Supplementary Information

Biocatalytic enantioselective formation and ring-opening of oxetanes

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1. Materials and methods

General.

^{1}H-NMR (400 MHz) and ^{13}C-NMR (100 MHz) were recorded on Agilent Technologies 400 MR. Chemical shifts were reported in parts per million (ppm) relative to residual signals of the solvent. The following abbreviations are used to indicate multiplicity: s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, dd = double of doublets, td = triple of doublets, tt = triple of triplets, dt = double of triplets, ddd = double of double of doublets. High-resolution mass spectra (HRMS) was recorded by ESI ionization sources. Flash column chromatography was carried out with 200-400 mesh silica gel. Melting point was uncorrected.

Chemicals (*rac*)-**1a**, (*S*)-**1a,** (*rac*)-**1f**, (*rac*)-**1da**, and (*rac*)-**1ea** were obtained from commercial suppliers. Other racemic γ-haloalcohols (*rac*)-**a**, oxetanes (*rac*)-**b**, γ-azidoalcohols (*rac*)-**c**, γ-cyanohydrin (*rac*)-**1d**, and γ-nitroalcohol **1e** were obtained by chemical synthesis. Isopropyl-*β*-D-thiogalactopyranoside (IPTG) and kanamycin sulfate (Kan) were purchased from Solarbio (Beijing, China). PrimeSTAR DNA polymerase and *Dpn* I endonuclease were purchased from Takara. Cells were grown using or terrific broth (TB) medium. Phosphate buffer (PB, KH_2PO_4-Na_2HPO_4) was used as a buffering system for whole cell biotransformations, unless otherwise specified. Unless otherwise noted, all the other reagents and solvents were purchased from commercial sources and used as such without further purification.

Safety concerning statements

Organic azides are potentially explosive substances that can decompose with minimal energy input from external sources. When preparing and using organic azides, we consistently adhere to the following equation which accounts for all nitrogen atoms in the organic azide, not just those in the azido group. It is crucial to handle organic azides and sodium azide with care. Moreover, we have implemented strict safety protocols and, fortunately, have never experienced a safety incident with these experiments.

$\frac{\mathbf{n}(C)+\mathbf{n}(O)}{\mathbf{n}(N)} \geq 3$, **n** sigifies the number of atoms.

Chromatography.

The enantiomeric excess (e.e.) values of chiral compounds and analytic yields were determined by chiral HPLC or GC analysis. The chiral HPLC was performed on Shimadzu LC-20A, equipped

with Chiralcel AD-H chiral column (4.6 mmΦ × 250 mmL, particle size 5 μm), Chiralcel OJ-H chiral column (4.6 mmΦ × 250 mmL, particle size 5 μm), Chiralpak OB-H chiral column (4.6 mmΦ × 250 mmL, particle size 5 μm), Chiralcel OD-H chiral column (4.6 mmΦ × 250 mmL, particle size 5 μm), Chiralcel OX-3 chiral column (4.6 mmΦ × 250 mmL, particle size 3 μm), Chiralcel IA-3 chiral column (4.6 mmΦ × 250 mmL, particle size 3 μm), Chiralcel IH chiral column (4.6 mmΦ × 250 mmL, particle size 5 μm), Chiralcel IC-3 chiral column (4.6 mmΦ × 250 mmL, particle size 3 μm). Chiral GC analysis was performed on Agilent 7890B gas chromatograph equipped with a flame ionization detector (FID) using Rt-bDEXcst column or CYCLODEX-B column with nitrogen as the carrier gas.

Preparation and screening of HHDH.

The recombinant *E. coli* (HHDH) strains were constructed to express the corresponding halohydrin dehalogenase (HHDH) genes, which have been preserved in our laboratory[1,2]. All variants described in this paper were cloned and expressed using plasmid pET-28b(+) as the vector and *Escherichia coli* BL21 (DE3) as the host. *E. coli* (HHDH) cells were cultured in TB medium containing 50 μg/mL kanamycin at 37 °C until the optical density at 600 nm (OD_{600}) reached a range of 0.6-0.8. IPTG was then added to a final concentration of 0.2 mM to induce enzyme expression. The culture was then further incubated at 28 °C for an additional 12-14 h. Recombinant *E. coli* (HHDH) cells expressing the target HHDH were harvested by centrifugation at 8800 × *g* for 3 min at 4 °C. The collected cell pellet was resuspended in phosphate buffer (PB, KH_2PO_4-Na_2HPO_4) to reach the desired cell density for the biotransformation reactions. The model dehalogenation reaction was carried out with 10 mM (*rac*)-**1a** and 10 g dcw/L (about OD_{600}= 20) *E. coli* (HHDH) cells in 5 mL PB buffer (50 mM, pH 8.5) at 30 °C for 8 h. The model ring-opening reaction was carried out with 10 mM (*rac*)-**1b**, 10 mM NaN_3 and 10 g dcw/L (about OD_{600}= 20) *E. coli* (HHDH) cells in 5 mL PB buffer (50 mM, pH 7.5) at 30 °C for 10 h. After the reactions were completed, the reaction mixtures were extracted using 5 mL of ethyl acetate. The organic phases were separated, dried over anhydrous Na_2SO_4, and analyzed by chiral HPLC. Chiral analysis of **1a**: Chiralpak OX-3, *n*-hexane/ ^{i}PrOH = 99/1, flaw rate = 0.5 mL/min, λ = 210 nm, $t_{(S)\text{-}\mathbf{1a}}$= 44.8 min, $t_{(R)\text{-}\mathbf{1a}}$ = 48.7 min. Chiral analysis of **1b** and **1c**: Chiralpak OX-3, *n*-hexane/ ^{i}PrOH = 97/3, flaw rate = 0.7 mL/min, λ = 210 nm, $t_{(S)\text{-}\mathbf{1b}}$= 10.1 min, $t_{(R)\text{-}\mathbf{1b}}$ = 11.3 min; $t_{(S)\text{-}\mathbf{1c}}$= 15.3 min, $t_{(R)\text{-}\mathbf{1c}}$ = 16.6 min.

Docking study.

The predicted structure model (AFDB code: AF-N6YXW4-F1) of the wild type HheD8 (HheD8-WT) was obatined AlphaFold Protein Structure Database (https://alphafold.ebi.ac.uk). Docking studies of (*R*)-**1b** in the active site of enzyme HheG-WT/AF model was carried out using AutoDock 4.0 software[3]. The docking study was performed using "Genetic Algorithm" search parameters and default docking parameters. The possible docking pose with hydrogen bonds between oxetane ring of substrate (*R*)-**1b** and S117-OH, Y130-OH was chosen for further analysis with the PyMOL software[4]. Residues F19, A69, Y168, M124, R127, Q160, N161 and R182 were identified as hot-spots for site saturation mutagenesis study.

Directed evolution of HheD8.

Mutagenesis and cultivation: Site-saturation mutagenesis experiments were carried out using QuickChange PCR with degenerate codons. The resulting PCR products were purified, digested with *Dpn* I and directly transformed into *E. coli* BL21(DE3) competent cells via the heat-shock method. Single colonies of *E. coli* cells were picked and cultured in 2-mL 96-deep-well plates containing TB-Kan medium (300 μL per well, 50 μg/mL kanamycin) at 37°C for 5 h. Subsequently, 900 μL of TB-Kan medium with IPTG (to achieve a final concentration of 0.2 mM) was added to each well, and the plates were shaken at 28°C and 900 rpm for 12 h. Induced cells were harvested by centrifugation at 1600 × *g* for 15 min at 4 ºC and subsequently utilized for biotransformation.

Screeing for dehalogenation reaction: To resuspend the *E. coli* (HheD8) cells, 500 μL of PB buffer (50 mM, pH 8.5) containing 10 mM (*rac*)-**1a** was added. The plates containing the cell and substrate suspensions were shaken at 30 ºC and 900 rpm for 8 h. After completion of the incubation, the reaction mixtures were extracted using 700 μL of ethyl acetate. The organic phases were separated, dried over anhydrous Na_2SO_4, and analyzed by chiral HPLC.

Screeing for ring-opening reaction: To resuspend the *E. coli* (HheD8) cells, 500 μL of PB buffer (50 mM, pH 7.5) containing 10 mM (*rac*)-**1b** and 10 mM NaN_3 was added. The plates containing the cell and substrate suspensions were shaken at 30 ºC and 900 rpm for 10 h. After completion of the incubation, the reaction mixtures were extracted using 700 μL of ethyl acetate. The organic phases were separated, dried over anhydrous Na_2SO_4, and analyzed by chiral HPLC.

The mutants demonstrating improved catalytic activity and/or enantioselectivity were further verified using 5 mL biotransformation reactions, followed by preservation and gene sequencing

analysis. The reaction conditions were consistent with those described for the earlier enzyme screening reactions.

Primers for site saturation mutagenesis

Mutation site	Primer	Primer sequence
F19	F19-F	5'-GGCAGATGCANNKATGGGTCCTGCAC-3'
	F19-R	5'-CAGGACCCATMNNTGCATCTGCCTGG-3'
A69	A69-F	5'-CTGGCAATTCCGNNKCCGAGCACACCG-3'
	A69-R	5'-ACCGGTGTGCTCGGMNNCGGAATTGCC-3'
M124 for M2	M124-M2-F	5'-CAGCAGCACTGCGTGGTNNKGCACTGCTGAGCAGC-3'
	M124-M2-R	5'-CTGCTCAGCAGTGCMNNACCACGCAGTGCTGCTGC-3'
M124 for M5	M124-M5-F	5'-CAGCAGCACTGCGTGGTNNKGCACTGGGGAGCAGC-3'
	M124-M5-R	5'-CTGCTCCCCAGTGCMNNACCACGCAGTGCTGCTGC-3'
R127	R127-F	5'-GGTATGGCACTGNNKAGCAGCTATGCAG-3'
	R127-R	5'-GCTGCATAGCTGCTMNNCAGTGCCATAC-3'
Q160	Q160-F	5'-GGTTAATGCAATTGCCNNKAATTTTGTTGAAAACC-3'
	Q160-R	5'-GGGTTTTCAACAAAATTMNNGGCAATTGCATTAAC-3'
N161	N161-F	5'-GCAATTGCCCAGNNKTTTGTTGAAAAC-3'
	N161-R	5'-GGTTTTCAACAAAMNNCTGGGCAATTG-3'
Y168	Y168-F	5'-TTGAAAACCCGACCNNKTTTCCGCCAG-3'
	Y168-R	5'-TGAACTTCTGGCGGAAAMNNGGTCGGG-3'
R182	R182-F	5'-CGGCATTTAAAGATNNKCTGAAATGGCAGG-3'
	R182-R	5'-CCTGCCATTTCAGMNNATCTTTAAATGCCGG-3'

Enzyme expression and purification.

To purify the HheD8-M3 mutant, we introduced a 6×His tag at its *N*-terminus, constructing the recombinant strain designated as *E. coli* (HheD8-M3-His). A single colony from this strain was used to inoculate 100 mL of LB medium supplemented with 50 μg/mL kanamycin. The culture was incubated overnight at 37 °C and 220 rpm. Subsequently, 4 liters of LB medium, also containing 50 μg/mL kanamycin, were inoculated with a 1:100 dilution of the overnight culture. This larger culture was then incubated at 37 °C and 220 rpm until the OD_{600} reached approximately 0.8 (3-5 h). To induce the expression of the recombinant protein, IPTG was added to the culture to achieve a final concentration of 0.5 mM, followed by further incubation at 16 ℃ and 220 rpm for another overnight. The cells were pelleted by centrifugation (8800×*g*, at 4 ℃ for 4 min), resuspended in lysis buffer A (25 mM Tris, pH 8.0, 350 mM NaCl), and lysed by sonication. Cell

debris was removed by centrifugation (11000×g and 4 °C for 15 min) to obtain a clarified supernatant.The resulting supernatant harboring HheD8-M3 with *N*-terminal 6 × His-tag was subsequently loaded onto a Ni-NTA affinity column (GE Healthcare) that had been pre-equilibrated with buffer A. To remove nonspecifically bound proteins, the column was washed with 20 column volumes of buffer B (25 mM Tris, 350 mM NaCl, 20 mM imidazole, pH 8.0). The bound target protein was then eluted using elution buffer C (25 mM Tris, 300 mM NaCl, 200 mM imidazole, pH 8.0) and the eluate was collected. The fractions were pooled and subsequently concentrated using a 10 kDa ultrafiltration cube (Amicon® Ultra-15, Millipore). The concentrated protein sample was filtered through a 0.2 μm filter and further purified with an anion exchange Q Sepharose column (HiTrap Q HP, GE Healthcare) eluting with buffer D (10 mM Tris, pH 8.0, 500 mM NaCl, 1 mM DTT) at a flow rate of 1 mL/min. Protein-containing fractions were collected and then concentrated to a final concentration of 20 mg/mL, in preparation for the subsequent crystallization experiments.

Crystallization and structure determination.

The crystallization experiment for HheD8-M3 was conducted at 18 °C using 96-well sitting-drop vapor diffusion plates in combination with commercial crystallization screen kits. In general, each drop was set up with 100 nL of the protein sample at a concentration of either 10 or 20 mg/mL, mixed with 100 nL of crystallization reagent, and the mixture was then equilibrated against 100 μL of reservoir solution. Crystals of HheD8-M3 were successfully grown in conditions containing 1.8 M ammonium sulfate. The crystals were rapidly soaked in the reservoir solution containing 20% (v/v) glycerol as cryo-protectant, mounted on loops, and flash-cooled at 100 K in a nitrogen gas cryo-stream. Crystal diffraction data were collected from a single crystal at the Shanghai Synchrotron Radiation Facility (SSRF, Shanghai, China) in BL02U beamline with a wavelength of 0.9791 Å at 100 K. The diffraction data obtained from the HheD8-M3 crystals were processed and scaled using the X-ray Diffraction Software (XDS) [5]. The structure of HheD8-M3 was then solved by the molecular replacement method using the predicted HheD8 structure (with an accession number AF-N6YXW4-F1 from the AlphaFold Protein Structure Database, https://alphafold.ebi.ac.uk) as the initial search model [6]. The initial model was built using PHENIX autobuild [7], and manual adjustment of the model was carried out using the program COOT [8]. Afterward, the models were refined by PHENIX refinement [7] and Refmac5 [9]. Finally, the

stereochemical quality of the refined structure was checked using [10]. The final validation of the HheD8-M3/Cl^- crystal structure was performed with Protein Data Bank ADIT Servers. The Ramachandran plot for HheD8-M3/Cl^- showed 95.51% of residues to be situated in the most favoured regions, 4.09% in additional allowed and 0.00% residues in outlier regions. Diffraction data and coordinates were deposited in the Protein Data Bank (PDB) with the accession number 8XXB (2.40 Å). All crystallographic figures were prepared using the PyMOL molecular graphics software package (Schrodinger, LLC)[11].

Gene and protein sequences of HheD8 enzymes.

