**Supporting Information**

# Brønsted acid-catalyzed multicomponent reaction for the synthesis of highly functionalized γ-lactam derivatives.

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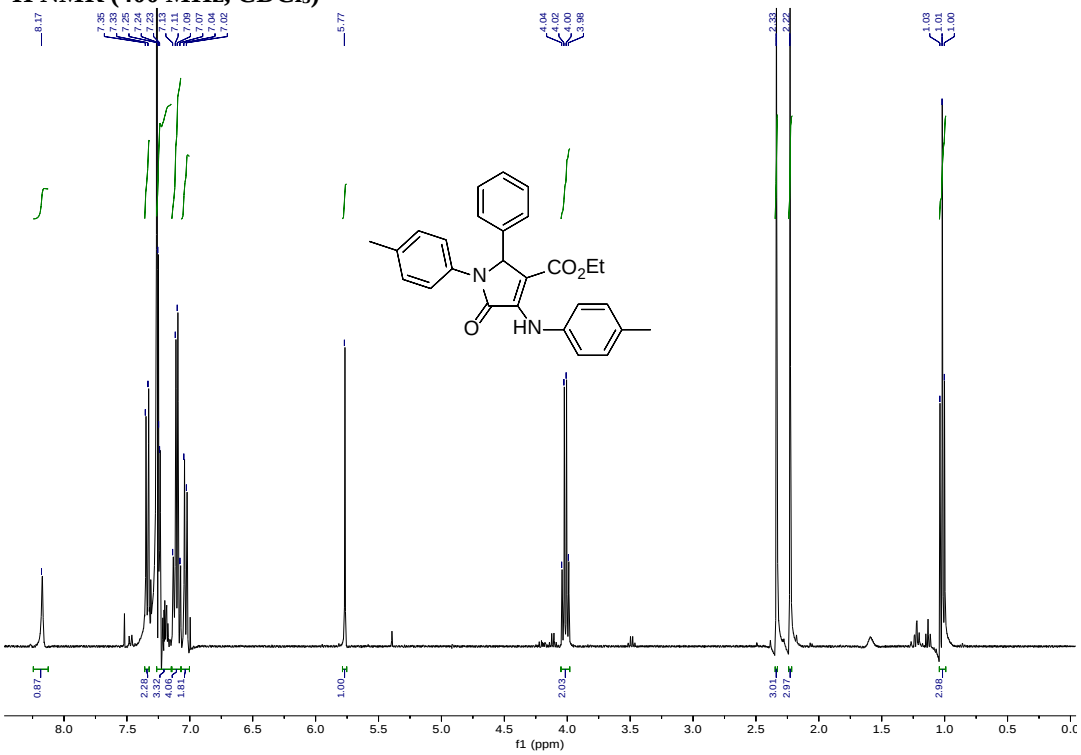
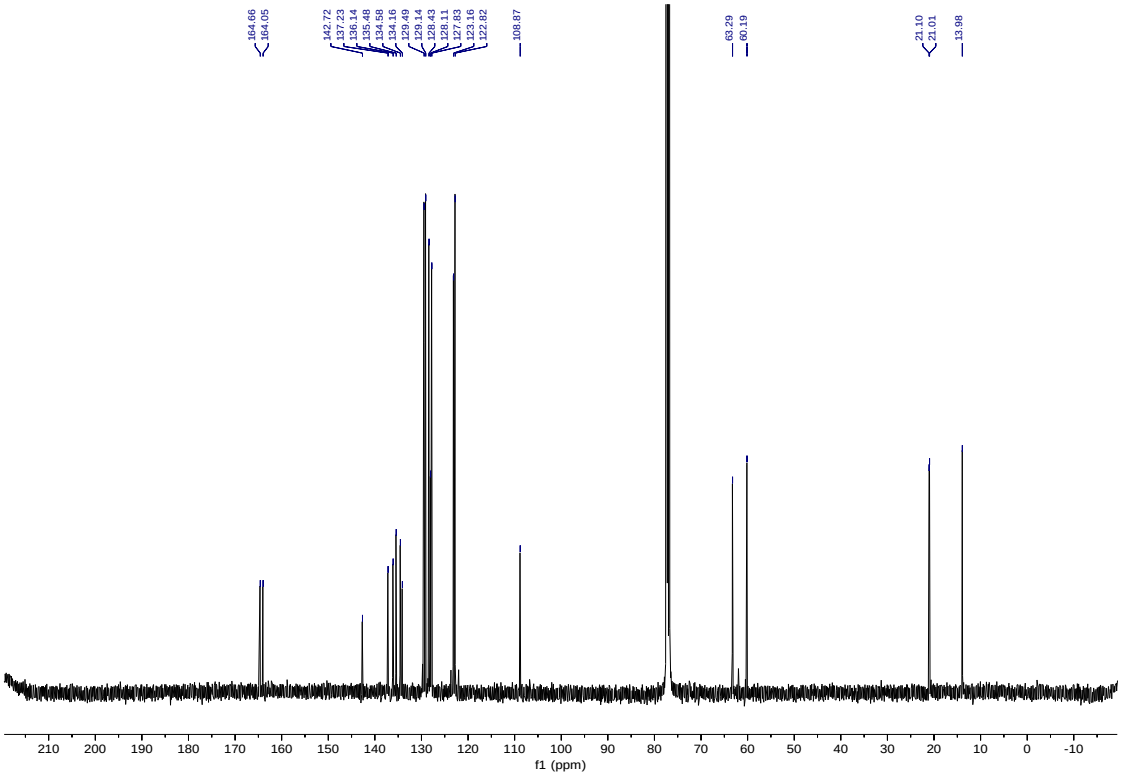
## 1. $^{1}H$ and $^{13}C$ NMR spectra of compounds 10, 11, 12 and 16.

