*Supporting Information for*

# Asymmetric transfer hydrogenation of cycloalkyl vinyl ketones to allylic alcohols catalyzed by ruthenium amido complexes

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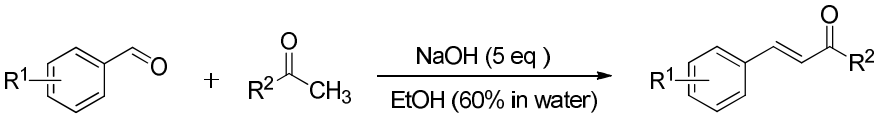
## 1. General Information

Unless otherwise noted, all reagents, catalysts and solvents were purchased from commercial suppliers and used without further purification. Column Chromatography was performed with silica gel (200-300 mesh). NMR spectra were recorded on Bruker ADVANCE III (400 MHz) spectrometers. Melting point were determined using a X-4 made by Peking Taike Apparatus Co. Ltd. $CDCl_3$ was the solvent used for the NMR analysis, with tetramethylsilane as the internal standard. Chemical shifts were reported up field to TMS (0.00 ppm) for $^1H$ NMR and relative to $CDCl_3$ (77.0 ppm) for $^{13}C$ NMR. HPLC analysis was conducted on a Waters 2489 Series instrument with chiral column OJ-H, AD-H, AS-H and OD-H. Optical rotations were measured on a MCP-500. Melting point was determined using a X-4 made by Peking Taike Apparatus Co. Ltd. HRMS spectra were acquired using an Agilent 6210 ESI/TOF mass spectrometer.

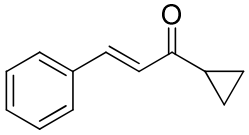
## 2. General Procedure for the Synthesis of (*E*)-*α*,*β*-unsaturated ketones [1]




To a solution of sodium hydroxide (1.5 g) in an aqueous ethanol (25 mL, 60%), the ketone (5 mmol) was added dropwise, and then the aldehyde (5 mmol) was added dropwise. The mixture was stirred at 60 °C for a period of time, when the reaction was complete monitored by TLC, the mixture was cooled to room temperature. The mixture was concentrated and extracted with ethyl acetate (3×20 mL). The combined organic phase was washed with water, dried over anhydrous $Na_2SO_4$, filtered, and concentrated under reduced pressure. The residue was purified by silica gel column chromatography (PE: EA = 15:1) to give the desired product. Compound **2a-2z**, **2aa-2ad** were prepared according to this procedure, compound **2ae** was purchased.

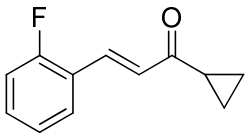
## 3. Analytical Data of the Products

(*E*)-1-cyclopropyl-3-phenylprop-2-en-1-one (**2a**)



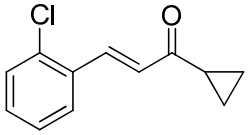

White solid; m.p. 51-52 °C, 90% yield (774 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.66 (d, $J$ = 16.0 Hz, 1H), 7.60 (t, $J$ = 4.0 Hz, 2H), 7.44-7.42 (m, 3H), 6.92 (d, $J$ = 16.0 Hz, 1H), 2.33-2.26 (m, 1H), 1.23-1.19 (m, 2H), 1.04-0.99 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 200.12, 142.03, 134.71, 130.36, 128.95, 128.31, 126.46, 19.68, 11.41.

(*E*)-1-cyclopropyl-3-(2-fluorophenyl)prop-2-en-1-one (**2b**)



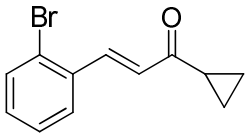
Colourless oil; 92% yield (855 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.89 (d, $J$ = 16.0 Hz, 1H), 7.56-7.61 (m, 1H), 7.42-7.38 (m, 1H), 7.23-7.12 (m, 2H), 6.96 (d, $J$ = 16.0 Hz, 1H), 2.34-2.28 (m, 1H), 1.23-1.19 (m, 2H), 1.06-1.01 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 200.34, 134.47 (d, $J$ = 3.0 Hz, 1C), 131.69 (d, $J$ = 8.6 Hz, 1C), 129.02 (d, $J$ = 9.0 Hz, 1C), 128.75 (d, $J$ = 6.0 Hz, 1C), 124.50 (d, $J$ = 3.5 Hz, 1C), 116.22 (d, $J$ = 21.9 Hz, 1C), 29.72, 19.61, 11.48.

(*E*)-3-(2-chlorophenyl)-1-cyclopropylprop-2-en-1-one (**2c**)



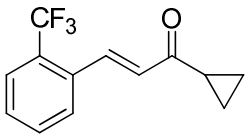
Colourless oil, 85% yield (850 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 8.02 (d, $J$ = 16.0 Hz, 1H), 7.69-7.64 (m, 2H), 7.39-7.35 (m, 1H), 7.29-7.25 (m, 1H), 6.81 (d, $J$ = 16.0 Hz, 1H), 2.38-2.32 (m, 1H), 1.23-1.20 (m, 2H), 1.07-1.03 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 199.99, 140.50, 134.77, 133.47, 131.25, 129.33, 127.78, 127.74, 125.74, 19.25, 11.61.

(*E*)-3-(2-bromophenyl)-1-cyclopropylprop-2-en-1-one (**2d**)



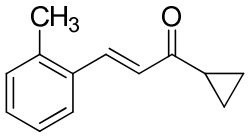
Colourless oil, 85% yield (1.06 g). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 8.06 (d, $J$ = 16.0 Hz, 1H), 7.71-7.69 (m, 1H), 7.47-7.45 (m, 1H), 7.37-7.30 (m, 2H), 7.85 (d, $J$ = 16.4 Hz, 1H), 2.37-2.32 (m, 1H), 1.23-1.19 (m, 2H), 1.06-1.01 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 200.05, 137.87, 135.26, 132.99, 131.08, 130.21, 129.11, 127.58, 127.14, 19.29, 11.61.

(*E*)-1-cyclopropyl-3-(2-(trifluoromethyl)phenyl)prop-2-en-1-one (**2e**)



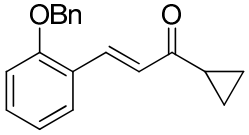
White solid; m.p. 59-60 °C, 95% yield (1.14 g). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 8.03 (d, $J$ = 16.0 Hz, 1H), 7.99-7.73 (m, 2H), 7.63-7.59 (m, 1H), 7.54-7.50 (m, 1H), 6.82 (d, $J$ = 16.0 Hz, 1H), 2.36-2.29 (m, 1H), 1.24-1.20 (m, 2H), 1.07-1.02 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 199.82, 137.48 (d, $J$ = 2.3 Hz, 1C), 132.96 (d, $J$ = 163.6 Hz, 1C), 130.68, 129.39 (d, $J$ = 38.7 Hz, 1C), 128.90, 127.84 126.19 (q, $J$ = 5.5 Hz, 1C), 125.37, 122.65, 19.22, 11.65.

(*E*)-1-cyclopropyl-3-(o-tolyl)prop-2-en-1-one (**2f**)



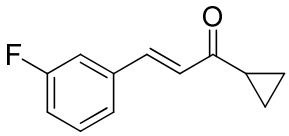
Colourless oil; 87% yield (809 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.95 (d, $J$ = 15.6 Hz, 1H), 7.65 (d, $J$ = 2.0 Hz, 1H), 7.63-7.24 (m, 3H), 6.85 (d, $J$ = 15.6 Hz, 1H), 2.49 (s, 3H), 2.31-2.25 (m, 1H), 1.23-1.20 (m, 2H), 1.05-1.00 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 200.17, 139.53, 138.09, 133.67, 130.86, 130.08, 127.37, 126.37, 126.35, 19.98, 19.86, 11.47.

(*E*)-3-(2-(benzyloxy)phenyl)-1-cyclopropylprop-2-en-1-one (**2g**)



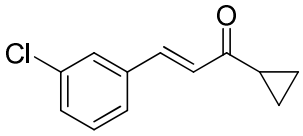
Colourless oil; 80% yield (648 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 8.08 (d, $J$ = 16.4 Hz, 1H), 7.64 (dd, $J_1$ = 7.6 Hz, $J_2$ = 1.6 Hz, 1H), 7.51-7.42 (m, 4H), 7.40-7.35 (m, 2H), 7.05-7.00 (m, 3H), 6.98 (s, 2H), 2.28-2.22 (m, 1H), 1.18-1.16 (m, 2H), 1.00-0.96 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 200.62, 137.40, 136.63, 131.54, 128.90, 128.70, 128.11, 127.30, 127.18, 124.09, 121.17, 112.80, 70.49, 19.48, 11.17.

(*E*)-1-cyclopropyl-3-(3-fluorophenyl)prop-2-en-1-one (**2h**)



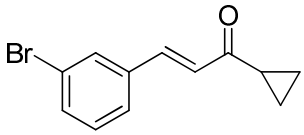
Colourless oil; 90% yield (855 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.59 (d, $J$ = 16.0 Hz, 1H), 7.42-7.30 (m, 2H), 7.28 (dd, $J_1$ = 2.8 Hz, $J_2$ = 2.0 Hz, 1H), 7.14-7.09 (m, 1H), 6.89 (d, $J$ = 16.0 Hz, 1H), 2.29-2.24 (m, 1H), 1.23-1.18 (m, 2H), 1.05-1.01 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 199.87, 163.03 (d, $J$ = 254.2 Hz, 1C), 140.51 (d, $J$ = 2.9 Hz, 1C), 137.00 (d, $J$ = 7.7 Hz, 1C), 130.49 (d, $J$ = 9 Hz, 1C), 127.47, 124.34 (d, $J$ = 0.7 Hz, 1C), 117.15 (d, $J$ = 21.4 1C), 114.35 (d, $J$ = 21.8 Hz, 1C), 19.93, 11.59.

(*E*)-3-(3-chlorophenyl)-1-cyclopropylprop-2-en-1-one (**2i**)



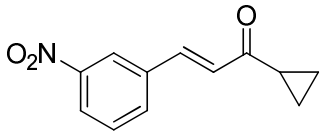
Colourless oil; 92% yield (947 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.56 (d, $J$ = 16.4 Hz, 2H), 7.46 (d, $J$ = 6.8 Hz, 1H), 7.37 (dd, $J_1$ = 17.6 Hz, $J_2$ = 10.4 Hz, 2H), 6.89 (d, $J$ = 16.0 Hz, 1H), 2.29-2.23 (m, 1H), 1.22-1.18 (m, 2H), 1.05-1.00 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 199.77, 140.25, 136.59, 134.93, 130.17, 130.15, 127.90, 127.49, 126.52, 19.97, 11.60.

(*E*)-3-(3-bromophenyl)-1-cyclopropylprop-2-en-1-one (**2j**)



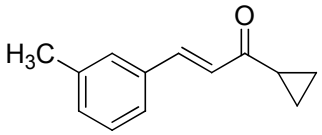
Colourless oil; 92% yield (1.15 g). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.75 (s, 1H), 7.74-7.50 (m, 3H), 7.30 (d, $J$ = 15.6 Hz, 1H), 6.95 (d, $J$ = 16.0 Hz, 1H), 2.28-2.24 (m, 1H), 1.23-1.18 (m, 2H), 1.05-1.01 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 199.77, 140.16, 136.86, 133.07, 130.85, 130.44, 127.49, 126.97, 123.06, 20.00, 11.63.

(*E*)-1-cyclopropyl-3-(3-nitrophenyl)prop-2-en-1-one (**2k**)



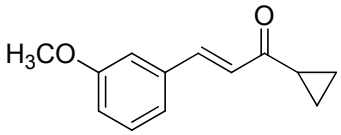
Colourless oil; 80% yield (868 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 8.46 (t, $J$ = 2.0 Hz, 1H), 8.28 (dd, $J_1$ = 1.2 Hz, $J_2$ = 1.2 Hz, 1H), 8.26 (dd, $J_1$ = 0.8 Hz, $J_2$ = 1.2 Hz, 1H), 7.91-.61 (m, 2H), 7.03 (d, $J$ = 16.4 Hz, 1H), 2.31-2.26 (m, 1H), 1.25-1.22 (m, 2H), 1.09-1.05 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 199.47, 148.72, 138.86, 136.57, 133.97, 130.00, 128.76, 124.51, 122.44, 20.30, 11.87.

(*E*)-1-cyclopropyl-3-(m-tolyl)prop-2-en-1-one (**2l**)



Colourless oil; 75% yield (697 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.63 (d, $J$ = 16.0 Hz, 1H), 7.41 (d, $J$ = 7.2 Hz, 2H), 7.32 (t, $J$ = 7.6 Hz, 1H), 7.24 (d, $J$ = 7.6 H, 1H), 6.90 (d, $J$ = 16.4 Hz, 1H), 2.42 (s, 3H), 2.31-2.26 (m, 1H), 1.22-1.18 (m, 2H), 1.03-0.99 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 200.16, 142.24, 138.59, 134.66, 131.21, 128.95, 128.83, 126.28, 125.52, 21.37, 19.64, 11.34.

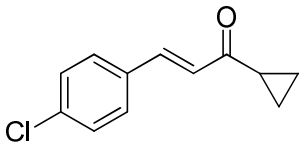
(*E*)-1-cyclopropyl-3-(3-methoxyphenyl)prop-2-en-1-one (**2m**)



Colourless oil; 70% yield (707 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.62 (d, $J$ = 16.0 Hz, 1H), 7.35 (t, $J$ = 8.0 Hz, 1H), 7.21 (t, $J$ = 1.2 Hz, 1H), 7.19-7.12 (m, 1H), 6.99-6.96 (m, 1H), 6.89 (d, $J$ = 16.0 Hz, 1H), 3.87 (s, 3H), 2.32-2.26 (m, 1H), 1.22-1.18 (m, 2H), 1.04-0.99 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 200.14, 159.92, 141.97, 136.10, 129.93, 126.75, 121.03, 116.21, 113.11, 55.33, 19.64, 11.42.

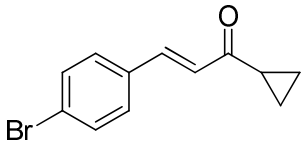
(*E*)-3-(4-chlorophenyl)-1-cyclopropylprop-2-en-1-one (**2n**)

White solid; m.p. 56-58 °C, 91% yield (972 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.59 (d, $J$ = 16.0 Hz, 1H), 7.53 (t, $J$ = 2.4 Hz, 2H),



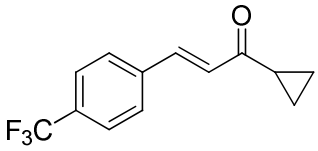
7.41 (t, $J$ = 2.0 Hz, 2H), 6.88 (d, $J$ = 16.0 Hz, 1H), 2.30-2.23 (m, 1H), 1.22-1.18 (m, 2H), 1.05-1.00 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 199.85, 140.48, 136.22, 133.22, 129.44, 129.23, 126.80, 19.87, 11.53.

(*E*)-3-(4-bromophenyl)-1-cyclopropylprop-2-en-1-one (**2o**, CAS: 72881-71-1)



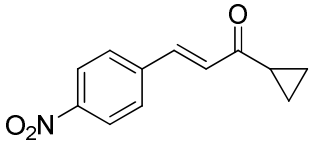
White solid; m.p. 74-76 °C, 92% yield (1.1 g). Purified by flash column chromatography (PE: EA = 15:1). **$^{1}$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.60-7.56 (m, 3H), 7.45 (dd, $J_1$ = 2.4 Hz, $J_2$ = 2.0 Hz, 2H), 6.90 (d, $J$ = 16.4 Hz, 2H), 2.30-2.24 (m, 1H), 1.23-1.19 (m, 2H), 1.05-1.00 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 199.85, 140.55, 133.66, 132.19, 125.88, 124.57, 19.89, 11.54.

(*E*)-1-cyclopropyl-3-(4-(trifluoromethyl)phenyl)prop-2-en-1-one (**2p**)



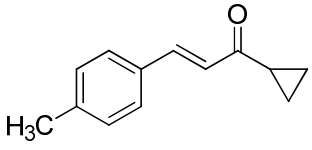
White solid; m.p. 48-50 °C, 91% yield (1.1 g). Purified by flash column chromatography (PE: EA = 15:1). **$^{1}$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.69 (s, 4H), 7.64 (d, $J$ = 16.0 Hz, 1H), 6.97 (d, $J$ = 16.0 Hz, 1H), 2.32-2.26 (m, 1H), 1.24-1.22 (m, 2H), 1.07-1.04 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 199.76, 139.95, 138.17, 131.75 (d, $J$ = 32.5 Hz, 2C), 128.41 (d, $J$ = 8.0 Hz, 2C), 126.78, 125.91 (q, $J$ = 3.8 Hz, 1C), 125.20, 122.49, 20.04, 11.75.

(*E*)-1-cyclopropyl-3-(4-nitrophenyl)prop-2-en-1-one (**2q**)



Light yellow solid; m.p. 118-120 °C, 95% yield (1.0 g). Purified by flash column chromatography (PE: EA = 15:1). **$^{1}$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 8.30 (d, $J$ = 8.8 Hz, 2H), 7.75 (d, $J$ = 8.4 Hz, 2H), 7.35 (d, $J$ = 16.0 Hz, 1H), 7.02 (d, $J$ = 16.0 Hz, 1H), 2.32-2.26 (m, 1H), 1.27-1.23 (m, 2H), 1.10-1.06 (m 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 199.48, 148.50, 140.99, 138.78, 129.80, 128.81, 124.21, 20.33, 12.00.

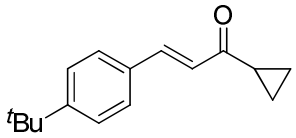
(*E*)-1-cyclopropyl-3-(p-tolyl)prop-2-en-1-one (**2r**)



White solid; m.p. 55-57 °C, 91% yield (795 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^{1}$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.66-7.56 (m, 2H), 7.52-7.46 (m, 2H), 7.24 (d, $J$ = 8.0 Hz), 6.90 (dd, $J_1$ = 16.0 Hz, $J_2$ = 8.4 Hz, 1H), 2.42 (s, 3H), 2.31-2.25 (m, 1H), 1.22-1.18 (m, 2H), 1.04-0.99 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 200.10, 142.07, 140.53, 132.19, 129.64,

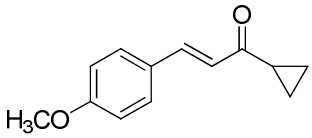
128.30, 125.56, 21.51, 19.57, 11.23.

(*E*)-3-(4-(tert-butyl)phenyl)-1-cyclopropylprop-2-en-1-one (**2s**)



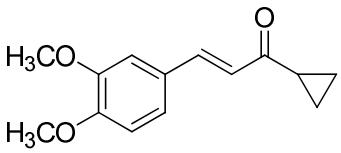
White solid; m.p. 59-61 °C, 65% yield (724 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.65 (d, $J$ = 16.0 Hz, 1H), 7.55 (d, $J$ = 8.4 Hz, 2H), 7.46 (d, $J$ = 8.4 Hz, 2H), 6.89 (d, $J$ = 16.0 Hz, 1H), 2.33-2.26 (m, 1H), 1.37 (s, 9H), 1.22-1.18 (m, 2H), 1.03-0.99 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 200.20, 153.95, 142.00, 131.95, 128.17, 125.93, 125.75, 34.93, 31.19, 19.55, 11.31.

(*E*)-1-cyclopropyl-3-(4-methoxyphenyl)prop-2-en-1-one (**2t**)



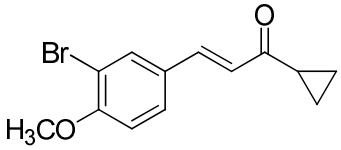
White solid; m.p. 68-70 °C, 90% yield (909 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.63 (d, $J$ = 16.0 Hz, 1H), 7.56 (d, $J$ = 8.8 Hz, 1H), 6.96 (d, $J$ = 8.8 Hz, 2H), 6.82 (d, $J$ = 16.0 Hz, 1H), 3.89 (s, 3H), 2.30-2.24 (m, 1H), 1.21-1.17 (m, 2H), 1.02-0.97 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 200.04, 161.48, 141.79, 129.99, 127.39, 124.32, 114.40, 99.98, 55.42, 19.57, 11.17.

(*E*)-1-cyclopropyl-3-(3,4-dimethoxyphenyl)prop-2-en-1-one (**2u**)



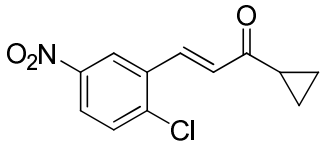
White solid; m.p. 88-90 °C, 75% yield (870 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.61 (d, $J$ = 16.0 Hz, 1H), 7.20 (dd, $J_1$ = 8.8 Hz, $J_2$ = 2.0 Hz, 1H), 7.14 (d, $J$ = 2.0 Hz, 1H), 6.92 (d, $J$ = 8.4 Hz, 1H), 6.80 (d, $J$ = 16.0 Hz, 1H), 3.96 (d, $J$ = 2.0 Hz, 6H), 2.32-2.25 (m, 1H), 1.20-1.17 (m, 2H), 1.02-0.98 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 119.98, 151.22, 142.08, 127.65, 124.62, 123.01, 111.08, 109.69, 56.00, 55.92, 19.46, 11.20.

(*E*)-3-(4-bromo-3-methoxyphenyl)-1-cyclopropylprop-2-en-1-one (**2v**)



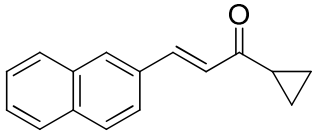
White solid; m.p. 68-69 °C, 85% yield (1.19 g). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$) $\delta$ = 7.82 (d, $J$ = 2.4 Hz, 1H), 7.55-7.49 (m, 2H), 6.94 (d, $J$ = 8.4 Hz, 1H), 6.79 (d, $J$ = 16.0 Hz, 1H), 3.96 (s, 3H), 2.27-2.21 (m, 1H), 1.20-1.14 (m, 2H), 1.02-0.99 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 199.81, 157.44, 140.17, 132.73, 129.32, 128.74, 125.29, 112.33, 111.88, 56.40, 19.86, 11.39.

(*E*)-3-(2-chloro-5-nitrophenyl)-1-cyclopropylprop-2-en-1-one (**2w**)



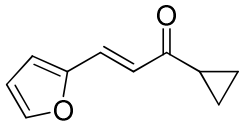
White solid; m.p. 116-117 °C, 90% yield (1.10 g). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$) $\delta$ = 8.58 (d, $J$ = 2.8 Hz, 1H), 8.21 (dd, $J_1$ = 8.8 Hz, $J_2$ = 2.8, 1H), 7.99 (d, $J$ = 16.0 Hz, 1H), 7.66 (d, $J$ = 8.8 Hz, 1H), 7.03 (d, $J$ = 16.0 Hz, 1H), 2.35-2.29 (m, 1H), 1.28-1.24 (m, 2H), 1.12-1.08 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 199.23, 146.81, 141.52, 135.19, 134.67, 131.24, 130.93, 124.97, 122.44, 20.40, 12.14.

(*E*)-1-cyclopropyl-3-(naphthalen-2-yl)prop-2-en-1-one (**2x**)



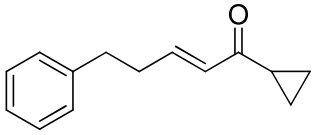
Yellow oil; 75% yield (832 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 8.50 (d, $J$ = 15.6 Hz, 1H), 8.25 (d, $J$ = 8.0 Hz, 1H), 7.93 (t, $J$ = 8.0, 2H), 7.85 (d, $J$ = 6.8 Hz, 1H), 7.64-7.52 (m, 3H), 7.01 (d, $J$ = 15.6 Hz, 1H), 2.39-2.32 (m, 1H), 1.30- 1.25 (m, 2H), 1.10-1.05 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 200.03, 138.86, 133.73, 132.12, 131.70, 130.61, 128.93, 128.81, 126.89, 126.27, 125.51, 125.04, 123.40, 20.09, 11.60.

(*E*)-1-cyclopropyl-3-(furan-2-yl)prop-2-en-1-one (**2y**)



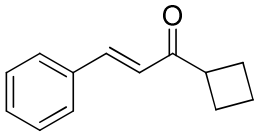
Red oil; 80% yield (648 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.52 (s, 1H), 7.38 (d, $J$ = 15.6 Hz, 1H), 6.80 (d, $J$ = 15.6 Hz, 1H), 6.68 (d, $J$ = 3.6 Hz, 1H), 6.51 (s, 1H), 2.18 (s, 1H). 1.16 (t, $J$ = 4.4 Hz, 1H), 0.97 (dd, $J_1$ = 4.0 Hz, $J_2$ = 3.6 Hz); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 199.75, 151.25, 144.79, 128.18, 123.47, 115.61, 112.51, 20.19, 11.27.

(*E*)-1-cyclopropyl-5-phenylpent-2-en-1-one (**2z**)



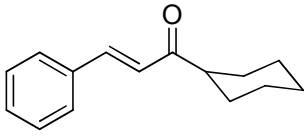
Light yellow oil; 80% yield (800 mg). Purified by flash column chromatography (PE: EA = 15:1). **$^1$H NMR** (400 MHz, $CDCl_3$) $\delta$ = 7.34 (t, $J$ = 7.2 Hz, 2H), 7.25 (t, $J$ = 8.8 Hz, 3H), 7.01-6.94 (m, 1H), 6.27 (td, $J_1$ = 16.0 Hz, $J_2$ = 2.8 Hz, $J_3$ = 1.2 Hz, 1H), 2.85 (t, $J$ = 7.6 Hz, 2H), 2.63-2.58 (m, 2H), 2.18-2.11 (m, 1H), 1.12-1.10 (m, 2H), 0.96-0.93 (m, 2H); **$^{13}$C NMR** (100 MHz, $CDCl_3$) :$\delta$ = 200.26, 145.60, 140.84, 130.84, 128.52, 128.37, 126.21, 34.52, 34.23, 18.79, 11.07.

(*E*)-1-cyclobutyl-3-phenylprop-2-en-1-one (**2aa**)



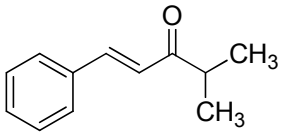
Colourless oil, 81% yield (1.32 g). Purified by flash column chromatography (PE: EA = 30:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.60-7.54 (m, 3H), 7.44-7.42 (m, 3H), 6.74 (d, $J$ = 16.0 Hz, 1H), 3.65 (p, $J$ = 8 Hz, 1H), 2.42-2.23 (m, 4H), 2.12-1.88 (m, 2H). **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 201.37, 142.64, 134.70, 130.35, 128.93, 128.22, 124.77, 43.90, 24.74, 18.05.

(*E*)-1-cyclohexyl-3-phenylprop-2-en-1-one (**2ab**)



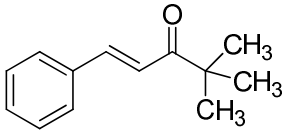
Colourless oil, 79% yield (1.08 g). Purified by flash column chromatography (PE: EA = 30:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.45-7.42 (m, 2H), 7.40-7.34 (m, 2H), 7.30-7.26 (m, 1H), 6.61 (d, $J$ = 16 Hz, 1H), 6.28 (dd, $J_1$= 16.0 Hz, $J_2$= 7.2 Hz, 1H), 4.07 (t, $J$ = 6.8 Hz, 1H), 1.98 (d, $J$ = 12.8 Hz 1H), 1.84-1.70 (m, 1H), 1.60-1.51 (m, 1H), 1.36-1.04 (m, 6H). **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 203.20, 142.25, 134.79, 130.30, 128.91, 128.28, 124.75, 49.45, 28.75, 25.94, 25.80.

(*E*)-4-methyl-1-phenylpent-1-en-3-one (**2ac**)



Colourless oil, 71% yield (0.64 g). Purified by flash column chromatography (PE: EA = 30:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.68 (d, $J$ = 16.0 Hz, 1H), 7.61-7.59 (m, 2H), 7.44-7.42 (t, $J$ = 3.6 Hz,3H), 6.88 (d, $J$ = 16.0 Hz, 1H), 2.98 (p, $J$ = 6.8 Hz, 1H), 1.23 (d, $J$ = 6.8 Hz, 6H).**$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 203.85, 142.44, 134.71, 130.36, 128.93, 128.29, 124.48, 39.31, 18.53.

(*E*)-4,4-dimethyl-1-phenylpent-1-en-3-one (**2ad**)



Colourless oil, 73% yield (0.74 g). Purified by flash column chromatography (PE: EA = 30:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.75 (d, $J$ = 15.6 Hz, 1H), 7.63-7.61 (m, 2H), 7.44-7.42 (m, 3H), 7.20 (d, $J$ = 16 Hz, 1H), 1.67-1.66 (m, 1H), 1.23 (s, 9H). **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 204.20, 142.92, 134.96, 130.22, 128.87, 128.30, 120.75, 43.27, 26.35.

**4. General Procedure for the Synthesis of Racemic (*E*)-Allylic Alcohols**

The (*E*)-$\alpha,\beta$-unsaturated ketone (0.2 mmol) was dissolved in 1.0 mL of MeOH, and $NaBH_4$ solid (0.4 mmol) was added slowly. The mixture was stirred until the starting material was disappeared. And then 5.0 mL of $H_2O$ was added slowly, the residue was extracted 3 times with ethyl acetate. The combined organic layer was dried over $Na_2SO_4$ and evaporated in vacuo. The

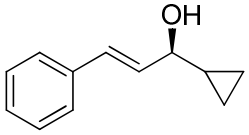
residue was purified by silica gel column to give the racemic (*E*)-allylic alcohol.

**5. General Procedure for Asymmetric Transfer Hydrogenation of (*E*)-*α,β*-unsaturated ketones**

Under nitrogen atmosphere, the catalyst (0.01 mmol) and (*E*)-*α,β*-unsaturated ketone (0.2 mmol) were added into a 10 mL of Schlenk tube, then 2 mL FA/TEA (5:2) azeotrope was added by a syringe. The reaction mixture was stirred at 40 ℃ for 24 h. After the reaction was complete, 5 mL of $H_2O$ was added. The mixture was extracted 3 times with ethyl acetate, and the combined organic layer was dried over $Na_2SO_4$ and evaporated in vacuo. The residue was further purified by silica gel column chromatography. The ee values of all compounds were determined by HPLC with a chiral column.

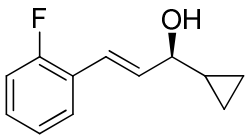
**6. Analytical Data of the Chiral Allylic Alcohols**

(*S,E*)-1-cyclopropyl-3-phenylprop-2-en-1-ol (**3a**)




Colourless oil; 90% yield (31.32 mg), 81% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.44 (d, $J$ = 7.2 Hz, 2H), 7.36 (t, $J$ = 7.2 Hz, 2H), 7.27 (d, $J$ = 7.2 Hz, 1H), 6.65 (d, $J$ = 16.0 Hz, 1H), 6.35 (dd, $J_1$ = 15.6 Hz, $J_2$ = 6.0 Hz, 1H), 3.69 (t, $J$ = 6.8 Hz, 1H), 1.94 (s, 1H), 1.15-1.10 (m, 1H), 0.66-0.60 (m, 2H), 0.48-0.44 (m, 1H), 0.40-0.35 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 136.81, 130.98, 130.04, 128.59, 127.63, 126.53, 77.09, 17.70, 3.27, 2.26. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 90:10 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 9.06 min (major), $t_R$ = 14.37 min (minor). **HRMS (ESI)** calcd for $C_{12}H_{14}ONa$ ($[M+Na]^+$): 197.0937. Found:197.0938.

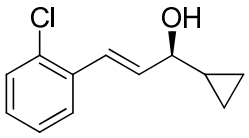
(*S,E*)-1-cyclopropyl-3-(2-fluorophenyl)prop-2-en-1-ol (**3b**)




Colourless oil; 85% yield (22.0 mg), 77% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.53-7.49 (m, 1H), 7.27-7.21 (m, 1H), 7.15-7.04 (m, 2H), 6.80 (d, $J$ = 16.4 Hz, 1H), 6.42 (dd, $J_1$ = 16.0 Hz, $J_2$ = 6.0 Hz, 1H), 3.70 (t, $J$ = 7.2 Hz, 1H), 2.04 (s, 1H), 1.16-1.10 (m, 1H), 0.66-0.58 (m, 2H), 0.49-0.44 (m, 1H), 0.40-0.36 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 161.55, 159.07, 133.59, 133.55, 128.90, 128.82, 127.52, 127.48, 124.64, 124.52, 124.10, 124.07, 122.45, 122.41, 115.84, 115.62, 77.20, 17.62, 3.28, 2.26. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 95:5 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 11.06 min (major), $t_R$

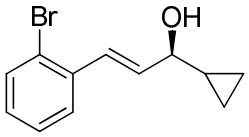
= 14.63 min (minor). **HRMS (ESI)** calcd for $C_{12}H_{13}FONa$ ($[M+Na]^+$): 215.0843. Found: 215.0841.

(*S*,*E*)-3-(2-chlorophenyl)-1-cyclopropylprop-2-en-1-ol (**3c**)



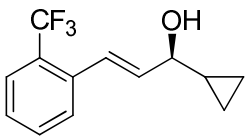

Colourless oil; 90% yield (37.4 mg), 85% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.59-7.56 (m, 2H), 7.32-7.28 (m, 1H), 7.16-7.11 (m, 1H), 6.96 (dd, $J_1$ = 16.0 Hz, $J_2$ = 1.2 Hz, 1H), 6.28 (dd, $J_1$ = 16.0 Hz, $J_2$ = 6.4 Hz, 1H), 3.75-3.71 (m, 1H), 1.98 (s, 1H), 1.17-1.11 (m, 1H), 0.67-0.59 (m , 2H), 0.51-0.45 (m ,1H), 0.41-0.36 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 136.71, 134.00, 132.93, 128.90, 128.88, 127.49, 127.13, 123.76, 76.92, 17.60, 3.33, 2.26. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 95:5 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 16.94 min (major), $t_R$ = 35.15 min (minor). **HRMS (ESI)** calcd for $C_{12}H_{13}ClONa$ ($[M+Na]^+$): 231.0547. Found: 231.0548.

(*S,E*)-3-(2-bromophenyl)-1-cyclopropylprop-2-en-1-ol (**3d**)




Colourless oil; 89% yield (44.8 mg), 83% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.57 (dd, $J_1$ = 7.6 Hz, $J_2$ = 1.6 Hz, 1H), 7.37 (dd, $J_1$ = 7.6 Hz, $J_2$ = 1.6 Hz, 1H), 7.26-7.18 (m, 2H), 7.02 (dd, $J_1$ = 16.0 Hz, $J_2$ = 1.2 Hz, 1H), 6.34 (dd, $J_1$ = 16.0 Hz, $J_2$ = 6.4 Hz, 1H), 3.74-3.70 (m, 1H), 2.28 (s, 1H), 1.16-1.09 (m, 1H), 0.66-0.57 (m, 2H), 0.50-0.45 (m, 1H), 0.40-0.34 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 134.96, 133.92, 133.16, 129.68, 128.60, 126.92, 126.85, 126.19, 76.69, 17.57, 3.35, 2.26. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 95:5 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 14.87 min (major), $t_R$ = 27.86 min (minor). **HRMS (ESI)** calcd for $C_{12}H_{13}BrONa$ ($[M+Na]^+$): 275.0042. Found: 275.0040.

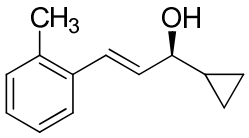
(*S,E*)-1-cyclopropyl-3-(2-(trifluoromethyl)phenyl)prop-2-en-1-ol (**3e**)




Colourless oil; 84% yield (40.6 mg), 86% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.68-7.74 (m, 2H), 7.54-7.49 (m, 1H), 7.38-7.34 (m, 1H), 7.02 (d, $J$ = 16.0 Hz, 1H), 6.35-6.29 (dd, $J_1$ = 16.0 Hz, $J_2$ = 6.0 Hz, 1H), 3.74-3.70 (m, 1H), 2.21 (s, 1H), 1.16-1.10 (m, 1H), 0.67-0.58 (m, 2H), 0.49-0.44 (m, 1H), 0.39-0.34 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 136.10, 136.08, 135.39, 131.83, 127.50, 127.30, 126.03, 126.01, 125.72 (q, $J$ = 5.6 Hz, 1C), 76.81, 17.49, 3.23, 2.09. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 95:5

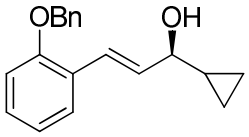
(v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 8.25 min (major), $t_R$ = 11.25 min (minor). **HRMS (ESI)** calcd for $C_{13}H_{14}F_3O$ ($[M+H]^+$): 243.0991. Found: 243.0989.

(*S*,*E*)-1-cyclopropyl-3-(o-tolyl)prop-2-en-1-ol (**3f**)



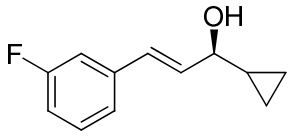

Colourless oil; 75% yield (28.2 mg), 80% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.51 (t, $J$ = 7.6 Hz, 1H), 7.22-7.18 (m, 3H), 6.85 (d, $J$ = 16.0 Hz, 1H), 6.24 (dd, $J_1$ = 16.0 Hz, $J_2$ = 6.4 Hz, 1H), 3.73 (t, $J$ = 6.4 Hz, 1H), 2.40 (s, 3H), 1.89 (s, 1H), 1.17-1.30 (m, 1H), 0.67-0.69 (m, 2H), 0.49-0.45 (m, 1H), 0.41-0.36 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 135.92, 135.54, 132.27, 130.29, 127.91, 127.53, 126.11, 125.72, 77.26, 19.86, 17.76, 3.30, 2.19. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 95:5 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 16.30 min (major), $t_R$ = 30.46 min (minor). **HRMS (ESI)** calcd for $C_{13}H_{16}ONa$ ($[M+Na]^+$): 211.1093. Found: 211.1092.

(*S*,*E*)-3-(2-(benzyloxy)phenyl)-1-cyclopropylprop-2-en-1-ol (**3g**)




Colourless oil; 70% yield (39.2 mg), 70% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.55-7.38 (m, 6H), 7.27-7.23 (m, 1H), 7.05-6.96 (m, 3H), 6.41 (dd, $J_1$ = 16.0 Hz, $J_2$ = 6.4 Hz, 1H), 5.15 (s, 2H), 3.71 (t, $J$ = 7.2 Hz, 1H), 1.90 (s, 1H), 1.14-1.09 (m, 1H), 0.64-0.57 (m, 2H), 0.46-0.44 (m, 1H), 0.38-0.35 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 137.15, 131.76, 128.67, 128.59, 127.91, 127.30, 127.07, 126.24, 125.11, 121.06, 112.59, 77.44, 70.37, 17.61, 3.24, 2.16. **HPLC** (Chiralcel AD-H column, n-hexane/2-propanol = 90:10 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_R$ = 14.16 min (minor), $t_S$ = 16.19 min (major). **HRMS (ESI)** calcd for $C_{19}H_{20}O_2Na$ ($[M+Na]^+$): 303.1356. Found: 303.1357.

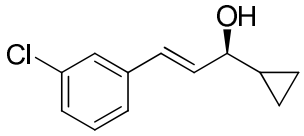
(*S,E*)-1-cyclopropyl-3-(3-fluorophenyl)prop-2-en-1-ol (**3h**)




Colourless oil; 85% yield (32.6 mg), 85% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.32-7.28 (m, 1H), 7.20-7.12 (m, 1H), 6.99-6.94 (m, 1H), 6.62 (d, $J$ = 16.0 Hz, 1H), 6.35 (dd, $J_1$ = 16.0 Hz, $J_2$ = 6.0 Hz, 1H), 3.70-3.66 (m, 1H), 1.88 (s, 1H), 1.14-1.09 (m, 1H), 0.66-0.59 (m, 2H), 0.49-0.42 (m, 1H), 0.39-0.34 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 163.10 (d, $J$ = 243.6 Hz, 1C), 139.23 (d, $J$ = 7.6 Hz, 1C), 132.39, 130.00 (d, $J$ = 8.4 Hz, 1C), 128.80 (d, $J$ = 2.6 Hz, 1C), 122.42 (d, $J$ = 2.8 Hz, 1C), 114.38 (d, $J$ = 21.3 Hz, 1C), 112.92 (d, $J$ =

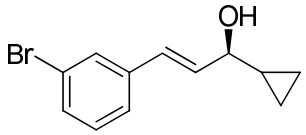
21.5 Hz, 1C), 76.83, 17.71, 3.27, 2.29. HPLC (Chiralcel OD-H column, n-hexane/2-propanol = 95:5 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 10.76 min (major), $t_R$ = 15.19 min (minor). **HRMS (ESI)** calcd for $C_{12}H_{13}FONa$ ($[M+Na]^+$): 215.0843. Found: 215.0839.

(*S,E*)-3-(3-chlorophenyl)-1-cyclopropylprop-2-en-1-ol (**3i**)



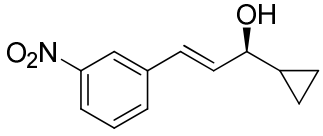

Colourless oil; 92% yield (38.2 mg), 85% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.42 (s, 1H), 7.31-7.23 (m, 3H), 6.60 (d, $J$ = 15.6 Hz, 1H), 6.35 (dd, $J_1$ = 16.0 Hz, $J_2$ = 6.0 Hz, 1H), 3.68 (t, $J$ = 15.6 Hz, 1H), 1.84 (s, 1H), 1.16-1.07 (m, 1H), 0.66-0.59 (m, 2H), 0.49-0.44 (m, 1H), 0.39-0.35 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 138.75, 134.51, 132.53, 129.78, 128.55, 127.52, 126.40, 124.76, 76.81, 17.71, 3.26, 2.29. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 95:5 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 11.64 min (major), $t_R$ = 17.42 min (minor). **HRMS (ESI)** calcd for $C_{12}H_{13}ClONa$ ($[M+Na]^+$): 231.0547. Found: 231.0545.

(*S,E*)-3-(3-bromophenyl)-1-cyclopropylprop-2-en-1-ol (**3j**)




Colourless oil; 90% yield (45.3 mg), 84% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.57 (t, $J$ = 2.0 Hz, 1H), 7.40-7.37 (m, 1H), 7.34-7.30 (m, 1H), 7.20 (t, $J$ = 8.0 Hz, 1H), 6.56 (dd, $J_1$ = 16.0 Hz, $J_2$ = 1.2 Hz, 1H), 6.34 (dd, $J_1$ = 16.0 Hz, $J_2$ = 6.0 Hz, 1H), 3.68-3.64 (m, 1H), 2.08 (s, 1H), 1.13-1.07 (m, 1H), 0.65-0.60 (m, 2H), 0.47-0.43 (m, 1H), 0.37-034 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 139.06, 132.64, 130.41, 130.08, 129.33, 128.42, 125.21, 122.76, 76.77, 17.68, 3.29, 2.29. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 95:5 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 12.90 min (major), $t_R$ = 20.41 min (minor). **HRMS (ESI)** calcd for $C_{12}H_{13}BrONa$ ($[M+Na]^+$): 275.0042. Found: 275.0043.

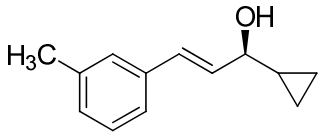
(*S,E*)-1-cyclopropyl-3-(3-nitrophenyl)prop-2-en-1-ol (**3k**)




Colourless oil; 87% yield (38.1 mg), 85% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 8.30 (t, $J$ = 2.0 Hz, 1H), 8.14-8.11 (m, 1H), 7.74-7.72 (m, 1H), 7.53 (t, $J$ = 8.0 Hz, 1H), 6.75 (dd, $J_1$ = 16.0 Hz, $J_2$ = 1.2 Hz, 1H), 6.52 (dd, $J_1$ = 16.0 Hz, $J_2$ = 5.6 Hz, 1H), 3.72-3.69 (m, 1H), 1.88 (s, 1H), 1.16-1.10 (m, 1H), 0.69-0.65 (m, 2H), 0.50-0.47 (m, 1H), 0.42-0.38 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 148.64, 138.74, 134.33, 132.41,

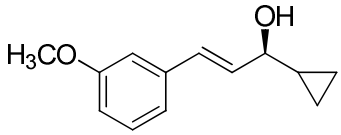
129.47, 127.45, 122.13, 121.03, 76.62, 17.77, 3.33, 2.39. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 95:5 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 19.92 min (major), $t_R$ = 25.26 min (minor). **HRMS (ESI)** calcd for $C_{12}H_{13}NO_3Na$ ([M+Na]$^+$): 242.0788. Found: 242.0786.

(*S*,*E*)-1-cyclopropyl-3-(m-tolyl)prop-2-en-1-ol (**3l**)



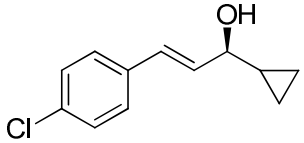

Colourless oil; 72% yield (27.1 mg), 74% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.27-7.25 (m, 3H), 7.11 (dd, $J_1$ = 4.4 Hz, $J_2$ = 2.8 Hz, 1H), 6.62 (d, $J$ = 16.0 Hz, 1H), 6.34 (dd, $J_1$ = 16.0 Hz, $J_2$ = 6.4 Hz, 1H), 3.69 (t, $J$ = 7.2 Hz, 1H), 2.40 (s, 3H), 2.00 (s, 1H), 1.16-1.11 (m, 1H), 0.66-0.58 (m, 2H), 0.50-0.44 (m, 1H), 0.41-0.34 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 138.12, 136.76, 130.81, 130.14, 128.49, 128.43, 127.24, 123.71, 77.13, 21.44, 17.69, 3.26, 2.24. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 95:5 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 11.55 min (major), $t_R$ = 18.60 min (minor). **HRMS (ESI)** calcd for $C_{13}H_{16}ONa$ ([M+Na]$^+$): 211.1093. Found: 211.1092.

(*S,E*)-1-cyclopropyl-3-(3-methoxyphenyl)prop-2-en-1-ol (**3m**)




Colourless oil; 80% yield (32.6 mg), 81% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.28 (dd, $J_1$ = 13.2 Hz, $J_2$ = 2.4 Hz, 1H), 7.03 (d, $J$ = 7.6 Hz, 1H), 6.97 (t, $J$ = 5.6 Hz, 1H), 6.85-6.82 (m, 1H), 6.61 (d, $J$ = 16.0 Hz, 1H), 6.33 (dd, $J_1$ = 15.6 Hz, $J_2$ = 6.0 Hz, 1H), 3.85 (s, 3H), 3.70-3.66 (m, 1H), 2.15 (s, 1H), 1.15-1.09 (m, 1H), 0.67-0.56 (m, 2H), 0.48-0.43(m, 1H), 0.38-0.33 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 159.80, 138.31, 131.41, 129.86, 129.55, 119.22, 113.31, 111.79, 76.93, 55.24, 17.66, 3.26, 2.25. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 95:5 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 10.65 min (major), $t_R$ = 14.88 min (minor). **HRMS (ESI)** calcd for $C_{13}H_{16}O_2Na$ ([M+Na]$^+$): 227.1043. Found: 227.1041.

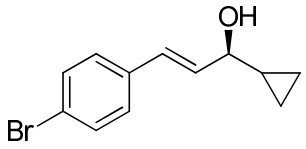
(*S,E*)-3-(4-chlorophenyl)-1-cyclopropylprop-2-en-1-ol (**3n**)




Colourless oil; 91% yield (37.8 mg), 79% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 8.58-8.56 (m, 1H), 7.68-7.63 (m, 1H), 7.35-7.32 (m, 1H), 7.17-7.14 (m, 1H), 6.86 (dd, $J_1$ = 16.0 Hz, $J_2$ = 5.6 Hz, 1H), 6.73 (dd, $J_1$ = 16.0 Hz, $J_2$ = 1.2 Hz, 1H), 3.74-3.70 (m ,1H), 2.56 (s, 1H), 1.16-1.07 (m, 1H), 0.64-0.59 (m, 2H), 0.49-0.44 (m, 1H),

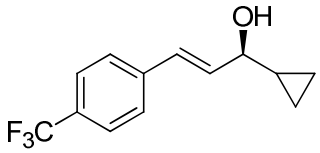
0.40-0.35 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 155.35, 149.42, 136.60, 135.96, 129.19, 122.16, 121.79, 76.48, 17.57, 3.34, 2.33. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 99:1 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 41.33 min (major), $t_R$ = 46.20 min (minor). **HRMS (ESI)** calcd for $C_{12}H_{13}ClONa$ ($[M+Na]^+$): 231.0547. Found: 231.0546.

(*S,E*)-3-(4-bromophenyl)-1-cyclopropylprop-2-en-1-ol (**3o**)



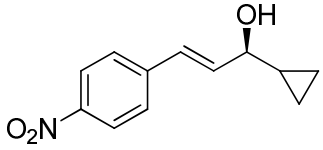

Colourless oil; 89% yield (44.8 mg), 79% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.47 (d, $J$ = 8.4 Hz, 2H), 7.29 (d, $J$ = 8.4 Hz, 2H), 6.58 (d, $J$ = 16.0 Hz, 1H), 6.35 (dd, $J_1$ = 15.6 Hz, $J_2$ = 6.0 Hz, 1H), 3.66 (t, $J$ = 7.2 Hz, 1H), 1.90 (s, 1H), 1.14-1.07 (m, 1H), 0.66-0.60 (m, 2H), 0.47-0.43 (m, 1H), 0.38-0.34 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 135.78, 131.78, 131.66, 128.76, 128.05, 121.34, 76.93, 17.69, 3.27, 2.32. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 99:1.0 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 46.24 min (major), $t_R$ = 52.34 min (minor). **HRMS (ESI)** calcd for $C_{12}H_{13}BrONa$ ($[M+Na]^+$): 275.0042. Found: 275.0041.

(*S,E*)-1-cyclopropyl-3-(4-(trifluoromethyl)phenyl)prop-2-en-1-ol (**3p**)




Colourless oil; 90% yield (43.5 mg), 82% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$= 7.60 (d, $J$ = 8.4 Hz, 2H), 7.52 (d, $J$ = 8.0 Hz, 2H), 6.69 (d, $J$ = 16.0 Hz, 1H), 6.47 (dd, $J_1$ = 16.0 Hz, $J_2$ = 6.0 Hz, 1H), 3.69 (t, $J$= 7.6 Hz, 1H), 1.99 (s, 1H), 1.15-1.09 (m, 1H), 0.67-0.62 (m, 2H), 0.50-0.45 (m, 1H), 0.40-0.36 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 140.37, 133.67, 129.35 (d, $J$ = 32.1 Hz, 2C), 128.45, 126.64 125.53 (dd, $J$ = 39 Hz, 1C), 122.85, 76.79, 17.70, 3.29, 2.33. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 99:1.0 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 30.64 min (major), $t_R$ = 33.27 min (minor). **HRMS (ESI)** calcd for $C_{13}H_{14}F_3O$ ($[M+H]^+$): 243.0991. Found: 243.0992.

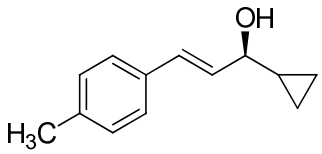
(*S,E*)-1-cyclopropyl-3-(4-nitrophenyl)prop-2-en-1-ol (**3q**)




Yellow solid; m.p. 50-52 ℃, 75% yield (32.8 mg), 78% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 8.22 (d, $J$ = 8.8 Hz, 2H), 7.56 (d, $J$ = 8.8 Hz, 2H), 6.75 (dd, $J_1$ = 16.0 Hz, $J_2$ = 2.0 Hz, 1H), 6.55 (dd, $J_1$ =16.4 Hz, $J_2$ = 5.6 Hz, 1H), 3.70 (t, $J$ = 7.2 Hz, 1H), 1.91 (s, 1H), 1.16-1.08 (m, 1H), 0.69-0.65 (m, 2H), 0.51-0.47 (m, 1H), 0.42-0.37

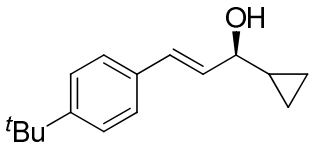
(m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 143.45, 135.92, 192.23, 127.61, 127.02, 124.02, 76.66, 17.74, 3.36, 2.43. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 99:1 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 41.36 min (minor), $t_R$ = 59.42 min (major). **HRMS (ESI)** calcd for $C_{12}H_{13}NO_3Na$ ($[M+Na]^+$): 242.0788. Found: 242.0786.

(*S,E*)-1-cyclopropyl-3-(p-tolyl)prop-2-en-1-ol (**3r**)



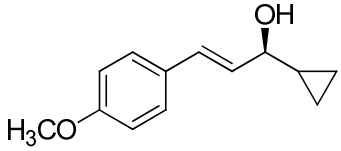

Colourless oil; 80% yield (30.0 mg), 78% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.33 (t, $J$ = 7.2 Hz, 2H), 7.16 (t, $J$ = 6.8 Hz, 2H), 6.63-6.55 (m, 1H), 6.33-6.25 (m, 1H), 3.67 (t, $J$ = 6.8 Hz, 1H), 2.37 (d, $J$ = 6.8 Hz, 2H), 2.38 (s, 1H), 1.14-1.10 (m, 1H), 0.64-0.57 (m, 2H), 0.46-0.43 (m ,1H), 0.37-0.33 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 137.44, 134.00, 130.01, 129.92, 129.27, 126.42, 77.11, 21.20, 17.68, 3.18, 2.20. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 95:5.0 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 12.16 min (major), $t_R$ = 14.23 min (minor). **HRMS (ESI)** calcd for $C_{13}H_{16}ONa$ ($[M+Na]^+$): 211.1093. Found: 211.1094.

(*S,E*)-3-(4-(*tert*-butyl)phenyl)-1-cyclopropylprop-2-en-1-ol (**3s**)




Colourless oil; 70% yield (32.2 mg), 82% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.39 (s, 4H), 6.64 (dd, $J_1$ =16.0 Hz, $J_2$ = 1.2 Hz, 1H), 6.33 (dd, $J_1$ = 16.0 Hz, $J_2$ = 6.4 Hz, 1H), 3.70 (t, $J$ = 7.2 Hz, 1H), 1.88 (s, 1H), 1.36 (s, 9H), 1.17-1.09 (m, 1H), 0.64-0.58 (m, 2H), 0.47-0.44 (m, 1H), 0.39-0.34 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 150.75, 134.02, 130.20, 129.86, 126.24, 125.50, 77.12, 34.60, 31.32, 17.71, 3.22, 2.17. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 95:5 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 8.71 min (major), $t_R$ = 10.94 min (minor). **HRMS (ESI)** calcd for $C_{16}H_{22}ONa$ ($[M+Na]^+$): 253.1563. Found: 253.1561.

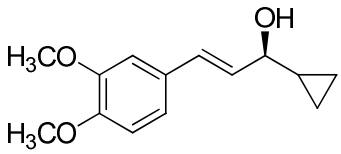
(*S,E*)-1-cyclopropyl-3-(4-methoxyphenyl)prop-2-en-1-ol (**3t**)




Colourless oil; 76% yield (31.0 mg), 73% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.37 (d, $J$ = 8.8 Hz, 2H), 6.89 (d, $J$ = 8.8 Hz, 2H), 6.58 (d, $J$ = 16.0 Hz, 1H), 6.20 (dd, $J_1$ = 16.0 Hz, $J_2$ = 6.4 Hz, 1H), 3.84 (s, 3H), 3.68-3.64 (m , 1H), 1.88 (s, 1H), 1.14-1.10 (m, 1H), 0.65-0.56 (m, 2H), 0.47-0.42 (m, 1H), 0.38-0.33 (m, 1H);

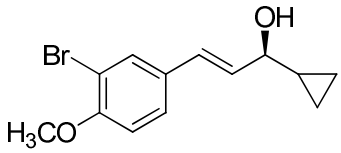
**$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 159.23, 129.66, 129.55, 128.78, 127.69, 113.99, 77.25, 55.32, 17.72, 3.22, 2.24. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 90:10 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 9.34 min (major), $t_R$ = 11.11 min (minor). **HRMS (ESI)** calcd for $C_{13}H_{16}O_2Na$ ([M+Na]$^+$): 227.1043. Found: 227.1044.

(*S,E*)-1-cyclopropyl-3-(3,4-dimethoxyphenyl)prop-2-en-1-ol (**3u**)



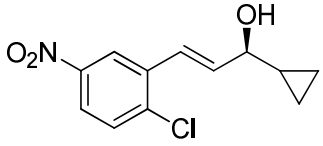
Colourless oil; 76% yield (35.5 mg), 73% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.00-6.96 (m, 2H), 6.86 (d, $J$ = 8.4 Hz, 1H), 6.56 (dd, $J_1$ = 16.0 Hz, $J_2$ = 1.2 Hz, 1H), 6.23 (dd, $J_1$ = 16.0 Hz, $J_2$ = 6.4 Hz, 1H), 3.95 (s, 3H), 3.92 (s, 3H), 3.67(t, $J$ = 8.8 Hz, 1H), 1.76 (s, 1H), 1.18-1.09 (m, 1H), 0.66-0.60 (m, 2H), 0.48-0.44 (m, 1H), 0.39-0.35 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 149.06, 148.88, 129.94, 129.87, 129.05, 119.76, 111.13, 108.87, 77.23, 55.95, 55.85, 17.76, 3.21, 2.31. **HPLC** (Chiralcel AD-H column, n-hexane/2-propanol = 90:10 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_R$ = 26.31 min (minor), $t_S$ = 32.28 min (major). HRMS (MALDI) calcd for $C_{14}H_{18}O_3$ ([M+Na]$^+$): 247.1093. Found: 247.1095.

(*S,E*)-3-(3-bromo-4-methoxyphenyl)-1-cyclopropylprop-2-en-1-ol (**3v**)



Colourless oil; 75% yield (42.3 mg), 78% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.64 (d, $J$ = 2.0 Hz, 1H), 7.32-7.30 (m, 1H), 6.88 (d, $J$ = 8.4 Hz, 1H), 6.51 (dd, $J_1$ = 16.0 Hz, $J_2$ = 1.2 Hz, 1H), 6.22 (dd, $J_1$ = 15.6 Hz, $J_2$ = 6.0 Hz, 1H), 3.93 (s, 3H), 3.67-3.63 (m, 1H), 1.84 (s, 1H), 1.14-1.06 (m, 1H), 0.65-0.59 (m, 2H), 0.48-0.43 (m, 1H), 0.38-0.33 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 139.59, 137.09, 136.69, 130.66, 124.08, 122.79, 121.81, 76.59, 18.00, 17.71, 3.41, 2.41. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 98:2 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 42.16 min (major), $t_R$ = 46.72 min (minor). **HRMS (ESI)** calcd for $C_{13}H_{15}BrO_2Na$ ([M+Na]$^+$): 305.0148. Found: 305.0146.

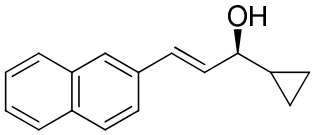
(*S,E*)-3-(2-chloro-5-nitrophenyl)-1-cyclopropylprop-2-en-1-ol (**3w**)



Yellow solid, m.p. 68-70 °C, 89% yield (45.0 mg), 87% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 8.46 (d, $J$ = 2.8 Hz, 1H), 8.06 (dd, $J_1$ = 8.8 Hz, $J_2$ = 2.8 Hz, 1H), 7.56 (t, $J$ = 6.8 Hz, 1H), 7.05 (dd, $J_1$ = 16.0 Hz, $J_2$ = 1.6 Hz, 1H), 6.54 (dd, $J_1$ = 16.0 Hz, $J_2$ = 1.6 Hz, 1H), 3.74 (dd, $J_1$ = 6.0 Hz, $J_2$ = 1.6 Hz, 1H), 1.91 (s, 1H), 1.17-1.12 (m,

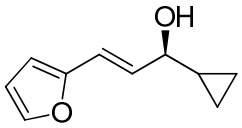
1H), 0.71-0.67 (m, 2H), 0.52-0.48 (m, 1H), 0.44-0.40 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 139.59, 137.09, 136.69, 130.66, 124.08, 122.79, 121.81, 76.59, 17.71, 3.41, 2.41. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 95:5 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_R$ = 15.64 min (minor), $t_S$ = 17.33 min (major). **HRMS (ESI)** calcd for $C_{12}H_{12}ClNO_3Na$ ($[M+Na]^+$): 276.0398. Found:276.0397

(*S,E*)-1-cyclopropyl-3-(naphthalen-2-yl)prop-2-en-1-ol (**3x**)



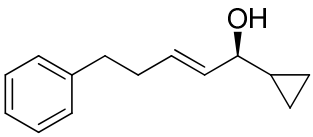

Colourless oil; 71% yield (31.8 mg), 82% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 8.13 (dd, $J_1$ = 7.2 Hz, $J_2$ = 1.6 Hz, 1H), 7.85 (dd, $J_1$ = 7.2 Hz, $J_2$ = 2.4 Hz, 1H), 7.78 (d, $J$ = 8.0 Hz, 1H), 7.62 (t, $J$ = 6.8 Hz, 1H), 7.52-7.43 (m, 3H), 7.37 (d, $J$ = 16.0 Hz, 1H), 6.35 (dd, $J_1$ = 16.0 Hz, $J_2$ = 2.0 Hz, 1H), 3.79 (t, $J$ = 7.2 Hz, 1H), 1.87 (s, 1H), 1.21-1.12 (m, 1H), 0.65-0.61 (m, 2H), 0.51-0.43 (m, 1H), 0.42-0.37 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 134.61, 134.20, 133.62, 131.22, 128.55, 127.97, 127.20, 126.04, 125.79, 125.63, 123.90, 123.81, 77.20, 17.82, 3.32, 2.28. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 80:20 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 10.11 min (major), $t_R$ = 14.87 min (minor). **HRMS (ESI)** calcd for $C_{16}H_{16}ONa$ ($[M+Na]^+$): 247.1093. Found: 247.1091.

(*S,E*)-1-cyclopropyl-3-(furan-2-yl)prop-2-en-1-ol (**3y**)




White oil; 60% yield (19.6 mg), 85% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 6.49-6.21 (m, 4H), 3.64 (t, $J$ = 6.8 Hz, 1H), 2.20 (s, 1H), 1.10-1.02 (m, 1H), 0.62-0.54 (m, 2H), 0.45-0.41 (m, 1H), 0.38-0.25 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 125.53, 141.89, 141.85, 129.74, 118.24, 111.28, 111.25, 107.98, 76.46, 17.60, 17.56, 3.21, 2.17. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 95:5 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_R$ = 10.40 min (major), $t_S$ = 11.38 min (minor). **HRMS (ESI)** calcd for $C_{10}H_{13}O_2$ ($[M+H]^+$): 165.0910. Found: 165.0909.