>HheD8-WT (gene sequence)

ATGGCCCATGCAATTAGCCTGAGCGGTCGTCGTGTTCTGGTTACCCAGGCAGATGCATTTAT
GGGTCCTGCACTGTGTGATGCATTTCGTGCAGCCGGTGCAGAAGTTGTTCCGGATCGTAGCG
CACTGCTGGAACGTGGTGCAGGTCGTGCAGTTATTGAAGCAGCAGGTCGTATTGATGTTCTG
GTGCTGAATCTGGCAATTCCGGCACCGAGCACACCGGTTCATCAGGTTAGCGGTGGTGAATG
GGAAACCACCTTTGCAGCACTGGTTCATCCGATGCGTGAAATGGTTGCAGCAGTTCTGCCGC
AGATGATTGAACGTAAAGCAGGTAAAATTCTGCTGATGGGTAGCGCAGCAGCACTGCGTGG
TATGGCACTGCGTAGCAGCTATGCAGCAGCCCGTGGTGCACAGCTGGCATATATTCAGGCAG
TTGGTGTTGAAGCCGCAGCACATGGTGTTCAGGTTAATGCAATTGCCCAGAATTTTGTTGAA
AACCCGACCTATTTTCCGCCAGAAGTTCAGGCAACACCGGCATTTAAAGATCGTCTGAAATG
GCAGGTTCCGCTGGGTCGTCTGGTTACAGCAGATGAAGATGCGAGCTTTGCAGTTTATCTGT
GTAGCGAAGCAGCCAATTGTTTTGTTGGTCAGGTTTTTCCGGTTTGTGGTGGTTGGGTTAATC
GTTAA

>HheD8-WT (protein sequence)

MAHAISLSGRRVLVTQADAFMGPALCDAFRAAGAEVVPDRSALLERGAGRAVIEAAGRIDVLV
LNLAIPAPSTPVHQVSGGEWETTFAALVHPMREMVAAVLPQMIERKAGKILLMGSAAALRGMA
LRSSYAAARGAQLAYIQAVGVEAAAHGVQVNAIAQNFVENPTYFPPEVQATPAFKDRLKWQVP
LGRLVTADEDASFAVYLCSEAANCFVGQVFPVCGGWVNR

>HheD8-M1 (gene sequence)

ATGGCCCATGCAATTAGCCTGAGCGGTCGTCGTGTTCTGGTTACCCAGGCAGATGCATTTAT
GGGTCCTGCACTGTGTGATGCATTTCGTGCAGCCGGTGCAGAAGTTGTTCCGGATCGTAGCG
CACTGCTGGAACGTGGTGCAGGTCGTGCAGTTATTGAAGCAGCAGGTCGTATTGATGTTCTG
GTGCTGAATCTGGCAATTCCGTTTCCGAGCACACCGGTTCATCAGGTTAGCGGTGGTGAATG
GGAAACCACCTTTGCAGCACTGGTTCATCCGATGCGTGAAATGGTTGCAGCAGTTCTGCCGC
AGATGATTGAACGTAAAGCAGGTAAAATTCTGCTGATGGGTAGCGCAGCAGCACTGCGTGG
TATGGCACTGCGTAGCAGCTATGCAGCAGCCCGTGGTGCACAGCTGGCATATATTCAGGCAG
TTGGTGTTGAAGCCGCAGCACATGGTGTTCAGGTTAATGCAATTGCCCAGAATTTTGTTGAA
AACCCGACCTATTTTCCGCCAGAAGTTCAGGCAACACCGGCATTTAAAGATCGTCTGAAATG
GCAGGTTCCGCTGGGTCGTCTGGTTACAGCAGATGAAGATGCGAGCTTTGCAGTTTATCTGT
GTAGCGAAGCAGCCAATTGTTTTGTTGGTCAGGTTTTTCCGGTTTGTGGTGGTTGGGTTAATC
GTTAA

>HheD8-M1 (protein sequence)

MAHAISLSGRRVLVTQADAFMGPALCDAFRAAGAEVVPDRSALLERGAGRAVIEAAGRIDVLV
LNLAIPFPSTPVHQVSGGEWETTFAALVHPMREMVAAVLPQMIERKAGKILLMGSAAALRGMA

LRSSYAAARGAQLAYIQAVGVEAAAHGVQVNAIAQNFVENPTYFPPEVQATPAFKDRLKWQVP
LGRLVTADEDASFAVYLCSEAANCFVGQVFPVCGGWVNR

>HheD8-M2 (gene sequence)
ATGGCCCATGCAATTAGCCTGAGCGGTCGTCGTGTTCTGGTTACCCAGGCAGATGCATTTAT
GGGTCCTGCACTGTGTGATGCATTTCGTGCAGCCGGTGCAGAAGTTGTTCCGGATCGTAGCG
CACTGCTGGAACGTGGTGCAGGTCGTGCAGTTATTGAAGCAGCAGGTCGTATTGATGTTCTG
GTGCTGAATCTGGCAATTCCGTTTCCGAGCACACCGGTTCATCAGGTTAGCGGTGGTGAATG
GGAAACCACCTTTGCAGCACTGGTTCATCCGATGCGTGAAATGGTTGCAGCAGTTCTGCCGC
AGATGATTGAACGTAAAGCAGGTAAAATTCTGCTGATGGGTAGCGCAGCAGCACTGCGTGG
TATGGCACTGGGGGAGCAGCTATGCAGCAGCCCGTGGTGCACAGCTGGCATATATTCAGGC
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AAAACCCGACCTATTTTCCGCCAGAAGTTCAGGCAACACCGGCATTTAAAGATCGTCTGAAA
TGGCAGGTTCCGCTGGGTCGTCTGGTTACAGCAGATGAAGATGCGAGCTTTGCAGTTTATCT
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TCGTTAA
>HheD8-M2 (protein sequence)
MAHAISLSGRRVLVTQADAFMGPALCDAFRAAGAEVVPDRSALLERGAGRAVIEAAGRIDVLV
LNLAIPFPSTPVHQVSGGEWETTFAALVHPMREMVAAVLPQMIERKAGKILLMGSAAALRGMA
LGSSYAAARGAQLAYIQAVGVEAAAHGVQVNAIAQNFVENPTYFPPEVQATPAFKDRLKWQVP
LGRLVTADEDASFAVYLCSEAANCFVGQVFPVCGGWVNR

>HheD8-M3 (gene sequence)
ATGGCCCATGCAATTAGCCTGAGCGGTCGTCGTGTTCTGGTTACCCAGGCAGATGCATTTAT
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CACTGCTGGAACGTGGTGCAGGTCGTGCAGTTATTGAAGCAGCAGGTCGTATTGATGTTCTG
GTGCTGAATCTGGCAATTCCGTTTCCGAGCACACCGGTTCATCAGGTTAGCGGTGGTGAATG
GGAAACCACCTTTGCAGCACTGGTTCATCCGATGCGTGAAATGGTTGCAGCAGTTCTGCCGC
AGATGATTGAACGTAAAGCAGGTAAAATTCTGCTGATGGGTAGCGCAGCAGCACTGCGTGG
TCCGGCACTGGGGGAGCAGCTATGCAGCAGCCCGTGGTGCACAGCTGGCATATATTCAGGC
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AAAACCCGACCTATTTTCCGCCAGAAGTTCAGGCAACACCGGCATTTAAAGATCGTCTGAAA
TGGCAGGTTCCGCTGGGTCGTCTGGTTACAGCAGATGAAGATGCGAGCTTTGCAGTTTATCT
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TCGTTAA
>HheD8-M3 (protein sequence)
MAHAISLSGRRVLVTQADAFMGPALCDAFRAAGAEVVPDRSALLERGAGRAVIEAAGRIDVLV
LNLAIPFPSTPVHQVSGGEWETTFAALVHPMREMVAAVLPQMIERKAGKILLMGSAAALRGPAL
GSSYAAARGAQLAYIQAVGVEAAAHGVQVNAIAQNFVENPTYFPPEVQATPAFKDRLKWQVPL
GRLVTADEDASFAVYLCSEAANCFVGQVFPVCGGWVNR

>HheD8-M4 (gene sequence)
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GTGCTGAATCTGGCAATTCCGTTTCCGAGCACACCGGTTCATCAGGTTAGCGGTGGTGAATG
GGAAACCACCTTTGCAGCACTGGTTCATCCGATGCGTGAAATGGTTGCAGCAGTTCTGCCGC
AGATGATTGAACGTAAAGCAGGTAAAATTCTGCTGATGGGTAGCGCAGCAGCACTGCGTGG
TCCGGCACTGGGGGAGCAGCTATGCAGCAGCCCGTGGTGCACAGCTGGCATATATTCAGGC
AGTTGGTGTTGAAGCCGCAGCACATGGTGTTCAGGTTAATGCAATTGCCCAGAATTTTGTTG
AAAACCCGACCTATTTTCCGCCAGAAGTTCAGGCAACACCGGCATTTAAAGATTGGCTGAAA

TGGCAGGTTCCGCTGGGTCGTCTGGTTACAGCAGATGAAGATGCGAGCTTTGCAGTTTATCT
GTGTAGCGAAGCAGCCAATTGTTTTGTTGGTCAGGTTTTTCCGGTTTGTGGTGGTTGGGTTAA
TCGTTAA

>HheD8-M4 (protein sequence)

MAHAISLSGRRVLVTQADAFMGPALCDAFRAAGAEVVPDRSALLERGAGRAVIEAAGRIDVLV
LNLAIPFPSTPVHQVSGGEWETTFAALVHPMREMVAAVLPQMIERKAGKILLMGSAAALRGPAL
GSSYAAARGAQLAYIQAVGVEAAAHGVQVNAIAQNFVENPTYFPPEVQATPAFKDWLKWQVP
LGRLVTADEDASFAVYLCSEAANCFVGQVFPVCGGWVNR

>HheD8-M5 (gene sequence)

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GGGTCCTGCACTGTGTGATGCATTTCGTGCAGCCGGTGCAGAAGTTGTTCCGGATCGTAGCG
CACTGCTGGAACGTGGTGCAGGTCGTGCAGTTATTGAAGCAGCAGGTCGTATTGATGTTCTG
GTGCTGAATCTGGCAATTCCGTTTCCGAGCACACCGGTTCATCAGGTTAGCGGTGGTGAATG
GGAAACCACCTTTGCAGCACTGGTTCATCCGATGCGTGAAATGGTTGCAGCAGTTCTGCCGC
AGATGATTGAACGTAAAGCAGGTAAAATTCTGCTGATGGGTAGCGCAGCAGCACTGCGTGG
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AAACCCGACCTATTTTCCGCCAGAAGTTCAGGCAACACCGGCATTTAAAGATCGTCTGAAAT
GGCAGGTTCCGCTGGGTCGTCTGGTTACAGCAGATGAAGATGCGAGCTTTGCAGTTTATCTG
TGTAGCGAAGCAGCCAATTGTTTTGTTGGTCAGGTTTTTCCGGTTTGTGGTGGTTGGGTTAAT
CGTTAA

>HheD8-M5 (protein sequence)

MAHAISLSGRRVLVTQADAFMGPALCDAFRAAGAEVVPDRSALLERGAGRAVIEAAGRIDVLV
LNLAIPFPSTPVHQVSGGEWETTFAALVHPMREMVAAVLPQMIERKAGKILLMGSAAALRGMA
LLSSYAAARGAQLAYIQAVGVEAAAHGVQVNAIAQNFVENPTYFPPEVQATPAFKDRLKWQVP
LGRLVTADEDASFAVYLCSEAANCFVGQVFPVCGGWVNR

>HheD8-M6 (gene sequence)

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GGGTCCTGCACTGTGTGATGCATTTCGTGCAGCCGGTGCAGAAGTTGTTCCGGATCGTAGCG
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GTGCTGAATCTGGCAATTCCGTTTCCGAGCACACCGGTTCATCAGGTTAGCGGTGGTGAATG
GGAAACCACCTTTGCAGCACTGGTTCATCCGATGCGTGAAATGGTTGCAGCAGTTCTGCCGC
AGATGATTGAACGTAAAGCAGGTAAAATTCTGCTGATGGGTAGCGCAGCAGCACTGCGTGG
TCCGGCACTGGTGGAGCAGCTATGCAGCAGCCCGTGGTGCACAGCTGGCATATATTCAGGCA
GTTGGTGTTGAAGCCGCAGCACATGGTGTTCAGGTTAATGCAATTGCCCAGAATTTTGTTGA
AAACCCGACCTATTTTCCGCCAGAAGTTCAGGCAACACCGGCATTTAAAGATCGTCTGAAAT
GGCAGGTTCCGCTGGGTCGTCTGGTTACAGCAGATGAAGATGCGAGCTTTGCAGTTTATCTG
TGTAGCGAAGCAGCCAATTGTTTTGTTGGTCAGGTTTTTCCGGTTTGTGGTGGTTGGGTTAAT
CGTTAA

>HheD8-M6 (protein sequence)

MAHAISLSGRRVLVTQADAFMGPALCDAFRAAGAEVVPDRSALLERGAGRAVIEAAGRIDVLV
LNLAIPFPSTPVHQVSGGEWETTFAALVHPMREMVAAVLPQMIERKAGKILLMGSAAALRGPAL
LSSYAAARGAQLAYIQAVGVEAAAHGVQVNAIAQNFVENPTYFPPEVQATPAFKDRLKWQVPL
GRLVTADEDASFAVYLCSEAANCFVGQVFPVCGGWVNR

>HheD8-M7 (gene sequence)

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CACTGCTGGAACGTGGTGCAGGTCGTGCAGTTATTGAAGCAGCAGGTCGTATTGATGTTCTG

GTGCTGAATCTGGCAATTCCGTTTCCGAGCACACCGGTTCATCAGGTTAGCGGTGGTGAATG
GGAAACCACCTTTGCAGCACTGGTTCATCCGATGCGTGAAATGGTTGCAGCAGTTCTGCCGC
AGATGATTGAACGTAAAGCAGGTAAAATTCTGCTGATGGGTAGCGCAGCAGCACTGCGTGG
TCCGGCACTGGTGGAGCAGCTATGCAGCAGCCCGTGGTGCACAGCTGGCATATATTCAGGCA
GTTGGTGTTGAAGCCGCAGCACATGGTGTTCAGGTTAATGCAATTGCCCAGAATTTTGTTGA
AAACCCGACCTATTTTCCGCCAGAAGTTCAGGCAACACCGGCATTTAAAGATTGGCTGAAAT
GGCAGGTTCCGCTGGGTCGTCTGGTTACAGCAGATGAAGATGCGAGCTTTGCAGTTTATCTG
TGTAGCGAAGCAGCCAATTGTTTTGTTGGTCAGGTTTTTCCGGTTTGTGGTGGTTGGGTTAAT
CGTTAA

>HheD8-M7 (protein sequence)