**Ethyl 5-oxo-2-phenyl-1-(p-tolyl)-4-(p-tolylamino)-2,5-dihydro-1H-pyrrole-3-carboxylate. (10a).**

**$^{1}H$ NMR (400 MHz, $CDCl_3$)**

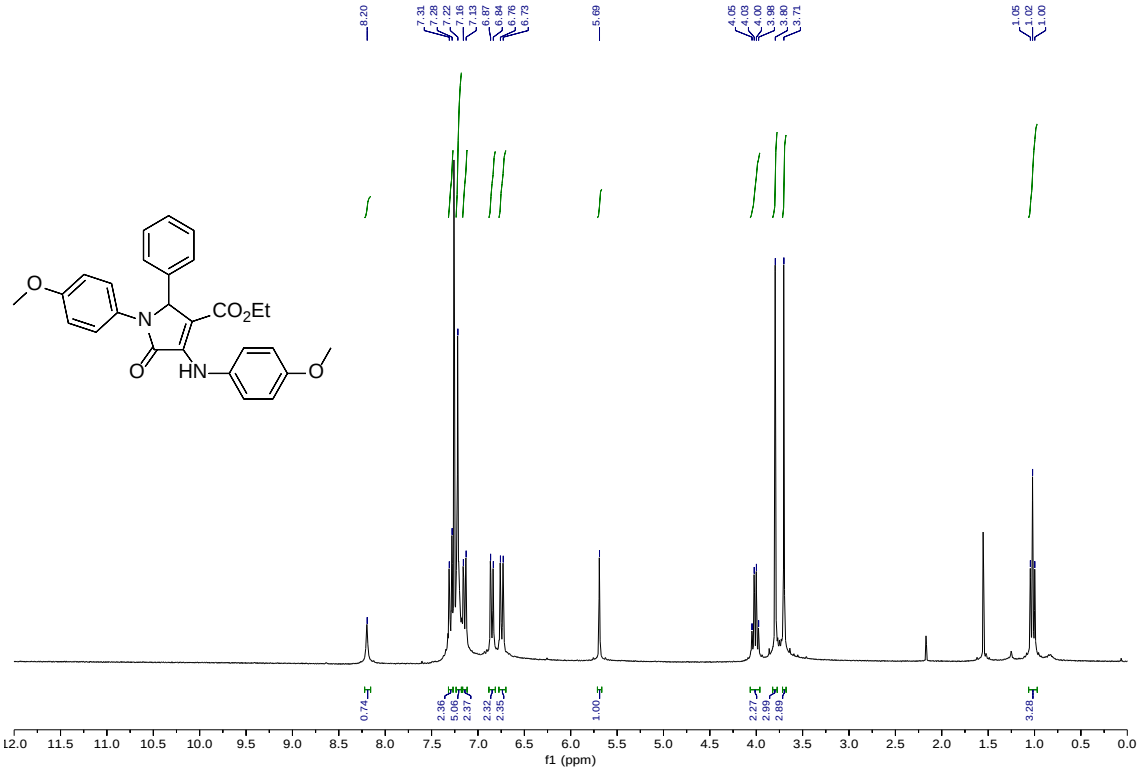



**$^{13}C$ NMR (101 MHz, $CDCl_3$)**

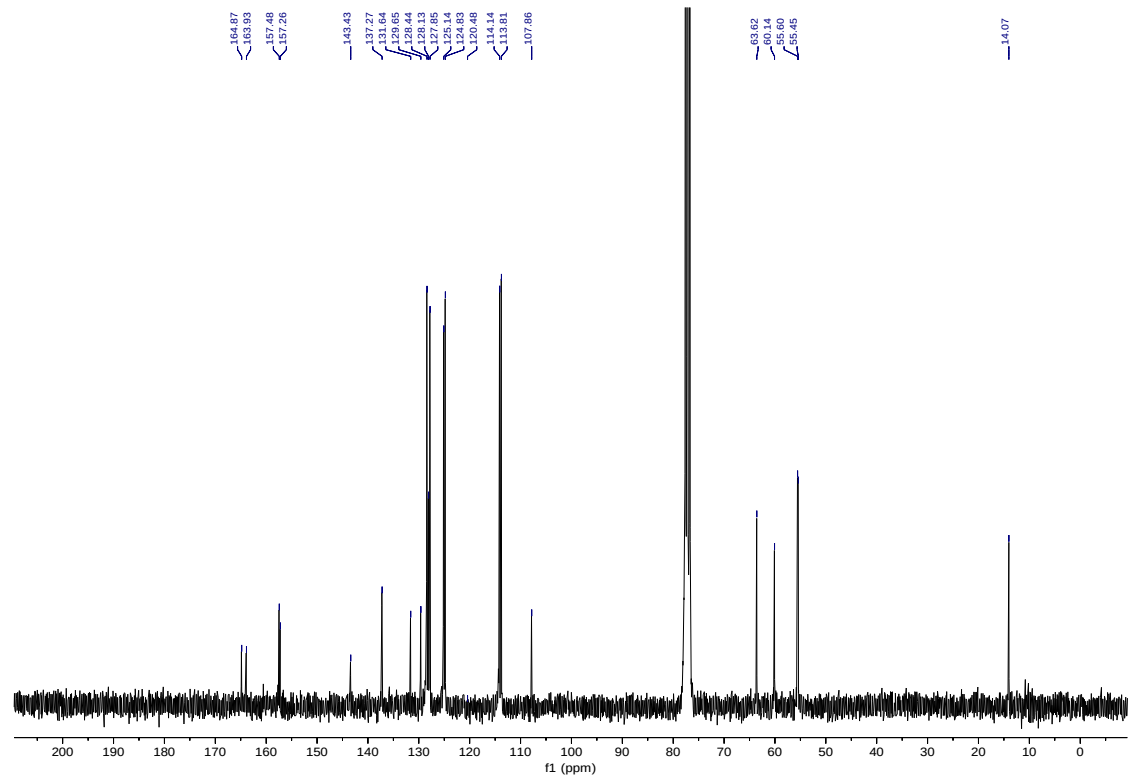


**Ethyl 1-(4-methoxyphenyl)-4-((4-methoxyphenyl)amino)-5-oxo-2-phenyl-2,5-dihydro-1H-pyrrole-3-carboxylate (10b).**

**$^{1}$H NMR (300 MHz, $CDCl_3$)**

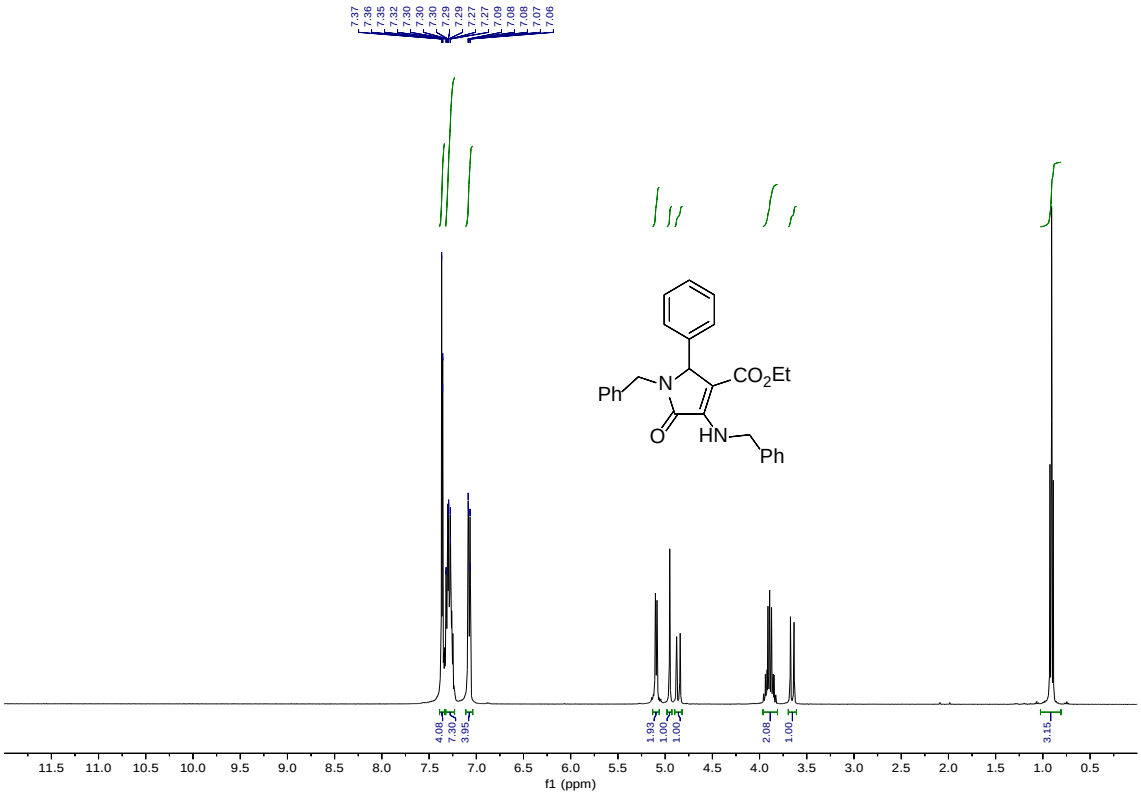



**$^{13}$C NMR (75 MHz, $CDCl_3$)**

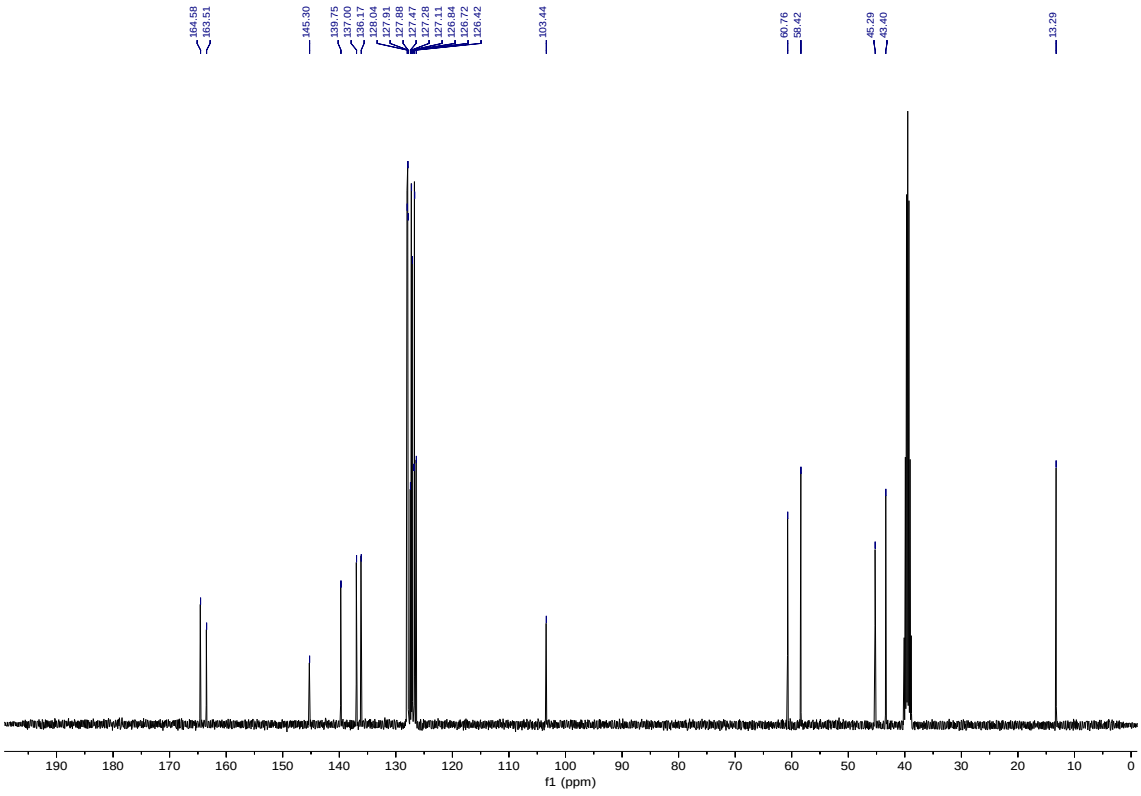


