Electronic Supplementary Information

Metal-free Cascade construction of C-C bond by activation of inert C(sp3)-H bond

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Contents:

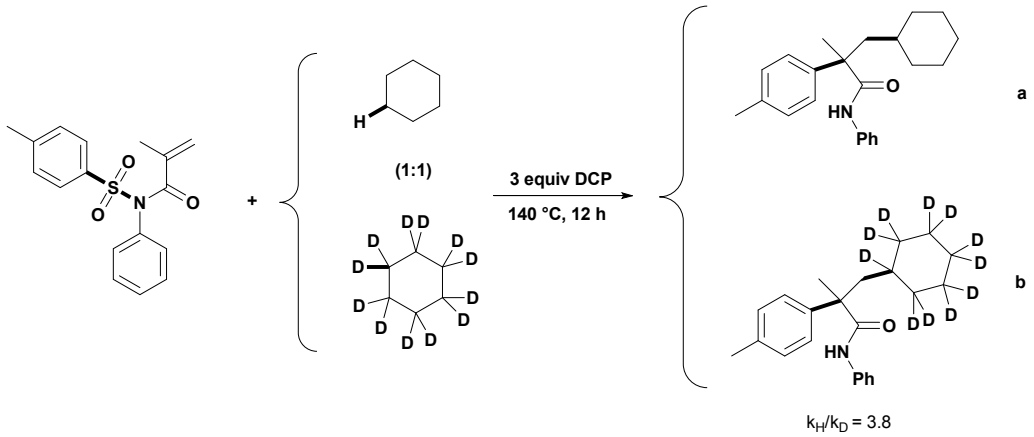
General Information

The regents were used as purchased from chemical suppliers. All reactions were carried out under N_2 atmosphere using Schlenk technology. The initial reactants were prepared according to literature.[S1] Thin Layer Chromatography (TLC) was used to follow the progress of reactions. ^{1}H NMR and ^{13}C NMR spectra were obtained using 400 MHz spectrometer at room temperature, with TMS as internal standard. Chemical shifts (δ) are determined in ppm downfield from tetramethylsilane. Abbreviations for signal couplings are: s, singlet; d, doublet; t, triplet; q, quartet; m, multiplet.

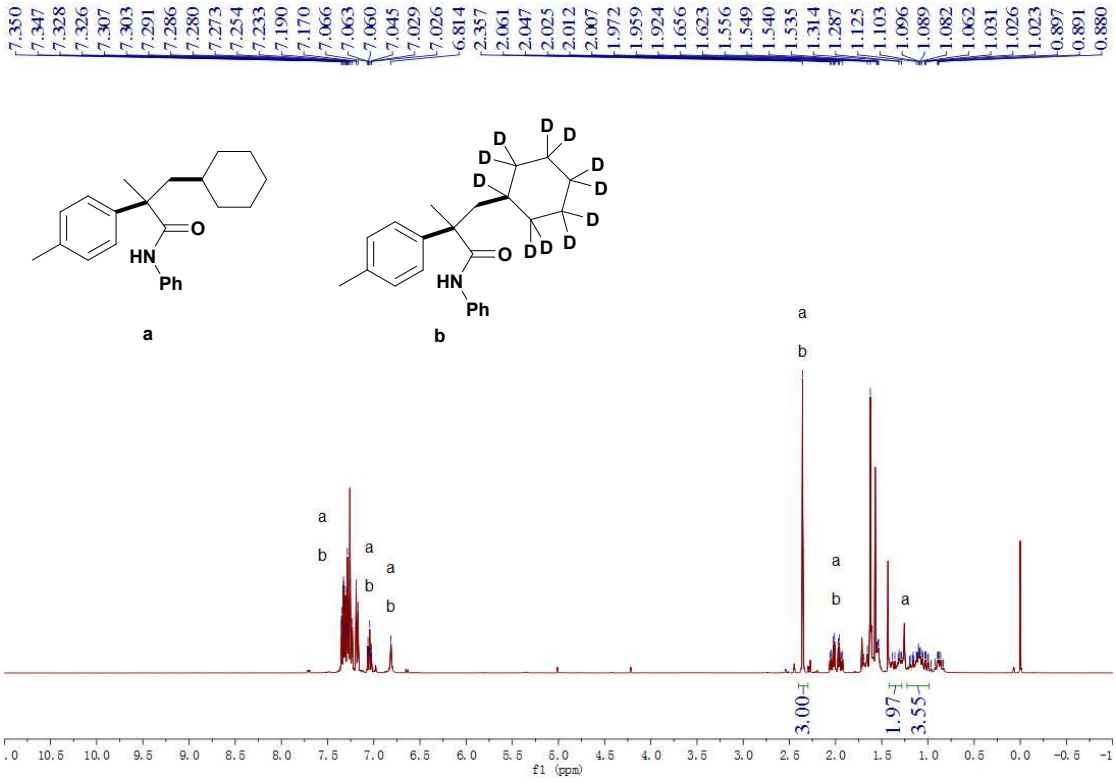
Mechanism studies

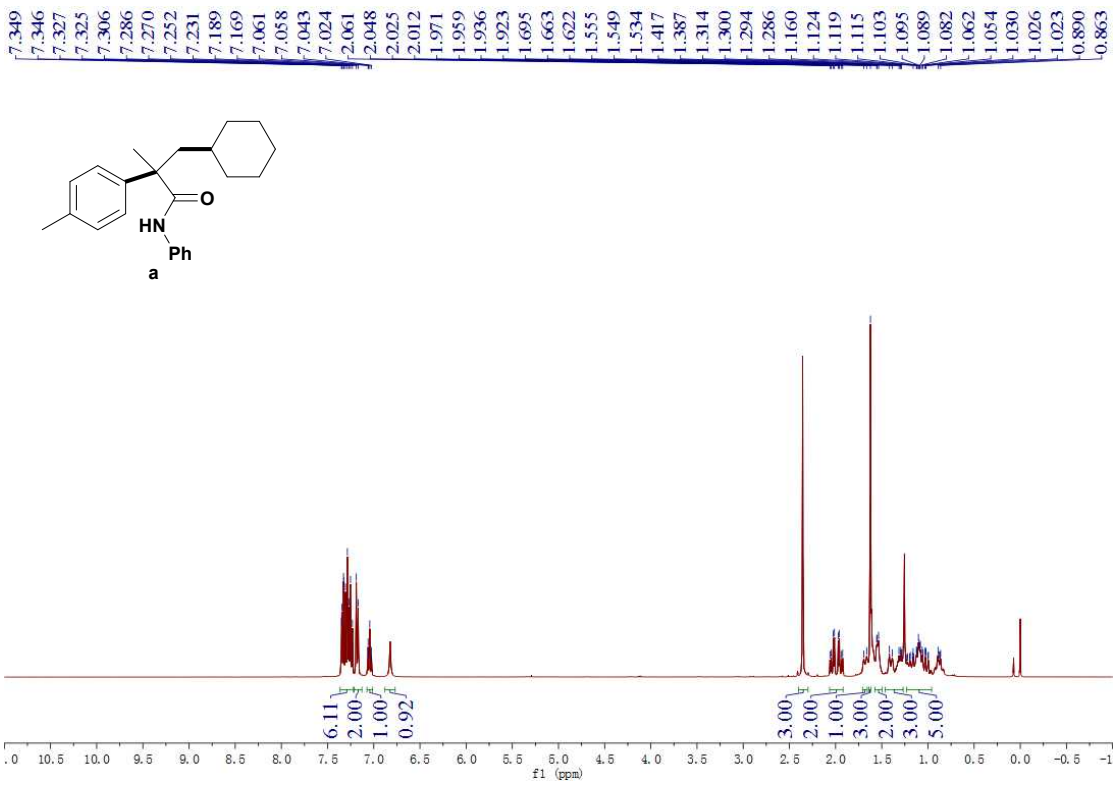
Kinetic Isotope Effect experimental procedure

N-phenyl-*N*-(phenylsulfonyl)methacrylamide (0.2 mmol, 1 equiv), dicumyl peroxide (DCP, 0.6 mmol, 3 equiv), cyclohexane (0.5 mL), cyclohexane-d_{12}(0.5 ml) and a stir bar were added into a sealed tube. The sealed tube was degassed by alternating vacuum evacuation and N_2 backfill three times. Then the sealed tube was heated at 140 ^{o}C for 12 h. And the mixture was concentrated in vacuum and the residue was purified using TLC on silica gel (GF254) to give the corresponding product **2**. The KIE value was calculated according to ^{1}H NMR spectra of the mixture of products **a** and **b.**



Scheme 2. Mechanism studies





General information of activation of inert C(sp^3)-H bond

N-phenyl-N-(phenylsulfonyl)methacrylamide (0.2 mmol, 1 equiv), dicumyl peroxide (DCP, 0.6 mmol, 3 equiv), cycloane (1 mL) and a stir bar were added into a sealed tube. The sealed tube was degassed by alternating vacuum evacuation and N_2 backfill three times. Then the tube was heated at

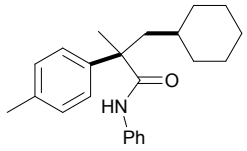
140 °C for 12 h. And the mixture was concentrated in vacuum and the residue was purified using TLC on silica gel to give the corresponding product **2**.

References

(S1) X. Mu, T. Wu, H.Y, Wang,Y. L. Guo and G. S. Liu, *J. Am. Chem. Soc.* 2012, **134**, 878.

Characterization of products 2

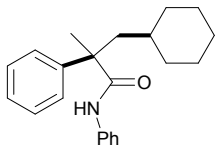
3-cyclohexyl-2-methyl-*N*-phenyl-2-(*p*-tolyl)propanamide (**2a**)



2a

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36-7.22 (m, 6H), 7.18 (d, J = 8.1 Hz, 2H), 7.07-7.01 (m, 1H), 6.82 (s, 1H), 2.36 (s, 3H), 2.07-1.92 (m, 2H), 1.71-1.66 (m, 1H), 1.62 (s, 3H), 1.57-1.50 (m, 2H), 1.46-1.27 (m, 3H), 1.23-0.96 (m, 5H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 175.6, 141.2, 138.0, 136.9, 129.5, 128.9, 126.8, 124.0, 119.7, 51.2, 46.0, 35.3, 35.3, 34.1, 26.5, 26.4, 26.2, 24.4, 21.0. HRMS (ESI) calcd. for$C_{23}H_{30}NO$ ($M+H^+$): 336.2322, found: 336.2322.

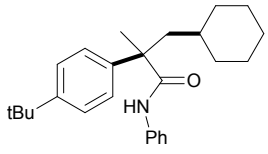
3-cyclohexyl-2-methyl-*N*,2-diphenylpropanamide (**2b**)



2b

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45-7.27 (m, 8H), 7.24 (s, 1H), 7.087-7.02 (m, 1H), 6.79 (s, 1H), 2.08-1.95 (m, 2H), 1.71-1.66 (m, 1H), 1.65 (s, 3H), 1.57-1.50 (m, 2H), 1.42-1.29 (m, 3H), 1.23-1.00 (m, 5H), 0.90-0.85 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.4, 144.3, 138.0, 128.9, 128.8, 127.3, 126.9, 124.1, 119.7, 51.6, 46.0, 35.3, 35.2, 34.1, 26.44, 3.41, 26.2, 24.3. HRMS(ESI) calcd. for $C_{22}H_{28}NO$ ($M+H^+$): 322.2165, found: 322.2168.

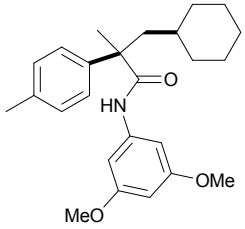
2-(4-(*tert*-butyl)phenyl)-3-cyclohexyl-2-methyl-*N*-phenylpropanamide (**2c**)



2c

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39-7.31 (m, 6H), 7.26 (m, 3H), 7.09-7.00 (m, 1H), 6.86 (s, 1H), 2.06-1.91 (m, 2H), 1.71-1.65 (m, 2H), 1.62 (s, 3H), 1.58-1.51 (m, 2H), 1.49-1.36 (m, 2H), 1.32 (s, 9H), 1.21-0.99 (m, 4H), 0.96-0.87 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 175.5, 150.1, 141.3, 138.0, 128.9, 126.5, 125.7, 124.0, 119.8, 51.2, 46.1, 35.4, 35.2, 34.4, 34.1, 31.3, 26.5, 26.4, 26.2, 24.5. HRMS (ESI) calcd. for $C_{28}H_{40}NO$ ($M+H^+$): 406.3104, found: 406.3104.

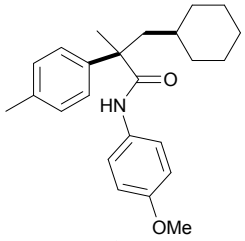
3-cyclohexyl-*N*-(3,5-dimethoxyphenyl)-2-methyl-2-(*p*-tolyl)propanamide (**2d**)



2d

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08 (d, *J* = 3.0 Hz, 1H), 7.69 (s, 1H), 7.35-7.29 (d, *J* = 8.3 Hz, 2H), 7.17 (d, *J* = 8.0 Hz, 2H), 6.68 (d, *J* = 8.9 Hz, 1H), 6.55-6.42 (m, 1H), 3.77 (s, 3H), 3.57 (s, 3H), 2.35 (s, 3H), 2.10-1.94 (m, 2H), 1.72-1.67 (m, 1H), 1.65 (s, 3H), 1.57-1.51 (m, 2H), 1.42 (m, 1H), 1.36-1.28 (m, 1H), 1.23-0.99 (m, 5H), 0.93-0.84 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.6, 154.0, 142.2, 141.2, 136.6, 129.3, 128.8, 126.8, 111.3, 108.6, 105.2, 56.5, 55.8, 51.5, 45.8, 35.3, 35.1, 34.1, 26.4, 26.4, 26.2, 24.0, 21.0. HRMS (ESI) calcd. for $C_{25}H_{34}NO_3$ ($M+H^+$): 396.2533, found: 396.2536.

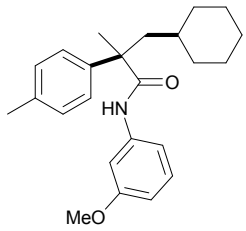
3-cyclohexyl-*N*-(4-methoxyphenyl)-2-methyl-2-(*p*-tolyl)propanamide (**2e**)



2e

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29 (d, *J* = 8.0 Hz, 2H), 7.26-7.21 (m, 2H), 7.17 (d, *J* = 8.0 Hz, 2H), 6.87-6.76 (m, 2H), 6.74 (s, 1H), 3.76 (s, 3H), 2.35 (s, 3H), 2.06-1.91 (m, 2H), 1.72-1.66 (m, 1H), 1.62 (s, 3H), 1.57-1.50 (m, 2H), 1.42-1.28 (m, 2H), 1.24-0.97 (m, 5H), 0.92-0.85 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.5, 156.24, 141.6, 136.8, 131.2, 129.5, 126.9, 121.6, 114.0, 55.5, 51.0, 46.0, 35.3, 35.3, 34.1, 26.5, 26.4, 26.21, 24.5, 21.0. HRMS (ESI) calcd. for $C_{24}H_{32}NO_2$($M+H^+$): 366.2428, found: 366.2425.

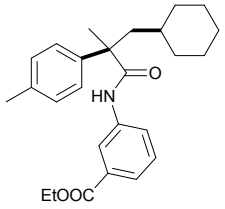
3-cyclohexyl-*N*-(3-methoxyphenyl)-2-methyl-2-(*p*-tolyl)propanamide (**2f**):



2f

yellow-green oil, ^{1}H NMR(400 MHz, $CDCl_3$) δ 7.31-7.26 (m, 2H), 7.22 (t, *J* = 2.2 Hz, 1H), 7.18 (d, *J* = 8.0 Hz, 2H), 7.12 (t, *J* = 8.1 Hz, 1H), 6.82 (s, 1H), 6.76-6.67 (m, 1H), 6.67-6.55 (m, 1H), 3.78 (s, 3H), 2.36 (s, 3H), 2.06-1.92 (m, 2H), 1.71-1.63 (m, 2H), 1.62 (s, 3H), 1.57-1.49 (m, 2H), 1.44-1.27 (m, 3H), 1.20-0.99 (m, 4H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.7, 160.1, 141.0, 139.3, 136.9, 129.6, 129.5, 126.8, 111.6, 110.1, 105.1, 55.3, 51.3, 45.9, 35.3, 35.3, 34.0, 26.4, 26.4, 26.2, 24.4, 21.0. HRMS (ESI) calcd. for $C_{24}H_{32}NO_2$ ($M+H^+$): 366.2428, found: 366.2428.

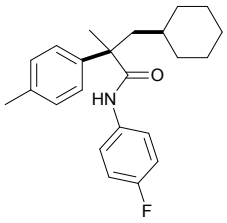
ethyl 3-(3-cyclohexyl-2-methyl-2-(*p*-tolyl)propanamido)benzoate (**2g**)



2g

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.86-7.79 (m, 1H), 7.76-7.69 (m, 2H), 7.35 (t, *J* = 7.9 Hz, 1H), 7.31-7.27 (m, 2H), 7.19 (d, *J* = 8.1 Hz, 2H), 6.92 (s, 1H), 4.35 (q, *J* = 7.1 Hz, 2H), 2.37 (s, 3H), 2.07-1.93 (m, 2H), 1.69-1.65 (m, 1H), 1.63 (s, 3H), 1.61-1.49 (m, 3H), 1.42-1.30 (m, 5H), 1.22-0.99 (m, 4H), 0.92-0.84 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.9, 166.3, 140.8, 138.2, 137.1, 131.1, 129.6, 129.0, 126.8,125.0, 124.1, 120.3, 61.1, 51.3, 45.9, 35.3, 35.2, 34.0, 26.4, 26.2, 24.3, 21.0, 14.3. HRMS (ESI) calcd. For $C_{26}H_{34}NO_3$ ($M+H^+$): 408.2533, found: 408.2533.

