

Supporting Information

**Direct Access of the Chiral Quinolinyl Core of Cinchona Alkaloids
via a Brønsted Acid and Chiral Amine Co-catalyzed Chemo- and
Enantioselective α -Alkylation of Quinolinylmethanols with Enals**

Mengchao Tong,^{†#} Sinan Wang,^{†#} Jinchen Zhuang,[†] Cong Qin,[†] Hao Li^{†,*} and Wei
Wang^{†,‡,*}

[†]*State Key Laboratory of Bioengineering Reactor, Shanghai Key Laboratory of New
Drug Design, and School of Pharmacy, East China University of Science and
Technology, 130 Mei-long Road, Shanghai 200237, China*

[‡]*Department of Chemistry and Chemical Biology, University of New Mexico,
Albuquerque, NM 87131-0001, USA*

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I. General Information

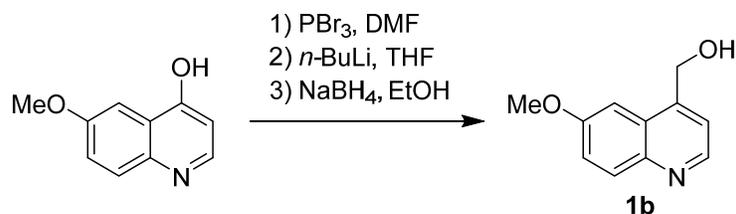
Unless otherwise noted, all reagents were obtained commercially and used without further purification. Unless otherwise specified, all other reagents were purchased from Acros, Aldrich, Adamas-beta Co. Ltd. or TCI and used without further purification. ^1H NMR spectra was recorded at 400 MHz, ^{13}C NMR spectra was recorded at 100 MHz. ^1H NMR spectra was recorded with tetramethylsilane ($\delta = 0.00$ ppm) as internal reference; ^{13}C NMR spectra was recorded with CDCl_3 ($\delta = 77.00$ ppm) as internal reference. Chemical shifts were reported in parts per million (ppm, δ) downfield from tetramethylsilane. Proton coupling patterns are described as singlet (s), doublet (d), triplet (t), quartet (q), multiplet (m), and broad (br). Chromatography was carried out with silica gel (200-300 mesh) using mixtures of petroleum ether (b.p. 60-80 °C) and ethyl acetate as eluents. The enantiomeric excess of products was detected on HPLC (Shimadzu LC-LabSolutions). Mass Spectra were obtained from East China University of Science and Technology mass spectral facility.

II. Synthesis of starting materials

2.1 Synthesis of compound **1a**, **1d**, **1e**

Quinolin-4-ylmethanol **1a** was prepared according to a previously reported method.¹ Quinolin-2-ylmethanol **1d** was prepared according to a previously reported method.² Isoquinolin-1-ylmethanol **1e** was synthesized from Isoquinoline-1-carboxylic acid according to a previously reported method.³

2.2 Synthesis of compound **1b**, **1c** and characterization data

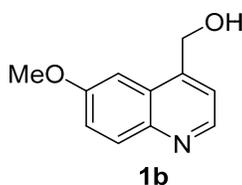


Scheme S1. Synthesis of (6-Methoxyquinolin-4-yl)methanol **1b**

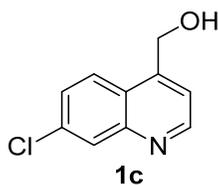
- 1) To a solution of 6-methoxyquinolin-4-ol (876 mg, 5 mmol) in 8 mL anhydrous DMF was added PBr_3 (1.39 g, 5.15 mmol) through a syringe under N_2 atmosphere. The reaction was stirred for 2 h at rt. Then the reaction was quenched with water. The pH value was adjusted to 10 by adding saturated aq. NaHCO_3 and precipitation was formed. The precipitation was filtered, washed with ice water and dried to obtain crude products. The crude product was purified by flash column chromatography on neutral Al_2O_3 (pure DCM) to give 4-bromo-6-methoxyquinoline in 70% yield as a white solid (829 mg).
- 2) To an oven-dried 100 mL two neck flask equipped with a stir bar was added 12 mL

anhydrous THF and 2.5 M *n*-BuLi in hexane (0.49 mL, 1.22 mmol) at -78 °C under N₂ atmosphere. Then 4-bromo-6-methoxyquinoline (206 mg, 0.87 mmol) in 5 mL anhydrous THF was added slowly via syringe. The mixture was stirred for half an hour at -78 °C. Then anhydrous DMF (107.6 μL, 1.39 mmol) was added through a syringe. The reaction was stirred for another 3 h at -78 °C. The reaction was quenched with water (5 mL) and extracted with EtOAc (15 mL × 3). The combined organic extracts were washed with brine (20 mL × 2), dried with Na₂SO₄, and concentrated in vacuo. The residue was purified by flash column chromatography on silica gel to give 6-methoxyquinoline-4-carbaldehyde in 37% yield as a yellow solid (58.56 mg).

- 3) To a solution of 6-methoxyquinoline-4-carbaldehyde (58.56 mg, 0.31 mmol) in 2 mL anhydrous methanol was added NaBH₄ (15.24 mg, 0.40 mmol) at 0 °C. The reaction was stirred for 4 h at rt. After the starting material was consumed, the reaction was diluted with ice water (2 mL) and extracted with EtOAc (5 mL × 3). The combined organic extracts were washed with brine, dried with Na₂SO₄, and concentrated in vacuo to give the desired compound in 88% yield as yellow solid (51.5 mg).

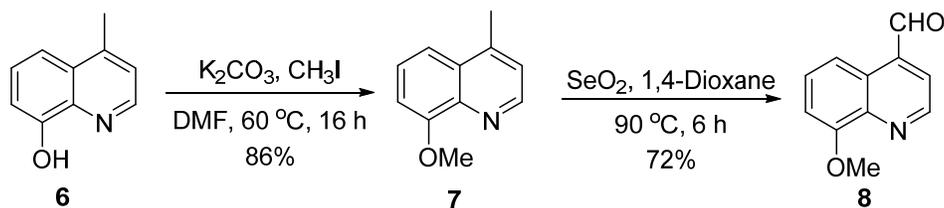


(6-Methoxyquinolin-4-yl)methanol (1b): ¹H NMR (400 MHz, CDCl₃): δ 8.65 (d, *J* = 4.4 Hz, 1H), 8.00 (d, *J* = 9.2 Hz, 1H), 7.46 (d, *J* = 4.4 Hz, 1H), 7.35 (dd, *J*₁ = 9.2 Hz, *J*₂ = 2.8 Hz, 1H), 7.15 (d, *J* = 2.8 Hz, 1H), 5.15 (s, 2H), 3.92 (s, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 157.8, 147.7, 145.0, 143.7, 131.2, 126.9, 121.7, 118.6, 101.1, 61.8, 55.6. HRMS (EI) *m/z* calcd. for C₁₁H₁₁NO₂ (M)⁺ 189.0790, found 189.0788.

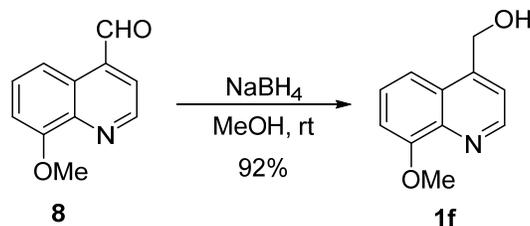


(7-Chloroquinolin-4-yl)methanol (1c): The title compound was prepared according to the procedure described above in 20% yield for three steps as pale yellow solid. ¹H NMR (400 MHz, CDCl₃): δ 8.90 (d, *J* = 4.4 Hz, 1H), 8.13 (d, *J* = 2.0 Hz, 1H), 7.92 (d, *J* = 8.9 Hz, 1H), 7.55-7.54 (m, 2H), 5.21 (s, 2H); ¹³C NMR (100 MHz, CDCl₃) δ 151.6, 148.5, 146.1, 135.2, 129.1, 127.7, 124.4, 124.3, 118.5, 61.7. HRMS (EI) *m/z* calcd. for C₁₀H₈ClNO (M)⁺ 193.0294, found 193.0293.

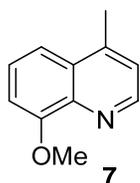
2.3 Synthesis of compound **1f** and characterization data



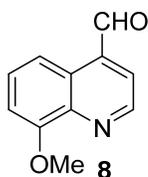
Scheme S2. Procedure for the synthesis of **7** and **8**



Scheme S3. Procedure for the synthesis of starting material **1f**

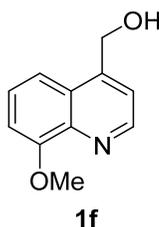


8-Methoxy-4-methylquinoline (7): To a solution of 4-methylquinolin-8-ol **5** (1.03 g, 6.5 mmol) in 30 mL DMF, K_2CO_3 (1.8 g, 13 mmol) was added at rt. Subsequently, Iodomethane (0.62 mL, 9.7 mmol) was added into the mixture via syringe and the reaction was stirred at $60\text{ }^\circ\text{C}$ for 16 h. After the starting material was consumed, the solvent was distilled off under reduced pressure. Then water (20 mL) and EtOAc (20 mL) were added into the residue. The layers were separated and the aqueous layer was extracted with EtOAc (20 mL \times 2). The combined organic layers were washed with brine, dried with Na_2SO_4 , and concentrated under vacuum. The residue was used in next step without purification.



8-Methoxyquinoline-4-carbaldehyde (8): To an oven-dried 100 mL round-bottomed flask equipped with a magnetic stirring bar was charged with selenium dioxide (2.21 g, 20 mmol), 8-methoxy-4-methylquinoline **7** (0.86g, 5 mmol) and 1,4-dioxane (20 mL) and the solution was heated at $95\text{ }^\circ\text{C}$ for 6 h. The reaction mixture was cooled to rt, filtered through a pad of celite and then concentrated under vacuum. The residue was purified by flash column chromatography on silica gel to afford the desired compound **8** in 72% yield as yellow solid.

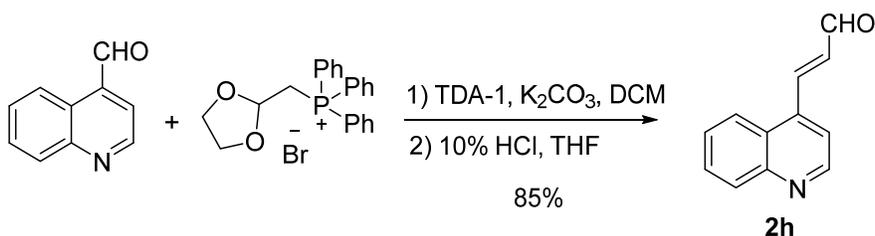
^1H NMR (400 MHz, DMSO- d_6): δ 10.60 (s, 1H), 9.22 (d, J = 4.2 Hz, 1H), 8.57 (d, J = 8.6 Hz, 1H) 8.12 (d, J = 4.2 Hz, 1H), 7.78 (t, J = 8.2 Hz, 1H), 7.39 (d, J = 7.8 Hz, 1H), 4.06 (s, 3H); ^{13}C NMR (100 MHz, DMSO- d_6): δ 195.0, 155.8, 149.7, 141.0, 136.6, 130.2, 126.5, 125.0, 115.7, 109.4, 56.2; HRMS (EI) m/z calcd. for $\text{C}_{11}\text{H}_9\text{NO}_2$ (M) $^+$ 187.0633, found 187.0632.



(8-Methoxyquinolin-4-yl)methanol (1f): To a solution of 8-methoxyquinoline-4-carbaldehyde **8** (273 mg, 1.46 mmol) in 10 mL methanol was added NaBH_4 (113 mg, 3 mmol) at 0 °C. The reaction was stirred for 6 h at rt. After the starting material was consumed, the reaction was diluted with ice water (2 mL) and extracted with EtOAc (8 mL \times 3). The combined organic extracts were washed with brine, dried with Na_2SO_4 , and concentrated in vacuo to give the desired compound **1f** in 92% yield as slight yellow solid (253 mg).

^1H NMR (400 MHz, CDCl_3): δ 8.88 (d, J = 4.4 Hz, 1H), 7.58 (d, J = 4.4 Hz, 1H), 7.52-7.45 (m, 2H), 7.06 (dd, J_1 = 5.7 Hz, J_2 = 3.2 Hz, 1H), 5.20 (s, 2H), 4.07 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3): δ 155.8, 149.1, 146.0, 139.8, 126.9, 126.7, 118.6, 114.4, 107.4, 61.8, 55.9; HRMS (EI) m/z calcd. for $\text{C}_{11}\text{H}_{11}\text{NO}_2$ (M) $^+$ 189.0790, found 189.0788.

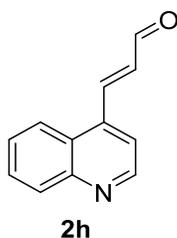
2.4 Synthesis of compound **2h** and characterization data



Scheme S4. Synthesis of (*E*)-3-(Quinolin-4-yl)acrylaldehyde **2h**

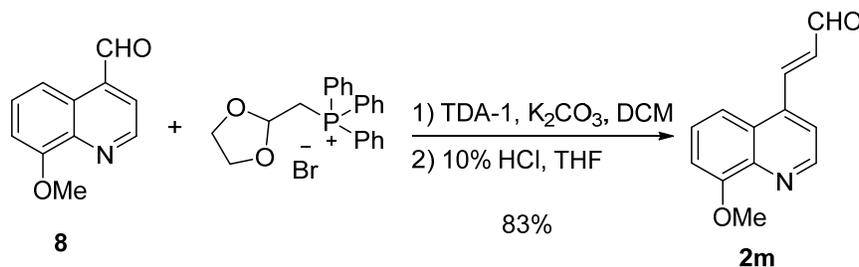
To an oven-dried 100 mL round-bottomed flask equipped with a magnetic stirring bar was charged with quinoline-4-carbaldehyde (500 mg, 3.18 mmol), (1,3-dioxolan-2-yl)triphenylphosphonium bromide (2.13 g, 4.96 mmol), TDA-1 (Tris(2-(2-methoxyethoxy)ethyl)amine) (1.08 g, 3.34 mmol), saturated aq. K_2CO_3 (16 mL) and dichloromethane (16 mL). The reaction mixture was heated to reflux for 20 h. Then the reaction mixture was cooled to rt. The layers were separated and the aqueous layer was extracted with dichloromethane (10 mL \times 3). The combined organic layers were washed

with brine, dried with Na₂SO₄, and concentrated in vacuo. THF (5 mL) and 10% HCl (5 mL) were added into the residue and the mixture was stirred for 1 h at rt. The reaction mixture was cooled to 0 °C, neutralized with 10% NaOH, and extracted with ethyl acetate (20 mL × 3). The combined organic layers were washed with brine, dried with Na₂SO₄, and concentrated in vacuo. Purification by silica gel flash column chromatography provided the title compound in 85% yield as slight yellow solid (494 mg).



(E)-3-(Quinolin-4-yl)acrylaldehyde (2h): ¹H NMR (400 MHz, CDCl₃): δ 9.91 (d, *J* = 7.5 Hz, 1H), 8.99 (d, *J* = 4.5 Hz, 1H), 8.25 (d, *J* = 15.6 Hz, 1H), 8.19 (d, *J* = 8.4 Hz, 1H), 8.15 (d, *J* = 8.4 Hz, 1H), 7.84-7.76 (m, 1H), 7.71-7.63 (m, 1H), 7.58 (d, *J* = 4.4 Hz, 1H), 6.92 (dd, *J*₁ = 15.9 Hz, *J*₂ = 7.5 Hz, 1H). ¹³C NMR (100 MHz, CDCl₃): δ 192.9, 150.1, 148.8, 146.1, 139.0, 133.8, 130.5, 129.9, 127.6, 125.5, 122.7, 118.3; HRMS (EI) *m/z* calcd. for C₁₂H₉NO (M)⁺ 183.0684, found 183.0683.

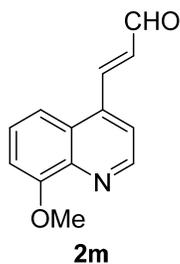
2.5 Synthesis of compound **2m** and characterization data



Scheme S5. Procedure for the synthesis of starting material **2m**

To an oven-dried 50 mL round-bottomed flask equipped with a magnetic stirring bar was charged with 8-methoxyquinoline-4-carbaldehyde **8** (170 mg, 0.91 mmol), (1,3-dioxolan-2-yl)triphenylphosphonium bromide (609 mg, 1.42 mmol), TDA-1 (308 mg, 0.95 mmol), saturated aq. K₂CO₃ (8 mL) and dichloromethane (8 mL). The reaction mixture was heated to reflux for 20 h. The layers were separated and the aqueous layer was extracted with dichloromethane (5 mL × 3). The combined organic layers were washed with brine, dried with Na₂SO₄ and concentrated in vacuo. THF (2.5 mL) and 10% HCl (2.5 mL) were added into the residue and the mixture was stirred for 1 h at rt. The reaction mixture was cooled to 0 °C, neutralized with 10% NaOH, and extracted with ethyl acetate (10 mL × 3). The combined organic layers were washed with brine, dried with Na₂SO₄ and concentrated in vacuo. Purification by silica gel flash column

chromatography provided the title compound in 83% yield as slight yellow solid (160 mg).



(E)-3-(8-Methoxyquinolin-4-yl)acrylaldehyde (2m): ^1H NMR (400 MHz, CDCl_3): δ 9.90 (d, $J = 7.5$ Hz, 1H), 9.00 (d, $J = 4.5$ Hz, 1H), 8.22 (d, $J = 16.0$ Hz, 1H), 7.74-7.65 (m, 1H), 7.62-7.56 (m, 2H), 7.15 (d, $J = 7.6$ Hz, 1H), 6.90 (dd, $J_1 = 16.0$ Hz, $J_2 = 7.6$ Hz, 1H), 4.12 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3): δ 192.9, 155.9, 148.8, 146.5, 140.9, 138.9, 133.7, 127.9, 126.7, 118.9, 114.4, 108.0, 56.1; HRMS (EI) m/z calcd. for $\text{C}_{13}\text{H}_{11}\text{NO}_2$ (M) $^+$ 213.0790, found 213.0789.

III. Oxidation method screening

Table S1. Screening results for the oxidation of the hemiacetal intermediate (**3a**)

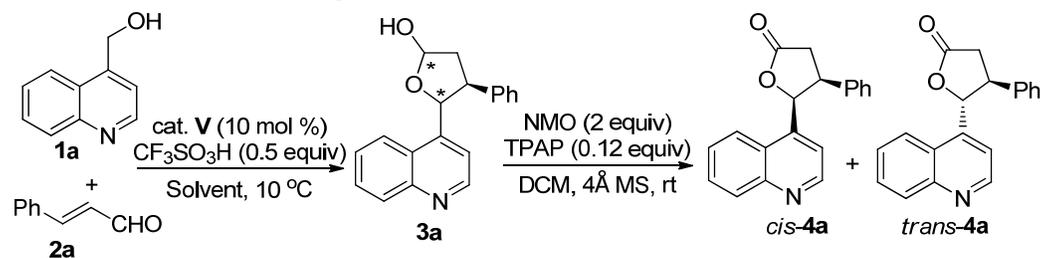
Entry	Oxidation Condition	Yield (%) ^g (4)
1	PCC ^a	40
2	$\text{NaClO}_2, \text{NaH}_2\text{PO}_4$ ^b	0
3	IBX ^c	0
4	MnO_2 ^d	0
5	Dess-Martin Oxidation ^e	39
6	Lay Oxidation ^f	70

^a Reaction condition: **3a** (0.1 mmol), PCC (0.15 mmol) in 2 mL DCM was stirred for 4 h at rt. ^b Reaction condition: **3a** (0.1 mmol), NaClO_2 (0.15 mmol), NaH_2PO_4 (0.3 mmol) in 2 mL THF and 1 mL H_2O was stirred for 12 h at rt. ^c Reaction condition: **3a** (0.1 mmol), IBX (0.2 mmol) in 2 mL DCM was stirred for 8 h at rt. ^d Reaction condition: **3a** (0.1 mmol), MnO_2 (0.15 mmol) in 2 mL DCM was stirred for 12 h at rt. ^e Reaction

condition: **3a** (0.1 mmol), Dess-Martin Reagent (0.2 mmol) in 2 mL DCM was stirred for 4 h at rt. ^f Reaction condition: **3a** (0.1 mmol), tetrapropylammonium perruthenate (TPAP) (0.012 mmol), 4-Methylmorpholine *N*-oxide (NMO) (0.2 mmol), 4Å molecular sieves (MS) in 2 mL of dry DCM was stirred for 4h at rt. ^g Yield of isolated product **4**.

IV. Solvent screening

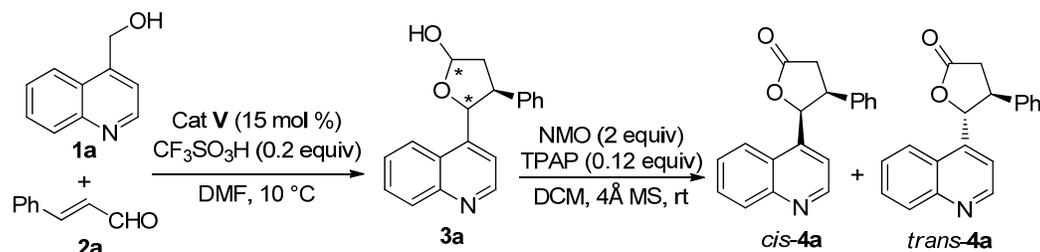
Table S2. Solvent screening results^a



entry	solvent	yield [%] ^b 3a	dr ^c (<i>cis</i> - 4a / <i>trans</i> - 4a)	<i>ee</i> [%] ^d (<i>cis</i> - 4a / <i>trans</i> - 4a)
1	DMF	63	1.5:1	73/78
2	DCM	30	n.d.	n.d.
3	CHCl ₃	35	n.d.	n.d.
4	MeCN	17	n.d.	n.d.
5	NMP	45	1.5:1	79/83
6	THF	48	1.3:1	53/58
7	Toluene	< 10	n.d.	n.d.

^a Unless otherwise specified, a mixture of **1a** (0.5 mmol), **2a** (0.75 mmol), amine catalyst **V** (0.05 mmol) and CF₃SO₃H (0.25 mmol) in Solvent (0.5 mL) was stirred for 96 h at 10 °C. ^b Isolated yields. ^c Determined by ¹H NMR of crude mixture. ^d Determined by chiral HPLC analysis. n.d.= not determined. NMO = 4-methylmorpholine *N*-oxide. TPAP = tetrapropylammonium perruthenate.

V. General Procedure for the Synthesis of Compounds **4**



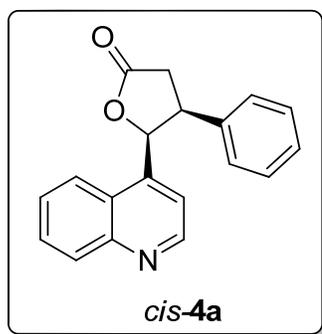
Scheme S6. General Procedure for the Synthesis of Compounds **4**

A screw cap glass vial equipped with a magnetic stirring bar was charged with

quinolin-4-ylmethanol **1a** (79.5 mg, 0.5 mmol), CF₃SO₃H (15 mg, 0.1 mmol) and DMF (0.2 mL) and the solution was stirred for 5 min at rt. Then catalyst **V** (27.5 mg, 0.075 mmol) was added into the solution and the resulting mixture was stirred for 5 min at 10 °C. Subsequently, trans-cinnamaldehyde **2a** (99 mg, 0.75 mmol) was added into the mixture and the reaction was stirred at 10 °C for 96 h. After the starting material was consumed, the reaction was diluted with saturated aq. Na₂CO₃ (2 mL) and extracted with EtOAc (5 mL × 3). The combined organic extracts were washed with brine, dried with Na₂SO₄, and concentrated in vacuo. The residue was purified by flash column chromatography on neutral Al₂O₃ (pure DCM to DCM:MeOH = 100:1) to give the hemiacetal intermediate **3a** in 82% yield (119 mg).

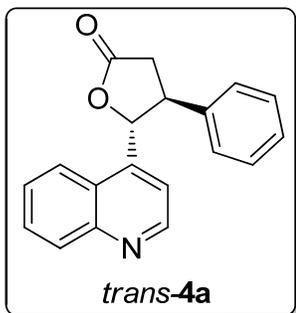
To a solution of the hemiacetal intermediate **3a** (119 mg, 0.41 mmol) in anhydrous DCM (3 mL) was added tetrapropylammonium perruthenate (TPAP) (17.2 mg, 0.049 mmol), 4-methylmorpholine *N*-oxide (NMO) (96 mg, 0.82 mmol) and 4Å molecular sieves. The reaction was stirred at rt and monitored by TLC. After the hemiacetal intermediate **3a** was consumed, the mixture was filtered and concentrated in vacuo. The residue was purified by flash column chromatography on silica gel (PE:EA = 8:1 - 4:1, containing 1% TEA) to give the mixture of *cis*-**4a** and *trans*-**4a** in 70% yield (83 mg). The mixture was repurified by preparation Thin-Layer Chromatography (DCM:acetone = 20:1). The less polar compound is the *cis*-product *cis*-**4a**. The more polar compound is the *trans*-product *trans*-**4a**.

(4*S*,5*S*)-4-Phenyl-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-4a**)**



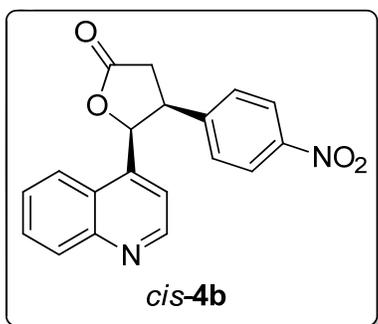
cis-**4a**: yellow solid, ¹H NMR (400 MHz, CDCl₃): δ 8.63 (d, *J* = 4.5 Hz, 1H), 8.05 (dd, *J*₁ = 8.4 Hz, *J*₂ = 0.6 Hz, 1H), 7.83 (d, *J* = 8.4 Hz, 1H), 7.70 (ddd, *J*₁ = 8.4 Hz, *J*₂ = 6.9 Hz, *J*₃ = 1.3 Hz, 1H), 7.57 (ddd, *J*₁ = 8.3 Hz, *J*₂ = 6.9 Hz, *J*₃ = 1.2 Hz, 1H), 7.18 (dd, *J*₁ = 4.5 Hz, *J*₂ = 0.7 Hz, 1H), 6.98-6.83 (m, 3H), 6.69-6.58 (m, 2H), 6.54 (d, *J* = 6.4 Hz, 1H), 4.32 (ddd, *J*₁ = 8.8 Hz, *J*₂ = 6.4 Hz, *J*₃ = 2.7 Hz, 1H), 3.35 (dd, *J*₁ = 17.6 Hz, *J*₂ = 8.4 Hz, 1H), 3.01 (dd, *J*₁ = 17.6 Hz, *J*₂ = 2.8 Hz, 1H); ¹³C NMR (100 MHz, CDCl₃): δ 176.0, 149.8, 147.5, 141.2, 136.8, 130.5, 129.2, 128.2, 127.7, 127.2, 126.8, 124.6, 122.1, 117.6, 81.1, 46.0, 36.6; HRMS (EI) *m/z* calcd. for C₁₉H₁₅NO₂ (M)⁺ 289.1103, found 289.1102. (Chiralpak OD-3, *i*-PrOH/hexane = 25/75, flow rate = 1.0 mL/min, λ = 254 nm): *t*_{major} = 14.49 min, *t*_{minor} = 20.64 min, ee = 92%.

(4*S*,5*R*)-4-Phenyl-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4a**)**



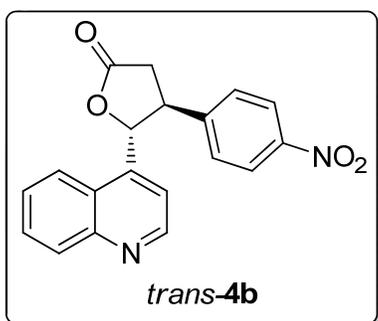
trans-4a: yellow solid, ^1H NMR (400 MHz, CDCl_3): δ 8.96 (d, $J = 4.5$ Hz, 1H), 8.17 (d, $J = 8.5$ Hz, 1H), 7.71 (ddd, $J_1 = 8.4$ Hz, $J_2 = 5.5$ Hz, $J_3 = 2.8$ Hz, 1H), 7.49 (dd, $J_1 = 4.5$ Hz, $J_2 = 0.5$ Hz, 1H), 7.45-7.33 (m, 5H), 7.29-7.24 (m, 2H), 6.21 (d, $J = 4.8$ Hz, 1H), 3.73-3.61 (m, 1H), 3.11 (dd, $J_1 = 18.0$ Hz, $J_2 = 9.2$ Hz, 1H), 2.83 (dd, $J_1 = 18.0$ Hz, $J_2 = 6.0$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 175.8, 150.3, 148.4, 144.3, 140.1, 130.6, 129.6, 128.3, 127.0, 126.9, 124.7, 122.8, 116.3, 83.6, 48.9, 36.1; HRMS (EI) m/z calcd. for $\text{C}_{19}\text{H}_{15}\text{NO}_2$ (M) $^+$ 289.1103, found 289.1102. (Chiralpak AS, *i*-PrOH/hexane = 25/75, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{minor}} = 20.77$ min, $t_{\text{major}} = 32.51$ min, ee = 92%.

(4S,5S)-4-(4-Nitrophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3H)-one (*cis*-4b)



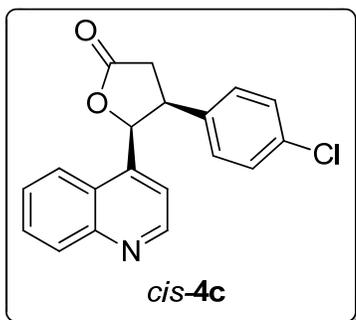
Following the general procedure, the title compounds (91.2 mg, combined *cis/trans* diastereoisomers) were isolated in 60% yield. ***cis*-4b:** yellow oil, ^1H NMR (400 MHz, CDCl_3): δ 8.68 (d, $J = 4.4$ Hz, 1H), 8.08 (d, $J = 8.0$ Hz, 1H), 7.83 (d, $J = 8.3$ Hz, 1H), 7.80-7.70 (m, 3H), 7.65-7.58 (m, 1H), 7.24 (d, $J = 4.0$ Hz, 1H), 6.85 (d, $J = 8.8$ Hz, 2H), 6.58 (d, $J = 6.4$ Hz, 1H), 4.47 (ddd, $J_1 = 8.7$ Hz, $J_2 = 6.5$ Hz, $J_3 = 2.3$ Hz, 1H), 3.44 (dd, $J_1 = 17.9$ Hz, $J_2 = 8.4$ Hz, 1H), 3.00 (dd, $J_1 = 17.9$ Hz, $J_2 = 2.4$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 173.7, 148.9, 146.7, 146.1, 143.2, 139.2, 129.9, 128.5, 127.1, 126.2, 123.1, 122.4, 120.6, 116.4, 79.5, 44.7, 35.6; HRMS (EI) m/z calcd. for $\text{C}_{19}\text{H}_{14}\text{N}_2\text{O}_4$ (M) $^+$ 334.0954, found 334.0953. (Chiralpak OD-3, *i*-PrOH/hexane = 25/75, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{minor}} = 36.73$ min, $t_{\text{major}} = 45.13$ min, ee = 83%.

(4S,5R)-4-(4-Nitrophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3H)-one (*trans*-4b).



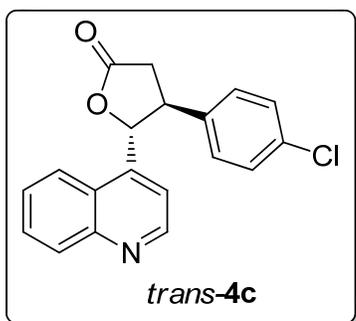
***trans*-4b:** yellow oil, ^1H NMR (400 MHz, CDCl_3): δ 8.99 (d, $J = 4.5$ Hz, 1H), 8.29 (d, $J = 8.8$ Hz, 2H), 8.20 (d, $J = 8.4$ Hz, 1H), 7.77-7.72 (m, 1H), 7.51-7.43 (m, 4H), 7.36 (d, $J = 8.4$ Hz, 1H), 6.23 (d, $J = 4.4$ Hz, 1H), 3.86-3.79 (m, 1H), 3.17 (dd, $J_1 = 18.0$ Hz, $J_2 = 9.2$ Hz, 1H), 2.81 (dd, $J_1 = 18.0$ Hz, $J_2 = 6.0$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 174.7, 150.3, 148.5, 147.8, 147.3, 143.3, 130.9, 129.8, 127.9, 127.4, 124.8, 124.4, 122.1, 116.4, 82.7, 48.5, 35.7; HRMS(EI) m/z calcd. for $\text{C}_{19}\text{H}_{14}\text{N}_2\text{O}_4$ (M) $^+$ 334.0954, found 334.0953. (Chiralpak OD-3, *i*-PrOH/hexane = 25/75, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{minor}} = 67.20$ min, $t_{\text{major}} = 73.73$ min, ee = 97%.

(4*S*,5*S*)-4-(4-Chlorophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-4c)



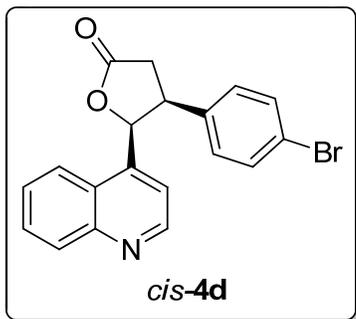
Following the general procedure, the title compounds (77.0 mg, combined *cis/trans* diastereoisomers) were isolated in 56% yield. *cis*-4c: yellow solid, $^1\text{H NMR}$ (400 MHz, CDCl_3): δ 8.67 (d, $J = 4.5$ Hz, 1H), 8.08 (d, $J = 8.4$ Hz, 1H), 7.82 (d, $J = 8.4$ Hz, 1H), 7.71 (ddd, $J_1 = 8.3$ Hz, $J_2 = 6.9$ Hz, $J_3 = 1.3$ Hz, 1H), 7.59 (ddd, $J_1 = 8.2$ Hz, $J_2 = 7.0$ Hz, $J_3 = 1.2$ Hz, 1H), 7.19 (dd, $J_1 = 4.5$ Hz, $J_2 = 0.6$ Hz, 1H), 6.87 (d, $J = 8.4$ Hz, 2H), 6.58 (d, $J = 8.4$ Hz, 2H), 6.52 (d, $J = 6.0$ Hz, 1H), 4.32 (ddd, $J_1 = 8.6$ Hz, $J_2 = 6.4$ Hz, $J_3 = 2.3$ Hz, 1H), 3.37 (dd, $J_1 = 17.8$ Hz, $J_2 = 8.6$ Hz, 1H), 2.94 (dd, $J_1 = 17.8$ Hz, $J_2 = 2.4$ Hz, 1H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3): δ 175.6, 149.9, 147.6, 140.9, 135.4, 133.5, 130.7, 129.4, 128.4, 127.1, 124.4, 121.9, 117.5, 80.9, 45.4, 36.7; HRMS (EI) m/z calcd. for $\text{C}_{19}\text{H}_{14}\text{ClNO}_2$ (M) $^+$ 323.0713, found 323.0714. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{major}} = 15.06$ min, $t_{\text{minor}} = 18.89$ min, ee = 90%.

(4*S*,5*R*)-4-(4-Chlorophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4c)



trans-4c: yellow solid, $^1\text{H NMR}$ (400 MHz, CDCl_3): δ 8.96 (d, $J = 4.5$ Hz, 1H), 8.17 (d, $J = 8.4$ Hz, 1H), 7.73 (ddd, $J_1 = 8.3$ Hz, $J_2 = 6.8$ Hz, $J_3 = 1.3$ Hz, 1H), 7.47-7.41 (m, 2H), 7.41-7.33 (m, 3H), 7.24-7.17 (m, 2H), 6.16 (d, $J = 4.9$ Hz, 1H), 3.67 (dt, $J_1 = 9.2$ Hz, $J_2 = 5.7$ Hz, 1H), 3.11 (dd, $J_1 = 18.0$ Hz, $J_2 = 9.2$ Hz, 1H), 2.78 (dd, $J_1 = 18.0$ Hz, $J_2 = 6.0$ Hz, 1H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3): δ 175.4, 150.3, 148.4, 143.9, 138.5, 134.2, 130.7, 129.8, 129.7, 128.2, 127.2, 124.6, 122.6, 116.4, 83.4, 48.2, 36.0; HRMS (EI) m/z calcd. for $\text{C}_{19}\text{H}_{14}\text{ClNO}_2$ (M) $^+$ 323.0713, found 323.0714. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{major}} = 17.46$ min, $t_{\text{minor}} = 19.33$ min, ee = 91%.

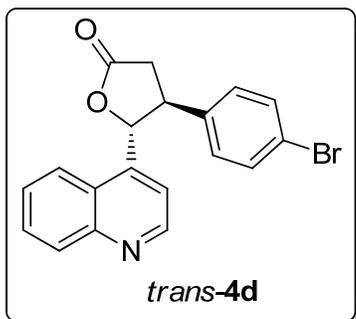
(4*S*,5*S*)-4-(4-Bromophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-4d)



Following the general procedure, the title compounds (89.6 mg, combined *cis/trans* diastereoisomers) were isolated in 56% yield. *cis*-4d: pale yellow solid, $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.68 (d, $J = 4.1$ Hz, 1H), 8.09 (d, $J = 8.4$ Hz, 1H), 7.82 (d, $J = 8.3$ Hz, 1H), 7.72 (t, $J = 7.6$ Hz, 1H), 7.60 (t, $J = 7.6$ Hz, 1H), 7.20 (d, $J = 4.4$ Hz, 1H), 7.03 (d, $J = 8.4$ Hz, 2H), 6.57-6.47 (m, 3H), 4.34-4.26 (m, 1H), 3.36 (dd, $J_1 = 18.0$ Hz, $J_2 = 8.4$ Hz, 1H), 2.95 (dd, $J_1 = 18.0$ Hz, $J_2 = 2.4$ Hz, 1H); $^{13}\text{C NMR}$ (100 MHz,

CDCl₃) δ 175.5, 149.9, 147.5, 140.9, 135.8, 131.4, 130.6, 129.4, 128.7, 127.1, 124.3, 121.8, 121.7, 117.5, 80.8, 45.5, 36.7; HRMS (EI) m/z calcd. for C₁₉H₁₄BrNO₂ (M)⁺ 367.0208, found 367.0209. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, λ = 254 nm): t_{major} = 15.26 min, t_{minor} = 18.02 min, ee = 90%.

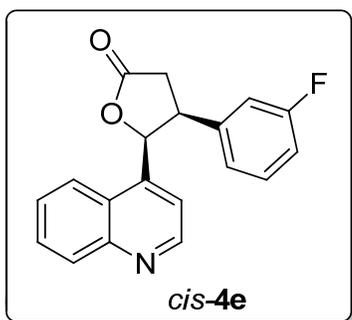
(4*S*,5*R*)-4-(4-Bromophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4*d*)



trans-4*d*: pale yellow solid, ¹H NMR (400 MHz, CDCl₃): δ 8.96 (d, J = 4.5 Hz, 1H), 8.18 (d, J = 8.0 Hz, 1H), 7.74 (ddd, J_1 = 8.4 Hz, J_2 = 6.8 Hz, J_3 = 1.4 Hz, 1H), 7.57-7.51 (m, 2H), 7.49-7.43 (m, 2H), 7.40-7.36 (m, 1H), 7.18-7.12 (m, 2H), 6.17 (d, J = 4.8 Hz, 1H), 3.66 (dt, J_1 = 9.3 Hz, J_2 = 5.5 Hz, 1H), 3.11 (dd, J_1 = 18.0 Hz, J_2 = 9.2 Hz, 1H), 2.77 (dd, J_1 = 18.0 Hz, J_2 = 6.0 Hz, 1H); ¹³C NMR (100 MHz, CDCl₃): δ 175.4, 150.3, 148.4, 143.9, 139.1, 132.7, 130.7, 129.7, 128.5, 127.2, 124.5, 122.5, 122.3,

116.3, 83.3, 48.3, 35.9; HRMS (EI) m/z calcd. for C₁₉H₁₄BrNO₂ (M)⁺ 367.0208, found 367.0209. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, λ = 254 nm): t_{major} = 16.90 min, t_{minor} = 19.39 min, ee = 92%.

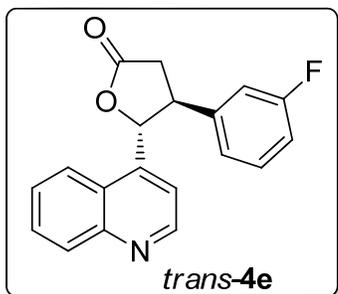
(4*S*,5*S*)-4-(3-Fluorophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-4*e*)



Following the general procedure, the title compounds (93.4 mg, combined *cis/trans* diastereoisomers) were isolated in 78% yield. *cis*-4*e*: yellow solid, ¹H NMR (400 MHz, CDCl₃): δ 8.67 (d, J = 4.5 Hz, 1H), 8.07 (d, J = 8.4 Hz, 1H), 7.82 (d, J = 8.4 Hz, 1H), 7.71 (ddd, J_1 = 8.2 Hz, J_2 = 7.0 Hz, J_3 = 1.2 Hz, 1H), 7.59 (ddd, J_1 = 8.2 Hz, J_2 = 7.0 Hz, J_3 = 1.2 Hz, 1H), 7.22 (d, J = 4.5 Hz, 1H), 6.89-6.81 (m, 1H), 6.68-6.61 (m, 1H), 6.54 (d, J = 6.4 Hz, 1H), 6.45-6.36 (m, 2H), 4.33 (ddd, J_1 = 8.7 Hz, J_2 = 6.5 Hz, J_3 = 2.5 Hz, 1H), 3.37

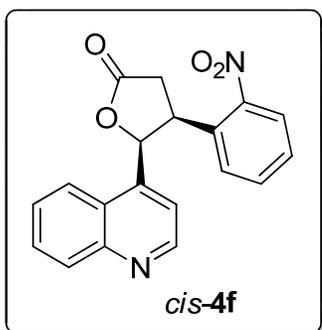
(dd, J_1 = 17.8 Hz, J_2 = 8.6 Hz, 1H), 2.98 (dd, J_1 = 17.8 Hz, J_2 = 2.5 Hz, 1H); ¹³C NMR (100 MHz, CDCl₃): δ 175.5, 163.5 (d, ¹ J_{C-F} = 246 Hz), 149.8, 147.6, 140.8, 139.3 (d, ³ J_{C-F} = 7 Hz), 130.6, 129.9 (d, ³ J_{CF} = 8 Hz), 129.4, 127.1, 124.4, 122.9 (d, ⁴ J_{C-F} = 3 Hz), 121.9, 117.5, 114.8 (d, ² J_{C-F} = 21 Hz), 114.4 (d, ² J_{C-F} = 22 Hz), 80.9, 45.7, 36.6; HRMS (EI) m/z calcd. for C₁₉H₁₄FNO₂ (M)⁺ 307.1009, found 307.1010. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, λ = 254 nm): t_{minor} = 46.81 min, t_{major} = 50.30 min, ee = 91%.

(4*S*,5*R*)-4-(3-Fluorophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4*e*)



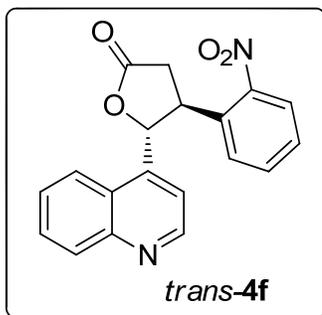
trans-4e: yellow solid, ^1H NMR (400 MHz, CDCl_3) δ 8.96 (d, $J = 4.5$ Hz, 1H), 8.18 (d, $J = 8.4$ Hz, 1H), 7.78-7.67 (m, 1H), 7.50-7.34 (m, 4H), 7.12-7.03 (m, 2H), 7.03-6.95 (m, 1H), 6.20 (d, $J = 4.8$ Hz, 1H), 3.69 (dt, $J_1 = 9.4$ Hz, $J_2 = 5.5$ Hz, 1H), 3.11 (dd, $J_1 = 18.0$ Hz, $J_2 = 9.2$ Hz, 1H), 2.80 (dd, $J_1 = 18.0$ Hz, $J_2 = 6.0$ Hz, 1H); ^{13}C NMR (100MHz, CDCl_3) δ 175.3, 164.5 (d, $^1J_{\text{C-F}} = 247$ Hz), 150.3, 148.4, 143.9, 142.5 (d, $^3J_{\text{C-F}} = 8$ Hz), 131.3 (d, $^3J_{\text{C-F}} = 8$ Hz), 130.6, 129.7, 127.2, 124.6, 122.5, 116.3, 115.4 (d, $^2J_{\text{C-F}} = 21$ Hz), 114.1 (d, $^2J_{\text{C-F}} = 21$ Hz), 83.2, 48.5, 35.9; HRMS (EI) m/z calcd. for $\text{C}_{19}\text{H}_{14}\text{FNO}_2$ (M) $^+$ 307.1009, found 307.1010. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{minor}} = 14.30$ min, $t_{\text{major}} = 15.40$ min, ee = 91%.

(4S,5S)-4-(2-Nitrophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3H)-one (cis-4f)



Following the general procedure, the title compounds (93.2 mg, combined *cis/trans* diastereoisomers) were isolated in 62% yield. **cis-4f**: yellow solid, ^1H NMR (400 MHz, CDCl_3) δ 8.96 (d, $J = 4.5$ Hz, 1H), 8.18 (d, $J = 8.4$ Hz, 1H), 7.93 (d, $J = 7.8$ Hz, 1H), 7.83-7.76 (m, 2H), 7.72 (ddd, $J_1 = 8.3$ Hz, $J_2 = 7.0$ Hz, $J_3 = 1.2$ Hz, 1H), 7.58 (ddd, $J_1 = 8.5$ Hz, $J_2 = 6.1$ Hz, $J_3 = 2.7$ Hz, 1H), 7.47 (d, $J = 4.4$ Hz, 1H), 7.45-7.41 (m, 1H), 7.30-7.25 (m, 1H), 6.38 (d, $J = 3.2$ Hz, 1H), 4.28 (dt, $J_1 = 9.5$ Hz, $J_2 = 3.8$ Hz, 1H), 3.24 (dd, $J_1 = 18.4$ Hz, $J_2 = 9.6$ Hz, 1H), 2.75 (dd, $J_1 = 18.4$ Hz, $J_2 = 4.0$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 175.0, 150.2, 149.2, 148.4, 143.4, 135.1, 134.4, 130.8, 129.8, 129.3, 127.6, 127.4, 125.2, 124.3, 121.8, 116.1, 82.0, 42.8, 36.1; HRMS (EI) m/z calcd. for $\text{C}_{19}\text{H}_{14}\text{N}_2\text{O}_4$ (M) $^+$ 334.0954, found 334.0955. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{major}} = 31.81$ min, $t_{\text{minor}} = 45.03$ min, ee = 96%.

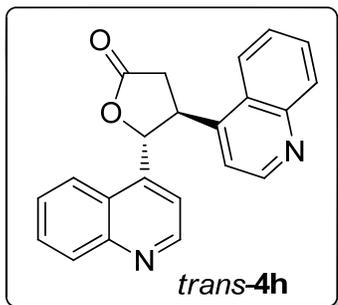
(4S,5R)-4-(2-Nitrophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3H)-one (trans-4f)



trans-4f: yellow solid, ^1H NMR (400 MHz, CDCl_3) δ 8.82 (d, $J = 4.4$ Hz, 1H), 7.99 (d, $J = 8.4$ Hz, 1H), 7.68 (d, $J = 8.4$ Hz, 1H), 7.63-7.56 (m, 1H), 7.54-7.48 (m, 1H), 7.38-7.31 (m, 2H), 7.13-7.05 (m, 2H), 6.75 (d, $J = 7.4$ Hz, 1H), 6.73-6.68 (m, 1H), 5.14 (q, $J = 8.0$ Hz, 1H), 3.19 (dd, $J_1 = 17.8$ Hz, $J_2 = 8.4$ Hz, 1H), 3.00 (dd, $J_1 = 17.6$ Hz, $J_2 = 7.6$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 175.0, 149.6, 147.7, 140.9, 132.5, 130.7, 130.2, 129.6, 128.7, 128.1, 127.1, 124.7, 124.6, 121.9, 117.5, 79.8, 40.1, 35.0; HRMS (EI) m/z calcd. for $\text{C}_{19}\text{H}_{14}\text{N}_2\text{O}_4$ (M) $^+$ 334.0954, found 334.0955. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{minor}} = 22.98$ min, $t_{\text{major}} = 27.97$ min, ee = 93%.

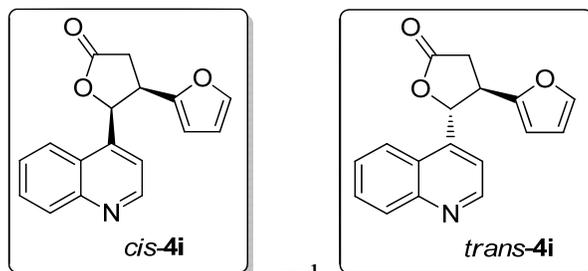
(100 MHz, CDCl₃): δ 174.8, 150.6, 150.3, 148.7, 148.4, 146.0, 143.7, 130.9, 130.8, 129.9, 129.8, 127.4, 125.8, 124.3, 122.1, 121.9, 117.5, 116.1, 81.4, 42.4, 35.5; HRMS (EI) *m/z* calcd. for C₂₂H₁₆N₂O₂ (M)⁺ 340.1212, found 340.1214. (Chiralpak AD-3, *i*-PrOH/hexane = 25/75, flow rate = 1.0 mL/min, λ = 254 nm): *t*_{minor} = 22.86 min, *t*_{major} = 30.41 min, ee = 97%.

(4*S*,5*R*)-4,5-di(Quinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4*h*)



trans-4*h*: pale yellow oil, ¹H NMR (400 MHz, CDCl₃): δ 8.59 (d, *J* = 4.6 Hz, 1H), 8.56 (d, *J* = 4.6 Hz, 1H), 7.86 (t, *J* = 8.0 Hz, 2H), 7.72-7.64 (m, 2H), 7.56 (t, *J* = 7.4 Hz, 1H), 7.48 (t, *J* = 7.4 Hz, 1H), 7.30 (t, *J* = 7.7 Hz, 1H), 7.15-7.10 (m, 2H), 6.92 (d, *J* = 4.6 Hz, 1H), 6.78 (d, *J* = 6.6 Hz, 1H), 5.26-5.17 (m, 1H), 3.41 (dd, *J*₁ = 17.6 Hz, *J*₂ = 8.2 Hz, 1H), 3.16 (dd, *J*₁ = 17.6 Hz, *J*₂ = 4.6 Hz, 1H); ¹³C NMR (100 MHz, CDCl₃): δ 175.3, 149.4, 149.3, 147.9, 147.5, 142.2, 139.9, 130.5, 130.3, 129.3, 129.3, 126.5, 126.3, 124.5, 121.7, 121.6, 118.5, 117.6, 79.5, 40.0, 35.7; HRMS (EI) *m/z* calcd. for C₂₂H₁₆N₂O₂ (M)⁺ 340.1212, found 340.1214. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, λ = 254 nm): *t*_{minor} = 33.51 min, *t*_{major} = 39.66 min, ee = 96%.

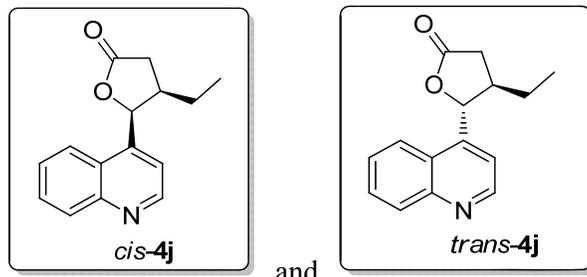
(4*R*,5*S*)-4-(Furan-2-yl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-4*i*) and (4*R*,5*R*)-4-(Furan-2-yl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4*i*)



Following the general procedure, the title compounds (44.5 mg, combined *cis/trans* diastereoisomers) were isolated in 53% yield as yellow oil. ¹H NMR (400 MHz, CDCl₃) δ 8.96 (d, *J* = 4.4 Hz, 1H), 8.73 (d, *J* = 4.4 Hz, 1H), 8.17 (d, *J* = 8.3 Hz, 1H), 8.12 (d, *J* = 8.1 Hz, 1H), 7.83 (d, *J* = 8.3 Hz, 1H), 7.77-7.73 (m, 1H), 7.73-7.70 (m, 1H), 7.63-7.57 (m, 2H), 7.55-7.51 (m, 2H), 7.50 (d, *J* = 4.2 Hz, 1H), 7.29 (d, *J* = 4.5 Hz, 1H), 6.95-6.88 (m, 1H), 6.44 (d, *J* = 6.2 Hz, 1H), 6.37 (dd, *J*₁ = 3.2 Hz, *J*₂ = 2.0 Hz, 1H), 6.29 (d, *J* = 5.3 Hz, 1H), 6.16 (d, *J* = 3.3 Hz, 1H), 5.87 (dd, *J*₁ = 3.2 Hz, *J*₂ = 2.0 Hz, 1H), 5.59 (d, *J* = 3.2 Hz, 1H), 4.45-4.35 (m, 1H), 3.83-3.74 (m, 1H), 3.23 (dd, *J*₁ = 17.2 Hz, *J*₂ = 8.4 Hz, 1H), 3.05-2.96 (m, 3H); ¹³C NMR (100 MHz, CDCl₃) δ 175.0, 174.9, 151.2, 150.3, 150.0, 149.8, 148.4, 147.7, 143.4, 143.0, 142.2, 141.2, 130.6, 130.5, 129.7, 129.2, 127.1, 126.9, 124.8, 124.7, 122.5, 121.9, 117.0, 116.4, 110.8, 110.0, 107.9, 107.8, 80.8, 80.0, 42.6, 40.4, 34.2, 33.1; (Chiralpak AD-3, *i*-PrOH/hexane = 10/90, flow rate = 1.0 mL/min, λ = 254 nm): *t*_{major} = 24.57 min, *t*_{minor} = 26.15 min, ee = 77%. (Chiralpak

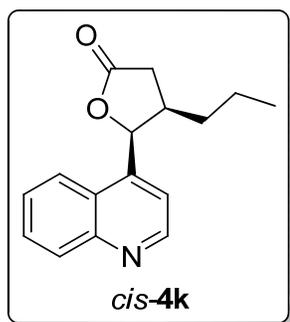
AD-3, *i*-PrOH/hexane = 10/90, flow rate = 1.0 mL/min, λ = 254 nm): t_{minor} = 43.39 min, t_{major} = 50.62 min, ee = 80%.

(4*R*,5*S*)-4-Ethyl-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-4j) and (4*R*,5*R*)-4-Ethyl-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4j)



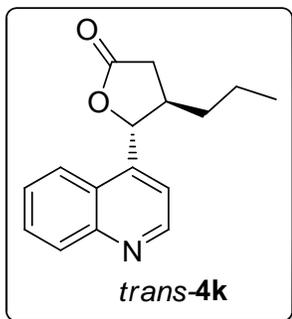
Following the general procedure, the title compounds (36.4 mg, combined *cis/trans* diastereoisomers) were isolated in 52% yield as yellow oil. ^1H NMR (400 MHz, CDCl_3) δ 8.99-8.87 (m, 2.6H), 8.20 (d, J = 8.4 Hz, 2.6H), 7.88 (d, J = 8.4 Hz, 1.6H), 7.83 (d, J = 8.4 Hz, 1H), 7.80-7.74 (m, 2.6H), 7.66-7.58 (m, 2.6H), 7.54 (dd, J_1 = 4.4 Hz, J_2 = 0.8 Hz, 1H), 7.42 (d, J = 4.0 Hz, 1.6H), 6.30 (d, J = 5.2 Hz, 1H), 5.87 (d, J = 4.8 Hz, 1.6H), 3.03-2.91 (m, 2H), 2.77 (dd, J_1 = 17.2 Hz, J_2 = 8.0 Hz, 1.6H), 2.58-2.50 (m, 1.6H), 2.42 (dd, J_1 = 17.2 Hz, J_2 = 5.6 Hz, 1.6H), 1.93-1.80 (m, 2H), 1.76-1.66 (m, 1.6H), 1.04 (t, J = 7.2 Hz, 4.8H), 0.92-0.79 (m, 2.6H), 0.70 (t, J = 7.2 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 176.3, 175.7, 150.3, 150.2, 148.4, 148.0, 144.1, 141.6, 130.8, 130.7, 129.6, 129.5, 127.2, 127.1, 125.1, 124.8, 122.4, 121.9, 117.6, 116.9, 82.1, 80.6, 44.7, 41.2, 34.3, 33.3, 26.4, 21.9, 11.6, 11.5; (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, λ = 254 nm): t_{major} = 14.29 min, t_{minor} = 15.48 min, ee = 87%. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, λ = 254 nm): t_{minor} = 14.63 min, t_{major} = 17.10 min, ee = 57%.

(4*R*,5*S*)-4-Propyl-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-4k)



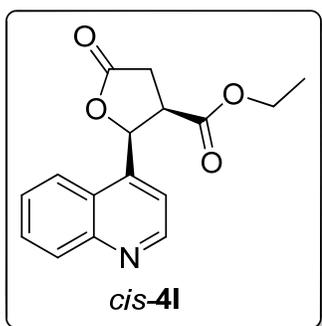
Following the general procedure, the title compounds (36.5 mg, combined *cis/trans* diastereoisomers) were isolated in 52% yield. *cis*-4k: yellow oil, ^1H NMR (400 MHz, CDCl_3) δ 8.96 (d, J = 4.4 Hz, 1H), 8.21 (d, J = 8.4 Hz, 1H), 7.87-7.73 (m, 2H), 7.67-7.56 (m, 1H), 7.54 (d, J = 4.4 Hz, 1H), 6.29 (d, J = 6.1 Hz, 1H), 3.11-3.01 (m, 1H), 3.01-2.90 (m, 1H), 2.63 (dd, J_1 = 17.2 Hz, J_2 = 2.4 Hz, 1H), 1.27-1.20 (m, 1H), 1.05-0.95 (m, 1H), 0.91-0.81 (m, 1H), 0.75-0.67 (m, 1H), 0.65 (t, J = 7.3 Hz, 3H); ^{13}C NMR (100 MHz, CDCl_3) δ 175.8, 150.4, 148.0, 141.6, 130.8, 129.5, 127.2, 124.8, 121.9, 117.7, 80.6, 39.3, 34.8, 30.7, 20.1, 13.6; HRMS (EI) m/z calcd. for $\text{C}_{16}\text{H}_{17}\text{NO}_2$ (M) $^+$ 255.1259, found 255.1260. (Chiralpak OD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, λ = 254 nm): t_{major} = 12.56 min, t_{minor} = 16.34 min, ee = 96 %.

(4*R*,5*R*)-4-Propyl-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4k)



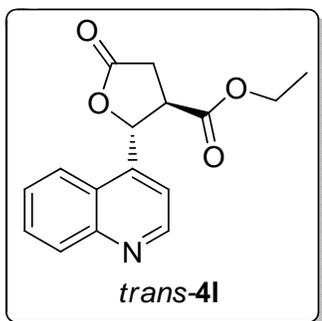
trans-4k: yellow oil, $^1\text{H NMR}$ (400 MHz, CDCl_3) δ 8.95 (d, $J = 4.5$ Hz, 1H), 8.20 (d, $J = 8.4$ Hz, 1H), 7.88 (d, $J = 8.3$ Hz, 1H), 7.83-7.74 (m, 1H), 7.69-7.59 (m, 1H), 7.42 (d, $J = 4.5$ Hz, 1H), 5.86 (d, $J = 4.8$ Hz, 1H), 2.77 (dd, $J_1 = 17.4$ Hz, $J_2 = 8.0$ Hz, 1H), 2.65-2.56 (m, 1H), 2.42 (dd, $J_1 = 17.4$ Hz, $J_2 = 6.0$ Hz, 1H), 1.82-1.72 (m, 1H), 1.68-1.59 (m, 1H), 1.55-1.43 (m, 1H), 1.41-1.30 (m, 1H), 0.95 (t, $J = 7.2$ Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3) δ 176.3, 150.3, 148.5, 144.1, 130.8, 129.6, 127.3, 125.1, 122.5, 117.0, 82.4, 43.1, 35.5, 33.8, 20.5, 13.9; HRMS (EI) m/z calcd. for $\text{C}_{16}\text{H}_{17}\text{NO}_2$ (M) $^+$ 255.1259, found 255.1260. (Chiralpak AD-3, *i*-PrOH/hexane = 15/85, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{minor}} = 24.72$ min, $t_{\text{major}} = 26.67$ min, ee = 71%.

Ethyl (2*S*,3*R*)-5-oxo-2-(quinolin-4-yl)tetrahydrofuran-3-carboxylate (*cis*-4l)



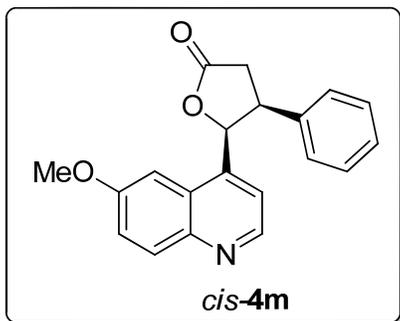
Following the general procedure, the title compounds (60.0 mg, combined *cis/trans* diastereoisomers) were isolated in 58% yield. *cis-4l*: pale yellow solid, $^1\text{H NMR}$ (400 MHz, CDCl_3): δ 8.95 (d, $J = 4.4$ Hz, 1H), 8.21 (d, $J = 8.4$ Hz, 1H), 8.02 (d, $J = 8.4$ Hz, 1H), 7.80 (t, $J = 7.6$ Hz, 1H), 7.65 (t, $J = 7.6$ Hz, 1H), 7.43 (d, $J = 4.4$ Hz, 1H), 6.50 (d, $J = 3.8$ Hz, 1H), 4.34 (q, $J = 7.2$ Hz, 2H), 3.40 (dt, $J_1 = 9.1$ Hz, $J_2 = 4.4$ Hz, 1H), 3.07 (dd, $J_1 = 18.0$ Hz, $J_2 = 4.8$ Hz, 1H), 2.82 (dd, $J_1 = 18.0$ Hz, $J_2 = 9.6$ Hz, 1H), 1.31 (t, $J = 7.2$ Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3): δ 174.3, 170.8, 150.2, 148.4, 143.4, 130.8, 129.8, 127.5, 124.3, 122.4, 116.4, 78.5, 62.5, 47.2, 30.5, 14.0; HRMS (EI) m/z calcd. for $\text{C}_{16}\text{H}_{15}\text{NO}_4$ (M) $^+$ 285.1001, found 285.1002. (Chiralpak OD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{minor}} = 30.88$ min, $t_{\text{major}} = 33.45$ min, ee = 79%.

Ethyl (2*R*,3*R*)-5-oxo-2-(quinolin-4-yl)tetrahydrofuran-3-carboxylate (*trans*-4l)



trans-4l: pale yellow solid, $^1\text{H NMR}$ (400 MHz, CDCl_3): δ 8.93 (d, $J = 4.4$ Hz, 1H), 8.19 (d, $J = 8.4$ Hz, 1H), 7.87 (d, $J = 8.4$ Hz, 1H), 7.78 (t, $J = 7.2$ Hz, 1H), 7.65 (t, $J = 7.6$ Hz, 1H), 7.53 (d, $J = 4.4$ Hz, 1H), 6.45 (d, $J = 7.2$ Hz, 1H), 3.98 (td, $J_1 = 8.3$ Hz, $J_2 = 2.7$ Hz, 1H), 3.54-3.46 (m, 1H), 3.38-3.30 (m, 1H), 3.12 (dd, $J_1 = 17.6$ Hz, $J_2 = 2.7$ Hz, 1H), 3.00 (dd, $J_1 = 17.6$ Hz, $J_2 = 8.4$ Hz, 1H), 0.41 (t, $J = 7.2$ Hz, 3H); $^{13}\text{C NMR}$ (100 MHz, CDCl_3): δ 174.0, 169.5, 150.2, 147.9, 140.5, 130.6, 129.5, 127.2, 124.8, 122.1, 117.4, 77.4, 61.1, 45.8, 32.4, 13.0; HRMS (EI) m/z calcd. for $\text{C}_{16}\text{H}_{15}\text{NO}_4$ (M) $^+$ 285.1001, found 285.1002. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{minor}} = 16.61$ min, $t_{\text{major}} = 19.98$ min, ee = 80%.

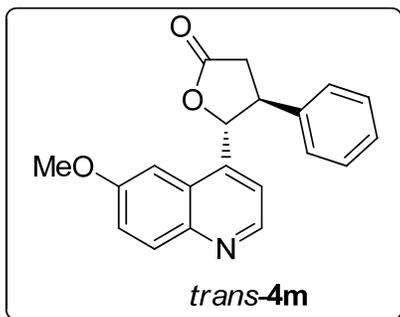
(4*S*,5*S*)-5-(6-Methoxyquinolin-4-yl)-4-phenyldihydrofuran-2(3*H*)-one (cis-4m)



Following the general procedure, the title compounds (49.8 mg, combined *cis/trans* diastereoisomers) were isolated in 60% yield. *cis-4m*: pale yellow solid, ¹H NMR (400 MHz, CDCl₃) δ 8.51 (d, *J* = 4.6 Hz, 1H), 7.95 (d, *J* = 9.2 Hz, 1H), 7.34 (dd, *J*₁ = 9.2, *J*₂ = 2.6 Hz, 1H), 7.15 (d, *J* = 4.5 Hz, 1H), 6.97-6.94 (m, 2H), 6.94-6.87 (m, 2H), 6.68 (d, *J* = 7.2 Hz, 2H), 6.45 (d, *J* = 6.4 Hz, 1H), 4.34-4.29 (m, 1H), 3.97 (s, 3H), 3.32 (dd, *J*₁ = 17.6 Hz, *J*₂ = 8.4 Hz, 1H), 3.02 (dd,

*J*₁ = 17.6 Hz, *J*₂ = 3.6 Hz, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 176.0, 157.8, 147.3, 143.7, 139.6, 136.6, 132.0, 128.3, 127.8, 127.2, 125.6, 121.1, 117.9, 100.9, 81.1, 55.7, 45.8, 36.4; HRMS (EI) *m/z* calcd. for C₂₀H₁₇NO₃ (M)⁺ 319.1208, found 319.1211. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, λ = 254 nm): *t*_{minor} = 20.55 min, *t*_{major} = 29.77 min, ee = 94%.

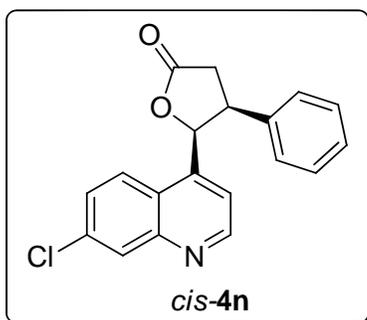
(4*S*,5*R*)-5-(6-Methoxyquinolin-4-yl)-4-phenyldihydrofuran-2(3*H*)-one (trans-4m)



trans-4m: pale yellow oil, ¹H NMR (400 MHz, CDCl₃) δ 8.82 (d, *J* = 4.4 Hz, 1H), 8.04 (d, *J* = 9.2 Hz, 1H), 7.48 (d, *J* = 4.5 Hz, 1H), 7.44-7.29 (m, 6H), 6.48 (d, *J* = 2.6 Hz, 1H), 6.16 (d, *J* = 5.2 Hz, 1H), 3.70-3.64 (m, 1H), 3.51 (s, 3H), 3.15 (dd, *J*₁ = 18.0 Hz, *J*₂ = 9.2 Hz, 1H), 2.85 (dd, *J*₁ = 18.0 Hz, *J*₂ = 6.8 Hz, 1H); ¹³C NMR (100 MHz, CDCl₃) δ 175.7, 158.0, 147.7, 144.5, 140.5, 131.9, 129.6, 128.3, 127.0, 125.6, 122.5, 116.3, 100.7, 83.7, 55.2, 48.9, 36.5; HRMS (EI) *m/z*

calcd. for C₂₀H₁₇NO₃ (M)⁺ 319.1208, found 319.1211. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, λ = 254 nm): *t*_{major} = 15.32 min, *t*_{minor} = 20.50 min, ee = 95%.

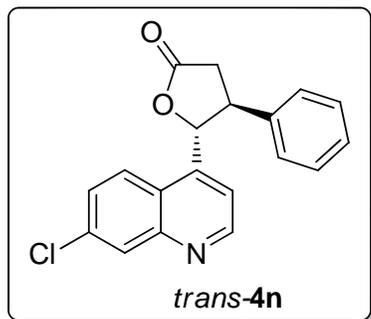
(4*S*,5*S*)-5-(7-Chloroquinolin-4-yl)-4-phenyldihydrofuran-2(3*H*)-one (cis-4n)



Following the general procedure, the title compounds (59.2 mg, combined *cis/trans* diastereoisomers) were isolated in 59% yield. *cis-4n*: yellow oil, ¹H NMR (400 MHz, CDCl₃) δ 8.64 (d, *J* = 4.4 Hz, 1H), 8.04 (d, *J* = 2.0 Hz, 1H), 7.76 (d, *J* = 9.2 Hz, 1H), 7.52 (dd, *J*₁ = 8.8 Hz, *J*₂ = 2.0 Hz, 1H), 7.19 (d, *J* = 4.4 Hz, 1H), 7.04-6.85 (m, 3H), 6.64 (d, *J* = 7.2 Hz, 2H), 6.48 (d, *J* = 6.4 Hz, 1H), 4.31-4.27 (m, 1H), 3.34 (dd, *J*₁ = 18.0 Hz, *J*₂ = 8.4

Hz, 1H), 3.01 (dd, $J_1 = 18.0$ Hz, $J_2 = 2.8$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 175.8, 151.0, 148.1, 141.5, 136.5, 135.1, 129.5, 128.4, 127.9, 127.1, 123.4, 123.0, 117.9, 80.9, 46.1, 36.5; HRMS (EI) m/z calcd. for $\text{C}_{19}\text{H}_{14}\text{NO}_2\text{Cl}$ (M^+) 323.0713, found 323.0717. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{minor}} = 12.99$ min, $t_{\text{major}} = 16.70$ min, ee = 70%.

