Supporting Information for:

Cu(II)-Catalyzed cyclization of *α*-diazo-*β*-oxoamides with amines leading to pyrrol-3(*2H*)-ones

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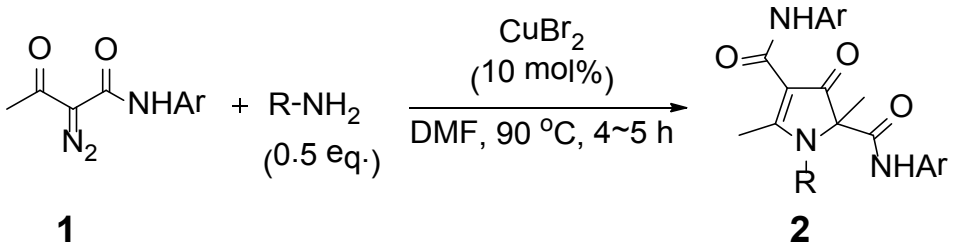
Contents

I. General Information

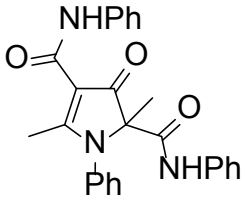
All reagents were purchased from commercial sources and used without treatment, unless otherwise indicated. The products were purified by column chromatography over silica gel. ^{1}H NMR and ^{13}C NMR spectra were recorded at 25 °C at 300MHz or 400MHz and 100MHz, respectively, with TMS as internal standard. Mass spectra were recorded on BRUKER AutoflexIII Smartbeam MS-spectrometer. High resolution mass spectra (HRMS) were recorded on Bruck microTof by using ESI method.

II. Synthesis and analytical data for compounds 2aa-2aj, 2ba-2bh and 2ca-2cb.



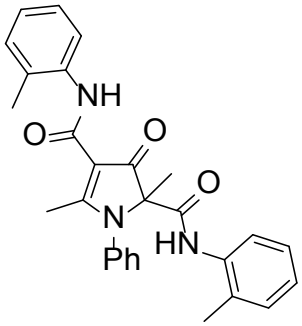
1 **2**

Synthesis of Pyrrol-3(2*H*)-ones 2aa-2aj and 2ba-2bh (with **2aa** as an example): To a solution of the **1a** (2 mmol) and aniline (1 mmol) dissolved in DMF (6 mL) was added 0.1 equiv of $CuBr_2$ (0.2 mmol). The mixture was warmed to 90 °C and stirred for 4 h. When **1a** disappeared (monitored by TLC), the reaction mixture was then treated with 50 mL brine, and extracted with dichloromethane (2 × 50 mL). The combined organic layer was washed with brine (3 × 50 mL), dried over $MgSO_4$ and filtered. The filtrate was concentrated in *vacuum*, and then purified by silica gel column chromatography to give **2aa** as a yellowish solid.



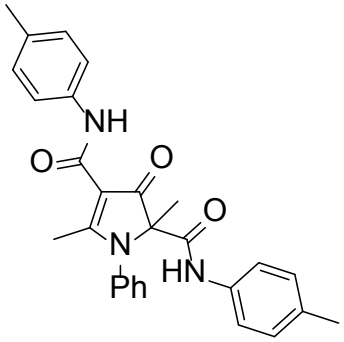
2,5-dimethyl-3-oxo-N^2,N^4,1-triphenyl-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

(**2aa**) Yellowish solid; mp 197-200 °C. **^{1}H-NMR** ($CDCl_3$, 300 MHz) δ 10.12 (s, 1H), 8.86 (s, 1H), 7.64-7.67 (m, 2H), 7.49-7.54 (m, 5H), 7.43-7.46 (m, 1H), 7.33 (t, J = 9.0Hz, 5H), 7.06-7.16 (m, 2H), 2.59 (s, 3H), 1.78 (s, 3H). **^{13}C-NMR** ($CDCl_3$, 100Hz) δ 195.3, 182.5, 163.2, 161.5, 138.4, 137.0, 135.6, 129.6, 129.5, 128.9, 128.8, 124.8, 123.5, 120.4, 120.0, 103.5, 76.7, 22.1, 16.4. **HRMS** Calcd for $C_{26}H_{24}N_3O_3$ ([M + H]$^+$) 426.1818; Found 426.1819.



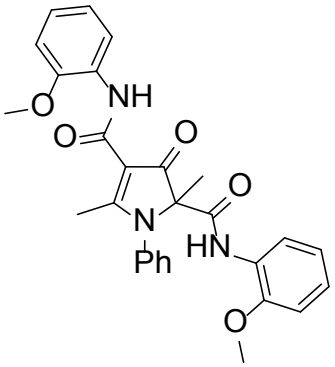
2,5-dimethyl-3-oxo-1-phenyl-N^2,N^4-di-*o*-tolyl-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

(**2ab**) White solid; mp 168-170 °C. **^{1}H-NMR** ($CDCl_3$, 300 MHz) δ 10.08 (s, 1H), 8.92 (s, 1H), 8.22-8.25 (m, 1H), 7.78-7.81 (m, 1H), 7.46-7.52 (m, 5H), 7.16-7.22 (m, 4H), 7.00-7.10 (m, 2H), 2.60 (s, 3H), 2.41 (s, 3H), 2.32 (s, 3H), 1.83 (s, 3H). **^{13}C-NMR** ($CDCl_3$, 100Hz) δ 195.7, 182.5, 163.5, 161.4, 136.9, 135.8, 134.9, 130.5, 130.2, 129.8, 129.4, 129.3, 129.2, 127.4, 126.6, 126.4, 125.3, 123.5, 122.4, 121.4, 103.8, 76.5, 22.5, 18.0, 17.5, 16.3. **HRMS** Calcd for $C_{28}H_{28}N_3O_3$ ($[M + H]^+$) 454.2131; Found 454.2130.



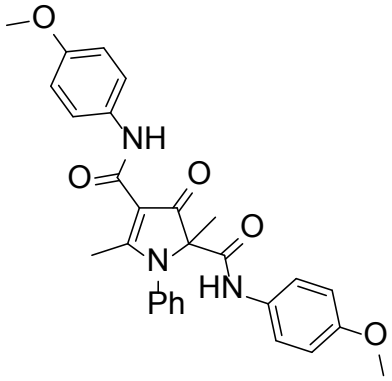
2,5-dimethyl-3-oxo-1-phenyl-N^2,N^4-di-*p*-tolyl-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

(**2ac**) White solid; mp 178-180 °C. **^{1}H-NMR** ($CDCl_3$, 300 MHz) δ 10.05 (s, 1H), 8.76 (s, 1H), 7.47-7.55 (m, 5H), 7.38-7.44 (m, 4H), 7.12 (d, *J* = 9.0Hz, 4H), 2.58 (s, 3H), 2.32 (s, 3H), 2.31 (s, 3H), 1.76 (s, 3H). **^{13}C-NMR** ($CDCl_3$, 100Hz) δ 195.3, 182.3, 163.1, 161.4, 135.8, 135.7, 134.5, 134.4, 132.9, 129.6, 129.4, 129.3, 120.4, 120.0, 103.6, 76.7, 22.0, 20.8, 16.3. **HRMS** Calcd for $C_{28}H_{28}N_3O_3$ ($[M + H]^+$) 454.2131; Found 454.2117.

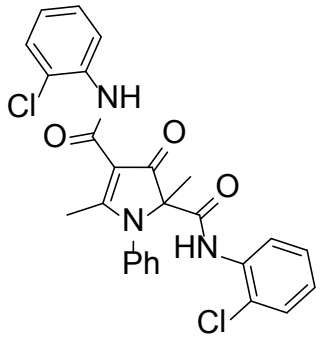


N^2,N^4-bis(2-methoxyphenyl)-2,5-dimethyl-3-oxo-1-phenyl-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

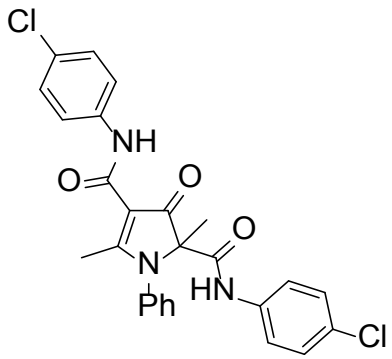
(**2ad**) White solid; mp 173-176 °C. **^{1}H-NMR** ($CDCl_3$, 300 MHz) δ10.55 (s, 1H), 9.00 (s, 1H), 8.50 (dd, *J* = 8.0 Hz, 1.5 Hz, 1H), 8.20 (dd, *J* = 8.0 Hz, 1.5 Hz, 1H), 7.38-7.50 (m, 5H), 6.98-7.10 (m, 2H), 6.85-6.98 (m, 4H), 3.97 (s, 3H), 3.91 (s, 3H), 2.64 (s, 3H), 1.74 (s, 3H). **^{13}C-NMR** ($CDCl_3$, 100Hz) δ 195.0, 182.0, 162.8, 161.6, 148.5, 135.8, 129.6, 129.4, 128.6, 126.8, 124.5, 122.9, 121.0, 120.8, 120.1, 110.2, 110.1, 104.1, 77.3, 55.94, 55.90, 20.9, 16.3. **HRMS** Calcd for $C_{28}H_{28}N_3O_5$ ($[M + H]^+$) 486.2029; Found 486.2013.



N^2,N^4-bis(4-methoxyphenyl)-2,5-dimethyl-3-oxo-1-phenyl-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide (**2ae)** White solid; mp 156-158 °C. **^{1}H-NMR** ($CDCl_3$, 300 MHz) δ 10.00 (s, 1H), 8.72 (s, 1H), 7.53-7.56 (m, 2H), 7.46-7.50 (m, 3H), 7.39-7.43 (m, 4H), 6.84-6.88 (m, 4H), 3.80 (s, 3H), 3.79 (s, 3H), 2.58 (s, 3H), 1.75 (s, 3H). **^{13}C-NMR** ($CDCl_3$, 100Hz) δ 195.3, 182.0, 163.0, 161.4, 156.6, 155.8, 135.4, 131.4, 130.2, 129.4, 129.2, 122.3, 121.6, 113.9, 103.4, 76.9, 55.3, 21.3, 16.2. **HRMS** Calcd for $C_{28}H_{28}N_3O_5$ ($[M + H]^+$) 486.2029; Found 486.2019.

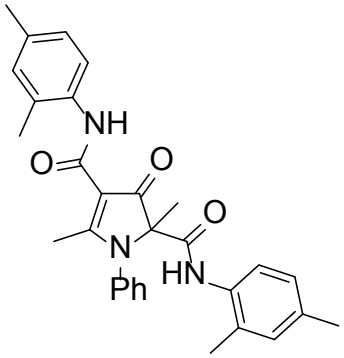


N^2,N^4-bis(2-chlorophenyl)-2,5-dimethyl-3-oxo-1-phenyl-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide (**2af**) Yellow solid; mp 159-161 °C. **^{1}H-NMR** ($CDCl_3$, 300 MHz) δ 10.58 (s, 1H), 9.22 (s, 1H), 8.51 (dd, *J* = 1.2Hz, 8.1Hz, 1H), 8.18 (dd, *J* = 1.2Hz, 8.1Hz, 1H), 7.47-7.54 (m, 3H), 7.35-7.46 (m, 4H), 7.22-7.27 (m, 2H), 6.98-7.09 (m, 2H), 2.62 (s, 3H), 1.82 (s, 3H). **^{13}C-NMR** ($CDCl_3$, 100Hz) δ 194.9, 182.6, 163.5, 161.6, 135.8, 135.7, 133.8, 129.7, 129.6, 129.5, 129.3, 129.2, 127.5, 127.2, 125.4, 124.2, 123.8, 123.3, 122.0, 121.9, 103.7, 76.9, 21.8, 16.5. **HRMS** Calcd for $C_{26}H_{22}Cl_2N_3O_3$ ($[M + H]^+$) 494.1028; Found 494.1038.



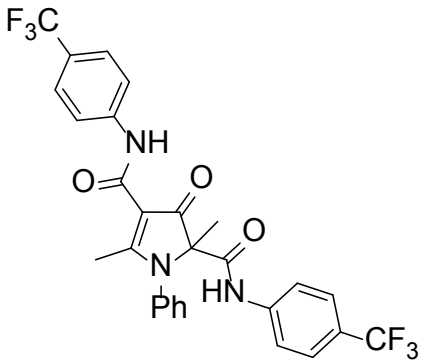
N^2,N^4-bis(4-chlorophenyl)-2,5-dimethyl-3-oxo-1-phenyl-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide (**2ag**) Yellowish solid; mp 150-152 °C. **^{1}H-NMR** ($CDCl_3$, 300 MHz) δ 10.12 (s, 1H), 8.91 (s, 1H), 7.60-7.63 (m, 2H), 7.47-7.53 (m, 4H), 7.41-7.47 (m, 3H) 7.27-7.30 (m, 4H), 2.58 (s, 3H), 1.79 (s,

3H). **^{13}C-NMR** ($CDCl_3$, 100Hz) δ 195.2, 182.7, 163.2, 161.4, 137.0, 135.6, 135.5, 129.9, 129.7, 129.6, 129.5, 129.0, 128.8, 128.4, 121.5, 121.2, 103.4, 76.6, 22.3, 16.4. **HRMS** Calcd for $C_{26}H_{22}Cl_2N_3O_3$ ([M + H]$^+$) 494.1038; Found 494.1027.



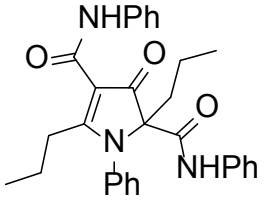
N^2,*N*^{4}-bis(2,4-dimethylphenyl)-2,5-dimethyl-3-oxo-1-phenyl-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

(**2ah**) Red solid; mp 184-186 °C. **^{1}H-NMR** ($CDCl_3$, 300 MHz) δ 10.01 (s, 1H), 8.79 (s, 1H), 8.05-8.08 (m, 1H), 7.60-7.63 (m, 1H), 7.45-7.51 (m, 5H), 6.97-7.02 (m, 4H), 2.59 (s, 3H), 2.37 (s, 3H), 2.30 (s, 3H), 2.27 (s, 3H), 2.25 (s, 3H), 1.81 (s, 3H). **^{13}C-NMR** ($CDCl_3$, 100Hz) δ 195.7, 182.3, 163.5, 161.4, 135.8, 135.0, 134.2, 133.0, 132.3, 131.1, 130.8, 129.8, 129.5, 129.3, 127.5, 127.0, 126.9, 122.7, 121.5, 103.8, 76.5, 22.2, 20.7, 17.9, 17.4, 16.2. **HRMS** Calcd for $C_{30}H_{32}N_3O_3$ ([M + H]$^+$) 482.2444; Found 482.2443.



2,5-dimethyl-3-oxo-1-phenyl-*N*^{2},*N*^{4}-bis(4-(trifluoromethyl)phenyl)-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

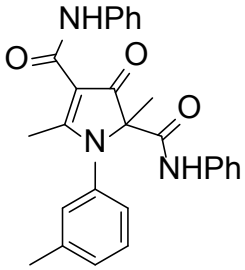
(**2ai**) Yellow solid; mp 209-211 °C. **^{1}H-NMR** ($CDCl_3$, 300 MHz) δ 10.28 (s, 1H), 9.11 (s, 1H), 7.76-7.79 (m, 2H), 7.65-7.68 (m, 2H), 7.53-7.60 (m, 7H), 7.44-7.47 (m, 2H), 2.59 (s, 3H), 1.82 (s, 3H). **^{13}C-NMR** ($CDCl_3$, 100Hz) δ 195.0, 183.0, 163.4, 161.6, 141.6, 140.1, 135.3, 129.8, 129.5, 129.6, 126.2, 126.19, 126.1, 120.0, 119.5, 103.3, 76.8, 22.3, 16.4. **HRMS** Calcd for $C_{28}H_{22}F_6N_3O_3$ ([M + H]$^+$) 562.1565; Found 562.1552.