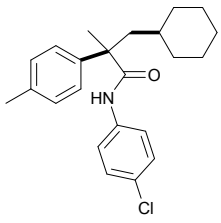
3-cyclohexyl-*N*-(4-fluorophenyl)-2-methyl-2-(*p*-tolyl)propanamide (**2h**)



2h

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39-7.26 (m, 4H), 7.18 (d, *J* = 8.1 Hz, 2H), 6.97-6.92 (m, 2H), 6.79 (s, 1H), 2.36 (s, 3H), 2.05-1.92 (m, 2H), 1.69-1.64 (m, 1H), 1.62 (s, 3H), 1.57-1.52 (m, 2H), 1.42-1.29 (m, 3H), 1.22-0.99 (m, 4H), 0.92-0.85 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.7, 141.1, 137.0, 129.6, 126.8, 121.6, 121.5, 115.6, 1154, 51.1, 45.9, 35.3, 35.2, 34.0, 30.3, 26.4, 26.4, 26.2, 24.4, 21.0. HRMS (ESI) calcd. for $C_{23}H_{299}FNO$ ($M+H^+$): 376.2047, found: 376.2048.

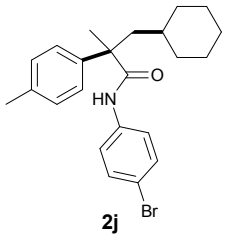
N-(4-chlorophenyl)-3-cyclohexyl-2-methyl-2-(*p*-tolyl)propanamide (**2i**)



2i

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.31-7.26 (m, 4H), 7.24-7.15 (m, 4H), 6.81 (s, 1H), 2.36 (s, 3H), 2.04-1.91 (m, 2H), 1.68-1.63 (m, 1H), 1.61 (s), 1.57-1.49 (m, 2H), 1.42-1.30 (m, 2H), 1.24-0.80 (m, 6H). ^{13}C NMR (100MHz, $CDCl_3$) δ 175.72, 140.9, 137.0, 136.6, 129.6, 129.0, 128.9, 126.8, 120.9, 51.3, 45.9, 35.3, 35.2, 34.0, 26.4, 26.2, 24.4, 21.0. HRMS (ESI) calcd. for $C_{23}H_{29}ClNO$ ($M+H^+$): 370.1932, found: 370.1933.

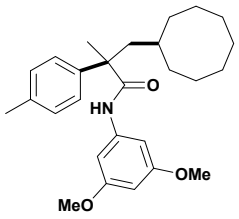
N-(4-bromophenyl)-3-cyclohexyl-2-methyl-2-(*p*-tolyl)propanamide (**2j**)



2j

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38-7.33 (m, 2H), 7.30-7.26 (m, 2H), 7.26-7.21 (m, 2H), 7.18 (d, *J* = 8.0 Hz, 2H), 6.81 (s, 1H), 2.36 (s, 3H), 2.05-1.91 (m, 2H), 1.68-1.63 (m, 1H), 1.61 (s, 3H), 1.57-1.50 (m, 2H), 1.41-1.29 (m, 2H), 1.24-0.82 (m, 6H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.7, 140.9, 137.1, 137.1, 131.8, 129.6, 126.8, 121.2, 116.5, 51.3, 45.9, 35.3, 35.2, 34.0, 26.4, 26.4, 26.2, 24.4, 21.0. HRMS (ESI) calcd. for $C_{23}H_{29}BrNO$ ($M+H^+$): 414.1427, found: 414.1425.

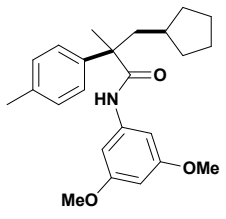
3-cyclooctyl-*N*-(3,5-dimethoxyphenyl)-2-methyl-2-(*p*-tolyl)propanamide (**2o**)



2o

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.08 (d, *J* = 3.0 Hz, 1H), 7.67 (s, 1H), 7.33-7.28 (m, 2H), 7.18 (d, *J* = 8.3 Hz, 2H), 6.68 (d, *J* = 8.9 Hz, 1H), 6.53-6.46 (m, 1H), 3.77 (s, 3H), 3.56 (s, 3H), 2.35 (s, 3H), 2.15-1.98 (m, 2H), 1.64 (s, 3H), 1.64-1.62 (m, 1H), 1.59-1.34 (m, 13H), 1.24-1.19 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.6, 154.0, 142.2, 141.1, 136.6, 129.3, 128.8, 126.9, 111.4, 108.6, 105.2, 56.5, 55.8, 51.9, 46.3, 34.1, 33.9, 33.4, 27.3, 26.3, 25.2, 25.0, 23.9, 21.0. HRMS (ESI) calcd. for $C_{27}H_{38}NO_3$ ($M+H^+$): 424.2846, found: 424.2843.

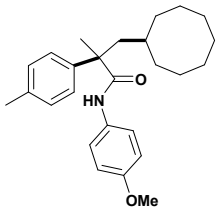
3-cyclopentyl-*N*-(3,5-dimethoxyphenyl)-2-methyl-2-(*p*-tolyl)propanamide (**2p**)



2p

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 8.09 (d, *J* = 3.0 Hz, 1H), 7.69 (s, 1H), 7.34-7.29 (m, 2H), 7.18 (d, *J* = 8.0 Hz, 2H), 6.71-6.65 (d, *J* = 9.0 Hz 1H), 6.53-6.47 (m, 1H), 3.77 (s, 3H), 3.57 (s, 3H), 2.35 (s, 3H), 2.27-2.16 (m, 2H), 1.81-1.69 (m, 2H), 1.66 (s, 3H), 1.59-1.50 (m, 3H), 1.43-1.33 (m, 2H), 1.19-1.10 (m, 1H), 1.04-0.96 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.7, 154.0, 142.2, 141.1, 136.6, 129.3, 128.8, 126.9, 111.4, 108.6, 105.15, 56.6, 55.8, 51.8, 44.8, 36.7, 34.7, 34.5, 25.0, 24.9, 24.2, 21.0. HRMS (ESI) calcd. for $C_{24}H_{32}NO_3$ ($M+H^+$):382.2377, found: 382.3376.

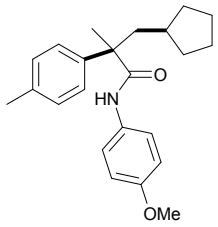
3-cyclooctyl-*N*-(4-methoxyphenyl)-2-methyl-2-(*p*-tolyl)propanamide (**2q**)



2q

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.31-7.27 (m, 2H), 7.26-7.21 (m, 2H), 7.18 (d, *J* = 8.0 Hz, 2H), 6.83-6.76 (m, 2H), 6.73 (s, 1H), 3.76 (s, 3H), 2.35 (s, 3H), 2.10-1.95 (m, 2H), 1.62 (s, 3H), 1.59-1.28 (m, 14H), 1.23 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.6, 156.2, 141.2, 136.8, 131.2, 129.5, 127.0, 121.6, 114.0, 55.5, 51.4, 46.5, 34.1, 34.1, 33.3, 27.3, 27.3, 26.3, 25.2, 25.0, 24.4, 21.0. HRMS (ESI) calcd. for $C_{26}H_{36}NO_2$ ($M+H^+$): 394.2741, found: 394.2743.

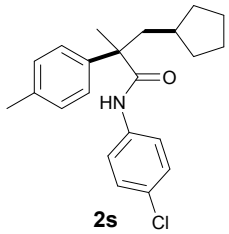
3-cyclopentyl-*N*-(4-methoxyphenyl)-2-methyl-2-(*p*-tolyl)propanamide (**2r**)



2r

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.32-7.26 (m, 3H), 7.25-7.23 (m, 1H), 7.18 (d, *J* = 8.0 Hz, 2H), 6.83-6.76 (m, 2H), 6.73 (s, 1H), 3.76 (s, 3H), 2.36 (s, 3H), 2.25-2.13 (m, 2H), 1.82-1.68 (m, 2H), 1.63 (s, 3H), 1.58-1.47 (m, 3H), 1.42-1.32 (m, 2H), 1.17-1.09 (m, 1H), 1.02-0.93 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.6, 156.2, 141.3, 136.8, 131.2, 129.5, 127.0, 121.5, 114.0, 55.5, 51.3, 45.0, 36.7, 34.6, 25.0, 24.9, 24.6, 21.0. HRMS (ESI) calcd. for $C_{23}H_{30}NO_2$ ($M+H^+$): 352.2271, found: 352.2269.

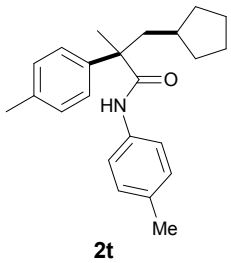
N-(4-chlorophenyl)-3-cyclopentyl-2-methyl-2-(*p*-tolyl)propanamide (**2s**)



2s

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.31 (t, *J* = 2.0 Hz, 1H), 7.29 (s, 2H), 7.27 (t, *J* = 1.6 Hz, 1H), 7.23-7.16 (m, 4H), 6.81 (s, 1H), 2.36 (s, 3H), 2.18 (m, 2H), 1.79-1.66 (m, 3H), 1.62 (s, 3H), 1.55-1.49 (m, 2H), 1.43-1.30 (m, 2H), 1.16-1.07 (m, 1H), 1.02-0.91 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.8, 140.8, 137.1, 136.6, 129.6, 128.9, 128.9, 126.9, 120.9, 51.5, 44.9, 36.6, 34.6, 34.5, 25.0, 24.9, 24.5, 21.0. HRMS (ESI) calcd. for $C_{22}H_{26}ClNNaO$ ($M+Na^+$): 378.1595, found: 378.1598.

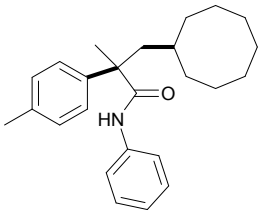
3-cyclopentyl-2-methyl-*N*,2-di-*p*-tolylpropanamide (**2t**):



2t

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.33-7.26 (m, 2H), 7.25-7.20 (m, 2H), 7.18 (d, *J* = 8.0 Hz, 2H), 7.06 (d, *J* = 8.3 Hz, 2H), 6.76 (s, 1H), 2.36 (s, 3H), 2.27 (s, 3H), 2.25-2.12 (m, 2H), 1.80-1.68 (m, 2H), 1.62 (s, 3H), 1.58-1.46(m, 3H), 1.42-1.32 (m, 2H), 1.18-1.10 (m, 1H), 1.03-0.92 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.6, 141.2, 136.9, 135.5, 133.6, 129.5, 129.3, 127.0, 119.7, 51.4, 45.0, 36.7, 34.6, 34.5, 25.0, 24.9, 24.6, 21.0, 20.8. HRMS (ESI) calcd. for $C_{23}H_{30}NO$ ($M+H^+$):336.2322, found: 336.2321.

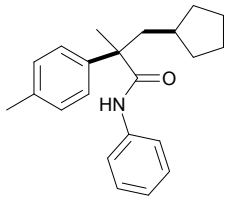
3-cyclooctyl-2-methyl-*N*-phenyl-2-(*p*-tolyl)propanamide (**2u**)



2u

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36-7.32 (m, 2H), 7.32-7.26 (m, 3H), 7.25-7.22 (m, 1H), 7.18 (d, *J* = 8.0 Hz, 2H), 7.07-7.02 (m, 1H), 6.82 (s, 1H), 2.36 (s, 3H), 2.11-1.95 (m, 2H), 1.64 (s, 1H), 1.62 (s, 3H), 1.60-1.34 (m, 12H), 1.29-1.27 (m, 1H), 1.24-1.13 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.7, 141.1, 138.0, 136.9, 129.5, 128.9, 127.0, 124.0, 119.7, 51.6, 46.5, 34.1, 33.3, 27.3, 27.3, 26.23, 25.2, 25.0, 24.3, 21.0. HRMS (ESI) calcd for $C_{25}H_{34}NO$ ($M+H^+$): 364.2635, found: 364.2636.

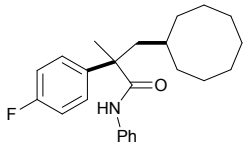
3-cyclopentyl-2-methyl-*N*-phenyl-2-(*p*-tolyl)propanamide (**2v**)



2v

yellow-green oil, ^{1}H NMR (400 MHz, $CDCl_3$) δ 7.36-7.33 (m, 2H), 7.31-7.27 (m, 2H), 7.25-7.23 (m, 1H), 7.19 (d, *J* = 8.1 Hz, 2H), 7.06-7.02 (m, 1H), 6.82 (s, 1H), 2.36 (s, 3H), 2.26-2.13 (m, 2H), 1.81-1.71 (m, 2H), 1.64 (s, 3H), 1.57-1.47 (m, 3H), 1.45-1.35 (m, 2H), 1.17-1.09 (m, 1H), 1.02-0.93 (m, 1H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 175.8, 141.1, 138.1, 136.9, 129.6, 128.9, 127.0, 124.0, 119.6, 51.5, 44.9, 36.7, 34.6, 34.6, 25.0, 24.9, 24.6, 21.0. HRMS (ESI) calcd for $C_{22}H_{28}NO$ ($M+H^+$):322.2165, found: 322.2163.

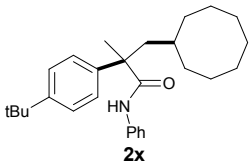
3-cyclooctyl-2-(4-fluorophenyl)-2-methyl-*N*-phenylpropanamide (**2w**)



2w

yellow-green oil,^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42-7.31 (m, 4H), 7.30-7.23 (m, 2H), 7.12-7.02 (m, 2H), 6.77 (s, 1H), 2.11-1.94 (m, 2H), 1.64 (s, 3H), 1.59-1.31 (m, 12H), 1.24-1.13 (m, 2H), 1.04-0.80 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.1, 128.9, 128.7, 128.7, 124.2, 119.7, 115.8, 115.5, 51.5, 46.8, 34.2, 34.1, 33.3, 27.2, 27.2, 26.3, 25.2, 25.1, 24.3. HRMS (ESI) calcd for $C_{24}H_{30}FNNaO$ ($M+Na^+$): 390.2204, found: 390.2206.

2-(4-(*tert*-butyl)phenyl)-3-cyclooctyl-2-methyl-*N*-phenylpropanamide (**2x**)

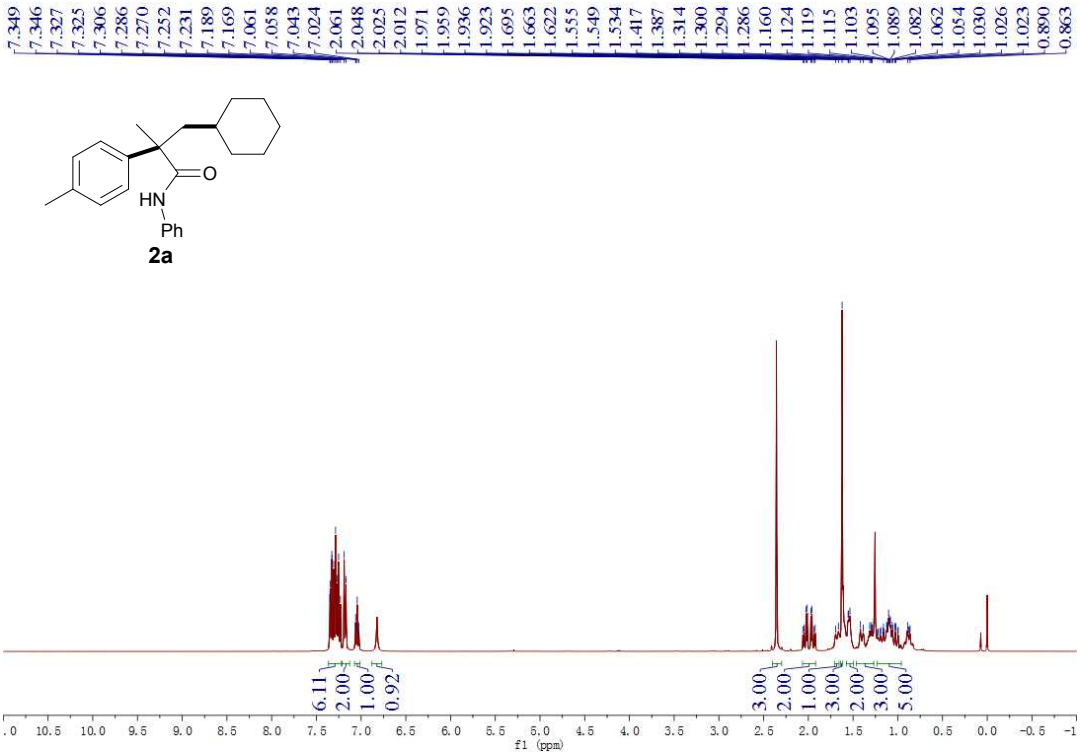


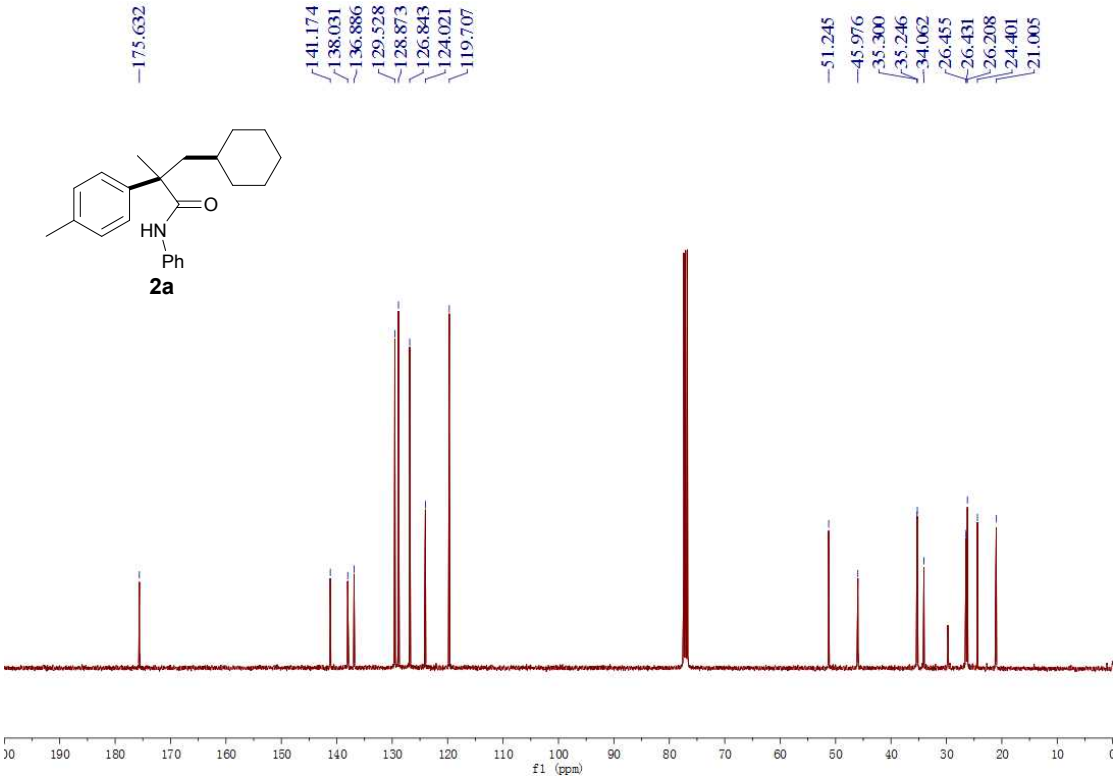
2x

yellow-green oil,^{1}H NMR (400 MHz, $CDCl_3$) δ 7.41-7.30 (m, 6H), 7.29-7.24 (m, 2H), 7.08-7.03 (m, 1H), 6.85 (s, 1H), 2.09-1.95 (m, 2H), 1.63 (s, 3H), 1.60 (s, 1H), 1.56-1.34 (m, 11H), 1.33 (s, 9H), 1.30 - 1.27 (m, 1H), 1.25-1.16 (m, 2H). ^{13}C NMR (100 MHz, $CDCl_3$) δ 175.6, 150.1, 141.0, 138.1, 128.9, 126.7, 125.6, 124.0, 119.8, 51.6, 46.8, 34.5, 34.3, 34.2, 33.3, 31.3, 27.3, 27.2, 26.3, 25.2, 25.1, 24.4. HRMS (ESI) calcd for $C_{28}H_{40}NO$ ($M+H^+$): 406.3104, found: 406.3104.