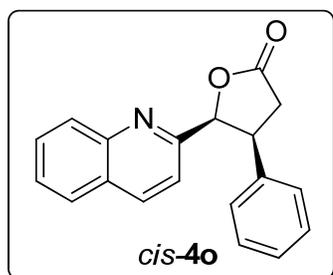
(4*S*,5*R*)-5-(7-Chloroquinolin-4-yl)-4-phenyldihydrofuran-2(3*H*)-one (*trans*-4n)



trans-4n: yellow oil, ^1H NMR (400 MHz, CDCl_3) δ 8.96 (d, $J = 4.4$ Hz, 1H), 8.15 (d, $J = 2.0$ Hz, 1H), 7.50 (d, $J = 4.5$ Hz, 1H), 7.43-7.35 (m, 3H), 7.35-7.30 (m, 1H), 7.26-7.20 (m, 3H), 6.14 (d, $J = 5.6$ Hz, 1H), 3.63 (dt, $J_1 = 8.9$ Hz, $J_2 = 6.5$ Hz, 1H), 3.13 (dd, $J_1 = 18.0$ Hz, $J_2 = 9.2$ Hz, 1H), 2.88 (dd, $J_1 = 18.0$ Hz, $J_2 = 7.2$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 175.4, 151.4, 148.9, 144.4, 139.4, 135.6, 129.7, 129.4, 128.5, 127.9, 126.9, 124.2, 116.6, 83.4, 49.3, 36.3; HRMS (EI) m/z calcd. for $\text{C}_{19}\text{H}_{14}\text{NO}_2\text{Cl}$

(M^+) 323.0713, found 323.0717. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{minor}} = 12.76$ min, $t_{\text{major}} = 16.24$ min, ee = 87%.

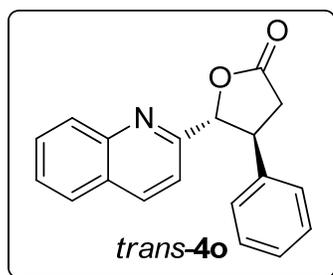
(4*S*,5*S*)-4-Phenyl-5-(quinolin-2-yl)dihydrofuran-2(3*H*)-one (*cis*-4o)



Following the general procedure, the title compounds (67.8 mg, combined *cis/trans* diastereoisomers) were isolated in 58% yield. *cis*-4o: pale yellow solid, ^1H NMR (400 MHz, CDCl_3) δ 8.21 (d, $J = 8.5$ Hz, 1H), 8.07 (d, $J = 8.5$ Hz, 1H), 7.84 (d, $J = 8.1$ Hz, 1H), 7.74 (ddd, $J_1 = 8.4$ Hz, $J_2 = 6.9$ Hz, $J_3 = 1.4$ Hz, 1H), 7.60-7.54 (m, 1H), 7.50 (d, $J = 8.5$ Hz, 1H), 7.39-7.28 (m, 5H), 5.70 (d, $J = 6.0$ Hz, 1H), 4.34-4.22 (m, 1H), 3.22 (dd, $J_1 = 17.7$ Hz, $J_2 = 9.0$ Hz, 1H), 2.88 (dd, $J_1 = 17.7$

Hz, $J_2 = 7.6$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 174.0, 155.0, 145.7, 138.1, 135.3, 128.0, 127.6, 127.1, 125.9, 125.7, 125.2, 125.1, 117.1, 85.7, 44.5, 34.3; HRMS (EI) m/z calcd. for $\text{C}_{19}\text{H}_{15}\text{NO}_2$ (M^+) 289.1103, found 289.1104. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{major}} = 14.16$ min, $t_{\text{minor}} = 24.06$ min, ee = 99%.

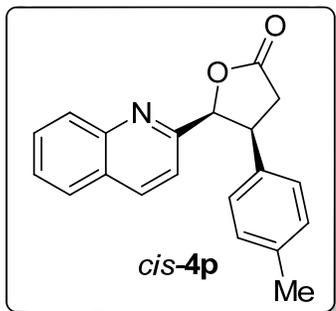
(4*S*,5*R*)-4-Phenyl-5-(quinolin-2-yl)dihydrofuran-2(3*H*)-one (*trans*-4o)



trans-4o: pale yellow solid, ^1H NMR (400 MHz, CDCl_3) δ 8.02 (d, $J = 8.4$ Hz, 1H), 7.81 (d, $J = 8.4$ Hz, 1H), 7.73-7.64 (m, 2H), 7.49 (t, $J = 7.5$ Hz, 1H), 7.04-6.94 (m, 3H), 6.91 (d, $J = 8.5$ Hz, 1H), 6.87-6.80 (m, 2H), 6.00 (d, $J = 6.8$ Hz, 1H), 4.31 (dd, $J_1 = 13.8$, $J_2 = 6.8$ Hz, 1H), 3.16 (qd, $J_1 = 17.3$, $J_2 = 6.9$ Hz, 2H); ^{13}C NMR (100 MHz, CDCl_3) δ 177.0, 156.3, 147.2, 136.7,

136.0, 129.7, 129.0, 128.3, 127.7, 127.6, 127.3, 127.2, 126.6, 118.5, 85.2, 46.3, 35.0; HRMS (EI) m/z calcd. for $C_{19}H_{15}NO_2$ (M)⁺ 289.1103, found 289.1104. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, λ = 254 nm): t_{minor} = 10.35 min, t_{major} = 14.29 min, ee = 98%.

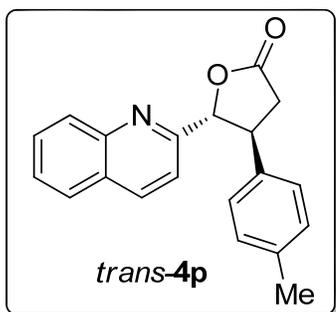
(4*S*,5*S*)-5-(Quinolin-2-yl)-4-(*p*-tolyl)dihydrofuran-2(3*H*)-one (*cis*-4*p*)



Following the general procedure, the title compounds (58.0 mg, combined *cis/trans* diastereoisomers) were isolated in 55% yield. *cis*-4*p*: pale yellow solid, ¹H NMR (400 MHz, CDCl₃): δ 8.19 (d, J = 8.4 Hz, 1H), 8.07 (d, J = 8.4 Hz, 1H), 7.83 (d, J = 8.4 Hz, 1H), 7.72 (t, J = 7.7 Hz, 1H), 7.55 (t, J = 7.5 Hz, 1H), 7.48 (d, J = 8.4 Hz, 1H), 7.17 (q, J = 8.1 Hz, 4H), 5.66 (d, J = 6.0 Hz, 1H), 4.21 (dd, J_1 = 14.9 Hz, J_2 = 8.2 Hz, 1H), 3.18 (dd, J_1 = 17.6 Hz, J_2 = 9.0 Hz, 1H), 2.85 (dd, J_1 = 17.6 Hz, J_2 = 8.0 Hz, 1H), 2.32 (s, 3H); ¹³C NMR (100 MHz,

CDCl₃): δ 176.1, 157.0, 147.7, 137.3, 137.2, 136.8, 129.9, 129.7, 129.6, 127.8, 127.6, 127.1, 127.0, 119.1, 87.8, 46.2, 36.4, 21.1; HRMS (EI) m/z calcd. for $C_{20}H_{17}NO_2$ (M)⁺ 303.1259, found 303.1260. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, λ = 254 nm): t_{major} = 13.71 min, t_{minor} = 23.28 min, ee = 99%.

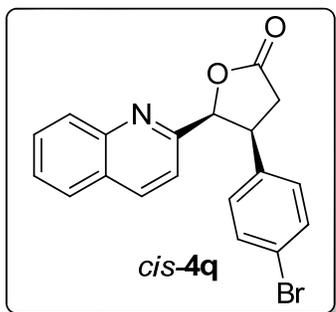
(4*S*,5*R*)-5-(Quinolin-2-yl)-4-(*p*-tolyl)dihydrofuran-2(3*H*)-one (*trans*-4*p*)



trans-4*p*: pale yellow oil, ¹H NMR (400 MHz, CDCl₃): δ 8.03 (d, J = 8.8 Hz, 1H), 7.83 (d, J = 8.8 Hz, 1H), 7.73-7.66 (m, 2H), 7.53-7.46 (m, 1H), 6.92 (d, J = 8.4 Hz, 1H), 6.81-6.70 (m, 4H), 5.97 (d, J = 6.8 Hz, 1H), 4.33-4.20 (m, 1H), 3.13 (qd, J_1 = 17.3, J_2 = 6.9 Hz, 2H), 2.12 (s, 3H); ¹³C NMR (100 MHz, CDCl₃): δ 177.1, 156.4, 147.2, 136.9, 136.0, 133.5, 129.6, 129.1, 128.9, 127.6, 127.5, 127.3, 126.5, 118.7, 85.3, 46.0, 35.2, 20.8; HRMS (EI) m/z calcd. for $C_{20}H_{17}NO_2$ (M)⁺ 303.1259, found 303.1260. (Chiralpak AD-3, *i*-

PrOH/hexane = 20/80, flow rate = 1.0 mL/min, λ = 254 nm): t_{minor} = 10.22 min, t_{major} = 14.51 min, ee = 98%.

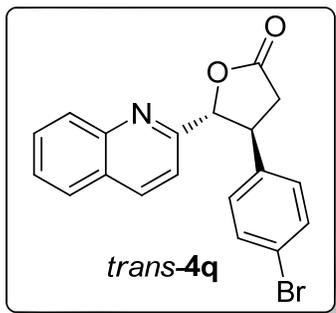
(4*S*,5*S*)-4-(4-Bromophenyl)-5-(quinolin-2-yl)dihydrofuran-2(3*H*)-one (*cis*-4*q*)



Following the general procedure, the title compounds (88.0 mg, combined *cis/trans* diastereoisomers) were isolated in 52% yield. *cis*-4*q*: pale yellow solid, ¹H NMR (400 MHz, CDCl₃): δ 8.22 (d, J = 8.4 Hz, 1H), 8.06 (d, J = 8.4 Hz, 1H), 7.84 (d, J = 8.0 Hz, 1H), 7.74 (t, J = 7.7 Hz, 1H), 7.57 (t, J = 7.5 Hz, 1H), 7.53-7.44 (m, 3H), 7.21 (d, J = 8.4 Hz, 2H), 5.64 (d, J = 6.2 Hz, 1H), 4.26 (dd, J_1 = 15.1 Hz, J_2 = 8.0 Hz, 1H), 3.19 (dd, J_1 = 17.6 Hz, J_2 = 8.8 Hz, 1H), 2.84 (dd, J_1 = 17.6 Hz,

$J_2 = 8.0$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 175.5, 156.6, 147.6, 138.9, 137.4, 132.2, 130.1, 129.5, 129.0, 127.8, 127.6, 127.2, 121.5, 118.9, 87.3, 45.9, 36.1; HRMS (EI) m/z calcd. for $\text{C}_{19}\text{H}_{14}\text{BrNO}_2$ (M) $^+$ 367.0208, found 367.0207. (Chiralpak OD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{minor}} = 21.65$ min, $t_{\text{major}} = 23.18$ min, ee = 98%.

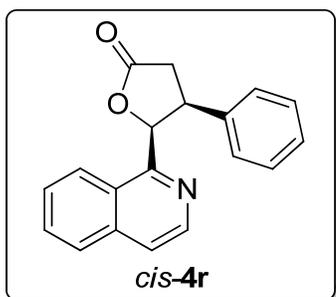
(4*S*,5*R*)-4-(4-Bromophenyl)-5-(quinolin-2-yl)dihydrofuran-2(3*H*)-one (*trans*-4q)



trans-4q: pale yellow solid, ^1H NMR (400 MHz, CDCl_3): δ 8.01 (d, $J = 8.2$ Hz, 1H), 7.90 (d, $J = 8.4$ Hz, 1H), 7.75-7.67 (m, 2H), 7.55-7.48 (m, 1H), 7.16-7.05 (m, 2H), 6.97 (d, $J = 8.8$ Hz, 1H), 6.78-6.70 (m, 2H), 5.98 (d, $J = 6.8$ Hz, 1H), 4.34-4.22 (m, 1H), 3.14 (d, $J = 6.8$ Hz, 2H); ^{13}C NMR (100 MHz, CDCl_3): δ 176.4, 155.9, 147.2, 136.4, 135.9, 131.4, 129.9, 129.3, 129.0, 127.7, 127.3, 126.7, 121.3, 118.4, 84.7, 45.8, 35.0; HRMS (EI) m/z calcd. for $\text{C}_{19}\text{H}_{14}\text{BrNO}_2$ (M) $^+$ 367.0208, found 367.0207. (Chiralpak OD-3, *i*-

PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{major}} = 16.37$ min, $t_{\text{minor}} = 19.94$ min, ee = 98%.

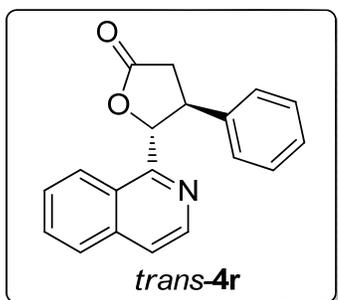
(4*S*,5*S*)-5-(Isoquinolin-1-yl)-4-phenyldihydrofuran-2(3*H*)-one (*cis*-4r)



Following the general procedure, the title compounds (74.0 mg, combined *cis/trans* diastereoisomers) were isolated in 61% yield. *cis*-4r: pale yellow solid, ^1H NMR (400 MHz, CDCl_3) δ 8.57 (d, $J = 5.6$ Hz, 1H), 8.10 (d, $J = 8.5$ Hz, 1H), 7.87 (d, $J = 8.2$ Hz, 1H), 7.75-7.60 (m, 2H), 7.64-7.56 (m, 1H), 7.40-7.33 (m, 4H), 7.32-7.27 (m, 1H), 6.31 (d, $J = 5.2$ Hz, 1H), 4.63 (ddd, $J_1 = 9.2$ Hz, $J_2 = 6.6$ Hz, $J_3 = 5.5$ Hz, 1H), 3.34 (dd, $J_1 = 18.0$ Hz, $J_2 = 9.2$ Hz, 1H), 2.89 (dd, $J_1 = 18.0$, $J_2 = 6.8$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 176.4,

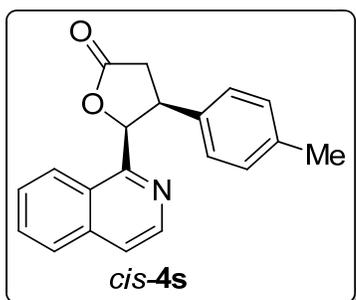
154.5, 141.7, 140.9, 136.6, 130.4, 129.2, 128.0, 127.6, 127.5, 127.2, 126.8, 124.2, 121.9, 83.9, 44.0, 36.3; HRMS (EI) m/z calcd. for $\text{C}_{19}\text{H}_{15}\text{NO}_2$ (M) $^+$ 289.1103, found 289.1102. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{major}} = 14.87$ min, $t_{\text{minor}} = 24.59$ min, ee = 96%.

(4*S*,5*R*)-5-(Isoquinolin-1-yl)-4-phenyldihydrofuran-2(3*H*)-one (*trans*-4r)



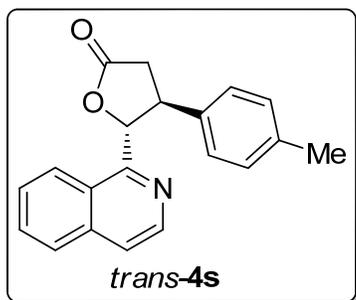
trans-4r: yellow oil, ^1H NMR (400 MHz, CDCl_3) δ 8.54 (d, $J = 5.6$ Hz, 1H), 7.66 (d, $J = 8.3$ Hz, 1H), 7.62 (d, $J = 8.6$ Hz, 1H), 7.56-7.44 (m, 2H), 7.31 (t, $J = 7.7$ Hz, 1H), 6.89-6.78 (m, 3H), 6.77-6.68 (m, 2H), 6.63 (d, $J = 8.0$ Hz, 1H), 4.47-4.34 (m, 1H), 3.44 (dd, $J_1 = 17.2$ Hz, $J_2 = 12.0$ Hz, 1H), 2.88 (dd, $J_1 = 17.2$ Hz, $J_2 = 8.4$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3) δ 177.4, 154.6, 141.5, 135.7, 135.2, 129.7, 128.0, 127.7, 127.4, 127.1, 127.0, 126.4, 123.3, 121.0, 79.4, 47.3, 32.9; HRMS (EI) m/z calcd. for $\text{C}_{19}\text{H}_{15}\text{NO}_2$ (M) $^+$ 289.1103, found 289.1102. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{major}} = 12.38$ min, $t_{\text{minor}} = 15.03$ min, ee = 89%.

(4S,5S)-5-(Isoquinolin-1-yl)-4-(p-tolyl)dihydrofuran-2(3H)-one (cis-4s)



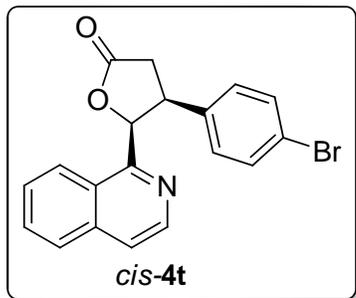
Following the general procedure, the title compounds (109.0 mg, combined *cis/trans* diastereoisomers) were isolated in 77% yield. **cis-4s**: pale yellow solid, ^1H NMR (400 MHz, CDCl_3): δ 8.55 (d, $J = 5.6$ Hz, 1H), 8.09 (d, $J = 8.4$ Hz, 1H), 7.85 (d, $J = 8.2$ Hz, 1H), 7.71-7.63 (m, 2H), 7.58 (ddd, $J_1 = 8.2$ Hz, $J_2 = 7.0$ Hz, $J_3 = 1.1$ Hz, 1H), 7.24-7.20 (m, 2H), 7.16 (d, $J = 8.0$ Hz, 1H), 6.27 (d, $J = 5.2$ Hz, 1H), 4.60-4.52 (m, 1H), 3.30 (dd, $J_1 = 17.6$ Hz, $J_2 = 9.2$ Hz, 1H), 2.85 (dd, $J_1 = 17.6$ Hz, $J_2 = 6.8$ Hz, 1H), 2.32 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3): δ 176.4, 154.6, 141.7, 137.8, 137.3, 136.5, 130.3, 129.8, 127.9, 127.5, 127.0, 126.8, 124.2, 121.7, 84.0, 43.7, 36.4, 21.0; HRMS (EI) m/z calcd. for $\text{C}_{20}\text{H}_{17}\text{NO}_2$ (M) $^+$ 303.1259, found 303.1258. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{major}} = 15.32$ min, $t_{\text{minor}} = 20.67$ min, ee = 98%.

(4S,5R)-5-(Isoquinolin-1-yl)-4-(p-tolyl)dihydrofuran-2(3H)-one (trans-4s)



trans-4s: pale yellow solid, ^1H NMR (400 MHz, CDCl_3): δ 8.53 (d, $J = 5.6$ Hz, 1H), 7.67 (d, $J = 8.3$ Hz, 1H), 7.64 (d, $J = 8.7$ Hz, 1H), 7.55-7.45 (m, 2H), 7.31 (ddd, $J_1 = 8.3$ Hz, $J_2 = 6.9$ Hz, $J_3 = 1.2$ Hz, 1H), 6.69-6.53 (m, 5H), 4.36 (dt, $J_1 = 12.0$ Hz, $J_2 = 8.3$ Hz, 1H), 3.42 (dd, $J_1 = 17.2$ Hz, $J_2 = 12.0$ Hz, 1H), 2.85 (dd, $J_1 = 17.2$ Hz, $J_2 = 8.4$ Hz, 1H), 2.00 (s, 3H); ^{13}C NMR (100 MHz, CDCl_3): δ 177.4, 154.8, 141.5, 136.9, 135.6, 132.1, 129.5, 128.6, 127.5, 127.0, 126.9, 126.4, 123.3, 120.9, 79.4, 46.9, 33.0, 20.7; HRMS (EI) m/z calcd. for $\text{C}_{20}\text{H}_{17}\text{NO}_2$ (M) $^+$ 303.1259, found 303.1258. (Chiralpak OD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{major}} = 16.63$ min, $t_{\text{minor}} = 33.72$ min, ee = 95%.

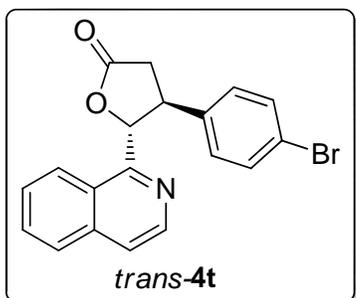
(4*S*,5*S*)-4-(4-Bromophenyl)-5-(isoquinolin-1-yl)dihydrofuran-2(3*H*)-one (*cis*-4t)



Following the general procedure, the title compounds (108.0 mg, combined *cis/trans* diastereoisomers) were isolated in 67% yield. *cis*-4t: yellow oil, ^1H NMR (400 MHz, CDCl_3): δ 8.55 (d, $J = 5.6$ Hz, 1H), 8.11 (d, $J = 8.4$ Hz, 1H), 7.88 (d, $J = 8.2$ Hz, 1H), 7.76-7.66 (m, 2H), 7.62 (t, $J = 7.6$ Hz, 1H), 7.48 (d, $J = 8.4$ Hz, 2H), 7.25-7.20 (m, 2H), 6.23 (d, $J = 5.6$ Hz, 1H), 4.73-4.59 (m, 1H), 3.32 (dd, $J_1 = 17.6$ Hz, $J_2 = 9.2$ Hz, 1H), 2.85 (dd, $J_1 = 17.6$ Hz, $J_2 = 7.2$ Hz,

1H); ^{13}C NMR (100 MHz, CDCl_3): δ 175.8, 153.9, 141.6, 139.7, 136.6, 132.2, 130.4, 128.9, 128.0, 127.5, 126.8, 124.2, 122.0, 121.5, 83.6, 43.2, 36.1; HRMS (EI) m/z calcd. for $\text{C}_{19}\text{H}_{14}\text{BrNO}_2$ (M) $^+$ 367.0208, found 367.0211. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{major}} = 18.70$ min, $t_{\text{minor}} = 31.90$ min, ee = 98%.

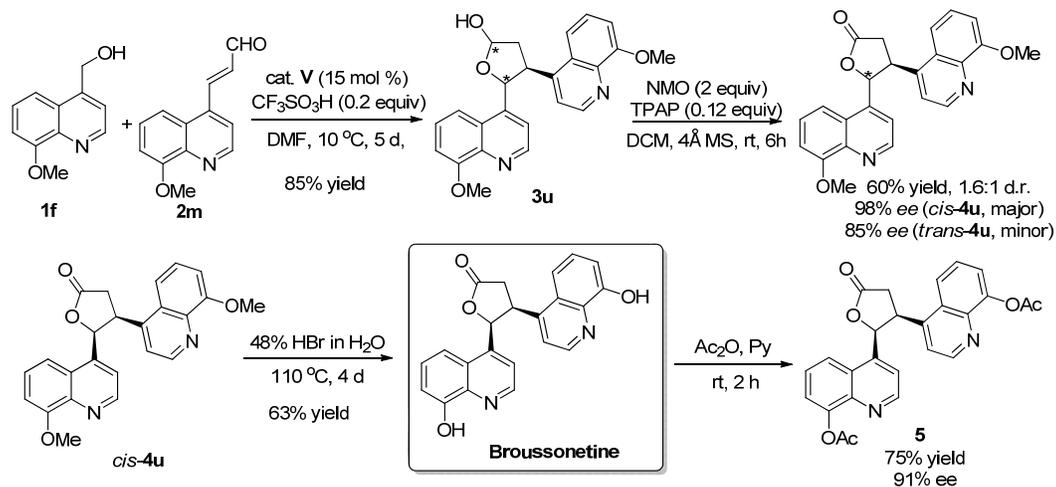
(4*S*,5*R*)-4-(4-Bromophenyl)-5-(isoquinolin-1-yl)dihydrofuran-2(3*H*)-one (*trans*-4t)



trans-4t: yellow oil, ^1H NMR (400 MHz, CDCl_3): δ 8.53 (d, $J = 5.6$ Hz, 1H), 7.72 (d, $J = 8.2$ Hz, 1H), 7.67 (d, $J = 8.6$ Hz, 1H), 7.60-7.49 (m, 2H), 7.42-7.34 (m, 1H), 6.98 (d, $J = 8.4$ Hz, 2H), 6.68-6.57 (m, 3H), 4.36 (dt, $J_1 = 11.8$ Hz, $J_2 = 8.3$ Hz, 1H), 3.41 (dd, $J_1 = 16.8$ Hz, $J_2 = 12.0$ Hz, 1H), 2.89 (dd, $J_1 = 16.8$ Hz, $J_2 = 8.4$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 176.8, 154.3, 141.5, 135.7, 134.4, 131.0, 129.9, 129.3, 127.4, 127.3, 126.3, 123.0, 121.3, 121.2, 78.9, 46.6, 33.0; HRMS (EI) m/z calcd. for $\text{C}_{19}\text{H}_{14}\text{BrNO}_2$ (M) $^+$

367.0208, found 367.0211. (Chiralpak OD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{major}} = 24.82$ min, $t_{\text{minor}} = 35.99$ min, ee = 98%.

VI. Synthetic procedure of Broussonetine

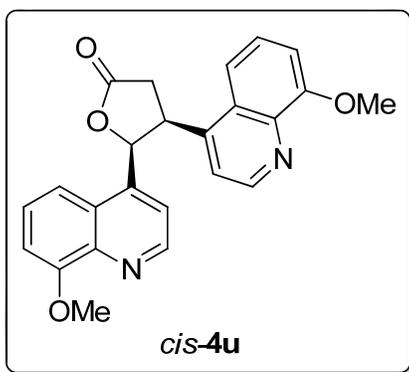


Scheme S7. Procedure for the synthesis of broussonetine

Synthesis of (4*S*,5*S*)-4,5-bis(8-Methoxyquinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-**4u**) and (4*S*,5*R*)-4,5-bis(8-Methoxyquinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-**4u**)

A screw cap glass vial equipped with a magnetic stirring bar was charged with (8-methoxyquinolin-4-yl)methanol **1f** (94.5 mg, 0.5 mmol), CF₃SO₃H (15 mg, 0.1 mmol) and DMF (0.2 mL) and the solution was stirred for 5 min at rt. Then catalyst **V** (27.5 mg, 0.075 mmol) was added into the solution and the resulting mixture was stirred for 5 min at 10 °C. Subsequently, (*E*)-3-(8-methoxyquinolin-4-yl)acrylaldehyde **2m** (160 mg, 0.75 mmol) was added into the mixture and the reaction was stirred at 10 °C for 5 d. After the starting material was consumed, the reaction was diluted with saturated aq. Na₂CO₃ (2 mL) and extracted with EtOAc (5 mL × 3). The combined organic extracts were washed with brine, dried with Na₂SO₄, and concentrated in vacuo. The residue was purified by flash column chromatography on neutral Al₂O₃ (pure DCM to DCM:MeOH = 100:1) to give the hemiacetal intermediate **3u** in 85% yield (170 mg). To a solution of the hemiacetal intermediate **3u** (170 mg, 0.425 mmol) in anhydrous DCM (4 mL) was added tetrapropylammonium perruthenate (TPAP) (17.9 mg, 0.051 mmol), 4-methylmorpholine *N*-oxide (NMO) (99.5 mg, 0.85 mmol) and 4 Å molecular sieves. The reaction was stirred at rt and monitored by TLC. After the hemiacetal intermediate **3u** was consumed, the mixture was filtered and concentrated in vacuo. The residue was purified by flash column chromatography on silica gel (DCM/MeOH = 100:1 – 50:1) to give the mixture of *cis*-**4u** and *trans*-**4u** in 60% yield (102 mg). The less polar compound is the *cis*-product *cis*-**4u**. The more polar compound is the *trans*-product *trans*-**4u**.

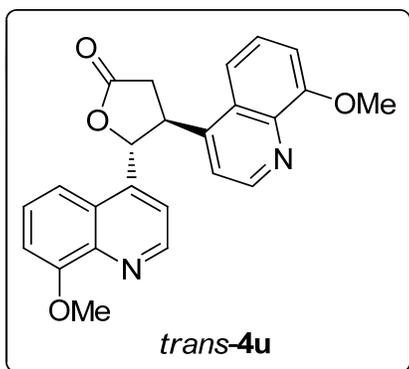
(4*S*,5*S*)-4,5-bis(8-Methoxyquinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-**4u**)



cis-4u: pale yellow oil, ^1H NMR (400 MHz, CDCl_3): δ 9.05 (d, $J = 4.4$ Hz, 1H), 9.01 (d, $J = 4.4$ Hz, 1H), 7.65 (d, $J = 4.4$ Hz, 1H), 7.57 (d, $J = 4.4$ Hz, 1H), 7.41 (t, $J = 8.4$ Hz, 1H), 7.23 (t, $J = 8.4$ Hz, 2H), 7.11 (d, $J = 7.6$ Hz, 1H), 7.04 (d, $J = 8.0$ Hz, 1H), 6.84 (d, $J = 8.4$ Hz, 1H), 6.52 (d, $J = 2.8$ Hz, 1H), 4.48 (dt, $J_1 = 9.3$ Hz, $J_2 = 3.4$ Hz, 1H), 4.12 (s, 3H), 4.09 (s, 3H), 3.23 (dd, $J_1 = 18.0$ Hz, $J_2 = 9.6$ Hz, 1H), 2.73 (dd, $J_1 = 18.0$ Hz, $J_2 = 3.8$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 174.9, 156.3, 156.2, 149.2, 149.0,

145.9, 143.7, 140.7, 140.4, 127.9, 127.7, 126.9, 125.4, 118.1, 116.7, 113.7, 113.6, 108.0, 107.9, 81.5, 56.2, 56.1, 42.8, 35.5; HRMS (EI) m/z calcd. for $\text{C}_{24}\text{H}_{20}\text{N}_2\text{O}_4$ (M) $^+$ 400.1423, found 400.1425. (Chiralpak IA, *i*-PrOH/hexane = 30/70, flow rate = 0.8 mL/min, $\lambda = 254$ nm): $t_{\text{major}} = 48.48$ min, $t_{\text{minor}} = 46.31$ min, ee = 98%.

(4*S*,5*R*)-4,5-bis(8-Methoxyquinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans-4u*)



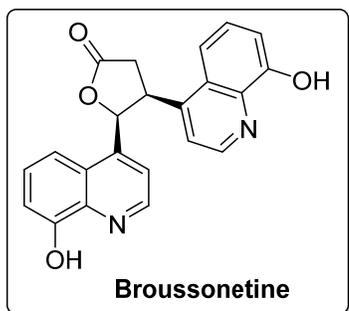
trans-4u: pale yellow oil, ^1H NMR (400 MHz, CDCl_3): δ 8.60 (d, $J = 4.8$ Hz, 1H), 8.58 (d, $J = 4.4$ Hz, 1H), 7.31 (d, $J = 8.8$ Hz, 1H), 7.23-7.18 (m, 2H), 7.16 (d, $J = 4.4$ Hz, 1H), 7.13 (t, $J = 8.2$ Hz, 1H), 6.92 (d, $J = 4.8$ Hz, 1H), 6.90-6.87 (m, 1H), 6.86 (d, $J = 7.6$ Hz, 1H), 6.72 (d, $J = 6.8$ Hz, 1H), 5.20-5.12 (m, 1H), 4.05-3.88 (m, 6H), 3.36 (dd, $J_1 = 17.6$ Hz, $J_2 = 8.0$ Hz, 1H), 3.12 (dd, $J_1 = 17.6$ Hz, $J_2 = 5.2$ Hz, 1H); ^{13}C NMR (100 MHz, CDCl_3): δ 175.3, 155.7, 155.6, 148.1, 147.9, 142.0, 139.9, 139.8, 139.5, 127.6, 126.9, 126.6,

125.8, 119.2, 118.2, 113.6, 113.4, 107.4, 79.6, 55.9, 40.4, 35.7; HRMS (EI) m/z calcd. for $\text{C}_{24}\text{H}_{20}\text{N}_2\text{O}_4$ (M) $^+$ 400.1423, found 400.1425. (Chiralpak AD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, $\lambda = 254$ nm): $t_{\text{major}} = 55.95$ min, $t_{\text{minor}} = 51.93$ min, ee = 85%.

Synthesis of Broussonetine

To a 15 mL sealed tube equipped with a magnetic stir bar was charged with (4*S*,5*S*)-4,5-bis(8-methoxyquinolin-4-yl)dihydrofuran-2(3*H*)-one *cis-4u* (30 mg, 0.075 mmol), HBr (48% in H_2O , 5 mL) and the solution was heated to 110 $^\circ\text{C}$ for 4 d. The reaction mixture was cooled to rt, neutralized with 6 M NaOH and saturated aq. NaHCO_3 until gray precipitation was formed. The precipitation was collected through centrifugation at 4000r/min for 10 min and dried in a freezer dryer to give (4*S*,5*S*)-4,5-bis(8-hydroxyquinolin-4-yl)dihydrofuran-2(3*H*)-one (**Broussonetine**) in 63% yield (17.5 mg) as gray solid.

(4*S*,5*S*)-4,5-bis(8-Hydroxyquinolin-4-yl)dihydrofuran-2(3*H*)-one (Broussonetine)



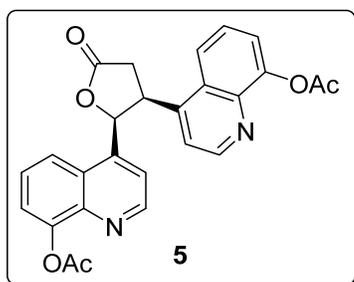
¹H NMR (400 MHz, DMSO-*d*₆): δ 9.92 (br, 1H), 9.84 (br, 1H), 8.94-8.84 (m, 2H), 8.02 (d, *J* = 4.4 Hz, 1H), 7.72 (d, *J* = 4.4 Hz, 1H), 7.33-7.20 (m, 3H), 7.10 (d, *J* = 8.4 Hz, 1H), 7.01 (d, *J* = 7.6 Hz, 2H), 6.75 (d, *J* = 7.2 Hz, 1H), 4.91-4.80 (m, 1H), 3.33-3.27 (m, 1H), 3.04 (dd, *J*₁ = 17.2 Hz, *J*₂ = 8.8 Hz, 1H); ¹³C NMR (100 MHz, DMSO-*d*₆) δ 175.5, 154.1, 154.1, 148.4, 145.4, 143.5, 139.1, 139.0, 128.3, 128.1, 127.8, 126.4, 119.6, 119.0, 113.2, 111.8, 111.6, 80.8, 42.9, 37.5; HRMS (EI) *m/z* calcd. for C₂₂H₁₆N₂O₄ (M)⁺ 372.1110,

found 372.1112; [α]_D²⁰ = 22.7 ° (*c* = 0.11, DMF).

Synthesis of ((2*S*,3*S*)-5-Oxotetrahydrofuran-2,3-diyl)bis(quinoline-4,8-diyl) diacetate (5**)**

To an oven-dried 10 mL round-bottomed flask equipped with a magnetic stirring bar was charged with (4*S*,5*S*)-4,5-bis(8-hydroxyquinolin-4-yl)dihydrofuran-2(3*H*)-one (**Broussonetine**) (15 mg, 0.04 mmol), Ac₂O (0.5 mL) and pyridine (1 mL) and the solution was stirred for 2 h at rt. The reaction mixture was diluted with ice water (3 mL) and extracted with EtOAc (5 mL × 3). The combined organic extracts were washed with brine, dried with Na₂SO₄ and concentrated in vacuo. The residue was purified by flash column chromatography on silica gel (PE/EA = 1:1) to provide ((2*S*,3*S*)-5-oxotetrahydrofuran-2,3-diyl)bis(quinoline-4,8-diyl) diacetate **5** in 75% yield (13.5 mg) as pale yellow solid.

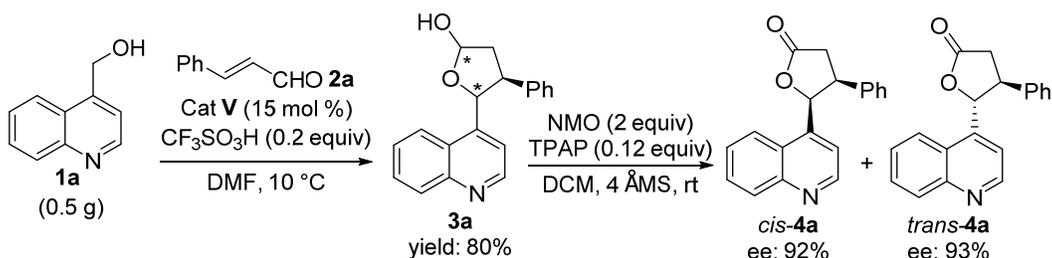
((2*S*,3*S*)-5-Oxotetrahydrofuran-2,3-diyl)bis(quinoline-4,8-diyl) diacetate (5**)**



¹H NMR (400 MHz, CDCl₃): δ 9.04 (d, *J* = 4.4 Hz, 1H), 9.00 (d, *J* = 4.4 Hz, 1H), 7.66 (d, *J* = 4.8 Hz, 1H), 7.60-7.55 (m, 2H), 7.52-7.47 (m, 2H), 7.43 (dd, *J*₁ = 7.6 Hz, *J*₂ = 1.2 Hz, 1H), 7.37 (t, *J* = 8.0 Hz, 1H), 7.21 (dd, *J*₁ = 8.4 Hz, *J*₂ = 1.0 Hz, 1H), 6.54 (d, *J* = 2.4 Hz, 1H), 4.53 (dt, *J*₁ = 9.2 Hz, *J*₂ = 2.8 Hz, 1H), 3.18 (dd, *J*₁ = 18.0 Hz, *J*₂ = 9.6 Hz, 1H), 2.72 (dd, *J*₁ = 18.0 Hz, *J*₂ = 3.2 Hz, 1H), 2.54 (s, 3H), 2.52 (s, 3H); ¹³C NMR (100 MHz, CDCl₃): δ 174.6, 169.9, 169.8, 150.6,

150.3, 148.4, 148.3, 146.2, 143.9, 141.8, 141.5, 127.5, 127.2, 127.1, 125.5, 122.2, 122.1, 120.2, 120.1, 118.0, 116.7, 81.0, 42.5, 35.2, 29.7, 21.1, 21.0; HRMS (EI) *m/z* calcd. for C₂₆H₂₁N₂O₆ (M+H)⁺ 457.1400, found 457.1401. (Chiralpak IA, *i*-PrOH/hexane = 25/75, flow rate = 0.8 mL/min, λ = 254 nm): *t*_{major} = 62.98 min, *t*_{minor} = 45.08 min, ee = 91%.

VII Scale up experiment



To a flame-dried Schlenk tube equipped with a magnetic stirring bar was charged with quinolin-4-ylmethanol **1a** (500.0 mg, 3.15 mmol), CF₃SO₃H (94.5 mg, 0.63 mmol) and DMF (1.5 mL) and the solution was stirred for 5 min at rt. Then catalyst **V** (173.2 mg, 0.472 mmol) was added into the solution and the resulting mixture was stirred for 5 min at 10 °C. Subsequently, trans-cinnamaldehyde **2a** (624 mg, 4.72 mmol) was added into the mixture and the reaction was stirred at 10 °C for 120 h. After the starting material was consumed, the reaction was diluted with saturated aq. Na₂CO₃ (12 mL) and extracted with EtOAc (20 mL × 3). The combined organic extracts were washed with brine, dried with Na₂SO₄, and concentrated in vacuo. The residue was purified by flash column chromatography on neutral Al₂O₃ (pure DCM to DCM:MeOH = 100:1) to give the hemiacetal intermediate **3a** in 80% yield (733 mg).

To a solution of the hemiacetal intermediate **3a** (733 mg, 2.52 mmol) in anhydrous DCM (15 mL) was added tetrapropylammonium perruthenate (TPAP) (106 mg, 0.30 mmol), 4-methylmorpholine *N*-oxide (NMO) (590 mg, 5.04 mmol) and 4 Å molecular sieves. The reaction was stirred at rt and monitored by TLC. After the hemiacetal intermediate **3a** was consumed, the mixture was filtered and concentrated in vacuo. The residue was purified by flash column chromatography on silica gel (PE:EA = 8:1 - 4:1, containing 1% TEA) to give the mixture of *cis-4a* and *trans-4a* in 73% yield (532 mg). (*cis-4a*: 92% ee, *trans-4a*: 93% ee)

VIII. Determination of the absolute configuration of compounds *cis*-4d and *trans*-4d

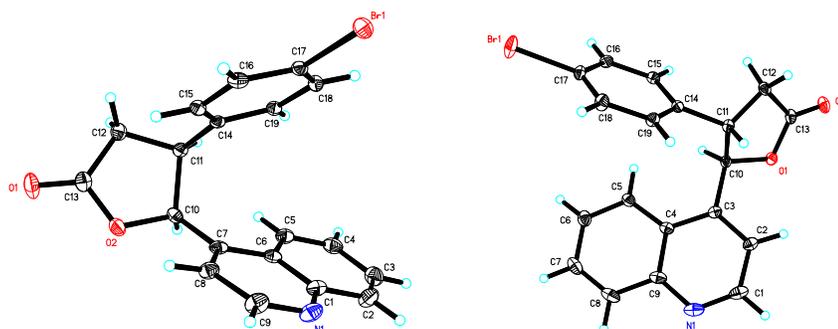


Figure S1. The X-ray Crystallographic Structures of Compounds *cis*-4d (left) and *trans*-4d.

Determination of absolute configuration of product *cis*-4d

Table S3. Crystal data and structure refinement for mo_dm15043_0m.

Identification code	mo_dm15043_0m	
Empirical formula	C ₁₉ H ₁₄ Br N O ₂	
Formula weight	368.22	
Temperature	130 K	
Wavelength	0.71073 Å	
Crystal system	Orthorhombic	
Space group	P 21 21 21	
Unit cell dimensions	a = 13.4117(10) Å	α = 90°.
	b = 16.6875(12) Å	β = 90°.
	c = 21.0576(15) Å	γ = 90°.
Volume	4712.9(6) Å ³	
Z	12	
Density (calculated)	1.557 Mg/m ³	
Absorption coefficient	2.626 mm ⁻¹	
F(000)	2232	
Crystal size	0.25 x 0.2 x 0.15 mm ³	
Theta range for data collection	1.557 to 30.630°.	
Index ranges	-19 ≤ h ≤ 19, -15 ≤ k ≤ 23, -30 ≤ l ≤ 30	
Reflections collected	48113	

Independent reflections	14476 [R(int) = 0.0645]
Completeness to theta = 26.000°	100.0 %
Absorption correction	Semi-empirical from equivalents
Max. and min. transmission	0.7461 and 0.6297
Refinement method	Full-matrix least-squares on F ²
Data / restraints / parameters	14476 / 0 / 622
Goodness-of-fit on F ²	0.985
Final R indices [I>2sigma(I)]	R1 = 0.0451, wR2 = 0.0696
R indices (all data)	R1 = 0.0906, wR2 = 0.0794
Absolute structure parameter	0.003(5)
Extinction coefficient	n/a
Largest diff. peak and hole	0.861 and -0.862 e.Å ⁻³

Table S4. Atomic coordinates ($\times 10^4$) and equivalent isotropic displacement parameters ($\text{\AA}^2 \times 10^3$) for mo_dm15043_0m. U(eq) is defined as one third of the trace of the orthogonalized U^{ij} tensor.

	x	y	z	U(eq)
Br(1)	-2333(1)	-7854(1)	-5188(1)	30(1)
O(1)	1754(2)	-5760(2)	-2439(1)	46(1)
O(2)	772(2)	-5105(2)	-3104(1)	32(1)
N(1)	-2289(3)	-4260(2)	-4298(2)	36(1)
C(1)	-1509(3)	-4132(2)	-4695(2)	30(1)
C(2)	-1703(3)	-3742(3)	-5276(2)	39(1)
C(3)	-952(4)	-3599(3)	-5700(2)	38(1)

C(4)	15(3)	-3851(3)	-5566(2)	33(1)
C(5)	233(3)	-4216(2)	-5005(2)	27(1)
C(6)	-521(3)	-4366(2)	-4548(2)	24(1)
C(7)	-348(3)	-4741(2)	-3953(2)	23(1)
C(8)	-1142(3)	-4858(2)	-3561(2)	28(1)
C(9)	-2094(3)	-4615(2)	-3752(2)	35(1)
C(10)	688(3)	-4993(2)	-3788(2)	23(1)
C(11)	1072(3)	-5794(2)	-4089(2)	20(1)
C(12)	1712(3)	-6136(2)	-3552(2)	27(1)
C(13)	1436(3)	-5681(3)	-2965(2)	29(1)
C(14)	263(3)	-6327(2)	-4347(2)	18(1)
C(15)	-307(3)	-6820(2)	-3962(2)	22(1)
C(16)	-1076(3)	-7280(2)	-4206(2)	24(1)
C(17)	-1272(2)	-7240(2)	-4854(2)	21(1)
C(18)	-713(3)	-6763(2)	-5251(2)	23(1)
C(19)	61(3)	-6319(2)	-4994(2)	20(1)
Br(2)	-2020(1)	-7959(1)	-1125(1)	38(1)
O(3)	1975(2)	-5281(2)	729(1)	28(1)
O(4)	867(2)	-4681(2)	102(1)	22(1)
N(2)	-2289(3)	-3922(2)	-1029(2)	34(1)
C(20)	-1527(3)	-3763(3)	-1439(2)	29(1)
C(21)	-1772(4)	-3382(3)	-2022(2)	41(1)
C(22)	-1055(4)	-3208(3)	-2449(2)	47(1)
C(23)	-58(3)	-3407(3)	-2332(2)	36(1)
C(24)	198(3)	-3770(2)	-1777(2)	28(1)
C(25)	-531(3)	-3956(2)	-1315(2)	23(1)
C(26)	-304(3)	-4334(2)	-723(2)	21(1)
C(27)	-1070(3)	-4490(2)	-319(2)	26(1)
C(28)	-2046(3)	-4276(2)	-493(2)	32(1)
C(29)	751(3)	-4546(2)	-580(2)	18(1)
C(30)	1184(3)	-5315(2)	-885(2)	21(1)
C(31)	2047(3)	-5473(2)	-422(2)	24(1)
C(32)	1664(3)	-5157(2)	200(2)	21(1)
C(33)	435(3)	-5985(2)	-936(2)	21(1)
C(34)	-178(3)	-6025(2)	-1470(2)	24(1)
C(35)	-905(3)	-6596(2)	-1535(2)	28(1)
C(36)	-1022(3)	-7152(2)	-1058(2)	28(1)
C(37)	-428(3)	-7142(3)	-522(2)	33(1)

C(38)	293(3)	-6556(2)	-466(2)	29(1)
Br(3)	-7239(1)	-7136(1)	-1410(1)	61(1)
O(5)	-2859(2)	-8820(2)	-3781(1)	34(1)
O(6)	-3913(2)	-9677(2)	-3325(1)	29(1)
N(3)	-7129(2)	-10867(2)	-2572(2)	30(1)
C(39)	-6428(3)	-11077(3)	-2132(2)	24(1)
C(40)	-6732(3)	-11604(3)	-1642(2)	32(1)
C(41)	-6087(3)	-11827(3)	-1179(2)	35(1)
C(42)	-5115(3)	-11537(2)	-1174(2)	33(1)
C(43)	-4794(3)	-11034(2)	-1641(2)	28(1)
C(44)	-5439(3)	-10786(2)	-2137(2)	20(1)
C(45)	-5155(3)	-10269(2)	-2644(2)	23(1)
C(46)	-5872(3)	-10061(2)	-3073(2)	27(1)
C(47)	-6839(3)	-10369(3)	-3020(2)	31(1)
C(48)	-4097(3)	-9988(2)	-2691(2)	23(1)
C(49)	-3751(3)	-9314(2)	-2235(2)	24(1)
C(50)	-2926(3)	-8925(3)	-2629(2)	29(1)
C(51)	-3197(3)	-9105(3)	-3308(2)	28(1)
C(52)	-4578(3)	-8750(2)	-2039(2)	23(1)
C(53)	-5028(3)	-8847(3)	-1450(2)	25(1)
C(54)	-5809(3)	-8365(3)	-1260(2)	31(1)
C(55)	-6140(3)	-7785(3)	-1659(2)	34(1)
C(56)	-5720(3)	-7660(3)	-2246(2)	40(1)
C(57)	-4932(3)	-8148(3)	-2429(2)	34(1)

Table S5. Bond lengths [\AA] and angles [$^\circ$] for mo_dm15043_0m.

Br(1)-C(17)	1.889(3)
O(1)-C(13)	1.194(5)
O(2)-C(10)	1.456(5)
O(2)-C(13)	1.344(5)
N(1)-C(1)	1.356(5)
N(1)-C(9)	1.320(5)
C(1)-C(2)	1.409(6)
C(1)-C(6)	1.414(6)
C(2)-H(2)	0.9500
C(2)-C(3)	1.367(6)

C(3)-H(3)	0.9500
C(3)-C(4)	1.393(6)
C(4)-H(4)	0.9500
C(4)-C(5)	1.360(6)
C(5)-H(5)	0.9500
C(5)-C(6)	1.418(6)
C(6)-C(7)	1.420(6)
C(7)-C(8)	1.362(5)
C(7)-C(10)	1.492(5)
C(8)-H(8)	0.9500
C(8)-C(9)	1.399(6)
C(9)-H(9)	0.9500
C(10)-H(10)	1.0000
C(10)-C(11)	1.566(5)
C(11)-H(11)	1.0000
C(11)-C(12)	1.529(5)
C(11)-C(14)	1.504(5)
C(12)-H(12A)	0.9900
C(12)-H(12B)	0.9900
C(12)-C(13)	1.497(6)
C(14)-C(15)	1.386(5)
C(14)-C(19)	1.390(5)
C(15)-H(15)	0.9500
C(15)-C(16)	1.384(5)
C(16)-H(16)	0.9500
C(16)-C(17)	1.391(5)
C(17)-C(18)	1.377(5)
C(18)-H(18)	0.9500
C(18)-C(19)	1.386(5)
C(19)-H(19)	0.9500
Br(2)-C(36)	1.904(4)
O(3)-C(32)	1.206(4)
O(4)-C(29)	1.463(4)
O(4)-C(32)	1.347(4)
N(2)-C(20)	1.363(5)
N(2)-C(28)	1.315(5)
C(20)-C(21)	1.421(6)
C(20)-C(25)	1.398(6)

C(21)-H(21)	0.9500
C(21)-C(22)	1.348(7)
C(22)-H(22)	0.9500
C(22)-C(23)	1.400(6)
C(23)-H(23)	0.9500
C(23)-C(24)	1.361(6)
C(24)-H(24)	0.9500
C(24)-C(25)	1.414(6)
C(25)-C(26)	1.430(6)
C(26)-C(27)	1.358(5)
C(26)-C(29)	1.489(5)
C(27)-H(27)	0.9500
C(27)-C(28)	1.407(6)
C(28)-H(28)	0.9500
C(29)-H(29)	1.0000
C(29)-C(30)	1.547(5)
C(30)-H(30)	1.0000
C(30)-C(31)	1.537(5)
C(30)-C(33)	1.508(5)
C(31)-H(31A)	0.9900
C(31)-H(31B)	0.9900
C(31)-C(32)	1.503(5)
C(33)-C(34)	1.396(5)
C(33)-C(38)	1.386(5)
C(34)-H(34)	0.9500
C(34)-C(35)	1.370(6)
C(35)-H(35)	0.9500
C(35)-C(36)	1.377(6)
C(36)-C(37)	1.383(5)
C(37)-H(37)	0.9500
C(37)-C(38)	1.379(6)
C(38)-H(38)	0.9500
Br(3)-C(55)	1.902(4)
O(5)-C(51)	1.194(5)
O(6)-C(48)	1.454(4)
O(6)-C(51)	1.355(5)
N(3)-C(39)	1.366(5)
N(3)-C(47)	1.316(5)

C(39)-C(40)	1.414(6)
C(39)-C(44)	1.413(5)
C(40)-H(40)	0.9500
C(40)-C(41)	1.356(6)
C(41)-H(41)	0.9500
C(41)-C(42)	1.391(6)
C(42)-H(42)	0.9500
C(42)-C(43)	1.363(6)
C(43)-H(43)	0.9500
C(43)-C(44)	1.417(5)
C(44)-C(45)	1.425(5)
C(45)-C(46)	1.364(5)
C(45)-C(48)	1.497(5)
C(46)-H(46)	0.9500
C(46)-C(47)	1.400(6)
C(47)-H(47)	0.9500
C(48)-H(48)	1.0000
C(48)-C(49)	1.549(6)
C(49)-H(49)	1.0000
C(49)-C(50)	1.528(5)
C(49)-C(52)	1.513(6)
C(50)-H(50A)	0.9900
C(50)-H(50B)	0.9900
C(50)-C(51)	1.504(6)
C(52)-C(53)	1.388(5)
C(52)-C(57)	1.382(6)
C(53)-H(53)	0.9500
C(53)-C(54)	1.380(5)
C(54)-H(54)	0.9500
C(54)-C(55)	1.357(6)
C(55)-C(56)	1.374(6)
C(56)-H(56)	0.9500
C(56)-C(57)	1.388(6)
C(57)-H(57)	0.9500
C(13)-O(2)-C(10)	110.9(3)
C(9)-N(1)-C(1)	117.0(4)
N(1)-C(1)-C(2)	117.6(4)

N(1)-C(1)-C(6)	123.0(4)
C(2)-C(1)-C(6)	119.3(4)
C(1)-C(2)-H(2)	119.6
C(3)-C(2)-C(1)	120.7(4)
C(3)-C(2)-H(2)	119.6
C(2)-C(3)-H(3)	120.0
C(2)-C(3)-C(4)	120.1(4)
C(4)-C(3)-H(3)	120.0
C(3)-C(4)-H(4)	119.6
C(5)-C(4)-C(3)	120.7(4)
C(5)-C(4)-H(4)	119.6
C(4)-C(5)-H(5)	119.5
C(4)-C(5)-C(6)	121.0(4)
C(6)-C(5)-H(5)	119.5
C(1)-C(6)-C(5)	118.1(4)
C(1)-C(6)-C(7)	117.9(4)
C(5)-C(6)-C(7)	124.0(4)
C(6)-C(7)-C(10)	118.9(4)
C(8)-C(7)-C(6)	118.1(4)
C(8)-C(7)-C(10)	123.0(4)
C(7)-C(8)-H(8)	120.1
C(7)-C(8)-C(9)	119.8(4)
C(9)-C(8)-H(8)	120.1
N(1)-C(9)-C(8)	124.2(4)
N(1)-C(9)-H(9)	117.9
C(8)-C(9)-H(9)	117.9
O(2)-C(10)-C(7)	109.8(3)
O(2)-C(10)-H(10)	108.1
O(2)-C(10)-C(11)	105.4(3)
C(7)-C(10)-H(10)	108.1
C(7)-C(10)-C(11)	116.9(3)
C(11)-C(10)-H(10)	108.1
C(10)-C(11)-H(11)	107.8
C(12)-C(11)-C(10)	101.8(3)
C(12)-C(11)-H(11)	107.8
C(14)-C(11)-C(10)	114.4(3)
C(14)-C(11)-H(11)	107.8
C(14)-C(11)-C(12)	116.7(3)

C(11)-C(12)-H(12A)	110.5
C(11)-C(12)-H(12B)	110.5
H(12A)-C(12)-H(12B)	108.6
C(13)-C(12)-C(11)	106.4(3)
C(13)-C(12)-H(12A)	110.5
C(13)-C(12)-H(12B)	110.5
O(1)-C(13)-O(2)	121.1(4)
O(1)-C(13)-C(12)	128.5(4)
O(2)-C(13)-C(12)	110.4(3)
C(15)-C(14)-C(11)	122.6(3)
C(15)-C(14)-C(19)	118.1(3)
C(19)-C(14)-C(11)	119.3(3)
C(14)-C(15)-H(15)	119.2
C(16)-C(15)-C(14)	121.6(4)
C(16)-C(15)-H(15)	119.2
C(15)-C(16)-H(16)	120.7
C(15)-C(16)-C(17)	118.6(4)
C(17)-C(16)-H(16)	120.7
C(16)-C(17)-Br(1)	118.8(3)
C(18)-C(17)-Br(1)	119.8(3)
C(18)-C(17)-C(16)	121.4(3)
C(17)-C(18)-H(18)	120.7
C(17)-C(18)-C(19)	118.7(4)
C(19)-C(18)-H(18)	120.7
C(14)-C(19)-H(19)	119.2
C(18)-C(19)-C(14)	121.6(4)
C(18)-C(19)-H(19)	119.2
C(32)-O(4)-C(29)	109.0(3)
C(28)-N(2)-C(20)	116.4(4)
N(2)-C(20)-C(21)	117.4(4)
N(2)-C(20)-C(25)	123.6(4)
C(25)-C(20)-C(21)	119.0(4)
C(20)-C(21)-H(21)	119.7
C(22)-C(21)-C(20)	120.5(4)
C(22)-C(21)-H(21)	119.7
C(21)-C(22)-H(22)	119.6
C(21)-C(22)-C(23)	120.8(4)
C(23)-C(22)-H(22)	119.6

C(22)-C(23)-H(23)	120.1
C(24)-C(23)-C(22)	119.9(4)
C(24)-C(23)-H(23)	120.1
C(23)-C(24)-H(24)	119.5
C(23)-C(24)-C(25)	121.0(4)
C(25)-C(24)-H(24)	119.5
C(20)-C(25)-C(24)	118.8(4)
C(20)-C(25)-C(26)	117.9(4)
C(24)-C(25)-C(26)	123.4(4)
C(25)-C(26)-C(29)	118.8(3)
C(27)-C(26)-C(25)	118.0(4)
C(27)-C(26)-C(29)	123.1(4)
C(26)-C(27)-H(27)	120.3
C(26)-C(27)-C(28)	119.4(4)
C(28)-C(27)-H(27)	120.3
N(2)-C(28)-C(27)	124.7(4)
N(2)-C(28)-H(28)	117.7
C(27)-C(28)-H(28)	117.7
O(4)-C(29)-C(26)	109.6(3)
O(4)-C(29)-H(29)	108.3
O(4)-C(29)-C(30)	103.8(3)
C(26)-C(29)-H(29)	108.3
C(26)-C(29)-C(30)	118.0(3)
C(30)-C(29)-H(29)	108.3
C(29)-C(30)-H(30)	109.7
C(31)-C(30)-C(29)	99.4(3)
C(31)-C(30)-H(30)	109.7
C(33)-C(30)-C(29)	113.3(3)
C(33)-C(30)-H(30)	109.7
C(33)-C(30)-C(31)	114.8(3)
C(30)-C(31)-H(31A)	111.0
C(30)-C(31)-H(31B)	111.0
H(31A)-C(31)-H(31B)	109.0
C(32)-C(31)-C(30)	103.6(3)
C(32)-C(31)-H(31A)	111.0
C(32)-C(31)-H(31B)	111.0
O(3)-C(32)-O(4)	121.1(4)
O(3)-C(32)-C(31)	128.7(3)

O(4)-C(32)-C(31)	110.2(3)
C(34)-C(33)-C(30)	119.0(4)
C(38)-C(33)-C(30)	123.4(4)
C(38)-C(33)-C(34)	117.5(4)
C(33)-C(34)-H(34)	118.9
C(35)-C(34)-C(33)	122.2(4)
C(35)-C(34)-H(34)	118.9
C(34)-C(35)-H(35)	120.7
C(34)-C(35)-C(36)	118.5(4)
C(36)-C(35)-H(35)	120.7
C(35)-C(36)-Br(2)	120.2(3)
C(35)-C(36)-C(37)	121.5(4)
C(37)-C(36)-Br(2)	118.4(3)
C(36)-C(37)-H(37)	120.6
C(38)-C(37)-C(36)	118.8(4)
C(38)-C(37)-H(37)	120.6
C(33)-C(38)-H(38)	119.2
C(37)-C(38)-C(33)	121.5(4)
C(37)-C(38)-H(38)	119.2
C(51)-O(6)-C(48)	110.3(3)
C(47)-N(3)-C(39)	116.4(3)
N(3)-C(39)-C(40)	117.1(4)
N(3)-C(39)-C(44)	123.6(4)
C(44)-C(39)-C(40)	119.4(4)
C(39)-C(40)-H(40)	119.6
C(41)-C(40)-C(39)	120.8(4)
C(41)-C(40)-H(40)	119.6
C(40)-C(41)-H(41)	119.8
C(40)-C(41)-C(42)	120.5(4)
C(42)-C(41)-H(41)	119.8
C(41)-C(42)-H(42)	119.8
C(43)-C(42)-C(41)	120.3(4)
C(43)-C(42)-H(42)	119.8
C(42)-C(43)-H(43)	119.4
C(42)-C(43)-C(44)	121.3(4)
C(44)-C(43)-H(43)	119.4
C(39)-C(44)-C(43)	117.8(4)
C(39)-C(44)-C(45)	117.7(4)

C(43)-C(44)-C(45)	124.5(4)
C(44)-C(45)-C(48)	119.4(3)
C(46)-C(45)-C(44)	117.5(4)
C(46)-C(45)-C(48)	123.0(4)
C(45)-C(46)-H(46)	119.7
C(45)-C(46)-C(47)	120.5(4)
C(47)-C(46)-H(46)	119.7
N(3)-C(47)-C(46)	124.2(4)
N(3)-C(47)-H(47)	117.9
C(46)-C(47)-H(47)	117.9
O(6)-C(48)-C(45)	109.4(3)
O(6)-C(48)-H(48)	108.0
O(6)-C(48)-C(49)	105.0(3)
C(45)-C(48)-H(48)	108.0
C(45)-C(48)-C(49)	118.1(3)
C(49)-C(48)-H(48)	108.0
C(48)-C(49)-H(49)	109.2
C(50)-C(49)-C(48)	100.8(3)
C(50)-C(49)-H(49)	109.2
C(52)-C(49)-C(48)	113.6(3)
C(52)-C(49)-H(49)	109.2
C(52)-C(49)-C(50)	114.6(3)
C(49)-C(50)-H(50A)	110.8
C(49)-C(50)-H(50B)	110.8
H(50A)-C(50)-H(50B)	108.8
C(51)-C(50)-C(49)	104.9(3)
C(51)-C(50)-H(50A)	110.8
C(51)-C(50)-H(50B)	110.8
O(5)-C(51)-O(6)	121.8(4)
O(5)-C(51)-C(50)	128.5(4)
O(6)-C(51)-C(50)	109.7(3)
C(53)-C(52)-C(49)	119.4(4)
C(57)-C(52)-C(49)	122.8(4)
C(57)-C(52)-C(53)	117.8(4)
C(52)-C(53)-H(53)	119.3
C(54)-C(53)-C(52)	121.4(4)
C(54)-C(53)-H(53)	119.3
C(53)-C(54)-H(54)	120.5

C(55)-C(54)-C(53)	118.9(4)
C(55)-C(54)-H(54)	120.5
C(54)-C(55)-Br(3)	119.2(4)
C(54)-C(55)-C(56)	122.1(4)
C(56)-C(55)-Br(3)	118.7(4)
C(55)-C(56)-H(56)	120.9
C(55)-C(56)-C(57)	118.3(4)
C(57)-C(56)-H(56)	120.9
C(52)-C(57)-C(56)	121.5(4)
C(52)-C(57)-H(57)	119.3
C(56)-C(57)-H(57)	119.3

Symmetry transformations used to generate equivalent atoms:

Table S6. Anisotropic displacement parameters ($\text{\AA}^2 \times 10^3$) for mo_dm15043_0m. The anisotropic displacement factor exponent takes the form: $-2\pi^2 [h^2 a^{*2} U^{11} + \dots + 2 h k a^* b^* U^{12}]$

	U ¹¹	U ²²	U ³³	U ²³	U ¹³	U ¹²
Br(1)	25(1)	27(1)	37(1)	-3(1)	-6(1)	-7(1)
O(1)	44(2)	71(2)	23(2)	1(2)	-7(2)	4(2)
O(2)	32(2)	40(2)	23(2)	-8(2)	-2(1)	6(1)
N(1)	26(2)	37(2)	45(2)	2(2)	7(2)	9(2)
C(1)	28(2)	25(2)	37(3)	-3(2)	3(2)	3(2)
C(2)	37(3)	37(3)	43(3)	6(2)	-1(2)	10(2)
C(3)	52(3)	33(3)	28(3)	3(2)	0(2)	0(2)
C(4)	40(3)	30(3)	30(3)	-3(2)	10(2)	0(2)
C(5)	25(2)	25(2)	32(3)	-3(2)	5(2)	0(2)
C(6)	28(2)	15(2)	29(2)	-4(2)	2(2)	-2(2)
C(7)	22(2)	14(2)	33(2)	-5(2)	1(2)	-2(2)
C(8)	26(2)	26(2)	31(2)	2(2)	6(2)	3(2)
C(9)	28(2)	37(2)	41(3)	5(2)	10(2)	2(2)
C(10)	24(2)	23(2)	22(2)	-4(2)	1(2)	-5(2)
C(11)	15(2)	22(2)	23(2)	-2(2)	1(2)	1(2)
C(12)	21(2)	30(2)	29(2)	-2(2)	-4(2)	0(2)
C(13)	21(2)	36(3)	28(3)	1(2)	-1(2)	-4(2)
C(14)	13(2)	17(2)	24(2)	-4(2)	0(2)	3(2)
C(15)	25(2)	23(2)	20(2)	-2(2)	1(2)	3(2)
C(16)	24(2)	19(2)	30(2)	-1(2)	6(2)	-1(2)
C(17)	17(2)	19(2)	27(2)	-6(2)	-4(2)	2(2)
C(18)	23(2)	25(2)	21(2)	-2(2)	-3(2)	2(2)
C(19)	19(2)	21(2)	20(2)	-1(2)	2(2)	1(2)
Br(2)	35(1)	25(1)	53(1)	-10(1)	-5(1)	-3(1)
O(3)	25(1)	35(2)	23(2)	3(1)	-4(1)	-5(1)
O(4)	20(1)	26(2)	20(1)	-3(1)	2(1)	2(1)
N(2)	23(2)	31(2)	46(2)	-10(2)	-4(2)	4(2)
C(20)	27(2)	29(2)	31(2)	-11(2)	-7(2)	9(2)
C(21)	37(3)	43(3)	42(3)	-8(2)	-14(2)	20(2)
C(22)	65(4)	43(3)	33(3)	-6(2)	-20(3)	21(3)
C(23)	47(3)	34(3)	26(2)	-1(2)	-3(2)	6(2)
C(24)	29(2)	26(2)	30(2)	-3(2)	-4(2)	4(2)
C(25)	26(2)	18(2)	26(2)	-6(2)	-4(2)	4(2)

C(26)	22(2)	16(2)	24(2)	-6(2)	0(2)	1(2)
C(27)	23(2)	22(2)	33(3)	-3(2)	0(2)	1(2)
C(28)	20(2)	30(2)	47(3)	-9(2)	5(2)	-1(2)
C(29)	20(2)	19(2)	16(2)	1(2)	0(2)	-1(2)
C(30)	20(2)	25(2)	17(2)	-2(2)	0(2)	3(2)
C(31)	18(2)	28(2)	25(2)	-3(2)	0(2)	0(2)
C(32)	16(2)	23(2)	23(2)	-2(2)	-3(2)	-7(2)
C(33)	18(2)	20(2)	25(2)	-4(2)	0(2)	6(2)
C(34)	28(2)	25(2)	20(2)	-2(2)	-1(2)	2(2)
C(35)	28(2)	28(2)	28(2)	-6(2)	-7(2)	7(2)
C(36)	27(2)	21(2)	34(2)	-10(2)	-2(2)	2(2)
C(37)	43(2)	23(2)	34(2)	3(2)	-5(2)	1(2)
C(38)	37(3)	26(2)	23(2)	0(2)	-9(2)	1(2)
Br(3)	36(1)	52(1)	96(1)	-43(1)	-22(1)	16(1)
O(5)	31(2)	44(2)	28(2)	7(1)	13(1)	-3(2)
O(6)	31(2)	37(2)	20(2)	-4(1)	7(1)	-7(2)
N(3)	22(2)	40(2)	30(2)	-2(2)	-4(2)	-1(2)
C(39)	21(2)	28(2)	24(2)	-6(2)	0(2)	1(2)
C(40)	30(2)	37(3)	29(3)	0(2)	2(2)	-12(2)
C(41)	49(3)	32(2)	25(2)	6(2)	6(2)	-7(2)
C(42)	40(3)	32(2)	26(2)	7(2)	-12(2)	-7(2)
C(43)	23(2)	29(2)	31(2)	4(2)	-6(2)	-6(2)
C(44)	21(2)	20(2)	20(2)	-2(2)	0(2)	-1(2)
C(45)	20(2)	24(2)	24(2)	-1(2)	2(2)	1(2)
C(46)	28(2)	30(2)	23(2)	4(2)	-3(2)	0(2)
C(47)	25(2)	39(2)	31(3)	3(2)	-9(2)	4(2)
C(48)	22(2)	28(2)	19(2)	4(2)	3(2)	-2(2)
C(49)	22(2)	31(2)	20(2)	2(2)	1(2)	-3(2)
C(50)	21(2)	37(2)	28(2)	0(2)	5(2)	-8(2)
C(51)	20(2)	31(2)	34(3)	-4(2)	7(2)	1(2)
C(52)	21(2)	27(2)	22(2)	-1(2)	-2(2)	-7(2)
C(53)	21(2)	31(2)	23(2)	0(2)	0(2)	-3(2)
C(54)	23(2)	39(3)	30(3)	-8(2)	-1(2)	-3(2)
C(55)	24(2)	30(3)	49(3)	-18(2)	-10(2)	1(2)
C(56)	47(3)	23(3)	50(3)	5(2)	-16(2)	-1(2)
C(57)	39(3)	33(3)	29(2)	6(2)	-1(2)	-4(2)

Table S7. Hydrogen coordinates ($\times 10^4$) and isotropic displacement parameters ($\text{\AA}^2 \times 10^{-3}$) for mo_dm15043_0m.

	x	y	z	U(eq)
H(2)	-2363	-3577	-5374	47
H(3)	-1090	-3327	-6086	45
H(4)	529	-3768	-5869	40
H(5)	900	-4372	-4918	33
H(8)	-1049	-5104	-3158	33
H(9)	-2634	-4712	-3471	42
H(10)	1153	-4553	-3915	28
H(11)	1526	-5652	-4448	24
H(12A)	1575	-6715	-3496	32
H(12B)	2429	-6066	-3649	32
H(15)	-168	-6843	-3520	27
H(16)	-1461	-7616	-3937	29
H(18)	-856	-6738	-5692	28
H(19)	464	-6001	-5267	24
H(21)	-2446	-3249	-2111	49
H(22)	-1228	-2947	-2834	56
H(23)	439	-3288	-2639	43
H(24)	876	-3901	-1698	34
H(27)	-946	-4742	78	31
H(28)	-2568	-4396	-203	39
H(29)	1183	-4083	-705	22
H(30)	1457	-5187	-1315	25
H(31A)	2196	-6053	-393	28
H(31B)	2658	-5185	-555	28
H(34)	-88	-5643	-1800	29
H(35)	-1320	-6608	-1901	34
H(37)	-514	-7531	-197	40
H(38)	702	-6544	-98	34
H(40)	-7395	-11803	-1639	38
H(41)	-6302	-12184	-855	42
H(42)	-4672	-11691	-844	39
H(43)	-4126	-10846	-1634	33

H(46)	-5713	-9705	-3410	32
H(47)	-7318	-10208	-3327	38
H(48)	-3652	-10461	-2624	28
H(49)	-3451	-9561	-1846	29
H(50A)	-2904	-8340	-2555	35
H(50B)	-2268	-9158	-2522	35
H(53)	-4794	-9254	-1172	30
H(54)	-6111	-8438	-856	37
H(56)	-5962	-7251	-2519	48
H(57)	-4629	-8065	-2832	40

Table S8. Torsion angles [°] for mo_dm15043_0m.