MAHAISLSGRRVLVTQADAFMGPALCDAFRAAGAEVVPDRSALLERGAGRAVIEAAGRIDVLV
LNLAIPFPSTPVHQVSGGEWETTFAALVHPMREMVAAVLPQMIERKAGKILLMGSAAALRGPAL
LSSYAAARGAQLAYIQAVGVEAAAHGVQVNAIAQNFVENPTYFPPEVQATPAFKDWLKWQVPL
GRLVTADEDASFAVYLCSEAANCFVGQVFPVCGGWVNR

>HheD8-M3+*N*-His-tag (gene sequence)

ATGGCCCATCATCATCATCATCACGCAATTAGCCTGAGCGGTCGTCGTGTTCTGGTTACCCA
GGCAGATGCATTTATGGGTCCTGCACTGTGTGATGCATTTCGTGCAGCCGGTGCAGAAGTTG
TTCCGGATCGTAGCGCACTGCTGGAACGTGGTGCAGGTCGTGCAGTTATTGAAGCAGCAGGT
CGTATTGATGTTCTGGTGCTGAATCTGGCAATTCCGTTTCCGAGCACACCGGTTCATCAGGTT
AGCGGTGGTGAATGGGAAACCACCTTTGCAGCACTGGTTCATCCGATGCGTGAAATGGTTGC
AGCAGTTCTGCCGCAGATGATTGAACGTAAAGCAGGTAAAATTCTGCTGATGGGTAGCGCA
GCAGCACTGCGTGGTCCGGCACTGGGGGAGCAGCTATGCAGCAGCCCGTGGTGCACAGCTG
GCATATATTCAGGCAGTTGGTGTTGAAGCCGCAGCACATGGTGTTCAGGTTAATGCAATTGC
CCAGAATTTTGTTGAAAACCCGACCTATTTTCCGCCAGAAGTTCAGGCAACACCGGCATTTA
AAGATCGTCTGAAATGGCAGGTTCCGCTGGGTCGTCTGGTTACAGCAGATGAAGATGCGAG
CTTTGCAGTTTATCTGTGTAGCGAAGCAGCCAATTGTTTTGTTGGTCAGGTTTTTCCGGTTTG
TGGTGGTTGGGTTAATCGTTAA

>HheD8-M3+ *N*-His-tag (protein sequence)

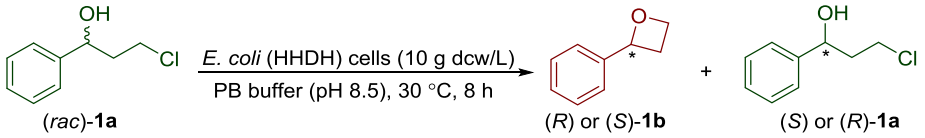
MAHHHHHHAISLSGRRVLVTQADAFMGPALCDAFRAAGAEVVPDRSALLERGAGRAVIEAAGR
IDVLVLNLAIPFPSTPVHQVSGGEWETTFAALVHPMREMVAAVLPQMIERKAGKILLMGSAAAL
RGPALGSSYAAARGAQLAYIQAVGVEAAAHGVQVNAIAQNFVENPTYFPPEVQATPAFKDRLK
WQVPLGRLVTADEDASFAVYLCSEAANCFVGQVFPVCGGWVNR

2. Supplementary Tables 1-11

Supplementary Table 1. Recombinant *E. coli* (HHDH) strains used in this study.

HHDHs	Source	Accession	Identified in Ref.
HheA2	*Arthrobacter* sp. AD2	AAK92100	[12]
HheA5	*Tistrella mobilis* KA081020-065	WP_014743557	[13]
HheA8	alpha proteobacterium Mf 1.05b.01	WP_051402546	[14]
HheA10	*Tsukamurella* sp. 1534	WP_019201195	[14]
HheA11	*Reyranella massiliensis* 521	WP_020698933	[14]
HheA13	*Pseudomonas* sp. G5(2012)	WP_042955870	[14]
HheB3	marine metagenome	EBL02020	[13]
HheB4	marine metagenome	EBP61646	[13]
HheB6	marine metagenome	EDB56284	[13]
HheC	*Agrobacterium tumefaciens* AD1	AAK92099	[12]
HheD	*Dechloromonas aromatica* RCB	WP_011285856	[13]
HheD2	gamma proteobacterium HTCC2207	WP_007233072	[13]
HheD6	*Marinobacter nanhaiticus* D15-8W	WP_004579485	[14]
HheD7	*Thauera* sp. 27	WP_002926105	[14]
HheD8	*Thauera aminoaromatica* S2	WP_004302136	[14]
HheD14	*Gammaproteobacteria* bacterium MOLA455	WP_035490777	[14]
HheD15	*Candidatus Competibacter denitrificans* Run_A_D11	WP_048670059	[14]
HheD16	*Methylibium* sp. T29	WP_036236554	[14]
HheE	marine metagenome	EBP63112	[13]
HheE5	marine metagenome	WP_009577001	[13]
HheF	uncultured bacterium	BAH89601	[13]
HheG	*Ilumatobacter coccineus* YM16-304	WP_015443096	[13]
HheG2	*Ilumatobacter nonamiensis* YM16-303	WP_040495182	[14]
HHDHn1	*Rhodobiaceae* bacterium	PCJ71437.1	[15]
HHDHn2	*Alphaproteobacteria* bacterium HGW-Alphaproteobacteria-3	YJ5359PY013	[15]
HHDHn3	*Alphaproteobacteria* bacterium 46_93_T64	OUR79898	[15]
HHDHn4	*Reyranella massiliensis*	WP_020698933.1	[15]
HHDHn5	*Alphaproteobacteria* bacterium 65-37	OJU34764.1	[15]
HHDHn6	*Rhodospirillales* bacterium URHD0017	WP_092824593.1	[15]
HHDHn7	*Alphaproteobacteria* bacterium RIFCSPHIGHO2_12_FULL_66_14	OFW98094.1	[15]
HHDHn8	*Enhydrobacter* aerosaccus	WP_085934632.1	[15]
HHDHn9	*Rhodospirillaceae* bacterium TMED8	OUT52242.1	[15]
HHDHn10	*Rhodomicrobium*	WP_088343515.1	[15]
HHDHn11	*Aurantiochytrium* sp. FCC1311	GBG24028.1	[15]
HHDHamb	*Acidimicrobiia bacterium*	MSO17354.1	[16]
HHDHapb	*Alphaproteobacteria* bacterium 32-64-14	OYX46376.1	[16]
HHDHabb	*Actinobacteria* bacterium IMCC26256	AKL74579.1	[16]
HHDHnsr	*Novosphingobium resinovorum*	WP_069709913.1	[16]

Supplementary Table 2. Screening of HHDHs for the dehalogenation reaction of (*rac*)-1a.[a]

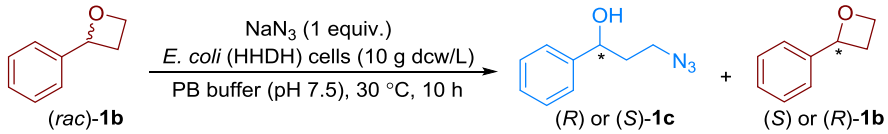


(*rac*)-**1a** (*R*) or (*S*)-**1b** (*S*) or (*R*)-**1a**

entry	biocatalyst	yield **1b** (%)[b]	e.e. **1b** (%)[b]	e.e. **1a** (%)[b]	*E*[c]
1	-	NR	ND	<5	ND
2	*E. coli*	NR	ND	<5	ND
3	*E. coli* (HheA2)	NR	ND	<5	ND
4	*E. coli* (HheA5)	13	97 (*R*)	15 (*S*)	76
5	*E. coli* (HheA8)	trace	>99 (*R*)	<5	ND
6	*E. coli* (HheA10)	NR	ND	<5	ND
7	*E. coli* (HheA11)	NR	ND	<5	ND
8	*E. coli* (HheA13)	NR	ND	<5	ND
9	*E. coli* (HheB3)	trace	>99 (*R*)	<5	ND
10	*E. coli* (HheB4)	trace	>99 (*R*)	<5	ND
11	*E. coli* (HheB6)	8	89 (*R*)	8 (*S*)	18
12	*E. coli* (HheC)	26	86 (*S*)	38 (*R*)	19
13	*E. coli* (HheD)	6	35 (*R*)	<5	ND
14	*E. coli* (HheD2)	16	33 (*R*)	7 (*S*)	2
15	*E. coli* (HheD6)	28	38 (*R*)	17 (*S*)	3
16	*E. coli* (HheD7)	5	14 (*S*)	<5	ND
17	*E. coli* (HheD8)	18	83 (*R*)	21 (*S*)	13
18	*E. coli* (HheD14)	13	31 (*R*)	<5	ND
19	*E. coli* (HheD15)	28	30 (*R*)	13 (*S*)	2
20	*E. coli* (HheD16)	28	53 (*R*)	23 (*S*)	4
21	*E. coli* (HheE)	trace	90 (*R*)	<5	ND
22	*E. coli* (HheE5)	5	86 (*R*)	<5	ND
23	*E. coli* (HheF)	NR	ND	<5	ND
24	*E. coli* (HheG)	NR	ND	<5	ND
25	*E. coli* (HheG2)	NR	ND	<5	ND
26	*E. coli* (HHDHn1)	trace	98 (*R*)	<5	ND
27	*E. coli* (HHDHn2)	NR	ND	<5	ND
28	*E. coli* (HHDHn3)	trace	44 (*R*)	<5	ND
29	*E. coli* (HHDHn4)	trace	89 (*R*)	<5	ND
30	*E. coli* (HHDHn5)	trace	78 (*R*)	<5	ND
31	*E. coli* (HHDHn6)	trace	55 (*R*)	<5	ND
32	*E. coli* (HHDHn7)	trace	92 (*R*)	<5	ND
33	*E. coli* (HHDHn8)	trace	93 (*R*)	<5	ND
34	*E. coli* (HHDHn9)	NR	ND	<5	ND
35	*E. coli* (HHDHn10)	NR	ND	<5	ND
36	*E. coli* (HHDHn11)	NR	ND	<5	ND
37	*E. coli* ((HHDHamb)	NR	ND	<5	ND
38	*E. coli* (HHDHapb)	7	68 (*R*)	<5	ND
39	*E. coli* (HHDHabb)	NR	ND	<5	ND
40	*E. coli* (HHDHnsr)	NR	ND	<5	ND

[a]The reactions were carried out in triplicate with 10 mM (*rac*)-**1a** and 10 g dcw/L *E. coli* (HHDH) cells in 5 mL PB buffer (50 mM, pH 8.5) at 30 °C for 8 h. [b]The yields and e.e. values were deteremined by chiral HPLC. [c]Calculated enantioselectivity: $E = \ln[(1-ee_{1a})/(1+ee_{1a}/ee_{1b})]/\ln[(1+ee_{1a})/(1+ee_{1a}/ee_{1b})]$. NR= no reaction. ND= not detected.

Supplementary Table 3. Screening of HHDHs for the ring-opening reaction of (*rac*)-1b.

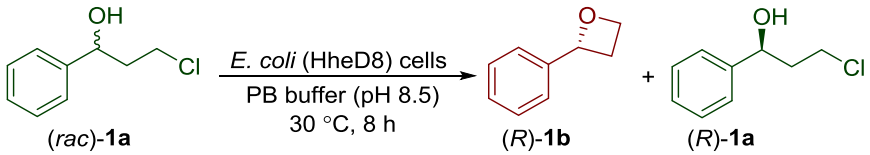


(*rac*)-**1b** (*R*) or (*S*)-**1c** (*S*) or (*R*)-**1b**

entry	biocatalyst	yield **1c** (%)[b]	e.e. **1c** (%)[b]	e.e. **1b** (%)[b]	*E*[c]
1	-	NR	ND	<5	ND
2	*E. coli*	NR	ND	<5	ND
3	*E. coli* (HheA5)	trace	<5	<5	ND
4	*E. coli* (HheA8)	trace	25 (*R*)	<5	ND
5	*E. coli* (HheB3)	trace	55 (*R*)	<5	ND
6	*E. coli* (HheB4)	trace	57 (*R*)	<5	ND
7	*E. coli* (HheB6)	trace	56 (*R*)	<5	ND
8	*E. coli* (HheC)	trace	>99 (*S*)	<5	ND
9	*E. coli* (HheD)	6	31 (*R*)	<5	ND
10	*E. coli* (HheD2)	trace	<5	<5	ND
11	*E. coli* (HheD6)	trace	16 (*R*)	<5	ND
12	*E. coli* (HheD7)	5	18 (*S*)	<5	ND
13	*E. coli* (HheD8)	18	74 (*R*)	18 (*S*)	8
14	*E. coli* (HheD14)	trace	6 (*R*)	<5	ND
15	*E. coli* (HheD15)	7	24 (*R*)	<5	ND
16	*E. coli* (HheD16)	trace	37 (*R*)	<5	ND
17	*E. coli* (HheE)	trace	46 (*R*)	<5	ND
18	*E. coli* (HheE5)	trace	45 (*R*)	<5	ND
19	*E. coli* (HHDHn1)	trace	29 (*S*)	<5	ND
20	*E. coli* (HHDHn3)	trace	49 (*S*)	<5	ND
21	*E. coli* (HHDHn4)	trace	45 (*R*)	<5	ND
22	*E. coli* (HHDHn5)	trace	41 (*R*)	<5	ND
23	*E. coli* (HHDHn6)	trace	34 (*R*)	<5	ND
24	*E. coli* (HHDHn7)	trace	<5	<5	ND
25	*E. coli* (HHDHn8)	trace	69 (*R*)	<5	ND
26	*E. coli* (HHDHapb)	trace	11 (*R*)	<5	ND

[a]The reactions were carried out in triplicate with 10 mM (*rac*)-**1b**, 10 mM NaN_3 and 10 g dcw/L *E. coli* (HHDH) cells in 5 mL PB buffer (50 mM, pH 7.5) at 30 °C for 10 h. [b]The yields and e.e. values were deteremined by chiral HPLC. [c]Calculated enantioselectivity: $E = \ln[(1-ee_{1b})/(1+ee_{1b}/ee_{1c})]/\ln[(1+ee_{1b})/(1+ee_{1b}/ee_{1c})]$. NR= no reaction. ND= not detected.