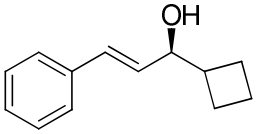
(*S,E*)-1-cyclopropyl-5-phenylpent-2-en-1-ol (**3z**) [2]




Colourless oil; 65% yield (26.2 mg), 83% ee. Purified by flash column chromatography (PE: EA = 3:1). ($[\alpha]_D^{25}$ +21.5 (*c* 1.0, MeOH)), {In reference [2]: $[\alpha]_D^{25}$ +28.2 (*c* 1.41, MeOH), 98% ee, *S* configuration}. **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.35-7.31 (m, 2H), 7.25-7.22 (m, 3H), 5.79-5.59

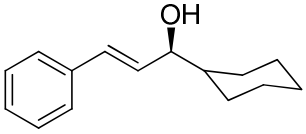
(m, 2H), 3.48 (t, $J$ = 7.2 Hz, 1H), 2.76 (t, $J$ = 7.2 Hz, 2H), 2.45-2.39 (m, 2H), 1.77 (s, 1H), 1.04-0.99 (m, 1H), 0.59-0.51 (m, 2H), 0.39-0.34 (m, 1H), 0.30-0.24 (m, 1H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 141.78, 132.09, 130.87, 128.49, 128.32, 125.86, 76.99, 35.66, 34.07, 55.49, 17.56, 3.13, 2.07. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 90:10 (v/v), 1.0 mL/min, 220 nm, 25 ℃), $t_S$ = 15.30 min (major), $t_R$ = 16.98 min (minor). **HRMS (ESI)** calcd for $C_{14}H_{18}ONa$ ($[M+Na]^+$): 225.1250. Found: 225.1251.

(*S,E*)-1-cyclobutyl-3-phenylprop-2-en-1-ol (**3aa**)



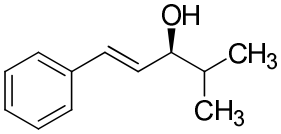

Colourless oil; 89% yield (33.5 mg), 67% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.44-7.42 (m, 2H), 7.38-7.34 (m, 2H), 7.30-7.26 (m, 1H), 6.65 (d, $J$ = 16.0 Hz, 1H), 6.24 (dd, $J_1$ = 16 Hz, $J_2$ = 6.8 Hz, 1H), 4.25 (t, $J$ = 7.2 Hz, 1H), 2.18-1.86 (m, 7H). **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 136.82, 130.65, 130.26, 128.57, 127.61, 126.47,125.63, 40.92, 24.43, 23.98, 18.01. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 90:10 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 7.74 min (major), $t_R$ = 11.20 min (minor). **HRMS (ESI)** calcd for $C_{13}H_{16}ONa$ ($[M+Na]^+$): 211.1093. Found: 211.1092.

(*S,E*)-1-cyclohexyl-3-phenylprop-2-en-1-ol (**3ab**)




Colourless oil; 86% yield (37.15 mg), 0% ee. Purified by flash column chromatography (PE: EA = 3:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.66-7.60 (m, 3H), 7.44-7.43 (m, 3H), 6.88 (dd, $J_1$ = 16.1 Hz, $J_2$ = 2 Hz, 1H), 2.74-2.68 (m, 1H), 1.96 (dd, $J_1$ = 27.6 Hz, $J_2$ = 11.6 Hz, 4H), 1.66 (s, 1H), 1.40 (m, 6H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 136.82, 131.24, 131.09, 128.58, 127.60, 126.45, 44.01, 28.93, 28.66, 26.53, 26.16, 26.10. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 90:10 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 7.38 min, $t_R$ = 10.72 min. **HRMS (ESI)** calcd for $C_{15}H_{20}ONa$ ($[M+Na]^+$): 239.1406. Found:239.1407.

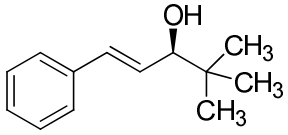
(*S,E*)-4-methyl-1-phenylpent-1-en-3-ol (**3ac**)




Colourless oil; 81% yield (28.5 mg), 39% ee. Purified by flash column chromatography (PE: EA = 25:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.45-7.43 (m, 4H), 7.29 (d, $J$ = 7.6 Hz, 1H), 6.64 (d, $J$ = 16.0 Hz, 1H), 6.30 (dd, $J_1$ = 16 Hz, $J_2$ = 8.0 Hz, 1H), 4.08 (t, $J$ = 8 Hz, 1H), 1.92-1.84 (m, 1H), 1.03 (dd, $J_1$ = 16.0 Hz, $J_2$ = 6.8 Hz, 6H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 136.83, 131.22, 130.88, 128.60,

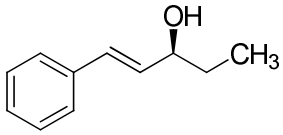
127.62, 126.46, 34.13, 18.34, 18.0. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 90:10 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 7.33 min (minor), $t_R$ = 10.22 min (major). **HRMS (ESI)** calcd for $C_{12}H_{16}ONa$ ($[M+Na]^+$): 199.1093. Found:199.1092.

(*S,E*)-4,4-dimethyl-1-phenylpent-1-en-3-ol (**3ad**)




Colourless oil; 87% yield (33.1 mg), 81% ee. Purified by flash column chromatography (PE: EA = 25:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.45-7.35 (m, 2H), 7.37 (t, $J$ = 6.8 Hz, 2H), 7.29 (d, $J$ = 7.2 Hz, 1H), 6.64 (d, $J$ = 16 Hz, 1H), 6.37 (dd, $J_1$ = 16 Hz, $J_2$ = 7.2 Hz, 1H), 3.99 (d, $J$ = 7.2 Hz, 1H), 1.02 (s, 9H); **$^{13}$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 136.9, 131.86, 129.58, 128.59, 127.60, 126.47, 81.03, 35.35, 25.82. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 90:10 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 6.71 min (minor), $t_R$ = 8.42 min (major). **HRMS (ESI)** calcd for $C_{13}H_{18}ONa$ ($[M+Na]^+$): 213.1250. Found:213.1249.

(*S,E*)-1-phenylpent-1-en-3-ol (**3ae**)



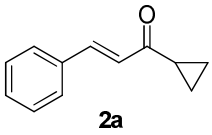

Colourless oil; 80% yield (25.9 mg), 0% ee. Purified by flash column chromatography (PE: EA = 25:1). **$^1$H NMR** (400 MHz, $CDCl_3$): $\delta$ = 7.49 (d, $J$ = 7.6 Hz, 1H), 7.42-7.39 (m, 4H), 7.12 (d, $J$ = 16.4 Hz, 1H), 6.65 (d, $J$ = 16.4 Hz, 1H), 4.46-4.42 (m, 1H), 1.49-1.22 (m, 2H), 0.89 (d, $J$ = 7.2 Hz, 3H); **$^3$C NMR** (100 MHz, $CDCl_3$): $\delta$ = 137.98, 128.66, 128.42, 128.28, 127.71, 127.37, 126.34, 126.23, 72.93, 31.49, 14.84. **HPLC** (Chiralcel OD-H column, n-hexane/2-propanol = 90:10 (v/v), 1.0 mL/min, 254 nm, 25 ℃), $t_S$ = 9.093 min, $t_R$ = 14.392 min. **HRMS (ESI)** calcd for $C_{11}H_{14}ONa$ ($[M+Na]^+$): 185.0937. Found:185.0935.

**Reference：**

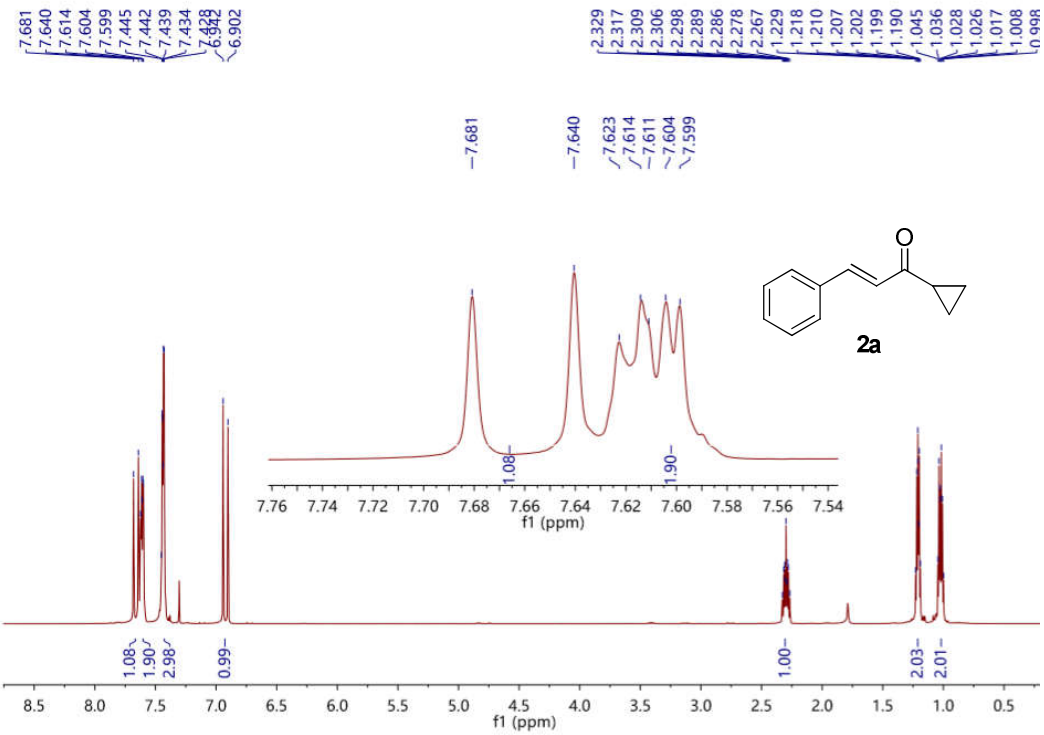
[1] Essam M. S.; Nagwa M. M. H. *Molecules* **2011**, *16*, 7736-7745.

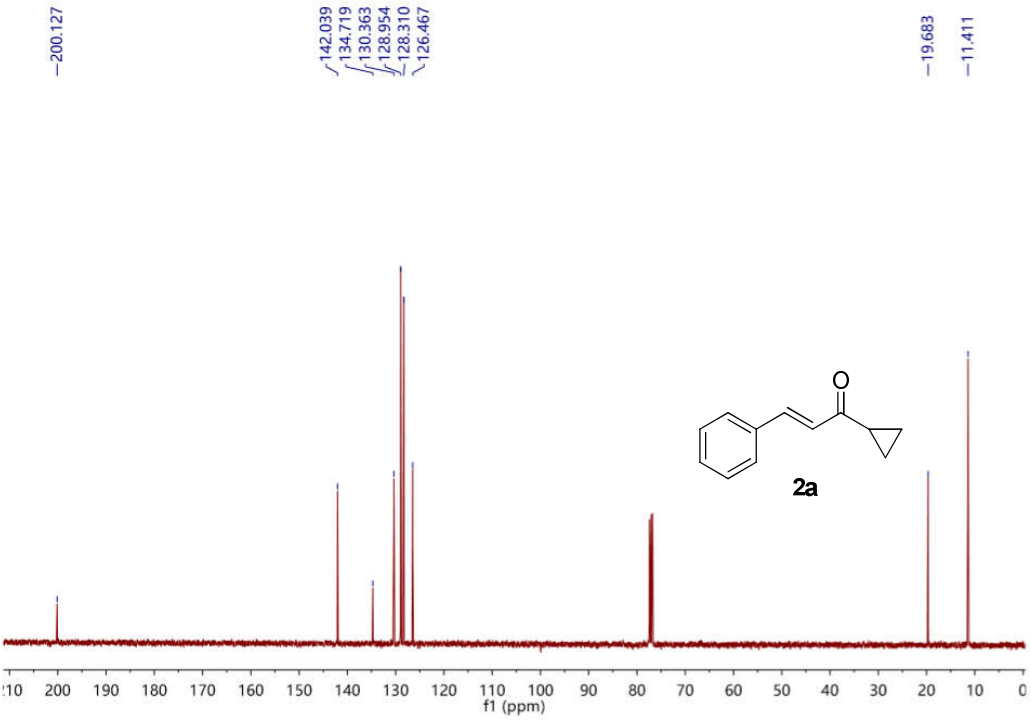
[2] Chen, F.; Zhang, Y.; Yu, L.; Zhu, S., *Angew. Chem. Int. Ed.,* **2017,** *56*, 2022-2025.

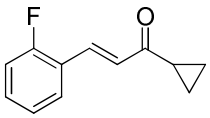
## 7. $^{1}$H NMR & $^{13}$C NMR Spectra of the Products



**2a**

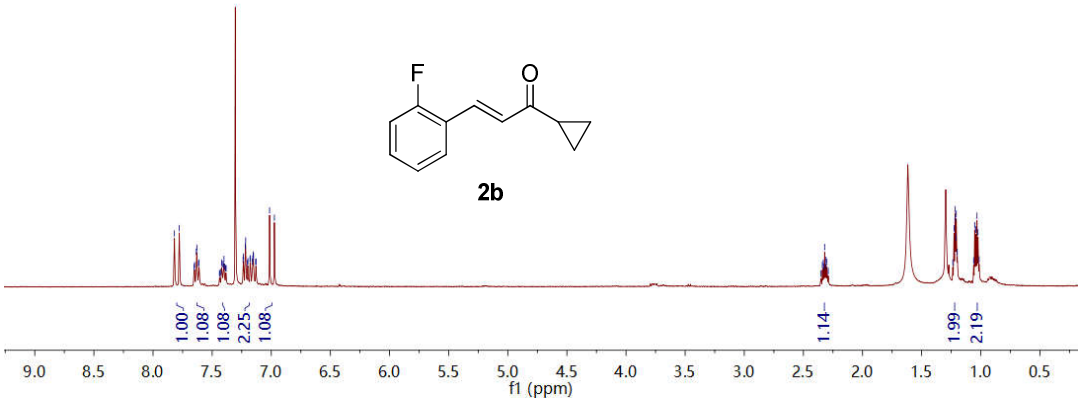


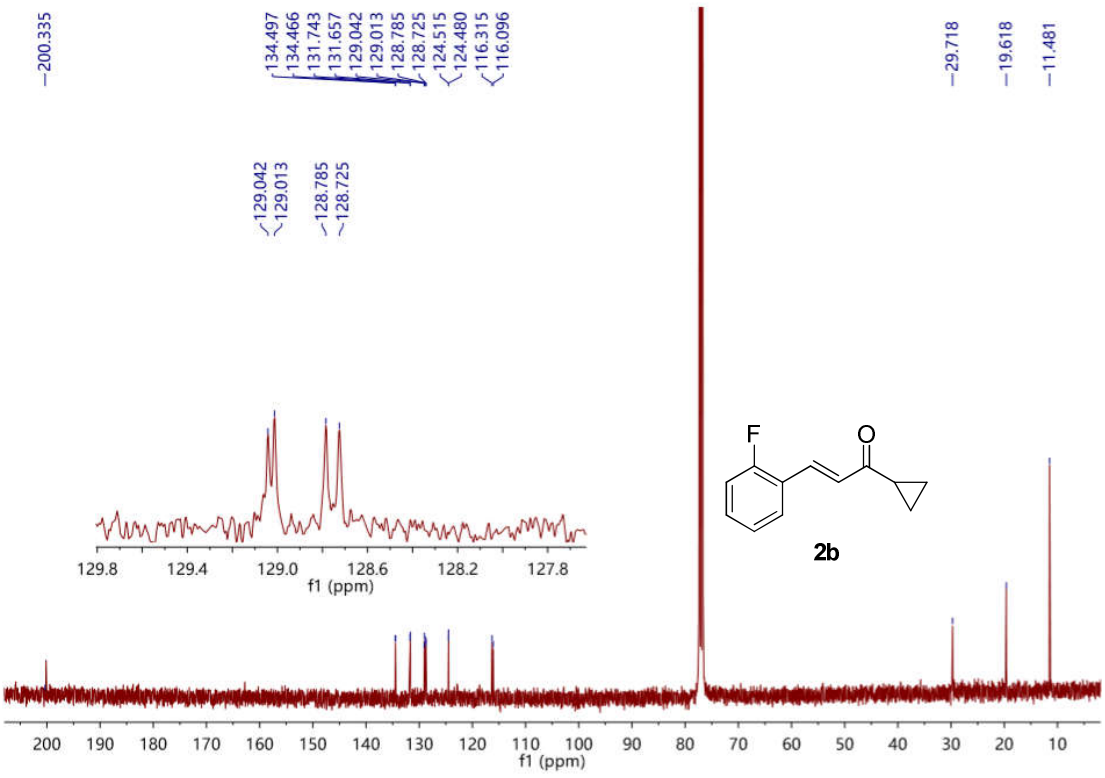



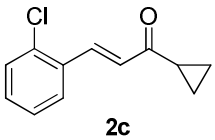

F
O

**2b**


7.819
7.778
7.653
7.649
7.634
7.630
7.615
7.611
7.420
7.415
7.406
7.400
7.395
7.386
7.382
7.239
7.236
7.220
7.217
7.201
7.198
7.180
7.177
7.159
7.157
7.153
7.150
7.132
7.129
7.015
6.974
2.340
2.332
2.329
2.320
2.312
2.309
2.301
2.289
1.237
1.226
1.218
1.215
1.210
1.207
1.199
1.060
1.052
1.042
1.032
1.023
1.014

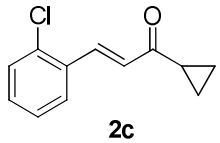

F
O
2b
1.00
1.08
1.08
2.25
1.08
1.14
1.99
2.19
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)


200.335
134.497
134.466
131.743
131.657
129.042
129.013
128.785
128.725
124.515
124.480
116.315
116.096
29.718
19.618
11.481
129.042
129.013
128.785
128.725
F
O
2b
129.8
129.4
129.0
128.6
128.2
127.8
f1 (ppm)
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

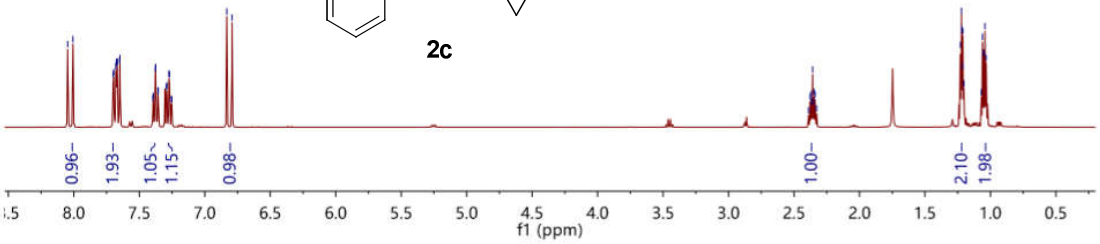

Cl
O

2c


8.047
8.007
7.699
7.695
7.680
7.676
7.671
7.668
7.651
7.648
7.396
7.393
7.378
7.374
7.358
7.355
7.294
7.289
7.274
7.270
7.255
7.251
6.832
6.792
2.389
2.378
2.370
2.367
2.358
2.350
2.347
2.339
2.327
1.230
1.222
1.219
1.213
1.210
1.202
1.070
1.061
1.053
1.051
1.042
1.033


Cl
O

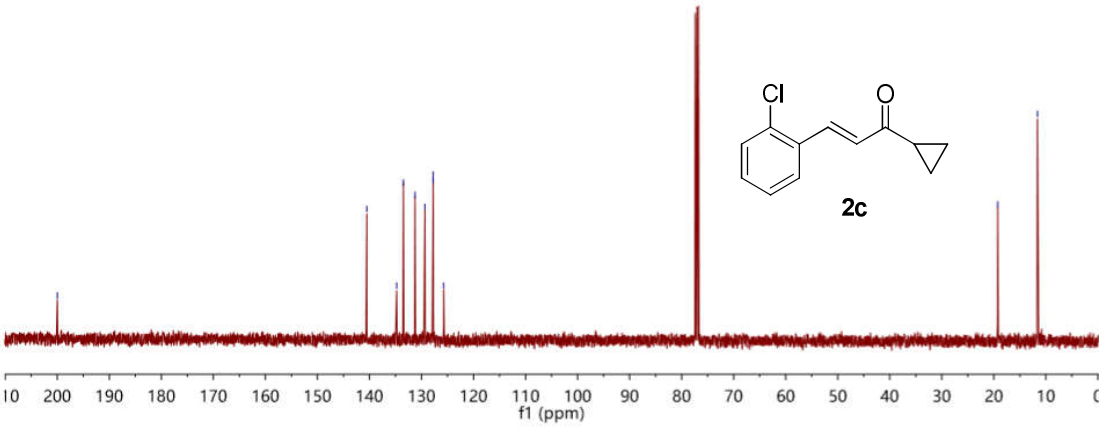
2c

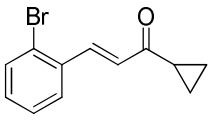

0.96
1.93
1.05
1.15
0.98
1.00
2.10
1.98
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)


199.991
140.509
134.771
133.478
131.254
129.339
127.783
127.746
125.743
19.254
11.619


Cl
O

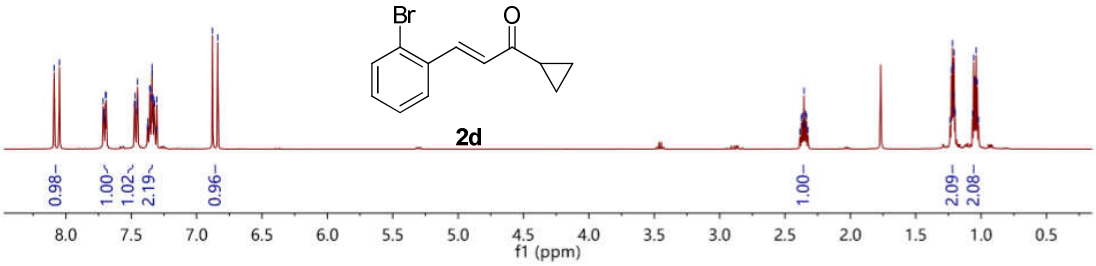
2c


200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

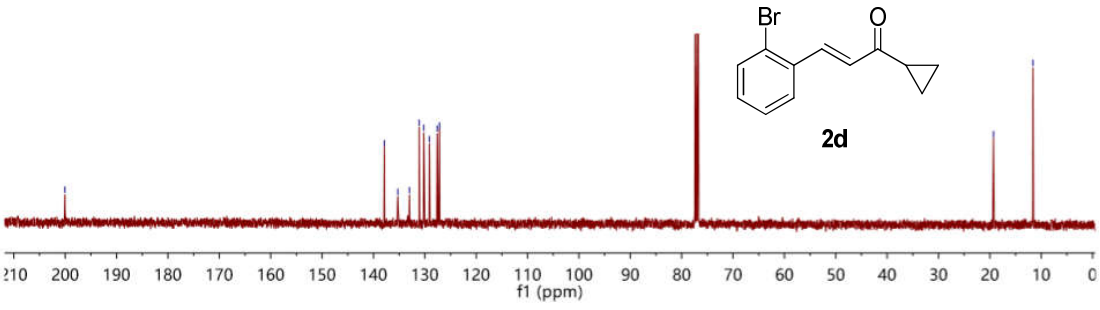

Br
O

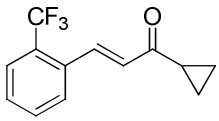
**2d**


8.089
8.049
7.715
7.711
7.709
7.707
7.697
7.691
7.475
7.470
7.458
7.455
7.452
7.377
7.372
7.359
7.353
7.346
7.341
7.340
7.334
7.327
7.323
7.309
7.304
6.879
6.838
2.375
2.366
2.363
2.355
2.347
2.344
2.335
2.324
1.237
1.227
1.219
1.216
1.211
1.208
1.205
1.199
1.066
1.057
1.049
1.047
1.038
1.029


Br
O
2d
0.98
1.00
1.02
2.19
0.96
1.00
2.09
2.08
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
f1 (ppm)

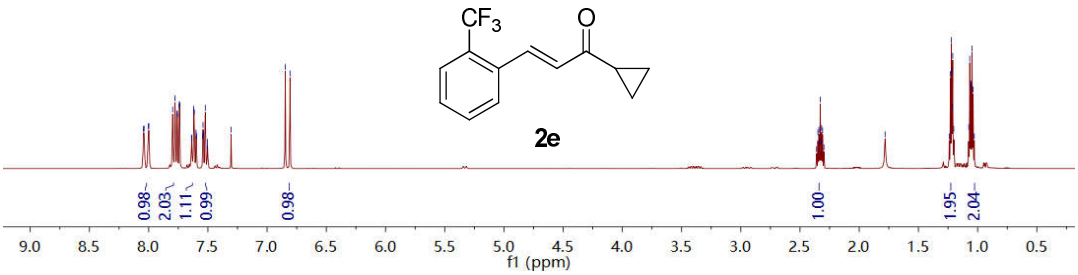

200.051
137.875
135.262
132.996
131.086
130.212
129.114
127.586
127.148
19.296
11.615


Br
O
2d
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

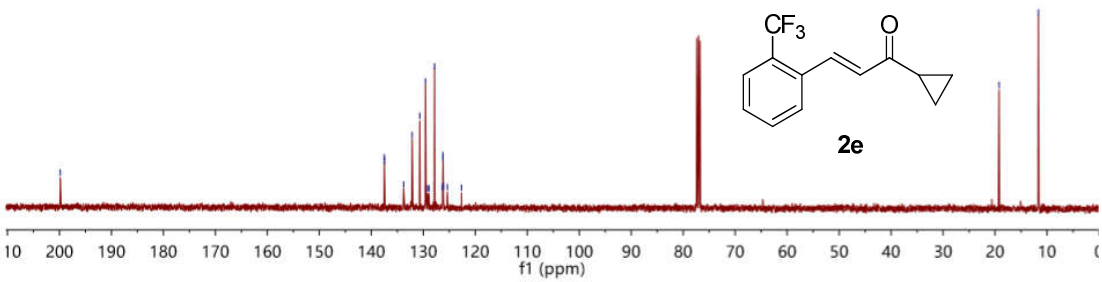

CF3
O

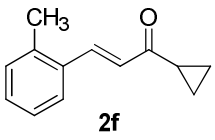
**2e**


8.044
8.039
8.004
7.999
7.797
7.777
7.761
7.758
7.741
7.738
7.639
7.635
7.619
7.616
7.600
7.597
7.544
7.541
7.539
7.522
7.505
7.503
7.304
6.847
6.806
2.360
2.348
2.340
2.337
2.329
2.321
2.318
2.309
2.298
1.781
1.240
1.230
1.222
1.219
1.213
1.210
1.202
1.075
1.066
1.059
1.056
1.047
1.038
1.029

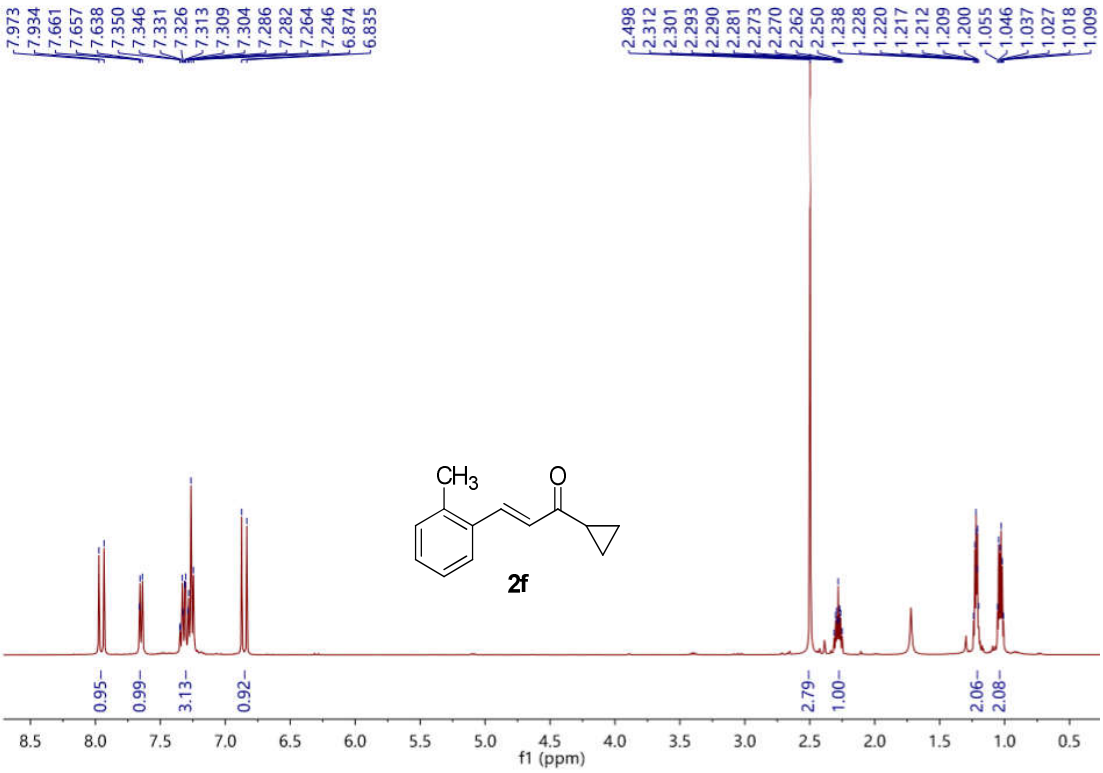

CF3
O
2e
0.98
2.03
1.11
0.99
0.98
1.00
1.95
2.04
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

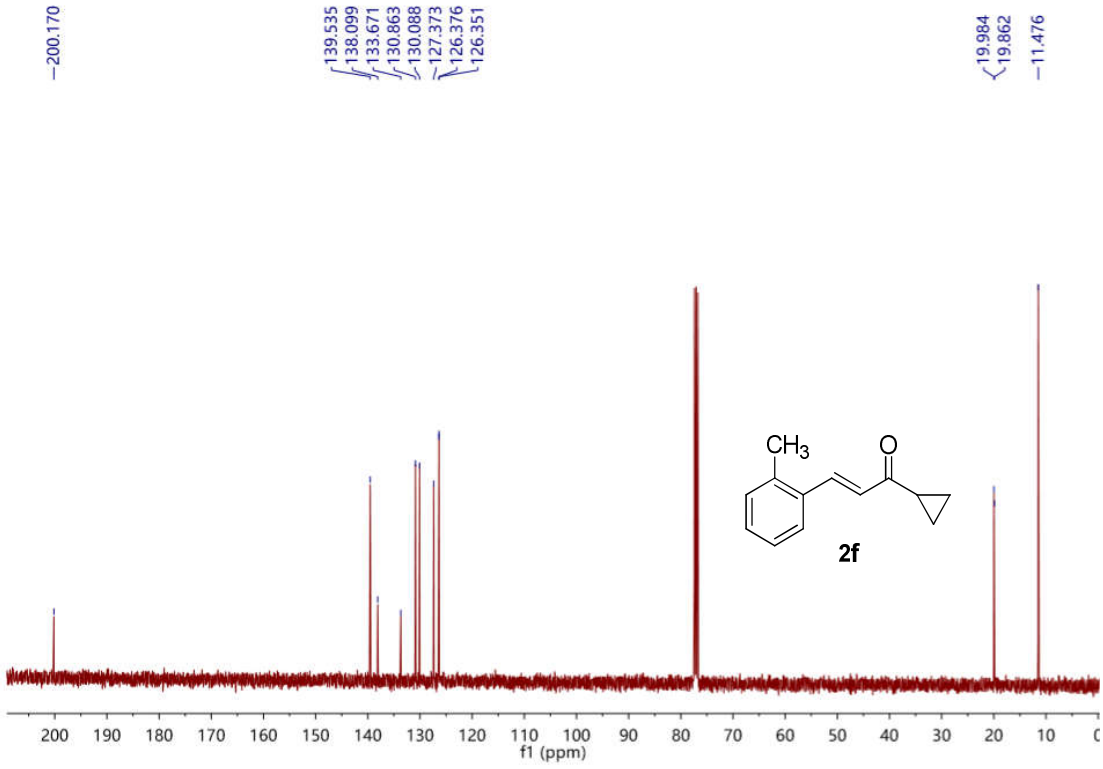

199.828
137.494
137.471
133.786
132.150
130.688
129.592
129.205
128.905
127.846
126.311
126.254
126.198
126.143
125.377
122.654
19.227
11.655

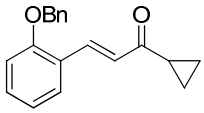

CF3
O
2e
10
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)


CH3
O

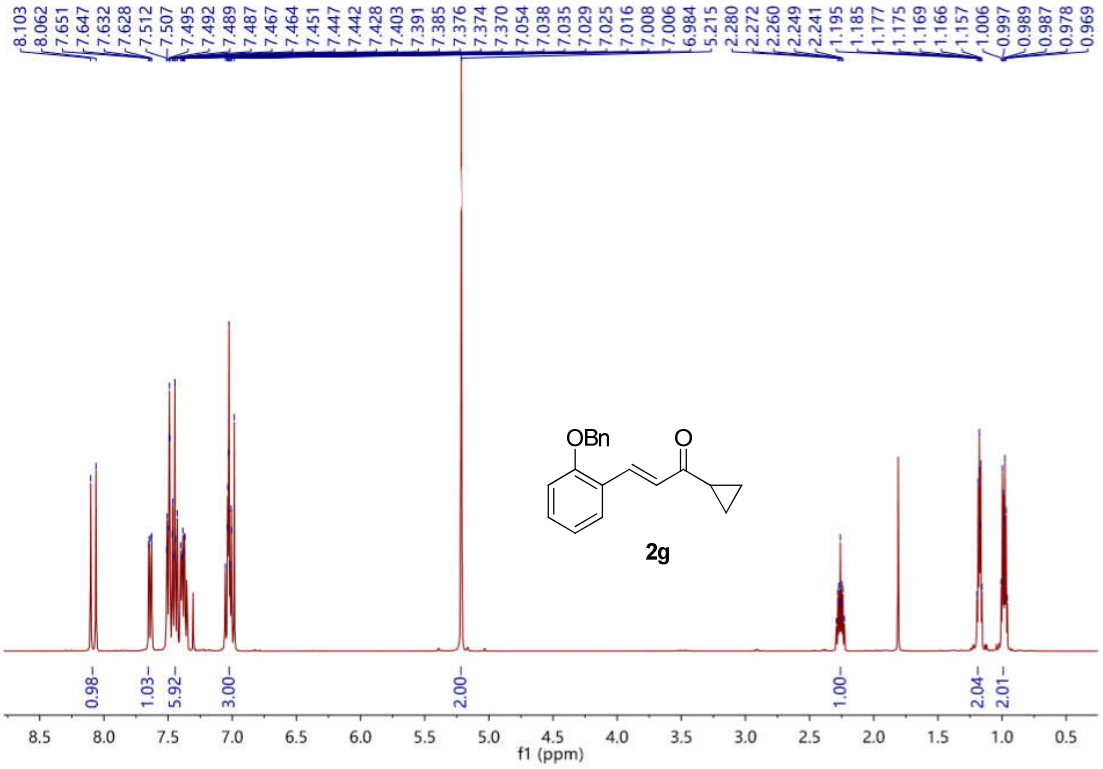
**2f**

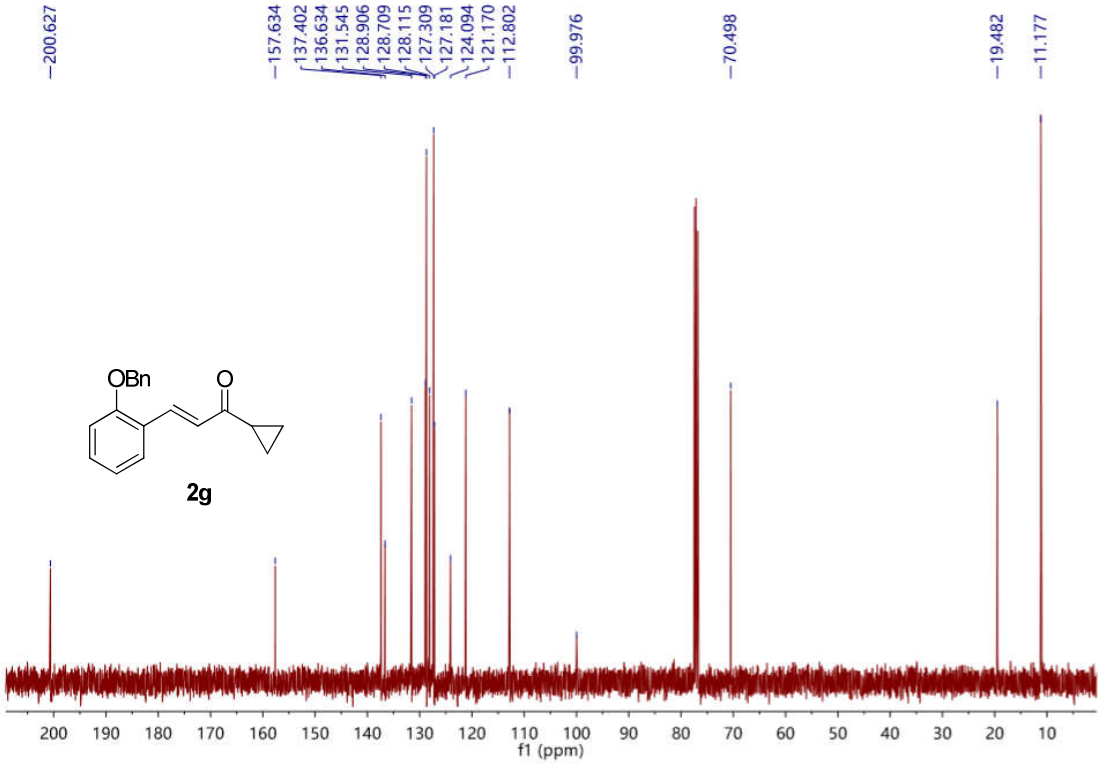

7.973
7.934
7.661
7.657
7.638
7.350
7.346
7.331
7.326
7.313
7.309
7.304
7.286
7.282
7.264
7.246
6.874
6.835
2.498
2.312
2.301
2.293
2.290
2.281
2.273
2.270
2.262
2.250
1.238
1.228
1.220
1.217
1.212
1.209
1.200
1.055
1.046
1.037
1.027
1.018
1.009
CH3
O
2f
0.95
0.99
3.13
0.92
2.79
1.00
2.06
2.08
f1 (ppm)

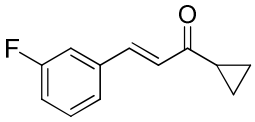

200.170
139.535
138.099
133.671
130.863
130.088
127.373
126.376
126.351
19.984
19.862
11.476
CH3
O
2f
f1 (ppm)


OBn
O

**2g**

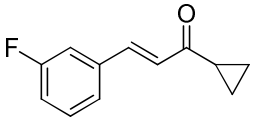

8.103
8.062
7.651
7.647
7.632
7.628
7.512
7.507
7.495
7.492
7.489
7.487
7.467
7.464
7.451
7.447
7.442
7.428
7.403
7.391
7.385
7.376
7.374
7.370
7.054
7.038
7.035
7.029
7.025
7.016
7.008
7.006
6.984
5.215
2.280
2.272
2.260
2.249
2.241
1.195
1.185
1.177
1.175
1.169
1.166
1.157
1.006
0.997
0.989
0.987
0.978
0.969
OBn
O
2g
0.98
1.03
5.92
3.00
2.00
1.00
2.04
2.01
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
f1 (ppm)


200.627
157.634
137.402
136.634
131.545
128.906
128.709
128.115
127.309
127.181
124.094
121.170
112.802
99.976
70.498
19.482
11.177
OBn
O
2g
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

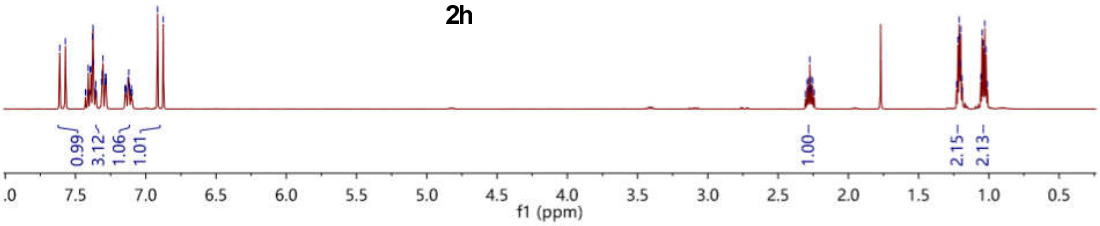



**2h**

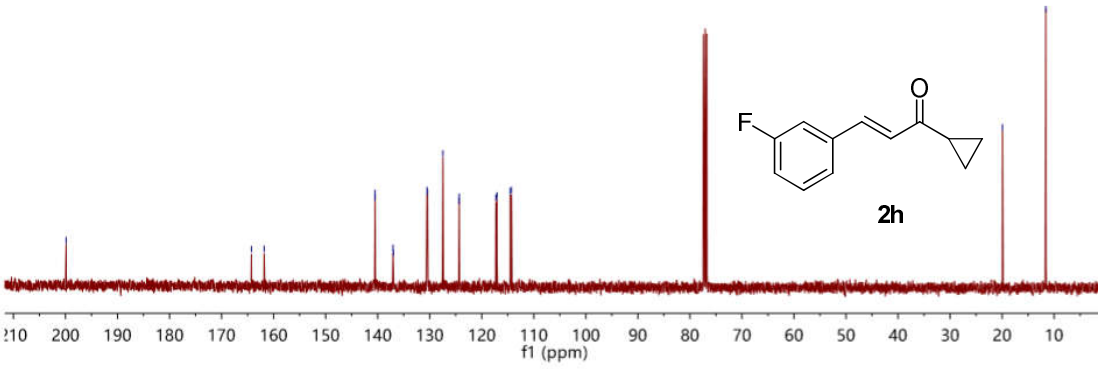
7.612
7.572
7.429
7.410
7.396
7.390
7.378
7.375
7.371
7.360
7.356
7.315
7.309
7.304
7.290
7.286
7.283
7.280
7.148
7.144
7.141
7.138
7.127
7.121
7.116
7.108
7.102
7.097
6.916
6.876
2.294
2.285
2.282
2.274
2.266
2.263
2.254
2.243
1.230
1.219
1.211
1.208
1.203
1.200
1.191
1.187
1.057
1.048
1.039
1.029
1.020
1.011




**2h**



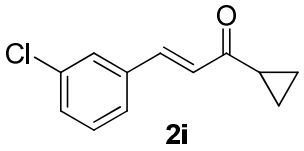

199.873
164.263
161.811
140.527
140.498
137.057
136.980
130.520
130.437
127.470
124.361
124.334
117.285
117.071
114.510
114.292
19.931
11.598



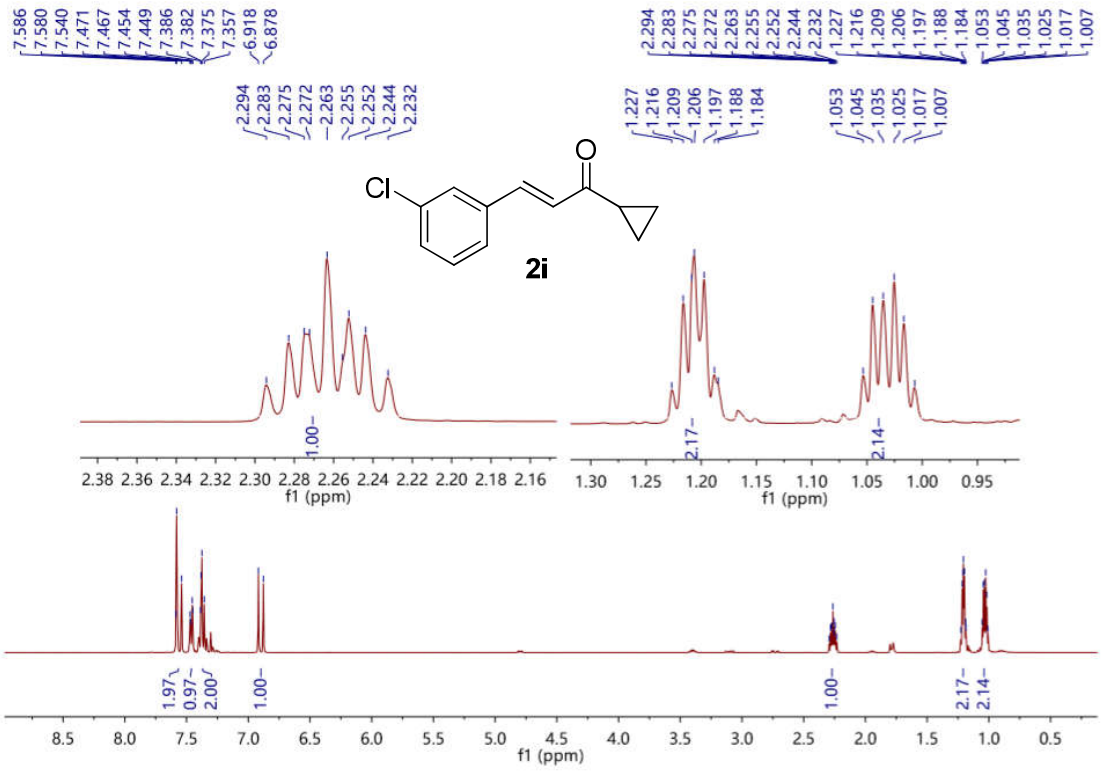


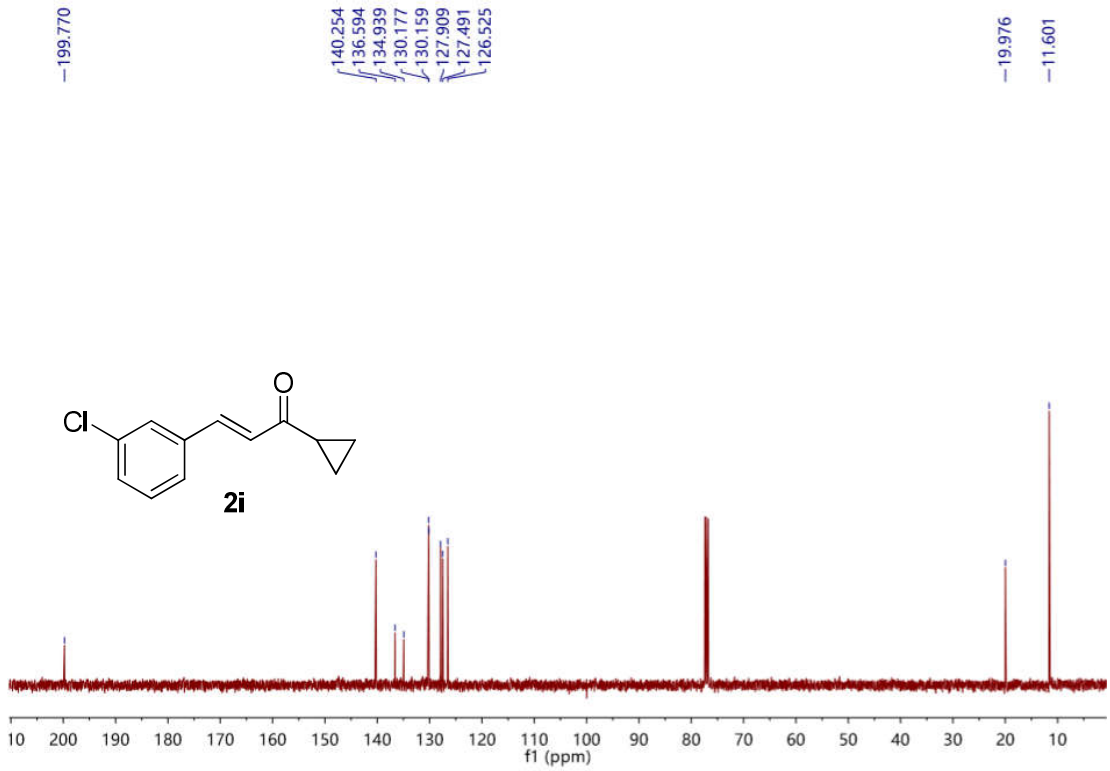


**2h**

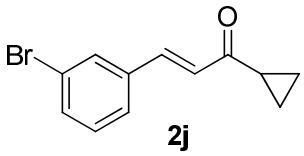

Cl
O

**2i**


7.586
7.580
7.540
7.471
7.467
7.454
7.449
7.386
7.382
7.375
7.357
6.918
6.878
2.294
2.283
2.275
2.272
2.263
2.255
2.252
2.244
2.232
1.227
1.216
1.209
1.206
1.197
1.188
1.184
1.053
1.045
1.035
1.025
1.017
1.007
Cl
O
1.00
2.17
2.14
2.38 2.36 2.34 2.32 2.30 2.28 2.26 2.24 2.22 2.20 2.18 2.16
1.30 1.25 1.20 1.15 1.10 1.05 1.00 0.95
f1 (ppm)
1.97
0.97
2.00
1.00
1.00
2.17
2.14
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
f1 (ppm)


199.770
140.254
136.594
134.939
130.177
130.159
127.909
127.491
126.525
19.976
11.601
Cl
O
10 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10
f1 (ppm)

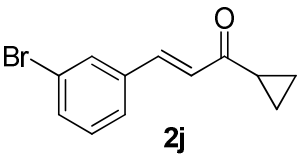
**2i**


Br
O

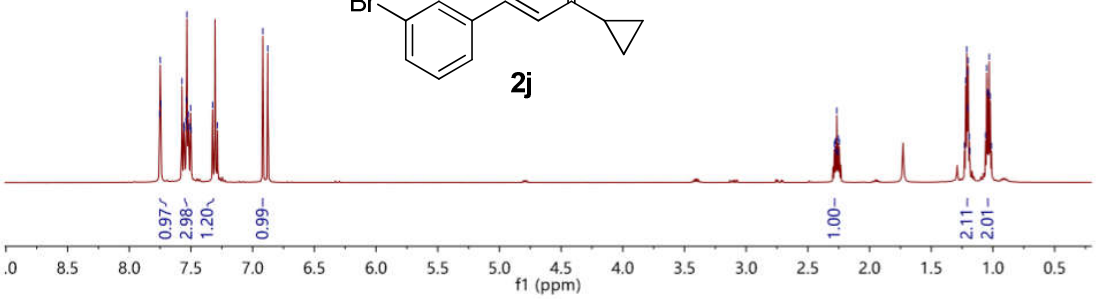
**2j**


7.754
7.749
7.744
7.573
7.540
7.537
7.533
7.522
7.503
7.325
6.878

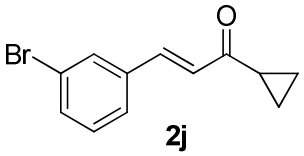

2.285
2.277
2.274
2.265
2.257
2.254
2.246
1.230
1.220
1.212
1.209
1.204
1.201
1.192
1.187
1.059
1.050
1.042
1.040
1.031
1.022
1.012


Br
O

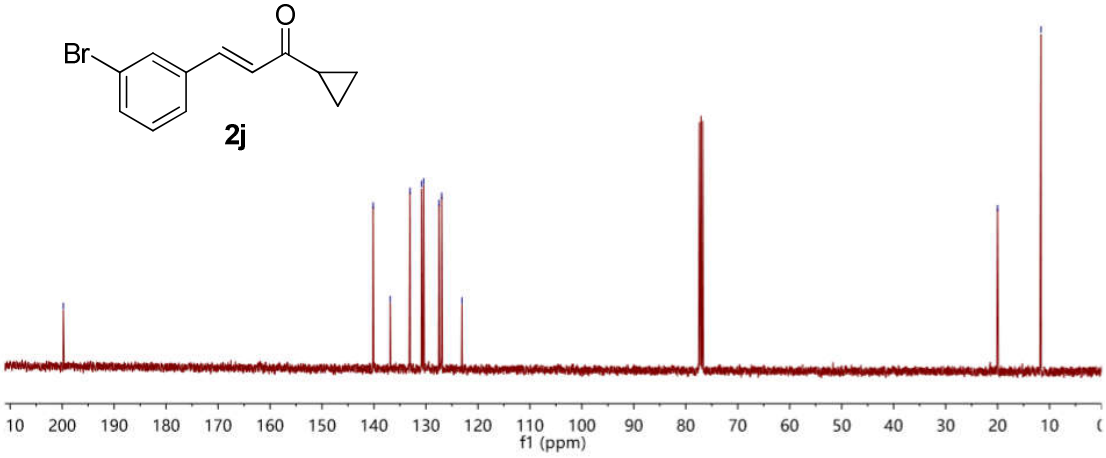
**2j**

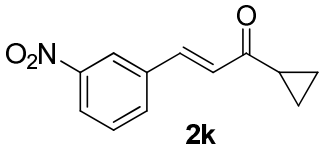

0.97
2.98
1.20
0.99
1.00
2.11
2.01
f1 (ppm)


199.776
140.169
136.865
133.074
130.856
130.444
127.494
126.973
123.063
20.004
11.634


Br
O

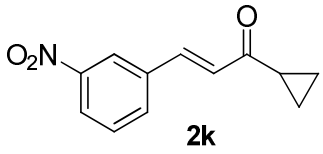
**2j**

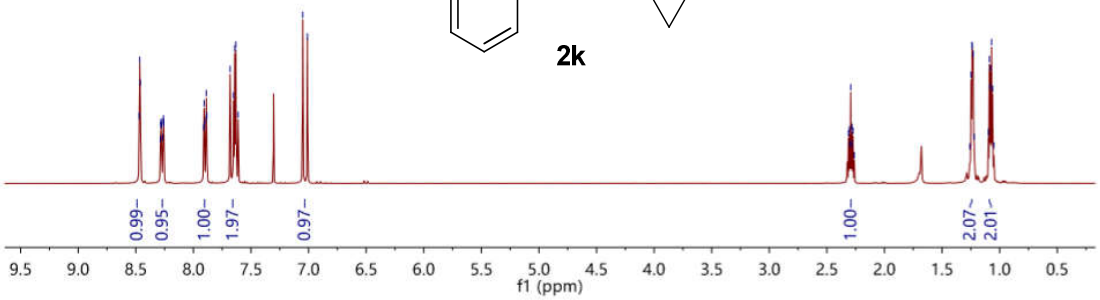

f1 (ppm)


O2N
O
2k

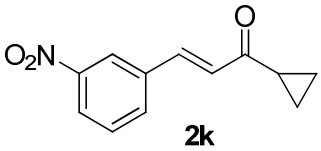

8.471
8.466
8.461
8.286
8.283
8.280
8.277
8.265
8.263
8.260
8.257
7.910
7.907
7.903
7.891
7.888
7.884
7.681
7.652
7.641
7.632
7.612
7.051
7.010

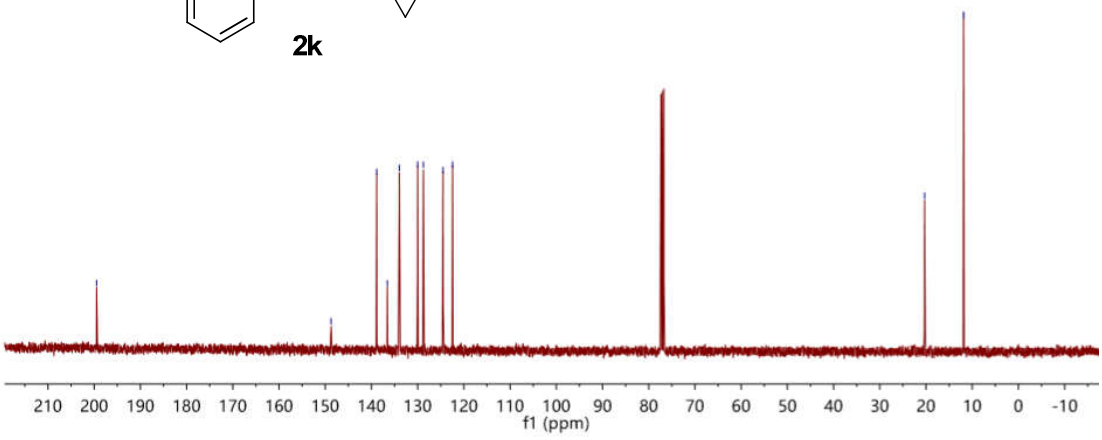

2.312
2.304
2.301
2.293
2.285
2.282
2.273
2.262
1.259
1.248
1.240
1.237
1.229
1.220
1.098
1.090
1.082
1.079
1.070
1.061
1.051

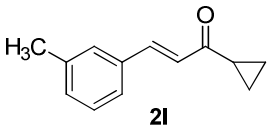

O2N
O
2k


0.99
0.95
1.00
1.97
0.97
1.00
2.07
2.01
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
f1 (ppm)


199.471
148.728
138.861
136.571
133.973
130.006
128.767
124.516
122.448
20.309
11.872

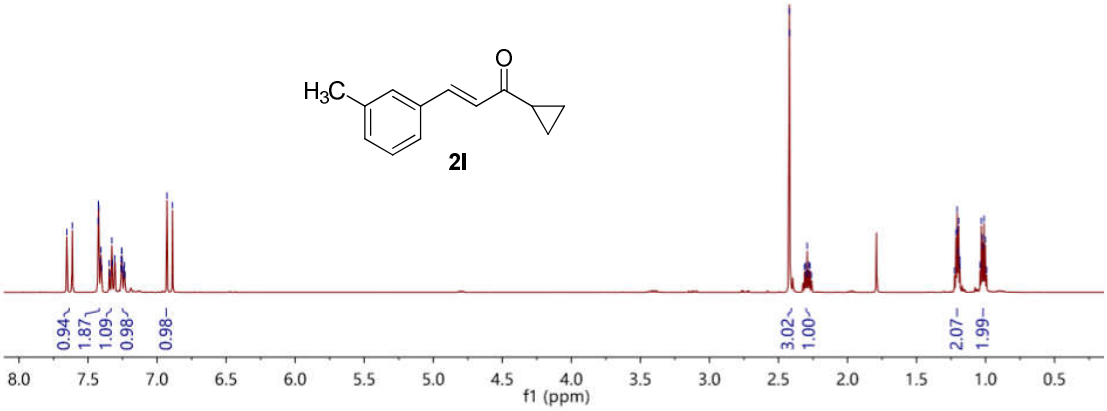

O2N
O
2k


210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0 -10
f1 (ppm)


H3C
O

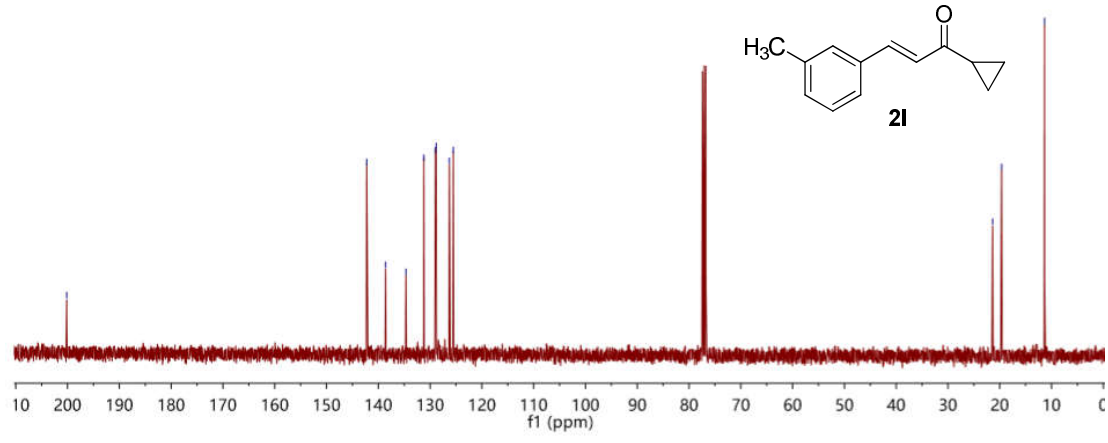
2l


7.654
7.614
7.427
7.425
7.423
7.410
7.406
7.402
7.347
7.343
7.328
7.325
7.307
7.261
7.259
7.257
7.255
7.253
7.251
7.242
7.240
7.237
7.233
6.929
6.889
2.422
2.420
2.311
2.303
2.300
2.292
2.283
2.280
2.272
2.261
1.224
1.214
1.206
1.203
1.197
1.195
1.187
1.185
1.039
1.030
1.022
1.020
1.011
1.002
0.993

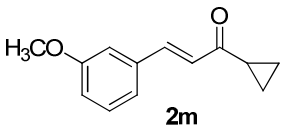

H3C
O
0.94
1.87
1.09
0.98
0.98
3.02
1.00
2.07
1.99
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