3-oxo-*N*^{2},*N*^{4},1-triphenyl-2,5-dipropyl-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

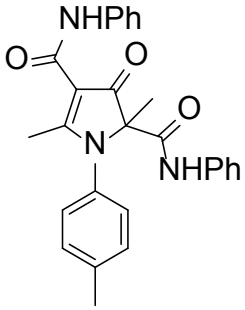
(**2aj**) Yellow solid; mp: 138-141 °C. **^{1}H-NMR** ($CDCl_3$, 300 MHz) δ 10.27 (s, 1H), 8.98 (s, 1H), 7.65-7.68 (m, 2H), 7.41-7.51 (m, 7H), 7.30-7.36 (m, 4H), 7.05-7.10 (m, 2H), 3.00-3.09 (m, 1H),

2.82-2.91 (m, 1H), 2.08-2.22 (m, 2H), 1.63-1.70 (m, 2H), 1.12-1.32 (m, 2H), 0.81-0.98 (m, 6H). **^{13}C-NMR** ($CDCl_3$, 100Hz) δ 195.3, 186.7, 163.0, 161.0, 138.6, 137.0, 136.0, 129.9, 129.5, 129.3, 129.0, 128.8, 125.6, 124.8, 123.4, 120.2, 119.8, 104.0, 80.5, 37.5, 30.5, 22.1, 16.6, 14.3, 13.7. **HRMS** Calcd for $C_{30}H_{32}N_3O_3$ ($[M + H]^+$) 482.2444; Found 482.2438.



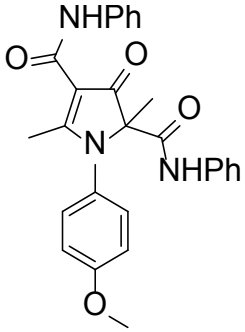
2,5-dimethyl-3-oxo-*N*^{2},*N*^{4}-diphenyl-1-(*m*-tolyl)-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

(**2ba**) White solid; mp 178-180 °C. **^{1}H-NMR** ($CDCl_3$, 300 MHz) δ 10.11 (s, 1H), 8.77 (s, 1H), 7.64-7.67 (m, 2H), 7.50-7.52 (m, 2H), 7.30-7.40 (m, 6H), 7.21-7.24 (m, 2H), 7.05-7.15 (m, 2H), 2.59 (s, 3H), 2.42 (s, 3H), 1.77 (s, 3H). **^{13}C-NMR** ($CDCl_3$, 100Hz) δ 195.3, 182.6, 163.3, 161.6, 139.6, 138.5, 137.0, 135.6, 130.3, 130.0, 129.2, 129.0, 128.8, 126.6, 124.8, 123.5, 120.3, 120.0, 103.5, 76.7, 22.1, 21.3, 16.4. **HRMS** Calcd for $C_{27}H_{26}N_3O_3$ ($[M + H]^+$) 440.1968; Found 440.1974.



2,5-dimethyl-3-oxo-*N*^{2},*N*^{4}-diphenyl-1-(*p*-tolyl)-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

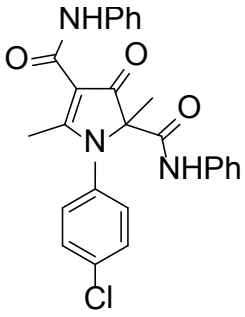
(**2bb**) Yellow solid; mp 171-173 °C. **^{1}H-NMR** ($CDCl_3$, 300 MHz) δ 10.14 (s, 1H), 8.86 (s, 1H), 7.64-7.67 (m, 2H), 7.51-7.54 (m, 2H), 7.30-7.35 (m, 8H), 7.06-7.15 (m, 2H), 2.58 (s, 3H), 2.42 (s, 3H), 1.77 (s, 3H). **^{13}C-NMR** ($CDCl_3$, 100Hz) δ 195.2, 182.5, 163.2, 161.6, 139.6, 138.4, 137.0, 132.7, 130.0, 129.3, 129.1, 128.8, 128.7, 124.8, 123.4, 120.4, 120.0, 119.4, 103.3, 76.7, 21.8, 21.0, 16.2. **HRMS** Calcd for $C_{27}H_{26}N_3O_3$ ($[M + H]^+$) 440.1974; Found 440.1970.



1-(4-methoxyphenyl)-2,5-dimethyl-3-oxo-*N*^{2},*N*^{4}-diphenyl-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

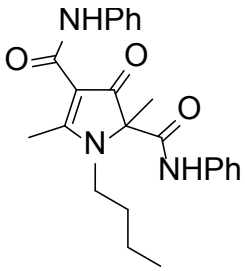
(**2bc**) Yellow solid; mp 178-181 °C. **^{1}H-NMR** ($CDCl_3$, 300 MHz) δ 10.12 (s, 1H), 8.85 (s, 1H), 7.64-7.66 (m, 2H), 7.50-7.53 (m, 2H), 7.30-7.37 (m, 6H), 7.05-7.15 (m, 2H), 6.97-7.00 (m, 2H), 3.86 (s, 3H), 2.58 (s, 3H), 1.76 (s, 3H). **^{13}C-NMR** ($CDCl_3$, 100Hz) δ 195.3, 182.8, 163.3, 161.6, 160.1, 138.4, 137.0, 130.8,

128.9, 128.8, 127.9, 124.8, 123.5, 120.3, 120.0, 114.5, 103.3, 76.6, 55.4, 22.1, 16.3. **HRMS** Calcd for $C_{27}H_{26}N_3O_4$ ([M + H]$^+$) 456.1923; Found 456.1931.



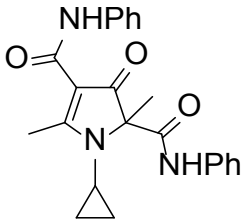
1-(4-chlorophenyl)-2,5-dimethyl-3-oxo-*N*^{2},*N*^{4}-diphenyl-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

(**2bd**) Yellow solid; mp 190-192 °C. ^{1}**H-NMR** ($CDCl_3$, 300 MHz) δ 10.07 (s, 1H), 8.93 (s, 1H), 7.63-7.67 (m, 2H), 7.47-7.52 (m, 4H), 7.40-7.43 (m, 2H), 7.33 (t, J = 8.1Hz, 4H), 7.09-7.17 (m, 2H), 2.59 (s, 3H), 1.78 (s, 3H). ^{13}**C-NMR** ($CDCl_3$, 100Hz) δ 195.2, 182.4, 163.2, 161.3, 138.3, 136.9, 135.6, 134.1, 131.1, 129.6, 128.9, 128.8, 124.9, 123.6, 120.3, 120.0, 103.7, 76.5, 22.3, 16.3. **HRMS** Calcd for $C_{26}H_{23}ClN_3O_3$ ([M + H]$^+$) 460.1428; Found 460.1416.



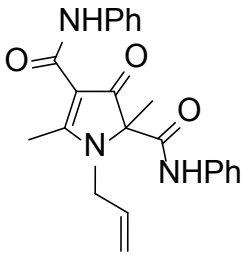
1-butyl-2,5-dimethyl-3-oxo-*N*^{2},*N*^{4}-diphenyl-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

(**2be**) Yellow solid; mp 193-195 °C. ^{1}**H-NMR** ($CDCl_3$, 400 MHz) δ 10.08 (s, 1H), 9.22 (s, 1H), 7.63 (d, *J* = 8.0Hz, 2H), 7.53 (d, *J* = 8.0Hz, 2H), 7.29-7.36 (m, 4H), 7.14 (t, *J* = 7.2Hz, 1H), 7.06 (t, *J* = 7.2Hz, 1H), 3.82-4.05 (m, 2H), 2.85 (s, 3H), 1.58-1.88 (m, 2H), 1.80 (s, 3H), 1.41-1.49 (m, 2H), 1.01 (t, *J* = 7.2Hz, 3H). ^{13}**C-NMR** ($CDCl_3$, 100Hz) δ 194.3, 180.9, 163.7, 161.7, 138.7, 137.0, 129.0, 128.8, 124.8, 123.3, 120.1, 120.0, 102.5, 74.6, 45.4, 32.3, 22.8, 20.3, 15.0, 13.5. **HRMS** Calcd for $C_{24}H_{28}N_3O_3$ ([M + H]$^+$) 406.2131; Found 406.2118.



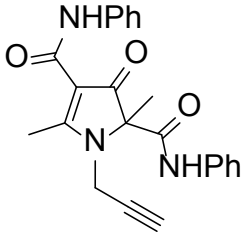
1-cyclopropyl-2,5-dimethyl-3-oxo-*N*^{2},*N*^{4}-diphenyl-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

(**2bf**) Yellow solid; mp 191-194 °C. ^{1}**H-NMR** ($CDCl_3$, 400 MHz) δ 10.03 (s, 1H), 8.40 (s, 1H), 7.60 (d, *J* = 8.0Hz, 2H), 7.50 (d, *J* = 8.0Hz, 2H), 7.27-7.35 (m, 4H), 7.13 (t, *J* = 7.2Hz, 1H), 7.05 (t, *J* = 7.2Hz, 1H), 2.98 (s, 3H), 2.90-2.94 (m, 1H), 1.85 (s, 3H), 1.26-1.33 (m, 1H), 1.01-1.15 (m, 2H), 0.91-1.00 (m, 1H). ^{13}**C-NMR** ($CDCl_3$, 100Hz) δ 194.5, 185.2, 164.0, 161.5, 138.5, 137.1, 129.0, 128.8, 124.8, 123.5, 120.3, 120.2, 103.5, 76.7, 27.5, 21.1, 15.7, 7.6, 6.1. **HRMS** Calcd for $C_{23}H_{24}N_3O_3$ ([M + H]$^+$) 390.1818; Found 390.1798.



1-allyl-2,5-dimethyl-3-oxo-N^2,N^4-diphenyl-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

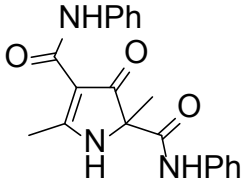
(**2bg**) Yellow solid; mp 136-139 °C. **^{1}H-NMR** ($CDCl_3$, 300 MHz) δ 10.08 (s, 1H), 9.25 (s, 1H), 7.63 (d, *J* = 8.1Hz, 2H), 7.53(d, *J* = 8.1Hz, 2H), 7.29-7.37 (m, 4H), 7.14 (t, *J* = 7.2Hz, 1H), 7.06 (t, *J* = 7.2Hz, 1H), 5.88-6.00 (m, 1H), 5.21-5.34 (m, 2H), 4.54-4.76 (m, 2H), 2.83 (s, 3H), 1.78 (s, 3H). **^{13}C-NMR** ($CDCl_3$, 100Hz) δ 194.4, 181.9, 163.8, 161.6, 138.5, 136.9, 132.8, 129.0, 128.8, 124.8, 123.3, 120.0, 119.9, 118.2, 102.6, 74.4, 47.8, 22.6, 15.0. **HRMS** Calcd for $C_{23}H_{24}N_3O_3$ ($[M + H]^+$) 390.1818; Found 390.1845.



2,5-dimethyl-3-oxo-N^2,N^4-diphenyl-1-(prop-2-yn-1-yl)-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

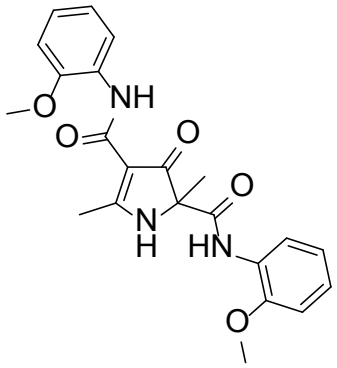
(**2bh**) Yellowish solid; mp: 155-157 °C. **^{1}H-NMR** ($CDCl_3$, 300 MHz) δ 10.01 (s, 1H), 9.28 (s, 1H), 7.62-7.64 (m, 2H), 7.52-7.55 (m, 2H), 7.32-7.37 (m, 4H), 7.05-7.15 (m, 4H), 5.02-5.09 (m, 1H), 4.57-4.64 (m, 1H), 2.97 (s, 3H), 2.40-2.41 (m, 1H), 1.89 (s, 3H). **^{13}C-NMR** ($CDCl_3$, 100Hz) δ 195.0, 181.8, 164.0, 161.4, 138.5, 136.8, 129.5, 129.1, 128.8, 125.0, 123.6, 120.1, 103.5, 77.3, 73.8, 65.8, 34.2, 23.0, 14.8. **HRMS** Calcd for $C_{23}H_{22}N_3O_3$ ($[M + H]^+$) 388.1661; Found 388.1668.

Synthesis and analytical data for compounds 2ca and 2cb. (with **2ca** as an example): To a solution of the **1a** (2 mmol) and NH_4OAc (1.2 mmol) dissolved in DMF (6 mL) was added 0.1 equiv of $CuBr_2$ (0.2 mmol) and 0.5 equiv of 4-methylbenzenesulfonic acid (1 mmol). The mixture was warmed to 100 °C and stirred for 6 h. When **1a** disappeared (monitored by TLC), the reaction mixture was then treated with 50 mL brine, and extracted with dichloromethane (2 × 50 mL). The combined organic layer was washed with brine (3 × 50 mL), dried over $MgSO_4$ and filtered. The filtrate was concentrated in *vacuum*, and then purified by silica gel column chromatography to give **2ca** as a red solid.



2,5-dimethyl-3-oxo-N^2,N^4-diphenyl-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

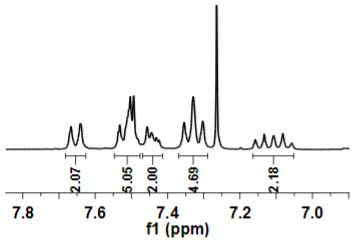
(2ca) Red solid; mp 202-205 °C. **^{1}H-NMR** ($CDCl_3$, 300 MHz) δ 9.87 (s, 1H), 9.32 (s, 1H), 8.06 (s, 1H), 7.64 (d, *J* = 8.4Hz, 2H), 7.58 (d, *J* = 8.1Hz, 2H), 7.30-7.39 (m, 4H), 7.18 (t, *J* = 7.2Hz, 1H), 7.08 (t, *J* = 7.2Hz, 1H), 2.77 (s, 3H), 1.77 (s, 3H). **^{13}C-NMR** ($CDCl_3$, 100Hz) δ 195.9, 181.7, 164.8, 161.6, 138.3, 136.4, 129.0, 128.8, 125.3, 123.5, 120.2, 120.0, 102.5, 70.3, 25.0, 17.4. **HRMS** Calcd for $C_{20}H_{20}N_3O_3$ ($[M + H]^+$) 350.1505; Found 350.1551.

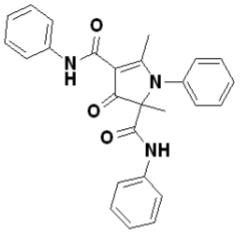


N^2,*N*^{4}-bis(4-methoxyphenyl)-2,5-dimethyl-3-oxo-2,3-dihydro-1*H*-pyrrole-2,4-dicarboxamide

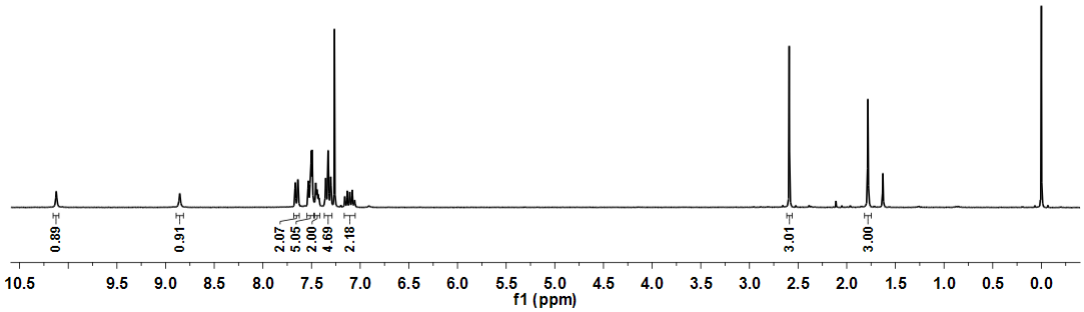
(2cb) Red solid; mp 113-115 °C. **^{1}H-NMR** (DMSO, 300 MHz) δ 10.77 (s, 1H), 10.40 (s, 1H), 9.63 (s, 1H), 8.39 (d, *J* = 7.8Hz, 1H), 8.08 (d, *J* = 7.8Hz, 1H), 6.86-7.09 (m, 6H), 3.91 (s, 6H), 2.64 (s, 3H), 1.63 (s, 3H). **^{13}C-NMR** (DMSO, 100Hz) δ 195.1, 181.0, 163.8, 161.3, 148.8, 147.7, 128.4, 126.4, 124.7, 122.5, 120.6, 120.5, 119.8, 119.0, 111.2, 110.7, 100.9, 70.9, 56.0, 55.9, 23.4, 16.8. **HRMS** Calcd for $C_{22}H_{24}N_3O_5$ ($[M + H]^+$) 410.1716; Found 410.1788.

