Supporting information

for

Construction of Spirocycles Containing Highly Substituted Pyrrolidine and 1-Indanone Motifs with Spiro Quaternary Stereogenic Centers via 1,3-Dipolar Cycloaddition of 2-Alkylidene-1-Indanone and Azomethine Ylides Promted by Simple Imidazolium Salts

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CONTENTS

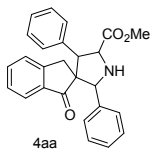
General information

All reagents were obtained from commercial supplier without further purification. Commercial grade solvent was dried and purified by standard procedures as specified in Purification of Laboratory Chemicals, 4th Ed (Armarego, W. L. F.; Perrin, D. D. Butterworth Heinemann: 1997). NMR spectra were recorded with tetramethylsilane as the internal standard. ^{1}H NMR spectra were recorded at 400 MHz, and ^{13}C NMR spectra were recorded at 100 MHz (Bruker Avance). Chemical shifts (δ) are reported in ppm downfield from $CDCl_3$ (δ = 7.26 ppm) for ^{1}H NMR and relative to the central $CDCl_3$ resonance (δ = 77.0 ppm) for ^{13}C NMR spectroscopy. The following abbreviations were used to describe peak patterns where appropriate: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet. Coupling constants were reported in Hertz (Hz). Flash column chromatography was carried out using silica gel eluting with ethyl acetate and petroleum ether. Reactions were monitored by TLC and visualized with ultraviolet light.

General procedure for 2-Alkylidene-1-Indanone with Azomethine Ylides Promted by Imidazolium Salts.

Typical experimental procedure for the Methyl 1-oxo-2',4'-diphenyl-1,3-dihydrospiro [indene-2,3'-pyrrolidine]-5'-carboxylate (4aa): A stirred solution of 2-alkylidene-1-indanone (**1a**, 0.20 mmol, 1.0 equiv), azomethine ylide (**2a**, 0.2 mmol, 1.0 equiv) and catalyst **3g** (20 mmol%) in CH_3CN (1.0 mL) was stirred at 40 °C. After the 2-alkylidene-1-indanone was consumed as indicated monitored by TLC, the reaction solution was added H_2O (20 mL), then extracted with CH_2Cl_2 (25 mL×3). The organic phase was dried with anhydrous $MgSO_4$, filtered and concentrated *in-vacuo*. The residue was purified by column chromatography on silica gel (eluent PE: EtOAc = 200:1 to 40:1) to afford pure products **4aa**. All known products were identified by spectroscopic data (^{1}H NMR) which are in good agreement with those reported.[6]

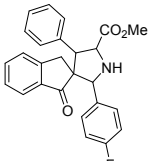
Methyl-1-oxo-2',4'-diphenyl-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4aa):



4aa

79.0 mg, 99% yield. **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm): 2.79 (d, *J* = 17.6 Hz, 1H), 2.88 (d, *J* = 17.6 Hz, 1H), 3.85 (s, 3H), 3.99 (d, *J* = 5.8 Hz, 1H), 4.36 (d, *J* = 5.9 Hz, 1H), 4.57 (s, 1H), 7.03 – 7.12 (m, 5H), 7.15 (dd, *J* = 7.6, 1.7 Hz, 2H), 7.28 – 7.34 (m, 5H), 7.37 – 7.41 (m, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ (ppm): 35.5, 52.4, 56.1, 65.7, 67.6, 74.1, 123.2, 125.4, 126.6, 127.1, 127.3, 127.8, 128.0, 128.7, 128.9, 134.4, 135.9, 136.1, 141.3, 151.8, 173.2, 207.9. IR (KBr, cm^{-1}): 3430, 3063, 3032, 3003, 2950, 2840, 1741, 1704, 1609, 1513, 1461, 1440, 1382, 1328, 1285, 1252, 1215, 1182, 1121, 1034, 959, 919, 834, 756, 703, 673, 555, 521. **HRMS (ESI-TOF)** calcd for $C_{26}H_{24}NO_3$ ($[M+H]^+$): 398.1751, found: 398.1768.

Methyl-2'-(4-fluorophenyl)-1-oxo-4'-phenyl-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4ab):

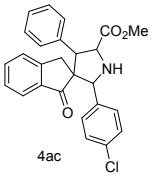


4ab

70.9 mg, 85% yield. **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm): 2.76 (d, *J* = 17.6 Hz, 1H), 2.88 (d, *J* = 17.6 Hz, 1H), 3.85 (s, 3H), 3.99 (d, *J* = 5.9 Hz, 1H), 4.35 (d, *J* = 5.9 Hz, 1H), 4.55 (s, 1H), 6.75 (t, *J* = 8.7 Hz, 2H), 7.07 – 7.18 (m, 4H), 7.29 – 7.41 (m, 7H). **^{13}C NMR** (100

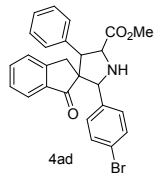
MHz, $CDCl_3$) δ (ppm): 35.6, 52.4, 55.8, 65.6, 67.4, 73.4, 114.8, 115.0, 123.3, 125.5, 127.3, 128.3, 128.4, 128.7, 128.9, 132.2, 134.6, 135.9, 141.1, 151.7, 161.0, 163.5, 173.1, 207.7. IR (KBr, cm^{-1}): 3425, 3066, 3034, 2951, 2924, 2851, 1737, 1704, 1606, 1508, 1461, 1435, 1377, 1329, 1287, 1220, 1153, 1096, 1024, 913, 841, 764, 703, 639, 522. **HRMS (ESI-TOF)** calcd for $C_{26}H_{23}FNO_3$ ($[M+H]^+$): 416.1656, found: 416.1653.

Methyl-2'-(4-chlorophenyl)-1-oxo-4'-phenyl-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4ac):



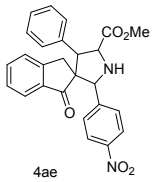
71.6 mg, 83% yield. **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm): 2.77 (d, *J* = 17.6 Hz, 1H), 2.89 (d, *J* = 17.6 Hz, 1H), 3.85 (s, 3H), 3.99 (d, *J* = 6.0 Hz, 1H), 4.36 (d, *J* = 6.0 Hz, 1H), 4.54 (s, 1H), 7.04 (d, *J* = 8.5 Hz, 2H), 7.08 – 7.16 (m, 4H), 7.27 – 7.41 (m, 7H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ (ppm): 35.6, 52.4, 55.8, 65.6, 67.3, 73.4, 123.4, 125.5, 127.3, 127.4, 128.1, 128.1, 128.7, 128.9, 135.6, 134.7, 135.1, 135.9, 140.9, 151.7, 173.1, 207.5. IR (KBr, cm^{-1}): 3337, 3061, 3033, 2950, 2922, 2849, 1737, 1704, 1603, 1490, 1461, 1439, 1329, 1287, 1215, 1136, 1093, 1041, 1017, 912, 829, 764, 705, 638, 512, 473, 416.

Methyl-2'-(4-bromophenyl)-1-oxo-4'-phenyl-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4ad):



82.7 mg, 87% yield. The ratio of **4ad**-A/**4ad**-B/**4ad**-C was 1:0.27:0.15 as determined by ^{1}H NMR. **^{1}H NMR** (400 MHz, $CDCl_3$, a mixture of three isomers) δ (ppm): 2.56 (dd, *J* = 36.0, 18.0 Hz, 2H, isomer B), 2.76 (dd, *J* = 21.6, 18.0 Hz, 2H, isomer A), 2.88 (d, *J* = 14.0 Hz, 2H, isomer C), 3.30 (s, 3H, isomer C), 3.42 (s, 3H, isomer B), 3.69 (s, 3H, isomer A), 3.88 (d, *J* = 7.6 Hz, 1H, isomer C), 4.14 (d, *J* = 8.4 Hz, 1H, isomer B), 4.32 (d, *J* = 9.2 Hz, 1H, isomer A), 4.51 (d, *J* = 9.2 Hz, 1H, isomer A), 4.63 (d, *J* = 8.4 Hz, 1H, isomer B), 4.67 (s, 1H, isomer B), 4.92 (s, 1H, isomer C), 5.02 (s, 1H, isomer A), 5.33 (d, *J* = 7.6 Hz, 1H, isomer C), 6.88 (t, *J* = 1.0 Hz, isomer A), 7.06 - 7.25 (m, 15H, for isomer A and isomer B and isomer C, overlapped), 7.31 (d, *J* = 7.2 Hz, 1H, isomer B), 7.36 (t, *J* = 7.2 Hz, 1H, isomer A), 7.62 (d, *J* = 7.6 Hz, 1H, isomer A), 7.71 (d, *J* = 7.2 Hz, 1H, isomer B). **^{13}C NMR** (100 MHz, $CDCl_3$) δ (ppm): 29.6, 33.4, 35.1, 51.5, 51.5, 52.5, 54.7, 56.7, 58.4, 60.6, 63.6, 64.1, 64.7, 65.3, 65.4, 68.7, 68.9, 70.2, 121.1, 121.3, 121.4, 123.3, 123.5, 123.7, 125.4, 125.7, 127.0, 127.1, 127.2, 127.3, 128.0, 128.2, 128.2, 128.4, 128.6, 128.8, 128.8, 128.9, 129.2, 130.8, 130.9, 130.9, 134.8, 134.9, 135.1, 135.7, 135.9, 136.2, 137.0, 137.4, 138.2, 139.2, 151.2, 153.5, 153.7, 172.5, 173.7, 175.2, 207.1, 207.2, 208.9. IR (KBr, cm^{-1}): 3342, 3062, 3032, 2951, 2925, 2851, 1738, 1704, 1605, 1489, 1459, 1436, 1407, 1326, 1285, 1214, 1134, 1073, 1010, 914, 822, 764, 705, 510, 472, 401. **HRMS (ESI-TOF)** calcd for $C_{26}H_{23}BrNO_3$ ($[M+H]^+$): 476.0856, found: 476.0850.

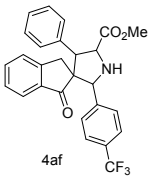
Methyl-2'-(4-nitrophenyl)-1-oxo-4'-phenyl-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4ae):



4ae

75.8 mg, 86% yield. **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm): 2.91 (d, *J* = 17.8 Hz, 1H), 2.99 (d, *J* = 17.8 Hz, 1H), 3.32 (s, 3H), 3.89 (d, *J* = 7.7 Hz, 1H), 5.09 (s, 1H), 5.33 (d, *J* = 7.6 Hz, 1H), 7.09 – 7.16 (m, 2H), 7.22 (d, *J* = 6.8 Hz, 2H), 7.30 – 7.39 (m, 5H), 7.47 (d, *J* = 8.7 Hz, 2H), 7.90 (d, *J* = 8.8 Hz, 2H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ (ppm): 35.5, 51.7, 54.7, 64.8, 65.9, 70.0, 122.9, 123.6, 125.5, 127.6, 127.7, 128.0, 128.7, 128.9, 135.1, 135.7, 139.0, 146.9, 147.3, 150.9, 173.6, 206.4. IR (KBr, cm^{-1}): 3427, 3065, 3031, 2952, 2925, 2853, 1740, 1709, 1607, 1562, 1467, 1438, 1406, 1363, 1325, 1210, 1128, 1068, 1030, 883, 826, 748, 703, 674, 514, 448. **HRMS (ESI-TOF)** calcd for $C_{26}H_{23}N_2O_5$ ($[M+H]^+$): 443.1601, found: 443.1593.

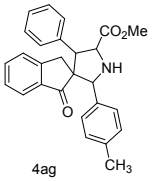
Methyl-1-oxo-4'-phenyl-2'-(4-(trifluoromethyl)phenyl)-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4af):



4af

79.4 mg, 85% yield. The ratio of **4af**-A/**4af**-B/**4af**-C was 1:0.31:0.24 as determined by ^{1}H NMR. **^{1}H NMR** (400 MHz, $CDCl_3$, a mixture of three isomers) δ (ppm): 2.49 (d, *J* = 17.6 Hz, 1H, isomer C), 2.60 (d, *J* = 17.6 Hz, 1H, isomer C), 2.71 (d, *J* = 17.2 Hz, 1H, isomer B), 2.80 (d, *J* = 17.2 Hz, 1H, isomer B), 2.84 (d, *J* = 17.6 Hz, 1H, isomer A), 2.93 (d, *J* = 17.6 Hz, 1H, isomer A), 3.30 (s, 3H, isomer A), 3.43 (s, 3H, isomer C), 3.70 (s, 3H, isomer B), 3.87 (d, *J* = 8.0 Hz, 1H, isomer A), 4.12 (d, *J* = 8.4 Hz, 1H, isomer C), 4.31 (d, *J* = 9.6 Hz, 1H, isomer B), 4.51 (d, *J* = 9.6 Hz, 1H, isomer B), 4.63 (d, *J* = 8.4 Hz, 1H, isomer C), 4.65 (s, 1H, isomer C), 4.92 (s, 1H, isomer A), 5.00 (s, 1H, isomer B), 5.30 (d, *J* = 8.0 Hz, 1H, isomer A), 6.90 – 6.96 (m, 1H, isomer A), 7.09 – 7.22 (m, 10H, for isomer A and isomer B and isomer C, overlapped), 7.29 – 7.43 (m, 8H, for isomer A and isomer B and isomer C, overlapped), 7.48 (d, *J* = 1.6 Hz, 1H, isomer B), 7.64 (d, *J* = 7.6 Hz, 1H, isomer B), 7.75 (d, *J* = 7.6 Hz, 1H, isomer C). **^{13}C NMR** (100 MHz, $CDCl_3$)δ(ppm): 29.7, 33.5, 35.3, 51.6, 51.7, 52.3, 54.4, 56.6, 60.6, 63.6, 64.1, 64.6, 65.3, 65.6, 68.1, 68.3, 68.6, 123.4, 123.6, 123.9, 125.5, 125.8, 126.2, 126.4, 126.6, 127.2, 127.2, 127.3, 127.4, 127.5, 128.1, 128.3, 128.7, 128.7, 128.9, 129.1, 129.2, 129.7, 129.7, 129.8, 131.1, 131.3, 131.4, 131.9, 132.0, 134.9, 135.1, 135.3, 136.0, 137.0, 138.2, 138.9, 139.0, 139.1, 151.0, 153.4, 153.5, 172.3, 173.7, 175.1, 206.6, 206.9. IR (KBr, cm^{-1}): 3372, 3065, 3033, 2953, 2926, 2854, 1741, 1705, 1611, 1497, 1462, 1437, 1327, 1276, 1212, 1167, 1124, 1069, 1019, 981, 925, 839, 756, 704, 676, 607, 551, 472, 411. **HRMS (ESI-TOF)** calcd for $C_{27}H_{23}F_3NO_3$ ($[M+H]^+$): 466.1625, found: 466.1631.

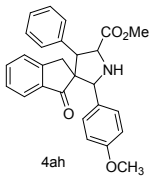
Methyl-1-oxo-4'-phenyl-2'-(p-tolyl)-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4ag):



4ag

76.6 mg, 93% yield. **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm): 2.14 (s, 3H), 2.83 (q, *J* = 17.6 Hz, 2H), 3.85 (s, 3H), 3.97 (d, *J* = 5.9 Hz, 1H), 4.37 (d, *J* = 5.9 Hz, 1H), 4.54 (s, 1H), 6.86 (d, *J* = 7.5 Hz, 2H), 7.04 (d, *J* = 7.7 Hz, 2H), 7.10 (d, *J* = 7.6 Hz, 2H), 7.29 – 7.33 (m, 5H), 7.36 – 7.42 (m, 3H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ (ppm): 20.9, 35.5, 52.4, 56.2, 65.6, 67.5, 73.9, 123.3, 125.5, 126.6, 127.1, 127.2, 128.7, 128.8, 128.8, 133.0, 134.4, 136.1, 137.4, 141.2, 151.9, 173.2, 208.0. IR (KBr, cm^{-1}): 3340, 3062, 3030, 2950, 2923, 2855, 1738, 1704, 1606, 1509, 1459, 1435, 1377, 1328, 1284, 1214, 1139, 1029, 913, 871, 820, 762, 704, 674, 515, 470. **HRMS (ESI-TOF)** calcd for $C_{27}H_{26}NO_3$ ($[M+H]^+$): 412.1907, found: 412.1909.