2l

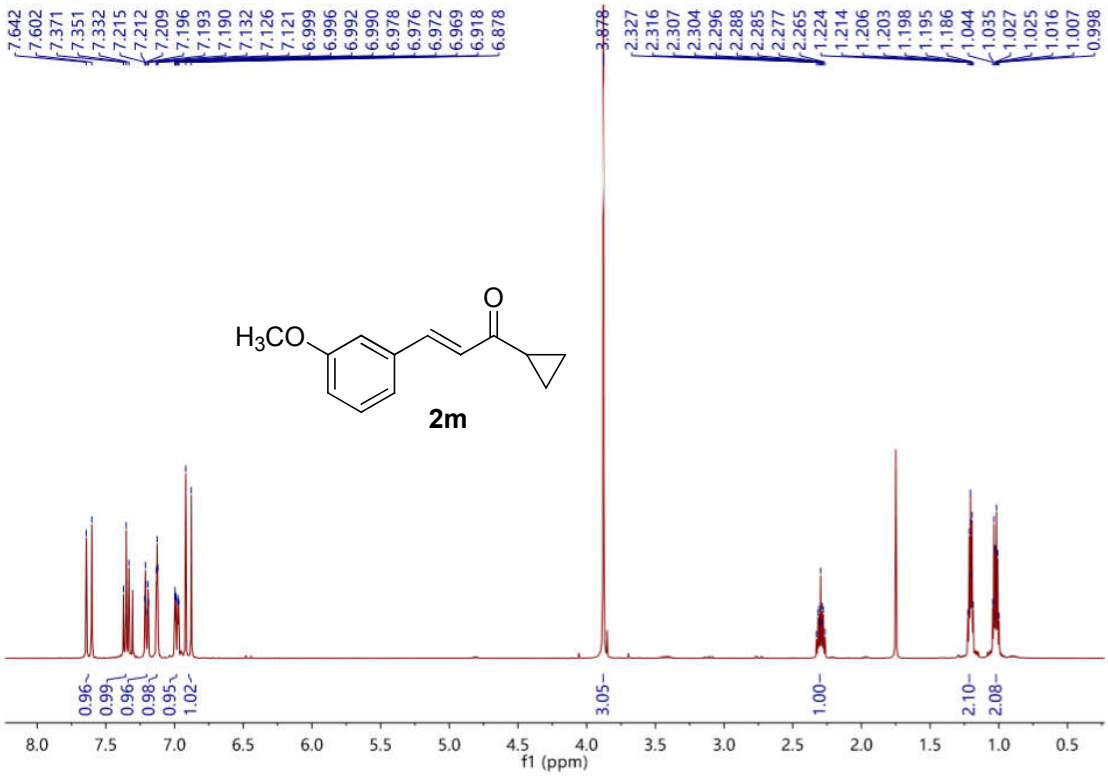

200.164
142.245
138.596
134.662
131.216
128.952
128.830
126.280
125.529
21.371
19.646
11.348


H3C
O
10
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

2l

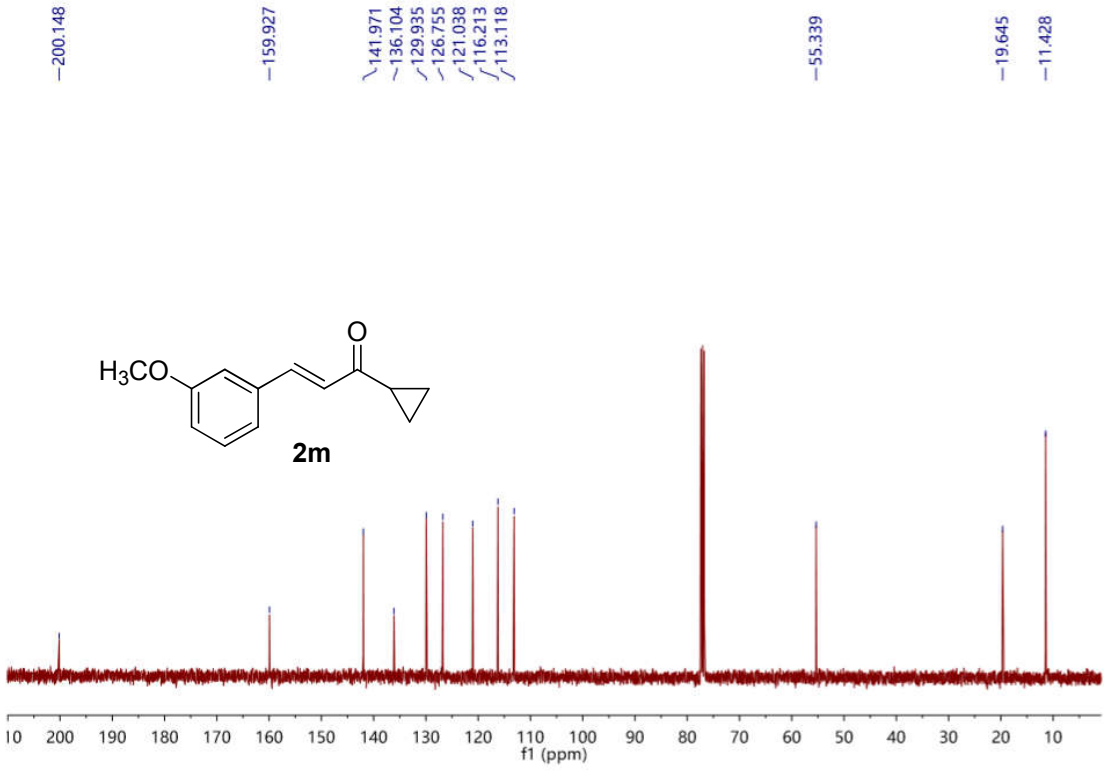

O
H3CO

**2m**


7.642
7.602
7.371
7.351
7.332
7.215
7.212
7.209
7.196
7.193
7.190
7.132
7.126
7.121
6.999
6.996
6.992
6.990
6.978
6.976
6.972
6.969
6.918
6.878
3.878
2.327
2.316
2.307
2.304
2.296
2.288
2.285
2.277
2.265
1.224
1.214
1.206
1.203
1.198
1.195
1.186
1.044
1.035
1.027
1.025
1.016
1.007
0.998
0.96
0.99
0.96
0.98
0.95
1.02
3.05
1.00
2.10
2.08
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
f1 (ppm)

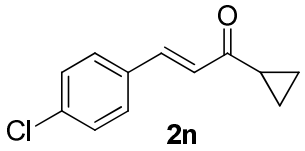

O
H3CO

**2m**

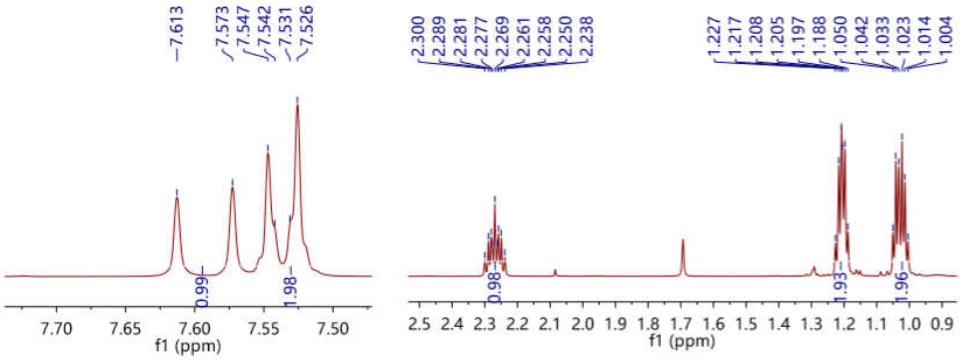

200.148
159.927
141.971
136.104
129.935
126.755
121.038
116.213
113.118
55.339
19.645
11.428
10
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

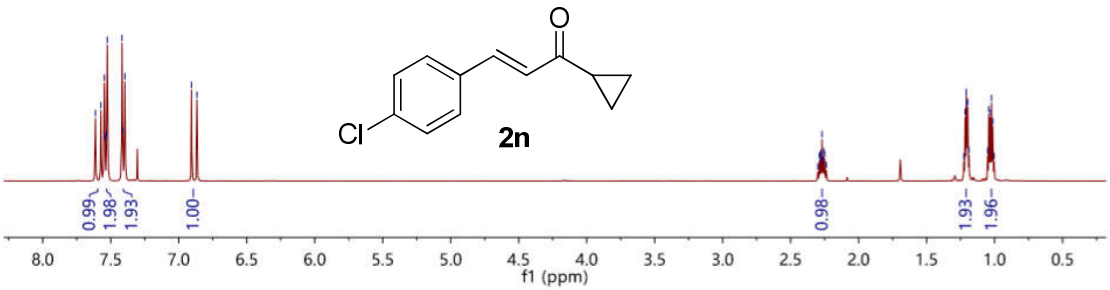

O
H3CO

**2m**

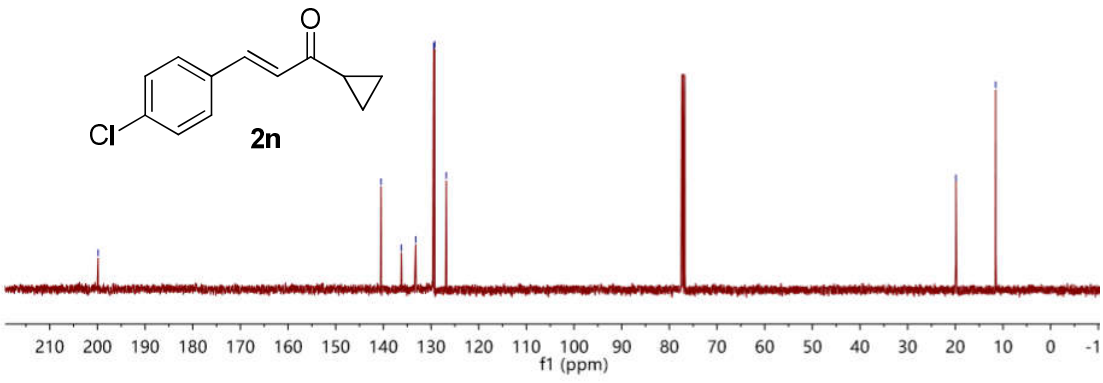

O
Cl
2n

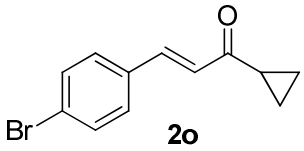

7.613
7.573
7.547
7.531
7.526
7.417
7.412
6.906
6.866
2.300
2.289
2.281
2.277
2.269
2.261
2.258
2.250
2.238
1.217
1.208
1.205
1.197
1.188
1.050
1.042
1.033
1.023
1.014


7.613
7.573
7.547
7.542
7.531
7.526
2.300
2.289
2.281
2.277
2.269
2.261
2.258
2.250
2.238
1.227
1.217
1.208
1.205
1.197
1.188
1.050
1.042
1.033
1.023
1.014
1.004
0.99
1.98
0.98
1.93
1.96
7.70
7.65
7.60
7.55
7.50
f1 (ppm)
2.5 2.4 2.3 2.2 2.1 2.0 1.9 1.8 1.7 1.6 1.5 1.4 1.3 1.2 1.1 1.0 0.9
f1 (ppm)


O
Cl
2n
0.99
1.98
1.93
1.00
0.98
1.93
1.96
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
f1 (ppm)

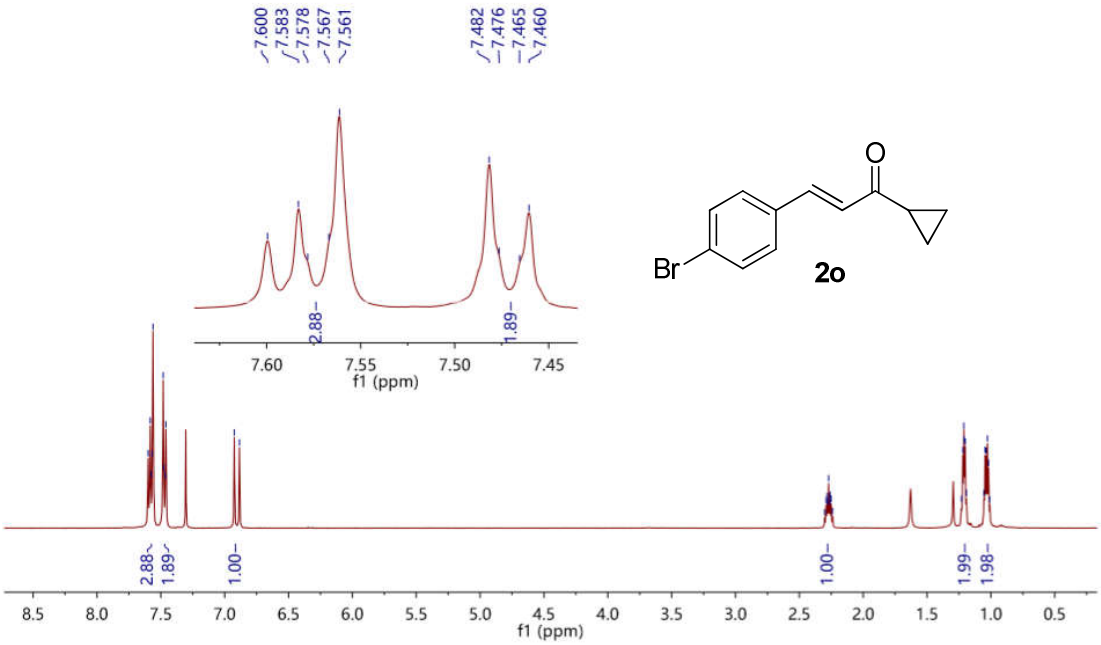

199.854
140.486
136.222
133.226
129.442
129.230
126.803
19.878
11.535

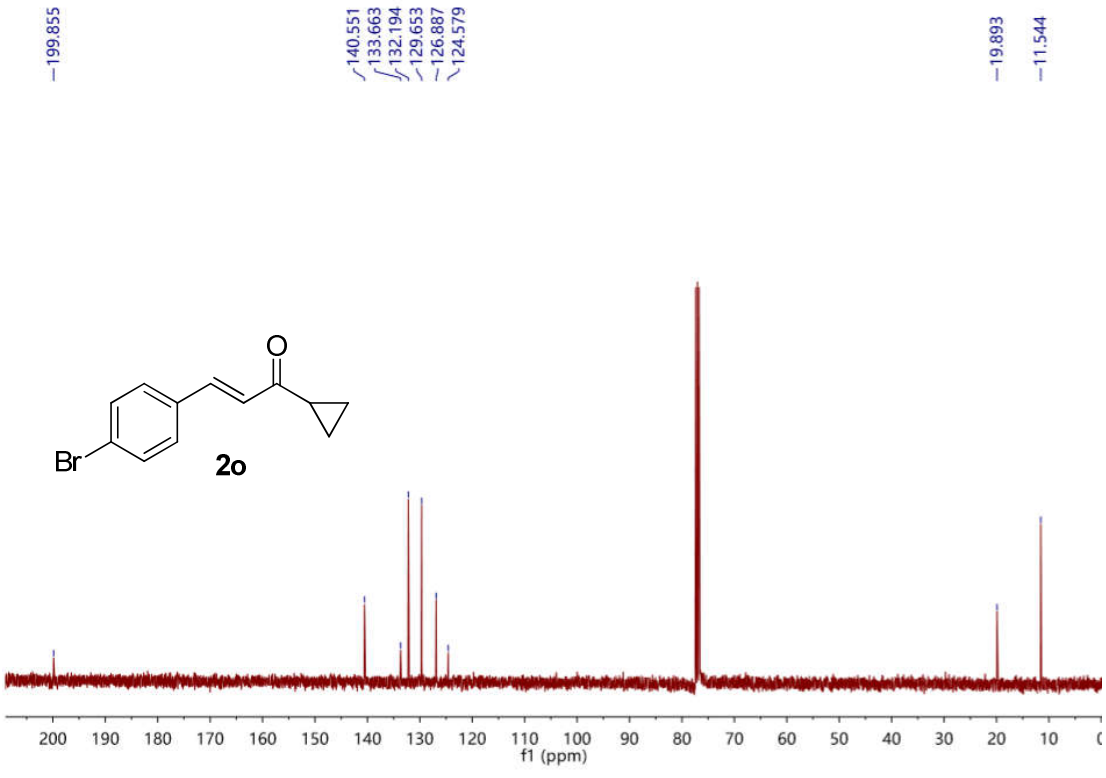

O
Cl
2n
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
-1
f1 (ppm)

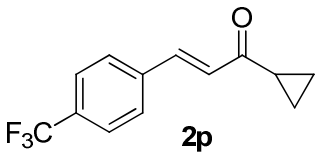

O
Br
2o

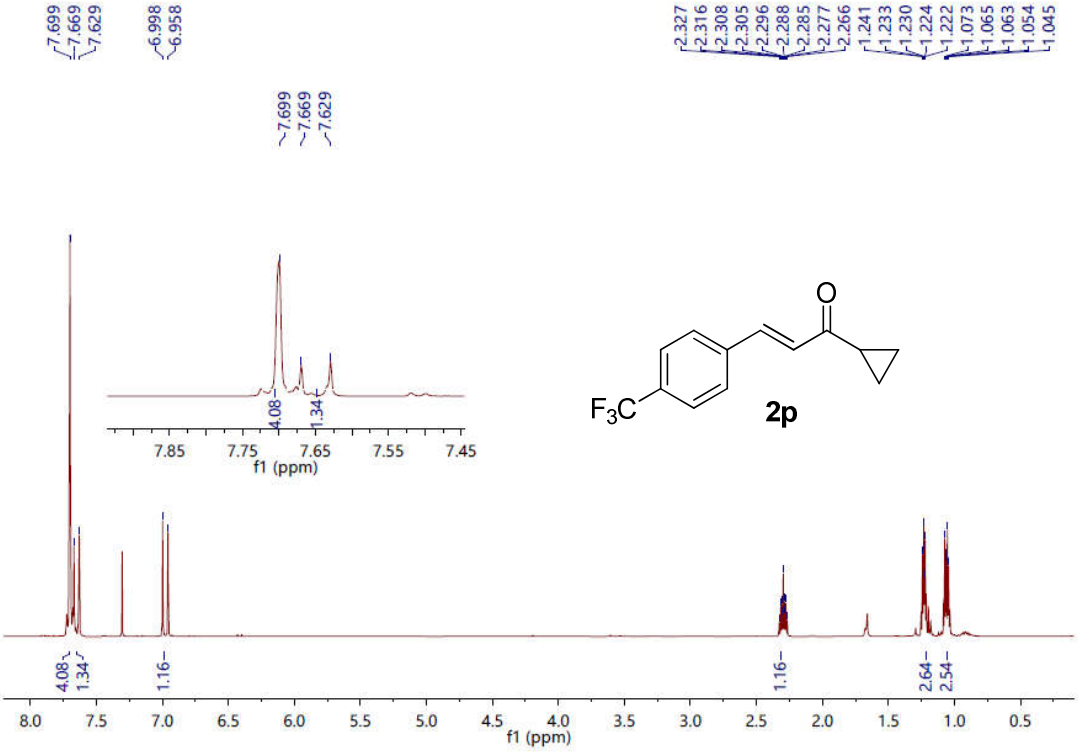

7.600
7.583
7.578
7.567
7.561
7.482
7.476
7.465
7.460
6.925
6.884

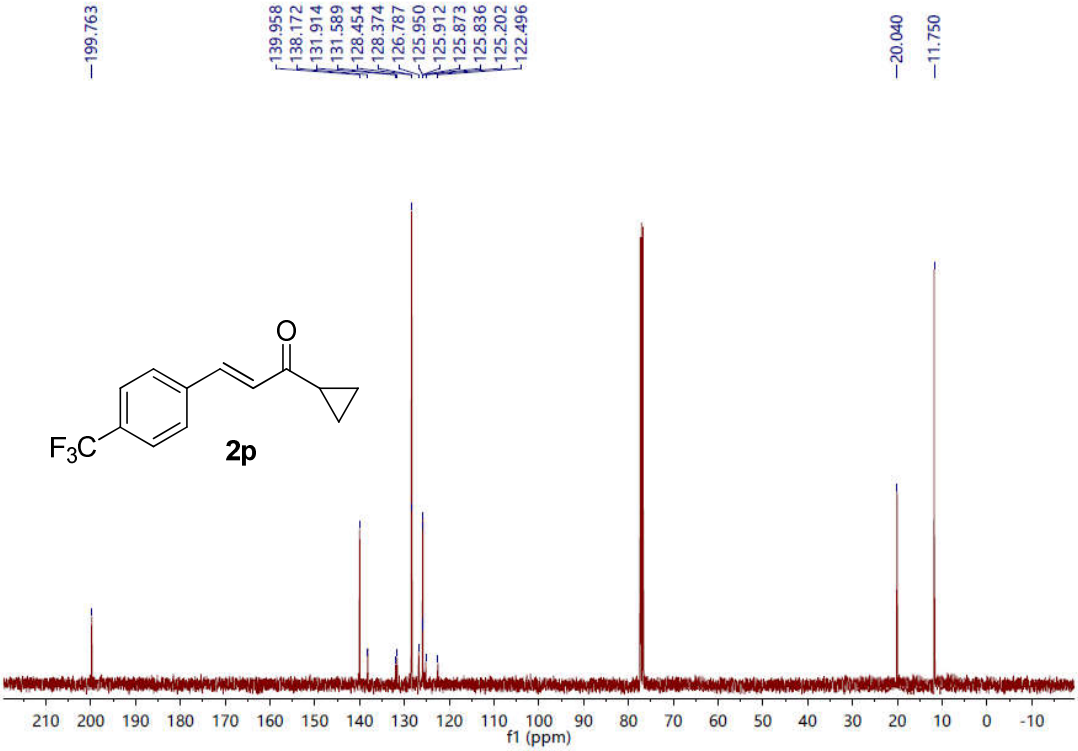

2.301
2.290
2.282
2.279
2.271
2.263
2.259
2.251
2.240
1.230
1.220
1.212
1.209
1.201
1.192
1.055
1.046
1.037
1.027
1.018
1.008

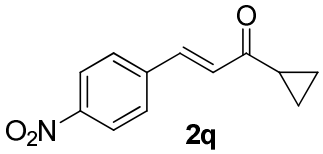

7.600
7.583
7.578
7.567
7.561
7.482
7.476
7.465
7.460
2.88
1.89
7.60
7.55
7.50
7.45
f1 (ppm)
O
Br
2o
2.88
1.89
1.00
1.00
1.99
1.98
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)


199.855
140.551
133.663
132.194
129.653
126.887
124.579
19.893
11.544
O
Br
2o
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

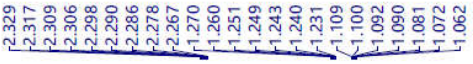

O
F3C
2p

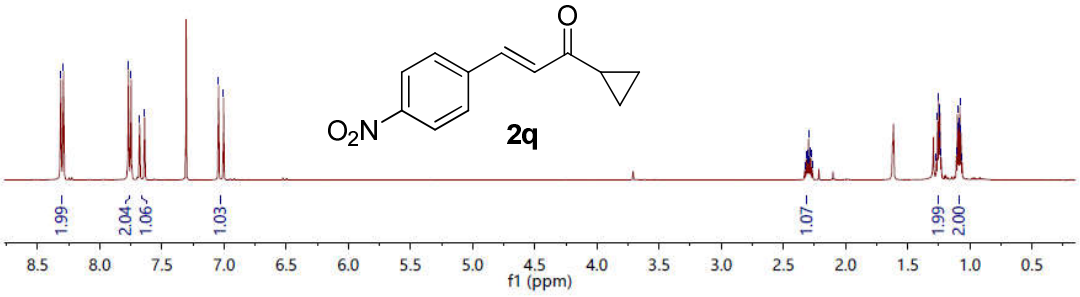

7.699
7.669
7.629
6.998
6.958
2.327
2.316
2.308
2.305
2.296
2.288
2.285
2.277
2.266
1.241
1.233
1.230
1.224
1.222
1.073
1.065
1.063
1.054
1.045
4.08
1.34
1.16
1.16
2.64
2.54
f1 (ppm)
O
F3C
2p

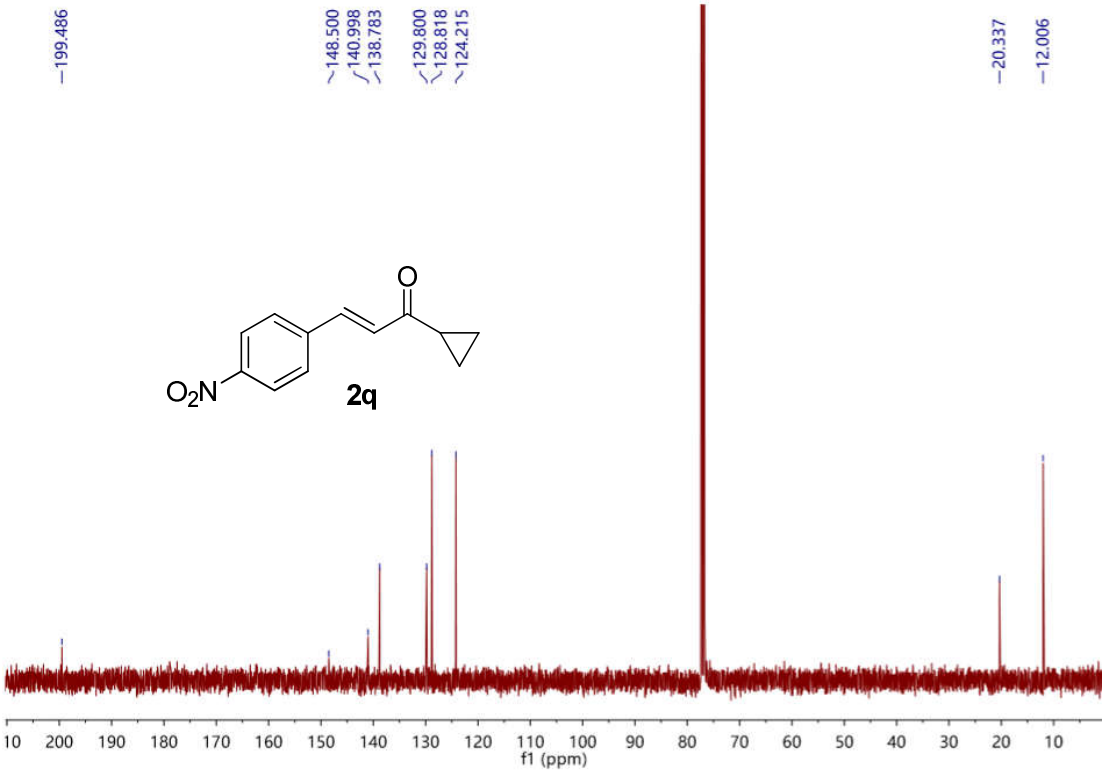

199.763
139.958
138.172
131.914
131.589
128.454
128.374
126.787
125.950
125.912
125.873
125.836
125.202
122.496
20.040
11.750
f1 (ppm)
O
F3C
2p

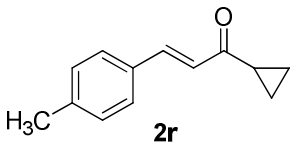

O
$O_2N$
2q


8.313
8.291
7.768
7.747
7.678
7.638
7.043
7.003


2.329
2.317
2.309
2.306
2.298
2.290
2.286
2.278
2.267
1.270
1.260
1.251
1.249
1.243
1.240
1.231
1.109
1.100
1.092
1.090
1.081
1.072
1.062

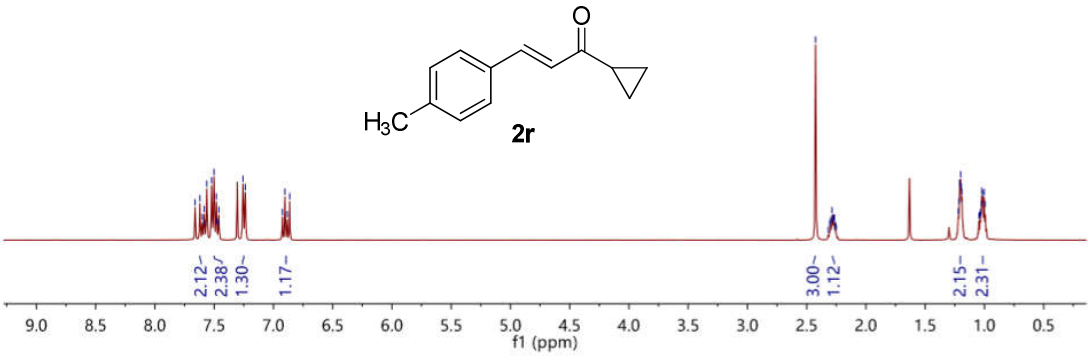

O
$O_2N$
2q
1.99
2.04
1.06
1.03
1.07
1.99
2.00
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

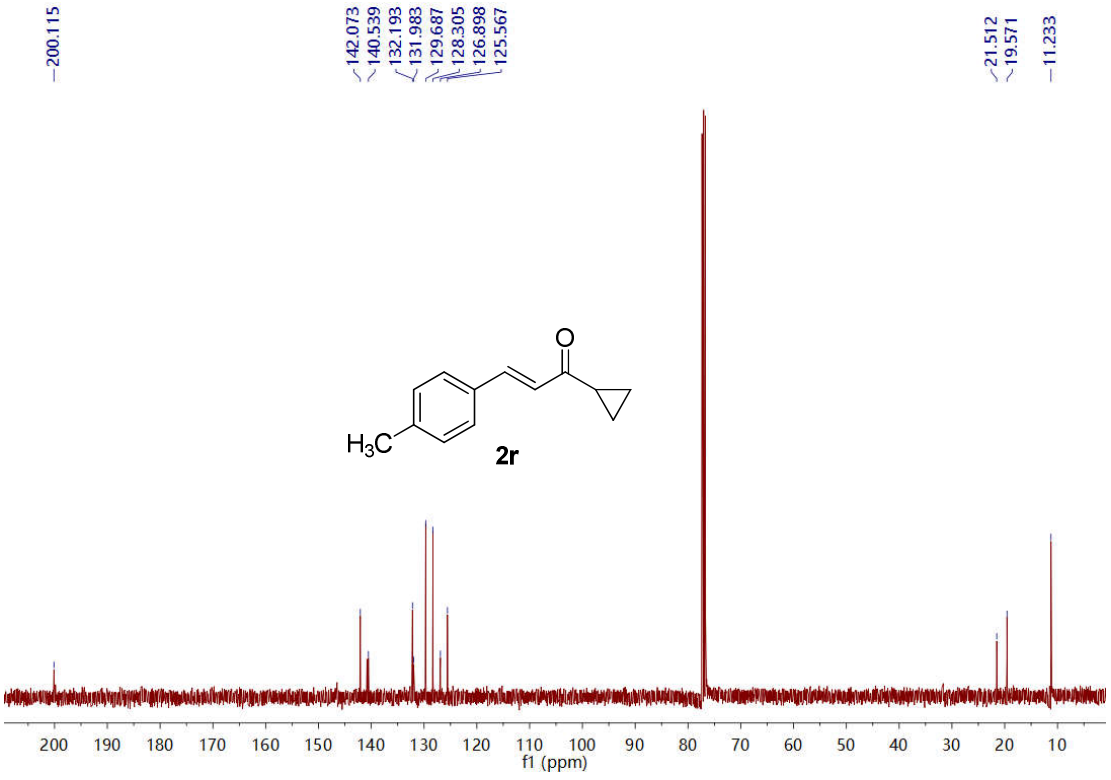

199.486
148.500
140.998
138.783
129.800
128.818
124.215
20.337
12.006
O
$O_2N$
2q
10
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

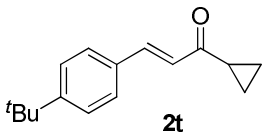

O
H3C
2r


7.661
7.621
7.600
7.584
7.579
7.562
7.522
7.502
7.482
7.476
7.465
7.460
7.257
7.237
6.924
6.903
6.884
6.863

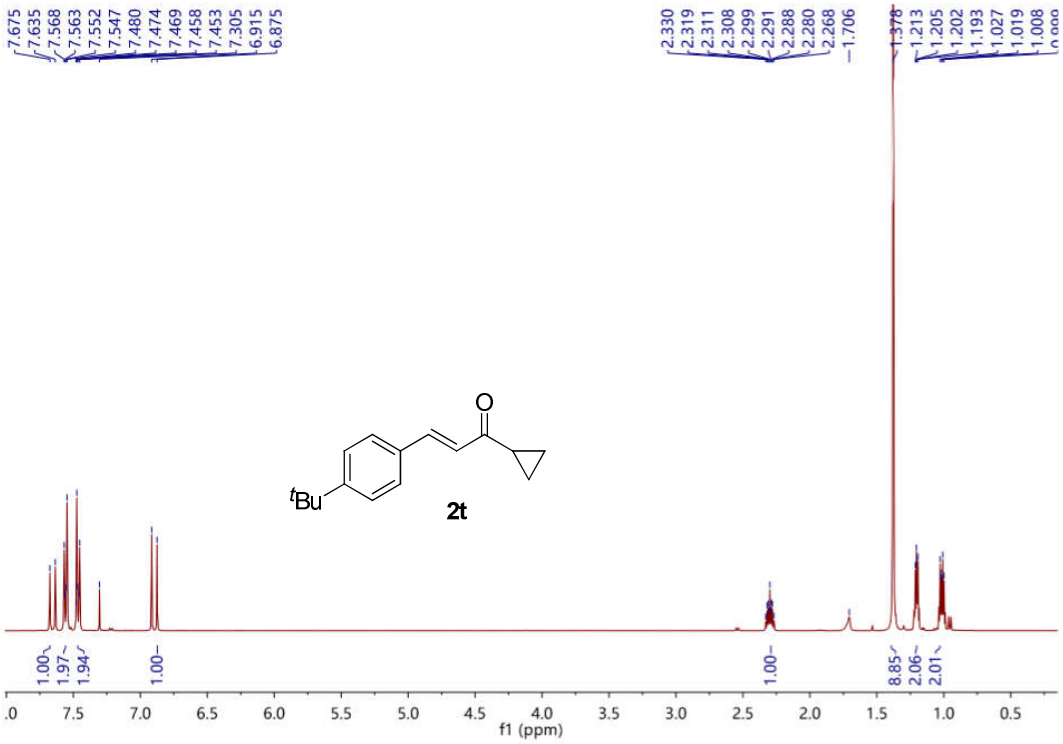

2.425
2.317
2.306
2.297
2.286
2.279
2.275
2.270
2.267
2.259
2.255
2.251
1.221
1.213
1.209
1.200
1.197
1.189
1.046
1.037
1.030
1.027
1.022
1.013
1.002
0.994


O
H3C
2r
2.12
2.38
1.30
1.17
3.00
1.12
2.15
2.31
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
f1 (ppm)


200.115
142.073
140.539
132.193
131.983
129.687
128.305
126.898
125.567
21.512
19.571
11.233
O
H3C
2r
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)


O
tBu

**2t**


7.675
7.635
7.568
7.563
7.552
7.547
7.480
7.474
7.469
7.458
7.453
7.305
6.915
6.875
2.330
2.319
2.311
2.308
2.299
2.291
2.288
2.280
2.268
1.706
1.376
1.213
1.205
1.202
1.193
1.027
1.019
1.008
1.00
1.97
1.94
1.00
1.00
8.85
2.06
2.01
f1 (ppm)

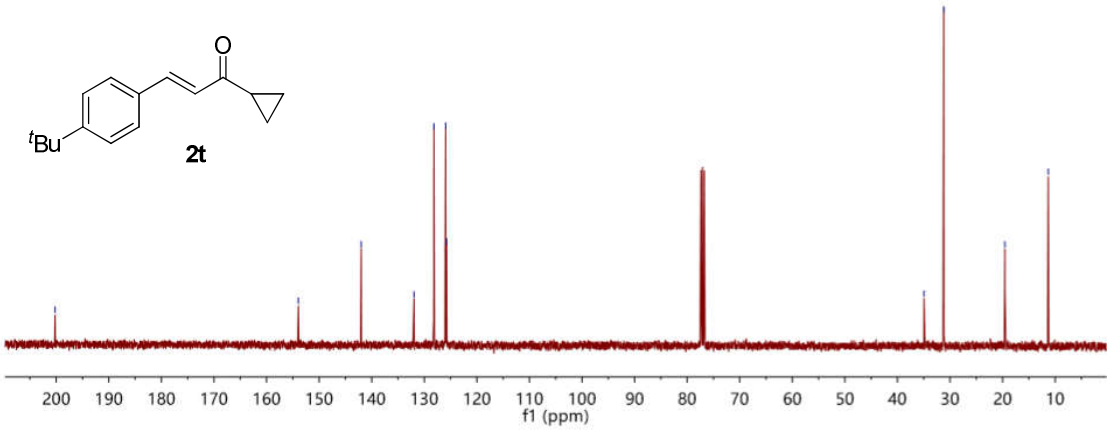

O
tBu

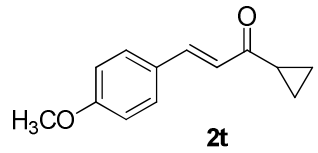
**2t**


200.207
153.956
142.004
131.950
128.170
125.939
125.754
34.939
31.190
19.558
11.312


O
tBu

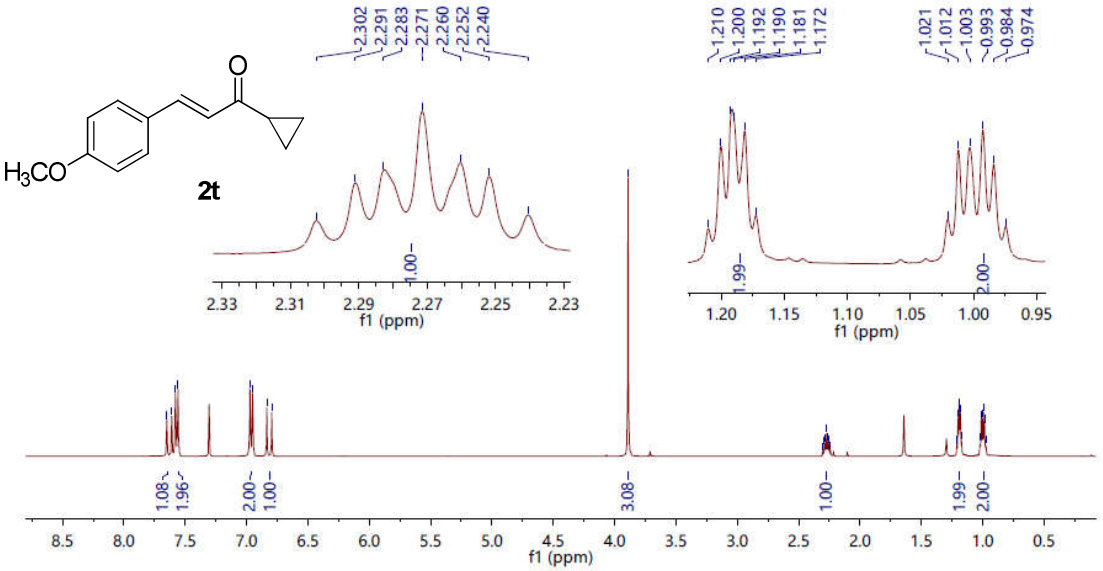
**2t**

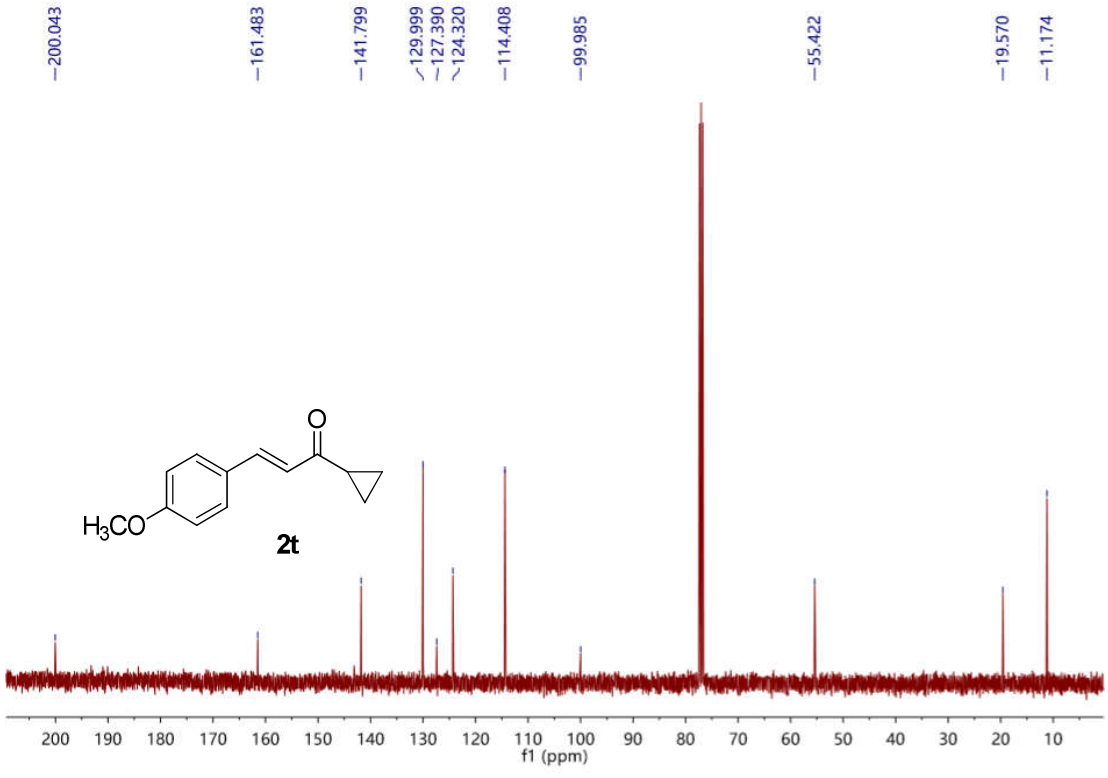

f1 (ppm)

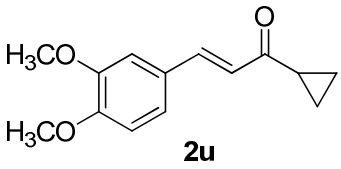

O
H3CO

**2t**

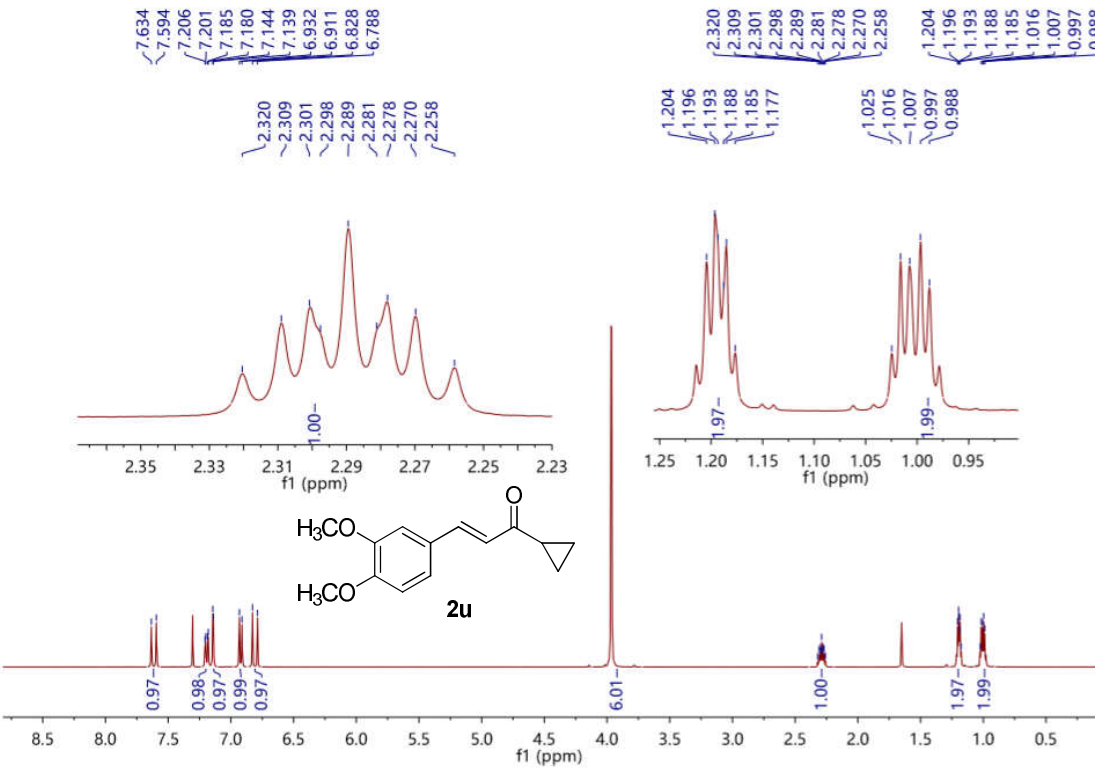

7.649
7.609
7.580
7.558
6.972
6.950
6.835
6.795
3.890
2.302
2.291
2.283
2.271
2.260
2.252
2.240
1.200
1.192
1.190
1.181
1.172
1.012
1.003
0.993

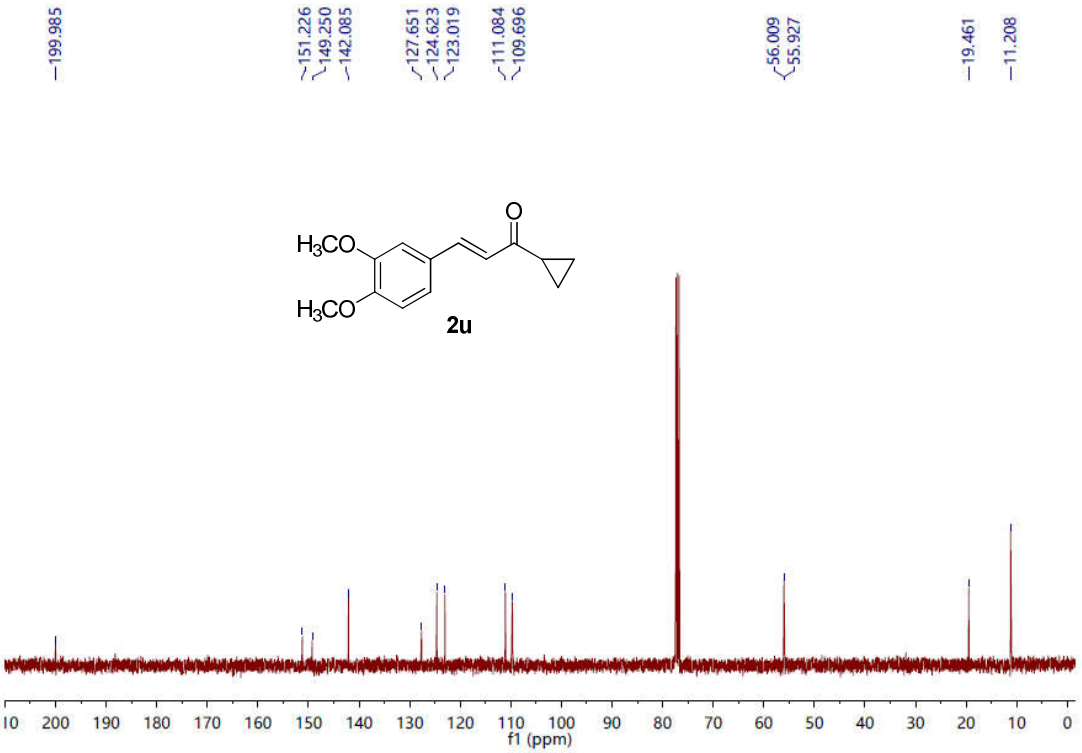

O
H3CO
2t
2.302
2.291
2.283
2.271
2.260
2.252
2.240
1.210
1.200
1.192
1.190
1.181
1.172
1.021
1.012
1.003
0.993
0.984
0.974
1.00
1.99
2.00
f1 (ppm)
1.08
1.96
2.00
1.00
3.08
1.00
1.99
2.00
f1 (ppm)

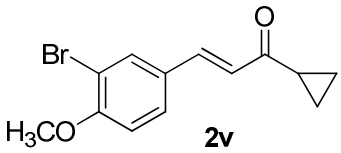

200.043
161.483
141.799
129.999
127.390
124.320
114.408
99.985
55.422
19.570
11.174
O
H3CO
2t
f1 (ppm)


O
H3CO
H3CO

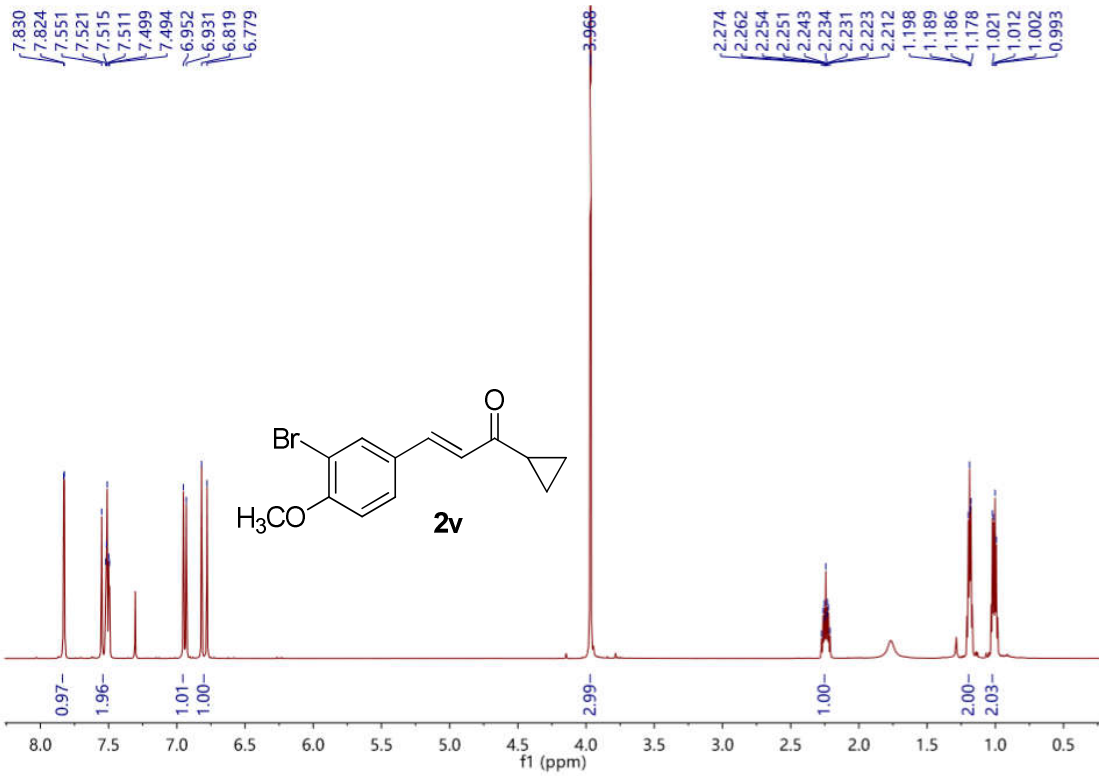
**2u**


7.634
7.594
7.206
7.201
7.185
7.180
7.144
7.139
6.932
6.911
6.828
6.788
2.320
2.309
2.301
2.298
2.289
2.281
2.278
2.270
2.258
1.204
1.196
1.193
1.188
1.185
1.177
1.025
1.016
1.007
0.997
0.988
1.00
1.97
1.99
f1 (ppm)
O
H3CO
H3CO
2u
0.97
0.98
0.97
0.99
0.97
6.01
1.00
1.97
1.99
f1 (ppm)

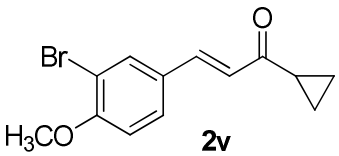

199.985
151.226
149.250
142.085
127.651
124.623
123.019
111.084
109.696
56.009
55.927
19.461
11.208
O
H3CO
H3CO
2u
f1 (ppm)


Br
O
H3CO

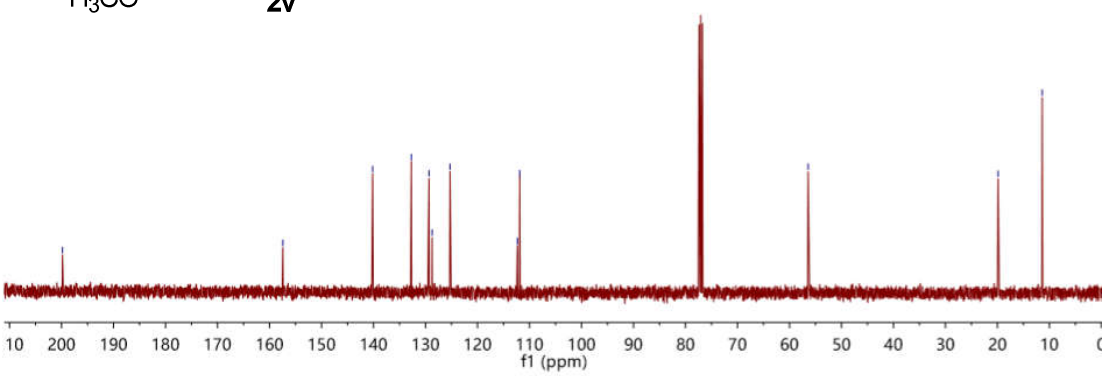
**2v**

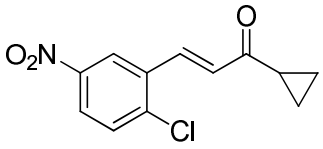

7.830
7.824
7.551
7.521
7.515
7.511
7.499
7.494
6.952
6.931
6.819
6.779
3.968
2.274
2.262
2.254
2.251
2.243
2.234
2.231
2.223
2.212
1.198
1.189
1.186
1.178
1.021
1.012
1.002
0.993
Br
O
H3CO
2v
0.97
1.96
1.01
1.00
2.99
1.00
2.00
2.03
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)


199.814
157.444
140.170
132.730
129.325
128.740
125.290
112.330
111.880
56.409
19.865
11.396


Br
O
H3CO

**2v**

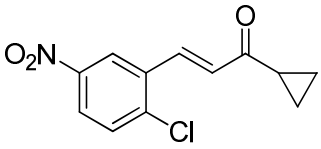

10
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)



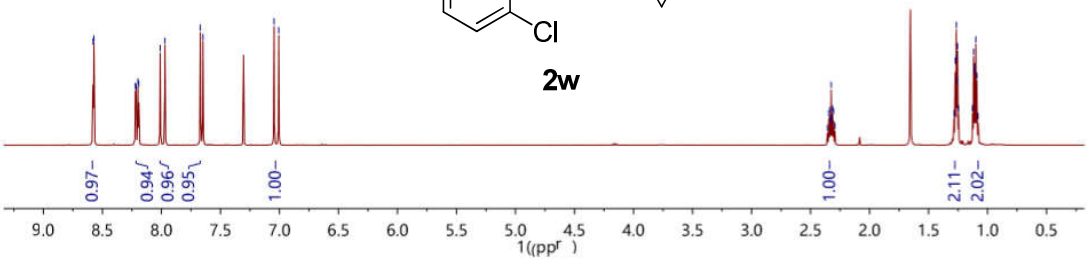
**2w**

8.579
8.572
8.221
8.214
8.199
8.192
8.010
7.970
7.670
7.648
7.046
7.006

2.356
2.344
2.336
2.333
2.325
2.317
2.314
2.305
2.294
1.284
1.274
1.265
1.263
1.257
1.254
1.246
1.127
1.119
1.111
1.108
1.099
1.091
1.081



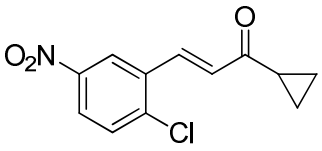
**2w**



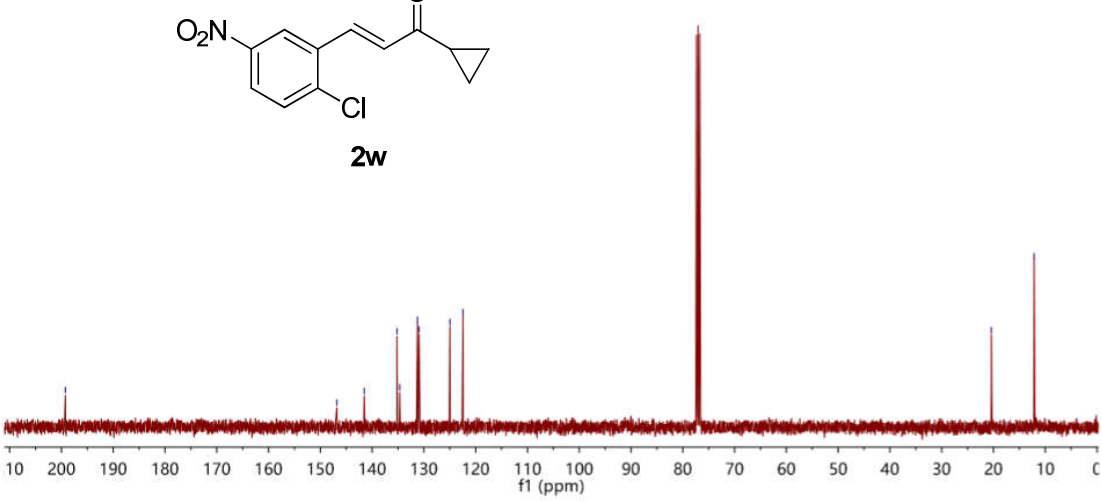

199.238

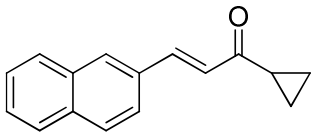
146.811
141.522
135.198
134.676
131.247
130.935
124.979
122.443

20.404
12.145

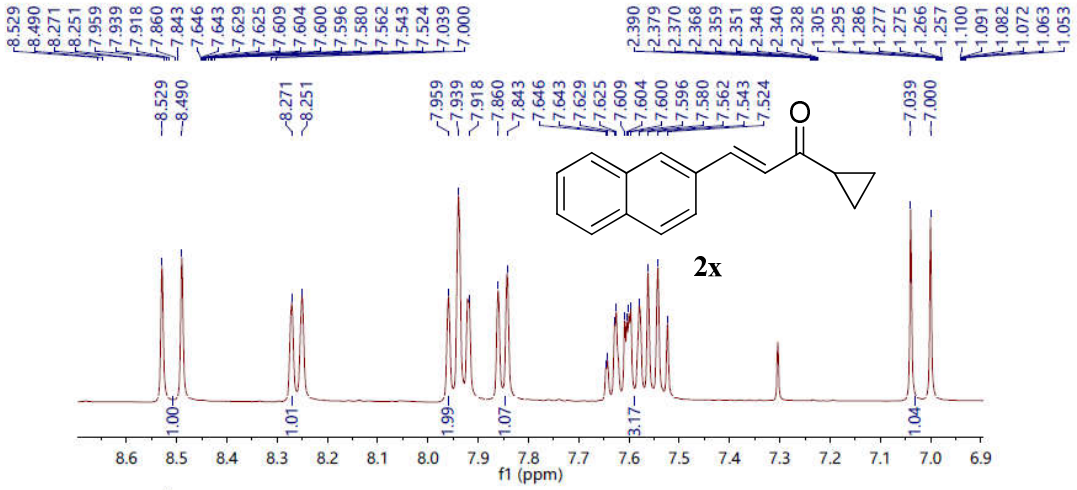


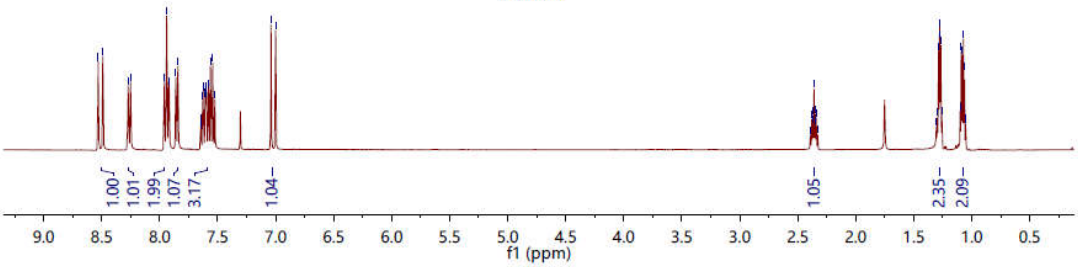
**2w**

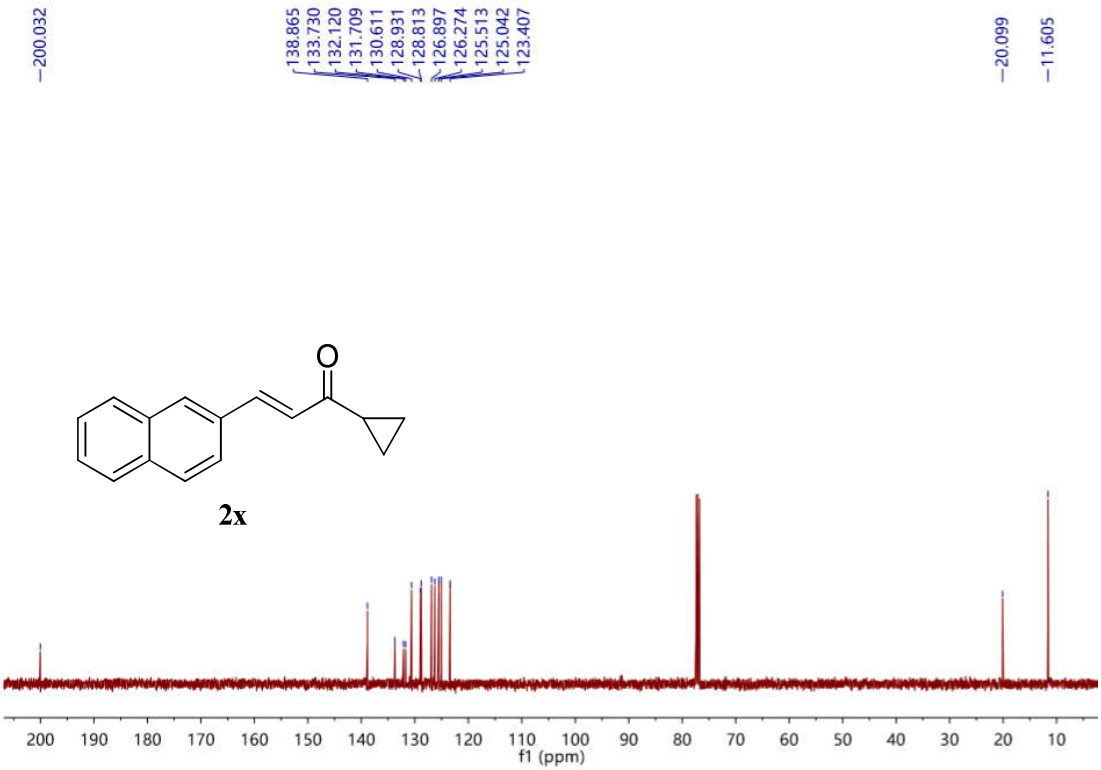




**2x**


8.529
8.490
8.271
8.251
7.959
7.939
7.918
7.860
7.843
7.646
7.643
7.629
7.625
7.609
7.604
7.600
7.596
7.580
7.562
7.543
7.524
7.039
7.000
2.390
2.379
2.370
2.368
2.359
2.351
2.348
2.340
2.328
1.305
1.295
1.286
1.277
1.275
1.266
1.257
1.100
1.091
1.082
1.072
1.063
1.053
2x
1.00
1.01
1.99
1.07
3.17
1.04
f1 (ppm)