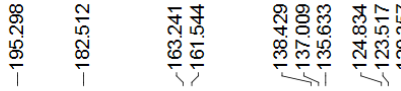
III. ^{1}H- and ^{13}C-NMR Spectra Copies

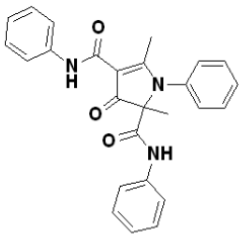




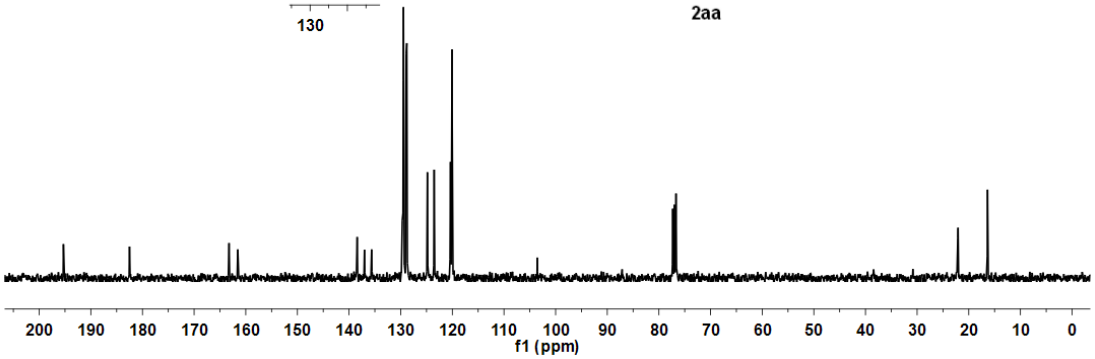
2aa

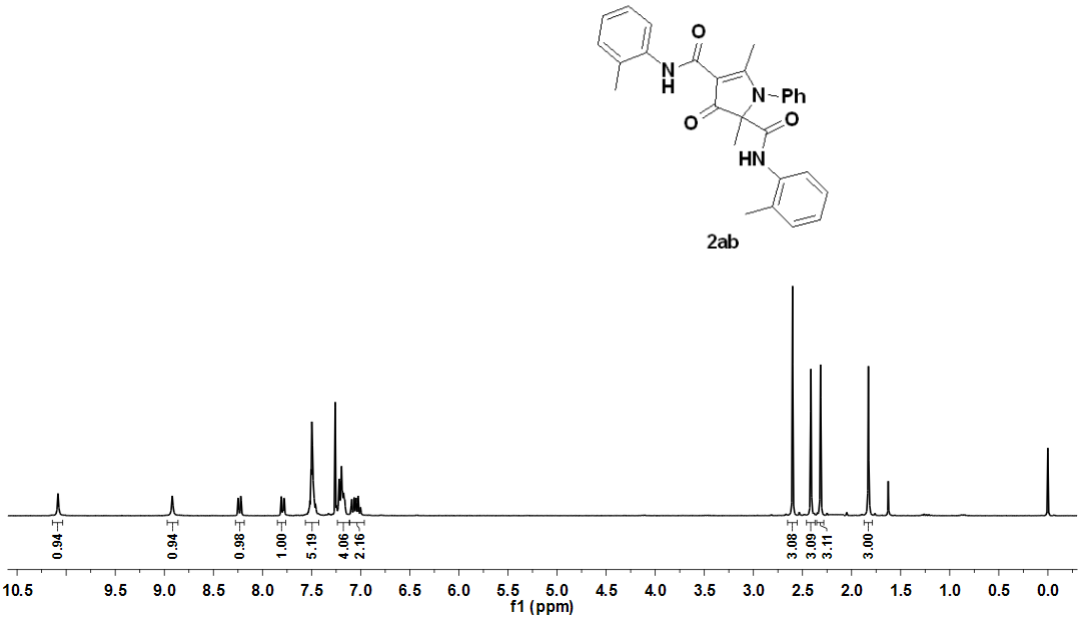






2aa

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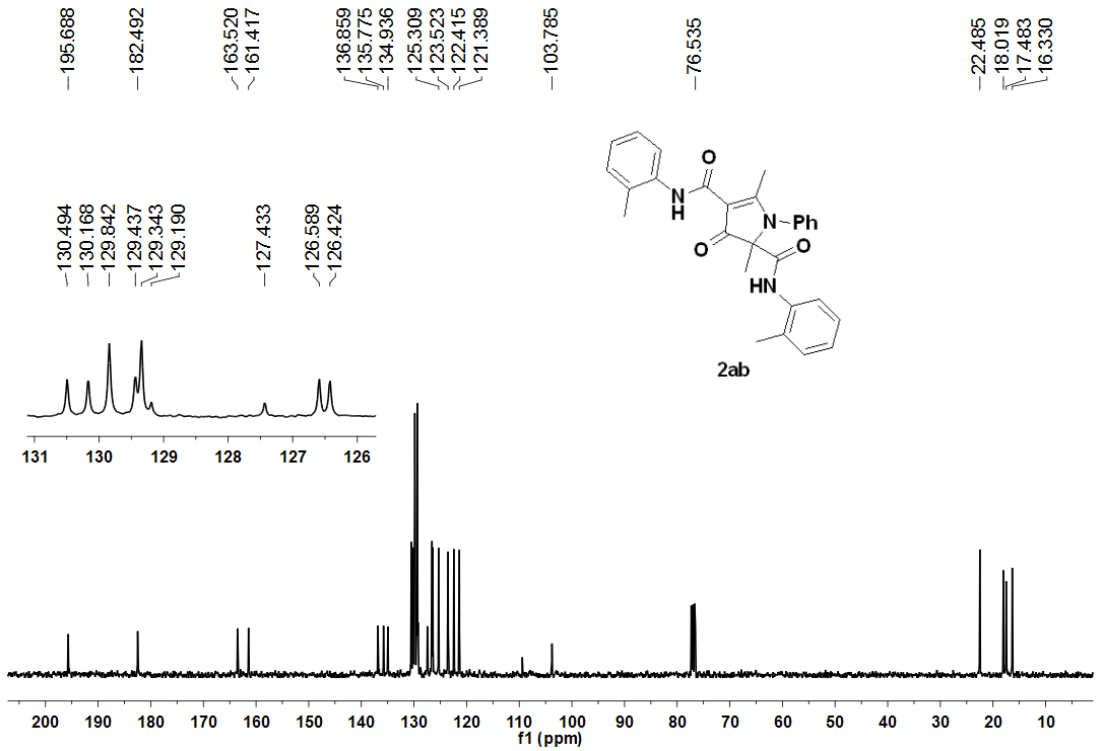
5.19
4.06
2.16
3.08
3.09
3.11
3.00
f1 (ppm)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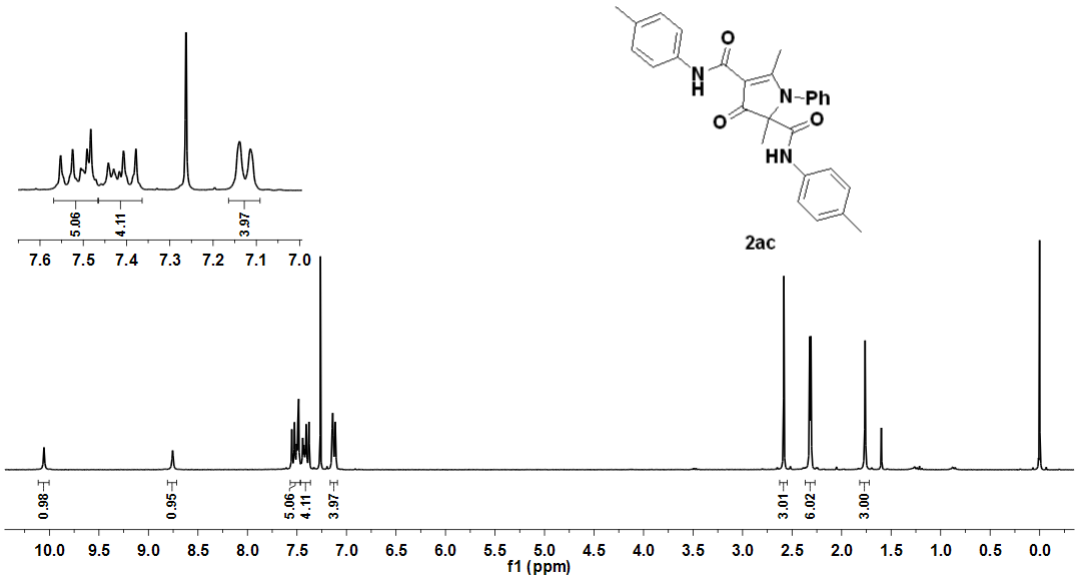
161.417
136.859
135.775
134.936
125.309
123.523
122.415
121.389
103.785
76.535
22.485
18.019
17.483
16.330
130.494
130.168
129.842
129.437
129.343
129.190
127.433
126.589
126.424
2ab
f1 (ppm)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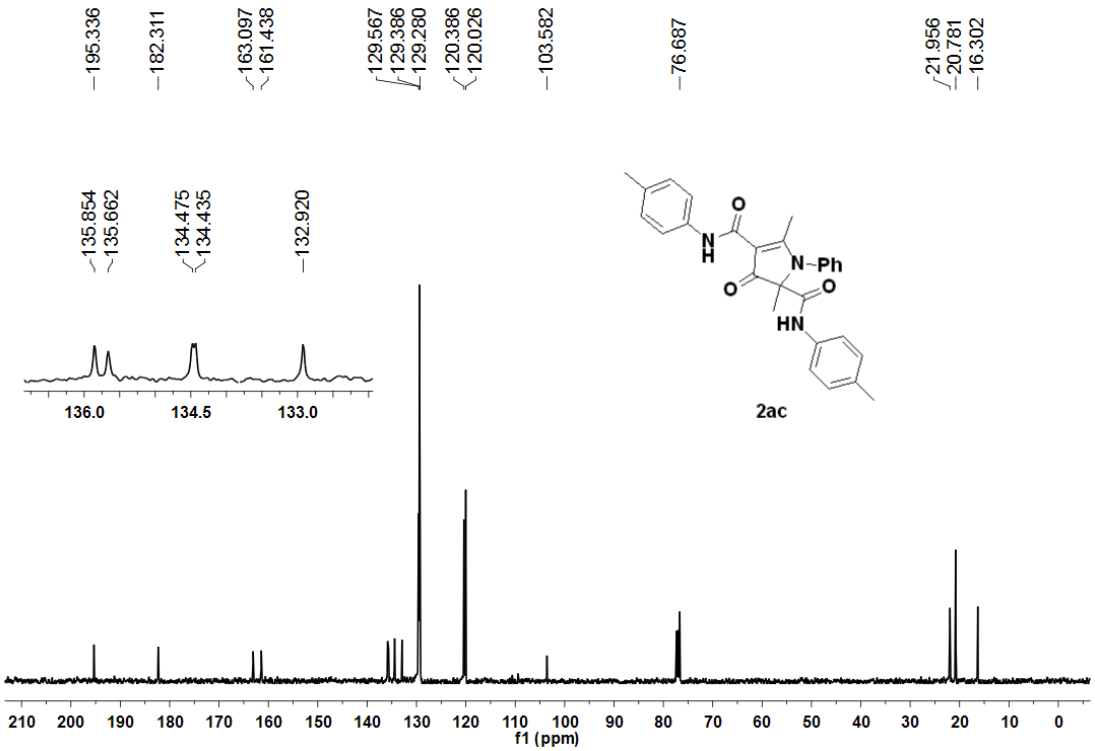
5.06
4.11
3.97
7.6 7.5 7.4 7.3 7.2 7.1 7.0
0.98
0.95
5.06
4.11
3.97
3.01
6.02
3.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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161.438
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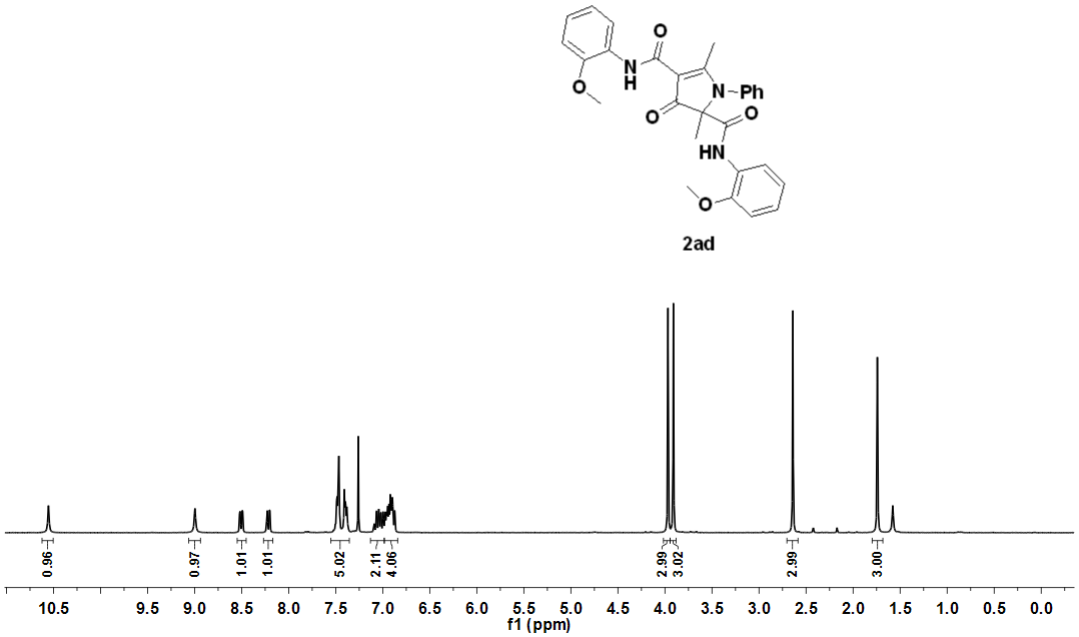
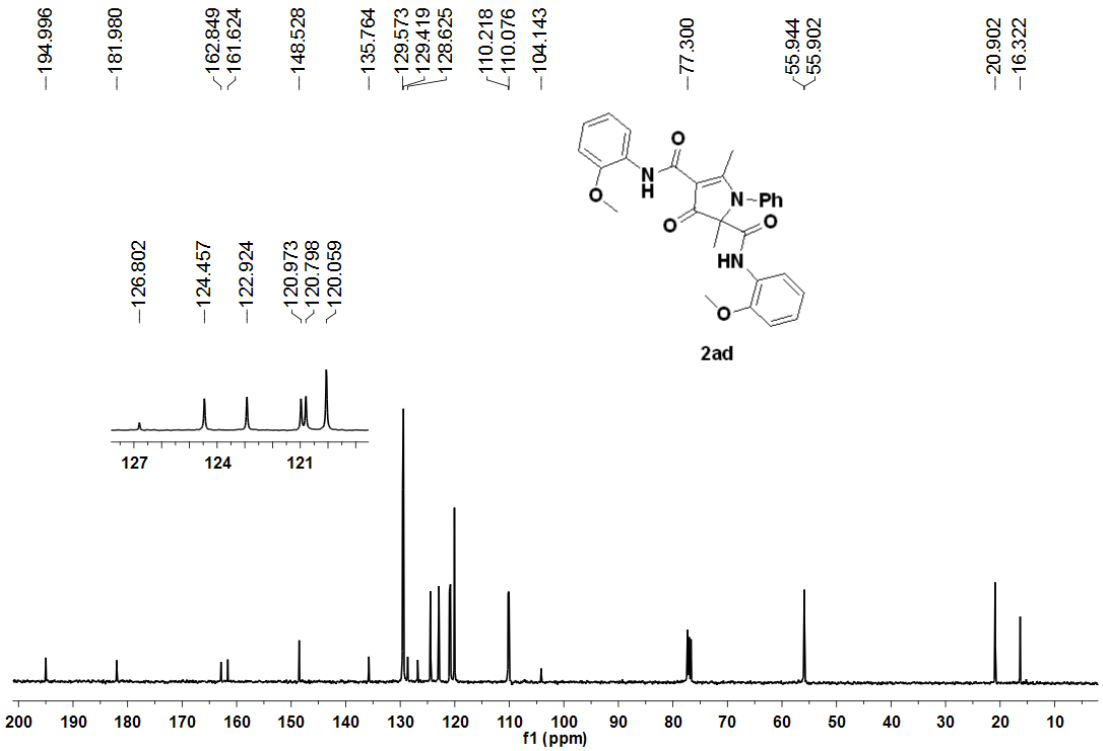
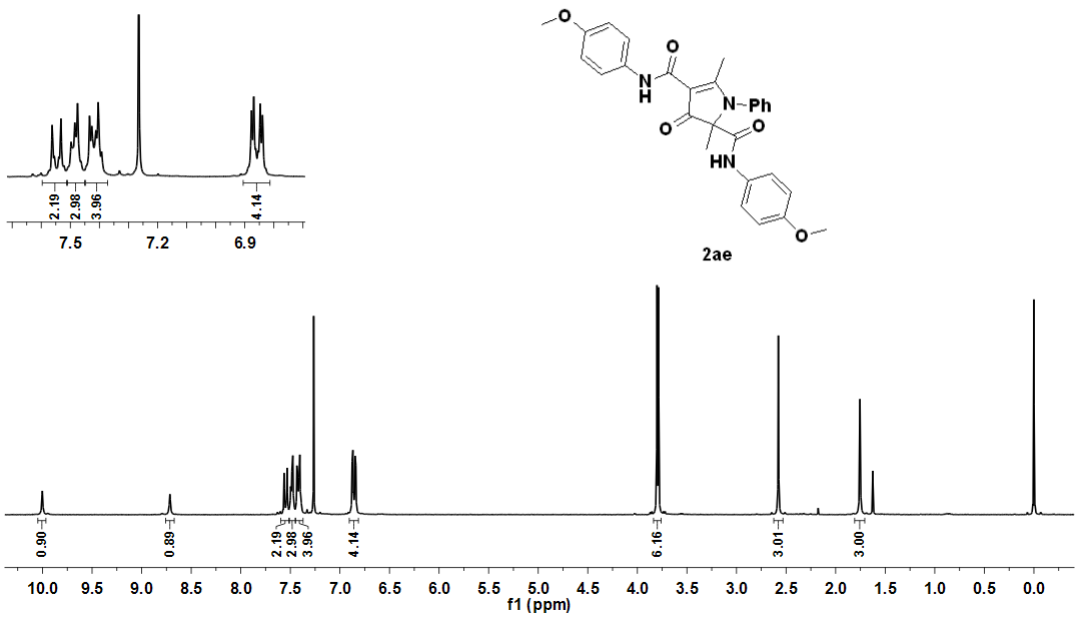
129.386
129.280
120.386
120.026
103.582
76.687
21.956
20.781
16.302
135.854
135.662
134.475
134.435
132.920
2ac
136.0
134.5
133.0
210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)