Br(1)-C(17)-C(18)-C(19)	-180.0(3)
O(2)-C(10)-C(11)-C(12)	-21.9(4)
O(2)-C(10)-C(11)-C(14)	105.0(4)
N(1)-C(1)-C(2)-C(3)	-179.6(4)
N(1)-C(1)-C(6)-C(5)	178.7(4)
N(1)-C(1)-C(6)-C(7)	-0.9(6)
C(1)-N(1)-C(9)-C(8)	0.4(7)
C(1)-C(2)-C(3)-C(4)	1.2(7)
C(1)-C(6)-C(7)-C(8)	0.4(6)
C(1)-C(6)-C(7)-C(10)	-179.9(3)
C(2)-C(1)-C(6)-C(5)	-1.7(6)
C(2)-C(1)-C(6)-C(7)	178.6(4)
C(2)-C(3)-C(4)-C(5)	-2.4(7)
C(3)-C(4)-C(5)-C(6)	1.5(7)
C(4)-C(5)-C(6)-C(1)	0.5(6)
C(4)-C(5)-C(6)-C(7)	-179.8(4)
C(5)-C(6)-C(7)-C(8)	-179.3(4)
C(5)-C(6)-C(7)-C(10)	0.4(6)
C(6)-C(1)-C(2)-C(3)	0.8(7)
C(6)-C(7)-C(8)-C(9)	0.5(6)
C(6)-C(7)-C(10)-O(2)	160.8(3)
C(6)-C(7)-C(10)-C(11)	-79.3(4)
C(7)-C(8)-C(9)-N(1)	-0.9(7)
C(7)-C(10)-C(11)-C(12)	-144.2(3)
C(7)-C(10)-C(11)-C(14)	-17.3(5)
C(8)-C(7)-C(10)-O(2)	-19.6(5)
C(8)-C(7)-C(10)-C(11)	100.4(5)
C(9)-N(1)-C(1)-C(2)	-179.1(4)
C(9)-N(1)-C(1)-C(6)	0.5(6)
C(10)-O(2)-C(13)-O(1)	165.5(4)
C(10)-O(2)-C(13)-C(12)	-11.9(4)
C(10)-C(7)-C(8)-C(9)	-179.2(4)
C(10)-C(11)-C(12)-C(13)	15.3(4)
C(10)-C(11)-C(14)-C(15)	-79.9(4)
C(10)-C(11)-C(14)-C(19)	98.9(4)
C(11)-C(12)-C(13)-O(1)	179.6(4)

C(11)-C(12)-C(13)-O(2)	-3.2(5)
C(11)-C(14)-C(15)-C(16)	177.2(3)
C(11)-C(14)-C(19)-C(18)	-176.2(3)
C(12)-C(11)-C(14)-C(15)	38.8(5)
C(12)-C(11)-C(14)-C(19)	-142.4(4)
C(13)-O(2)-C(10)-C(7)	148.4(3)
C(13)-O(2)-C(10)-C(11)	21.7(4)
C(14)-C(11)-C(12)-C(13)	-110.0(4)
C(14)-C(15)-C(16)-C(17)	0.0(5)
C(15)-C(14)-C(19)-C(18)	2.6(5)
C(15)-C(16)-C(17)-Br(1)	-179.0(3)
C(15)-C(16)-C(17)-C(18)	0.7(5)
C(16)-C(17)-C(18)-C(19)	0.3(5)
C(17)-C(18)-C(19)-C(14)	-2.0(6)
C(19)-C(14)-C(15)-C(16)	-1.6(5)
Br(2)-C(36)-C(37)-C(38)	-179.6(3)
O(4)-C(29)-C(30)-C(31)	-36.6(3)
O(4)-C(29)-C(30)-C(33)	85.6(4)
N(2)-C(20)-C(21)-C(22)	-180.0(4)
N(2)-C(20)-C(25)-C(24)	179.4(4)
N(2)-C(20)-C(25)-C(26)	-0.6(6)
C(20)-N(2)-C(28)-C(27)	0.6(6)
C(20)-C(21)-C(22)-C(23)	0.8(7)
C(20)-C(25)-C(26)-C(27)	0.7(6)
C(20)-C(25)-C(26)-C(29)	180.0(4)
C(21)-C(20)-C(25)-C(24)	-0.4(6)
C(21)-C(20)-C(25)-C(26)	179.5(4)
C(21)-C(22)-C(23)-C(24)	-0.9(7)
C(22)-C(23)-C(24)-C(25)	0.4(7)
C(23)-C(24)-C(25)-C(20)	0.3(6)
C(23)-C(24)-C(25)-C(26)	-179.7(4)
C(24)-C(25)-C(26)-C(27)	-179.4(4)
C(24)-C(25)-C(26)-C(29)	-0.1(6)
C(25)-C(20)-C(21)-C(22)	-0.1(7)
C(25)-C(26)-C(27)-C(28)	-0.2(6)
C(25)-C(26)-C(29)-O(4)	162.1(3)
C(25)-C(26)-C(29)-C(30)	-79.4(4)
C(26)-C(27)-C(28)-N(2)	-0.5(6)

C(26)-C(29)-C(30)-C(31)	-158.1(3)
C(26)-C(29)-C(30)-C(33)	-35.9(5)
C(27)-C(26)-C(29)-O(4)	-18.6(5)
C(27)-C(26)-C(29)-C(30)	99.9(4)
C(28)-N(2)-C(20)-C(21)	179.8(4)
C(28)-N(2)-C(20)-C(25)	0.0(6)
C(29)-O(4)-C(32)-O(3)	171.8(3)
C(29)-O(4)-C(32)-C(31)	-8.4(4)
C(29)-C(26)-C(27)-C(28)	-179.4(4)
C(29)-C(30)-C(31)-C(32)	31.3(4)
C(29)-C(30)-C(33)-C(34)	87.2(4)
C(29)-C(30)-C(33)-C(38)	-90.4(4)
C(30)-C(31)-C(32)-O(3)	163.9(4)
C(30)-C(31)-C(32)-O(4)	-15.9(4)
C(30)-C(33)-C(34)-C(35)	-177.0(4)
C(30)-C(33)-C(38)-C(37)	177.4(4)
C(31)-C(30)-C(33)-C(34)	-159.6(3)
C(31)-C(30)-C(33)-C(38)	22.8(5)
C(32)-O(4)-C(29)-C(26)	156.3(3)
C(32)-O(4)-C(29)-C(30)	29.3(4)
C(33)-C(30)-C(31)-C(32)	-89.8(4)
C(33)-C(34)-C(35)-C(36)	-0.7(6)
C(34)-C(33)-C(38)-C(37)	-0.2(6)
C(34)-C(35)-C(36)-Br(2)	-179.9(3)
C(34)-C(35)-C(36)-C(37)	0.2(6)
C(35)-C(36)-C(37)-C(38)	0.4(6)
C(36)-C(37)-C(38)-C(33)	-0.4(6)
C(38)-C(33)-C(34)-C(35)	0.7(6)
Br(3)-C(55)-C(56)-C(57)	-178.6(3)
O(6)-C(48)-C(49)-C(50)	-29.9(4)
O(6)-C(48)-C(49)-C(52)	93.2(4)
N(3)-C(39)-C(40)-C(41)	-178.5(4)
N(3)-C(39)-C(44)-C(43)	178.2(4)
N(3)-C(39)-C(44)-C(45)	-2.4(6)
C(39)-N(3)-C(47)-C(46)	1.0(6)
C(39)-C(40)-C(41)-C(42)	0.4(7)
C(39)-C(44)-C(45)-C(46)	3.0(6)
C(39)-C(44)-C(45)-C(48)	-176.2(4)

C(40)-C(39)-C(44)-C(43)	-0.5(6)
C(40)-C(39)-C(44)-C(45)	178.9(4)
C(40)-C(41)-C(42)-C(43)	-0.9(7)
C(41)-C(42)-C(43)-C(44)	0.7(7)
C(42)-C(43)-C(44)-C(39)	0.0(6)
C(42)-C(43)-C(44)-C(45)	-179.3(4)
C(43)-C(44)-C(45)-C(46)	-177.7(4)
C(43)-C(44)-C(45)-C(48)	3.2(6)
C(44)-C(39)-C(40)-C(41)	0.3(6)
C(44)-C(45)-C(46)-C(47)	-1.8(6)
C(44)-C(45)-C(48)-O(6)	163.3(3)
C(44)-C(45)-C(48)-C(49)	-76.8(5)
C(45)-C(46)-C(47)-N(3)	-0.3(7)
C(45)-C(48)-C(49)-C(50)	-152.1(4)
C(45)-C(48)-C(49)-C(52)	-29.0(5)
C(46)-C(45)-C(48)-O(6)	-15.8(6)
C(46)-C(45)-C(48)-C(49)	104.1(5)
C(47)-N(3)-C(39)-C(40)	179.2(4)
C(47)-N(3)-C(39)-C(44)	0.4(6)
C(48)-O(6)-C(51)-O(5)	172.8(4)
C(48)-O(6)-C(51)-C(50)	-6.4(4)
C(48)-C(45)-C(46)-C(47)	177.3(4)
C(48)-C(49)-C(50)-C(51)	25.9(4)
C(48)-C(49)-C(52)-C(53)	100.2(4)
C(48)-C(49)-C(52)-C(57)	-78.0(5)
C(49)-C(50)-C(51)-O(5)	167.3(4)
C(49)-C(50)-C(51)-O(6)	-13.5(4)
C(49)-C(52)-C(53)-C(54)	-177.7(4)
C(49)-C(52)-C(57)-C(56)	177.4(4)
C(50)-C(49)-C(52)-C(53)	-144.6(4)
C(50)-C(49)-C(52)-C(57)	37.2(5)
C(51)-O(6)-C(48)-C(45)	151.2(3)
C(51)-O(6)-C(48)-C(49)	23.6(4)
C(52)-C(49)-C(50)-C(51)	-96.4(4)
C(52)-C(53)-C(54)-C(55)	0.0(6)
C(53)-C(52)-C(57)-C(56)	-0.9(6)
C(53)-C(54)-C(55)-Br(3)	178.3(3)
C(53)-C(54)-C(55)-C(56)	-0.3(6)

C(54)-C(55)-C(56)-C(57)	-0.1(6)
C(55)-C(56)-C(57)-C(52)	0.7(6)
C(57)-C(52)-C(53)-C(54)	0.6(6)

Symmetry transformations used to generate equivalent atoms:

Determination of absolute configuration of product *trans*-**4d**

Table S9. Crystal data and structure refinement for mo_dm15183_0m.

Identification code	mo_dm15183_0m	
Empirical formula	C ₁₉ H ₁₄ Br N O ₂	
Formula weight	368.22	
Temperature	130 K	
Wavelength	0.71073 Å	
Crystal system	Orthorhombic	
Space group	P 21 21 21	
Unit cell dimensions	a = 5.9991(5) Å	α = 90°.
	b = 15.8057(13) Å	β = 90°.
	c = 16.9358(14) Å	γ = 90°.
Volume	1605.9(2) Å ³	
Z	4	
Density (calculated)	1.523 Mg/m ³	
Absorption coefficient	2.569 mm ⁻¹	
F(000)	744	
Crystal size	0.2 x 0.18 x 0.11 mm ³	
Theta range for data collection	1.762 to 30.630°.	
Index ranges	-8 ≤ h ≤ 8, -22 ≤ k ≤ 22, -24 ≤ l ≤ 22	
Reflections collected	16298	
Independent reflections	4941 [R(int) = 0.0326]	
Completeness to theta = 25.242°	100.0 %	
Absorption correction	Semi-empirical from equivalents	
Max. and min. transmission	0.7461 and 0.5035	
Refinement method	Full-matrix least-squares on F ²	
Data / restraints / parameters	4941 / 0 / 208	
Goodness-of-fit on F ²	1.008	
Final R indices [I > 2σ(I)]	R1 = 0.0302, wR2 = 0.0569	
R indices (all data)	R1 = 0.0443, wR2 = 0.0598	
Absolute structure parameter	0.018(5)	
Extinction coefficient	n/a	
Largest diff. peak and hole	0.320 and -0.343 e.Å ⁻³	

Table S10. Atomic coordinates ($\times 10^4$) and equivalent isotropic displacement parameters ($\text{\AA}^2 \times 10^3$) for mo_dm15183_0m. $U(\text{eq})$ is defined as one third of the trace of the orthogonalized U^{ij} tensor.

	x	y	z	U(eq)
Br(1)	3812(1)	7680(1)	-1411(1)	40(1)
O(1)	-870(3)	11840(1)	935(1)	21(1)
O(2)	-1714(3)	12901(1)	132(1)	29(1)
N(1)	-1866(4)	9517(1)	2923(1)	32(1)
C(1)	-3034(5)	10169(2)	2691(2)	31(1)
C(2)	-2503(4)	10671(2)	2031(1)	25(1)
C(3)	-673(4)	10479(1)	1587(1)	20(1)
C(4)	656(4)	9772(1)	1810(1)	20(1)
C(5)	2599(4)	9510(1)	1412(2)	24(1)
C(6)	3799(5)	8830(2)	1678(1)	30(1)
C(7)	3133(5)	8381(2)	2348(2)	32(1)
C(8)	1264(5)	8613(2)	2744(1)	33(1)
C(9)	-25(5)	9312(2)	2494(1)	25(1)
C(10)	-134(4)	10970(1)	851(1)	18(1)
C(11)	-1317(4)	10648(1)	100(1)	18(1)
C(12)	-1524(4)	11464(1)	-385(1)	23(1)
C(13)	-1400(4)	12154(1)	218(1)	23(1)
C(14)	-109(4)	9924(1)	-285(1)	18(1)
C(15)	1966(4)	10046(1)	-631(1)	19(1)
C(16)	3120(4)	9379(1)	-957(1)	22(1)
C(17)	2194(4)	8576(1)	-939(1)	23(1)
C(18)	146(4)	8437(2)	-603(2)	26(1)
C(19)	-996(4)	9113(1)	-275(1)	21(1)

Table S11. Bond lengths [Å] and angles [°] for mo_dm15183_0m.

Br(1)-C(17)	1.893(2)
O(1)-C(10)	1.451(3)
O(1)-C(13)	1.349(3)
O(2)-C(13)	1.205(3)
N(1)-C(1)	1.307(3)
N(1)-C(9)	1.362(3)
C(1)-H(1)	0.9500
C(1)-C(2)	1.408(3)
C(2)-H(2)	0.9500
C(2)-C(3)	1.365(3)
C(3)-C(4)	1.425(3)
C(3)-C(10)	1.503(3)
C(4)-C(5)	1.408(3)
C(4)-C(9)	1.428(3)
C(5)-H(5)	0.9500
C(5)-C(6)	1.369(3)
C(6)-H(6)	0.9500
C(6)-C(7)	1.397(4)
C(7)-H(7)	0.9500
C(7)-C(8)	1.357(4)
C(8)-H(8)	0.9500
C(8)-C(9)	1.412(4)
C(10)-H(10)	1.0000
C(10)-C(11)	1.543(3)
C(11)-H(11)	1.0000
C(11)-C(12)	1.534(3)
C(11)-C(14)	1.504(3)
C(12)-H(12A)	0.9900
C(12)-H(12B)	0.9900
C(12)-C(13)	1.497(3)
C(14)-C(15)	1.389(3)
C(14)-C(19)	1.388(3)
C(15)-H(15)	0.9500
C(15)-C(16)	1.377(3)
C(16)-H(16)	0.9500
C(16)-C(17)	1.386(3)

C(17)-C(18)	1.372(3)
C(18)-H(18)	0.9500
C(18)-C(19)	1.385(3)
C(19)-H(19)	0.9500
C(13)-O(1)-C(10)	109.38(16)
C(1)-N(1)-C(9)	117.5(2)
N(1)-C(1)-H(1)	117.9
N(1)-C(1)-C(2)	124.2(3)
C(2)-C(1)-H(1)	117.9
C(1)-C(2)-H(2)	120.2
C(3)-C(2)-C(1)	119.6(2)
C(3)-C(2)-H(2)	120.2
C(2)-C(3)-C(4)	118.6(2)
C(2)-C(3)-C(10)	121.0(2)
C(4)-C(3)-C(10)	120.3(2)
C(3)-C(4)-C(9)	117.1(2)
C(5)-C(4)-C(3)	124.5(2)
C(5)-C(4)-C(9)	118.4(2)
C(4)-C(5)-H(5)	119.7
C(6)-C(5)-C(4)	120.6(2)
C(6)-C(5)-H(5)	119.7
C(5)-C(6)-H(6)	119.5
C(5)-C(6)-C(7)	121.0(3)
C(7)-C(6)-H(6)	119.5
C(6)-C(7)-H(7)	120.0
C(8)-C(7)-C(6)	120.0(3)
C(8)-C(7)-H(7)	120.0
C(7)-C(8)-H(8)	119.5
C(7)-C(8)-C(9)	121.1(2)
C(9)-C(8)-H(8)	119.5
N(1)-C(9)-C(4)	123.0(2)
N(1)-C(9)-C(8)	118.1(2)
C(8)-C(9)-C(4)	119.0(2)
O(1)-C(10)-C(3)	110.01(18)
O(1)-C(10)-H(10)	109.2
O(1)-C(10)-C(11)	104.68(17)
C(3)-C(10)-H(10)	109.2

C(3)-C(10)-C(11)	114.45(18)
C(11)-C(10)-H(10)	109.2
C(10)-C(11)-H(11)	108.5
C(12)-C(11)-C(10)	101.64(16)
C(12)-C(11)-H(11)	108.5
C(14)-C(11)-C(10)	112.76(19)
C(14)-C(11)-H(11)	108.5
C(14)-C(11)-C(12)	116.49(19)
C(11)-C(12)-H(12A)	111.0
C(11)-C(12)-H(12B)	111.0
H(12A)-C(12)-H(12B)	109.0
C(13)-C(12)-C(11)	104.02(17)
C(13)-C(12)-H(12A)	111.0
C(13)-C(12)-H(12B)	111.0
O(1)-C(13)-C(12)	110.99(18)
O(2)-C(13)-O(1)	120.4(2)
O(2)-C(13)-C(12)	128.6(2)
C(15)-C(14)-C(11)	120.6(2)
C(19)-C(14)-C(11)	120.9(2)
C(19)-C(14)-C(15)	118.5(2)
C(14)-C(15)-H(15)	119.6
C(16)-C(15)-C(14)	120.8(2)
C(16)-C(15)-H(15)	119.6
C(15)-C(16)-H(16)	120.3
C(15)-C(16)-C(17)	119.4(2)
C(17)-C(16)-H(16)	120.3
C(16)-C(17)-Br(1)	118.06(19)
C(18)-C(17)-Br(1)	120.96(18)
C(18)-C(17)-C(16)	121.0(2)
C(17)-C(18)-H(18)	120.5
C(17)-C(18)-C(19)	119.0(2)
C(19)-C(18)-H(18)	120.5
C(14)-C(19)-H(19)	119.4
C(18)-C(19)-C(14)	121.2(2)
C(18)-C(19)-H(19)	119.4

Symmetry transformations used to generate equivalent atoms:

Table S12. Anisotropic displacement parameters ($\text{\AA}^2 \times 10^3$) for mo_dm15183_0m. The anisotropic displacement factor exponent takes the form: $-2\pi^2 [h^2 a^{*2} U^{11} + \dots + 2 h k a^* b^* U^{12}]$

	U ¹¹	U ²²	U ³³	U ²³	U ¹³	U ¹²
Br(1)	36(1)	24(1)	60(1)	-12(1)	15(1)	5(1)
O(1)	27(1)	16(1)	21(1)	-4(1)	-1(1)	1(1)
O(2)	32(1)	19(1)	36(1)	-3(1)	-9(1)	6(1)
N(1)	39(1)	37(1)	20(1)	0(1)	2(1)	-15(1)
C(1)	28(1)	44(2)	20(1)	-4(1)	3(1)	-10(1)
C(2)	25(1)	30(1)	21(1)	-4(1)	2(1)	-2(1)
C(3)	20(1)	21(1)	18(1)	-4(1)	-1(1)	-5(1)
C(4)	25(1)	19(1)	17(1)	-2(1)	-5(1)	-6(1)
C(5)	27(1)	23(1)	22(1)	1(1)	-4(1)	0(1)
C(6)	33(1)	26(1)	31(1)	-4(1)	-5(1)	3(1)
C(7)	43(2)	21(1)	33(1)	2(1)	-15(1)	-1(1)
C(8)	51(2)	25(1)	23(1)	5(1)	-11(1)	-12(1)
C(9)	34(1)	23(1)	17(1)	-1(1)	-4(1)	-12(1)
C(10)	20(1)	16(1)	19(1)	-3(1)	-1(1)	2(1)
C(11)	17(1)	18(1)	20(1)	-3(1)	-1(1)	0(1)
C(12)	28(1)	21(1)	20(1)	-2(1)	-6(1)	4(1)
C(13)	19(1)	21(1)	28(1)	-3(1)	-4(1)	3(1)
C(14)	20(1)	16(1)	16(1)	-2(1)	-3(1)	0(1)
C(15)	21(1)	16(1)	20(1)	1(1)	-1(1)	-4(1)
C(16)	21(1)	24(1)	21(1)	1(1)	4(1)	-1(1)
C(17)	26(1)	18(1)	25(1)	-2(1)	3(1)	5(1)
C(18)	28(1)	16(1)	34(1)	-3(1)	3(1)	-4(1)
C(19)	19(1)	19(1)	24(1)	0(1)	4(1)	-2(1)

Table S13. Hydrogen coordinates ($\times 10^4$) and isotropic displacement parameters ($\text{\AA}^2 \times 10^{-3}$) for mo_dm15183_0m.

	x	y	z	U(eq)
H(1)	-4323	10314	2988	37
H(2)	-3413	11141	1895	30
H(5)	3082	9807	956	29
H(6)	5104	8661	1402	36
H(7)	3989	7913	2527	39
H(8)	814	8301	3196	39
H(10)	1515	10961	763	22
H(11)	-2848	10454	248	22
H(12A)	-290	11512	-771	27
H(12B)	-2961	11482	-672	27
H(15)	2597	10597	-642	23
H(16)	4539	9468	-1191	26
H(18)	-481	7885	-596	31
H(19)	-2411	9020	-39	25

Table S14. Torsion angles [°] for mo_dm15183_0m.

Br(1)-C(17)-C(18)-C(19)	-179.02(19)
O(1)-C(10)-C(11)-C(12)	30.2(2)
O(1)-C(10)-C(11)-C(14)	155.63(18)
N(1)-C(1)-C(2)-C(3)	0.5(4)
C(1)-N(1)-C(9)-C(4)	-0.3(3)
C(1)-N(1)-C(9)-C(8)	179.3(2)
C(1)-C(2)-C(3)-C(4)	-0.2(3)
C(1)-C(2)-C(3)-C(10)	176.4(2)
C(2)-C(3)-C(4)-C(5)	-179.1(2)
C(2)-C(3)-C(4)-C(9)	-0.3(3)
C(2)-C(3)-C(10)-O(1)	31.6(3)
C(2)-C(3)-C(10)-C(11)	-85.9(3)
C(3)-C(4)-C(5)-C(6)	178.8(2)
C(3)-C(4)-C(9)-N(1)	0.6(3)
C(3)-C(4)-C(9)-C(8)	-179.0(2)
C(3)-C(10)-C(11)-C(12)	150.7(2)
C(3)-C(10)-C(11)-C(14)	-83.9(3)
C(4)-C(3)-C(10)-O(1)	-151.88(19)
C(4)-C(3)-C(10)-C(11)	90.6(3)
C(4)-C(5)-C(6)-C(7)	-0.1(4)
C(5)-C(4)-C(9)-N(1)	179.5(2)
C(5)-C(4)-C(9)-C(8)	-0.2(3)
C(5)-C(6)-C(7)-C(8)	0.4(4)
C(6)-C(7)-C(8)-C(9)	-0.6(4)
C(7)-C(8)-C(9)-N(1)	-179.2(2)
C(7)-C(8)-C(9)-C(4)	0.5(4)
C(9)-N(1)-C(1)-C(2)	-0.3(4)
C(9)-C(4)-C(5)-C(6)	0.0(3)
C(10)-O(1)-C(13)-O(2)	-168.3(2)
C(10)-O(1)-C(13)-C(12)	12.1(3)
C(10)-C(3)-C(4)-C(5)	4.3(3)
C(10)-C(3)-C(4)-C(9)	-176.9(2)
C(10)-C(11)-C(12)-C(13)	-22.9(2)
C(10)-C(11)-C(14)-C(15)	-67.2(3)
C(10)-C(11)-C(14)-C(19)	110.1(2)
C(11)-C(12)-C(13)-O(1)	8.0(3)

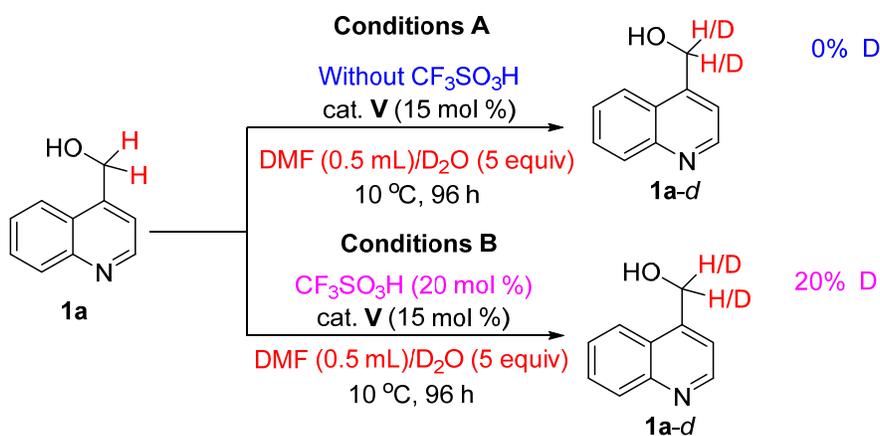
C(11)-C(12)-C(13)-O(2)	-171.6(3)
C(11)-C(14)-C(15)-C(16)	177.4(2)
C(11)-C(14)-C(19)-C(18)	-177.6(2)
C(12)-C(11)-C(14)-C(15)	49.8(3)
C(12)-C(11)-C(14)-C(19)	-132.9(2)
C(13)-O(1)-C(10)-C(3)	-150.48(19)
C(13)-O(1)-C(10)-C(11)	-27.1(2)
C(14)-C(11)-C(12)-C(13)	-145.9(2)
C(14)-C(15)-C(16)-C(17)	0.0(3)
C(15)-C(14)-C(19)-C(18)	-0.2(3)
C(15)-C(16)-C(17)-Br(1)	178.86(17)
C(15)-C(16)-C(17)-C(18)	0.1(4)
C(16)-C(17)-C(18)-C(19)	-0.3(4)
C(17)-C(18)-C(19)-C(14)	0.3(4)
C(19)-C(14)-C(15)-C(16)	0.0(3)

Symmetry transformations used to generate equivalent atoms:

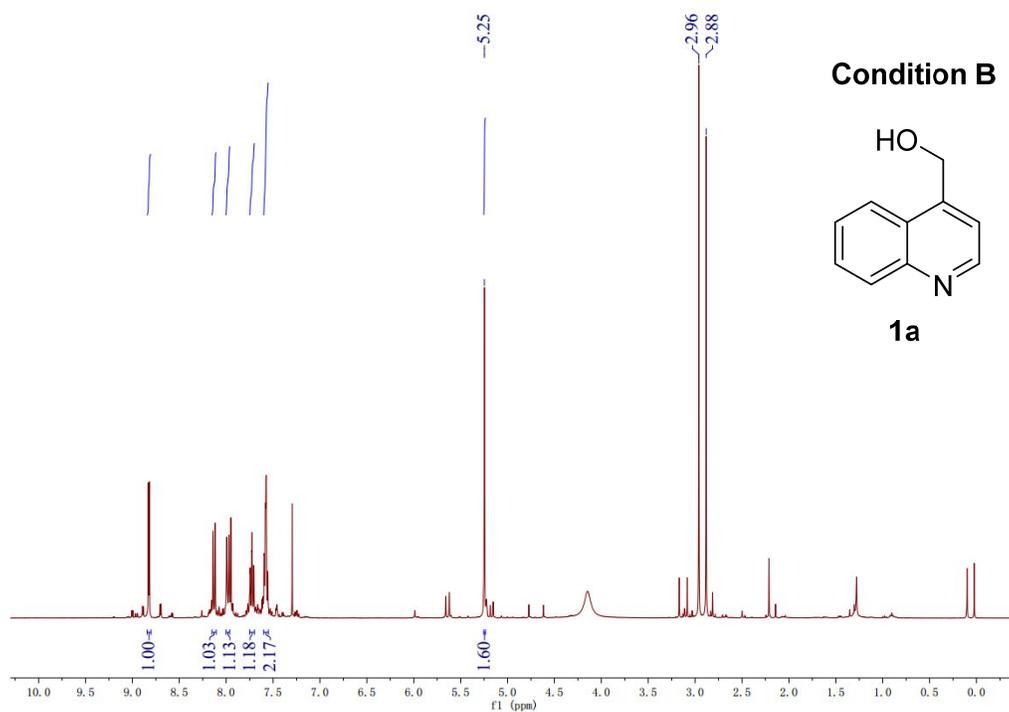
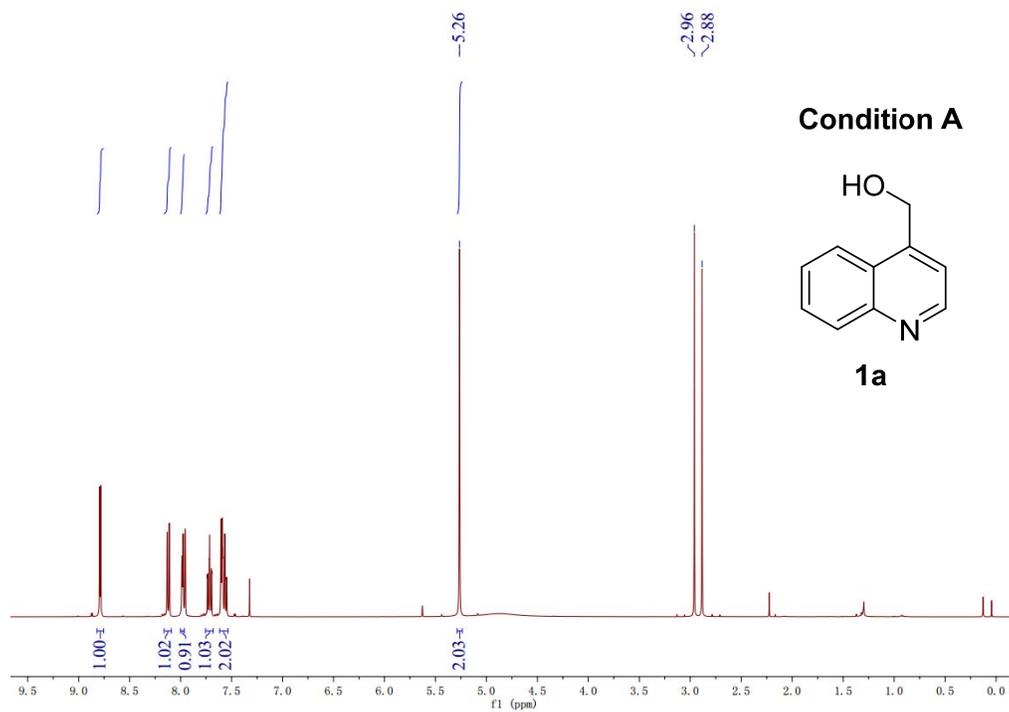
IX. Mechanistic studies

Deuterium exchange ^1H NMR experiments

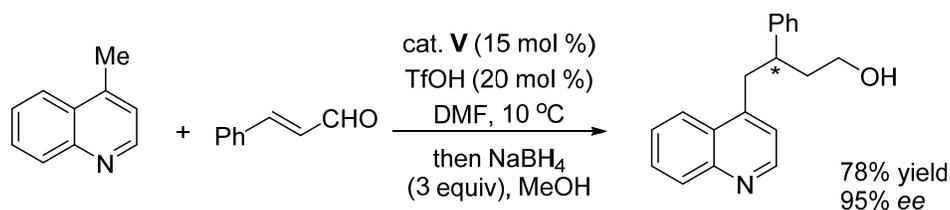
A screw cap glass vial equipped with a magnetic stirring bar was charged with quinolin-4-ylmethanol **1a** (0.5 mmol, 1 equiv), $\text{CF}_3\text{SO}_3\text{H}$ (0.1 mmol, 0.2 equiv), catalyst **V** (0.075 mmol, 0.15 equiv), D_2O (2.5 mmol, 5 equiv) and DMF (0.5 mL). The resulting mixture was stirred at 10 °C for 96 h. Subsequently, the reaction was diluted with saturated aq. Na_2CO_3 (2 mL) and extracted with EtOAc (5 mL \times 3). The combined organic extracts were washed with brine, dried with Na_2SO_4 , and concentrated in vacuo. The residue was redissolved in CDCl_3 and the resulting clear solution was then analyzed by ^1H NMR spectroscopy from which the percentage of deuterium incorporation was determined. For the corresponding control experiment, $\text{CF}_3\text{SO}_3\text{H}$ was omitted.



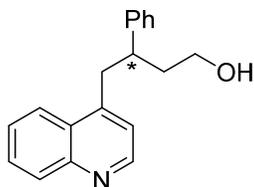
^1H NMR (CDCl_3) of quinolin-4-ylmethanol **1a** after deuterium exchange experiments in different reaction conditions



4-Methyl quinoline as nucleophile

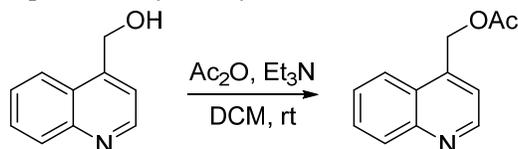


A screw cap glass vial equipped with a magnetic stirring bar was charged with 4-methylquinoline (71.5 mg, 0.5 mmol), CF₃SO₃H (15 mg, 0.1 mmol) and DMF (0.5 mL) and the solution was stirred for 5 min at room temperature. Then catalyst **V** (27.5 mg, 0.075 mmol) was added into the solution and the resulting mixture was stirred for 5 min at 10 °C. Subsequently, trans-cinnamaldehyde **2a** (99 mg, 0.75 mmol) was added into the mixture and the reaction was stirred at 10 °C for 48 h. After the starting material was consumed, the reaction was diluted with saturated aq. Na₂CO₃ (2 mL) and extracted with EtOAc (5 mL × 3). The combined organic extracts were washed with brine, dried with Na₂SO₄, and concentrated in vacuo. Subsequently the residue was dissolved in 5 mL MeOH. Then NaBH₄ (56 mg, 1.5 mmol) was added and the reaction mixture was stirred for 30 minutes at room temperature. The methanol was evaporated and the residue diluted with water (5 mL) and extracted with EtOAc (2 × 5 mL). The combined organic layers were washed with brine, dried with Na₂SO₄, and concentrated in vacuo. Purification by silica gel flash column chromatography provided the final compound in 78% yield as a slight yellow oil.

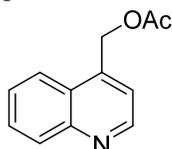


3-Phenyl-4-(quinolin-4-yl)butan-1-ol: ¹H NMR (400 MHz, CDCl₃): δ 8.55 (d, *J* = 4.4 Hz, 1H), 8.10 – 7.99 (m, 2H), 7.72 – 7.61 (m, 1H), 7.57 – 7.48 (m, 1H), 7.25 – 7.20 (m, 2H), 7.20 – 7.14 (m, 1H), 7.13 – 7.07 (m, 2H), 6.92 (d, *J* = 4.4 Hz, 1H), 3.58 (dt, *J* = 11.7, 6.0 Hz, 1H), 3.50 – 3.34 (m, 2H), 3.30 – 3.18 (m, 2H), 2.49 (br, 1H), 2.08 – 1.95 (m, 2H); ¹³C NMR (101 MHz, CDCl₃) δ 149.6, 148.1, 146.4, 143.7, 129.9, 129.1, 128.6, 127.6, 127.5, 126.7, 126.5, 123.6, 122.1, 60.4, 42.9, 39.9, 38.6. HRMS (EI) *m/z* calcd. for C₁₉H₁₉NO (M)⁺ 277.1467, found 277.1469. (Chiralpak OD-3, *i*-PrOH/hexane = 20/80, flow rate = 1.0 mL/min, λ = 254 nm): *t*_{minor} = 9.60 min, *t*_{major} = 11.81 min, ee = 95%.

synthetic procedure of quinolin-4-ylmethyl acetate

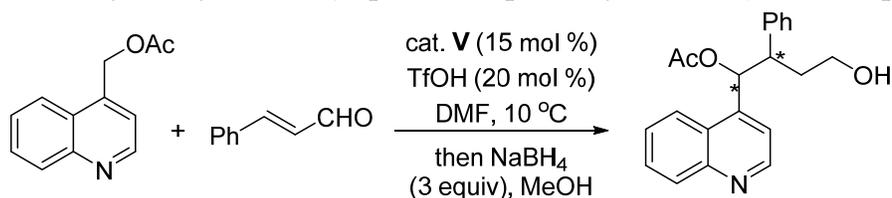


To a solution of quinolin-4-ylmethanol (600 mg, 3.77 mmol) in CH₂Cl₂ (12 mL) were added triethylamine (1.05 mL, 7.54 mmol) and acetic anhydride (1.06 mL, 11.31 mmol) at room temperature. After stirring for 8 h, the reaction mixture was quenched with water (20 mL). The aqueous phase was extracted with CH₂Cl₂ (30 mL × 3). The combined organic layers were washed with brine, dried with Na₂SO₄, and concentrated under reduced pressure. Purification by silica gel flash column chromatography provided the final compound in 85% yield as a slight yellow solid.



Quinolin-4-ylmethyl acetate : ¹H NMR (400 MHz, CDCl₃) δ 8.91 (d, *J* = 4.4 Hz, 1H), 8.16 (d, *J* = 8.4 Hz, 1H), 7.95 (d, *J* = 8.3 Hz, 1H), 7.79 – 7.71 (m, 1H), 7.61 (dd, *J* = 11.2, 4.0 Hz, 1H), 7.44 (d, *J* = 4.3 Hz, 1H), 5.60 (s, 2H), 2.19 (s, 3H); ¹³C NMR (101 MHz, CDCl₃) δ 170.6, 150.3, 148.2, 140.9, 130.3, 129.5, 127.0, 125.9, 122.9, 119.7, 62.6, 20.9. HRMS (EI) *m/z* calcd. for C₁₂H₁₁NO₂ (M)⁺ 201.0790, found 201.0793.

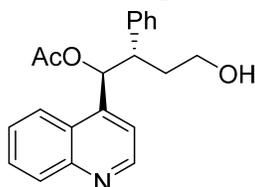
Quinolin-4-ylmethyl acetate (O-protected quinolinylmethanol) as nucleophile



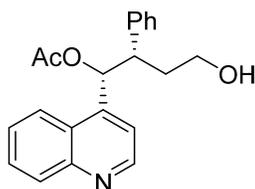
yield: 80%
dr: *trans/cis*: 1.2/1
ee %: *trans/cis*: 70/86

A screw cap glass vial equipped with a magnetic stirring bar was charged with quinolin-4-ylmethyl acetate (100.5 mg, 0.5 mmol), CF₃SO₃H (15 mg, 0.1 mmol) and DMF (0.5 mL) and the solution was stirred for 5 min at room temperature. Then catalyst V (27.5 mg, 0.075 mmol) was added into the solution and the resulting mixture was stirred for 5 min at 10 °C. Subsequently, *trans*-cinnamaldehyde **2a** (99 mg, 0.75 mmol) was added into the mixture and the reaction was stirred at 10 °C for 48 h. After the starting material was consumed, the reaction was diluted with saturated aq. Na₂CO₃ (2 mL) and extracted with EtOAc (5 mL × 3). The combined organic extracts were washed with brine, dried with Na₂SO₄, and concentrated in vacuo. Subsequently the residue was dissolved in 5 mL MeOH. Then NaBH₄ (56 mg, 1.5 mmol) was added and the reaction mixture was stirred for 30 minutes at room temperature. The methanol was

evaporated and the residue diluted with water (5 mL) and extracted with EtOAc (2 × 5 mL). The combined organic layers were washed with brine, dried with Na₂SO₄, and concentrated in vacuo. Purification by silica gel flash column chromatography provided the final compound in 80% yield as a slight yellow oil (*trans/cis*: 1.2/1).



(1*S*,2*S*)-4-Hydroxy-2-phenyl-1-(quinolin-4-yl)butyl acetate : ¹H NMR (400 MHz, CDCl₃) δ 8.62 (d, *J* = 4.5 Hz, 1H), 8.21 (d, *J* = 8.4 Hz, 1H), 8.09 (d, *J* = 8.4 Hz, 1H), 7.70 (t, *J* = 7.4 Hz, 1H), 7.58 (t, *J* = 7.4 Hz, 1H), 7.23 – 7.16 (m, 3H), 7.06 – 6.98 (m, 3H), 6.75 (d, *J* = 6.4 Hz, 1H), 3.58 (dt, *J* = 11.1, 5.8 Hz, 1H), 3.55 – 3.48 (m, 1H), 3.42 (ddd, *J* = 10.6, 7.9, 5.9 Hz, 1H), 2.64 (br, 1H), 2.07 – 1.98 (m, 4H), 1.87 (td, *J* = 13.5, 6.2 Hz, 1H); ¹³C NMR (101 MHz, CDCl₃) δ 169.9, 149.5, 148.0, 145.2, 138.9, 130.1, 129.4, 128.9, 128.2, 127.2, 127.0, 125.7, 123.2, 118.8, 74.1, 59.9, 47.0, 34.7, 20.9. HRMS (EI) *m/z* calcd. for C₂₁H₂₁NO₃ (M)⁺ 335.1521, found 335.1520. (Chiralpak OD-3, *i*-PrOH/hexane = 15/85, flow rate = 1.0 mL/min, λ = 254 nm): *t*_{minor} = 13.02 min, *t*_{major} = 15.25 min, ee = 70%.



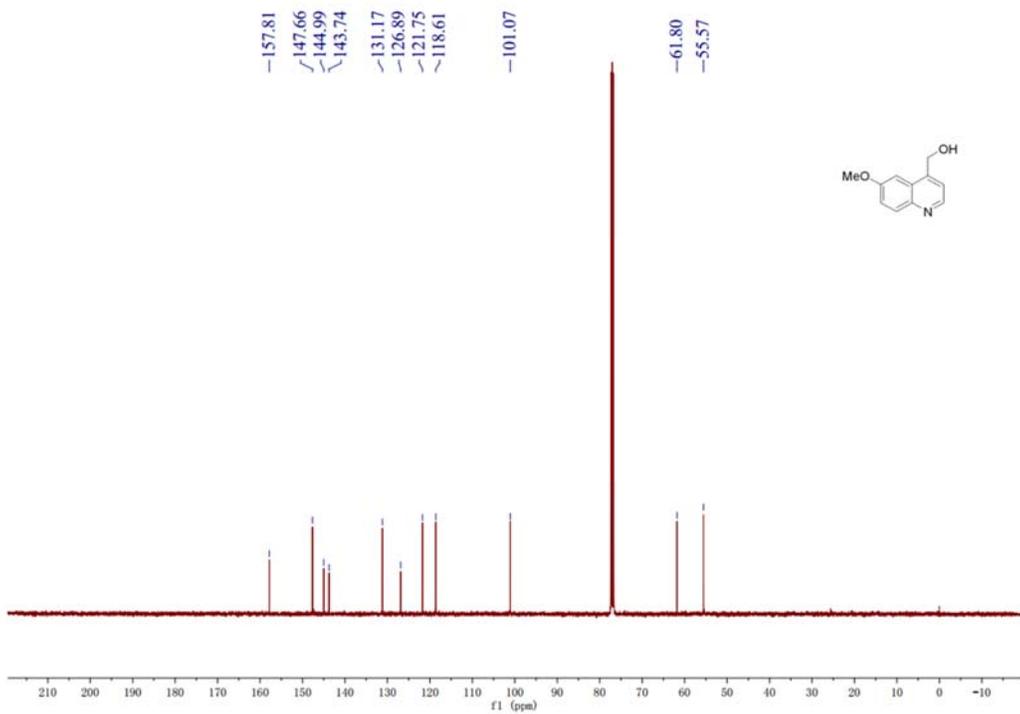
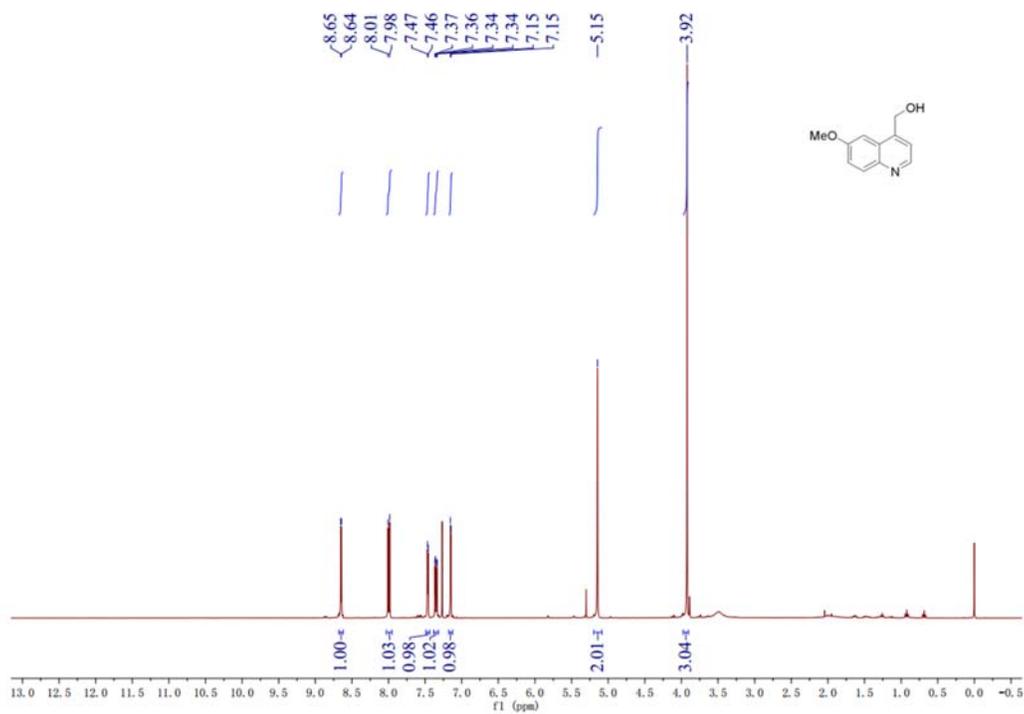
(1*R*,2*S*)-4-Hydroxy-2-phenyl-1-(quinolin-4-yl)butyl acetate : ¹H NMR (400 MHz, CDCl₃) δ 8.73 (d, *J* = 4.4 Hz, 1H), 8.10 (d, *J* = 8.5 Hz, 1H), 8.05 (d, *J* = 8.4 Hz, 1H), 7.66 (t, *J* = 7.6 Hz, 1H), 7.54 (t, *J* = 7.6 Hz, 1H), 7.23 (d, *J* = 4.4 Hz, 1H), 7.19 – 7.06 (m, 5H), 6.53 (d, *J* = 6.7 Hz, 1H), 3.58 – 3.46 (m, 2H), 3.38 – 3.28 (m, 1H), 2.21 – 2.10 (m, 5H); ¹³C NMR (126 MHz, CDCl₃) δ 169.8, 149.5, 148.3, 144.7, 139.4, 130.1, 129.1, 128.5, 128.2, 127.2, 126.6, 125.5, 123.3, 119.1, 75.8, 60.2, 46.9, 32.7, 20.9. HRMS (EI) *m/z* calcd. for C₂₁H₂₁NO₃ (M)⁺ 335.1521, found 335.1520. (Chiralpak OD-3, *i*-PrOH/hexane = 10/90, flow rate = 0.8 mL/min, λ = 254 nm): *t*_{minor} = 39.99 min, *t*_{major} = 45.27 min, ee = 86%.

X. Reference

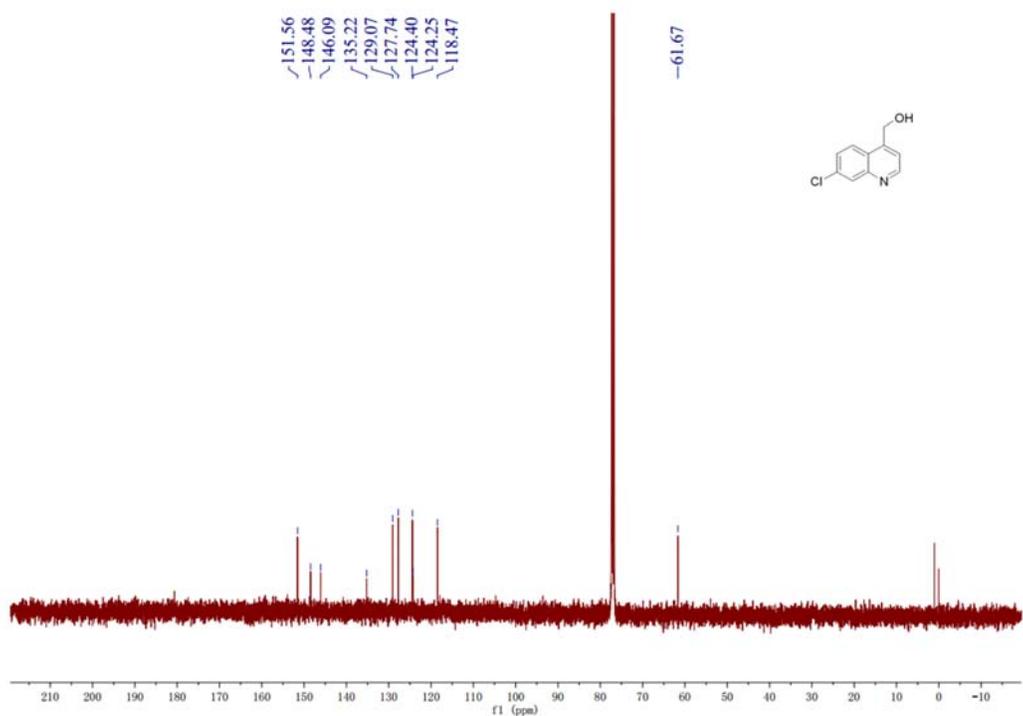
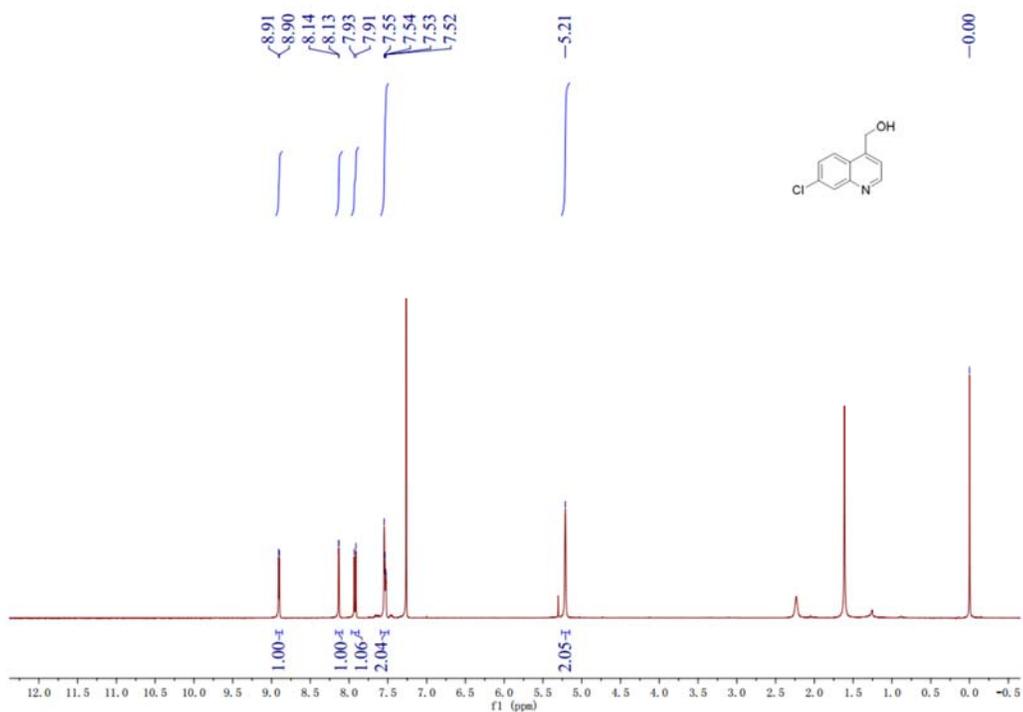
- [1] Jeong, J.; Patel, P.; Hwang, H.; Chang, S. *Org. Lett.* **2014**, *16*, 4598.
- [2] Ding, D.-R.; Dvoskin, L. P.; Crooks, P. A. *Tetrahedron Lett.* **2013**, *54*, 5211
- [3] Weitgenant, J. A.; Mortison, J. D.; Helquist, P. *Org. Lett.* **2005**, *7*, 3609.

XI. ^1H NMR and ^{13}C NMR spectra

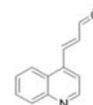
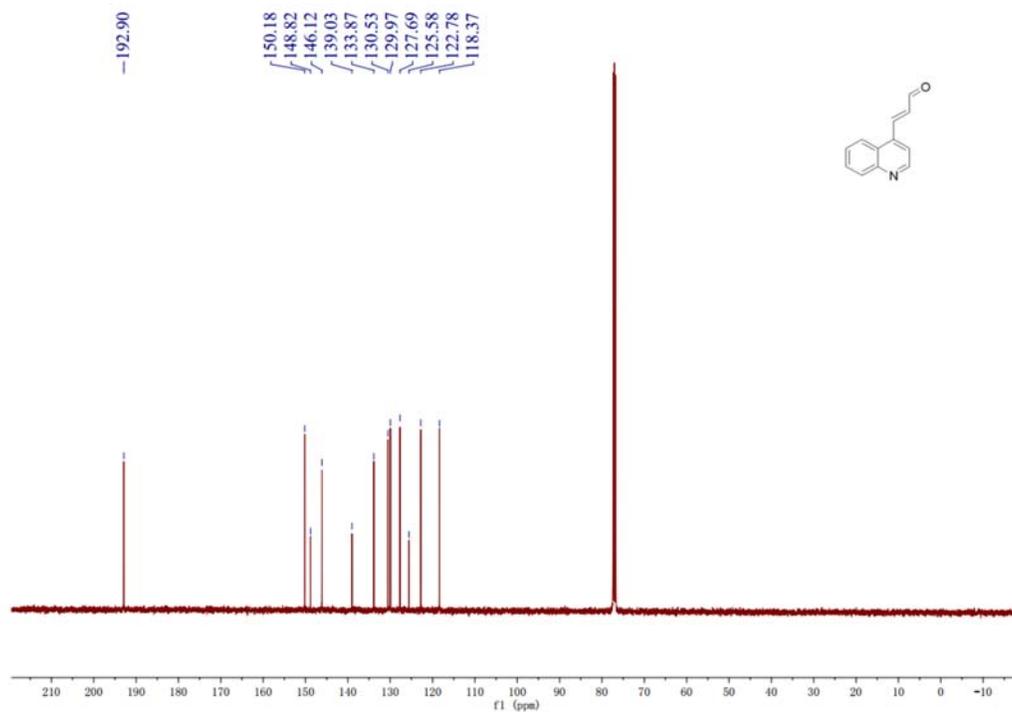
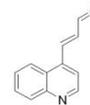
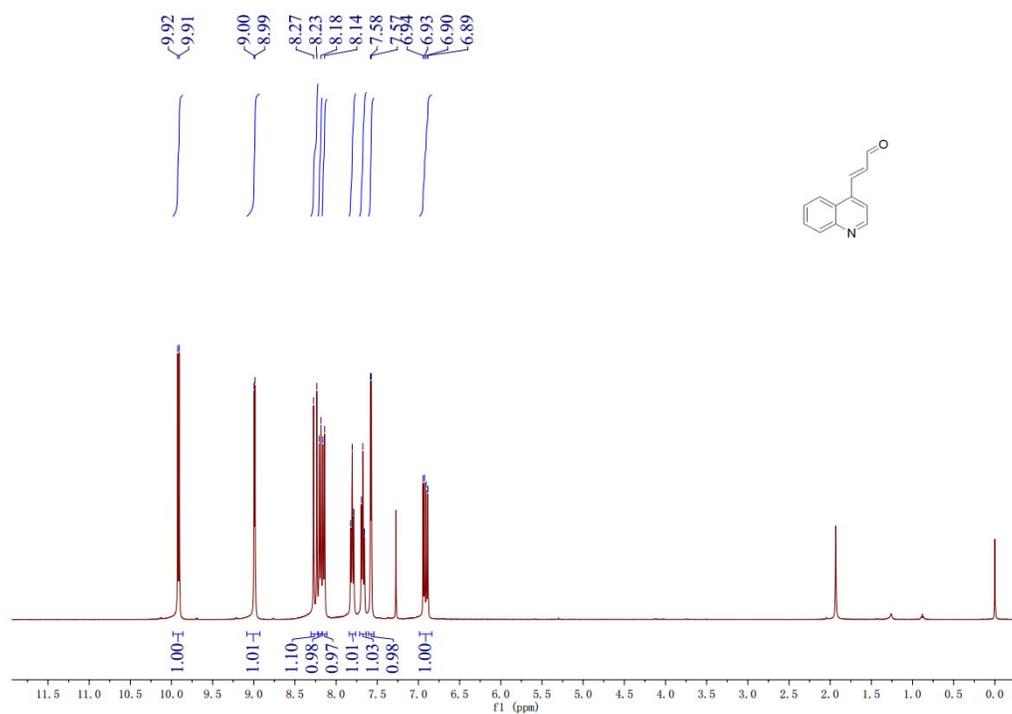
(6-Methoxyquinolin-4-yl)methanol (1b)



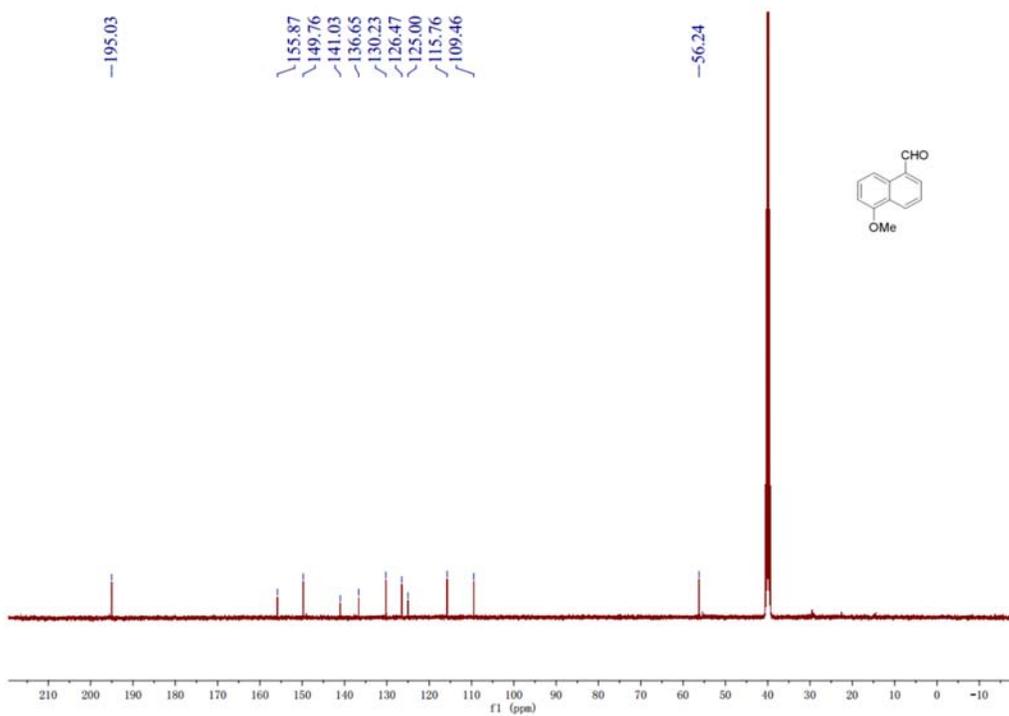
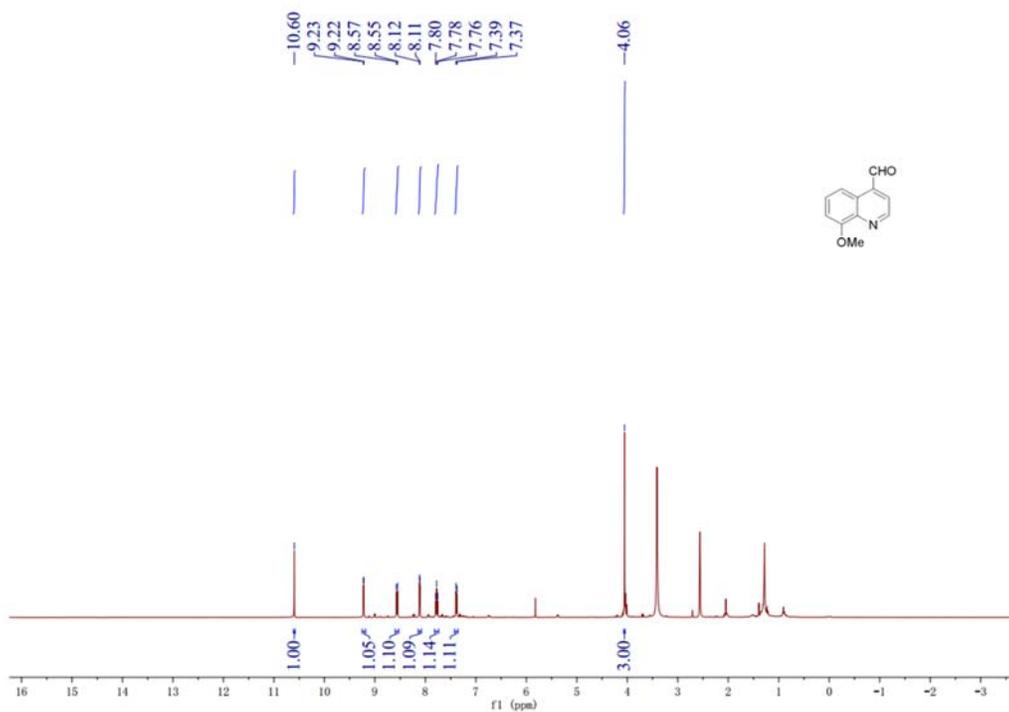
(7-Chloroquinolin-4-yl)methanol (1c)



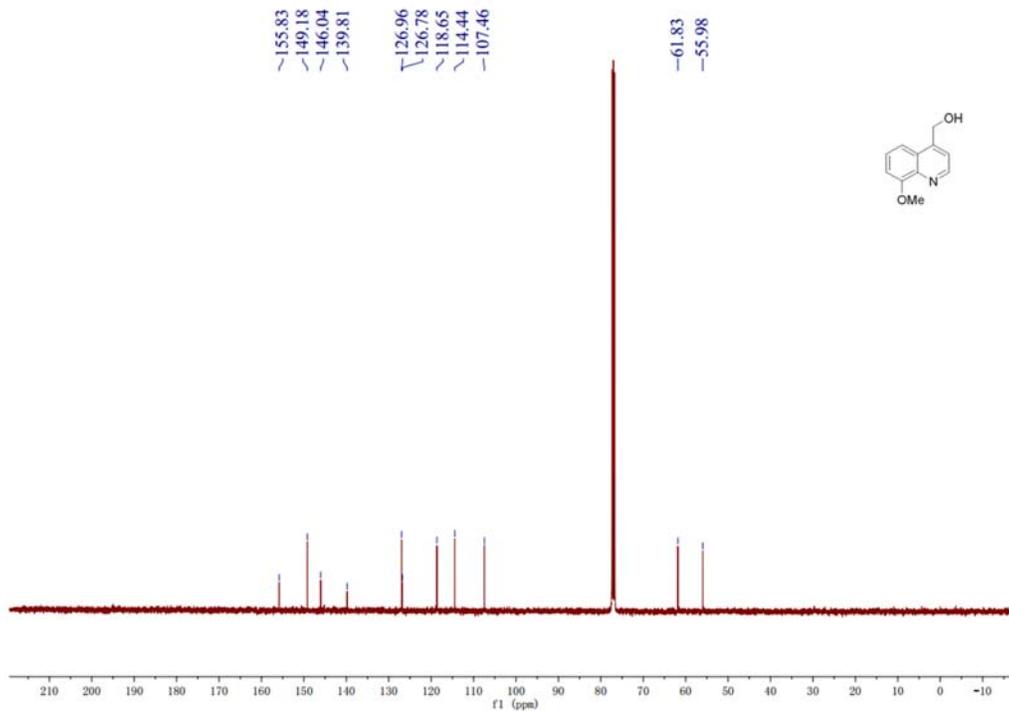
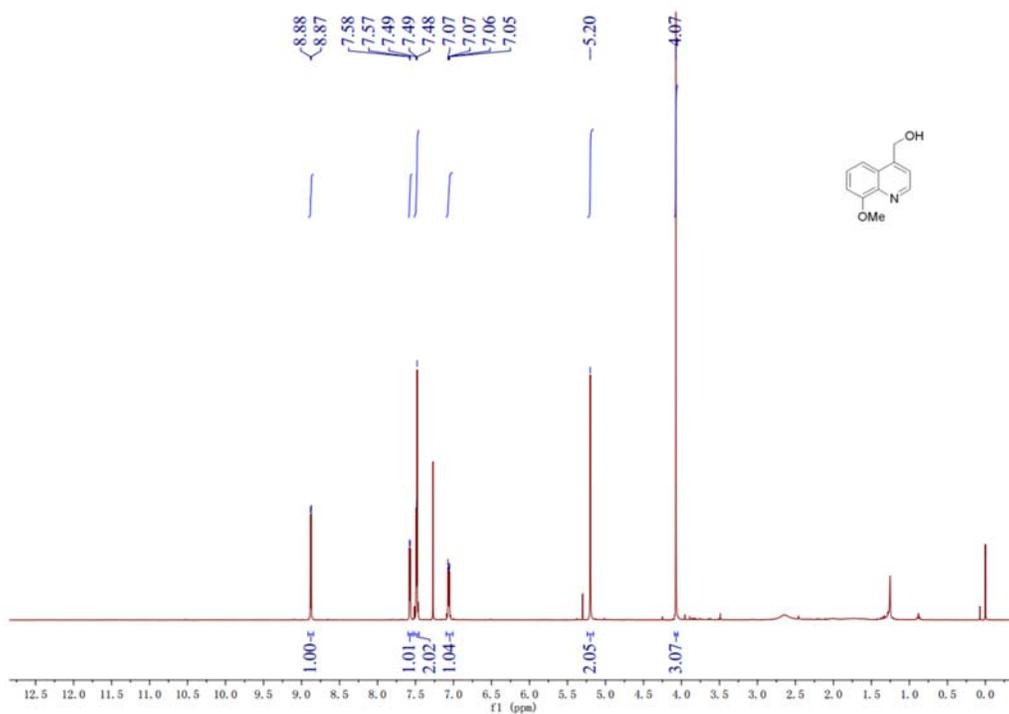
(E)-3-(Quinolin-4-yl)acrylaldehyde (2h)



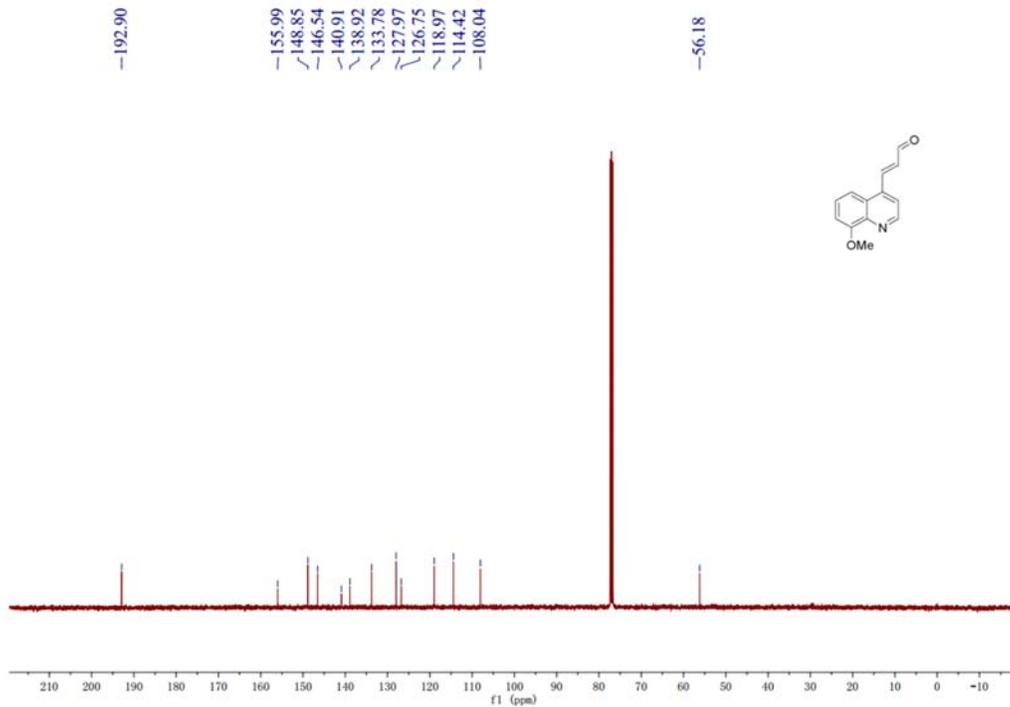
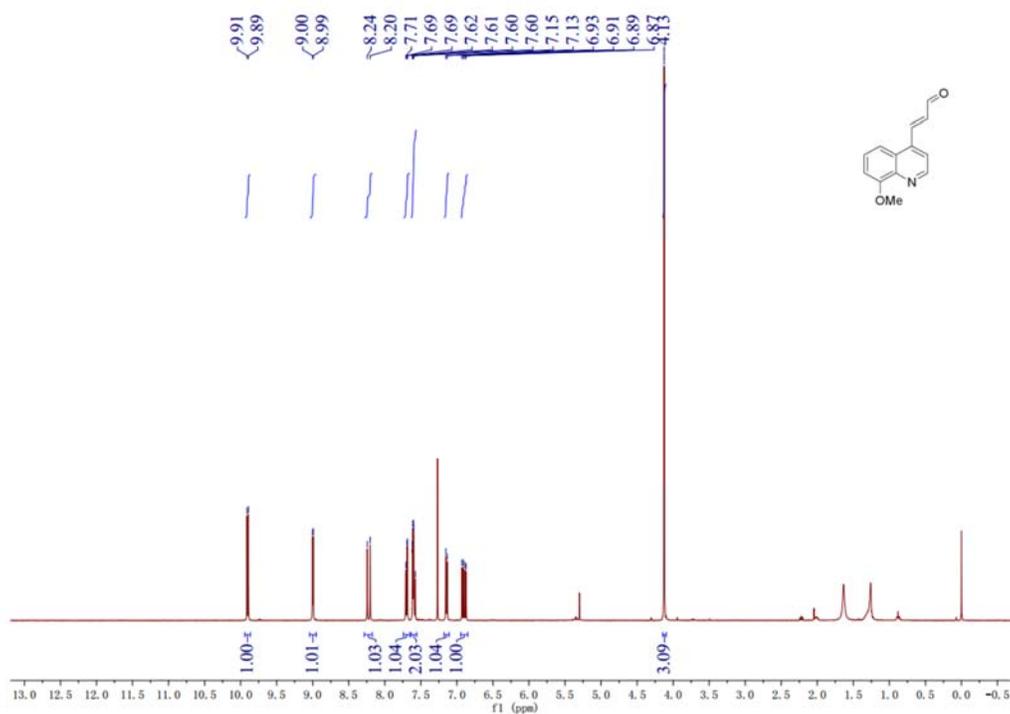
8-Methoxyquinoline-4-carbaldehyde (8)