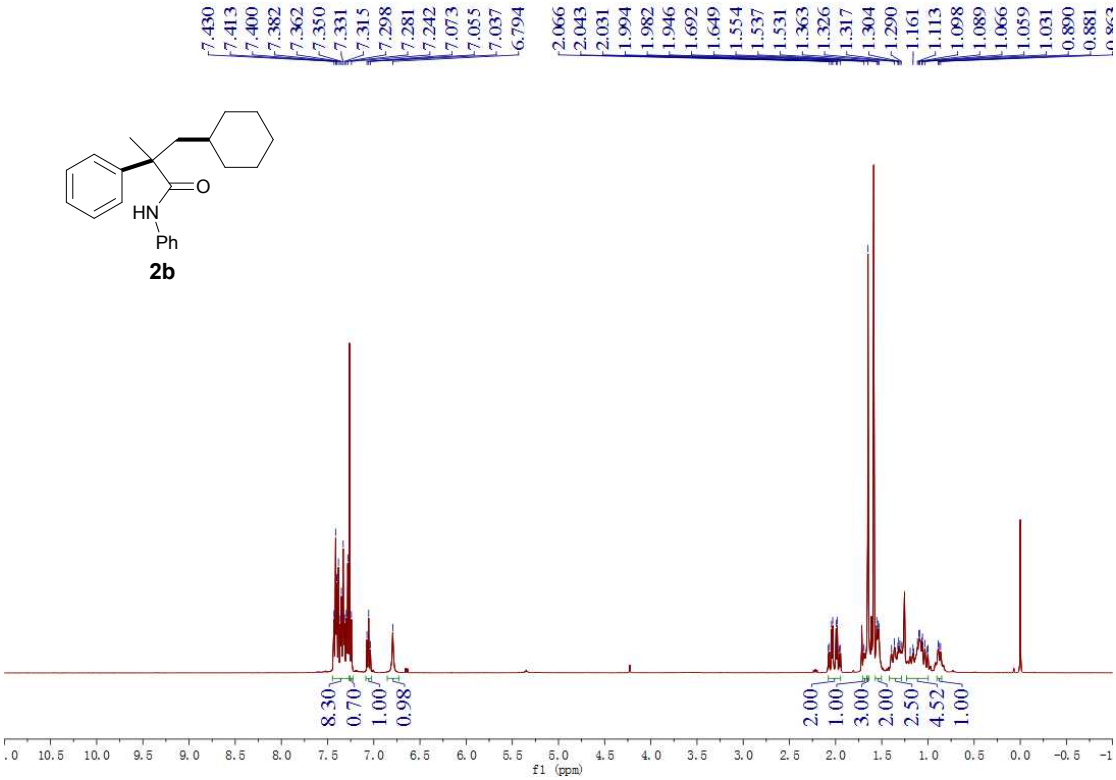
Copies of ^{1}H NMR, ^{13}C NMR

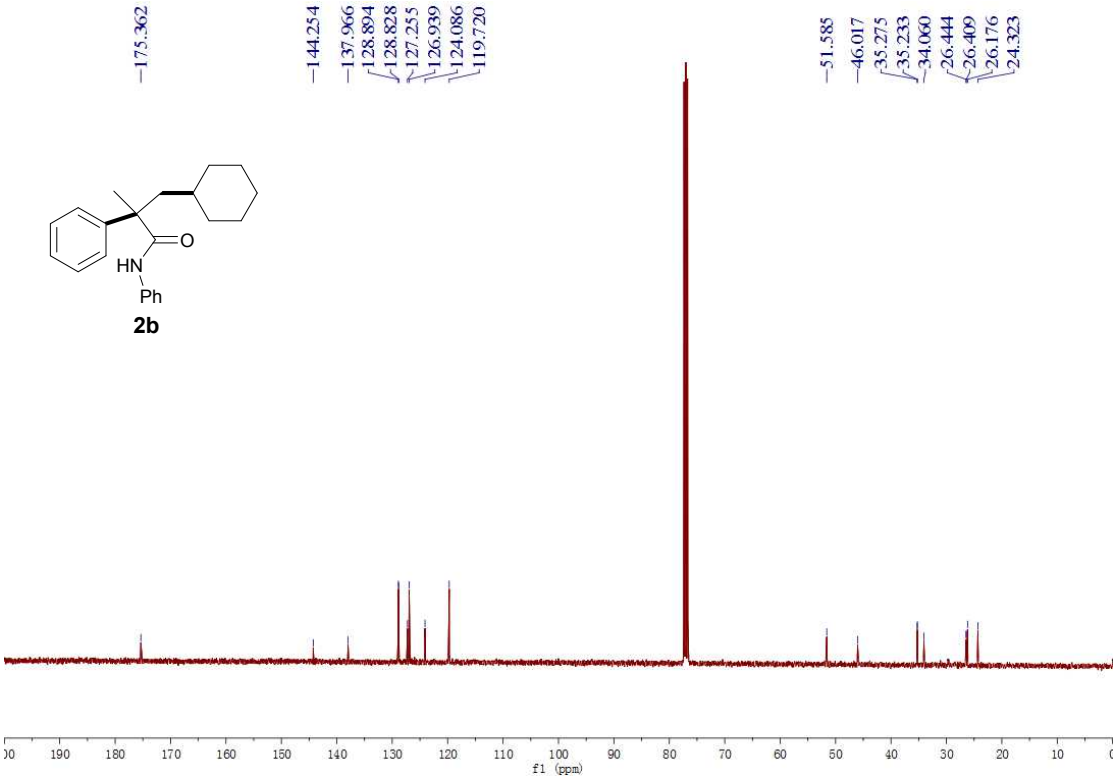
3-cyclohexyl-2-methyl-*N*-phenyl-2-(*p*-tolyl)propanamide (**2a)**





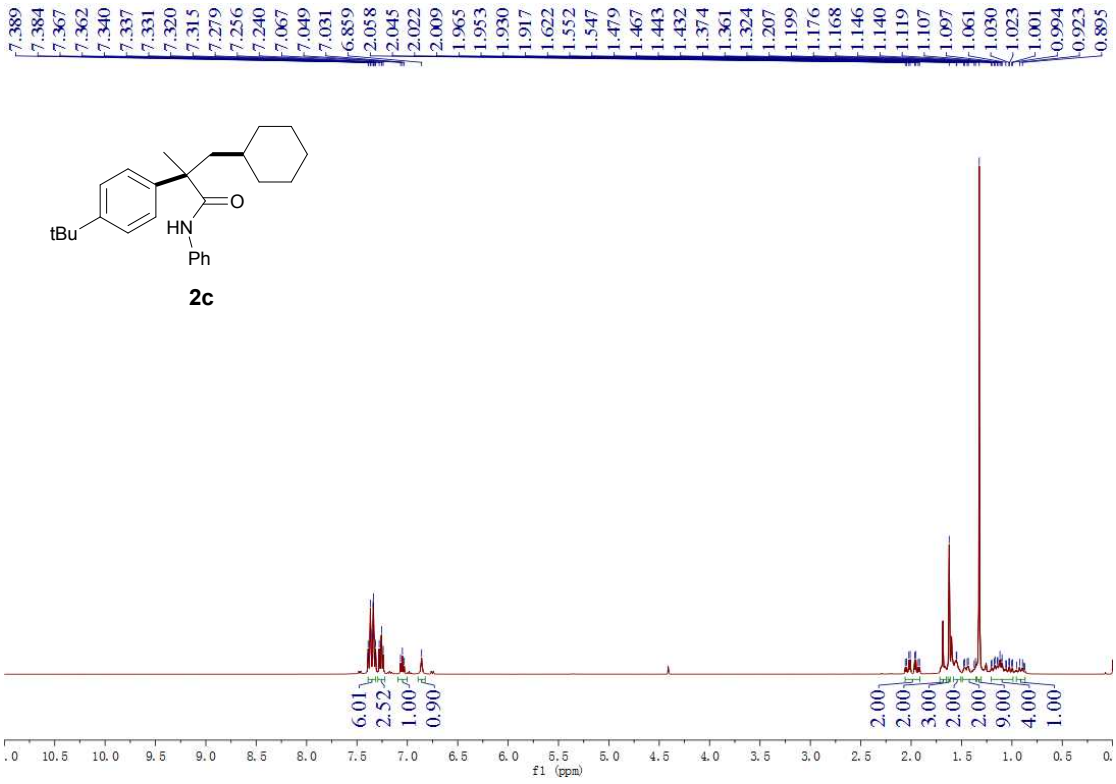
3-cyclohexyl-2-methyl-*N*,2-diphenylpropanamide (**2b)**