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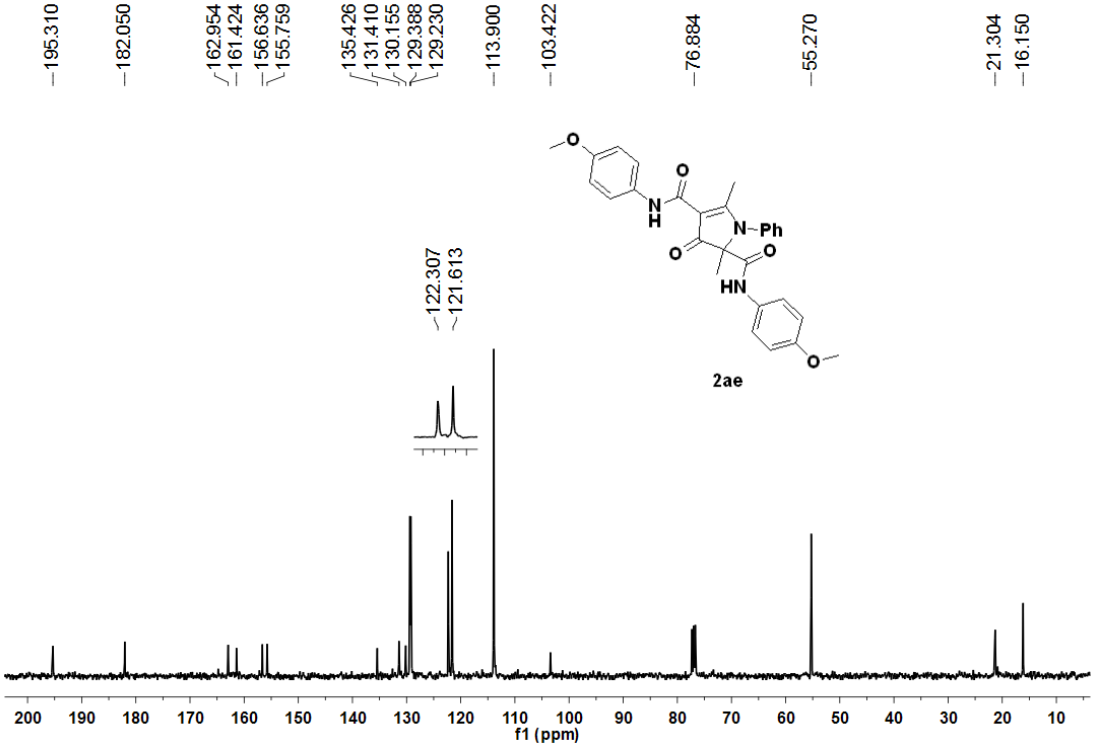
2.98
3.96
4.14
7.5
7.2
6.9
2ae
0.90
0.89
2.19
2.98
3.96
4.14
6.16
3.01
3.00
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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113.900
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76.884
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16.150
122.307
121.613
2ae
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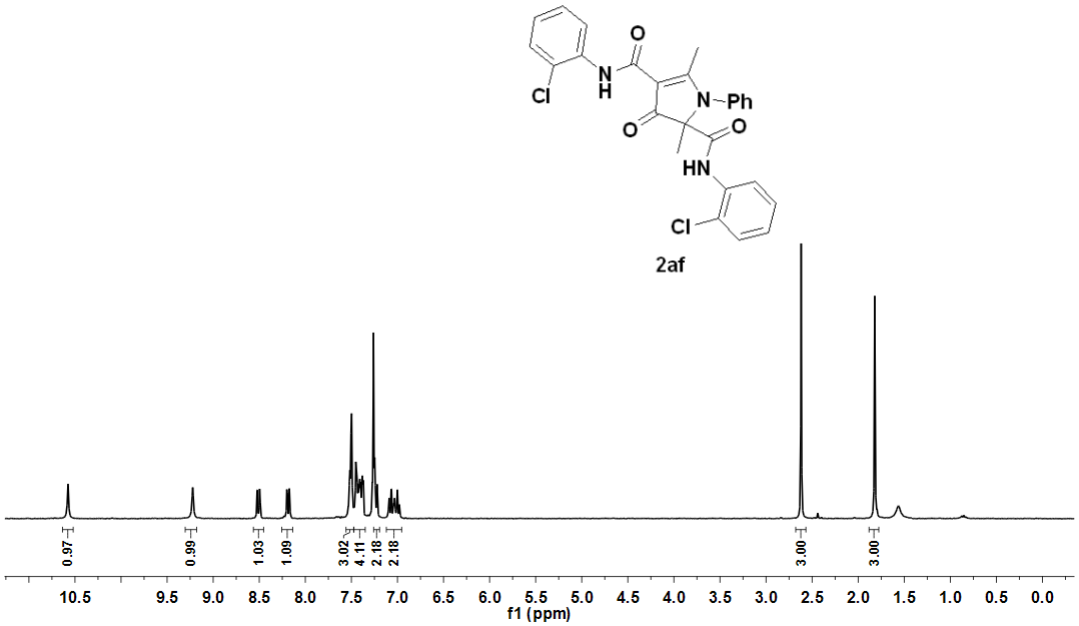
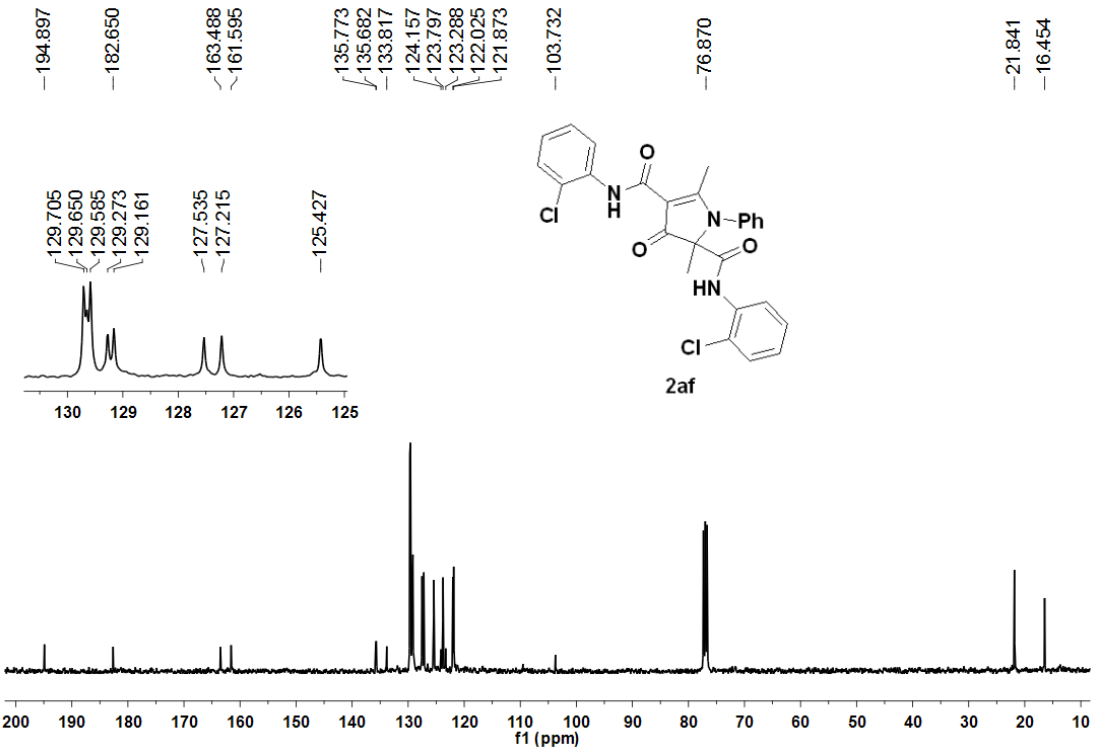
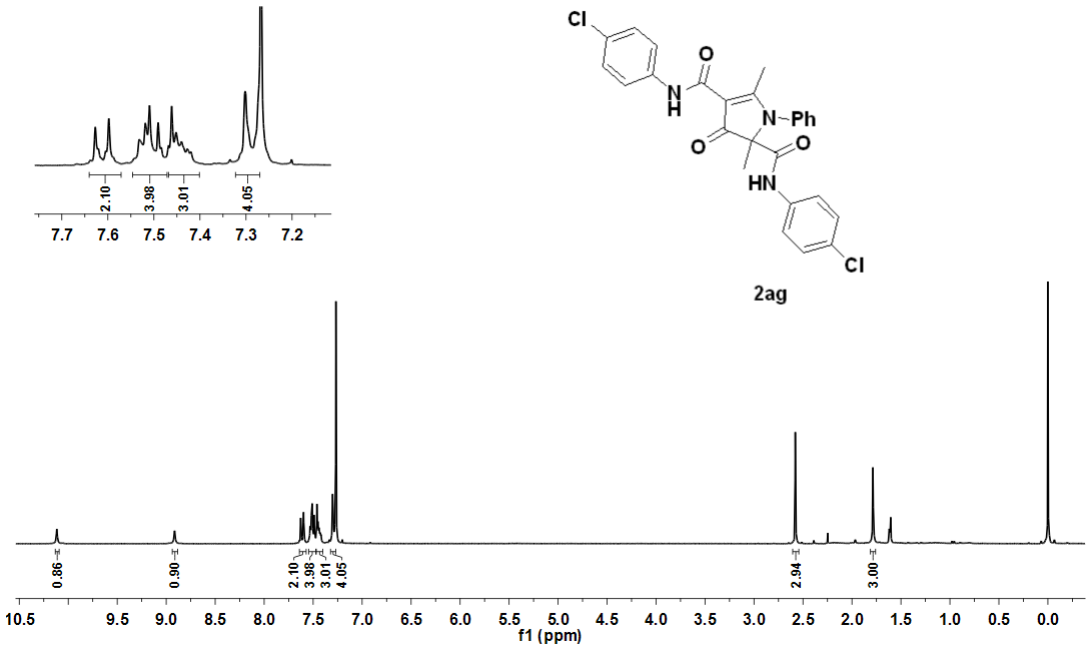
f1 (ppm)