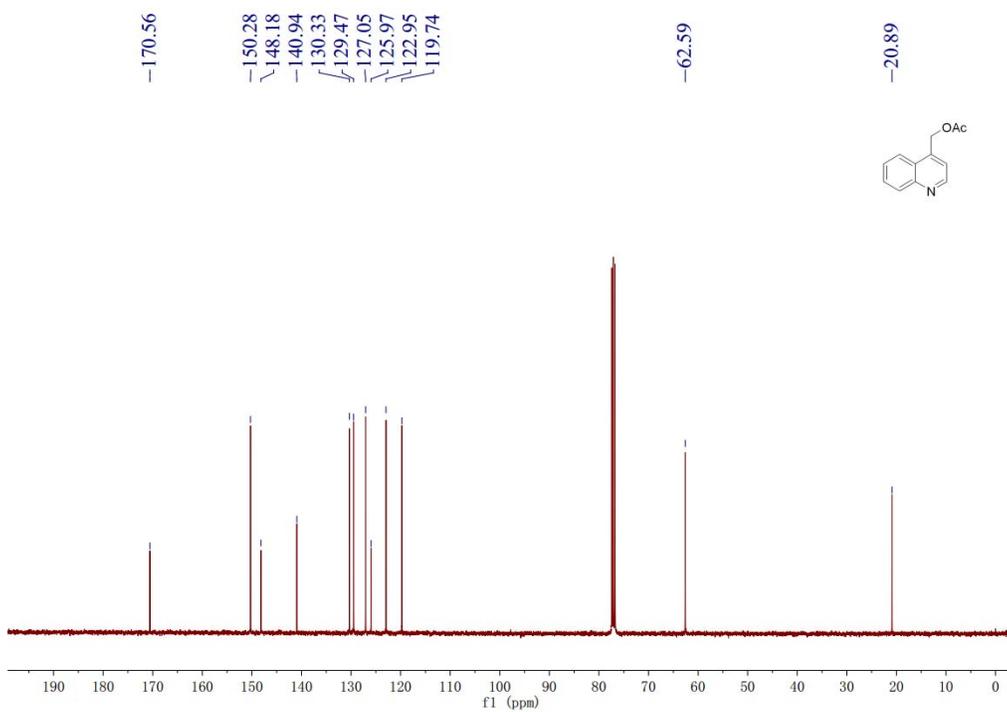
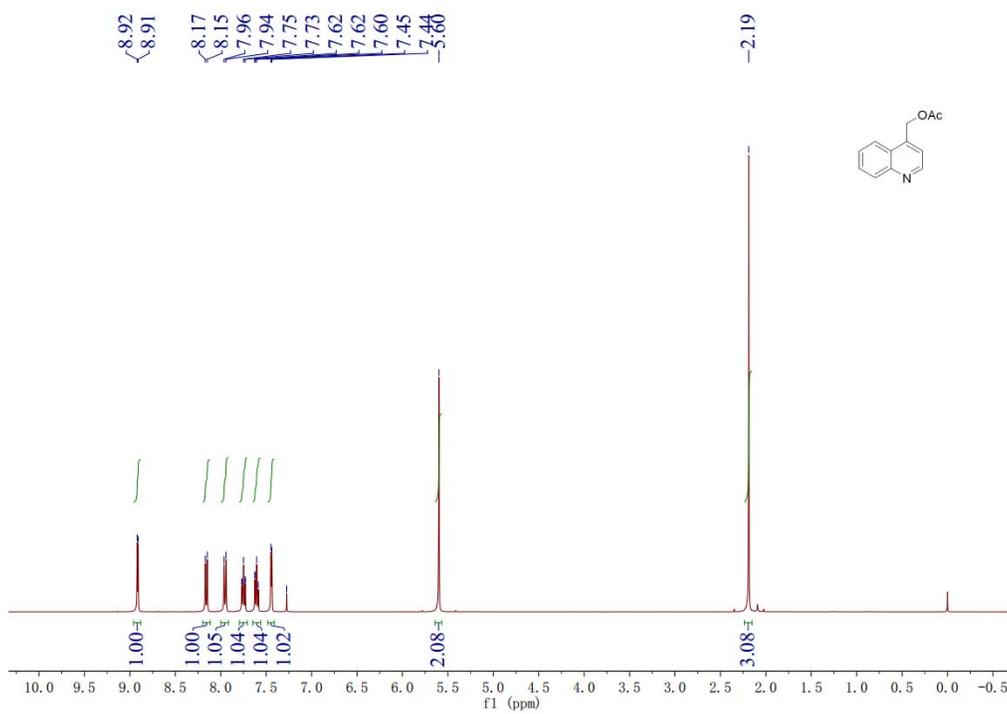
(8-Methoxyquinolin-4-yl)methanol (1f)



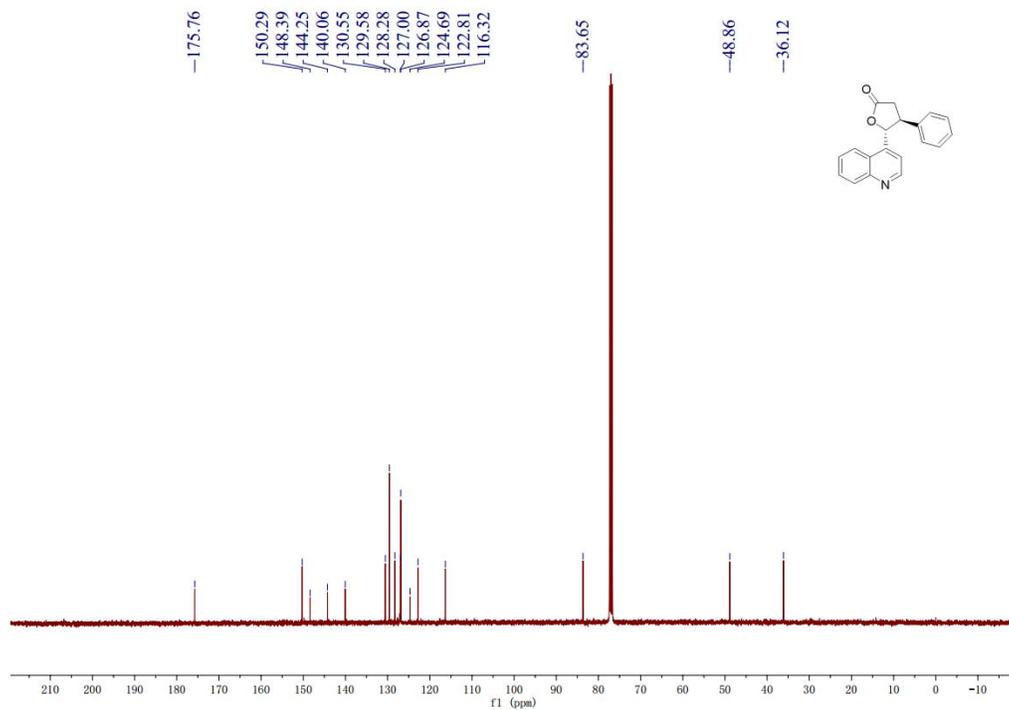
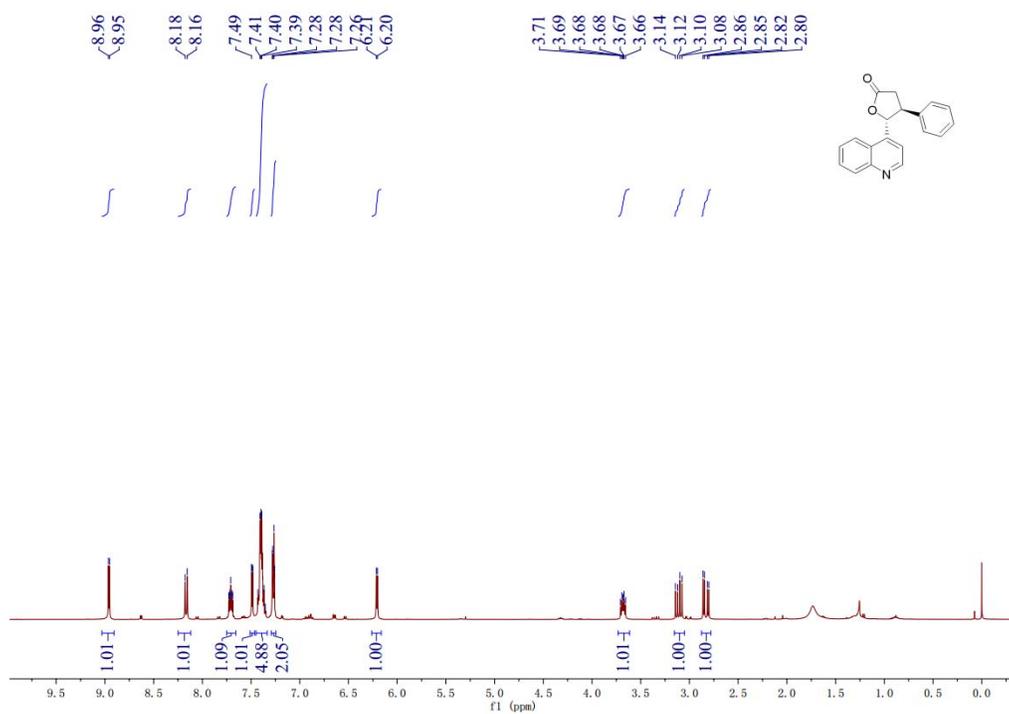
(E)-3-(8-Methoxyquinolin-4-yl)acrylaldehyde (2m)



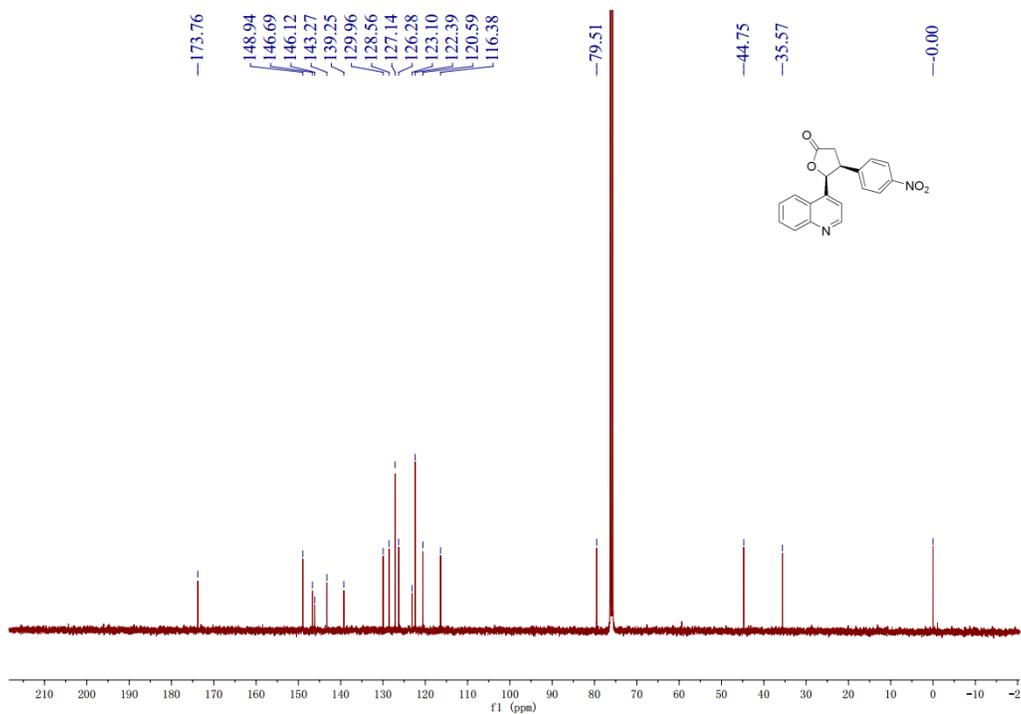
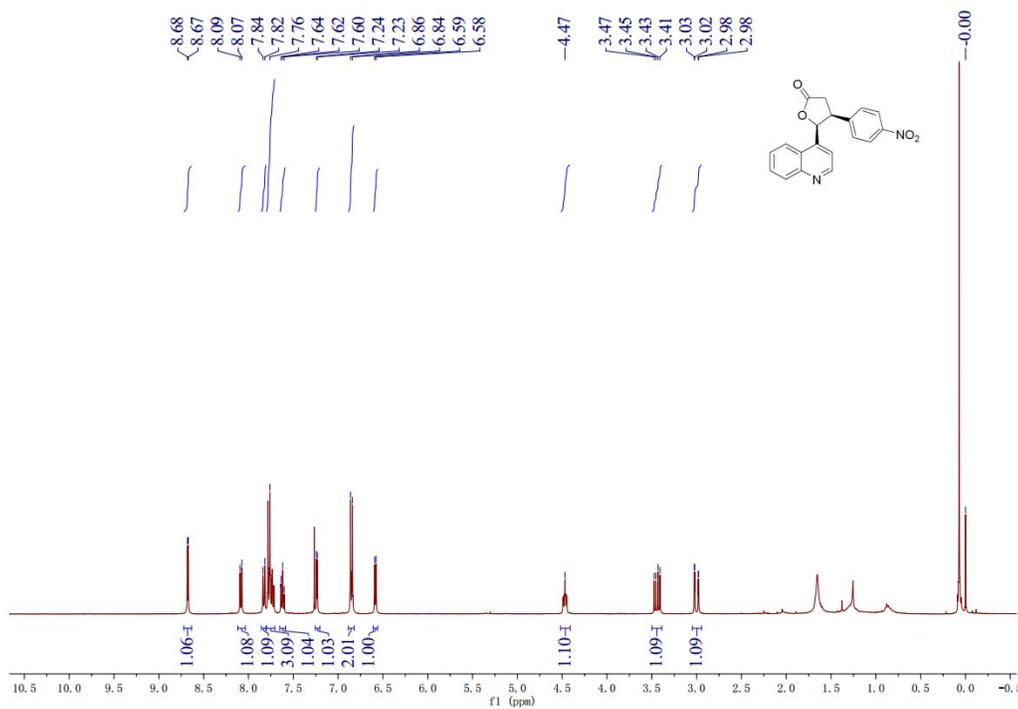
Quinolin-4-ylmethyl acetate



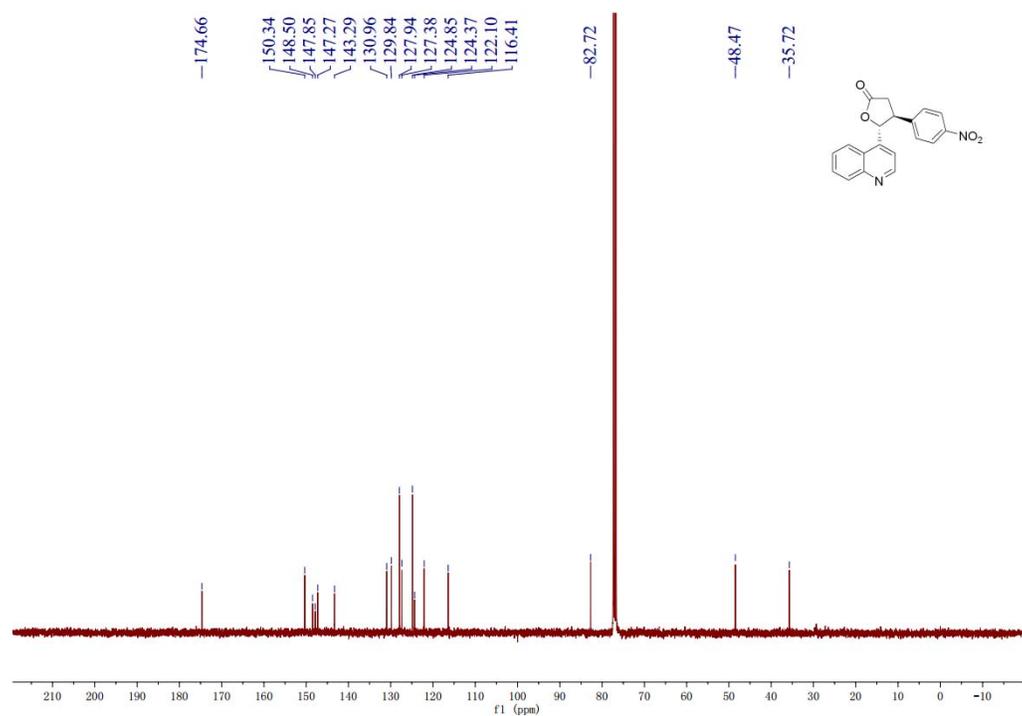
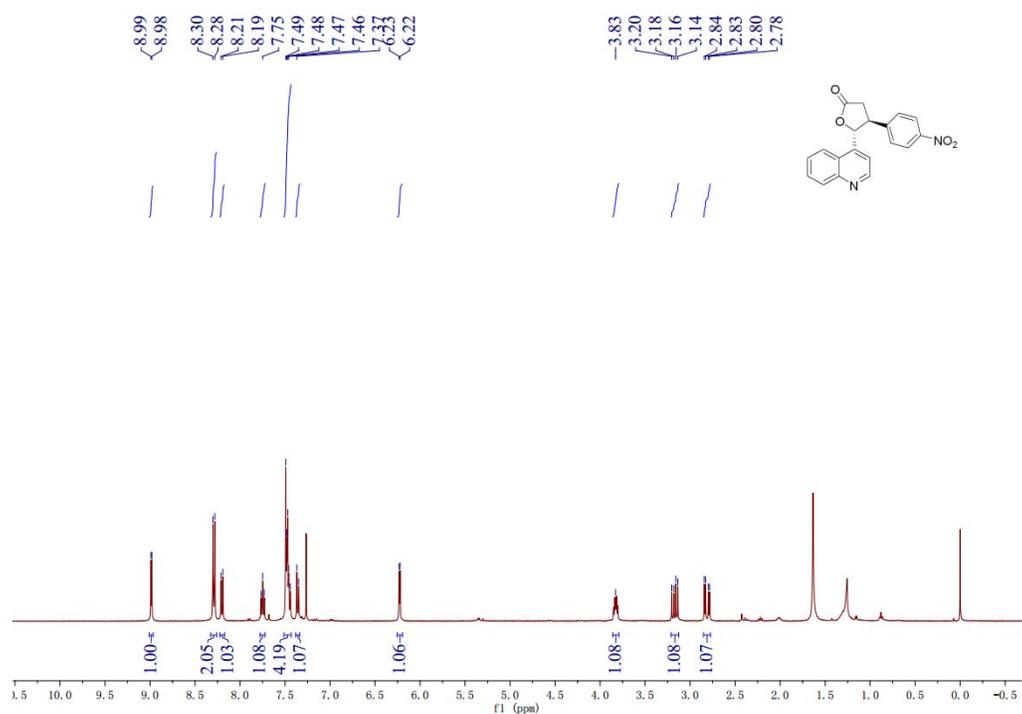
(4*S*,5*R*)-4-Phenyl-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4a)



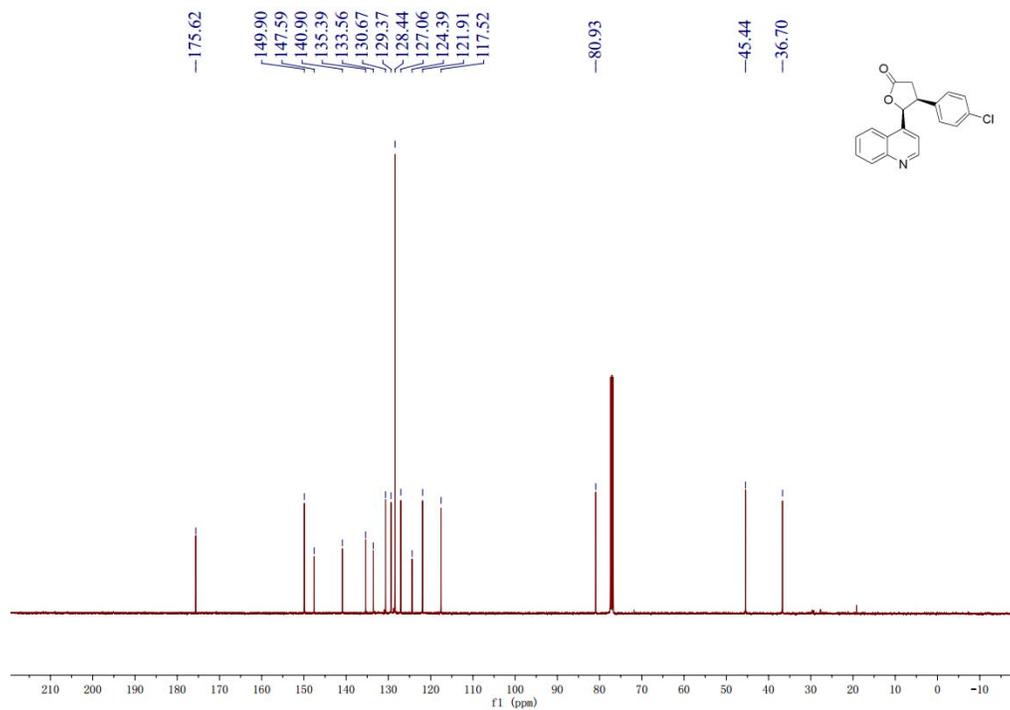
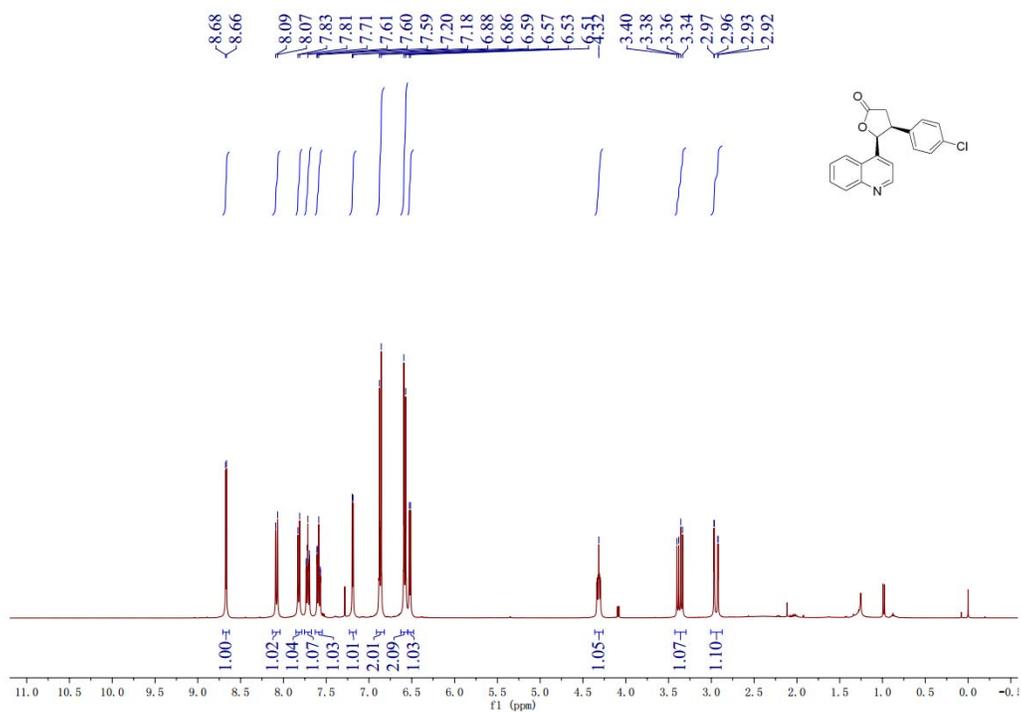
(4*S*,5*S*)-4-(4-Nitrophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-4b)



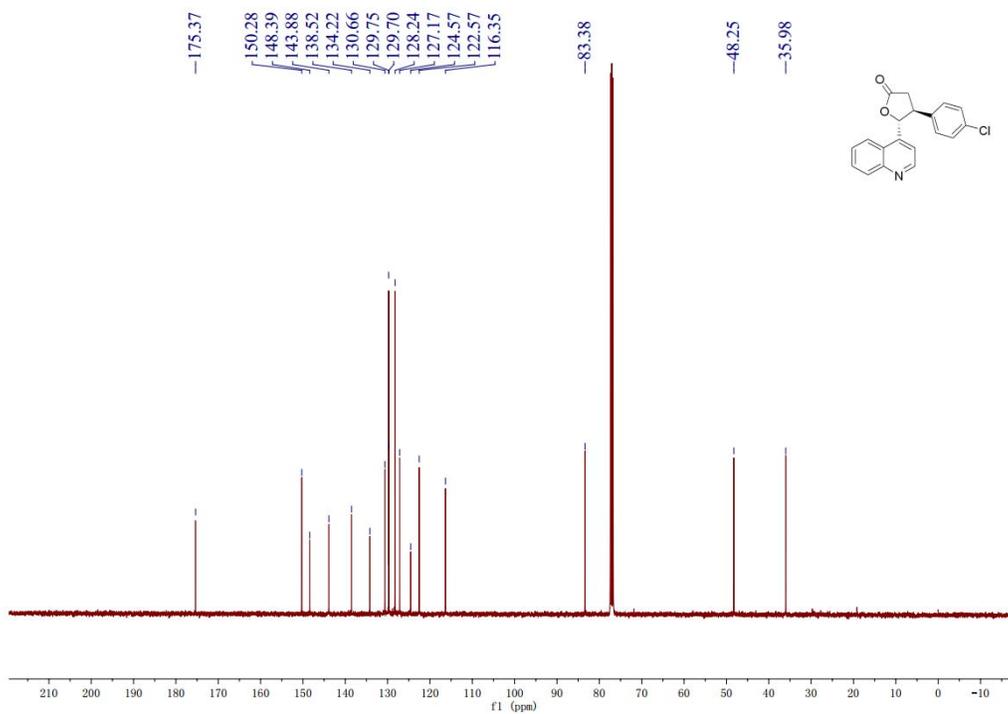
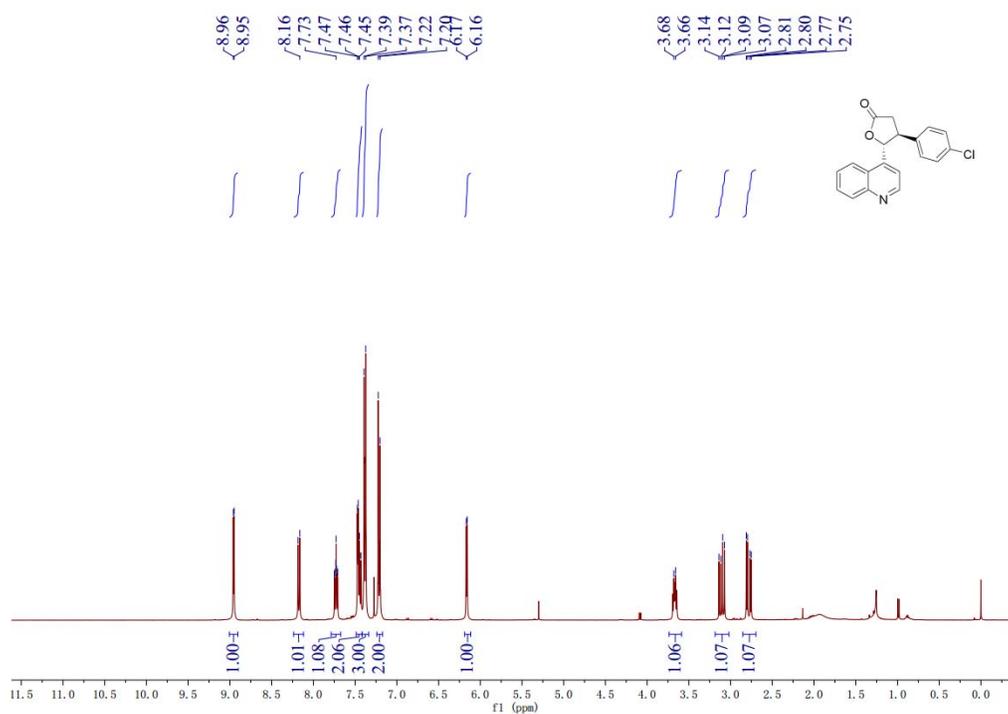
(4*S*,5*R*)-4-(4-Nitrophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4b)



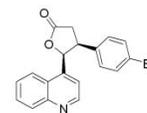
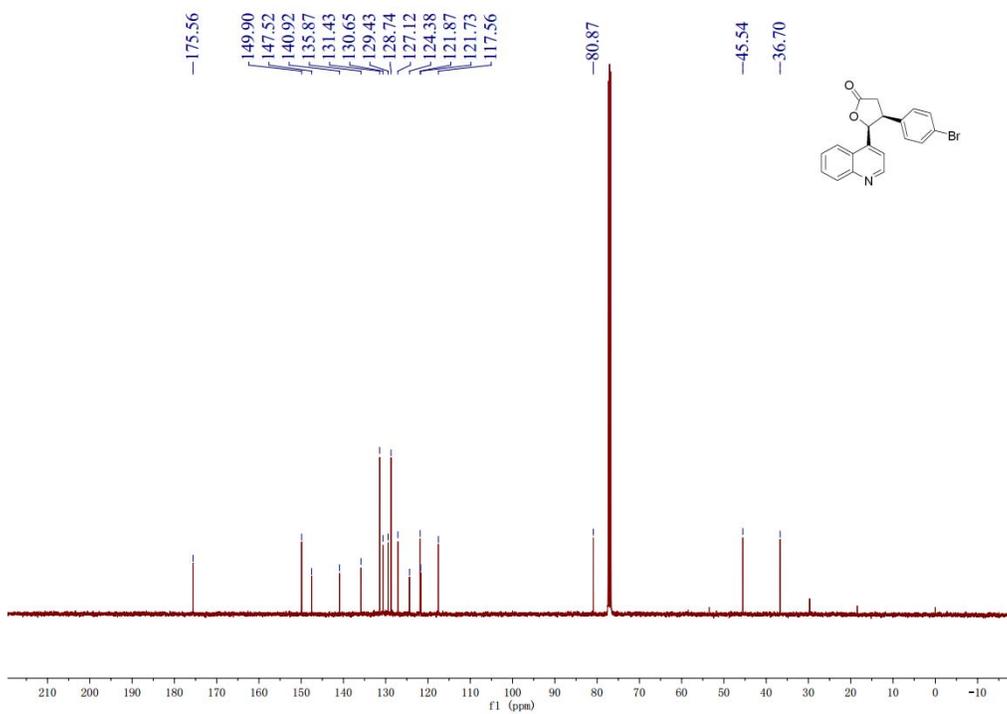
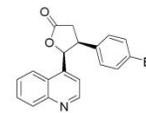
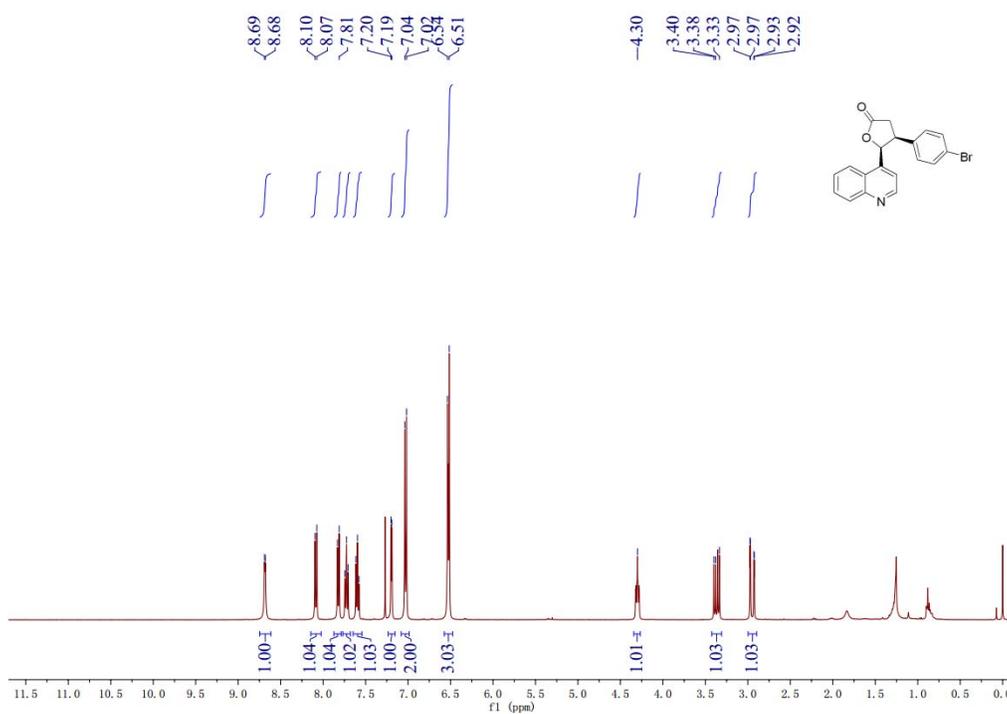
(4*S*,5*S*)-4-(4-Chlorophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-4c)



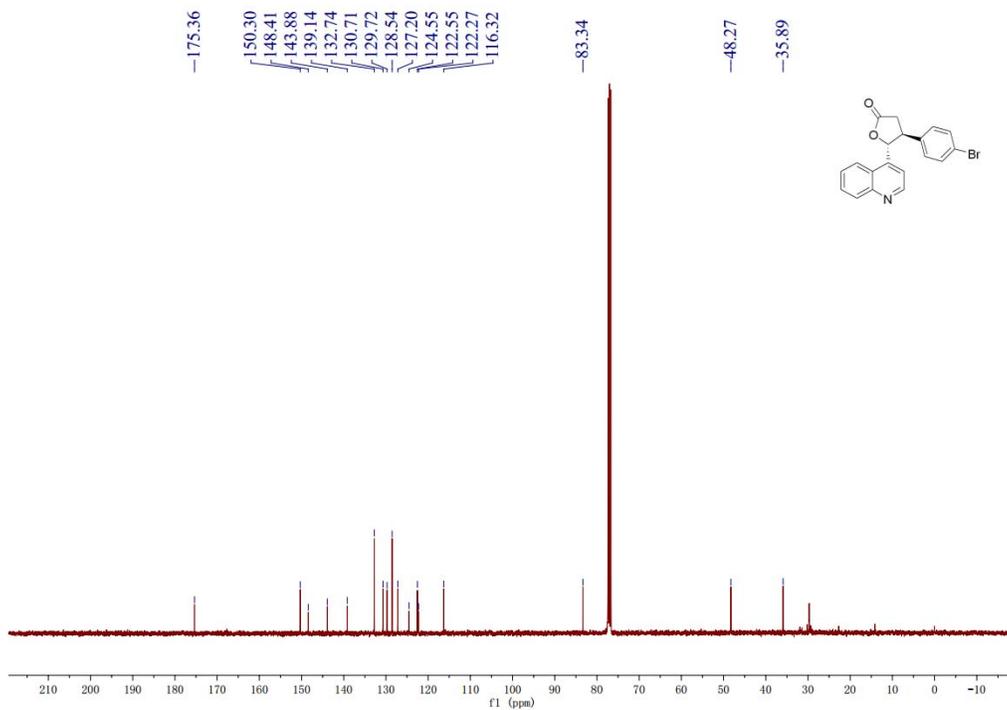
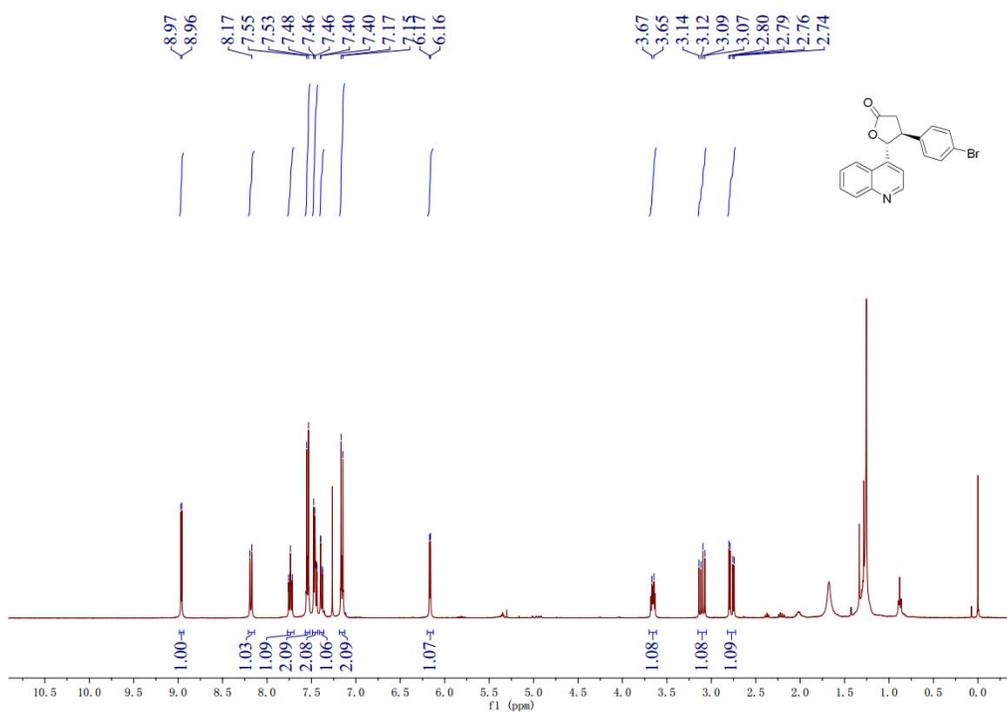
(4*S*,5*R*)-4-(4-Chlorophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4c)



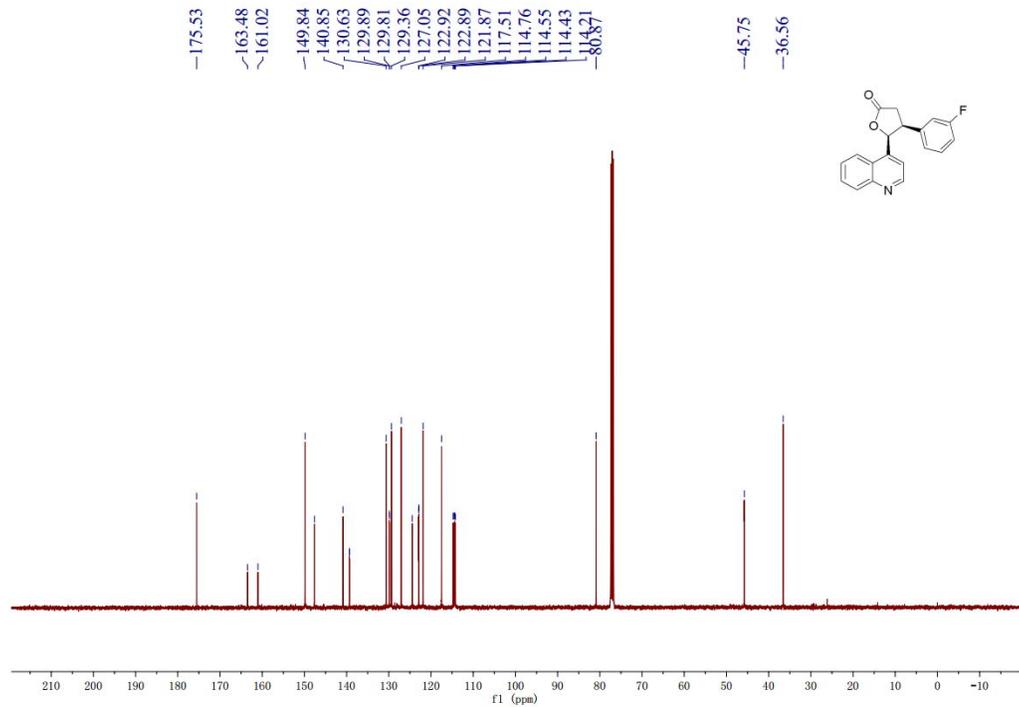
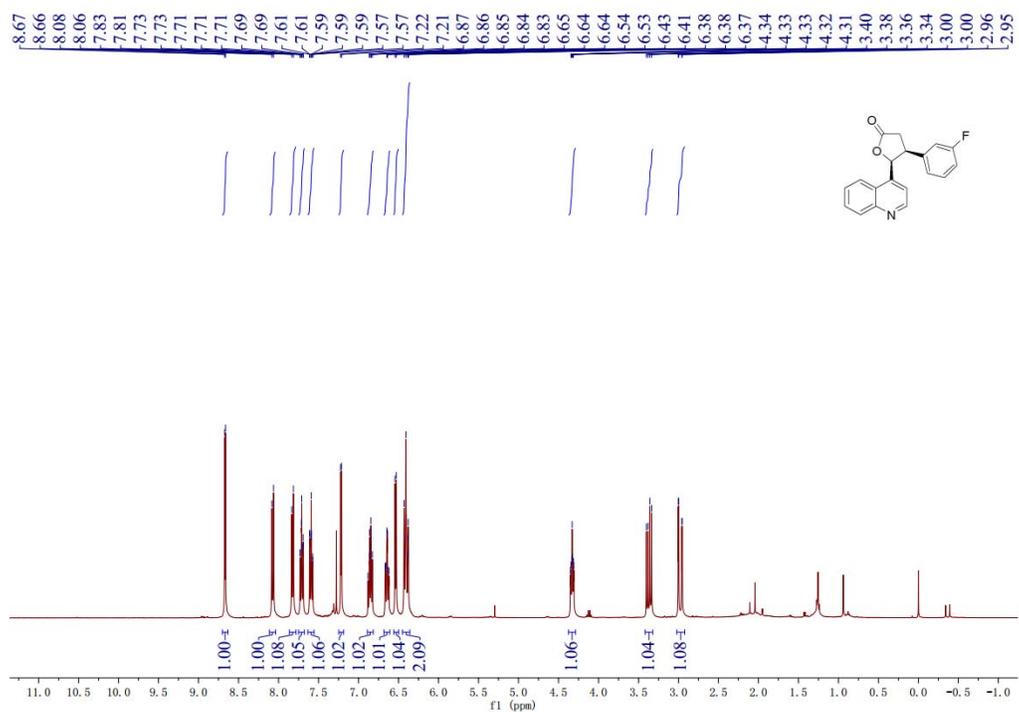
(4*S*,5*S*)-4-(4-Bromophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-4d)



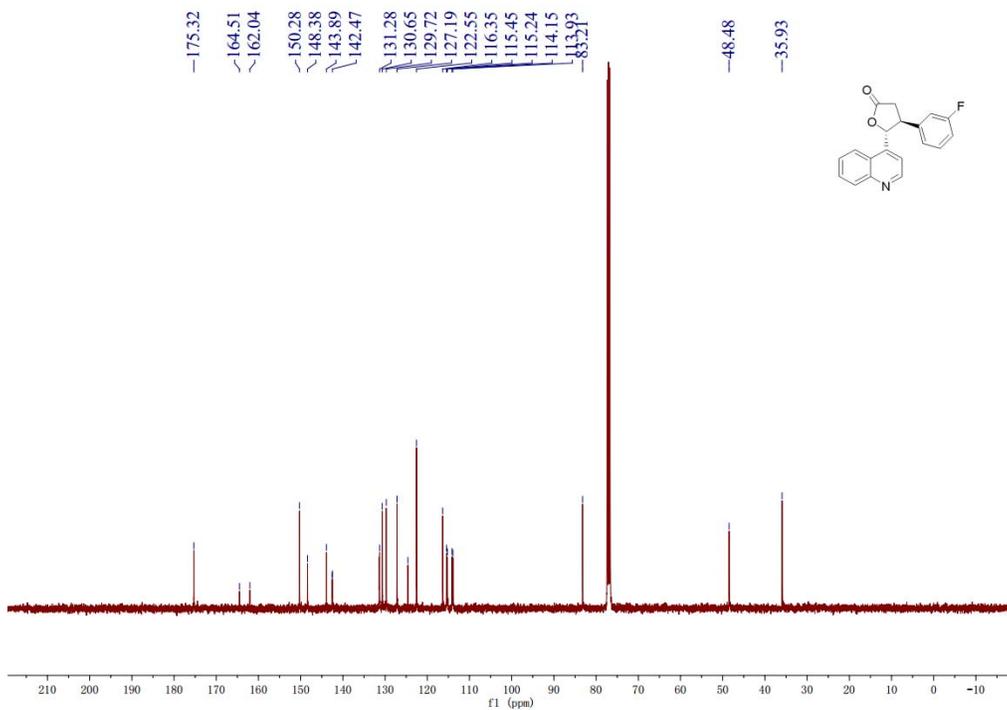
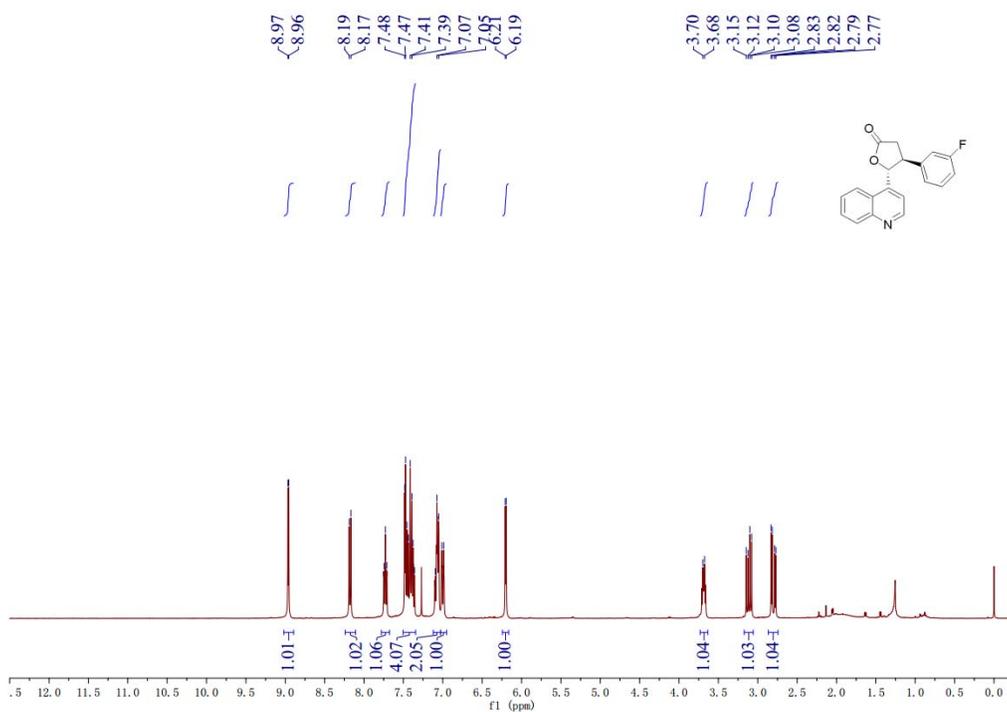
(4*S*,5*R*)-4-(4-Bromophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4d)



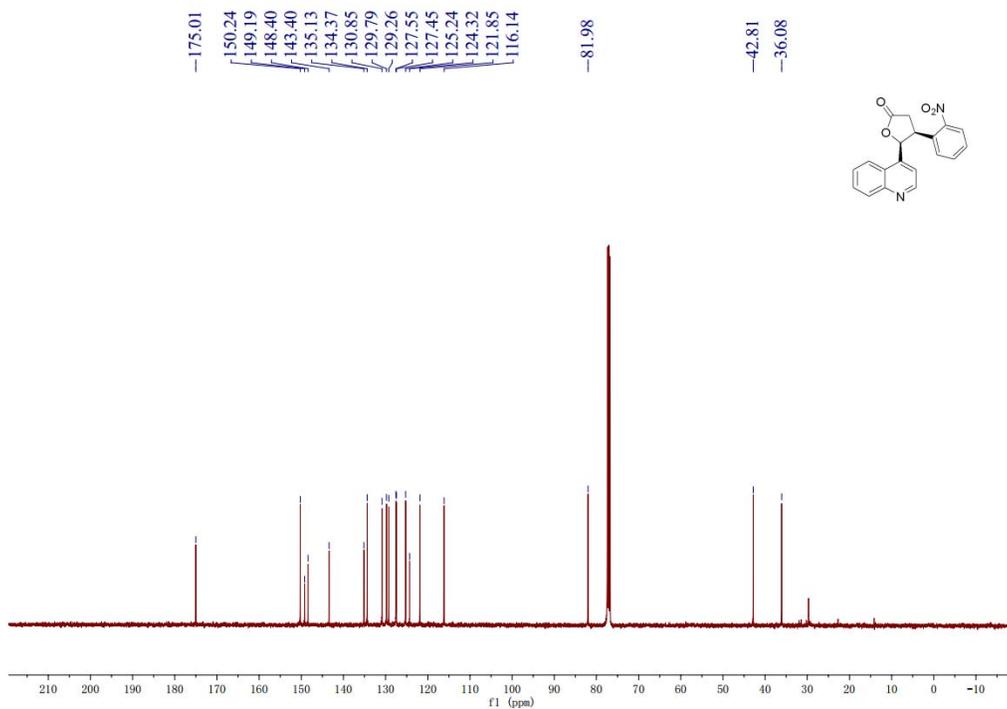
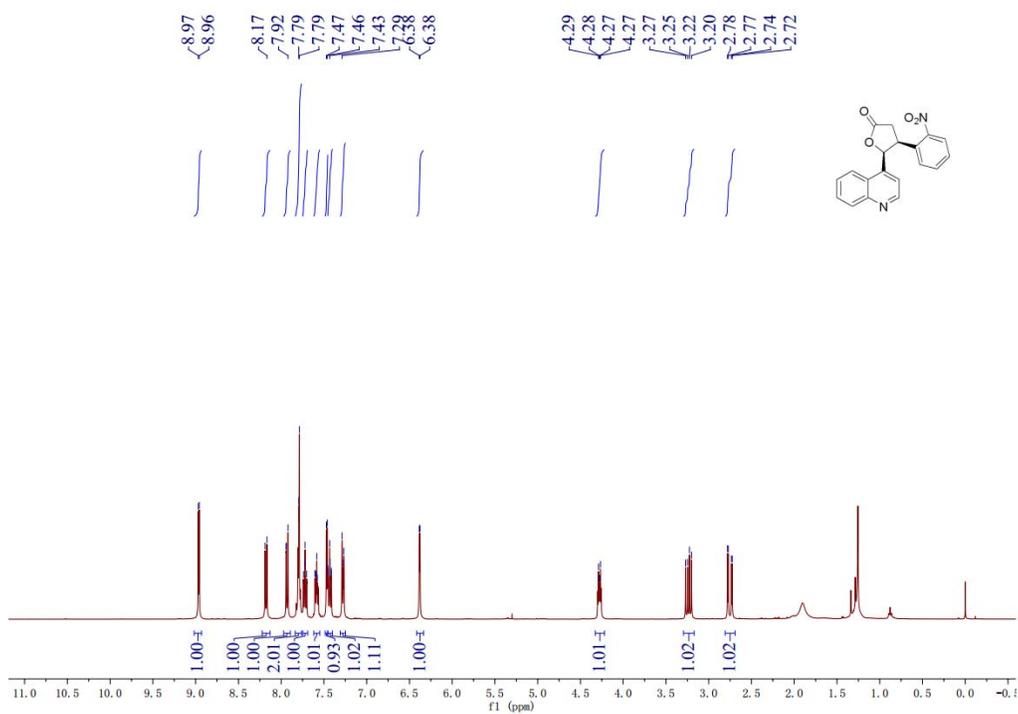
(4*S,S*)-4-(3-Fluorophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-4e)



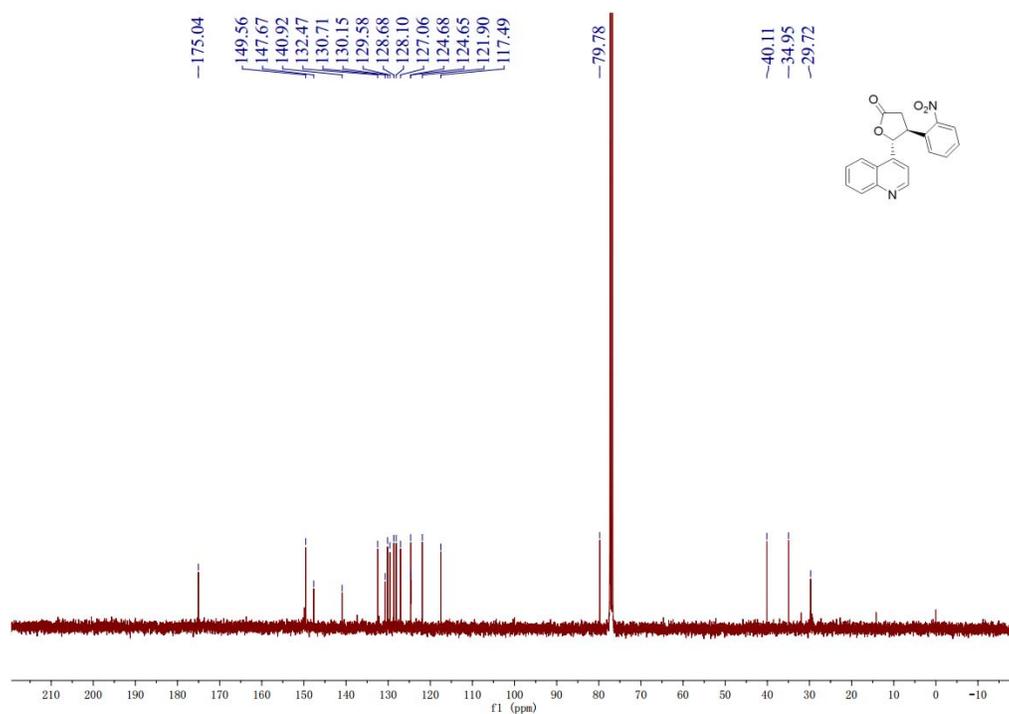
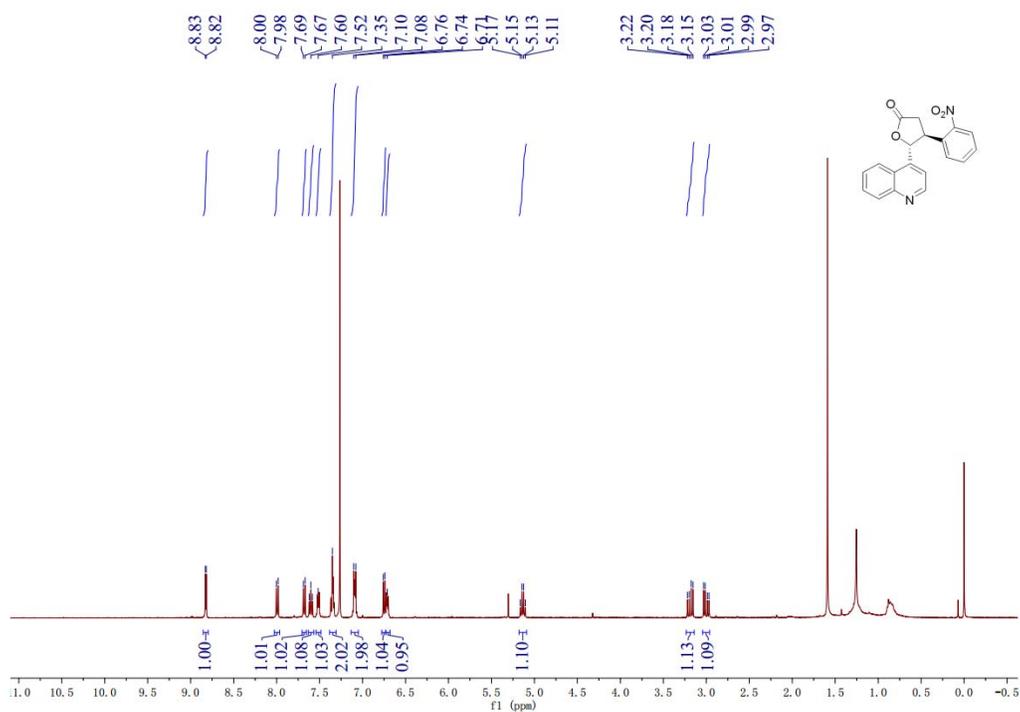
(4*S*,5*R*)-4-(3-Fluorophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4e)



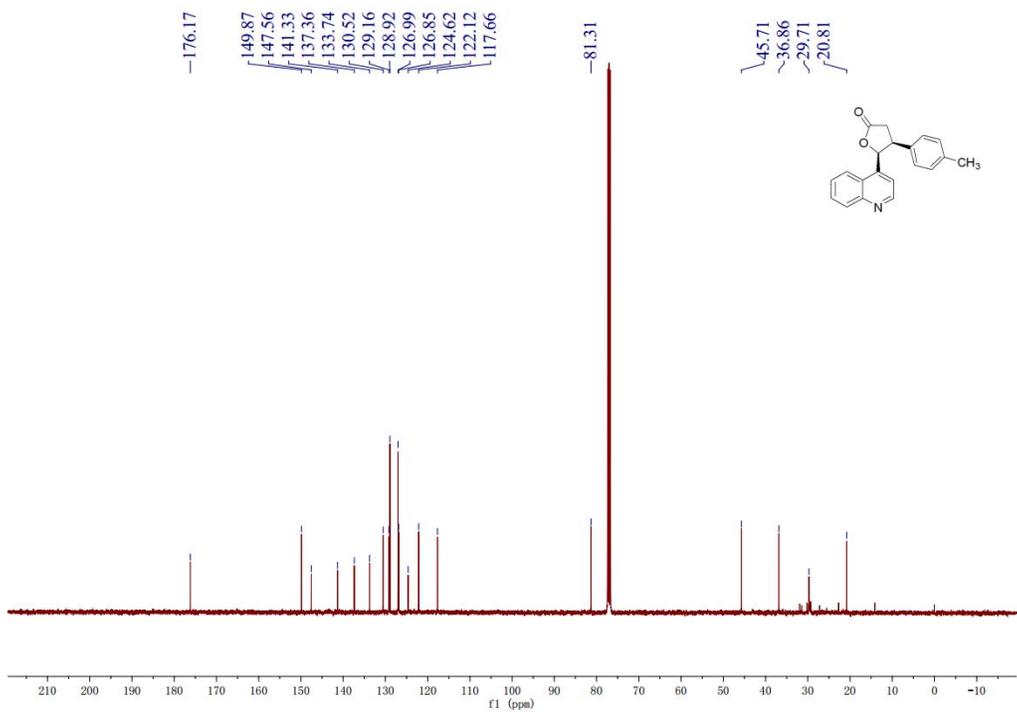
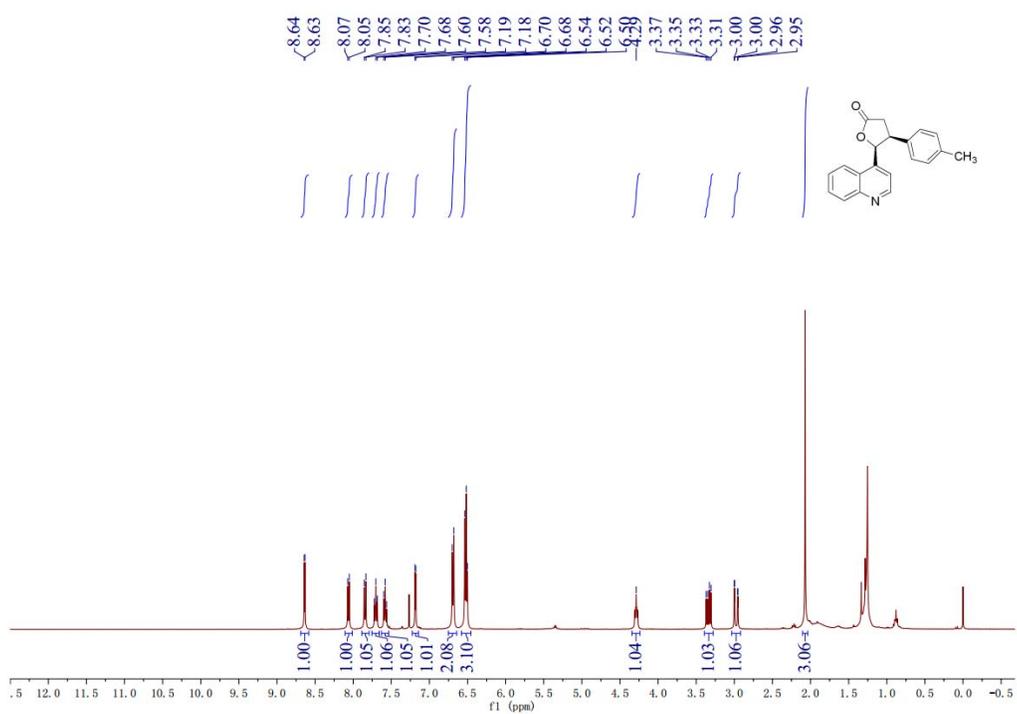
(4*S*,5*S*)-4-(2-Nitrophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-4f)



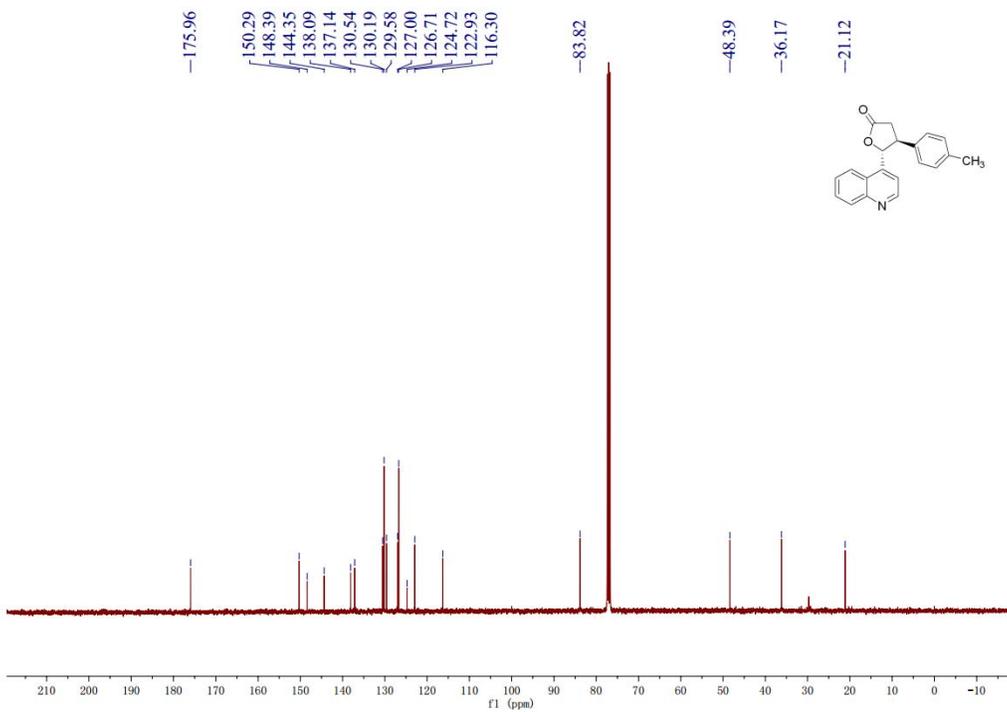
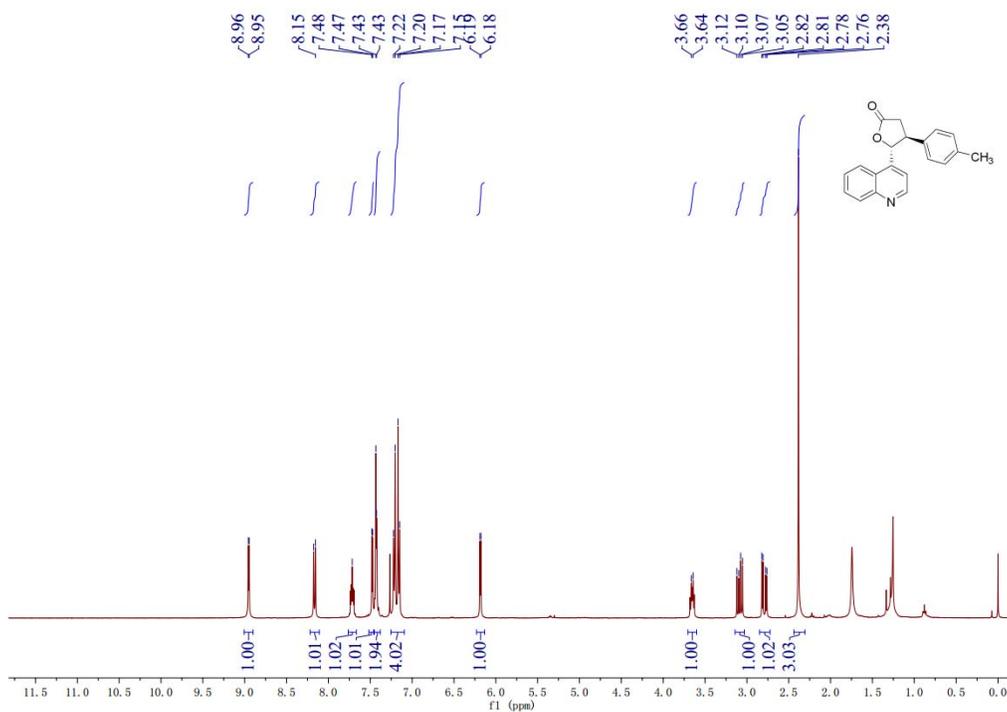
(4*S*,5*R*)-4-(2-Nitrophenyl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (trans-4f)



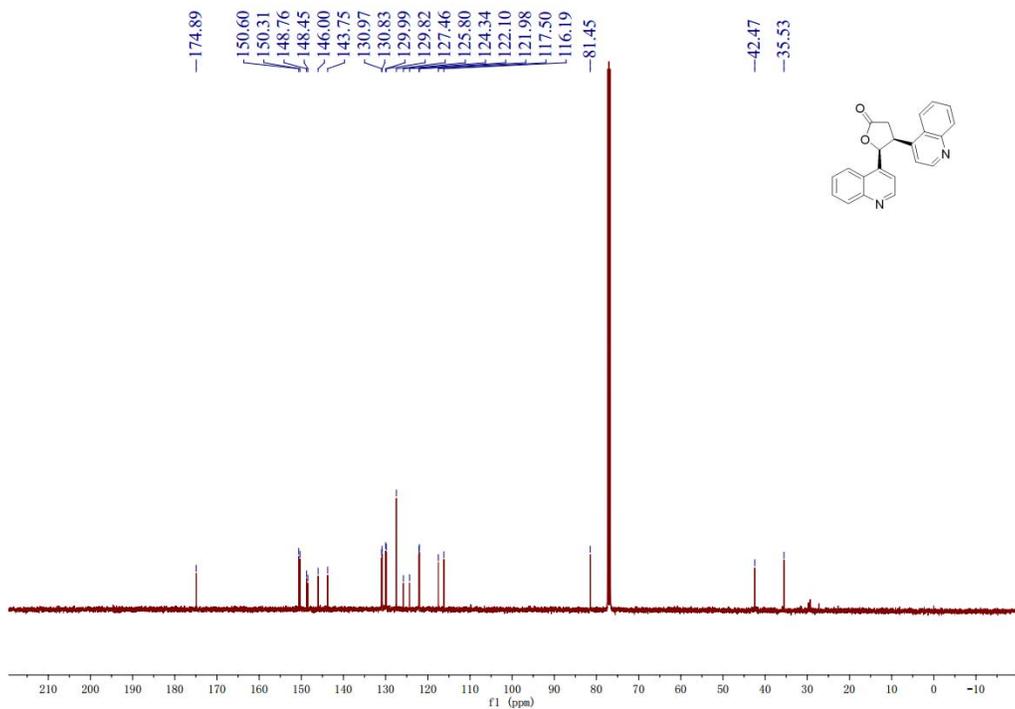
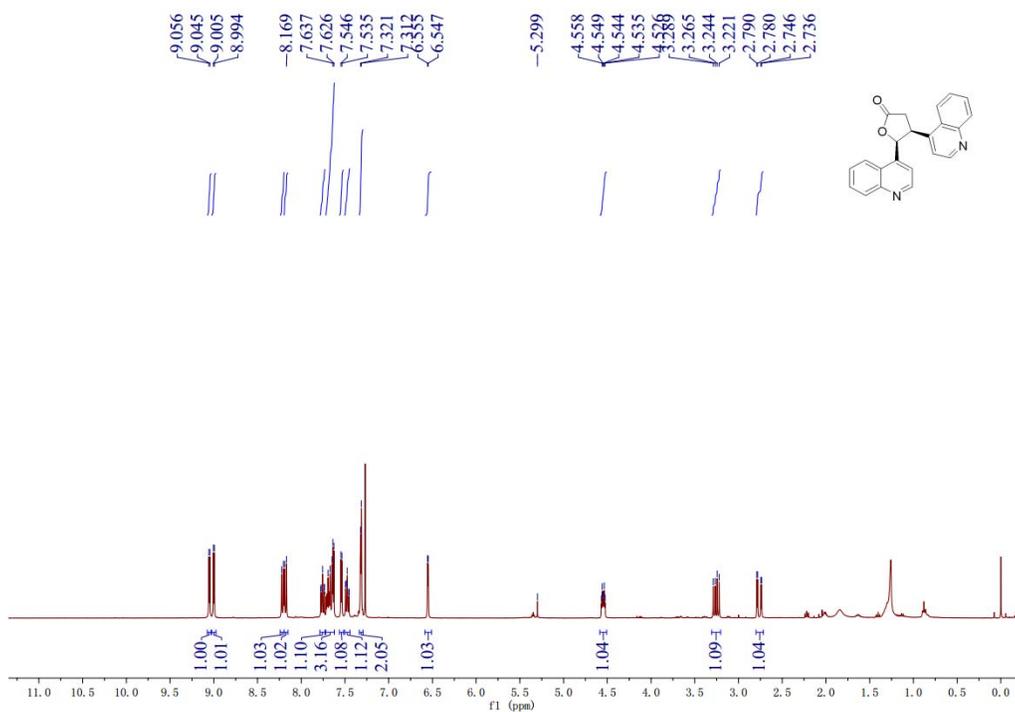
(4*S*,5*S*)-5-(Quinolin-4-yl)-4-(*p*-tolyl)dihydrofuran-2(3*H*)-one (*cis*-4g)



