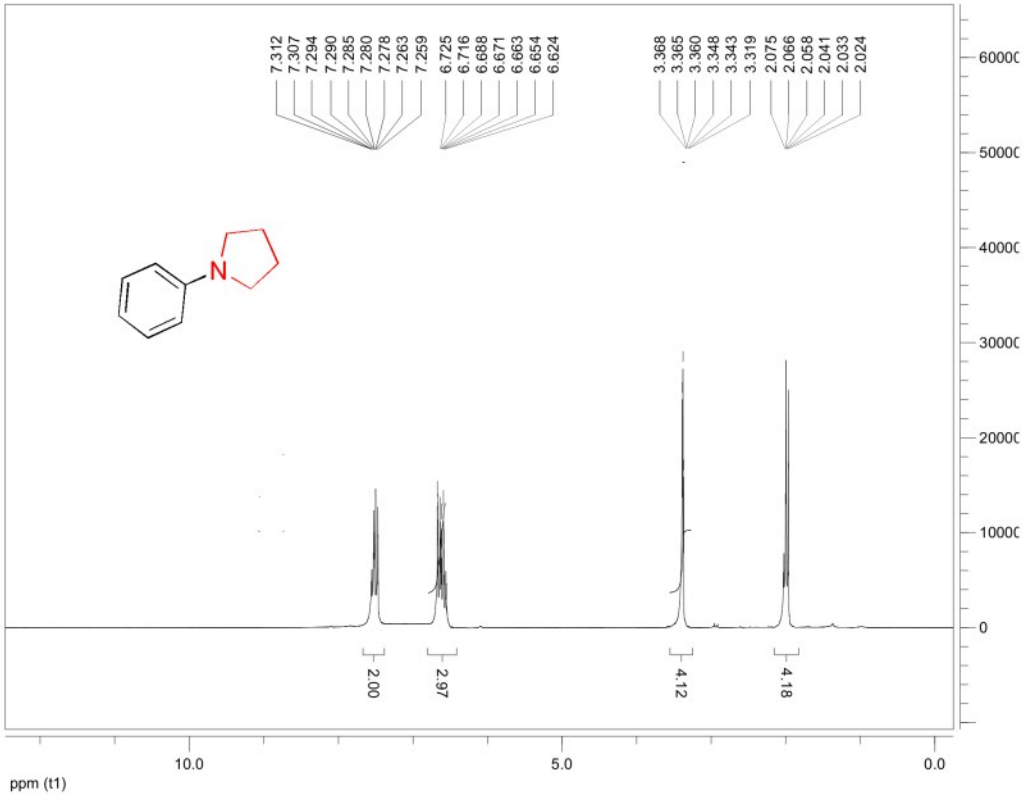


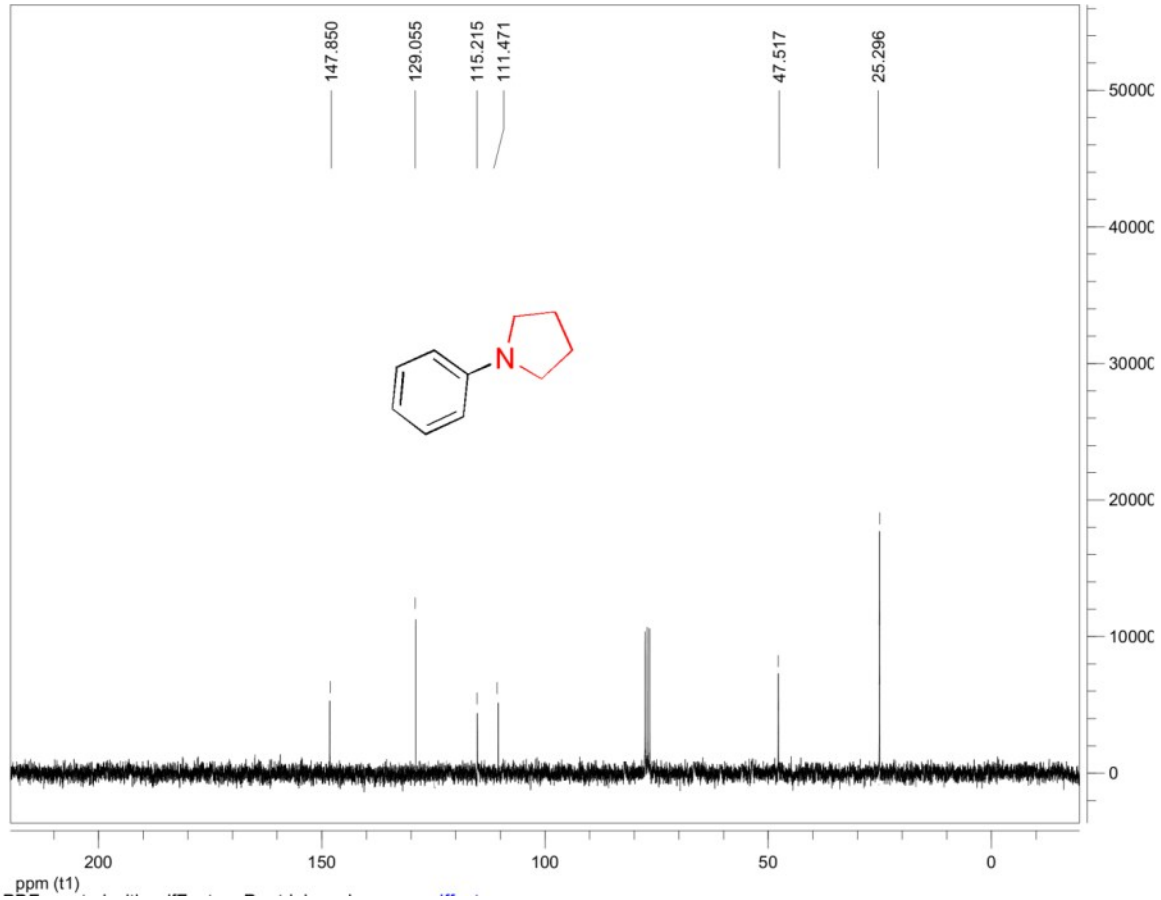
2.37. 4-Morpholinobenzonitrile (7m)





2.38. 1-Phenylpyrrolidine (7n)





3. SEM Images of Recovered PFG-Pd catalyst