**Ethyl 1-benzyl-4-(benzylamino)-5-oxo-2-phenyl-2,5-dihydro-1H-pyrrole-3-carboxylate (10c).**

**$^{1}$H NMR (400 MHz, DMSO-$d_6$)**

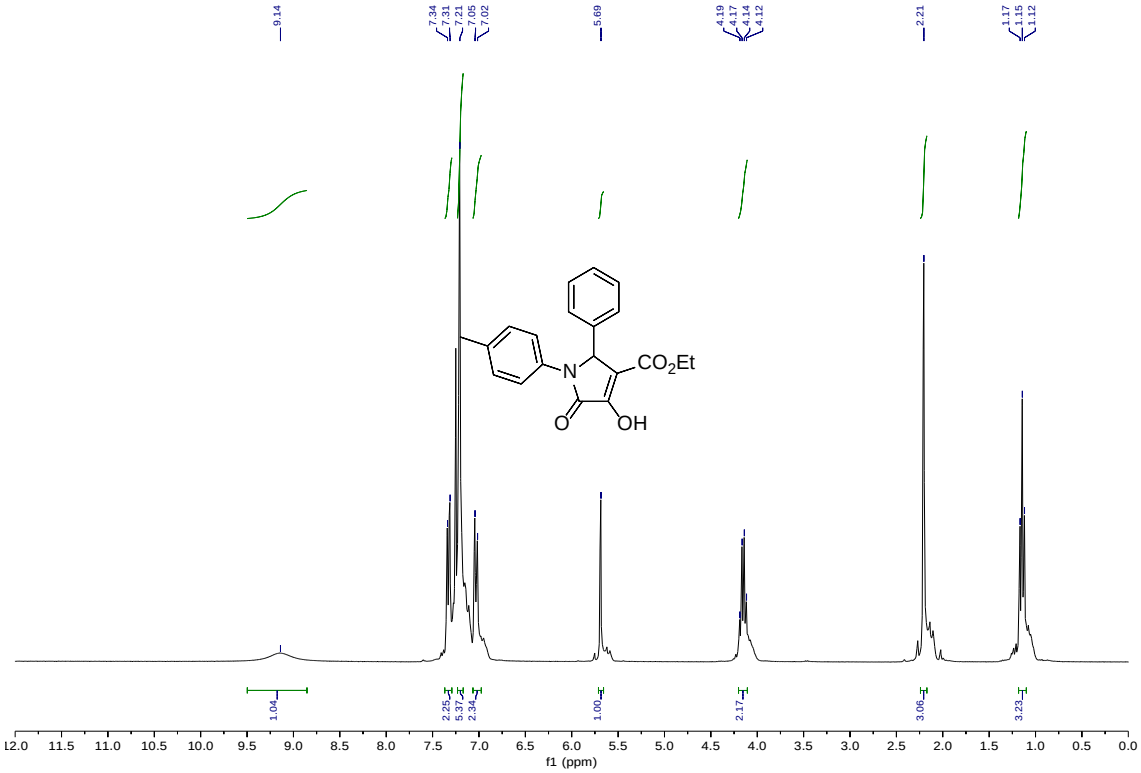



**$^{13}$C NMR (101 MHz, DMSO $d_6$)**

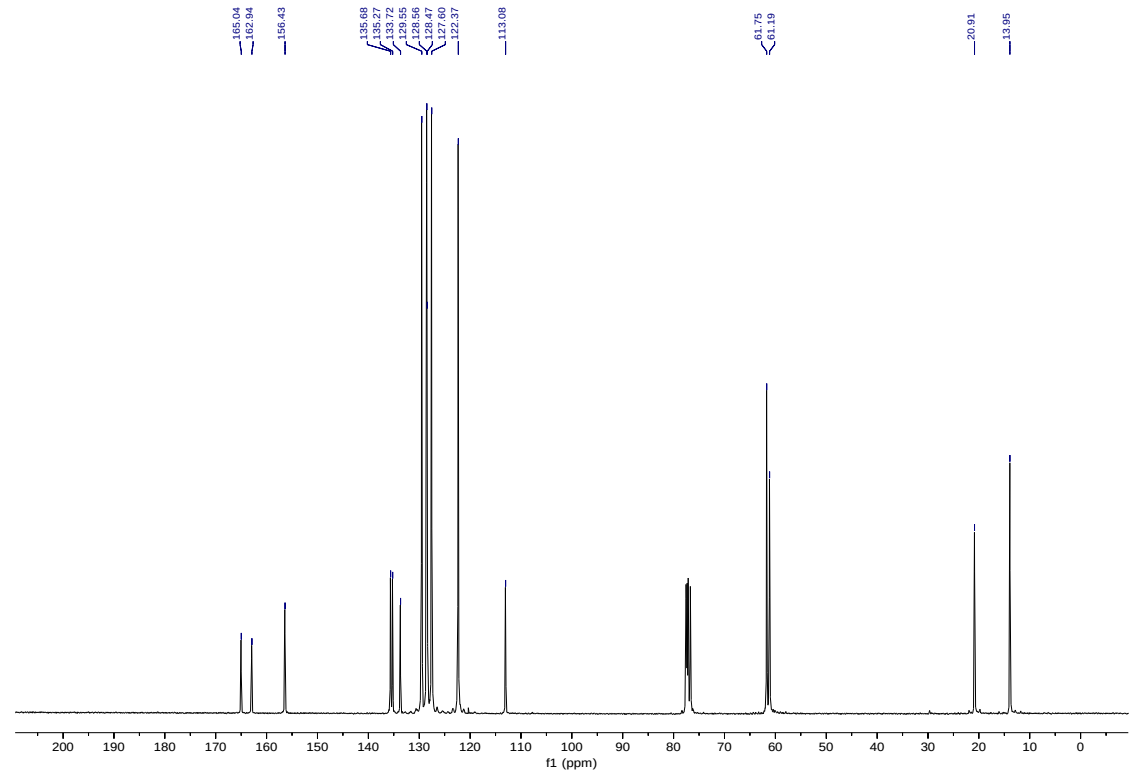


**Ethyl 4-hydroxy-5-oxo-2-phenyl-1-(p-tolyl)-2,5-dihydro-1H-pyrrole-3-carboxylate. (11a).**

**$^{1}$H NMR (300 MHz, $CDCl_3$)**

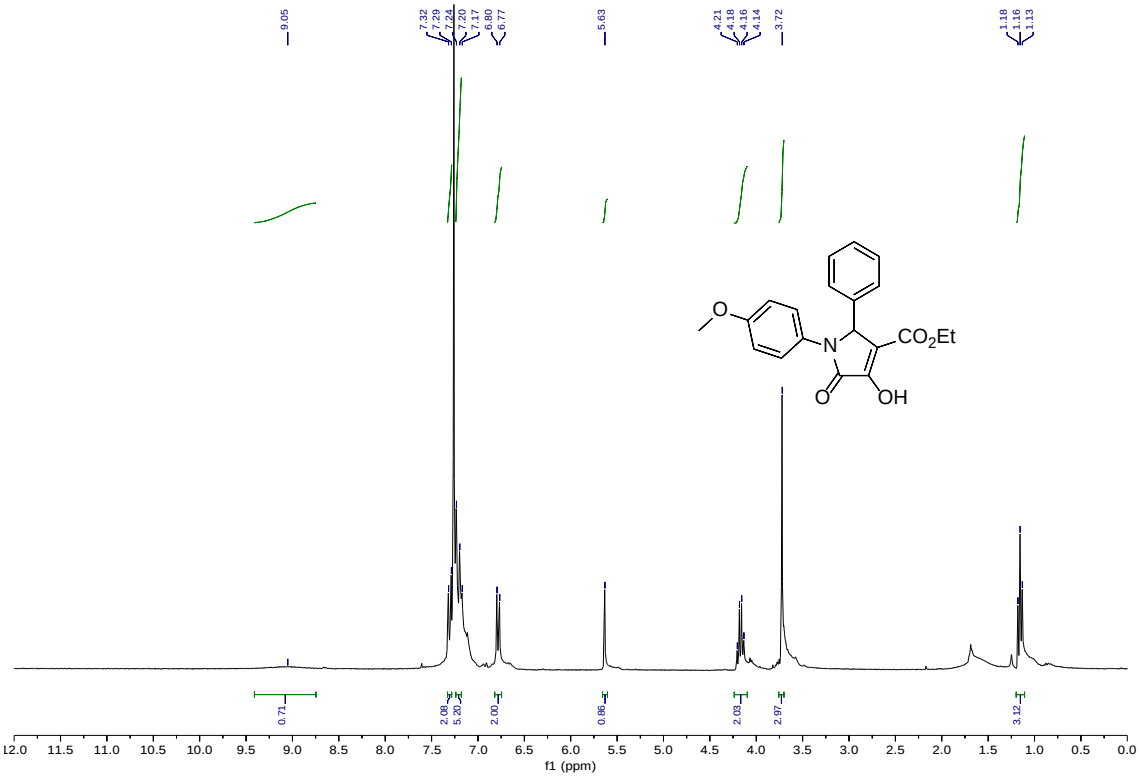



**$^{13}$C NMR (75 MHz, $CDCl_3$**

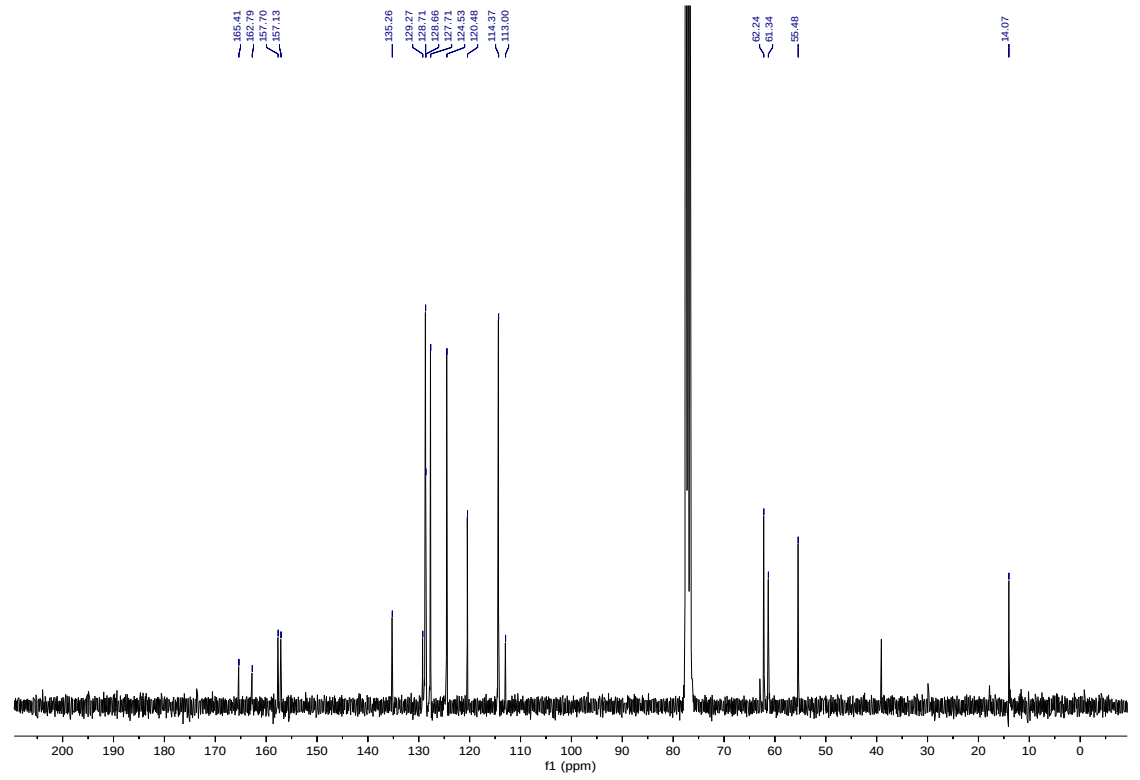


