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Supporting Information

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Supporting Information

Palladium Catalyzed Synthesis of Münchnones from α-Amido Ethers: A Mild New Route to Pyrroles

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General Procedures

Unless otherwise noted, all manipulations were performed under an inert atmosphere in a Vacuum Atmospheres 553-2 dry box or by using standard Schlenk or vacuum line techniques. Carbon monoxide (99.99%) was purchased from Megs and used as received. Palladium catalyst **6** is synthesized by literature.[1] Compound **1** was synthesized in analogy to literature procedures.[2] All other reagents were purchased from Aldrich® and used as received. Acetonitrile was distilled from CaH_2 under nitrogen. Deuterated solvents were dried as their protonated analogues, but were transferred under vacuum from the drying agent, and stored over 3Å molecular sieves. ^{1}H, ^{19}F and ^{13}C NMR spectra were recorded on Varian Mercury 300 MHz or Mercury 400MHz, spectrometers. Mass spectra were obtained from McGill University mass spectral facilities.

Table 1, entry 8, Pyridin-3-yl 2-(N-benzylbenzamido)-2-p-tolylacetate Product was purified by silica gel chromatograph using 40:60 ethylacetate hexanes mixture as eluent, isolated yield 87%. ^{1}H NMR (500 MHz, CD_3CN) δ 8.48-8.42 (m, 2H), 7.58-7.20 (m, 16H), 5.41 (s, 1H), 4.80 (d, 1H), 4.60 (d, 1H) 2.38 (s, 3H). ^{13}C NMR (500 MHz, CD_3CN) δ 172.9, 168.7, 147.4, 143.6, 139.0, 135.9, 131.0, 130.4, 129.8, 129.6, 129.4, 129.0, 128.8, 128.2, 127.7, 127.4, 126.9, 124.5, 124.3, 63.2, 52.9, 20.5. HRMS calculated for $C_{28}H_{24}N_2O_3$+Na^+: 459.1685 found M+Na^+ 459.1679.

Table 2, entry 1, (Acetyl-benzyl-amino)-p-tolyl-acetic acid pyridin-3-yl ester Product was purified by silica gel chromatograph using 40:60 ethylacetate hexanes mixture as eluent, isolated yield 74%. ^{1}H NMR (400 MHz, CD_3CN) δ 8.44-8.38 (m, 2H), 7.58-7.20 (m, 11H), 5.41 (s, 1H), 4.80 (d, 1H), 4.60 (d, 1H) 2.34 (s, 3H), 2.17 (s, 3H). ^{13}C NMR (500 MHz, CD_3CN) δ 172.1,

168.9, 148.1, 147.3, 143.6, 138.8, 138.3, 137.4, 131.4, 129.7, 129.3, 128.8, 127.6, 127.1, 124.4, 63.3, 51.4, 21.4, 20.4. HRMS calculated for $C_{23}H_{22}N_2O_3$+Na^+: 397.1528 found M+Na^+ 397.1523.

Table 2, entry 2, [Benzyl-(furan-2-carbonyl)-amino]-p-tolyl-acetic acid pyridin-3-yl ester

Product was purified by silica gel chromatograph using 40:60 ethylacetate hexanes mixture as eluent, isolated yield 68%. ^{1}H NMR (400 MHz, CD_3CN) δ 8.44-8.38 (m, 2H), 7.60-7.11 (m, 13H), 6.46 (m, 1H), 5.50 (b, 1H), 5.22 (d, 1H), 4.48 (d, 1H) 2.32 (s, 3H). ^{13}C NMR (500 MHz, CD_3CN) δ 168.4, 161.5, 147.8, 147.2, 145.1, 143.4, 139.3, 137.0, 130.1, 129.8, 129.7, 129.6, 129.1, 128.7, 127.6, 127.3, 124.1, 117.9, 111.9, 64.0, 51.4, 21.4. HRMS calculated for $C_{26}H_{22}N_2O_4$+Na^+: 449.1417 found M+Na^+ 449.14718.

Table 2, entry 3, [Ethyl-(4-methyl-benzoyl)-amino]-[1-(toluene-4-sulfonyl)-1H-indol -2-yl]-acetic acid pyridin-3-yl ester Product was purified by silica gel chromatograph using 40:60 ethylacetate hexanes mixture as eluent, isolated yield 38%. ^{1}H NMR (400 MHz, CD_3CN) δ 8.54-8.42 (m, 2H), 8.05-7.28 (m, 15H), 5.98 (s, 1H), 3.38 (m, 2H), 2.40 (s, 3H), 2.32 (s, 3H) 0.96 (t, 3H). ^{13}C NMR (500 MHz, CD_3CN) δ 172.4, 168.2, 148.0, 147.5, 146.4, 143.5, 140.5, 134.9, 134.6, 133.3, 130.4, 130.1, 129.5, 129.4, 127.3, 127.1, 126.7, 126.3, 126.1, 125.6, 124.2, 120.5, 114.0, 55.2, 44.5, 20.8, 20.7, 14.2. HRMS calculated for $C_{32}H_{29}N_3O_5S$+H^+: 568.1906 found M+H^+ 568.1901.

Table 2, entry 4, 2-[Benzyl-(4-methyl-benzoyl)-amino]-3,3-dimethyl-butyric acid pyridin-3-yl ester Product was purified by silica gel chromatograph using 40:60 ethylacetate hexanes mixture as eluent, isolated yield 86%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.42 (b, 1H), 8.16 (b, 1H),

7.42-7.24 (m, 11H), 5.04 (b, 1H), 4.58 (b, 1H), 4.20 (b, 1H) 2.39 (s, 3H), 1.26 (b, 9H). ^{13}C NMR (500 MHz, $CDCl_3$) δ 173.1, 167.5, 147.0, 143.5, 140.6, 137.1, 133.6, 132.3, 132.2, 129.5, 129.4, 128.7, 128.5, 127.5, 124.3, 66.4, 55.9, 37.6, 27.4, 20.7. HRMS calculated for $C_{26}H_{28}N_2O_3$+Na^+: 439.1998 found M+Na^+ 439.1992.

Table 2, entry 5, [(4-Methoxy-phenyl)-(4-methyl-benzoyl)-amino]-p-tolyl-acetic acid pyridin-3-yl ester Product was purified by silica gel chromatograph using 40:60 ethylacetate hexanes mixture as eluent, isolated yield 72%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.48 (d, 1H), 8.47 (s, 1H), 7.59-6.53 (m, 14H), 6.27 (s, 1H), 3.66 (s, 3H), 2.31 (s, 3H), 2.23 (s, 3H). ^{13}C NMR (500 MHz, $CDCl_3$) δ 171.7, 1690.4, 158.6, 147.9, 147.3, 143.6, 140.2, 138.9, 133.7, 132.7, 131.7, 130.5, 130.3, 129.6, 129.6, 129.0, 128.6, 124.1, 113.8, 65.6, 55.4, 21.6, 21.4. HRMS calculated for $C_{30}H_{28}N_2O_4$+Na^+: 489.1790 found M+Na^+ 489.17848.

Table 2, entry 6, (Benzyl-isobutyryl-amino)-p-tolyl-acetic acid pyridin-3-yl ester Product was purified by silica gel chromatograph using 40:60 ethylacetate hexanes mixture as eluent, isolated yield 73%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.46 (d, 1H), 8.39 (s, 1H), 7.56-7.09 (m, 11H), 5.66 (s, 1H), 4.73 (d, 1H), 4.37 (d, 1H), 2.78 (m, 1H), 2.31 (s, 3H), 1.16 (m, 6H). ^{13}C NMR (500 MHz, $CDCl_3$) δ 179.2, 168.9, 147.9, 147.2, 143.5, 139.2, 137.4, 130.4, 129.8, 129.7, 129.5, 128.8, 127.6, 126.4, 124.1, 63.1, 49.6, 31.4, 21.4, 19.9, 19.6. HRMS calculated for $C_{25}H_{26}N_2O_3$+Na: 425.1814 found M+Na^+ 425.1836.

Table 2, entry 7, [Isopropyl-(4-methyl-benzoyl)-amino]-naphthalen-1-yl-acetic acid pyridin-3-yl ester Product was purified by silica gel chromatograph using 40:60 ethylacetate

hexanes mixture as eluent, isolated yield 85%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.50-8.45 (m, 2H), 7.95-7.26 (m, 13H), 5.24 (s, 1H), 4.36 (b, 1H), 2.41 (s, 3H), 1.44 (d, 3H), 1.00 (d, 3H). ^{13}C NMR (500 MHz, $CDCl_3$) δ 172.4, 168.7, 148.3, 147.1, 143.5, 140.3, 134.1, 134.0, 133.4, 133.3, 129.8, 129.6, 128.5, 128.4, 128.1, 127.9, 126.7, 126.5, 126.4, 126.4, 124.1, 59.3, 51.8, 22.3, 21.7, 21.3. HRMS calculated for $C_{28}H_{26}N_2O_3$+H^+: 439.2022 found M+H^+ 439.2016.

Table 2, entry 8, (Benzoyl-thiophen-2-ylmethyl-amino)-p-tolyl-acetic acid pyridin-3-yl ester

Product was purified by silica gel chromatograph using 40:60 ethylacetate hexanes mixture as eluent, isolated yield 58%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.46 (d, 1H), 8.39 (s, 1H), 7.56-6.65 (m, 15H), 5.66 (b, 1H), 4.85 (d, 1H), 4.46 (b, 1H), 2.38 (s, 3H). ^{13}C NMR (500 MHz, $CDCl_3$) δ173.2, 168.5, 147.8, 147.3, 143.4, 139.8, 139.4, 135.4, 130.6, 130.1, 129.8, 129.6, 129.5, 129.0, 127.2, 1207.0, 126.7, 125.7, 124.1, 62.9, 47.7, 21.5. HRMS calculated for $C_{27}H_{24}N_2O_3$+Na^+: 465.1249 found M+Na^+ 465.1243.

Methyl 1-benzyl-4-phenyl-2,5-bis(p-tolyl)-1H-pyrrole-3-carboxylate (9a) Product was purified by silica gel chromatograph using 10:90 ethylacetate hexanes mixture as eluent, isolated yield 68%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.26-6.63 (m, 18H), 4.96 (s, 2H), 3.45 (s, 3H), 2.37 (s, 3H), 2.27 (s, 3H). ^{13}C NMR (300 MHz, $CDCl_3$) δ 166.1, 139.1, 138.5, 138.2, 137.6, 135.7, 133.0, 131.4, 130.9, 130.8, 129.4, 129.0, 128.9, 128.9, 128.4, 127.4, 127.1, 126.3, 126.0, 124.5, 113.3, 50.8, 48.6, 21.6, 21.5. HRMS calculated for $C_{33}H_{29}NO_2$+H^+: 472.2277 found M+H^+ 472.2271.

Methyl 1-ethyl-4-phenyl-2,5- bis(p-tolyl)-1H-pyrrole-3-carboxylate (9b) Product was purified by silica gel chromatograph using 10:90 ethylacetate hexanes mixture as eluent, isolated yield

72%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.40-7.12 (m, 13H), 3.78 (q, 2H), 3.43 (s, 3H), 2.44 (s, 3H), 2.34 (s, 3H) 0.88 (t, 3H). ^{13}C NMR (300 MHz, $CDCl_3$) δ 165.9, 138.0, 138.9, 137.4, 135.5, 131.8, 131.2, 130.6, 130.5, 129.6, 129.1, 129.0, 128.8, 127.1, 125.6, 123.9, 112.5, 50.6, 39.8, 21.5, 21.3, 16.3. HRMS calculated for $C_{28}H_{27}NO_2$+H^+: 410.2120 found M+H^+ 410.2114.

Methyl 1-(4-methoxyphenyl)-4-phenyl-2,5-bis(p-tolyl)-1H-pyrrole-3-carboxylate (9c)

Product was purified by silica gel chromatograph using 10:90 ethylacetate hexanes mixture as eluent, isolated yield 48%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.21-6.62 (m, 17H), 3.71 (s, 3H), 3.60 (s, 3H), 2.29 (s, 3H), 2.20 (s, 3H). ^{13}C NMR (300 MHz, $CDCl_3$) δ 166.5, 158.5, 138.4, 137.4, 136.6, 135.6, 133.0, 131.3, 131.1, 130.9, 130.8, 130.2, 129.1, 128.7, 128.5, 128.5, 127.6, 126.1, 123.8, 113.7, 113.6, 55.5, 51.0, 21.5, 21.4. HRMS calculated for $C_{33}H_{29}NO_3$+H^+: 488.2226 found M+H^+ 488.2220.

1-benzyl-N,N-dimethyl-2,5- bis(p-tolyl)-1H-pyrrole-3-carboxamide (9d) Product was purified by silica gel chromatograph using 10:90 ethylacetate hexanes mixture as eluent, isolated yield 63%. ^{1}H NMR (400 MHz, CD_3CN) δ 7.34-6.35 (m, 14H), 5.23 (s, 2H), 2.84 (s, 6H), 2.34 (s, 6H). ^{13}C NMR (300 MHz, CD_3CN) δ 168.0, 139.1, 138.0, 137.7, 135.8, 134.5, 130.3, 130.0, 129.5, 129.4, 129.2, 129.1, 128.5, 127.1, 125.7, 119.4, 109.2, 48.4, 38.4, 34.0, 20.5, 20.4. HRMS calculated for $C_{28}H_{28}N_2O$+H^+: 409.2280 found M+H^+ 409.2274.

Methyl 1-benzyl-5-tert-butyl-4-phenyl-2-p-tolyl-1H-pyrrole-3-carboxylate (9e) Product was purified by silica gel chromatograph using 10:90 ethylacetate hexanes mixture as eluent, isolated yield 39%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38-6.64 (m, 14H), 5.28 (s, 2H), 3.22 (s, 3H), 2.28 (s,

3H), 1.14 (s, 9H). ^{13}C NMR (300 MHz, $CDCl_3$) δ 165.9, 139.8, 139.7, 139.6, 137.7, 137.3, 131.5, 130.5, 129.8, 128.6, 128.5, 127.1, 127.0, 126.4, 125.7, 123.7, 115.1, 50.6, 50.4, 34.5, 33.0, 21.6. HRMS calculated for $C_{30}H_{31}NO_2+H^+$: 438.2433 found $M+H^+$ 438.2428.

1-benzyl-3-phenyl-2,5-bis(p-tolyl)-1H-pyrrole (9f) Product was purified by silica gel chromatograph using 10:90 ethylacetate hexanes mixture as eluent, isolated yield 38%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38-6.55 (m, 19H), 5.01 (s, 2H), 2.34 (s, 3H), 2.32 (s, 3H). ^{13}C NMR (300 MHz, $CDCl_3$) δ 139.6, 137.5, 137.1, 136.6, 135.6, 132.3, 131.4, 130.8, 130.4, 129.3, 129.2, 128.4, 128.2, 127.8, 126.9, 126.2, 125.2, 123.2, 109.4, 109.3, 48.5, 27.7, 21.5. HRMS calculated for $C_{31}H_{27}N+H^+$: 414.2222 found $M+H^+$ 414.2216.

1-benzyl-2,5-bis(p-tolyl)-1H-pyrrole-3-carbonitrile (9g) Product was purified by silica gel chromatograph using 10:90 ethylacetate hexanes mixture as eluent, isolated yield 48%. ^{1}H NMR (400 MHz, CD_3CN) δ 7.37-6.59 (m, 14H), 5.24 (s, 2H), 2.37 (s, 3H), 2.34 (s, 3H). ^{13}C NMR (300 MHz, CD_3CN) δ 143.0, 139.8, 138.6, 138.0, 136.7, 129.9, 129.7, 129.5, 129.4, 128.9, 128.7, 127.4, 127.2, 125.8, 117.3, 111.5, 92.9, 48.9, 20.6, 20.5. HRMS calculated for $C_{26}H_{22}N_2+H^+$: 363.1861 found $M+H^+$ 363.1856.

1-(1-benzyl-4-phenyl-2,5-bis(p-tolyl)-1H-pyrrol-3-yl)ethanone (9h) Product was purified by silica gel chromatograph using 10:90 ethylacetate hexanes mixture as eluent, isolated yield 54%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.21-6.63 (m, 18H), 4.93 (s, 2H), 2.36 (s, 3H), 2.25 (s, 3H), 1.89 (s, 3H). ^{13}C NMR (300 MHz, $CDCl_3$) δ 197.0, 138.6, 138.5, 137.7, 137.6, 136.0, 133.0, 131.4,

131.0, 130.9, 129.5, 129.2, 129.0, 128.8, 128.4, 127.8, 127.1, 126.3, 126.2, 124.1, 124.1, 48.5, 31.4, 21.6, 21.4. HRMS calculated for $C_{33}H_{29}NO+H^+$: 456.2327 found $M+H^+$ 456.2338.

Methyl 1-benzyl-2-methyl-4-phenyl-5-p-tolyl-1H-pyrrole-3-carboxylate (9i) Product was purified by silica gel chromatograph using 10:90 ethylacetate hexanes mixture as eluent, isolated yield 62%. ^{1}H NMR (400 MHz, CD_3CN) δ 7.38-6.88 (m, 14H), 5.07 (s, 2H), 3.56 (s, 3H), 2.37 26(s, 3H), 2.17 (s, 3H). ^{13}C NMR (300 MHz, CD_3CN) δ 166.0, 138.2, 138.1, 136.5, 135.6, 132.3, 131.6, 131.0, 129.0, 128.9, 128.9, 127.9, 127.4, 127.2, 125.9, 125.9, 123.8, 50.1, 47.5, 20.4, 11.4. HRMS calculated for $C_{33}H_{29}NO_2+H^+$: 396.1964 found $M+H^+$ 396.1958.