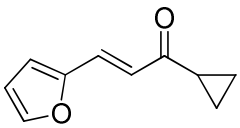

1.00
1.01
1.99
1.07
3.17
1.04
1.05
2.35
2.09
f1 (ppm)


200.032
138.865
133.730
132.120
131.709
130.611
128.931
128.813
126.897
126.274
125.513
125.042
123.407
20.099
11.605



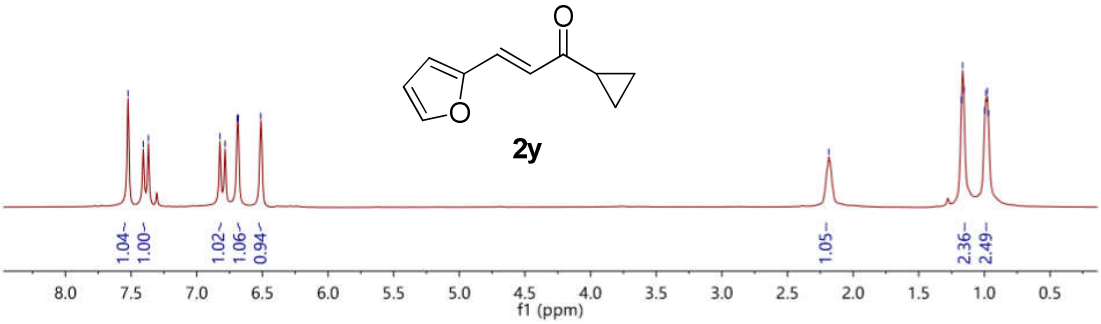
**2x**


f1 (ppm)

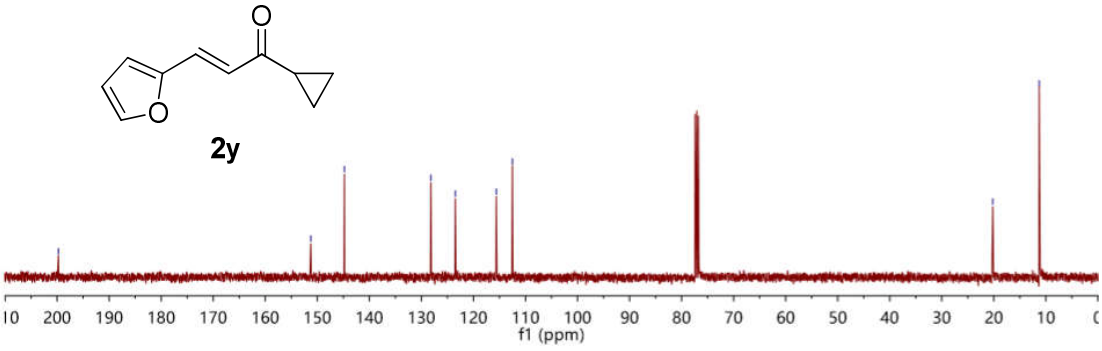


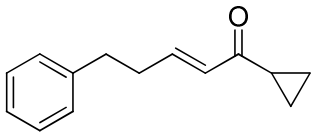
**2y**

7.523
7.407
7.368
6.823
6.784
6.692
6.683
6.512
2.185
1.175
1.166
1.156
0.998
0.988
0.978
0.969

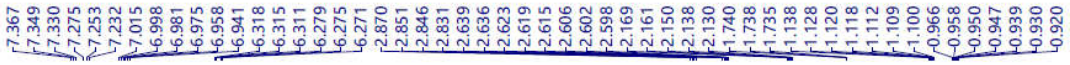


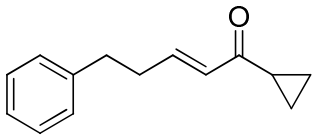

199.752
151.254
144.795
128.181
123.478
115.616
112.517
20.197
11.279



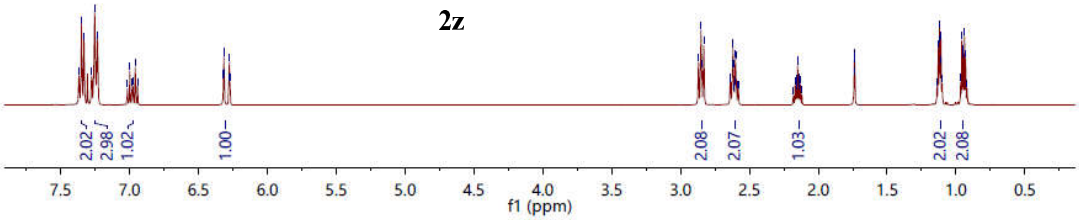


**2z**


7.367
7.349
7.330
7.275
7.253
7.232
7.015
6.998
6.981
6.975
6.958
6.941
6.318
6.315
6.311
6.279
6.275
6.271
2.870
2.851
2.846
2.831
2.639
2.636
2.623
2.619
2.615
2.606
2.602
2.598
2.169
2.161
2.150
2.138
2.130
1.740
1.738
1.735
1.138
1.128
1.120
1.118
1.112
1.109
1.100
0.966
0.958
0.950
0.947
0.939
0.930
0.920



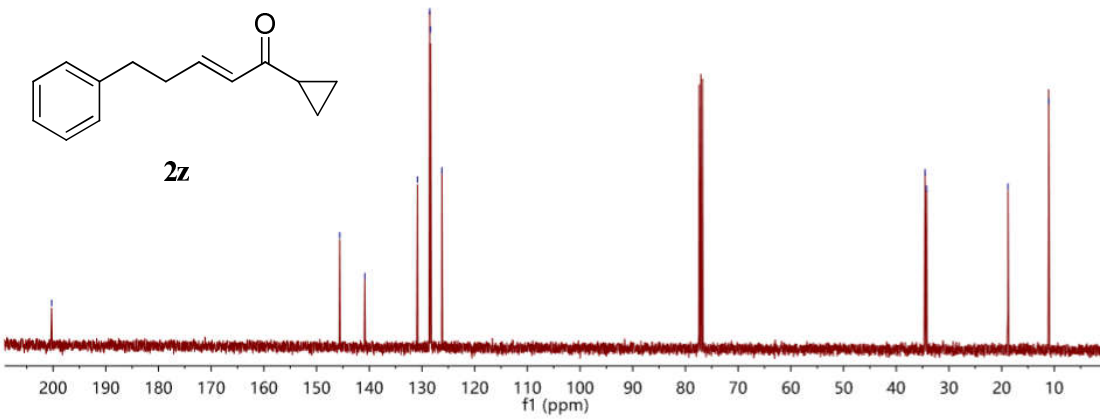
**2z**

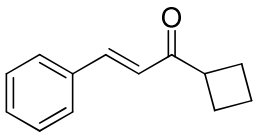

2.02
2.98
1.02
1.00
2.08
2.07
1.03
2.02
2.08
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)


200.267
145.604
140.849
130.849
128.527
128.372
126.214
34.524
34.233
18.789
11.072

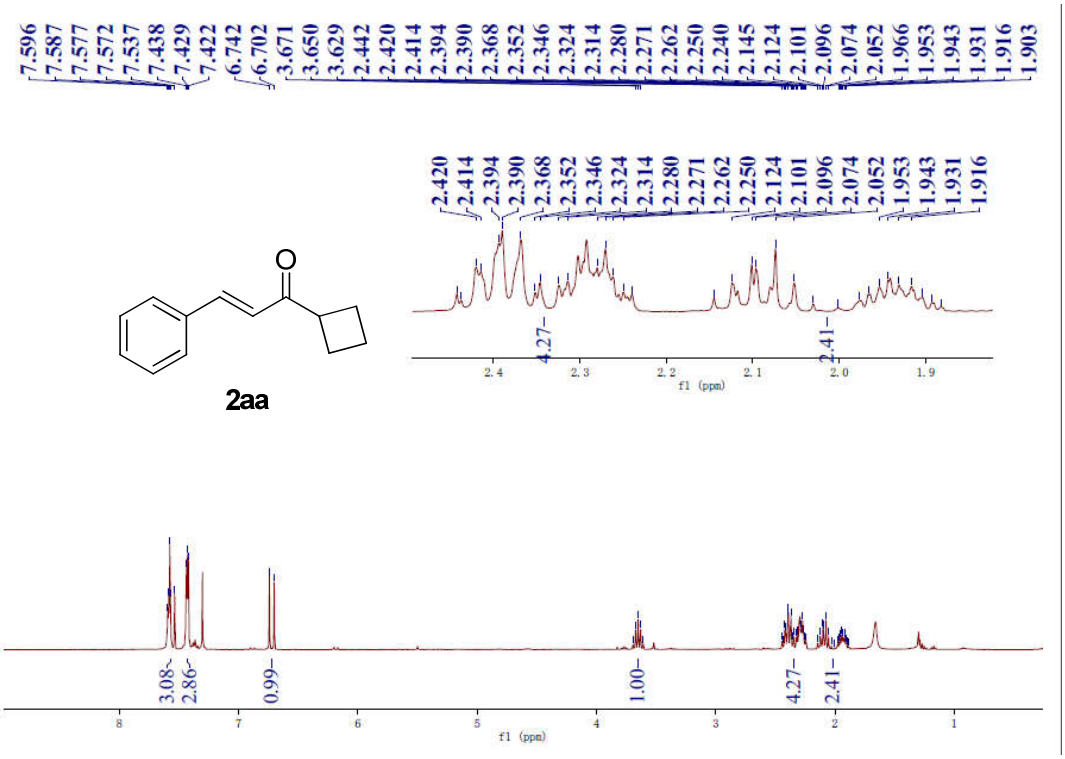


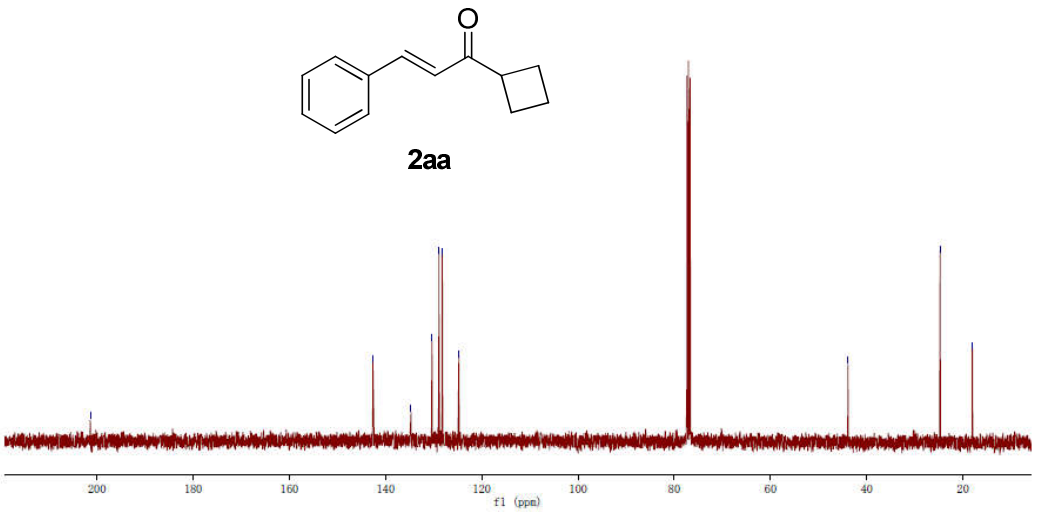
**2z**

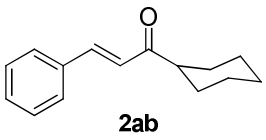

200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)



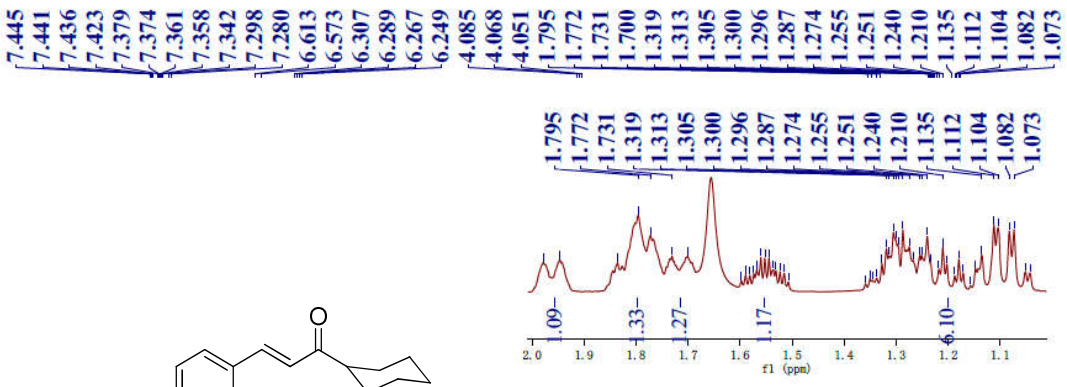
2aa

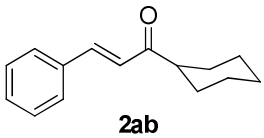

7.596
7.587
7.577
7.572
7.537
7.438
7.429
7.422
6.742
6.702
3.671
3.650
3.629
2.442
2.420
2.414
2.394
2.390
2.368
2.352
2.346
2.324
2.314
2.280
2.271
2.262
2.250
2.240
2.145
2.124
2.101
2.096
2.074
2.052
1.966
1.953
1.943
1.931
1.916
1.903
2aa
4.27
2.41
f1 (ppm)
3.08
2.86
0.99
1.00
4.27
2.41
f1 (ppm)


201.372
142.642
134.707
130.349
128.926
128.216
124.769
43.902
24.738
18.047
2aa
f1 (ppm)

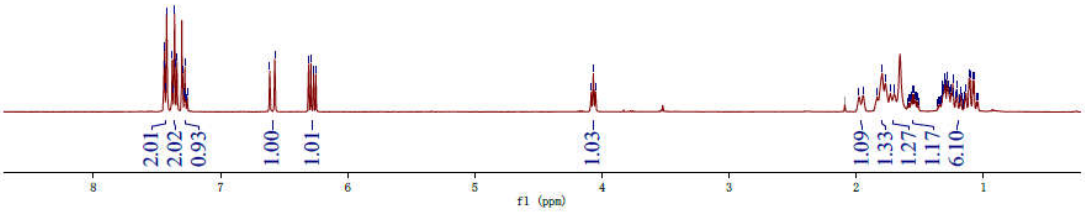


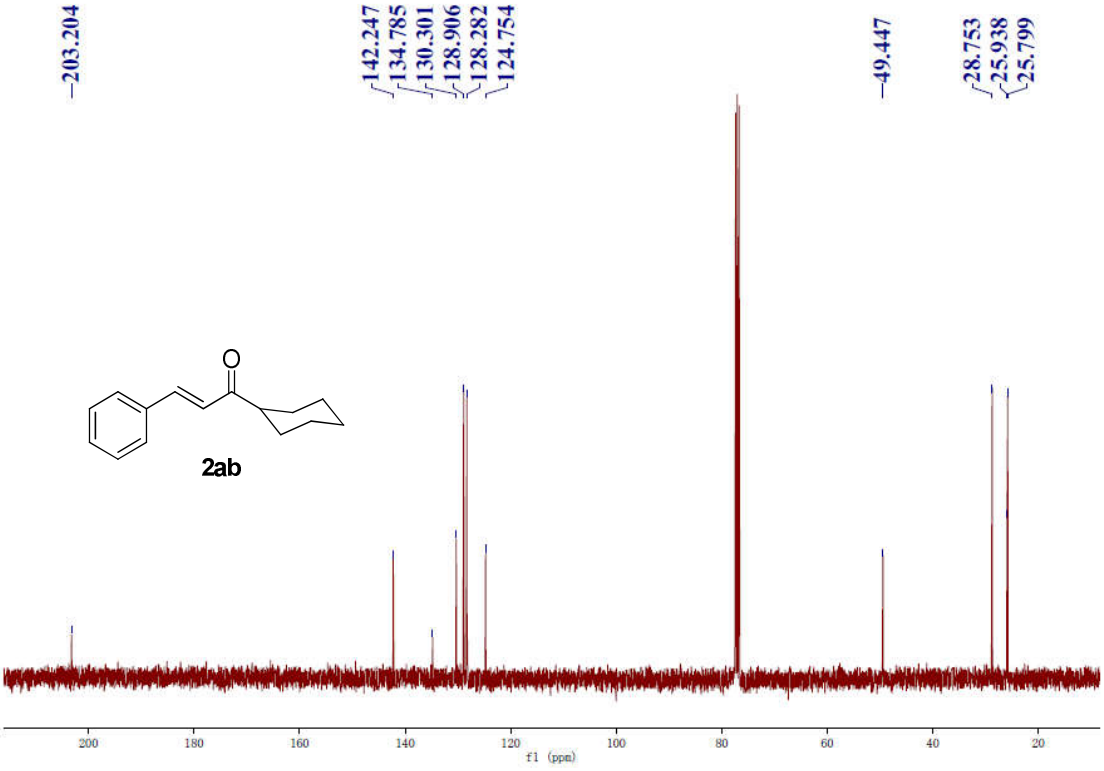
2ab


7.445
7.441
7.436
7.423
7.379
7.374
7.361
7.358
7.342
7.298
7.280
6.613
6.573
6.307
6.289
6.267
6.249
4.085
4.068
4.051
1.795
1.772
1.731
1.700
1.319
1.313
1.305
1.300
1.296
1.287
1.274
1.255
1.251
1.240
1.210
1.135
1.112
1.104
1.082
1.073
1.09
1.33
1.27
1.17
6.10
f1 (ppm)



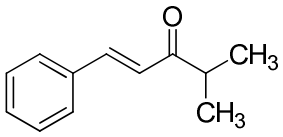
2ab


2.01
2.02
0.93
1.00
1.01
1.03
1.09
1.33
1.27
1.17
6.10
f1 (ppm)


203.204
142.247
134.785
130.301
128.906
128.282
124.754
49.447
28.753
25.938
25.799
f1 (ppm)



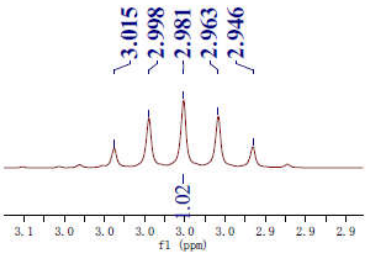
2ab

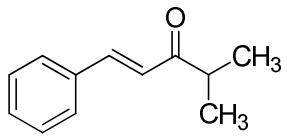

O
CH3
CH3

**2ac**

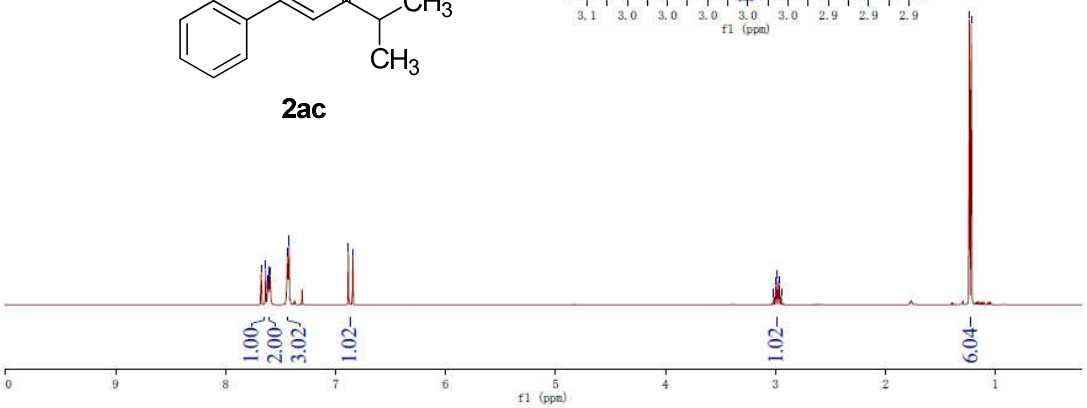

7.675
7.635
7.617
7.614
7.608
7.604
7.598
7.593
7.439
7.430
7.423
6.883
6.843


3.015
2.998
2.981
2.963
2.946
1.237
1.220

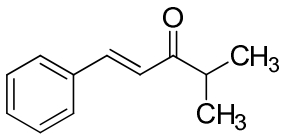

3.015
2.998
2.981
2.963
2.946
1.02
3.1 3.0 3.0 3.0 3.0 3.0 2.9 2.9 2.9
f1 (ppm)


O
CH3
CH3

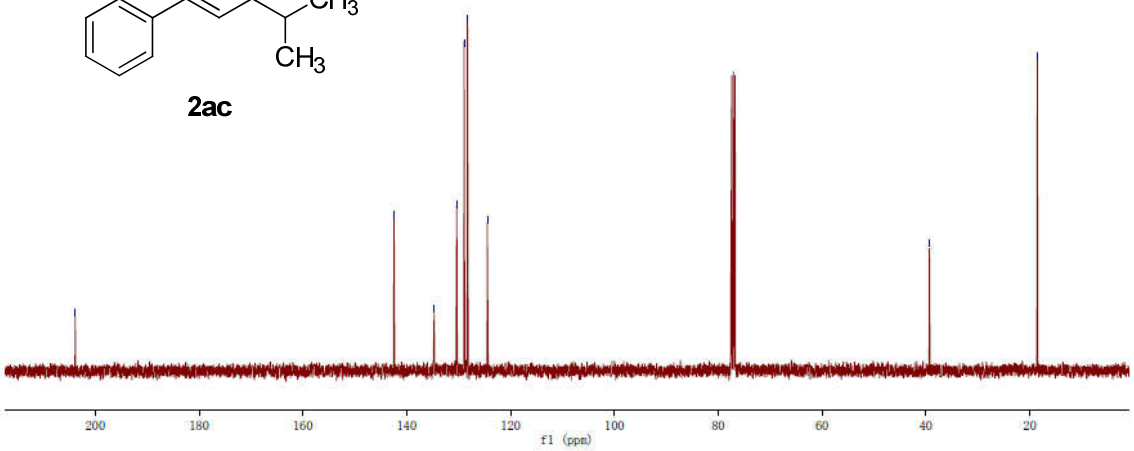
**2ac**

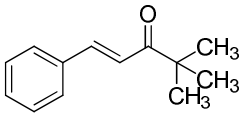

1.00
2.00
3.02
1.02
1.02
6.04
0 9 8 7 6 5 4 3 2 1
f1 (ppm)


203.852
142.436
134.714
130.358
128.929
128.294
124.478
39.312
18.528

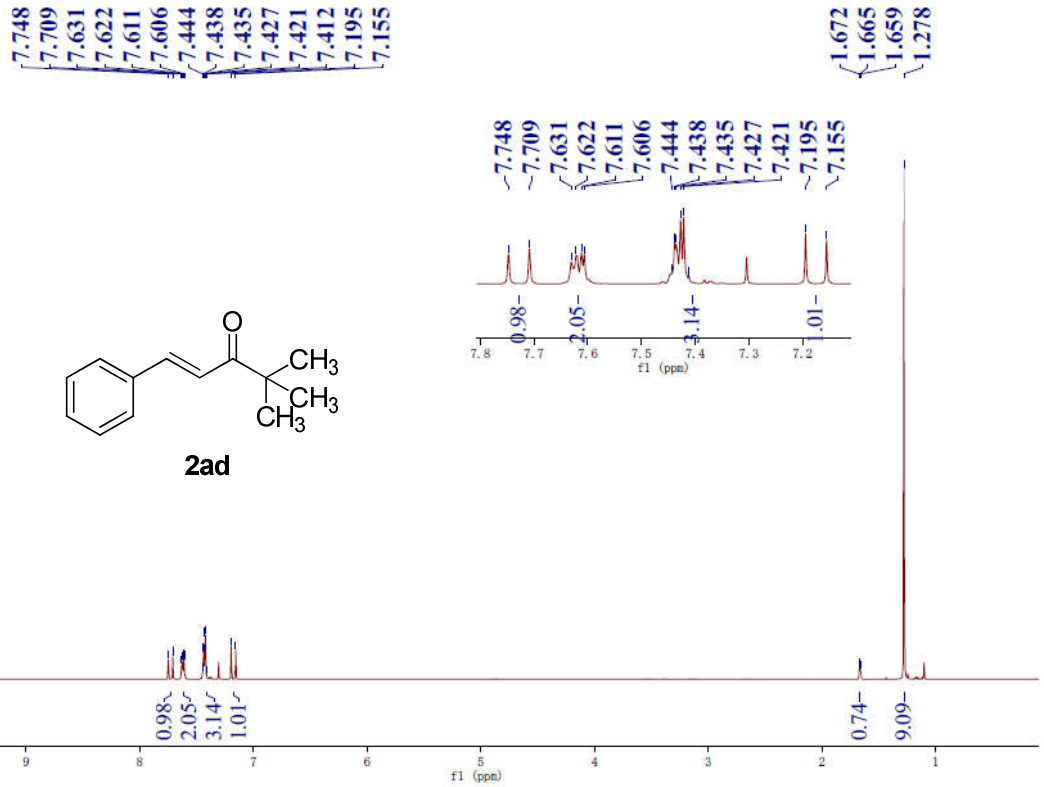

O
CH3
CH3

**2ac**


200 180 160 140 120 100 80 60 40 20
f1 (ppm)

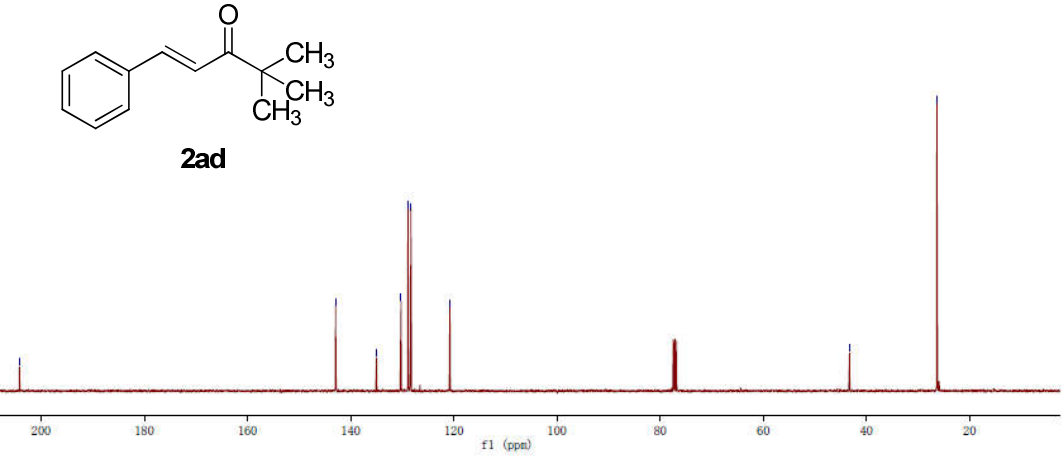


**2ad**


7.748
7.709
7.631
7.622
7.611
7.606
7.444
7.438
7.435
7.427
7.421
7.412
7.195
7.155
1.672
1.665
1.659
1.278
0.98
2.05
3.14
1.01
0.74
9.09
f1 (ppm)

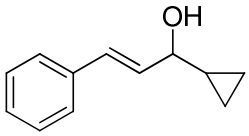


**2ad**

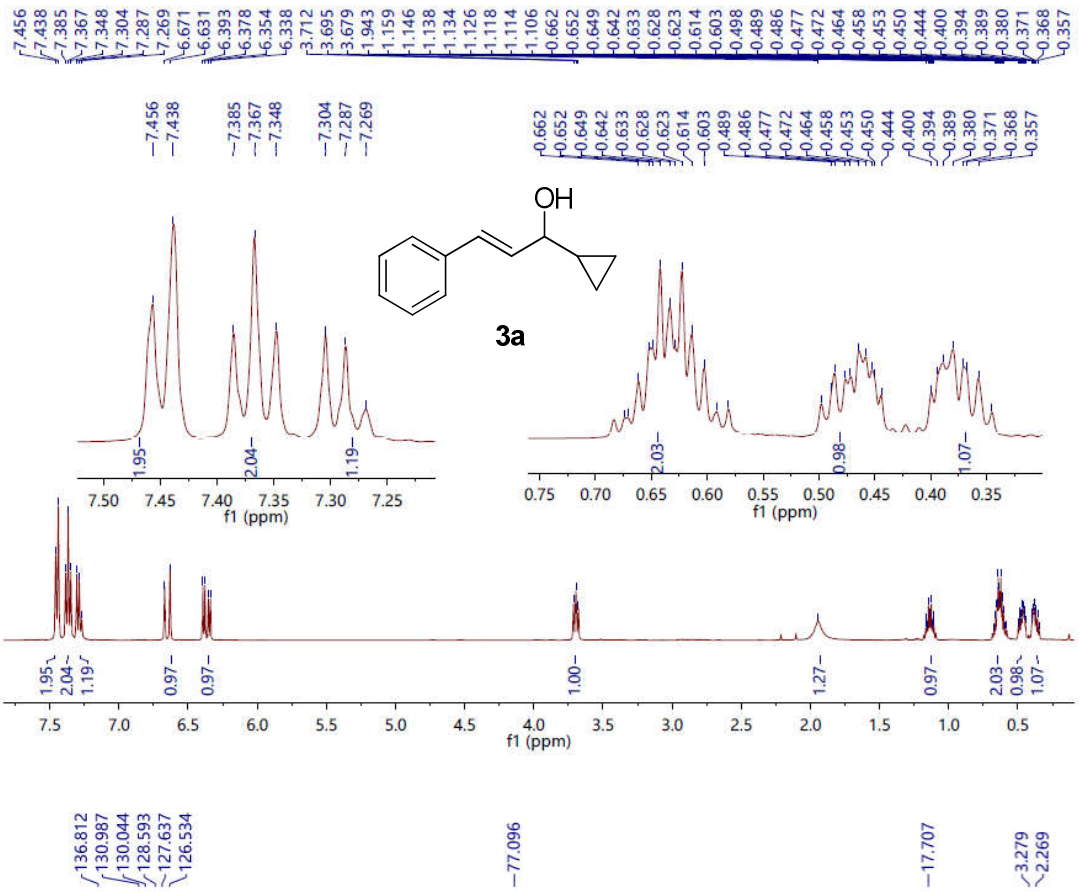

204.196
142.920
134.964
130.218
128.875
128.299
120.752
43.271
26.347
f1 (ppm)

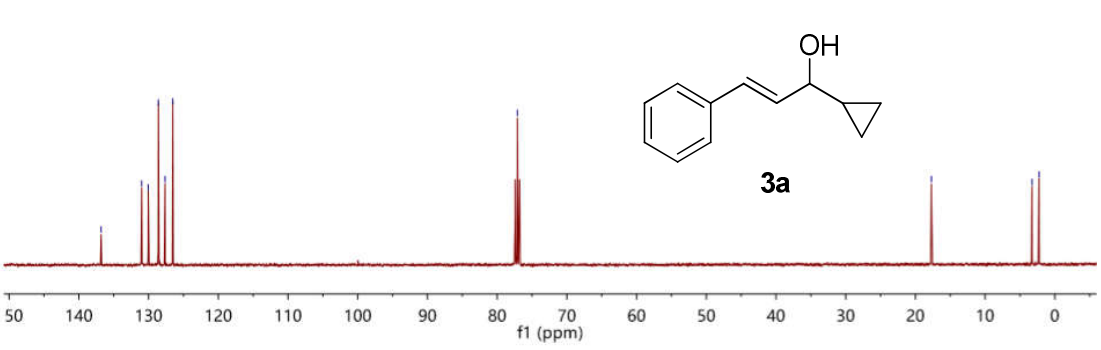


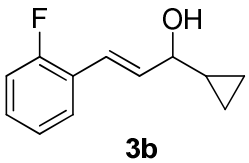
**2ad**


OH

**3a**

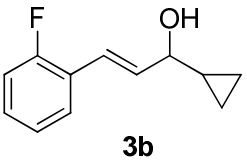

7.456
7.438
7.385
7.367
7.348
7.304
7.287
7.269
6.671
6.631
6.393
6.378
6.354
6.338
3.712
3.695
3.679
1.943
1.159
1.146
1.138
1.134
1.126
1.118
1.114
1.106
0.662
0.652
0.649
0.642
0.633
0.628
0.623
0.614
0.603
0.498
0.489
0.486
0.477
0.472
0.464
0.458
0.453
0.450
0.444
0.400
0.394
0.389
0.380
0.371
0.368
0.357
OH
3a
1.95
2.04
1.19
2.03
0.98
1.07
f1 (ppm)
0.97
1.00
1.27
f1 (ppm)


136.812
130.987
130.044
128.593
127.637
126.534
77.096
17.707
3.279
2.269
OH
3a
f1 (ppm)

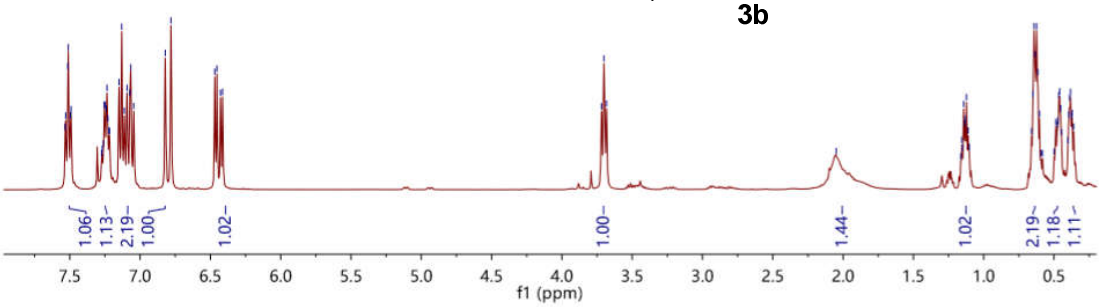

F
OH

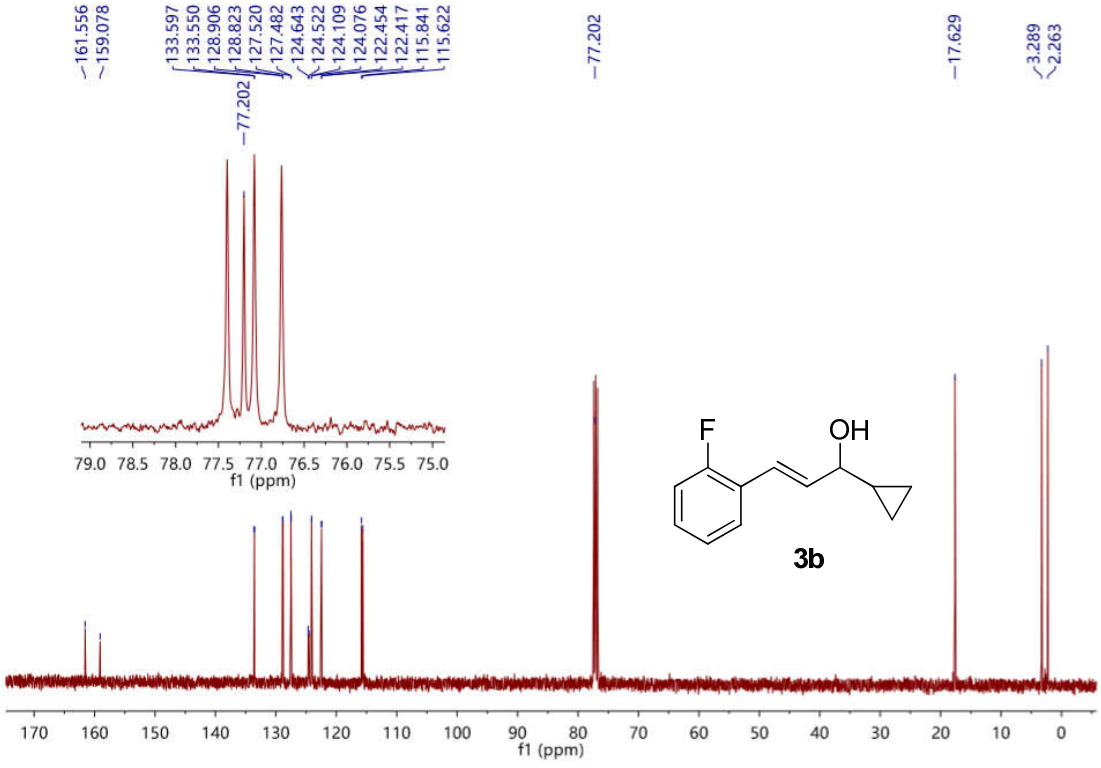
**3b**


7.534
7.529
7.515
7.510
7.495
7.491
7.255
7.250
7.241
7.235
7.230
7.222
7.217
7.150
7.131
7.112
7.093
7.073
7.066
7.045
6.821
6.780
6.469
6.454
6.429
6.413
3.719
3.701
3.683
1.143
1.135
1.131
1.122
1.111
0.650
0.642
0.635
0.623
0.614
0.604
0.487
0.478
0.472
0.465
0.459
0.452
0.396
0.389
0.382
0.375
0.371
0.360


F
OH

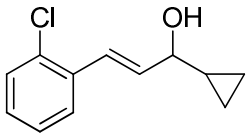
**3b**


1.06
1.13
2.19
1.00
1.02
1.00
1.44
1.02
2.19
1.18
1.11
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
f1 (ppm)

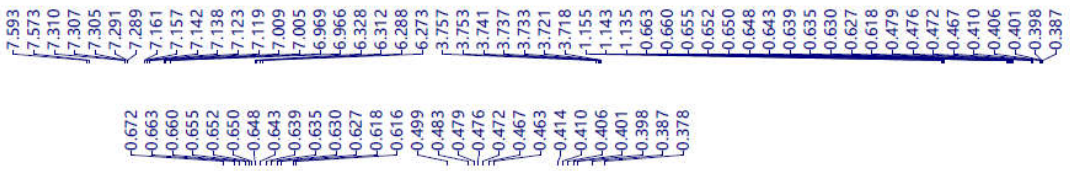

161.556
159.078
133.597
133.550
128.906
128.823
127.520
127.482
124.643
124.522
124.109
124.076
122.454
122.417
115.841
115.622
77.202
17.629
3.289
2.263
79.0
78.5
78.0
77.5
77.0
76.5
76.0
75.5
75.0
f1 (ppm)
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

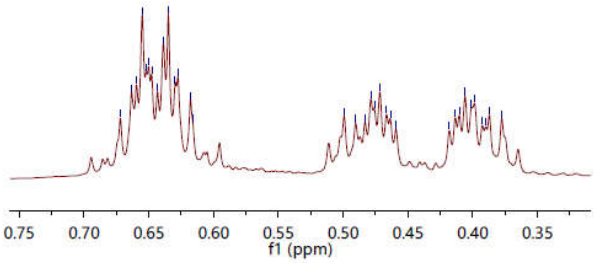

F
OH

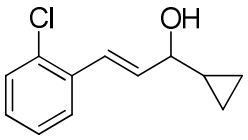
**3b**


Cl
OH

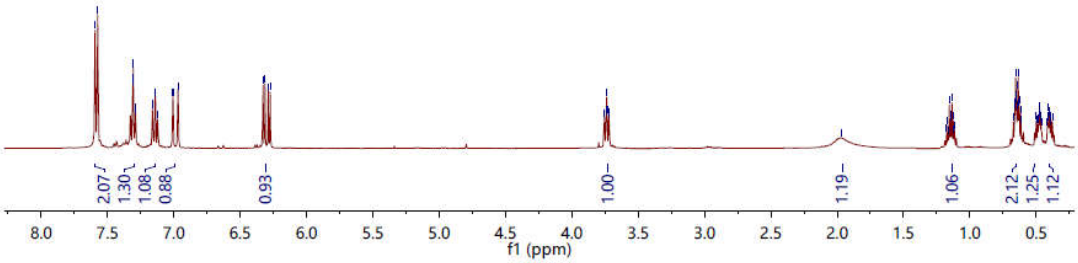
**3c**

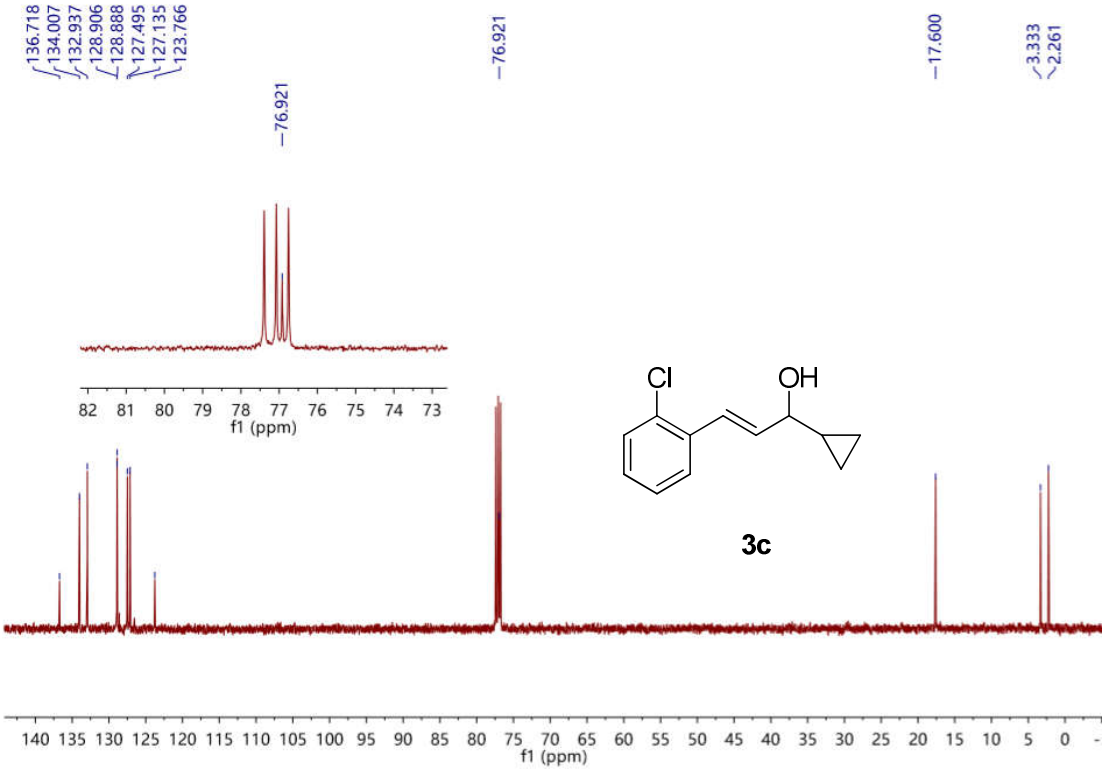



0.75 0.70 0.65 0.60 0.55 0.50 0.45 0.40 0.35
f1 (ppm)


Cl
OH

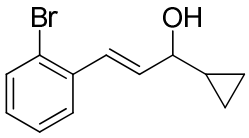
**3c**


2.07
1.30
1.08
0.88
0.93
1.00
1.19
1.06
2.12
1.25
1.12
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
f1 (ppm)


136.718
134.007
132.937
128.906
128.888
127.495
127.135
123.766
76.921
76.921
17.600
3.333
2.261
82 81 80 79 78 77 76 75 74 73
f1 (ppm)
140 135 130 125 120 115 110 105 100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0
f1 (ppm)

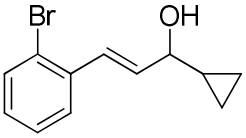

Cl
OH

**3c**

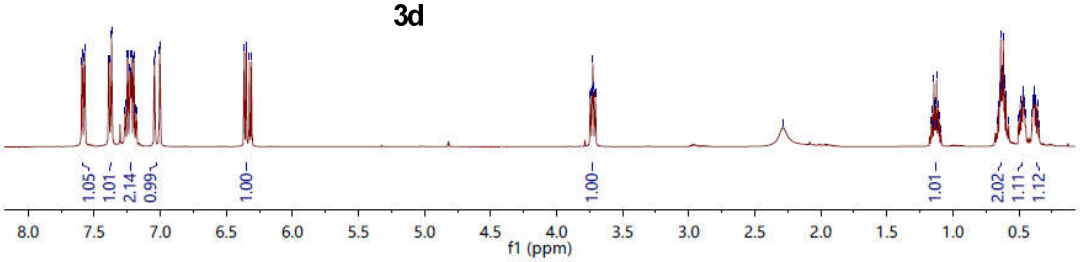

Br
OH

**3d**

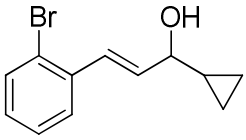

7.594
7.590
7.575
7.571
7.391
7.387
7.372
7.368
7.250
7.246
7.231
7.227
7.223
7.218
7.204
7.199
7.045
7.042
7.005
7.002
6.365
6.349
6.325
6.310
3.746
3.742
3.730
3.726
3.722
3.710
3.706
1.144
1.124
0.648
0.645
0.639
0.633
0.630
0.624
0.619
0.612
0.610
0.600
0.491
0.471
0.468
0.463
0.393
0.390
0.384
0.381
0.370


Br
OH

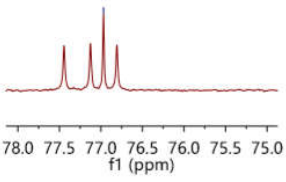
**3d**

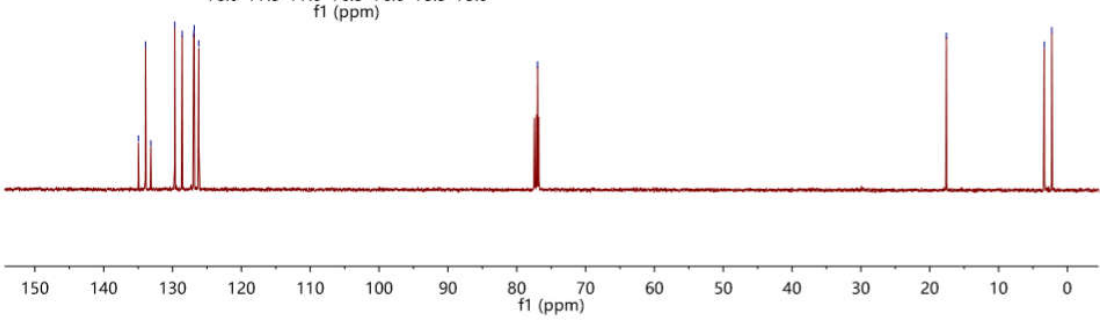

1.05
1.01
2.14
0.99
1.00
1.00
1.01
2.02
1.11
1.12
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

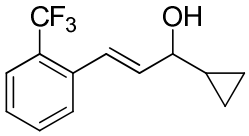

134.964
133.925
133.163
129.686
128.607
126.925
126.850
126.194
76.969
17.577
3.356
2.268
76.969


Br
OH

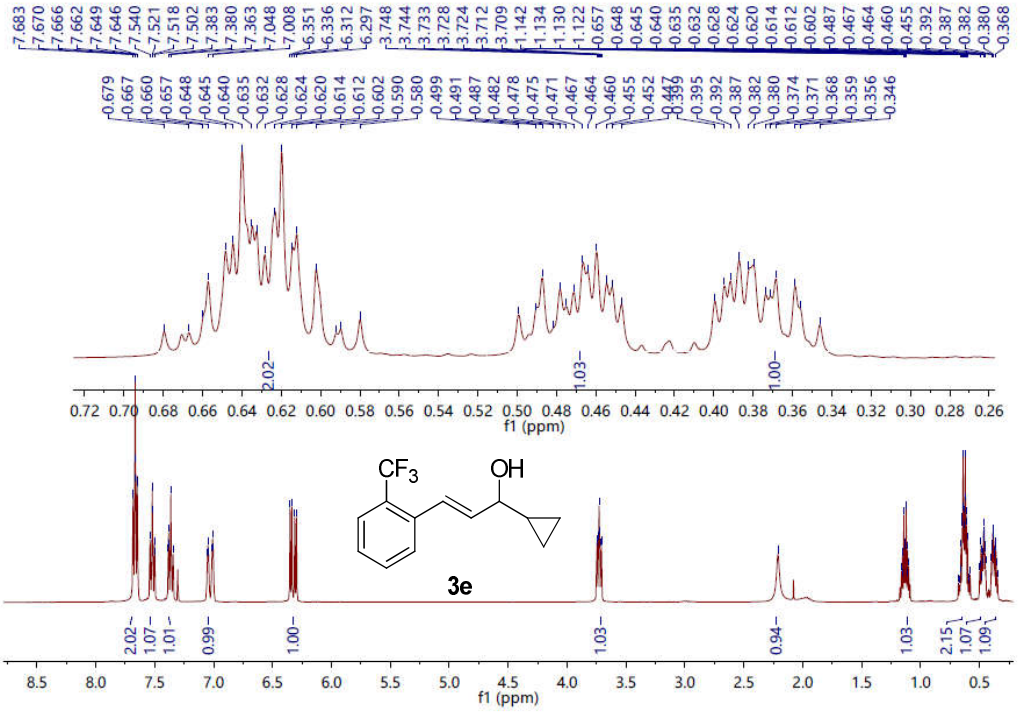
**3d**

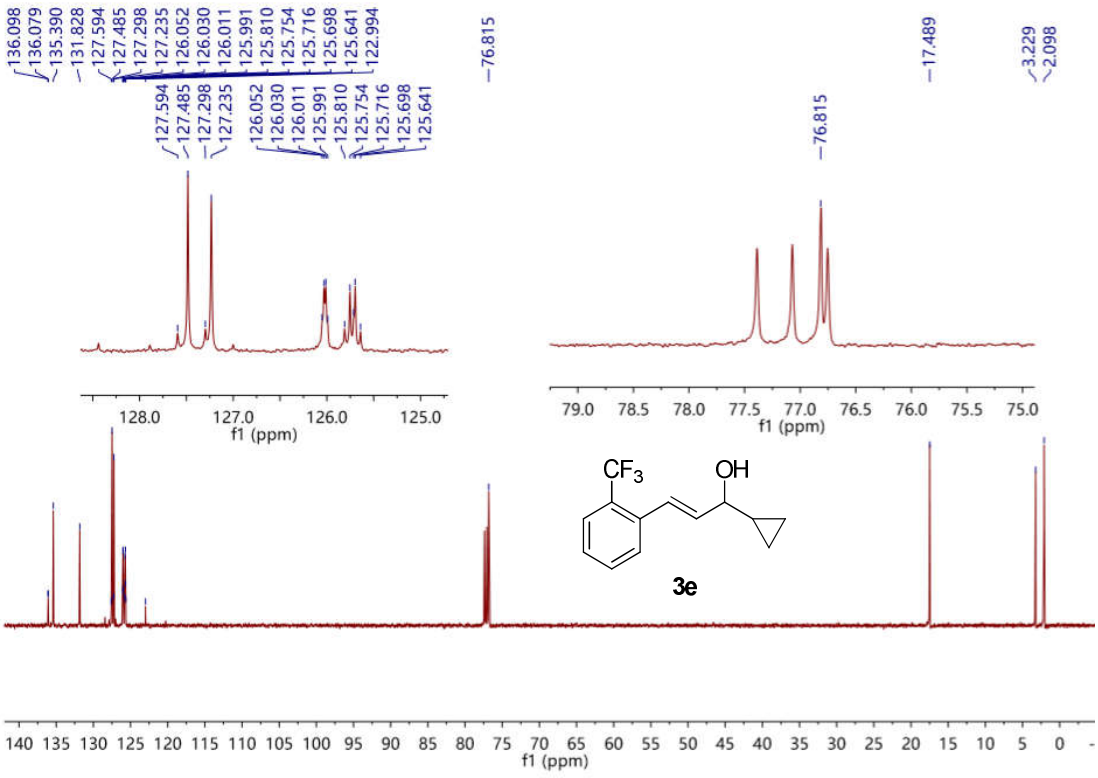

78.0
77.5
77.0
76.5
76.0
75.5
75.0
f1 (ppm)

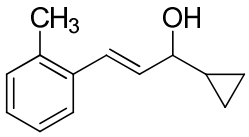

150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)



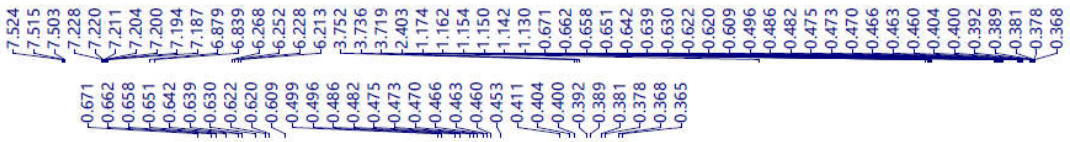

**3e**

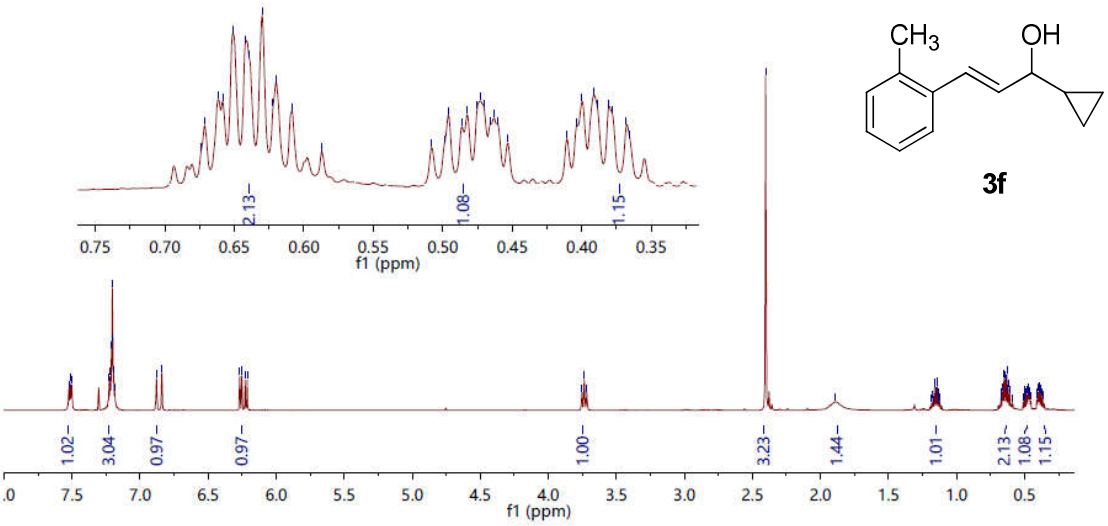




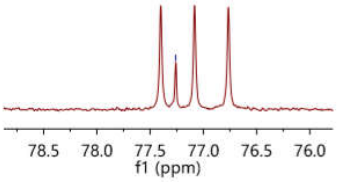
**3f**

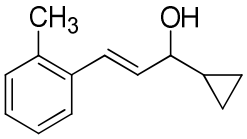




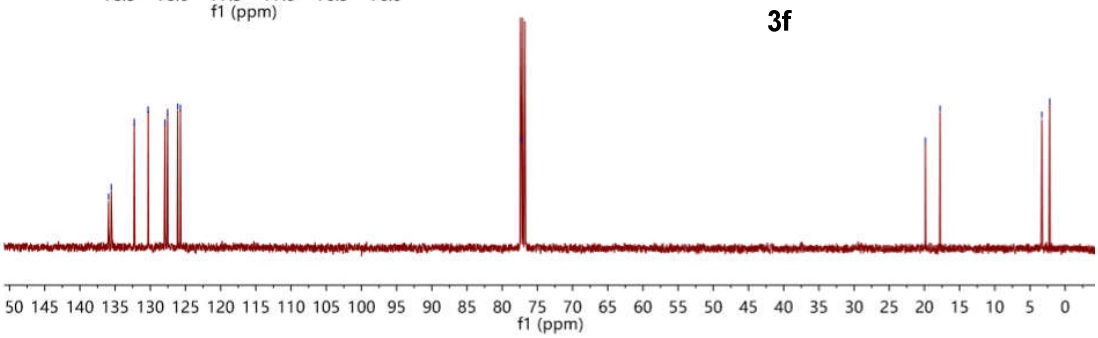


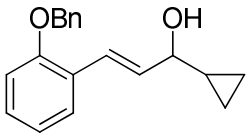
**3f**



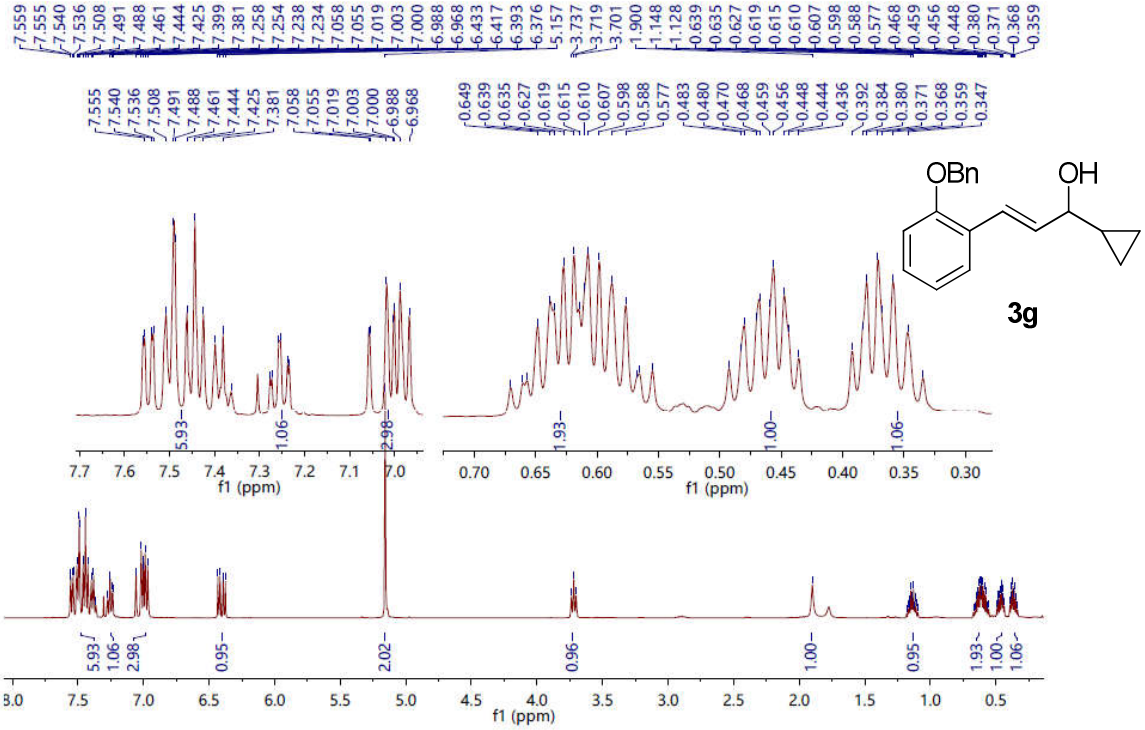


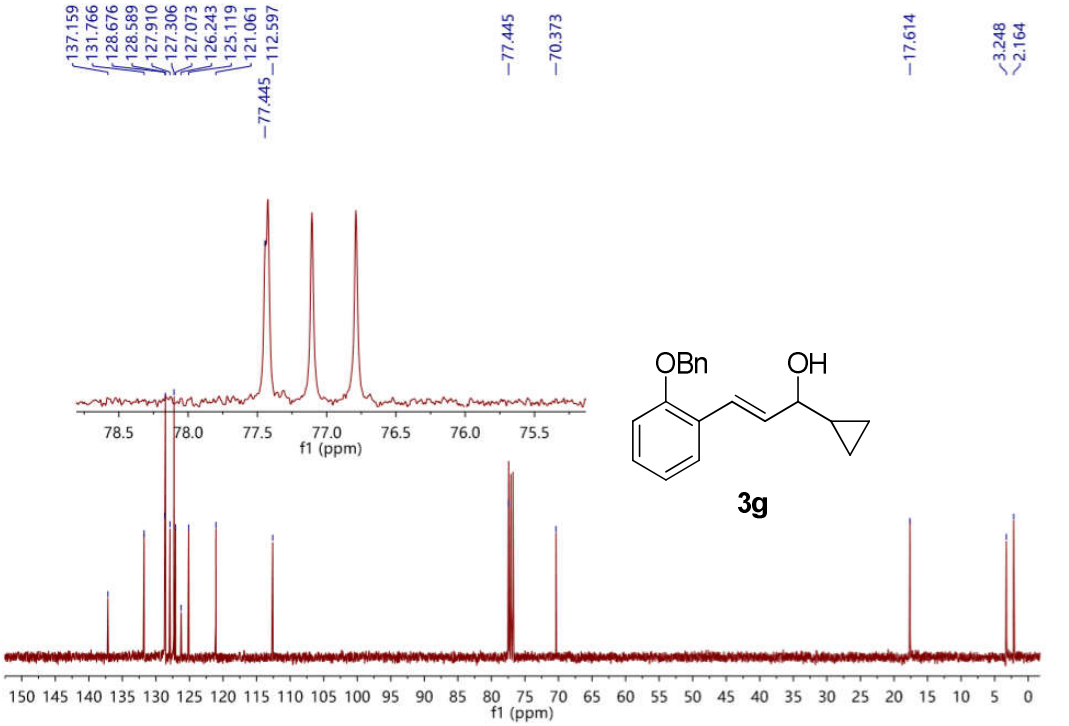
**3f**

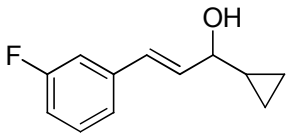




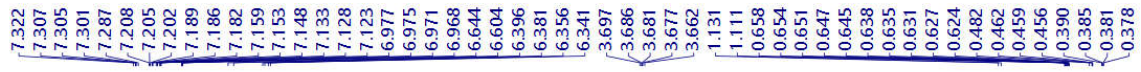

**3g**

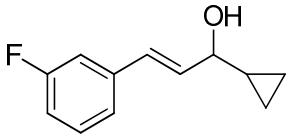


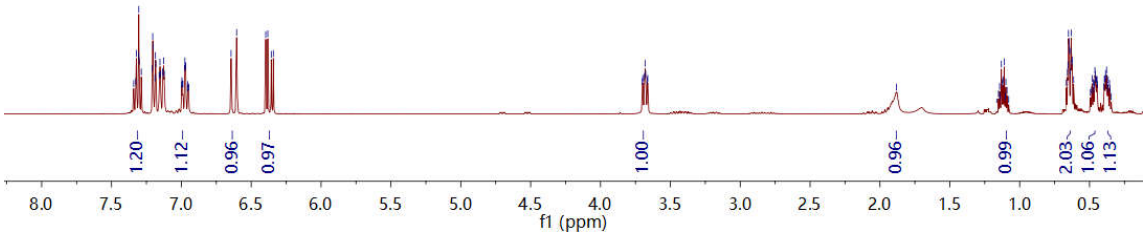

OH
F

**3h**

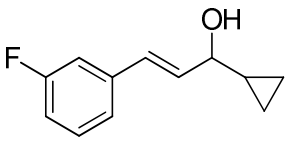

7.322
7.307
7.305
7.301
7.287
7.208
7.205
7.202
7.189
7.186
7.182
7.159
7.153
7.148
7.133
7.128
7.123
6.977
6.975
6.971
6.968
6.644
6.604
6.396
6.381
6.356
6.341
3.697
3.686
3.681
3.677
3.662
1.131
1.111
0.658
0.654
0.651
0.647
0.645
0.638
0.635
0.631
0.627
0.624
0.482
0.462
0.459
0.456
0.390
0.385
0.381
0.378