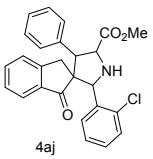
Methyl-2'-(4-methoxyphenyl)-1-oxo-4'-phenyl-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4ah):



4ah

83.6 mg, 98% yield. The ratio of **4ah**-A/**4ah**-B was 1:0.87 as determined by ^{1}H NMR. **1H NMR** (400MHz, $CDCl_3$, a mixture of two isomers) δ (ppm): 2.74 (d, *J* = 17.2 Hz, 1H, isomer A), 2.81 (d, *J* = 11.2 Hz, 1H, isomer B), 2.85 (d, *J* = 11.2 Hz, 1H, isomer B), 2.99 (d, *J* = 17.2 Hz, 1H, isomer A), 3.30 (s, 3H, isomer B), 3.64 (s, 3H, isomer B), 3.67 (s, 3H, isomer A), 3.70 (s, 3H, isomer A), 3.89 (d, *J* = 7.9 Hz, 1H, isomer B), 4.34 (d, *J* = 9.1 Hz, 1H, isomer A), 4.50 (d, *J* = 9.1 Hz, 1H, isomer A), 4.89 (s, 1H, isomer B), 5.01 (s, 1H, isomer A), 5.35 (d, *J* = 7.9 Hz, 1H, isomer B), 6.60 (dd, *J* = 14.1, 8.7 Hz, 1H, for isomer A and isomer B, overlapped), 7.10 (d, *J* = 7.2 Hz, 3H, for isomer A and isomer B, overlapped), 7.13 – 7.15 (m, 5H, for isomer A and isomer B, overlapped), 7.16 – 7.24 (m, 7H, for isomer A and isomer B, overlapped), 7.29 – 7.39 (m, 6H, for isomer A and isomer B, overlapped), 7.61 (d, *J* = 7.6 Hz, 1H, isomer A). **^{13}C NMR** (100 MHz, $CDCl_3$) δ (ppm): 29.7, 35.0, 51.5, 52.4, 54.8, 55.1, 55.1, 56.6, 60.7, 64.8, 65.3, 65.6, 69.1, 70.7, 113.1, 113.3, 113.8, 113.9, 123.2, 123.4, 125.4, 125.7, 126.8, 127.1, 127.1, 127.2, 127.8, 128.1, 128.2, 128.5, 129.1, 130.2, 134.5, 134.6, 136.2, 136.7, 137.2, 136.7, 137.2, 139.5, 151.5, 153.8, 158.7, 159.0, 173.9, 175.4, 207.6, 207.7. IR (KBr, cm^{-1}): 3429, 3063, 3032, 3002, 2928, 2844, 1736, 1704, 1608, 1512, 1461, 1439, 1379, 1290, 1250, 1214, 1178, 1144, 1033, 958, 914, 836, 762, 704, 622, 535, 472. **HRMS (ESI-TOF)** calcd for $C_{27}H_{26}NO_4$ ($[M+H]^+$): 428.1856, found: 428.1860.

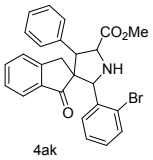
Methyl-2'-(2-chlorophenyl)-1-oxo-4'-phenyl-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4aj):



4aj

56.2 mg, 65% yield. **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm): 2.89 (d, *J* = 17.3 Hz, 1H), 3.23 (d, *J* = 17.3 Hz, 1H), 3.82 (s, 3H), 4.09 (d, *J* = 7.4 Hz, 1H), 4.44 (d, *J* = 7.4 Hz, 1H), 5.25 (s, 1H), 7.00 – 7.12 (m, 3H), 7.18 (dd, *J* = 13.2, 7.2 Hz, 2H), 7.28 – 7.36 (m, 7H), 7.64 (d, *J* = 7.8 Hz, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ (ppm): 35.9, 52.4, 55.2, 66.1, 66.5, 68.2, 123.2, 125.6, 126.8, 127.1, 127.3, 128.6, 128.6, 128.7, 128.7, 129.1, 133.4, 134.4, 135.5, 136.1, 139.4, 151.9, 173.3, 206.9. IR (KBr, cm^{-1}): 3363, 3062, 3030, 2949, 2923, 2850, 1740, 1702, 1606, 1496, 1462, 1440, 1382, 1331, 1244, 1207, 1179, 1094, 1040, 961, 920, 870, 760, 700, 670, 575, 466. **HRMS (ESI-TOF)** calcd for $C_{26}H_{23}ClNO_3$ ($[M+H]^+$): 432.1361, found: 432.1358.

Methyl-2'-(2-bromophenyl)-1-oxo-4'-phenyl-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4ak)

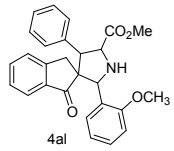


4ak

81.1 mg, 85% yield. **^{1}H NMR** (400 MHz, $CDCl_3$) δ(ppm): 2.91 (d, *J* = 17.2 Hz, 1H), 3.29 (d, *J* = 17.2 Hz, 1H), 3.80 (s, 3H), 4.10 (d, *J* = 7.5 Hz, 1H), 4.45 (d, *J* = 7.5 Hz, 1H), 5.22 (s, 1H), 6.95 (t, *J* = 7.5 Hz, 1H), 7.10 (t, *J* = 7.2 Hz, 1H), 7.17 (d, *J* = 7.5 Hz, 1H), 7.22 – 7.39 (m, 9H), 7.67 (d, *J* = 7.7 Hz, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ (ppm): 35.9, 52.3, 55.0, 65.8, 66.4, 70.6, 123.2, 124.2, 125.6, 127.1, 127.2, 127.3, 128.6, 128.7, 128.9, 129.0, 132.4, 134.4, 136.3, 137.4, 139.1, 151.9, 173.3, 206.8. IR (KBr, cm^{-1}): 3380, 3062, 3032, 2951, 2924, 2852, 1739, 1707, 1606,

1496, 1464, 1436, 1379, 1328, 1272, 1211, 1105, 1075, 1023, 920, 868, 758, 703, 660, 523, 459. **HRMS (ESI-TOF)** calcd for $C_{26}H_{23}BrNO_3$ ([M+H]$^+$): 476.0856, found: 476.0852.

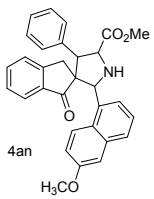
Methyl-2'-(2-methoxyphenyl)-1-oxo-4'-phenyl-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4al):



4al

57.6 mg, 67% yield. The ratio of **4al**-A/**4al**-B/**4al**-C was 1:0.7:0.52 as determined by ^{1}H NMR. **^{1}H NMR** (400 MHz, $CDCl_3$ a mixture of three isomers) δ (ppm): 2.38 (d, *J* = 17.6 Hz, 1H, isomer A), 2.46 (d, *J* = 17.6 Hz, 1H, isomer A), 2.56 (d, *J* = 17.2 Hz, 1H, isomer B), 2.75 (d, *J* = 17.2 Hz, 1H, isomer B), 2.82 (d, *J* = 15.6 Hz, 1H, isomer C), 2.90 (d, *J* = 15.6 Hz, 1H, isomer C), 3.04 (s, 3H, isomer A), 3.27 (s, 3H, isomer C), 3.33 (s, 3H, isomer B), 3.37 (s, 3H, isomer A), 3.45 (s, 3H, isomer C), 3.72 (s, 3H, isomer B), 3.79 (d, *J* = 7.6 Hz, 1H, isomer C), 3.92 (d, *J* = 1.6 Hz, 1H, isomer B), 3.94 (d, *J* = 1.6 Hz, 1H, isomer B), 4.45 (d, *J* = 8.0 Hz, 1H, isomer A), 4.74 (d, *J* =8.0 Hz, 1H, isomer A), 4.96 (s, 1H, isomer A), 5.12 (s, 1H, isomer B), 5.28 (d, *J* = 7.6 Hz, 1H, isomer C), 5.54 (s, 1H, isomer C), 6.33 (d, *J* = 7.9 Hz, 1H, isomer C), 6.38 (d, *J* = 7.9 Hz, 1H, isomer C), 6.52 (d, *J* = 7.9 Hz, 1H, isomer A), 6.78 – 6.83 (m, 1H, for isomer A and isomer B and isomer C, overlapped), 6.88 – 6.96 (m, 2H, for isomer A and isomer B and isomer C, overlapped), 7.00 – 7.08 (m, 3H, for isomer A and isomer B and isomer C, overlapped), 7.13 – 7.23 (m, 10H, for isomer A and isomer B and isomer C, overlapped), 7.25 – 7.30 (m, 4H, for isomer A and isomer B and isomer C, overlapped), 7.33 – 7.37 (m, 3H, for isomer A and isomer B and isomer C, overlapped), 7.50 (dd, *J* = 7.7, 1.5 Hz, 1H, isomer B), 7.62 (d, *J* = 7.3 Hz, 1H, isomer B), 7.78 (t, *J* = 6.2 Hz, 2H, for isomer A and isomer B), 7.91 (d, *J* = 7.5 Hz, 1H, isomer A). **^{13}C NMR** (100 MHz, $CDCl_3$)δ(ppm): 31.0, 34.6, 36.5, 51.3, 51.4, 52.4, 53.6, 54.6, 55.3, 55.4, 56.1, 58.4, 61.9, 62.8, 63.5, 64.0, 64.3, 64.3, 65.0, 65.3, 65.9, 108.6, 109.1, 119.7, 120.2, 120.3, 122.8, 123.1, 123.5, 125.1, 125.4, 125.5, 126.3, 126.7, 126.8, 126.9, 126.9, 127.1, 127.3, 127.4, 127.4, 127.7, 127.8, 127.9, 127.9, 128.0, 128.2, 128.2, 128.4, 128.5, 128.7, 128.7, 129.2, 129.7, 133.9, 134.0, 134.2, 135.5, 136.0, 136.9, 137.9, 139.3, 139.5, 152.2, 152.6, 153.6, 156.4, 156.5, 156.5, 172.1, 173.6, 175.2, 206.4, 208.0, 209.7. IR (KBr, cm^{-1}): 3424, 3065, 3033, 3003, 2950, 2842, 1740, 1708, 1604, 1492, 1462, 1438, 1328, 1280, 1244, 1207, 1177, 1104, 1028, 913, 869, 756, 703, 665, 575, 471. **HRMS (ESI-TOF)** calcd for $C_{27}H_{26}NO_4$ ([M+H]$^+$): 428.1856, found: 428.1853.

Methyl-2'-(6-methoxynaphthalen-1-yl)-1-oxo-4'-phenyl-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4am):

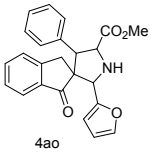


4an

85.5 mg, 90% yield. The ratio of **4am**-A/**4am**-B was 1:0.32 as determined by ^{1}H NMR. **^{1}H NMR** (400 MHz, $CDCl_3$, a mixture of two isomers) δ (ppm): 2.79 (d, *J* = 17.9 Hz, 1H, isomer B), 2.88 (d, *J* = 17.9Hz, 1H, isomer B), 2.91 (d, *J* = 18.2 Hz, 1H, isomer A), 2.96 (d, *J* = 18.2 Hz, 1H, isomer A), 3.32 (s, 3H, isomer A), 3.72 (s, 3H, isomer B), 3.84 (s, 3H, isomer A), 3.84 (s, 3H, isomer B), 3.93 (d, *J* = 7.8 Hz, 1H, isomer A), 4.39 (d, *J* = 9.2 Hz, 1H, isomer B), 4.57 (d, *J* = 9.2 Hz, 1H, isomer B), 5.07 (s, 1H, isomer A), 5.22 (s, 1H, isomer B), 5.42 (d, *J* = 7.8 Hz, 1H, isomer A), 6.76 (d, *J* = 7.6 Hz, 1H, isomer B), 6.93 – 7.04 (m, 3H, for isomer A and

isomer B, overlapped), 7.07 – 7.15 (m, 3H, for isomer A and isomer B, overlapped), 7.28 – 7.43 (m, 10H, for isomer A and isomer B, overlapped), 7.56 (d, *J* = 8.8 Hz, 1H, isomer A), 7.62 -7.64 (m, 2H, for isomer A and isomer B, overlapped), 7.81 (s, 1H, isomer B). **^{13}C NMR** (100 MHz, $CDCl_3$) δ (ppm): 30.5, 35.1, 51.5, 52.5, 54.9, 55.1, 57.1, 58.4, 60.8, 64.8, 65.5, 65.5, 69.3, 71.1, 105.3, 105.4, 118.5, 118.6, 123.2, 123.4, 125.3, 125.4, 125.6, 125.6, 125.7, 126.2, 126.2, 126.4, 126.8, 127.1, 127.1, 127.3, 128.1, 128.2, 128.3, 128.4, 128.6, 128.8, 129.1, 129.3, 129.4, 130.9, 133.0, 133.8, 134.0, 134.5, 134.7, 136.0, 136.4, 137.1, 139.5, 151.4, 157.4, 173.9, 207.6. IR (KBr, cm^{-1}): 3432, 3060, 3031, 3002, 2949, 2845, 1740, 1705, 1632, 1607, 1487, 1461, 1437, 1386, 1327, 1267, 1214, 1175, 1120, 1032, 955, 906, 855, 811, 763, 705, 672, 564, 476. **HRMS (ESI-TOF)** calcd for $C_{31}H_{28}NO_4$ ($[M+H]^+$): 478.2013, found: 478.2025.

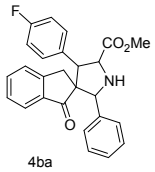
Methyl-2'-(furan-2-yl)-1-oxo-4'-phenyl-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4an):



4ao

46.3 mg, 61% yield. **^{1}H NMR** (400 MHz, $CDCl_3$) δ (ppm): 2.72 (d, *J* = 17.7 Hz, 1H), 2.78 (d, *J* = 17.7 Hz, 1H), 3.43 (s, 3H), 4.08 (d, *J* = 8.6 Hz, 1H), 4.61 (d, *J* = 8.6 Hz, 1H), 4.72 (s, 1H), 6.20 (s, 2H), 7.07 (d, *J* = 7.6 Hz, 1H), 7.16 – 7.25 (m, 6H), 7.29 (d, *J* = 7.5 Hz, 1H), 7.42 (t, *J* = 7.4 Hz, 1H), 7.71 (d, *J* = 7.4 Hz, 1H). **^{13}C NMR** (100 MHz, $CDCl_3$) δ (ppm): 33.4, 51.6, 55.8, 64.1, 64.5, 64.9, 108.0, 110.0, 124.0, 125.7, 127.2, 127.3, 128.2, 129.5, 134.9, 135.3, 137.4, 142.0, 152.1, 153.6, 172.4, 208.2. IR (KBr, cm^{-1}): 3344, 3062, 3031, 2949, 2924, 2852, 1960, 1895, 1817, 1740, 1704, 1606, 1494, 1458, 1435, 1371, 1326, 1291, 1212, 1150, 1114, 1075, 1036, 928, 869, 843, 759, 703, 665, 581, 544, 469. **HRMS (ESI-TOF)** calcd for $C_{24}H_{22}NO_4$ ($[M+H]^+$): 388.1543, found: 388.1536.

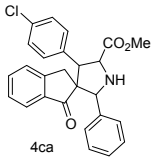
Methyl-4'-(4-fluorophenyl)-1-oxo-2'-phenyl-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4ba):



4ba

66.2 mg, 80% yield. The ratio of **4ba**-A/**4ba**-B/**4ba**-C was 1:0.24:0.23 as determined by ^{1}H NMR. **^{1}H NMR** (400 MHz, $CDCl_3$, a mixture of three isomers) δ (ppm): 2.68 (d, *J* = 11.6 Hz, 2H, isomer C), 2.73 (d, *J* = 10.8 Hz, 1H, isomer A), 2.79 (d, *J* = 21.2 Hz, 1H, isomer A), 2.87 (s, 2H, isomer B), 3.35 (s, 3H, isomer C), 3.67 (s, 3H, isomer B), 3.70 (s, 3H, isomer A), 3.74 (d, *J* = 10.2 Hz, 1H, isomer C), 3.91 (d, *J* = 7.8 Hz, 1H, isomer B), 4.32 (d, *J* = 9.3 Hz, 1H, isomer A), 4.46 (d, *J* = 9.3 Hz, 1H, isomer A), 4.75 (s, 1H, isomer C), 4.83 (d, *J* = 10.2 Hz, 1H, isomer C), 4.90 (s, 1H, isomer B), 5.06 (s, 1H, isomer A), 5.37 (d, *J* = 7.8 Hz, 1H, isomer B), 6.76 – 6.88 (m, 3H, for isomer A, isomer B and isomer C, overlapped), 7.00 – 7.26 (m, 13H, for isomer A, isomer B and isomer C, overlapped), 7.32 – 7.40 (m, 2H, for isomer A, isomer B and isomer C, overlapped), 7.51 (d, *J* = 7.8 Hz, 1H, isomer B), 7.62 (d, *J* = 7.6 Hz, 1H, isomer A). **^{13}C NMR** (100 MHz, $CDCl_3$) δ (ppm): 29.6, 35.2, 35.9, 51.5, 52.1, 52.4, 54.0, 56.0, 57.3, 61.0, 62.6, 64.8, 65.0, 65.4, 65.4, 66.8, 69.3, 71.2, 115.0, 115.2, 115.3, 115.5, 123.3, 123.4, 123.6, 125.4, 125.7, 126.7, 126.9, 127.2, 127.4, 127.5, 127.6, 127.7, 127.9, 128.5, 129.6, 129.6, 130.3, 130.4, 130.6, 130.7, 132.2, 132.3, 134.5, 134.8, 134.8, 135.2, 136.0, 137.1, 138.1, 151.1, 152.1, 153.6, 160.5, 163.0, 173.6, 173.9, 175.0, 207.3. IR (KBr, cm^{-1}): 3428, 3064, 3033, 2950, 2854, 1737, 1704, 1608, 1493, 1460, 1434, 1328, 1286, 1227, 1104, 1096, 1013, 910, 872, 841, 759, 701, 649, 586, 471. **HRMS (ESI-TOF)** calcd for $C_{26}H_{23}FNO_3$ ($[M+H]^+$): 416.1656, found: 416.1653.