Methyl 1-benzyl-2,5-bis(4-chlorophenyl)-4-phenyl-1H-pyrrole-3-carboxylate (9j) Product was purified by silica gel chromatograph using 10:90 ethylacetate hexanes mixture as eluent, isolated yield 51%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38-6.61 (m, 18H), 4.91 (s, 2H), 3.44 (s, 3H). ^{13}C NMR (300 MHz, $CDCl_3$) δ 165.6, 138.0, 137.8, 134.9, 134.8, 134.2, 132.7, 132.3, 132.1, 130.8, 130.6, 130.2, 128.7, 128.7, 128.5, 127.6, 127.5, 126.5, 126.0, 125.4, 113.8, 51.0, 48.8. HRMS calculated for $C_{31}H_{23}Cl_2NO_2+H^+$: 512.1184 found $M+H^+$ 512.1179.

Methyl 1-benzyl-2-(furan-2-yl)-4-phenyl-5-p-tolyl-1H-pyrrole-3- carboxylate (9k) Product was purified by silica gel chromatograph using 10:90 ethylacetate hexanes mixture as eluent, isolated yield 65%. ^{1}H NMR (400 MHz, CD_3CN) δ 7.38-6.42 (m, 17H), 5.09 (s, 2H), 3.48 (s, 3H), 2.28 (s, 3H). ^{13}C NMR (300 MHz, CD_3CN) δ 165.3, 144.6, 143.4, 138.5, 138.3, 135.3, 134.4, 131.6, 130.7, 129.0, 128.6, 128.4, 127.6, 127.4, 126.4, 126.4, 126.0, 124.5, 115.7, 112.0, 111.2, 50.7, 48.8, 20.5. HRMS calculated for $C_{30}H_{25}NO_3+H^+$: 448.1913 found $M+H^+$ 448.1902.

Methyl 1-isopropyl-4-phenyl-bis(p-tolyl)-1H-pyrrole-3-carboxylate (9l) Product was purified by silica gel chromatograph using 10:90 ethylacetate hexanes mixture as eluent, isolated yield 67%. ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38-7.08 (m, 13H), 4.35 (m, 1H), 3.37 (s, 3H), 2.43 (s, 3H) 2.33 (s, 3H) 1.16 (d, 6H). ^{13}C NMR (300 MHz, $CDCl_3$) δ 166.1, 138.2, 138.1, 137.8, 135.9, 132.5, 132.1, 131.4, 130.7, 130.3, 130.0, 128.8, 128.7, 127.2, 125.7, 124.4, 113.2, 50.7, 49.9, 23.7, 21.7, 21.5. HRMS calculated for $C_{29}H_{29}NO_2$+H^+: 424.2277 found M+H^+ 424.2188.

References

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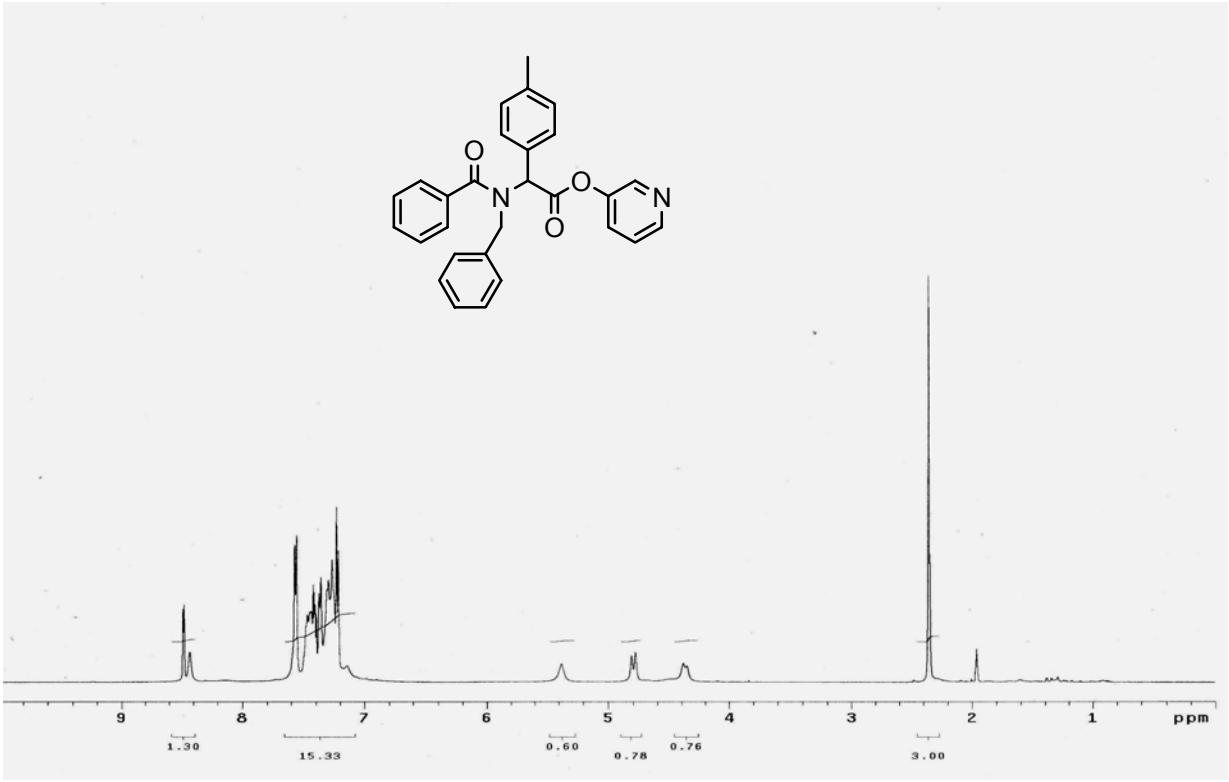
2. a) W. N. Speckamp, M. J. Moolenaar, *Tetrahedron* **2000**, *56*, 3817-3856. b) H. Hiemstra, H. P. Fortgens, S. Stegenga, W. N. Speckamp *Tetrahedron Lett*. **1985**, *26*, 3155-3158.

^{1}H NMR of pyridin-3-yl 2-(N-benzylbenzamido)-2-p-tolylacetate (table 1, entry 8)



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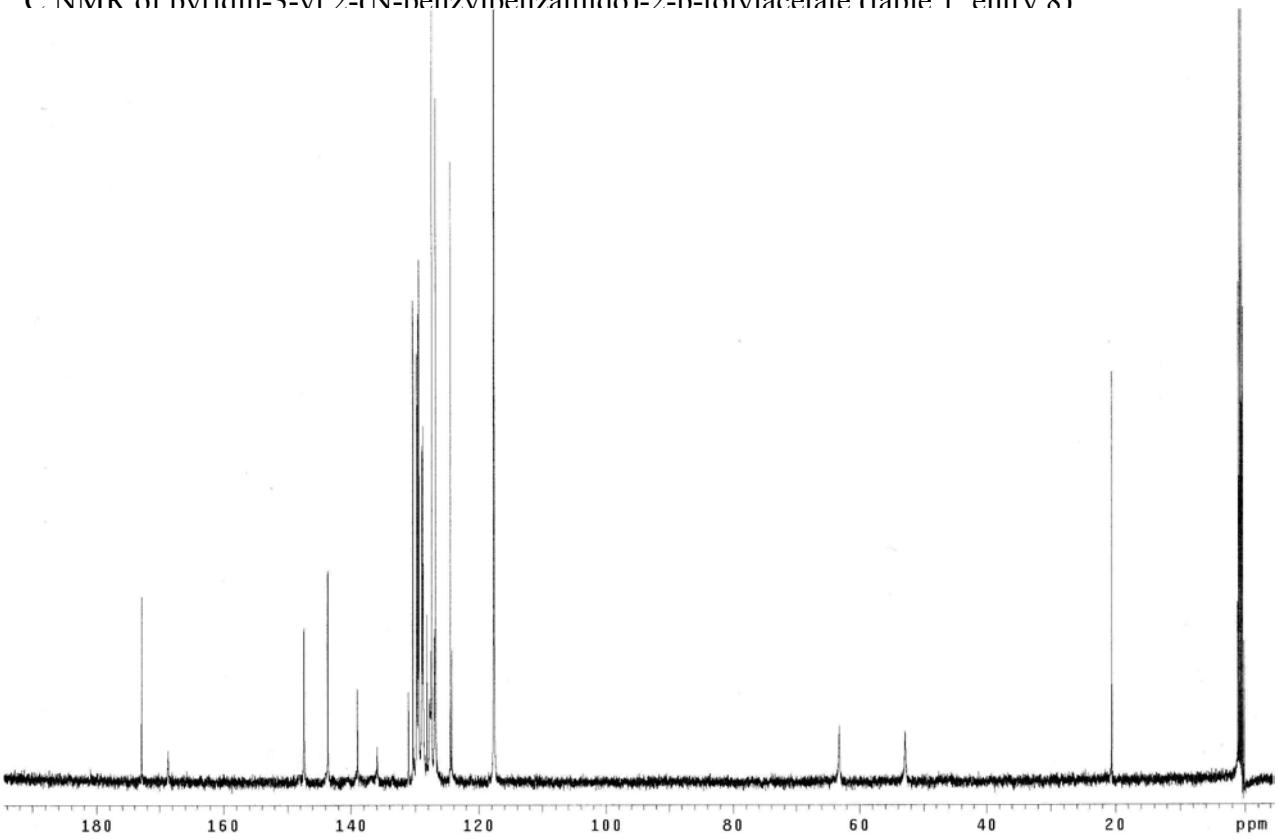

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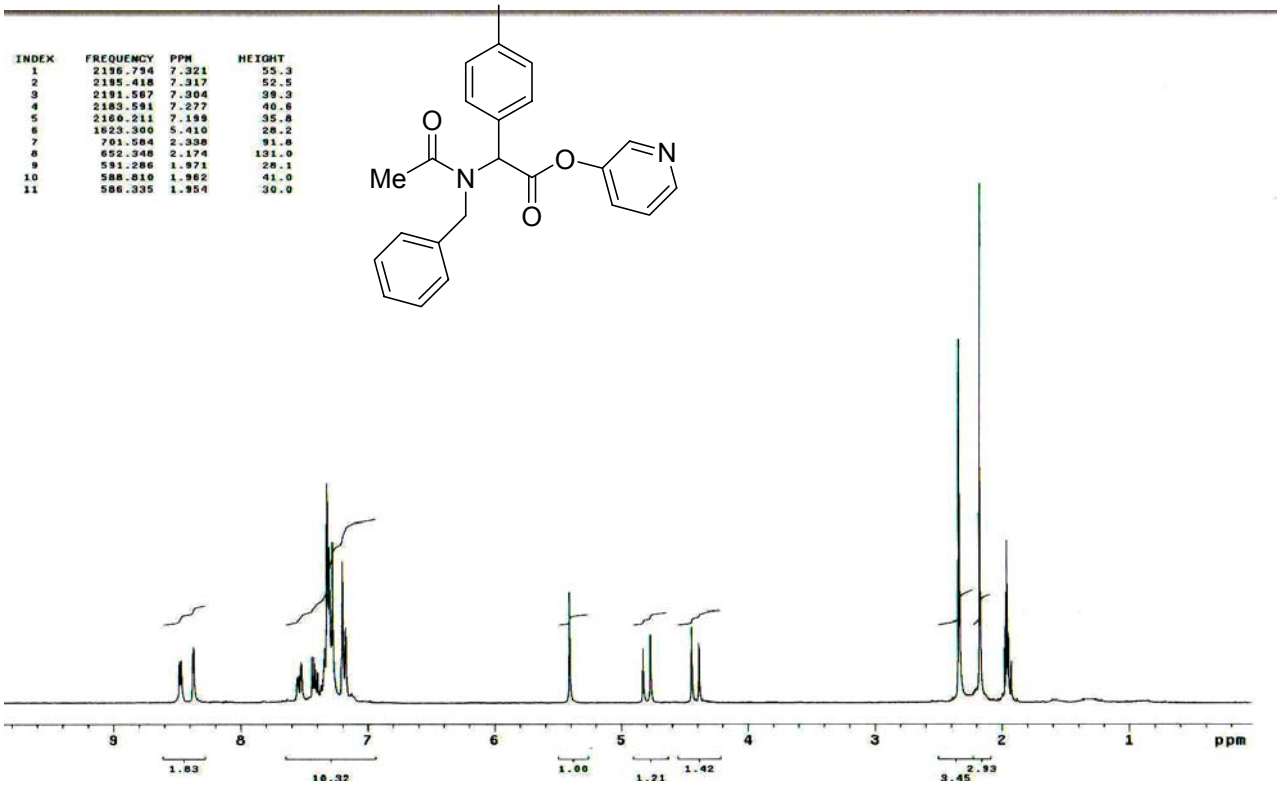

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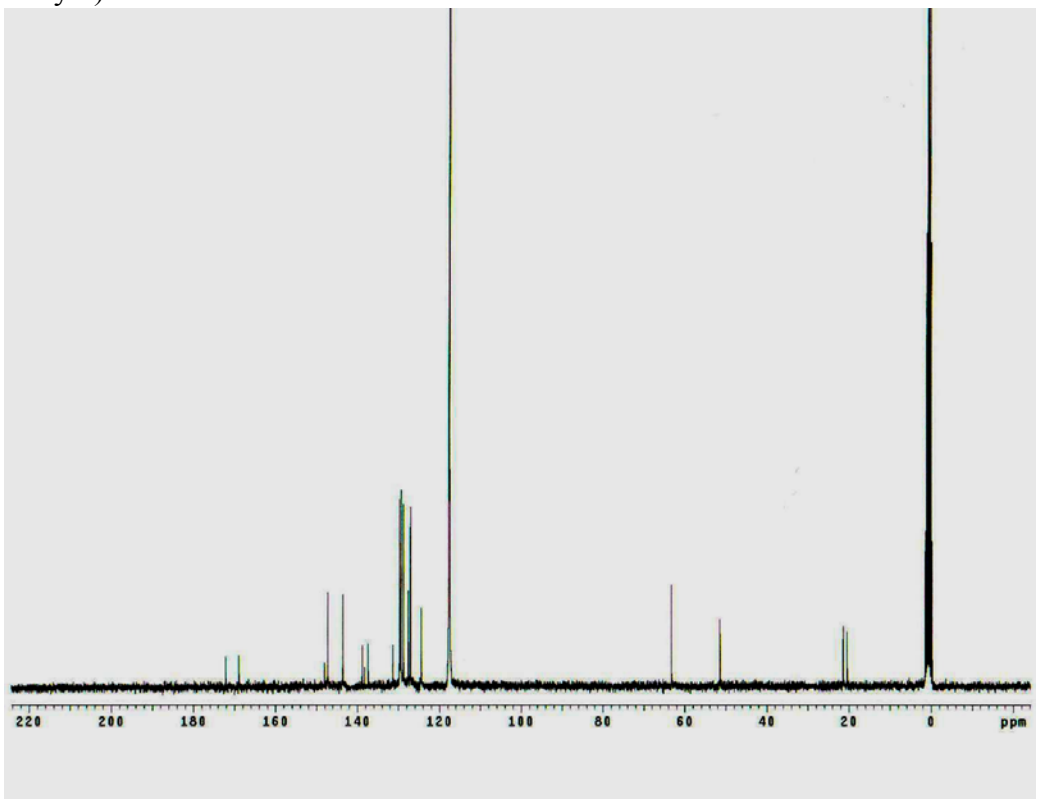
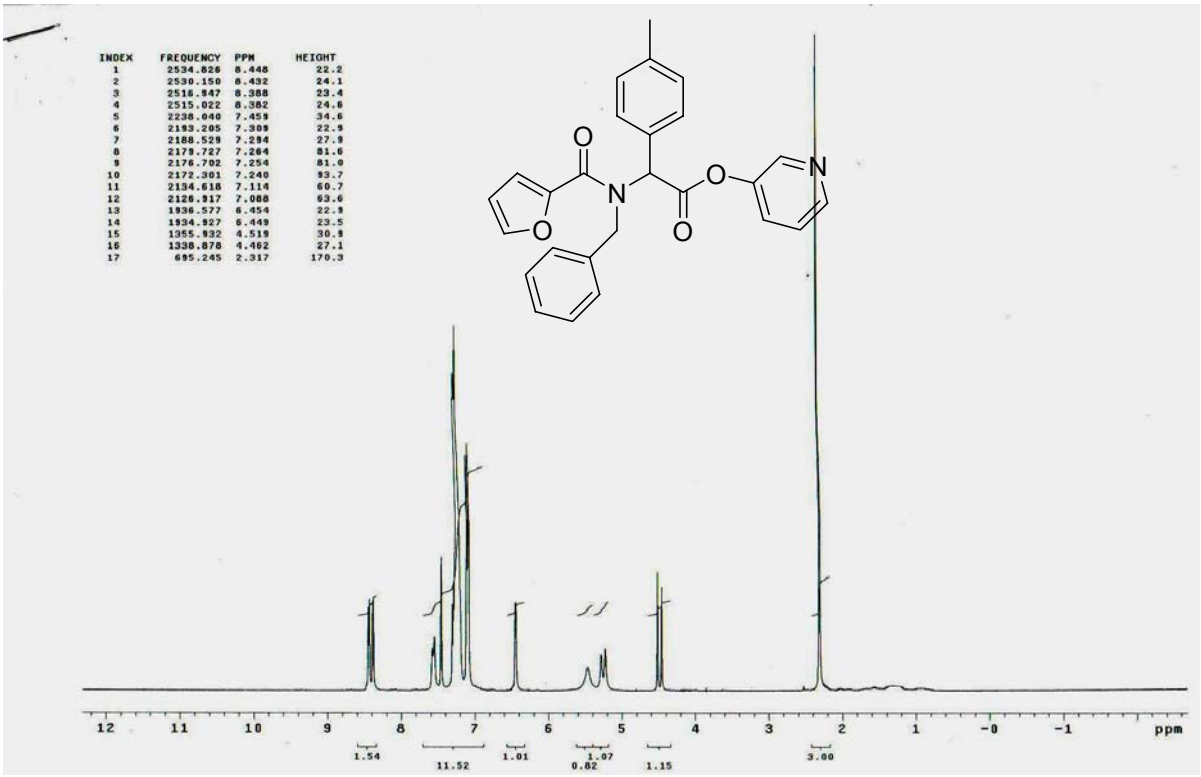
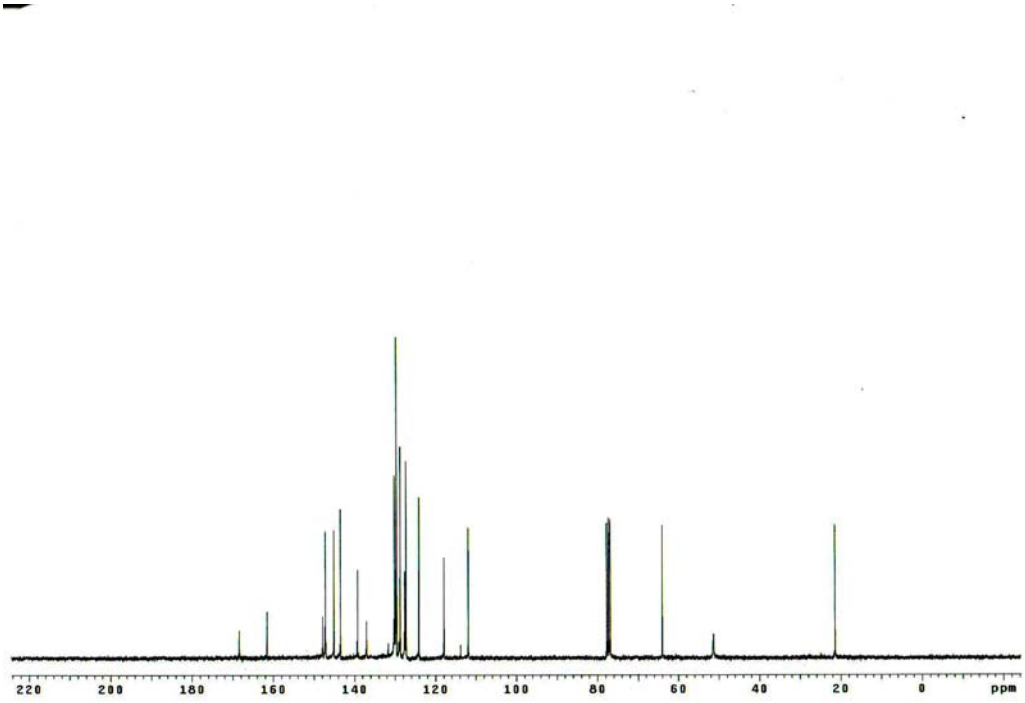