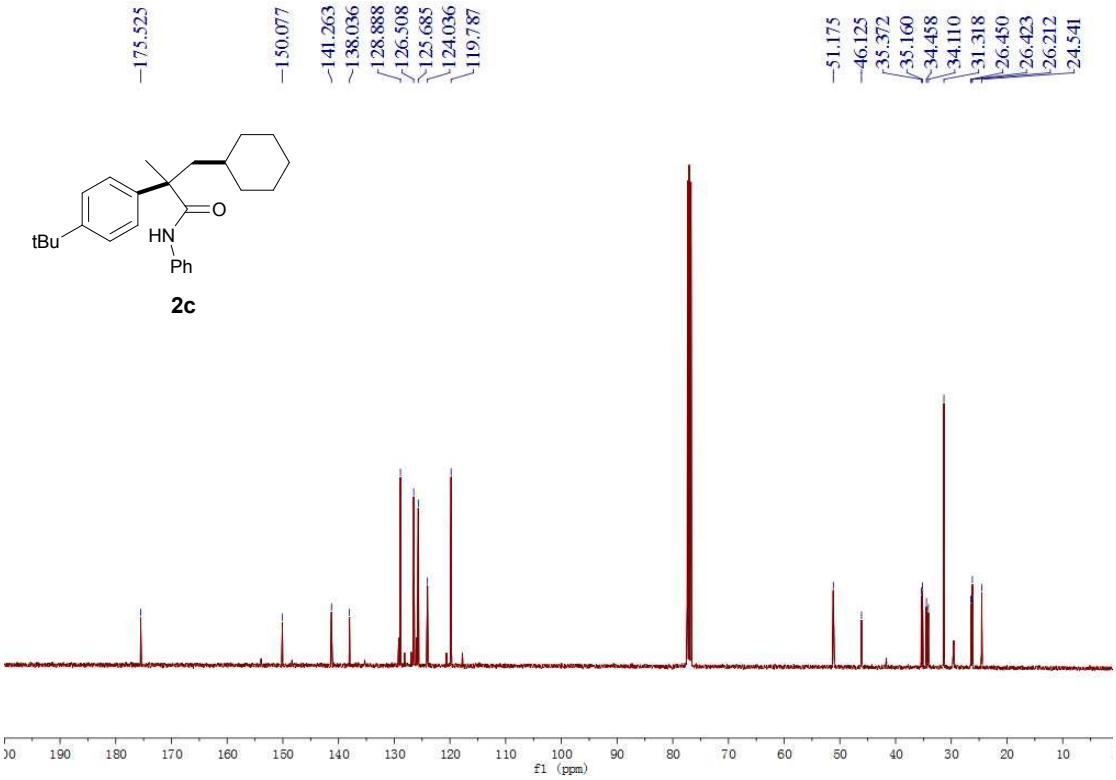


2b

2-(4-(*tert*-butyl)phenyl)-3-cyclohexyl-2-methyl-*N*-phenylpropanamide (**2c)**

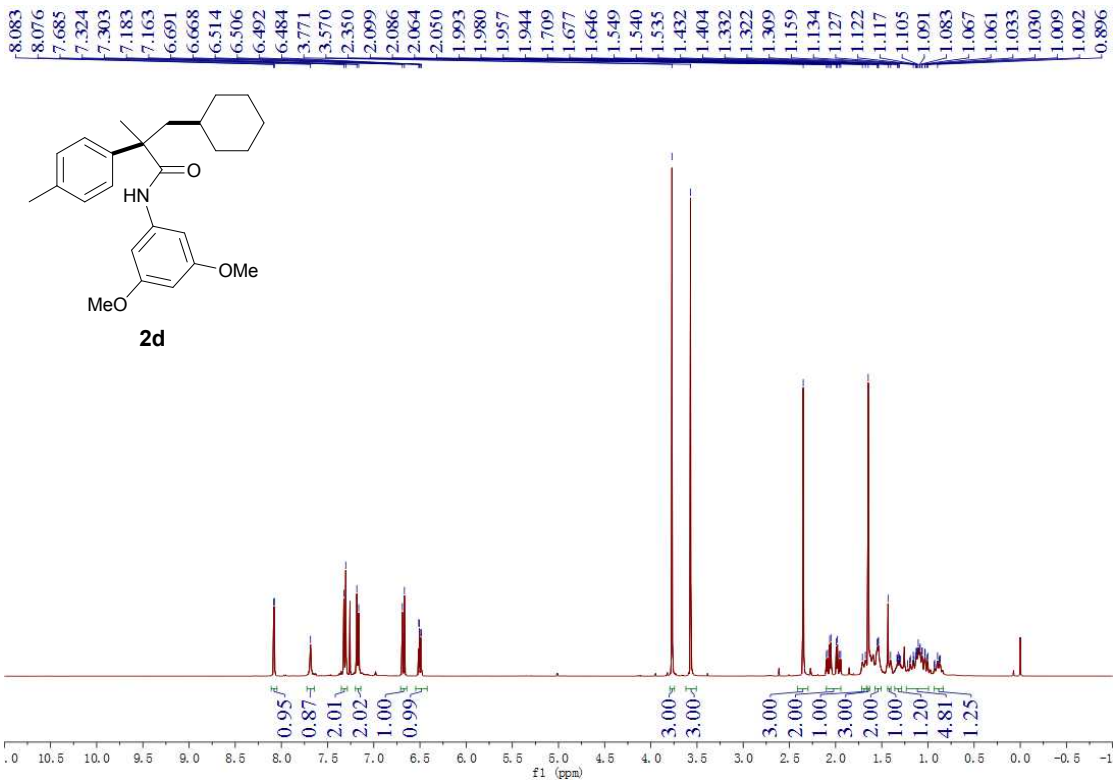


2c

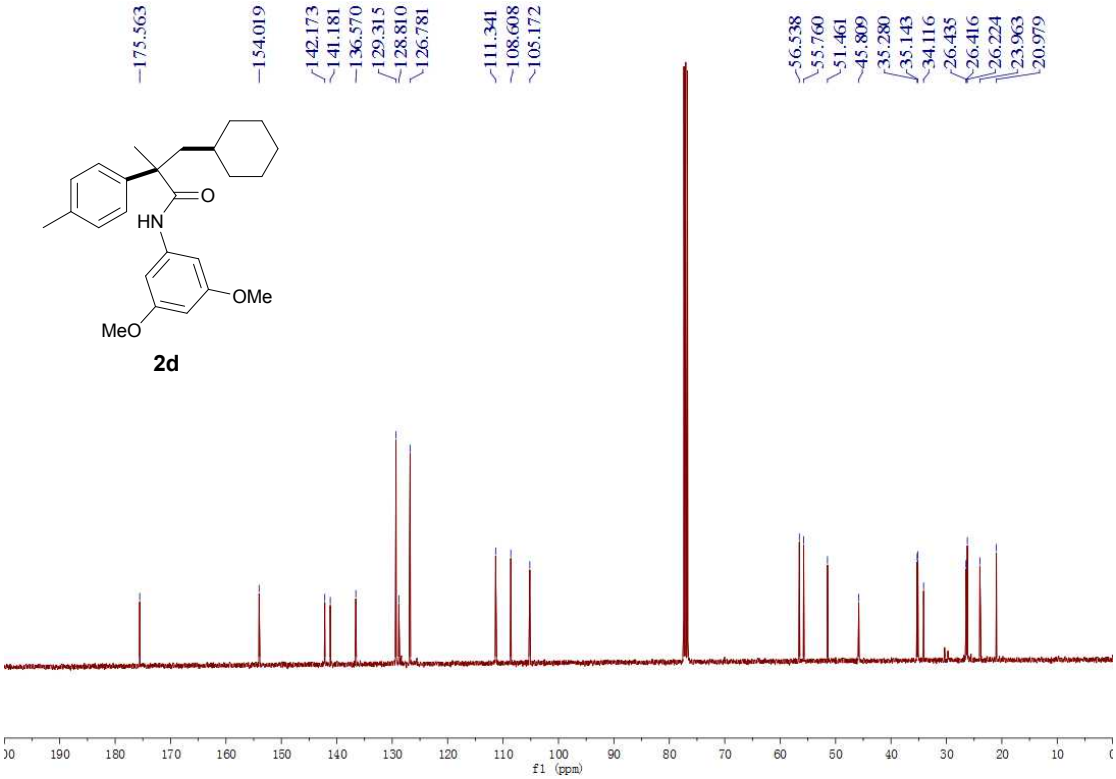


2c

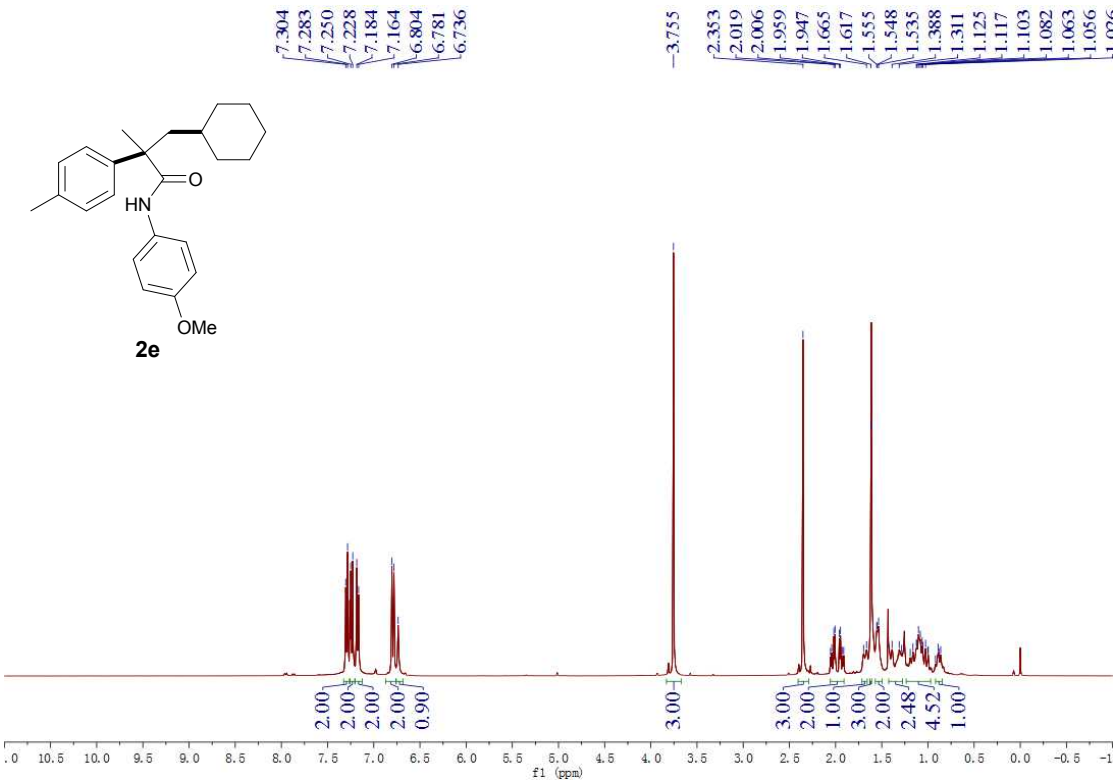
3-cyclohexyl-*N*-(3,5-dimethoxyphenyl)-2-methyl-2-(*p*-tolyl)propanamide **(2d)**

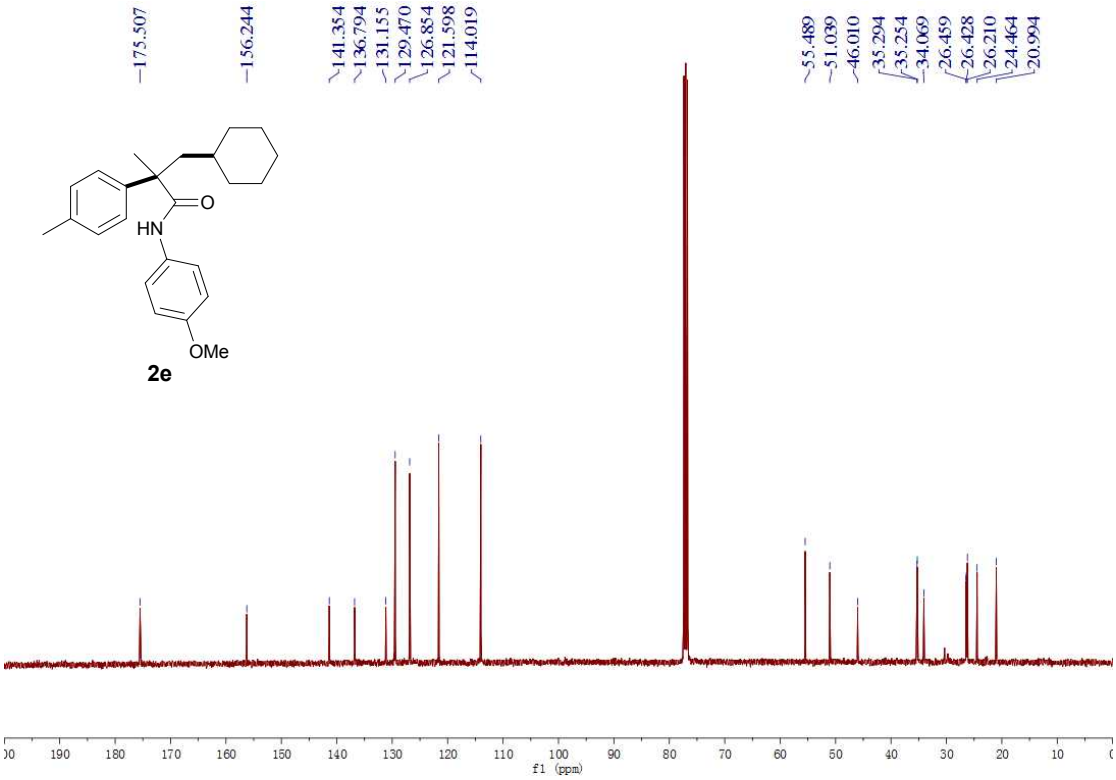


2d



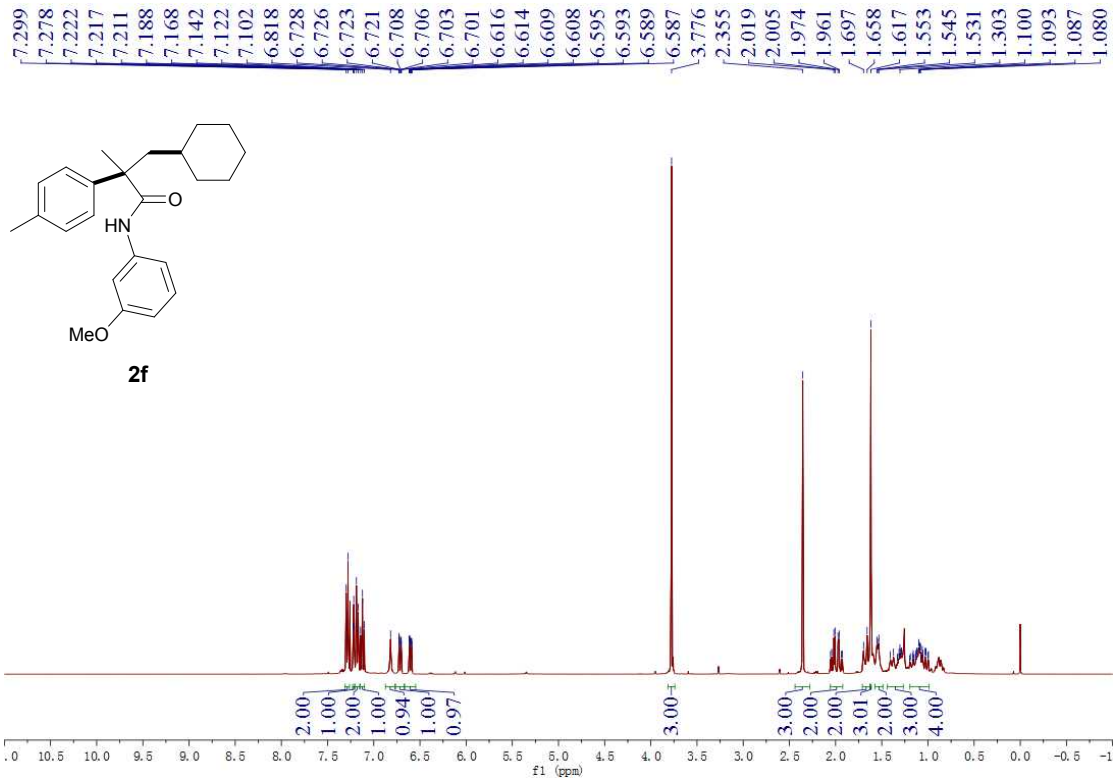
3-cyclohexyl-*N*-(4-methoxyphenyl)-2-methyl-2-(*p*-tolyl)propanamide (**2e)**