OH
F

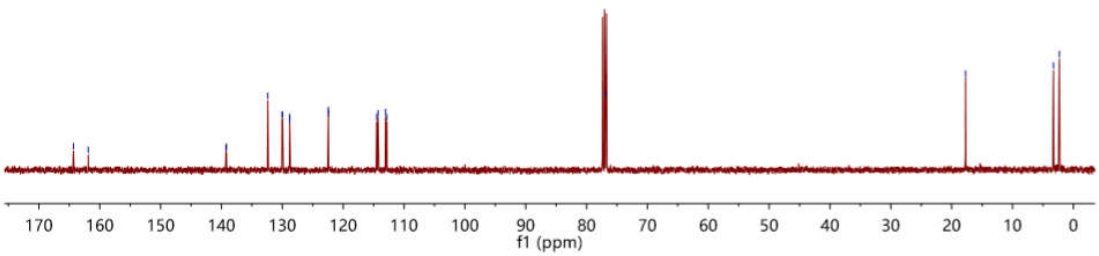
**3h**

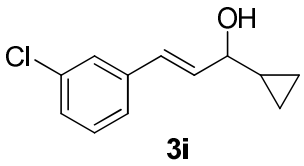

1.20
1.12
0.96
0.97
1.00
0.96
0.99
2.03
1.06
1.13
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)


164.321
161.885
139.269
139.193
132.390
130.042
129.958
128.815
128.789
122.439
122.411
114.491
114.278
113.034
112.819
76.836
17.713
3.274
2.298
76.836
79.0
78.5
78.0
77.5
77.0
76.5
76.0
75.5
75.0
f1 (ppm)

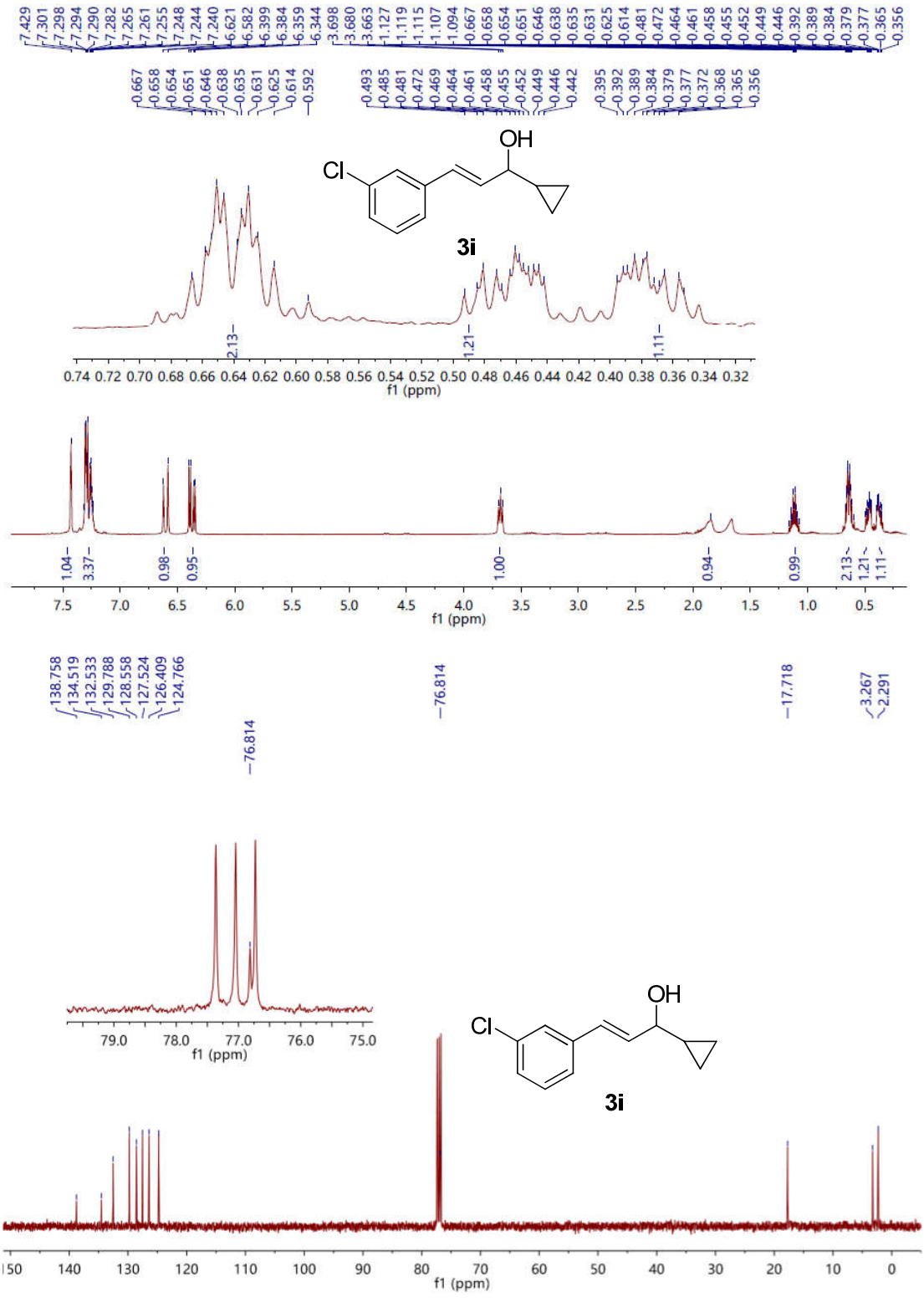

OH
F

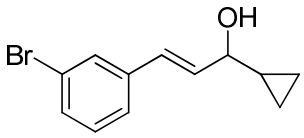
**3h**


170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

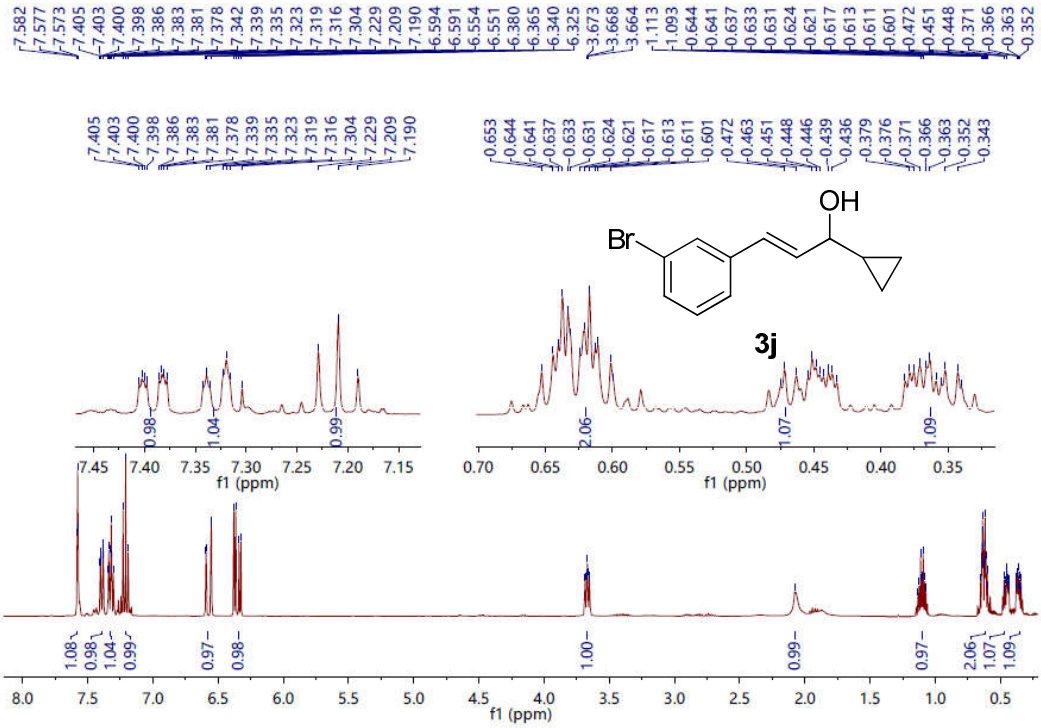

OH
Cl

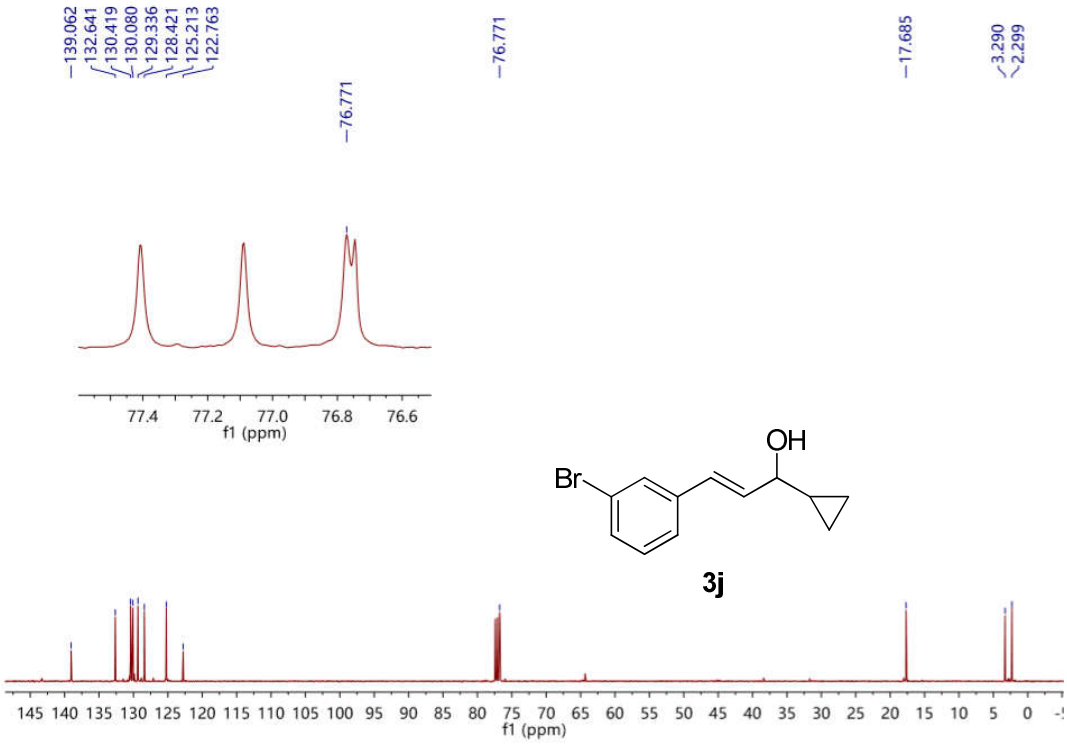
**3i**

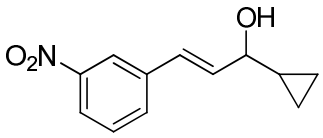

7.429 7.301 7.298 7.294 7.290 7.282 7.265 7.261 7.255 7.248 7.244 7.240 6.621 6.582 6.399 6.384 6.359 6.344
3.698 3.680 3.663 1.127 1.119 1.115 1.107 1.094 0.667 0.658 0.654 0.651 0.646 0.638 0.635 0.631 0.625 0.614 0.481 0.472 0.464 0.461 0.458 0.455 0.452 0.449 0.446 0.392 0.389 0.384 0.379 0.377 0.365 0.356
0.667 0.658 0.654 0.651 0.646 0.638 0.635 0.631 0.625 0.614 0.592
0.493 0.485 0.481 0.472 0.469 0.464 0.461 0.458 0.455 0.452 0.449 0.446 0.442 0.395 0.392 0.389 0.384 0.379 0.377 0.372 0.368 0.365 0.356
OH
Cl
3i
2.13
1.21
1.11
0.74 0.72 0.70 0.68 0.66 0.64 0.62 0.60 0.58 0.56 0.54 0.52 0.50 0.48 0.46 0.44 0.42 0.40 0.38 0.36 0.34 0.32
f1 (ppm)
1.04
3.37
0.98
0.95
1.00
0.94
0.99
2.13
1.21
1.11
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
f1 (ppm)
138.758
134.519
132.533
129.788
128.558
127.524
126.409
124.766
76.814
76.814
17.718
3.267
2.291
79.0 78.0 77.0 76.0 75.0
f1 (ppm)
OH
Cl
3i
150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)




**3j**

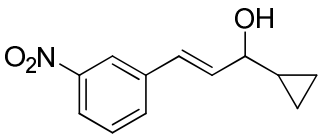


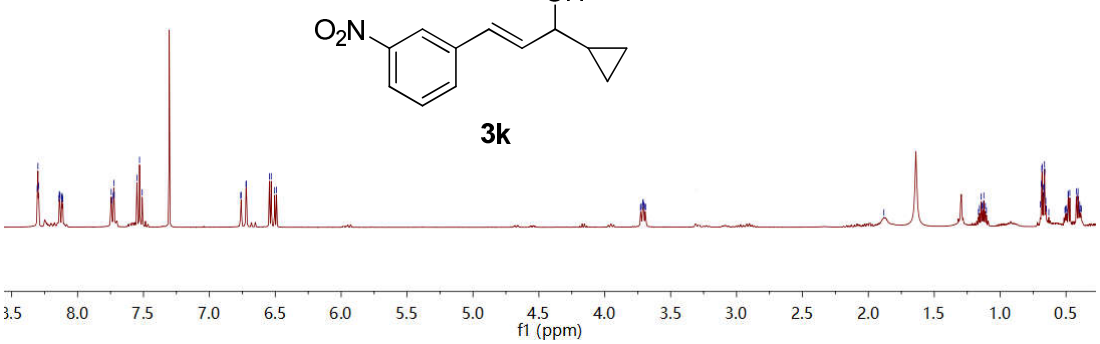

OH
O2N

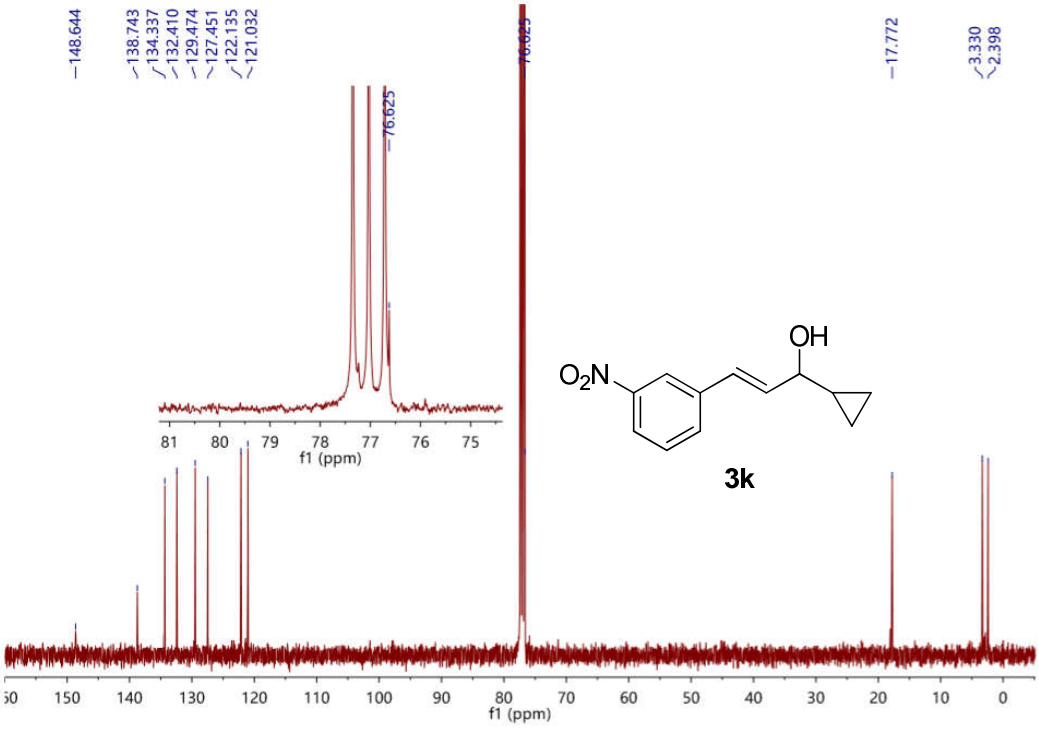
**3k**

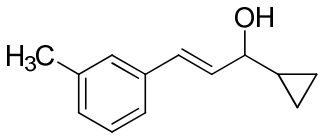

8.306
8.301
8.296
8.141
8.139
8.135
8.133
8.121
8.118
8.115
8.112
7.745
7.741
7.729
7.725
7.722
7.550
7.530
7.510
6.762
6.759
6.722
6.719
6.545
6.531
6.505
6.491
3.715
3.711
3.708
3.704
1.145
1.132
1.124
1.112
0.694
0.687
0.684
0.682
0.674
0.668
0.666
0.663
0.662
0.654
0.485
0.482
0.471
0.422
0.411
0.409
0.396


OH
O2N

**3k**

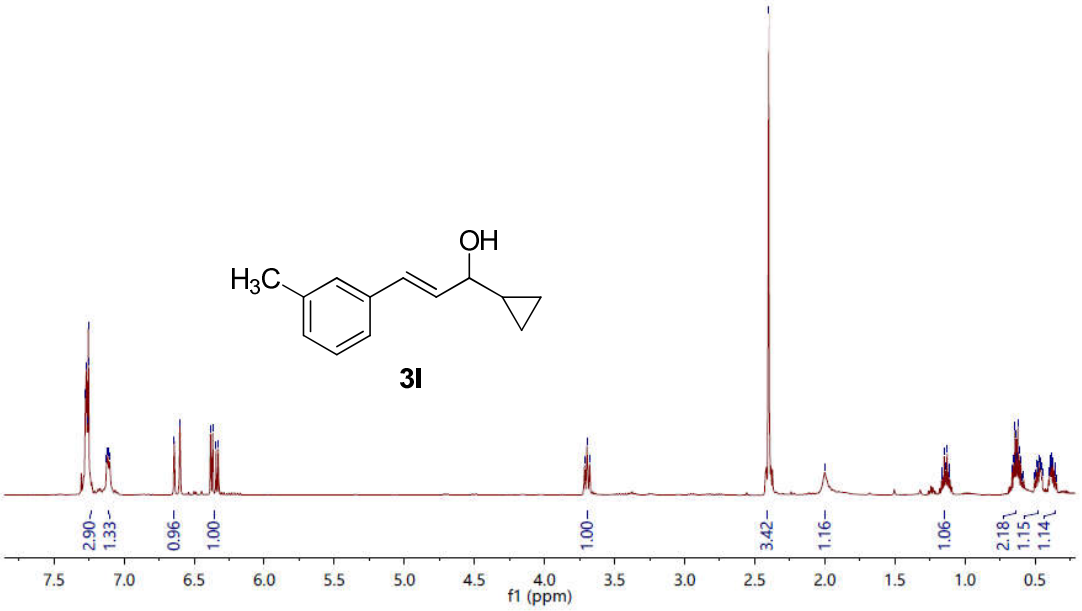

8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)


148.644
138.743
134.337
132.410
129.474
127.451
122.135
121.032
77.253
77.000
76.625
17.772
3.330
2.398
81
80
79
78
77
76
75
f1 (ppm)
OH
O2N
3k
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

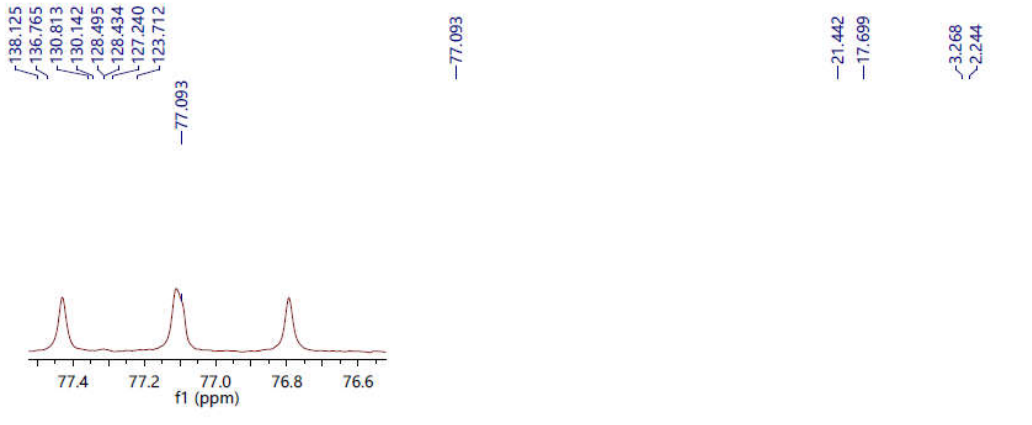

OH
H3C

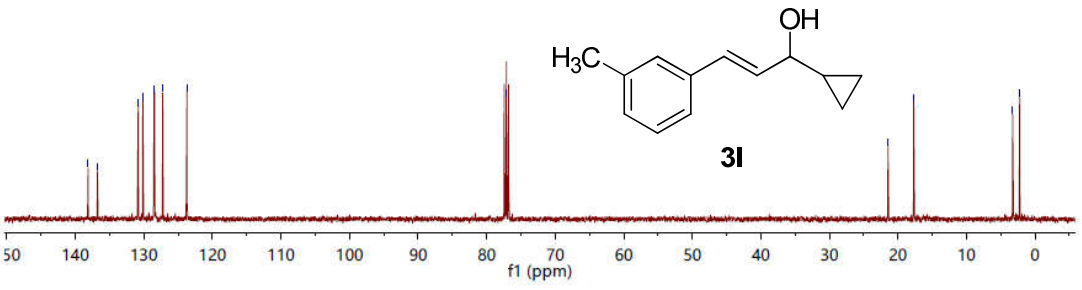
**3l**


7.275
7.269
7.262
7.255
7.252
7.125
7.118
7.114
7.105
6.644
6.604
6.383
6.367
6.343
6.327
3.714
3.697
3.678
2.400
2.001
1.160
1.148
1.140
1.136
1.127
1.115
0.663
0.654
0.650
0.643
0.634
0.630
0.623
0.613
0.602
0.490
0.481
0.477
0.469
0.465
0.461
0.458
0.455
0.402
0.395
0.391
0.385
0.383
0.380
0.373
0.369
0.360

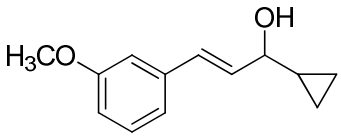

OH
H3C
2.90
1.33
0.96
1.00
1.00
3.42
1.16
1.06
2.18
1.15
1.14
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
f1 (ppm)

**3l**

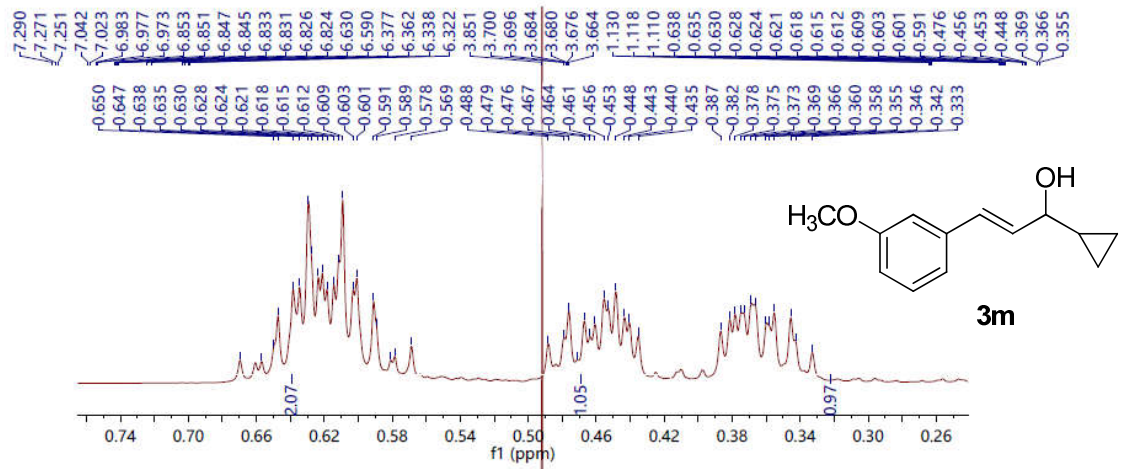

138.125
136.765
130.813
130.142
128.495
128.434
127.240
123.712
77.093
77.093
21.442
17.699
3.268
2.244
77.4
77.2
77.0
76.8
76.6
f1 (ppm)


OH
H3C
50
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

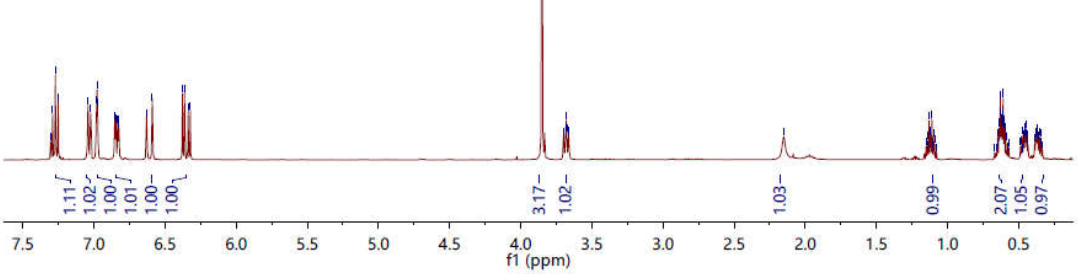
**3l**

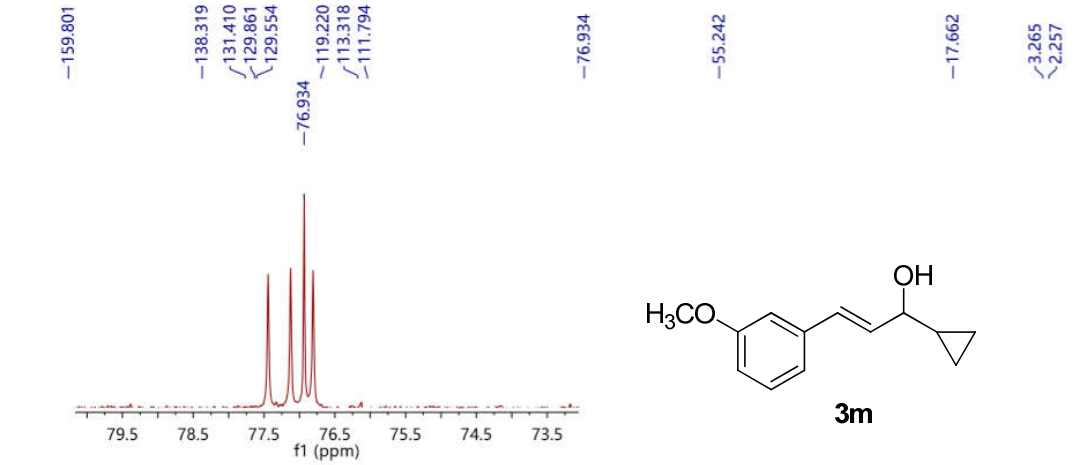

OH
H3CO

**3m**


OH
H3CO
2.07
1.05
0.97
f1 (ppm)

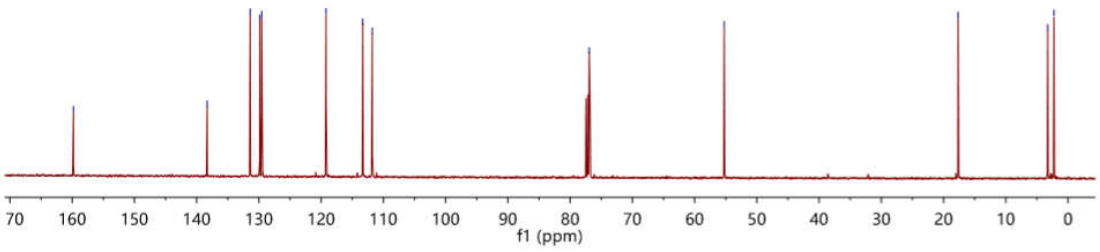
**3m**

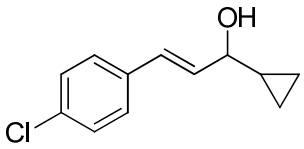

1.11
1.02
1.00
1.01
1.00
1.00
3.17
1.02
1.03
0.99
2.07
1.05
0.97
f1 (ppm)


159.801
138.319
131.410
129.861
129.554
76.934
119.220
113.318
111.794
76.934
55.242
17.662
3.265
2.257
f1 (ppm)

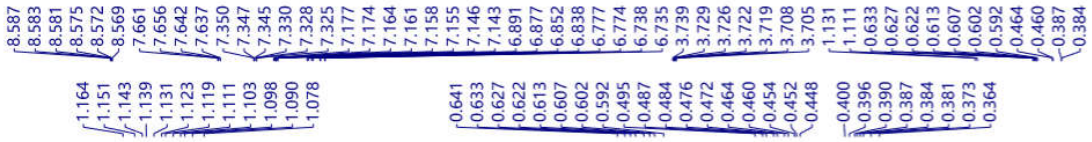

OH
H3CO

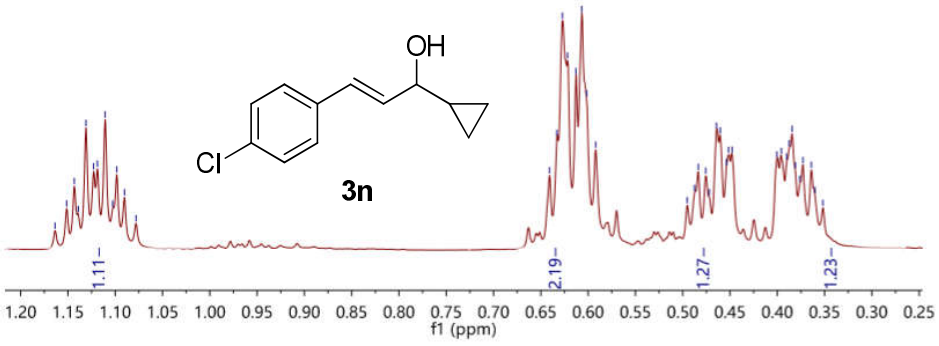
**3m**

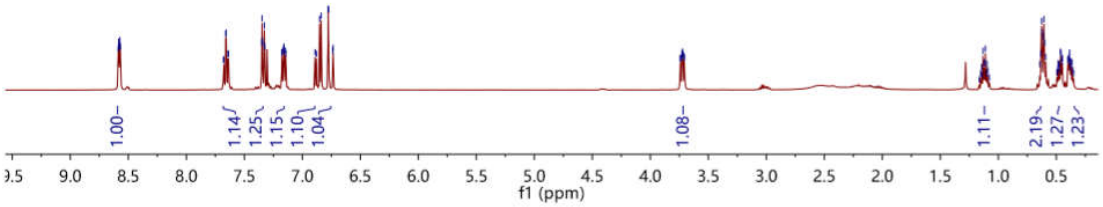

f1 (ppm)

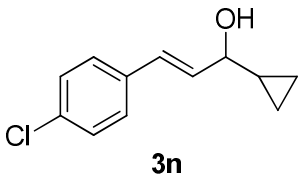

OH
Cl

**3n**

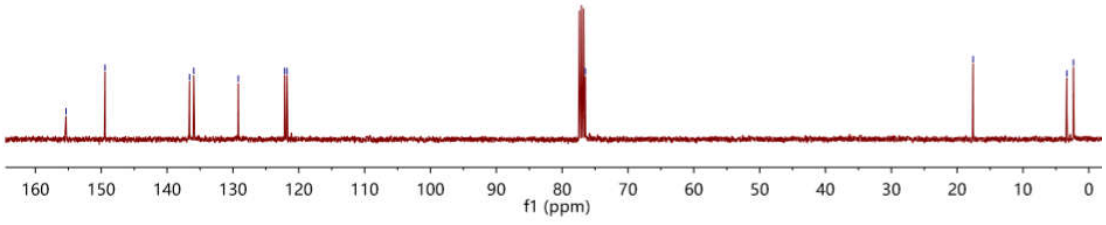


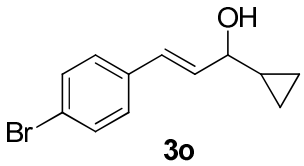

OH
Cl
3n
1.11
2.19
1.27
1.23
1.20 1.15 1.10 1.05 1.00 0.95 0.90 0.85 0.80 0.75 0.70 0.65 0.60 0.55 0.50 0.45 0.40 0.35 0.30 0.25
f1 (ppm)


1.00
1.14
1.25
1.15
1.10
1.04
1.08
1.11
2.19
1.27
1.23
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
f1 (ppm)

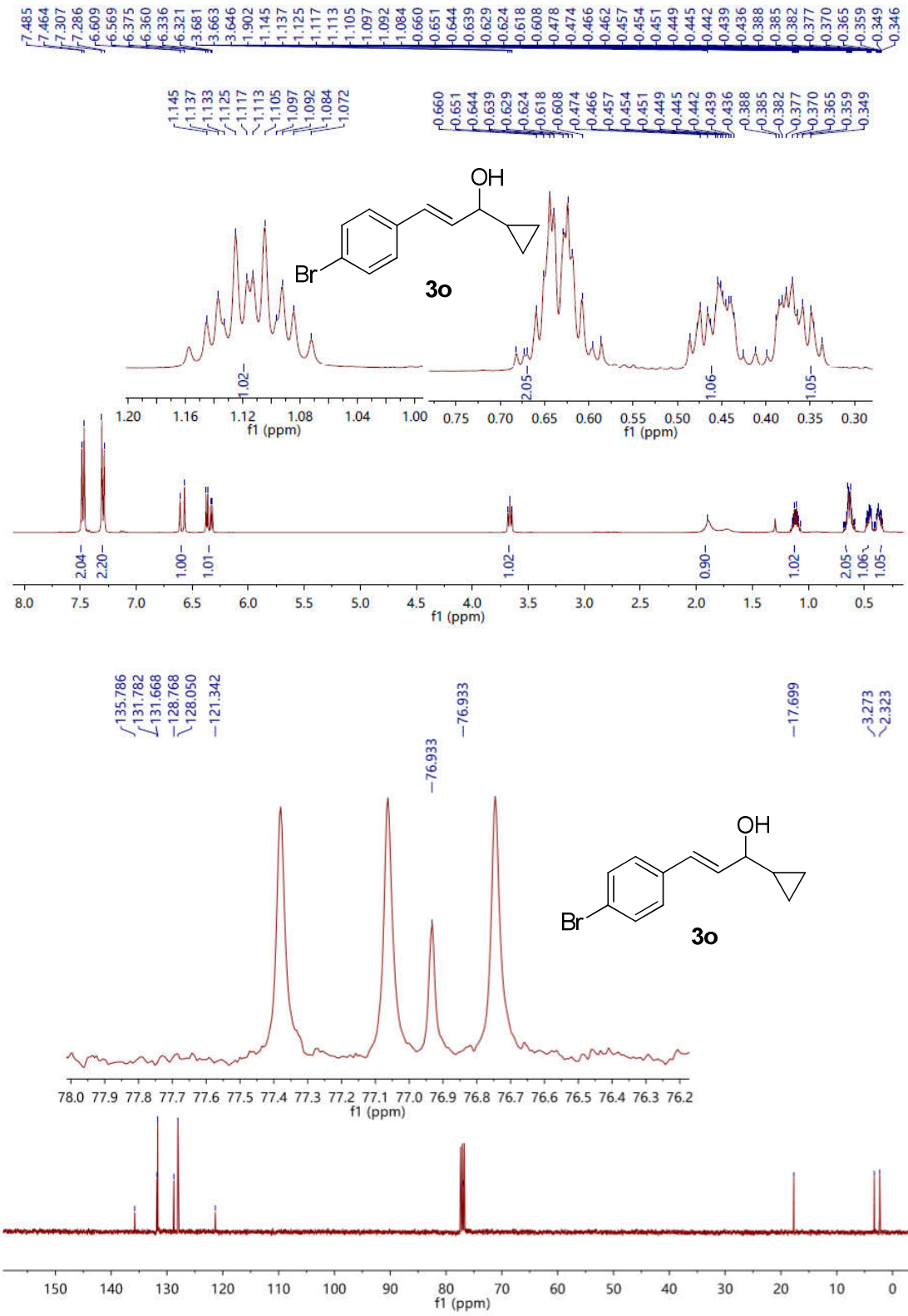

OH
Cl

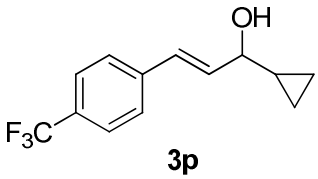
**3n**


160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)

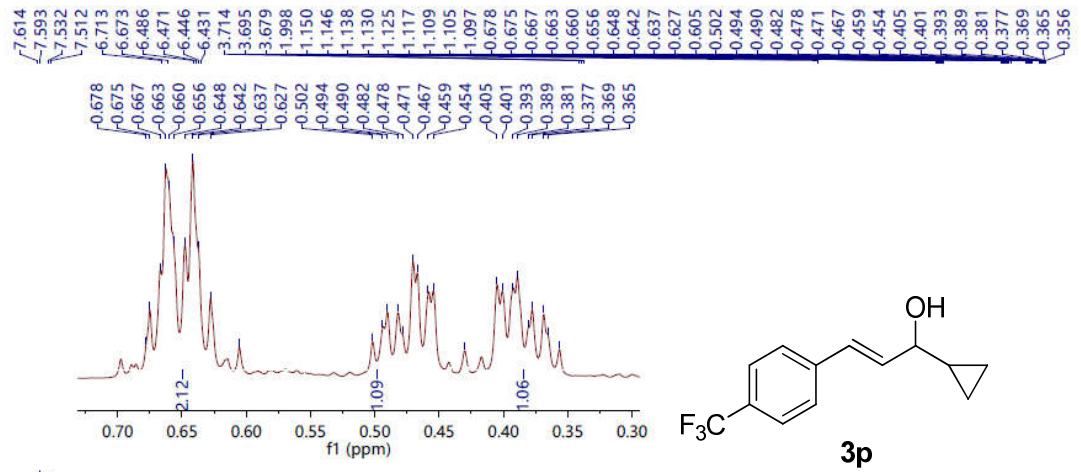



**3o**



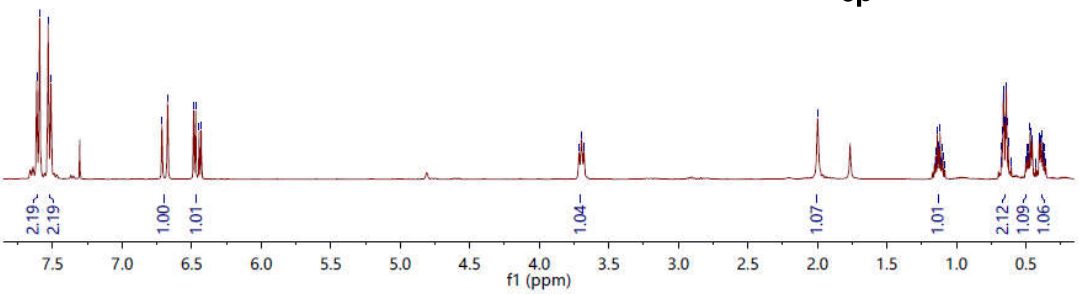

OH
F3C

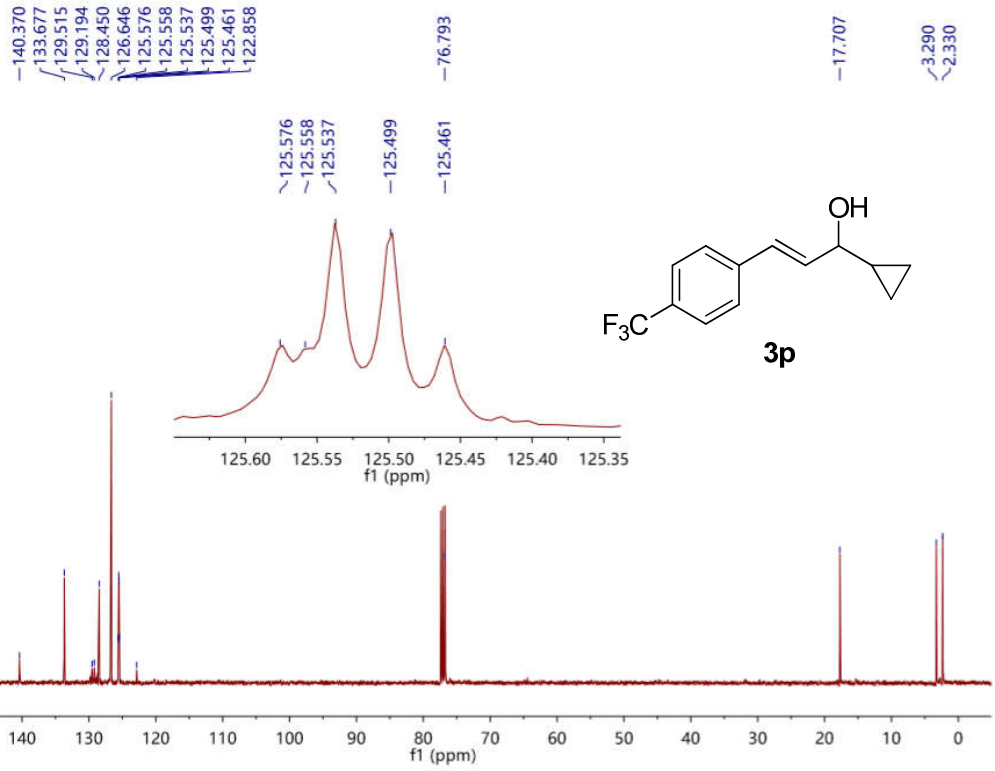
**3p**


7.614
7.593
7.532
7.512
6.713
6.673
6.486
6.471
6.446
6.431
3.714
3.695
3.679
1.998
1.150
1.146
1.138
1.130
1.125
1.117
1.109
1.105
1.097
0.678
0.675
0.667
0.663
0.660
0.656
0.648
0.642
0.637
0.627
0.605
0.502
0.494
0.490
0.482
0.478
0.471
0.467
0.459
0.454
0.405
0.401
0.393
0.389
0.381
0.377
0.369
0.365
0.356
2.12
1.09
1.06
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
f1 (ppm)


OH
F3C

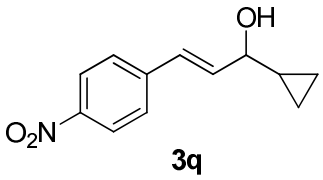
**3p**


2.19
2.19
1.00
1.01
1.04
1.07
1.01
2.12
1.09
1.06
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
f1 (ppm)

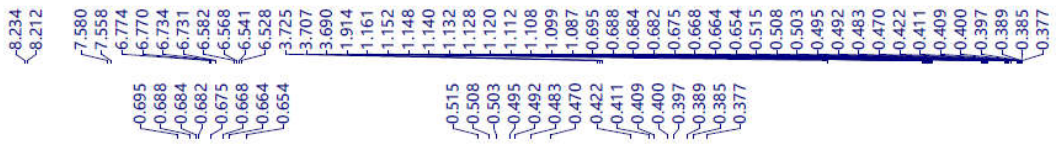

140.370
133.677
129.515
129.194
128.450
126.646
125.576
125.558
125.537
125.499
125.461
122.858
76.793
17.707
3.290
2.330
125.576
125.558
125.537
125.499
125.461
125.60
125.55
125.50
125.45
125.40
125.35
f1 (ppm)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)

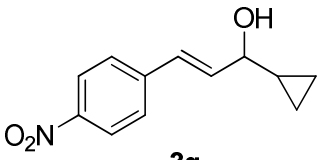

OH
F3C

**3p**

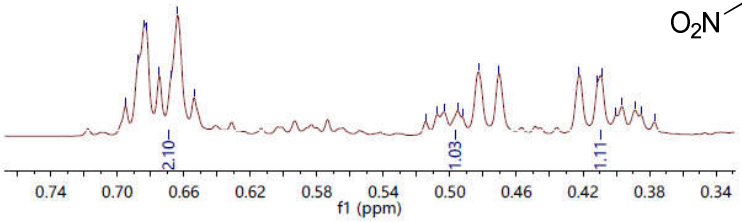

OH
$O_2N$

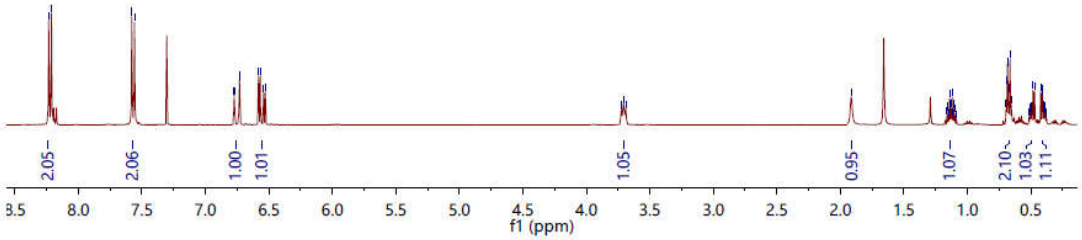
**3q**

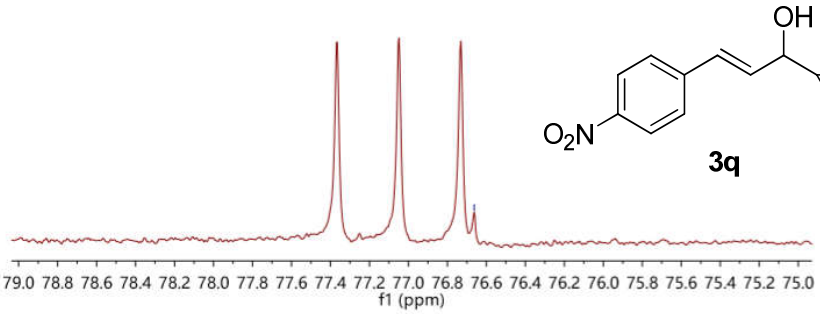


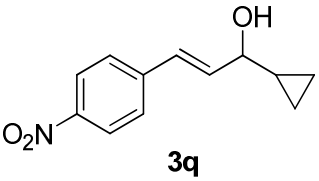

OH
$O_2N$

**3q**

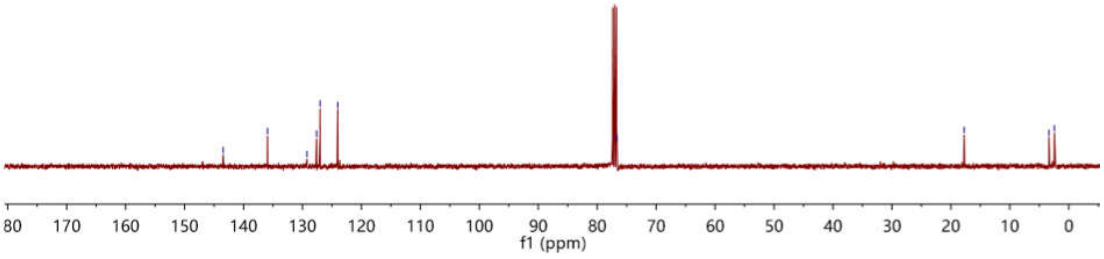

2.10
1.03
1.11
0.74 0.70 0.66 0.62 0.58 0.54 0.50 0.46 0.42 0.38 0.34
f1 (ppm)

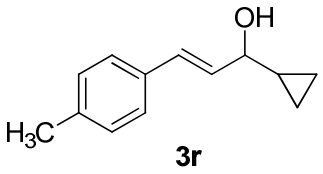

2.05
2.06
1.00
1.01
1.05
0.95
1.07
2.10
1.03
1.11
3.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5
f1 (ppm)


79.0 78.8 78.6 78.4 78.2 78.0 77.8 77.6 77.4 77.2 77.0 76.8 76.6 76.4 76.2 76.0 75.8 75.6 75.4 75.2 75.0
f1 (ppm)


OH
$O_2N$

**3q**

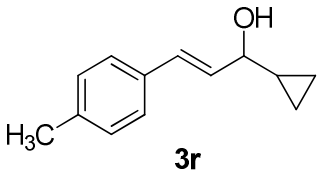

80 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
f1 (ppm)


OH
H3C

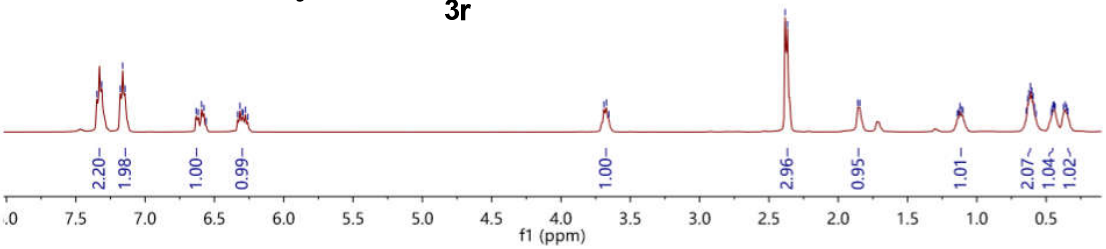
3r


7.348
7.313
7.179
7.162
7.144
6.632
6.616
6.593
6.576
6.559
6.333
6.316
6.299
6.293
6.276
6.259


3.690
3.673
3.655
2.383
2.366
1.859
1.844
1.141
1.132
1.121
1.110
1.101
0.642
0.633
0.623
0.614
0.604
0.594
0.584
0.573
0.463
0.456
0.449
0.444
0.435
0.374
0.363
0.353
0.343


OH
H3C

3r

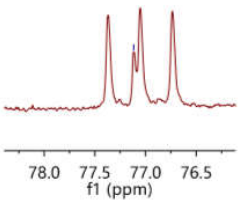

2.20
1.98
1.00
0.99
1.00
2.96
0.95
1.01
2.07
1.04
1.02
f1 (ppm)

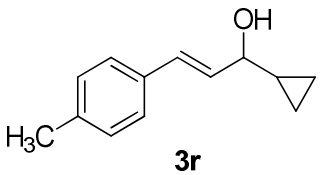

137.442
134.007
130.016
129.928
129.270
126.429


77.117

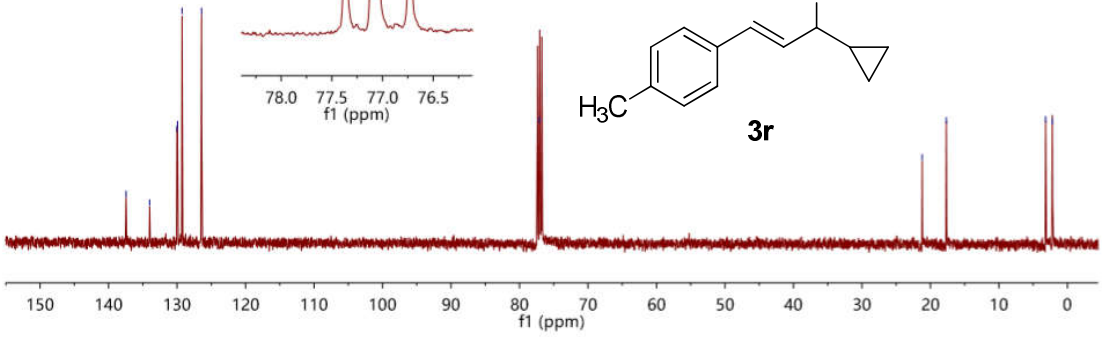

21.205
17.684
3.188
2.209

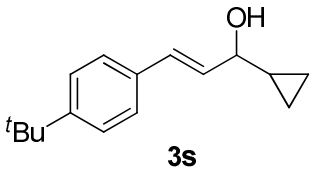

77.117


78.0
77.5
77.0
76.5
f1 (ppm)

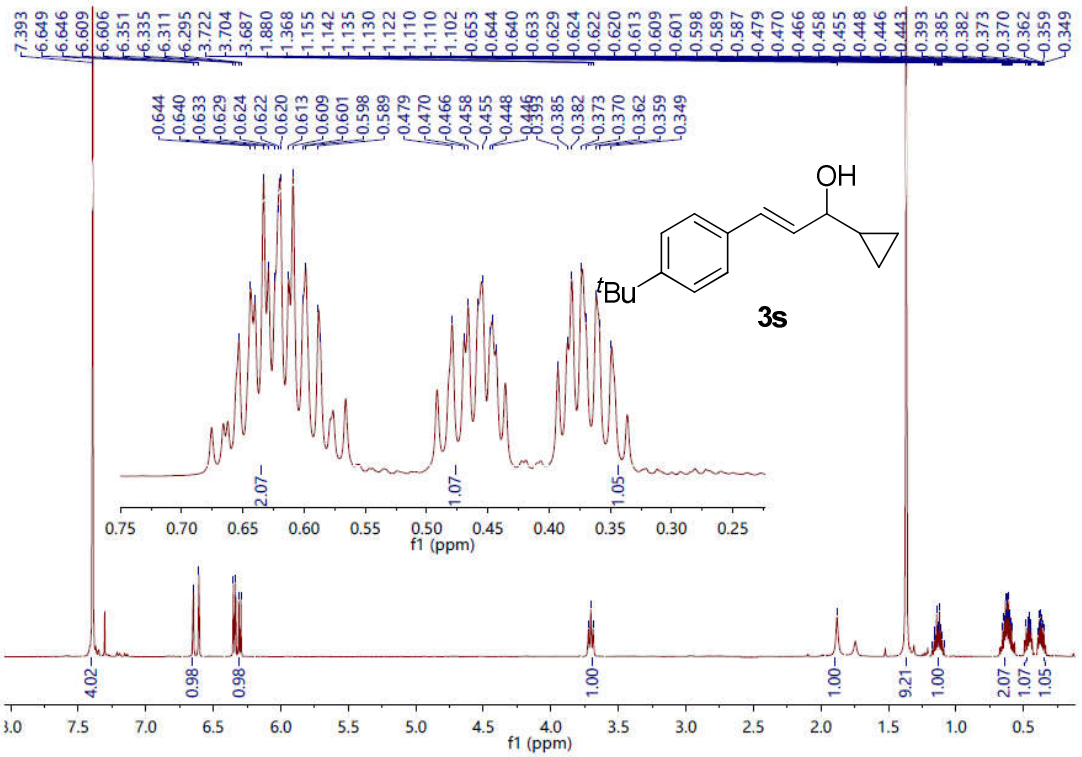

OH
H3C

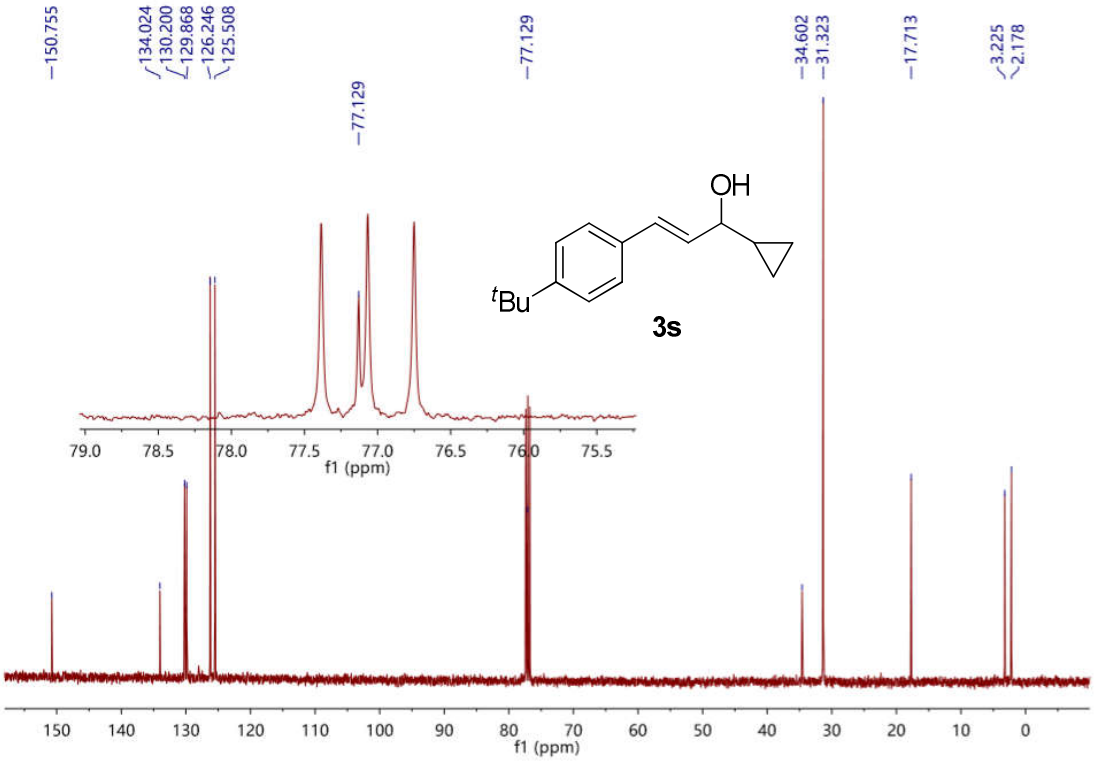
3r

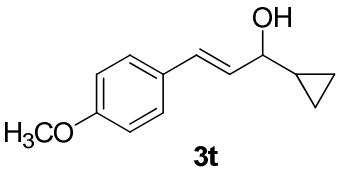

150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)