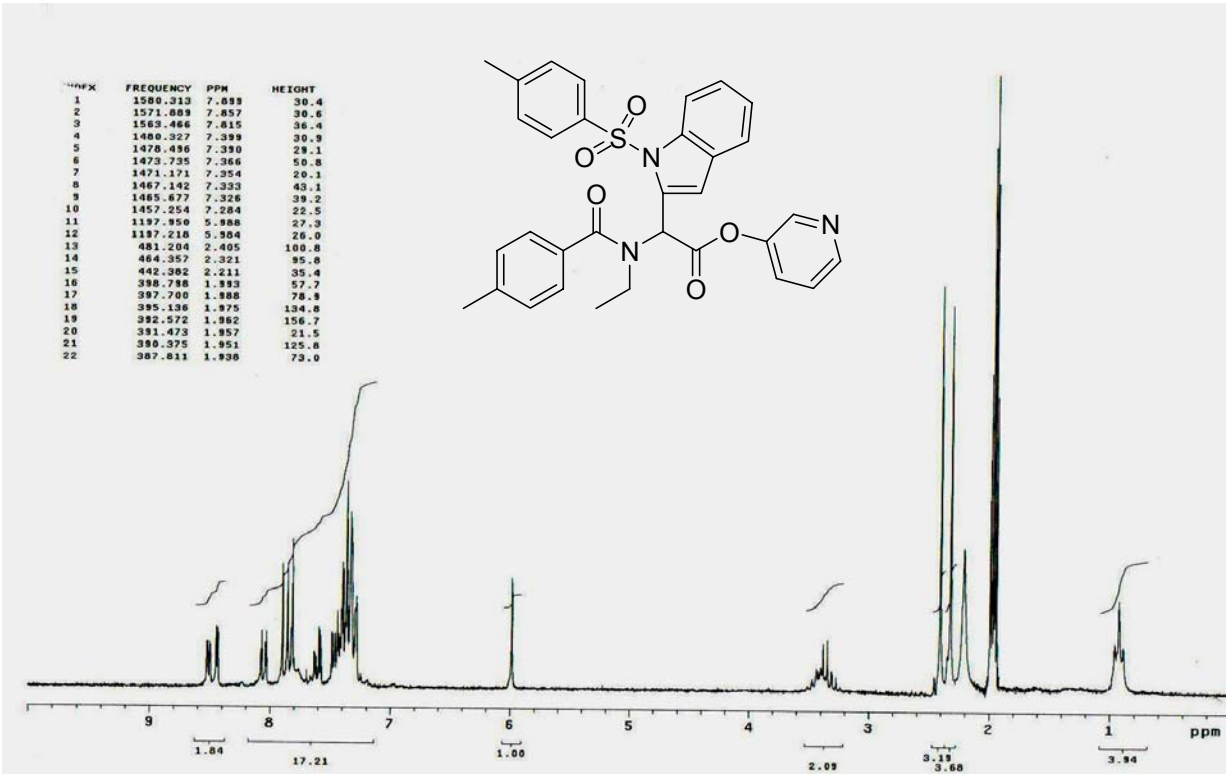
^{1}H NMR of [Benzyl-(furan-2-carbonyl)-amino]-p-tolyl-acetic acid pyridin-3-yl ester (table 2, entry 2)



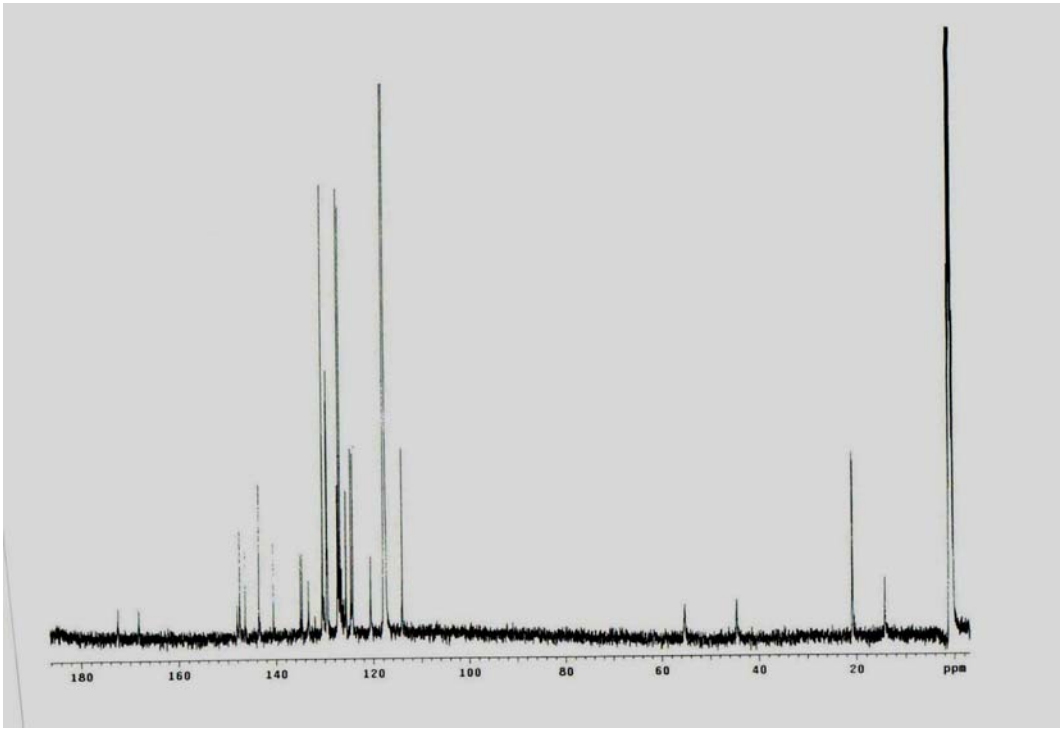
^{13}C NMR of [Benzyl-(furan-2-carbonyl)-amino]-p-tolyl-acetic acid pyridin-3-yl ester (table 2, entry 2)



^{1}H NMR of [Ethyl-(4-methyl-benzoyl)-amino]-[1-(toluene-4-sulfonyl)-1H-indol-2-yl] -acetic acid pyridin-3-yl ester (table 2, entry 3)



^{13}C NMR of [Ethyl-(4-methyl-benzoyl)-amino]-[1-(toluene-4-sulfonyl)-1H-indol-2-yl] -acetic acid pyridin-3-yl ester (table 2, entry 3)



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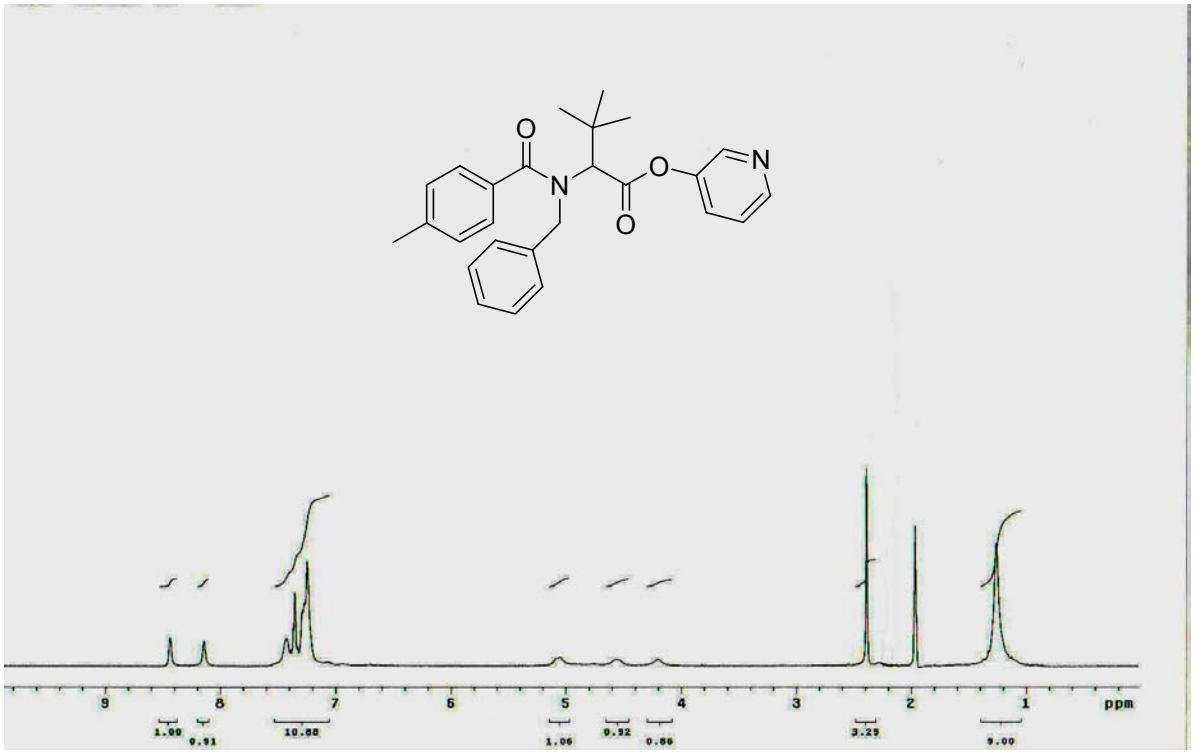

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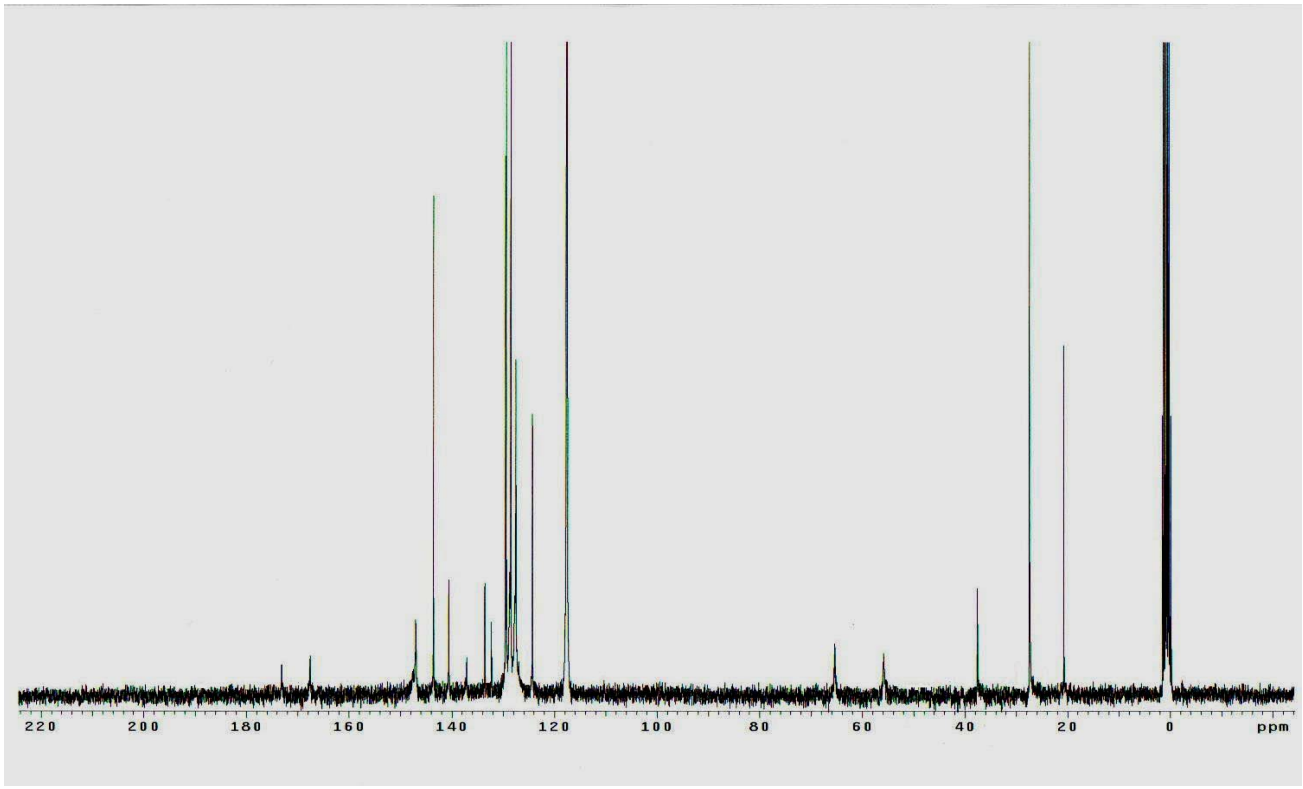
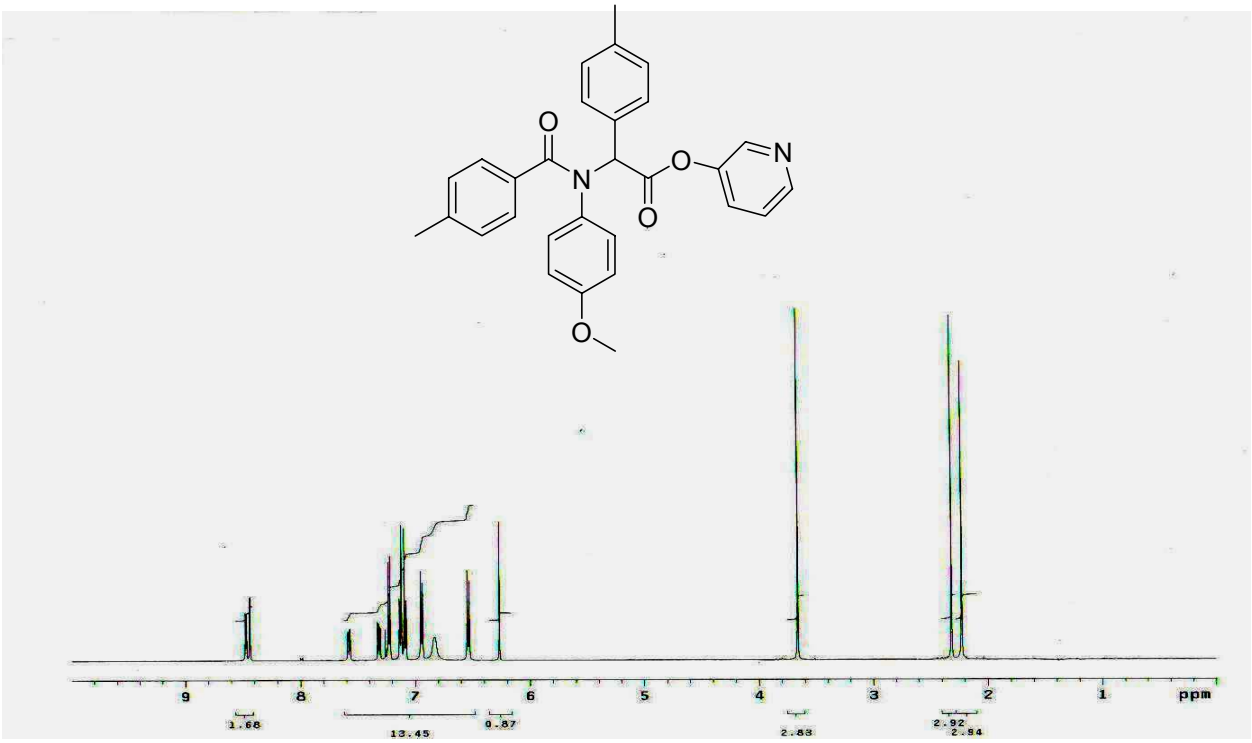
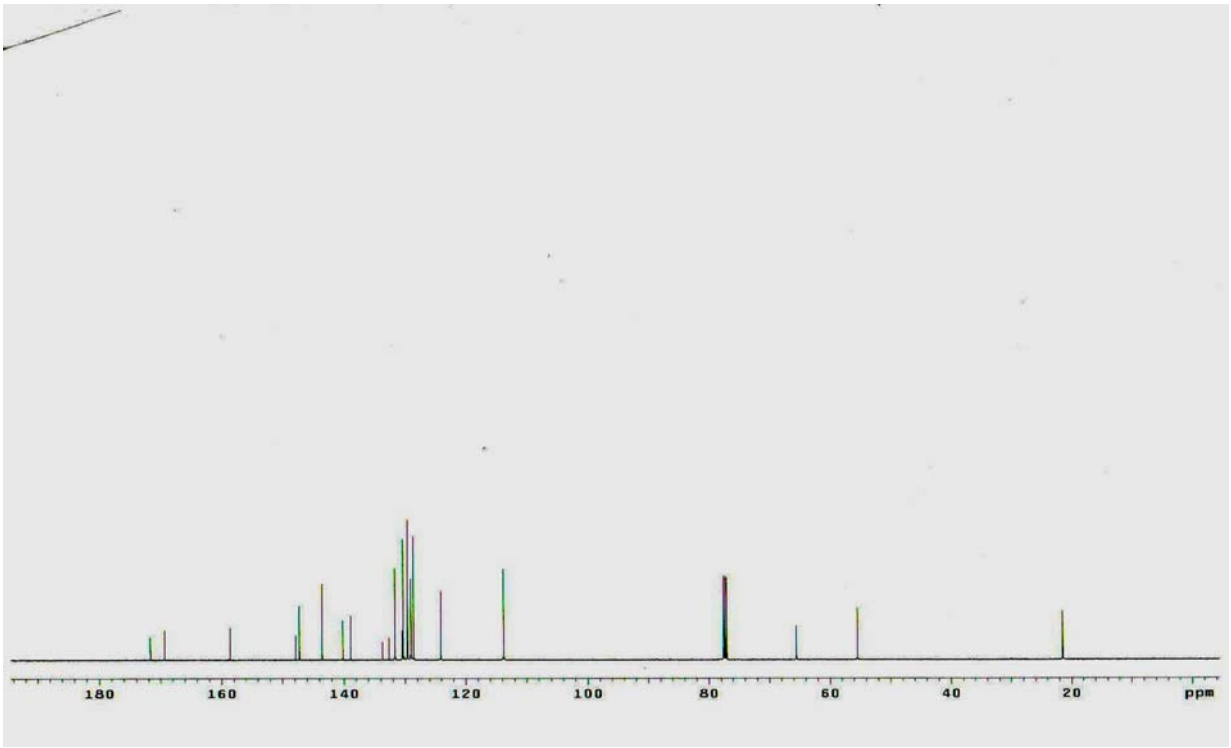