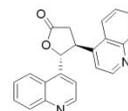
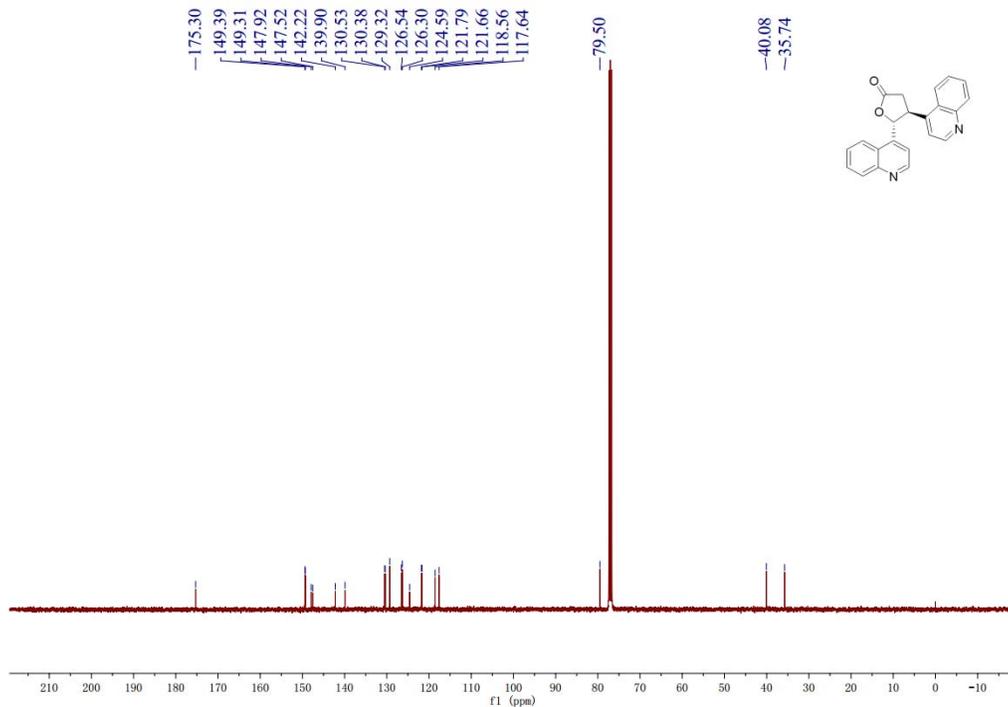
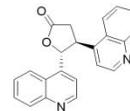
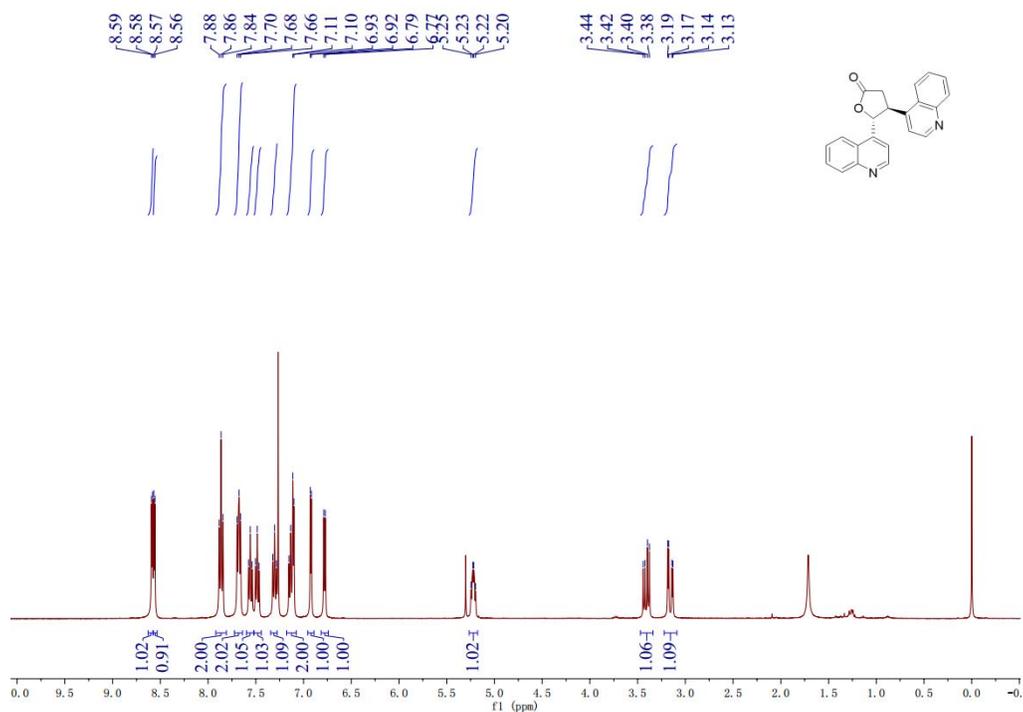
(4*S*,5*R*)-5-(Quinolin-4-yl)-4-(*p*-tolyl)dihydrofuran-2(3*H*)-one (*trans*-4*g*)



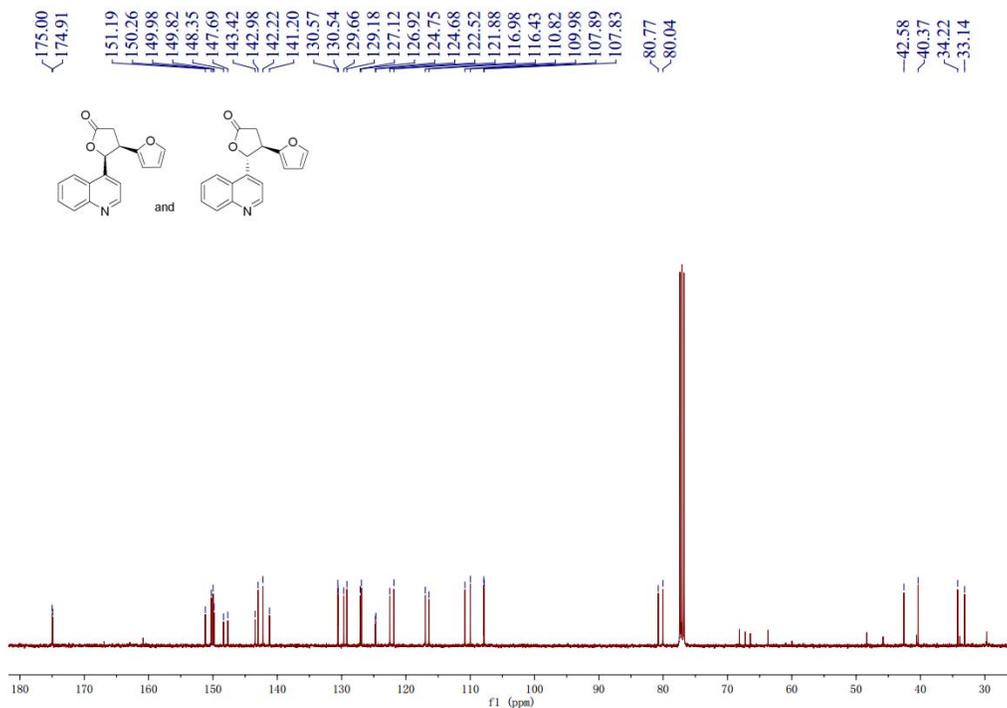
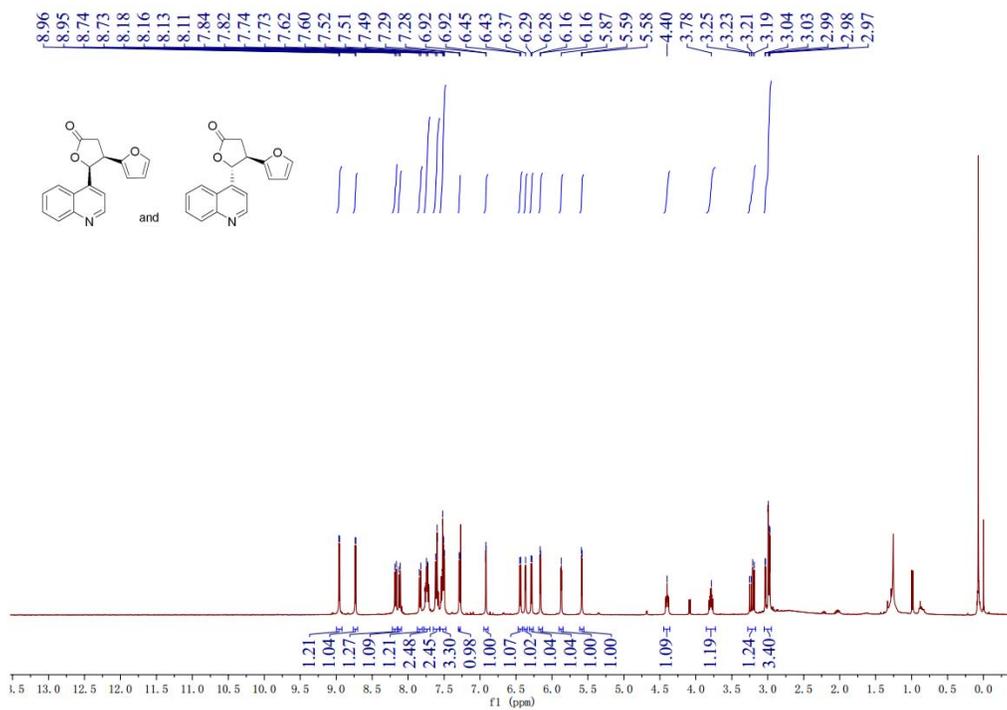
(4*S*,5*S*)-4,5-di(Quinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-4*h*)



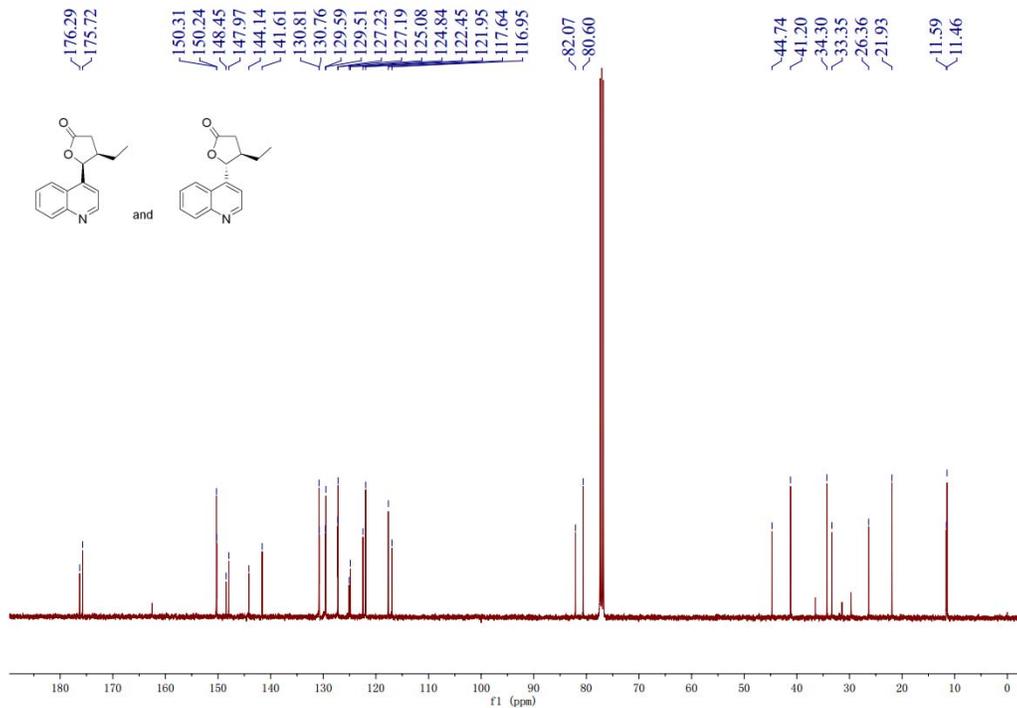
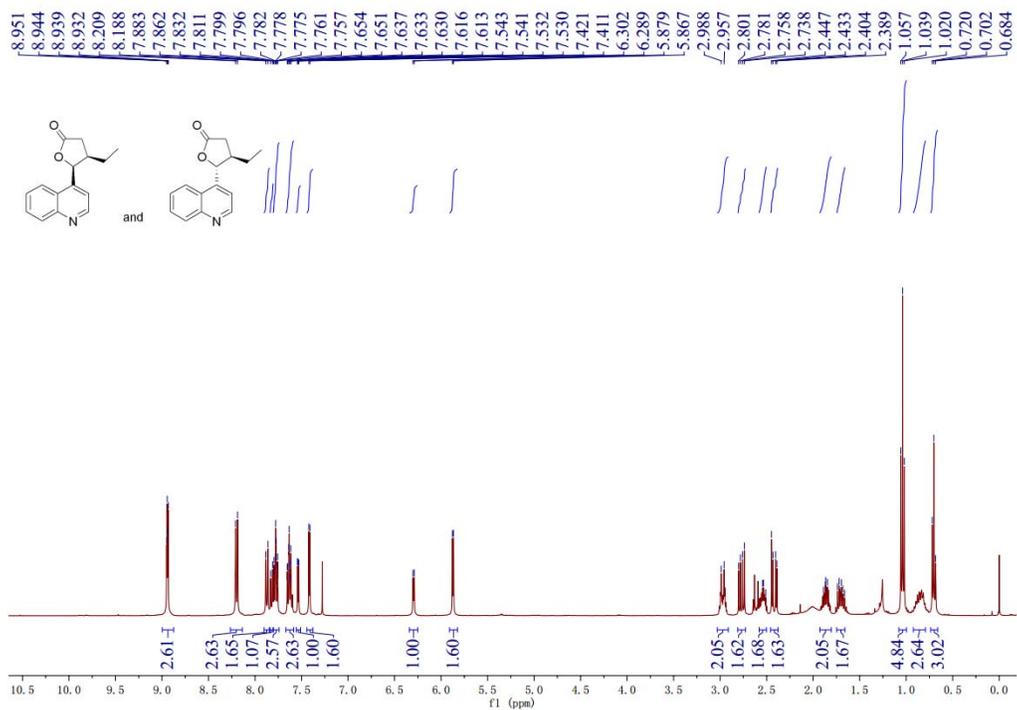
(4*S*,5*R*)-4,5-di(Quinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4h)



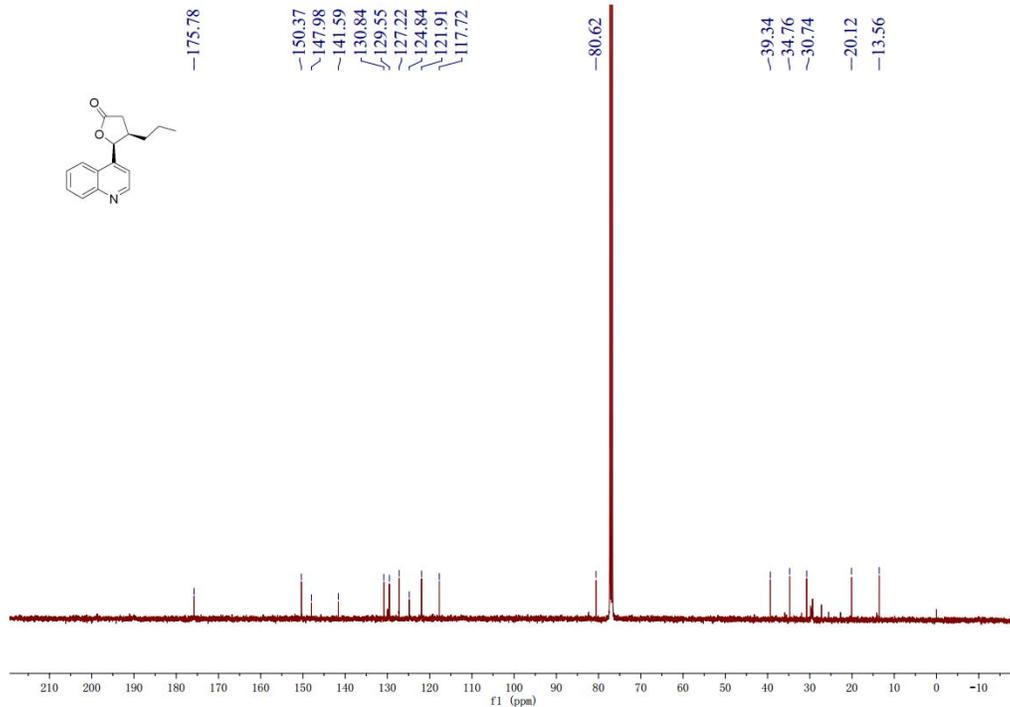
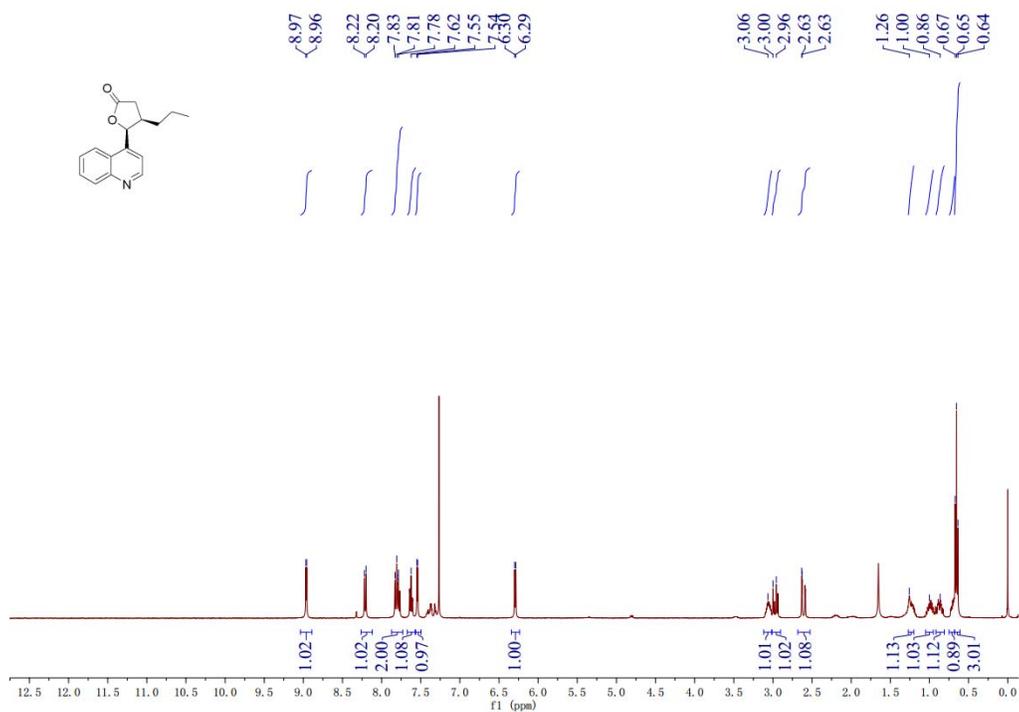
**(4*R*,5*S*)-4-(Furan-2-yl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (cis-4i) and
(4*R*,5*R*)-4-(Furan-2-yl)-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (trans-4i)**



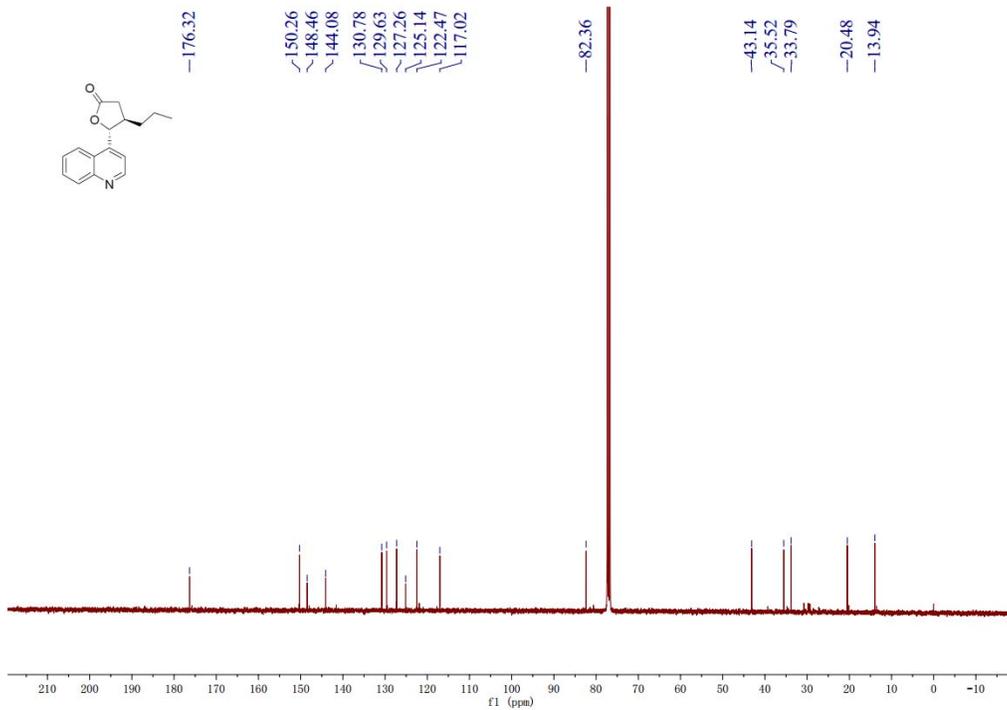
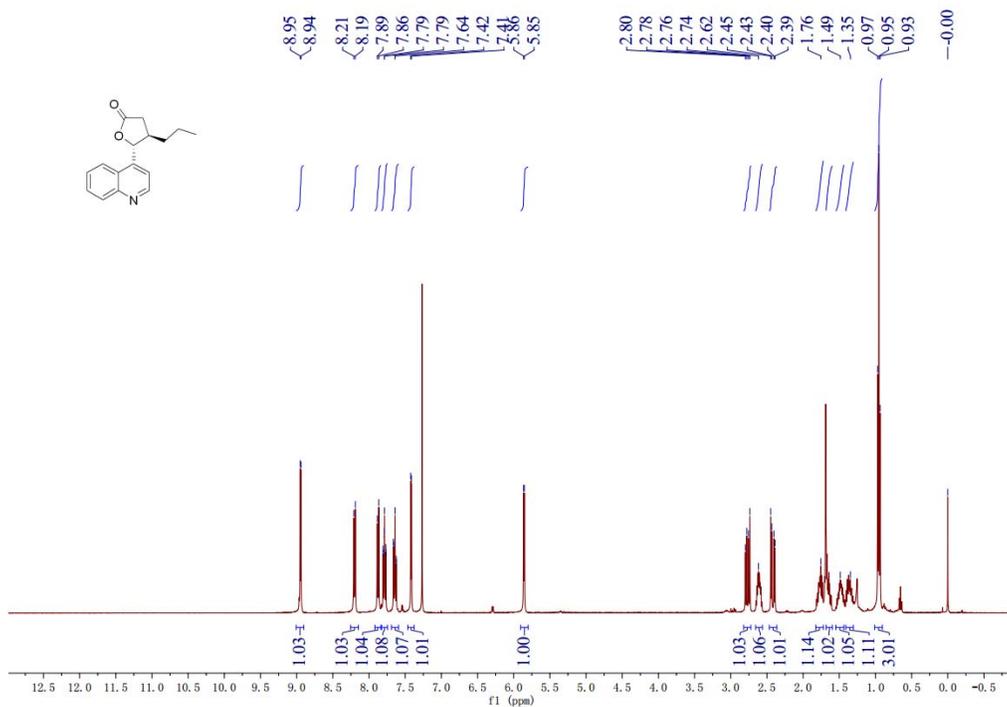
(4*R*,5*S*)-4-Ethyl-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-4j) and (4*R*,5*R*)-4-Ethyl-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4j)



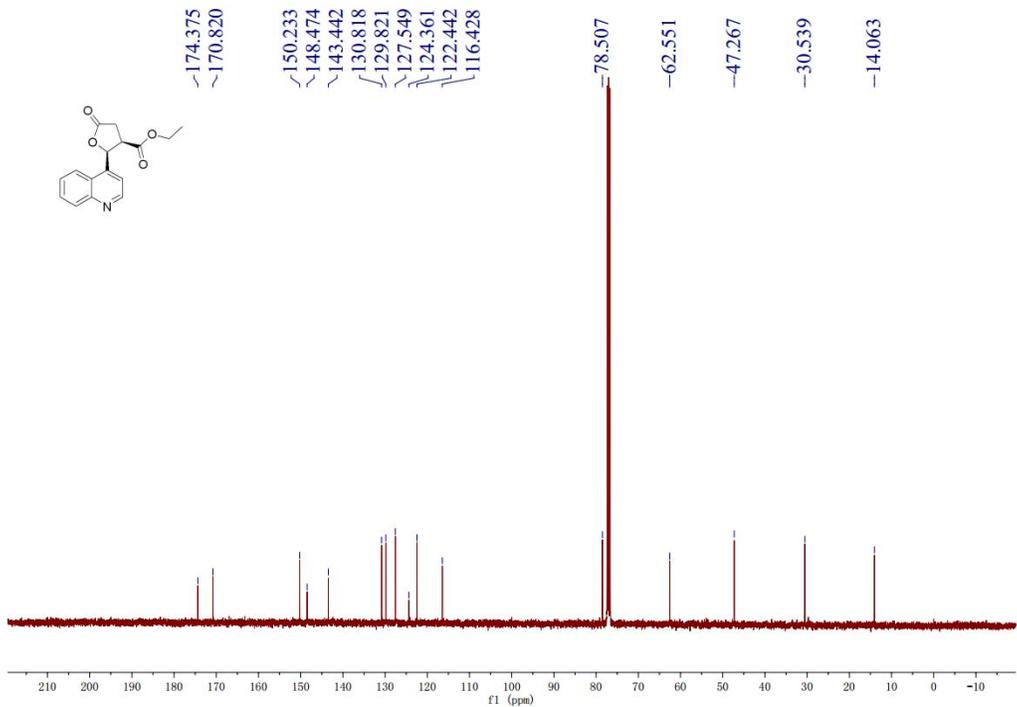
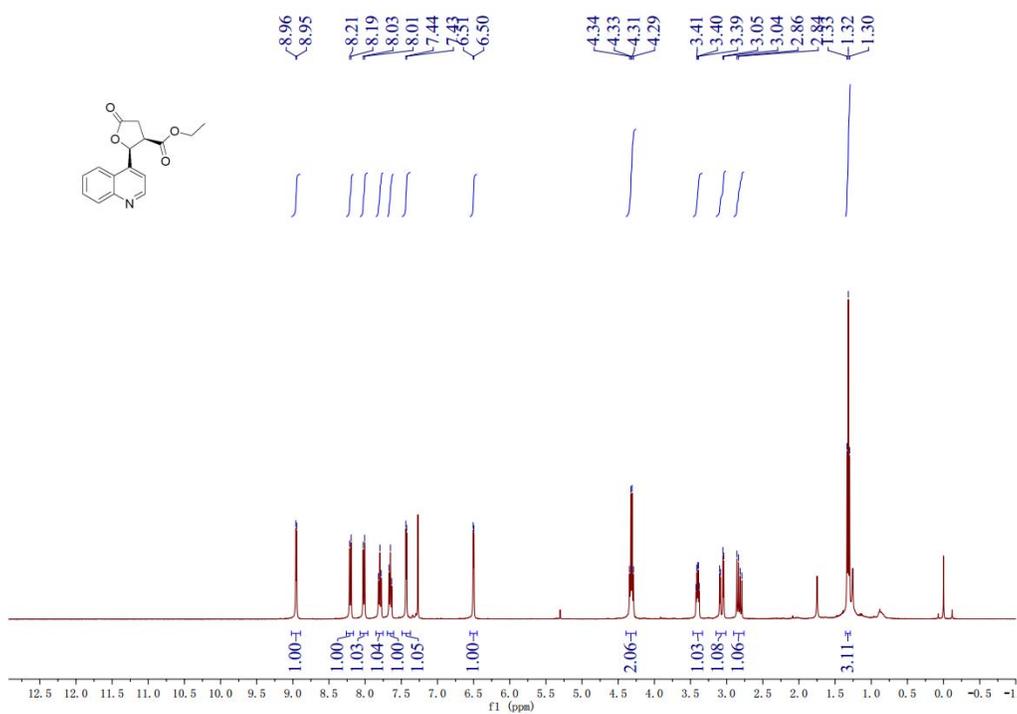
(4*R*,5*S*)-4-Propyl-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-4k)



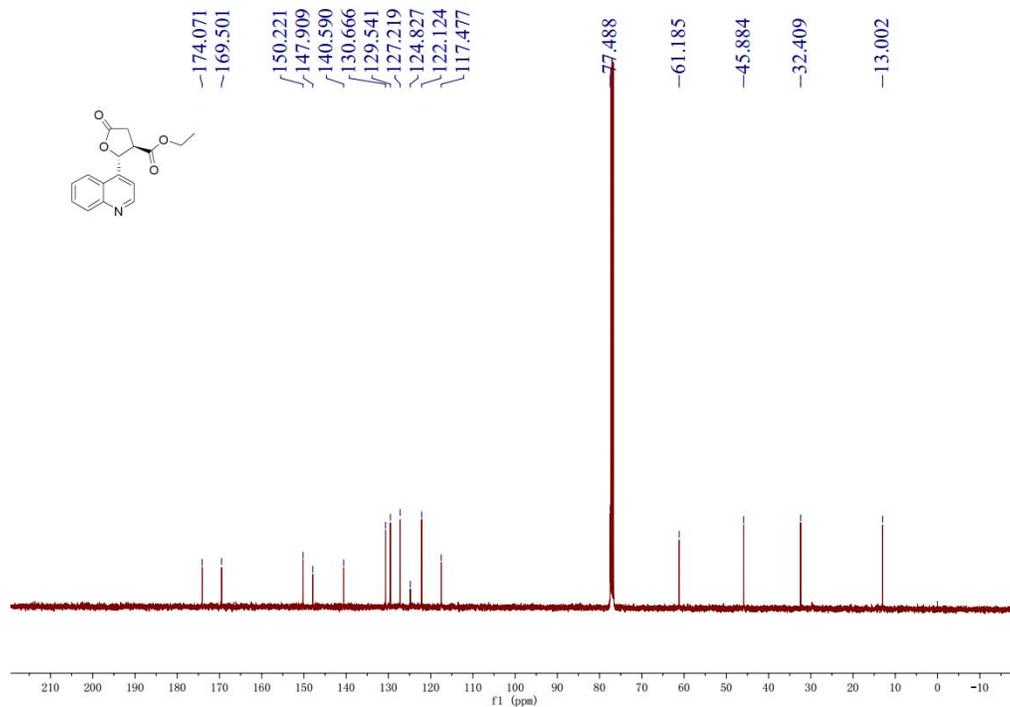
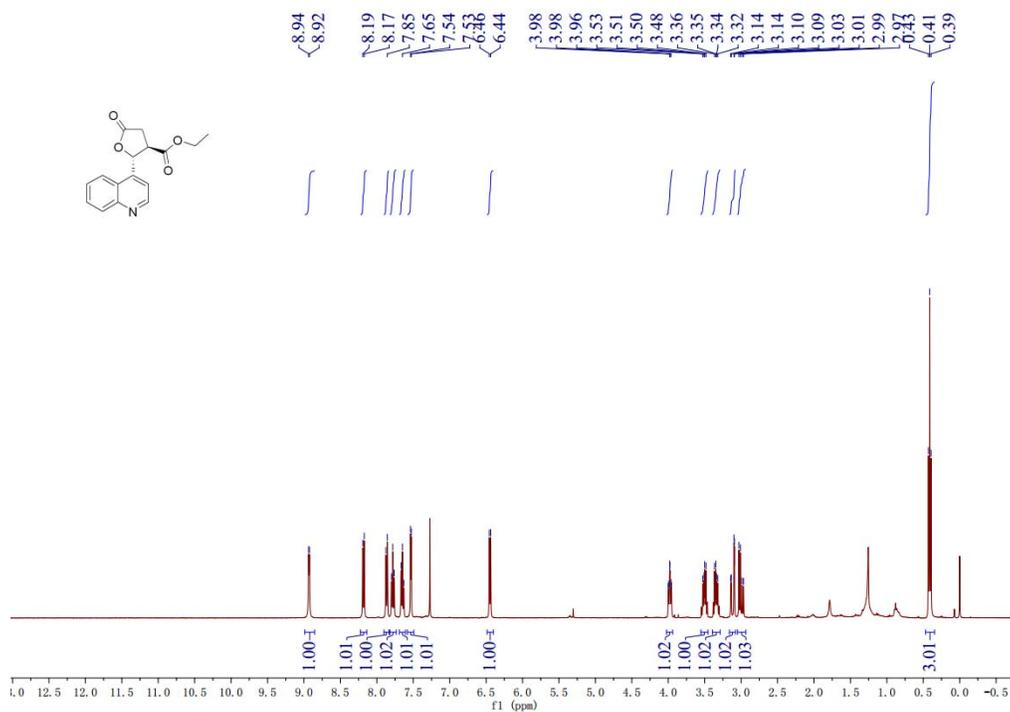
(4*R*,5*R*)-4-Propyl-5-(quinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4k)



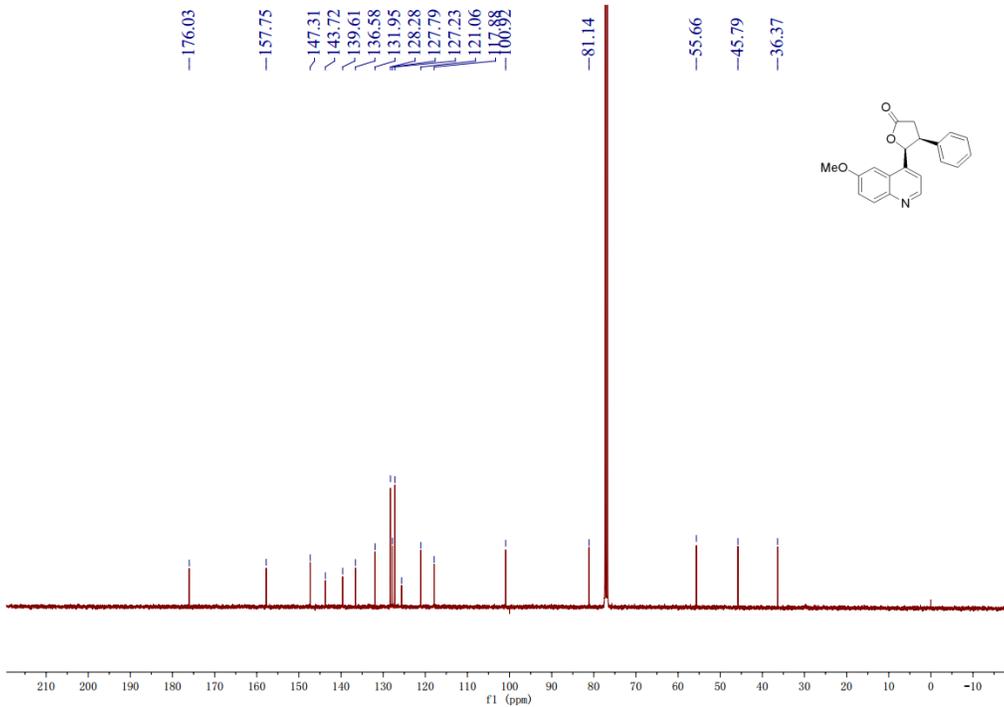
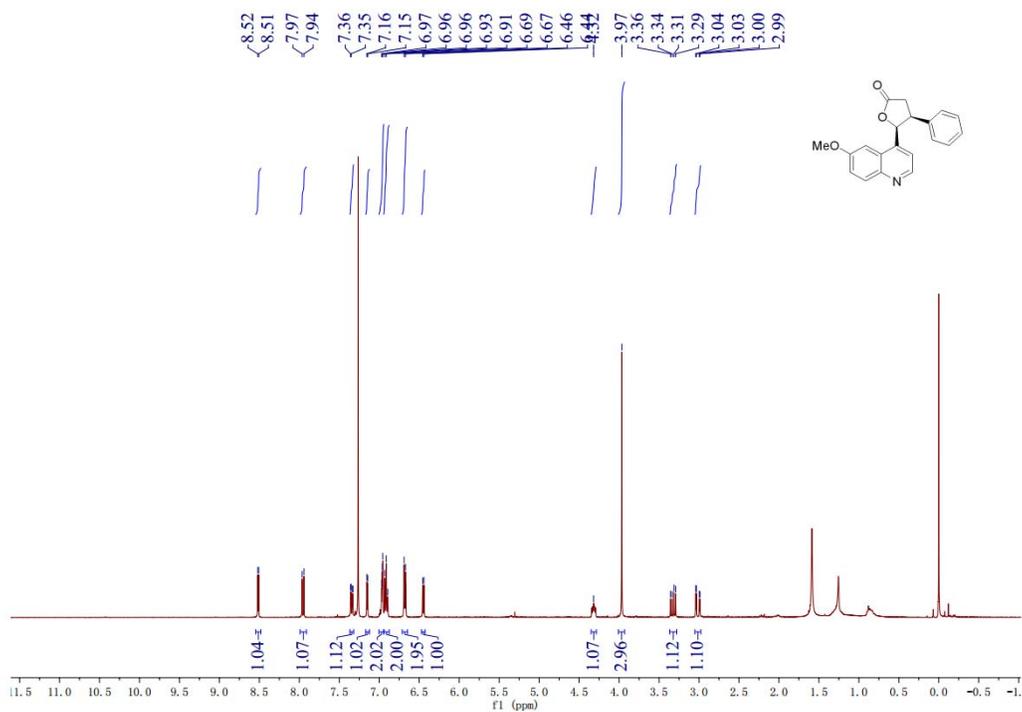
Ethyl (2*S*,3*R*)-5-oxo-2-(quinolin-4-yl)tetrahydrofuran-3-carboxylate (*cis*-4l)



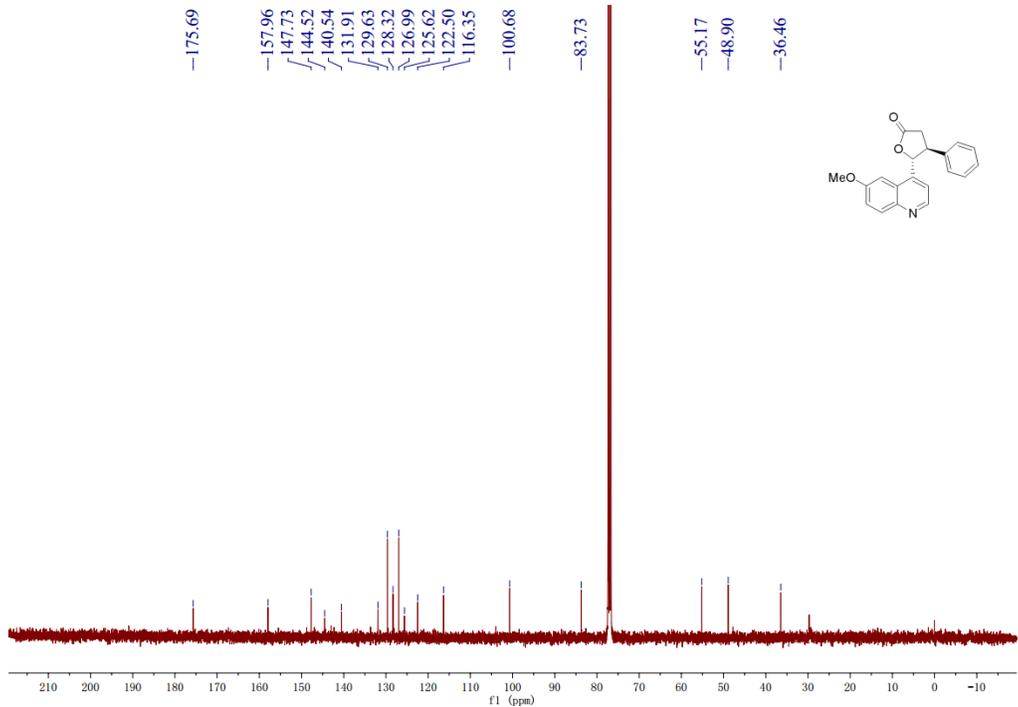
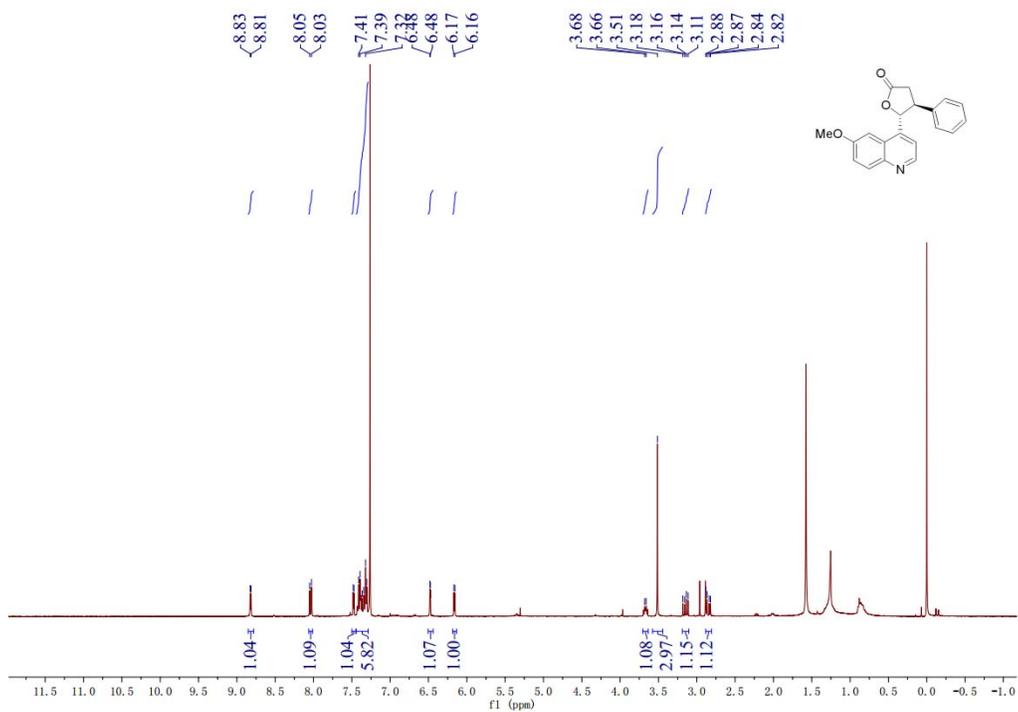
Ethyl (2*R*,3*R*)-5-oxo-2-(quinolin-4-yl)tetrahydrofuran-3-carboxylate (*trans*-4l)



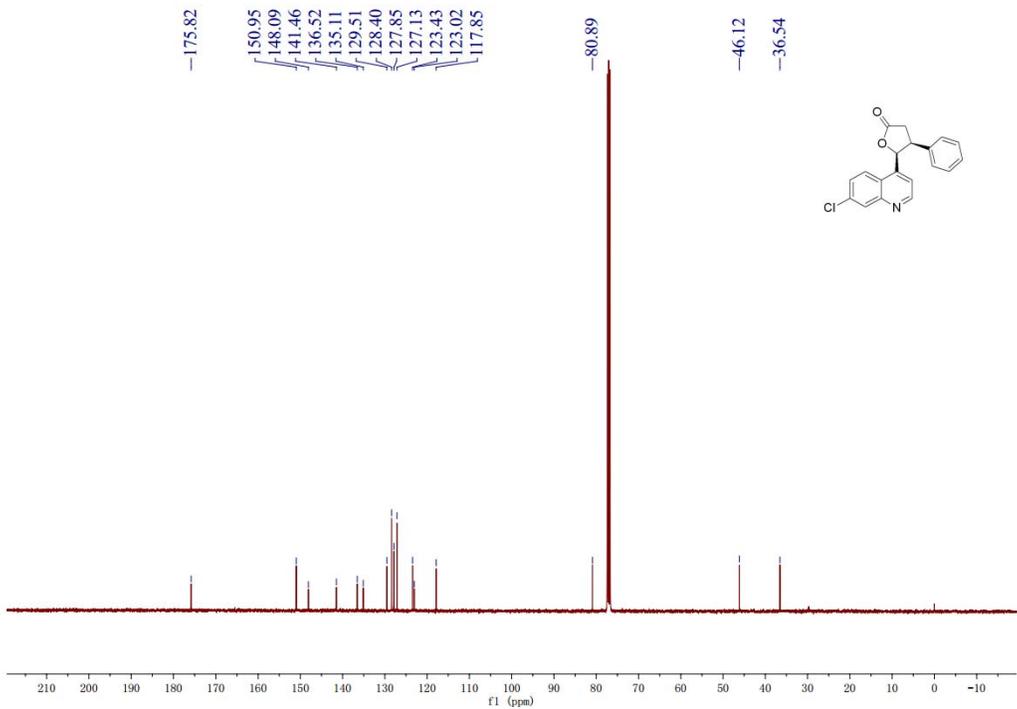
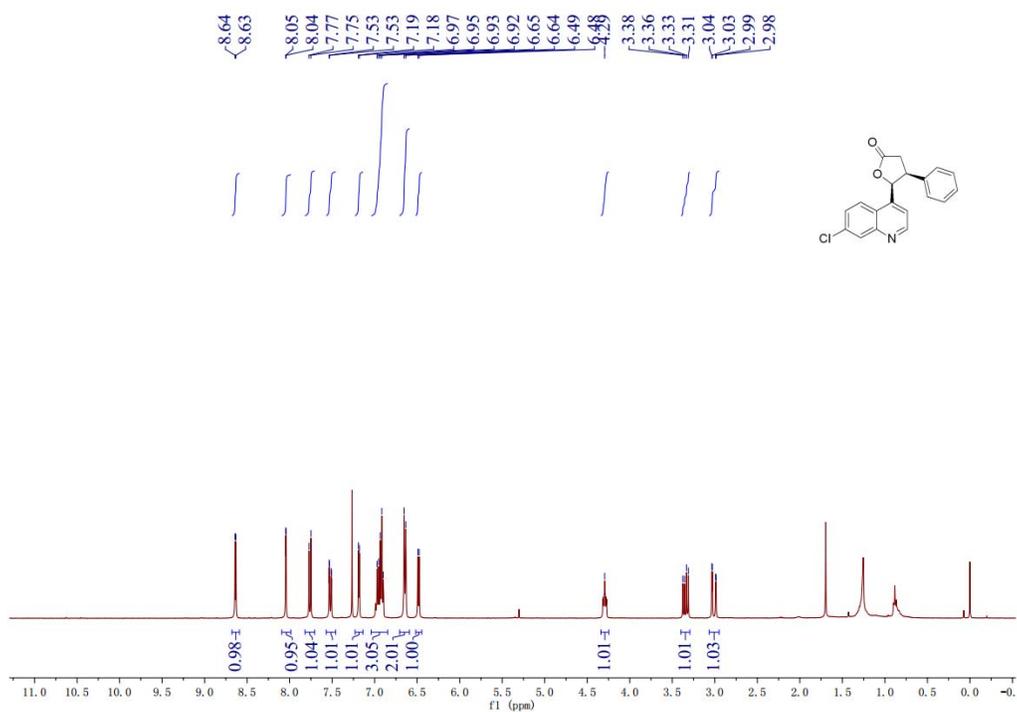
(4*S*,5*S*)-5-(6-Methoxyquinolin-4-yl)-4-phenyldihydrofuran-2(3*H*)-one (*cis*-4*m*)



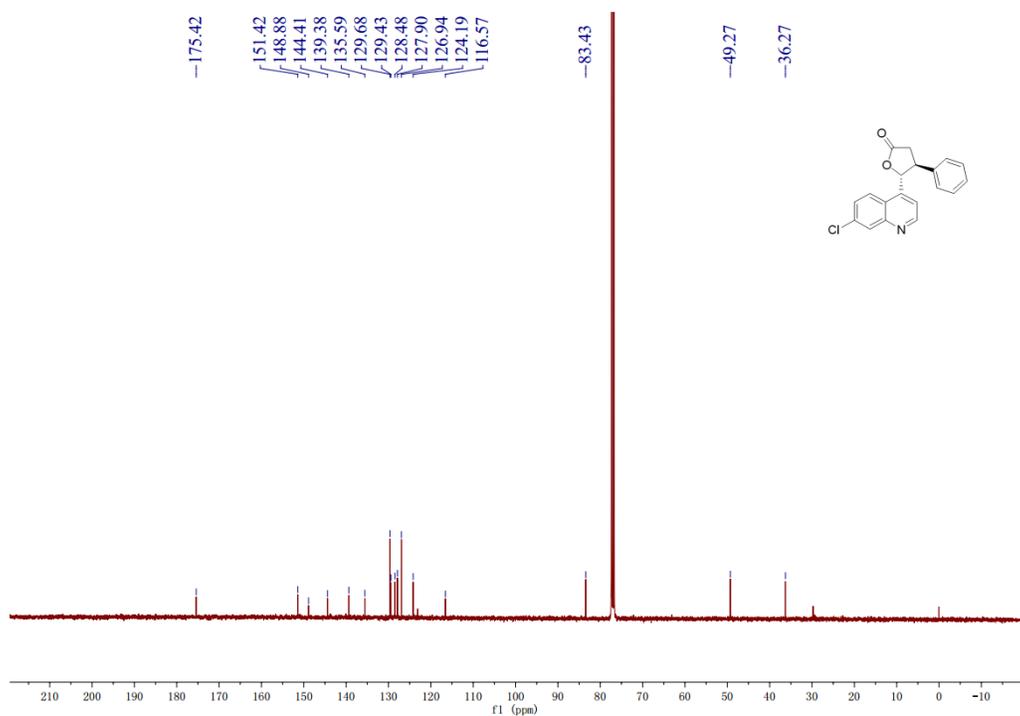
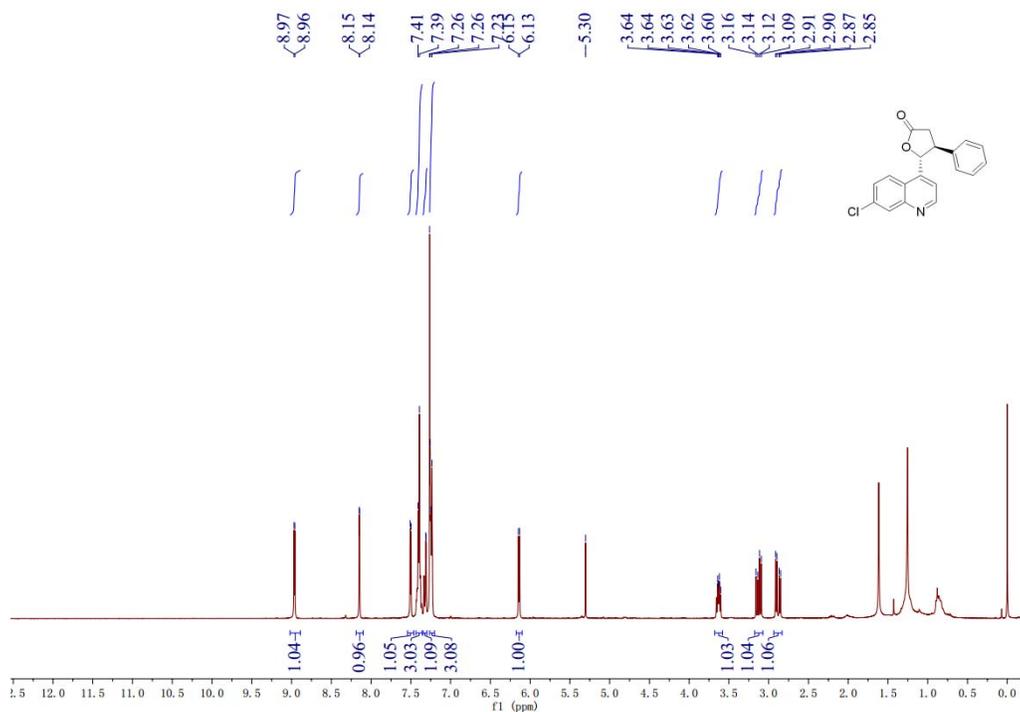
(4*S*,5*R*)-5-(6-Methoxyquinolin-4-yl)-4-phenyldihydrofuran-2(3*H*)-one (*trans*-4*m*)



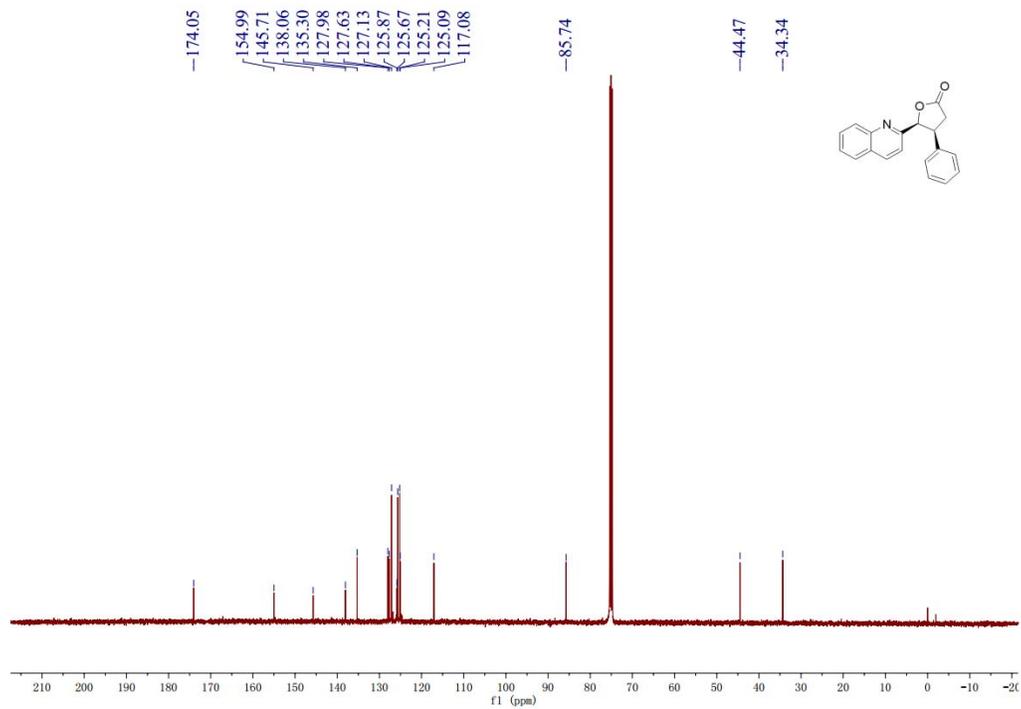
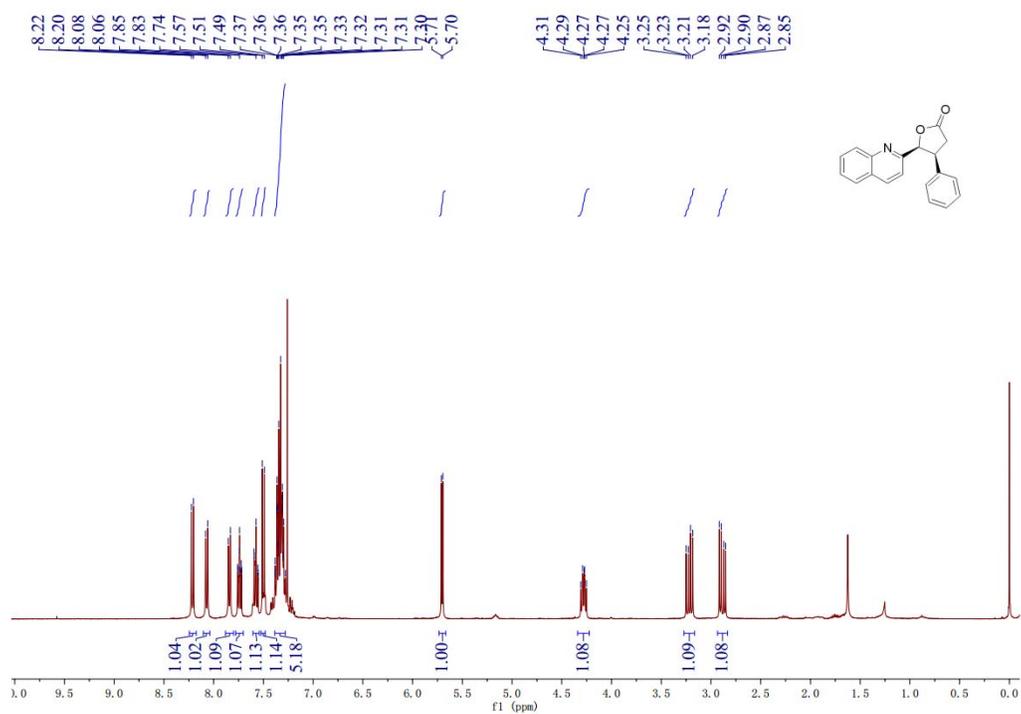
(4*S*,5*S*)-5-(7-Chloroquinolin-4-yl)-4-phenyldihydrofuran-2(3*H*)-one (*cis*-4n)



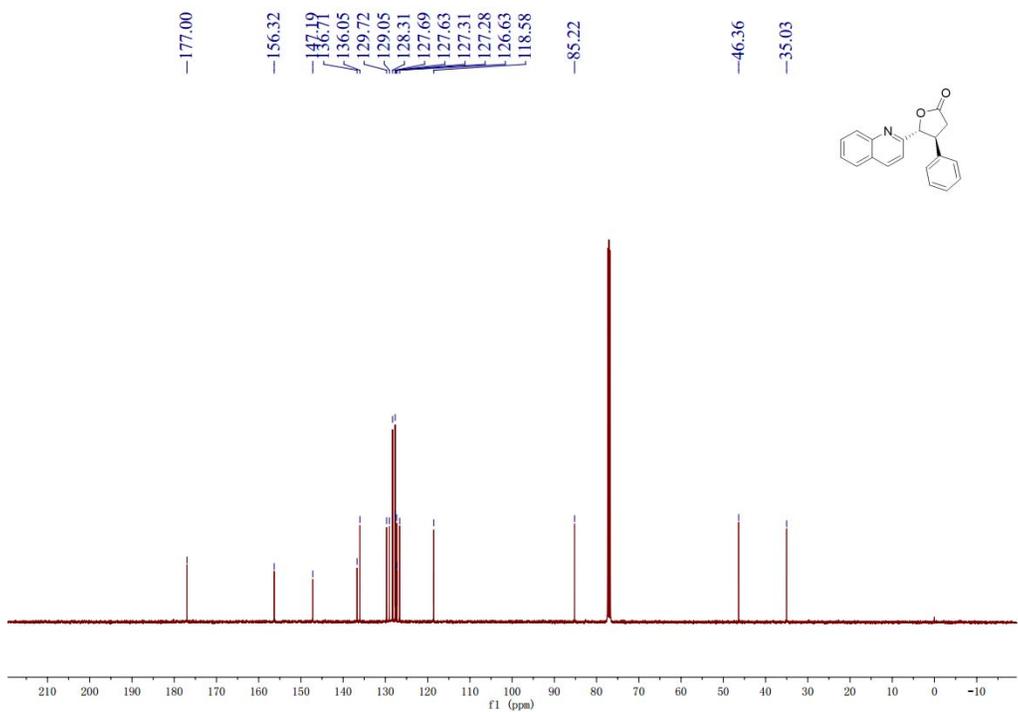
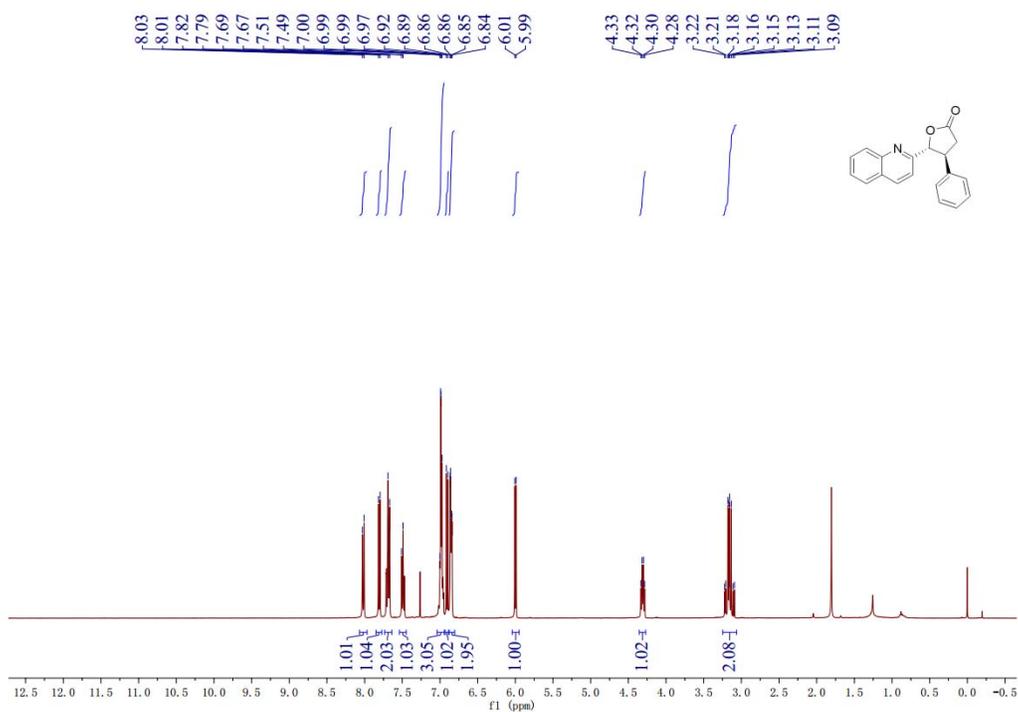
(4*S*,5*R*)-5-(7-Chloroquinolin-4-yl)-4-phenyldihydrofuran-2(3*H*)-one (*trans*-4n)



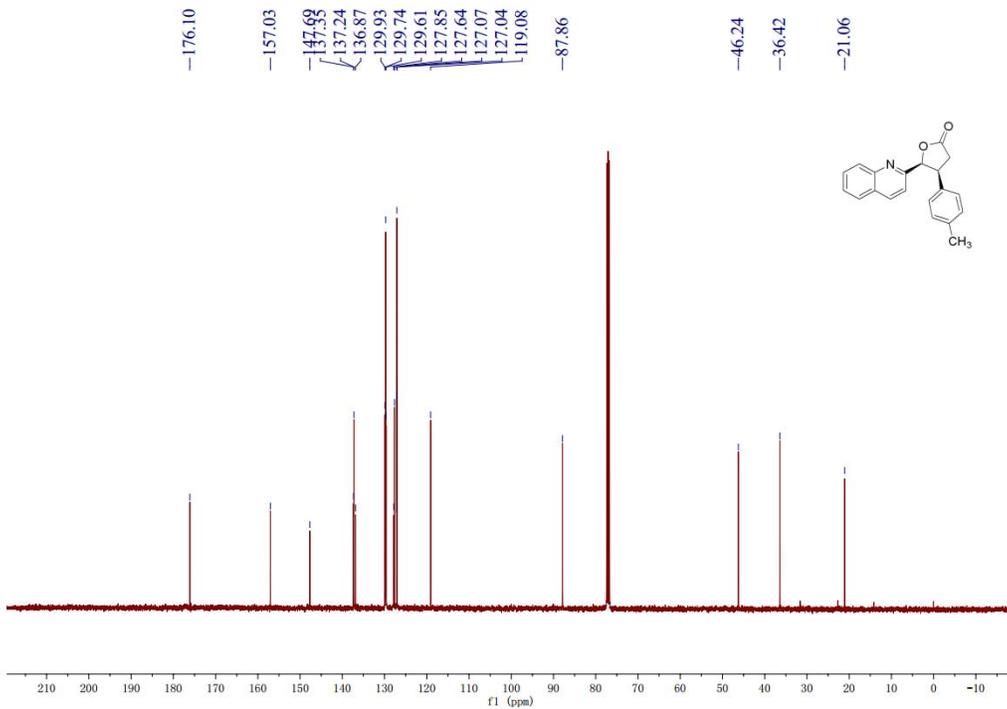
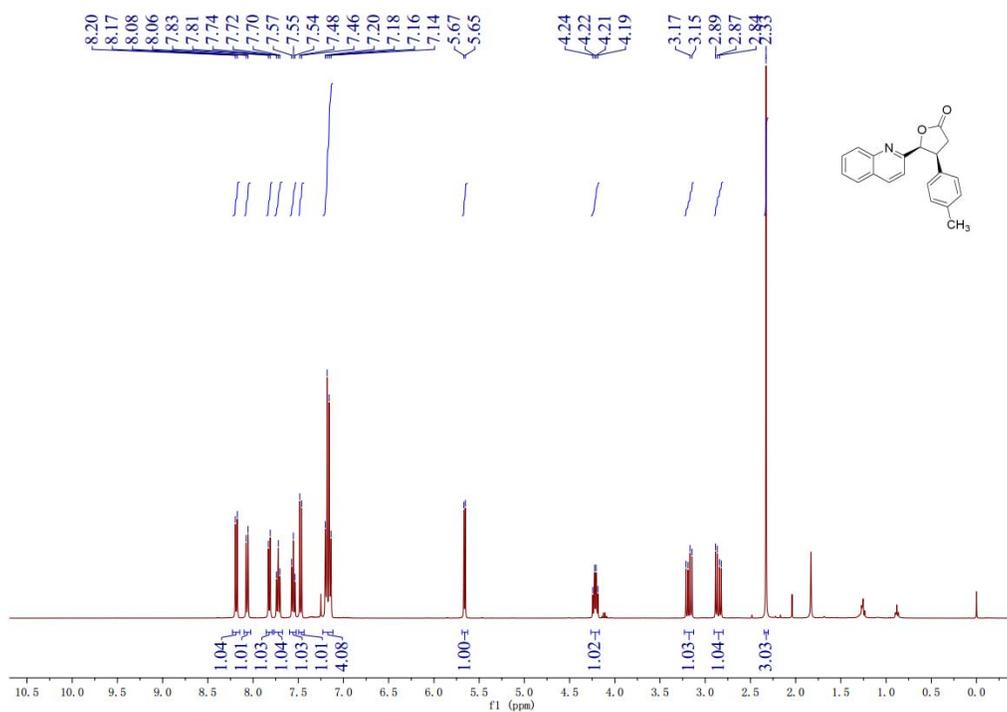
(4*S*,5*S*)-4-Phenyl-5-(quinolin-2-yl)dihydrofuran-2(3*H*)-one (*cis*-4o)



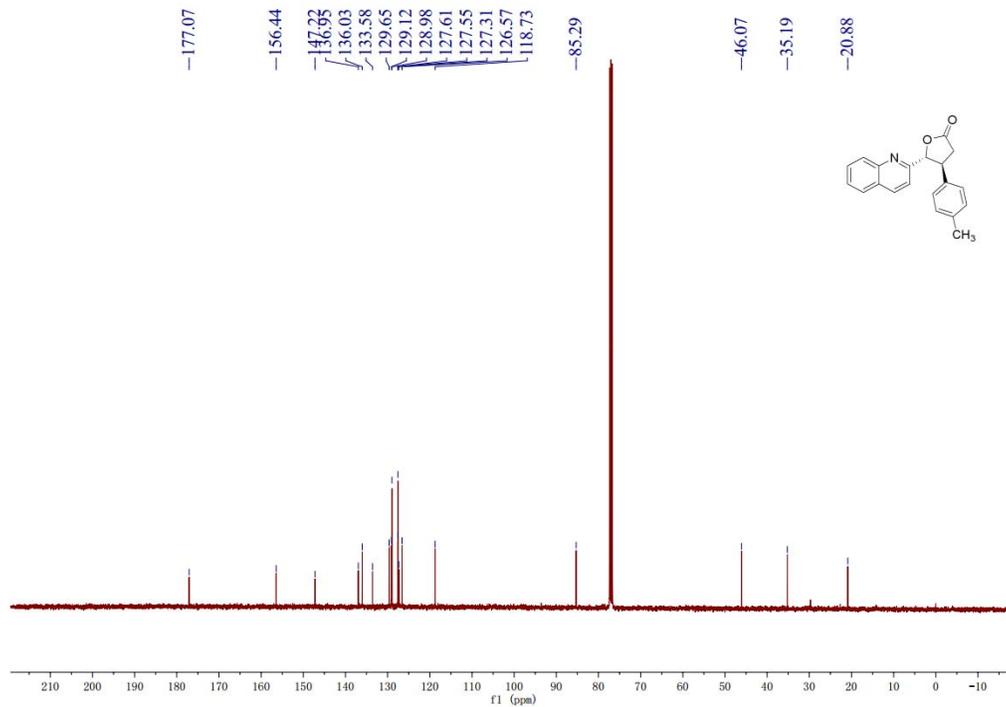
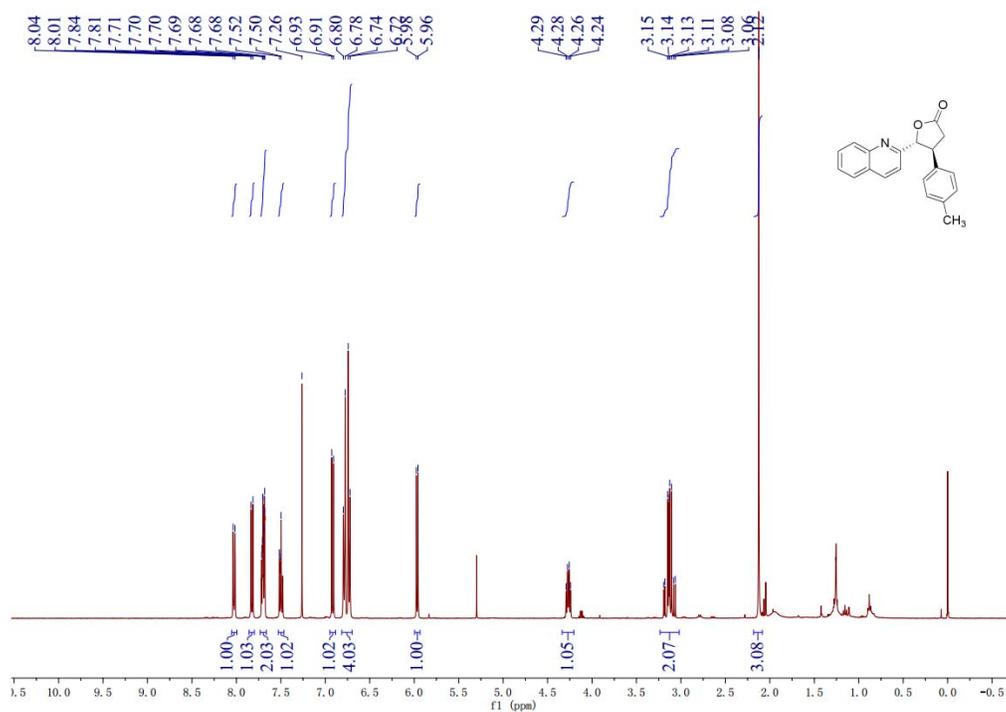
(4*S*,5*R*)-4-Phenyl-5-(quinolin-2-yl)dihydrofuran-2(3*H*)-one (*trans*-4o)