**Ethyl 4-hydroxy-1-(4-methoxyphenyl)-5-oxo-2-phenyl-2,5-dihydro-1H-pyrrole-3-carboxylate. (11b).**

**$^{1}$H NMR (300 MHz, $CDCl_3$)**

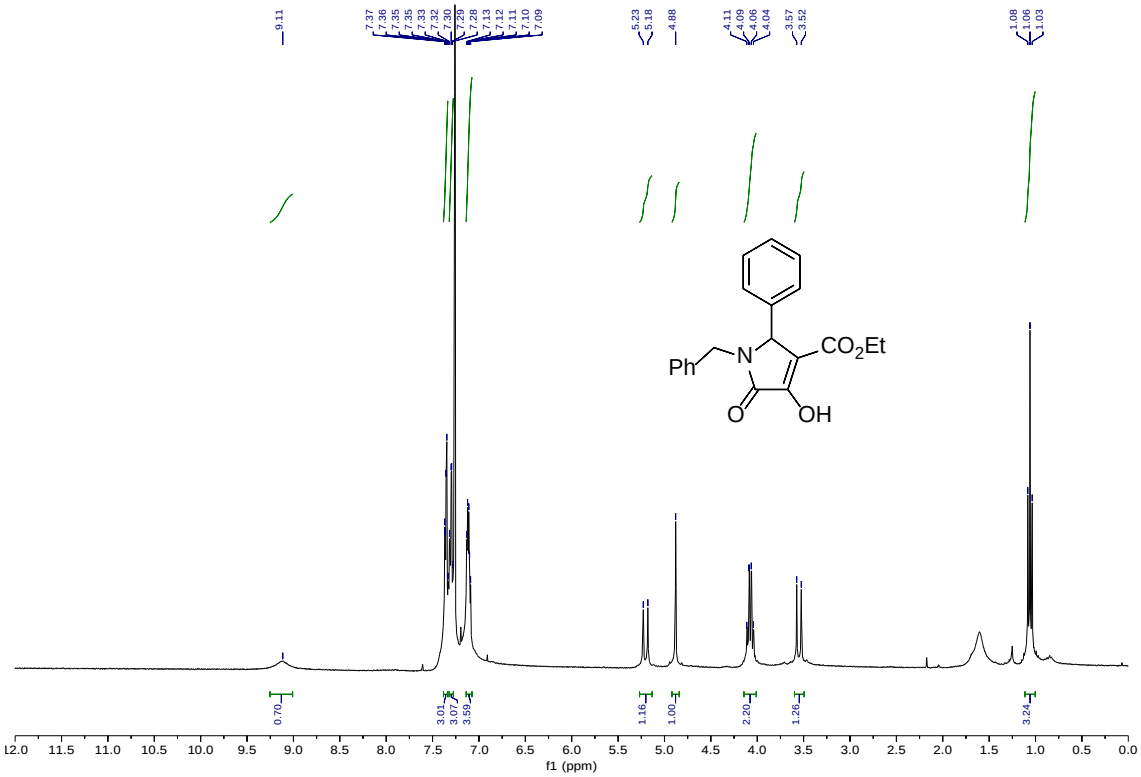



**$^{13}$C NMR (75 MHz, $CDCl_3$)**

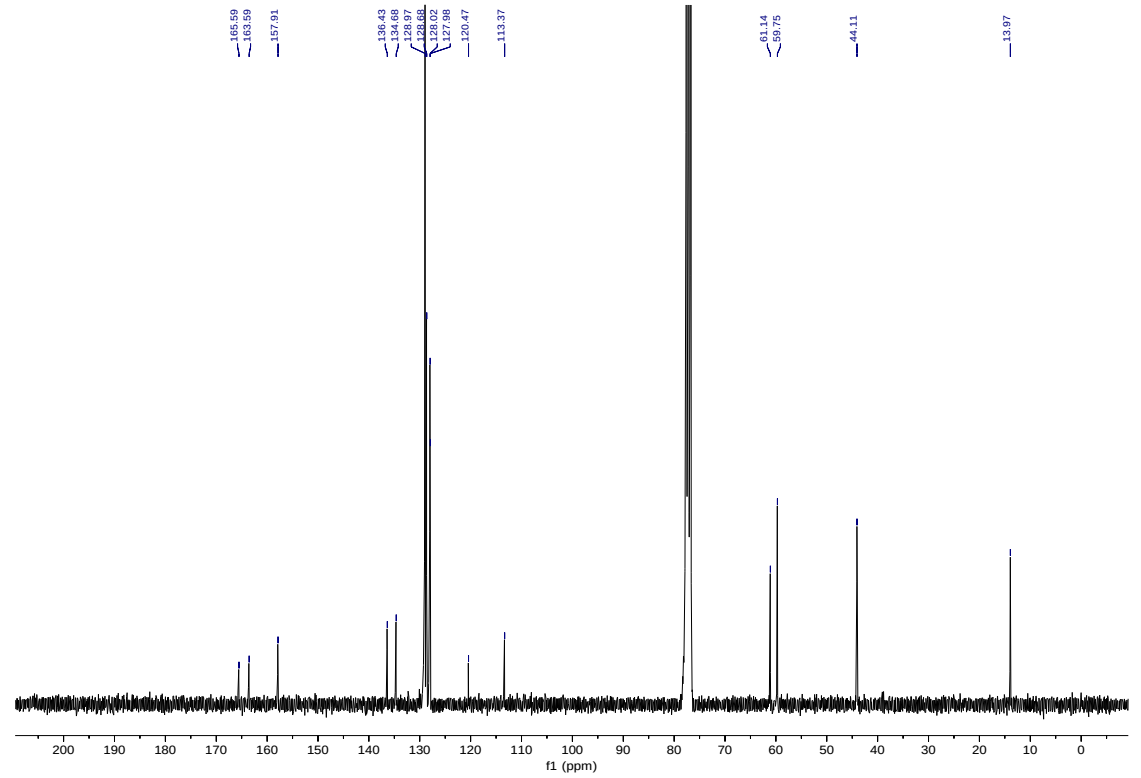


**Ethyl 1-benzyl-4-hydroxy-5-oxo-2-phenyl-2,5-dihydro-1H-pyrrole-3-carboxylate. (11c).**

**$^{1}$H NMR (300 MHz, $CDCl_3$)**

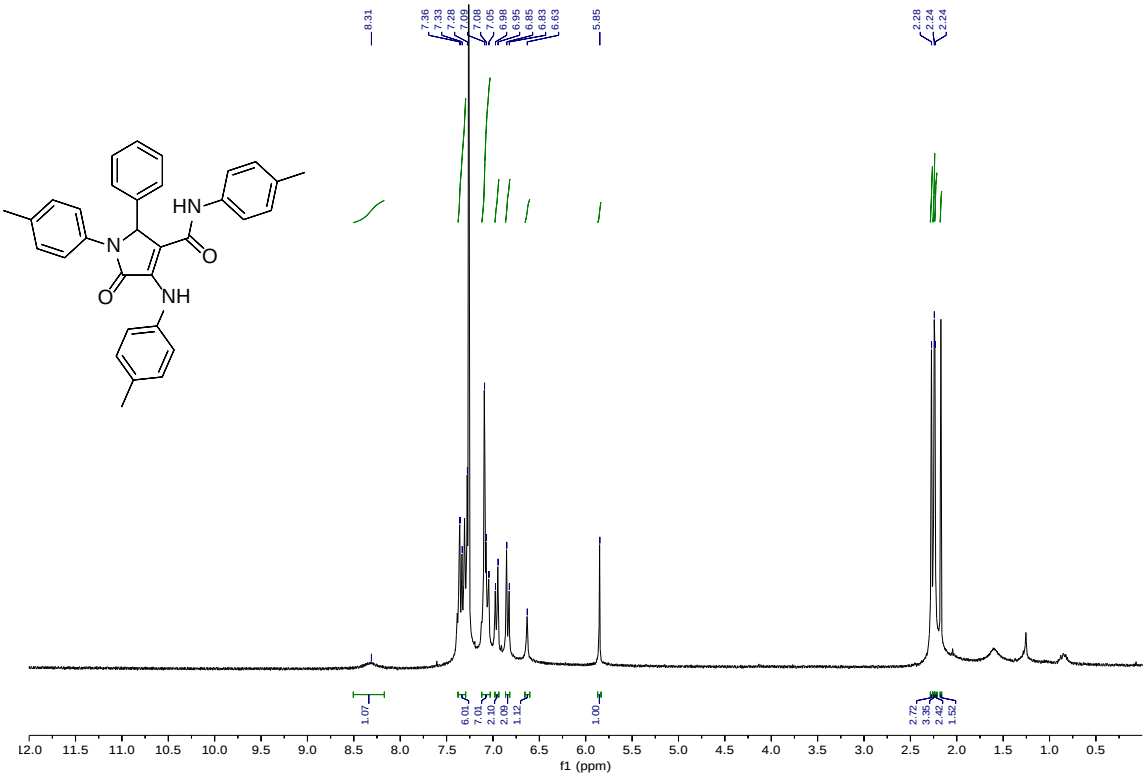



**$^{13}$C NMR (75 MHz, $CDCl_3$)**

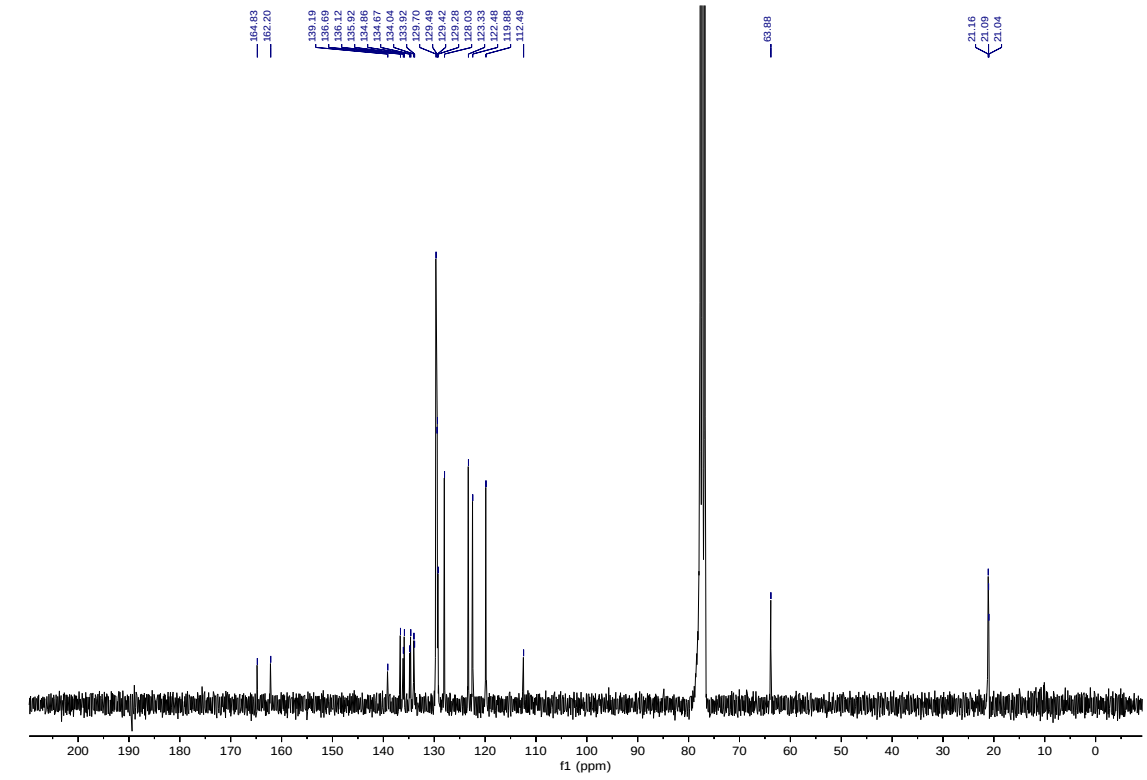