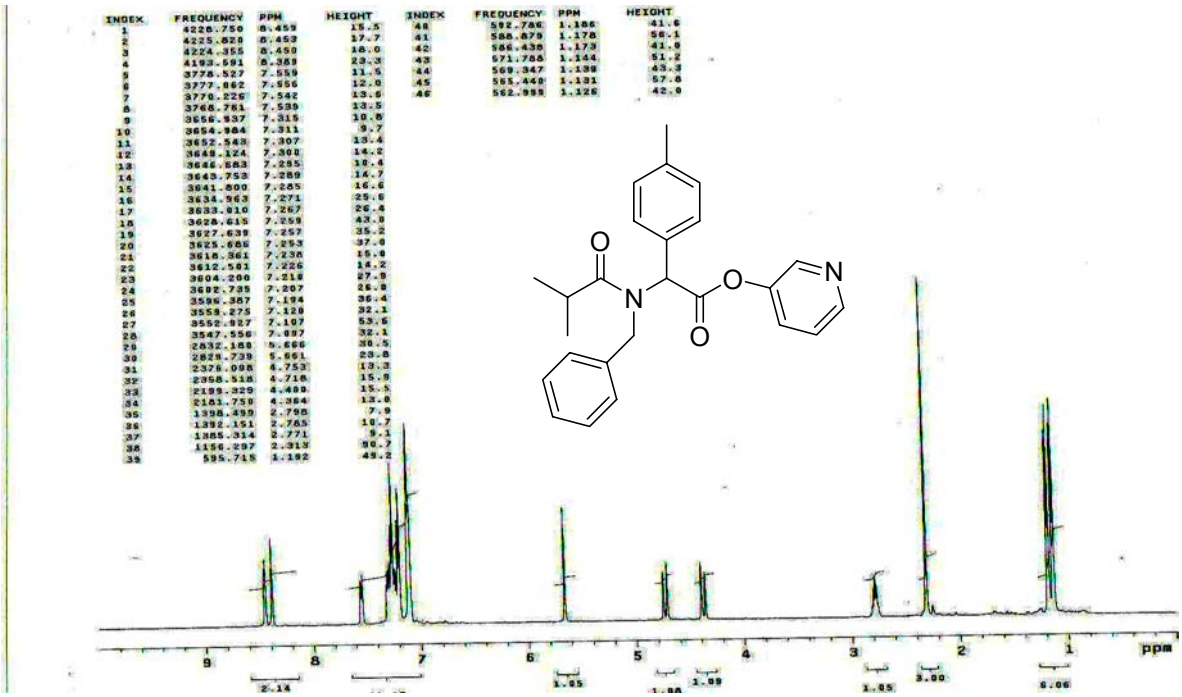
^{1}H NMR of [(4-Methoxy-phenyl)-(4-methyl-benzoyl)-amino]-p-tolyl-acetic acid pyridin-3-yl ester (table 2, entry 5)



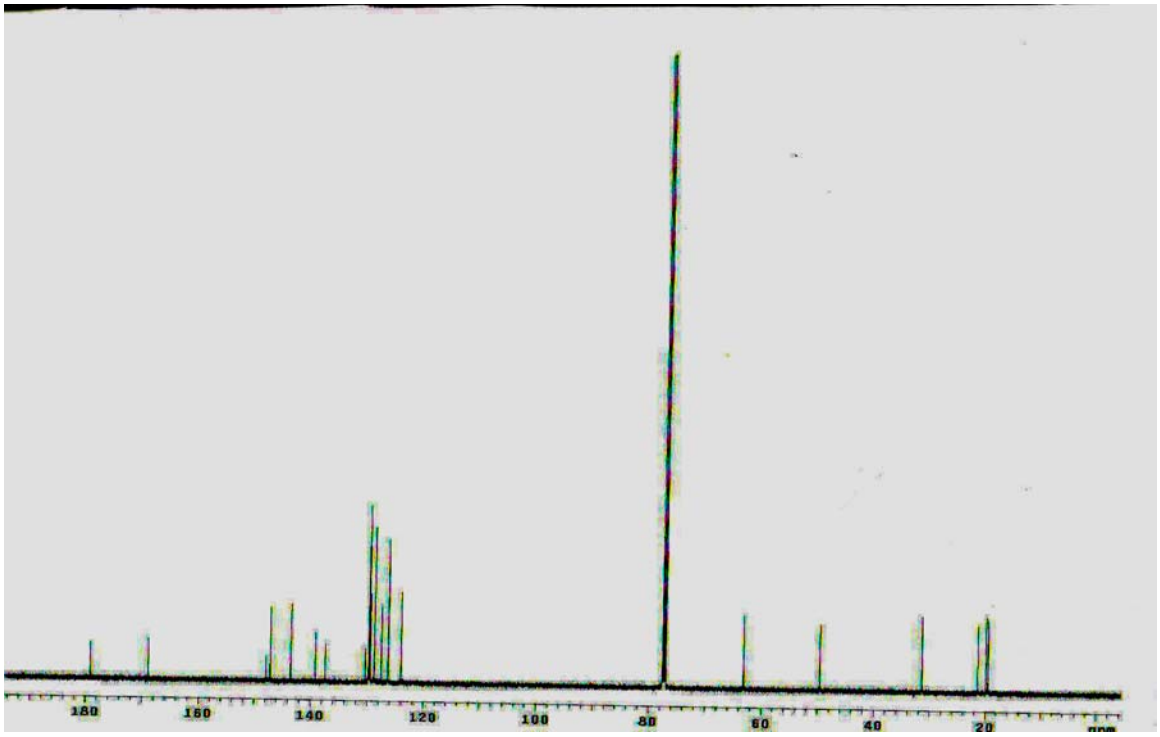
^{13}C NMR of [(4-Methoxy-phenyl)-(4-methyl-benzoyl)-amino]-p-tolyl-acetic acid pyridin-3-yl ester (table 2, entry 5)



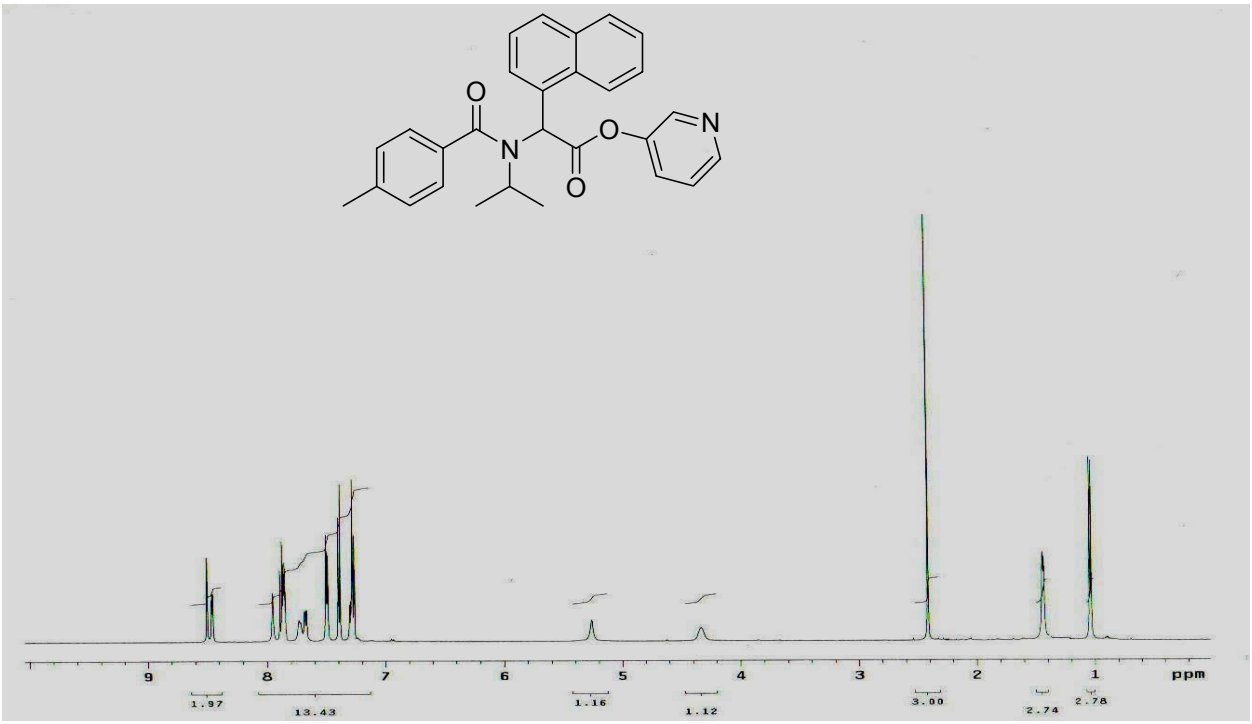
^{1}H NMR of (Benzyl-isobutyryl-amino)-p-tolyl-acetic acid pyridin-3-yl ester (table 2, entry 6)



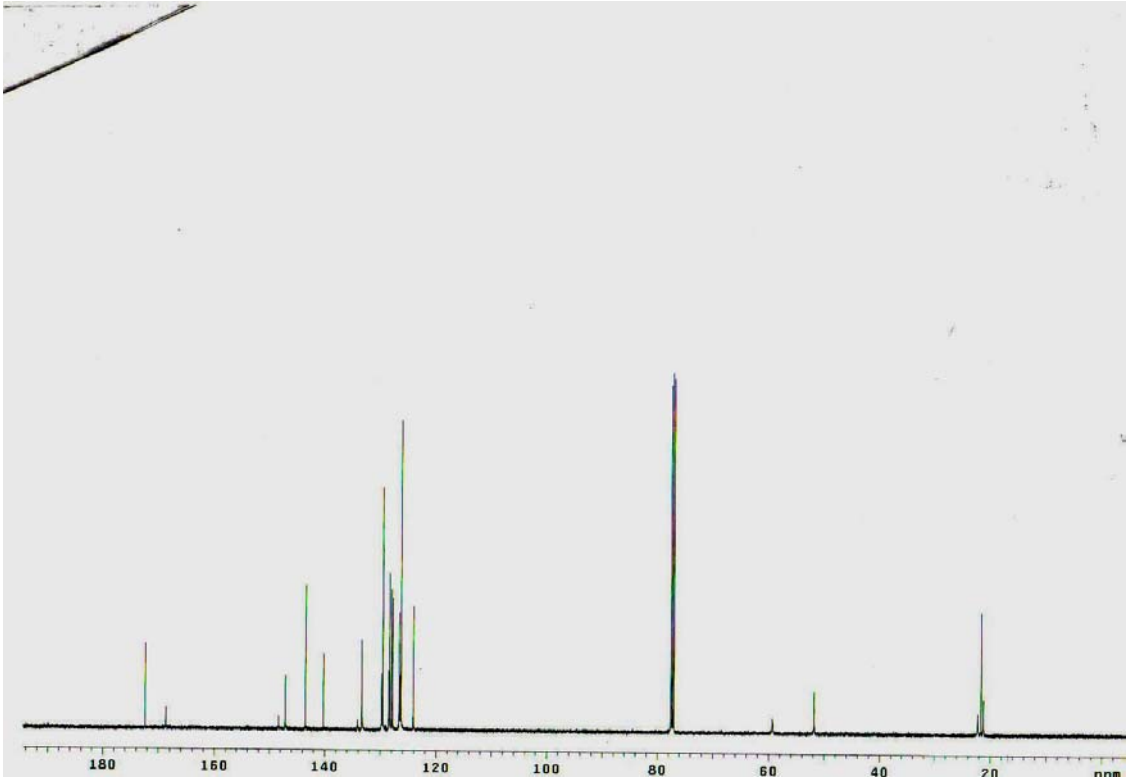
^{13}C NMR of (Benzyl-isobutyryl-amino)-p-tolyl-acetic acid pyridin-3-yl ester (table 2, entry 6)



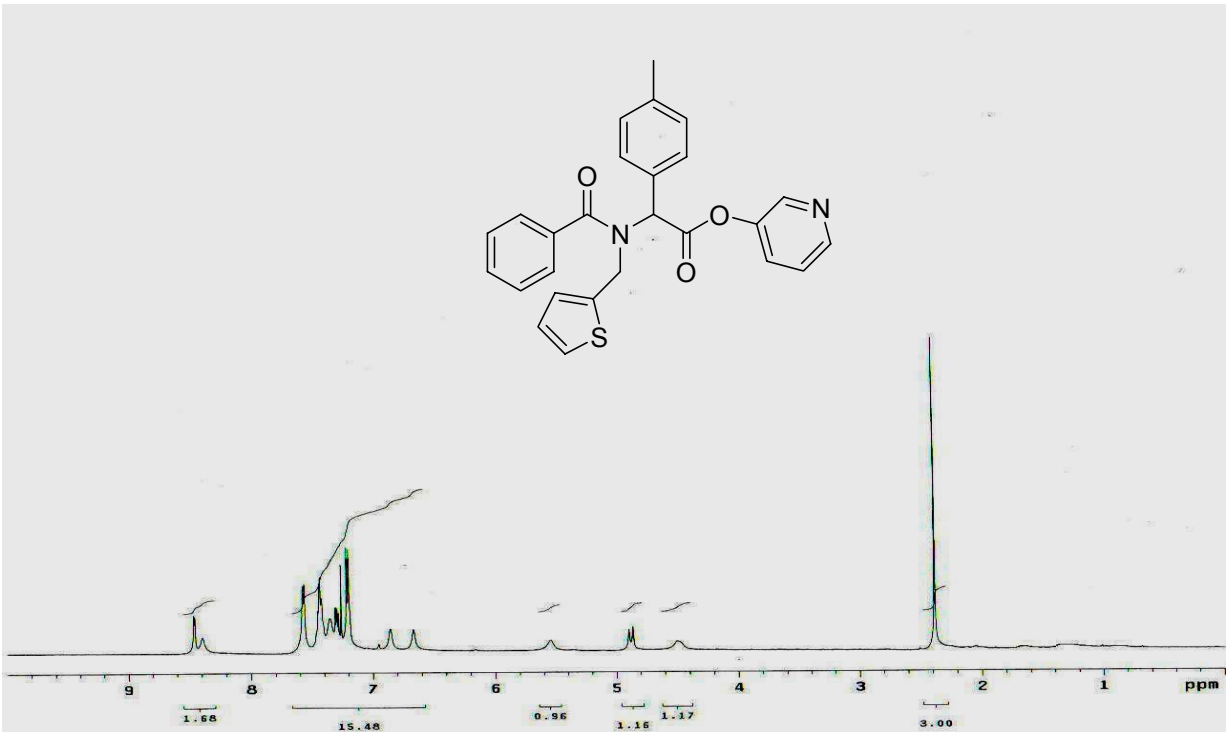
^{1}H NMR of [Isopropyl-(4-methyl-benzoyl)-amino]-naphthalen-1-yl-acetic acid pyridin-3-yl ester (table 2, entry 7)