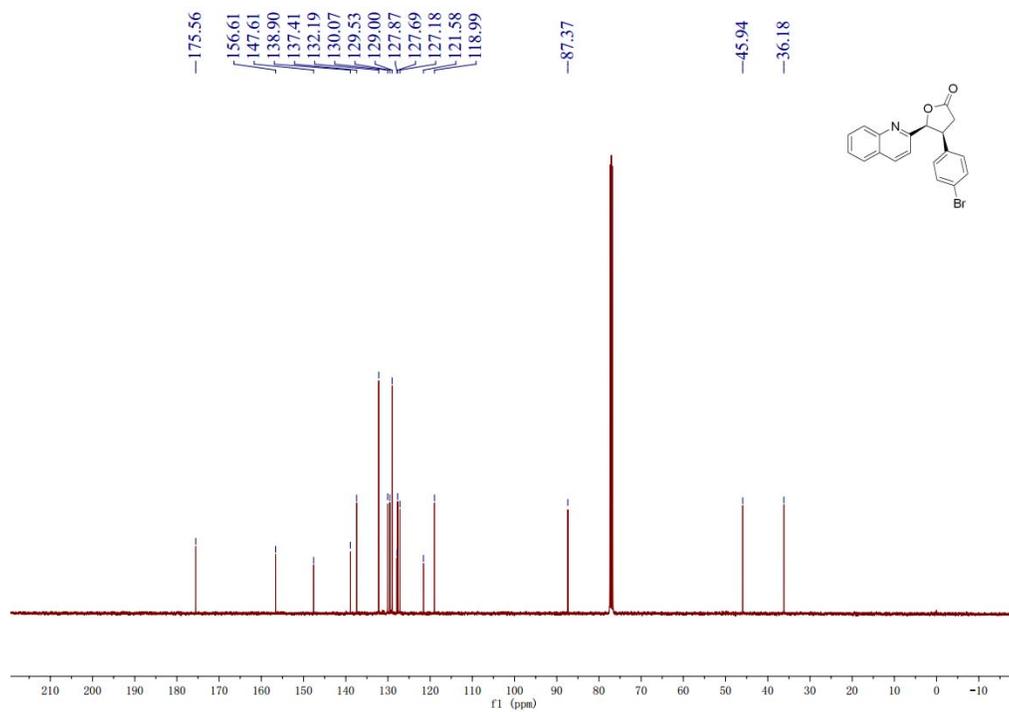
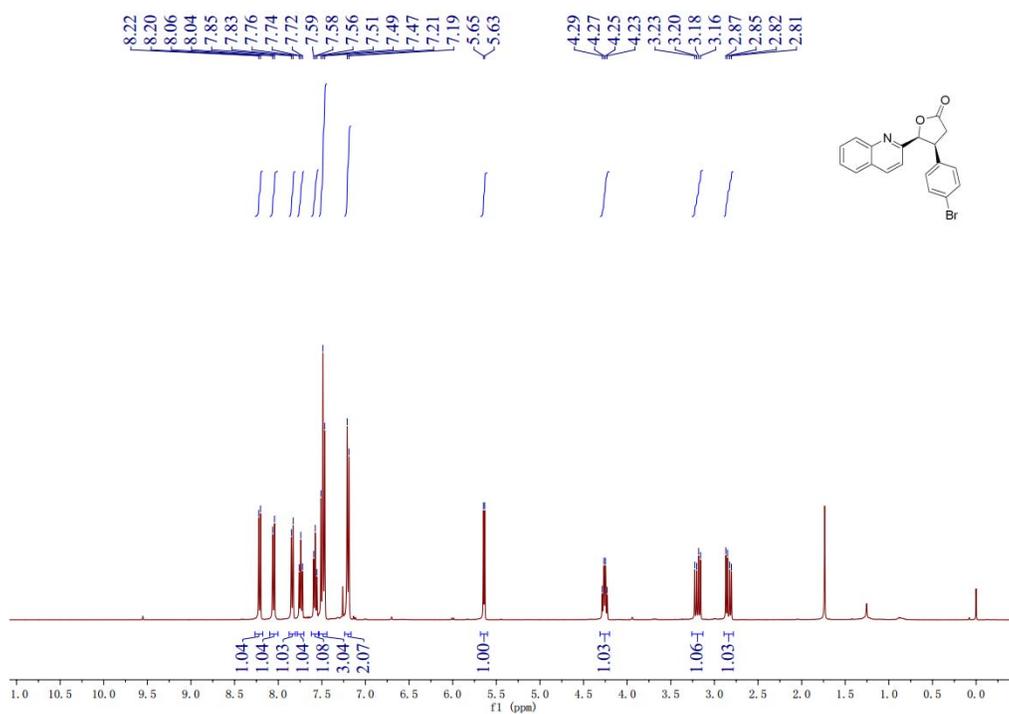
(4*S*,5*S*)-5-(Quinolin-2-yl)-4-(*p*-tolyl)dihydrofuran-2(3*H*)-one (*cis*-4*p*)



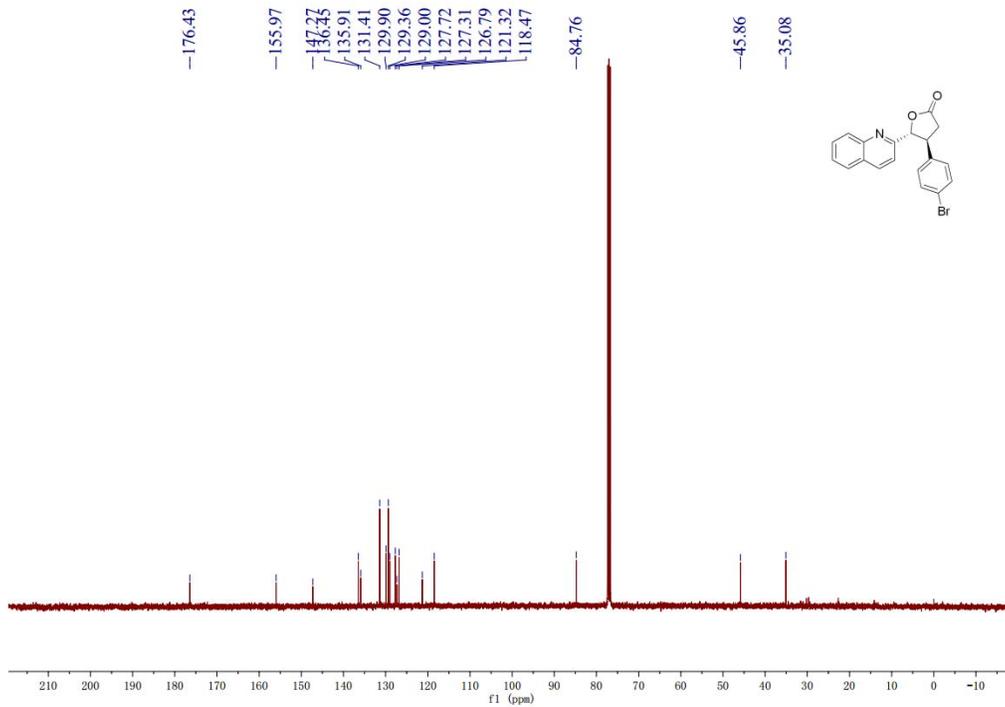
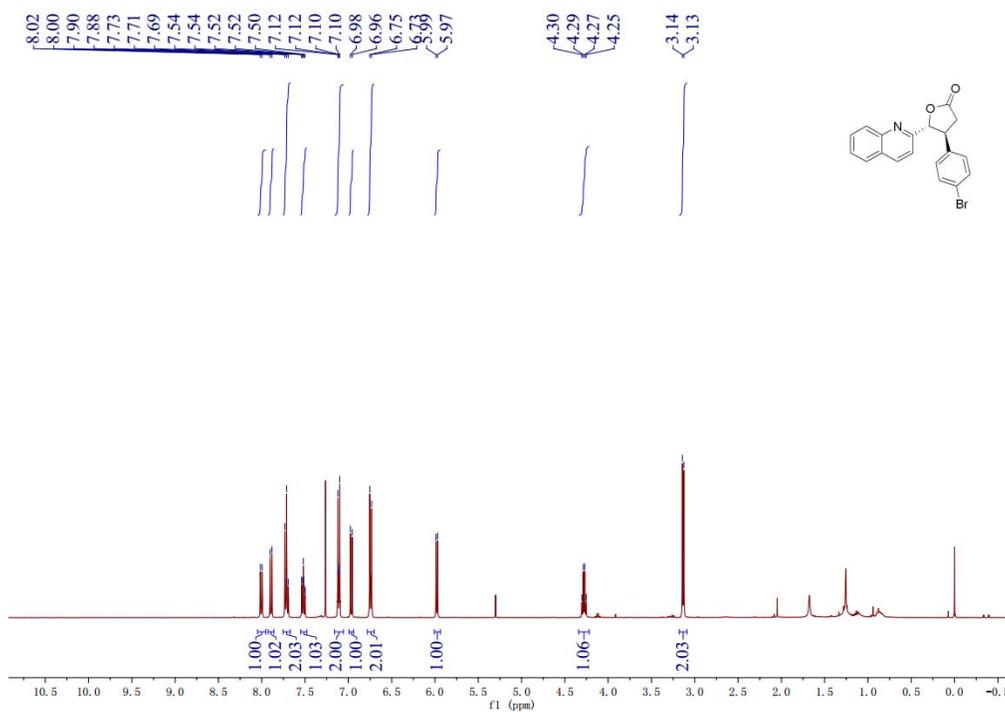
(4*S*,5*R*)-5-(Quinolin-2-yl)-4-(*p*-tolyl)dihydrofuran-2(3*H*)-one (*trans*-4*p*)



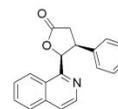
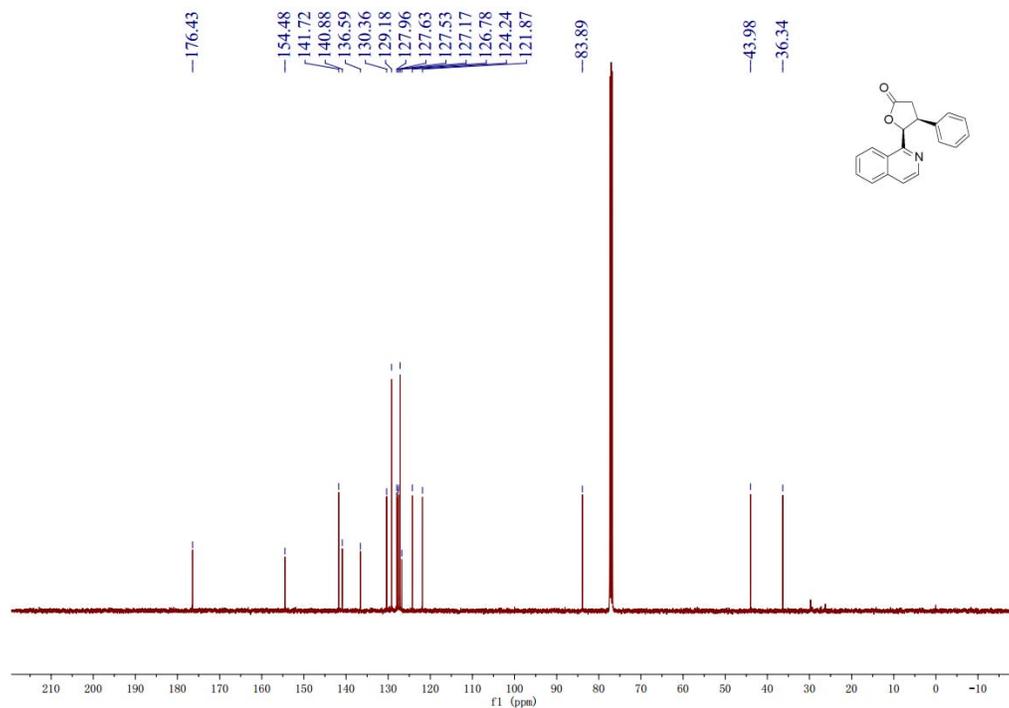
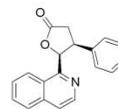
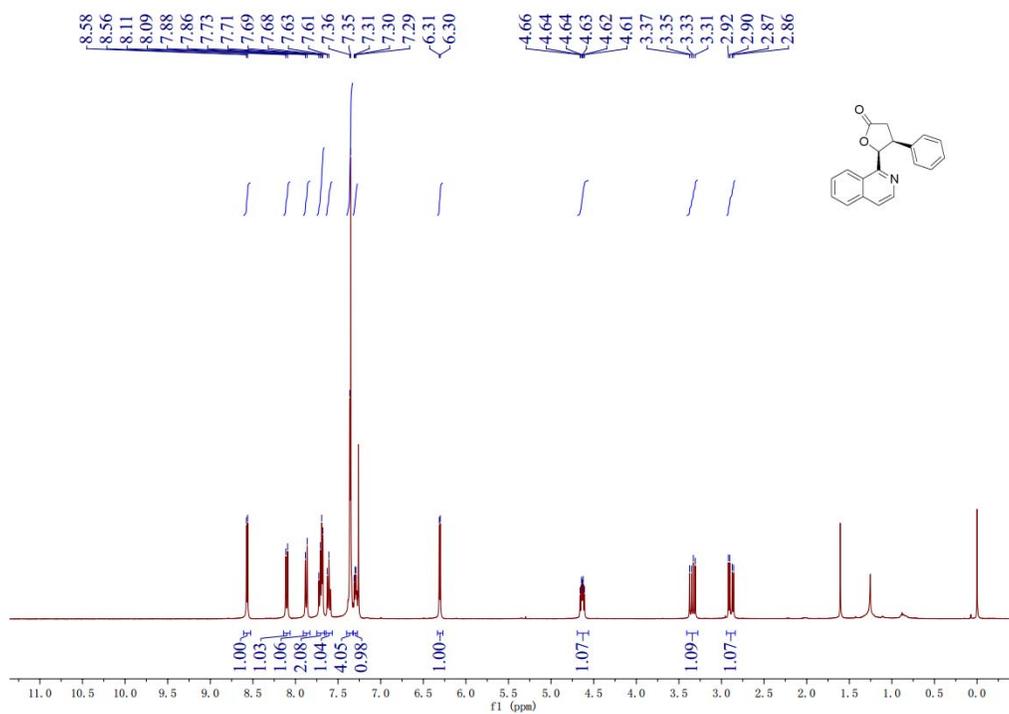
(4*S*,5*S*)-4-(4-Bromophenyl)-5-(quinolin-2-yl)dihydrofuran-2(3*H*)-one (*cis*-4q)



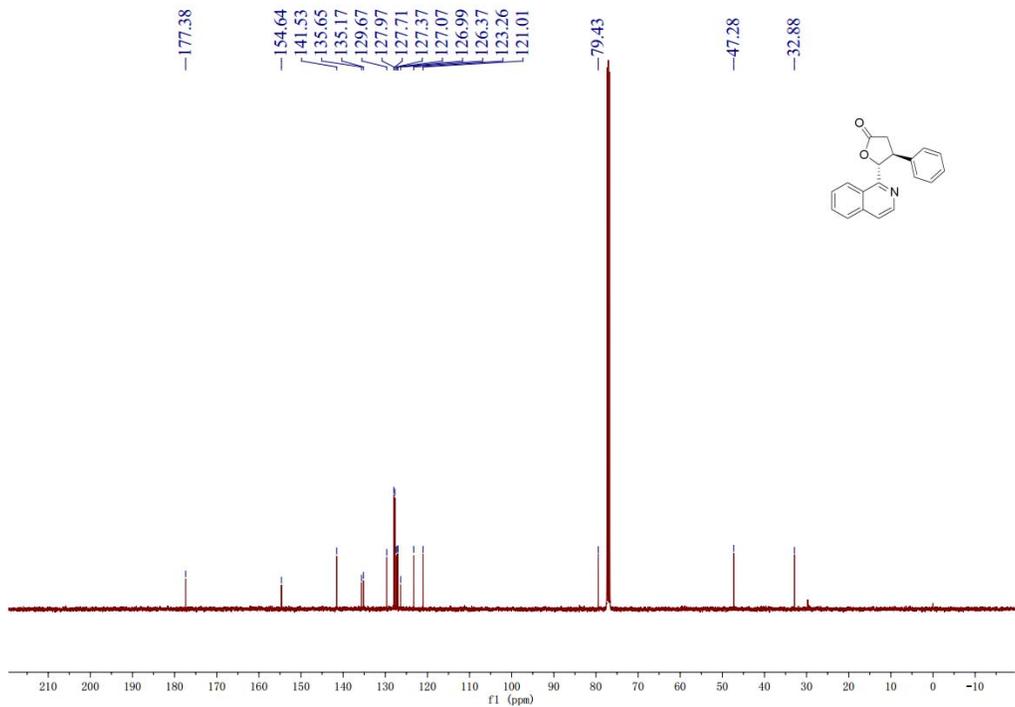
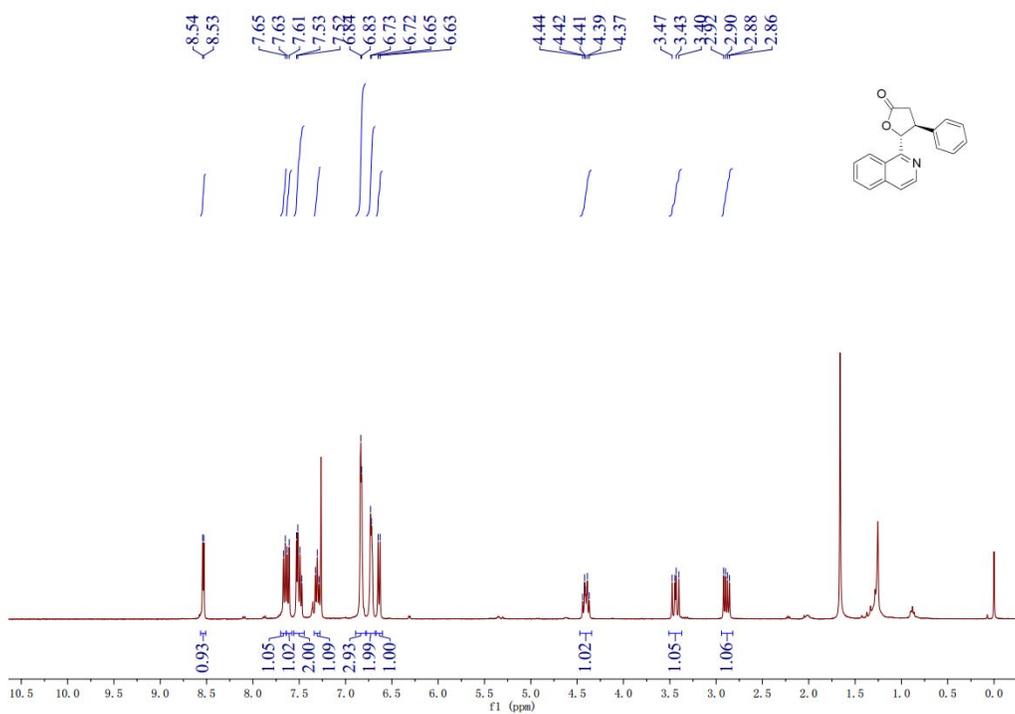
(4*S*,5*R*)-4-(4-Bromophenyl)-5-(quinolin-2-yl)dihydrofuran-2(3*H*)-one (*trans*-4q)



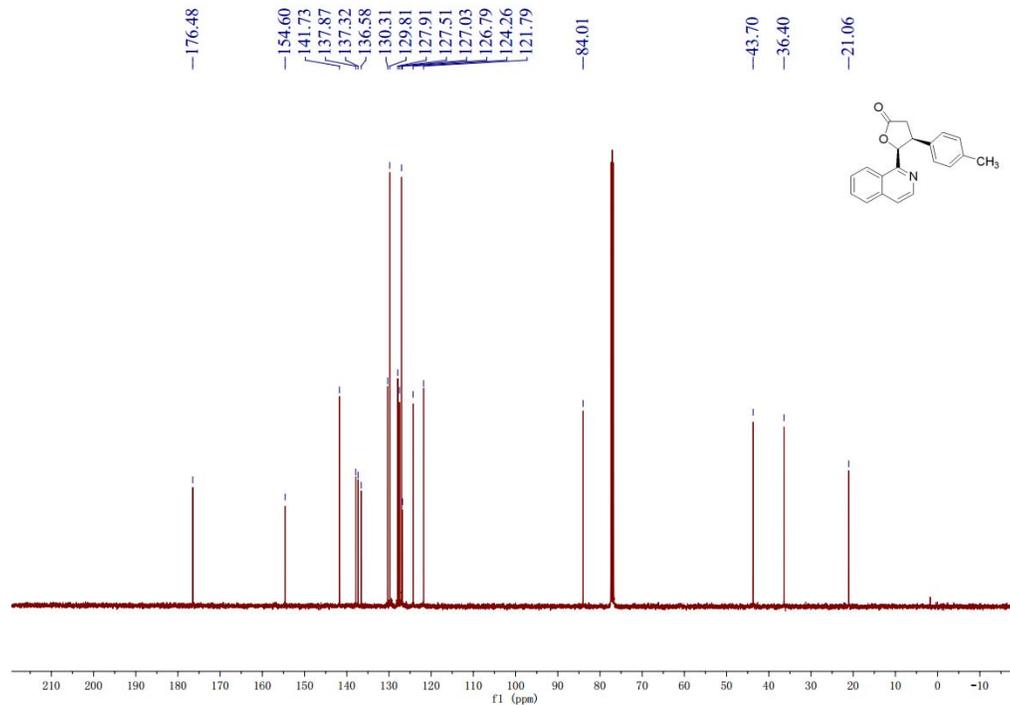
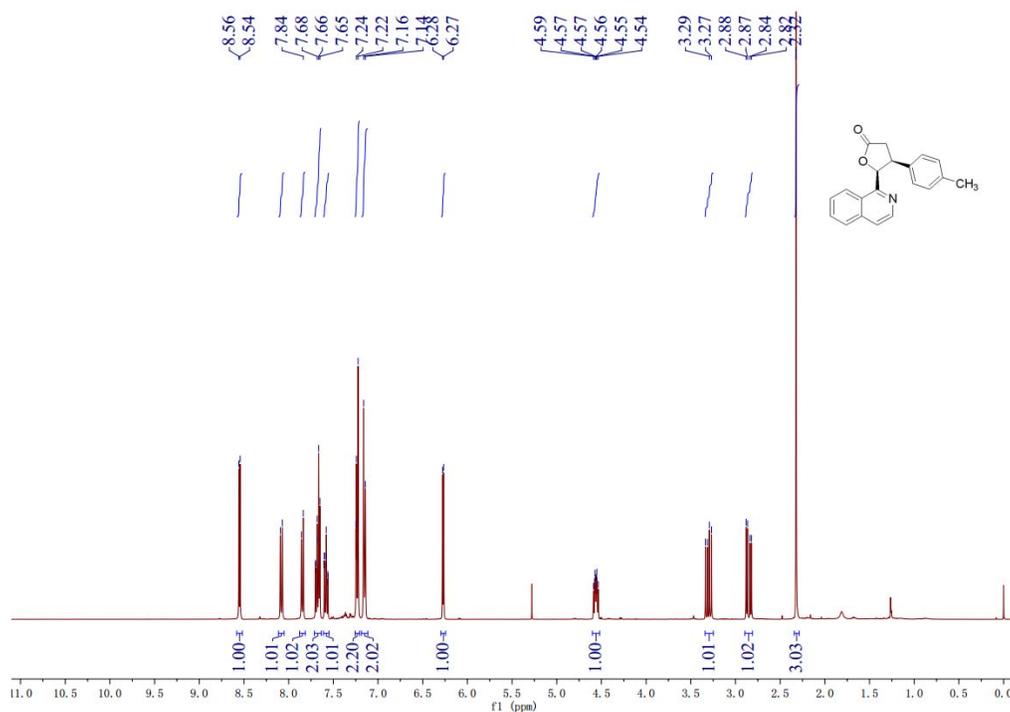
(4*S*,5*S*)-5-(Isoquinolin-1-yl)-4-phenyldihydrofuran-2(3*H*)-one (*cis*-4*r*)



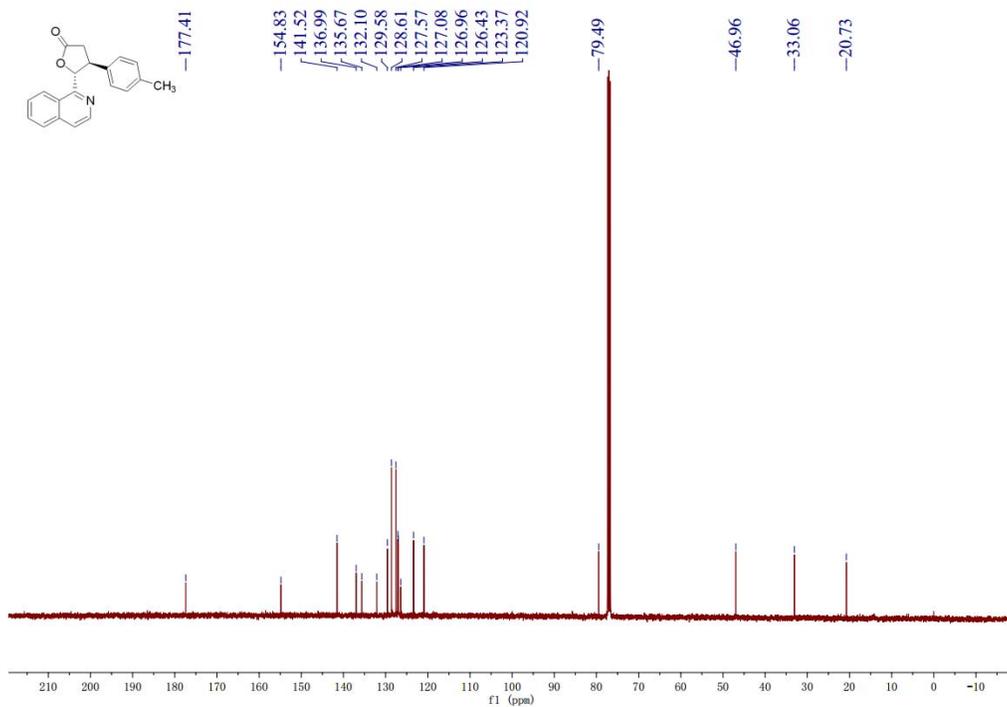
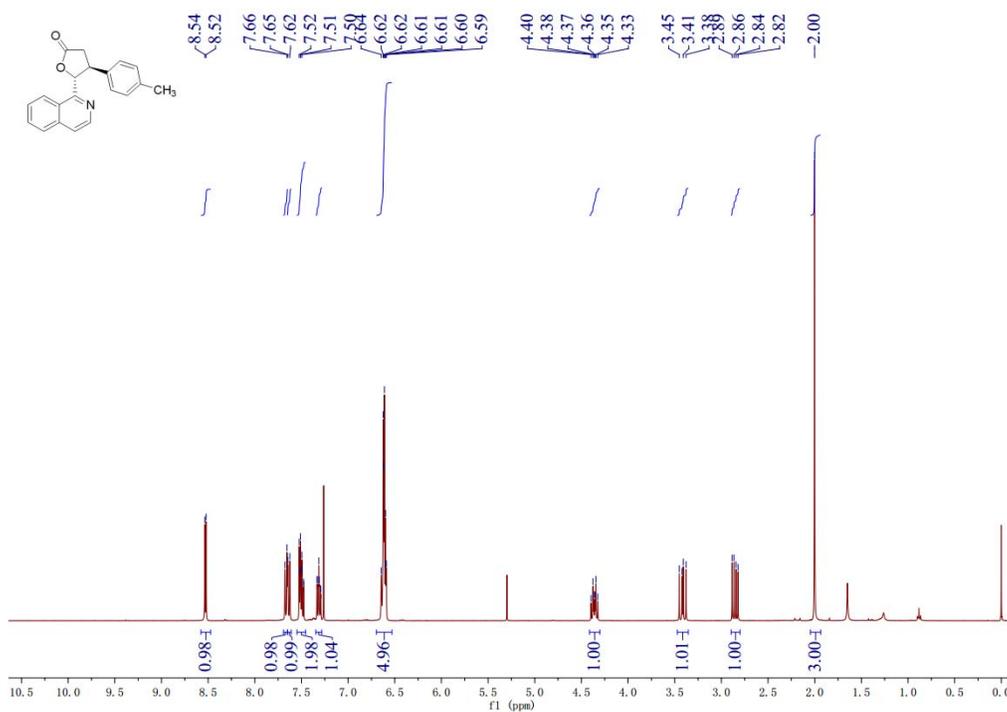
(4*S*,5*R*)-5-(Isoquinolin-1-yl)-4-phenyldihydrofuran-2(3*H*)-one (*trans*-4r)



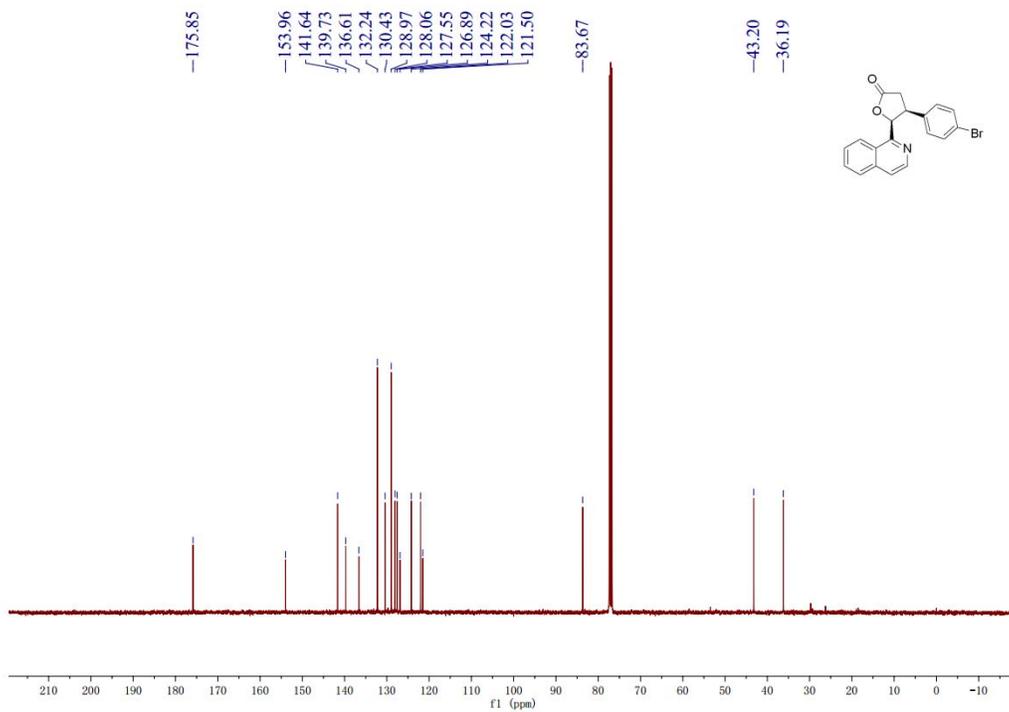
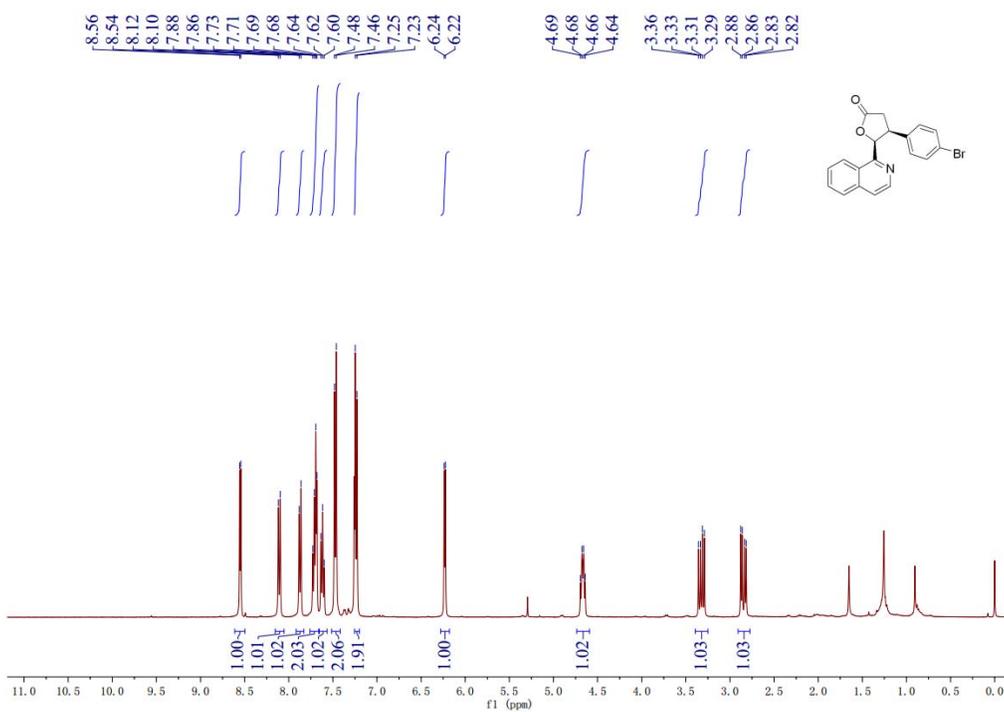
(4*S*,5*S*)-5-(Isoquinolin-1-yl)-4-(*p*-tolyl) dihydrofuran-2(3*H*)-one (*cis*-4*s*)



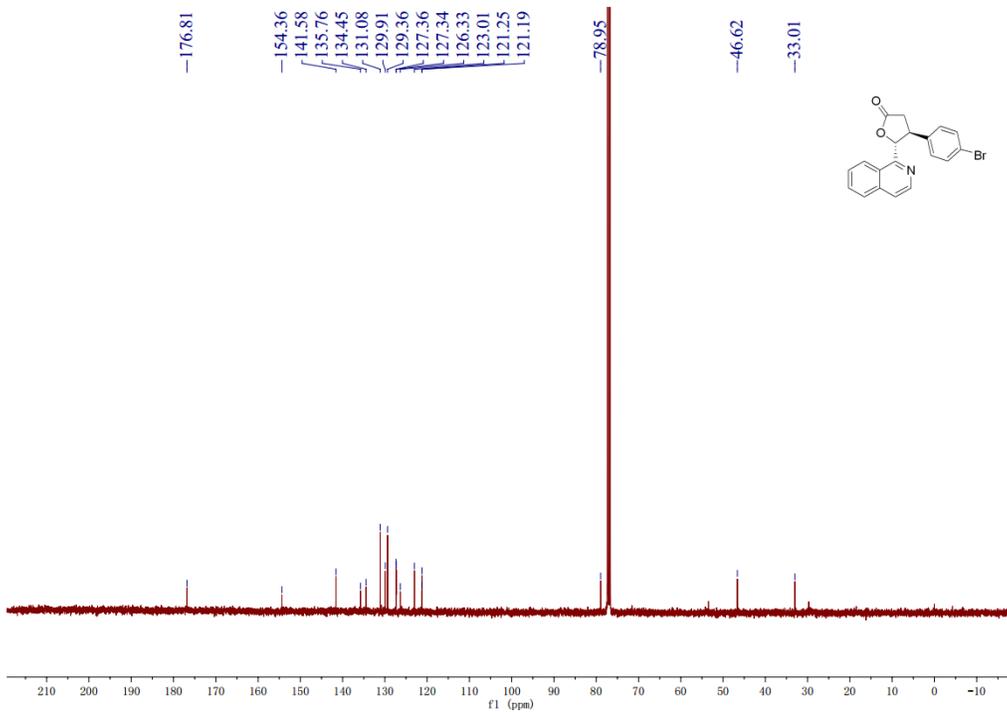
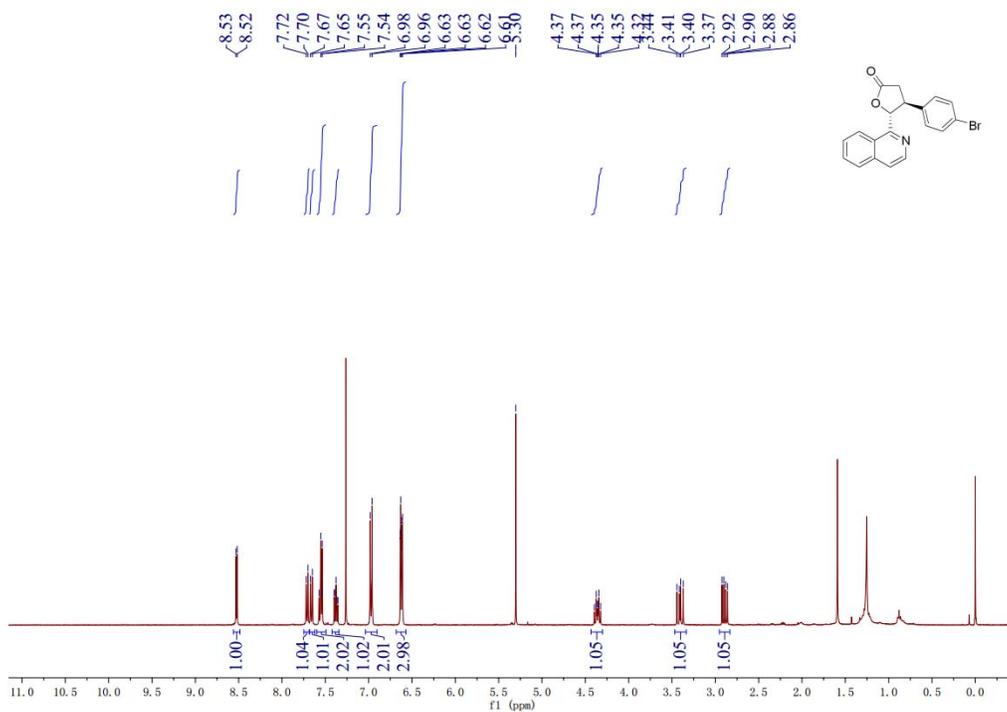
(4*S*,5*R*)-5-(Isoquinolin-1-yl)-4-(*p*-tolyl)dihydrofuran-2(3*H*)-one (*trans*-4*s*)



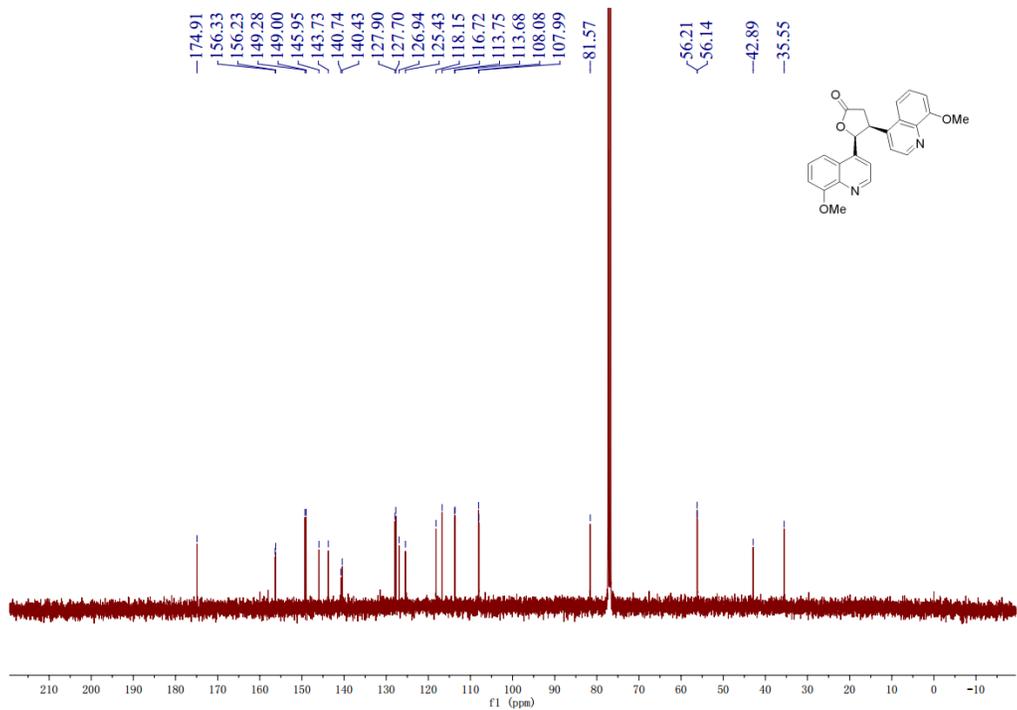
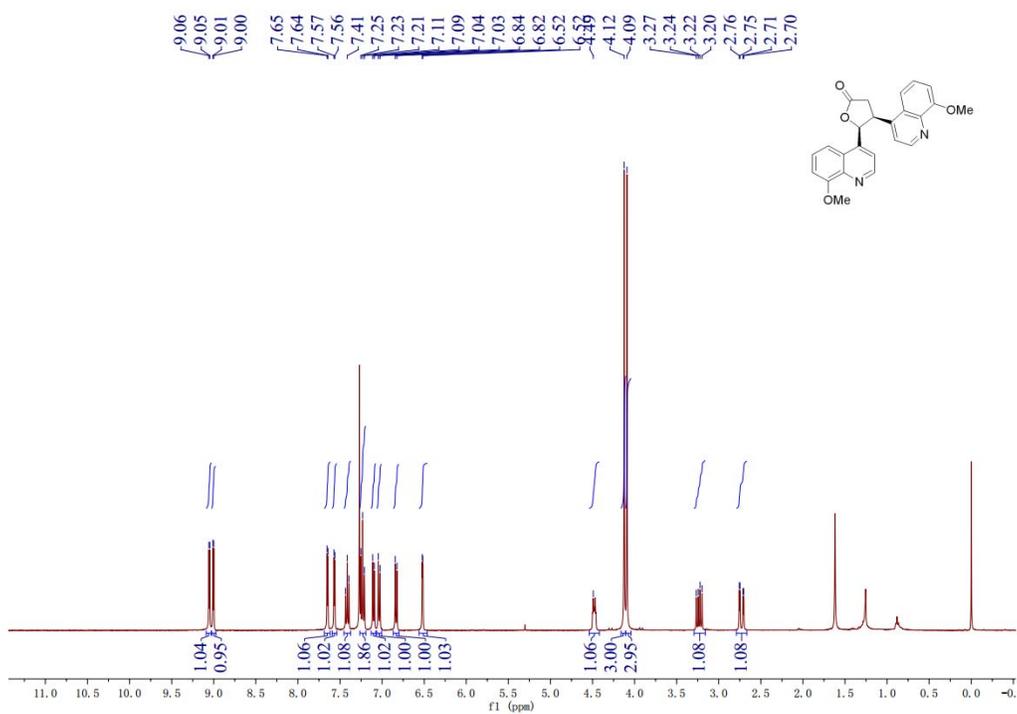
(4*S*,5*S*)-4-(4-Bromophenyl)-5-(isoquinolin-1-yl)dihydrofuran-2(3*H*)-one (*cis*-4t)



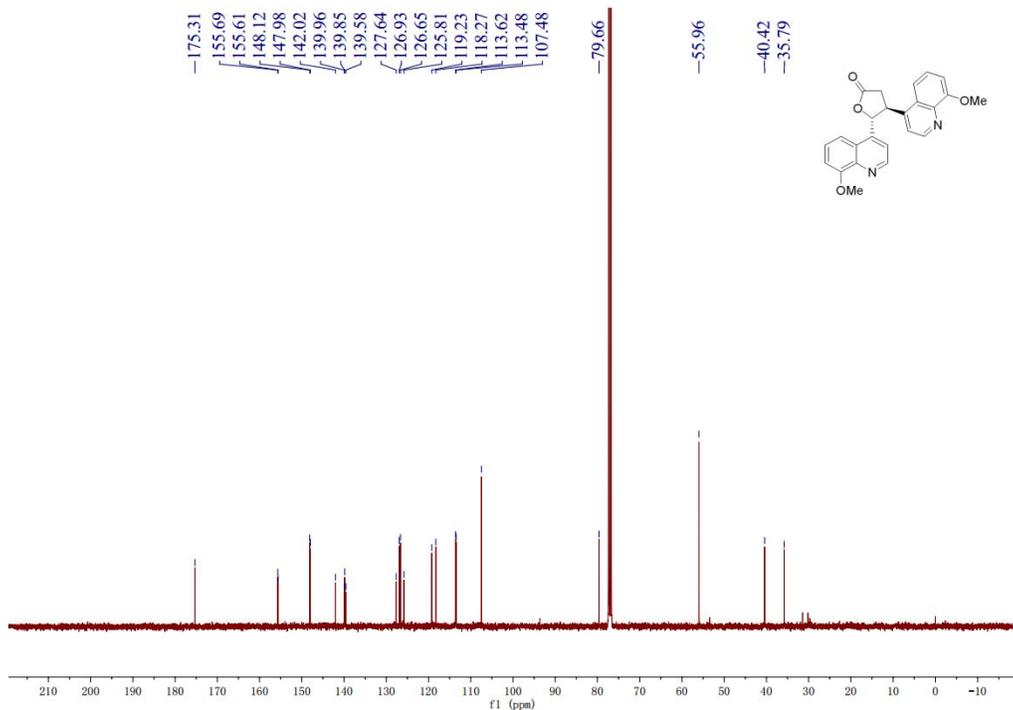
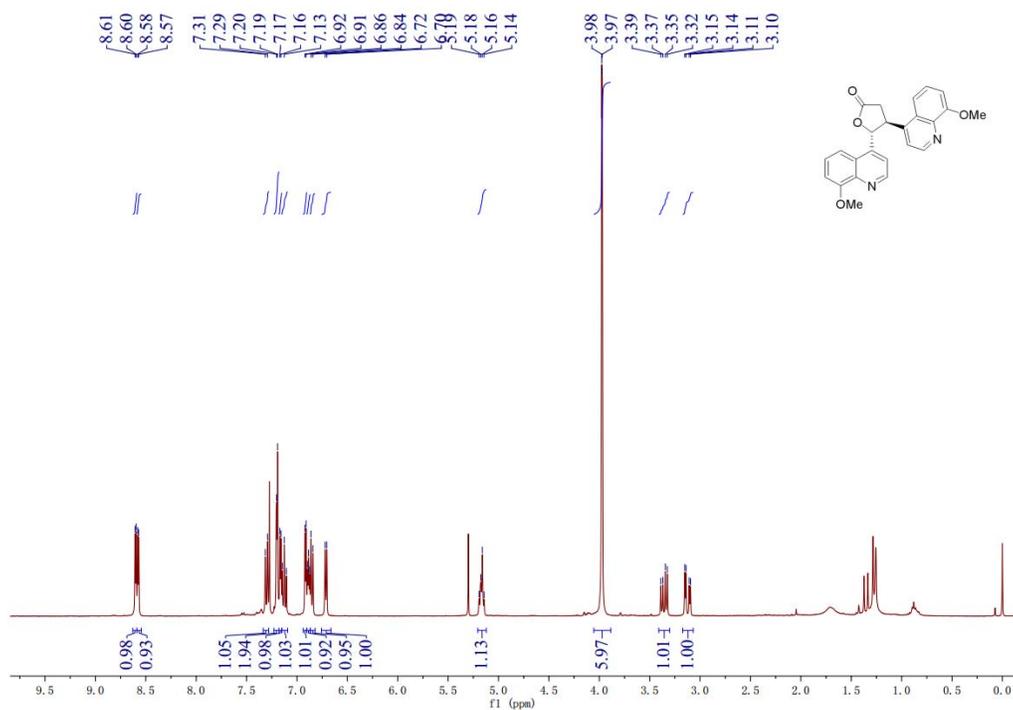
(4*S*,5*R*)-4-(4-Bromophenyl)-5-(isoquinolin-1-yl)dihydrofuran-2(3*H*)-one (*trans*-4t)



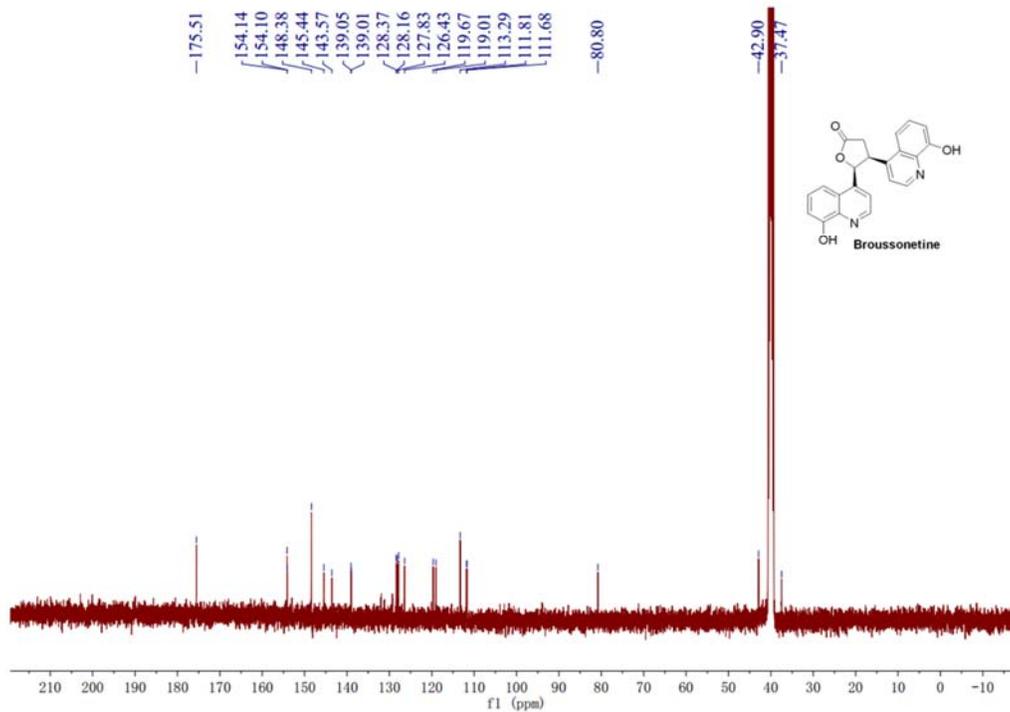
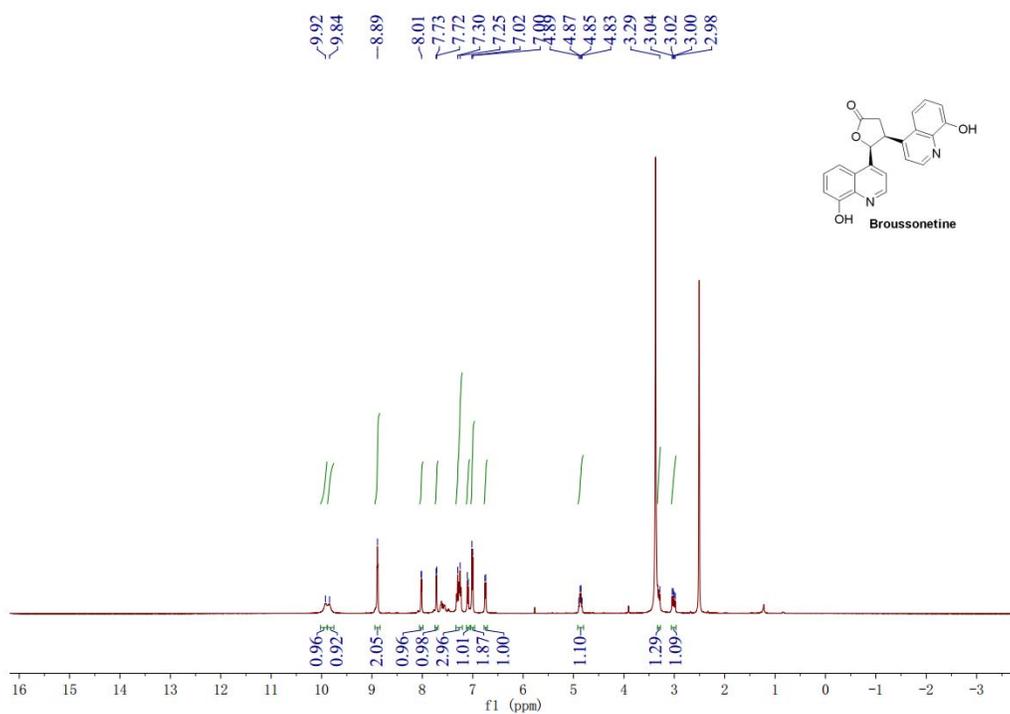
(4*S*,5*S*)-4,5-bis(8-Methoxyquinolin-4-yl)dihydrofuran-2(3*H*)-one (*cis*-4u)



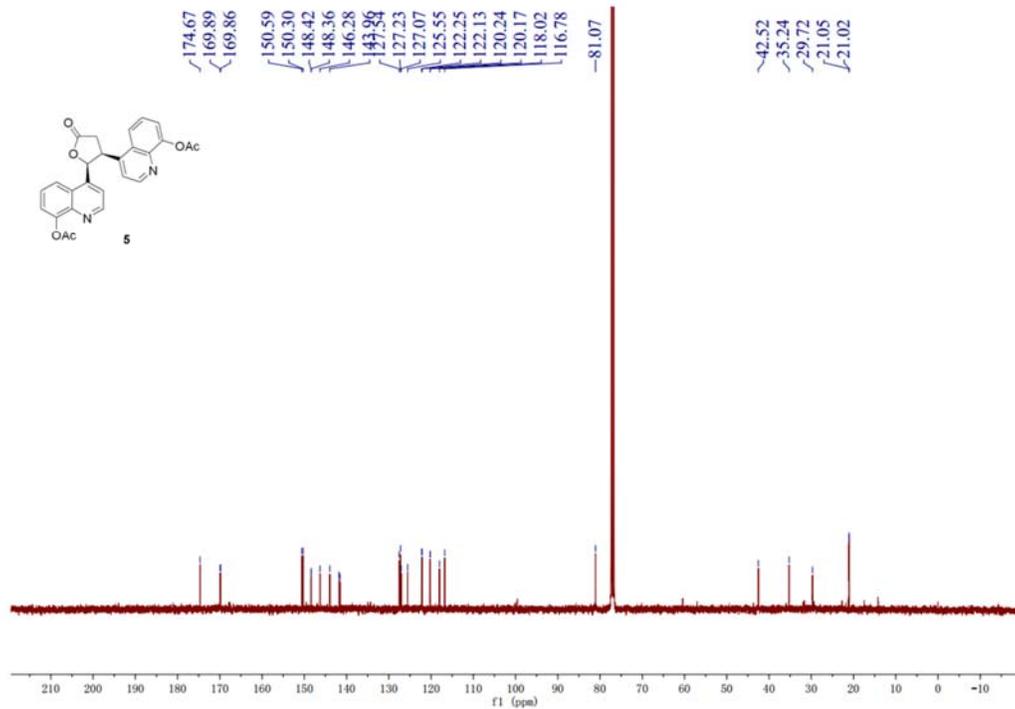
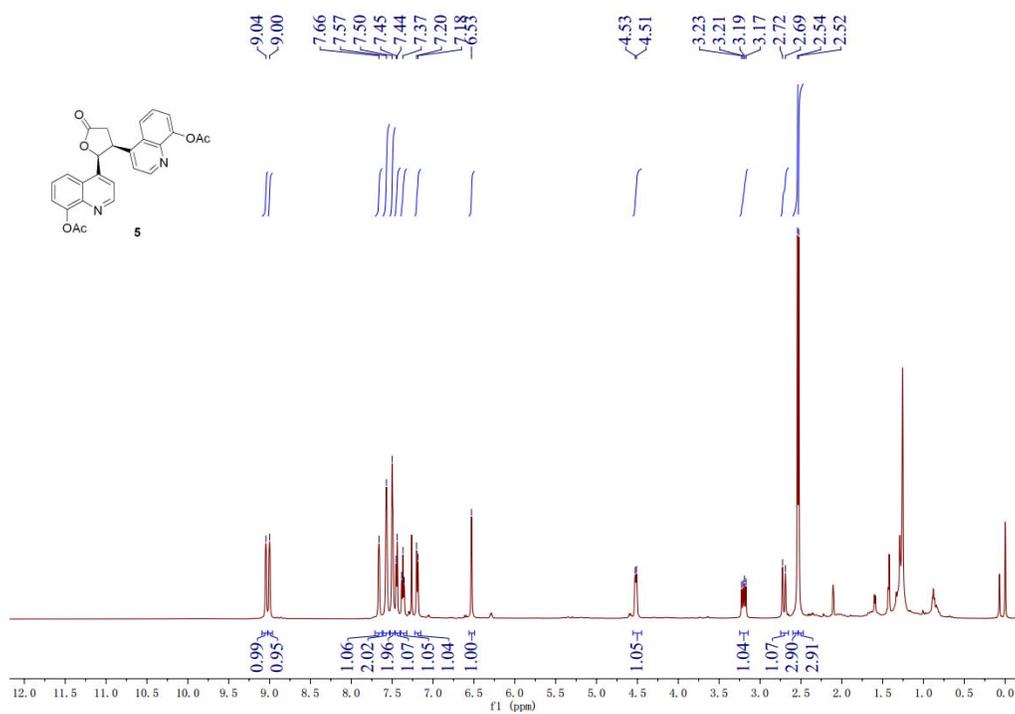
(4*S*,5*R*)-4,5-bis(8-Methoxyquinolin-4-yl)dihydrofuran-2(3*H*)-one (*trans*-4*u*)



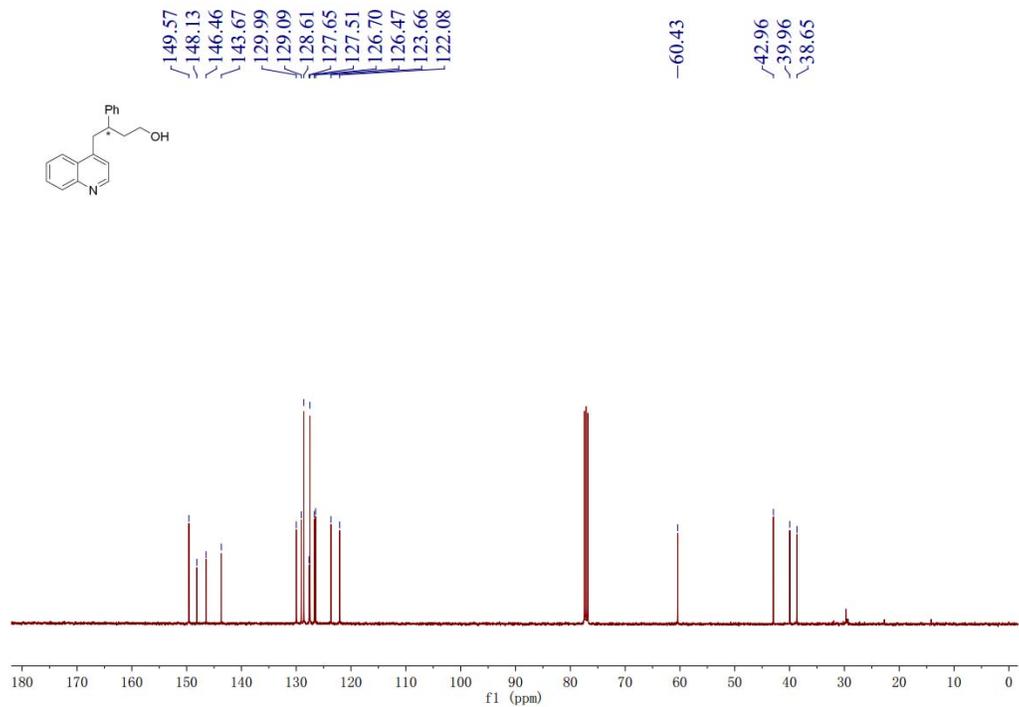
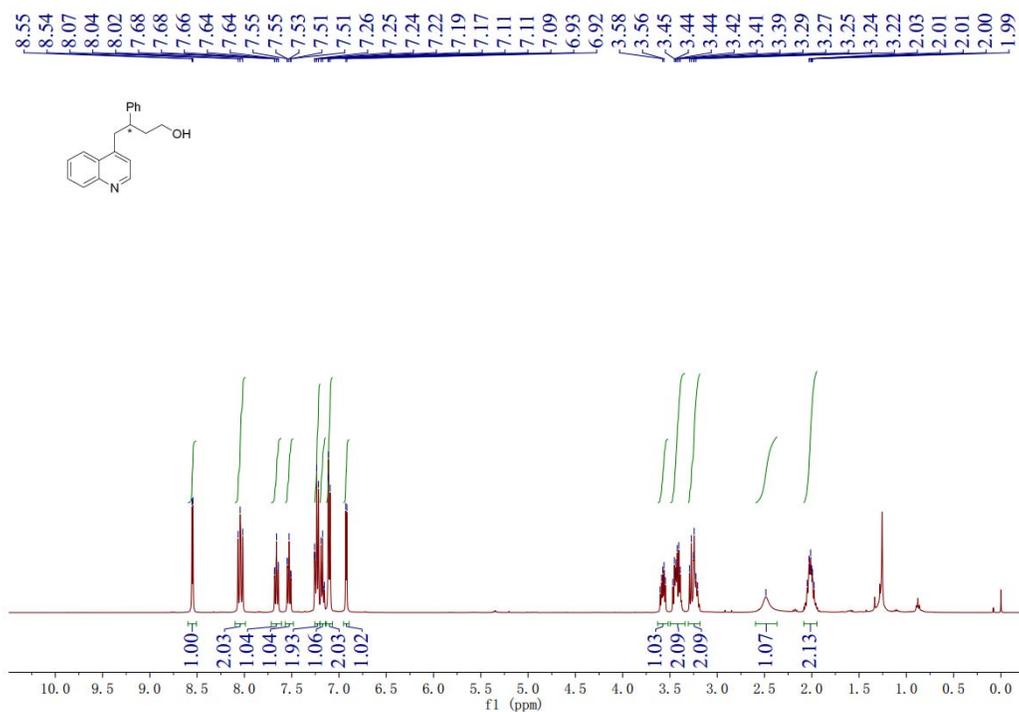
(4*S*,5*S*)-4,5-bis(8-Hydroxyquinolin-4-yl)dihydrofuran-2(3*H*)-one (Broussonetine)



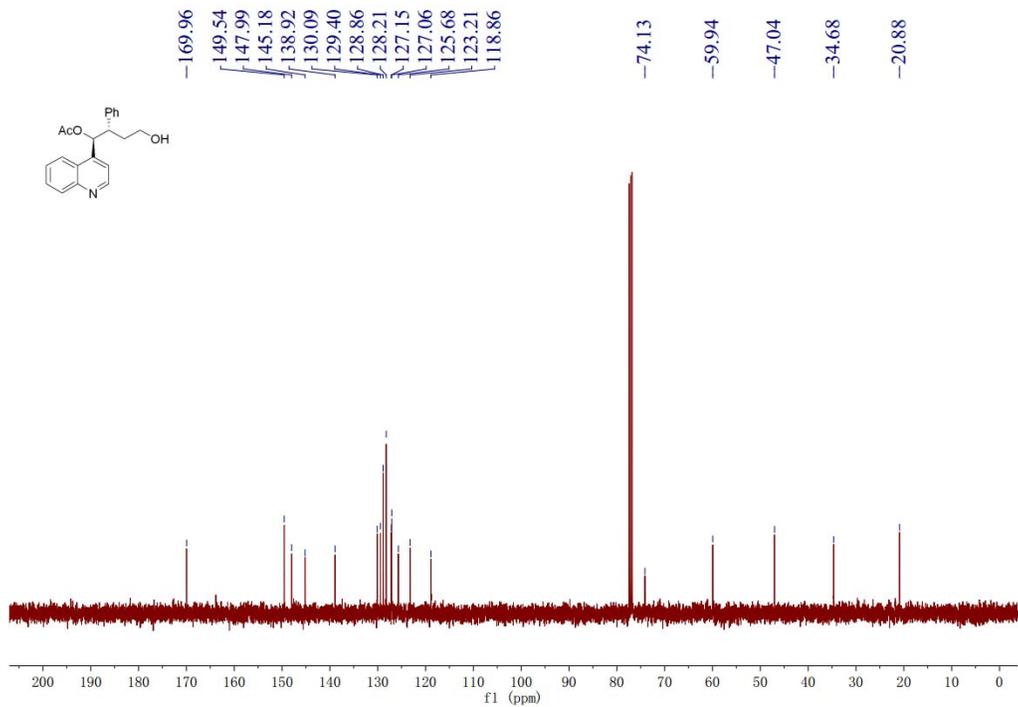
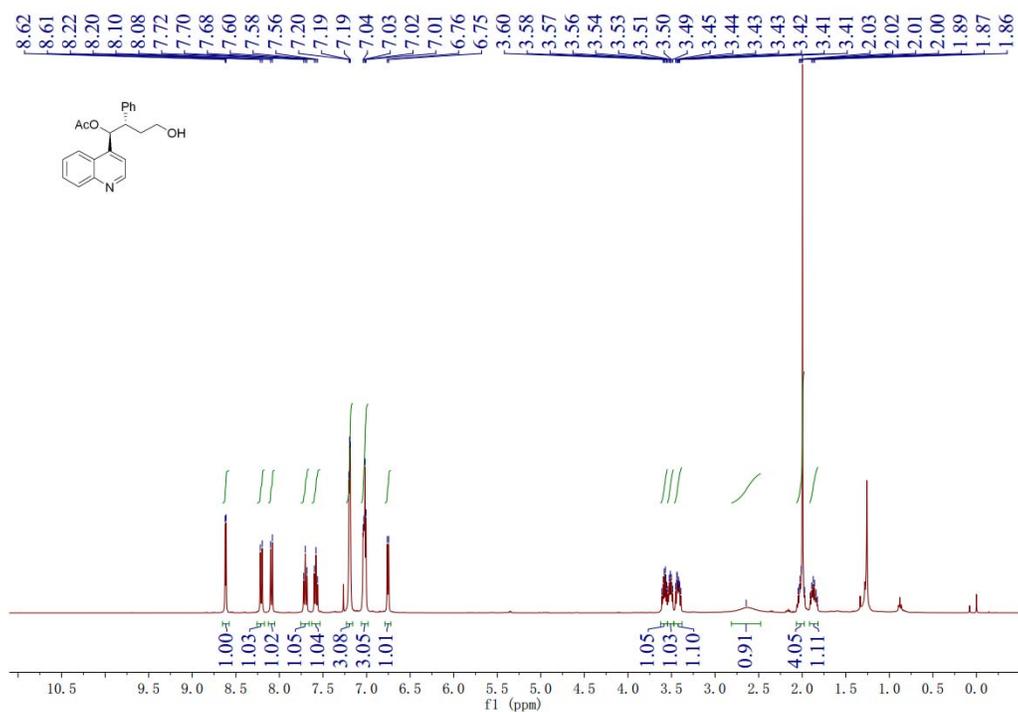
((2S,3S)-5-Oxotetrahydrofuran-2,3-diyl)bis(quinoline-4,8-diyl) diacetate (5)