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N
H
N–Ph
O
O
HN
Cl
2ag
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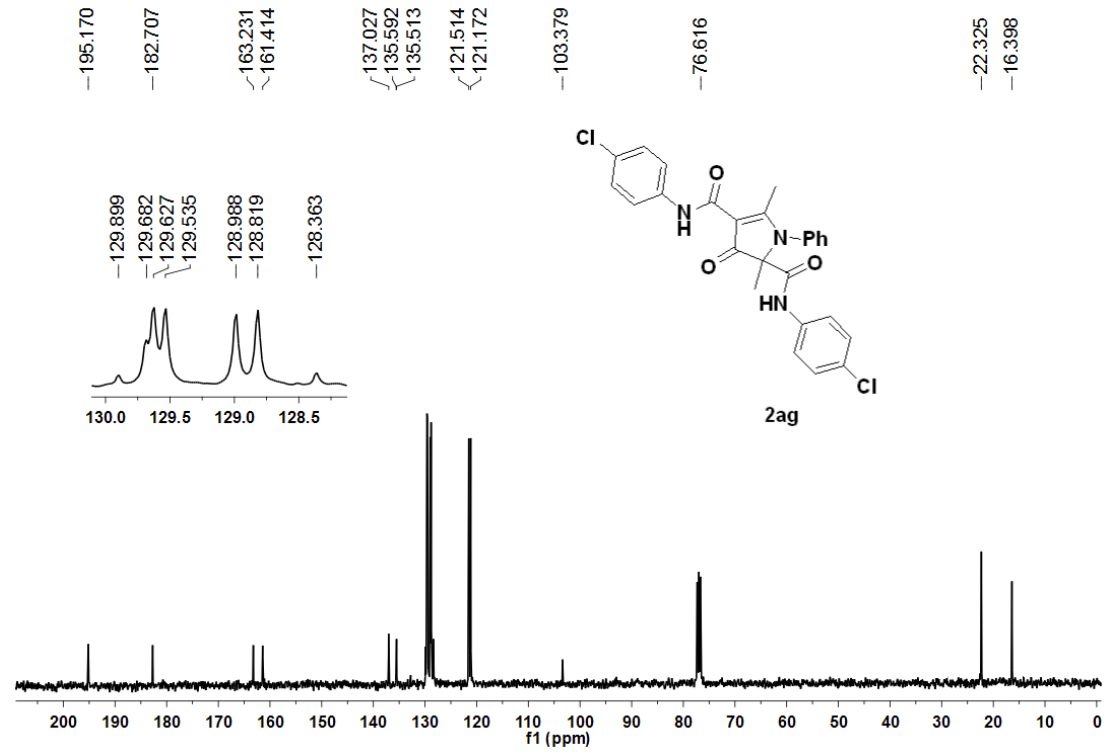
3.01
4.05
7.7
7.6
7.5
7.4
7.3
7.2
0.86
0.90
2.10
3.98
3.01
4.05
2.94
3.00
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)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129.899
129.682
129.627
129.535
128.988
128.819
128.363
Cl
O
N
H
N–Ph
O
O
HN
Cl
2ag
130.0
129.5
129.0
128.5
200
190
180
170
160
150
140
130
120
110
100
90
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70
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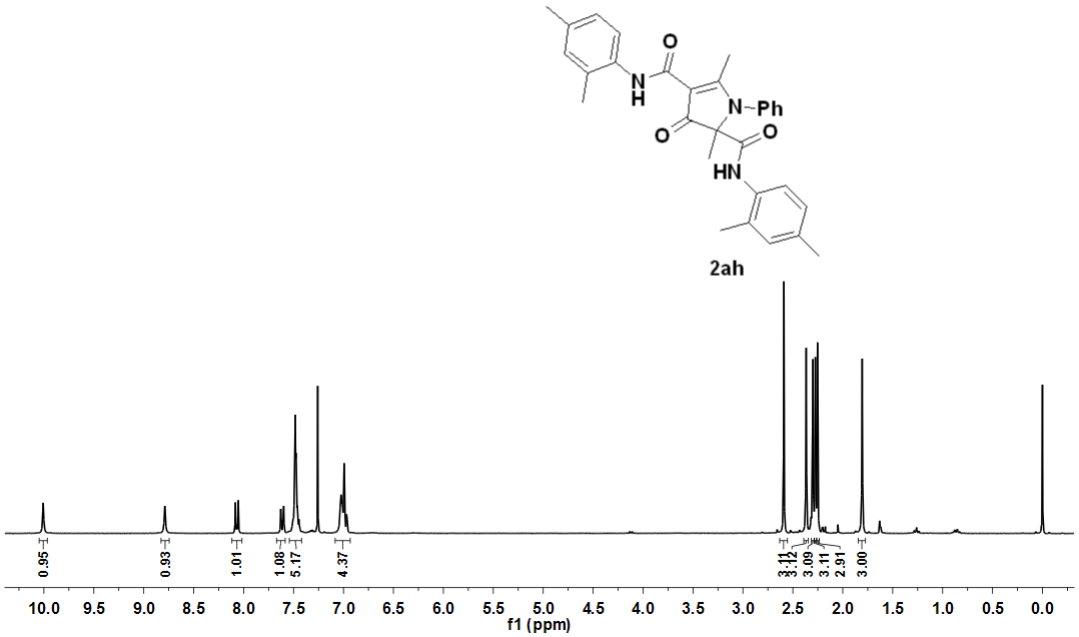
50
40
30
20
10
0
f1 (ppm)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3.11
3.12
3.09
3.11
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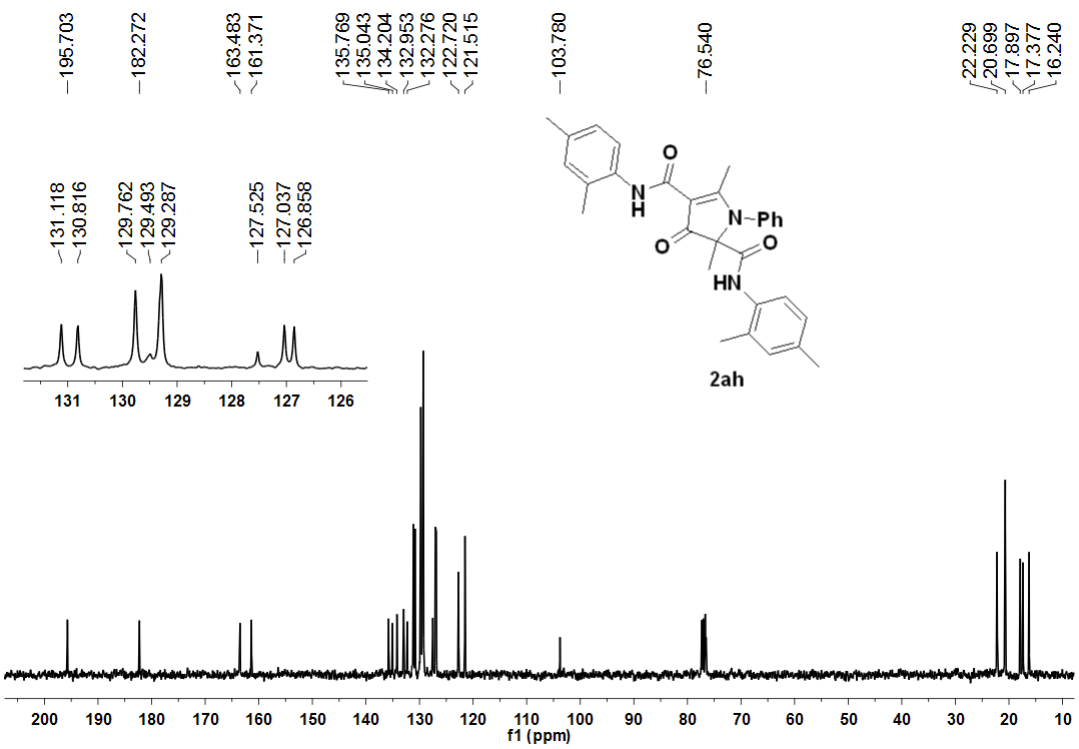
3.00
f1 (ppm)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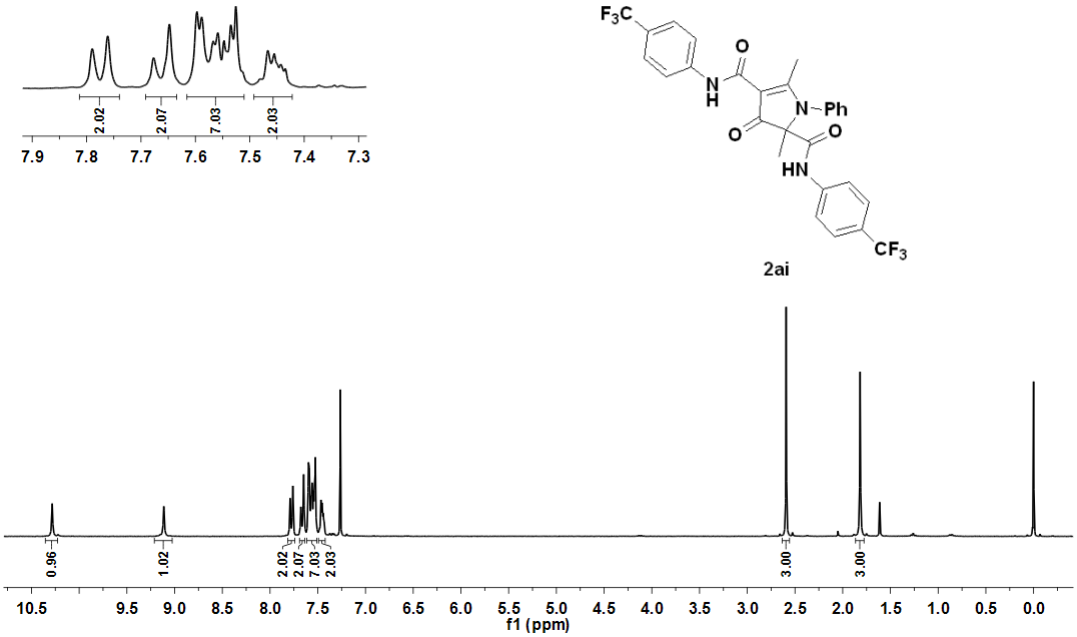
2ah
f1 (ppm)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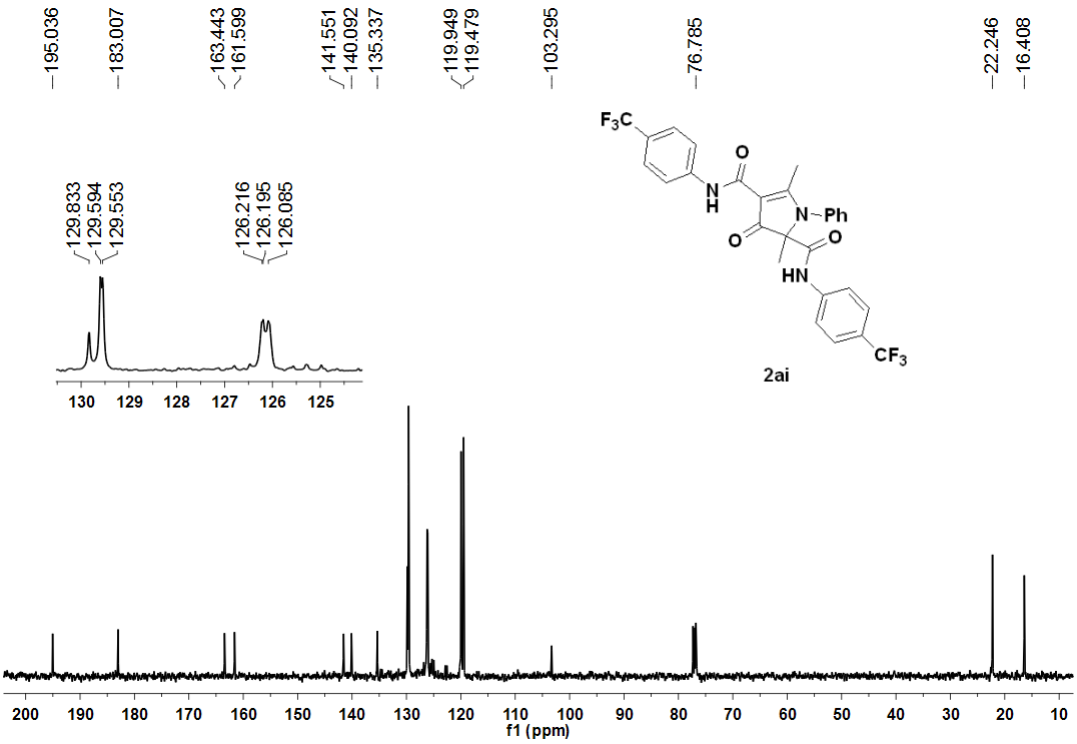
2.07
7.03
2.03
7.9 7.8 7.7 7.6 7.5 7.4 7.3
F3C
O
N
H
N–Ph
O
O
HN
CF3
2ai
0.96
1.02
2.02
2.07
7.03
2.03
3.00
3.00
10.5 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)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76.785
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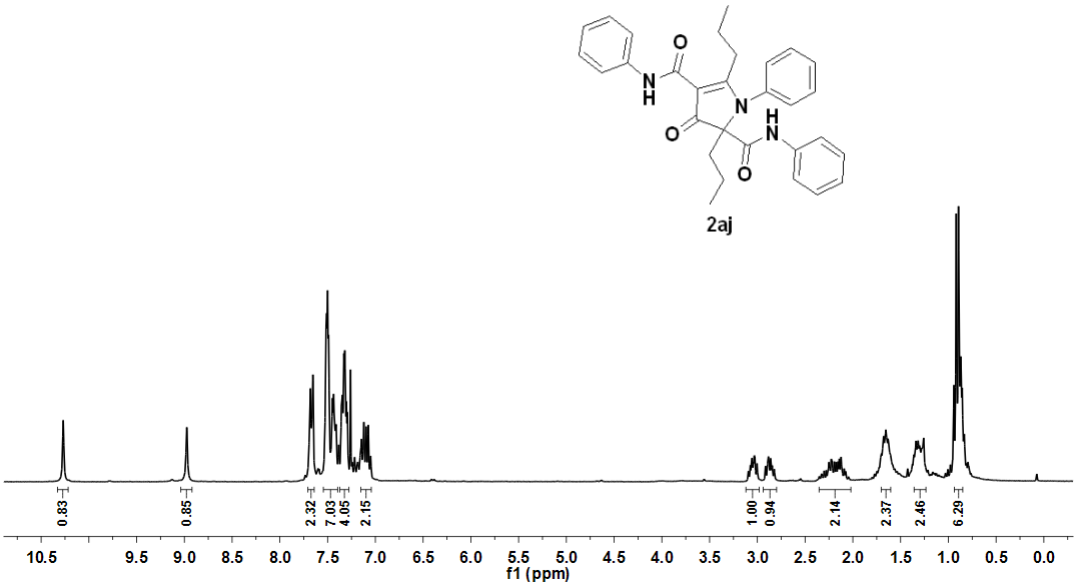
129.833
129.594
129.553
126.216
126.195
126.085
130 129 128 127 126 125
F3C
O
N
H
N–Ph
O
O
HN
CF3
2ai
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)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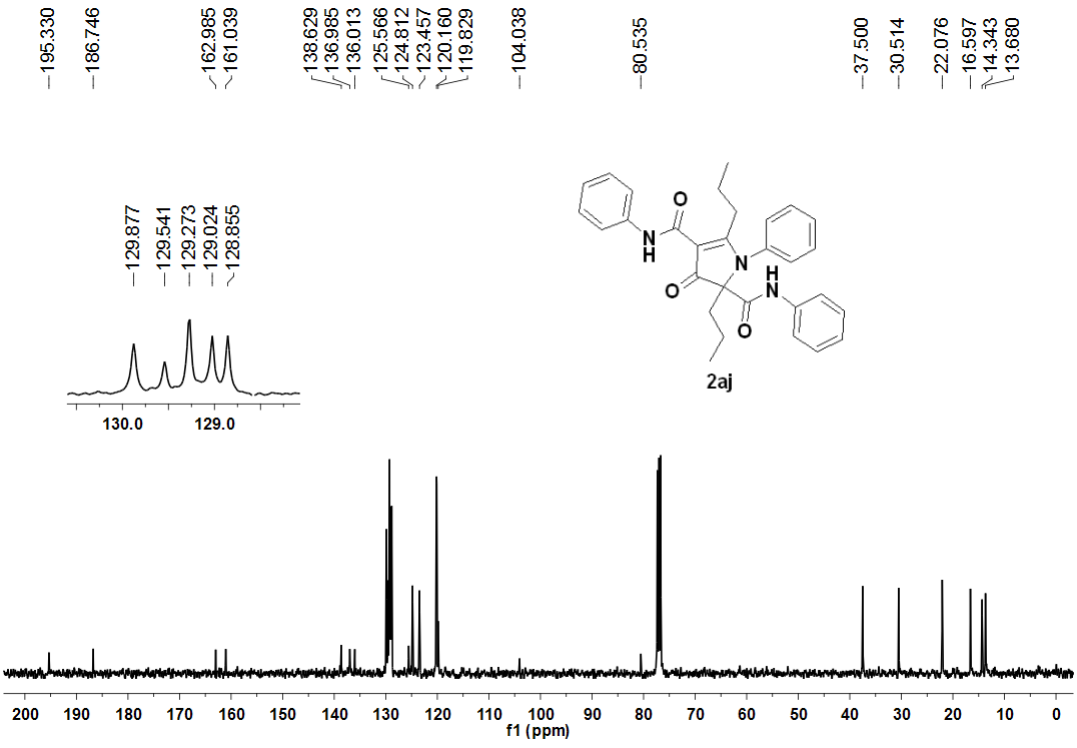
6.29
f1 (ppm)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138.629
136.985
136.013
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119.829
104.038
80.535
37.500
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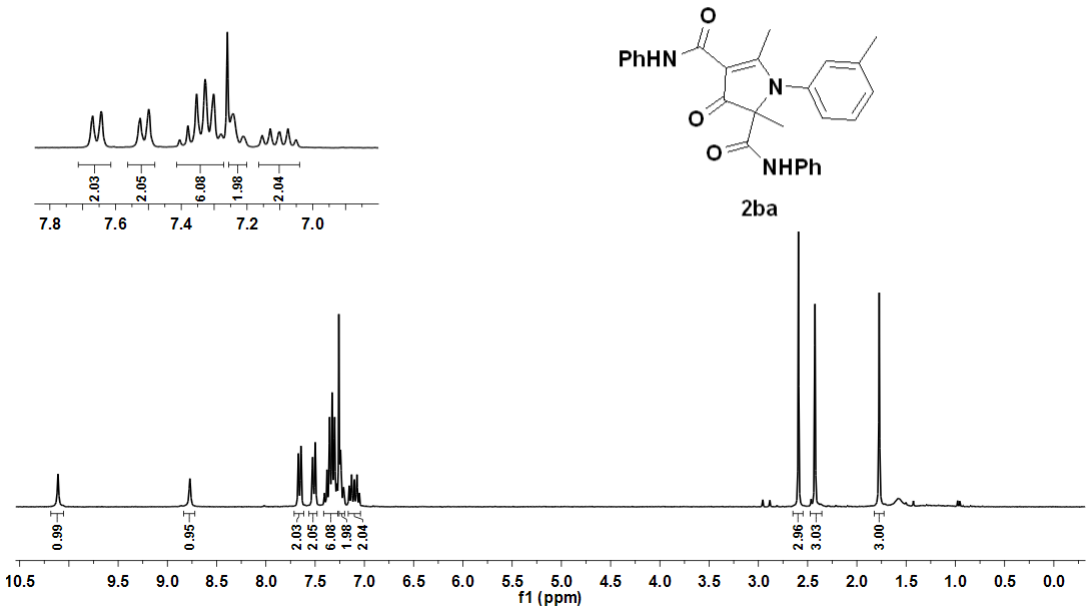
f1 (ppm)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NHPh
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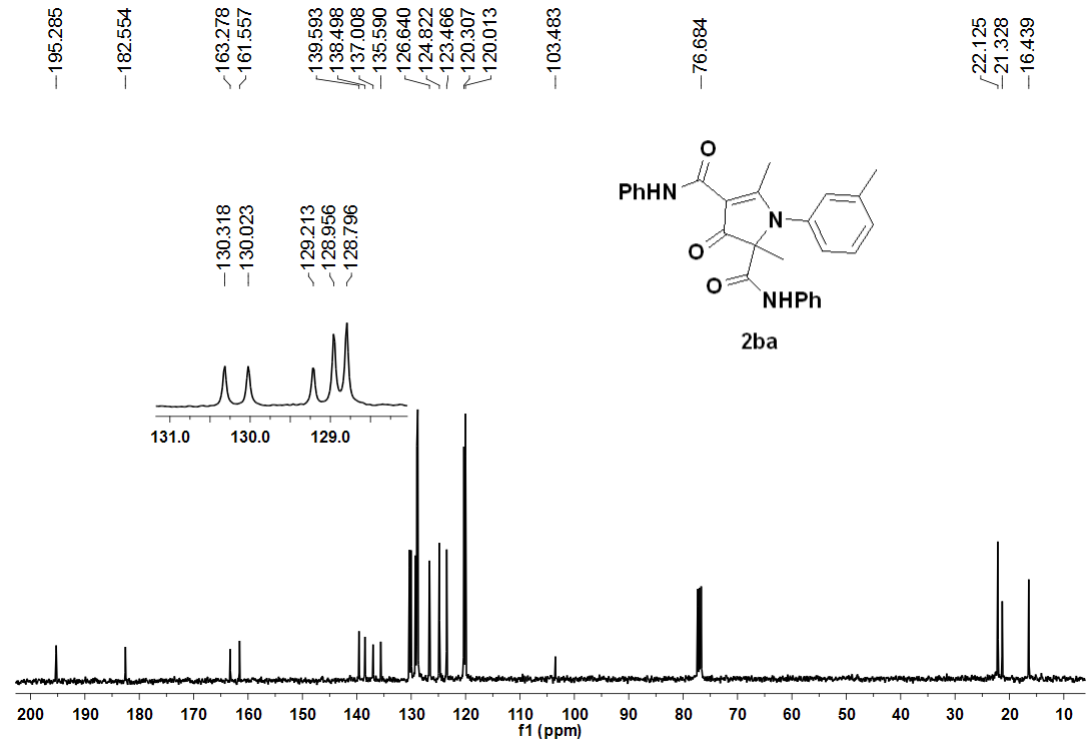
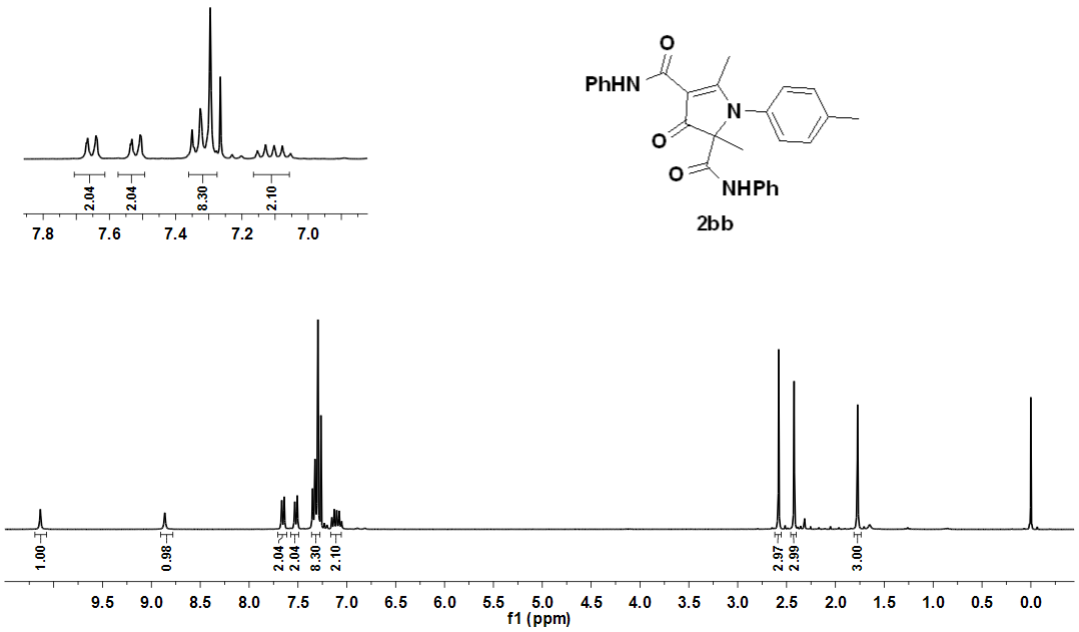
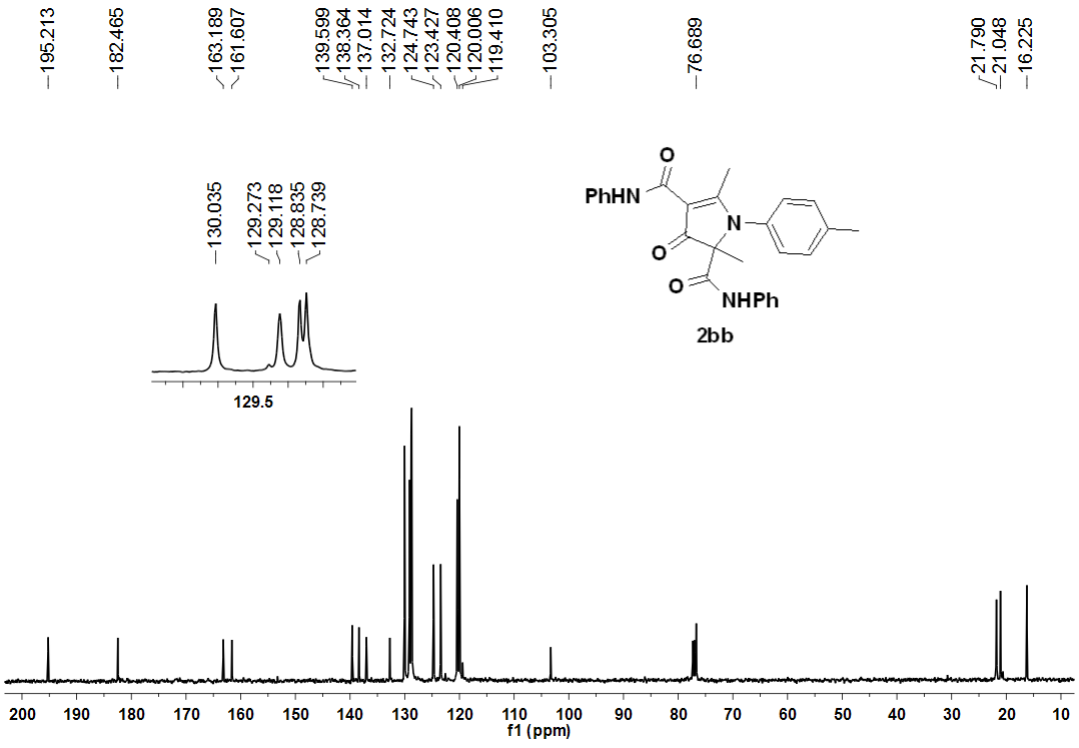
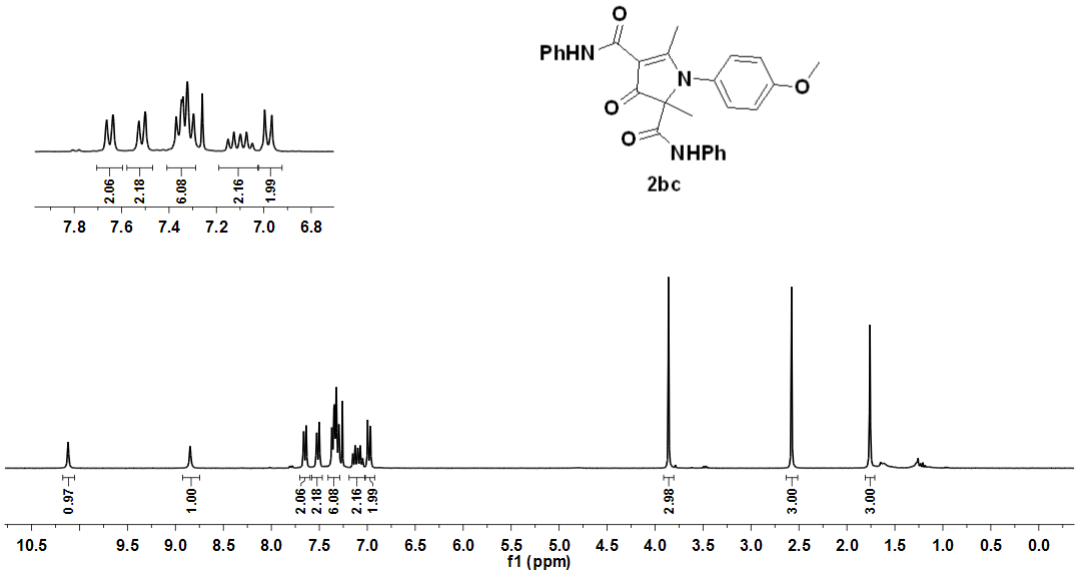
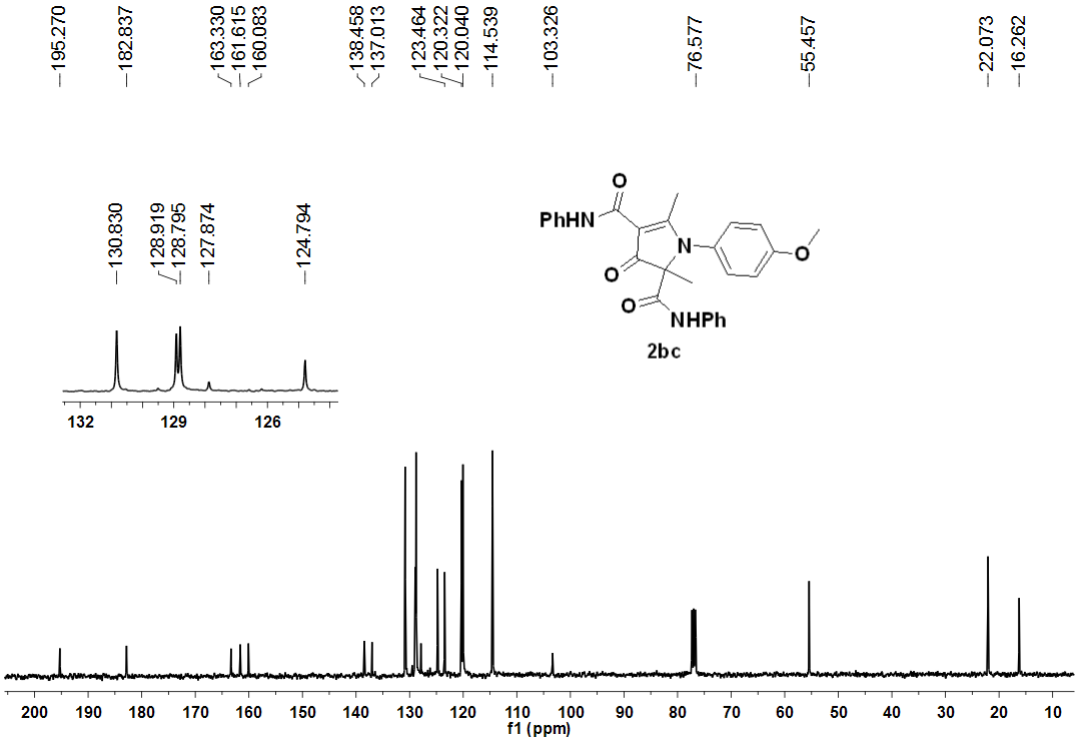
2.05
6.08
1.98
2.04
7.8
7.6
7.4
7.2
7.0
0.99
0.95
2.03
2.05
6.08
1.98
2.04
2.96
3.03
3.00
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