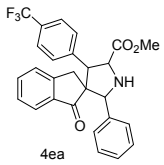
Methyl-4'-(4-chlorophenyl)-1-oxo-2'-phenyl-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4ca):



4ca

65.6mg, 76% yield. The ratio of **4ca**-A/**4ca**-B/**4ca**-C was 1:0.29:0.16 as determined by ^{1}H NMR. **^{1}H NMR** (400 MHz, $CDCl_3$, a mixture of three isomers) δ (ppm): 2.69 (d, *J* = 17.6 Hz, 1H, isomer A), 2.79 (d, *J* = 17.6 Hz, 2H, isomer C), 2.85 (d, *J* = 17.6 Hz, 1H, isomer A), 2.86 (s, 2H, isomer B), 3.37 (s, 3H, isomer C), 3.68 (s, 3H, isomer B), 3.71 (s, 3H, isomer A), 3.82 (d, *J* = 10.2 Hz, 1H, isomer B), 3.89 (d, *J* = 7.7 Hz, 1H, isomer C), 4.32 (d, *J* = 9.2 Hz, 1H, isomer A), 4.46 (d, *J* = 9.2 Hz, 1H, isomer A), 4.74 (s, 1H, isomer B), 4.83 (d, *J* = 10.2 Hz, 1H, isomer B), 4.88 (s, 1H, isomer C), 5.04 (s, 1H, isomer A), 5.39 (d, *J* = 7.7 Hz, 1H, isomer C), 6.87 (d, *J* = 7.7 Hz, 1H, isomer A), 7.06 – 7.17 (m, 10H, for isomer A and isomer B and isomer C, overlapped), 7.21 – 7.25 (m, 4H, for isomer A and isomer B and isomer C, overlapped), 7.33 – 7.40 (m, 2H, for isomer A and isomer B and isomer C, overlapped), 7.53 (d, *J* = 7.6 Hz, 1H, isomer B), 7.62 (d, *J* = 7.6 Hz, 1H, isomer A). **^{13}C NMR** (100 MHz, $CDCl_3$) δ (ppm): 29.6, 35.2, 35.8, 51.6, 52.2, 52.5, 54.1, 55.9, 57.3, 60.9, 62.6, 64.7, 65.0, 65.3, 65.4, 67.0, 69.5, 71.2, 123.3, 123.4, 123.7, 125.4, 125.7, 125.7, 126.7, 126.9, 127.0, 127.2, 127.4, 127.6, 127.6, 127.7, 127.9, 128.3, 128.4, 128.6, 128.7, 129.5, 130.2, 130.4, 132.9, 133.3, 133.7, 134.6, 134.8, 134.9, 135.2, 136.0, 137.0, 138.0, 142.5, 151.1, 152.1, 153.3, 160.8, 173.6, 175.0, 207.2. IR (KBr, cm^{-1}): 3388, 3070, 3033, 2952, 2926, 2853, 1738, 1707, 1631, 1602, 1521, 1439, 1346, 1275, 1212, 1109, 1015, 921, 854, 800, 757, 701, 632, 510, 472. **HRMS (ESI-TOF)** calcd for $C_{26}H_{23}ClNO_3$ ($[M+H]^+$): 432.1361, found: 432.1359.

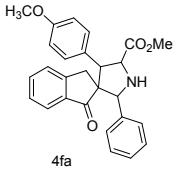
Methyl-1-oxo-2'-phenyl-4'-(4-(trifluoromethyl)phenyl)-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4ea)



4ea

72.7 mg, 78% yield. The ratio of **4ea**-A/4**ea**-B was 1:0.31 as determined by ^{1}H NMR. **^{1}H NMR** (400 MHz, $CDCl_3$, a mixture of two isomers) δ (ppm): 2.65 (d, *J* = 17.2 Hz, 1H, isomer A), 2.72 (d, *J* = 18.0 Hz, 1H, isomer B), 2.82 (d, *J* = 18.0 Hz, 1H, isomer B), 2.87 (d, *J* = 17.2 Hz, 1H, isomer A), 3.69 (s, 3H, isomer B), 3.72 (s, 3H, isomer A), 3.82 (d, *J* = 10.0 Hz, 1H, isomer B), 4.41 (d, *J* = 8.8 Hz, 1H, isomer A), 4.53 (d, *J* = 8.8 Hz, 1H, isomer A), 4.78 (s, 1H, isomer B), 4.89 (d, *J* = 10.0 Hz, 1H, isomer B), 5.04 (s, 1H, isomer A), 6.85 (d, *J* = 7.6 Hz, 1H, isomer A), 7.04 – 7.18 (m, 5H, for isomer A and isomer B, overlapped), 7.18 – 7.24 (m, 4H, for isomer A and isomer B, overlapped), 7.27 – 7.39 (m, 6H, for isomer A and isomer B, overlapped), 7.43 (d, *J* = 8.2 Hz, 2H, isomer A), 7.51 (d, *J* = 7.8 Hz, 1H, isomer B), 7.63 (d, *J* = 7.6 Hz, 1H, isomer A). **^{13}C NMR** (100 MHz, $CDCl_3$) δ (ppm): 29.7, 35.9, 52.2, 52.5, 56.0, 57.6, 60.8, 62.6, 65.2, 65.4, 67.0, 69.6, 122.5, 123.4, 123.7, 125.2, 125.2, 125.7, 126.7, 126.9, 127.1, 127.5, 127.5, 127.6, 127.6, 127.8, 128.5, 128.6, 129.2, 134.9, 135.0, 135.9, 137.0, 137.8, 139.6, 141.0, 142.3, 152.0, 153.4, 173.6, 174.9, 206.9, 207.6. IR (KBr, cm^{-1}): 3431, 3062, 3032, 2949, 2925, 2852, 1740, 1705, 1606, 1488, 1460, 1436, 1379, 1327, 1279, 1214, 1123, 1074, 1012, 922, 828, 799, 757, 703, 671, 513, 471. **HRMS (ESI-TOF)** calcd for $C_{27}H_{23}F_3NO_3$ ($[M+H]^+$): 466.1625, found: 466.1627.

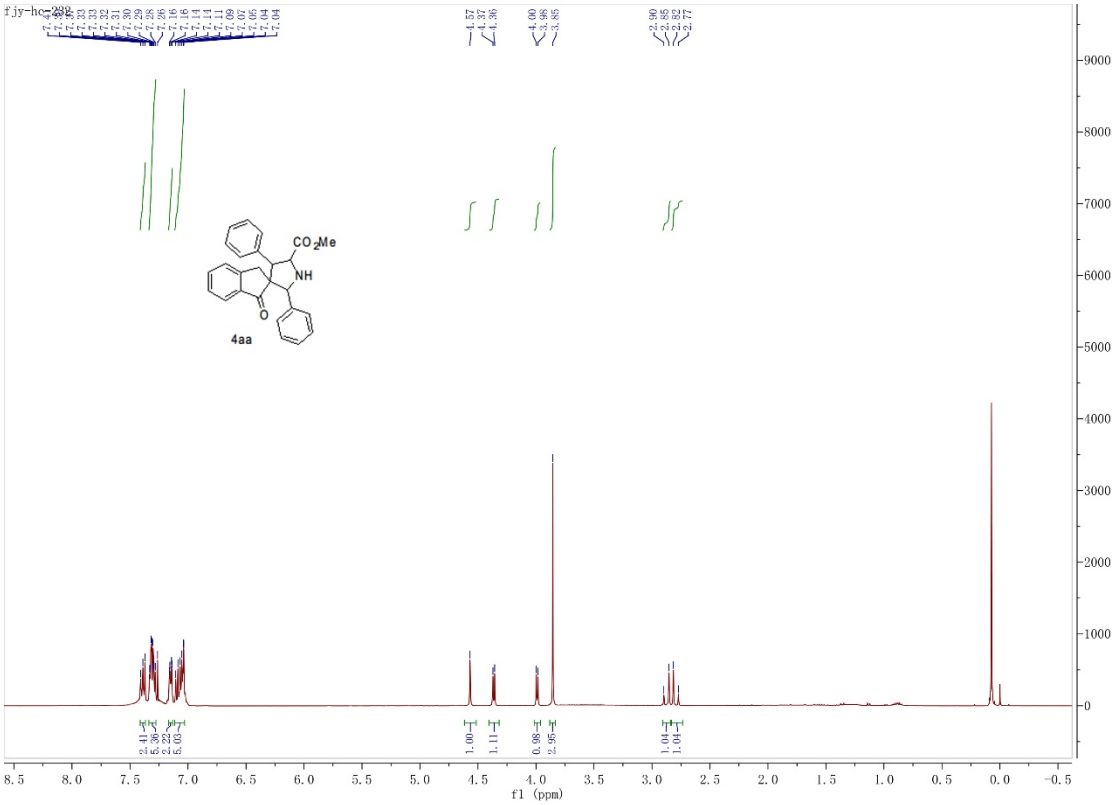
Methyl-4'-(4-methoxyphenyl)-1-oxo-2'-phenyl-1,3-dihydrospiro[indene-2,3'-pyrrolidine]-5'-carboxylate (4fa):

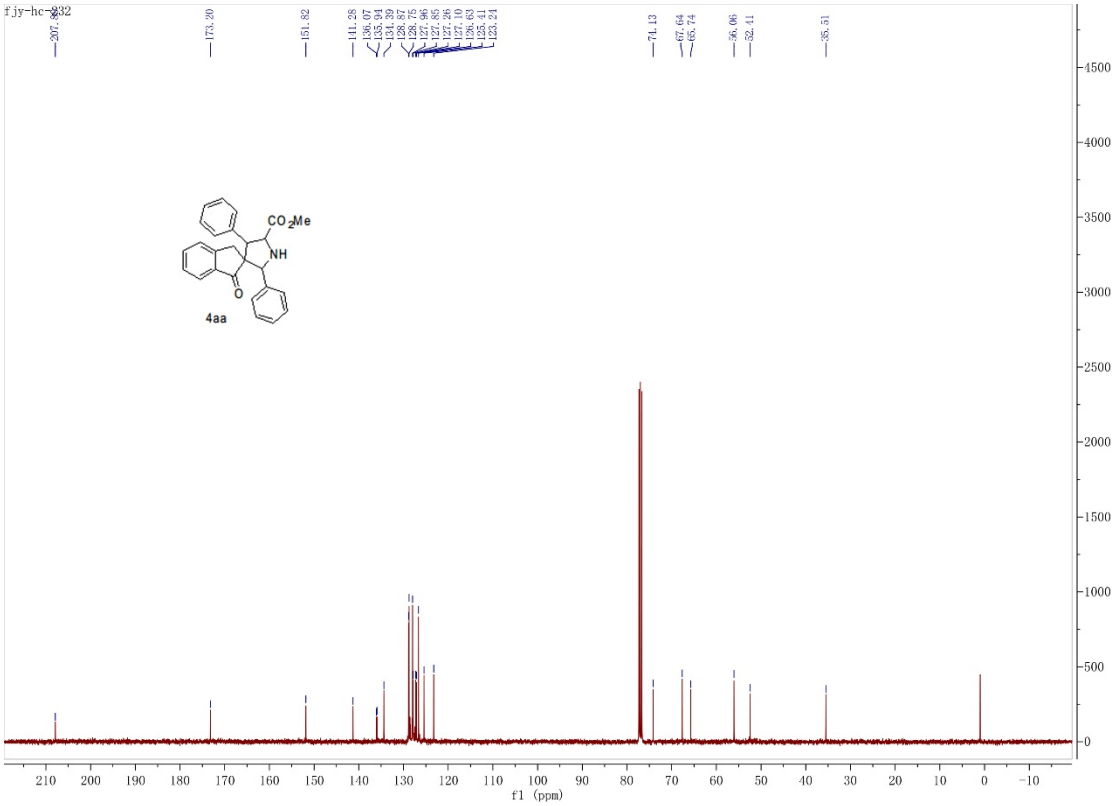


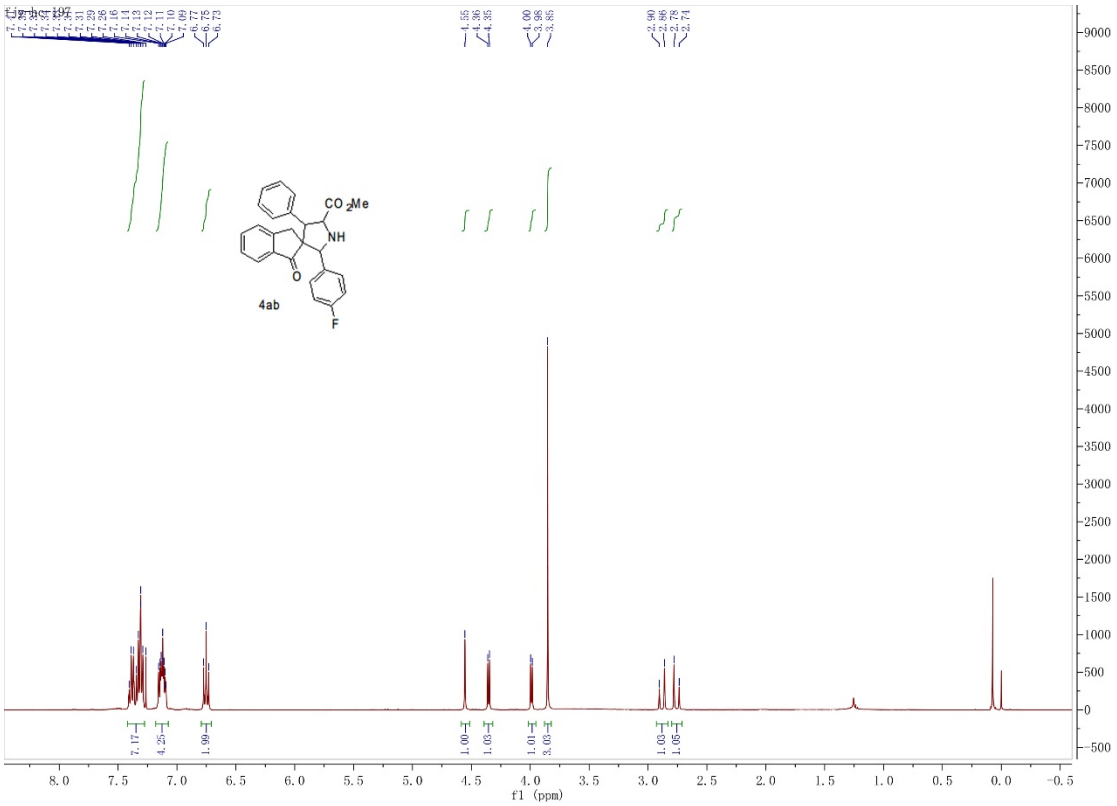
4fa

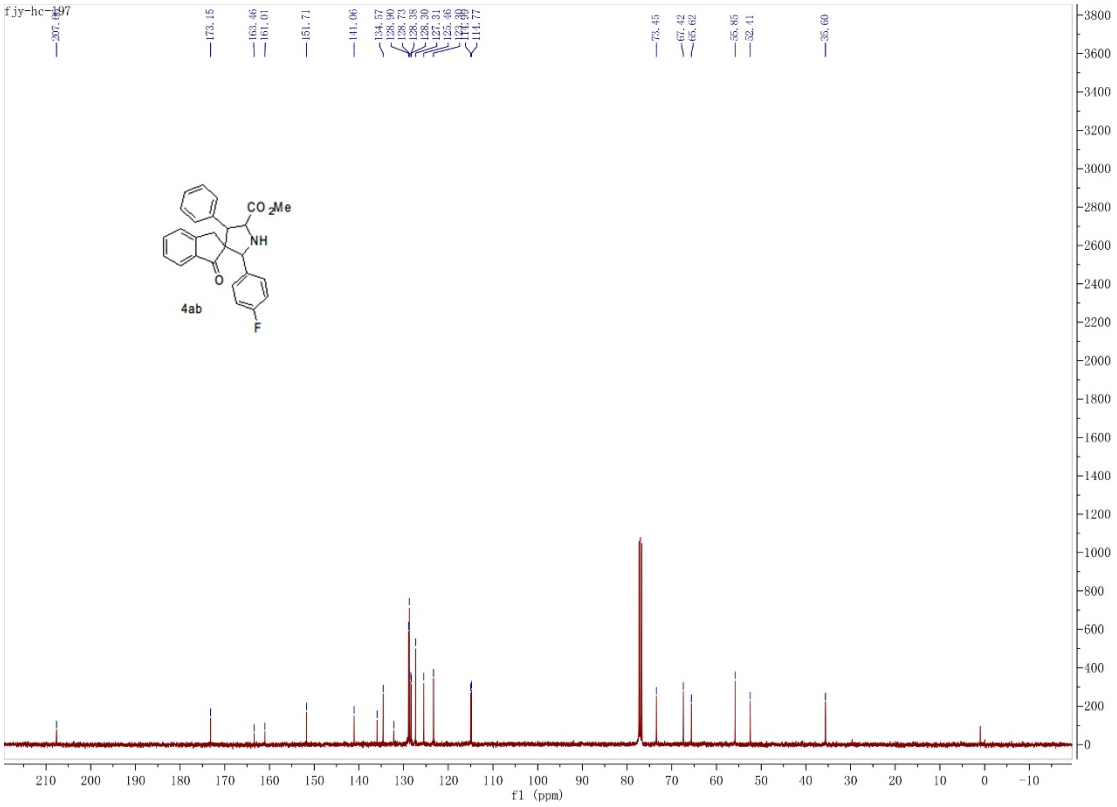
54.5 mg, 64% yield. The ratio of **4fa**-A/**4fa**-B/**4fa**-C was 1:0.43:0.17 as determined by ^{1}H NMR. **^{1}H NMR** (400 MHz, $CDCl_3$, a mixture of three isomers) δ (ppm): 2.74 (d, *J* = 8.4 Hz, 2H, isomer A), 2.80 (d, *J* = 8.0 Hz, 2H, isomer C), 2.83 (d, *J* = 8.0 Hz, 2H, isomer B), 3.35 (s, 3H, isomer B), 3.66 (s, 3H, isomer C), 3.67 (s, 3H, isomer C), 3.69 (s, 3H, isomer A), 3.70 (s, 3H, isomer A), 3.82 (s, 3H, isomer B), 3.87 (d, *J* = 7.9 Hz, 1H, isomer B), 4.31 (d, *J* = 9.3 Hz, 1H, isomer A), 4.46 (d, *J* = 9.3 Hz, 1H, isomer A), 4.72 (s, 1H, isomer C), 4.84 (d, *J* = 10.2 Hz, 1H, isomer C), 4.92 (s, 1H, isomer B), 5.05 (s, 1H, isomer A), 5.34 (d, *J* = 7.9 Hz, 1H, isomer B), 6.63 (d, *J* = 8.7 Hz, 1H, isomer B), 6.69 (d, *J* = 8.7 Hz, 2H, isomer A), 6.87 (t, *J* = 7.5 Hz, 2H, isomer A), 7.00 – 7.10 (m, 5H, for isomer A and isomer B and isomer C, overlapped), 7.12 – 7.15 (m, 3H, for isomer A and isomer B and isomer C, overlapped), 7.18 – 7.24 (m, 5H, for isomer A and isomer B and isomer C, overlapped), 7.32 – 7.40 (m, 2H, for isomer A and isomer B and isomer C, overlapped), 7.53 (d, *J* = 7.7 Hz, 1H, isomer C), 7.61 (d, *J* = 7.6 Hz, 1H, isomer A). **^{13}C NMR** (100 MHz, $CDCl_3$) δ (ppm): 29.3, 35.0, 35.6, 45.7, 51.2, 52.1, 54.0, 54.8, 54.8, 55.0, 56.1, 60.8, 61.2, 62.6, 64.7, 64.8, 65.3, 65.4, 66.7, 69.2, 70.8, 113.3, 113.3, 113.6, 122.9, 123.0, 123.2, 125.3, 125.5, 126.6, 126.9, 127.0, 127.1, 127.2, 127.3, 127.5, 127.6, 128.3, 128.3, 129.0, 129.7, 130.0, 130.2, 131.2, 134.2, 134.4, 136.0, 136.0, 137.0, 138.1, 138.2, 151.3, 152.1, 153.6, 158.3, 158.5, 173.6, 175.1, 207.2. IR (KBr, cm^{-1}): 3425, 3330, 3063, 3033, 2926, 2854, 1741, 1706, 1607, 1498, 1462, 1437, 1377, 1326, 1281, 1219, 1152, 1122, 1069, 1015, 957, 887, 813, 759, 706, 677, 602, 557. **HRMS (ESI-TOF)** calcd for $C_{27}H_{26}NO_3$ ($[M+H]^+$): 428.1856, found: 428.1854.