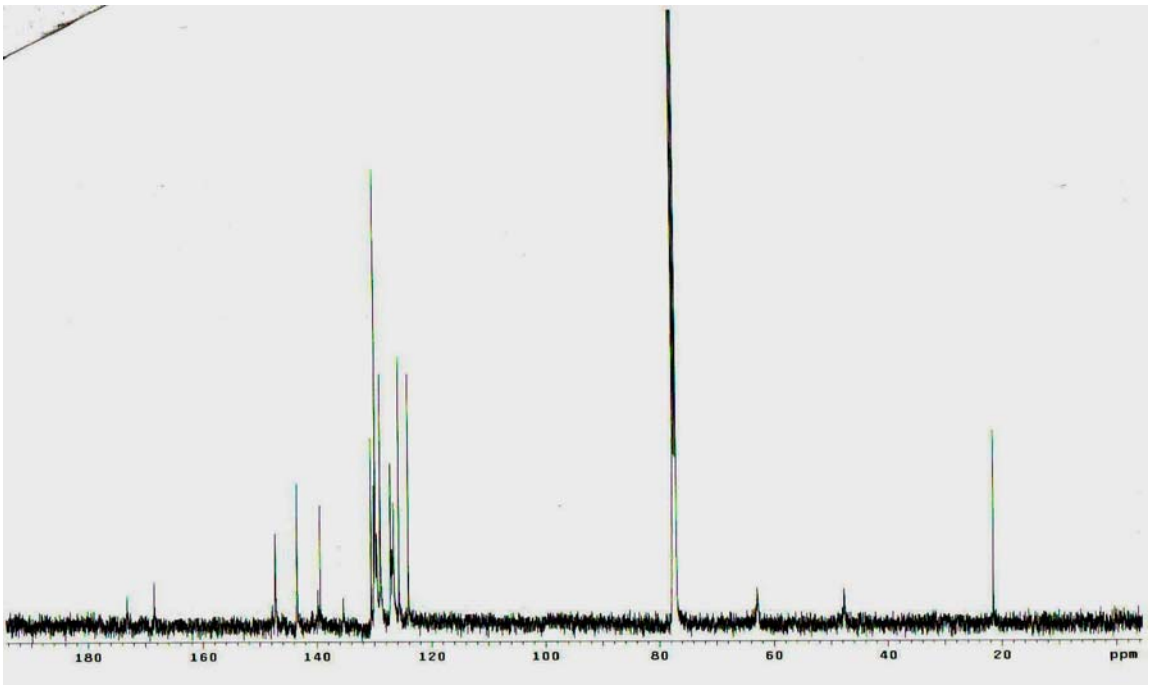
^{13}C NMR of [Isopropyl-(4-methyl-benzoyl)-amino]-naphthalen-1-yl-acetic acid pyridin-3-yl ester (table 2, entry 7)



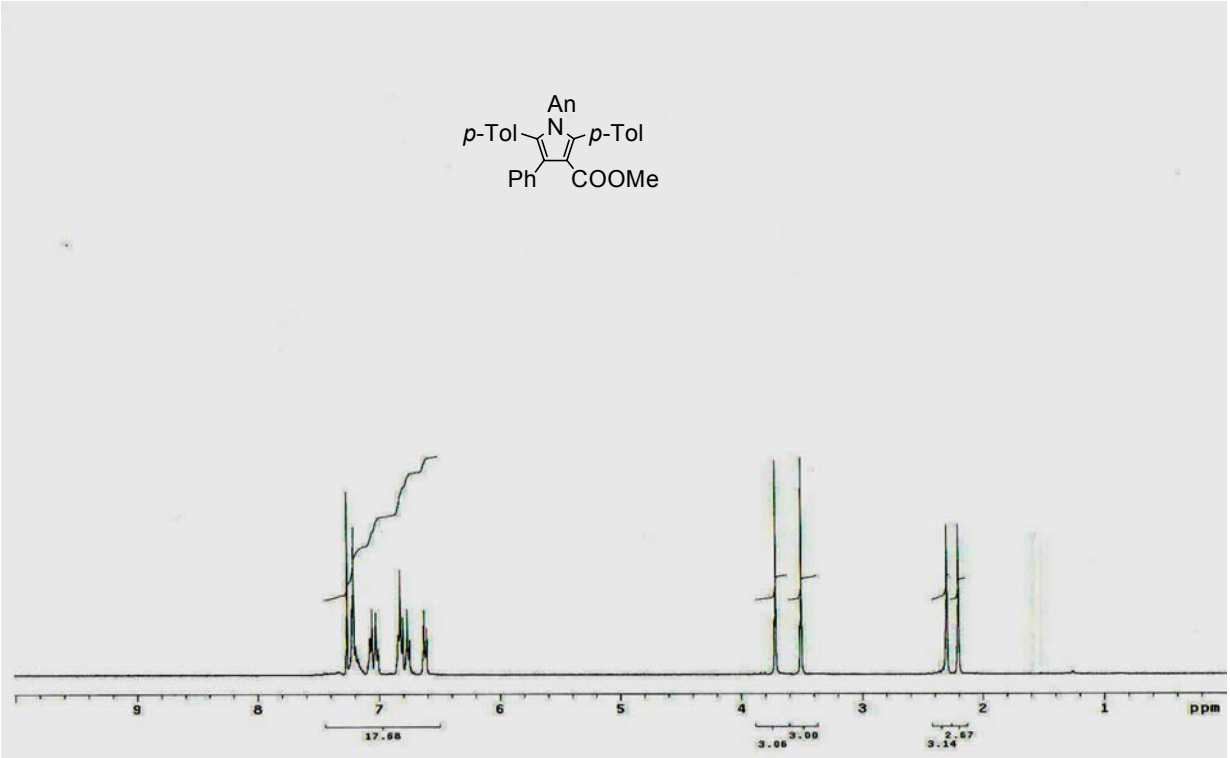
^{1}H NMR of (Benzoyl-thiophen-2-ylmethyl-amino)-p-tolyl-acetic acid pyridin-3-yl ester (table 2, entry 8)



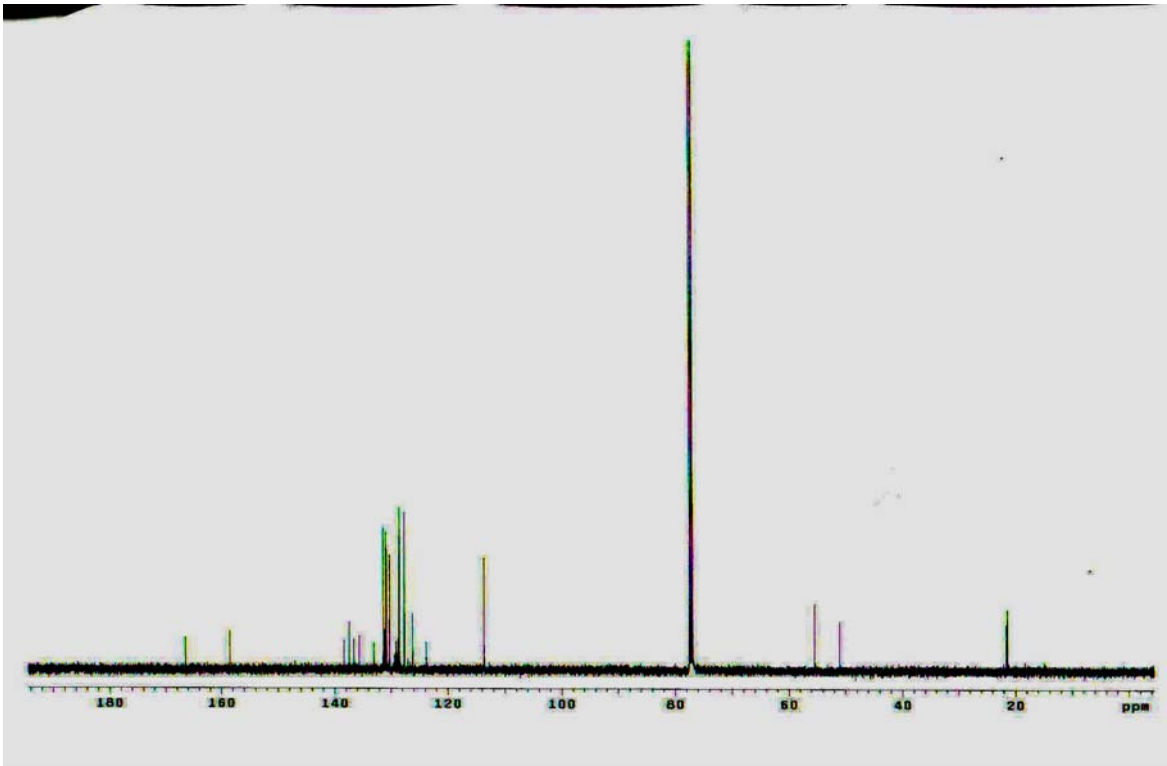
^{13}C NMR of (Benzoyl-thiophen-2-ylmethyl-amino)-p-tolyl-acetic acid pyridin-3-yl ester (table 2, entry 8)



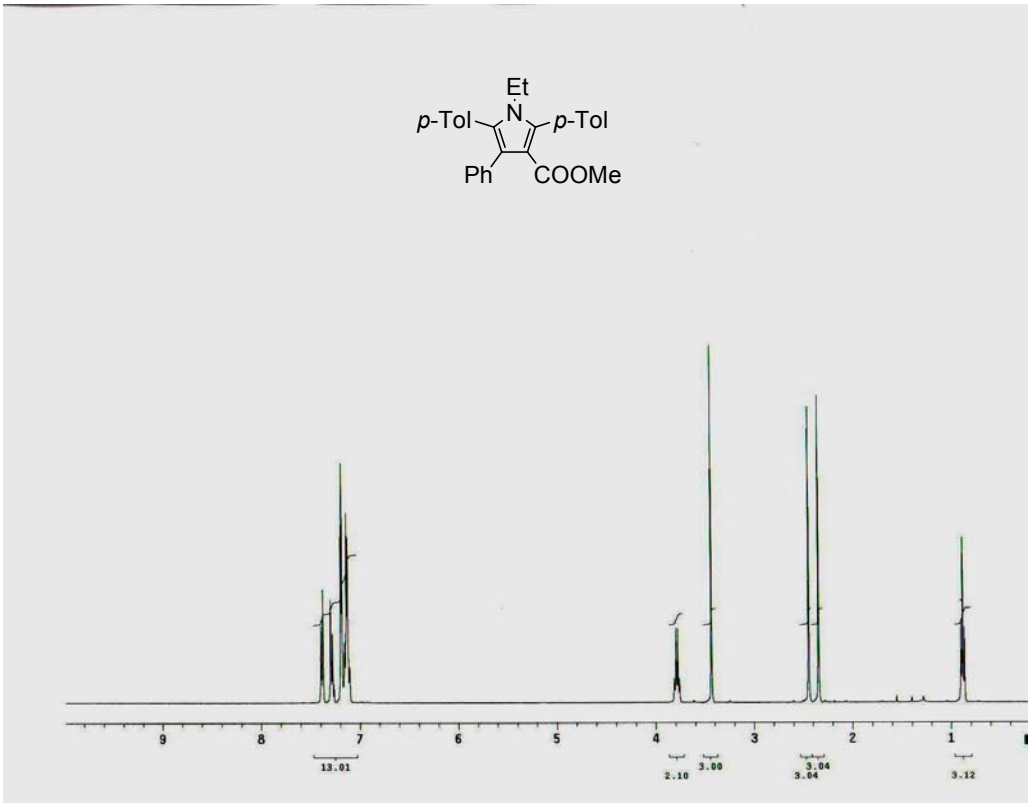
^{1}H NMR of methyl 1-(4-methoxyphenyl)-4-phenyl-2,5-bis(p-tolyl)-1H-pyrrole-3-carboxylate (**9c)**



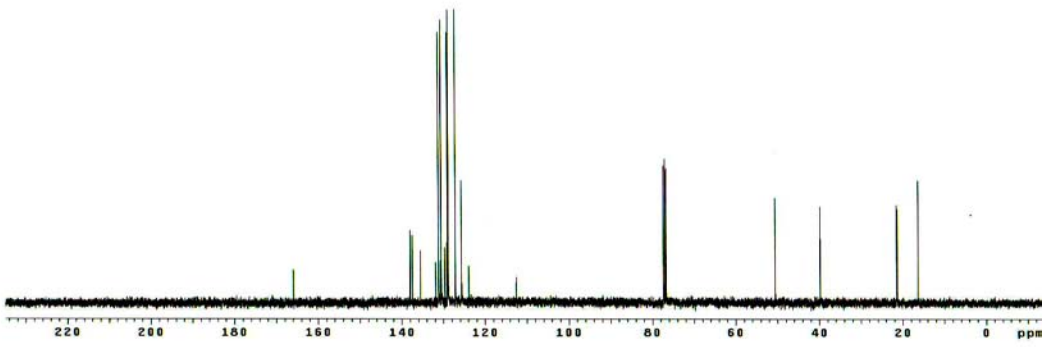
^{13}C NMR of methyl 1-(4-methoxyphenyl)-4-phenyl-2,5- bis(p-tolyl)-1H-pyrrole-3-carboxylate (**9c)**



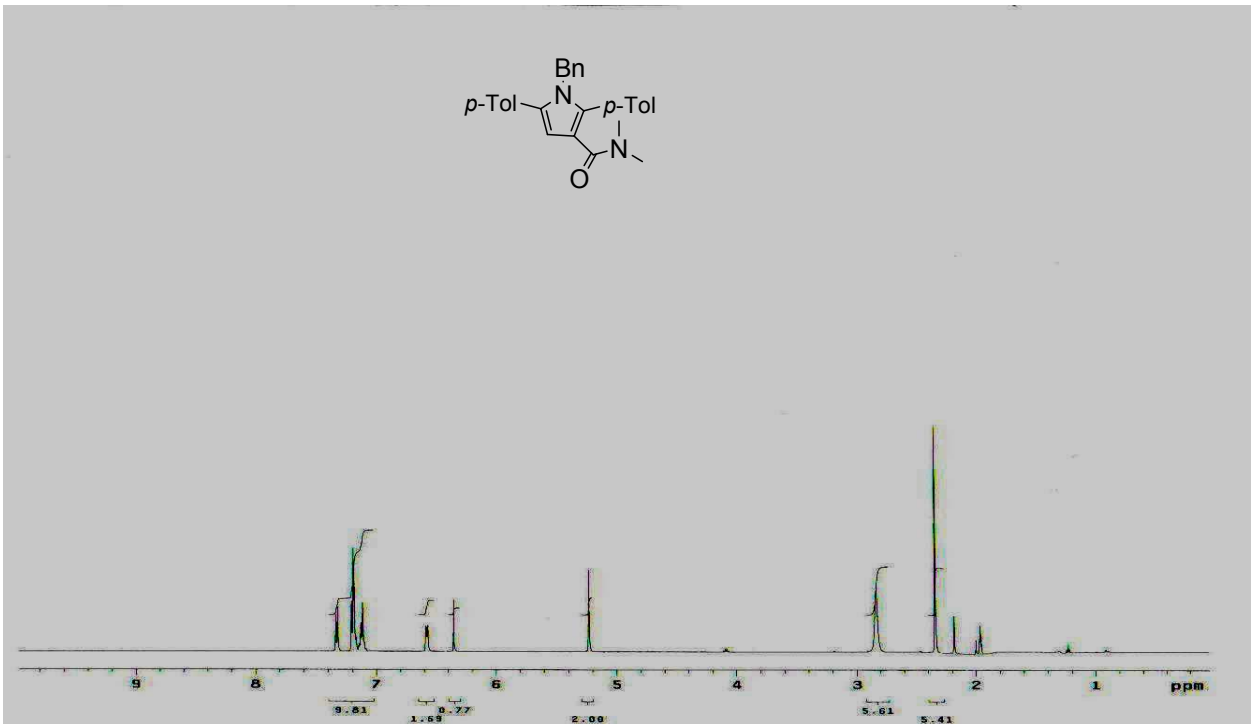
^{1}H NMR of methyl 1-ethyl-4-phenyl-2,5- bis(p-tolyl)-1H-pyrrole-3-carboxylate (**9b)**



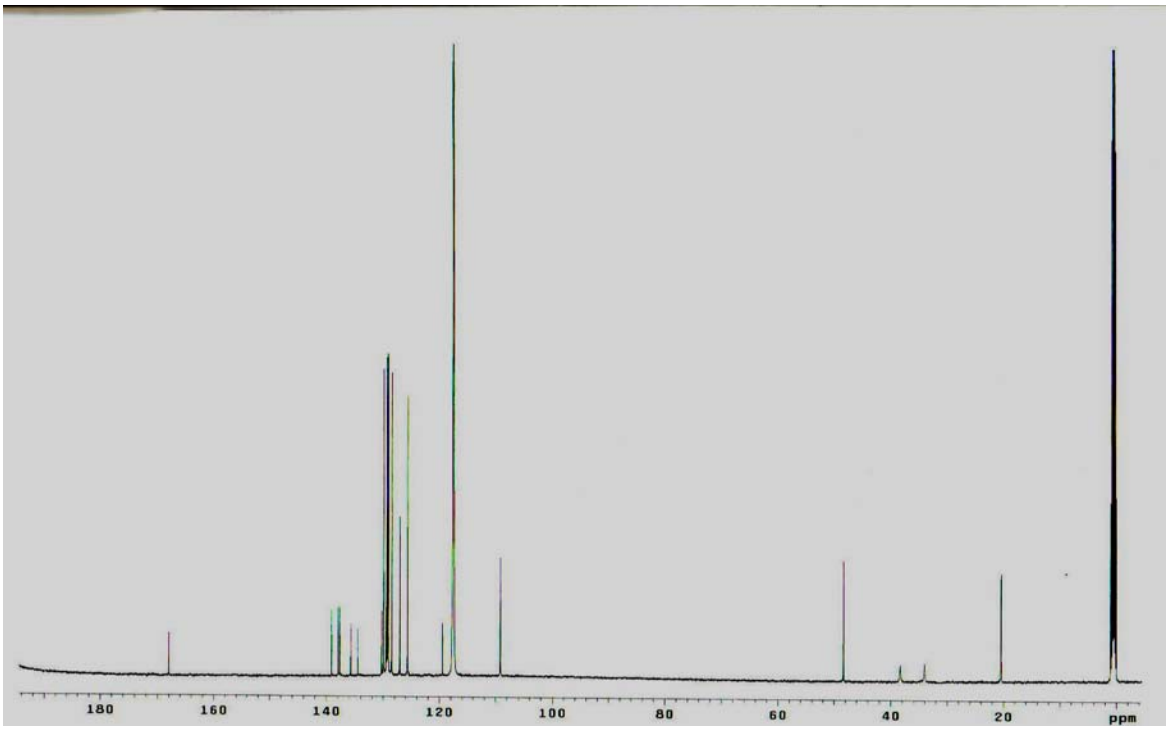
^{13}C NMR of methyl 1-ethyl-4-phenyl-2,5-bis(p-tolyl)-1H-pyrrole-3-carboxylate (**9b)**