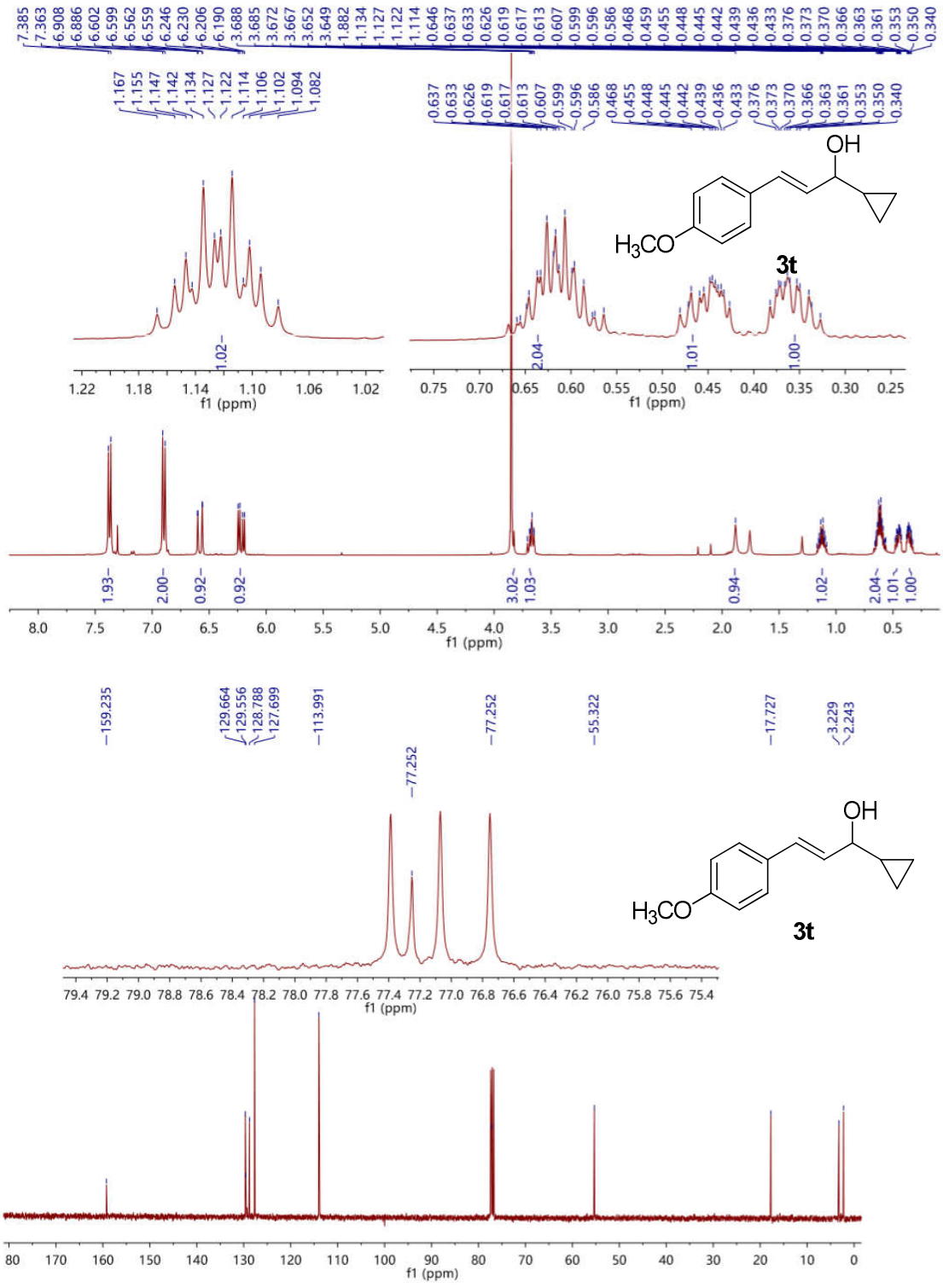

**3s**

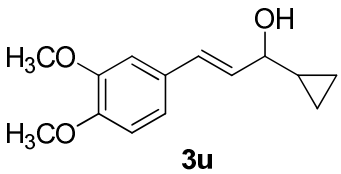


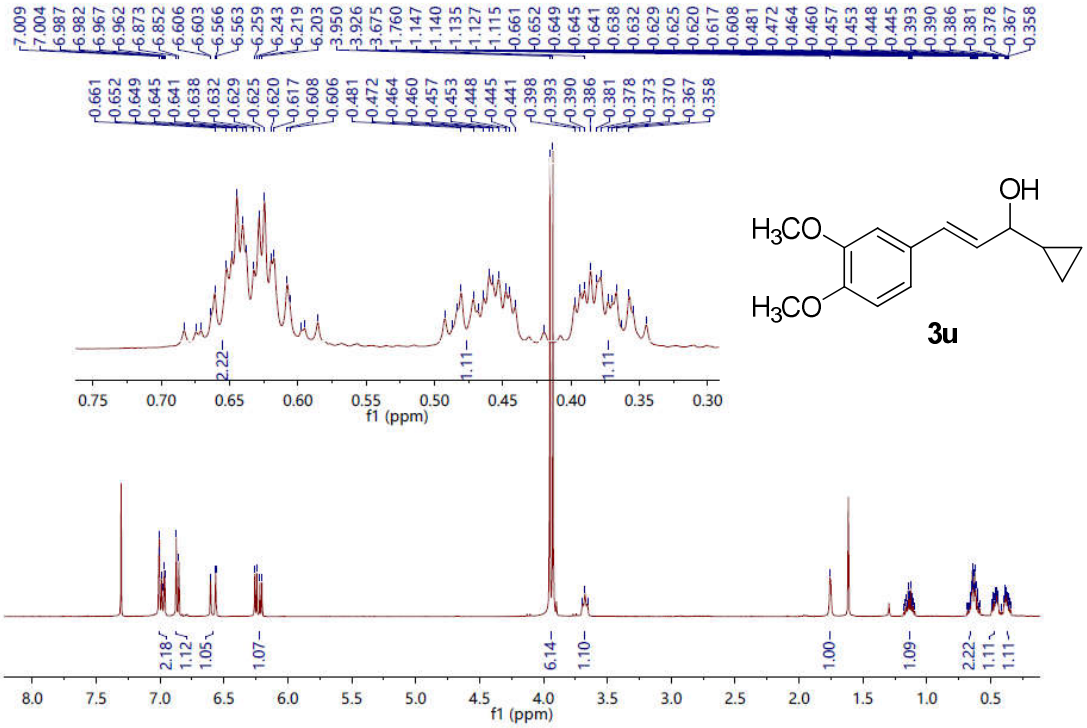


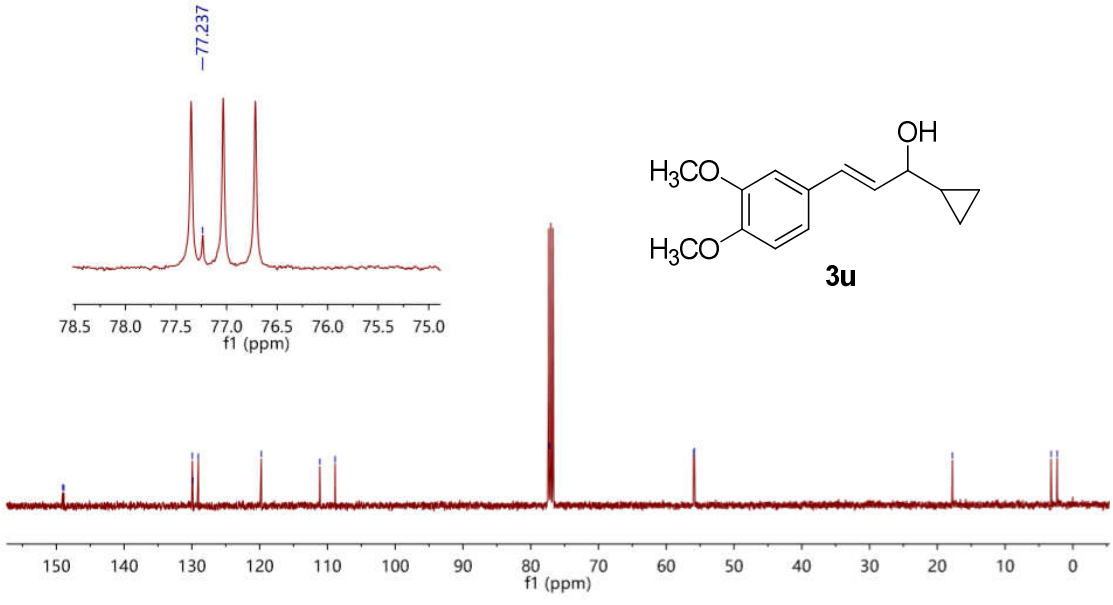

**3t**

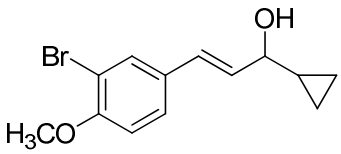




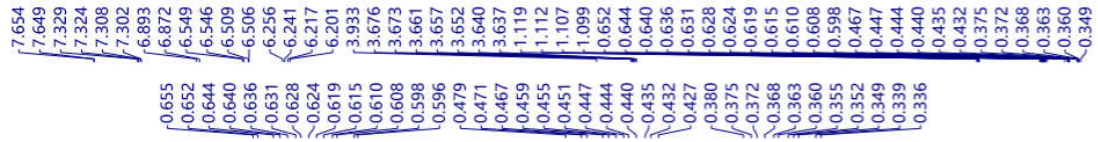

**3u**

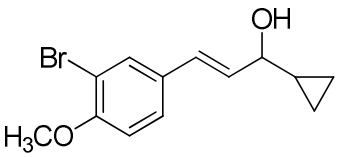


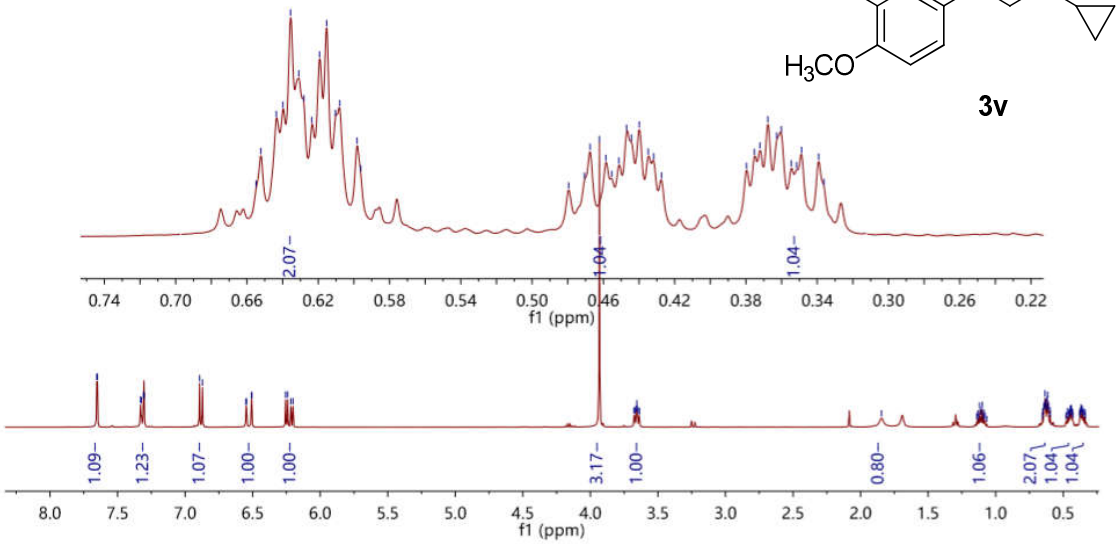

OH
Br
H3CO

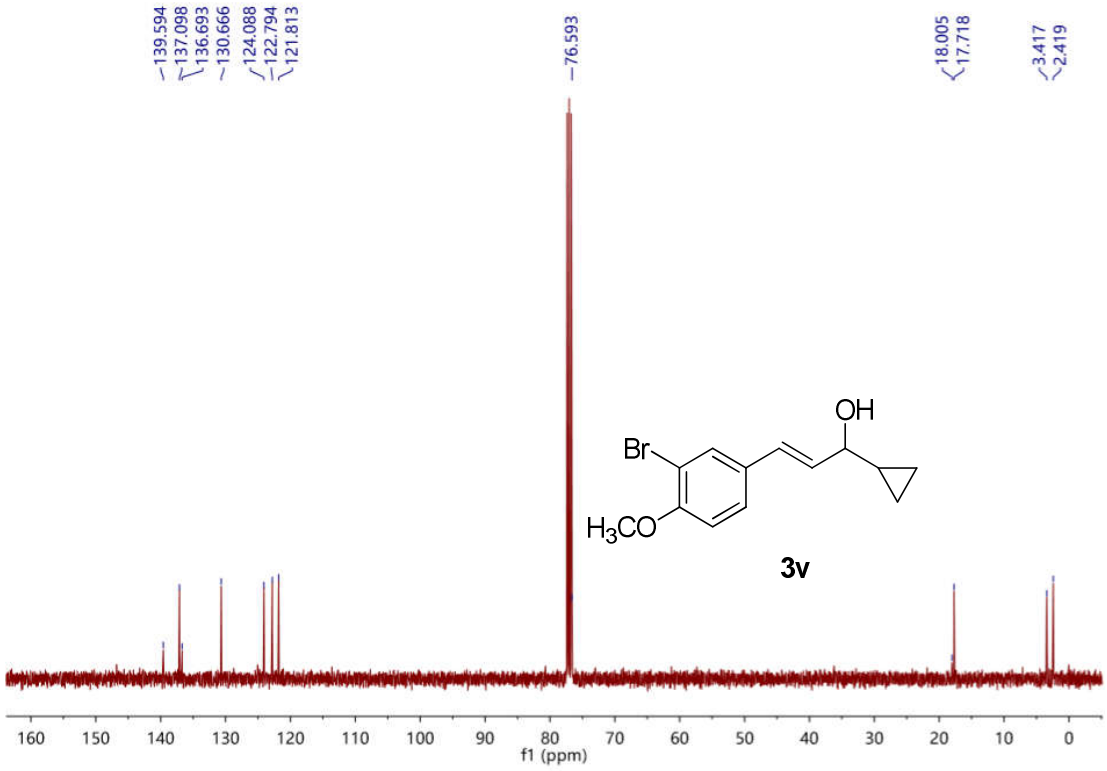
**3v**



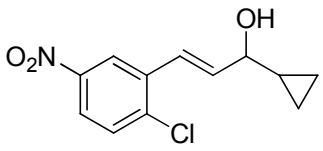

OH
Br
H3CO

**3v**


2.07
1.04
1.04
f1 (ppm)
1.09
1.23
1.07
1.00
1.00
3.17
1.00
0.80
1.06
2.07
1.04
1.04
f1 (ppm)


139.594
137.098
136.693
130.666
124.088
122.794
121.813
76.593
18.005
17.718
3.417
2.419
OH
Br
H3CO
f1 (ppm)

**3v**

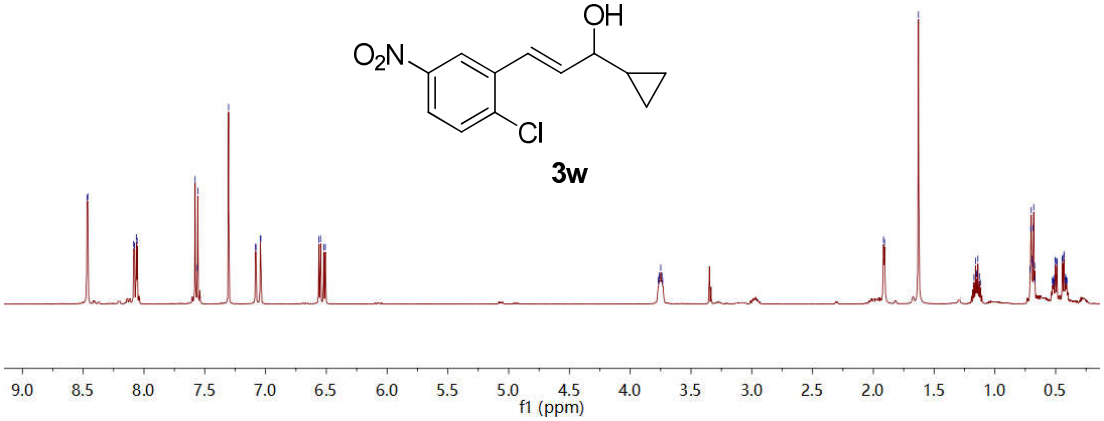



**3w**

8.469 8.462 8.085 8.078 8.063 8.056 7.579 7.562 7.557 7.304 7.083 7.079 7.043 7.039 6.562 6.548 6.522 6.508 3.764 3.760 3.749 3.739 1.917 1.908 1.629 1.172 1.160 1.152 1.148 1.140 1.128 0.711 0.705 0.701 0.694 0.691 0.685 0.681 0.673 0.671 0.527 0.515 0.504 0.500 0.491 0.488 0.446 0.443 0.434 0.431 0.418 0.411



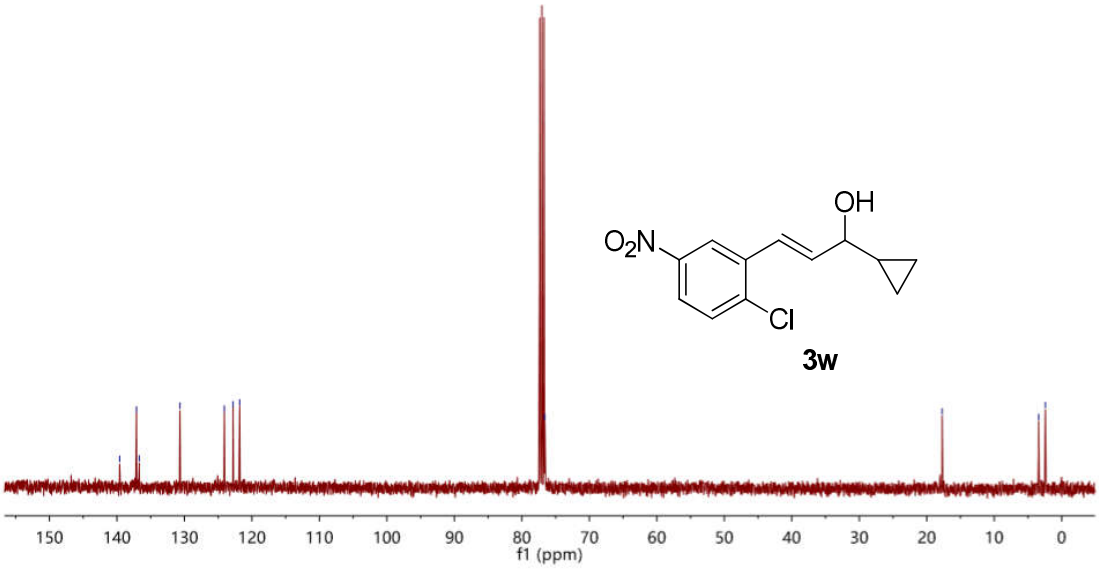

**3w**

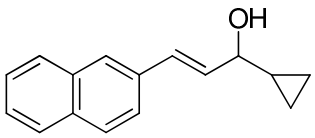



139.594 137.098 136.693 130.666 124.088 122.794 121.813 76.592 17.718 3.417 2.419

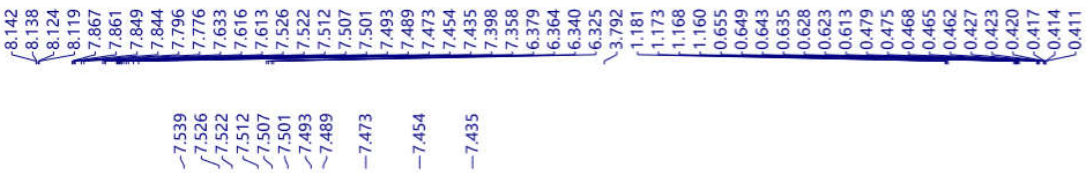


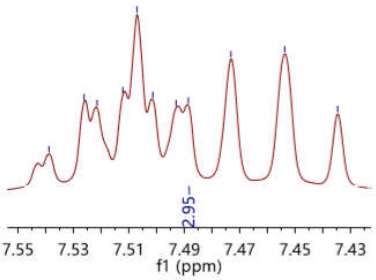

**3w**

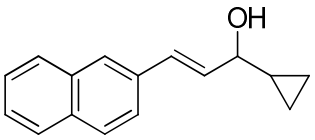




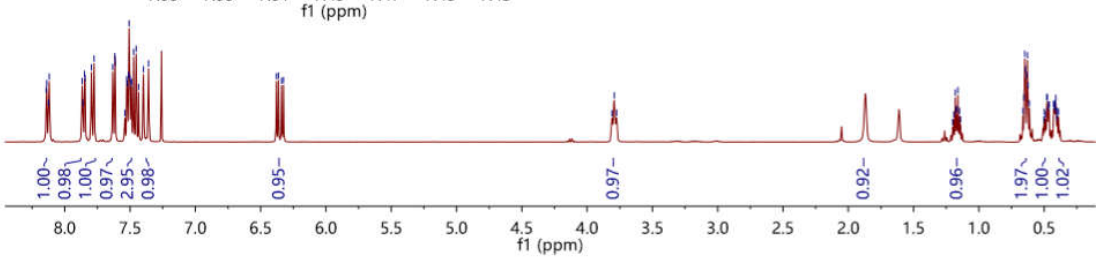

**3x**

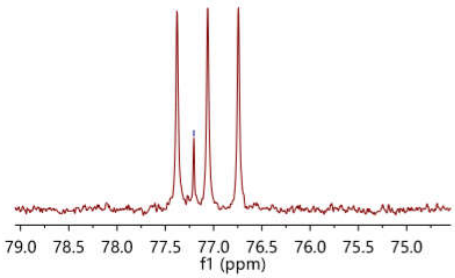


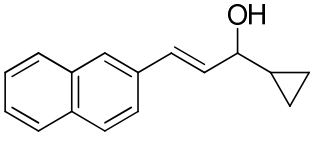




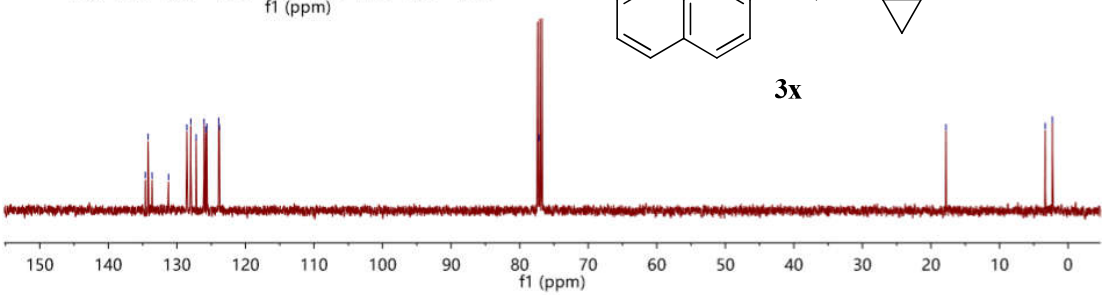

**3x**

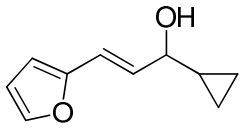




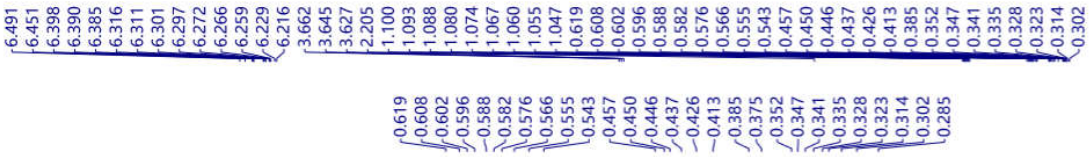


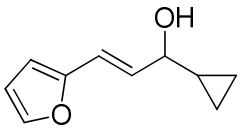

**3x**



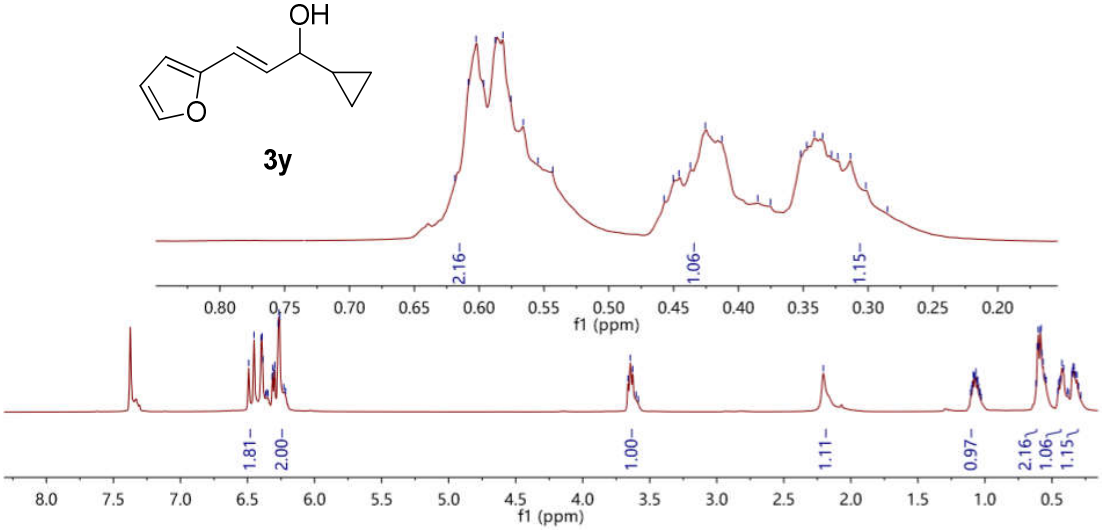

OH
O

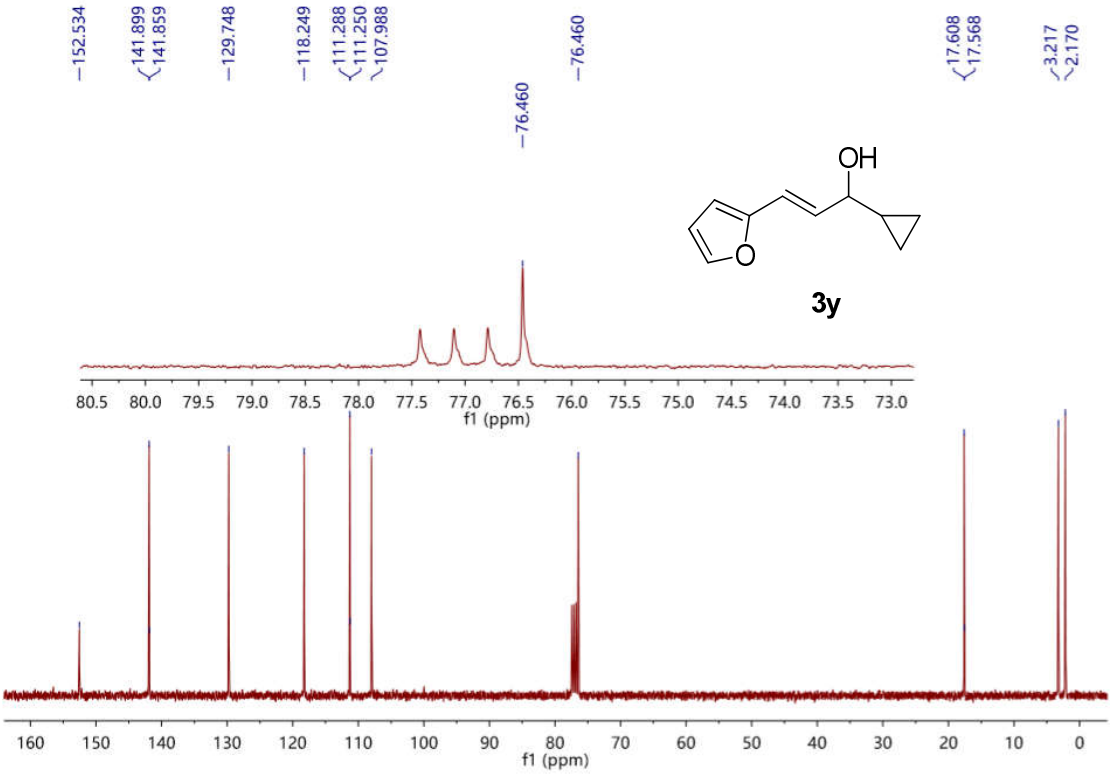
**3y**



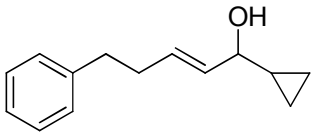

OH
O

**3y**

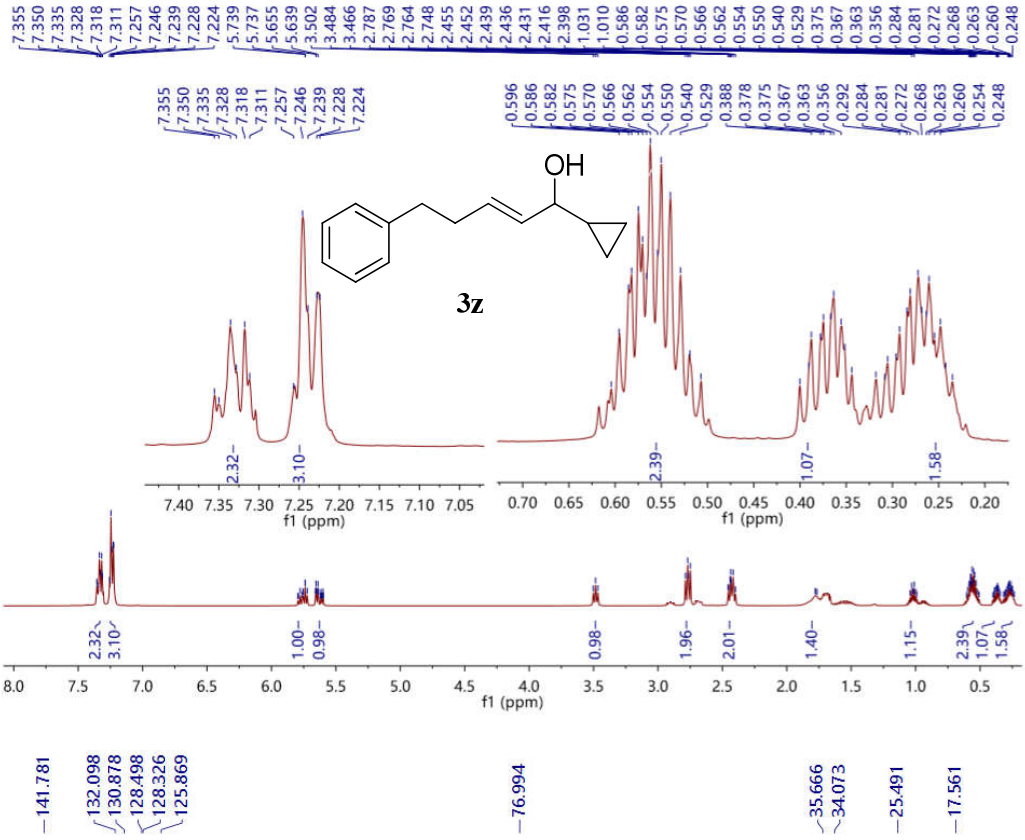

2.16
1.06
1.15
f1 (ppm)
1.81
2.00
1.00
1.11
0.97
2.16
1.06
1.15
f1 (ppm)

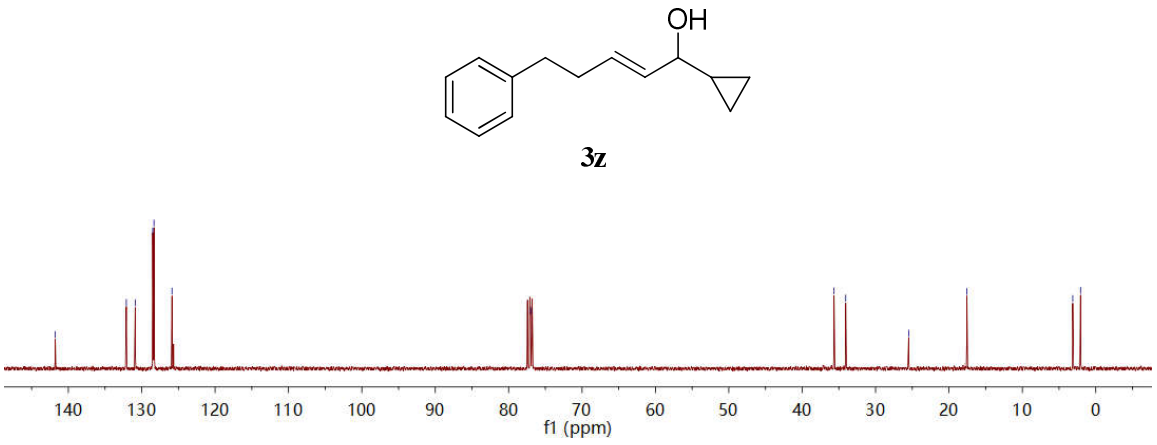

152.534
141.899
141.859
129.748
118.249
111.288
111.250
107.988
76.460
76.460
17.608
17.568
3.217
2.170
OH
O
f1 (ppm)
f1 (ppm)

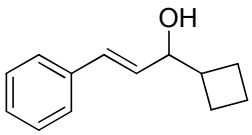
**3y**




**3z**

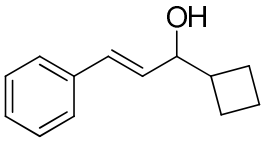


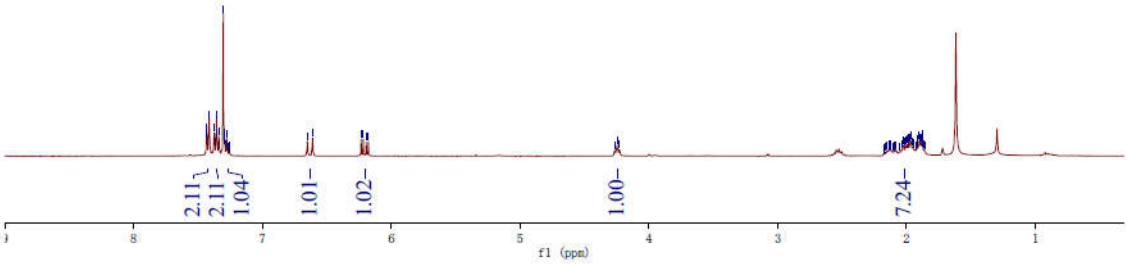

OH

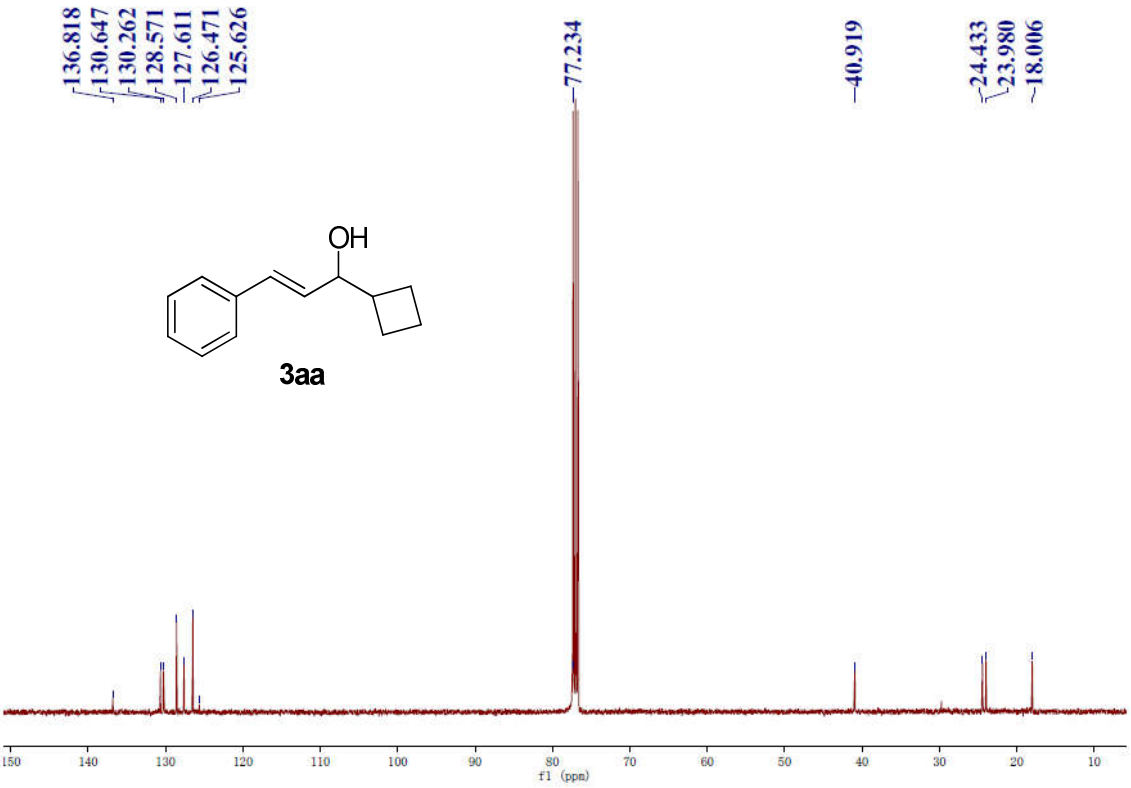
**3aa**


7.436
7.432
7.415
7.375
7.370
7.357
7.353
7.337
7.304
7.295
7.292
7.282
7.277
6.651
6.611
6.235
6.218
6.195
6.178
4.247
2.037
2.028
2.019
2.008
1.998
1.989
1.984
1.974
1.969
1.956
1.948
1.942
1.919
1.911
1.901
1.894
1.888
1.880
1.873
1.868


OH

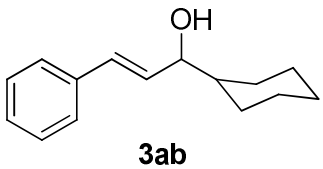
**3aa**


2.11
2.11
1.04
1.01
1.02
1.00
7.24
f1 (ppm)


136.818
130.647
130.262
128.571
127.611
126.471
125.626
77.234
40.919
24.433
23.980
18.006
f1 (ppm)


OH

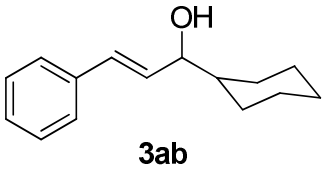
**3aa**


OH

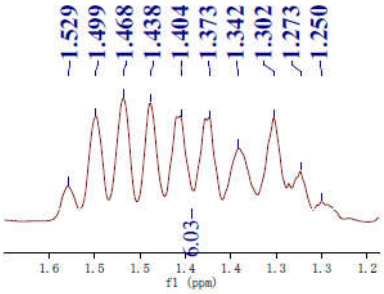
3ab

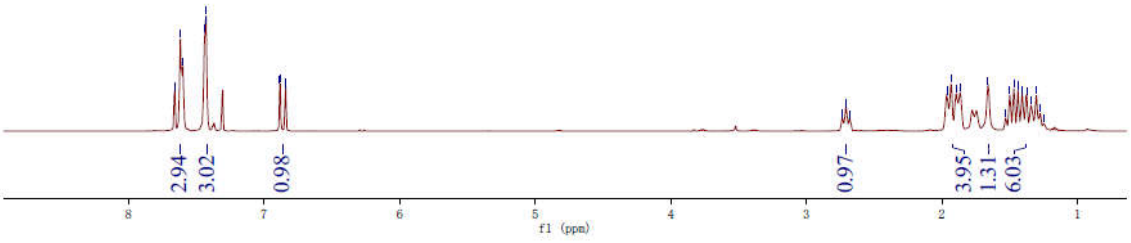

7.661
7.657
7.616
7.598
7.438
7.433
7.427
6.884
6.879
6.844
6.839


2.738
2.732
2.710
2.704
2.682
2.676
1.961
1.932
1.892
1.866
1.662
1.529
1.499
1.468
1.438
1.404
1.373
1.342
1.302
1.273
1.250


OH

3ab


1.529
1.499
1.468
1.438
1.404
1.373
1.342
1.302
1.273
1.250
6.03
1.6
1.5
1.5
1.4
1.4
1.3
1.3
1.2
f1 (ppm)

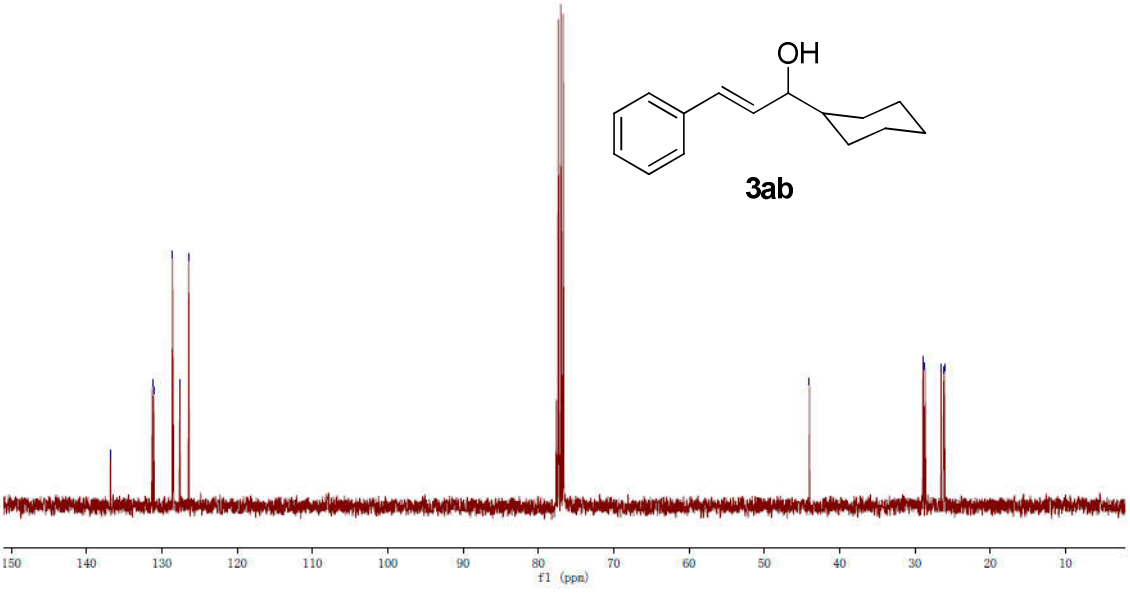

2.94
3.02
0.98
0.97
3.95
1.31
6.03
8
7
6
5
4
3
2
1
f1 (ppm)

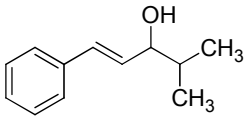

136.824
131.244
131.095
128.585
127.596
126.450


44.007
28.931
28.664
26.531
26.163
26.102


OH

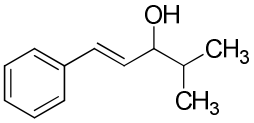
3ab


150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
f1 (ppm)

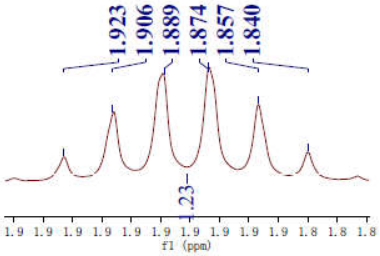

OH
CH3
CH3

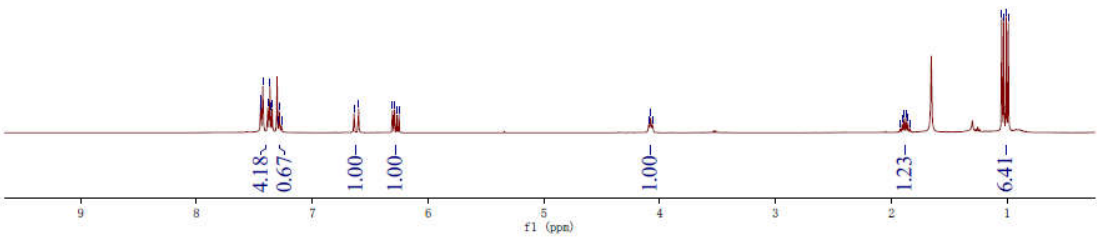
**3ac**

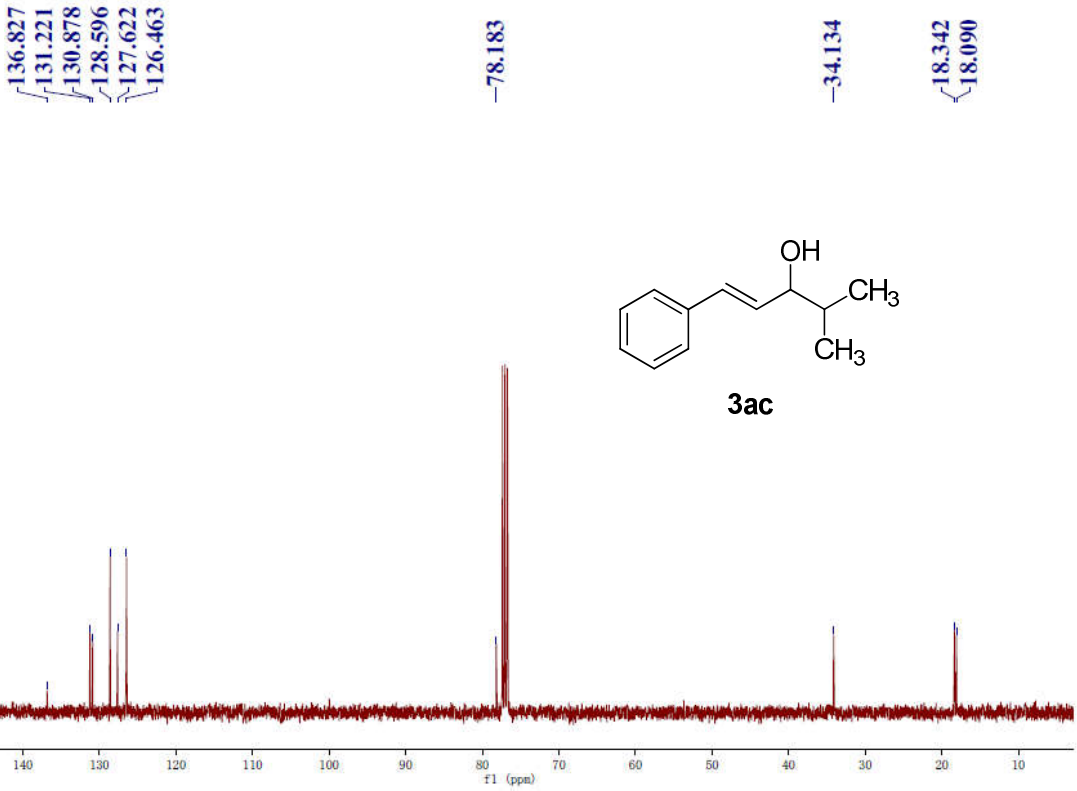

7.449
7.445
7.428
7.384
7.366
7.362
7.346
7.290
7.285
7.266
6.640
6.600
6.308
6.290
6.268
6.251
4.095
4.079
4.063
1.923
1.906
1.889
1.874
1.857
1.840
1.047
1.030
1.007
0.990


OH
CH3
CH3

**3ac**

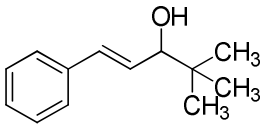

1.923
1.906
1.889
1.874
1.857
1.840
1.23
f1 (ppm)


4.18
0.67
1.00
1.00
1.00
1.23
6.41
f1 (ppm)


136.827
131.221
130.878
128.596
127.622
126.463
78.183
34.134
18.342
18.090
f1 (ppm)


OH
CH3
CH3

**3ac**

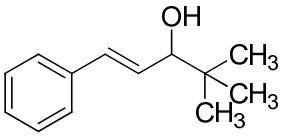



**3ad**

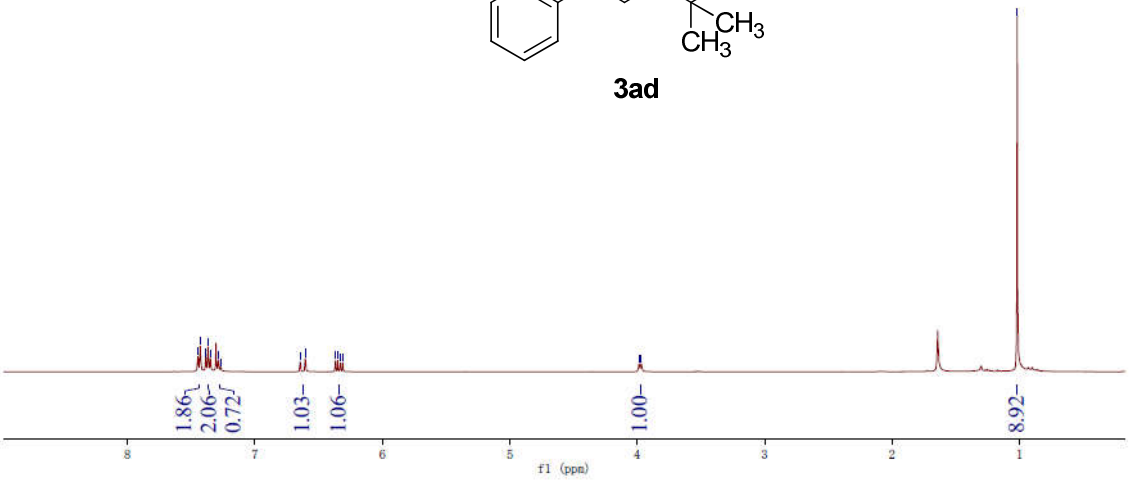
7.446
7.428
7.384
7.367
7.347
7.285
7.267
6.643
6.603
6.367
6.349
6.327
6.309

3.985
3.967

1.018




**3ad**

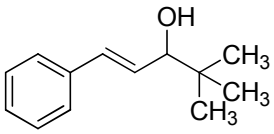



136.902
131.862
129.578
128.589
127.604
126.469

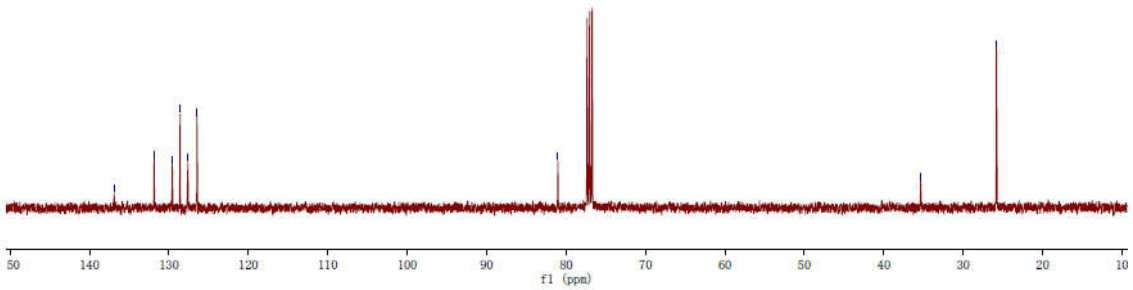
81.026

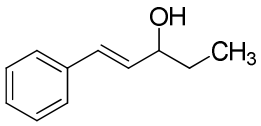
35.346

25.818




**3ad**



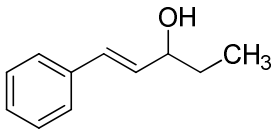



**3ae**

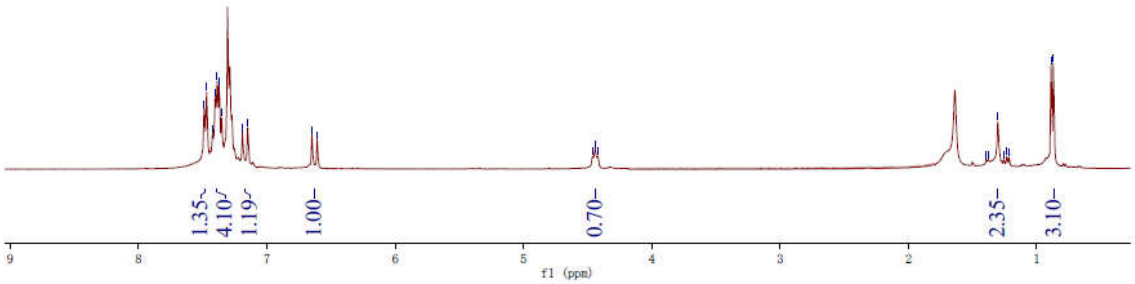
7.489
7.470
7.420
7.404
7.387
7.374
7.354
7.191
7.150
6.648
6.607

4.460
4.441
4.421

1.392
1.375
1.304
1.258
1.234
1.217
0.889
0.871




**3ae**

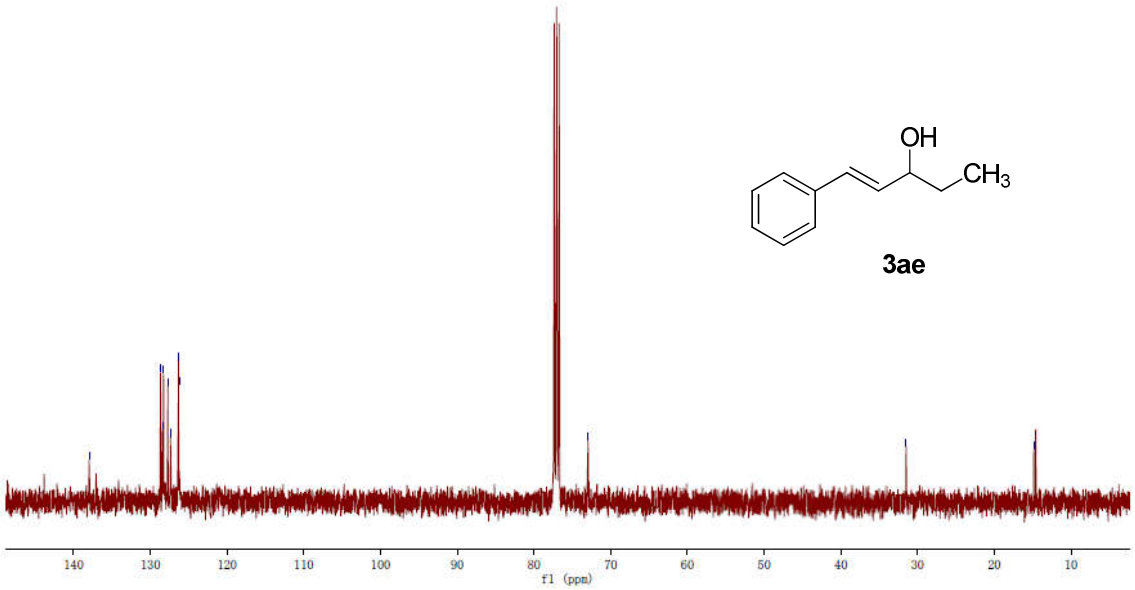



137.984
128.657
128.421
128.280
127.709
127.370
126.340
126.233

72.931

31.490

14.845

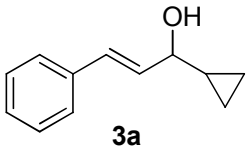




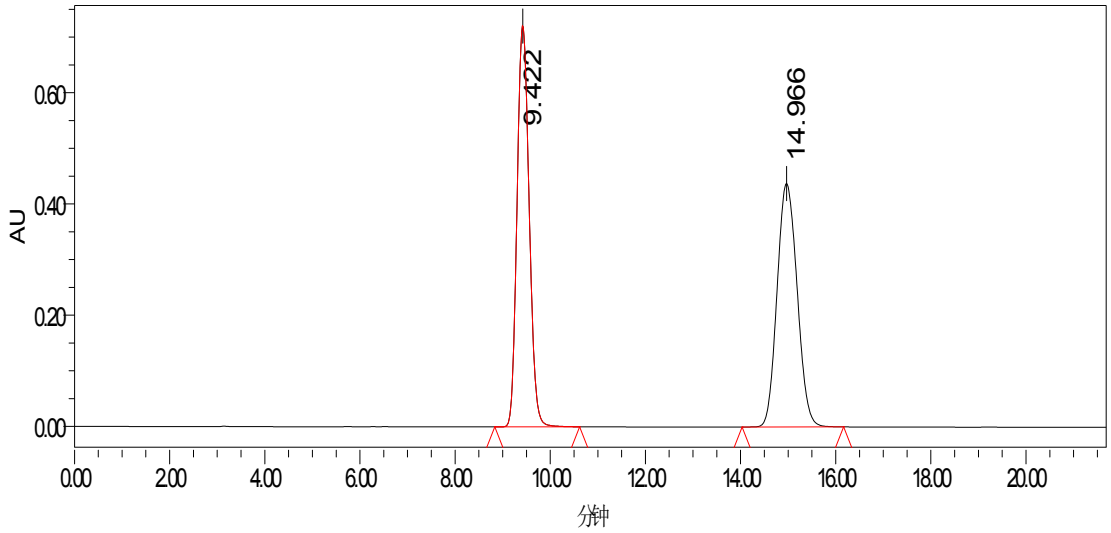


**3ae**

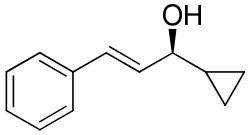
## 8. HPLC Spectra of the Products

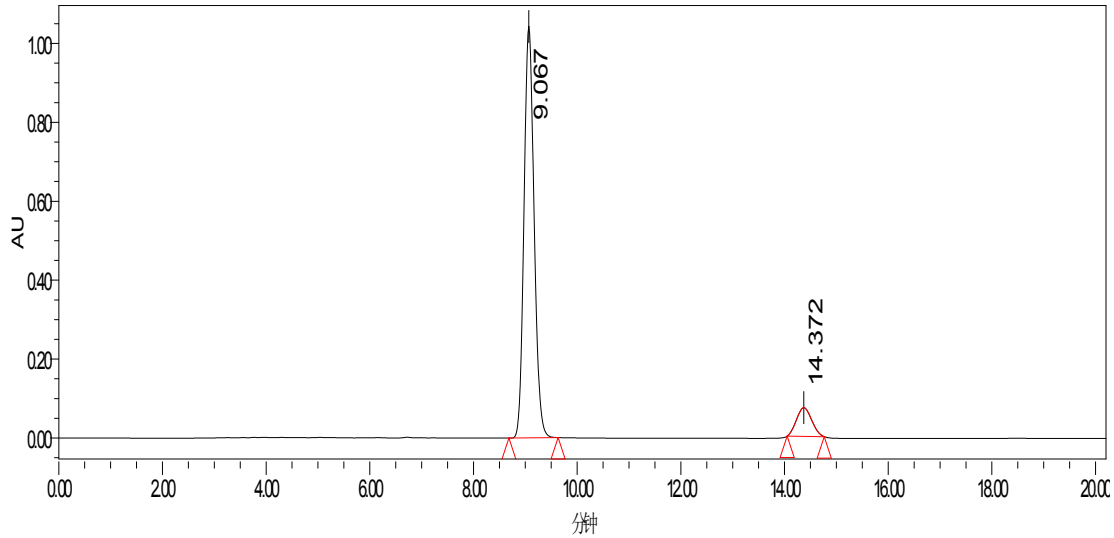



**3a**

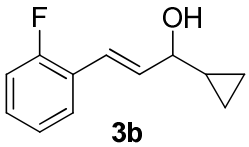



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 9.422 | 49.91 | racemic |
| 2 | 14.966 | 50.09 | |

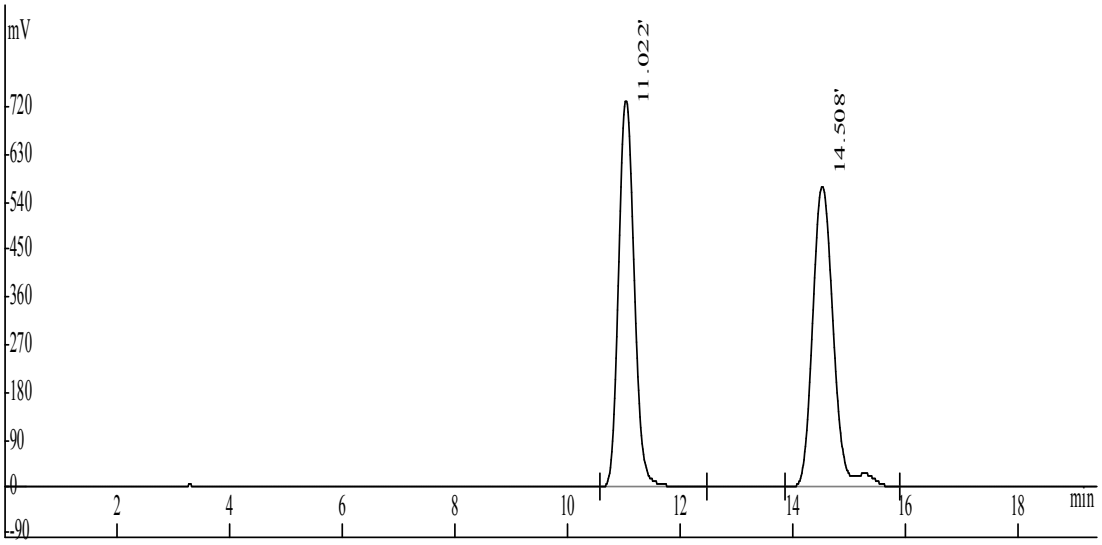


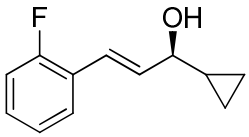

| Peak | Ret Time [min] | % Area | ee value(%) |
|---|---|---|---|
| 1 | 9.067 | 90.58 | 81 |
| 2 | 14.372 | 9.42 | |

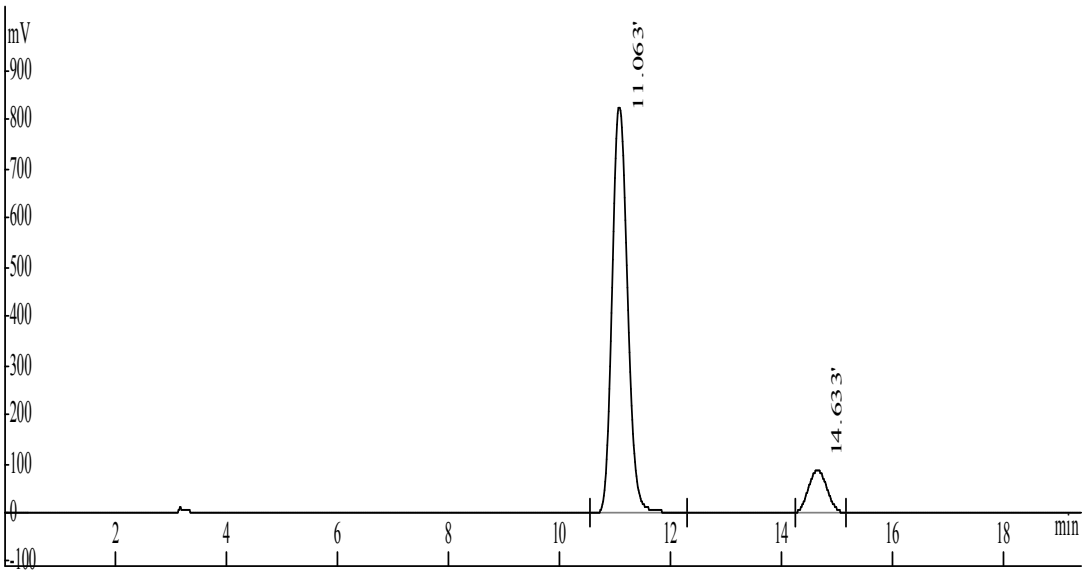



**3b**

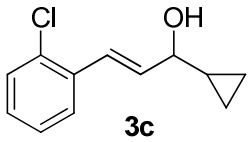



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 11.022 | 49.88 | racemic |
| 2 | 14.508 | 50.12 | |

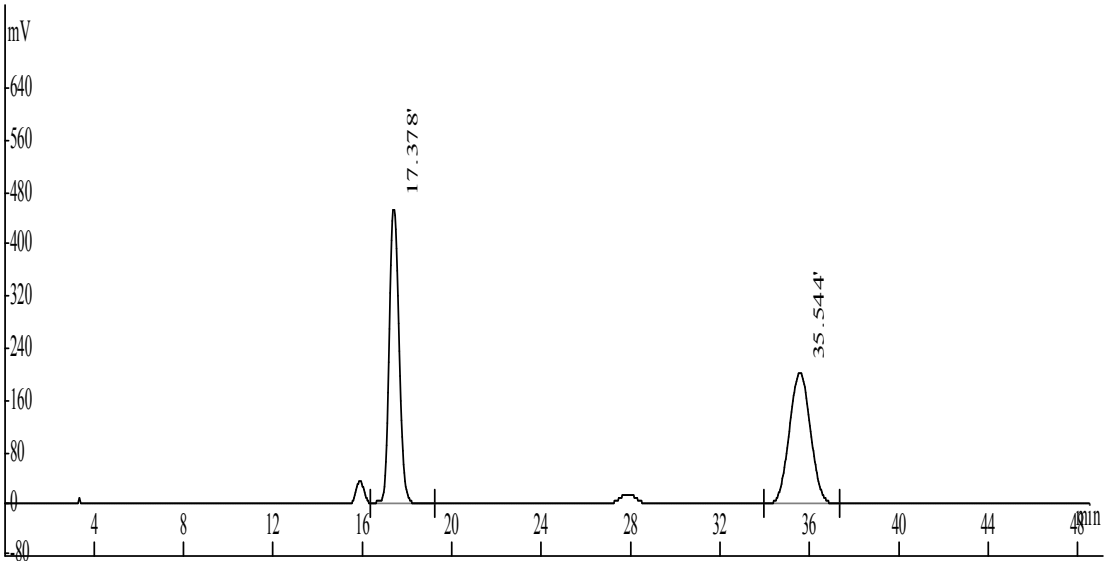


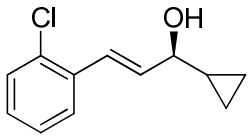

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 11.063 | 88.68 | 77 |
| 2 | 14.631 | 11.32 | |