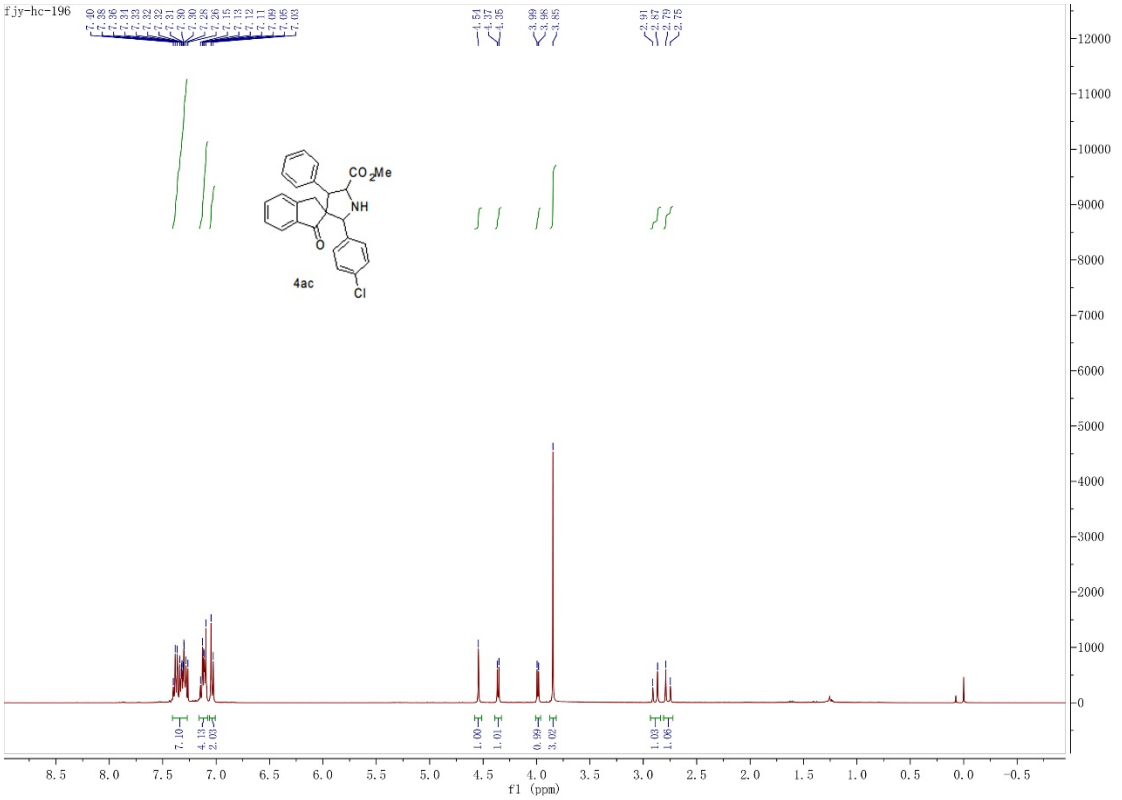
Selected NMR spectra

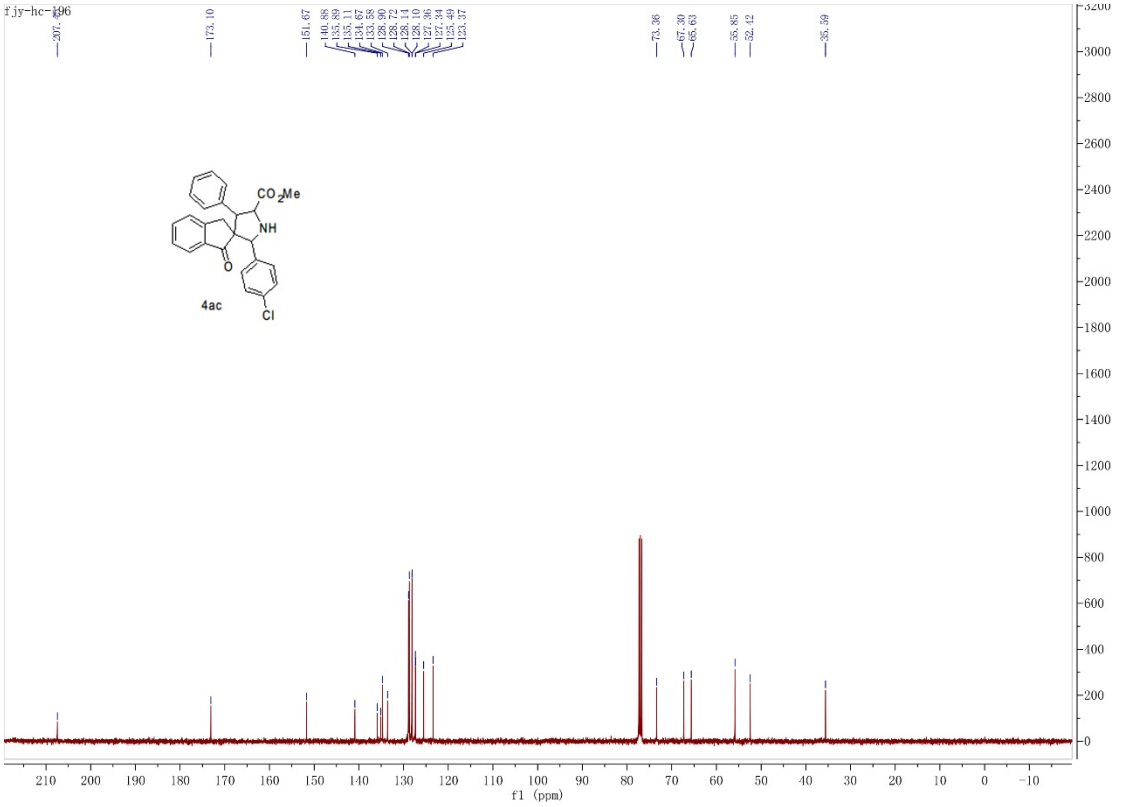


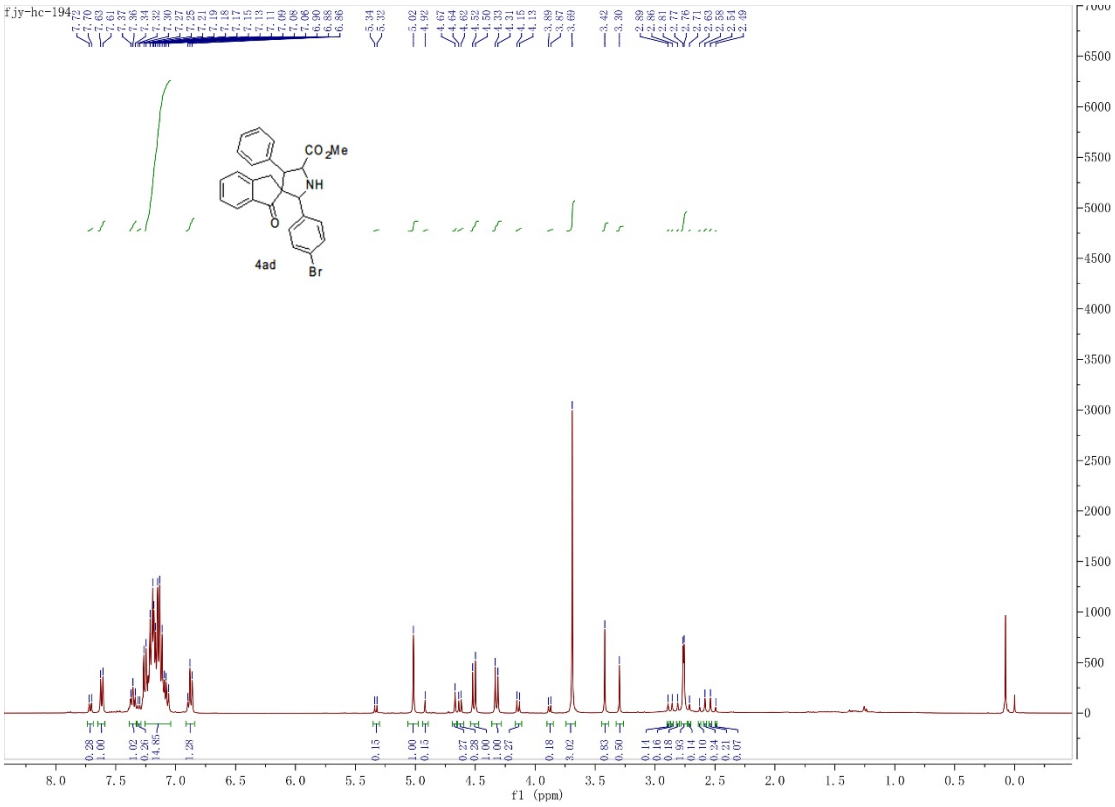


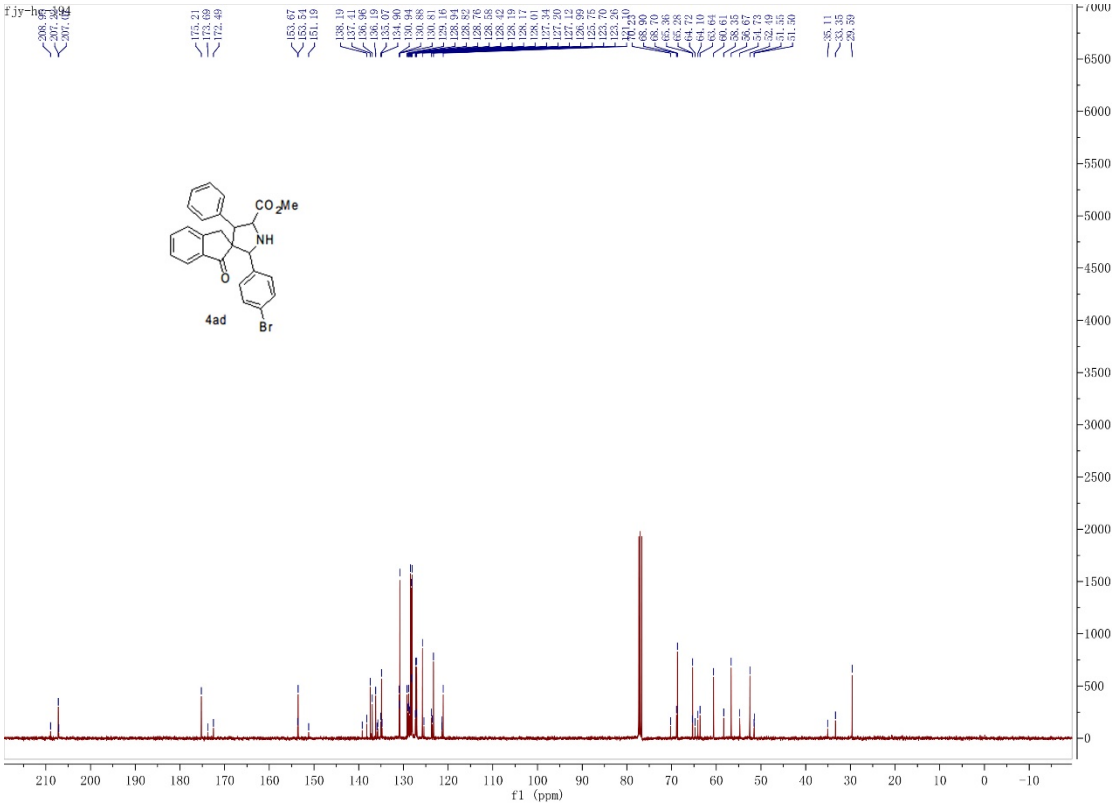

4ab
f1 (ppm)

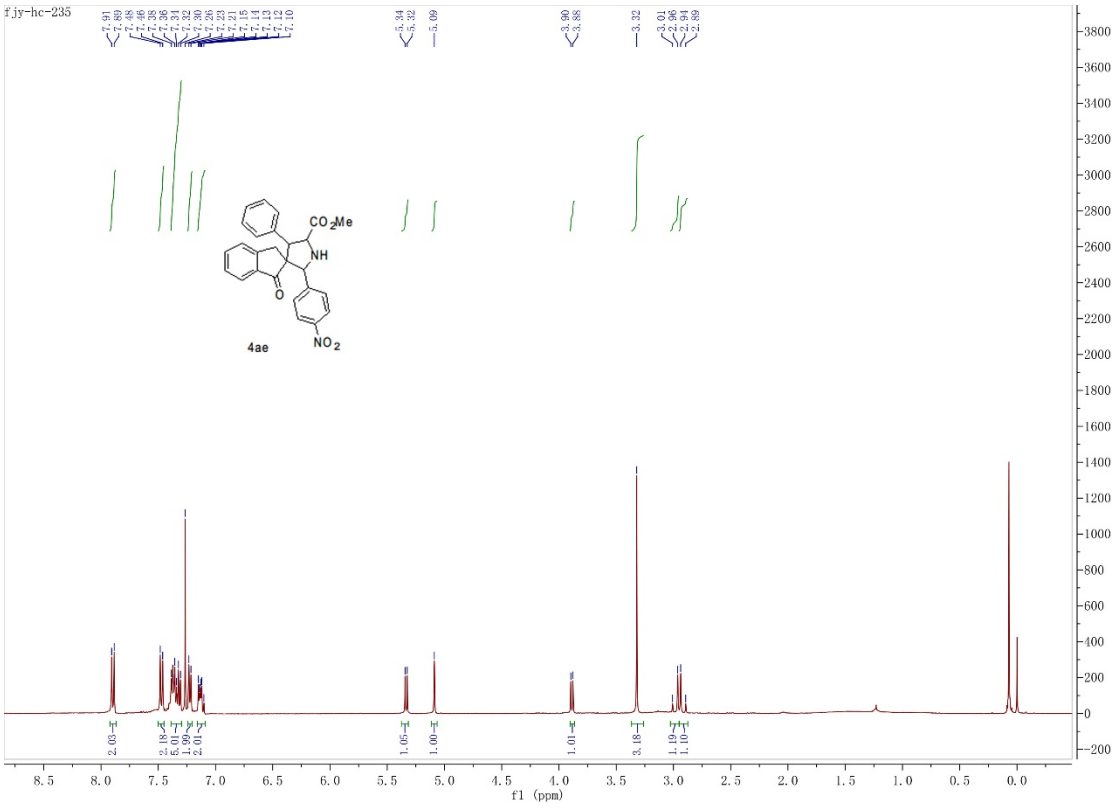

4ab
f1 (ppm)