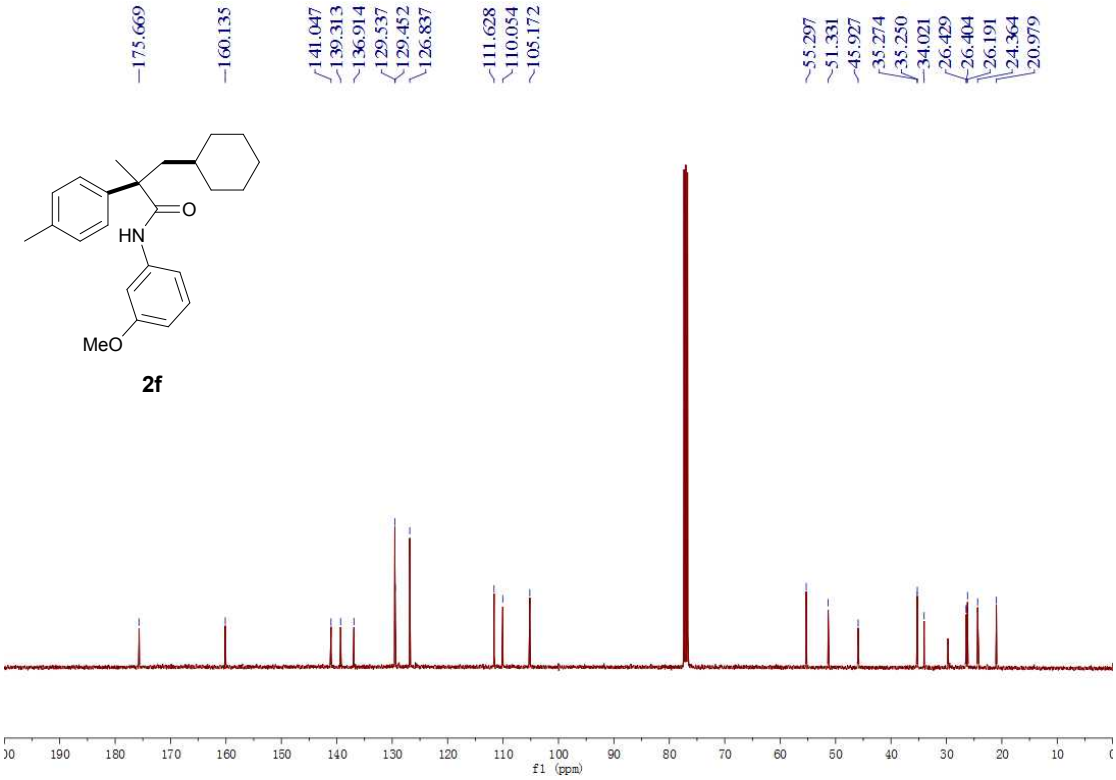


2e

3-cyclohexyl-*N*-(3-methoxyphenyl)-2-methyl-2-(*p*-tolyl)propanamide (**2f)**

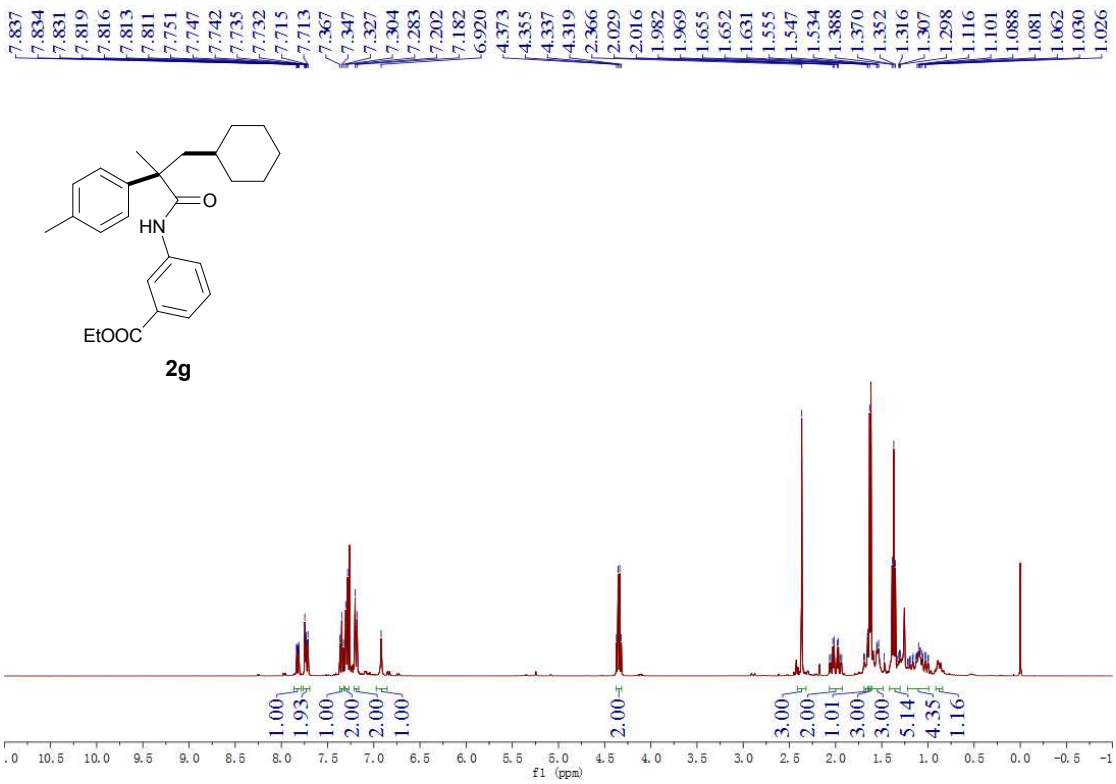


2f

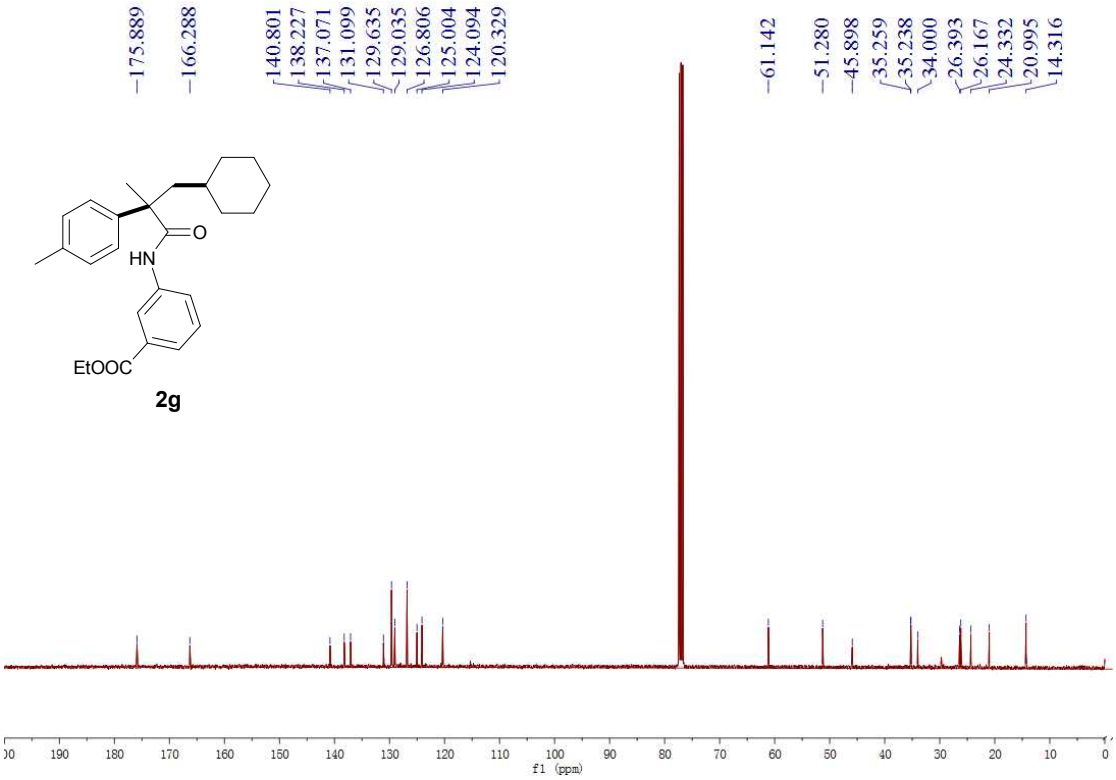


2f

ethyl 3-(3-cyclohexyl-2-methyl-2-(*p*-tolyl)propanamido)benzoate (**2g)**

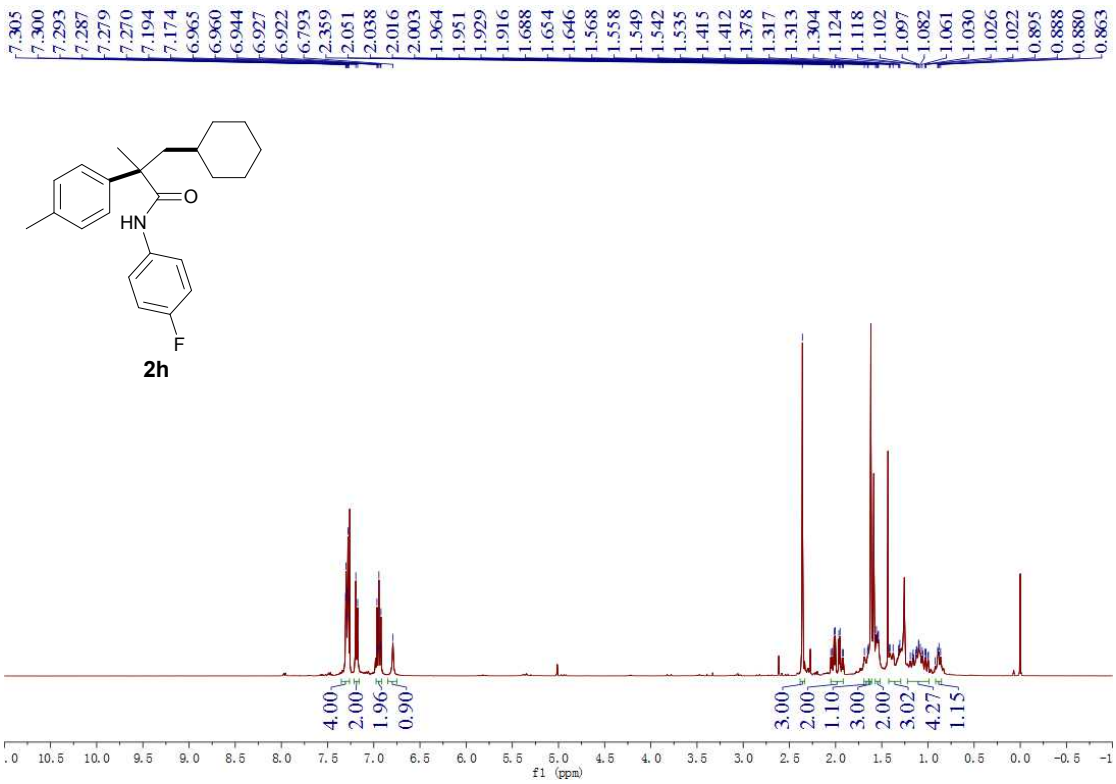


2g

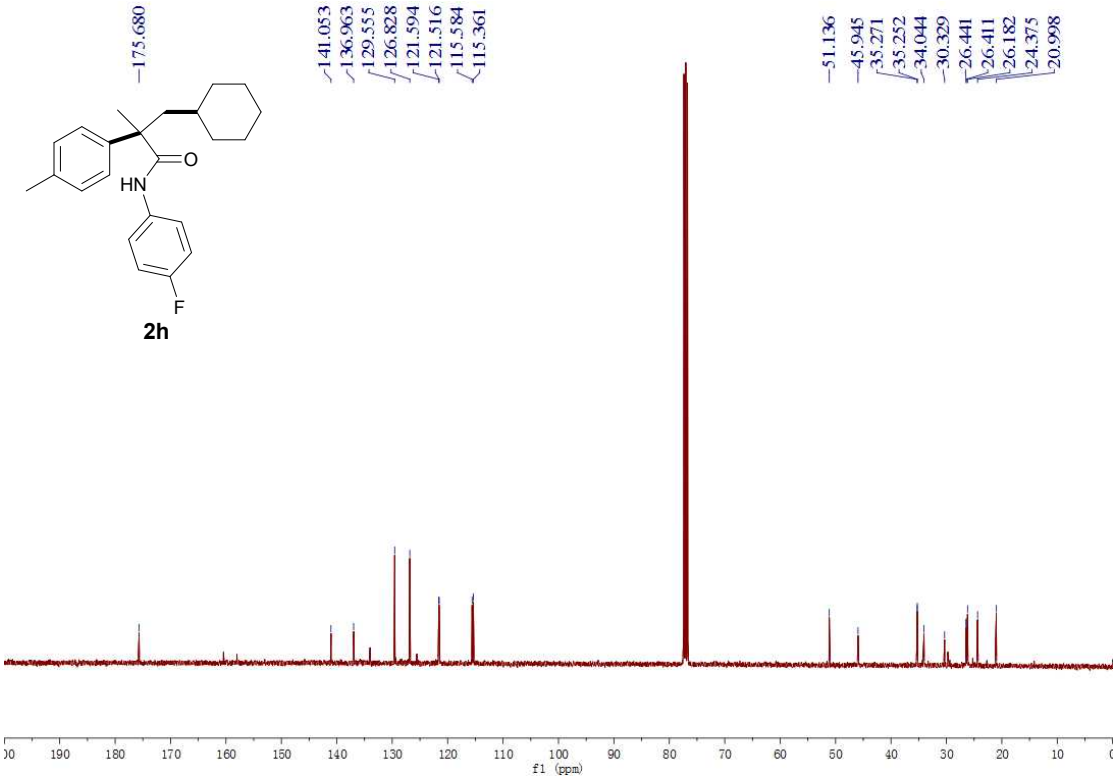


2g

3-cyclohexyl-*N*-(4-fluorophenyl)-2-methyl-2-(*p*-tolyl)propanamide (**2h)**

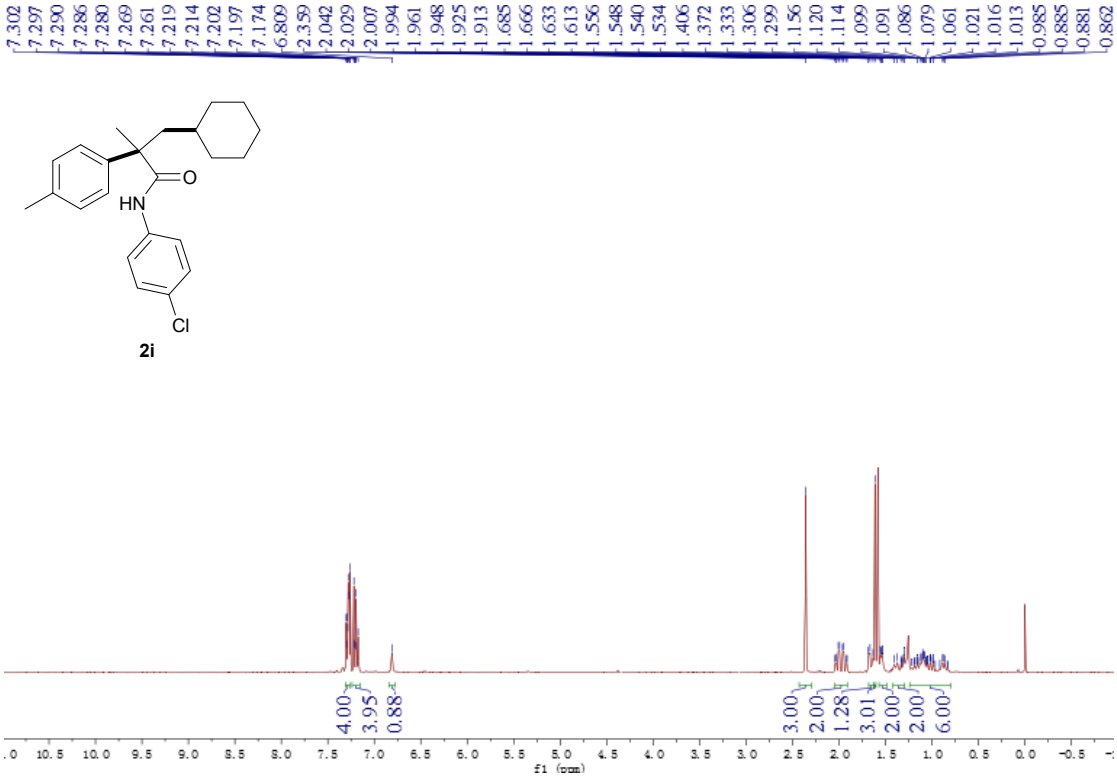


2h

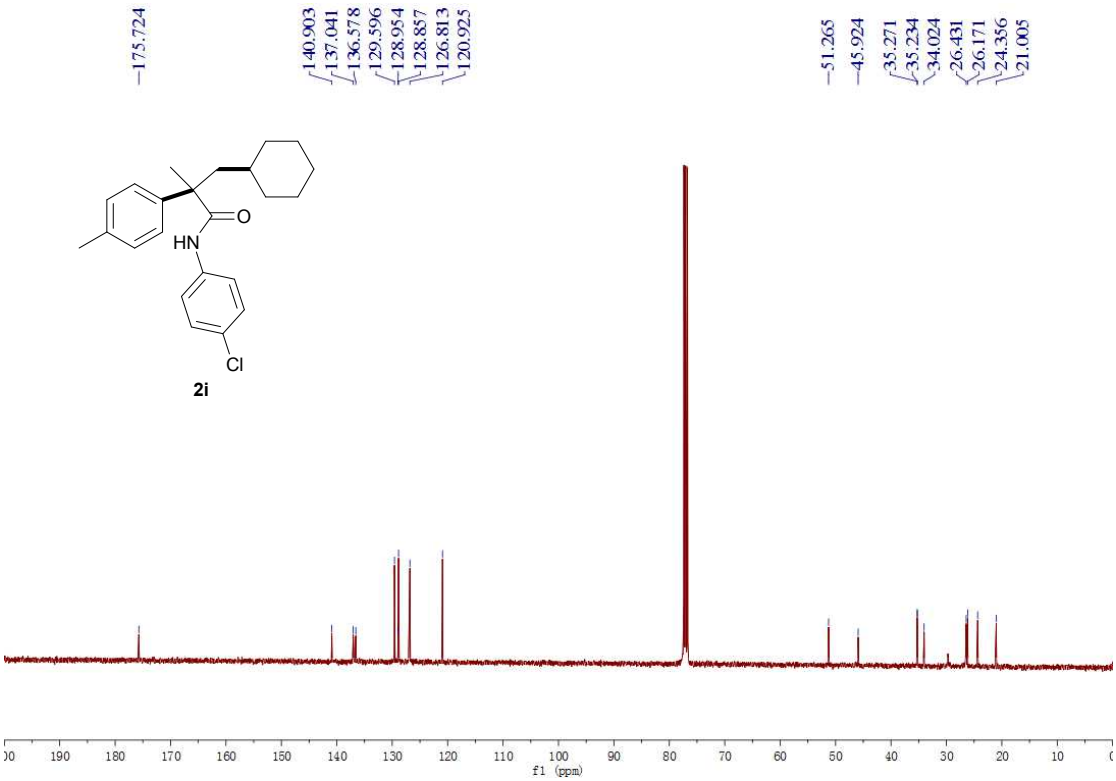


2h

N-(4-chlorophenyl)-3-cyclohexyl-2-methyl-2-(*p*-tolyl)propanamide (**2i)**

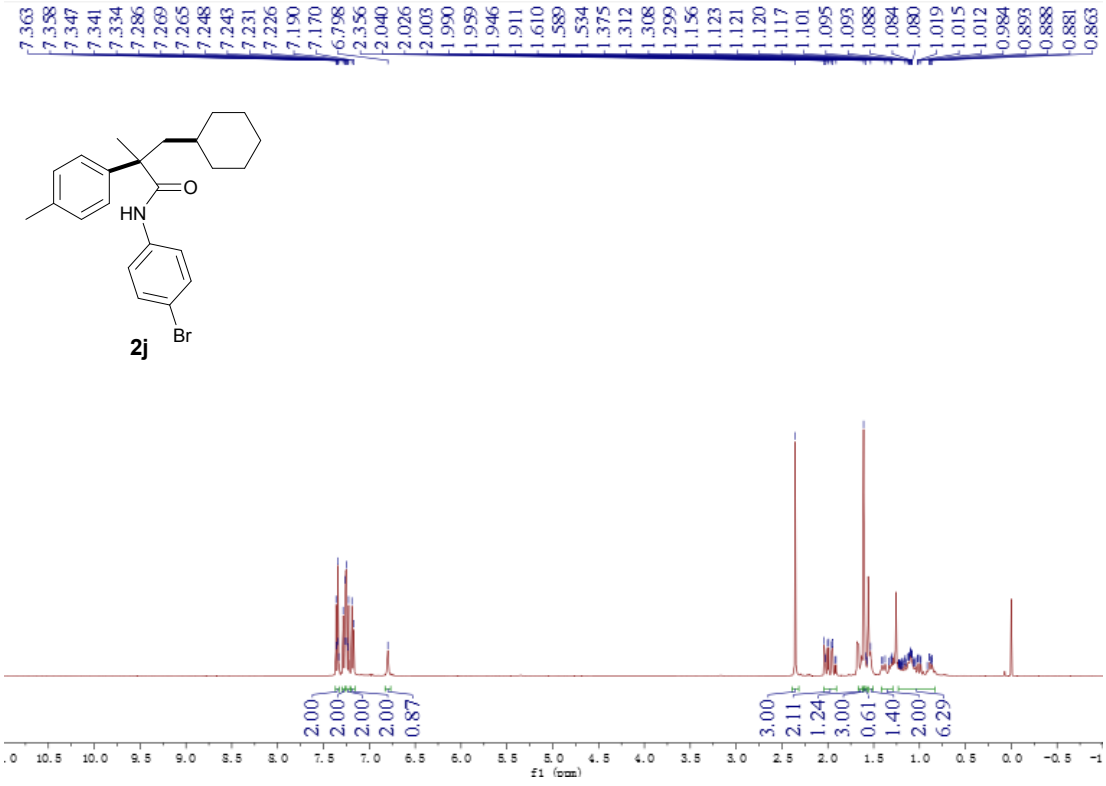


2i

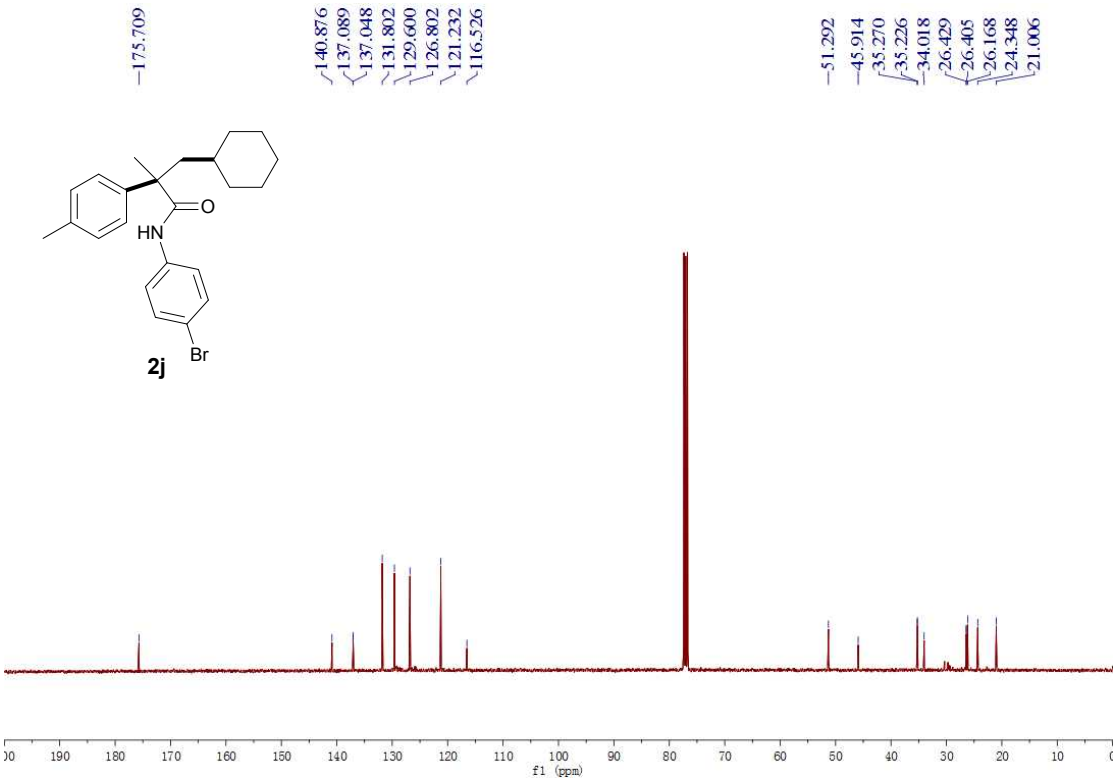


2i

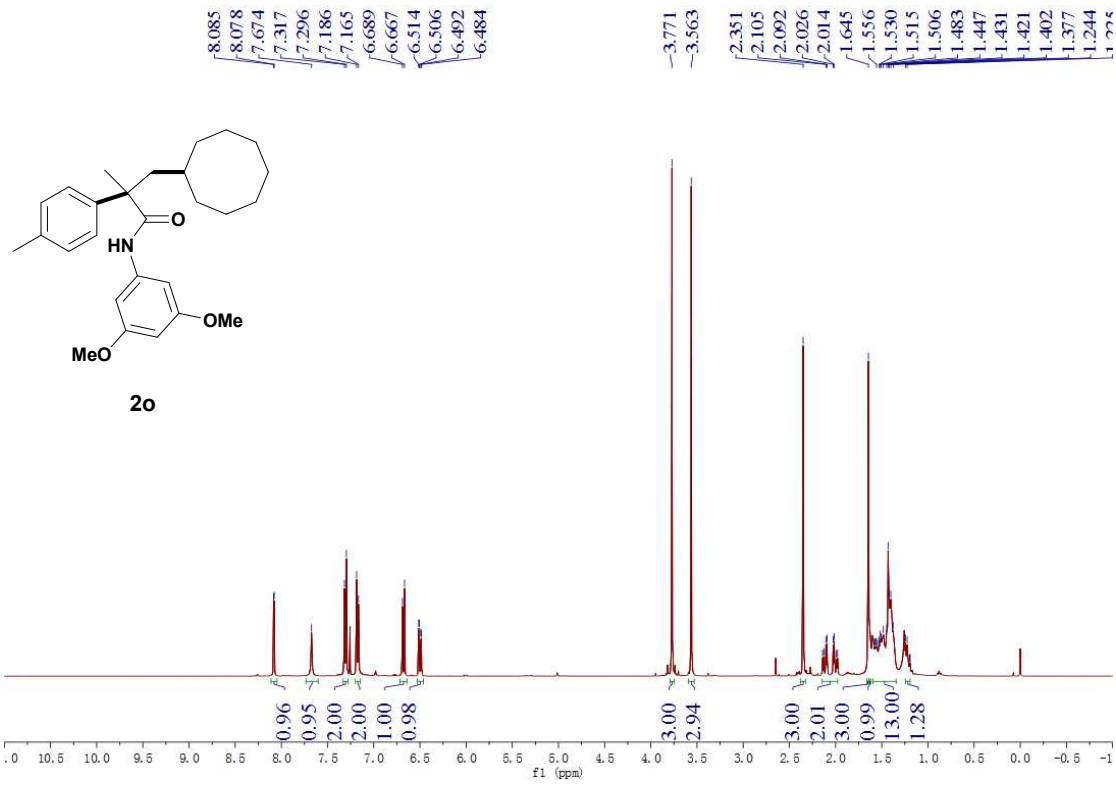
N-(4-bromophenyl)-3-cyclohexyl-2-methyl-2-(*p*-tolyl)propanamide (**2j)**