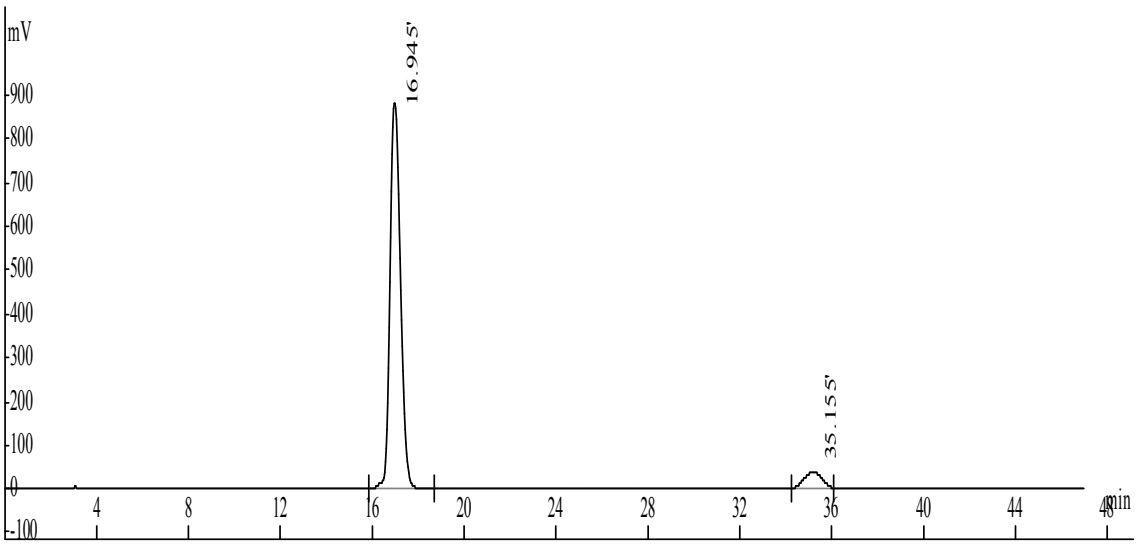



**3c**

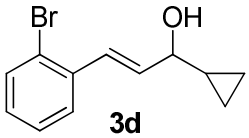



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 17.378 | 50.11 | racemic |
| 2 | 35.544 | 49.89 | |

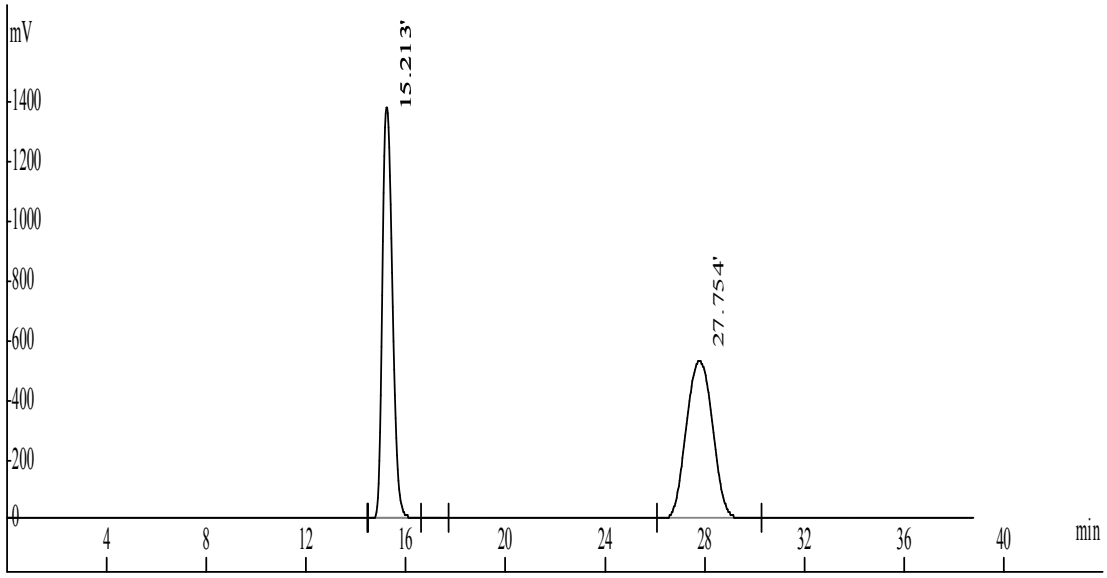


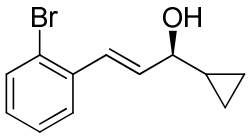

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 16.945 | 92.95 | 85 |
| 2 | 35.155 | 7.053 | |

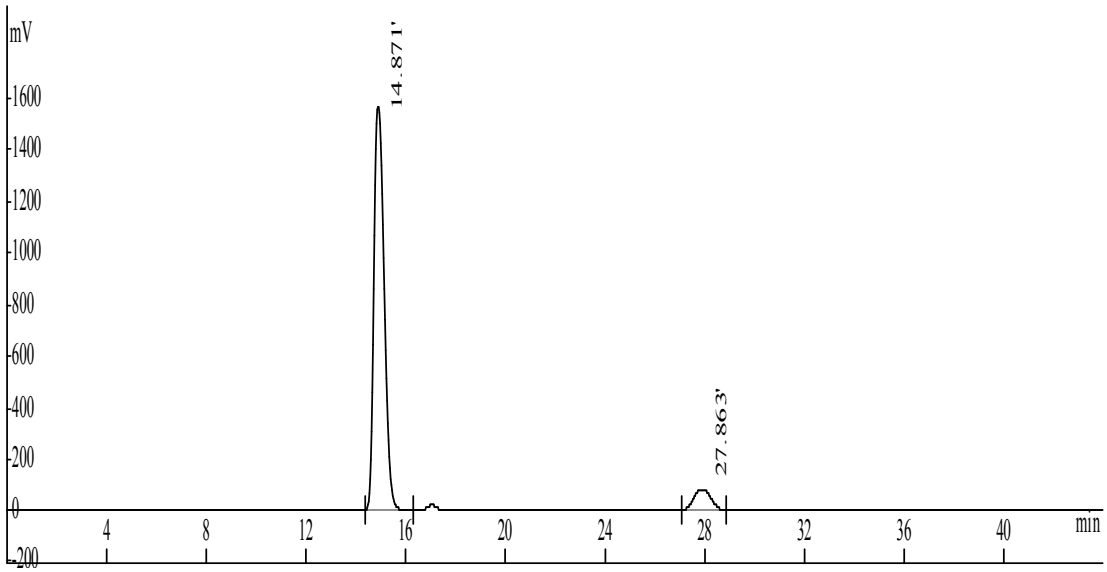



**3d**

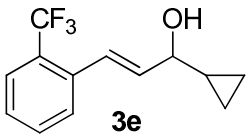



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 15.213 | 49.17 | racemic |
| 2 | 27.754 | 50.83 | |

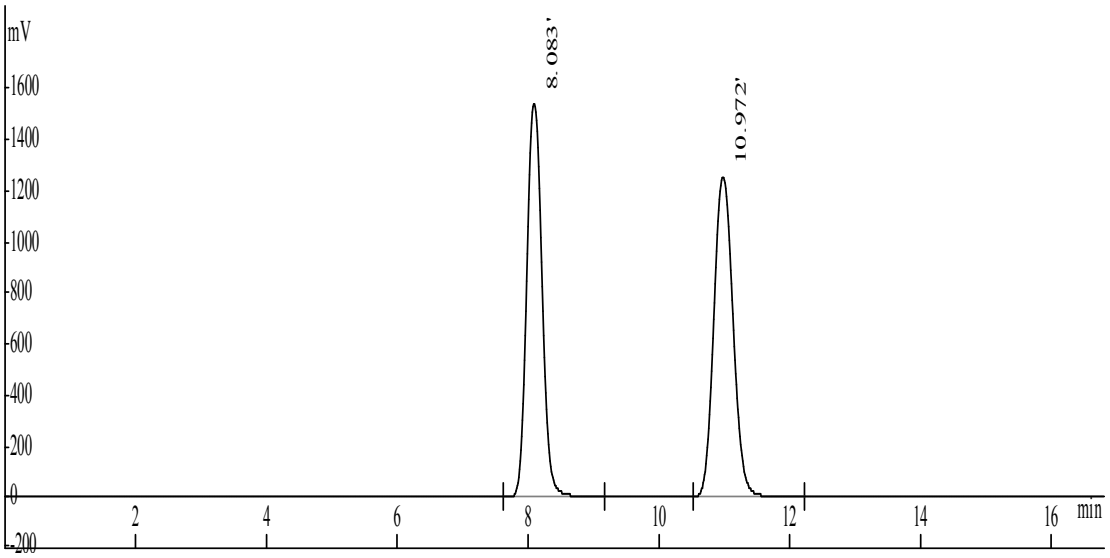


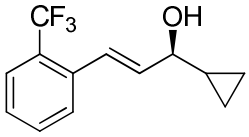

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 14.871 | 91.55 | 83 |
| 2 | 27.863 | 8.453 | |

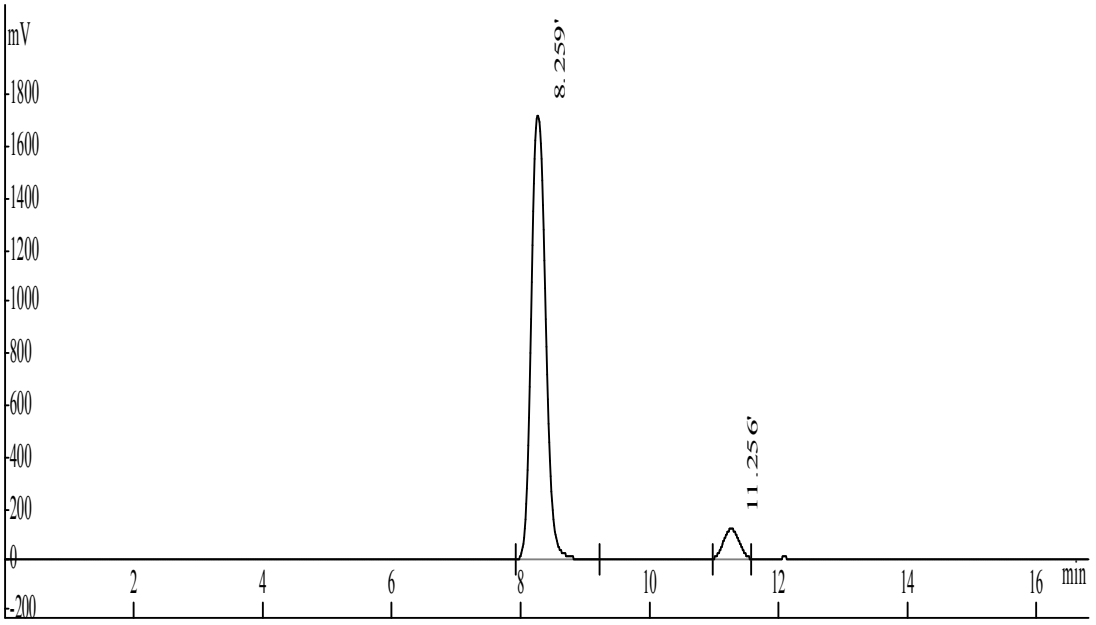



**3e**

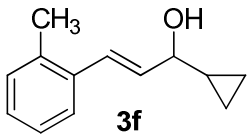



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 8.083 | 49.15 | racemic |
| 2 | 10.972 | 50.85 | |

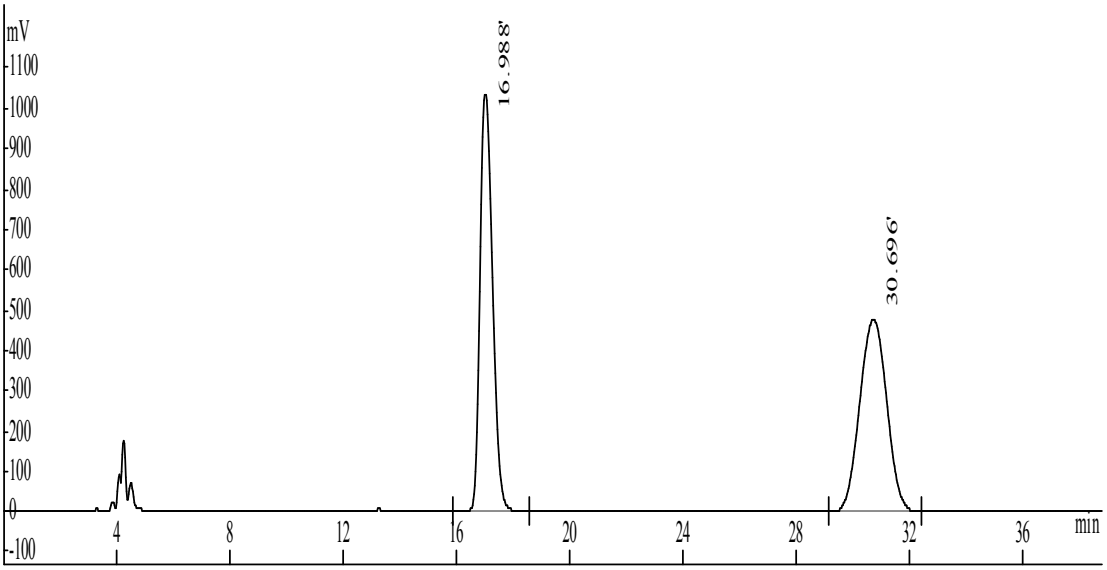


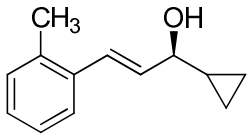

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 8.259 | 93.71 | 86 |
| 2 | 11.256 | 6.29 | |

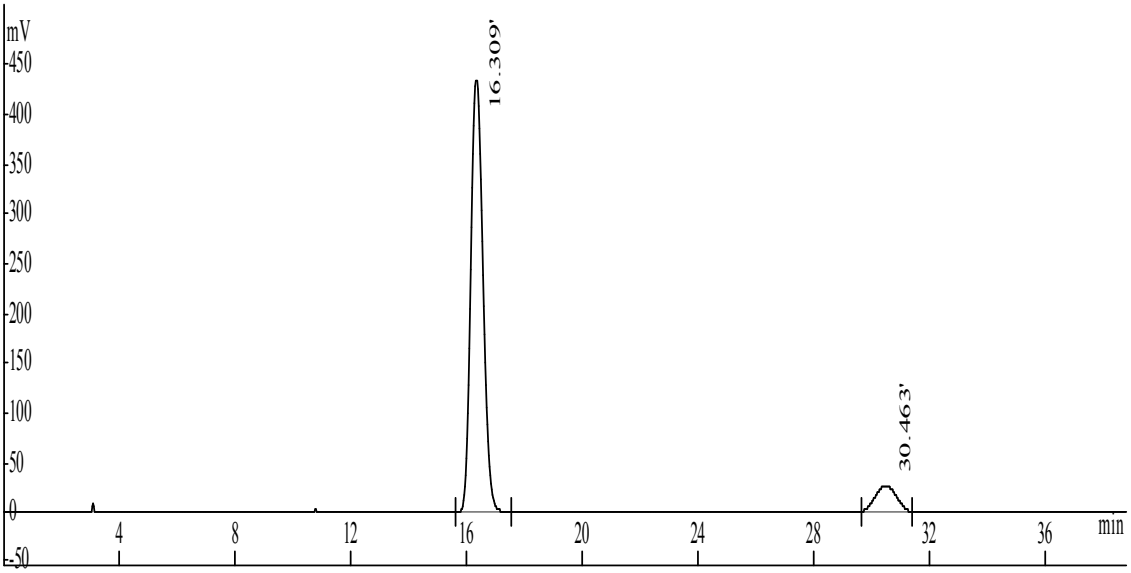



**3f**

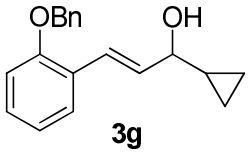



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 16.988 | 49.48 | racemic |
| 2 | 30.696 | 50.52 | |

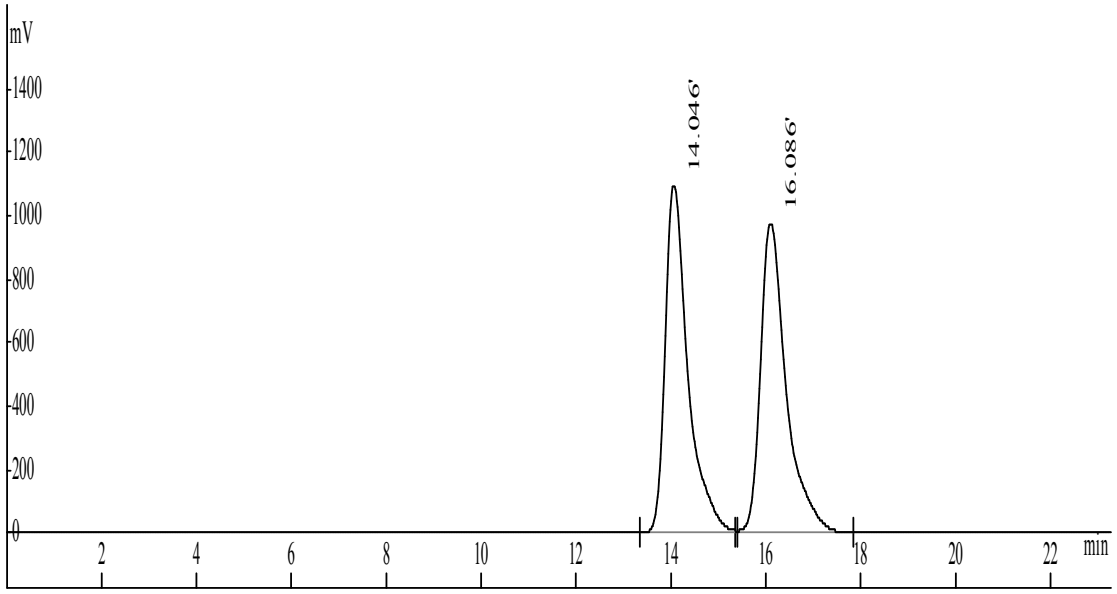


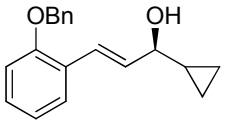

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 16.309 | 90.57 | 81 |
| 2 | 30.463 | 9.43 | |

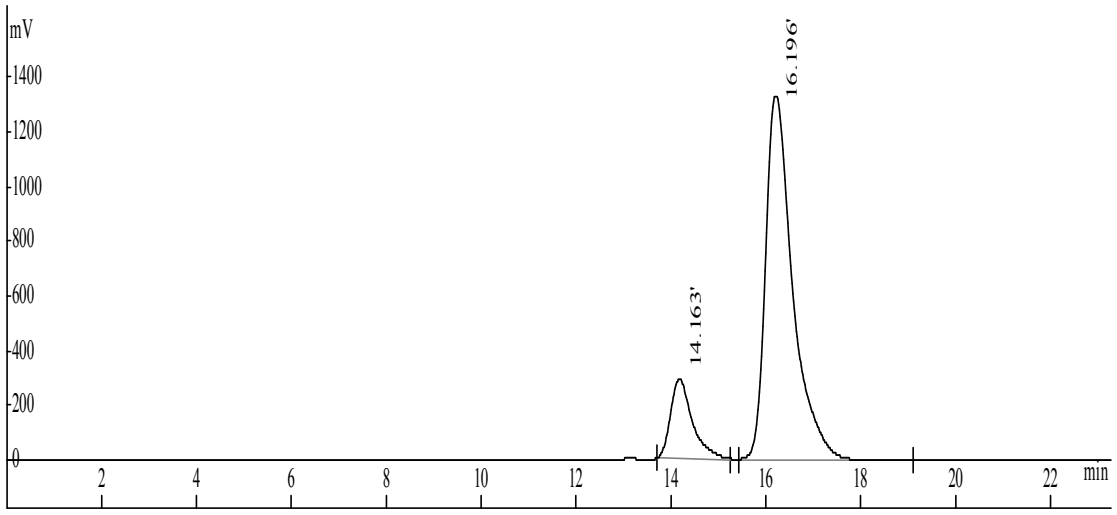



**3g**

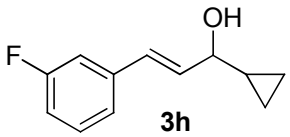



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 14.046 | 49.74 | racemic |
| 2 | 16.086 | 50.26 | |

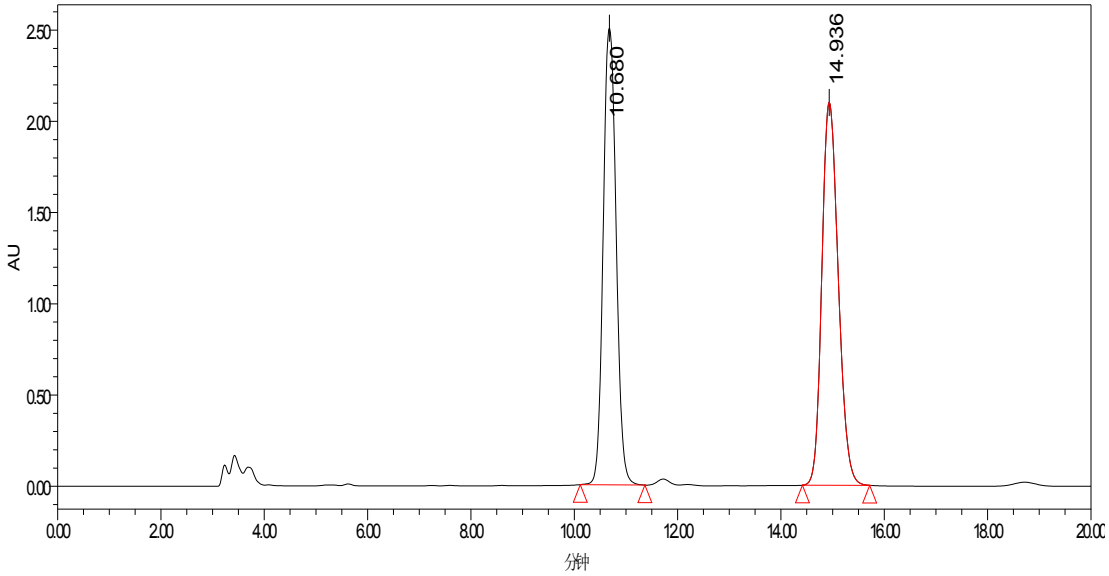


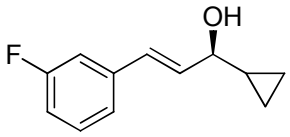

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 14.163 | 14.8 | 70 |
| 2 | 16.196 | 85.2 | |

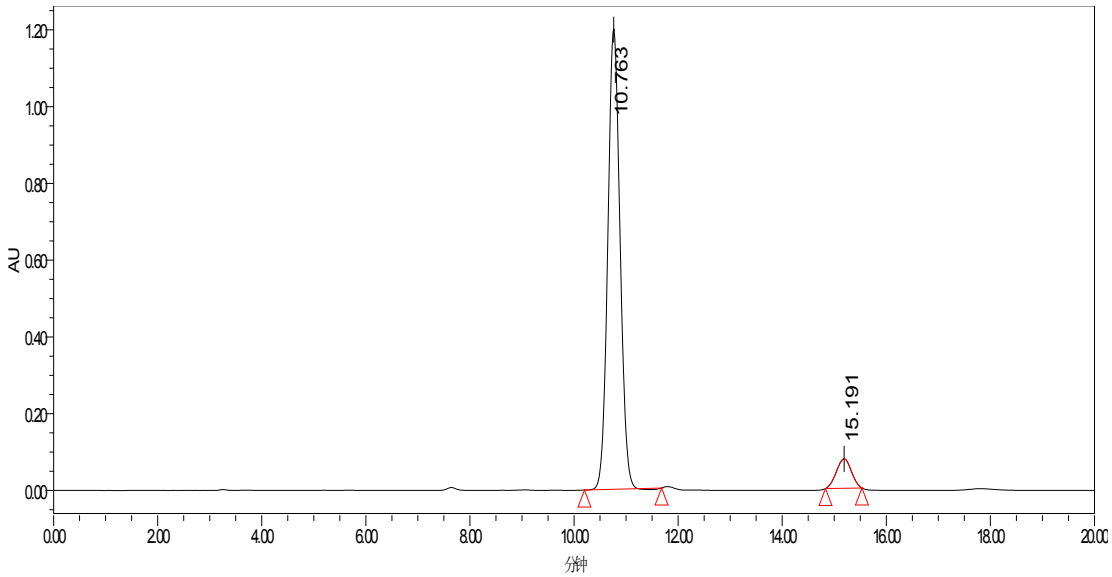



**3h**

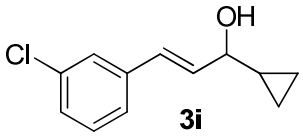



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 10.680 | 49.34 | racemic |
| 2 | 14.936 | 50.66 | |

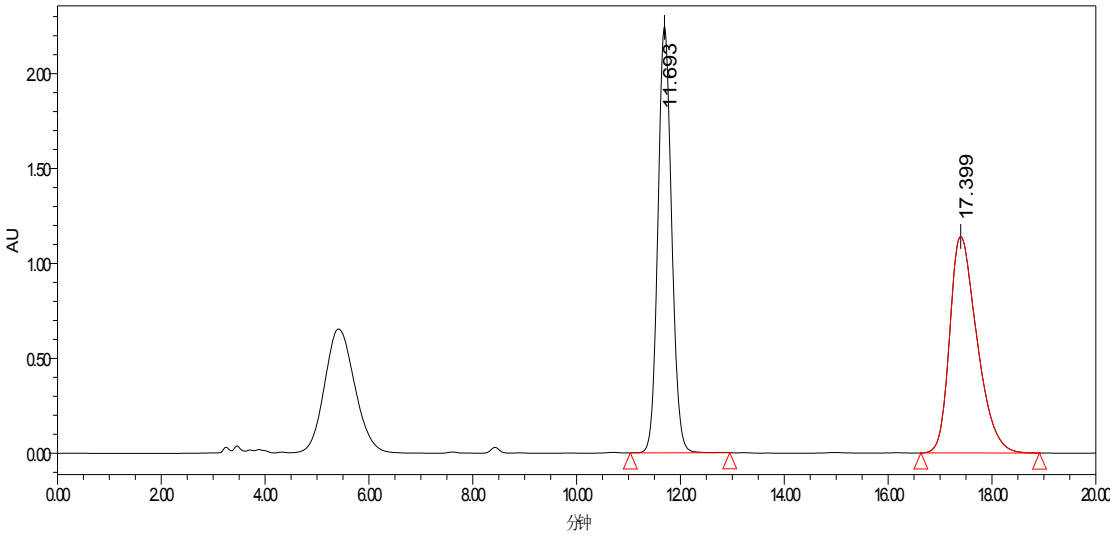


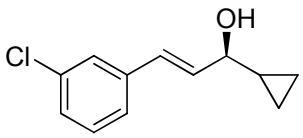

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 10.763 | 92.74 | 85 |
| 2 | 15.191 | 7.26 | |

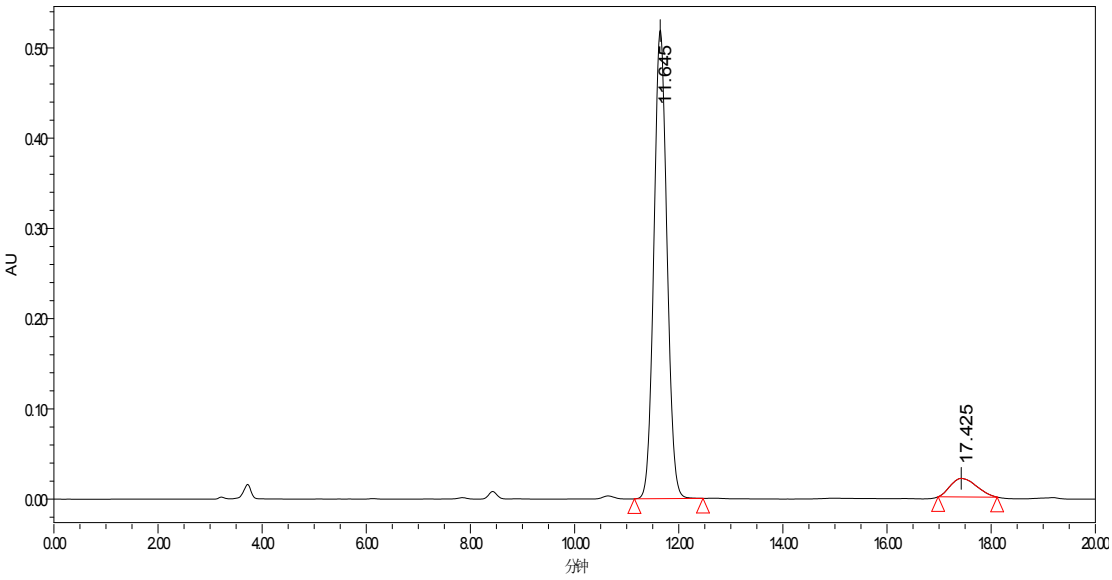



**3i**

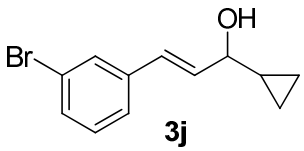



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 11.693 | 49.75 | racemic |
| 2 | 17.399 | 50.25 | |

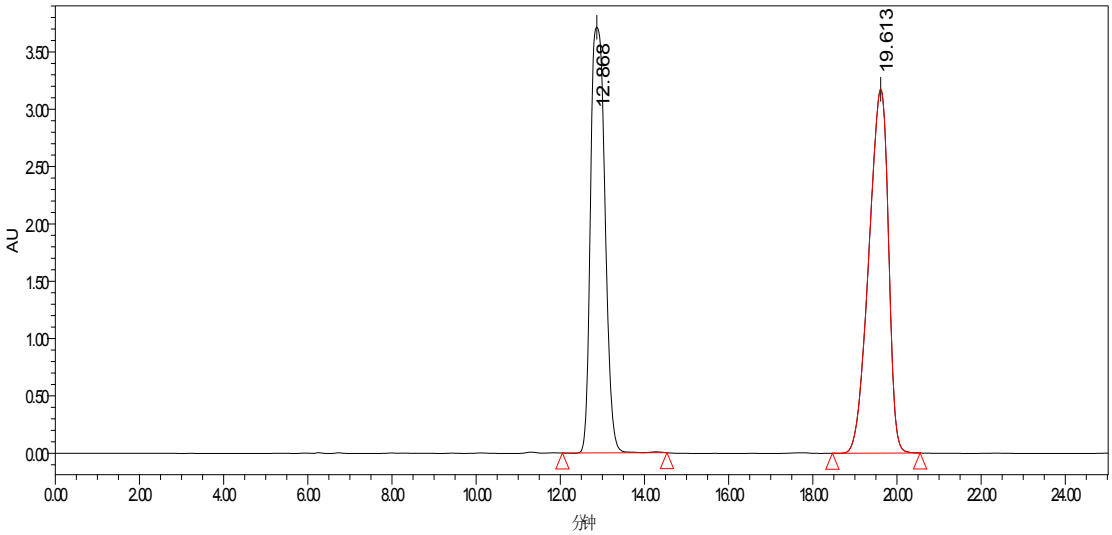


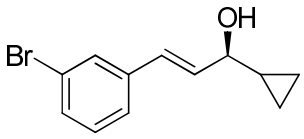

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 11.645 | 92.70 | 85 |
| 2 | 17.425 | 7.30 | |

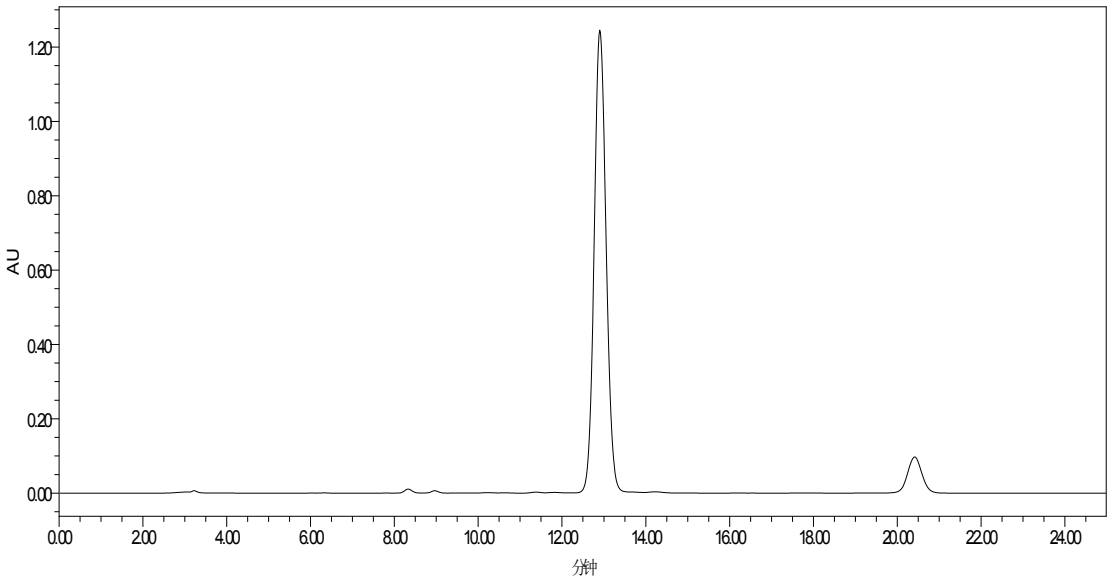



**3j**

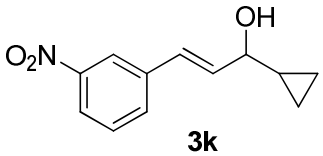



| Peak | Ret Time [min] | Area | % Area | |
|---|---|---|---|---|
| 1 | 12.868 | 89191936 | 46.54 | racemic |
| 2 | 19.613 | 102470699 | 53.46 | |

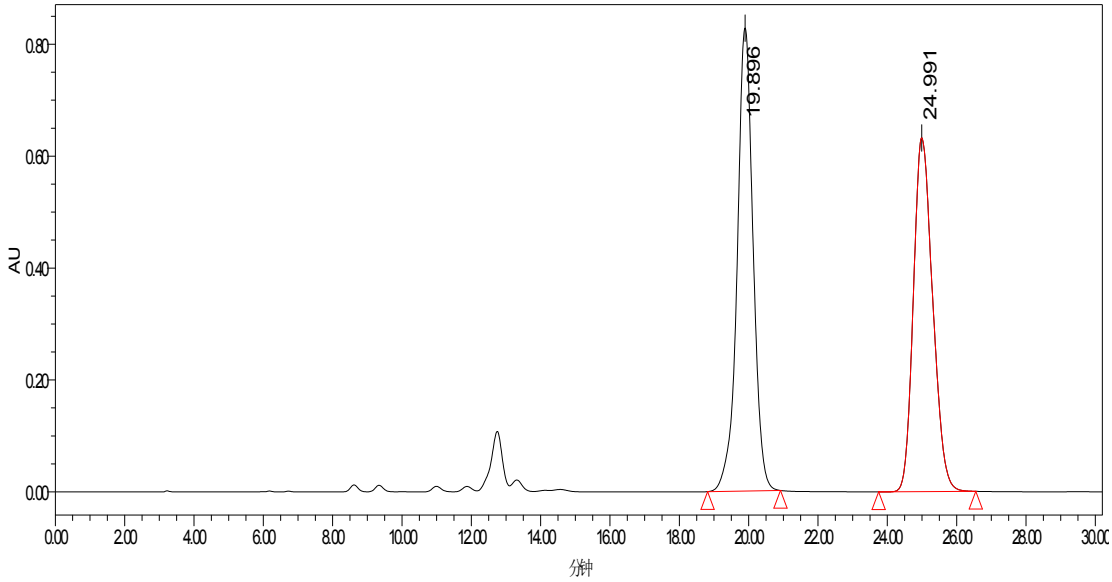


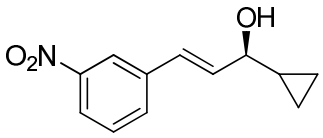

| Peak | Ret Time [min] | Area | % Area | ee value (%) |
|---|---|---|---|---|
| 1 | 12.903 | 24458849 | 96.00 | 84 |
| 2 | 20.416 | 2077025 | 12.00 | |

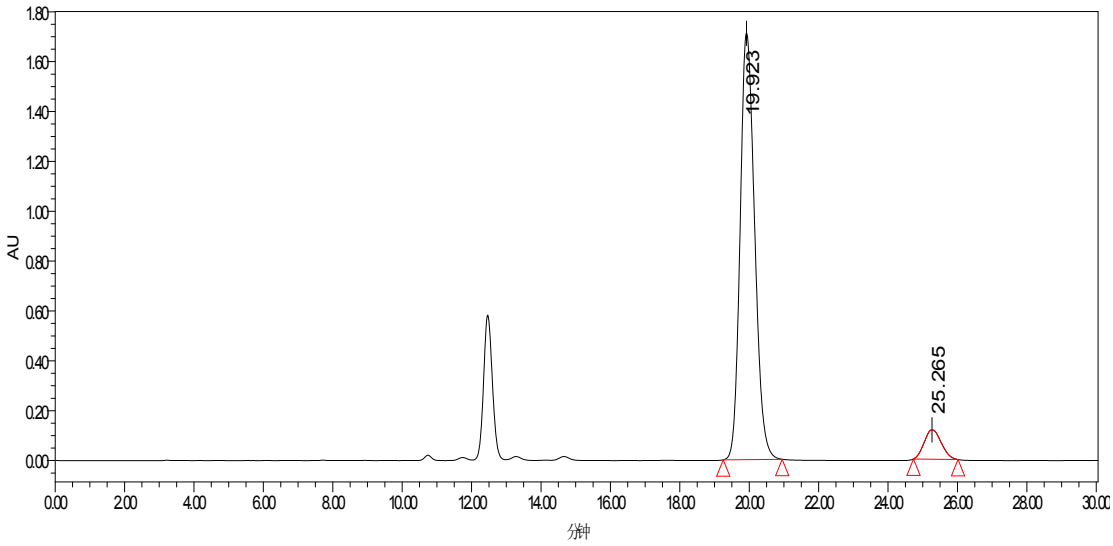



**3k**

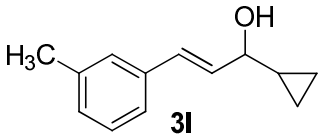



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 19.896 | 51.96 | racemic |
| 2 | 24.991 | 48.04 | |

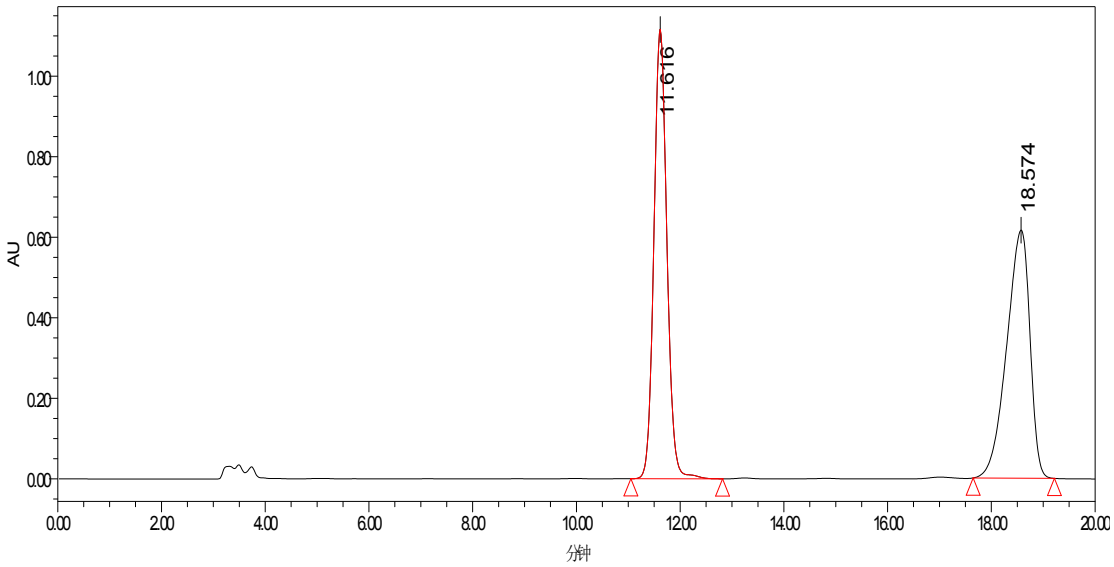


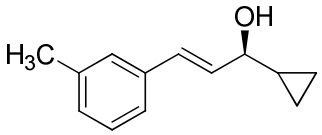

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 19.923 | 92.50 | 85 |
| 2 | 25.265 | 7.50 | |

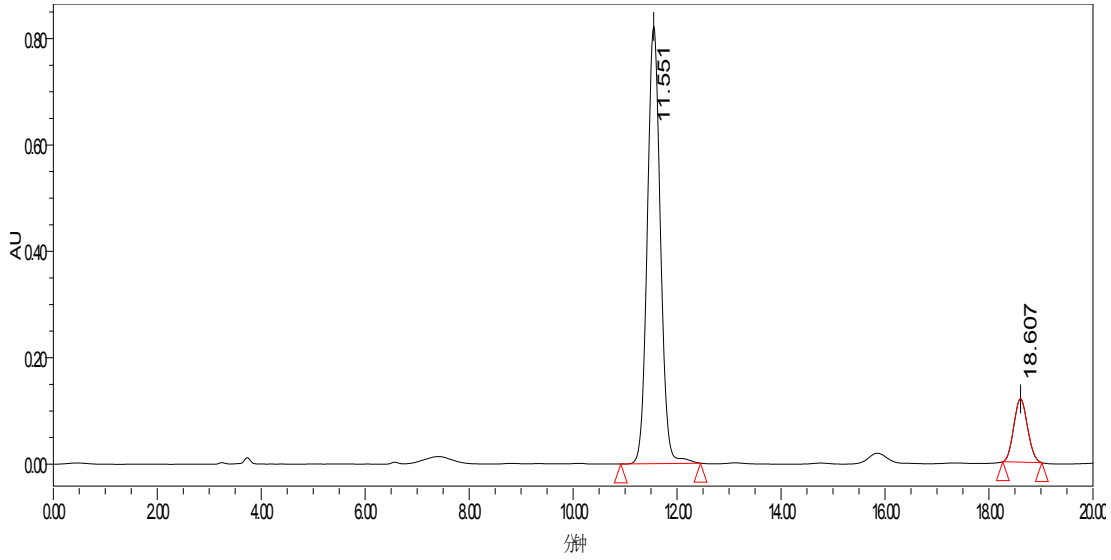



**3l**

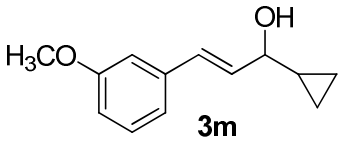



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 11.616 | 50.37 | racemic |
| 2 | 18.574 | 49.63 | |

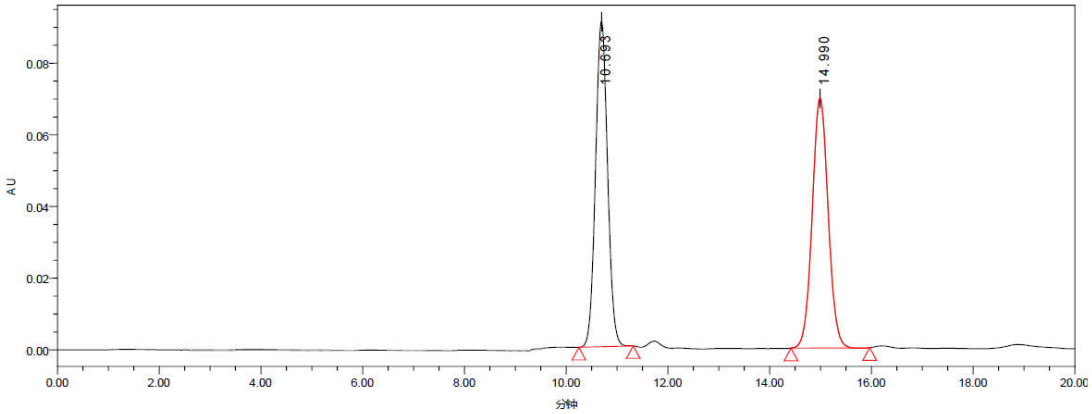


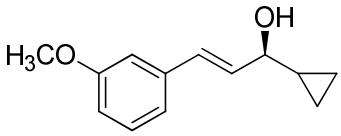

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 11.551 | 86.84 | 74 |
| 2 | 18.607 | 13.16 | |

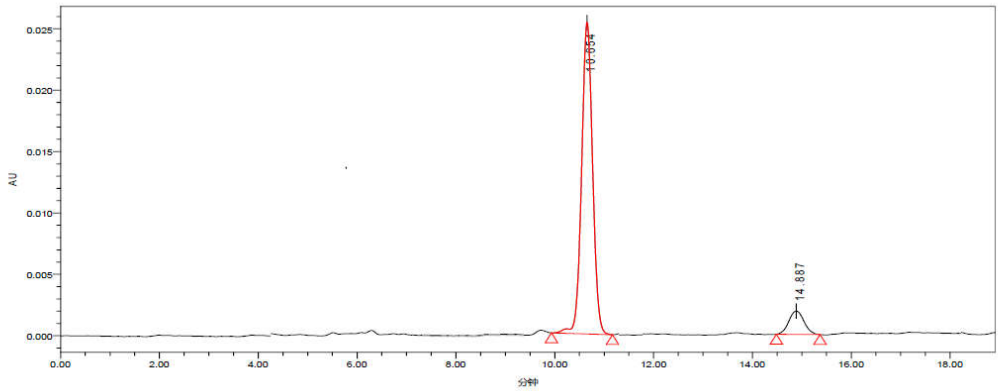



**3m**

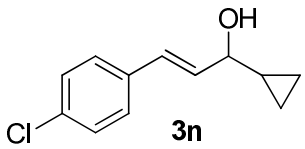



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 10.693 | 49.54 | racemic |
| 2 | 14.990 | 50.46 | |

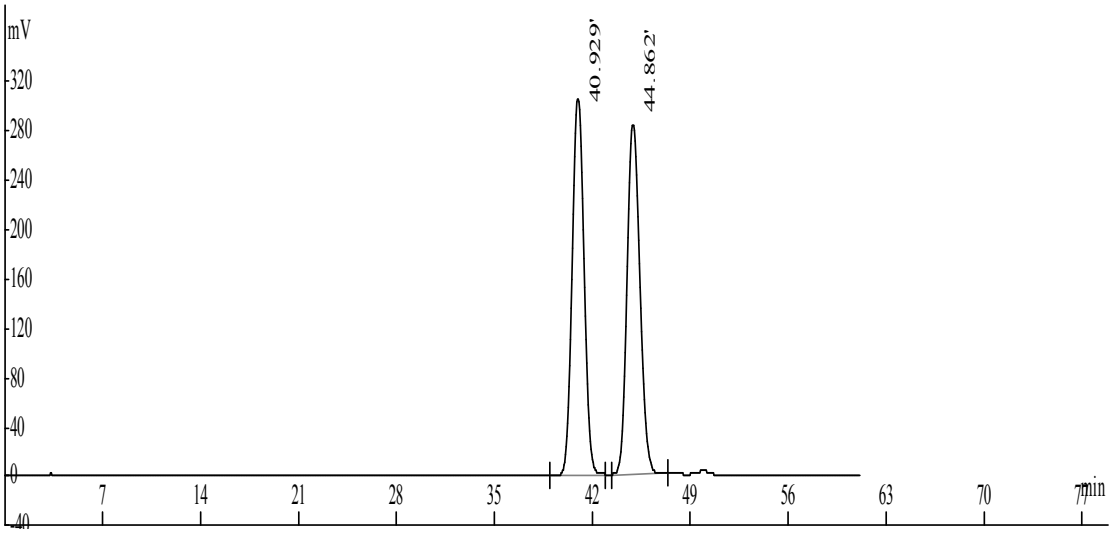


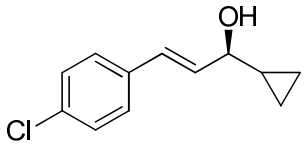

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 10.654 | 90.60 | 81 |
| 2 | 14.887 | 9.40 | |

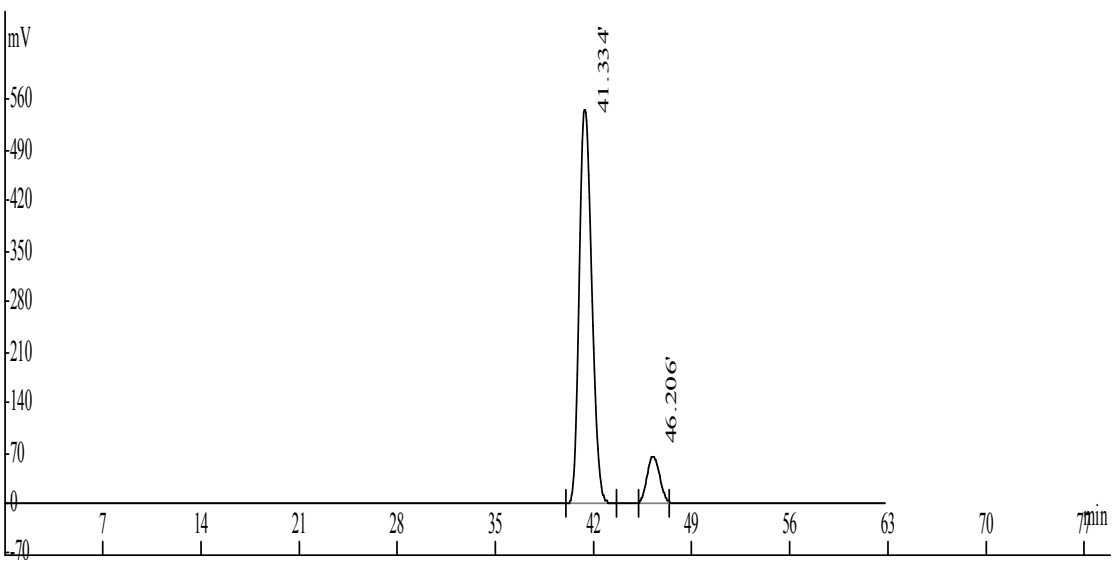



**3n**

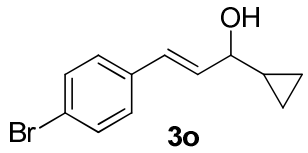



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 40.929 | 49.77 | racemic |
| 2 | 44.862 | 50.23 | |

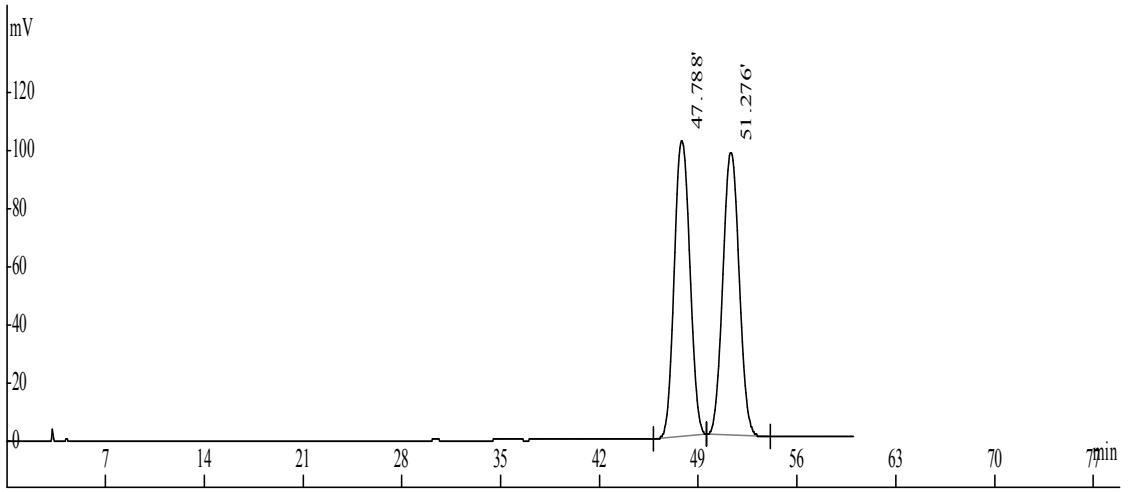


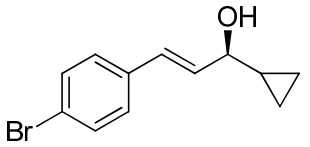

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 41.334 | 89.68 | 79 |
| 2 | 46.206 | 10.32 | |

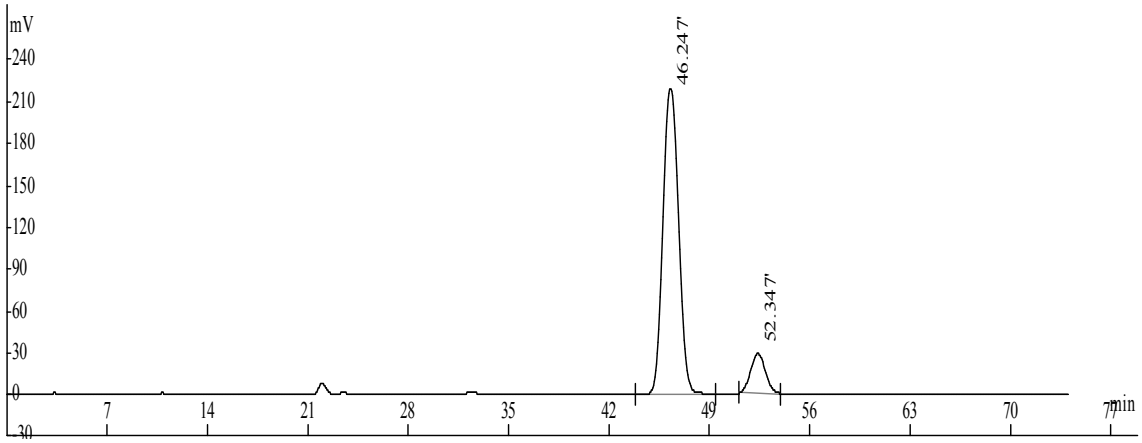



**3o**

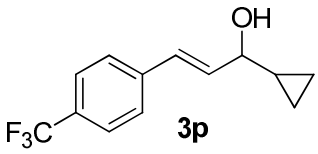



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 47.788 | 49.96 | racemic |
| 2 | 51.276 | 50.04 | |

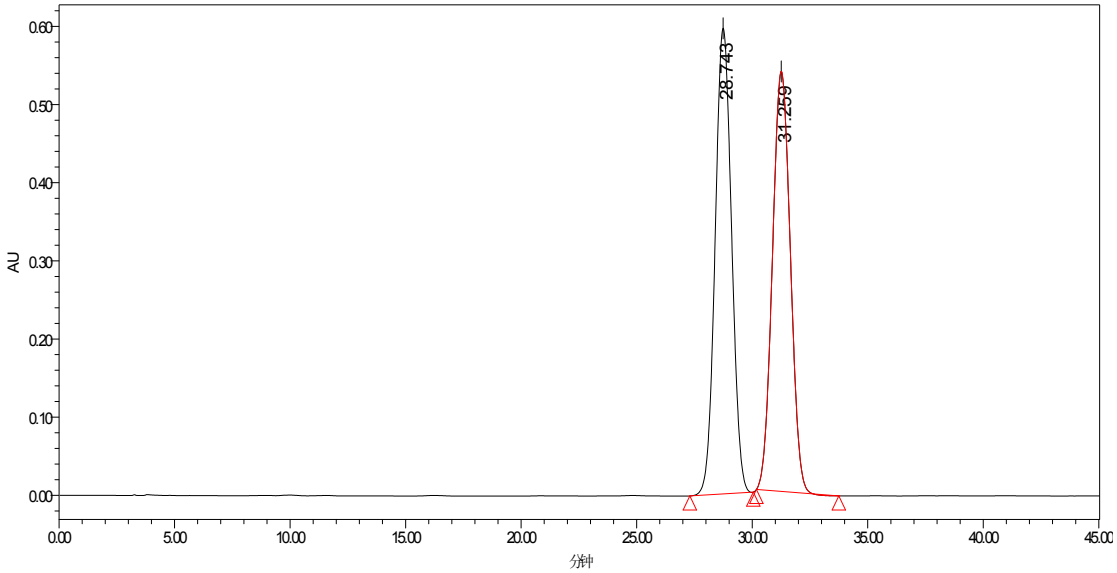


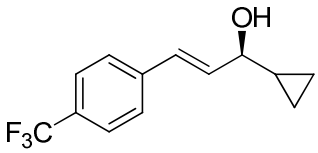

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 46.247 | 89.61 | 79 |
| 2 | 52.347 | 10.39 | |

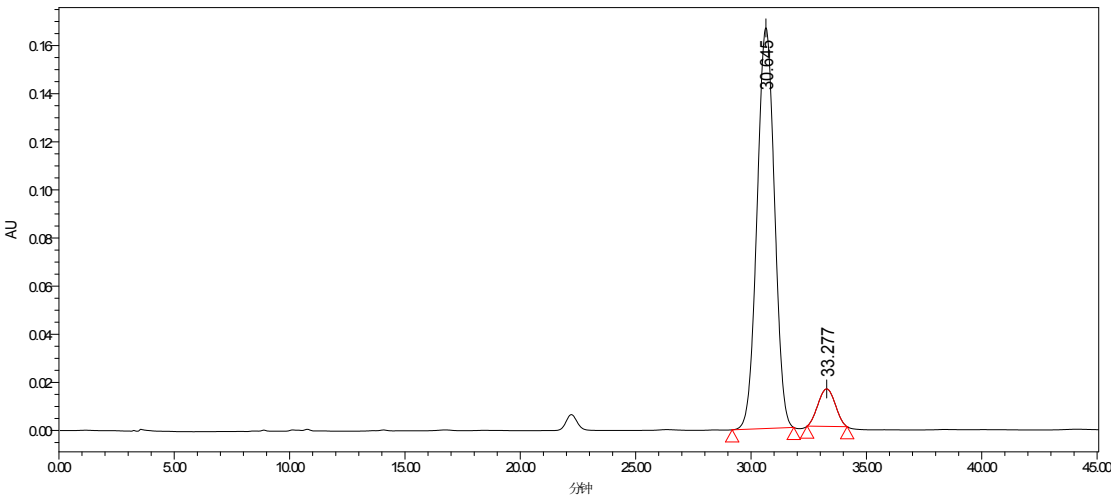



3p

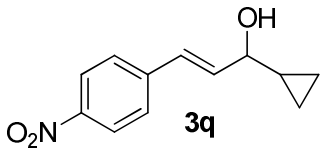



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 28.743 | 50.35 | racemic |
| 2 | 31.259 | 49.65 | |

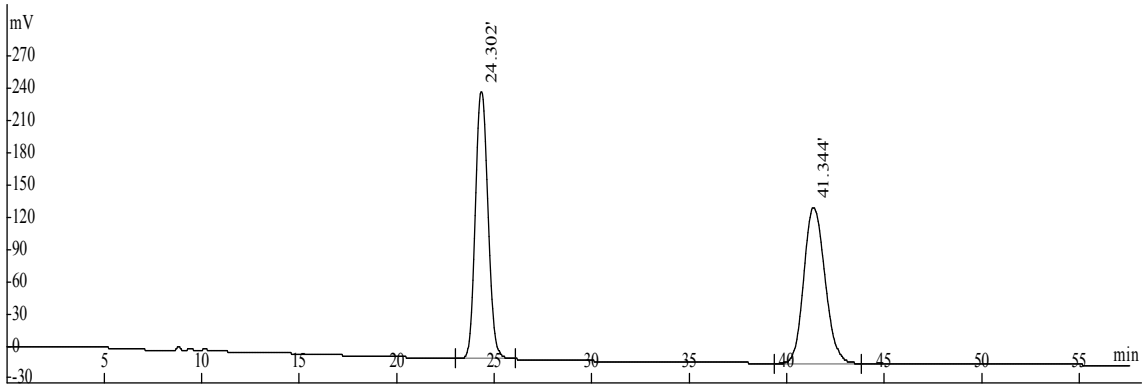


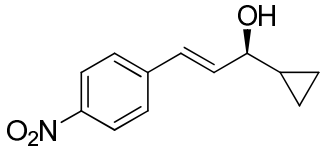

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 30.645 | 91.53 | 82 |
| 2 | 33.277 | 8.47 | |

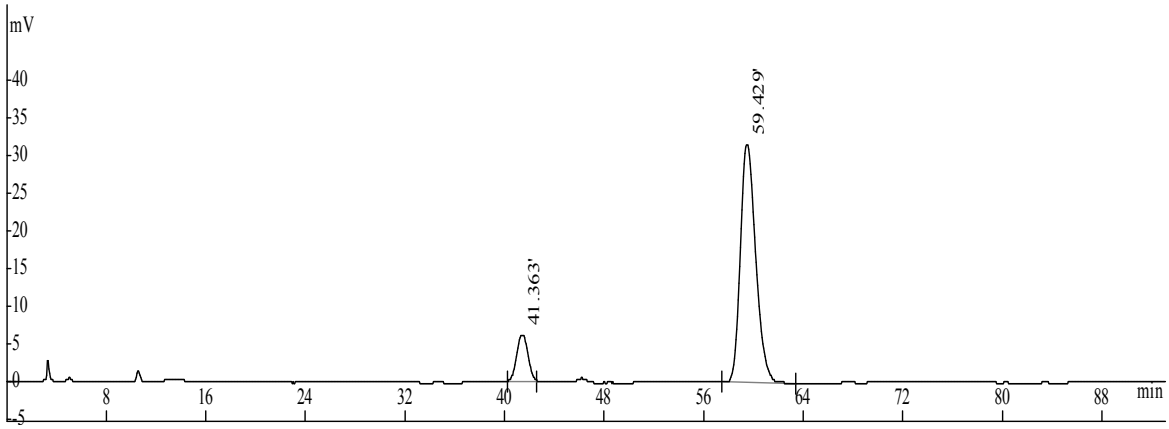



3q

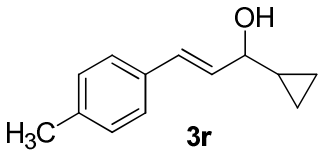



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 24.302 | 50.28 | racemic |
| 2 | 41.344 | 49.72 | |