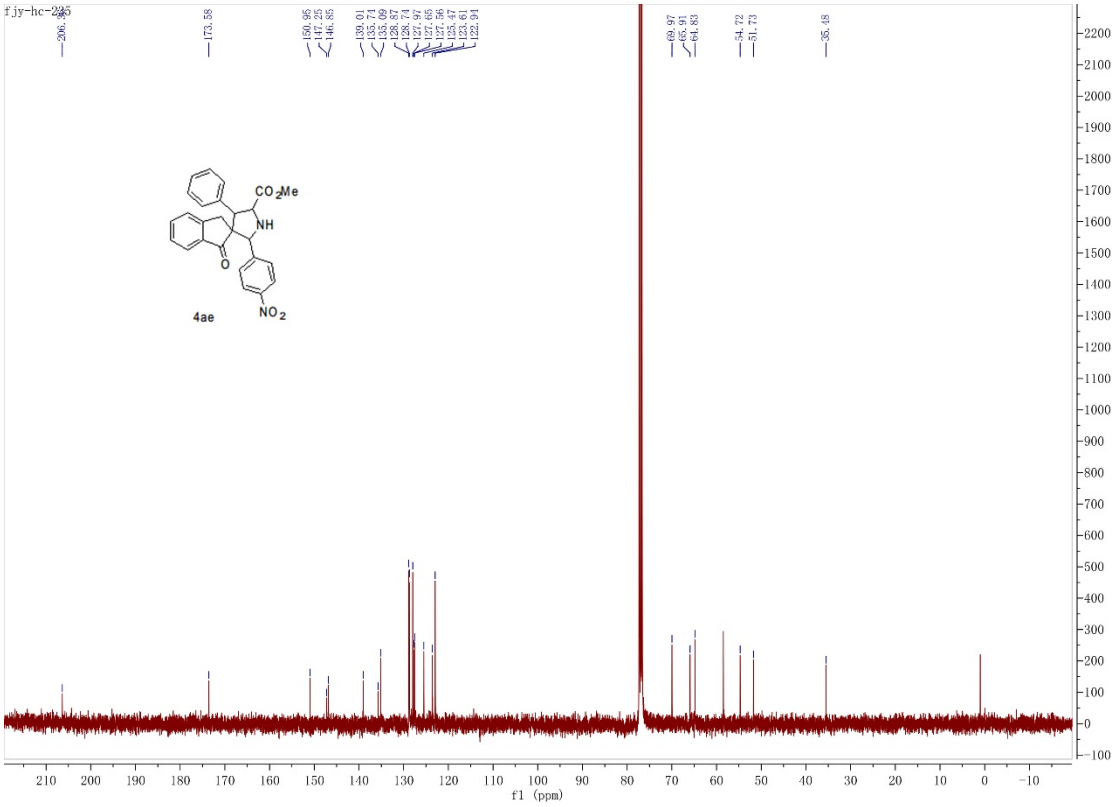

fjy-hc-196
7.40
7.38
7.36
7.34
7.33
7.32
7.31
7.30
7.28
7.26
7.15
7.13
7.12
7.11
7.09
7.07
7.05
4.54
4.37
4.35
3.99
3.98
3.85
2.91
2.87
2.79
2.75
CO2Me
NH
O
Cl
4ac
7.10
4.13
2.03
1.00
1.01
0.99
3.02
1.03
1.06
f1 (ppm)

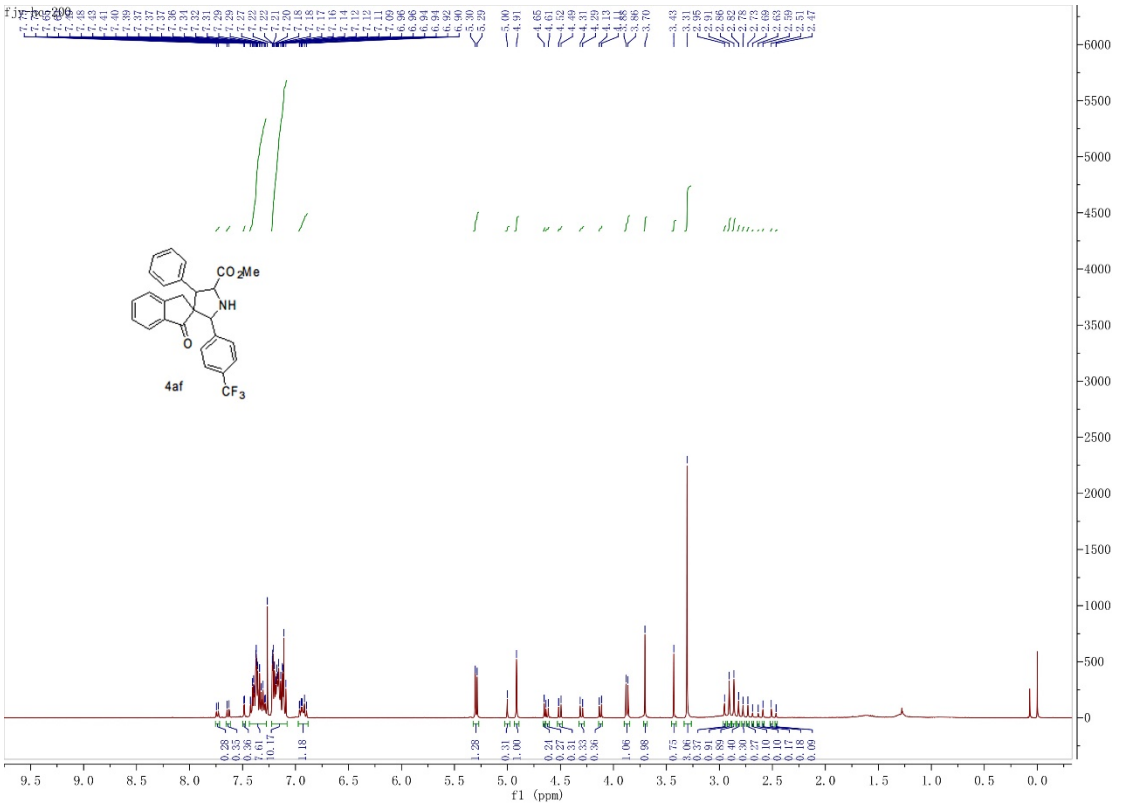

fjy-hc-196
207.76
173.10
151.67
140.88
135.89
135.11
134.67
133.58
128.90
128.72
128.14
128.10
127.36
127.34
125.49
123.37
73.36
67.30
65.63
55.85
52.42
35.59
CO2Me
NH
O
Cl
4ac
f1 (ppm)

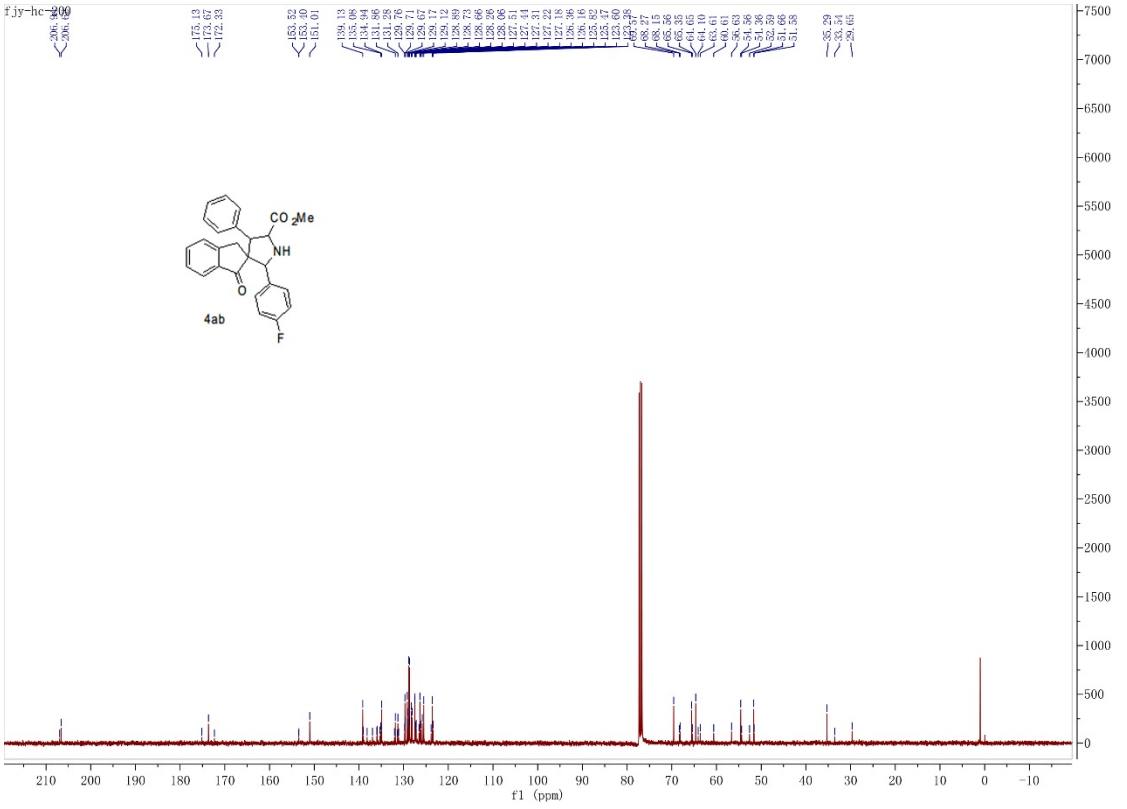

fjy-hc-194
CO2Me
NH
O
4ad
Br
f1 (ppm)

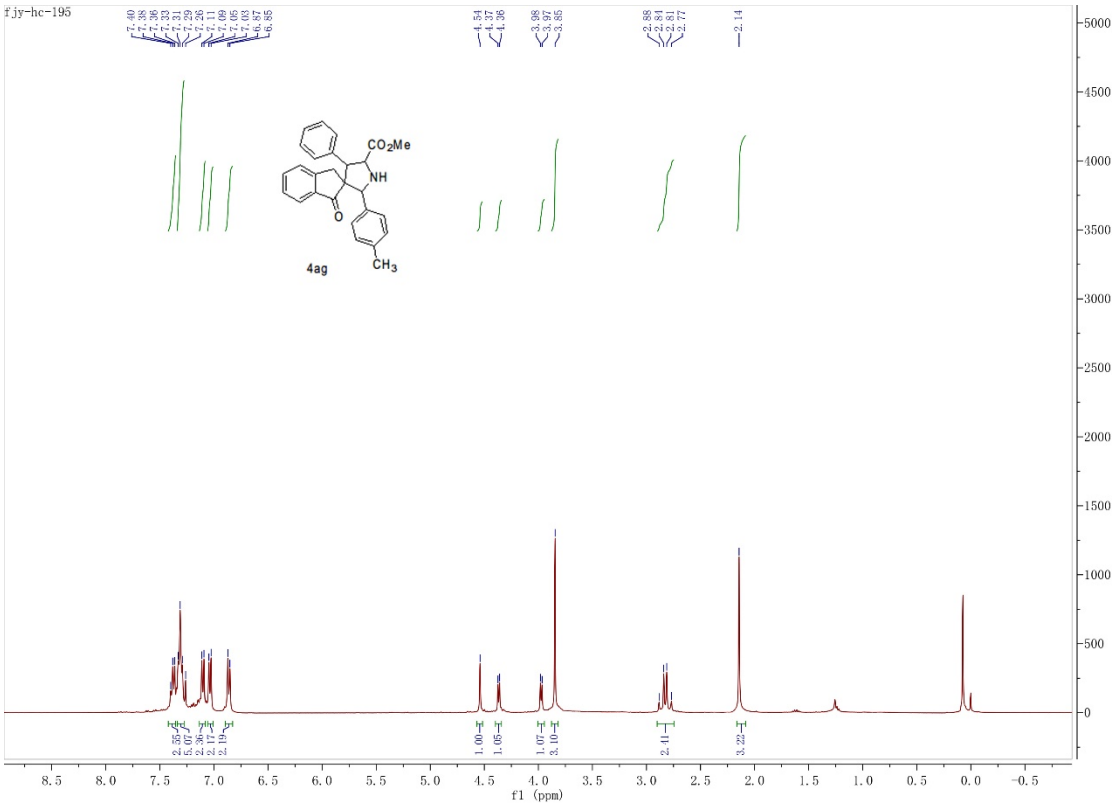

fjy-hc-194
CO2Me
NH
O
4ad
Br
f1 (ppm)

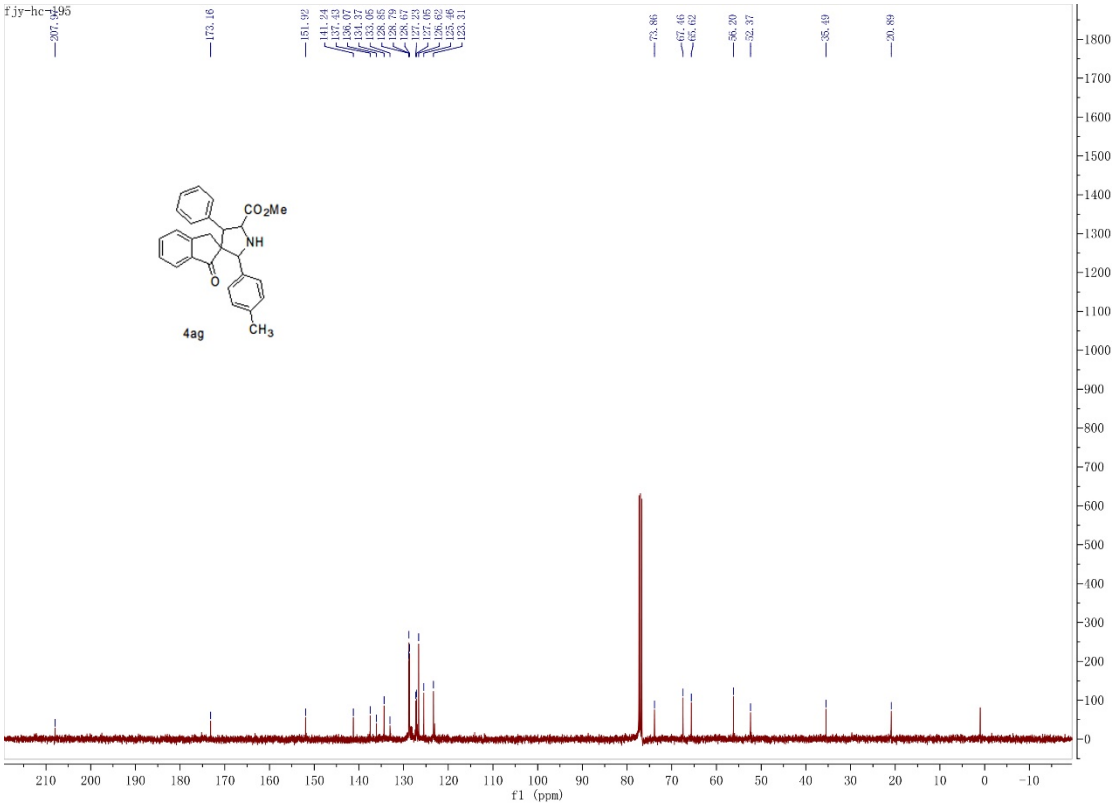

fjy-hc-235
7.91
7.89
7.48
7.46
7.38
7.36
7.34
7.32
7.30
7.26
7.23
7.21
7.15
7.14
7.13
7.12
7.10
5.34
5.32
5.09
3.90
3.88
3.32
3.01
2.98
2.94
2.89
CO2Me
NH
O
NO2
4ae
2.03
2.18
5.01
1.99
2.01
1.05
1.00
1.01
3.18
1.19
1.10
f1 (ppm)

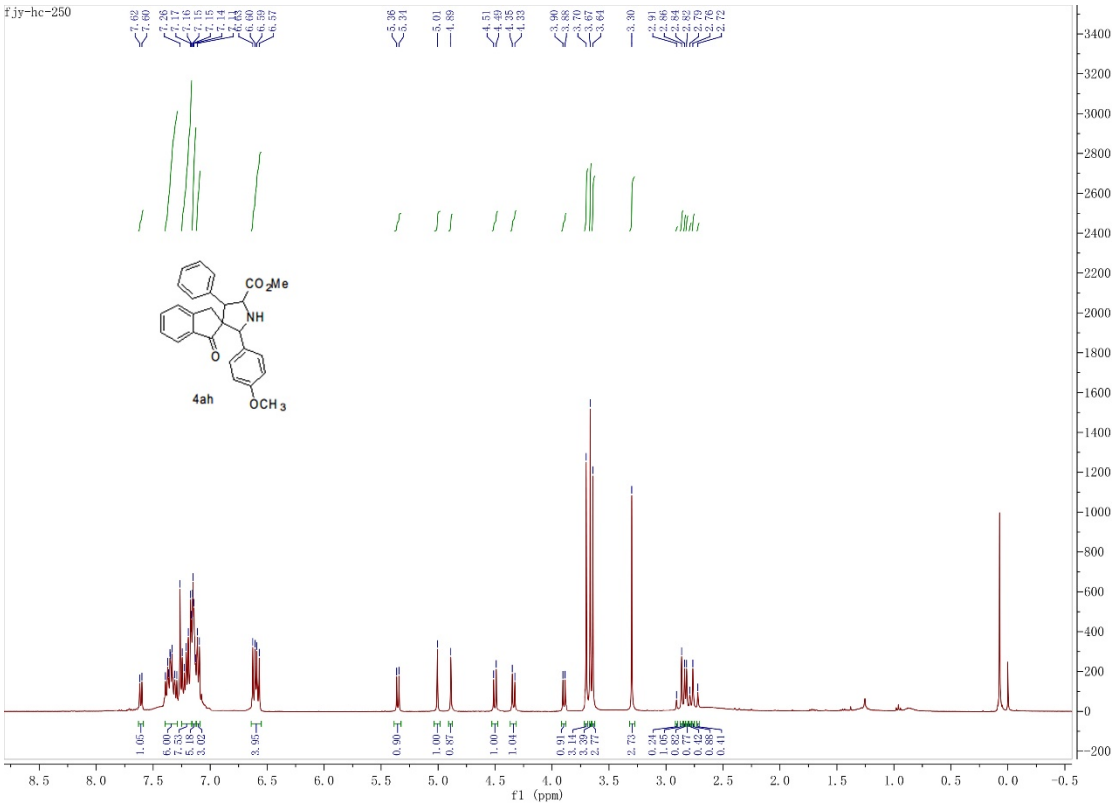

fjy-hc-235
206.85
173.58
150.95
147.25
146.85
139.01
133.74
130.09
128.87
128.74
127.97
127.65
127.56
125.47
123.61
122.94
69.97
65.91
64.83
54.72
51.73
35.48
CO2Me
NH
O
NO2
4ae
f1 (ppm)