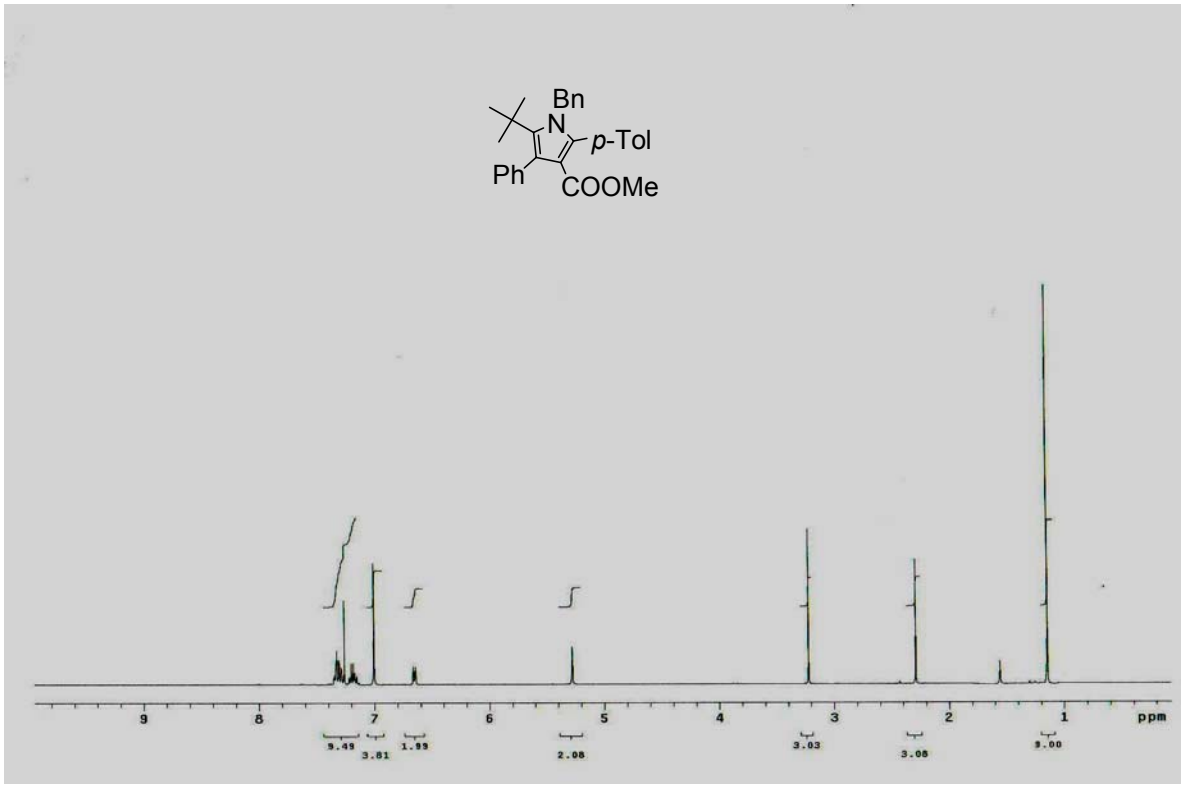
^{1}H NMR of 1-benzyl-N,N-dimethyl-2,5- bis(p-tolyl)-1H-pyrrole-3-carboxamide (**9d)**



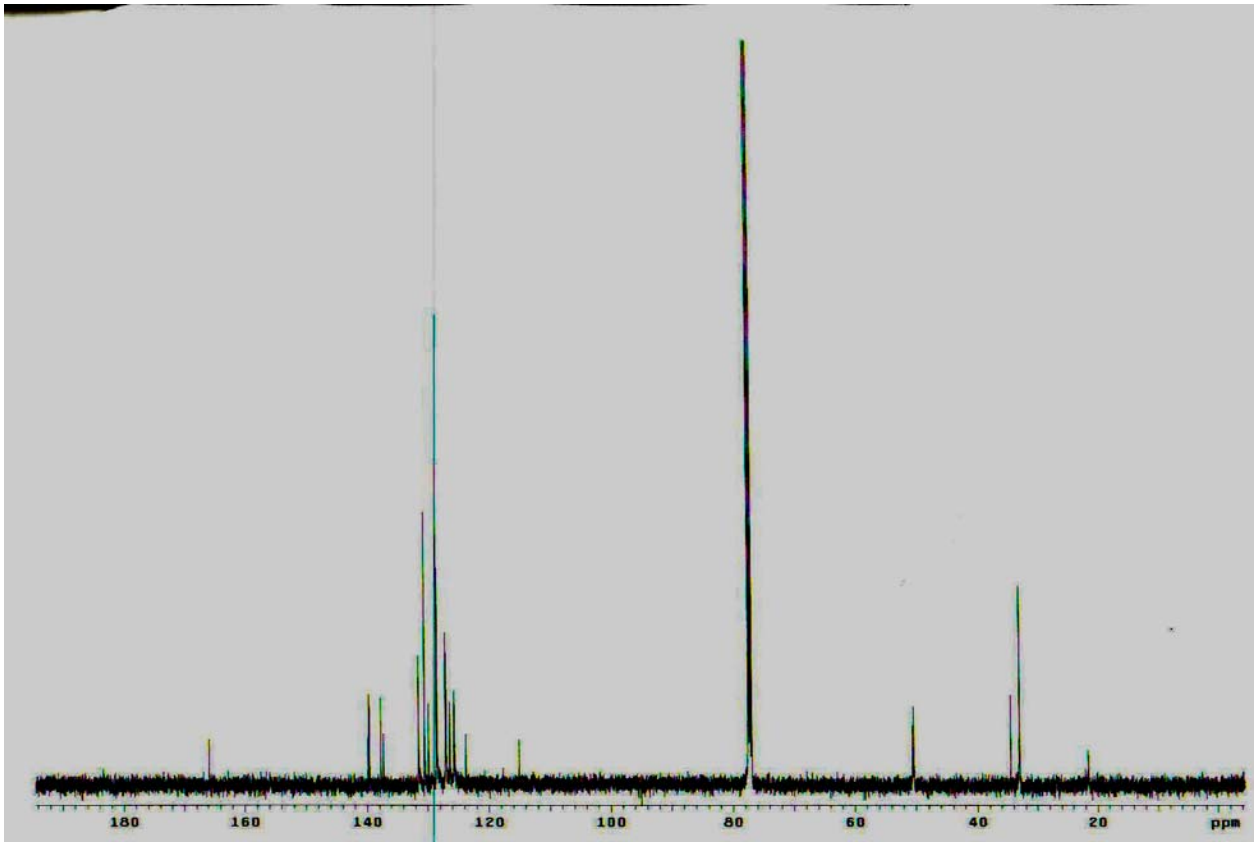
^{13}C NMR of 1-benzyl-N,N-dimethyl-2,5- bis(p-tolyl)-1H-pyrrole-3-carboxamide (**9d)**



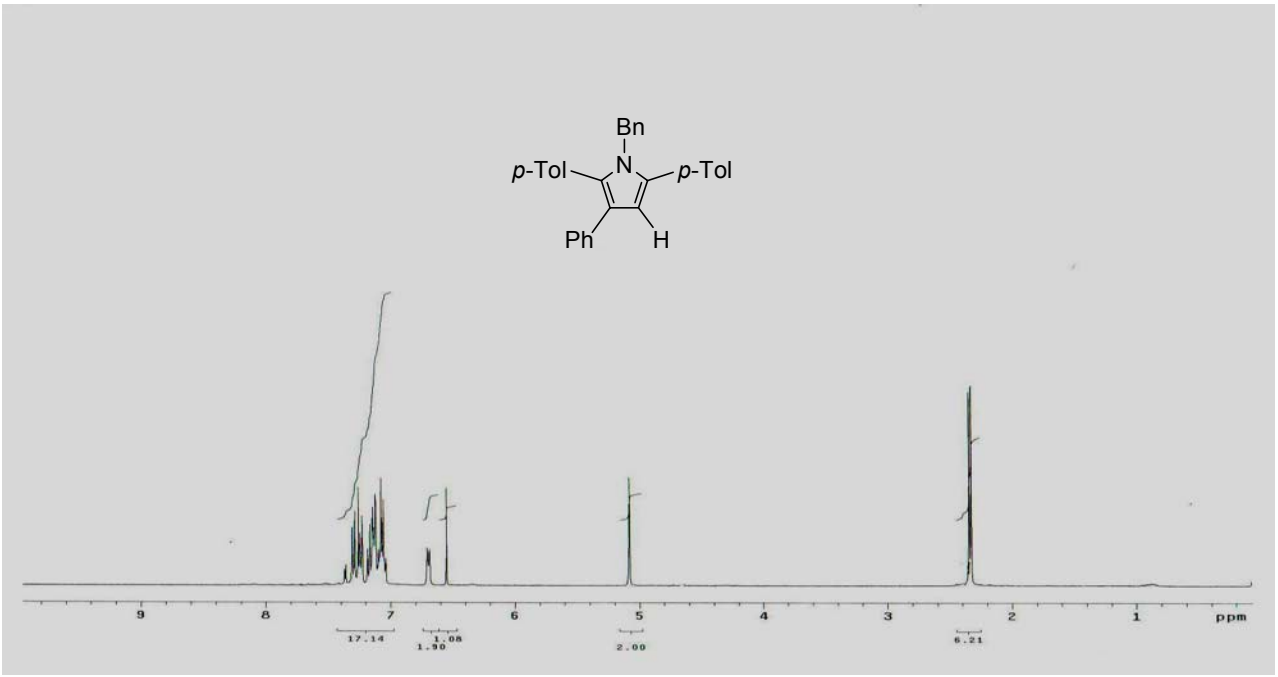
^{1}H NMR of methyl 1-benzyl-5-tert-butyl-4-phenyl-2-p-tolyl-1H-pyrrole-3-carboxylate **(9e)**



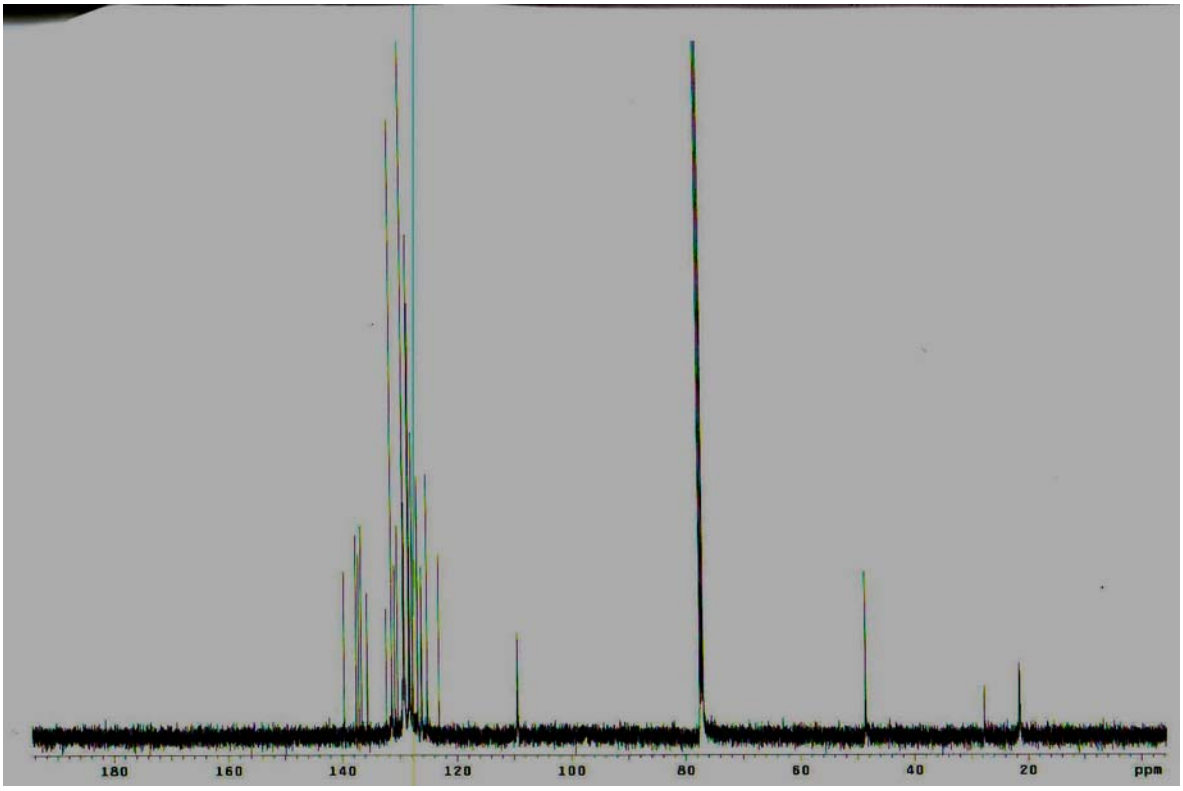
^{13}C NMR of methyl 1-benzyl-5-tert-butyl-4-phenyl-2-p-tolyl-1H-pyrrole-3-carboxylate **(9e)**



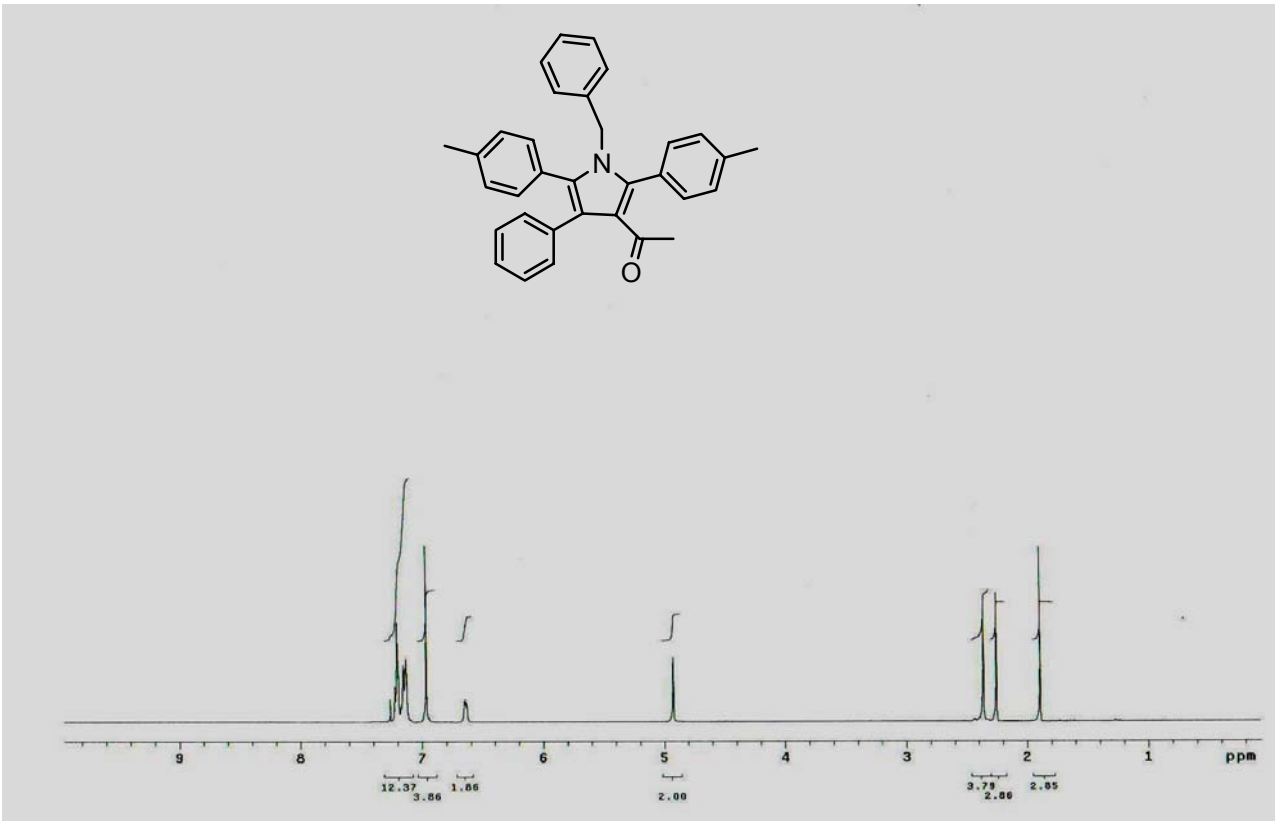
^{1}H NMR of 1-benzyl-3-phenyl-2,5- bis(p-tolyl)-1H-pyrrole (**9f)**