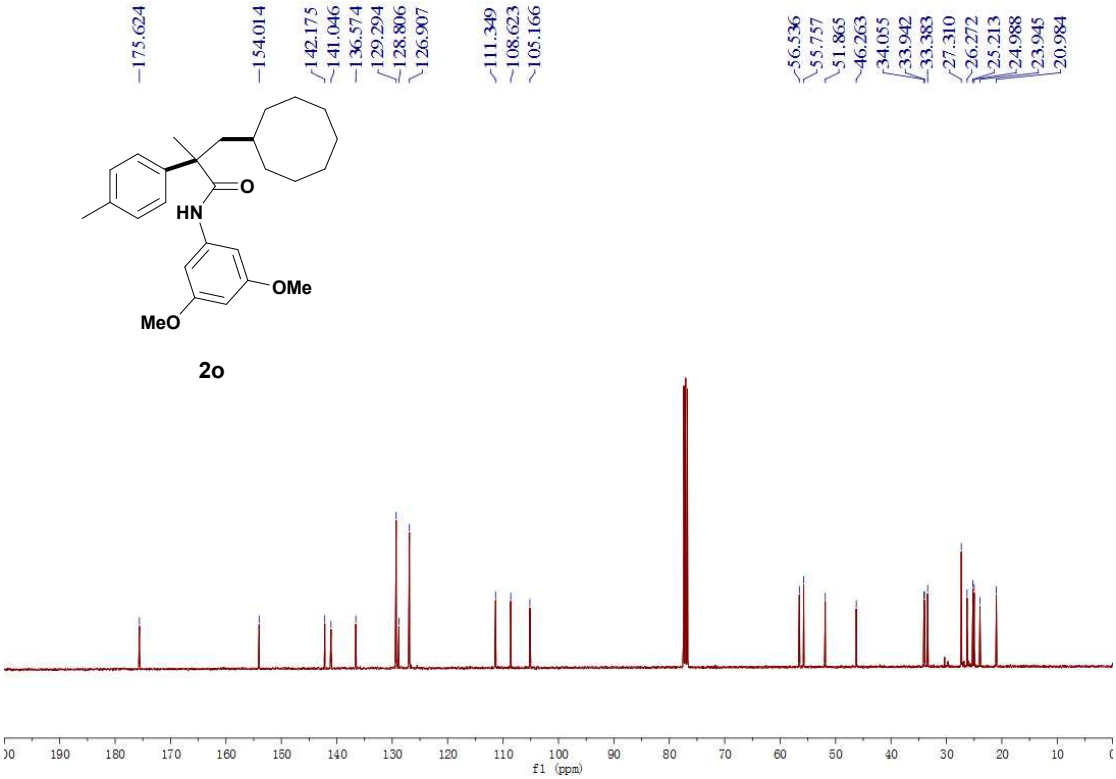


2j



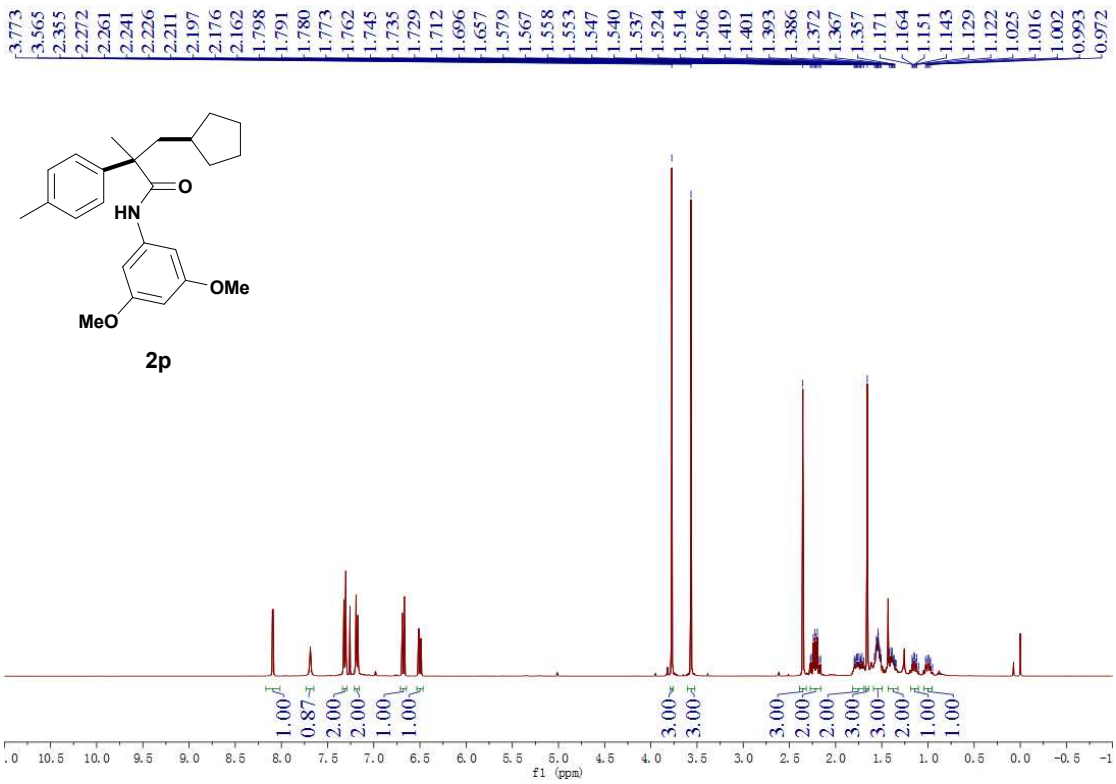
3-cyclooctyl-*N*-(3,5-dimethoxyphenyl)-2-methyl-2-(*p*-tolyl)propanamide (**2o)**



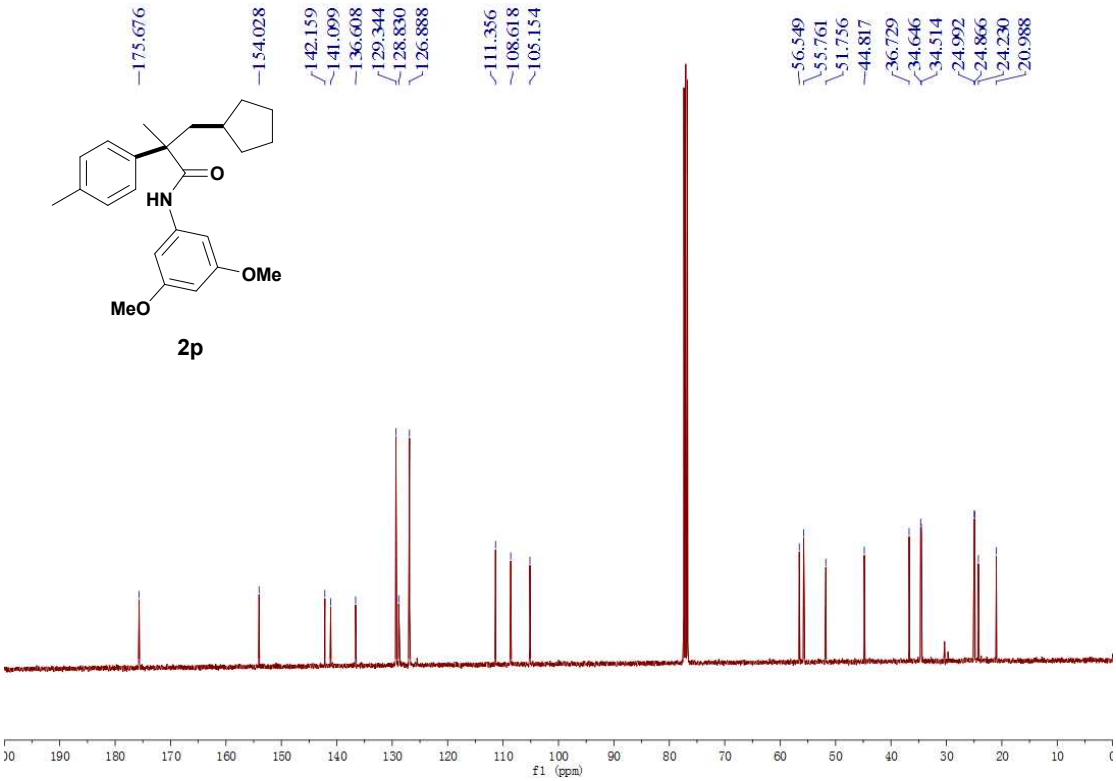


2o

3-cyclopentyl-*N*-(3,5-dimethoxyphenyl)-2-methyl-2-(*p*-tolyl)propanamide (**2p)**

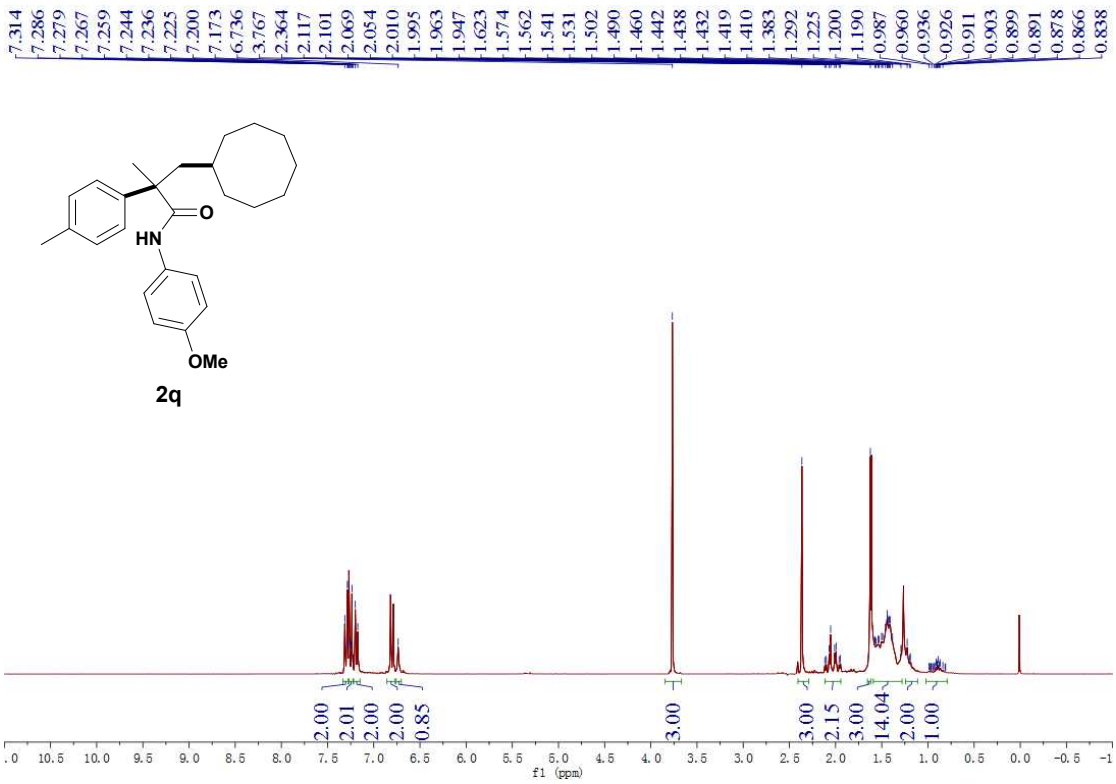


2p

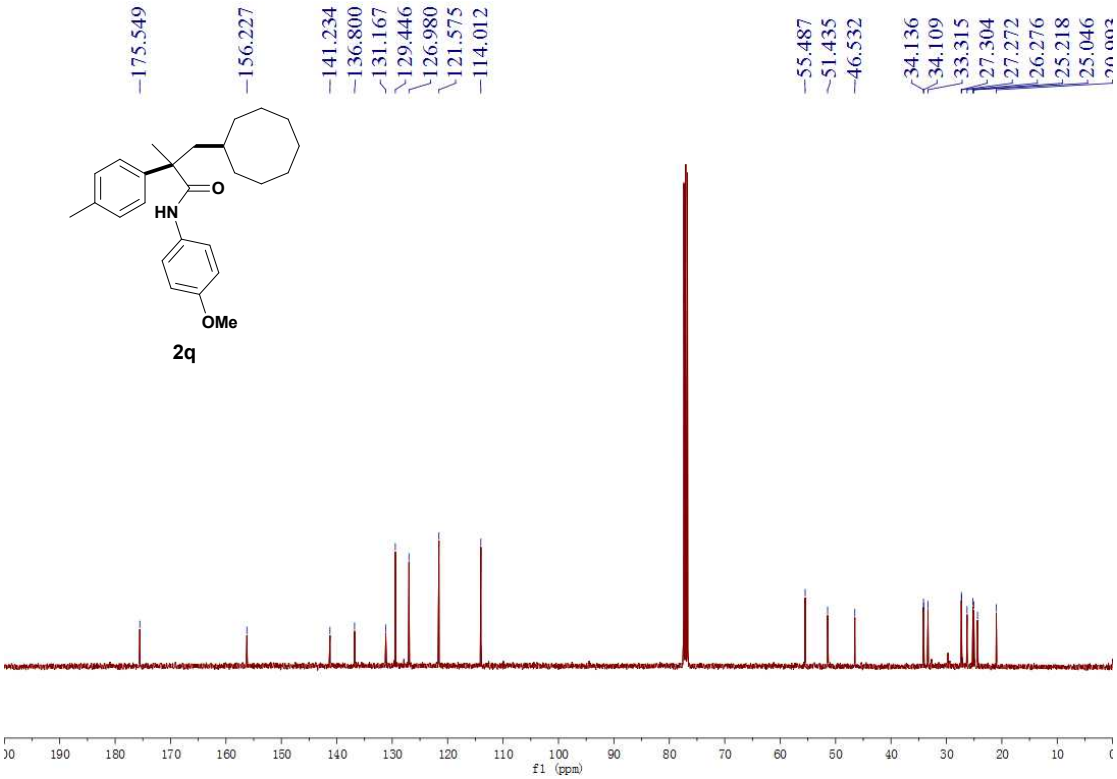


2p

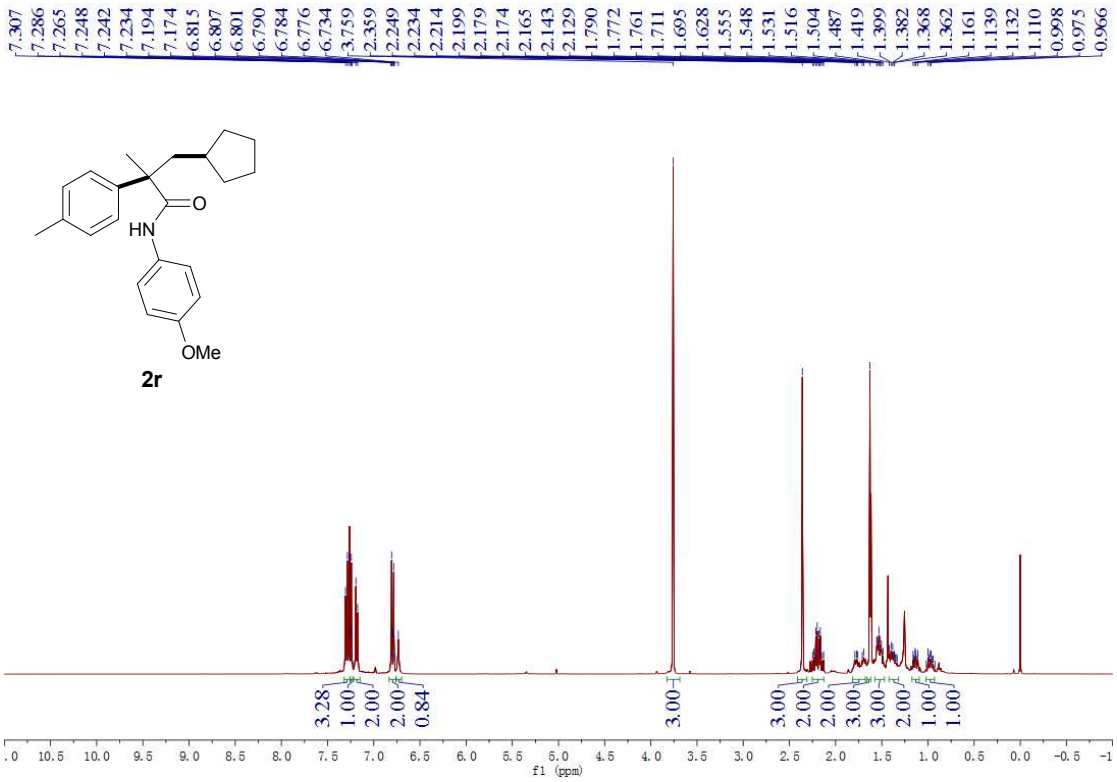
3-cyclooctyl-*N*-(4-methoxyphenyl)-2-methyl-2-(*p*-tolyl)propanamide (**2q)**