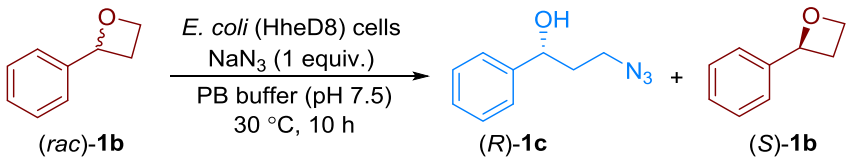
Supplementary Table 4. Directed evolution of HheD8 for enantioselective dehalogenation of γ-haloalcohol (*rac*)-1a.[a]



entry	HheD8	mutation	conc. **1a** (mM)	*ee* (*R*)-**1b** (%)[b]	*ee* (*S*)-**1a** (%)[b]	conv. **1a** (%)[c]	*E*[d]
1	WT	-	10	82	21	20	12
2	M1	A69F	10	98	22	18	123
3	M2	A69F/R127G	10	98	54	36	170
4	M3	A69F/R127G/M124P	10	98	96	50	>200
5	M3	A69F/R127G/M124P	20	>99	76	43	>200
6	M4	A69F/R127G/M124P/R182W	20	>99	94	49	>200
7	M5	A69F/R127L	10	91	5	5	22
8	M6	A69F/R127L/M124P	10	99	38	28	>200
9	M7	A69F/R127L/M124P/R182W	20	>99	36	27	>200

[a]The reactions were carried out in triplicate with 10 mM (*rac*)-**1a** and 10 g dcw/L *E. coli* (HHDH) cells in 5 mL PB buffer (50 mM, pH 8.5) at 30 °C for 8 h. [b]The e.e. values were deteremined by chiral HPLC. [c]Calculated conversions: *conv.* = $ee_{1a}/(ee_{1a}+ee_{1b})$. [d]Calculated enantioselectivity: *E* = $\ln[(1-ee_{1a})/(1+ee_{1a}/ee_{1b})]/\ln[(1+ee_{1a})/(1+ee_{1a}/ee_{1b})]$.

Supplementary Table 5. Directed evolution of HheD8 for enantioselective ring-opening of oxetane (*rac*)-1b with azide.[a]

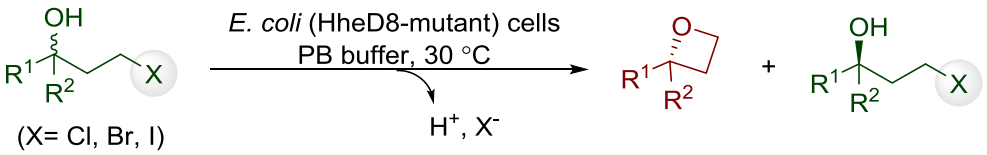


(*rac*)-**1b** (*R*)-**1c** (*S*)-**1b**

entry	HheD8	mutation	conc. **1b** (mM)	*ee* (*R*)-**1c** (%)[b]	*ee* (*S*)-**1b** (%)[b]	conv. **1b** (%)[c]	E^d
1	WT	-	10	75	21	22	9
2	M1	A69F	10	>99	17	15	>200
3	M5	A69F/R127L	10	99	31	24	>200
4	M6	A69F/R127L/M124P	10	>99	75	43	>200
5	M6	A69F/R127L/M124P	20	>99	64	39	>200
6	M7	A69F/R127L/M124P/R182W	20	>99	84	46	>200
7	M2	A69F/R127G	10	>99	19	16	>200
8	M3	A69F/R127G/M124P	20	99	82	45	>200
9	M4	A69F/R127G/M124P/R182W	20	99	>99	50	>200

[a]The reactions were carried out in triplicate with 10 mM (*rac*)-**1b**, 10 mM NaN_3 and 10 g dcw/L *E. coli* (HHDH) cells in 5 mL PB buffer (50 mM, pH 7.5) at 30 °C for 10 h. [b]The e.e. values were deteremined by chiral HPLC. [c]Calculated conversions: *conv.* = $ee_{1b}/(ee_{1b}+ee_{1c})$. [d]Calculated enantioselectivity: $E = \ln[(1-ee_{1b})/(1+ee_{1b}/ee_{1c})]/\ln[(1+ee_{1b})/(1+ee_{1b}/ee_{1c})]$.

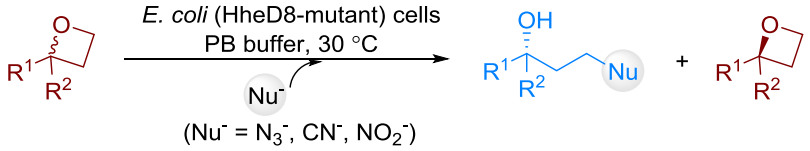
Supplementary Table 6. Scope of the biocatalytic enantioselective dehalogenation of γ-haloalcohols.[a]



Substrate	Product	T (h)	yield **b** (%)[b]	*ee* (*R*)-**b** (%)[c]	yield **a** (%)[b]	*ee* (*S*)-**a** (%)[c]	conv. **a** (%)[d]	*E*[e]
1a	**1b**	8	41	98	50	>99	50	>200
2a	**2b**	6	39	98	49	98	50	>200
3a	**3b**	24	43	97	51	94	49	>200
4a	**4b**	24	46	96	50	93	49	168
5a	**5b**	24	33	99	50	93	48	>200
6a	**6b**	12	36	>99	47	94	49	>200
7a	**7b**	48	45	98	48	93	49	>200
8a	**8b**	48	43	95	50	92	49	129
9a	**9b**	24	34	99	51	91	48	>200
10a	**10b**	48	43	97	51	91	48	>200
11a	**11b**	12	34	>99	52	93	48	>200
12a	**12b**	48	37	>99	50	93	48	>200
13a	**13b**	48	42	98	50	92	48	>200
14a[f]	**14b**	82	37	93	53	86	48	77
15a	**15b**	12	32	98	51	92	48	>200
16a[g]	**16b**	82	37	>99	50	96	49	>200
17a	**17b**	1.5	36	>99	49	>99	50	>200
18a	**18b**	77	42	97	50	89	48	198
19a[f]	**19b**	48	44	96	48	97	50	>200
20a	**20b**	12	NI	NI	50	>99	ND	ND
21a[f]	**21b**	60	35	>99	48	>99	49	>200
22a	**1b**	6	30	92	50	>99	50	126
23a	**1b**	1.5	39	93	48	>99	50	145

[a]The reactions were carried out with 20 mM (*rac*)-**a** and 10 g dcw/L *E. coli* (HHD8-M4) cells in 100 mL PB buffer (50 mM, pH 8.5) at 30 °C. [b]The isolated yield were obtained by silica gel chromatography. [c]The e.e. values were deteremined by chiral HPLC/GC. [d]Calculated conversions: *conv.* = $ee_a/(ee_a+ee_b)$. [f]Calculated enantioselectivity: $E = \ln[(1-ee_a)/(1+ee_a/ee_b)]/\ln[(1+ee_a)/(1+ee_a/ee_b)]$. [f]Reactions were carried out at the substrate concentration of 10 mM. [g]Reaction was carried out with *E. coli* (HHD8-M3) cells. NI: the oxetane **20b** was not isolated due to its unstable properties. ND= not detected.

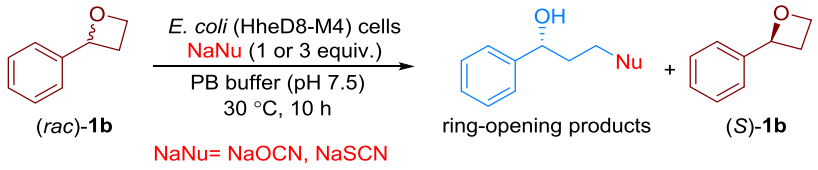
Supplementary Table 7. Scope of the biocatalytic enantioselective ring-opening of oxetanes.[a]



Substrate	Product	T (h)	yield **c/d/e/f** (%)[b]	*ee* (*R*)-**c/d/e/f** (%)[c]	yield **b** (%)[b]	*ee* (*S*)-**b** (%)[c]	conv. **b** (%)[d]	*E*[e]
1b	**1c**	10	47	97	33	>99	51	>200
2b	**2c**	10	48	98	35	>99	50	>200
3b	**3c**	37	48	94	42	92	49	106
4b	**4c**	60	44	91	48	93	51	72
5b	**5c**	33	44	97	30	97	50	>200
6b	**6c**	12	47	>99	38	>99	50	>200
7b	**7c**	24	47	97	46	94	49	>200
8b	**8c**	23	48	95	48	95	50	146
9b	**9c**	24	48	98	37	94	49	>200
10b	**10c**	24	43	95	42	95	50	146
11b	**11c**	16	50	98	36	>99	50	>200
12b	**12c**	11	48	99	45	97	49	>200
13b	**13c**	26	47	98	42	98	50	>200
14b[f]	**14c**	45	41	94	49	86	48	90
15b	**15c**	16	43	>99	42	>99	50	>200
16b[g]	**16c**	45	43	95	35	98	51	180
17b[h]	**17c**	14	39	>99	27	85	46	>200
18b[i]	**18c**	26	48	98	45	99	50	>200
19b[j]	**19c**	30	49	>99	46	95	49	>200
21b[k]	**21c**	96	43	97	32	89	48	198
1b[l]	**1d**	22	46	>99	37	97	49	>200
1b[m]	**1e**	24	23	>99	43	>99	50	>200
	1f		19	88				82

[a]The reactions were carried out with 20 mM (*rac*)-**b**, 20 mM NaN_3 and 10 g dcw/L *E. coli* (HHD8-M4) cells in 100 mL PB buffer (50 mM, pH 7.5) at 30 °C. [b]The isolated yield were obtained by silica gel chromatography. [c]The e.e. values were deteremined by chiral HPLC/GC. [d]Calculated conversions: *conv.* = $ee_b/(ee_b+ee_c)$. [e]Calculated enantioselectivity: $E = \ln[(1-ee_b)/(1+ee_b/ee_c)]/\ln[(1+ee_b)/(1+ee_b/ee_c)]$. [f]The reaction was carried out with 5 mM (*rac*)-**14b**, 5 mM NaN_3 and 10 g dcw/L *E. coli* (HHD8-M4) cells. [g]The reaction was carried out with 5 mM (*rac*)-**16b**, 5 mM NaN_3 and 10 g dcw/L *E. coli* (HHD8-M3). [h]The reaction was carried with 5 mM (*rac*)-**17b**, 15 mM NaN_3 and 30 g dcw/L *E. coli* (HHD8-M7) cells in 100 mL Gly-NaOH buffer (300 mM, pH 9.5). [i]The reaction was carried out with 20 mM (*rac*)-**18b**, 20 mM NaN_3 and 10 g dcw/L *E. coli* (HHD8-M4) cells in 100 mL PB buffer (50 mM, pH 6.5). [j]The reaction was carried out with 10 mM (*rac*)-**19b**, 10 mM NaN_3 and 10 g dcw/L *E. coli* (HHD8-M4) cells in 100 mL PB buffer (50 mM, pH 6.5). [k]The reaction was carried out in 200 mL round-bottom flask with 5 mM (*rac*)-**21b**, 15 mM NaN_3 and 30 g dcw/L *E. coli* (HHD8-M4) cells. [l]The reaction was carried with 20 mM (*rac*)-**1b**, 40 mM mandelonitrile and 10 g dcw/L *E. coli* (HHD8-M4) cells.[m]The reaction was carried out with 40 mM (*rac*)-**1b**, 40 mM $NaNO_2$ and 10 g dcw/L *E. coli* (HHD8-M4) cells in 200 mL PB buffer (50 mM, pH 7.5).

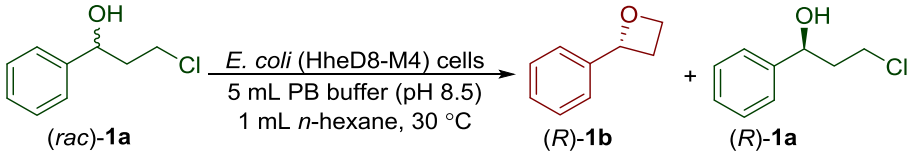
Supplementary Table 8. Ring-opening of (*rac*)-1b with cyanate and thiocyanate.[a]



entry	Nucleophile (NaNu)	NaNu: **1b**	Conversion **1b** (%)[b]	*ee* (*S*)-**1b** (%)[b]	*E*[c]
1	NaOCN	1:1	28	8	2
2	NaOCN	1:3	29	8	2
3	NaSCN	1:1	29	7	2
4	NaSCN	1:3	32	11	2

[a]The reactions were carried out in triplicate with 5 mM (*rac*)-**1b**, 5 or 15 mM NaNu and 20 g dcw/L *E. coli* (HheD8-M4) cells in 5 mL PB buffer (50 mM, pH 7.5) at 30 °C for 24 h. [b]The conversions and ee values of **1b** were deteremined by chiral HPLC. [c]Calculated enantioselectivity: $E = \ln[(1-c)/(1-ee_s)]/\ln[(1-c)/(1+ee_s)]$. c= Conversion of **1b**; ee_s= e.e. values of (*S*)-**1b**.

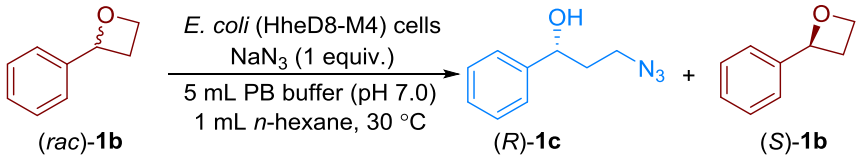
Supplementary Table 9. Time-course studies of the enantioselective dehalogenation reaction of (*rac*)-1a at different substrate concentrations.[a]



Concentration **1a** (mM)	T (h)	*ee* (*R*)-**1b** (%)[b]	*ee* (*S*)-**1a** (%)[b]	Conversion (%)[c]	*E*[d]
40	3	>99	96	49	>200
	6	>99	>99	50	>200
	12	>99	>99	50	>200
	24	>99	>99	50	>200
80	3	>99	44	31	>200
	6	>99	80	44	>200
	12	>99	92	48	>200
	24	>99	96	49	>200
	36	>99	98	49	>200
	48	>99	97	49	> 200
100	3	>99	32	24	> 200
	6	>99	57	36	>200
	12	>99	79	44	>200
	24	>99	92	48	>200
	36	>99	94	48	>200
	48	>99	96	49	>200
120	3	>99	26	21	>200
	6	>99	44	31	>200
	12	>99	67	40	>200
	24	>99	85	46	>200
	36	>99	91	48	>200
	48	>99	92	48	>200
140	3	>99	22	18	>200
	6	>99	39	28	>200
	12	>99	57	36	>200
	24	>99	75	43	>200
	36	>99	84	46	>200
	48	>99	87	47	>200

[a]The reactions were carried out at 30 °C within a two-phase system (PB buffer, 5 mL, 200 mM, pH 8.5; *n*-hexane, 1 mL) contaning 40-140 mM (*rac*)-**1a** and 10 g dcw/L *E. coli* (HHD8-M4) cells. [b]The e.e. values were deteremined by chiral HPLC. [c]Calculated conversions: *conv.* = $ee_{1a}/(ee_{1a}+ee_{1b})$. [d]Calculated enantioselectivity: $E = \ln[(1-ee_{1a})/(1+ee_{1a}/ee_{1b})]/\ln[(1+ee_{1a})/(1+ee_{1a}/ee_{1b})$.