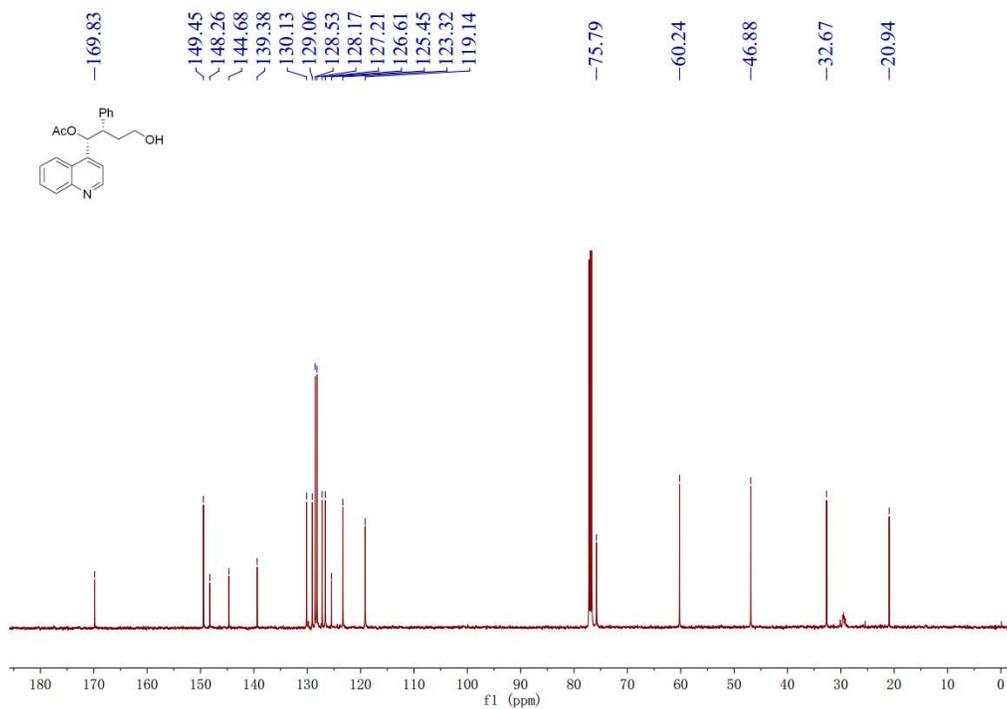
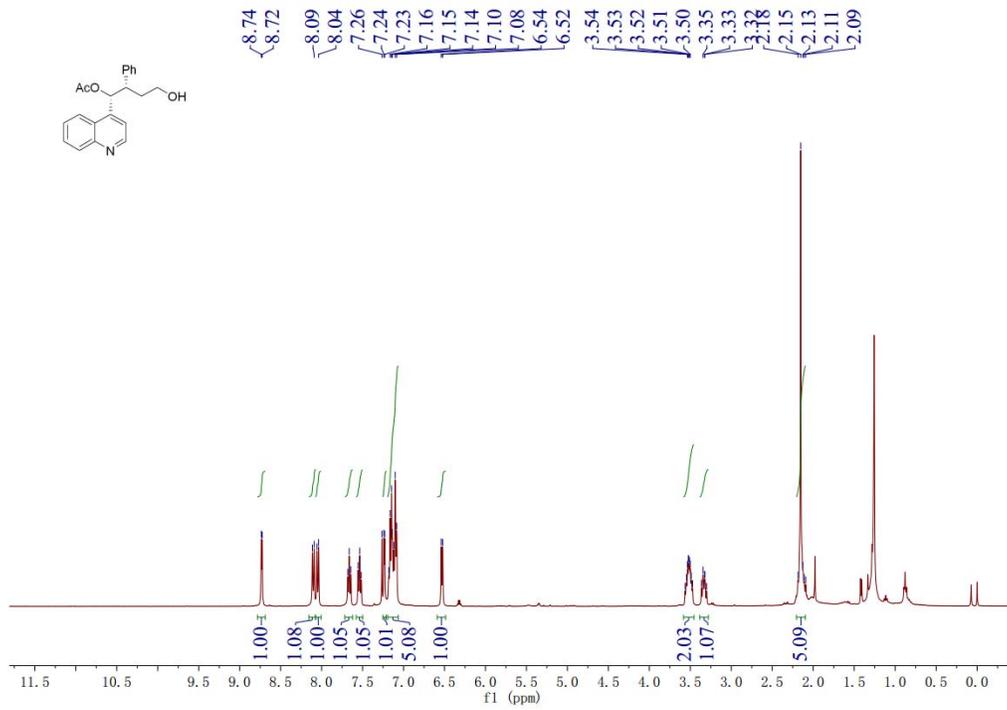
3-Phenyl-4-(quinolin-4-yl)butan-1-ol



(1*S*,2*S*)-4-hydroxy-2-phenyl-1-(quinolin-4-yl)butyl acetate



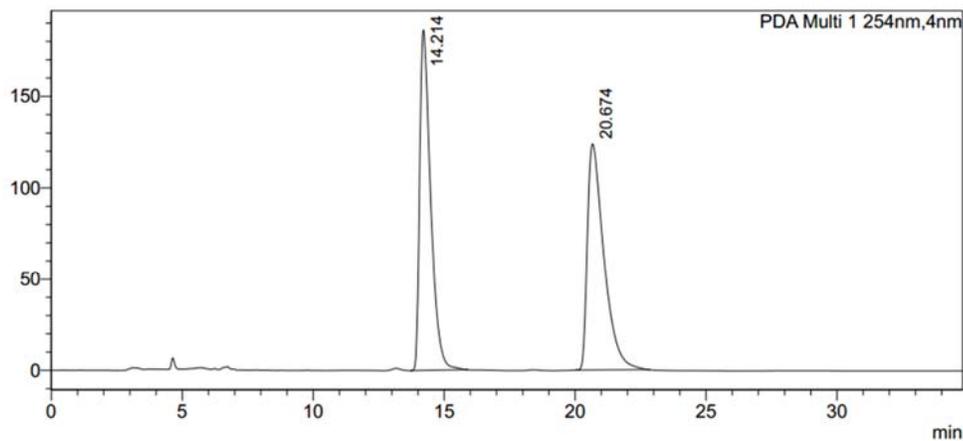
(1*R*,2*S*)-4-hydroxy-2-phenyl-1-(quinolin-4-yl)butyl acetate



XII. Chiral HPLC analysis spectra

<Chromatogram>

mAU



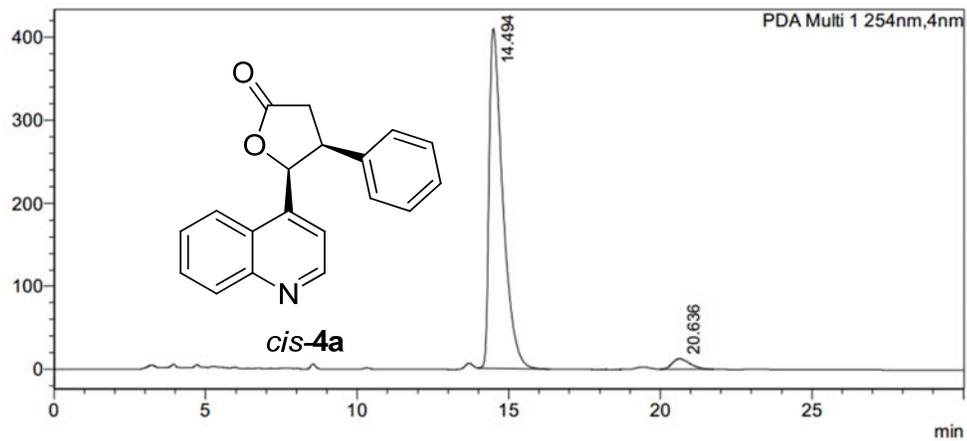
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	14.214	5428660	185433	49.907	%		RT:14.214
2	20.674	5448920	123640	50.093	%		RT:20.674
Total		10877580	309073				

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mAU



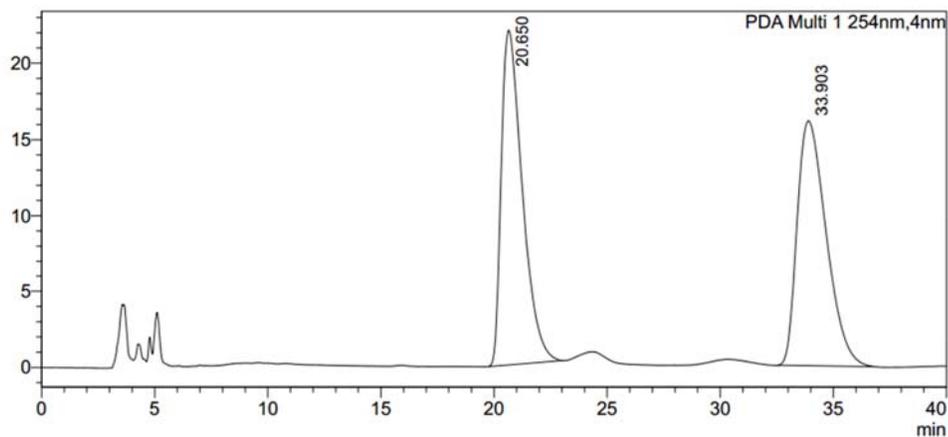
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	14.494	12768269	409085	96.188	%		RT:14.494
2	20.636	506058	12466	3.812	%		RT:20.636
Total		13274326	421551				

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mAU



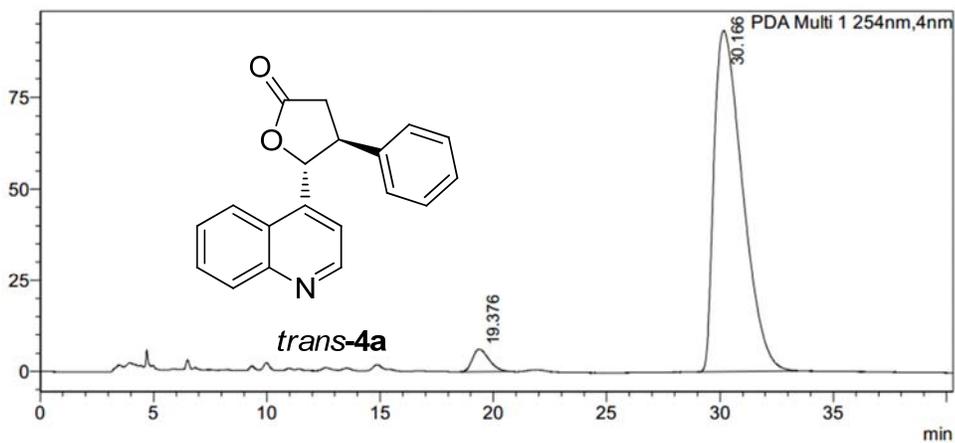
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	20.650	1421267	21987	49.674	%		RT:20.650
2	33.903	1439949	16127	50.326	%		RT:33.903
Total		2861216	38114				

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mAU



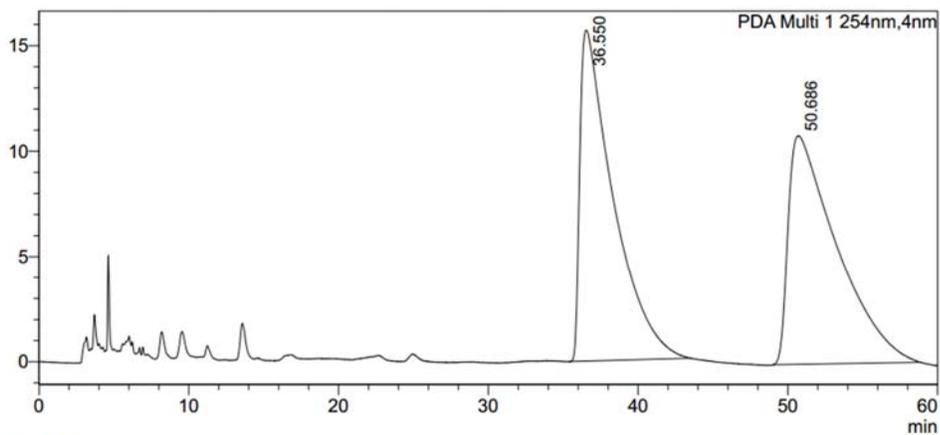
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	19.376	312114	6135	3.678	%		RT:19.376
2	30.166	8174422	93278	96.322	%		RT:30.166
Total		8486536	99413				

<Chromatogram>

mAU



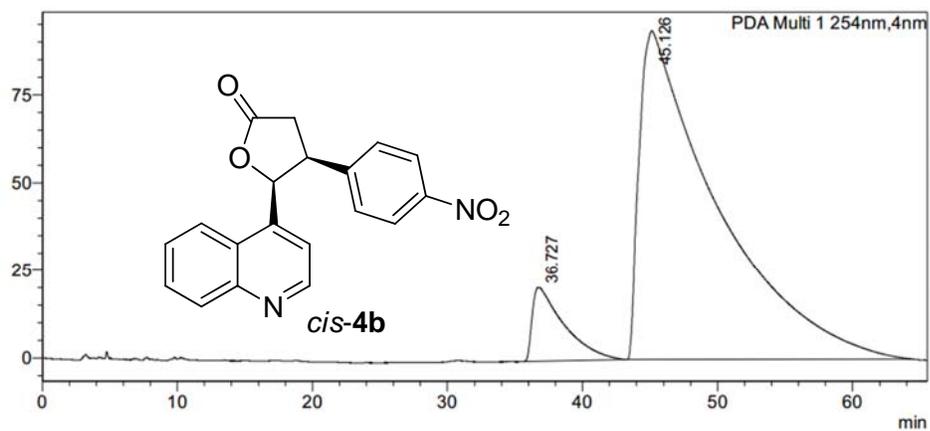
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	36.550	2429283	15706	49.793	%		RT:36.550
2	50.686	2449516	10849	50.207	%		RT:50.686
Total		4878799	26555				

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mAU



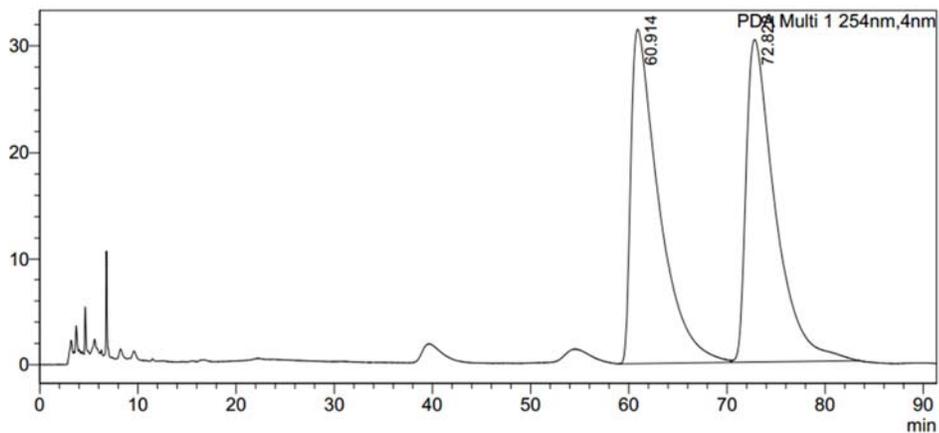
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	36.727	3409406	20990	8.356	%		RT:36.727
2	45.126	37394227	93632	91.644	%	S	RT:45.126
Total		40803633	114622				

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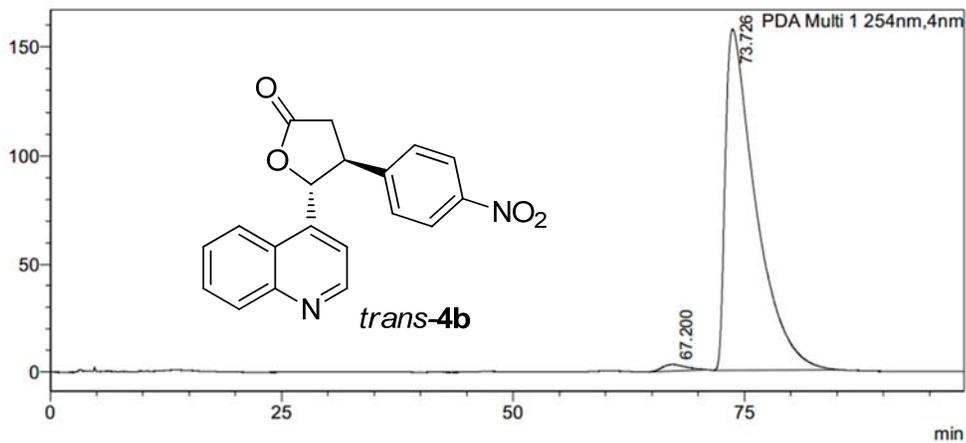
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	60.914	6237403	31453	50.000	%		RT:60.914
2	72.822	6237489	30347	50.000	%	V	RT:72.822
Total		12474892	61800				

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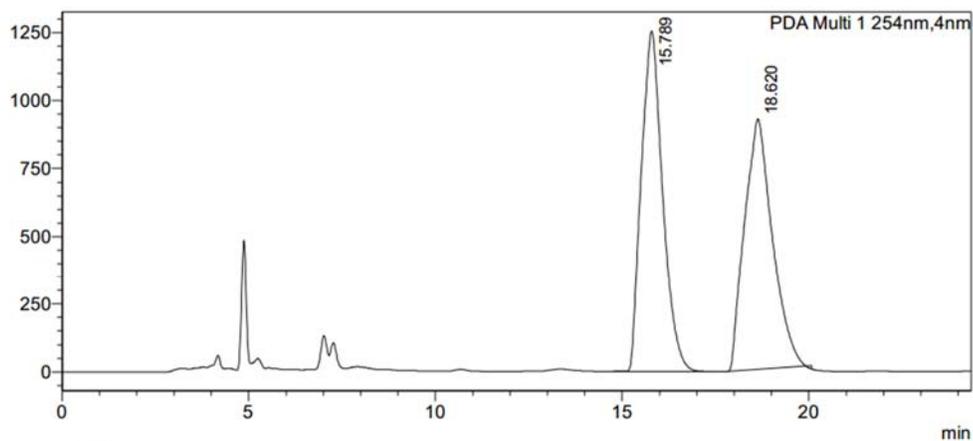
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	67.200	527664	2982	1.445	%	V	RT:67.200
2	73.726	35987039	157318	98.555	%	S	RT:73.726
Total		36514703	160299				

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mAU



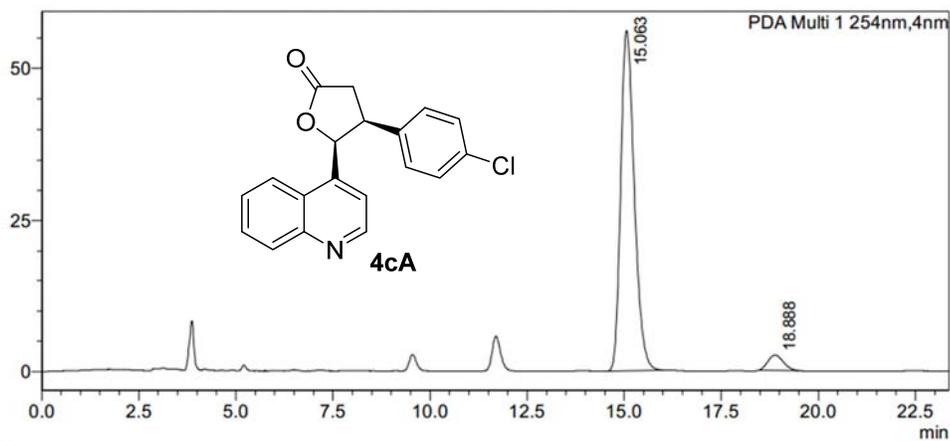
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	15.789	49875571	976286	51.082	%		RT:15.789
2	18.620	47761945	855298	48.918	%		RT:18.620
Total		97637516	1831583				

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mAU

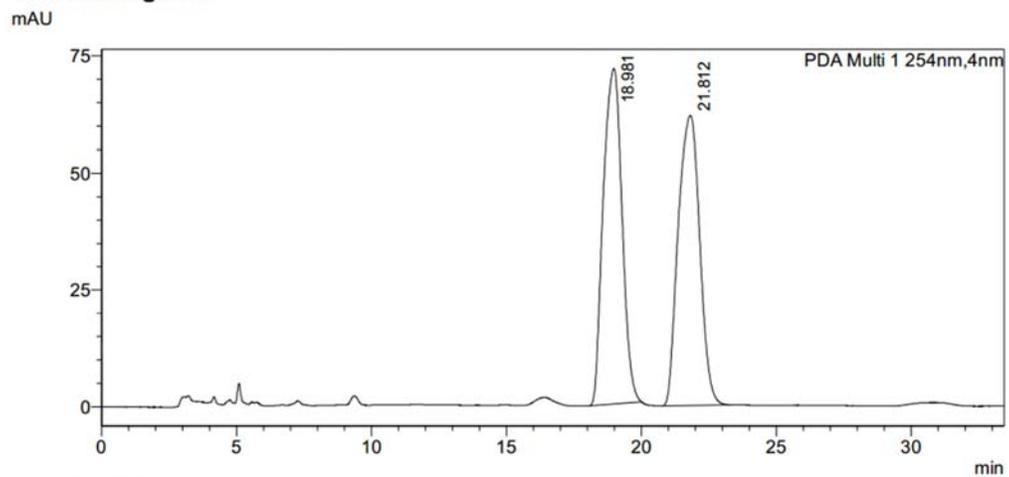


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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	15.063	1369272	56108	95.181	%		RT:15.063
2	18.888	69326	2516	4.819	%		RT:18.888
Total		1438598	58625				

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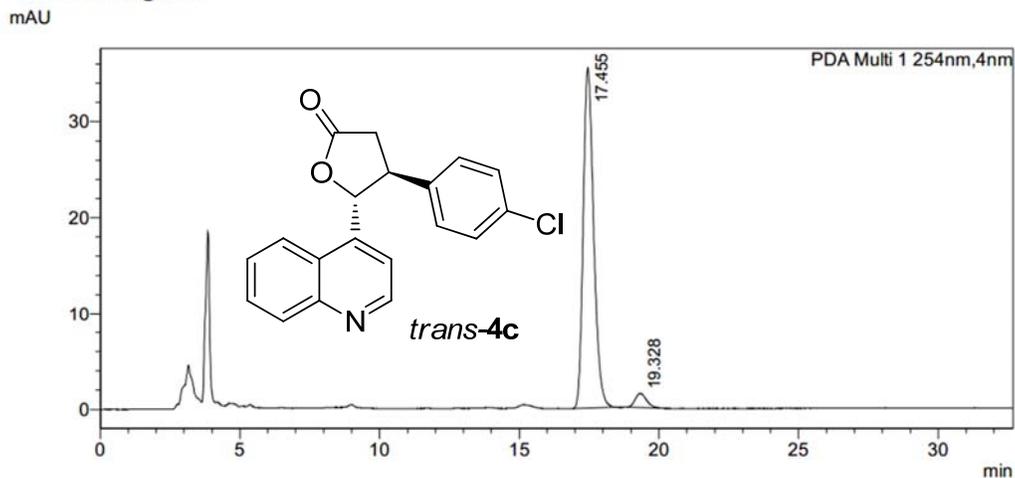


<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	18.981	3458451	71675	50.181	%		RT:18.981
2	21.812	3433484	61954	49.819	%		RT:21.812
Total		6891935	133629				

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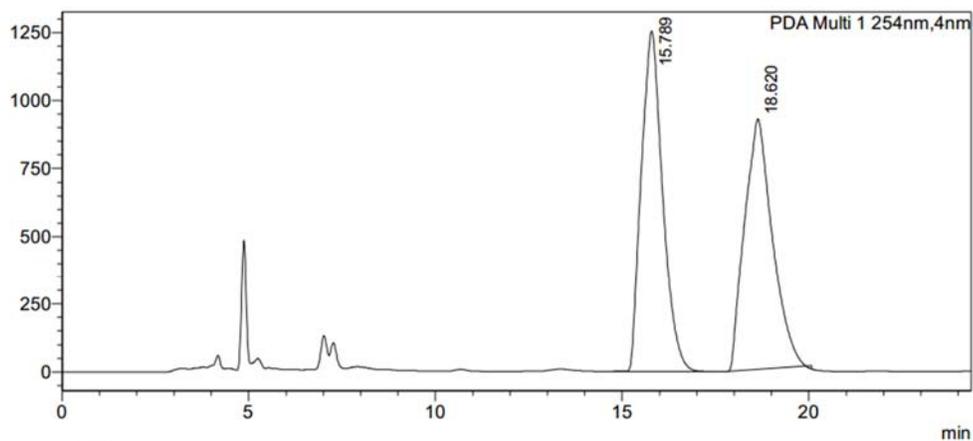
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	17.455	923356	35497	95.673	%		RT:17.455
2	19.328	41764	1487	4.327	%		RT:19.328
Total		965121	36985				

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mAU



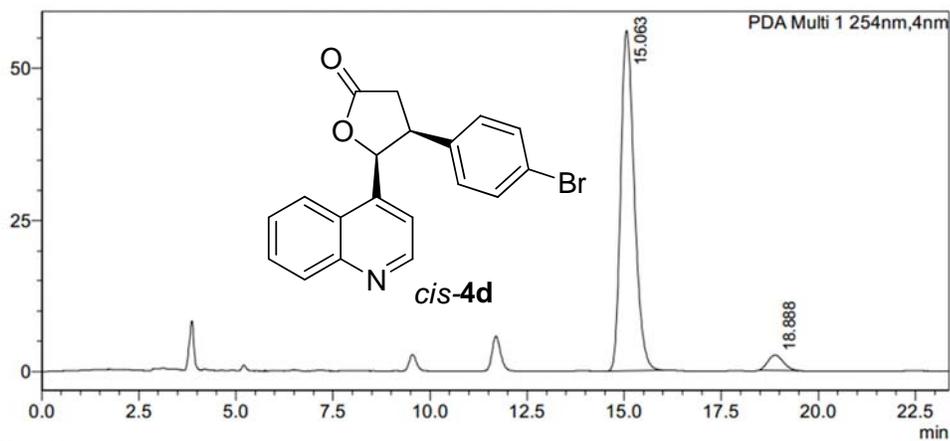
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	15.789	49875571	976286	51.082	%		RT:15.789
2	18.620	47761945	855298	48.918	%		RT:18.620
Total		97637516	1831583				

<Chromatogram>

mAU

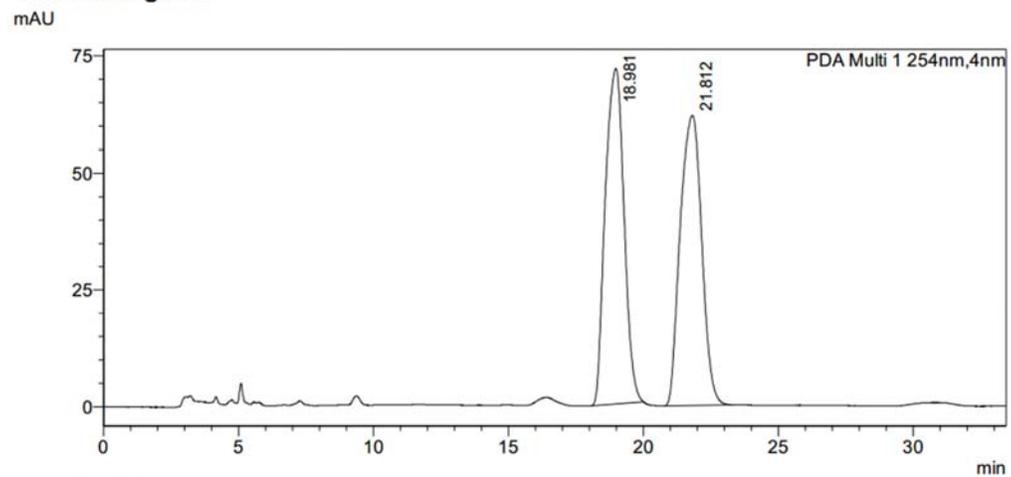


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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	15.063	1369272	56108	95.181	%		RT:15.063
2	18.888	69326	2516	4.819	%		RT:18.888
Total		1438598	58625				

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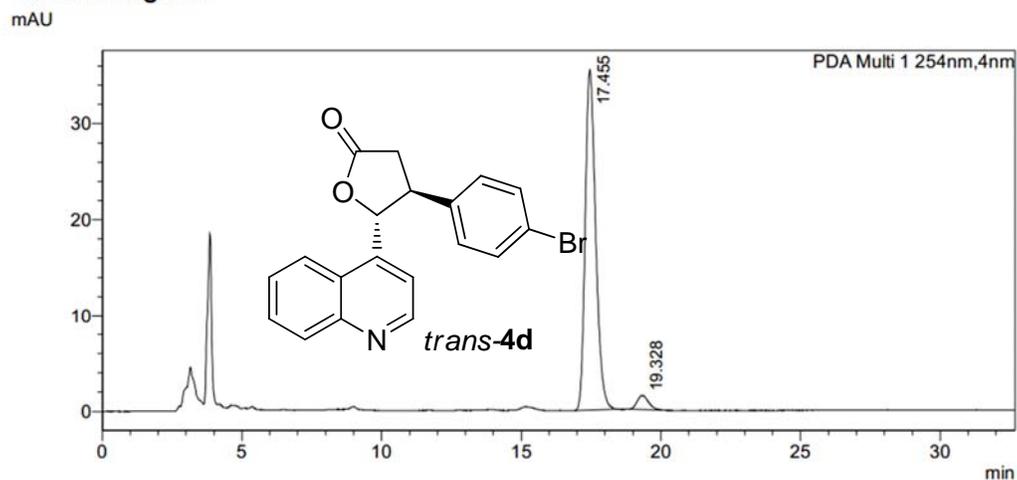


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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	18.981	3458451	71675	50.181	%		RT:18.981
2	21.812	3433484	61954	49.819	%		RT:21.812
Total		6891935	133629				

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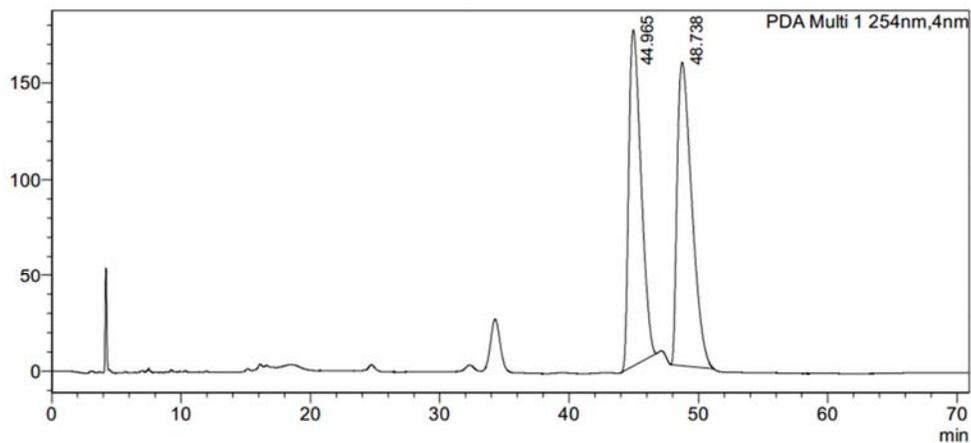
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	17.455	923356	35497	95.673	%		RT:17.455
2	19.328	41764	1487	4.327	%		RT:19.328
Total		965121	36985				

<Chromatogram>

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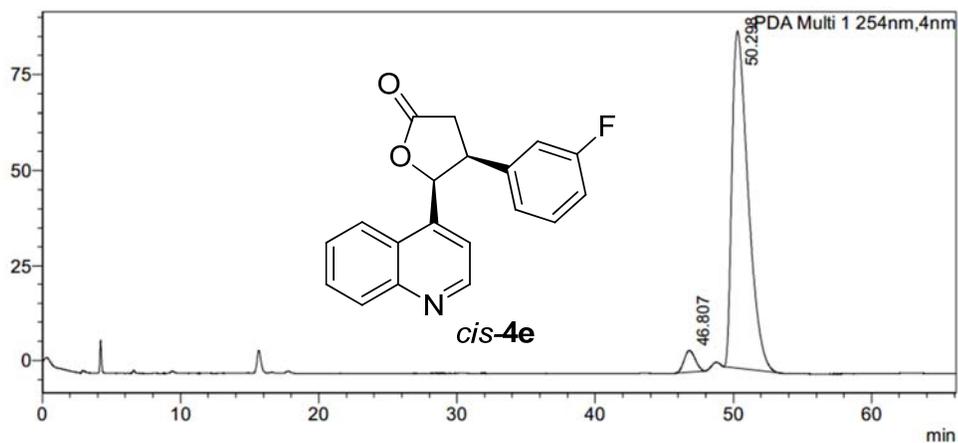
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	44.965	11526403	174948	48.039	%		RT:44.965
2	48.738	12467649	157907	51.961	%		RT:48.738
Total		23994051	332855				

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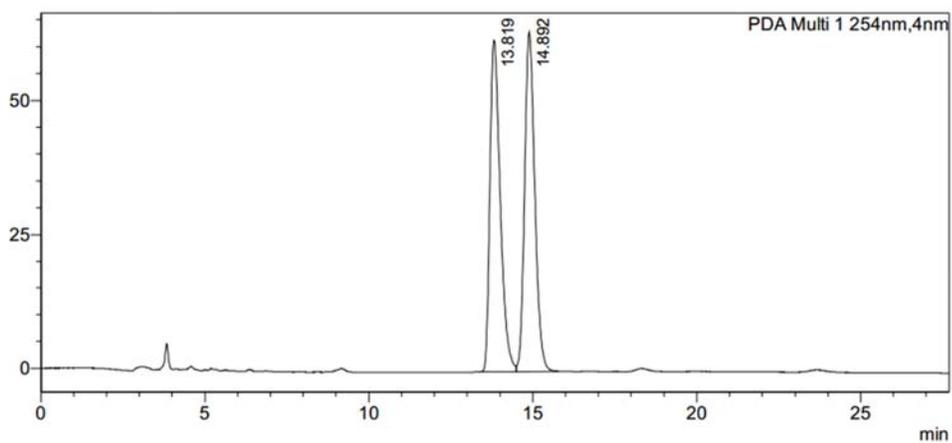
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	46.807	321078	5695	4.268	%		RT:46.807
2	50.298	7201917	88389	95.732	%		RT:50.298
Total		7522995	94084				

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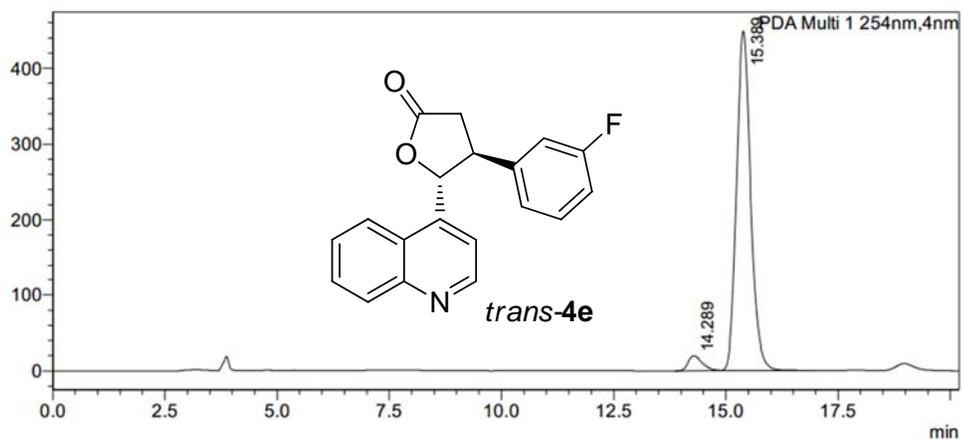
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	13.819	1357137	61908	49.788	%		RT:13.819
2	14.892	1368690	63309	50.212	%	V	RT:14.892
Total		2725828	125218				

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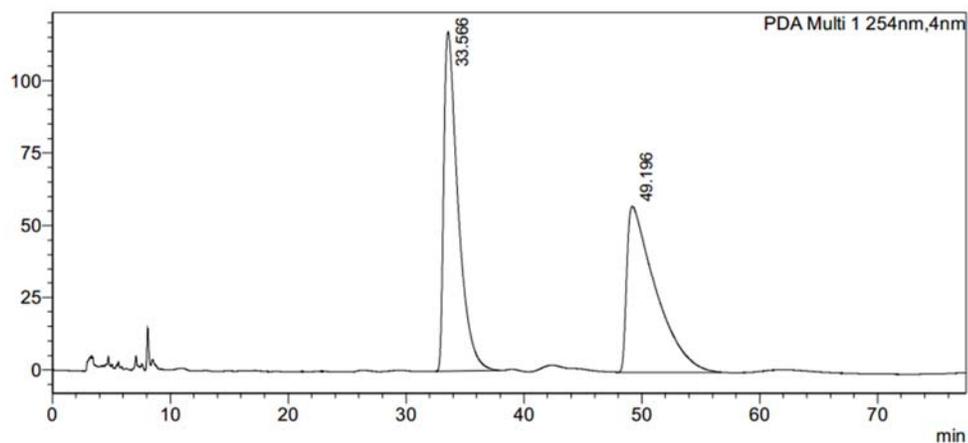
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	14.289	440678	19699	4.272	%		RT:14.289
2	15.389	9874071	448613	95.728	%	V	RT:15.389
Total		10314749	468311				

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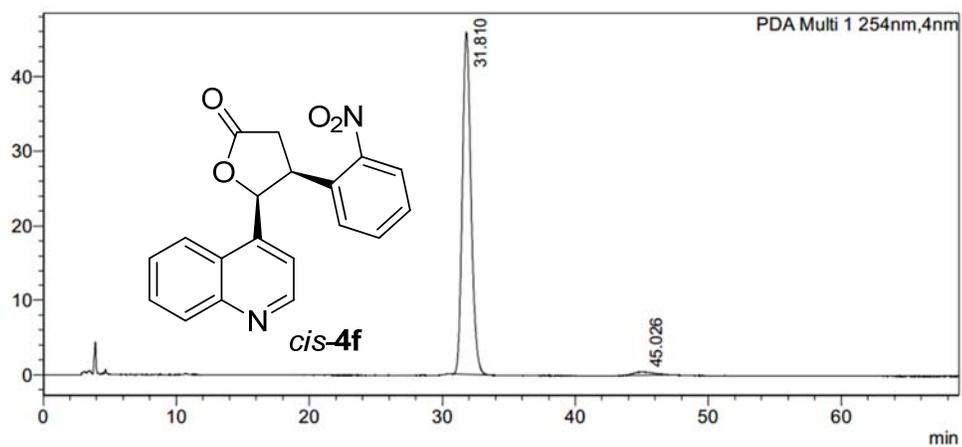
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Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	33.566	9880061	117220	50.395	%		RT:33.566
2	49.196	9725110	57390	49.605	%		RT:49.196
Total		19605171	174609				

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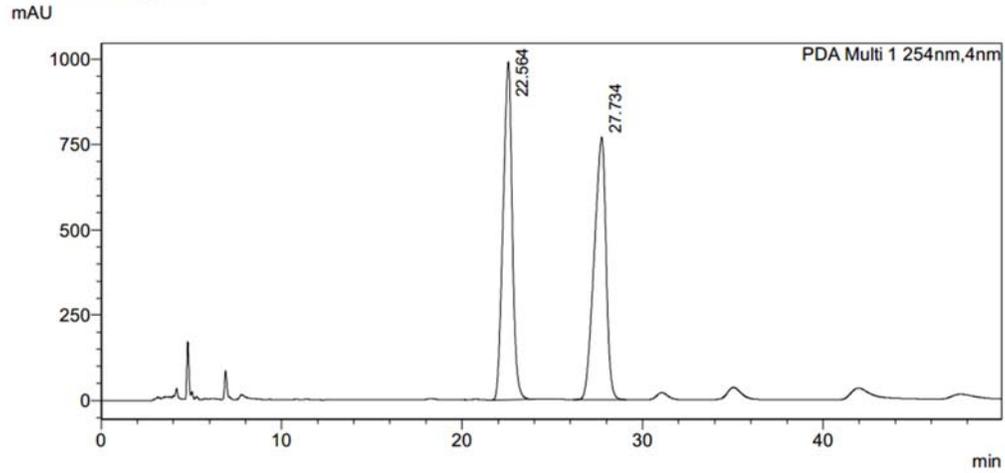


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Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	31.810	2088070	45784	97.951	%		RT:31.810
2	45.026	43688	431	2.049	%		RT:45.026
Total		2131758	46215				

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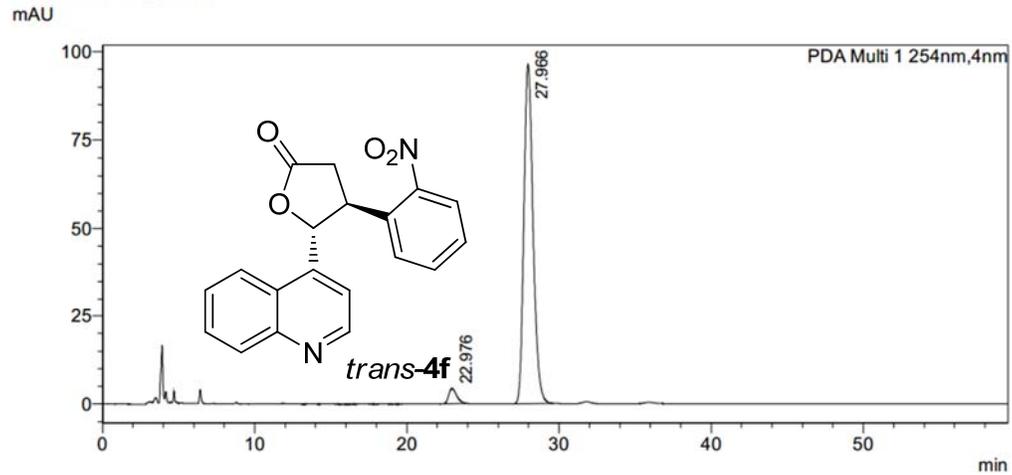


<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	22.564	34874962	988003	49.836	%		RT:22.564
2	27.734	35105169	767125	50.164	%		RT:27.734
Total		69980131	1755129				

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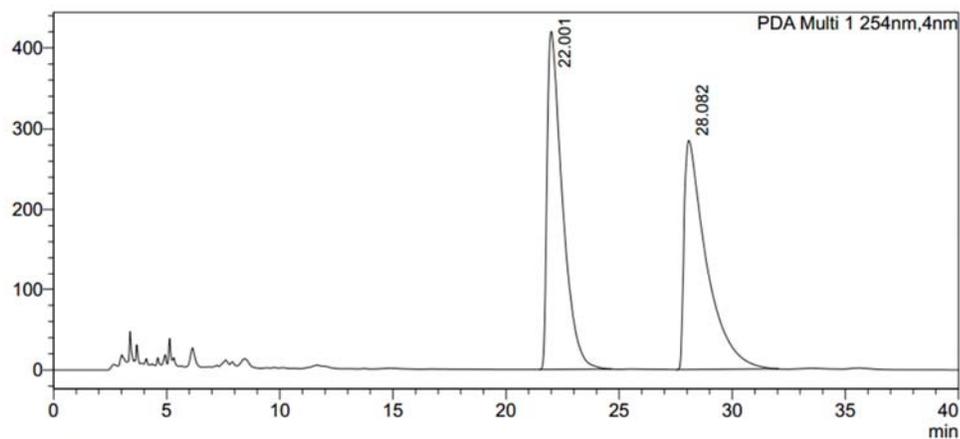
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	22.976	155491	4333	3.705	%		RT:22.976
2	27.966	4040753	96350	96.295	%		RT:27.966
Total		4196244	100683				

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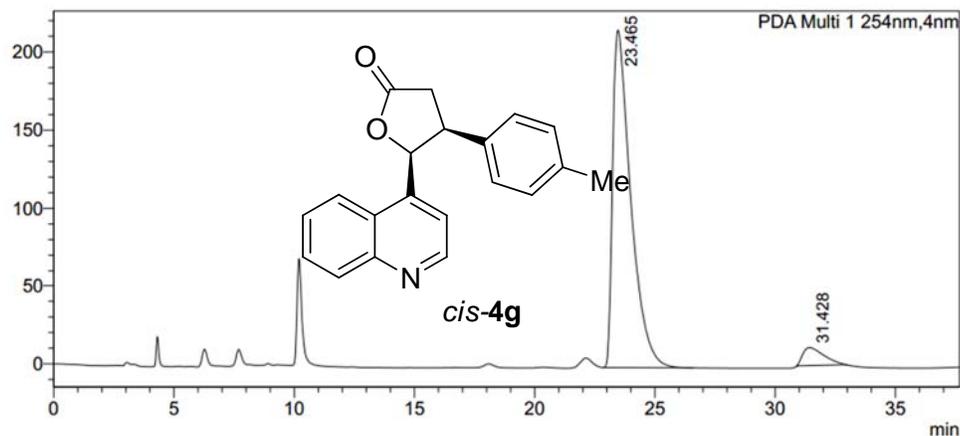
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	22.001	19782679	419566	50.274	%		RT:22.001
2	28.082	19567068	284960	49.726	%		RT:28.082
Total		39349748	704526				

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mAU



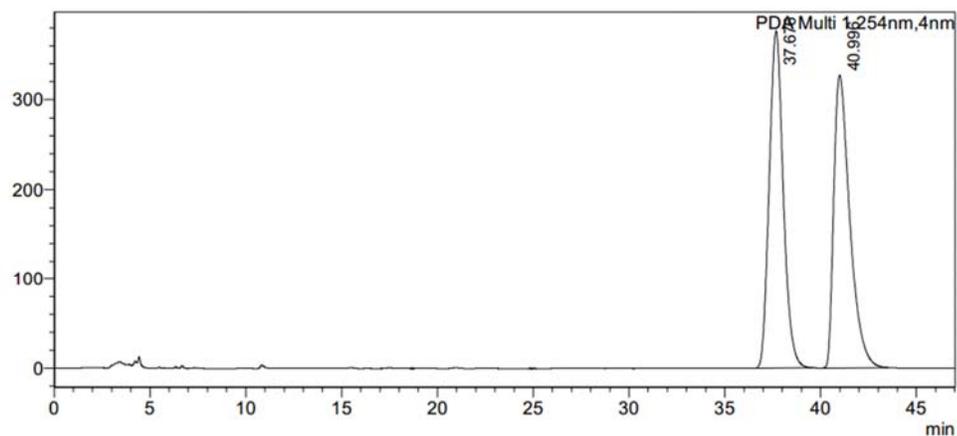
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	23.465	11356045	216428	94.190	%		RT:23.465
2	31.428	700470	11498	5.810	%		RT:31.428
Total		12056515	227926				

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mAU



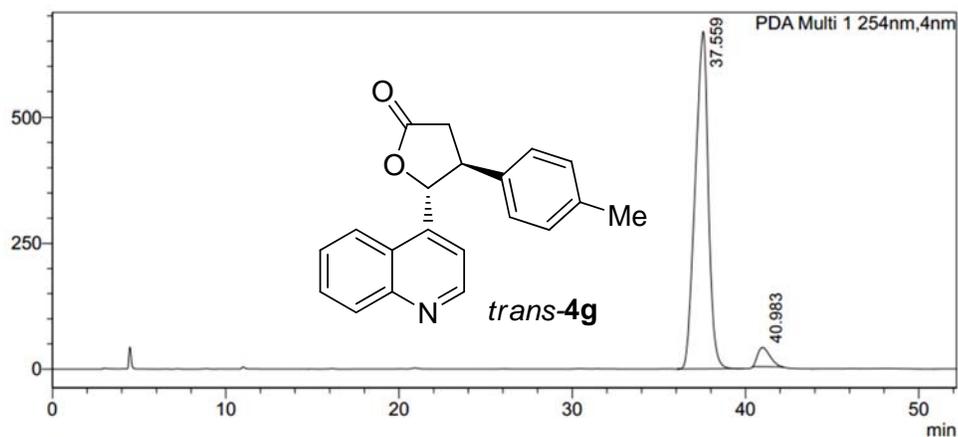
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	37.676	19209764	376244	50.244	%		RT:37.676
2	40.996	19023094	326799	49.756	%		RT:40.996
Total		38232857	703043				

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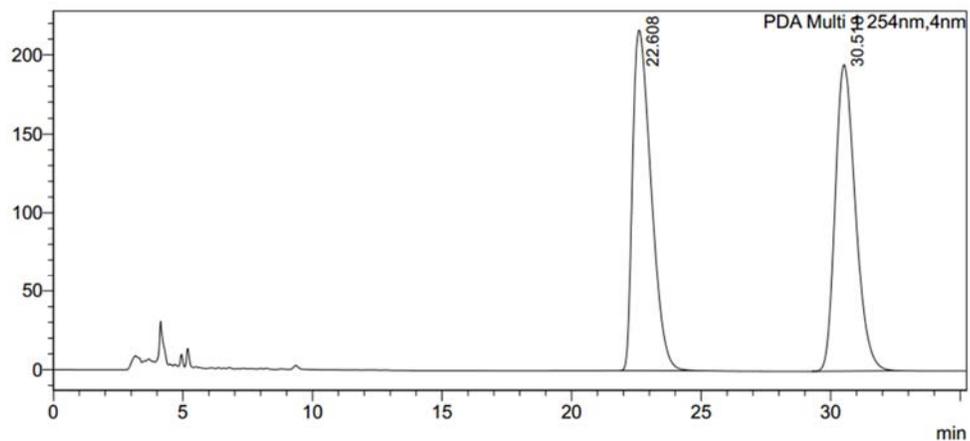
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	37.559	35227891	668710	94.904	%		RT:37.559
2	40.983	1891454	38312	5.096	%		RT:40.983
Total		37119345	707021				

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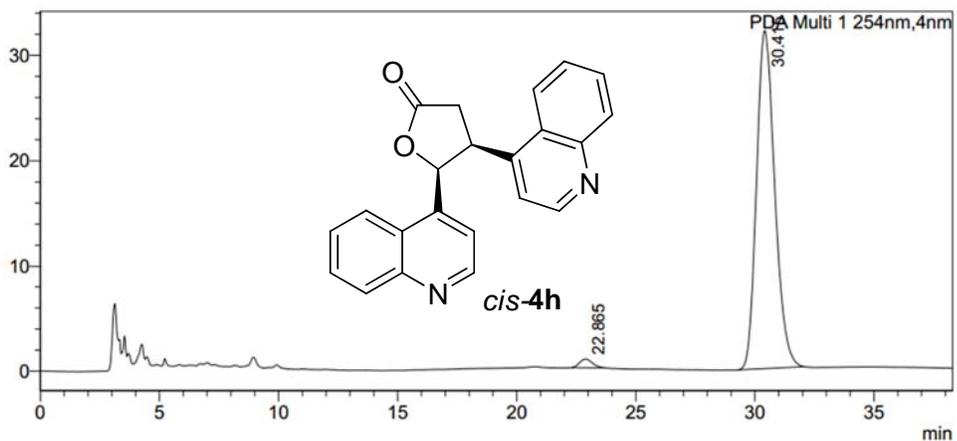
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	22.608	10749228	216353	50.320			
2	30.518	10612595	194689	49.680			
Total		21361824	411042				

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mAU



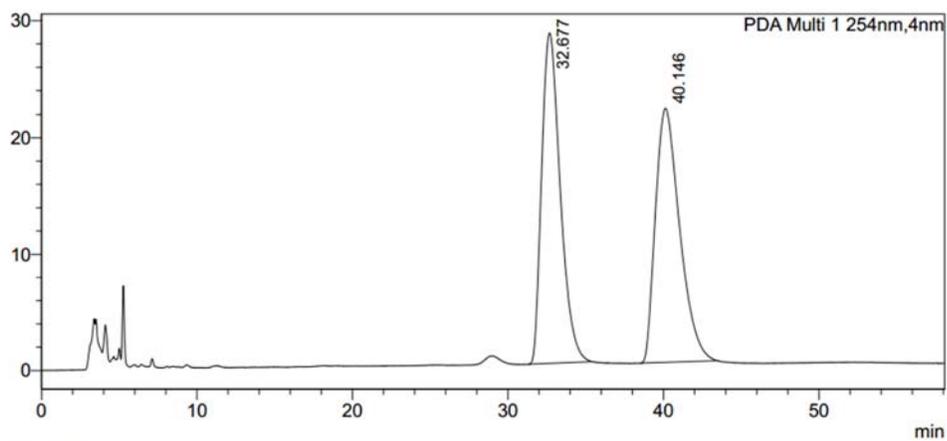
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	22.865	30253	824	1.741	%		RT:22.865
2	30.415	1707609	32109	98.259	%		RT:30.415
Total		1737862	32933				

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mAU



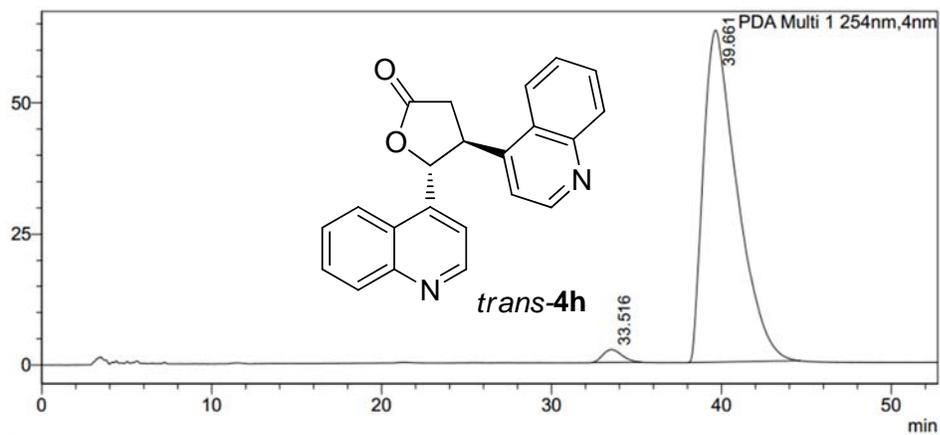
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	32.677	2355122	28341	49.886	%		RT:32.677
2	40.146	2365873	21783	50.114	%		RT:40.146
Total		4720995	50124				

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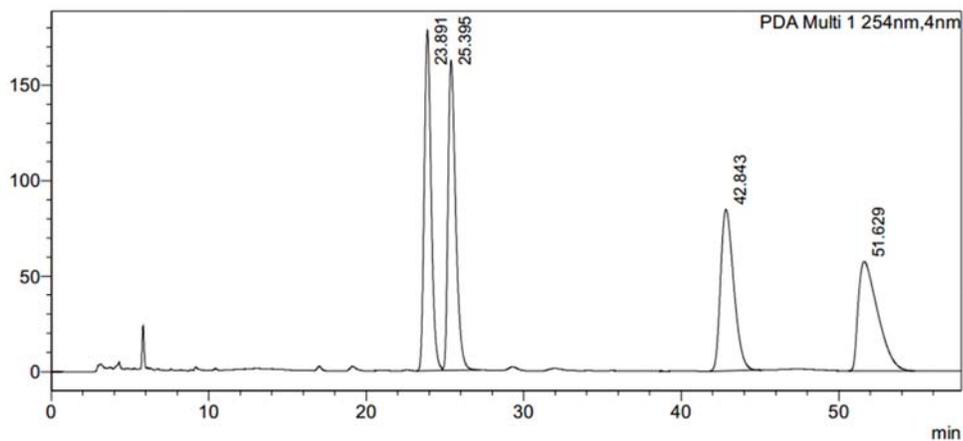
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	33.516	190412	2439	2.136	%		RT:33.516
2	39.661	8722018	63244	97.864	%		RT:39.661
Total		8912430	65683				

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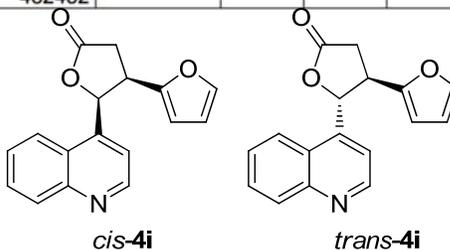
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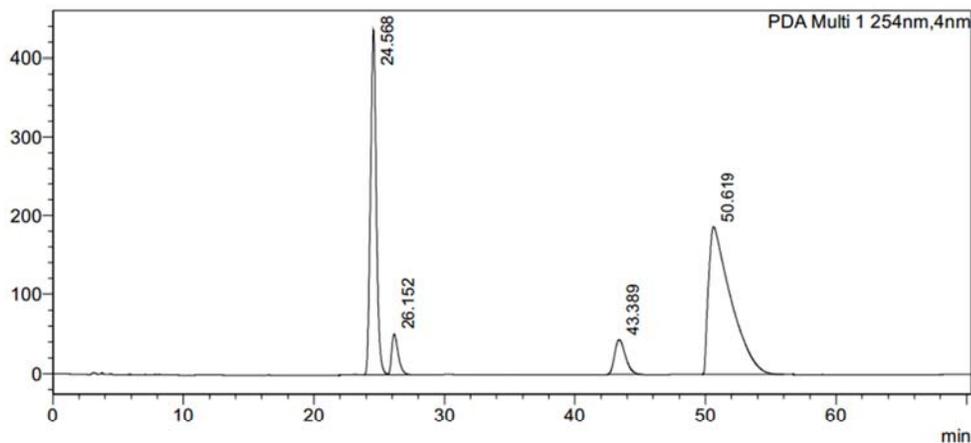
PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	23.891	5443424	178119	26.245	%		RT:23.891
2	25.395	5453366	162281	26.293	%	V	RT:25.395
3	42.843	4919453	84647	23.718	%		RT:42.843
4	51.629	4924869	57406	23.744	%		RT:51.629
Total		20741112	482452				



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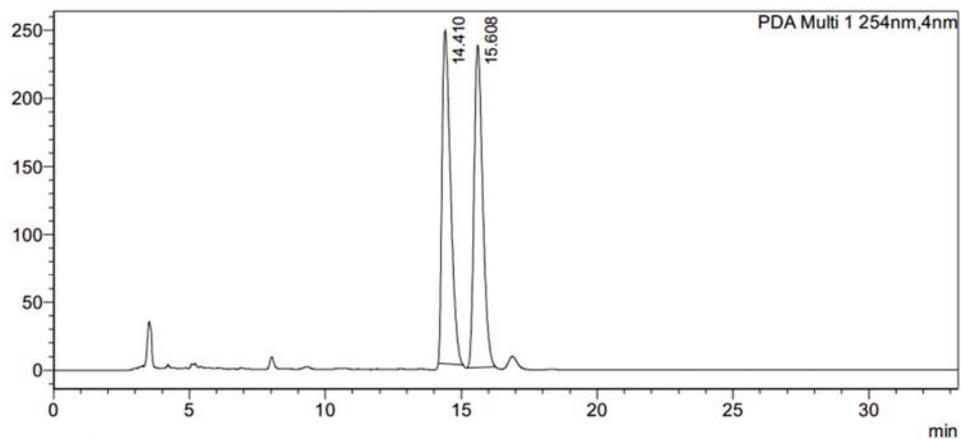
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	24.568	13486412	436707	33.706	%		RT:24.568
2	26.152	1787840	51871	4.468	%	V	RT:26.152
3	43.389	2520639	44091	6.300	%		RT:43.389
4	50.619	22216807	186592	55.526	%		RT:50.619
Total		40011698	719261				

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mAU



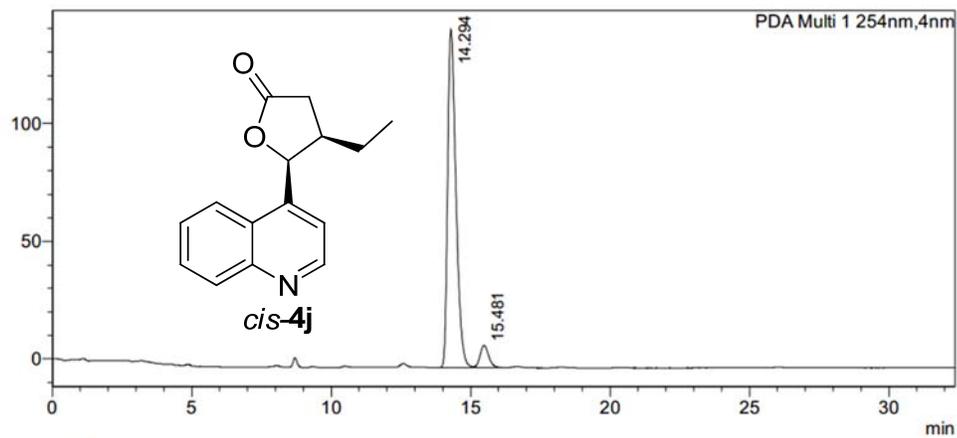
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	14.410	5331434	245236	50.444	%		RT:14.410
2	15.608	5237613	237113	49.556	%		RT:15.608
Total		10569047	482349				

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mAU



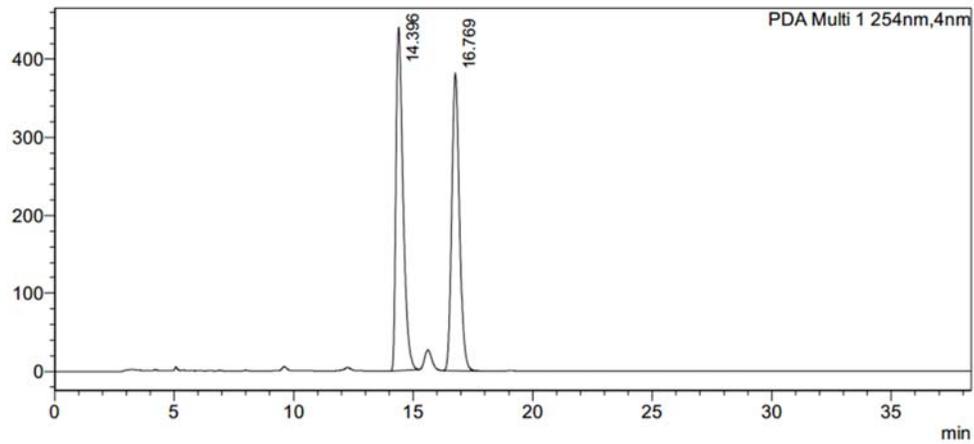
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	14.294	2972352	143256	93.624	%		RT:14.294
2	15.481	202435	9471	6.376	%	V	RT:15.481
Total		3174787	152728				

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mAU



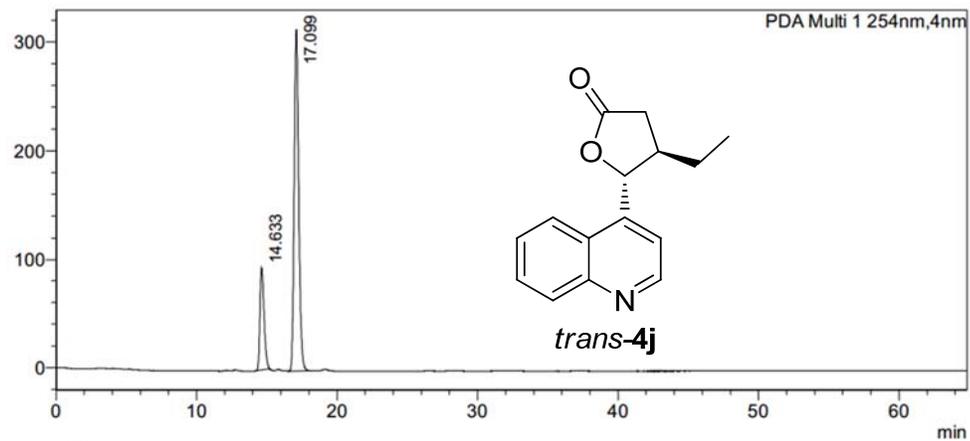
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	14.396	9107187	439321	51.635	%		RT:14.396
2	16.769	8530442	380367	48.365	%		RT:16.769
Total		17637629	819688				

<Chromatogram>

mAU



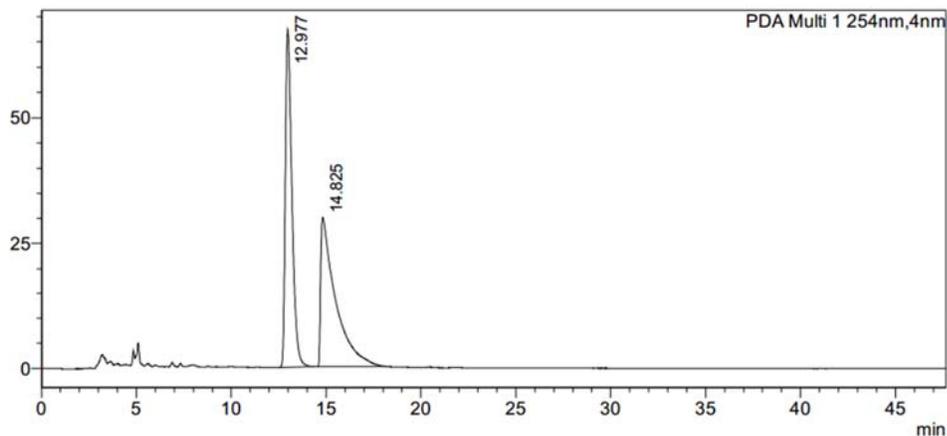
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	14.633	1930973	94672	21.469	%		RT:14.633
2	17.099	7063469	314428	78.531	%		RT:17.099
Total		8994442	409099				

<Chromatogram>

mAU



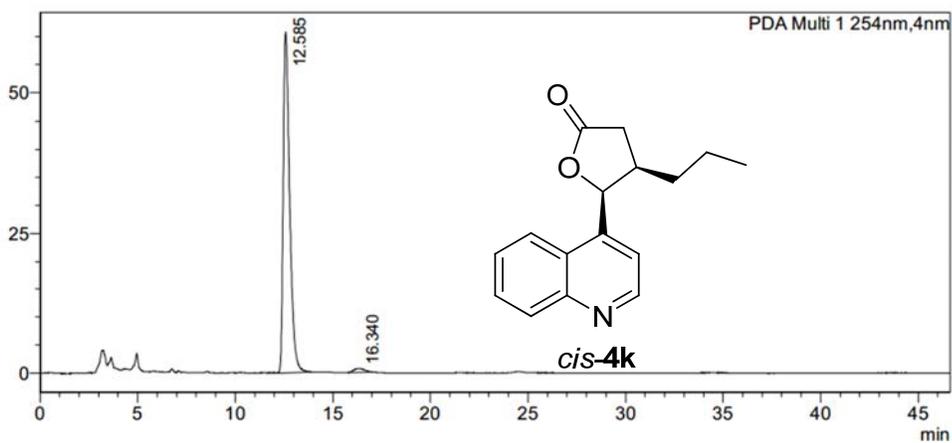
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	12.977	1635647	67295	50.072	%		RT:12.977
2	14.825	1630973	29820	49.928	%		RT:14.825
Total		3266621	97114				

<Chromatogram>

mAU



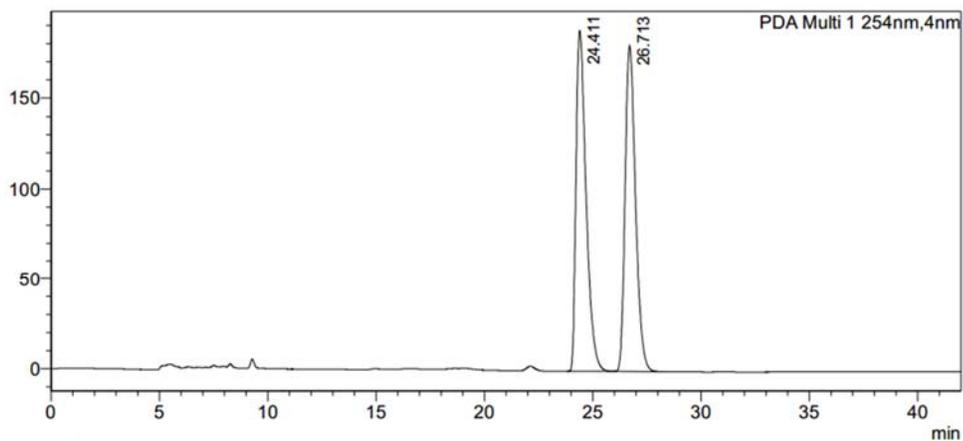
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	12.585	1404671	60809	98.049	%		RT:12.585
2	16.340	27958	698	1.951	%		RT:16.340
Total		1432629	61507				

<Chromatogram>

mAU



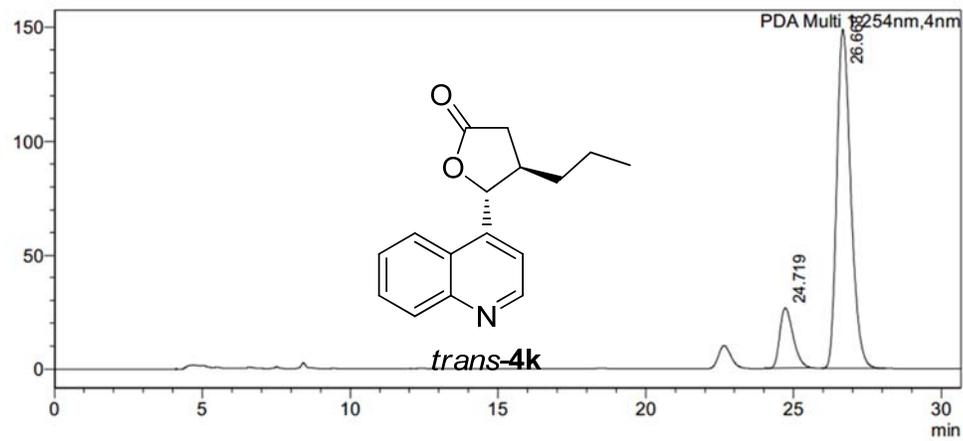
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	24.411	6127140	188760	50.316	%		RT:24.411
2	26.713	6050160	180605	49.684	%		RT:26.713
Total		12177299	369366				

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mAU



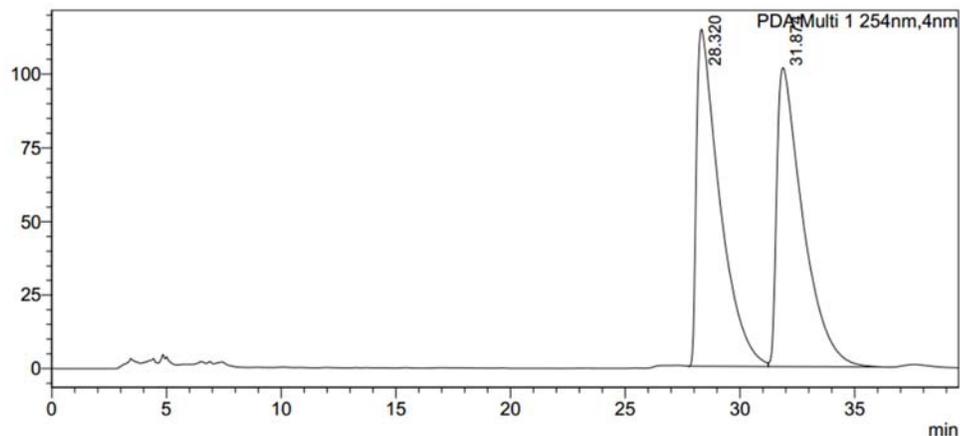
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	24.719	828079	26286	14.442	%		RT:24.719
2	26.668	4905638	148700	85.558	%		RT:26.668
Total		5733717	174986				

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mAU



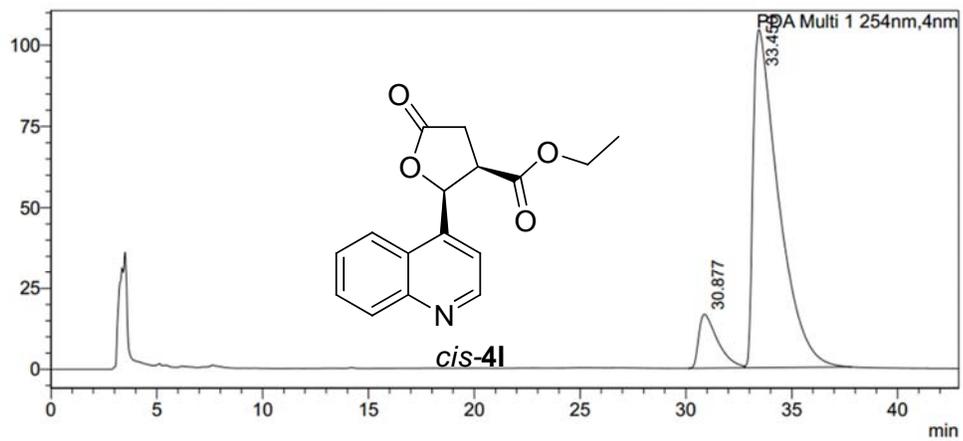
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	28.320	8062452	114406	50.119	%		RT:28.320
2	31.874	8024165	101512	49.881	%	V	RT:31.874
Total		16086617	215918				