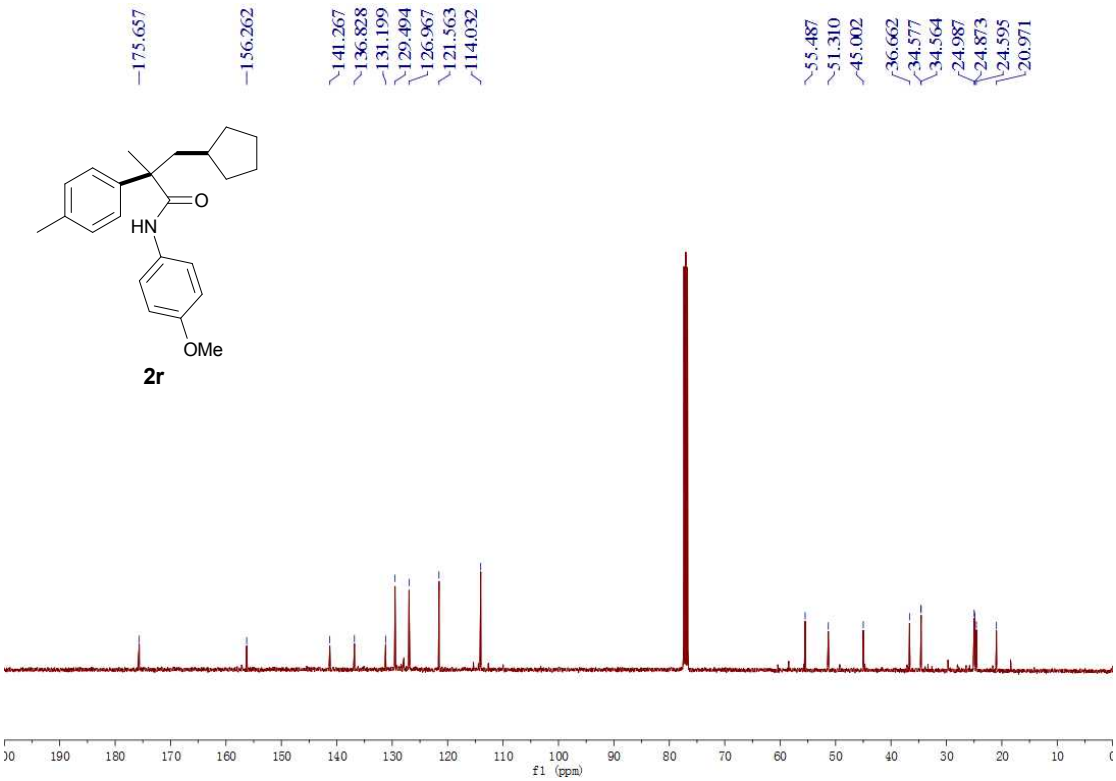


2q

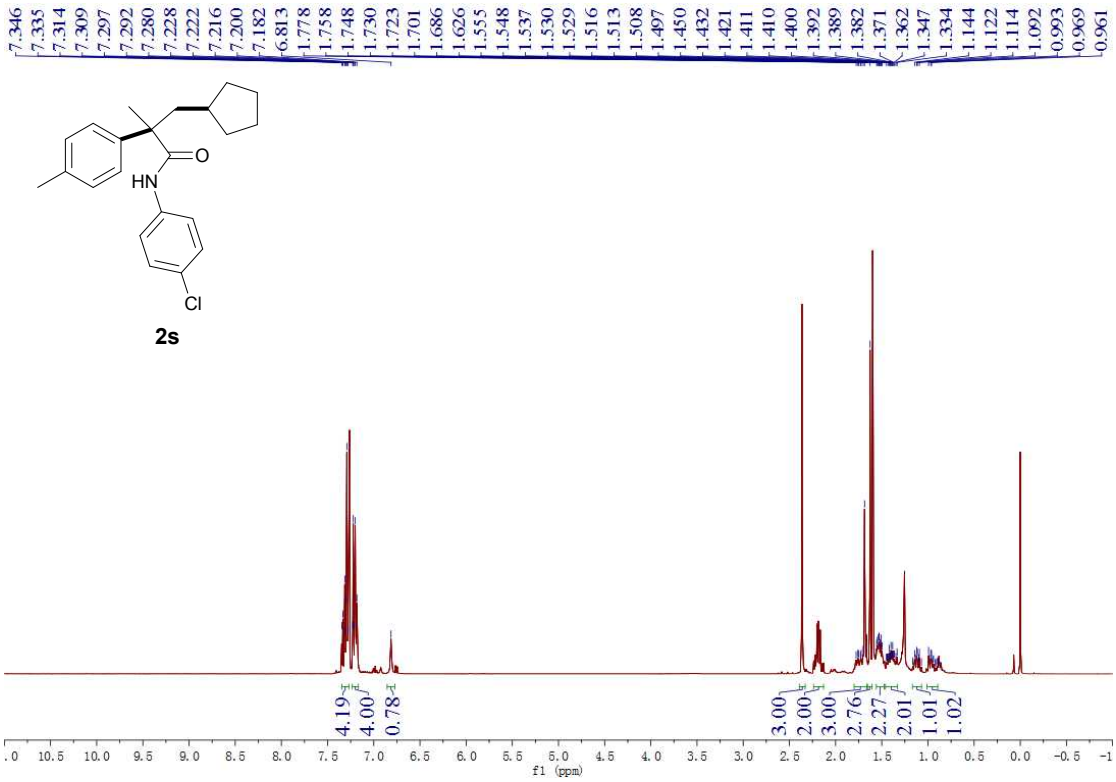


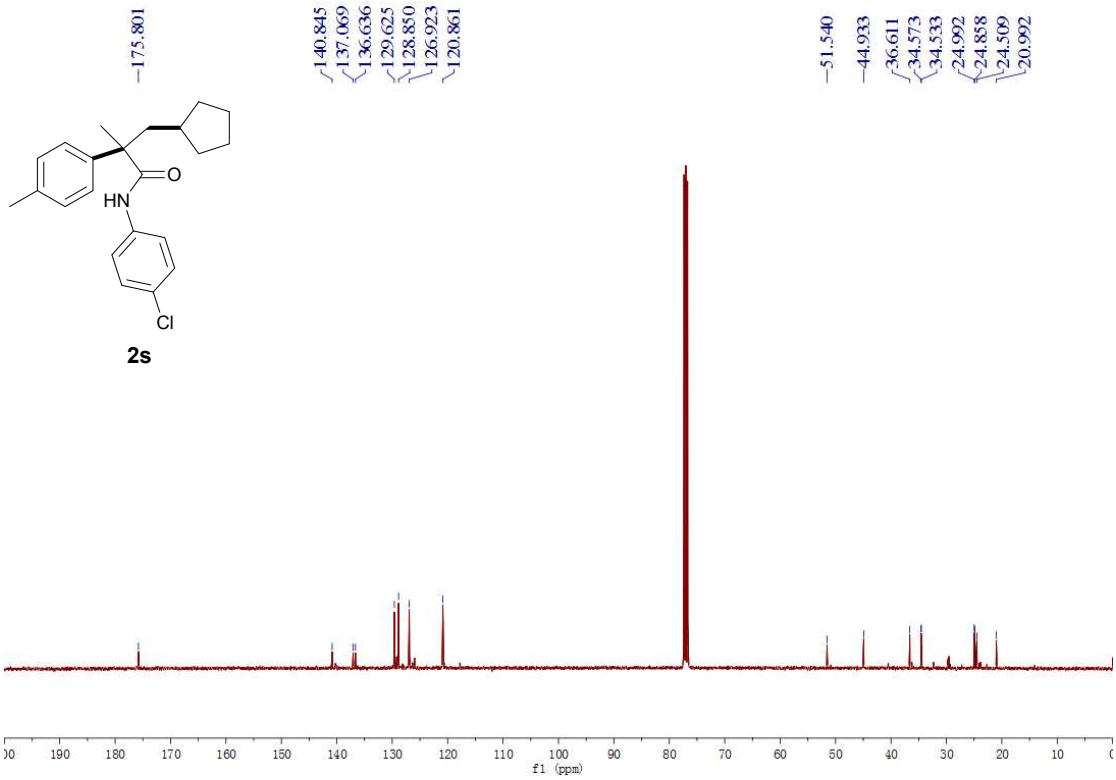
3-cyclopentyl-*N*-(4-methoxyphenyl)-2-methyl-2-(*p*-tolyl)propanamide (**2r)**





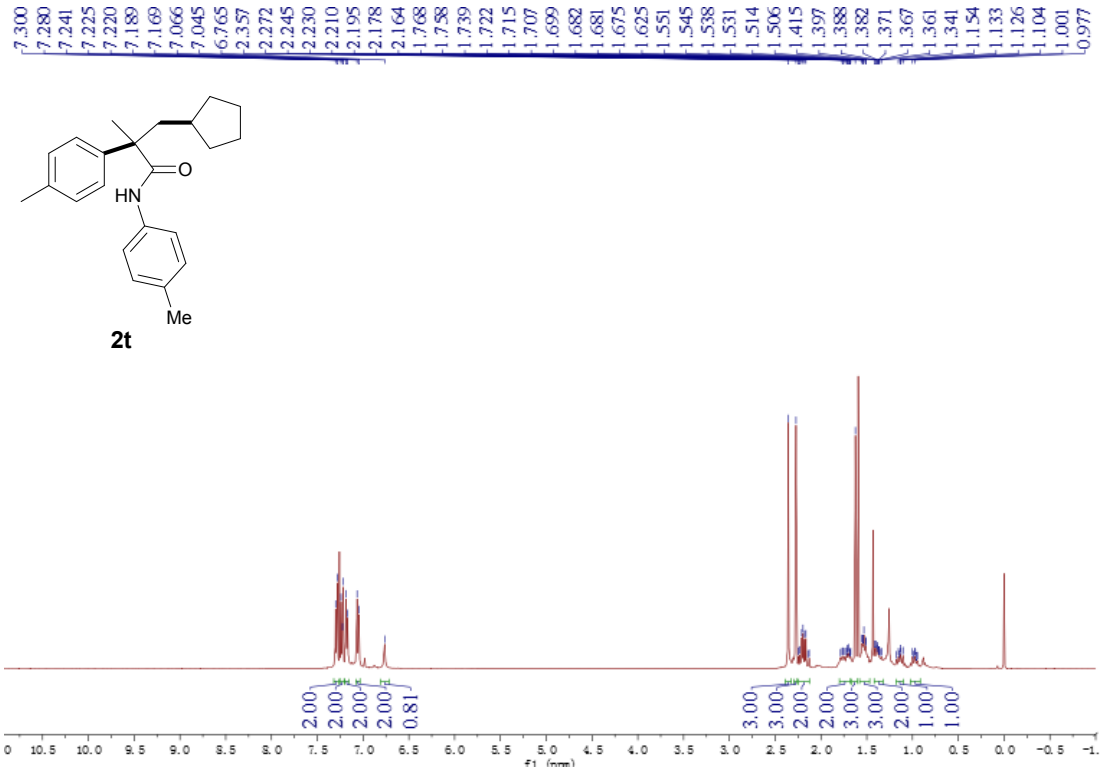
N-(4-chlorophenyl)-3-cyclopentyl-2-methyl-2-(*p*-tolyl)propanamide (**2s)**