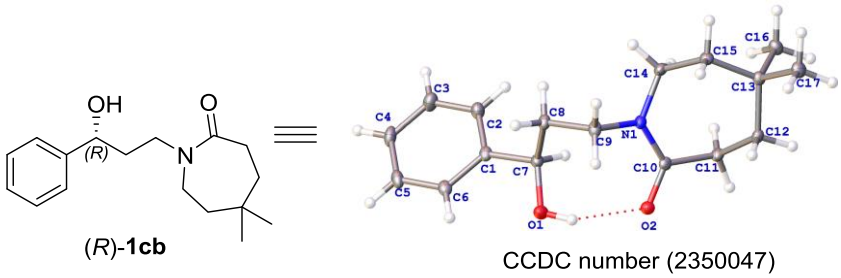
Supplementary Table 10. Time-course studies of the enantioselective azide-mediated ring-opening reaction of (*rac*)-1b at different substrate concentrations.[a]



Concentration **1b** (mM)	T (h)	*ee* (*R*)-**1c** (%)[b]	*ee* (*S*)-**1b** (%)[b]	Conversion (%)[c]	*E*[e]
40	3	>99	44	31	>200
	6	>99	81	45	>200
	12	>99	99	50	>200
	24	>99	>99	50	>200
	36	>99	>99	50	>200
80	3	>99	25	20	>200
	6	>99	51	34	>200
	12	>99	87	47	>200
	24	>99	>99	50	>200
	36	>99	>99	50	>200
120	3	>99	25	20	>200
	6	>99	46	32	>200
	12	>99	80	44	>200
	24	>99	>99	50	>200
	36	>99	>99	50	>200
160	3	>99	18	15	>200
	6	>99	33	25	>200
	12	>99	63	39	>200
	24	>99	96	49	>200
	36	>99	>99	50	>200
200	3	>99	14	12	>200
	6	>99	28	22	>200
	12	>99	51	34	>200
	24	>99	92	48	>200
	36	>99	99	50	>200

[a]The reactions were carried out at 30 °C within a two-phase system (PB buffer, 5 mL, 300 mM, pH 7.0; *n*-hexane, 1 mL) contaning 40-200 mM (*rac*)-**1b**, 1 equivalent NaN_3, and 10 g dcw/L *E. coli* (HHD8-M4) cells. [b]The e.e. values were deteremined by chiral HPLC. [c]Calculated conversions: *conv.* = $ee_{1b}/(ee_{1b}+ee_{1c})$. [d]Calculated enantioselectivity: $E = \ln[(1-ee_{1b})/(1+ee_{1b}/ee_{1c})]/\ln[(1+ee_{1b})/(1+ee_{1b}/ee_{1c})]$.

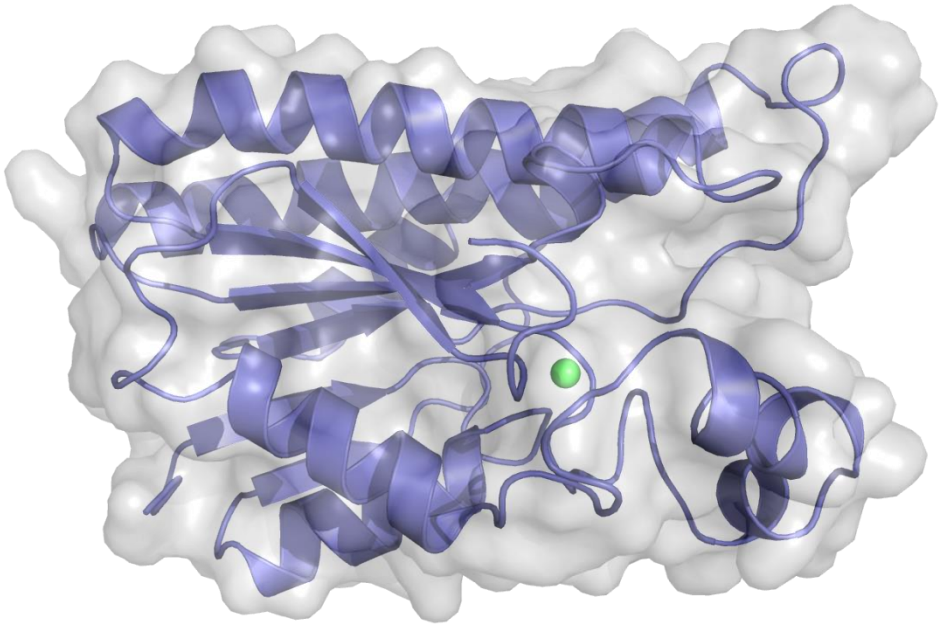
Supplementary Table 11. Crystal data and structure refinement for (*R*)-**1cb**.



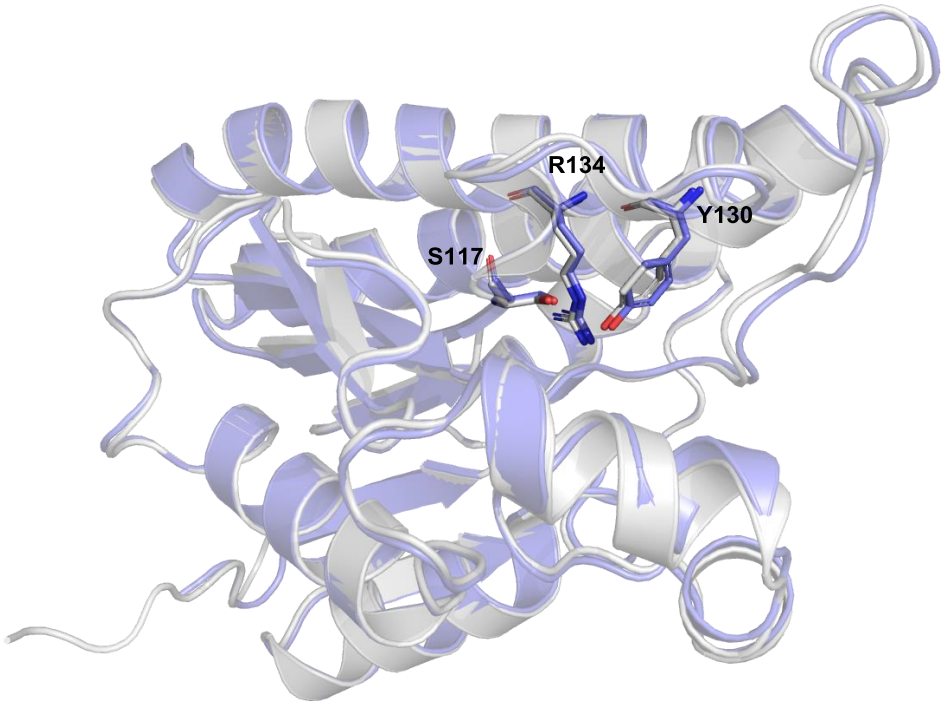
Identification code	(*R*)-**1cb**
Empirical formula	$C_{17}H_{25}NO_2$
Formula weight	275.38
Temperature/K	99.98(11)
Crystal system	monoclinic
Space group	$P2_1$
a/Å	6.0384(3)
b/Å	7.4549(4)
c/Å	17.5882(11)
α/°	90
β/°	99.789(6)
γ/°	90
Volume/Å^3	780.22(8)
Z	2
ρ_{calc}g/cm^3	1.172
μ/mm^{-1}	0.596
F(000)	300.0
Crystal size/mm^3	0.14 × 0.12 × 0.11
Radiation	Cu Kα (λ = 1.54184)
2Θ range for data collection/°	5.098 to 148.018
Index ranges	$-7 \le h \le 6$, $-9 \le k \le 6$, $-21 \le l \le 21$
Reflections collected	7816
Independent reflections	2532 [R_{int} = 0.0232, R_{sigma} = 0.0154]
Data/restraints/parameters	2532/1/185
Goodness-of-fit on F^2	1.042
Final R indexes [I>=2σ (I)]	R_1 = 0.0266, wR_2 = 0.0675
Final R indexes [all data]	R_1 = 0.0268, wR_2 = 0.0676
Largest diff. peak/hole / e Å^{-3}	0.20/-0.12
Flack/Hooft parameter	0.08(9)/0.09(6)

3. Supplementary Figures 1-2

Supplementary Fig. 1 | Cartoon and surface representation of the mutant HheD8-M3 complex with chloride. The ligand Cl^- is highlighted in green sphere.

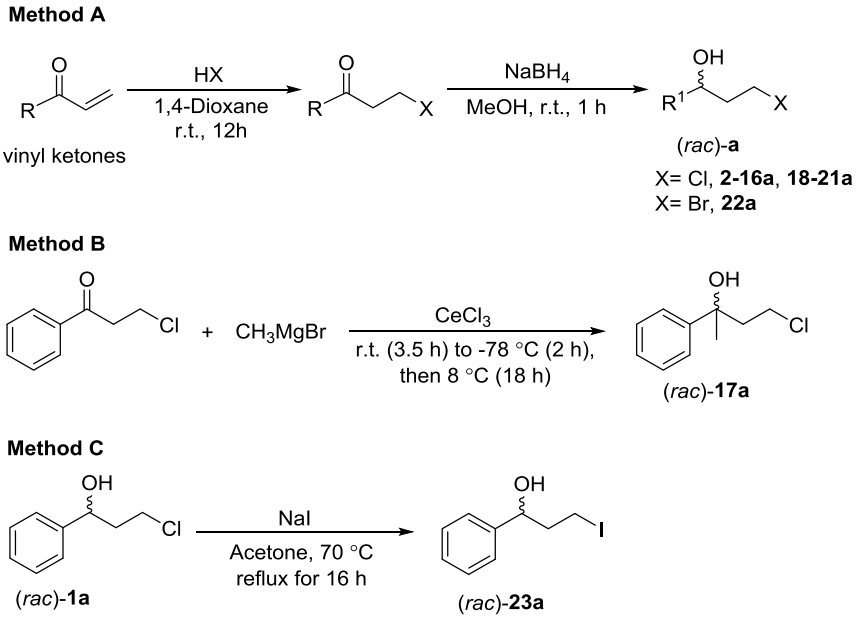


Supplementary Fig. 2 | Overlap structure analysis of the mutant HheD8-M3 with HheD8-WT/AF. HheD8-M3 (PDB code: 8XXB) is shown as blue cartoon. HheD8-WT/AF (AFDB code: AF-N6YXW4-F1) is shown as gray cartoon. Catalytic triads S117-Y130-R134 are highlighted in sticks.



4. Chemical synthesis and characterization of racemic compounds

Synthesis of racemic γ-haloalcohols:



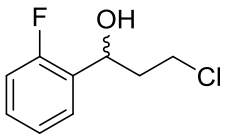
Racemic γ-haloalcohols **2-16a** and **18-22a** were synthesized from the corresponding vinyl ketones (Method A)[17,18]. General procedure: To a 100-mL round-bottom flask, 20 mmol of vinyl ketone substrates was added, followed by the addition of 10 mL HCl (4 M in 1,4-dioxane). The reaction mixture was then stirred at room temperature for 12 h. Afterward, the reaction mixture was concentrated under reduced pressure to obtain the crude β-halo ketone intermediates. To a 100-mL round-bottom flask cooled with an ice bath, 15 mmol (1.0 eq.) crude β-halo ketones and 20 mL of methanol were added, followed by the addition of 18 mmol (1.2 eq.) $NaBH_4$. The reaction mixture was then stirred at room temperature for 1 h. Afterward, the methanol solvent was removed under reduced pressure, followed by the addition of 10 mL distilled water to the flask. The mixture was then extracted with ethyl acetate (3 × 10 mL) and saturated brine (twice). The organic layer was then dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to obtain the crude product. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl acetate = 30:1 ~ 15:1; dichloromethane : ethyl acetate = 6:1 ~ 3:1) to afford the racemic γ-haloalcohols (*rac*)-**a**.

Racemic γ-chloroalcohol **17a** was synthesized from the corresponding β-halo ketone (Method B)[19]. To a 200-mL round-bottom flask, 5.6 g (22.6 mmol) of anhydrous $CeCl_3$ and 40 mL of dry tetrahydrofuran (THF) were added under under nitrogen atmosphere. The reaction mixture was

then stirred at room temperature for 3.5 h and cooled to -78 °C, followed by the addition of 40 mL methylmagnesium bromide (1M in THF). The reaction was allowed to proceed at -78 °C for 2 h. Then, 3.4 g (20 mmol) 3-chloro-1-phenylpropan-1-one in 30 mL dry THF was added dropwise to the reaction mixture. The temperature was then gradually raised to 8 °C and the reaction was allowed to proceed for 18 h. Afterward, the reaction mixture was quenched with 15 mL of saturated NH_4Cl solution, extracted with ethyl acetate (3 × 20 mL), and washed with saturated brine. The organic layer was then dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to obtain the crude product. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl acetate = 30:1~20:1) to afford the racemic γ-chloroalcohol (*rac*)-**17a**.

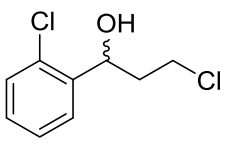
Racemic γ-iodoalcohol **23a** was synthesized from racemic **1a**[20]. To a 100-mL round-bottom flask, 1.0 g (5.89 mmol) of (*rac*)-**1a** and 25 mL of acetone were added, followed by the addition of 1.5 g (9.96 mmol) sodium iodide. The temperature was then gradually raised to 70 °C and the reaction was refluxed for 16 h. Afterward, the acetone was removed under reduced pressure, followed by the addition of 10 mL distilled water to the flask. The mixture was then extracted with ethyl acetate (3 × 10 mL) and saturated brine (twice). The organic layer was then dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to afford the racemic γ-iodoalcohol (*rac*)-**23a**.

(*rac*)-3-chloro-1-(2-fluorophenyl)propan-1-ol [(*rac*)-2a]



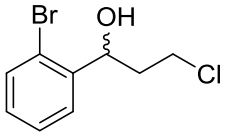
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 (td, *J* = 7.5, 1.8 Hz, 1H), 7.29 - 7.24 (m, 1H), 7.15 (t, *J* = 7.6 Hz, 1H), 7.05 - 7.00 (m, 1H), 5.22 (dd, *J* = 8.5, 4.3 Hz, 1H), 3.77 - 3.71 (m, 1H), 3.61 (dt, *J* = 11.0, 6.0 Hz, 1H), 2.27 - 2.11 (m, 3H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 159.8 (d, *J* = 245.0 Hz), 130.6 (d, *J* = 13.0 Hz), 129.4 (d, *J* = 8.0 Hz), 127.4 (d, *J* = 5.0 Hz), 124.5 (d, *J* = 3.0 Hz), 115.6 (d, *J* = 22.0 Hz), 65.9, 41.6, 40.2 (d, *J* = 1.0 Hz).

(*rac*)-3-chloro-1-(2-chlorophenyl)propan-1-ol [(*rac*)-3a]



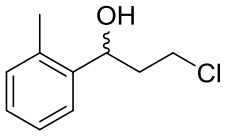
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.56 (dd, *J* = 7.6, 1.7 Hz, 1H), 7.35 - 7.28 (m, 2H), 7.22 (td, *J* = 7.7, 1.8 Hz, 1H), 5.34 (dd, *J* = 9.0, 3.3 Hz, 1H), 3.83 - 3.76 (m, 1H), 3.71 - 3.65 (m, 1H), 2.25 - 2.17 (m, 2H), 2.14 - 2.05 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 141.2, 131.8, 129.7, 128.9, 127.4, 127.1, 68.1, 41.8, 39.8.