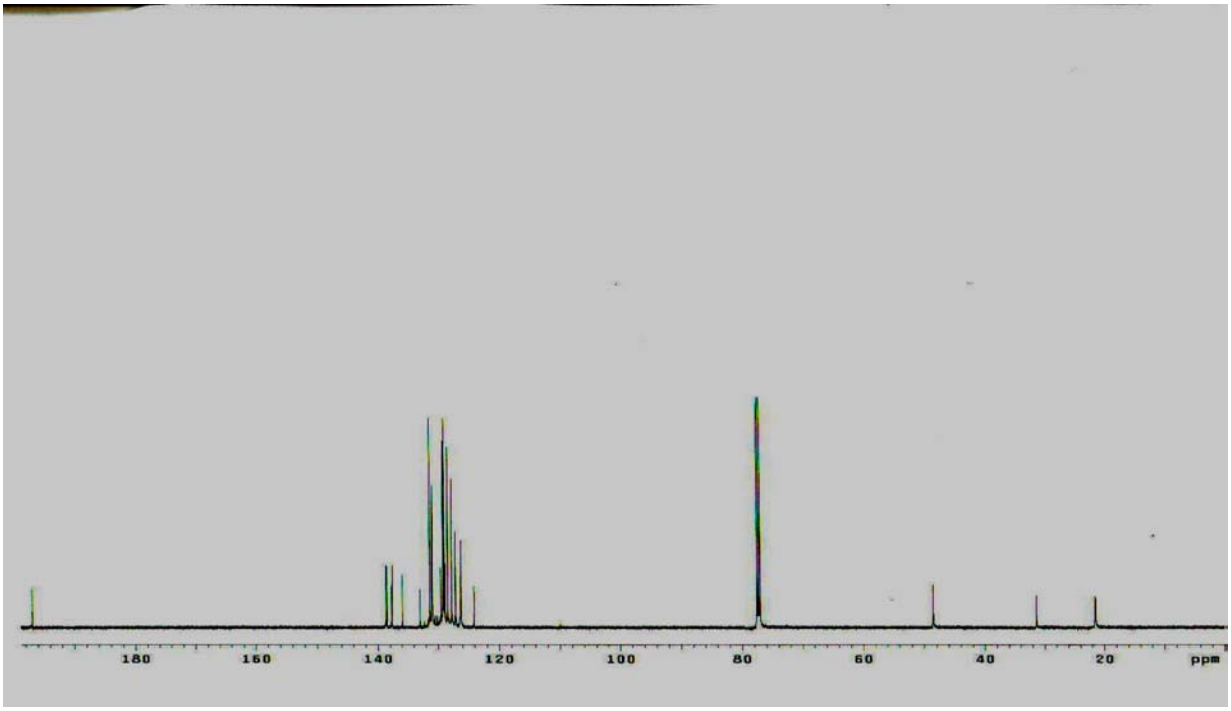
^{13}C NMR of 1-benzyl-3-phenyl-2,5- bis(p-tolyl)-1H-pyrrole (**9f)**



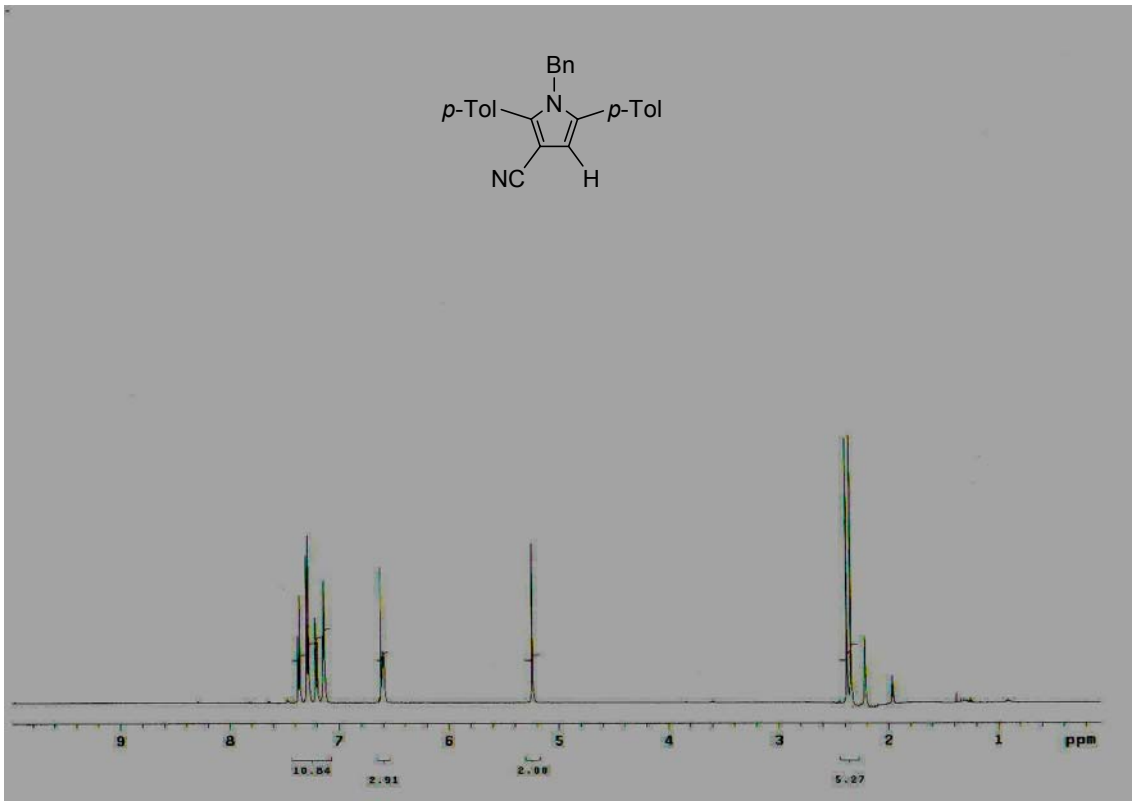
^{1}H NMR of 1-(1-benzyl-4-phenyl-2,5- bis(p-tolyl)-1H-pyrrol-3-yl)ethanone (**9h)**



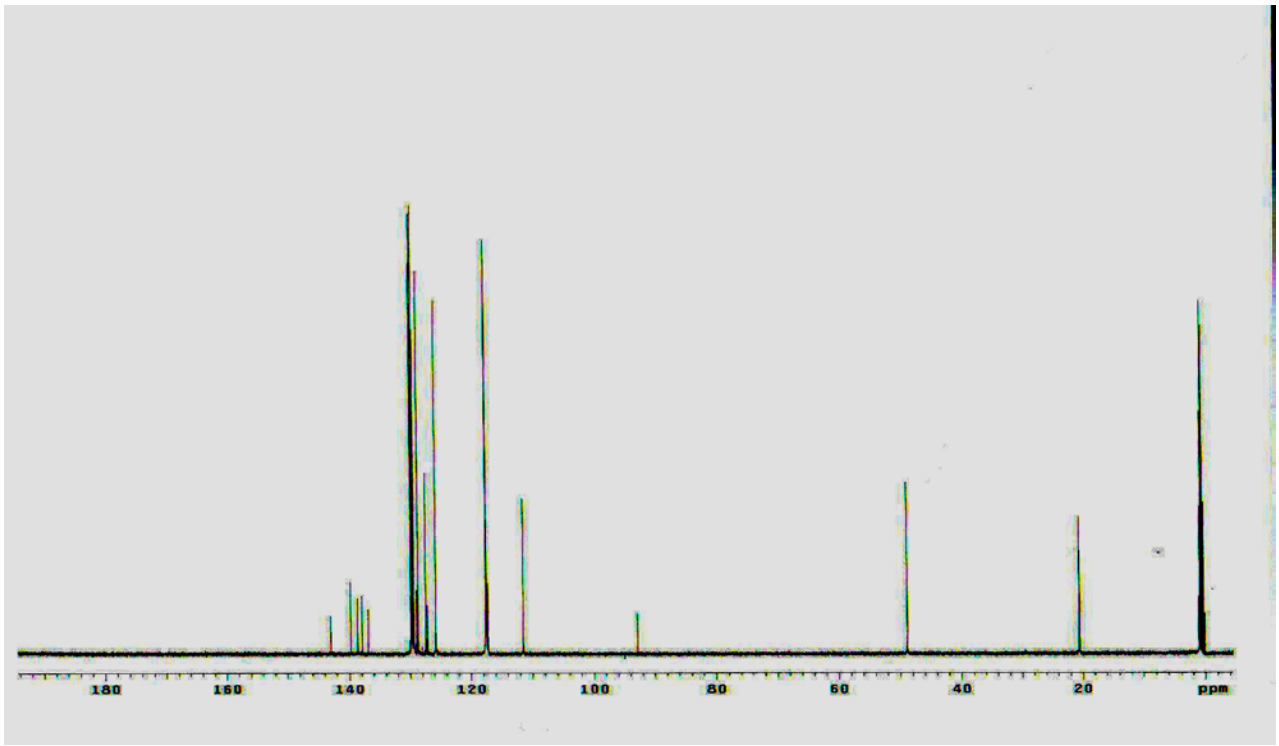
^{13}C NMR of1-(1-benzyl-4-phenyl-2,5- bis(p-tolyl)-1H-pyrrol-3-yl)ethanone (**9h)**



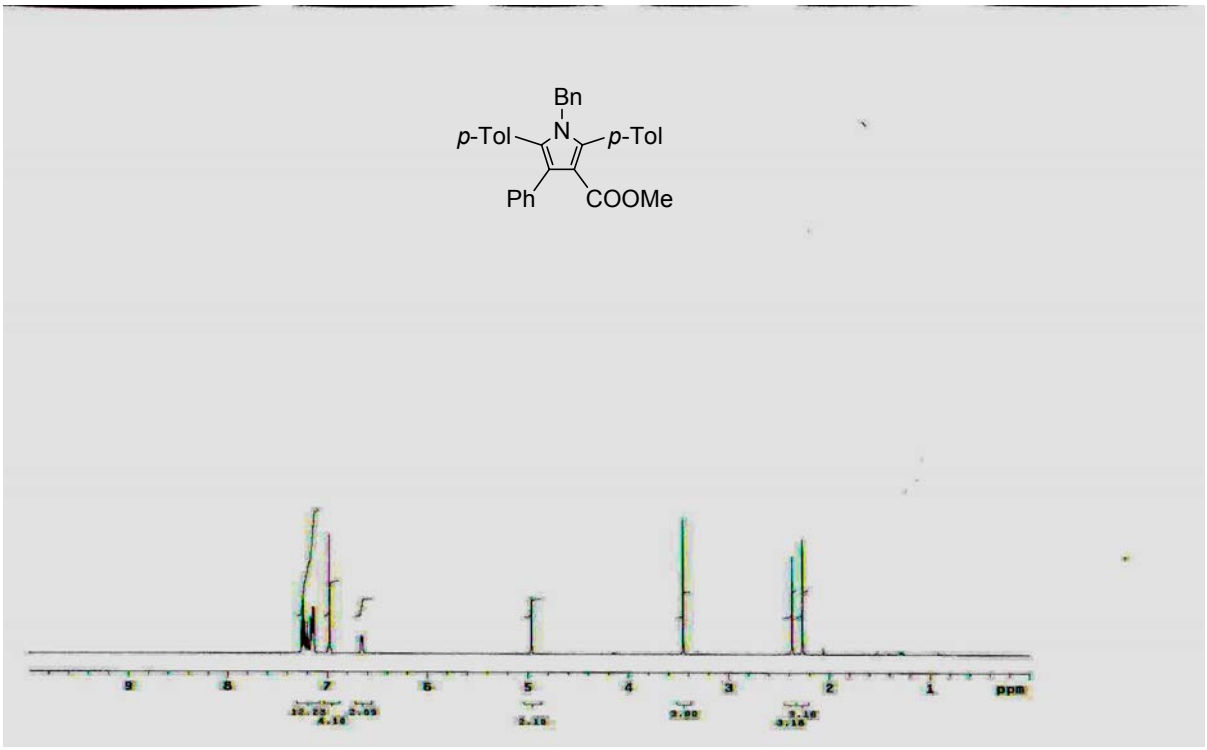
^{1}H NMR of 1-benzyl-2,5- bis(p-tolyl)-1H-pyrrole-3-carbonitrile (**9g)**



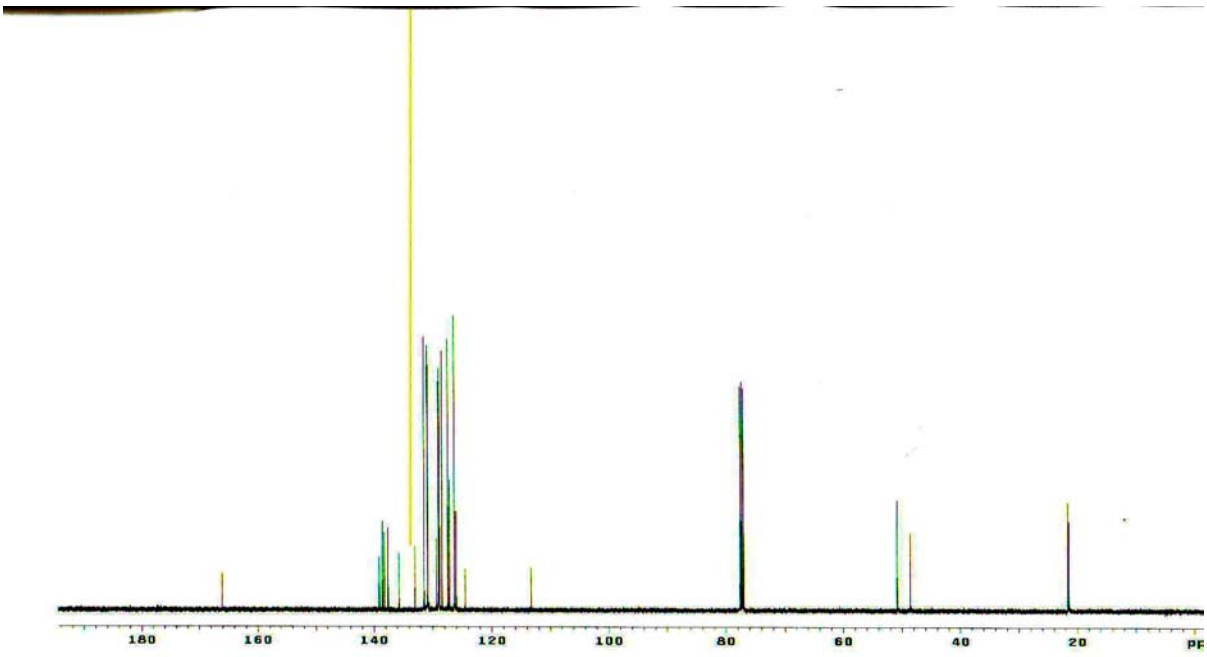
^{13}C NMR of 1-benzyl-2,5- bis(p-tolyl)-1H-pyrrole-3-carbonitrile (**9g)**



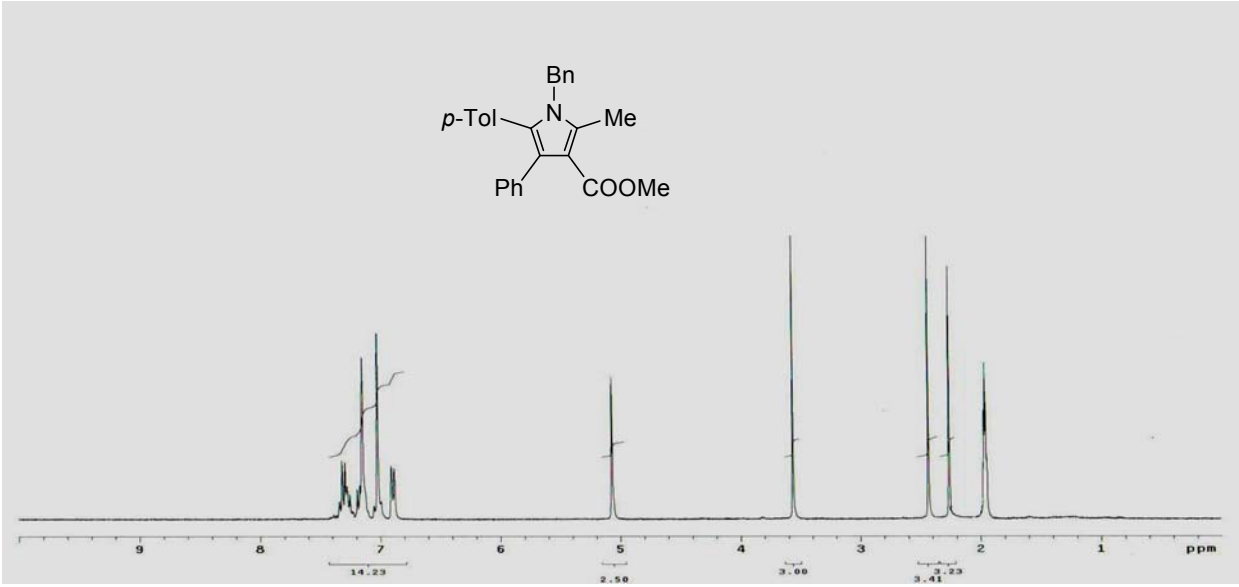
^{1}H NMR of methyl 1-benzyl-4-phenyl-2,5-bis(p-tolyl)-1H-pyrrole-3-carboxylate (**9a)**