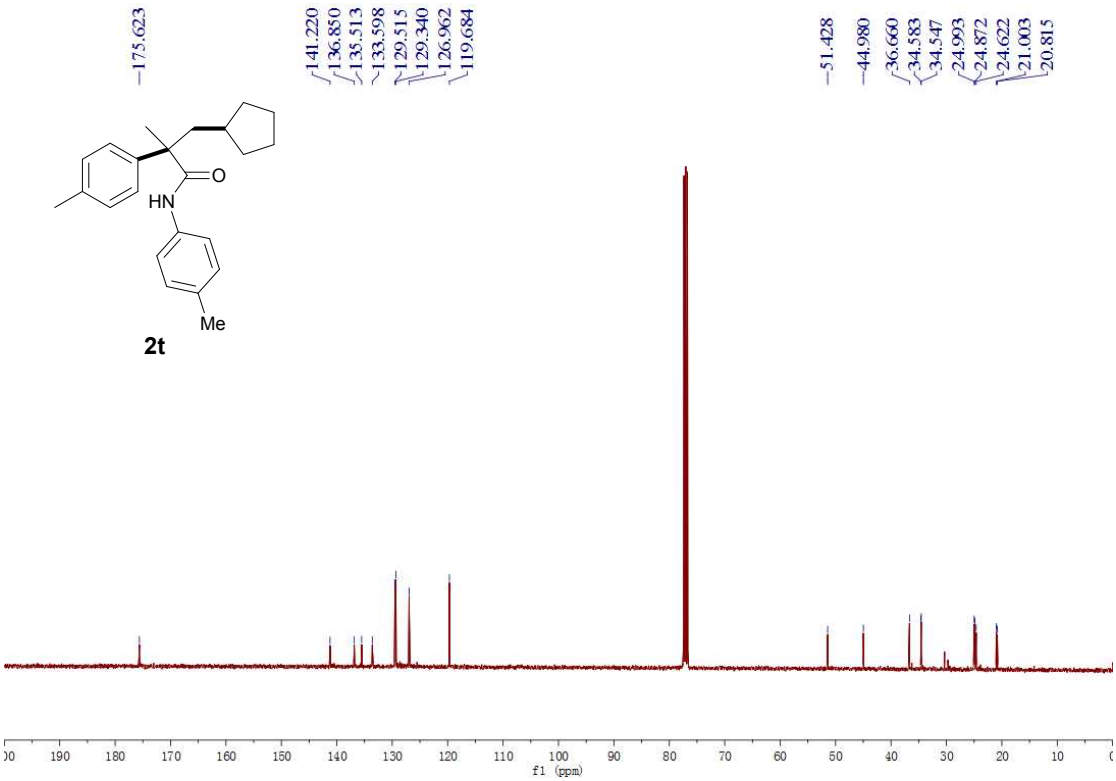


2s

3-cyclopentyl-2-methyl-*N*,2-di-*p*-tolylpropanamide (**2t)**

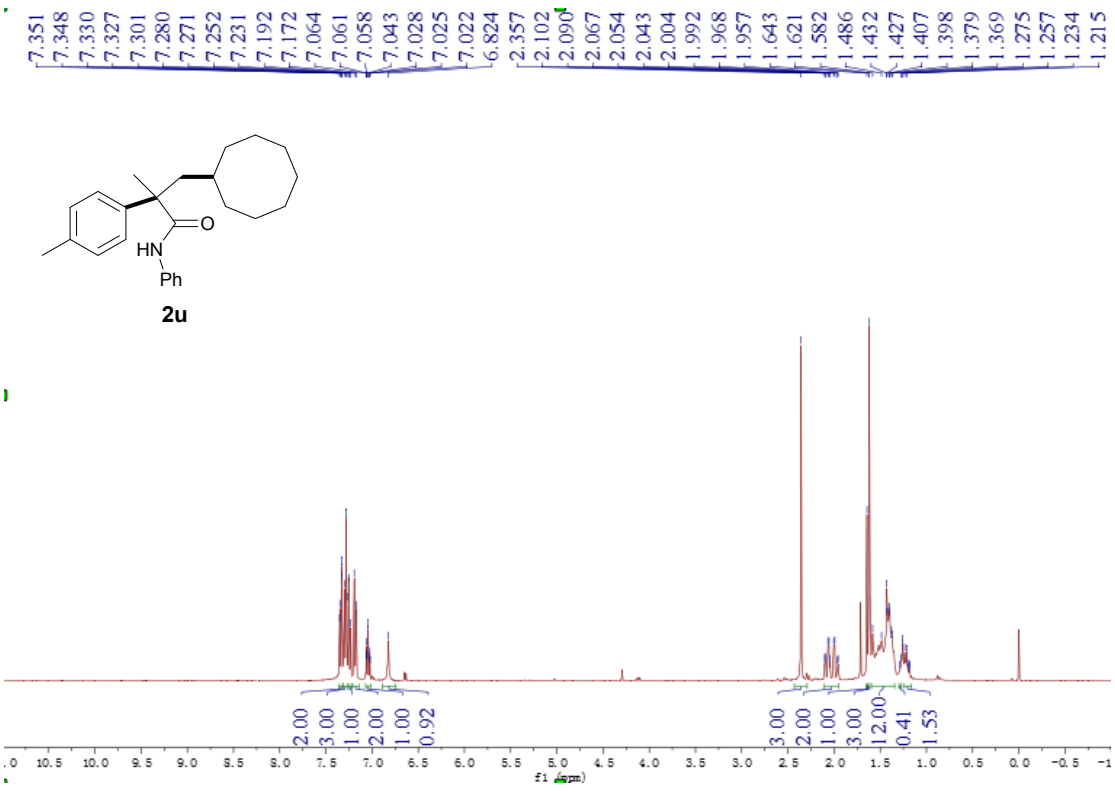


2t

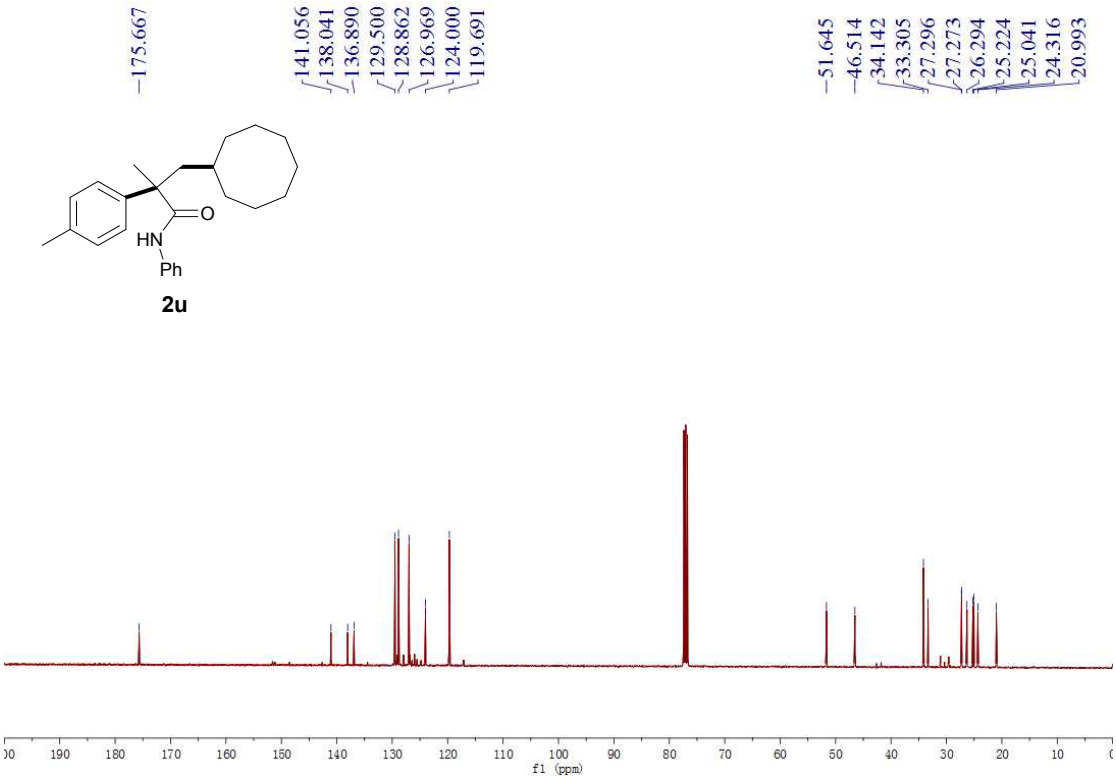


2t

3-cyclooctyl-2-methyl-*N*-phenyl-2-(*p*-tolyl)propanamide (**2u)**

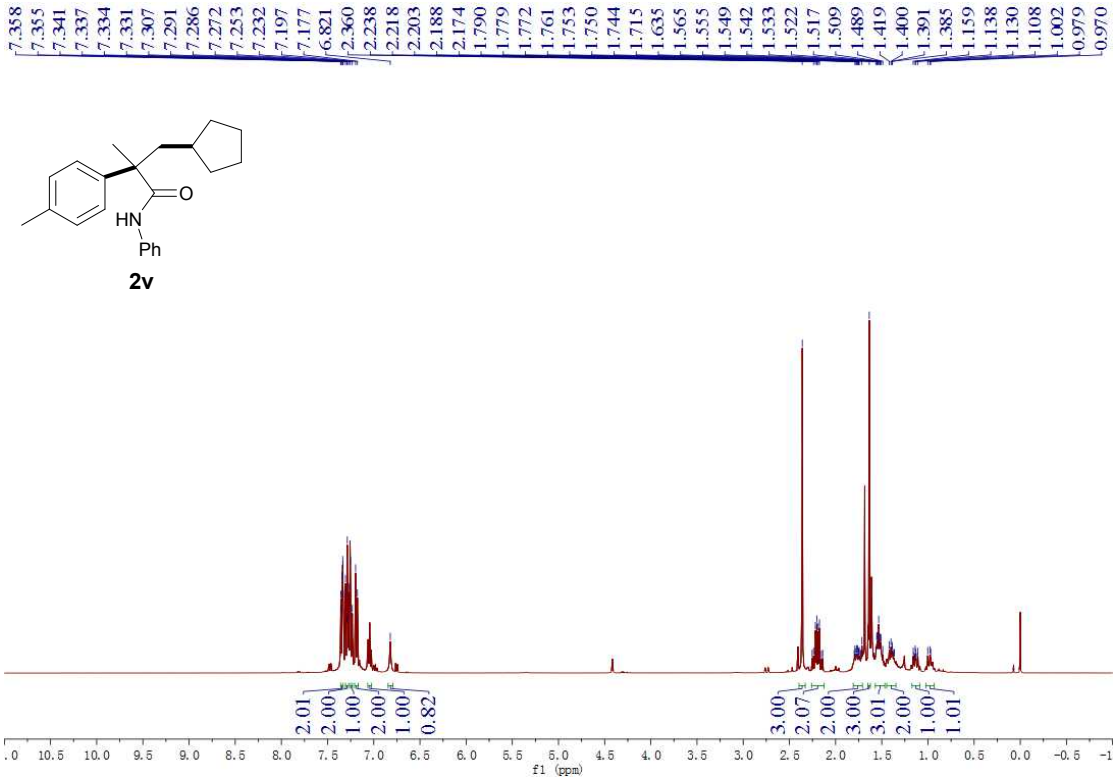


2u

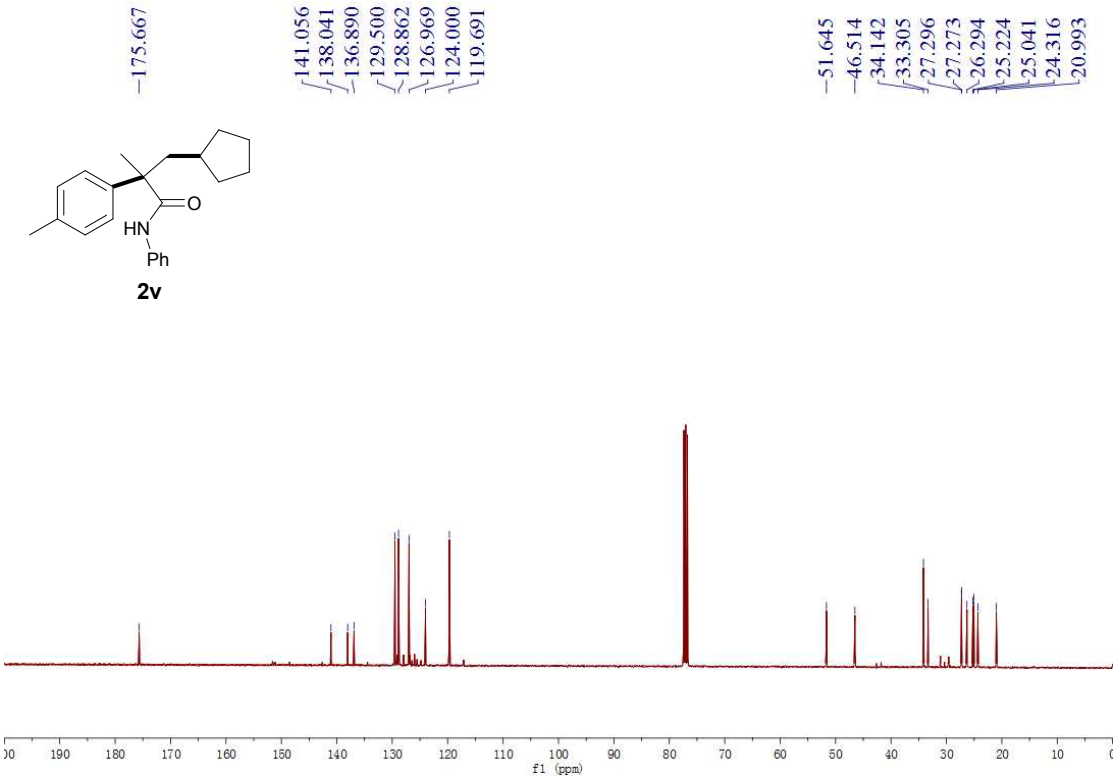


2u

3-cyclopentyl-2-methyl-*N*-phenyl-2-(*p*-tolyl)propanamide (**2v)**

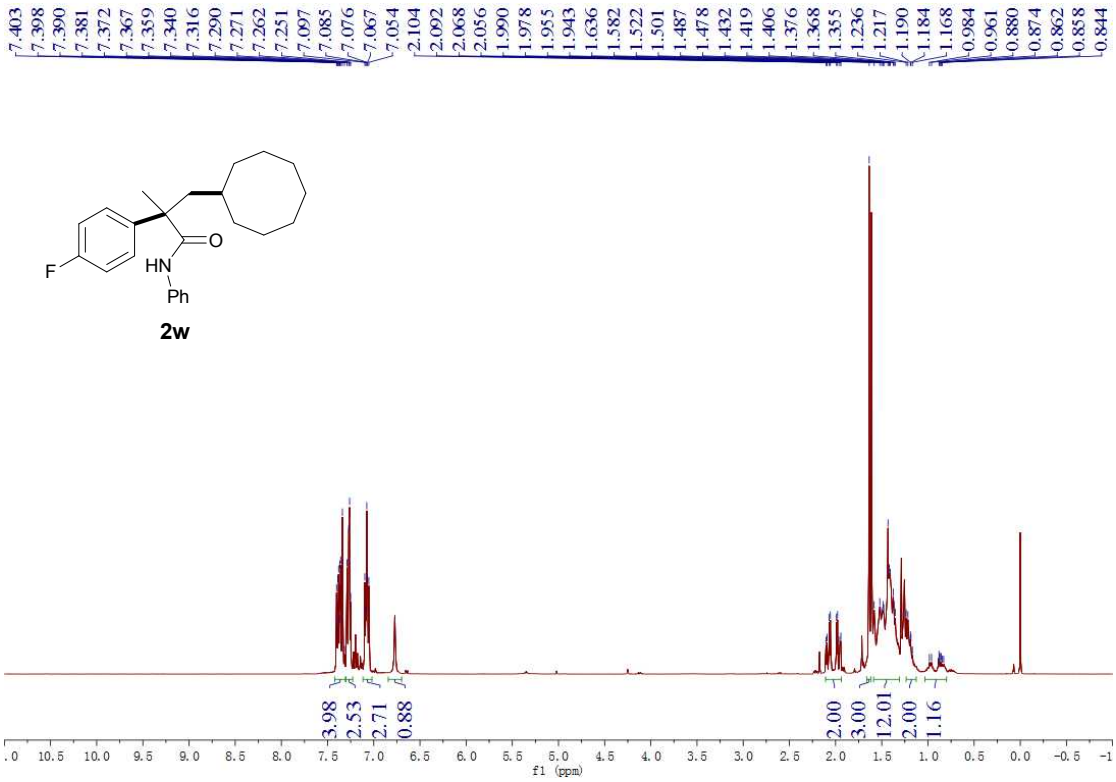


2v

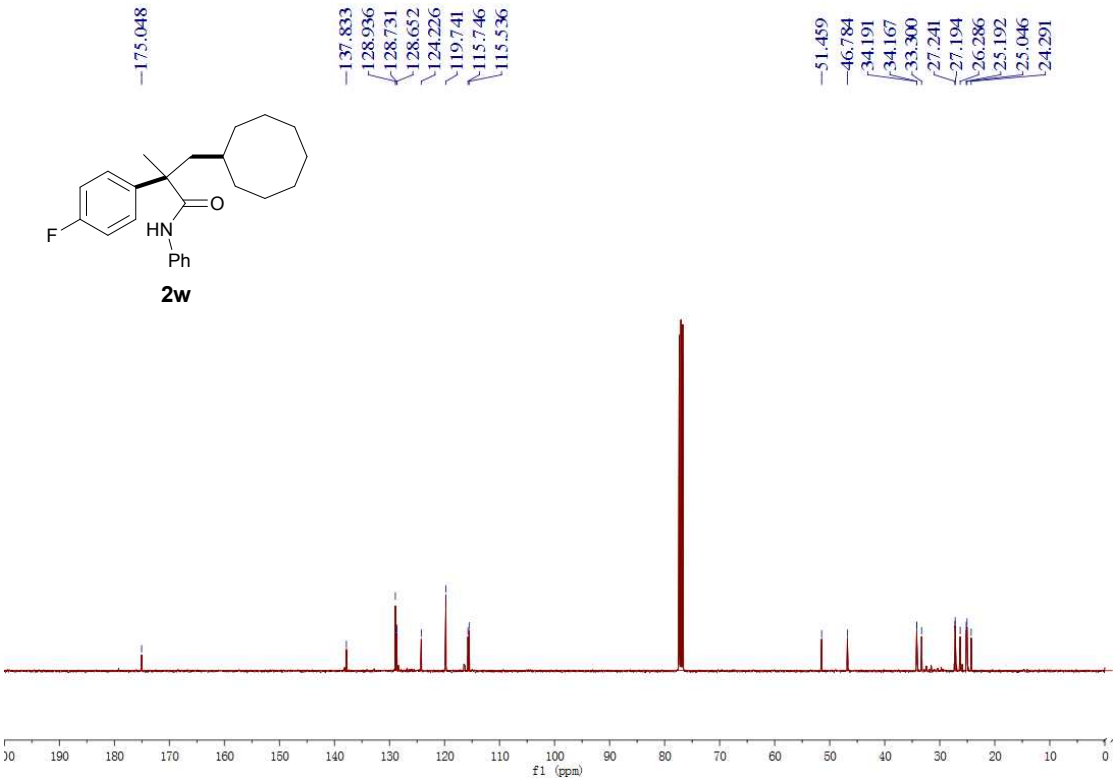


2v

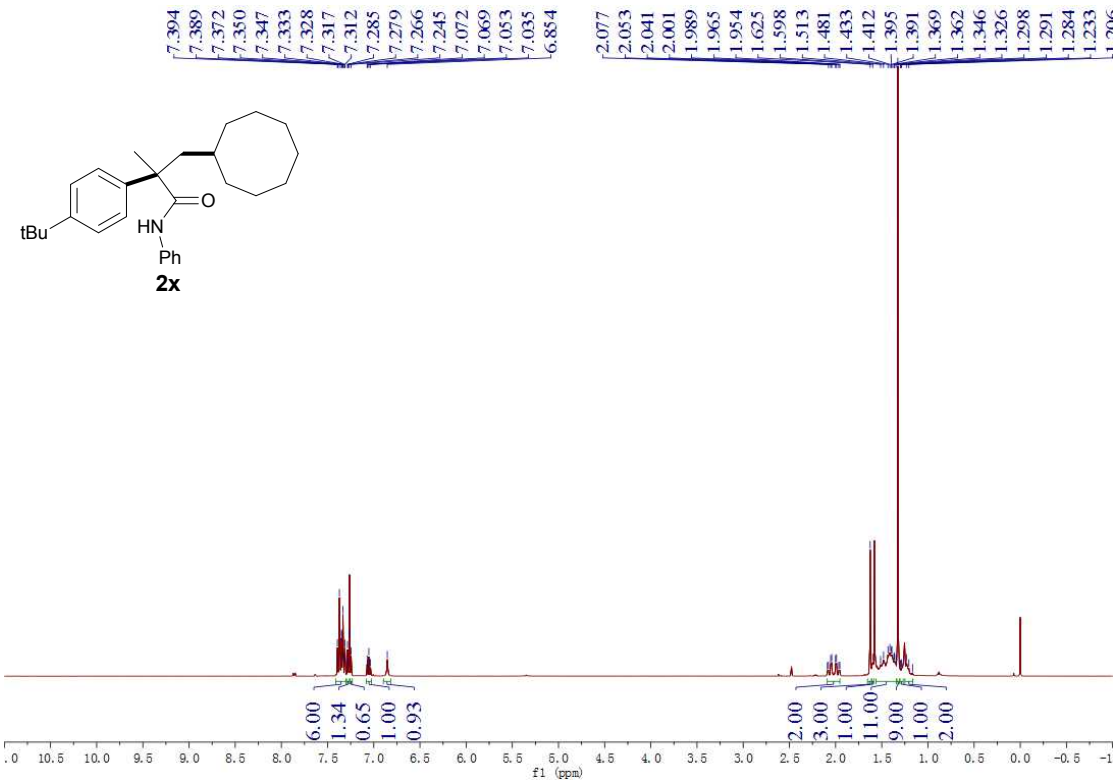
3-cyclooctyl-2-(4-fluorophenyl)-2-methyl-*N*-phenylpropanamide (**2w)**

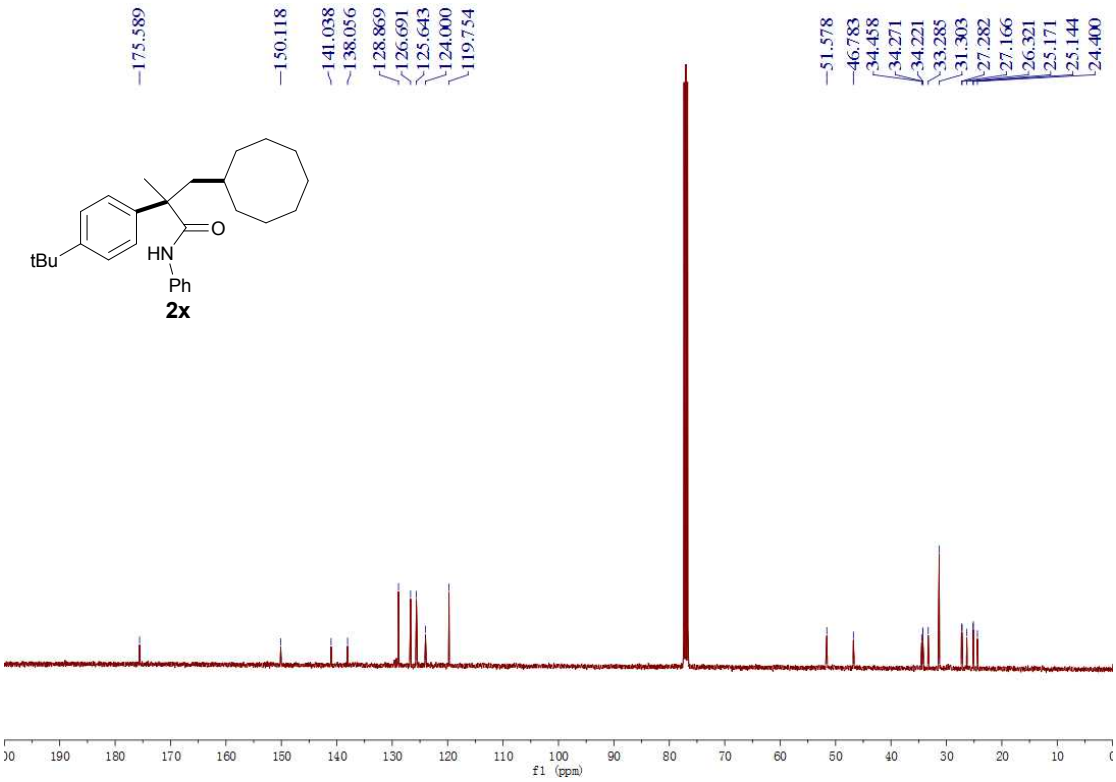


2w



2-(4-(*tert*-butyl)phenyl)-3-cyclooctyl-2-methyl-*N*-phenylpropanamide (**2x)**

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34.271
34.221
33.285
31.303
27.282
27.166
26.321
25.171
25.144
24.400
tBu
HN
O
Ph
2x
f1 (ppm)