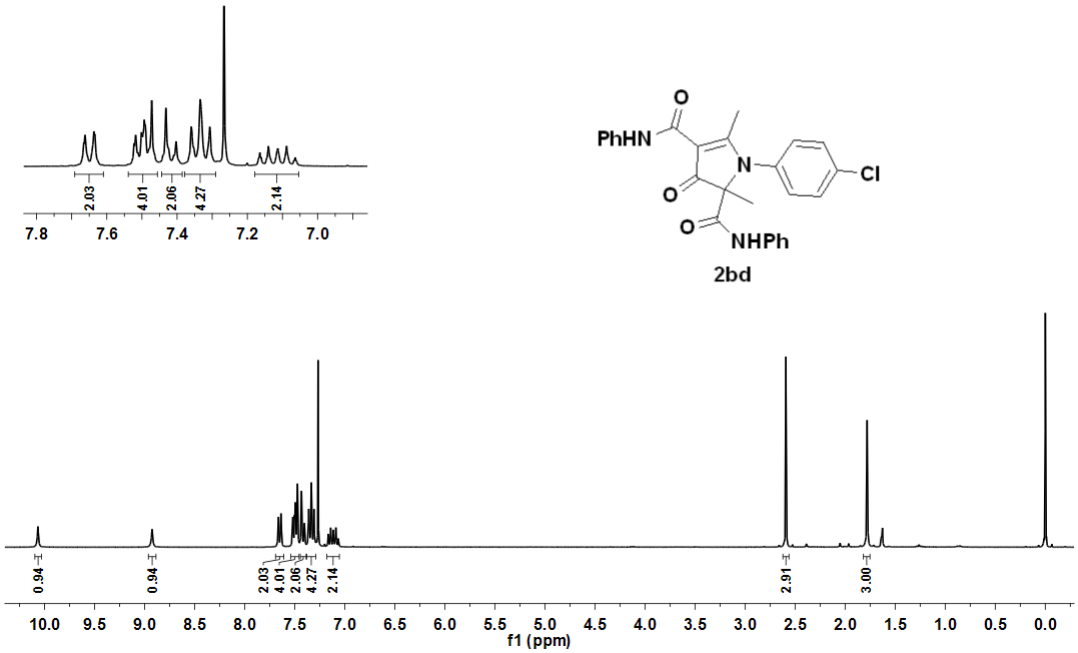

195.285
182.554
163.278
161.557
139.593
138.498
137.008
135.590
126.640
124.822
123.466
120.307
120.013
103.483
76.684
22.125
21.328
16.439
130.318
130.023
129.213
128.956
128.796
PhHN
O
N
O
O
NHPh
2ba
131.0
130.0
129.0
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