(*rac*)-1-(2-bromophenyl)-3-chloropropan-1-ol [(*rac*)-4a]



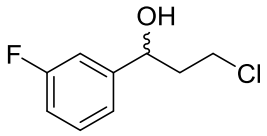
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.54 (dd, *J* = 11.8, 8.1 Hz, 2H), 7.34 (t, *J* = 7.5 Hz, 1H), 7.15 (t, *J* = 7.7 Hz, 1H), 5.28 (d, *J* = 9.3 Hz, 1H), 3.83 - 3.77 (m, 1H), 3.71 - 3.66 (m, 1H), 2.41 (s, 1H), 2.25 - 2.17 (m, 1H), 2.10 - 2.01 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 142.8, 132.9, 129.2, 128.0, 127.3, 121.8, 70.3, 41.8, 39.8.

(*rac*)-3-chloro-1-(o-tolyl)propan-1-ol [(*rac*)-5a]



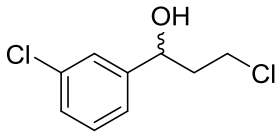
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48 (d, *J* = 7.6 Hz, 1H), 7.27 - 7.14 (m, 3H), 5.20 (dd, *J* = 8.8, 3.7 Hz, 1H), 3.86 - 3.79 (m, 1H), 3.68 - 3.62 (m, 1H), 2.36 (s, 3H), 2.17 - 2.04 (m, 2H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 142.1, 134.5, 130.6, 127.6, 126.5, 125.1, 67.6, 42.2, 40.6, 19.0.

(*rac*)-3-chloro-1-(3-fluorophenyl)propan-1-ol [(*rac*)-6a]



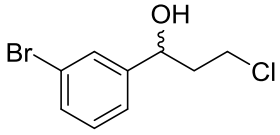
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.32 (td, *J* = 8.1, 6.2 Hz, 1H), 7.13 - 7.06 (m, 2H), 6.98 (td, *J* = 8.4, 2.6 Hz, 1H), 4.94 (dd, *J* = 8.8, 4.6 Hz, 1H), 3.76 - 3.70 (m, 1H), 3.55 (dt, *J* = 11.0, 5.8 Hz, 1H), 2.31 (d, *J* = 13.8 Hz, 1H), 2.22 - 2.14 (m, 1H), 2.10 - 2.01 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 163.1 (d, *J* = 245.0 Hz), 146.5 (d, *J* = 6.0 Hz), 130.3 (d, *J* = 7.0 Hz), 121.4, 114.8 (d, *J* = 21.0 Hz), 112.8 (d, *J* = 22.0 Hz), 70.7 (d, *J* = 11.0 Hz), 41.6, 41.4.

(*rac*)-3-chloro-1-(3-chlorophenyl)propan-1-ol [(*rac*)-7a]



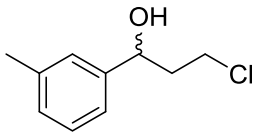
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37 (s, 1H), 7.32 - 7.22 (m, 3H), 4.93 (dd, *J* = 8.3, 4.3 Hz, 1H), 3.78 - 3.71 (m, 1H), 3.59 - 3.53 (m, 1H), 2.23 - 2.02 (m, 3H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 145.9, 134.7, 130.1, 128.1, 126.1, 124.0, 70.8, 41.6, 41.2.

(*rac*)-1-(3-bromophenyl)-3-chloropropan-1-ol [(*rac*)-8a]



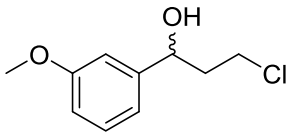
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.53 (s, 1H), 7.42 (dt, *J* = 7.7, 1.6 Hz, 1H), 7.29 - 7.21 (m, 2H), 4.94 - 4.91 (m, 1H), 3.78 - 3.71 (m, 1H), 3.56 (dt, *J* = 11.0, 5.7 Hz, 1H), 2.23 -2.14 (m, 2H), 2.10 - 2.01 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 146.2, 131.1, 130.4, 129.0, 124.5, 122.9, 70.7, 41.6, 41.5.

(*rac*)-3-chloro-1-(m-tolyl)propan-1-ol [(*rac*)-9a]



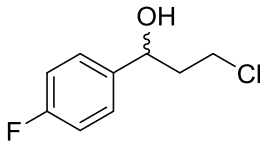
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.25 (t, *J* = 7.5 Hz, 1H), 7.17 - 7.10 (m, 3H), 4.88 (dd, *J* = 8.6, 4.7 Hz, 1H), 3.75 - 3.69 (m, 1H), 3.55 (dt, *J* = 10.9, 6.0 Hz, 1H), 2.36 (s, 3H), 2.26 - 2.17 (m, 1H), 2.12 - 2.03 (m, 2H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 143.8, 138.5, 128.8, 128.7, 126.6, 122.9, 71.4, 41.9, 41.5, 21.6.

(*rac*)-3-chloro-1-(3-methoxyphenyl)propan-1-ol [(*rac*)-10a]



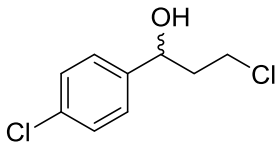
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.27 (t, *J* = 7.6 Hz, 1H), 6.94 - 6.90 (m, 2H), 6.84- 6.81 (m, 1H), 4.89 (dd, *J* = 8.5, 4.6 Hz, 1H), 3.80 (s, 3H), 3.76 - 3.69 (m, 1H), 3.58 - 3.51 (m, 1H), 2.26 - 2.16 (m, 2H), 2.11 - 2.02 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 159.9, 145.5, 129.8, 118.1, 113.4, 111.3, 71.3, 55.3, 41.8, 41.5.

(*rac*)-3-chloro-1-(4-fluorophenyl)propan-1-ol [(*rac*)-11a]



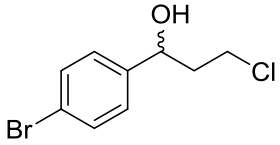
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.28 - 7.23 (m, 2H), 7.00 (t, *J* = 8.6 Hz, 2H), 4.84 (dd, *J* = 8.6, 5.1 Hz, 1H), 3.67 - 3.60 (m, 1H), 3.48 - 3.41 (m, 1H), 3.06 (s, 1H), 2.16 - 2.07 (m, 1H), 2.02 - 1.93 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 162.4 (d, *J* = 244.0 Hz), 139.5 (d, *J* = 3.0 Hz), 127.6 (d, *J* = 8.0 Hz), 115.6 (d, *J* = 21.0 Hz), 70.7 (d, *J* = 11.0 Hz), 41.7, 41.5.

(*rac*)-3-chloro-1-(4-chlorophenyl)propan-1-ol [(*rac*)-12a]



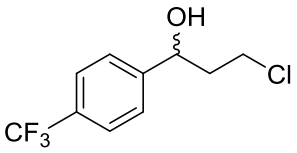
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.29 (q, *J* = 8.4 Hz, 4H), 4.91 (dt, *J* = 8.7, 4.1 Hz, 1H), 3.75 - 3.68 (m, 1H), 3.51 (dt, *J* = 11.0, 5.9 Hz, 1H), 2.29 (d, *J* = 4.8 Hz, 1H), 2.22 - 2.13 (m, 1H), 2.07 - 1.99 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 142.2, 133.6, 128.9, 127.3, 70.7, 41.7, 41.4.

(*rac*)-1-(4-bromophenyl)-3-chloropropan-1-ol [(*rac*)-13a]



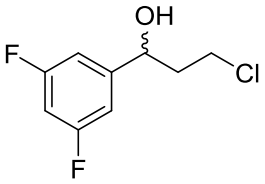
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.48 (d, *J* = 8.4 Hz, 2H), 7.23 (d, *J* = 8.4 Hz, 2H), 4.90 (dd, *J* = 8.7, 4.7 Hz, 1H), 3.75 - 3.69 (m, 1H), 3.53 (dt, *J* = 12.6, 4.2 Hz, 1H), 2.22 - 2.13 (m, 2H), 2.07 - 1.99 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 142.8, 131.8, 127.6, 121.8, 70.7, 41.6, 41.4.

(*rac*)-3-chloro-1-(4-(trifluoromethyl)phenyl)propan-1-ol [(*rac*)-14a]



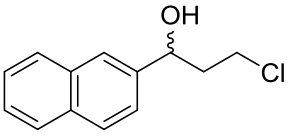
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.62 (d, *J* = 8.1 Hz, 2H), 7.48 (d, *J* = 8.0 Hz, 2H), 5.02 (dd, *J* = 8.8, 4.4 Hz, 1H), 3.79 - 3.73 (m, 1H), 3.56 (dt, *J* = 11.0, 5.7 Hz, 1H), 2.39 (s, 1H), 2.22 - 2.15(m, 1H), 2.11 - 2.02 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 147.8, 130.1 (d, *J* = 32.0 Hz), 127.2, 125.7 (q, *J* = 3.0 Hz), 125.5 (t, *J* = 270.0 Hz), 70.7, 41.6, 41.5.

(*rac*)-3-chloro-1-(3,5-difluorophenyl)propan-1-ol [(*rac*)-15a]



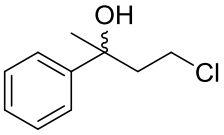
^{1}H NMR (400 MHz, $CDCl_3$) δ 6.89 (d, *J* = 6.0 Hz, 2H), 6.72 (tt, *J* = 8.8, 2.5 Hz, 1H), 4.94 (dd, *J* = 8.4, 4.0 Hz, 1H), 3.78 - 3.72 (m, 1H), 3.59 - 3.53 (m, 1H), 2.19 - 2.10 (m, 1H), 2.08 - 2.00 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** 163.3 (dd, *J* = 248.0, 13.0 Hz), 148.0 (t, *J* = 9.0 Hz), 108.7(dd, *J* = 19.0, 7.0 Hz), 103.2 (t, *J* = 25.0 Hz), 70.4 (d, *J* = 12.0 Hz), 41.4 (d, *J* = 10.0 Hz).

(*rac*)-3-chloro-1-(naphthalen-2-yl)propan-1-ol [(*rac*)-16a]



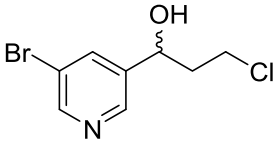
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.13 - 8.10 (m, 1H), 7.90 - 7.88 (m, 1H), 7.80 (d, *J* = 8.2 Hz, 1H), 7.66 (d, *J* = 7.2 Hz, 1H), 7.57 - 7.46 (m, 3H), 5.73 (dd, *J* = 8.9, 3.5 Hz, 1H), 3.94 - 3.88 (m, 1H), 3.68 (dt, *J* = 10.8, 4.8 Hz, 1H), 2.36 - 2.20 (m, 3H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 139.7, 133.9, 130.2, 129.1, 128.4, 126.4, 125.8, 125.6, 123.0, 122.8, 68.0, 42.4, 40.8.

(*rac*)-4-chloro-2-phenylbutan-2-ol [(*rac*)-17a]



^{1}H NMR (400 MHz, $CDCl_3$) δ 7.44 - 7.41 (m, 2H), 7.37 (t, *J* = 7.4 Hz, 2H), 7.29 - 7.25 (m, 1H), 3.58 - 3.51 (m, 1H), 3.37 - 3.31 (m, 1H), 2.37 - 2.26 (m, 2H), 1.61 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 146.5, 128.6, 127.1, 124.6, 74.4, 46.7, 40.6, 31.0.

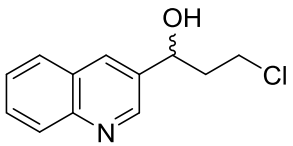
(*rac*)-1-(5-bromopyridin-3-yl)-3-chloropropan-1-ol [(*rac*)-18a]



^{1}H NMR (400 MHz, $CDCl_3$) δ 8.54 (d, *J* = 2.2 Hz, 1H), 8.45 (d, *J* = 1.9 Hz, 1H), 7.90 (t, *J* = 2.0 Hz, 1H), 5.01 (dd, *J* = 9.1, 4.1 Hz, 1H), 3.83 -

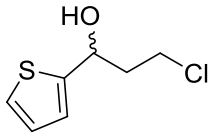
3.76 (m, 1H), 3.60 (dt, *J* = 11.1, 5.4 Hz, 1H), 2.24 - 2.15 (m, 1H), 2.10 - 2.02 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 150.2, 145.7, 141.5, 136.5, 121.2, 68.1, 41.4, 41.3.

(*rac*)-3-chloro-1-(quinolin-3-yl)propan-1-ol [(*rac*)-19a]



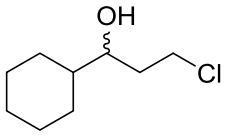
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.68 - 8.64 (m, 1H), 8.06 (s, 1H), 7.96 (d, *J* = 8.7 Hz, 1H), 7.70 (d, *J* = 8.0 Hz, 1H), 7.62 (t, *J* = 7.3 Hz, 1H), 7.49 (t, *J* = 7.6 Hz, 1H), 5.11 - 5.08 (m, 1H), 3.83 - 3.77 (m, 1H), 3.56 (dt, *J* = 11.3, 5.4 Hz, 1H), 2.28 - 2.20 (m, 1H), 2.12 - 2.02 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 149.0, 147.2, 137.1, 133.2, 129.7, 128.6, 127.9, 127.8, 127.1, 68.7, 41.6, 41.4.

(*rac*)-3-chloro-1-(thiophen-2-yl)propan-1-ol [(*rac*)-20a]



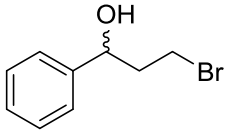
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.27 (dd, *J* = 5.0, 1.4 Hz, 1H), 7.02 - 6.96 (m, 2H), 5.20 (dd, *J* = 8.5, 5.2 Hz, 1H), 3.78 - 3.72 (m, 1H), 3.58 (dt, *J* = 10.9, 5.9 Hz, 1H), 2.37 - 2.28 (m, 2H), 2.24 - 2.15 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 147.6, 126.9, 125.1, 124.3, 67.2, 41.6.

(*rac*)-3-chloro-1-cyclohexylpropan-1-ol [(*rac*)-21a]



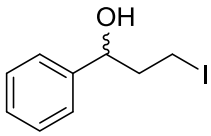
^{1}H NMR (400 MHz, $CDCl_3$) δ 3.70 - 3.66 (m, 2H), 3.58 - 3.53 (m, 1H), 1.98 (s, 1H), 1.93 - 1.71 (m, 5H), 1.65 (d, *J* = 10.7 Hz, 1H), 1.35 - 0.90 (m, 6H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 73.0, 43.8, 42.2, 36.8, 29.1, 28.0, 26.5, 26.3, 26.1.