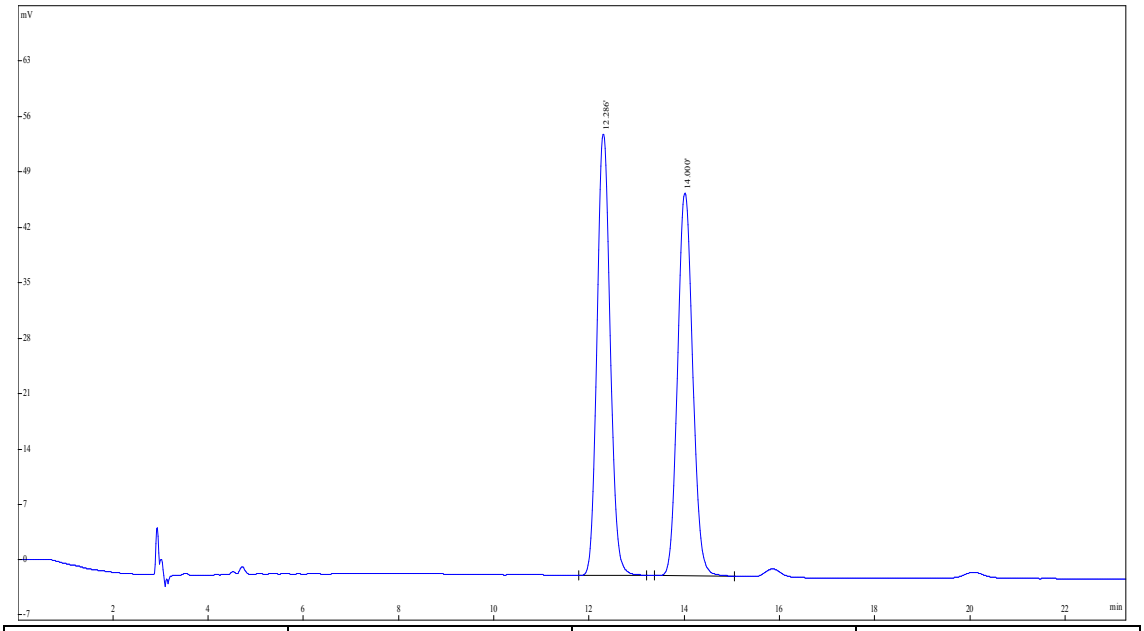


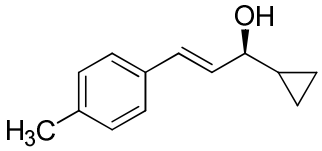

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 41.363 | 11.11 | 78 |
| 2 | 59.429 | 88.89 | |

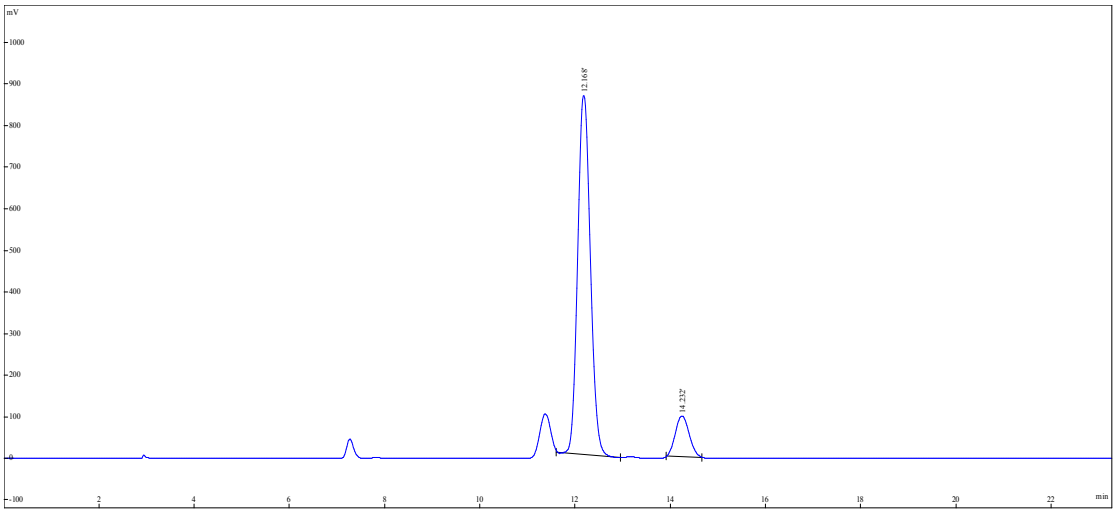



**3r**

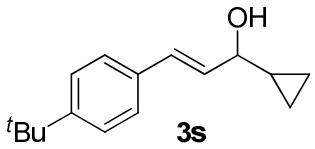



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 12.286 | 49.94 | racemic |
| 2 | 14.000 | 50.06 | |

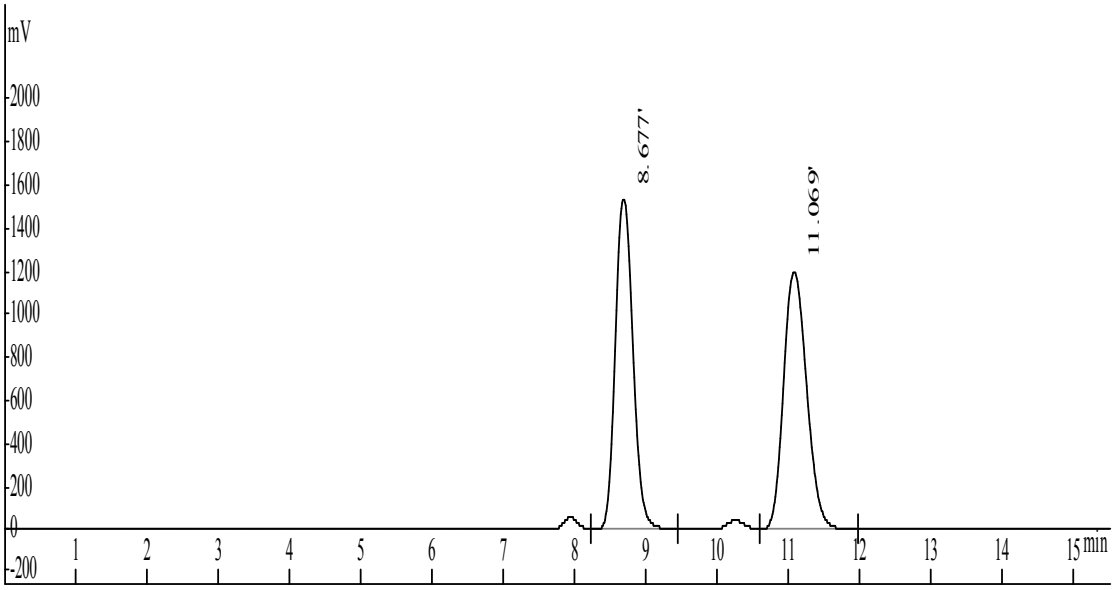


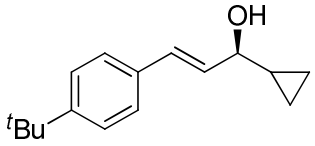

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 12.168 | 88.89 | 78 |
| 2 | 14.232 | 11.11 | |

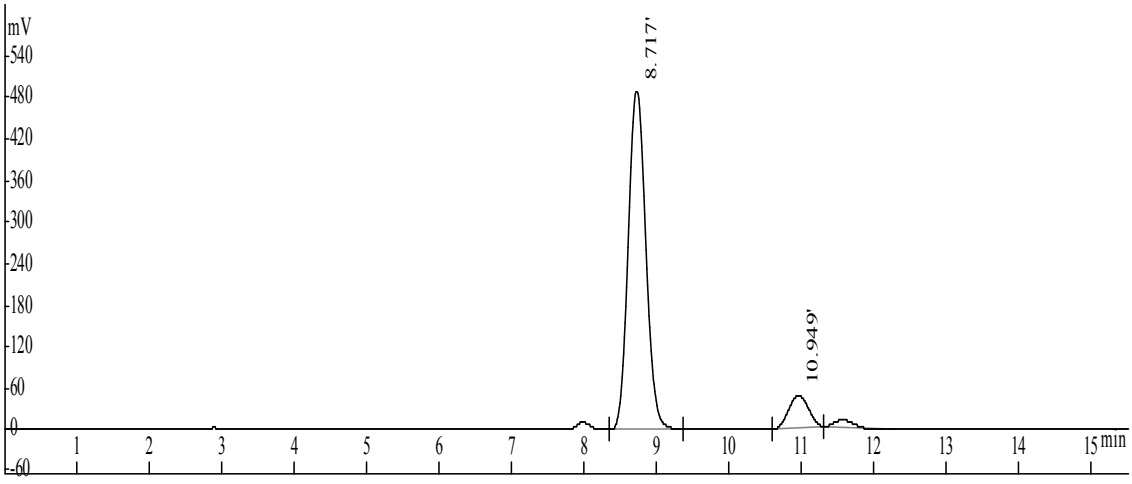



**3s**

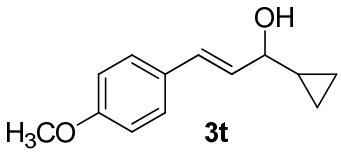



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 8.677 | 49.16 | racemic |
| 2 | 11.069 | 50.84 | |

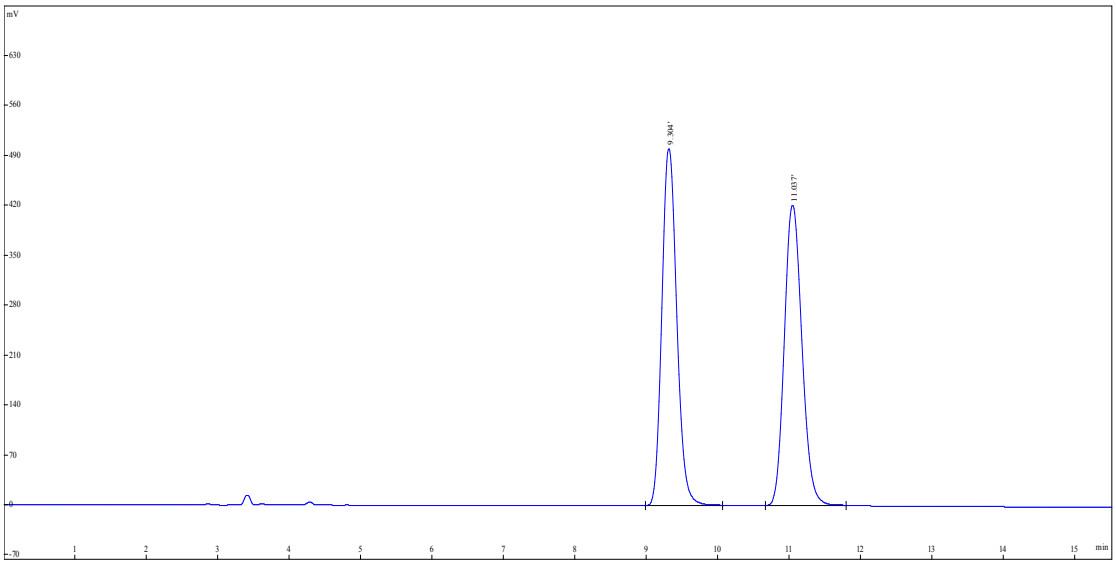


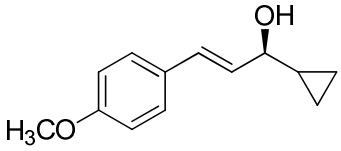

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 8.717 | 91.12 | 82 |
| 2 | 10.949 | 8.88 | |

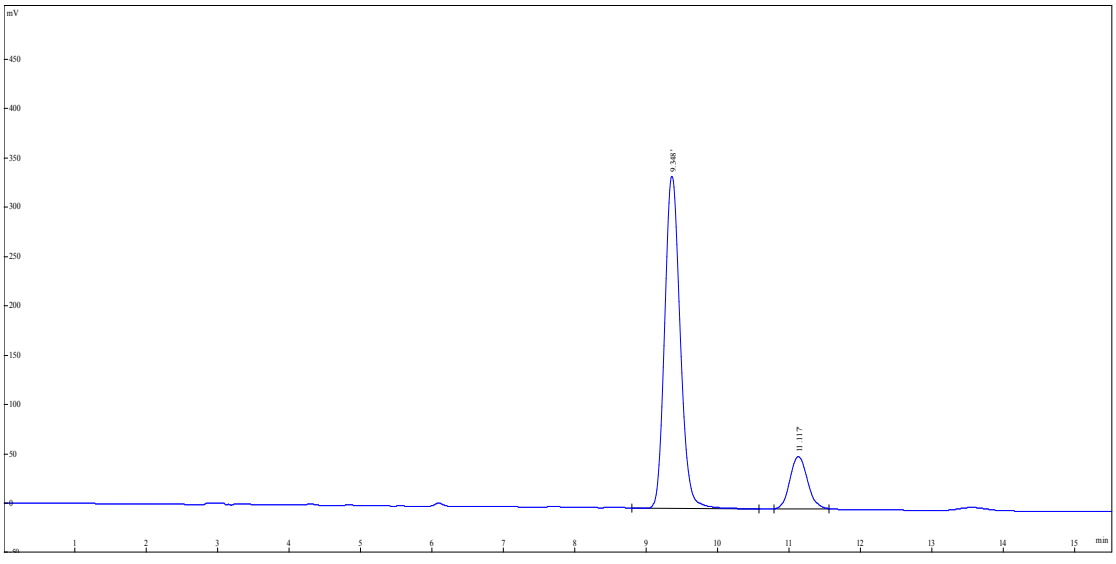



**3t**

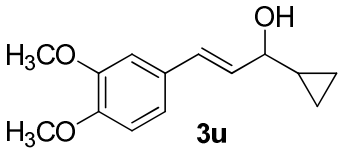



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 9.304 | 49.99 | racemic |
| 2 | 11.037 | 50.01 | |

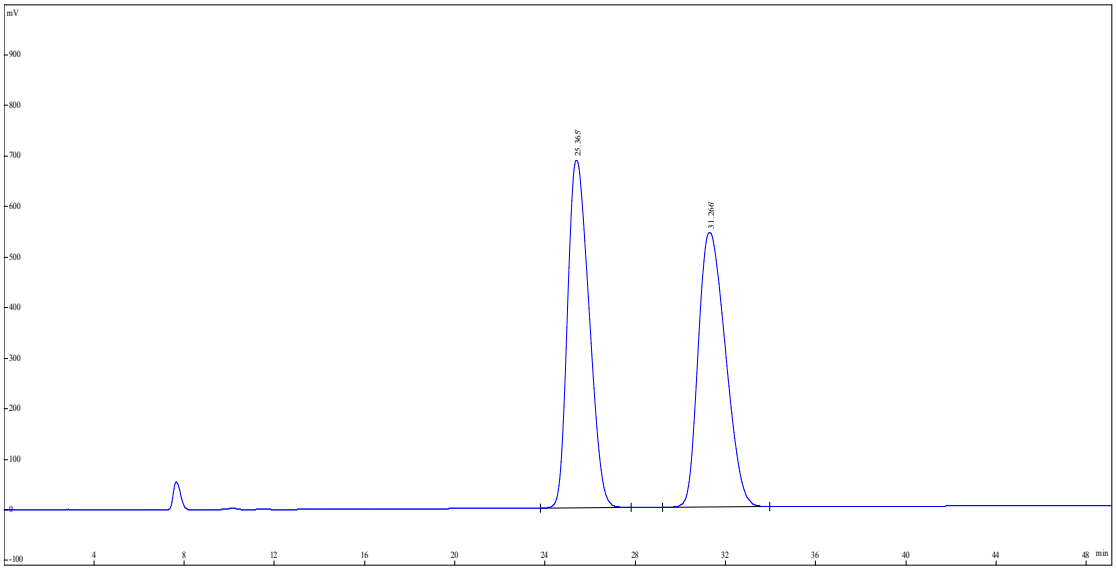


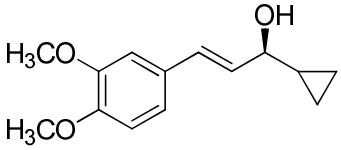

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 9.348 | 86.56 | 73 |
| 2 | 11.117 | 13.44 | |

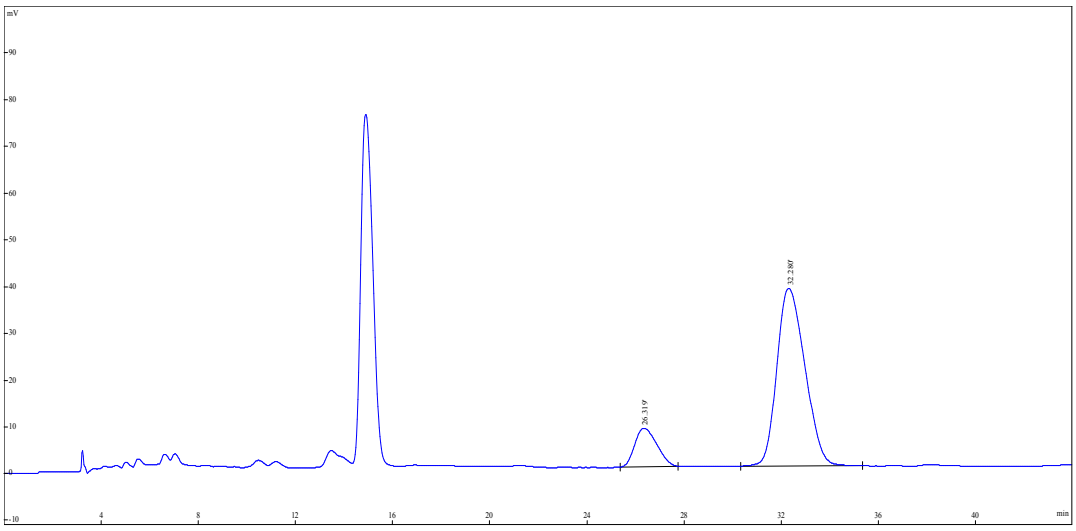



**3u**

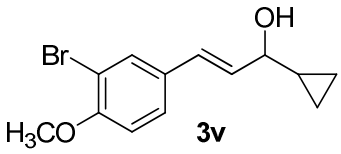



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 25.365 | 49.86 | racemic |
| 2 | 31.266 | 50.14 | |

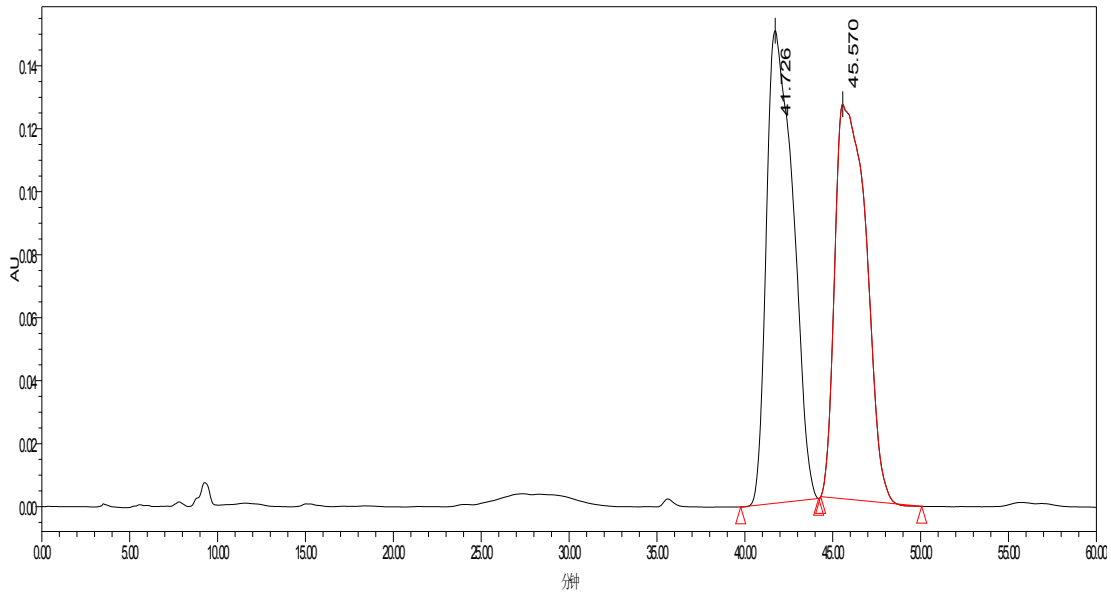


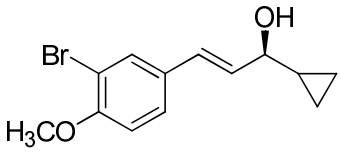

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 26.319 | 11.51 | 74 |
| 2 | 32.280 | 85.49 | |

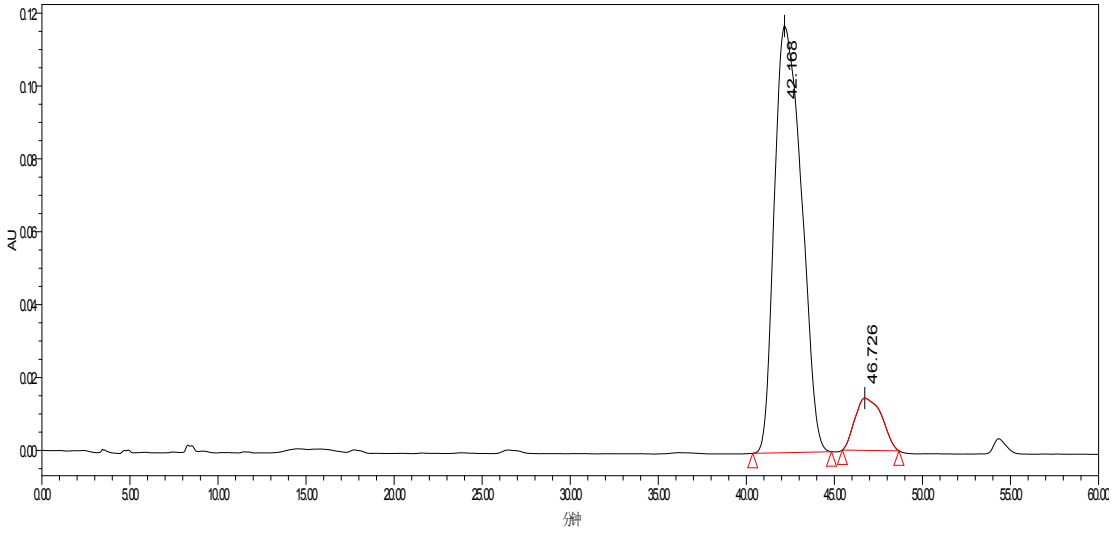



**3v**

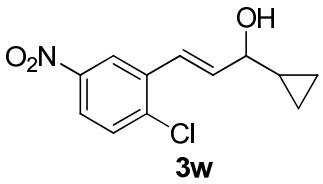



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 41.726 | 50.51 | racemic |
| 2 | 45.570 | 49.49 | |

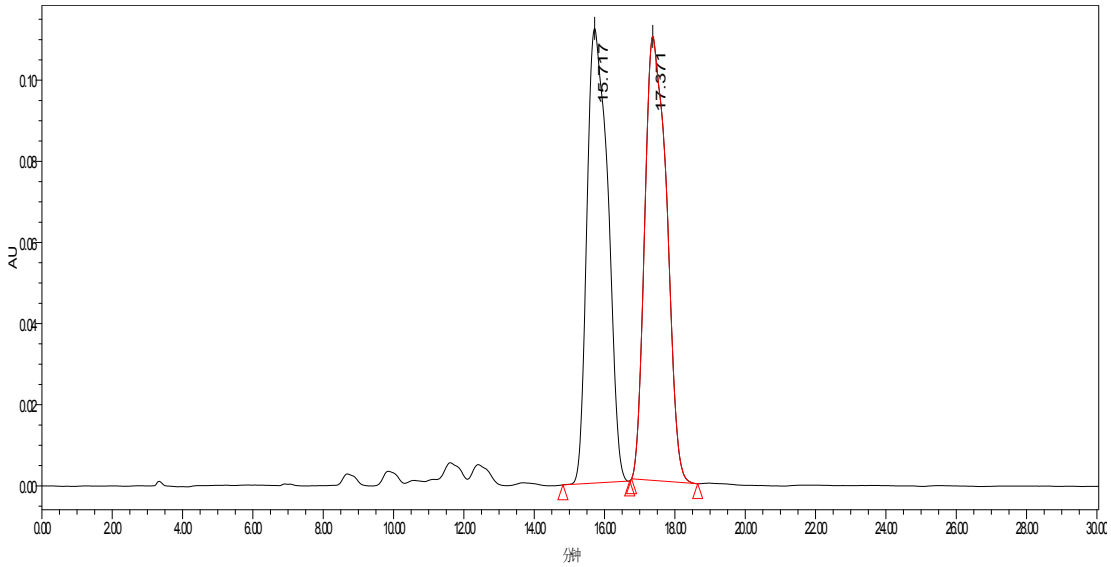


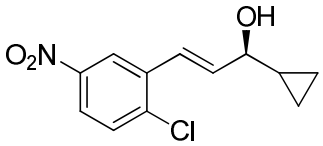

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 42.168 | 89.71 | 78 |
| 2 | 46.726 | 10.29 | |

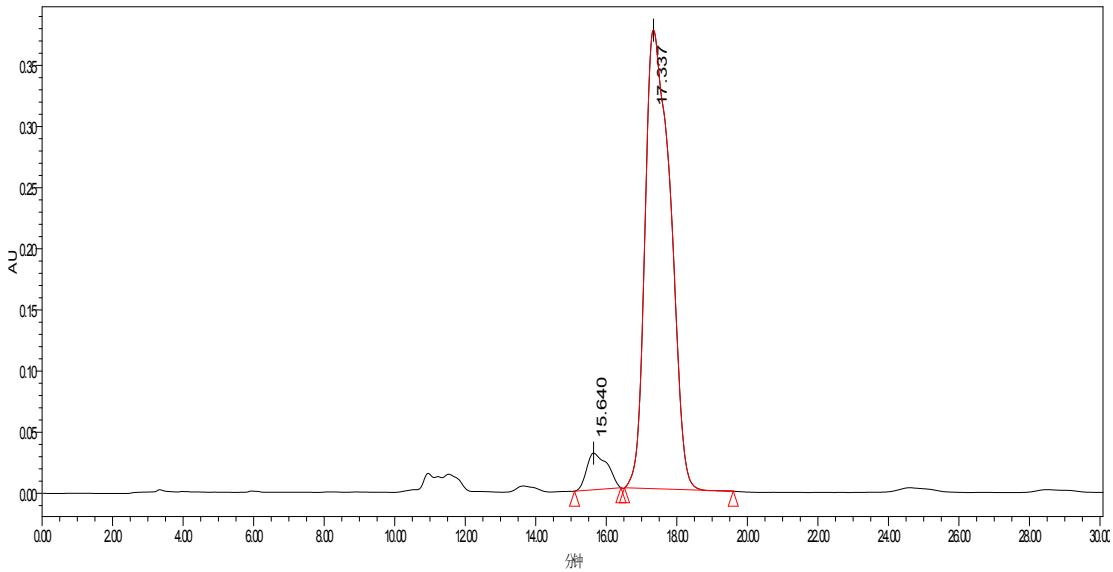



**3w**

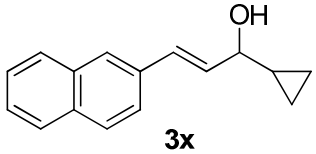



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 15.717 | 49.44 | racemic |
| 2 | 17.371 | 50.56 | |

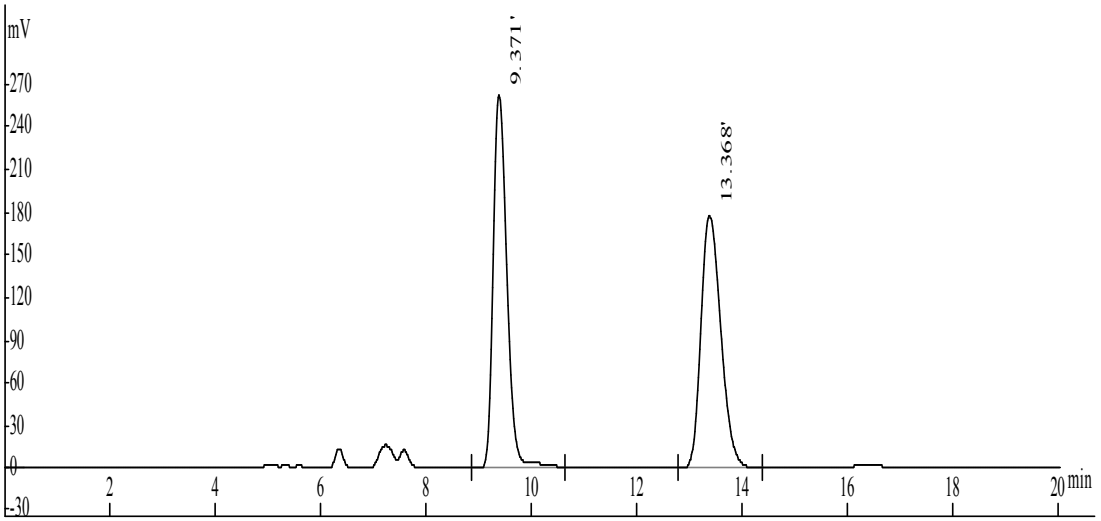


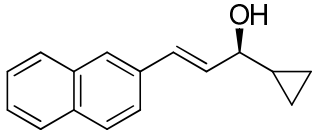

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 15.640 | 6.13 | 87 |
| 2 | 17.337 | 93.87 | |

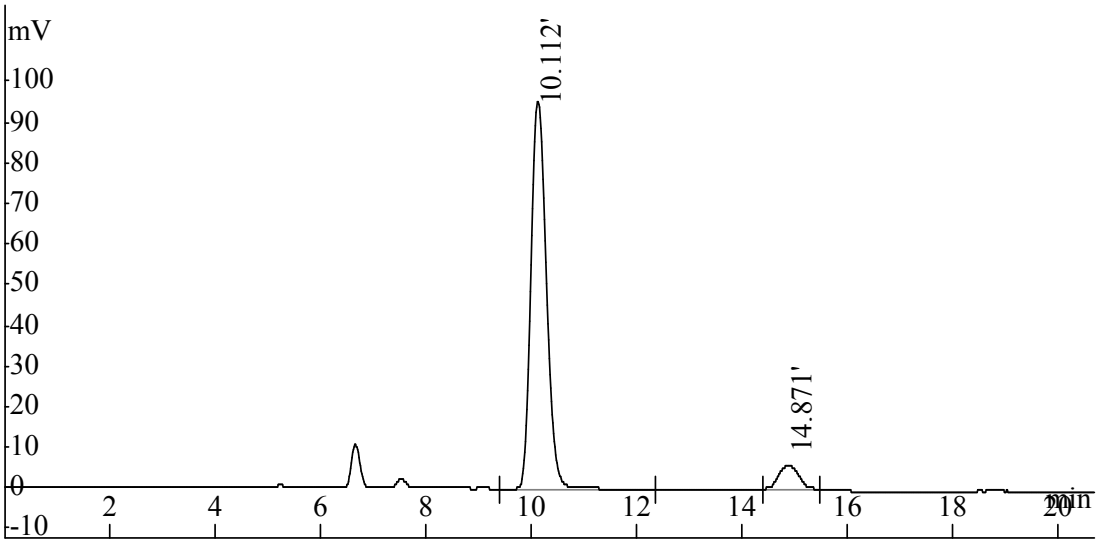



**3x**

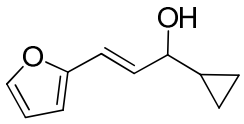



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 9.371 | 50.25 | racemic |
| 2 | 13.368 | 49.75 | |

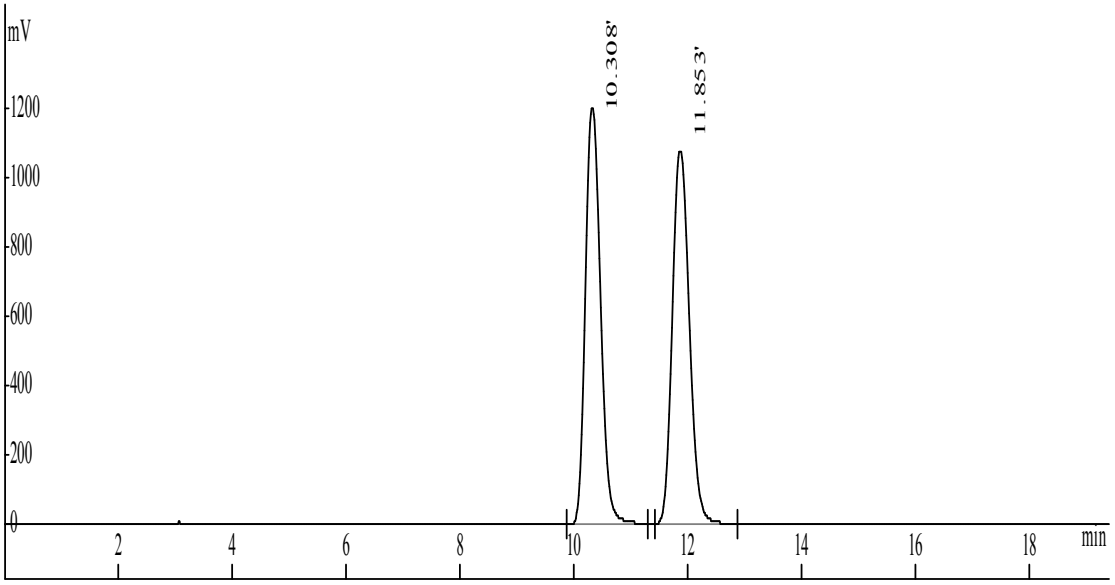


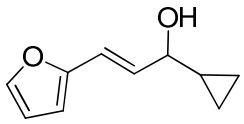

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 10.112 | 91.73 | 82 |
| 2 | 14.871 | 8.27 | |

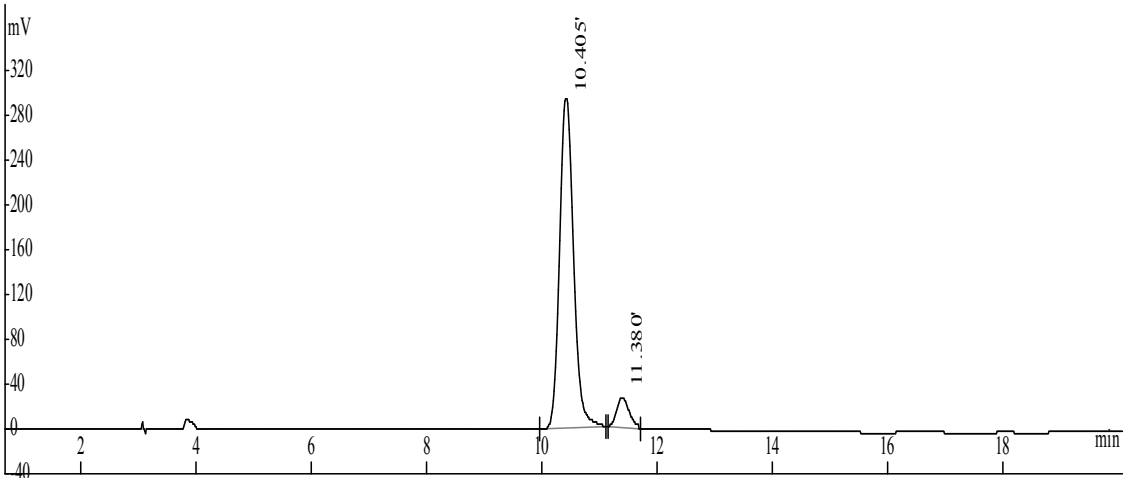



**3y**

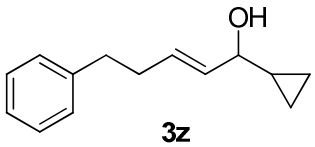



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 10.308 | 49.82 | racemic |
| 2 | 11.853 | 50.18 | |

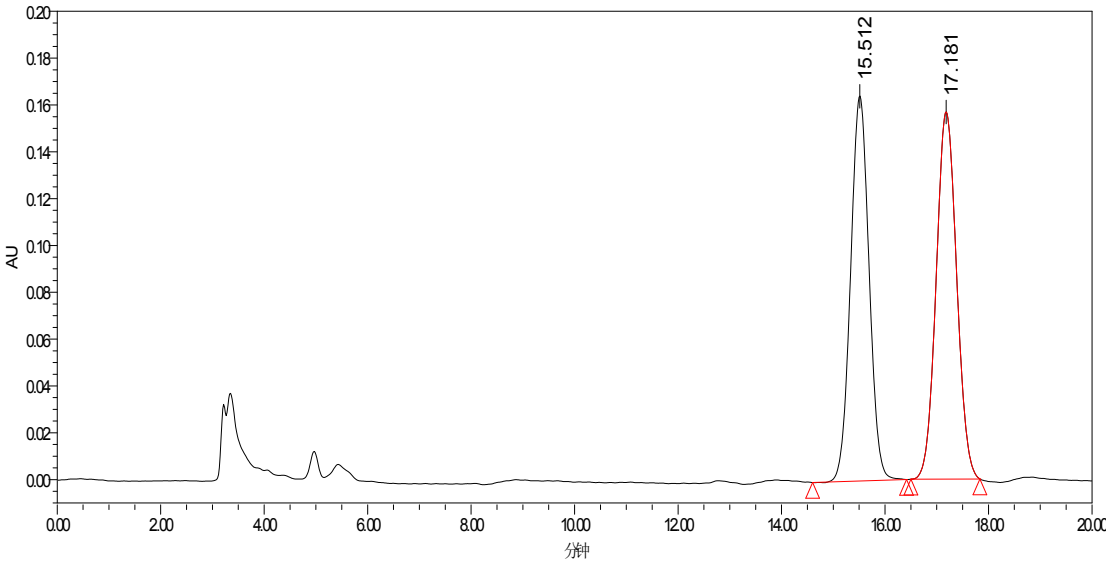


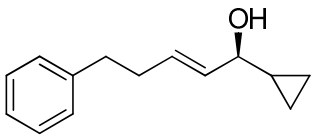

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 10.405 | 92.44 | 85 |
| 2 | 11.380 | 7.563 | |

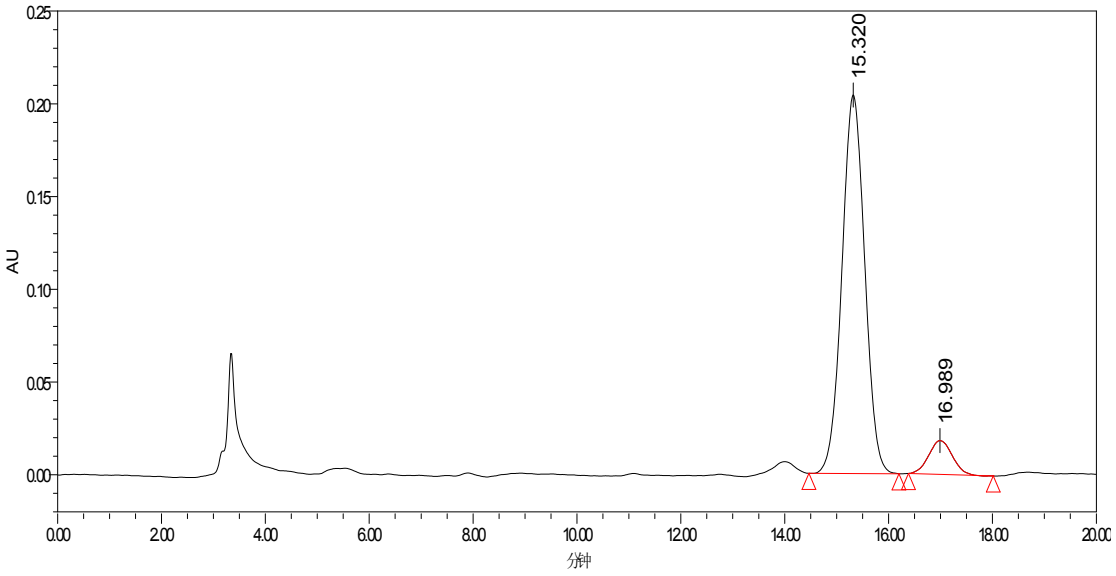



3z

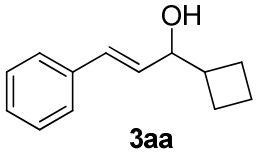



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 15.512 | 49.62 | racemic |
| 2 | 17.181 | 50.38 | |

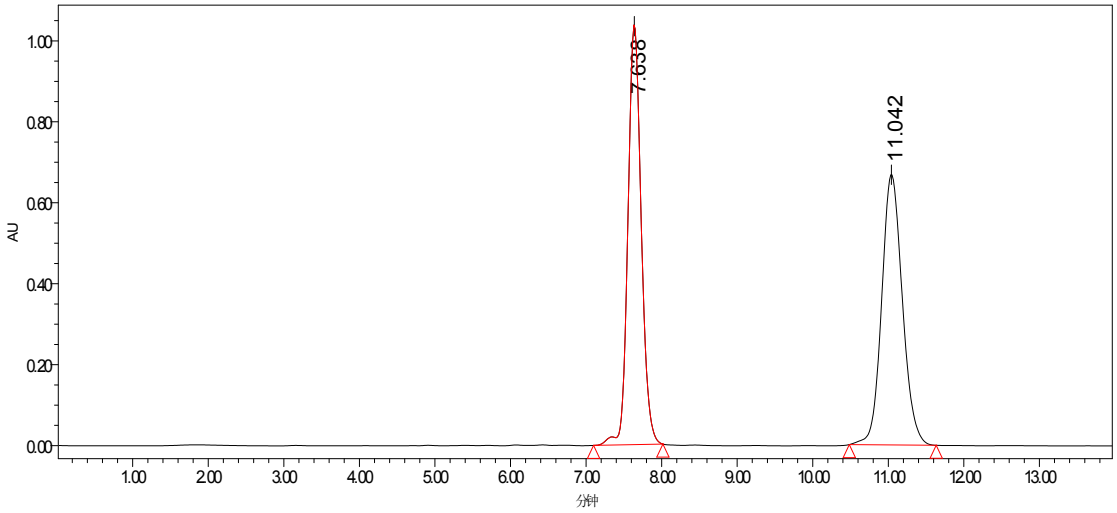


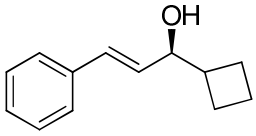

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 15.320 | 91.51 | 83 |
| 2 | 16.989 | 8.49 | |

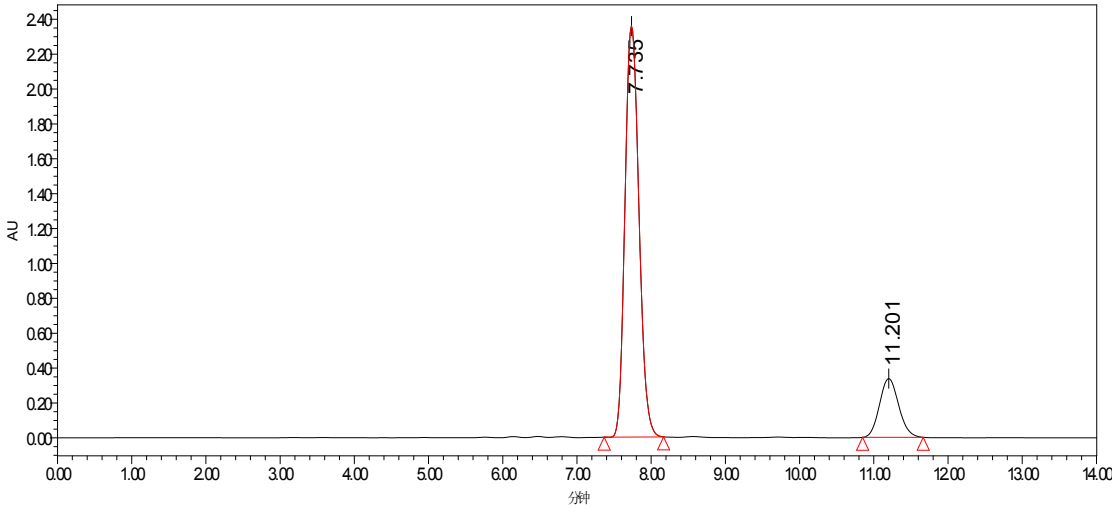



**3aa**

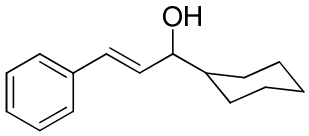



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 7.638 | 49.96 | racemic |
| 2 | 11.042 | 50.04 | |

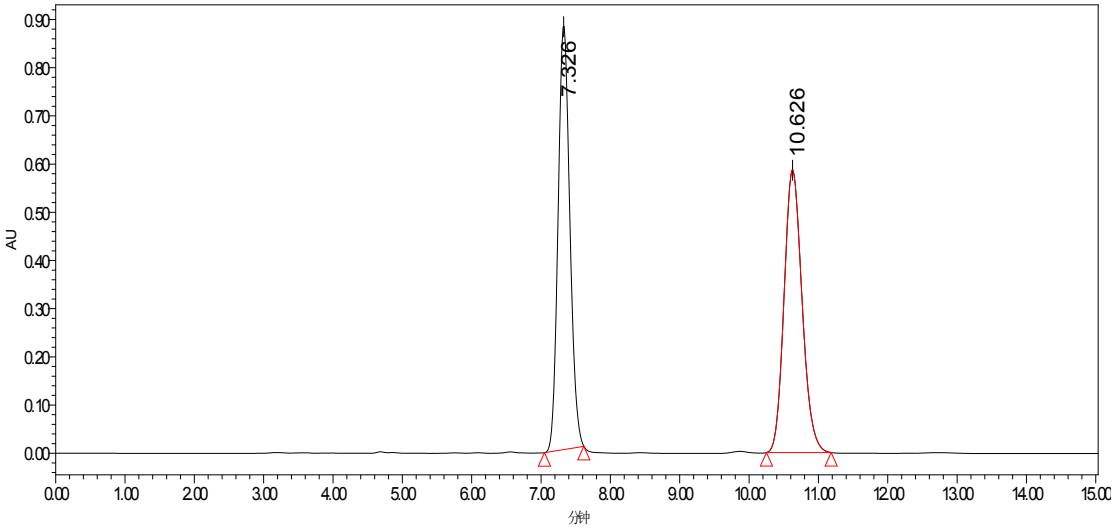


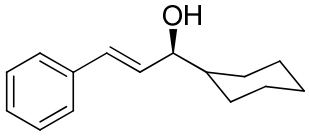

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 7.735 | 83.61 | 67 |
| 2 | 11.201 | 16.39 | |

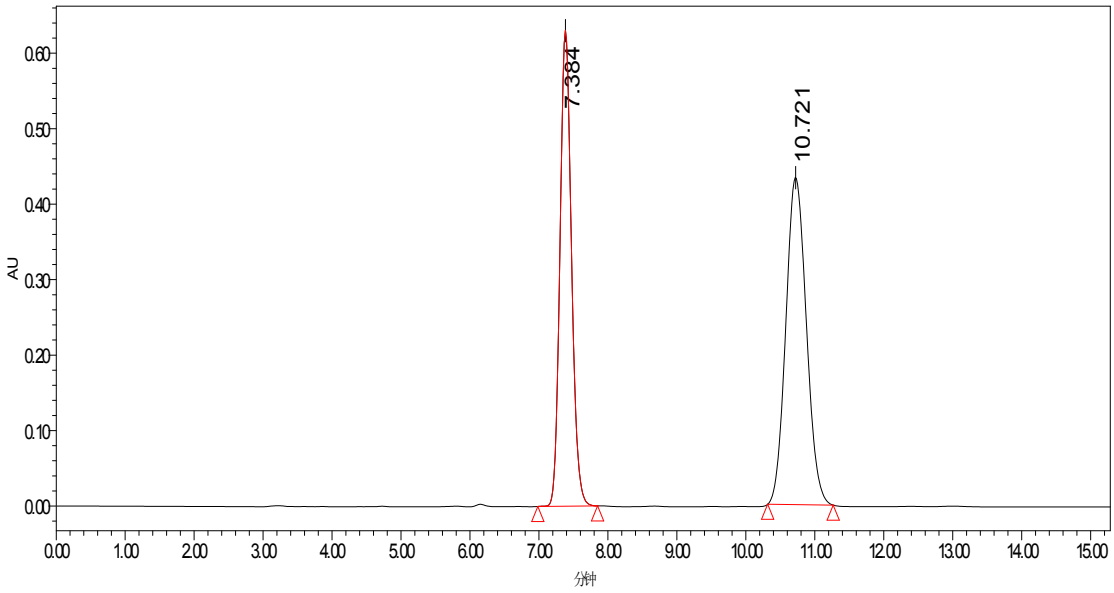



**3ab**

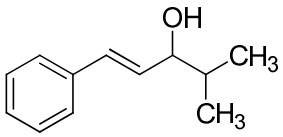



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 7.326 | 49.58 | racemic |
| 2 | 10.626 | 50.42 | |

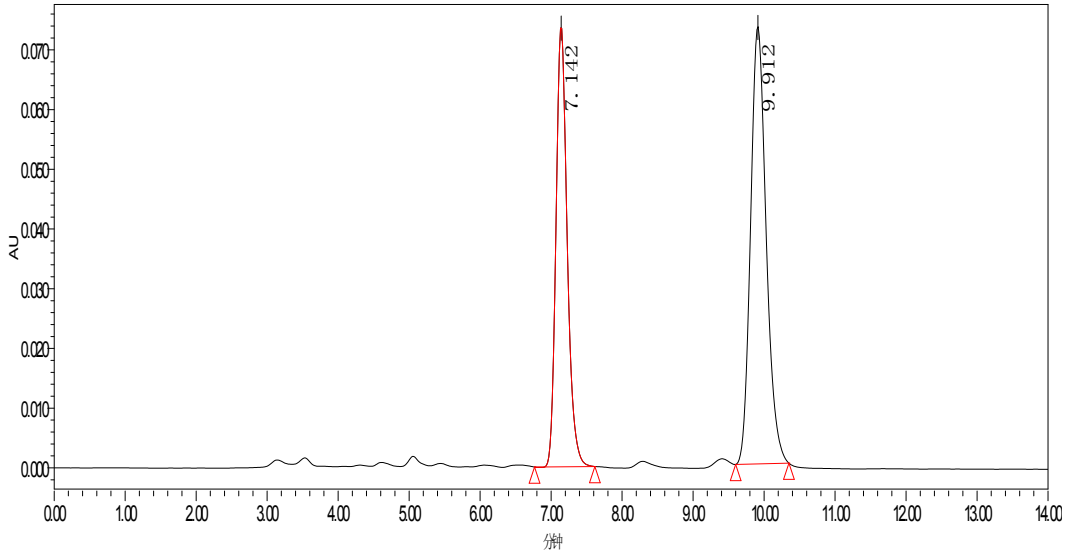


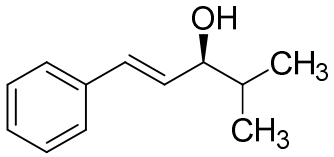

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 7.384 | 49.90 | 0 |
| 2 | 10.721 | 50.10 | |

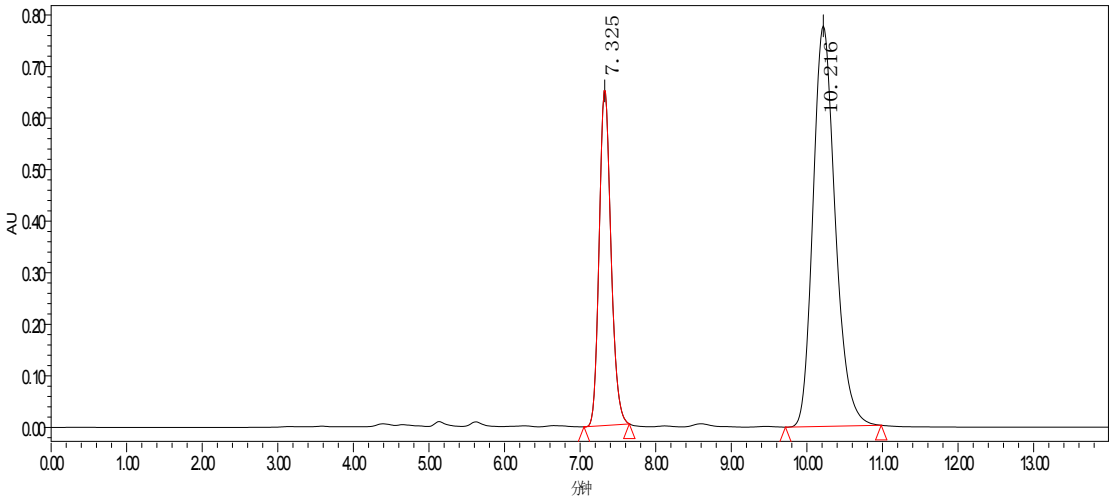



**3ac**

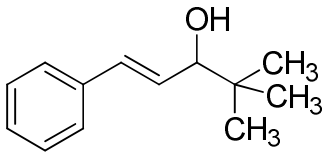



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 7.142 | 49.05 | racemic |
| 2 | 9.912 | 50.95 | |

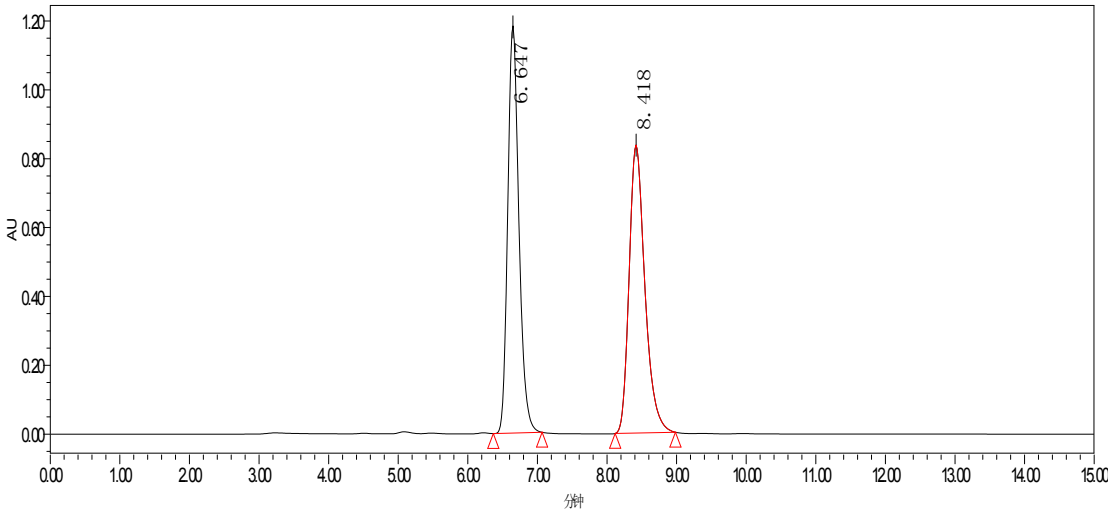


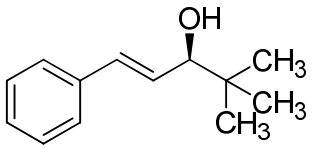

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 7.325 | 30.25 | 39 |
| 2 | 10.216 | 69.75 | |

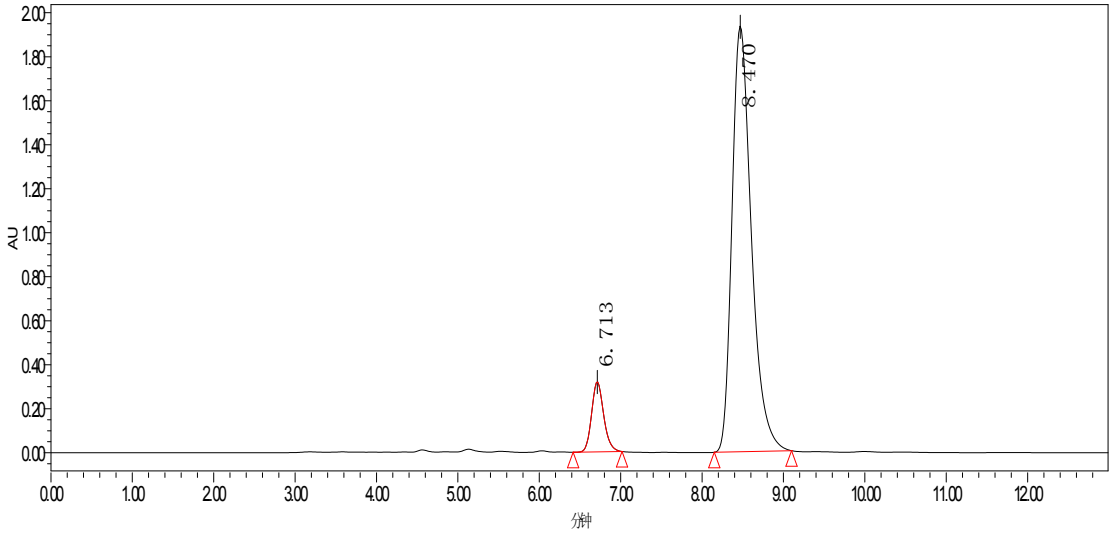



**3ad**

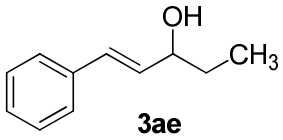



| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 6.647 | 50.02 | racemic |
| 2 | 8.418 | 49.98 | |

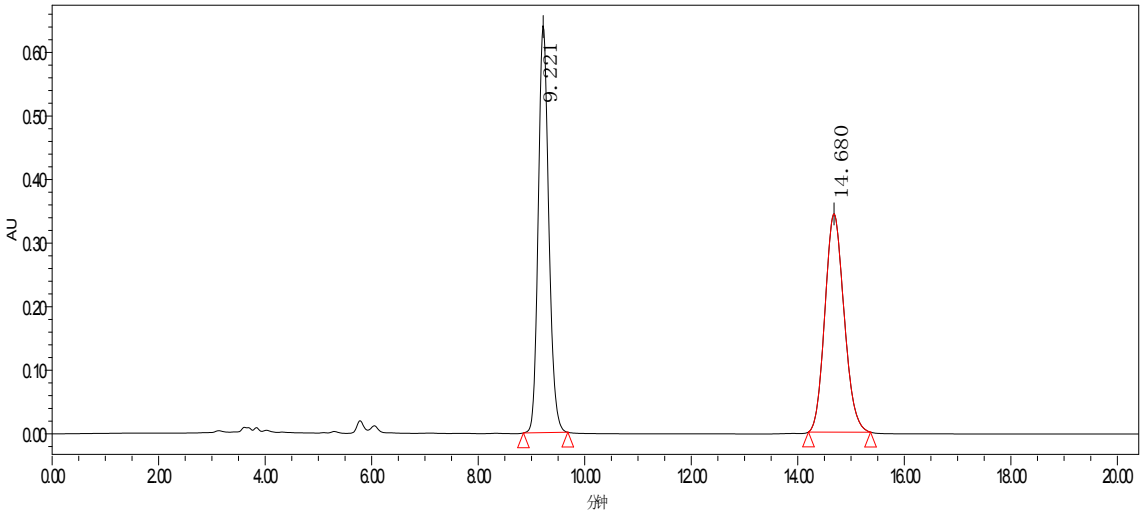


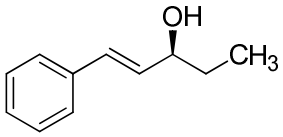

| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 6.713 | 9.32 | 81 |
| 2 | 8.470 | 90.68 | |

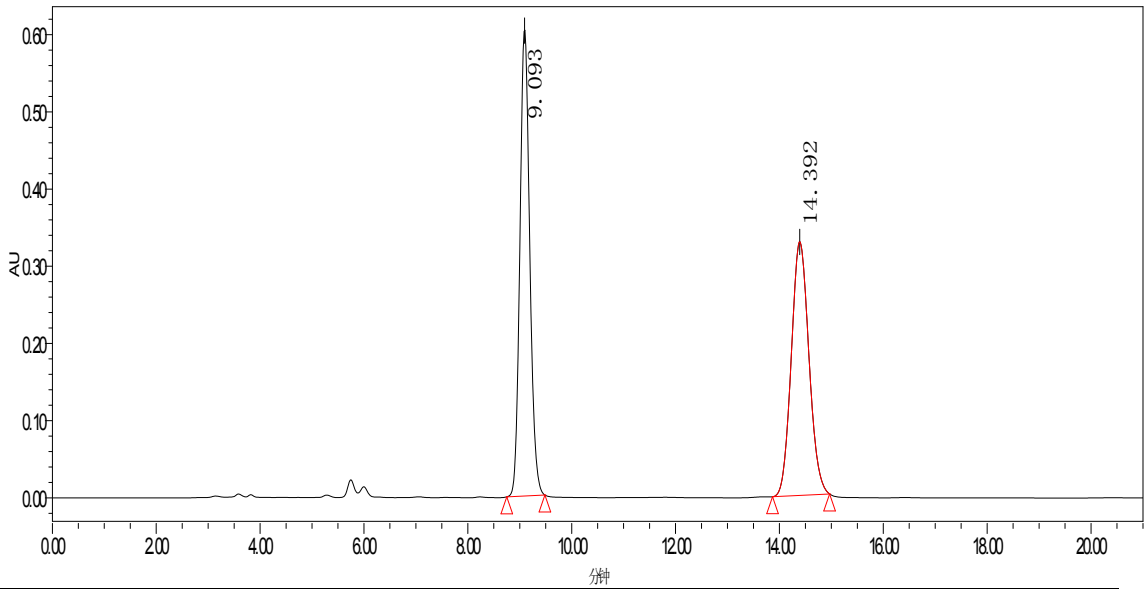



**3ae**




| Peak | Ret Time [min] | % Area | |
|---|---|---|---|
| 1 | 9.221 | 50.53 | racemic |
| 2 | 14.680 | 49.47 | |




| Peak | Ret Time [min] | % Area | ee value (%) |
|---|---|---|---|
| 1 | 9.093 | 50.64 | 0 |
| 2 | 14.392 | 49.36 | |