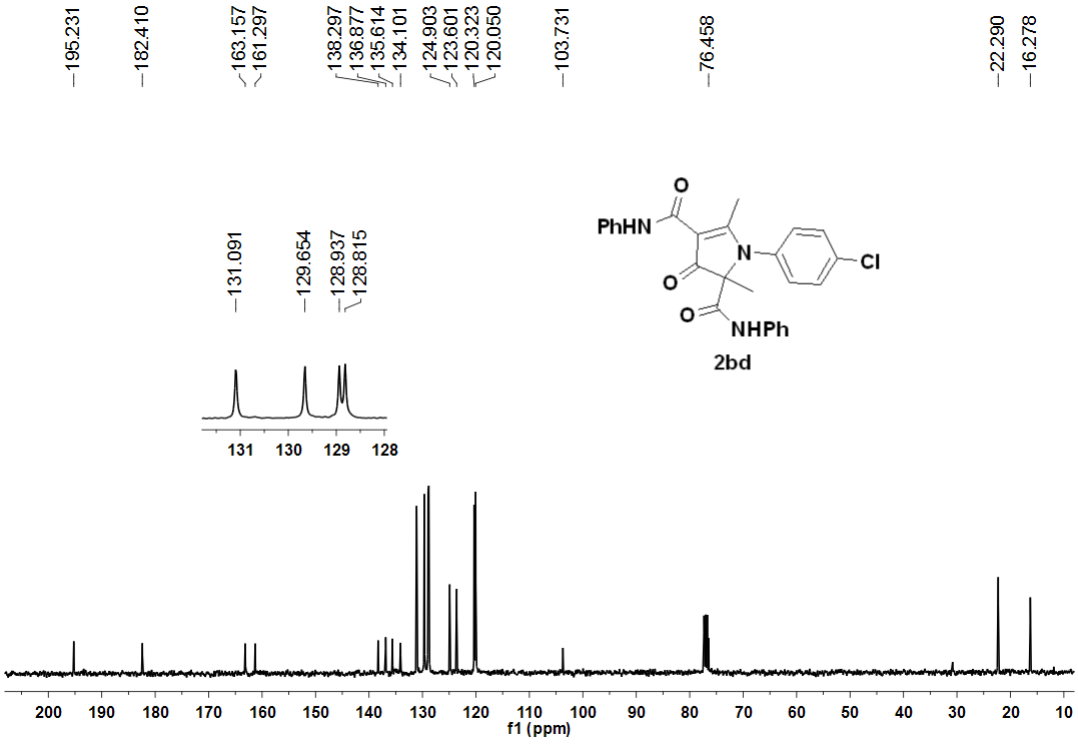

2.04
2.04
8.30
2.10
7.8
7.6
7.4
7.2
7.0
PhHN
O
N
O
O
NHPh
2bb
1.00
0.98
2.04
2.04
8.30
2.10
2.97
2.99
3.00
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

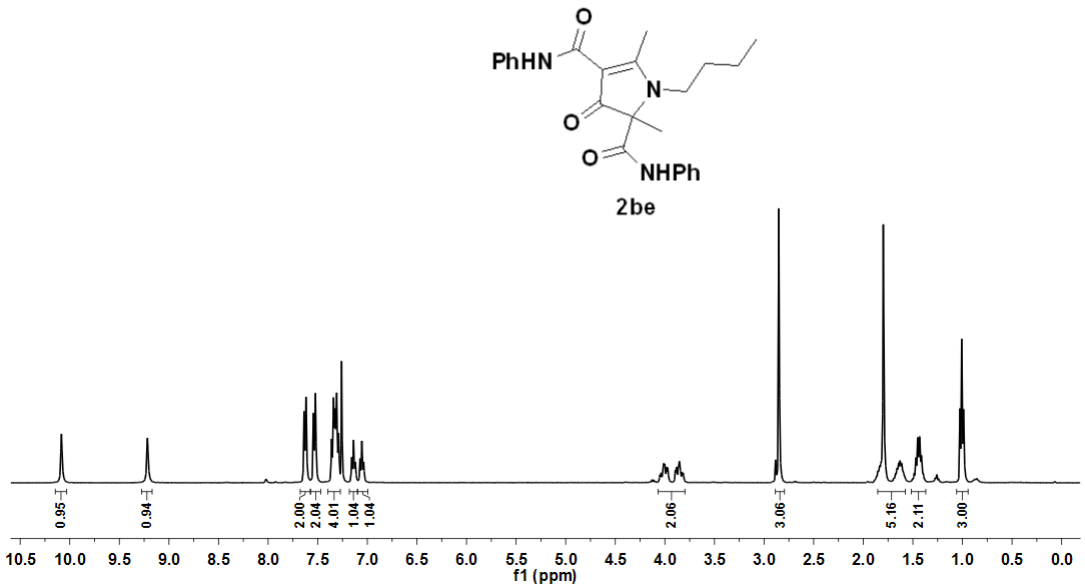

195.213
182.465
163.189
161.607
139.599
138.364
137.014
132.724
124.743
123.427
120.408
120.006
119.410
103.305
76.689
21.790
21.048
16.225
130.035
129.273
129.118
128.835
128.739
129.5
PhHN
O
N
O
O
NHPh
2bb
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

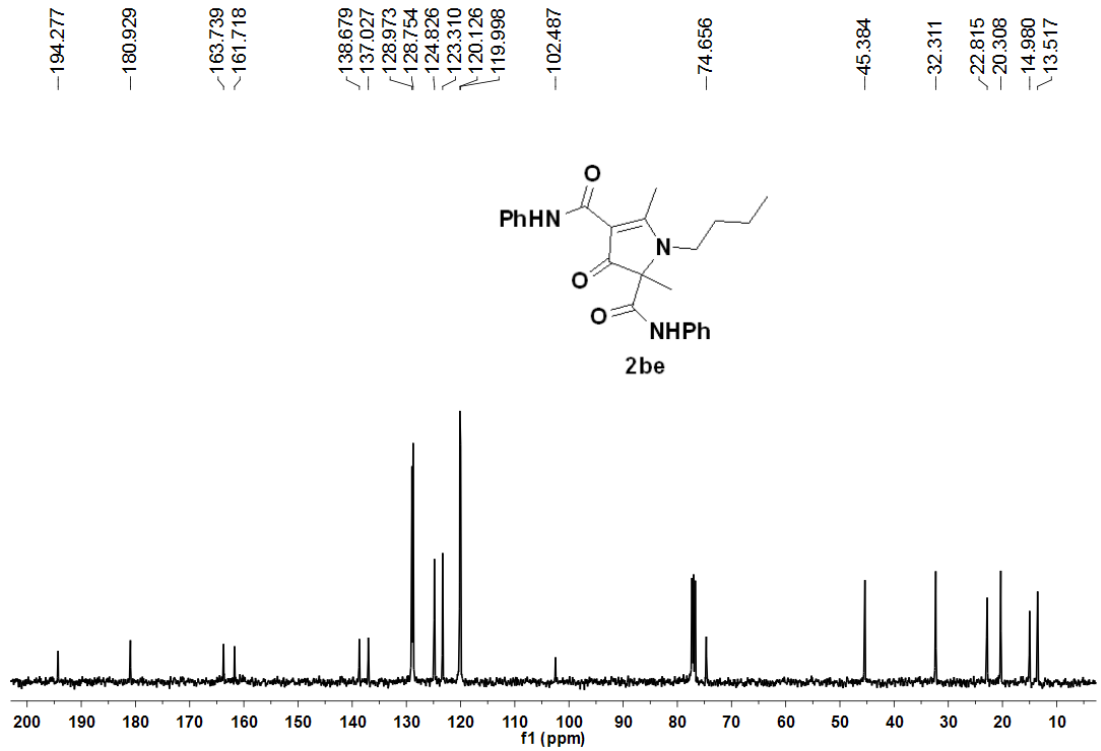


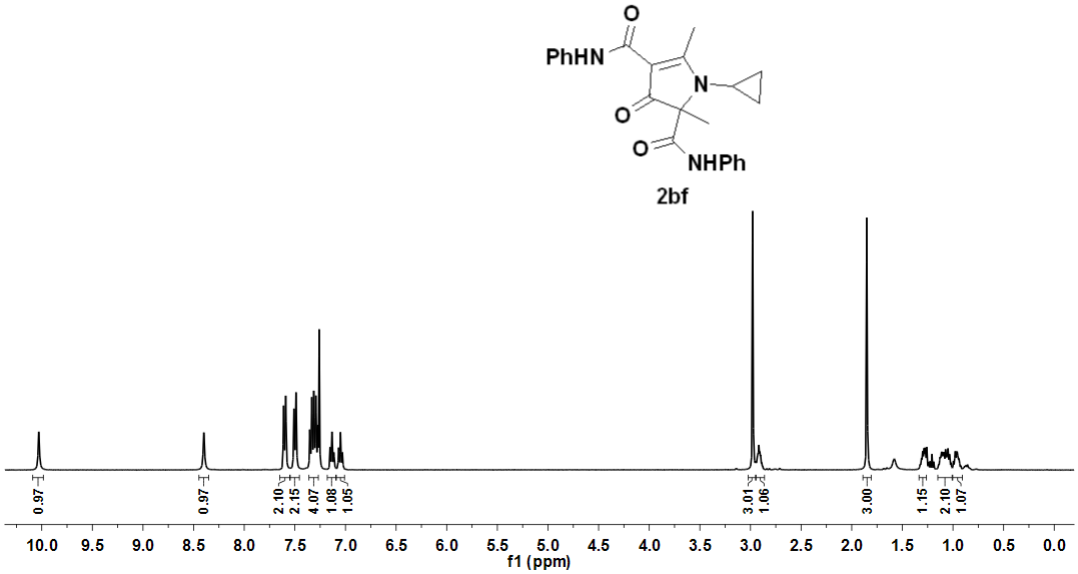


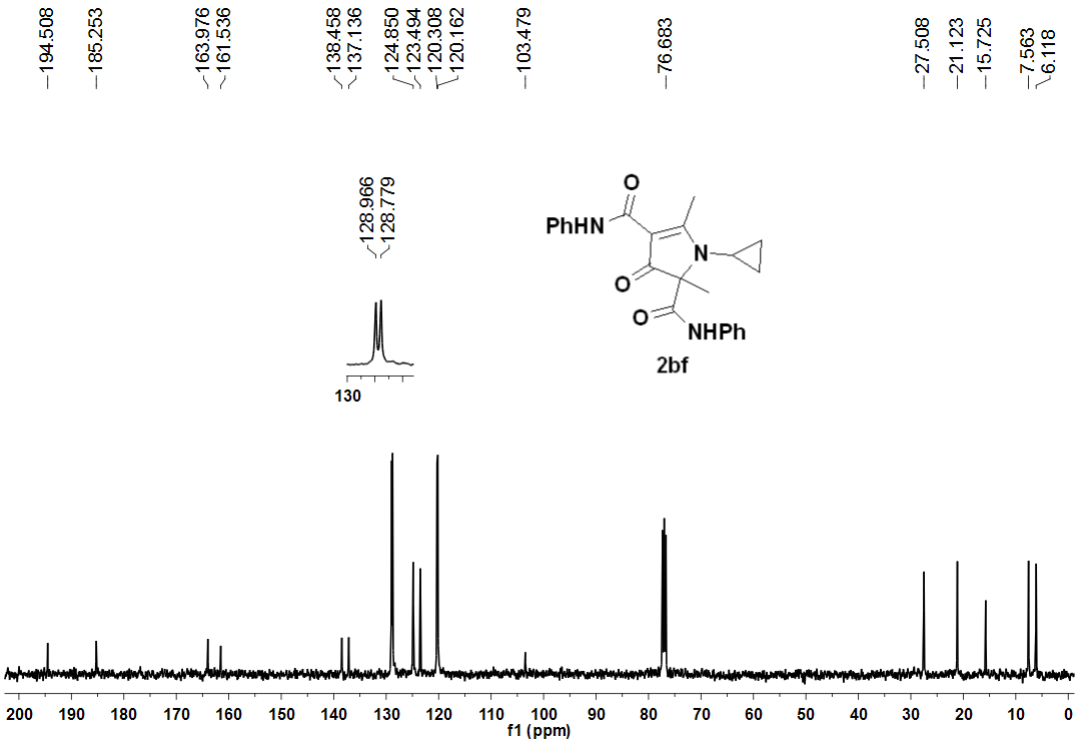

2.03
4.01
2.06
4.27
2.14
7.8
7.6
7.4
7.2
7.0
PhHN
O
N
Cl
O
O
NHPh
2bd
0.94
0.94
2.03
4.01
2.06
4.27
2.14
2.91
3.00
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

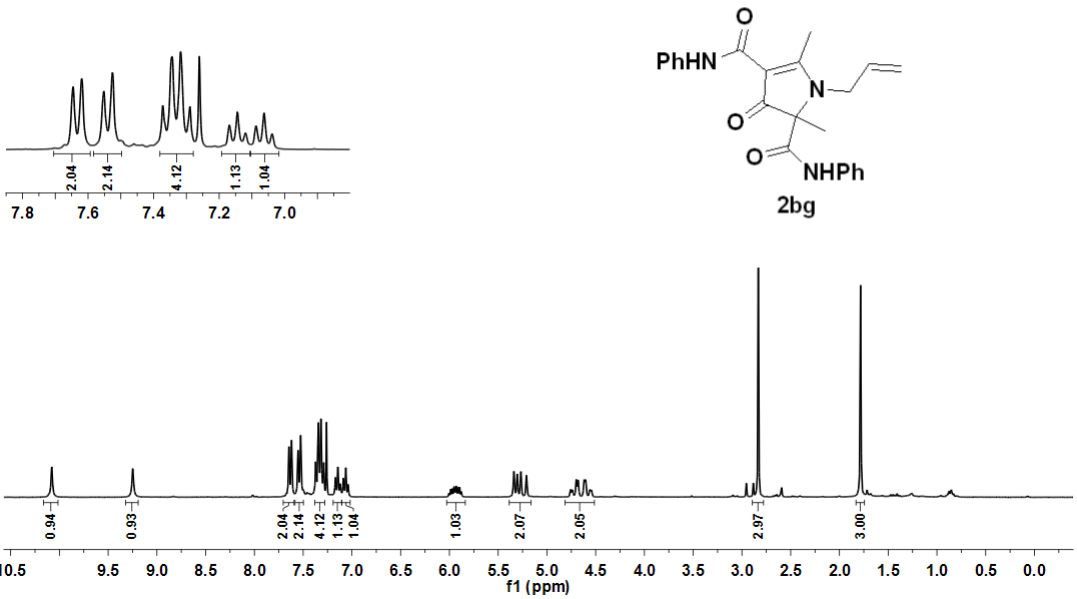

195.231
182.410
163.157
161.297
138.297
136.877
135.614
134.101
124.903
123.601
120.323
120.050
103.731
76.458
22.290
16.278
131.091
129.654
128.937
128.815
131
130
129
128
PhHN
O
N
Cl
O
O
NHPh
2bd
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