**5-oxo-2-phenyl-N,1-di-p-tolyl-4-(p-tolylamino)-2,5-dihydro-1H-pyrrole-3-carboxamide (12a).**

**$^{1}$H NMR (300 MHz, $CDCl_3$)**

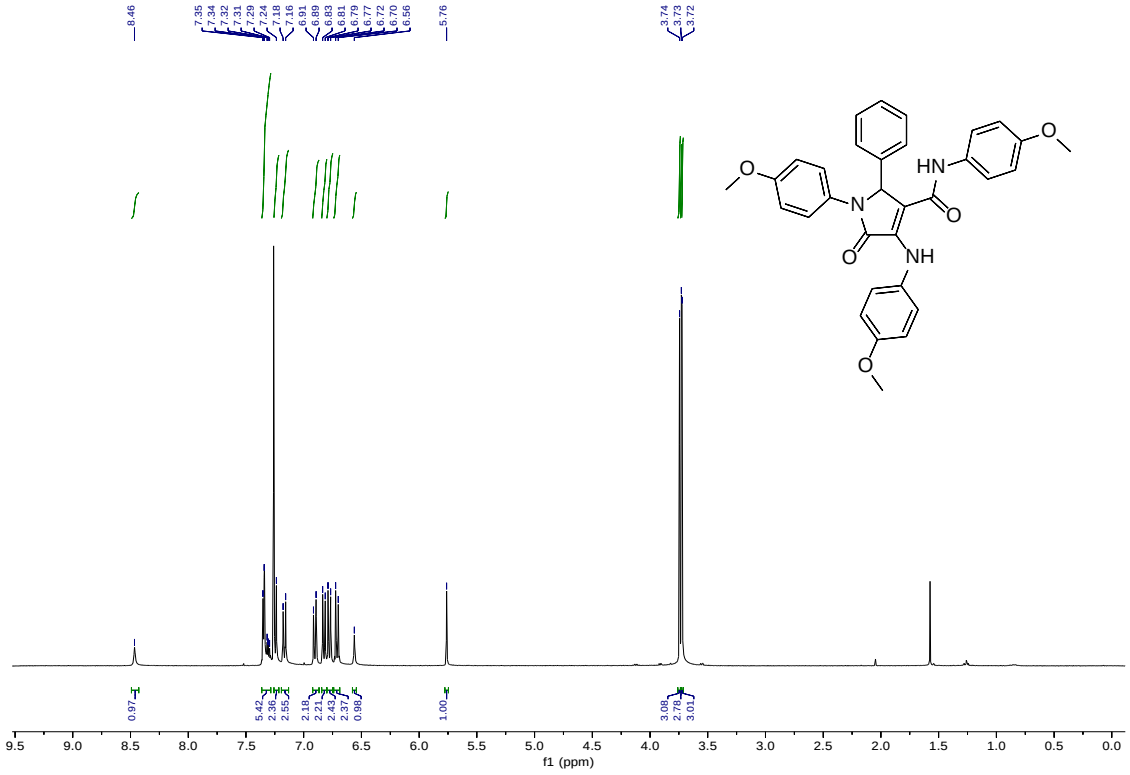



**$^{13}$C NMR (75 MHz, $CDCl_3$)**

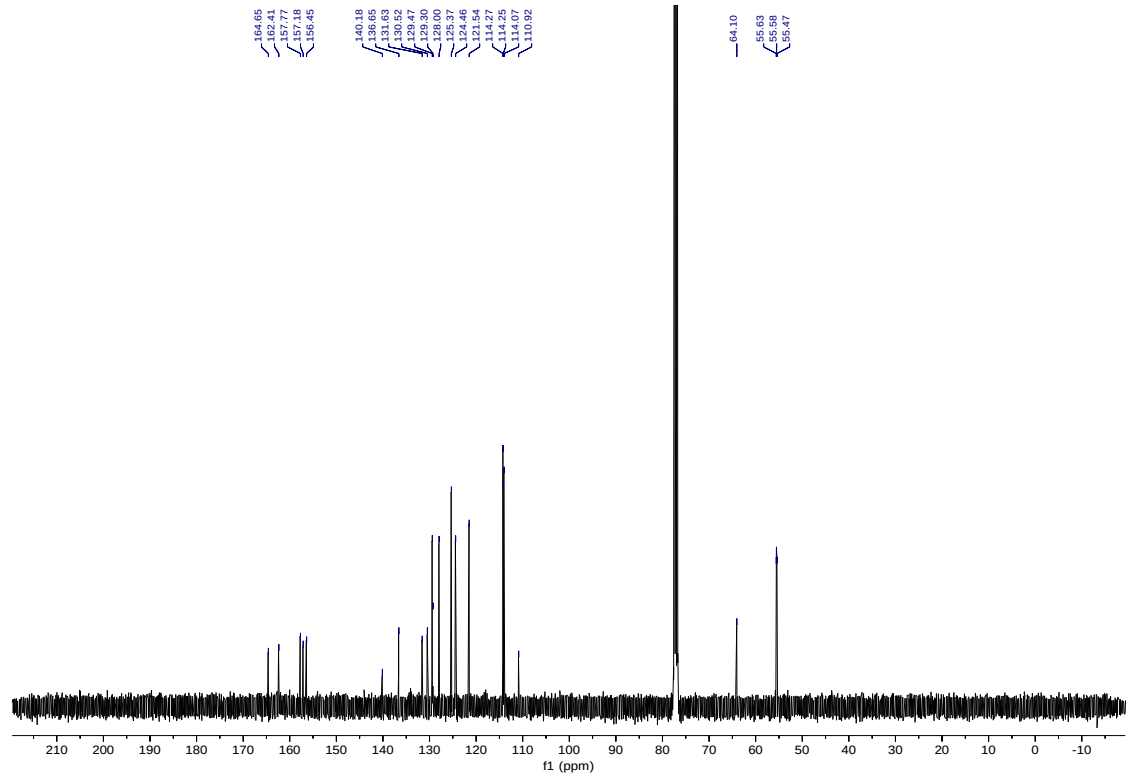


**N,1-bis(4-methoxyphenyl)-4-((4-methoxyphenyl)amino)-5-oxo-2-phenyl-2,5-dihydro-1H-pyrrole-3-carboxamide. (12b).**

**$^{1}$H NMR (400 MHz, $CDCl_3$)**

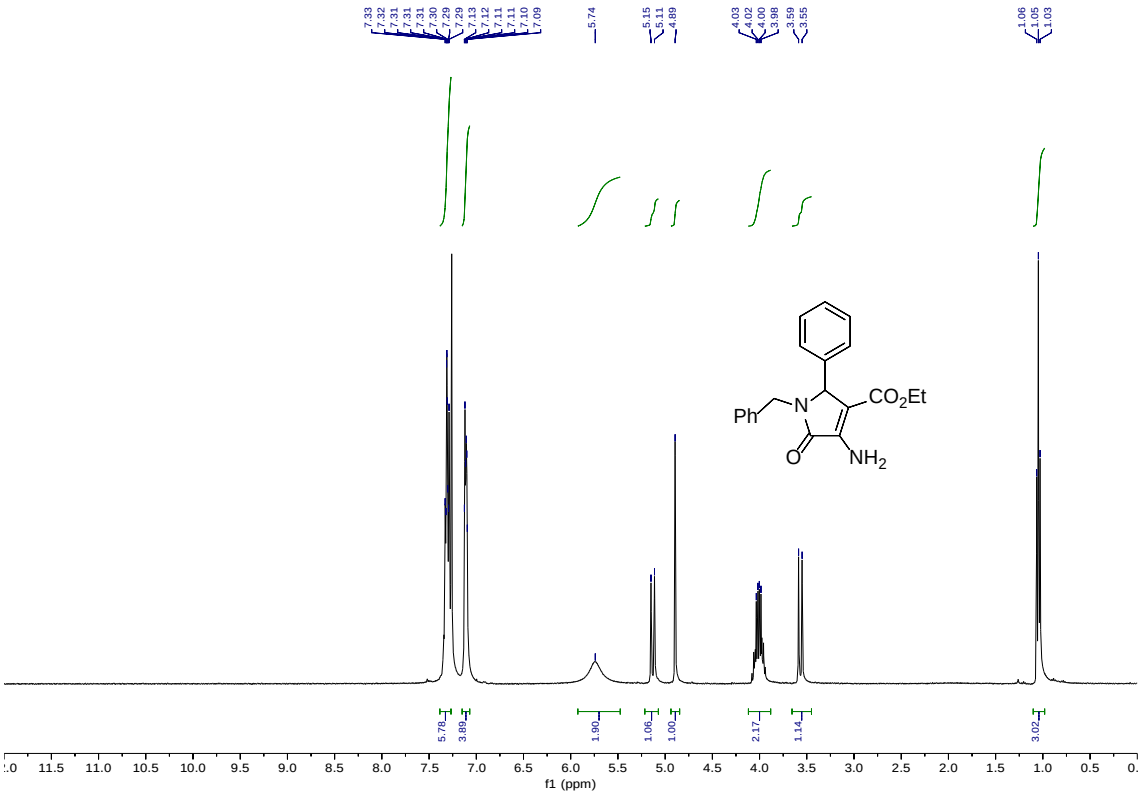



**$^{13}$C NMR (101 MHz, $CDCl_3$)**

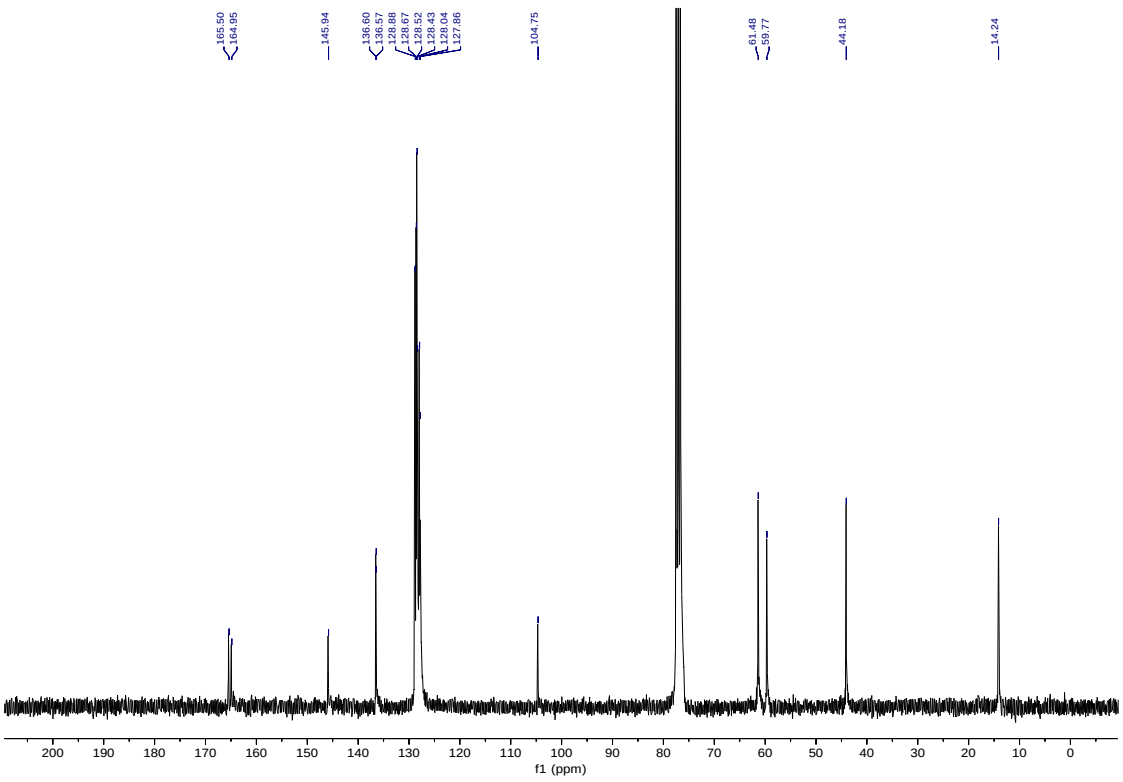