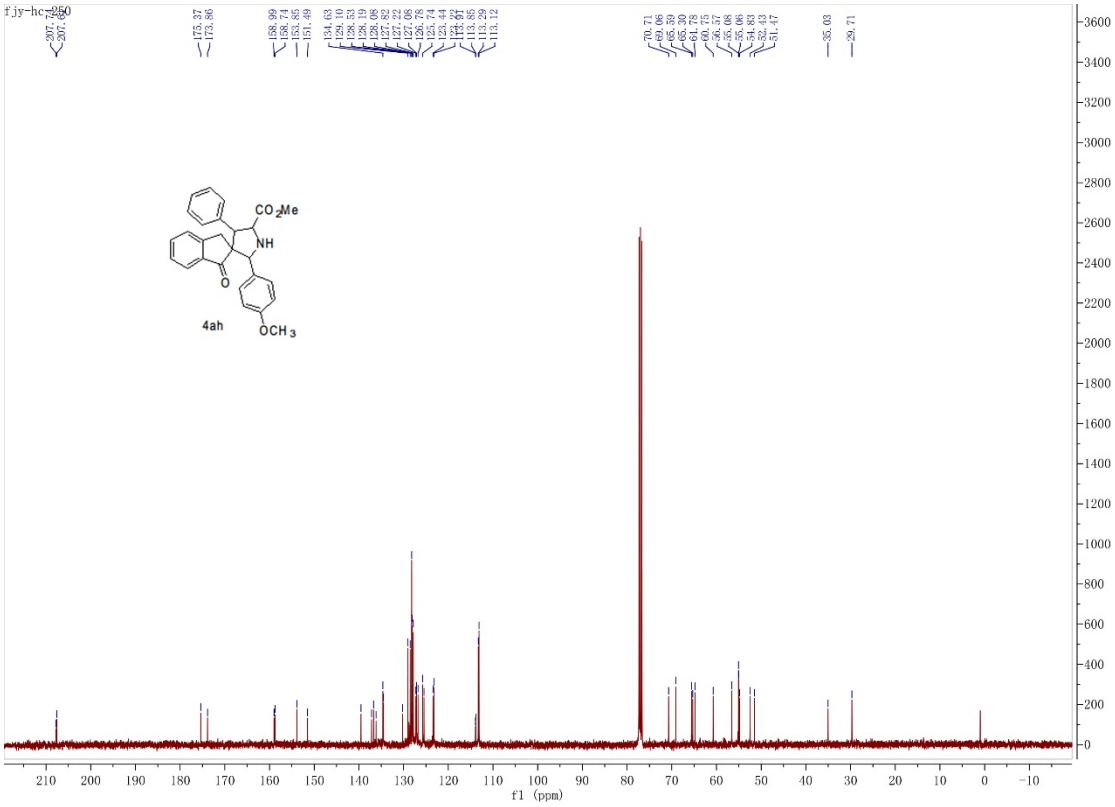

fjy-hc-200
CO2Me
NH
O
4af
CF3
f1 (ppm)

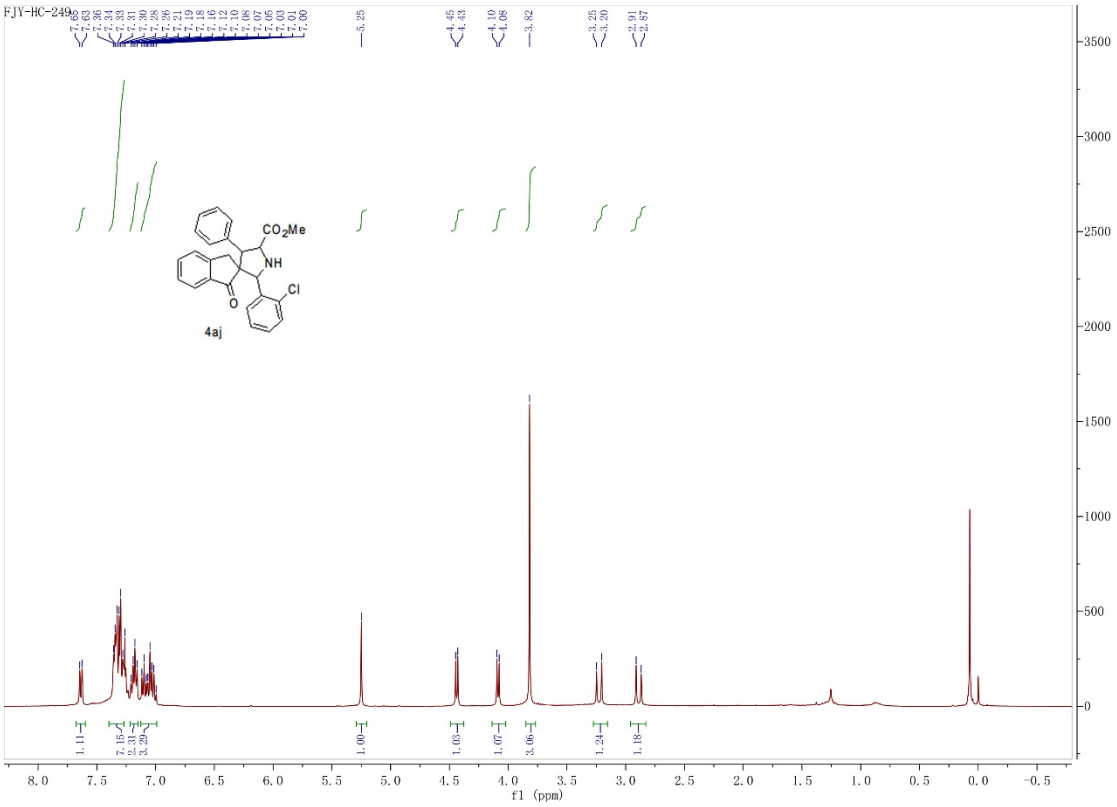

fjy-hc-200
CO2Me
NH
O
4ab
F
f1 (ppm)

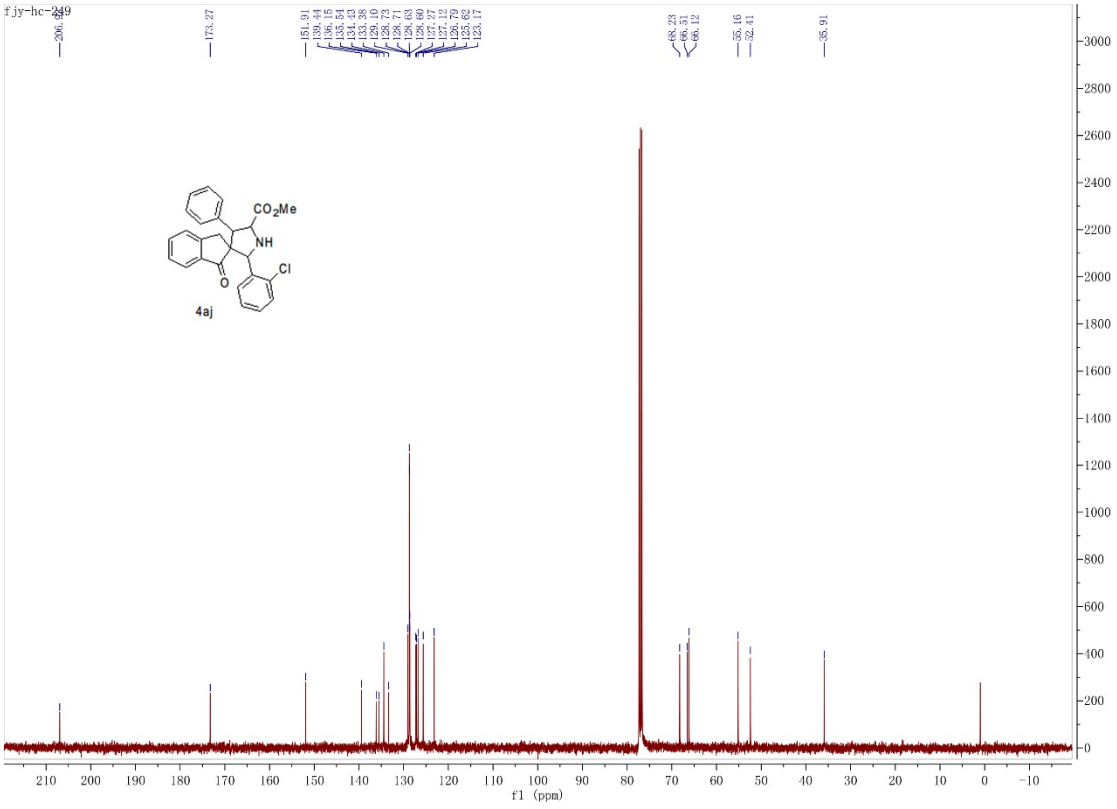

fjy-hc-195
7.40
7.38
7.36
7.33
7.31
7.29
7.26
7.11
7.09
7.05
7.03
6.87
6.85
4.54
4.37
4.36
3.98
3.97
3.85
2.88
2.84
2.81
2.77
2.14
CO2Me
NH
O
CH3
4ag
2.55
5.07
2.36
2.17
2.19
1.00
1.05
1.07
3.10
2.11
3.22
f1 (ppm)

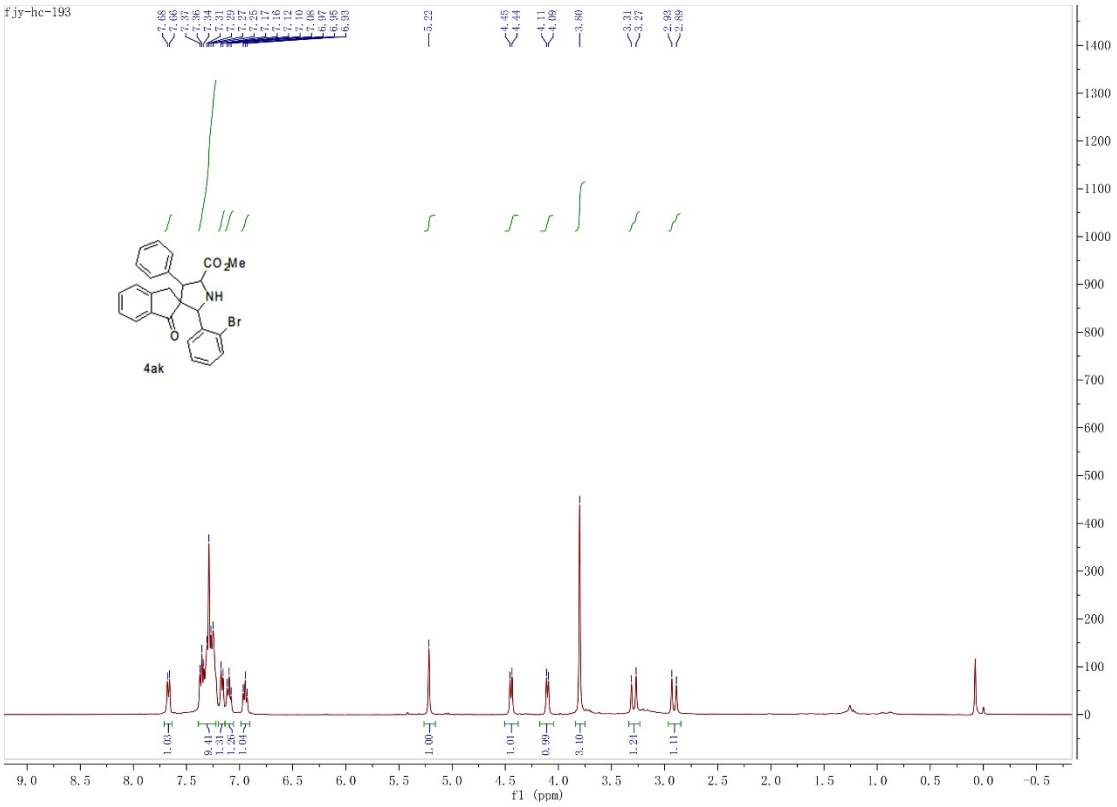

fjy-hc-195
207.94
173.16
151.92
141.24
137.43
136.07
134.37
133.06
128.85
128.79
128.67
127.23
127.05
126.62
125.46
123.31
73.86
67.46
65.62
56.20
52.37
35.49
20.89
CO2Me
NH
O
CH3
4ag
f1 (ppm)

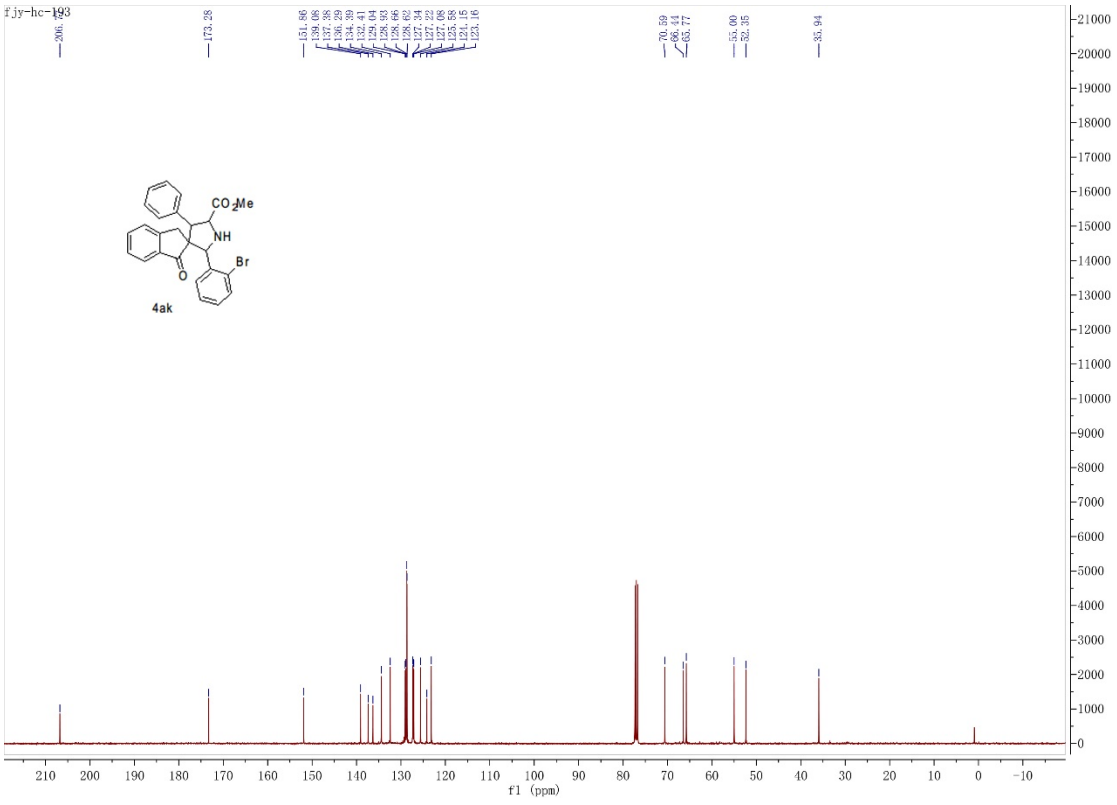

fjy-hc-250
CO2Me
NH
O
OCH3
4ah
f1 (ppm)

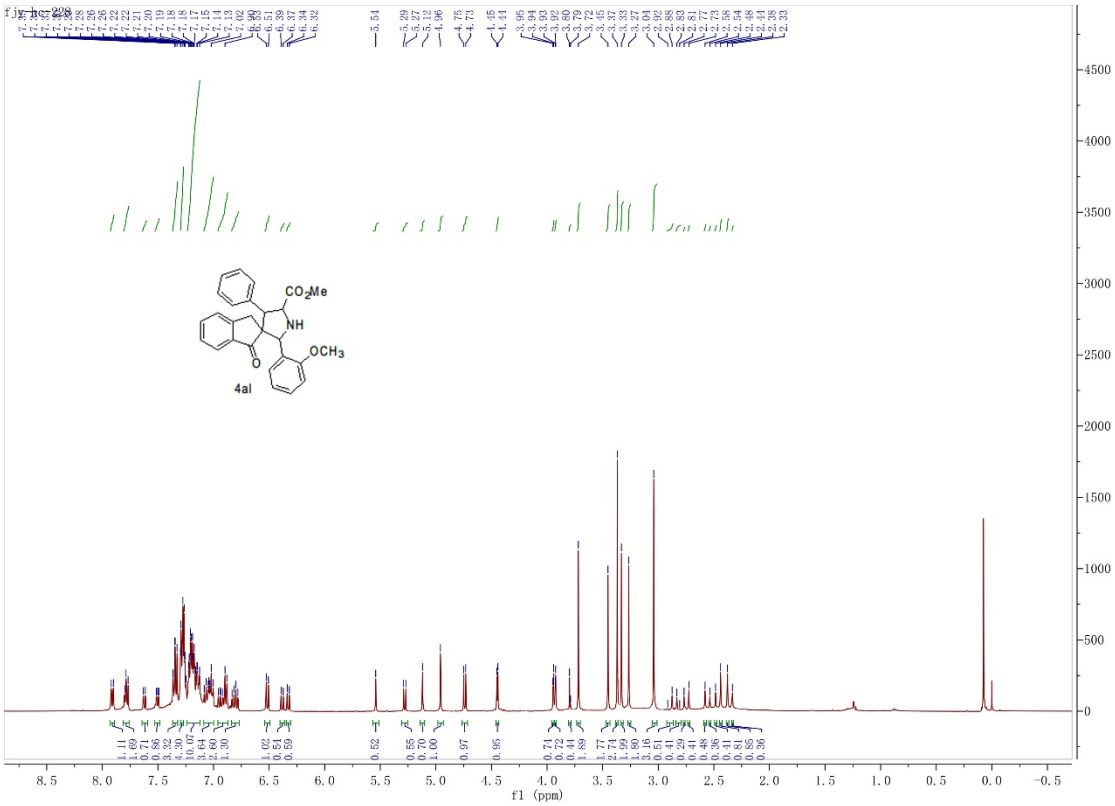

fjy-hc-250
CO2Me
NH
O
OCH3
4ah
f1 (ppm)