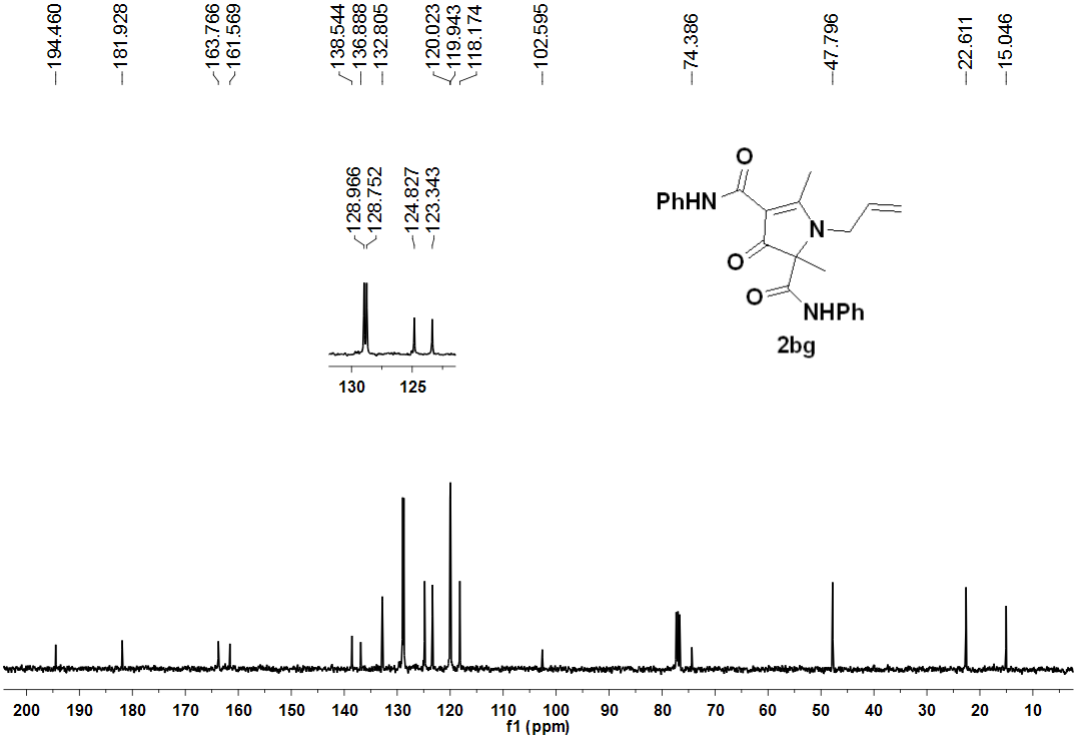


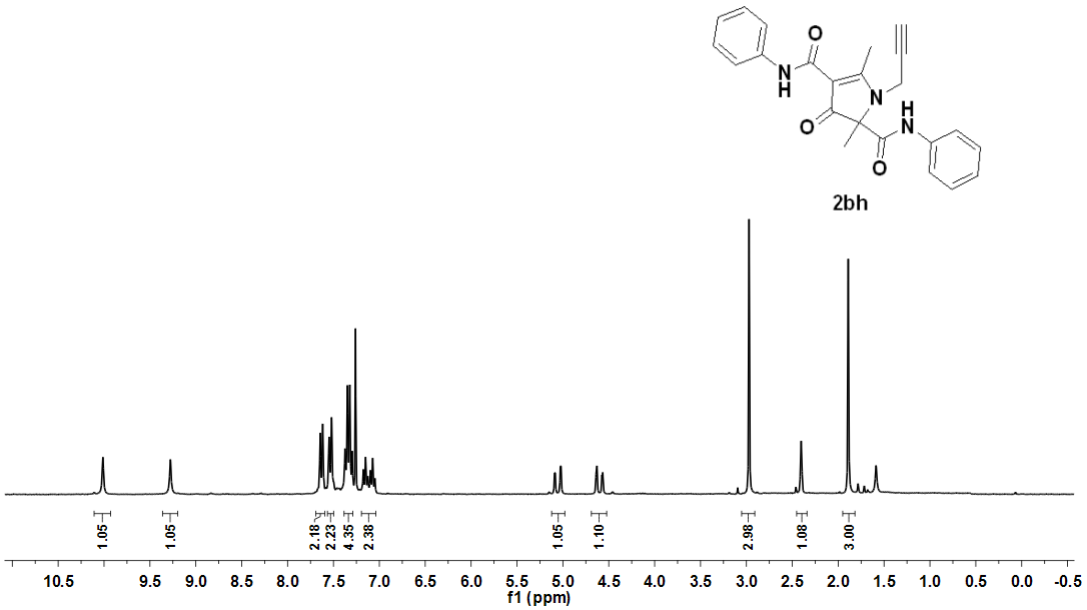


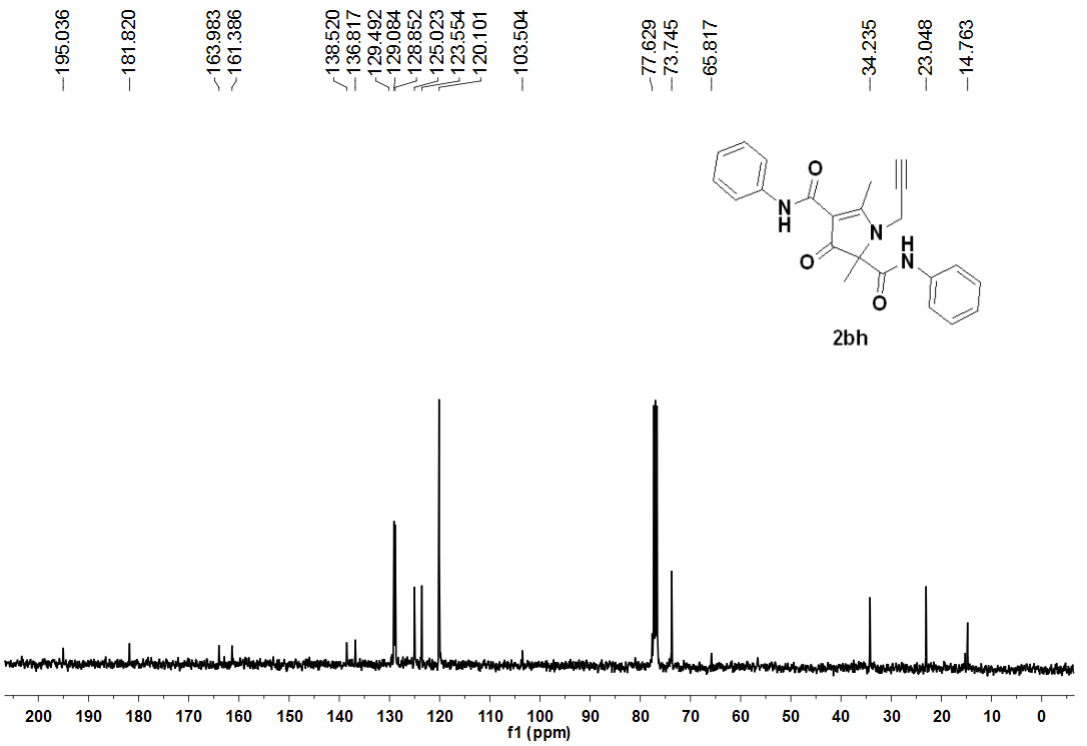

PhHN
O
N
O
O
NHPh
2bf
0.97
0.97
2.10
2.15
4.07
1.08
1.05
3.01
1.06
3.00
1.15
2.10
1.07
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

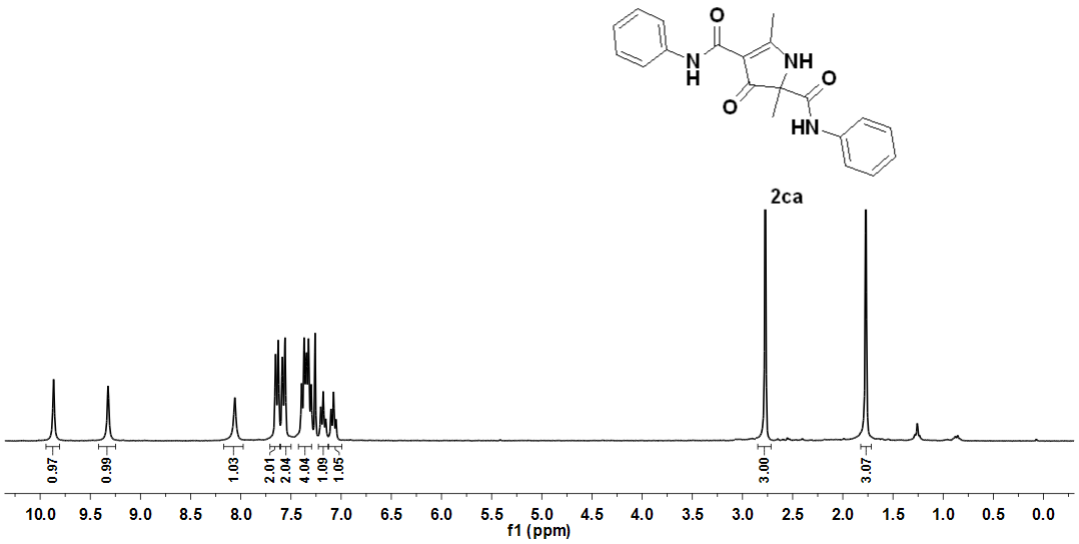

194.508
185.253
163.976
161.536
138.458
137.136
124.850
123.494
120.308
120.162
103.479
76.683
27.508
21.123
15.725
7.563
6.118
128.966
128.779
130
PhHN
O
N
O
O
NHPh
2bf
200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

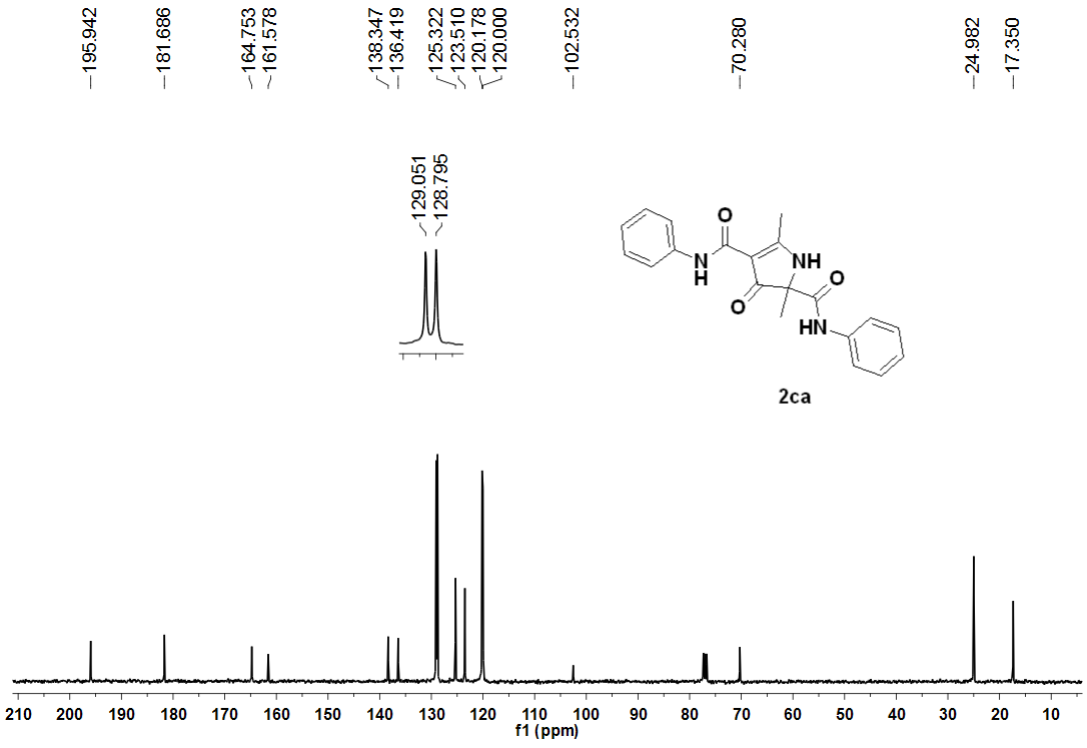

PhHN
N
O
O
NHPh
2bg
2.04
2.14
4.12
1.13
1.04
7.8
7.6
7.4
7.2
7.0
0.94
0.93
2.04
2.14
4.12
1.13
1.04
1.03
2.07
2.05
2.97
3.00
10.5
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
f1 (ppm)

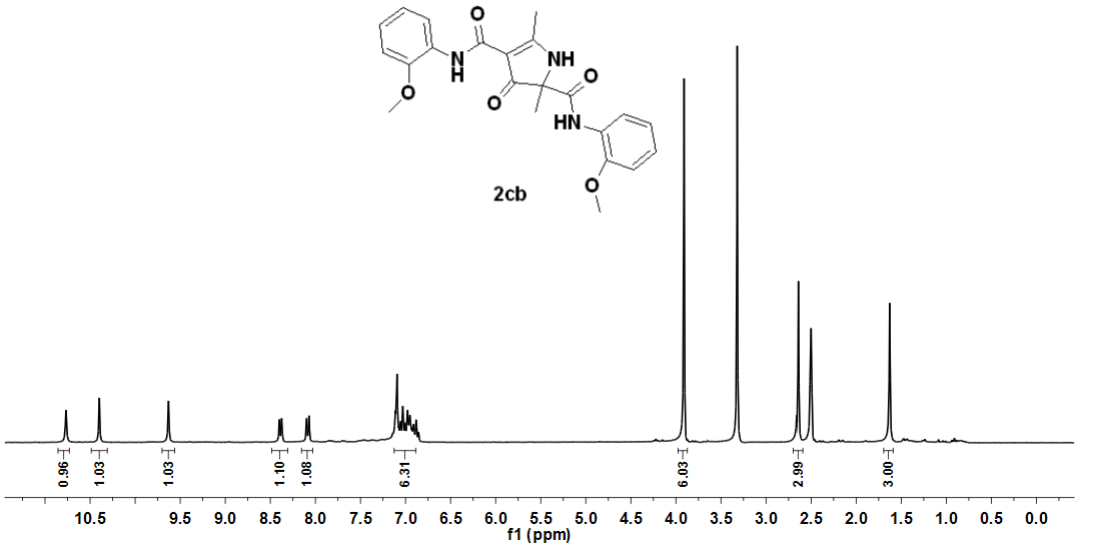

194.460
181.928
163.766
161.569
138.544
136.888
132.805
120.023
119.943
118.174
102.595
74.386
47.796
22.611
15.046
128.966
128.752
124.827
123.343
PhHN
N
O
O
NHPh
2bg
130
125
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

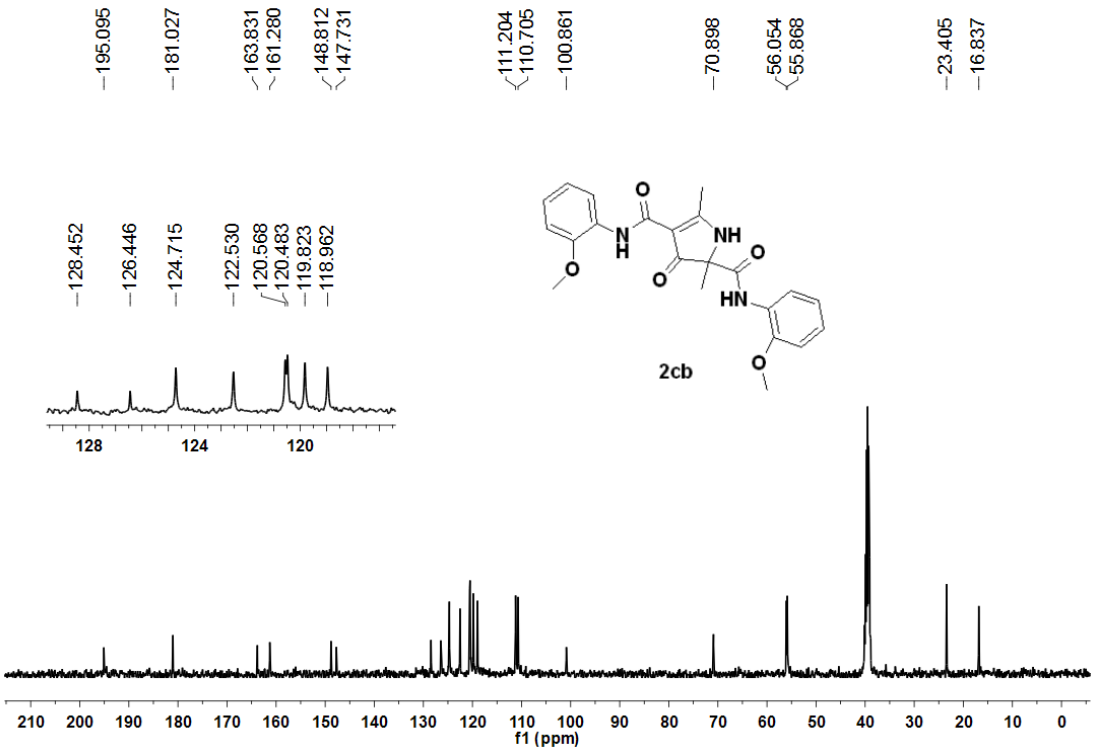

2bh
1.05
1.05
2.18
2.23
4.35
2.38
1.05
1.10
2.98
1.08
3.00
f1 (ppm)


195.036
181.820
163.983
161.386
138.520
136.817
129.492
129.084
128.852
125.023
123.554
120.101
103.504
77.629
73.745
65.817
34.235
23.048
14.763
2bh
f1 (ppm)






2cb
0.96
1.03
1.03
1.10
1.08
6.31
6.03
2.99
3.00
f1 (ppm)


195.095
181.027
163.831
161.280
148.812
147.731
111.204
110.705
100.861
70.898
56.054
55.868
23.405
16.837
128.452
126.446
124.715
122.530
120.568
120.483
119.823
118.962
2cb
f1 (ppm)