**Ethyl 4-amino-1-benzyl-5-oxo-2-phenyl-2,5-dihydro-1H-pyrrole-3-carboxylate (16).**

**$^{1}$H NMR (400 MHz, $CDCl_3$)**




**$^{13}$C NMR (75 MHz, $CDCl_3$)**



**2. Crystal structure determination for compound 11a.**

**Thermal ellipsoid plot/ORTEP for compound 11a (50% contour probability level).**

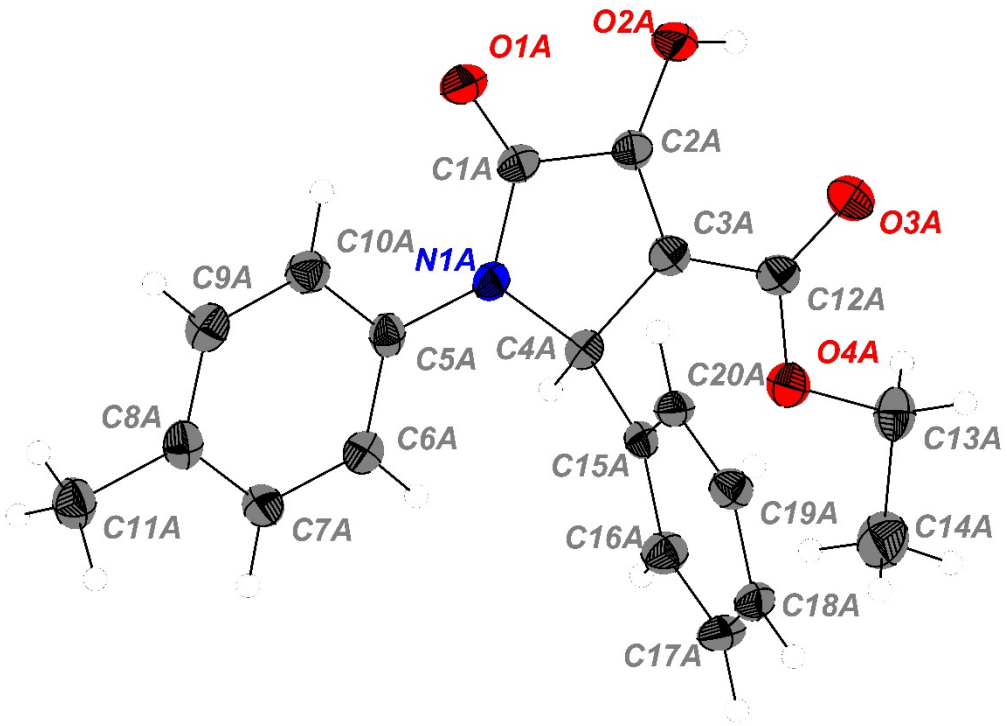



**Table. Crystal data and structure refinement for 11a.**

| | |
|---|---|
| Identification code | a20180048_EM336OH |