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mAU



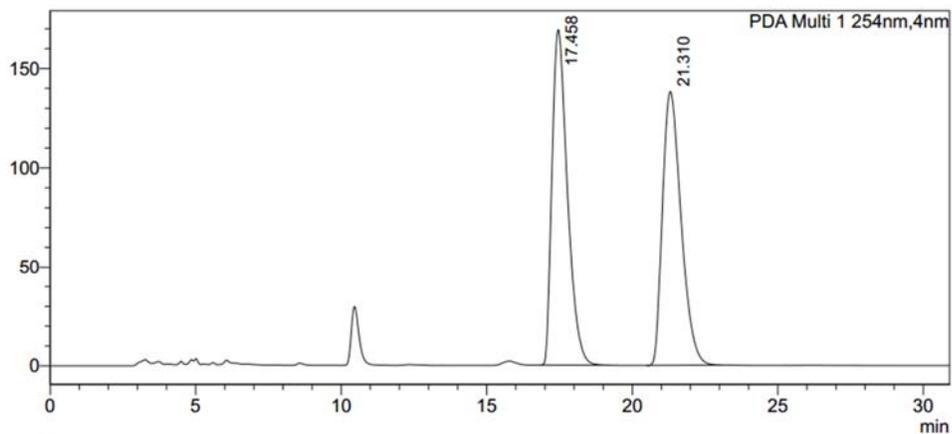
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	30.877	1035543	16649	10.580	%		RT:30.877
2	33.450	8752343	104313	89.420	%	V	RT:33.450
Total		9787885	120962				

<Chromatogram>

mAU



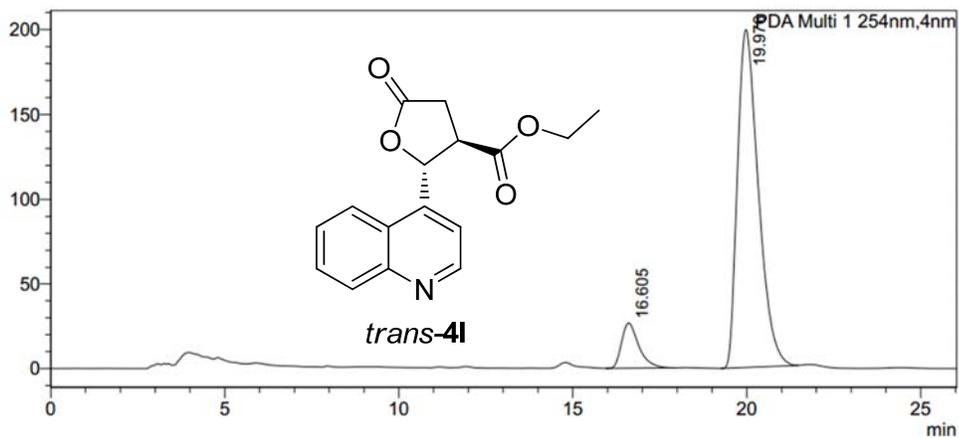
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	17.458	6224377	169226	50.301	%		RT:17.458
2	21.310	6150000	138210	49.699	%		RT:21.310
Total		12374377	307436				

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mAU

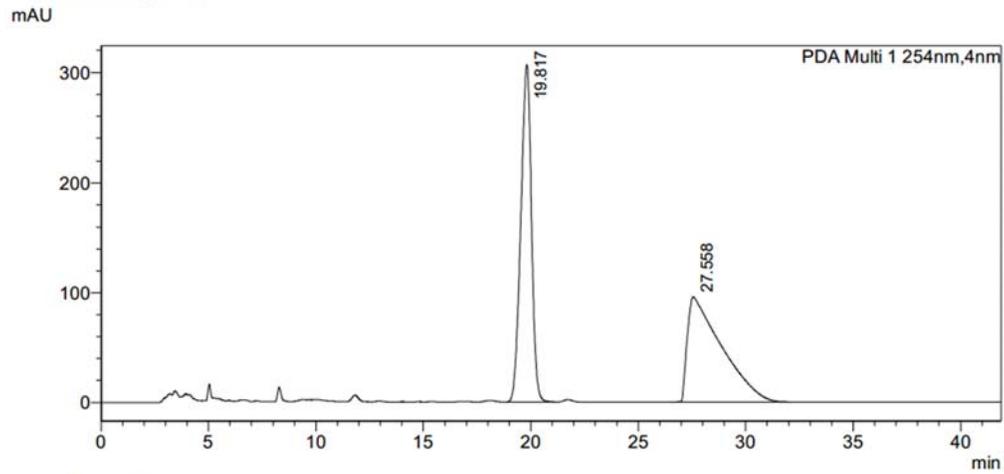


<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	16.605	915741	26651	9.916	%		RT:16.605
2	19.976	8319354	199349	90.084	%		RT:19.976
Total		9235095	226000				

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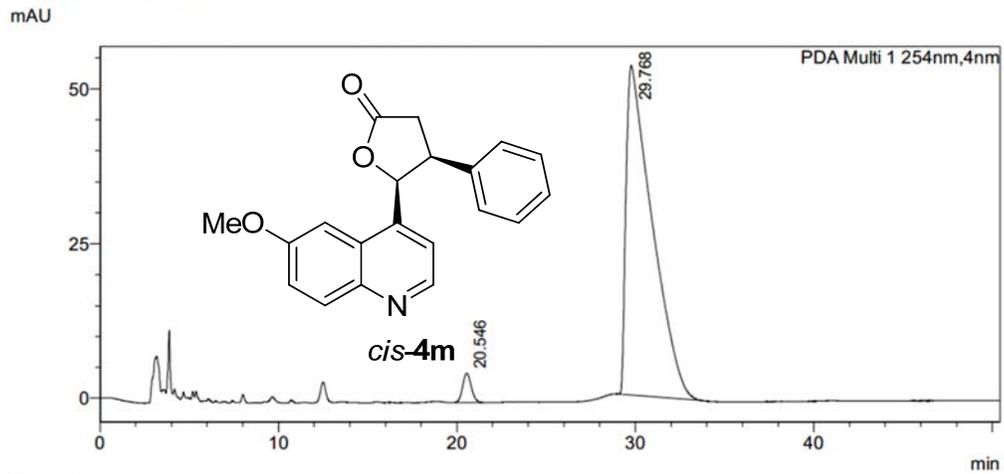


<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	19.817	10548502	306604	49.825	%		RT:19.817
2	27.558	10622396	96243	50.175	%		RT:27.558
Total		21170899	402847				

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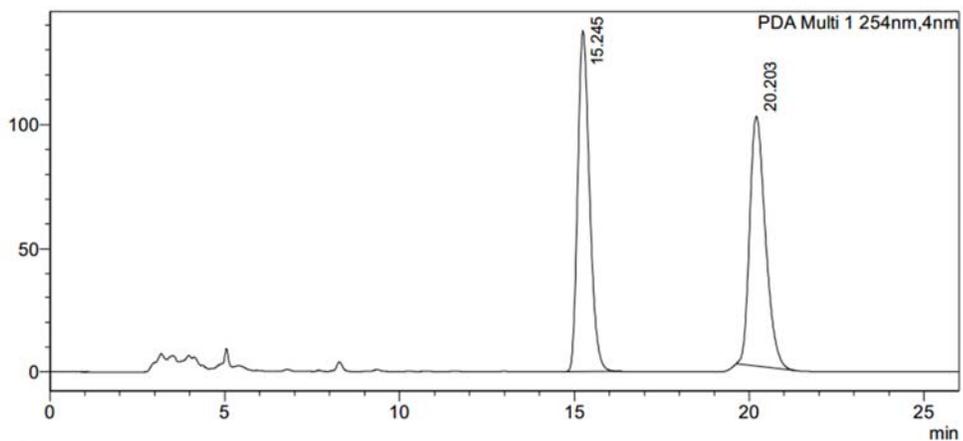
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	20.546	157433	4734	2.828	%		RT:20.546
2	29.768	5409889	53226	97.172	%		RT:29.768
Total		5567322	57960				

<Chromatogram>

mAU



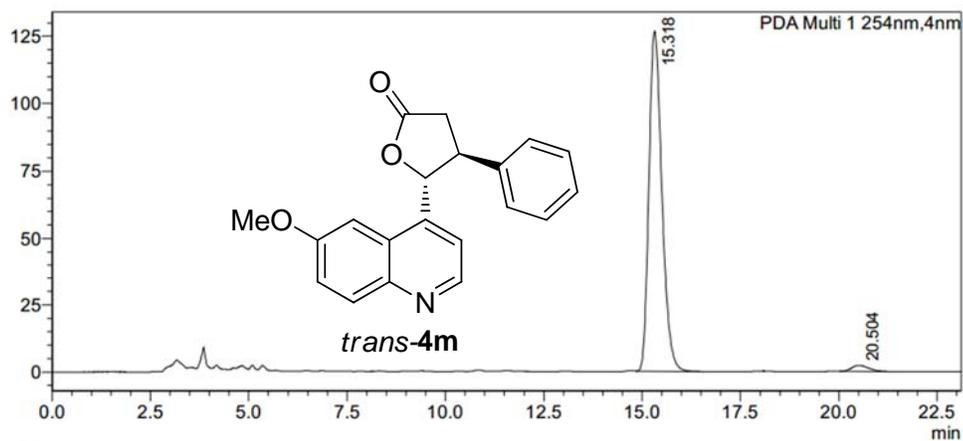
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	15.245	3242831	137605	50.563	%		RT:15.245
2	20.203	3170560	101095	49.437	%		RT:20.203
Total		6413392	238700				

<Chromatogram>

mAU



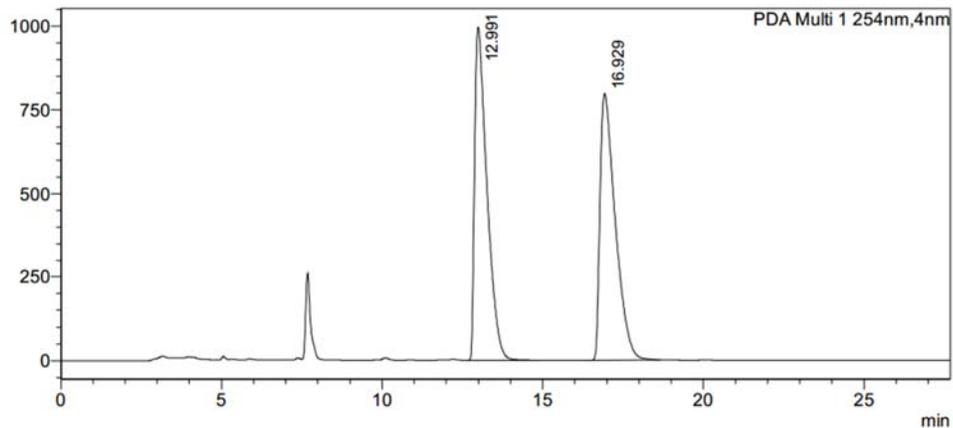
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	15.318	2893462	126552	97.692	%		RT:15.318
2	20.504	68356	2238	2.308	%		RT:20.504
Total		2961819	128790				

<Chromatogram>

mAU



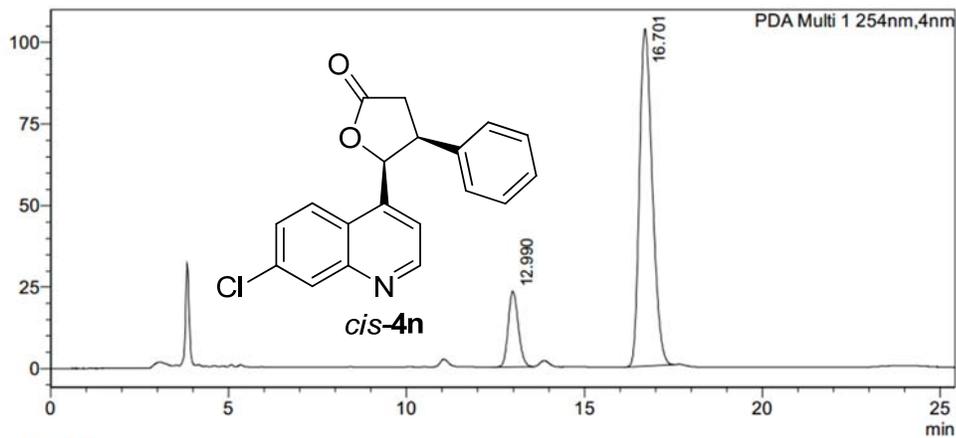
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	12.991	26646624	995548	50.231	%		RT:12.991
2	16.929	26401057	798159	49.769	%		RT:16.929
Total		53047681	1793707				

<Chromatogram>

mAU



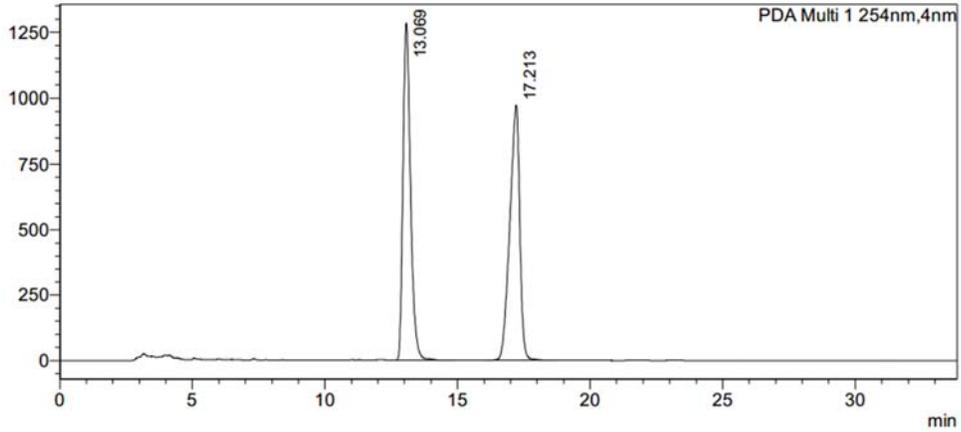
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	12.990	458529	23255	14.998	%		RT:12.990
2	16.701	2598749	103416	85.002	%		RT:16.701
Total		3057278	126671				

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mAU



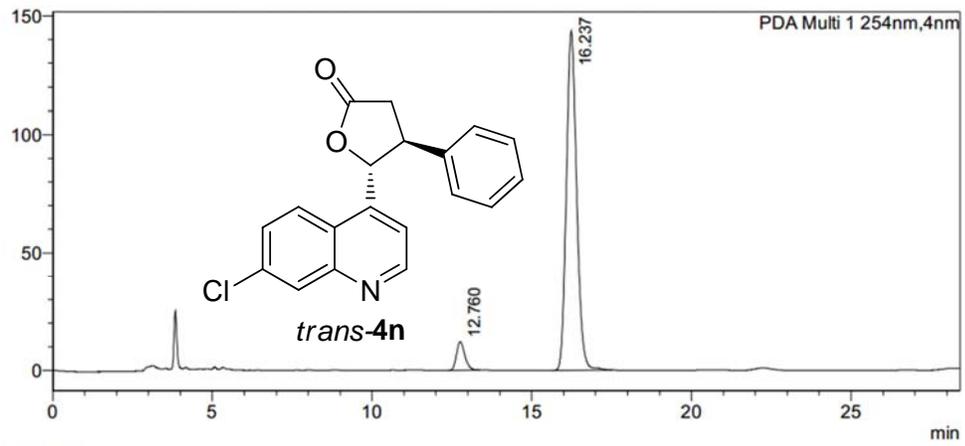
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	13.069	25396074	1283350	50.005	%		RT:13.069
2	17.213	25390813	974527	49.995	%	S	RT:17.213
Total		50786887	2257877				

<Chromatogram>

mAU



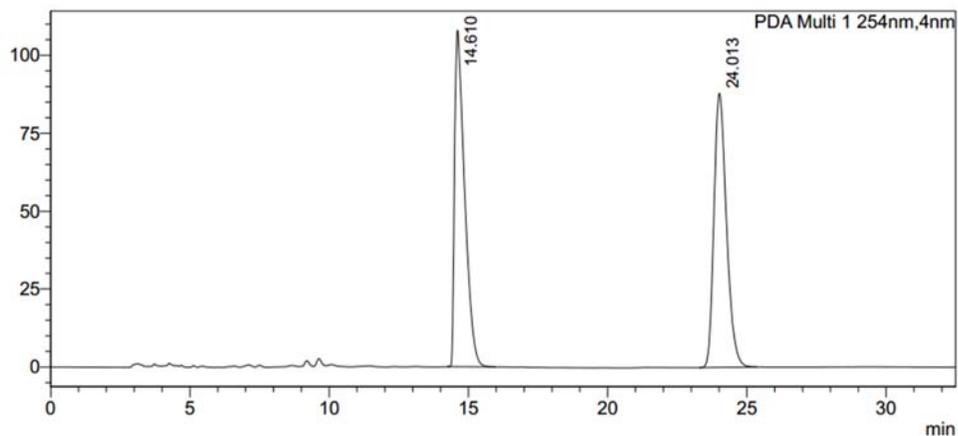
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	12.760	218943	12037	6.376	%		RT:12.760
2	16.237	3215127	143500	93.624	%		RT:16.237
Total		3434069	155537				

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mAU



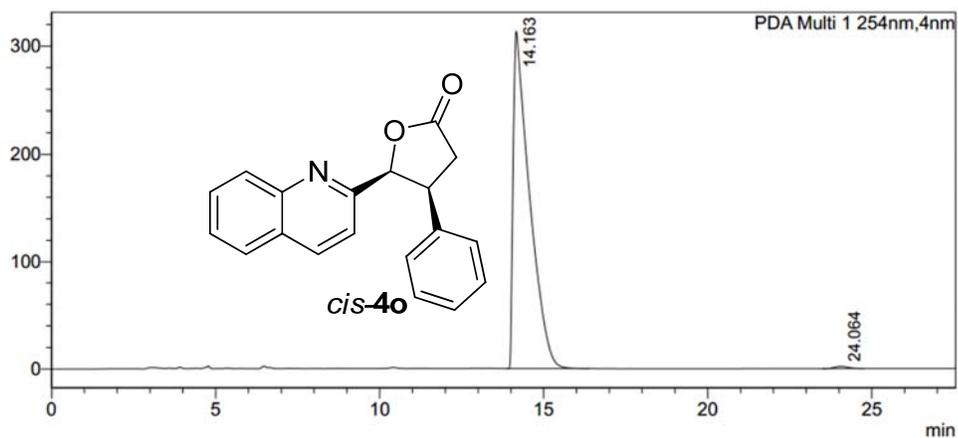
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	14.610	2716853	108001	49.656			
2	24.013	2754480	87979	50.344			
Total		5471333	195980				

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mAU



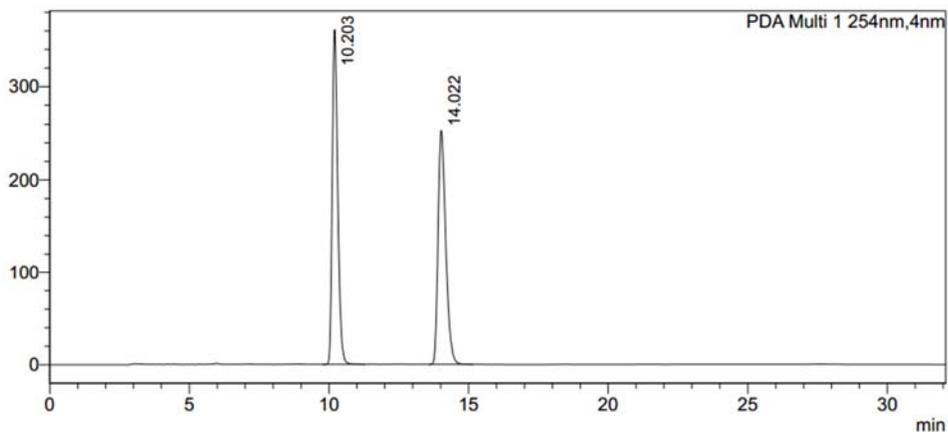
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	14.163	10857653	313393	99.448	%		RT:14.163
2	24.064	60252	2062	0.552	%		RT:24.064
Total		10917904	315455				

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mAU



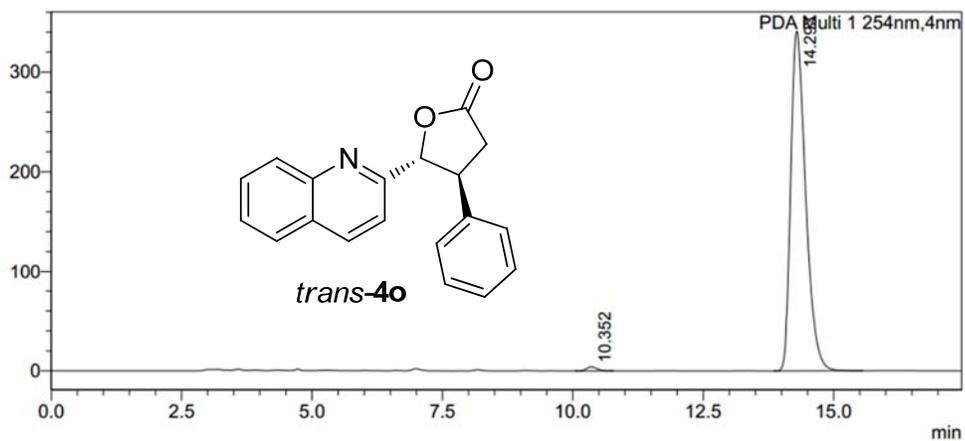
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	10.203	4918795	360949	50.420			
2	14.022	4836876	253096	49.580			
Total		9755672	614045				

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mAU



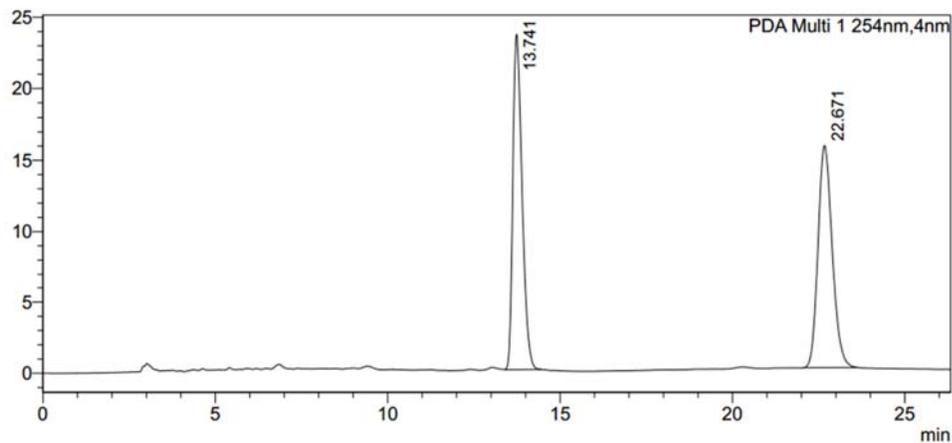
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	10.352	57942	4108	0.845	%		RT:10.352
2	14.293	6800411	341208	99.155	%		RT:14.293
Total		6858353	345316				

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mAU



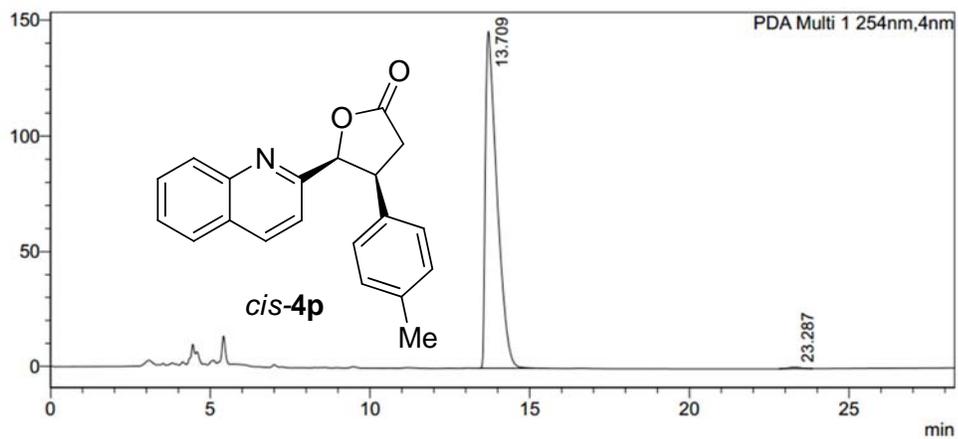
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	13.741	438478	23553	49.440			
2	22.671	448406	15650	50.560			
Total		886884	39203				

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mAU



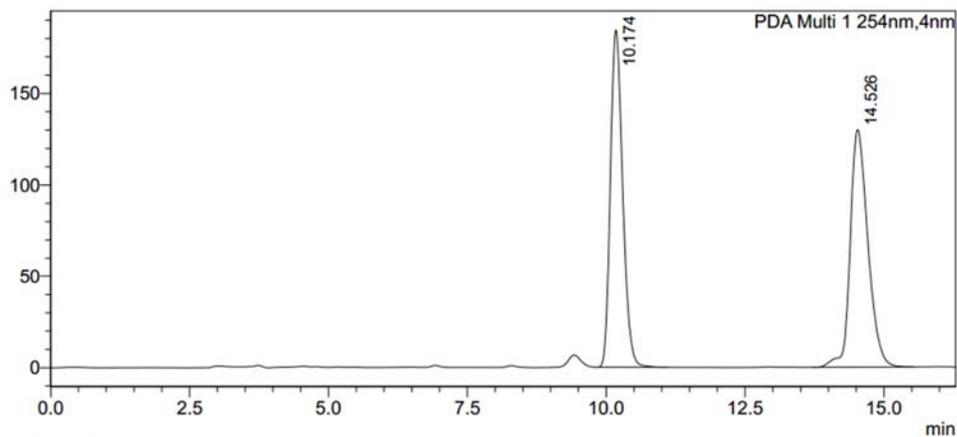
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	13.709	3692412	145959	99.527	%		RT:13.709
2	23.287	17536	631	0.473	%		RT:23.287
Total		3709948	146590				

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mAU



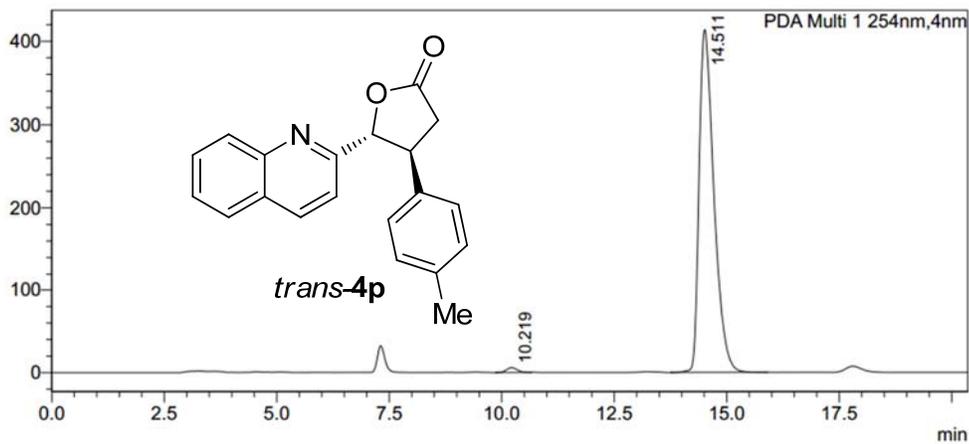
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	10.174	2839939	184443	49.579	%		RT:10.174
2	14.526	2888152	129962	50.421	%		RT:14.526
Total		5728091	314405				

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mAU



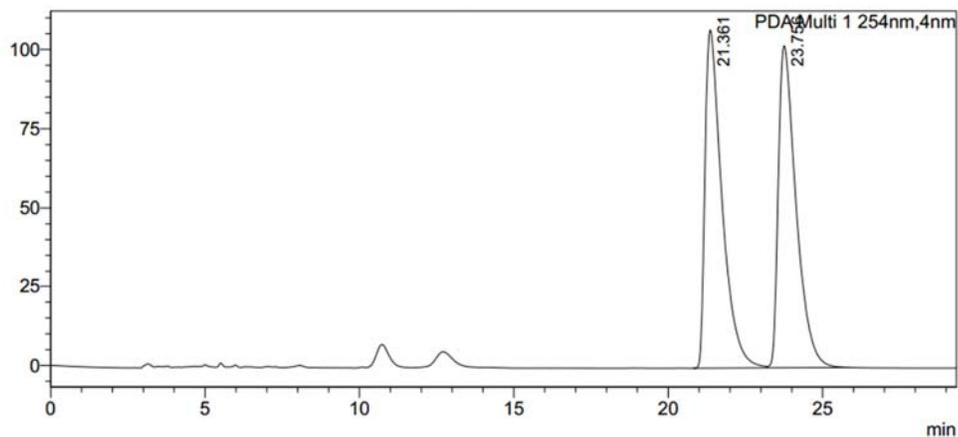
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	10.219	95236	5753	0.989	%		RT:10.219
2	14.511	9531941	413896	99.011	%		RT:14.511
Total		9627177	419649				

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mAU



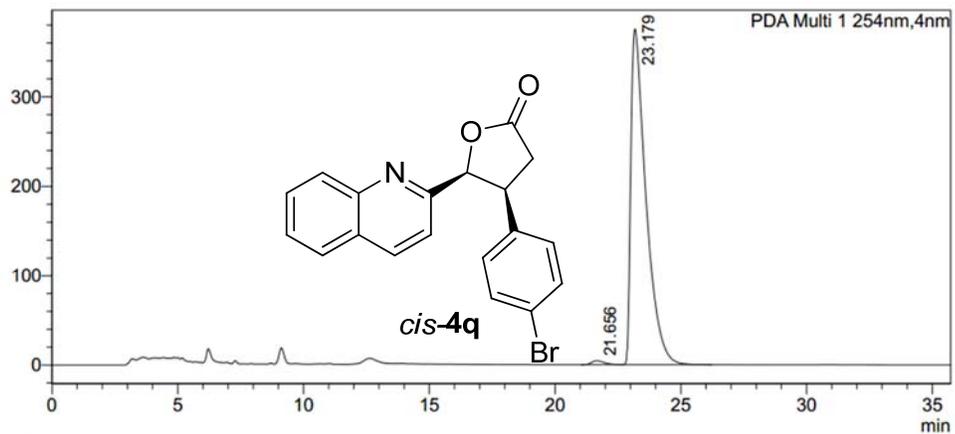
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	21.361	4112090	107019	50.228	%		RT:21.361
2	23.756	4074767	101947	49.772	%	V	RT:23.756
Total		8186858	208966				

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mAU



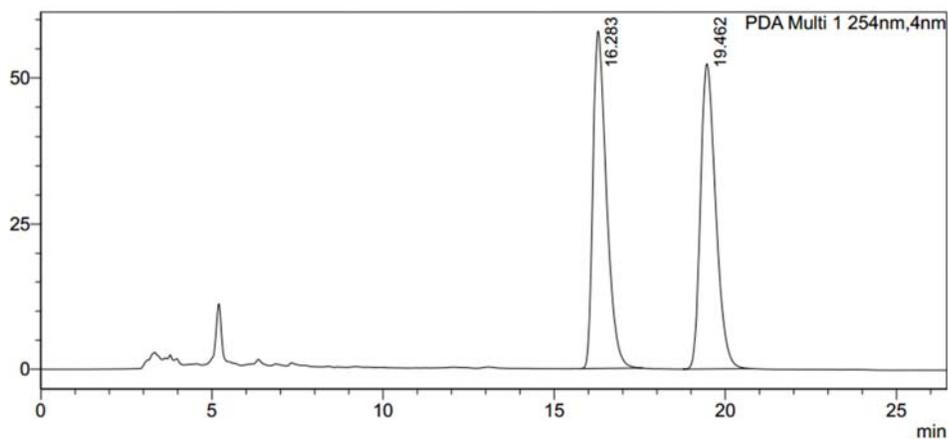
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	21.656	157775	4398	0.996	%		RT:21.656
2	23.179	15676373	375177	99.004	%	V	RT:23.179
Total		15834148	379575				

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mAU



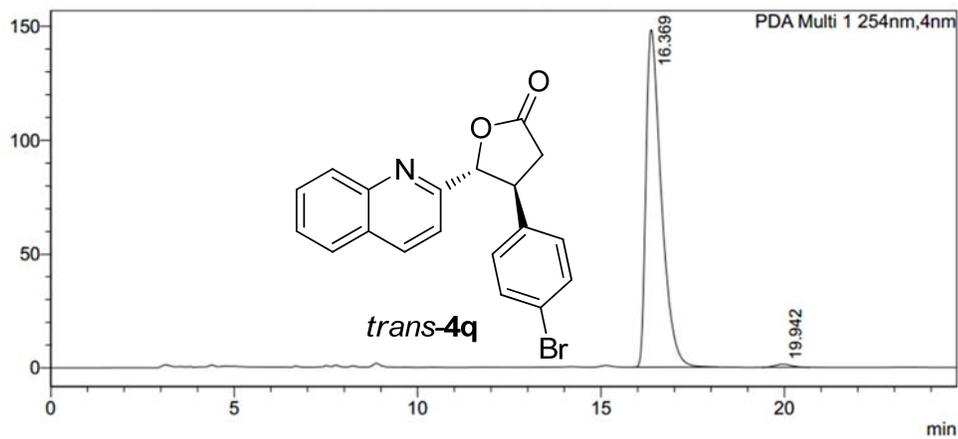
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	16.283	1597744	57915	49.515	%		RT:16.283
2	19.462	1629054	52370	50.485	%		RT:19.462
Total		3226798	110285				

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mAU



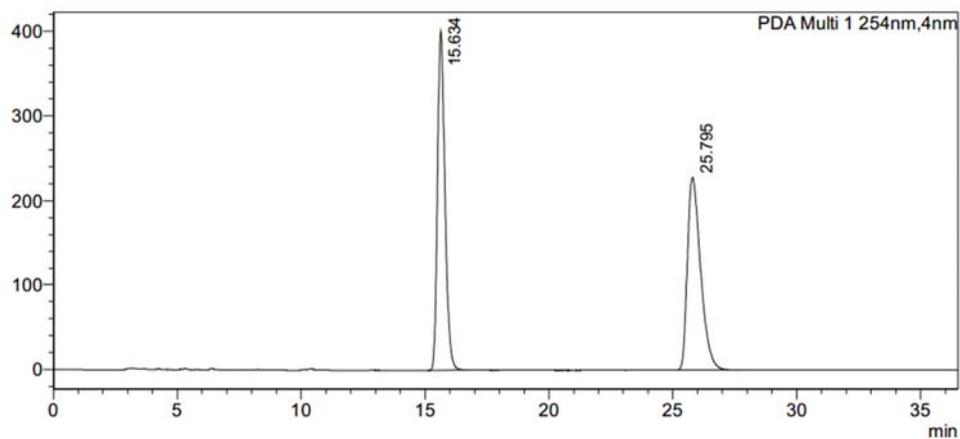
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	16.369	4320647	148256	99.017	%		RT:16.369
2	19.942	42912	1364	0.983	%		RT:19.942
Total		4363559	149620				

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mAU



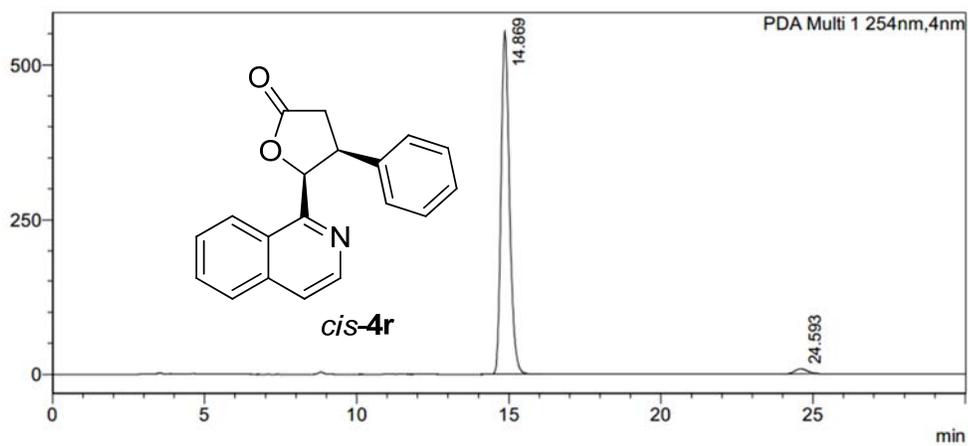
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PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	15.634	8427508	400854	49.868	%		RT:15.634
2	25.795	8472229	228573	50.132	%	S	RT:25.795
Total		16899737	629427				

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mAU



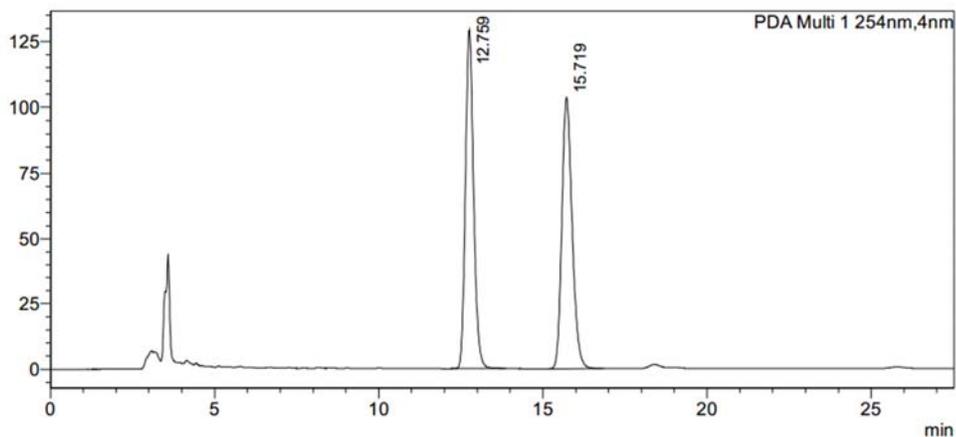
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	14.869	10673932	553019	97.812	%		RT:14.869
2	24.593	238786	8040	2.188	%		RT:24.593
Total		10912718	561059				

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mAU



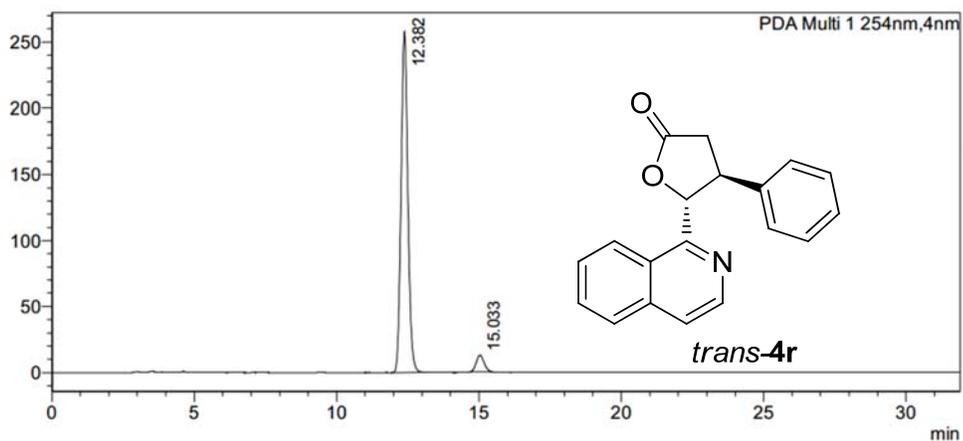
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	12.759	2234940	129040	49.766	%		RT:12.759
2	15.719	2255982	103462	50.234	%		RT:15.719
Total		4490922	232502				

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mAU



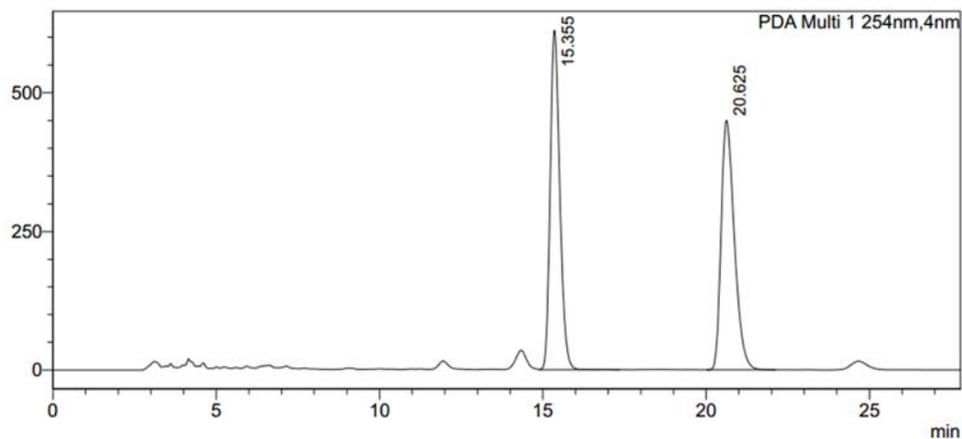
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	12.382	4281243	257623	94.711	%		RT:12.382
2	15.033	239066	12497	5.289	%		RT:15.033
Total		4520309	270120				

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mAU



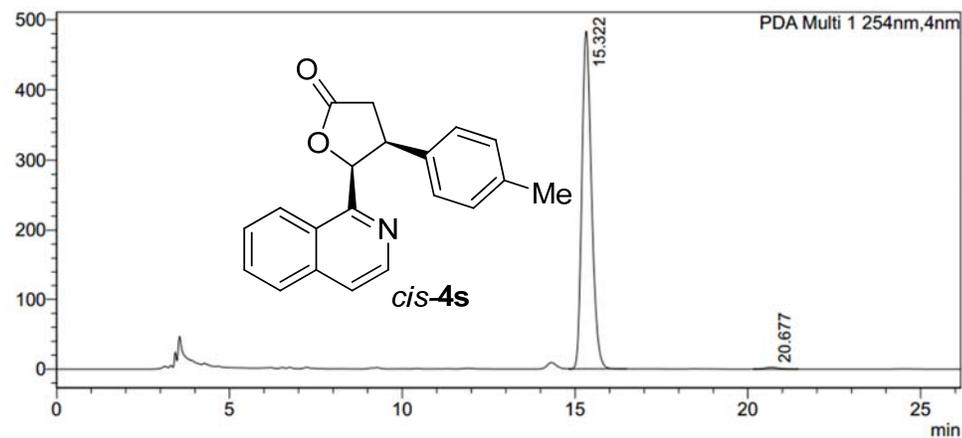
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	15.355	12534616	611858	49.712		SV	
2	20.625	12679838	449909	50.288			
Total		25214454	1061767				

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mAU



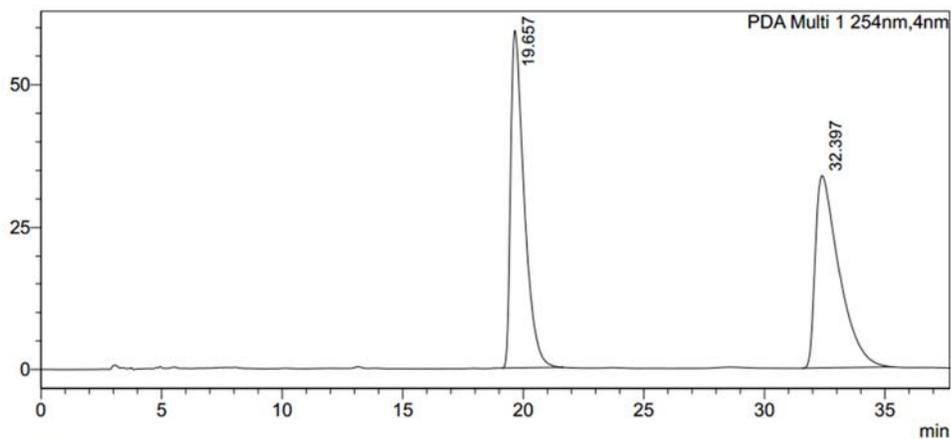
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	15.322	9409592	483515	99.236	%		RT:15.322
2	20.677	72435	2679	0.764	%		RT:20.677
Total		9482027	486193				

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mAU



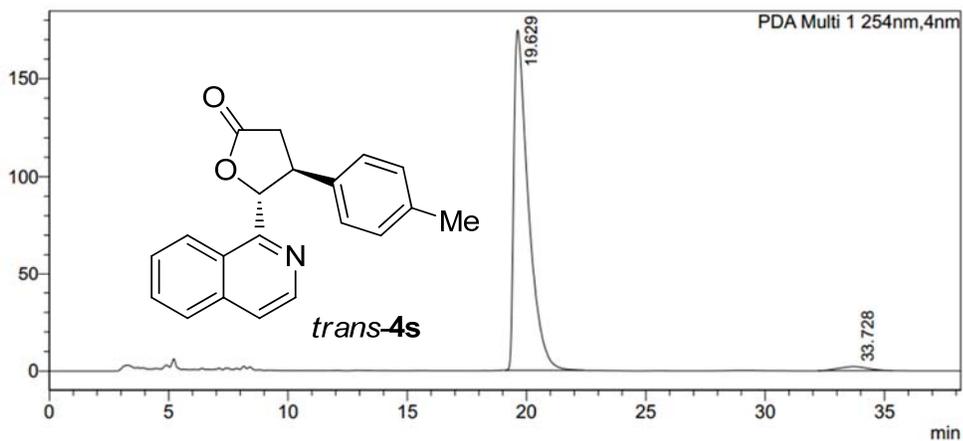
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	19.657	2313054	59249	49.832	%		RT:19.657
2	32.397	2328667	33823	50.168	%		RT:32.397
Total		4641721	93072				

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mAU



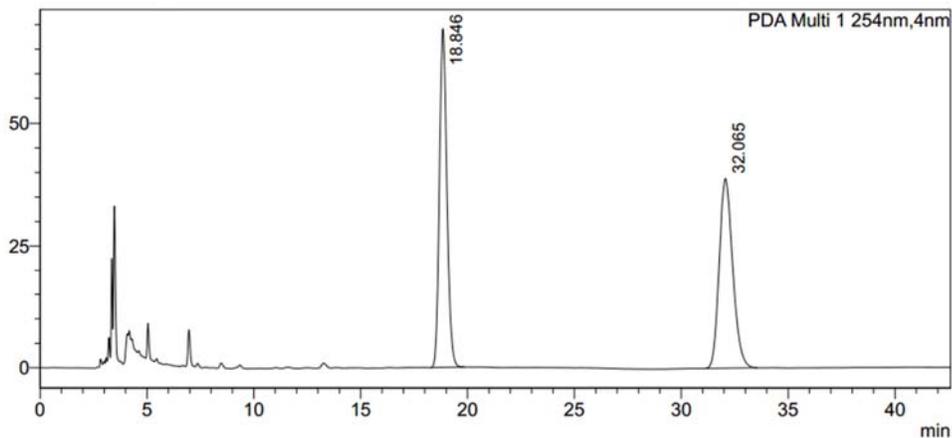
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	19.629	7382516	174489	97.693	%		RT:19.629
2	33.728	174326	2084	2.307	%		RT:33.728
Total		7556843	176574				

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mAU



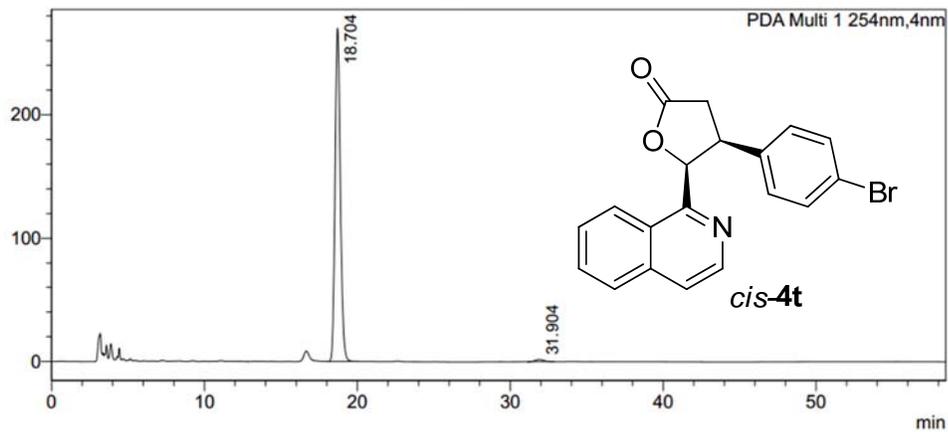
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	18.846	1682269	69105	49.668	%		RT:18.846
2	32.065	1704773	38845	50.332	%		RT:32.065
Total		3387042	107950				

<Chromatogram>

mAU



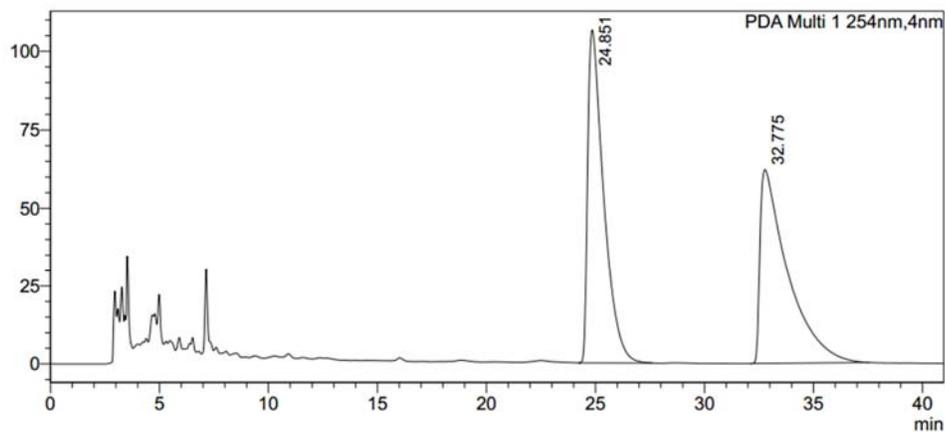
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	18.704	6458593	269997	98.940	%		RT:18.704
2	31.904	69218	1691	1.060	%		RT:31.904
Total		6527811	271688				

<Chromatogram>

mAU



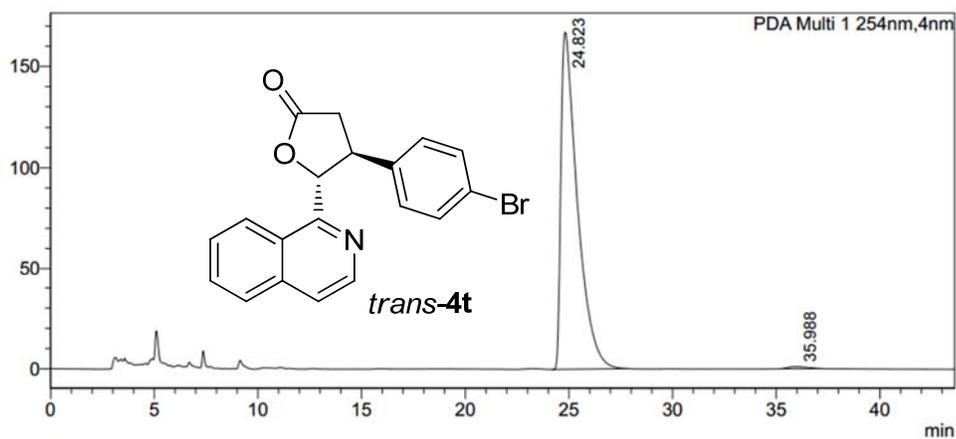
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	24.851	5430201	106511	49.762	%		RT:24.851
2	32.775	5482146	62194	50.238	%		RT:32.775
Total		10912347	168705				

<Chromatogram>

mAU



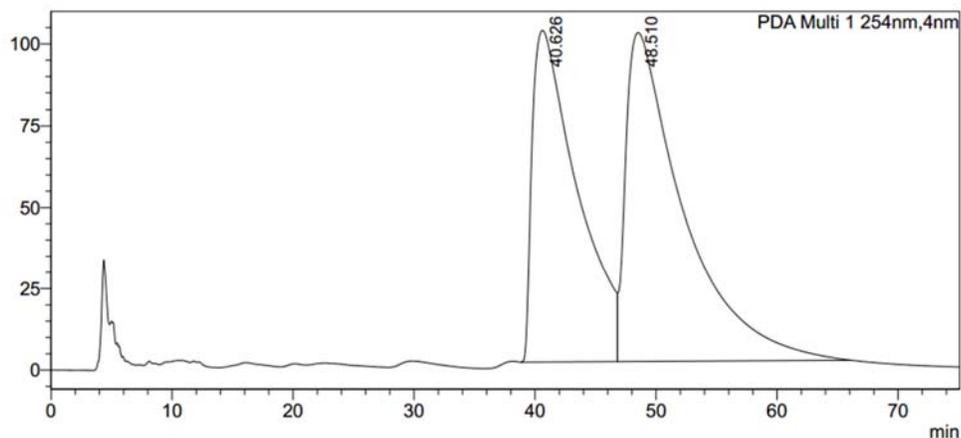
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	24.823	9231375	167378	99.247	%		RT:24.823
2	35.988	70021	1119	0.753	%		RT:35.988
Total		9301396	168497				

<Chromatogram>

mAU



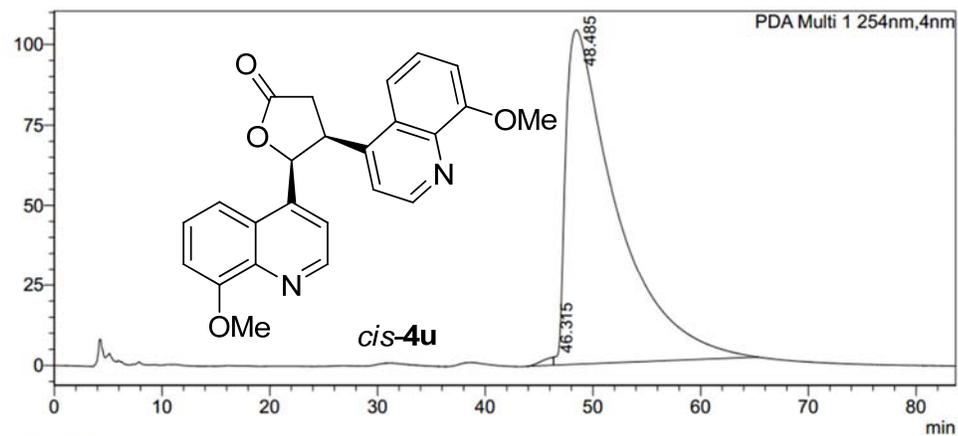
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	40.626	26272951	101682	43.981	%		RT:40.626
2	48.510	33463640	100834	56.019	%	SV	RT:48.510
Total		59736592	202516				

<Chromatogram>

mAU



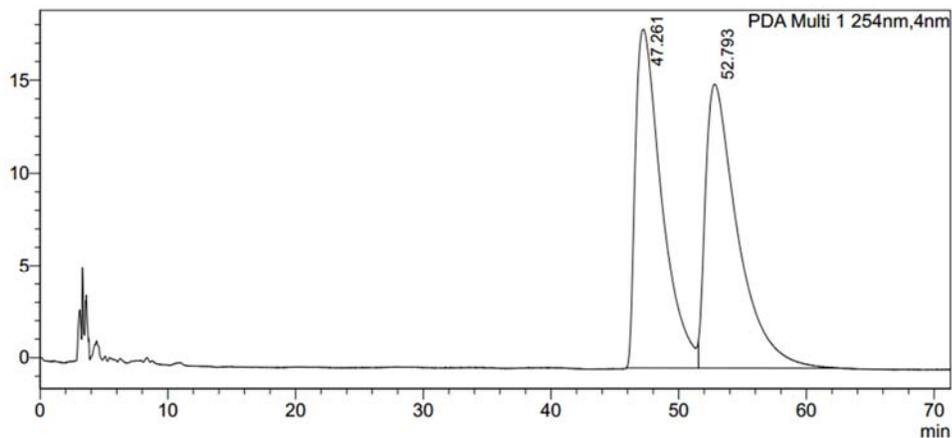
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	46.315	181488	2491	0.526	%		RT:46.315
2	48.485	34330740	104159	99.474	%	V	RT:48.485
Total		34512228	106650				

<Chromatogram>

mAU



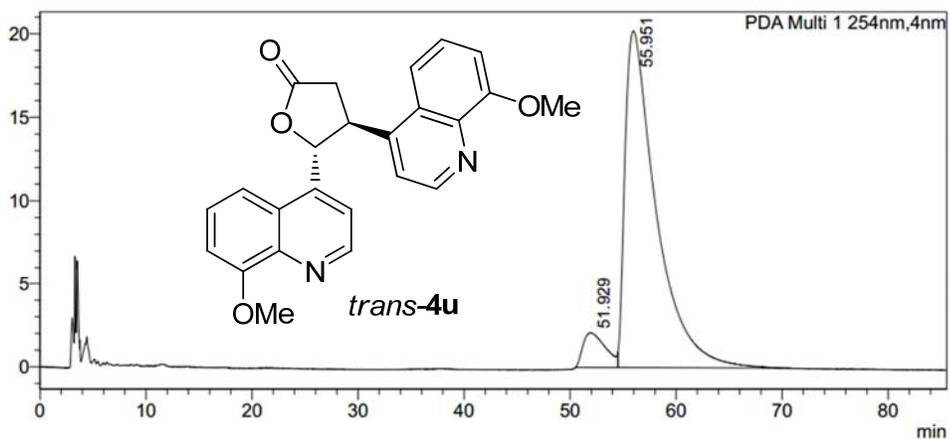
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	47.261	2630992	18301	49.356		M	
2	52.793	2699611	15347	50.644		V M	
Total		5330604	33648				

<Chromatogram>

mAU



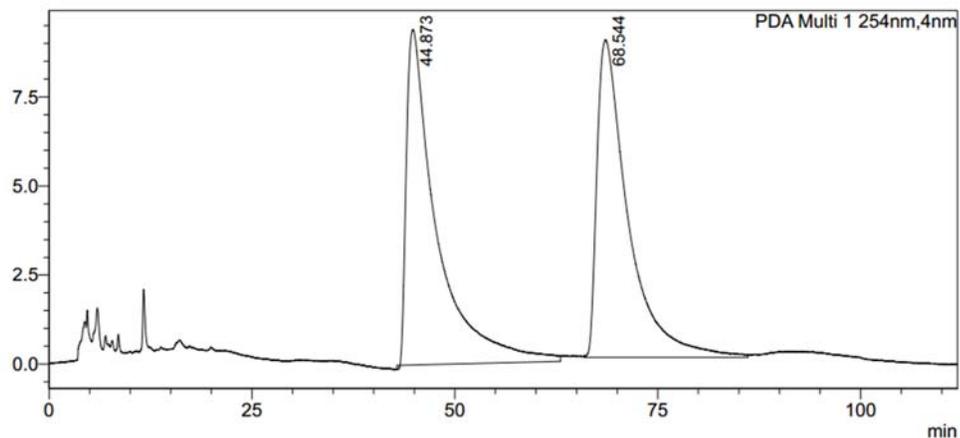
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	51.929	308106	2086	6.911		M	
2	55.951	4149768	20216	93.089		V M	
Total		4457874	22302				

<Chromatogram>

mAU



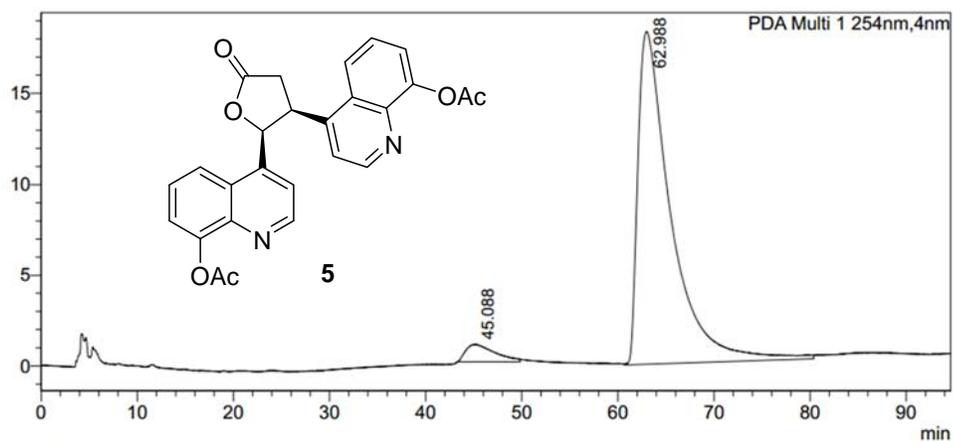
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	44.873	2432801	9413	50.584	%	M	RT:44.873
2	68.544	2376591	8917	49.416	%	M	RT:68.544
Total		4809392	18330				

<Chromatogram>

mAU



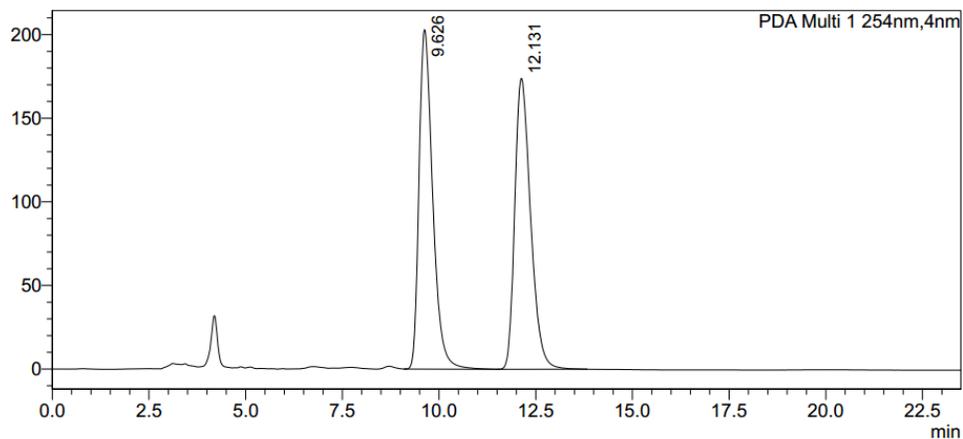
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	45.088	204104	972	4.467	%	M	RT:45.088
2	62.988	4364936	18305	95.533	%	M	RT:62.988
Total		4569040	19277				

<Chromatogram>

mAU



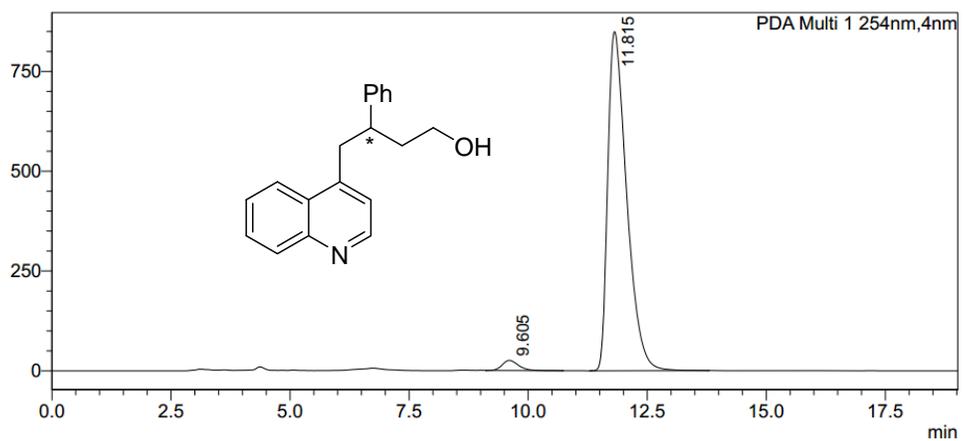
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	9.626	4987869	203054	50.189	%		RT:9.626
2	12.131	4950309	173986	49.811	%		RT:12.131
Total		9938178	377040				

<Chromatogram>

mAU

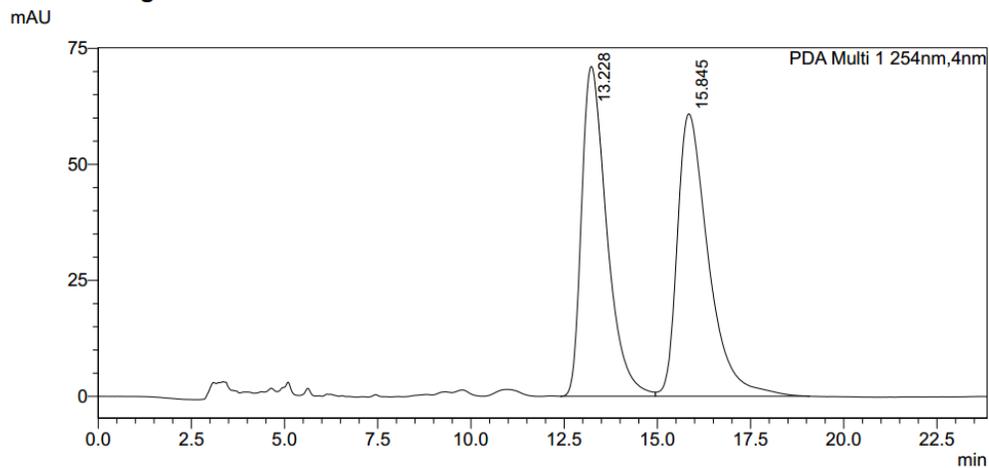


<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	9.605	605414	25506	2.514	%		RT:9.605
2	11.815	23477595	849507	97.486	%		RT:11.815
Total		24083009	875013				

<Chromatogram>

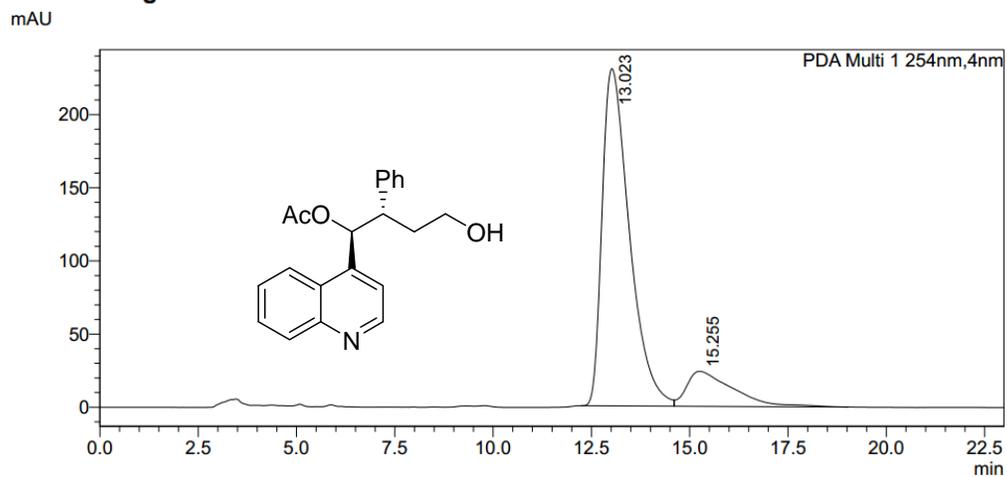


<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	13.228	3341207	71096	48.616	%		RT:13.228
2	15.845	3531395	60876	51.384	%	SV	RT:15.845
Total		6872603	131972				

<Chromatogram>



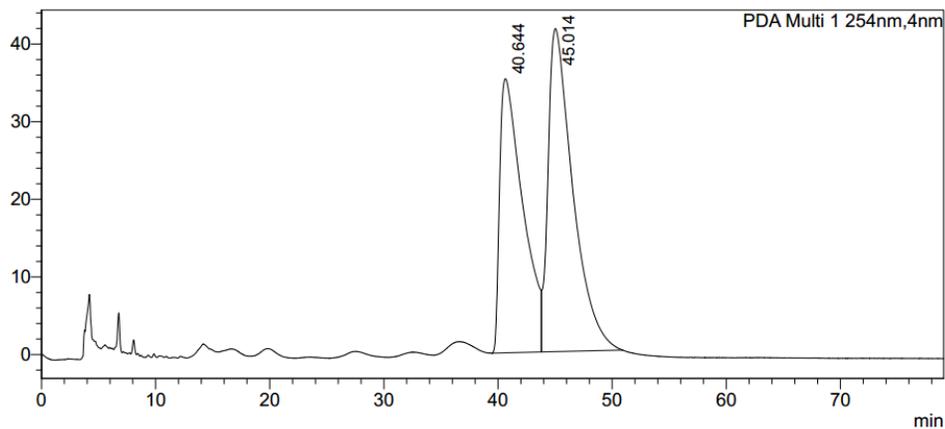
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	13.023	11146576	230450	85.065	%		RT:13.023
2	15.255	1956951	23900	14.935	%	V	RT:15.255
Total		13103527	254350				

<Chromatogram>

mAU



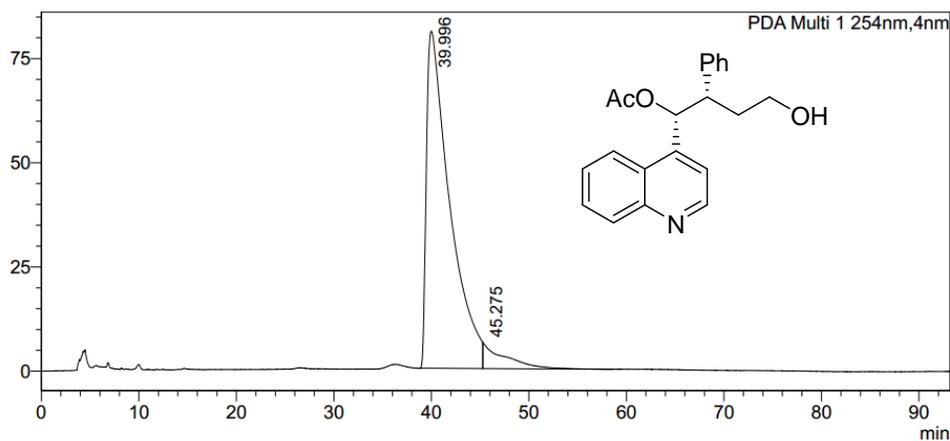
<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	40.644	4958508	35318	44.130	%		RT:40.644
2	45.014	6277557	41620	55.870	%	V	RT:45.014
Total		11236064	76938				

<Chromatogram>

mAU



<Peak Table>

PDA Ch1 254nm

Peak#	Ret. Time	Area	Height	Conc.	Unit	Mark	Name
1	39.996	13358035	80865	93.388	%	M	RT:39.996
2	45.275	945779	6302	6.612	%	V M	RT:45.275
Total		14303814	87167				