(*rac*)-3-bromo-1-phenylpropan-1-ol [(*rac*)-22a]



^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 - 7.36 (m, 4H), 7.32 - 7.28 (m, 1H), 4.90 (dd, *J* = 8.4, 4.7 Hz, 1H), 3.60 - 3.54 (m, 1H), 3.43 - 3.37 (m, 1H), 2.35 - 2.26 (m, 1H), 2.19 - 2.12 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 143.6, 128.8, 128.0, 125.9, 72.3, 41.6, 30.4.

(*rac*)-3-iodo-1-phenylpropan-1-ol [(*rac*)-23a]

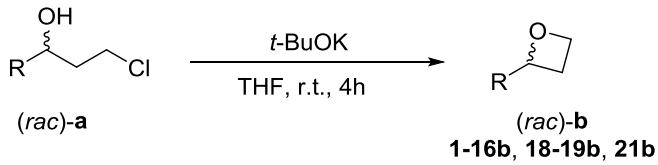


^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37 (d, *J* = 4.3 Hz, 4H), 7.32 - 7.28 (m, 1H), 4.83 (dd, *J* = 8.2, 4.8 Hz, 1H), 3.35 - 3.29 (m, 1H), 3.22 - 3.16 (m, 1H), 2.31 -

2.22 (m, 1H), 2.21 - 2.12 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 142.5, 130.1, 128.1, 125.4, 74.3, 42.4, 3.6.

Synthesis of racemic oxetanes:

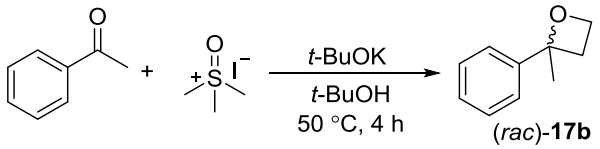
Method A



(*rac*)-**a** (*rac*)-**b**

1-16b, **18-19b**, **21b**

Method B

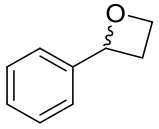


(*rac*)-**17b**

Racemic oxetanes **1-16b**, **18-19b**, and **21b** were synthesized from the corresponding γ-haloalcohols (Method A)[21]. General procedure: To a 100-mL round-bottom flask, 10 mmol of γ-haloalcohols (*rac*)-**a** substrates and 20 mL THF were added, followed by the addition of 3.4 g (30 mmol) of potassium tert-butoxide (*t*-BuOK). The reaction mixture was then stirred at room temperature for 4 h. Afterward, the reaction mixture was quenched with 10 mL of distilled water, extracted with ethyl acetate (3 × 15 mL), and washed with saturated brine. The organic layer was then dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to obtain the crude product. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl acetate = 50:1 ~ 10:1) to afford the racemic oxetanes (*rac*)-**b**.

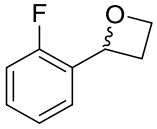
Racemic oxetane **17b** was synthesized from acetophenone (Method B)[22]. To a 200-mL round-bottom flask, 20 mmol of trimethylsulfoxonium iodide (4.4 g) and 20 mL of tertbutanol were added, followed by the addition of 2.2 g (20 mmol) of *t*-BuOK. The reaction mixture was then heated to 50 °C in an oil bath and stirred for 2 h. Afterwards, a solution of 10 mmol acetophenone in 10 mL tertbutanol was added dropwise to the reaction mixture. The reaction was allowed to proceed at 50 °C for 24 h. Water was added and the resulting layers were separated. The aqueous phase was extracted with hexane (thrice). The organic layers were then combined, dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to obtain the crude product. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl acetate = 80:1) to afford the racemic oxetane (*rac*)-**17b**.

(*rac*)-2-phenyloxetane [(*rac*)-1b]



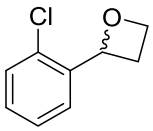
^{1}H NMR (400 MHz, CDCl$_3$) δ 7.48 - 7.46 (m, 2H), 7.42 (t, *J* = 7.5 Hz, 2H), 7.36 - 7.30 (m, 1H), 5.84 (t, *J* = 7.5 Hz, 1H), 4.85 (td, *J* = 8.0, 5.8 Hz, 1H), 4.68 (dt, *J* = 9.3, 5.8 Hz, 1H), 3.09 - 2.99 (m, 1H), 2.74 - 2.64 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 143.6, 128.5, 127.9, 125.3, 83.0, 68.3, 30.8.

(*rac*)-2-(2-fluorophenyl)oxetane [(*rac*)-2b]



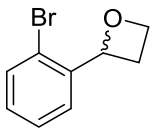
^{1}H NMR (400 MHz, CDCl$_3$) δ 7.67 (t, *J* = 7.5 Hz, 1H), 7.29 - 7.24 (m, 1H), 7.20 (t, *J* = 7.4 Hz, 1H), 7.01 (t, *J* = 10.2 Hz, 1H), 6.05 (t, *J* = 7.6 Hz, 1H), 4.83 (td, *J* = 8.1, 6.2 Hz, 1H), 4.68 (dt, *J* = 9.2, 5.9 Hz, 1H), 3.12 - 3.04 (m, 1H), 2.70 - 2.61 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 159.3 (d, *J* = 245.0 Hz), 130.8 (d, *J* = 14.0 Hz), 129.2 (d, *J* = 8.0 Hz), 126.9 (d, *J* = 4.3 Hz), 124.3 (d, *J* = 3.5 Hz), 115.2 (d, *J* = 20.9 Hz), 77.7, 68.8, 29.9.

(*rac*)-2-(2-chlorophenyl)oxetane [(*rac*)-3b]



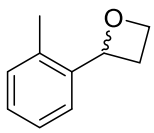
^{1}H NMR (400 MHz, CDCl$_3$) δ 7.75 (dt, *J* = 7.4, 1.4 Hz, 1H), 7.39 - 7.30 (m, 2H), 7.27 - 7.19 (m, 1H), 6.02 (t, *J* = 7.5 Hz, 1H), 4.84 (ddd, *J* = 8.4, 7.4, 5.8 Hz, 1H), 4.65 (dt, *J* = 9.1, 6.0 Hz, 1H), 3.24 - 3.13 (m, 1H), 2.58 - 2.45 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 141.4, 130.4, 129.2, 128.5, 127.0, 126.0, 80.4, 68.6, 30.0.

(*rac*)-2-(2-bromophenyl)oxetane [(*rac*)-4b]



^{1}H NMR (400 MHz, CDCl$_3$) δ 7.75 (ddd, *J* = 7.7, 1.8, 0.8 Hz, 1H), 7.51 (dd, *J* = 7.9, 1.2 Hz, 1H), 7.40 (td, *J* = 7.6, 1.2 Hz, 1H), 7.16 (td, *J* = 7.7, 1.7 Hz, 1H), 5.94 (t, *J* = 7.5 Hz, 1H), 4.83 (ddd, *J* = 8.4, 7.3, 5.8 Hz, 1H), 4.64 (dt, *J* = 9.1, 6.0 Hz, 1H), 3.27 - 3.17 (m, 1H), 2.53 - 2.43 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 142.9, 132.4, 128.8, 127.6, 126.3, 119.8, 82.2, 68.4, 30.1.

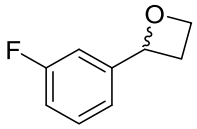
(*rac*)-2-(*o*-tolyl)oxetane [(*rac*)-5b]



^{1}H NMR (400 MHz, CDCl$_3$) δ 7 .74 (d, *J* = 7.7 Hz, 1H), 7.33 (t, *J* = 7.5 Hz, 1H), 7.24 (t, *J* = 7.3 Hz, 1H), 7.17 (d, *J* = 7.5 Hz, 1H), 6.02 (t, *J* = 7.6 Hz, 1H), 4.88 (td, *J* = 8.0, 5.9 Hz, 1H), 4.68 (dt, *J* = 9.1, 5.8 Hz, 1H), 3.16 - 3.06 (m, 1H), 2.62 - 2.52 (m, 1H), 2.21 (s, 3H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 141.7, 133.3, 130.0, 127.2, 126.1, 124.0,

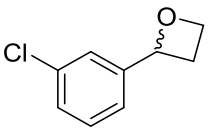
80.6, 68.1, 29.7, 18.4.

(*rac*)-2-(3-fluorophenyl)oxetane [(*rac*)-6b]



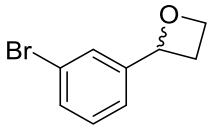
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.34 (td, *J* = 7.8, 5.7 Hz, 1H), 7.20 - 7.15 (m, 2H), 6.98 (td, *J* = 8.4, 2.5 Hz, 1H), 5.79 (t, *J* = 7.5 Hz, 1H), 4.83 (td, *J* = 8.1, 6.2 Hz, 1H), 4.66 (dt, *J* = 9.3, 5.8 Hz, 1H), 3.09 - 3.00 (m, 1H), 2.66 - 2.57 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 163.2 (d, *J* = 246.0 Hz), 146.5 (d, *J* = 6.8 Hz), 130.2 (d, *J* = 8.2 Hz), 120.7 (d, *J* = 2.8 Hz), 114.7 (d, *J* = 21.1 Hz), 112.2 (d, *J* = 22.1 Hz), 82.2, 68.5, 30.7.

(*rac*)-2-(3-chlorophenyl)oxetane [(*rac*)-7b]



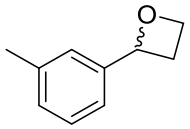
H NMR (400 MHz, $CDCl_3$) δ 7.45 (s, 1H), 7.34 - 7.24 (m, 3H), 5.77 (t, *J* = 7.5 Hz, 1H), 4.83 (td, *J* = 8.0, 5.9 Hz, 1H), 4.66 (dt, *J* = 9.2, 5.9 Hz, 1H), 3.08 - 2.99 (m, 1H), 2.67 - 2.56 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 145.8, 134.6, 129.9, 127.9, 125.4, 123.3, 82.2, 68.5, 30.7.

(*rac*)-2-(3-bromophenyl)oxetane [(*rac*)-8b]



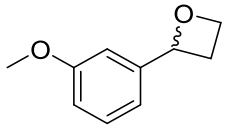
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.61 (s, 1H), 7.41 (d, *J* = 7.8 Hz, 1H), 7.32 (d, *J* = 7.7 Hz, 1H), 7.24 (t, *J* = 7.8 Hz, 1H), 5.75 (t, *J* = 7.5 Hz, 1H), 4.81 (td, *J* = 8.0, 6.0 Hz, 1H), 4.69 - 4.59 (m, 1H), 3.06 - 2.97 (m, 1H), 2.65 - 2.54 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 146.0, 130.7, 130.1, 128.2, 123.7, 122.7, 82.0, 68.4, 30.7.

(*rac*)-2-(*m*-tolyl)oxetane [(*rac*)-9b]



^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37 - 7.24 (m, 3H), 7.16 (d, *J* = 7.4 Hz, 1H), 5.83 (t, *J* = 7.5 Hz, 1H), 4.86 (td, *J* = 8.1, 5.9 Hz, 1H), 4.69 (dt, *J* = 9.1, 5.7 Hz, 1H), 3.08 - 2.99 (m, 1H), 2.75 - 2.65 (m, 1H), 2.43 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 143.5, 138.1, 128.5, 128.4, 125.8, 122.3, 82.9, 68.2, 30.7, 21.4.

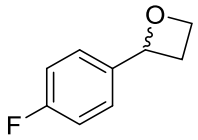
(*rac*)-2-(3-methoxyphenyl)oxetane [(*rac*)-10b]



^{1}H NMR (400 MHz, $CDCl_3$) δ 7.31 (t, *J* = 7.9 Hz, 1H), 7.05 - 6.96 (m, 2H), 6.85 (ddd, *J* = 8.2, 2.6, 1.0 Hz, 1H), 5.80 (t, *J* = 7.5 Hz, 1H), 4.83 (td, *J* = 8.0, 5.8 Hz, 1H), 4.66 (dt, *J* = 9.2, 5.8 Hz, 1H), 3.84 (s, 3H), 3.07 - 2.98 (m, 1H),

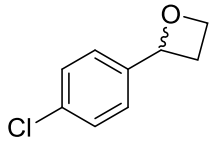
2.70 - 2.60 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 159.9, 145.4, 129.7, 117.4, 113.4, 110.5, 82.8, 68.4, 55.3, 30.7.

(*rac*)-2-(4-fluorophenyl)oxetane [(*rac*)-11b]



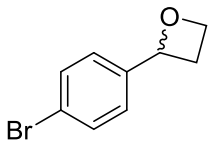
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.42 (dd, *J* = 8.4, 5.6 Hz, 2H), 7.07 (t, *J* = 8.5 Hz, 2H), 5.78 (t, *J* = 7.5 Hz, 1H), 4.81 (td, *J* = 8.4, 6.4 Hz, 1H), 4.63 (dt, *J* = 9.0, 5.7 Hz, 1H), 3.04 - 2.96 (m, 1H), 2.68 - 2.59 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 162.4 (d, *J* = 245.7 Hz), 139.4 (d, *J* = 3.0 Hz), 127.2 (d, *J* = 8.2 Hz), 115.4 (d, *J* = 21.5 Hz), 82.4, 68.2, 30.9.

(*rac*)-2-(4-chlorophenyl)oxetane [(*rac*)-12b]



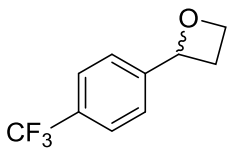
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.39 - 7.31 (m, 4H), 5.76 (t, *J* = 7.5 Hz, 1H), 4.81 (td, *J* = 8.0, 5.9 Hz, 1H), 4.63 (dt, *J* = 9.2, 5.8 Hz, 1H), 3.05 - 2.96 (m, 1H), 2.64 - 2.54 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 142.1, 133.4, 128.6, 126.7, 82.1, 68.2, 30.8.

(*rac*)-2-(4-bromophenyl)oxetane [(*rac*)-13b]



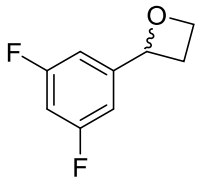
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.55 - 7.44 (m, 2H), 7.33 - 7.27 (m, 2H), 5.74 (t, *J* = 7.6 Hz, 1H), 4.80 (td, *J* = 8.1, 5.9 Hz, 1H), 4.62 (dt, *J* = 9.3, 5.8 Hz, 1H), 3.04 - 2.94 (m, 1H), 2.62 - 2.52 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 142.6, 131.5, 126.9, 121.5, 82.1, 68.2, 30.6.