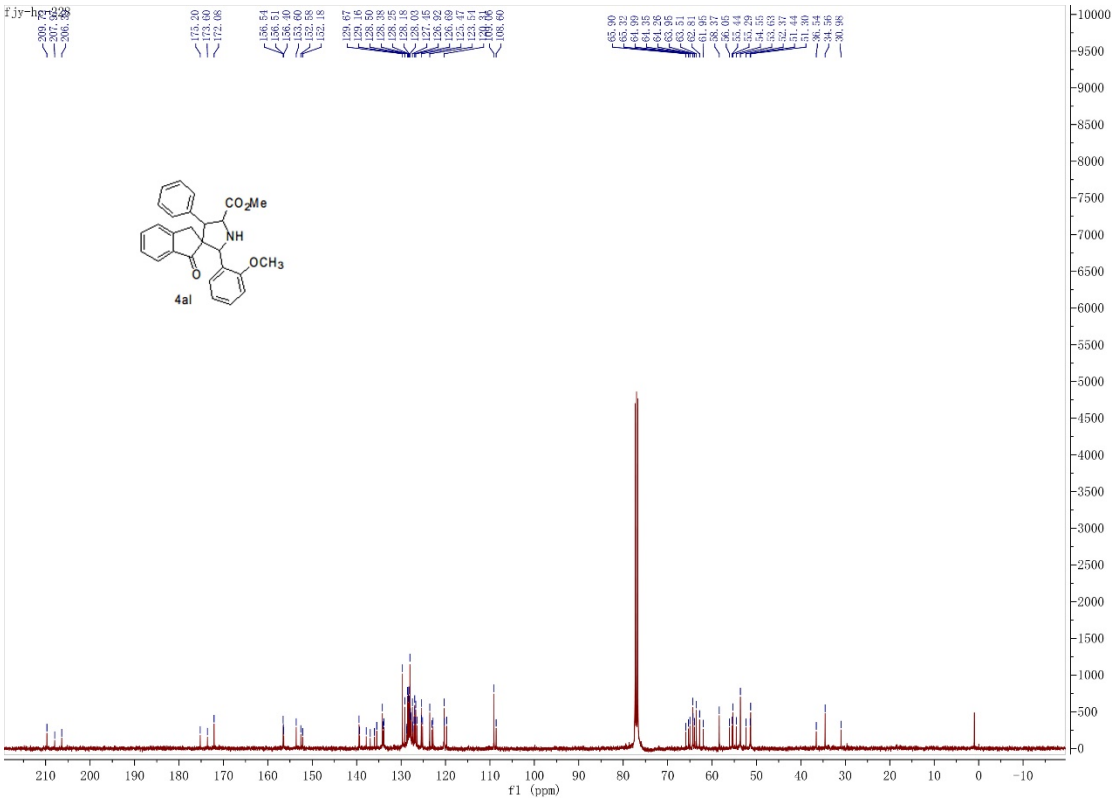

FJY-HC-249
7.65
7.63
7.38
7.36
7.34
7.33
7.31
7.30
7.28
7.26
7.21
7.19
7.18
7.16
7.12
7.10
7.08
7.07
7.05
7.03
7.01
7.00
5.25
4.45
4.43
4.10
4.08
3.82
3.25
3.20
2.91
2.87
CO2Me
NH
Cl
O
4aj
1.11
7.15
2.31
3.29
1.00
1.03
1.07
3.06
1.24
1.18
f1 (ppm)

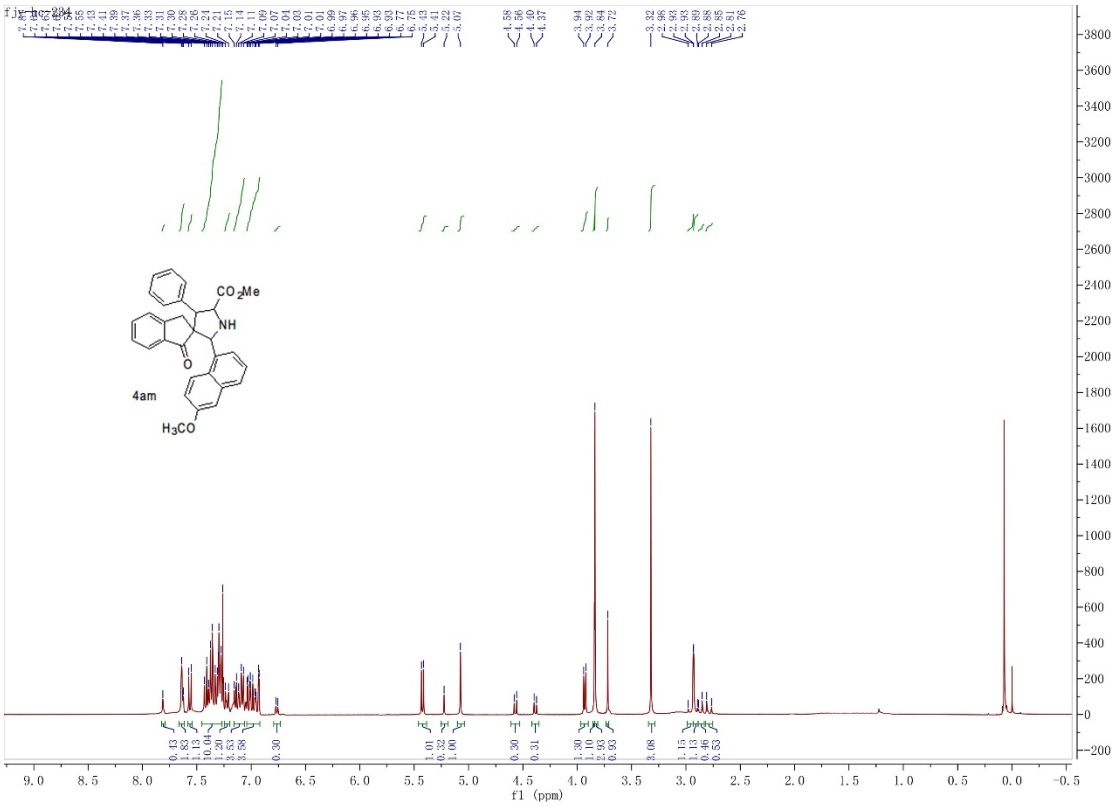

fjy-hc-249
206.42
173.27
151.91
139.44
136.15
135.54
134.63
133.38
129.10
128.73
128.71
128.63
128.60
127.27
127.12
126.79
125.62
125.17
68.23
66.51
66.12
55.16
52.41
35.91
CO2Me
NH
Cl
O
4aj
f1 (ppm)

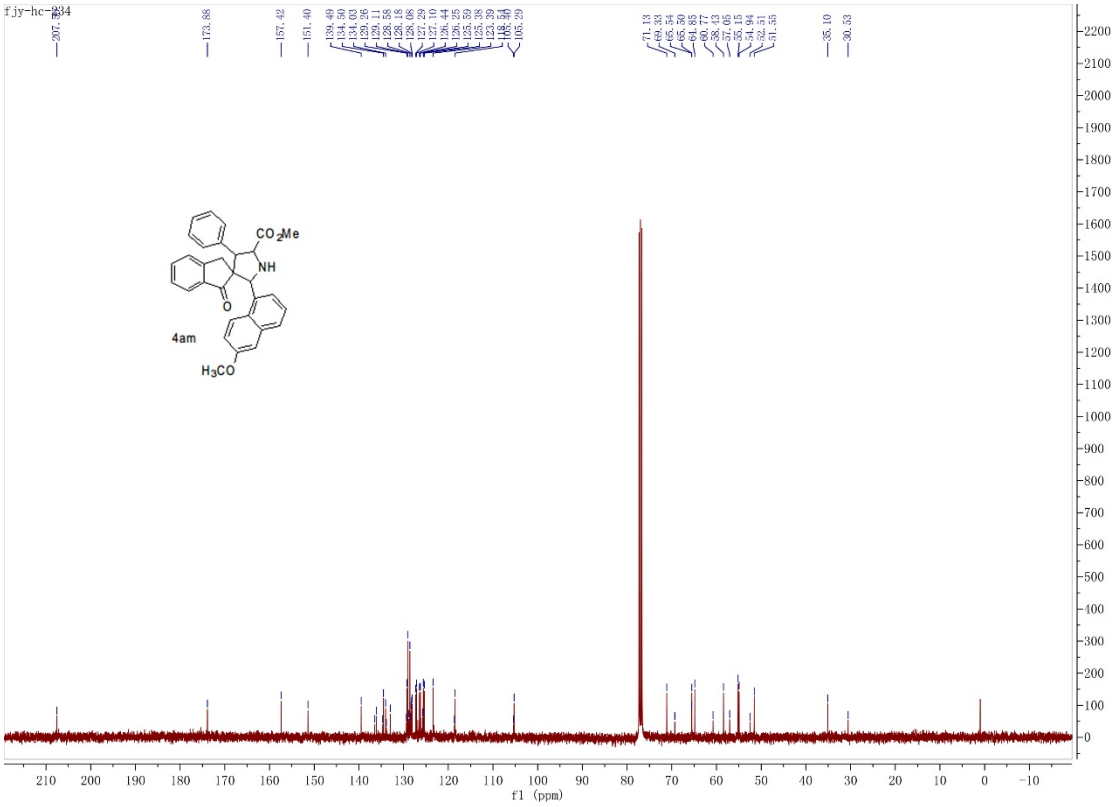

fjy-hc-193
7.68
7.66
7.37
7.36
7.34
7.31
7.29
7.27
7.25
7.17
7.16
7.12
7.10
7.08
6.97
6.95
6.93
5.22
4.45
4.44
4.11
4.09
3.80
3.31
3.27
2.93
2.89
CO2Me
NH
Br
O
4ak
1.03
9.41
1.31
1.26
1.04
1.00
1.01
0.99
3.10
1.24
1.11
f1 (ppm)

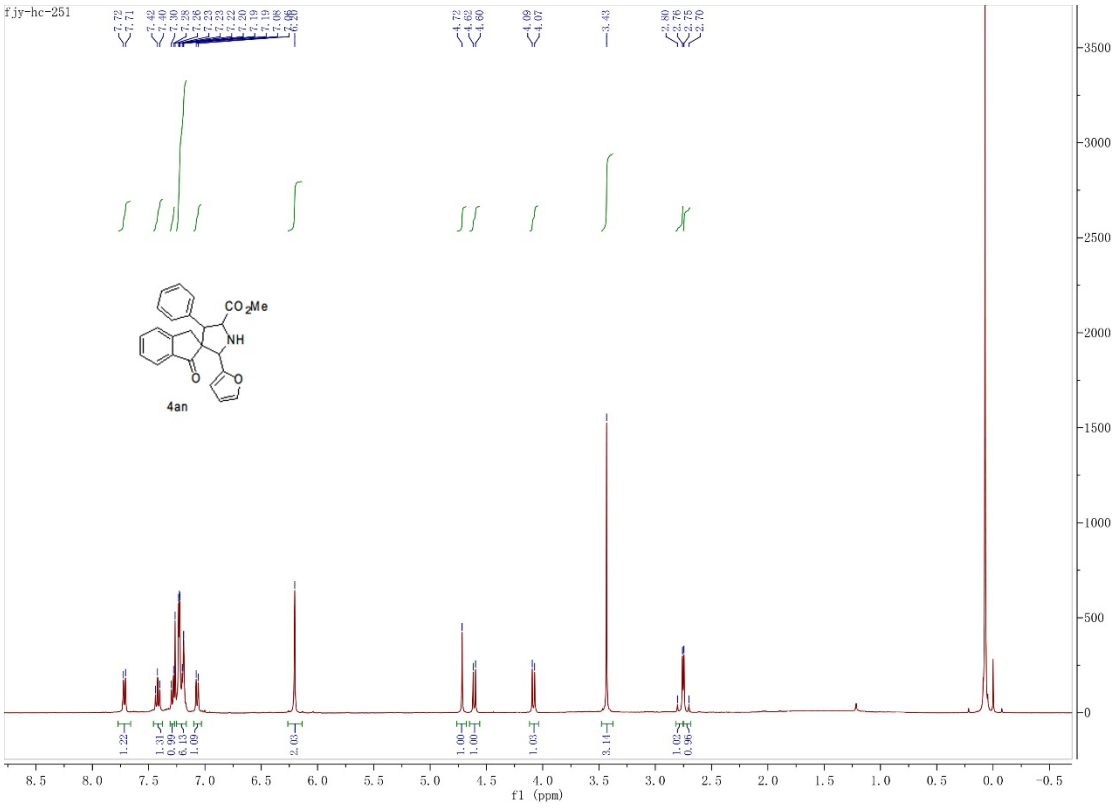

fjy-hc-193
206.49
173.28
151.86
139.06
137.98
136.89
134.39
132.41
129.04
128.66
128.62
127.34
127.22
127.08
125.68
124.15
123.16
70.59
66.44
65.77
55.00
52.35
35.94
CO2Me
NH
Br
O
4ak
f1 (ppm)

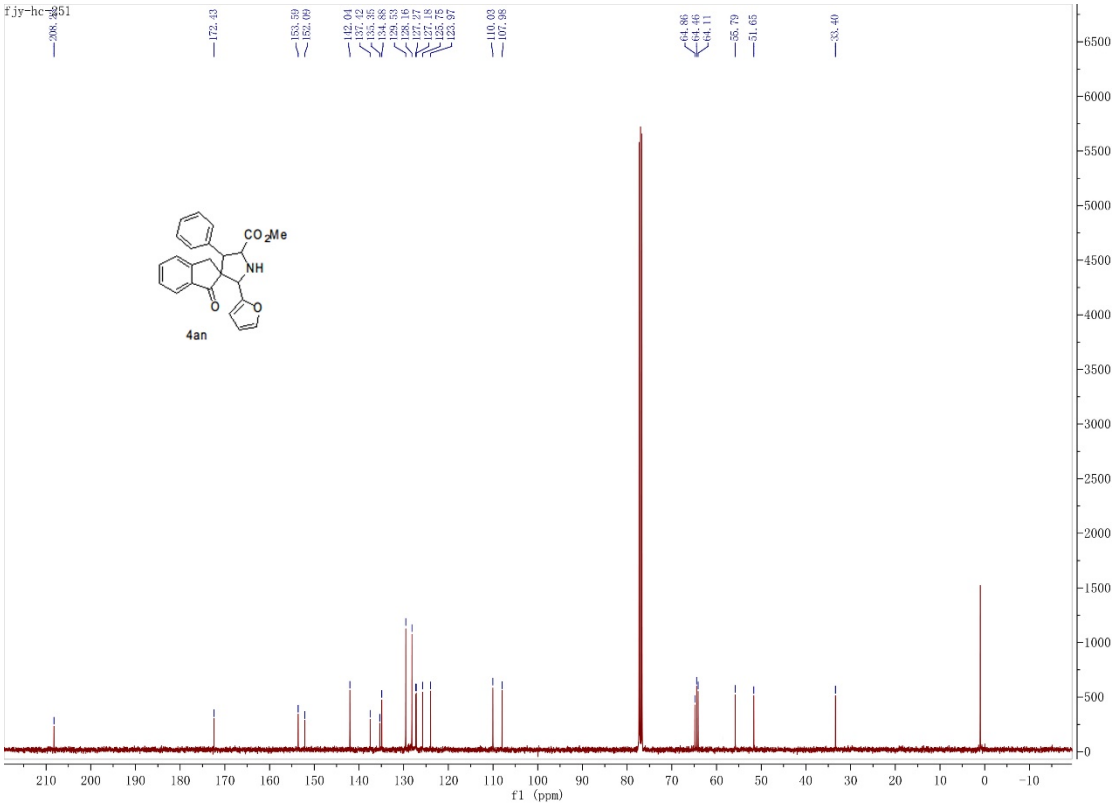

CO2Me
NH
OCH3
O
4al
f1 (ppm)