| Empirical formula | $C_{20}H_{19}NO_4$ |
| Formula weight | 3376.36 |
| Temperature/K | 149.99(10) |
| Crystal system | triclinic |
| Space group | P1 |
| a/Å | 9.8131(3) |
| b/Å | 16.1669(7) |
| c/Å | 17.7028(7) |
| $\alpha$/° | 114.324(4) |
| $\beta$/° | 90.139(3) |
| $\gamma$/° | 100.214(3) |
| Volume/Å$^3$ | 2509.70(17) |
| Z | 6 |
| $\rho_{calc}$g/cm$^3$ | 1.339 |
| $\mu$/mm$^{-1}$ | 0.765 |
| F(000) | 1068.0 |
| Crystal size/mm$^3$ | 0.257 × 0.12 × 0.052 |
| Radiation | CuK$\alpha$ ($\lambda$ = 1.54184) |
| 2$\Theta$ range for data collection/° | 9.19 to 137.994 |
| Index ranges | -9 ≤ h ≤ 11, -19 ≤ k ≤ 19, -21 ≤ l ≤ 21 |
| Reflections collected | 18227 |

| | |
|---|---|
| Independent reflections | 9284 [$R_{int}$ = 0.0487, $R_{sigma}$ = 0.0647] |
| Data/restraints/parameters | 9284/0/685 |
| Goodness-of-fit on $F^2$ | 1.039 |
| Final R indexes [I>=2$\sigma$ (I)] | $R_1$ = 0.0447, $wR_2$ = 0.1034 |
| Final R indexes [all data] | $R_1$ = 0.0662, $wR_2$ = 0.1148 |
| Largest diff. peak/hole / e $Å^{-3}$ | 0.45/-0.21 |