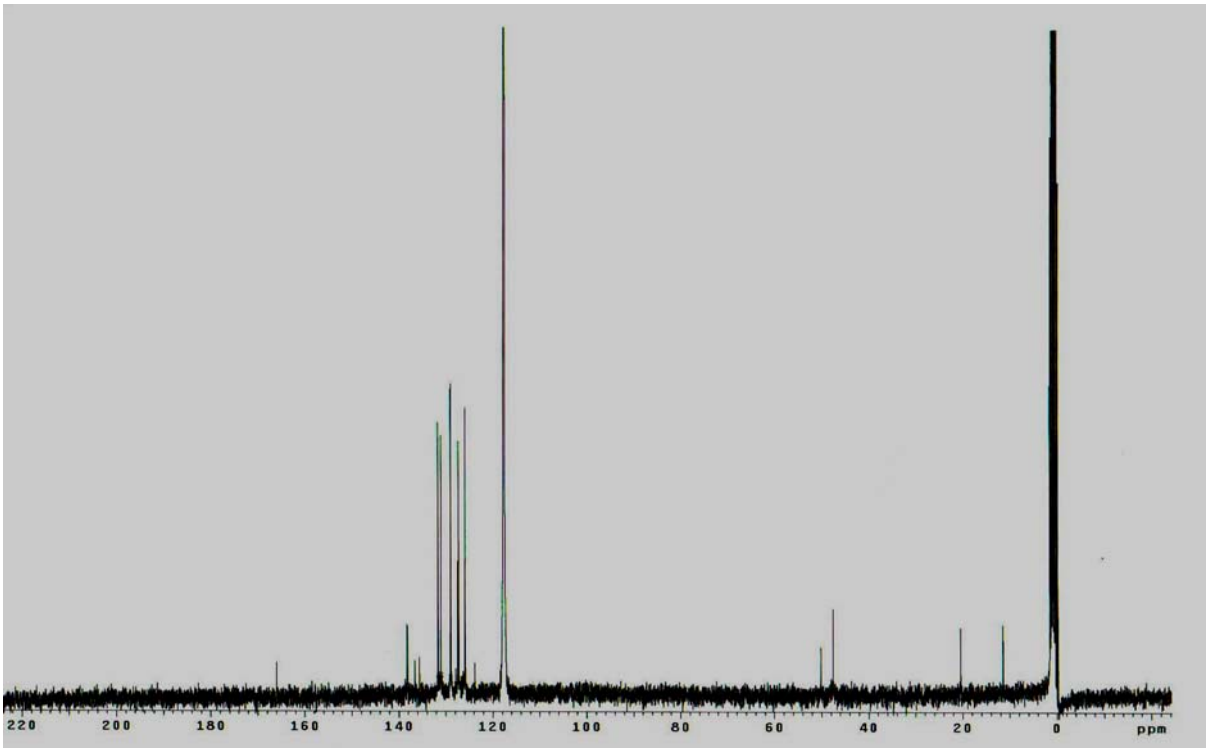
^{13}C NMR of methyl 1-benzyl-4-phenyl-2,5- bis(p-tolyl)-1H-pyrrole-3-carboxylate (**9a)**



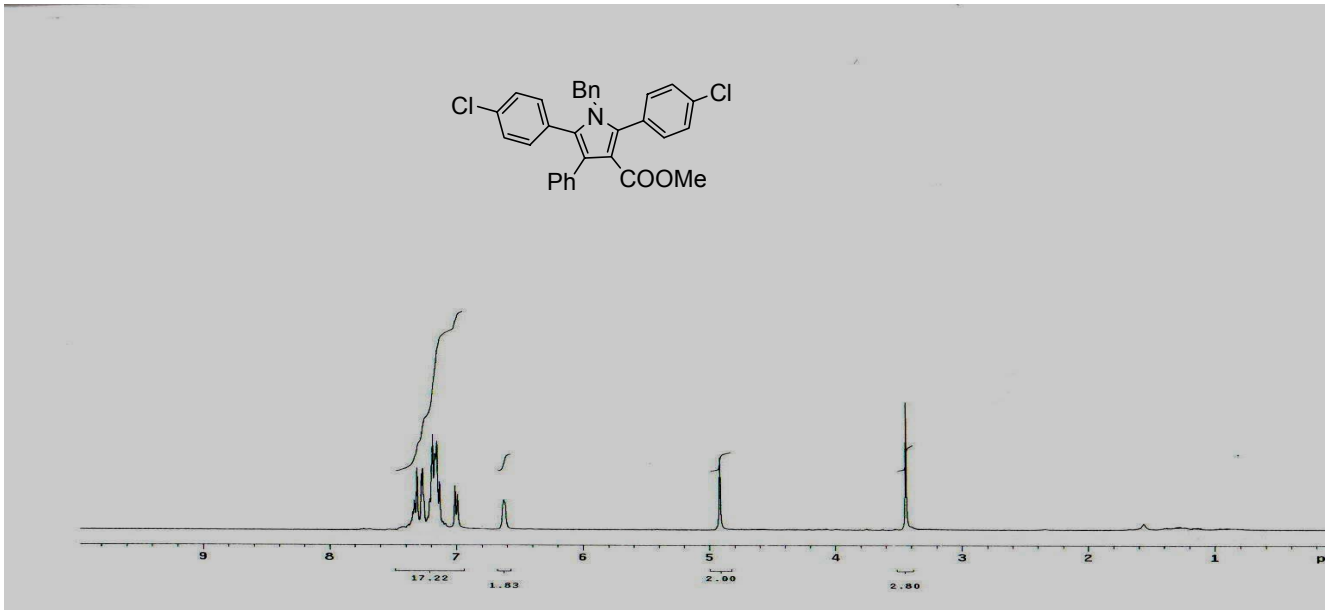
^{1}H NMR of methyl 1-benzyl-2-methyl-4-phenyl-5-p-tolyl-1H-pyrrole-3-carboxylate **(9i)**



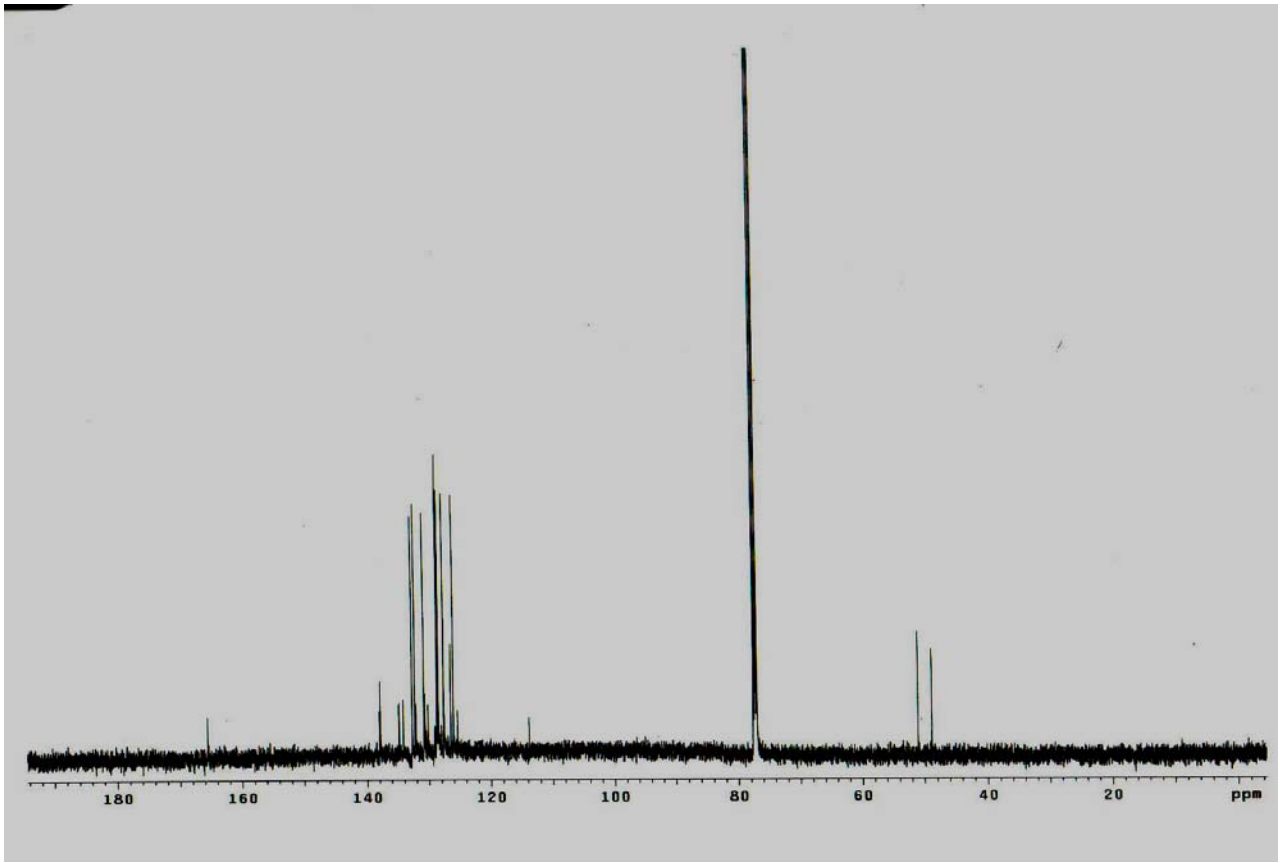
^{13}C NMR of methyl 1-benzyl-2-methyl-4-phenyl-5-p-tolyl-1H-pyrrole-3-carboxylate **(9i)**



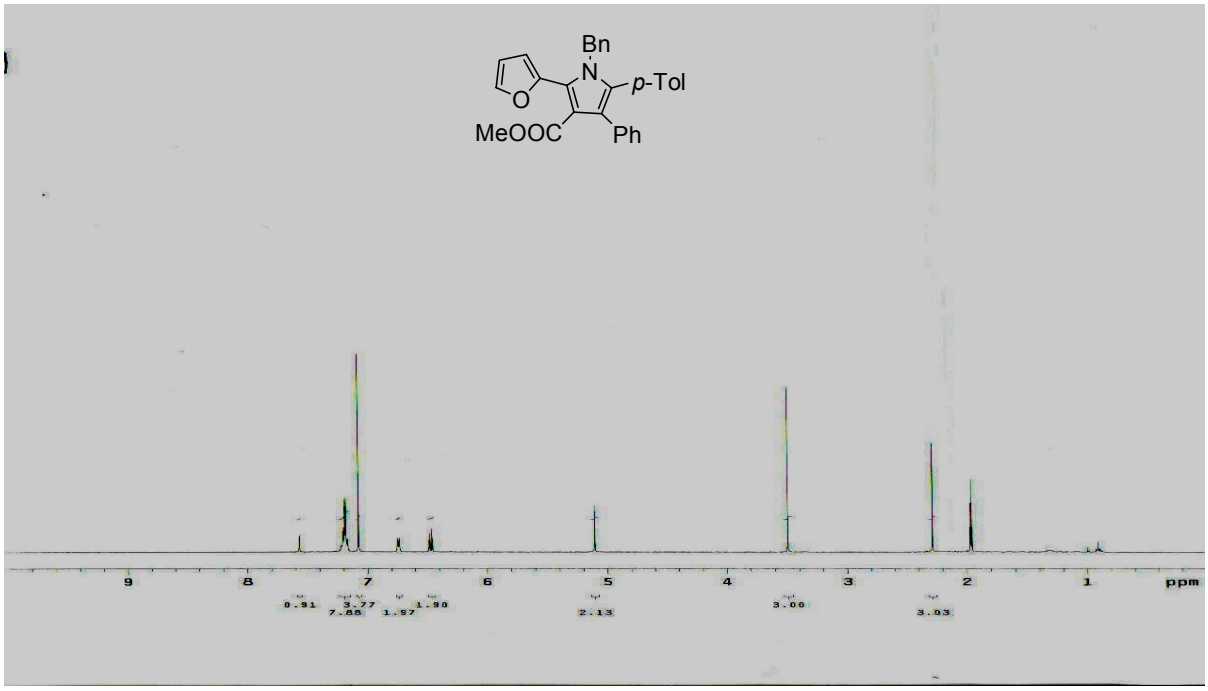
^{1}H NMR of methyl 1-benzyl-2,5-bis(4-chlorophenyl)-4-phenyl-1H-pyrrole-3-carboxylate **(9j)**



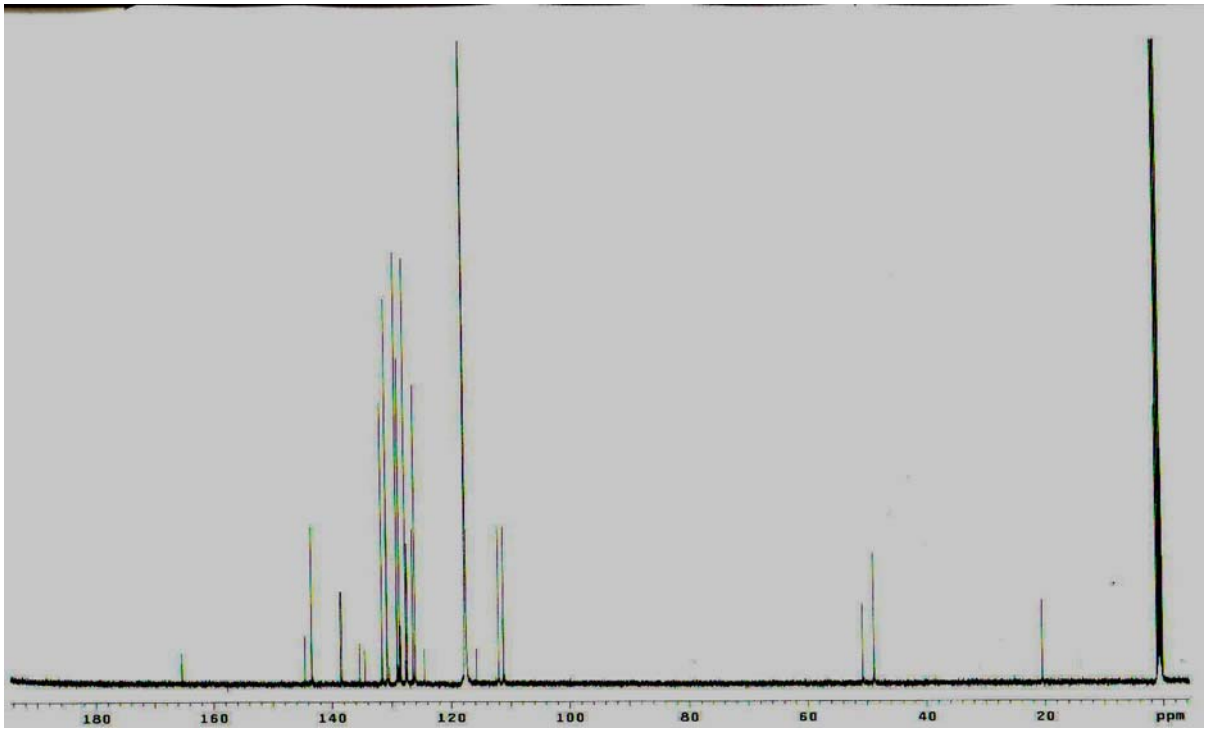
^{13}C NMR of methyl 1-benzyl-2,5-bis(4-chlorophenyl)-4-phenyl-1H-pyrrole-3-carboxylate **(9j)**



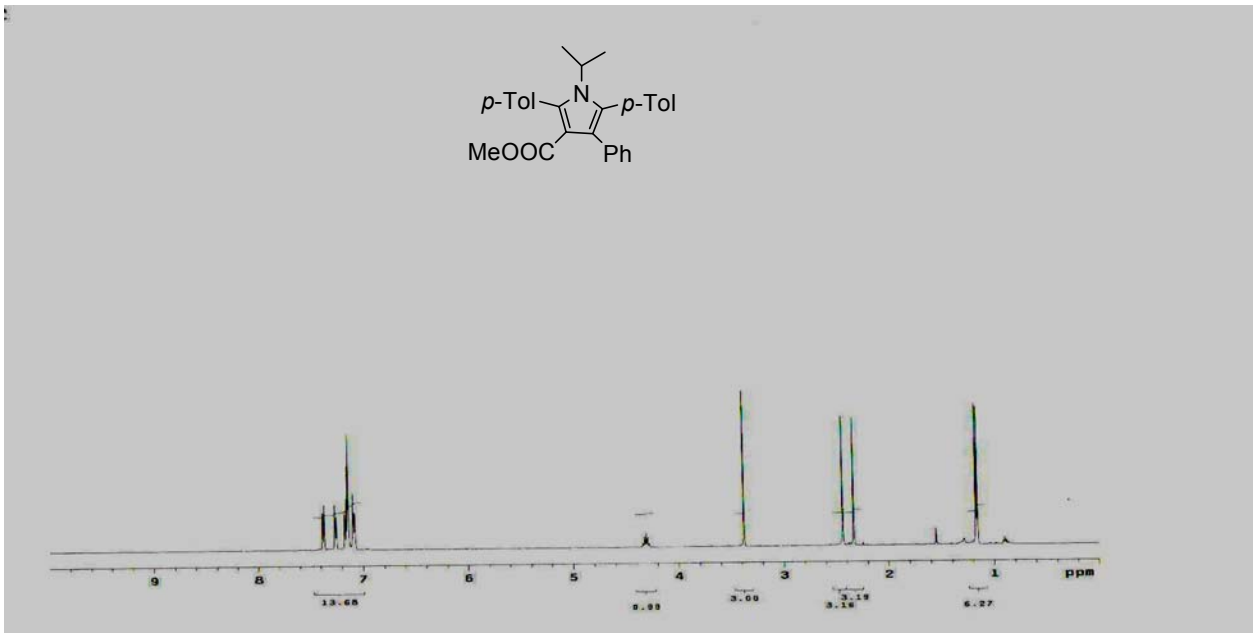
^{1}H NMR of methyl 1-benzyl-2-(furan-2-yl)-4-phenyl-5-p-tolyl-1H-pyrrole-3-carboxylate (**9k)**



^{13}C NMR of methyl 1-benzyl-2-(furan-2-yl)-4-phenyl-5-p-tolyl-1H-pyrrole-3-carboxylate (**9k)**



^{1}H NMR of methyl 1-isopropyl-4-phenyl-2,5- bis(p-tolyl)-1H-pyrrole-3-carboxylate (**9l)**



^{13}C NMR of methyl 1-isopropyl-4-phenyl-2,5- bis(p-tolyl)-1H-pyrrole-3-carboxylate (**9l)**