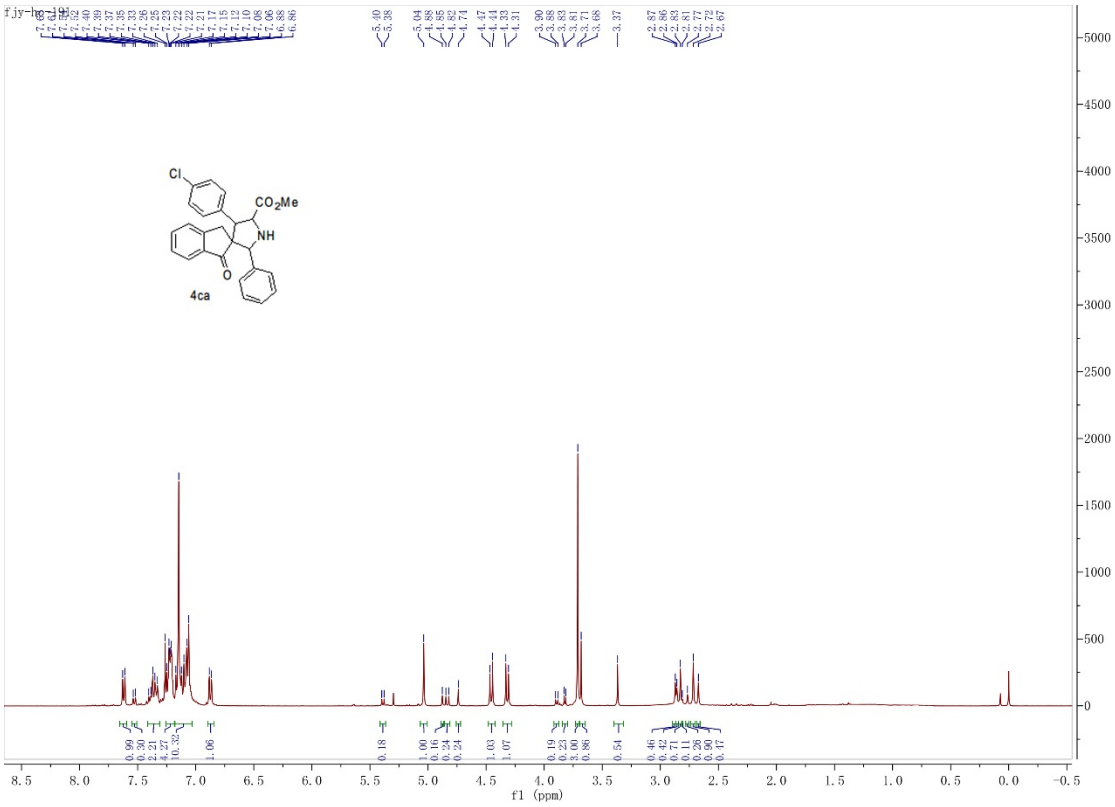

CO2Me
NH
OCH3
O
4al
f1 (ppm)

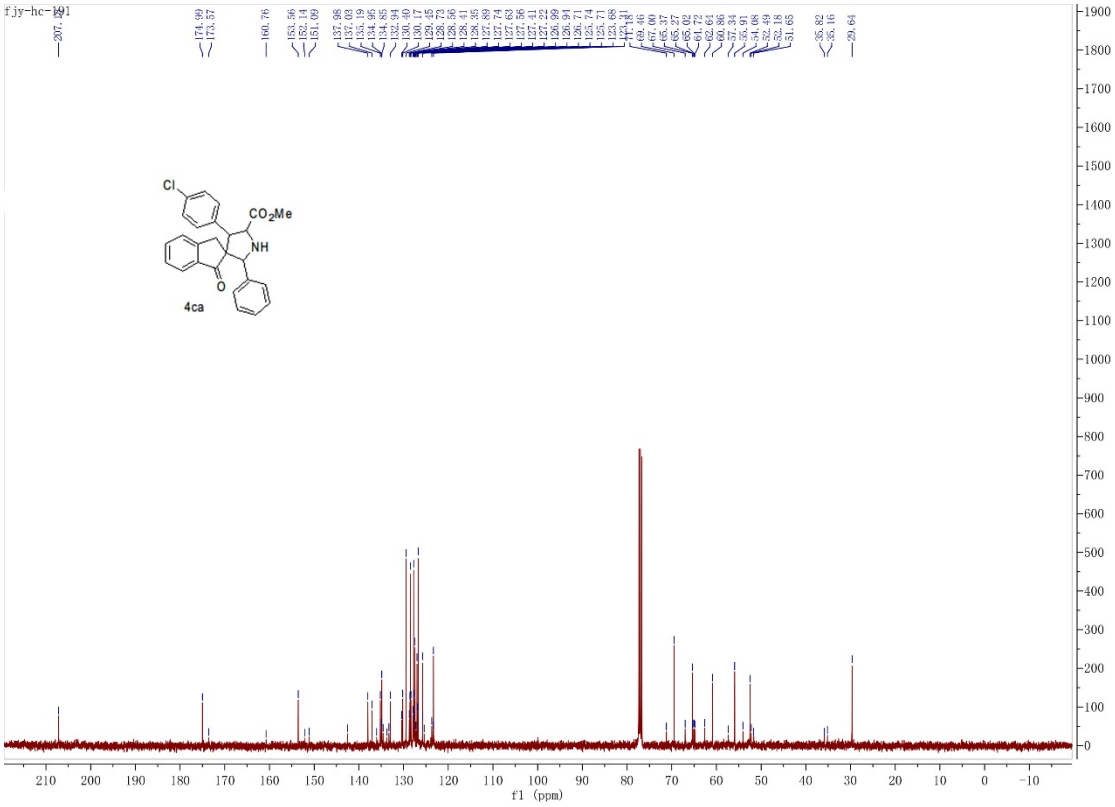

CO2Me
NH
O
4am
H3CO
f1 (ppm)

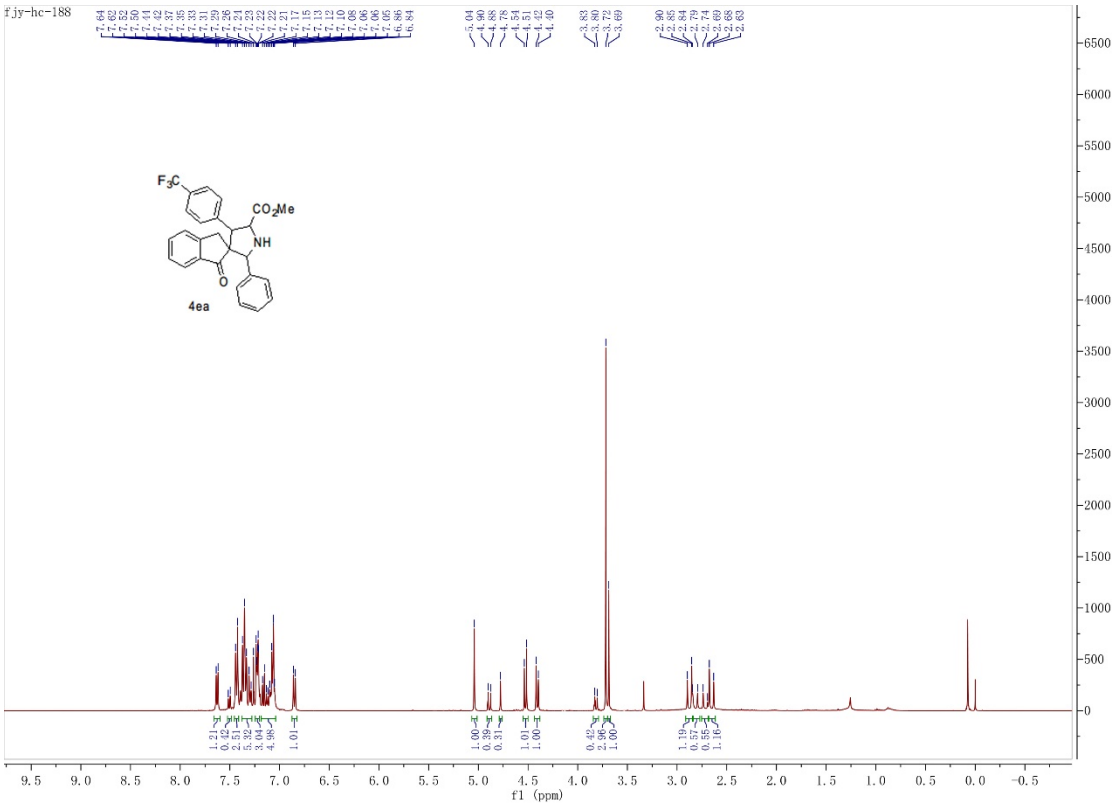

CO2Me
NH
O
4am
H3CO
f1 (ppm)

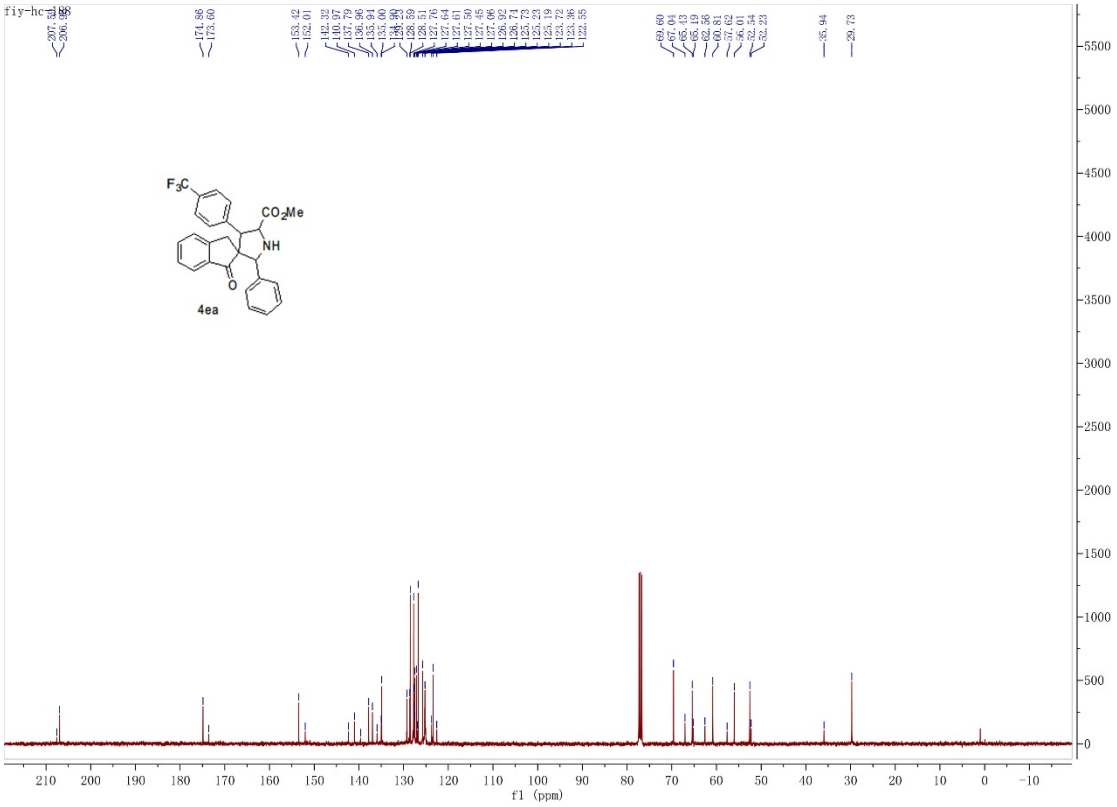

fjy-hc-251
7.72
7.71
7.42
7.40
7.39
7.38
7.38
7.23
7.22
7.20
7.19
7.19
7.08
7.06
6.95
4.72
4.62
4.60
4.09
4.07
3.43
2.80
2.76
2.75
2.70
CO2Me
NH
O
O
4an
1.22
1.31
0.99
0.15
1.09
2.03
1.00
1.00
1.03
3.14
1.02
0.96
f1 (ppm)

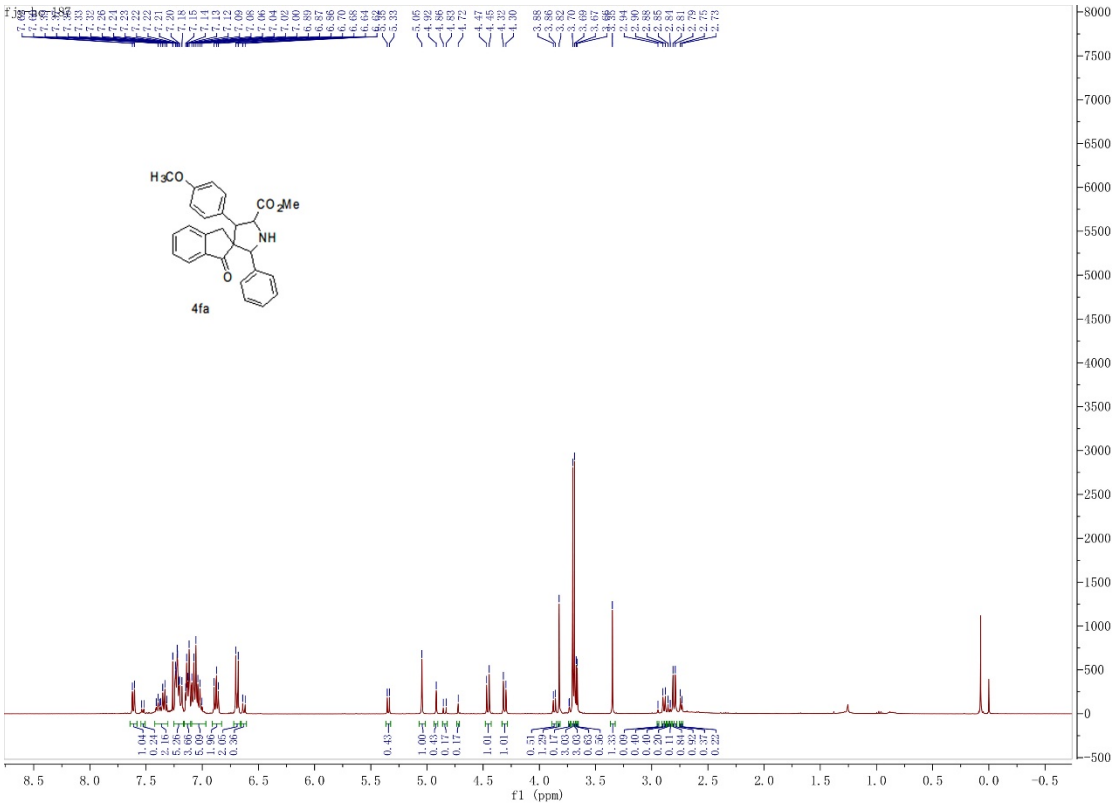

fjy-hc-251
208.34
172.43
153.59
152.09
142.04
137.42
133.35
134.86
130.53
128.16
127.27
127.18
125.75
125.97
110.03
107.98
64.86
64.46
64.11
55.79
51.65
33.40
CO2Me
NH
O
O
4an
f1 (ppm)

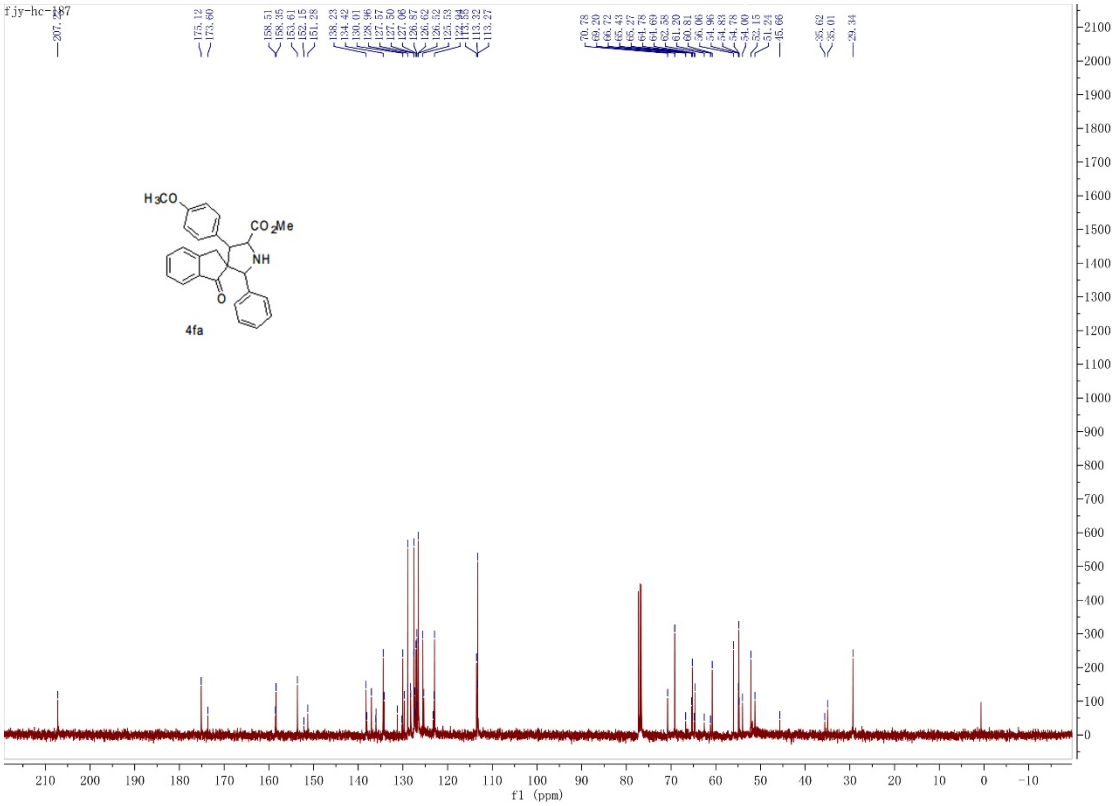

Cl
CO2Me
NH
O
4ca
f1 (ppm)


Cl
CO2Me
NH
O
4ca
f1 (ppm)


fjy-hc-188
4ea
f1 (ppm)


fjy-hc-188
4ea
f1 (ppm)


H3CO
CO2Me
NH
O
4fa
f1 (ppm)


fjy-hc-187
H3CO
CO2Me
NH
O
4fa
f1 (ppm)