(*rac*)-2-(4-(trifluoromethyl)phenyl)oxetane [(*rac*)-14b]



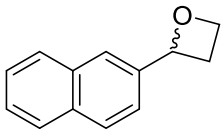
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.64 (d, *J* = 8.0 Hz, 2H), 7.53 (d, *J* = 8.1 Hz, 2H), 5.85 (t, *J* = 7.6 Hz, 1H), 4.84 (td, *J* = 8.0, 6.0 Hz, 1H), 4.66 (dt, *J* = 9.2, 5.9 Hz, 1H), 3.11 - 3.02 (m, 1H), 2.64 - 2.55 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 147.8, 129.9 (q, *J* = 32.0 Hz), 125.6 (q, *J* = 3.0 Hz), 125.4, 124.2 (q, *J* = 270.0 Hz), 82.5, 68.6, 30.7.

(*rac*)-2-(3,5-difluorophenyl)oxetane [(*rac*)-15b]



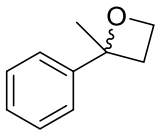
^{1}H NMR (400 MHz, $CDCl_3$) δ 6.93 - 6.87 (m, 2H), 6.66 (tt, *J* = 8.9, 2.4 Hz, 1H), 5.70 (t, *J* = 7.5 Hz, 1H), 4.76 (td, *J* = 8.2, 6.1 Hz, 1H), 4.59 (dt, *J* = 9.2, 6.1 Hz, 1H), 3.04 - 2.96 (m, 1H), 2.56 - 2.47 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 163.2 (dd, *J* = 247.0, 12.0 Hz), 148.0 (t, *J* = 8.0 Hz), 107.8 (dd, *J* = 19.0, 7.0 Hz), 103.0 (td, *J* = 26.0, 6.0 Hz), 81.7, 68.3, 30.6.

(*rac*)-2-(naphthalen-2-yl)oxetane [(*rac*)-16b]



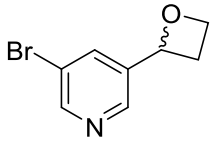
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.06 - 7.98 (m, 2H), 7.89 (d, *J* = 8.4 Hz, 1H), 7.75 - 7.73 (m, 1H), 7.69 - 7.65 (m, 2H) 7.60 - 7.57 (m, 2H), 6.56 (t, *J* = 7.5 Hz, 1H), 5.02 - 4.95 (m, 1H), 4.80 - 4.74 (m, 1H), 3.27 - 3.16 (m, 1H), 2.75 - 2.64 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 139.1, 133.4, 128.8, 128.6, 127.4, 125.7, 125.4, 125.4, 122.5, 121.2, 80.3, 68.3, 29.8.

(*rac*)-2-methyl-2-phenyloxetane [(*rac*)-17b]



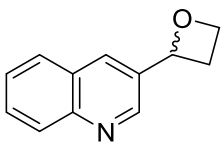
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.45 - 7.38 (m, 4H), 7.30 - 7.26 (m, 1H), 4.66 (dt, *J* = 8.6, 6.3 Hz, 1H), 4.55 (dt, *J* = 9.1, 6.6 Hz, 1H), 2.86 - 2.73 (m, 1H), 1.77 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$)**δ 148.2, 128.2, 126.6, 123.6, 86.5, 64.5, 35.5, 30.7.

(*rac*)-3-bromo-5-(oxetan-2-yl) pyridine [(*rac*)-18b]



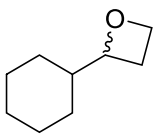
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.59 (d, *J* = 2.3 Hz, 1H), 8.49 (d, *J* = 1.9 Hz, 1H), 7.96 (t, *J* = 2.1 Hz, 1H), 5.79 (t, *J* = 7.5 Hz, 1H), 4.83 (td, *J* = 8.0, 5.9 Hz, 1H), 4.66 (dt, *J* = 9.2, 5.9 Hz, 1H), 3.11 - 3.03 (m, 1H), 2.66 - 2.58 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 150.3, 145.2, 140.7, 135.7, 121.1, 79.8, 68.7, 30.5.

(*rac*)-3-(oxetan-2-yl)quinoline [(*rac*)-19b]



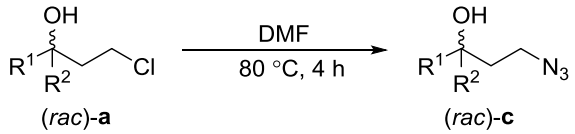
^{1}H NMR (400 MHz, $CDCl_3$) δ 8.94 (d, *J* = 2.2 Hz, 1H), 8.21 (s, 1H), 8.11 (d, *J* = 8.5 Hz, 1H), 7.83 (d, *J* = 8.2 Hz, 1H), 7.74 - 7.66 (m, 1H), 7.55 (td, *J* = 8.1, 1.2 Hz, 1H), 6.01 (t, *J* = 7.6 Hz, 1H), 4.90 (td, *J* = 8.0, 5.8 Hz, 1H), 4.75 (dt, *J* = 9.2, 5.8 Hz, 1H), 3.18 - 3.09 (m, 1H), 2.78 - 2.69 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 148.6, 147.9, 136.1, 132.3, 129.6, 129.3, 128.0, 127.8, 127.0, 81.0, 68.7, 30.7.

(*rac*)-2-cyclohexyloxetane [(*rac*)-21b]



^{1}H NMR (400 MHz, $CDCl_3$) δ 4.63 (td, *J* = 8.1, 5.9 Hz, 1H), 4.51 - 4.35 (m, 2H), 2.60 - 2.48 (m, 1H), 2.42 - 2.29 (m, 1H), 1.89 - 1.81 (m, 1H), 1.79 - 1.53 (m, 5H), 1.31 - 1.09 (m, 3H), 0.91 - 0.74 (m, 2H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 86.8, 68.2, 44.8, 27.6, 27.5, 26.6, 26.2, 25.8, 25.6.

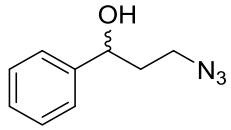
Synthesis of racemic γ-azidoalcohols[23]:



(*rac*)-**a** (*rac*)-**c**

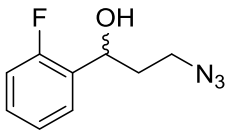
General procedure: To a 10-mL round-bottom flask, 1.0 mmol of racemic γ-haloalcohol substrates (*rac*)-**a** and 2 mL of *N*, *N*-dimethylformamide (DMF) were added, followed by the addition of 4.0 mmol 260.0 mg (4.0 mmol)NaN_3. The reaction mixture was then stirred at room temperature for 15 min. The temperature was then gradually raised to 80 °C and the reaction was allowed to proceed for 4 h. Afterward, the reaction mixture was quenched with 10 mL of distilled water, extracted with ethyl acetate (3 × 5 mL), and washed with distilled water (twice) and saturated NH_4Cl solution (thrice). The organic layer was then dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to obtain the crude product. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl acetate = 10:1 ~ 3:1) to afford the racemic γ-azidoalcohols (*rac*)-**c**.

(*rac*)-3-azido-1-phenylpropan-1-ol [(*rac*)-1c]



^{1}H NMR (400 MHz, **DMSO-*d*$_6$)** δ 7.39 - 7.32 (m, 4H), 7.27 - 7.23 (m, 1H), 5.50 - 5.41 (m, 1H), 4.71 - 4.63 (m, 1H), 3.52 - 3.44 (m, 1H), 3.41 - 3.32 (m, 1H), 1.91 - 1.82 (m, 2H). **^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 145.7, 128.2, 127.0, 125.7, 69.6, 47.9, 38.2.

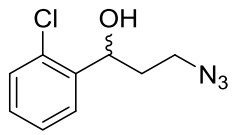
(*rac*)-3-azido-1-(2-fluorophenyl)propan-1-ol [(*rac*)-2c]



^{1}H NMR (400 MHz, **DMSO-*d*$_6$)** δ 7.52 (t, *J* = 7.7 Hz, 1H), 7.32 - 7.10 (m, 3H), 5.53 (d, *J* = 5.0 Hz, 1H), 4.94 (dt, *J* = 8.0, 5.0 Hz, 1H), 3.51 - 3.39 (m, 2H), 1.88 - 1.80 (m, 2H). **^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 158.9 (d, *J* = 242.0 Hz), 132.3 (d, *J* = 13.0 Hz), 128.7 (d, *J* = 9.0 Hz), 127.5 (d, *J* = 4.0 Hz),

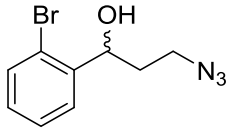
124.4 (d, *J* = 4.0 Hz), 115.0 (d, *J* = 21.0 Hz), 63.2, 47.6, 36.9.

(*rac*)-3-azido-1-(2-chlorophenyl)propan-1-ol [(*rac*)-3c]



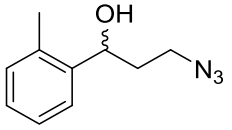
^{1}H NMR (400 MHz, **DMSO-*d*$_6$)** δ 7.61 (d, *J* = 7.7 Hz, 1H), 7.39 - 7.34 (m, 2H), 7.29 - 7.24 (m, 1H), 5.61 (d, *J* = 4.3 Hz, 1H), 5.01 (dd, *J* = 8.6, 3.9 Hz, 1H), 3.49 - 3.46 (m, 2H), 1.93 - 1.85 (m, 1H), 1.73 - 1.64 (m, 1H).**^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 142.9, 130.4, 129.0, 128.5, 127.5, 127.3, 66.0, 47.6, 36.5.

(*rac*)-3-azido-1-(2-bromophenyl)propan-1-ol [(*rac*)-4c]



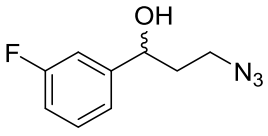
^{1}H NMR (400 MHz, **DMSO-*d*$_6$)** δ 7.60 (dd, *J* = 7.8, 1.8 Hz, 1H), 7.55 (dd, *J* = 8.0, 1.3 Hz, 1H), 7.40 (t, *J* = 7.5 Hz, 1H), 7.19 (td, *J* = 7.6, 1.9 Hz, 1H), 5.65 (d, *J* = 4.6 Hz, 1H), 5.00 - 4.90 (m, 1H), 3.54 - 3.43 (m, 2H), 1.96 - 1.83 (m, 1H), 1.72 - 1.59 (m, 1H). **^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 144.5, 132.2, 128.9, 127.9, 127.7, 120.8, 68.3, 47.7, 36.6.

(*rac*)-3-azido-1-(o-tolyl)propan-1-ol [(*rac*)-5c]



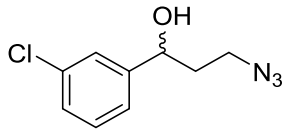
^{1}H NMR (400 MHz, **DMSO-*d*$_6$)** δ 7.45 (d, *J* = 7.6 Hz, 1H), 7.21 - 7.10 (m, 3H), 5.31 - 5.29 (m, 1H), 4.85 - 4.83 (m, 1H), 3.52 - 3.40 (m, 2H), 2.28 (s, 3H), 1.83 - 1.67 (m, 2H). **^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 143.7, 133.6, 130.0, 126.6, 125.9, 125.3, 65.9, 48.0, 36.9, 18.5.

(*rac*)-3-azido-1-(3-fluorophenyl)propan-1-ol [(*rac*)-6c]



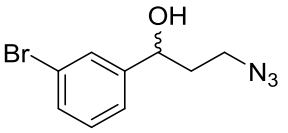
^{1}H NMR (400 MHz, **DMSO-*d*$_6$)** δ 7.39 - 7.33 (m, 1H), 7.18 - 7.14 (m, 2H), 7.05 (t, *J* = 8.6 Hz, 1H), 5.54 (dd, *J* = 4.7, 1.6 Hz, 1H), 4.66 (dt, *J* = 8.0, 5.0 Hz, 1H), 3.48 - 3.41 (m, 1H), 3.39 - 3.32 (m, 1H), 1.88 - 1.78 (m, 2H). **^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 162.3 (d, *J* = 242.0 Hz), 148.8 (d, *J* = 6.0 Hz), 130.1 (d, *J* = 8.2 Hz), 121.7 (d, *J* = 2.6 Hz), 113.6 (d, *J* = 21.0 Hz), 112.3 (d, *J* = 21.6 Hz), 68.9, 47.7, 37.9.

(*rac*)-3-azido-1-(3-chlorophenyl)propan-1-ol [(*rac*)-7c]



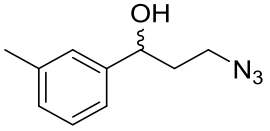
^{1}H NMR (400 MHz, DMSO-*d*$_6$) δ 7.40 - 7.27 (m, 4H), 5.55 (d, *J* = 4.6 Hz, 1H), 4.67 - 4.63 (m, 1H), 3.48 - 3.41 (m, 1H), 3.39 - 3.32 (m, 1H), 1.87 - 1.77 (m, 2H). **^{13}C NMR (100 MHz, DMSO-*d*$_6$)** δ 148.3, 133.0, 130.1, 126.8, 125.6, 124.4, 68.9, 47.7, 37.9.

(*rac*)-3-azido-1-(3-bromophenyl)propan-1-ol [(*rac*)-8c]



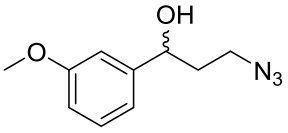
^{1}H NMR (400 MHz, DMSO-*d*$_6$) δ 7.54 (s, 1H), 7.43 (d, *J* = 7.8, 1.8 Hz, 1H), 7.35 - 7.26 (m, 2H), 5.55 (d, *J* = 4.7 Hz, 1H), 4.64 (dt, *J* = 9.1, 5.0 Hz, 1H), 3.47 - 3.41 (m, 1H), 3.39 - 3.33 (m, 1H), 1.87 - 1.77 (m, 2H). **^{13}C NMR (100 MHz, DMSO-*d*$_6$)** δ 148.5, 130.4, 129.7, 128.4, 124.8, 121.6, 68.9, 47.7, 37.9.

(*rac*)-3-azido-1-(*m*-tolyl)propan-1-ol [(*rac*)-9c]



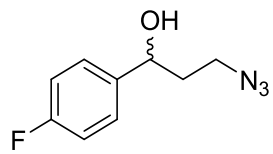
^{1}H NMR (400 MHz, DMSO-*d*$_6$) δ 7.21 (t, *J* = 7.6 Hz, 1H), 7.15 - 7.10 (m, 2H), 7.04 (d, *J* = 7.5 Hz, 1H), 5.35 (d, *J* = 4.5 Hz, 1H), 4.60 - 4.58 (dt, *J* = 7.6, 5.4 Hz, 1H), 3.46 - 3.39 (m, 1H), 3.35 - 3.31 (m, 1H), 2.30 (s, 3H), 1.80 (q, *J* = 6.8 Hz, 2H). **^{13}C NMR (100 MHz, DMSO-*d*$_6$)** δ 145.6, 137.2, 128.1, 127.5, 126.3, 122.8, 69.5, 47.9, 38.2, 21.2.

(*rac*)-3-azido-1-(3-methoxyphenyl)propan-1-ol [(*rac*)-10c]



^{1}H NMR (400 MHz, DMSO-*d*$_6$) δ 7.25 (t, *J* = 7.9 Hz, 1H), 6.95 - 6.91 (m, 2H), 6.81 (d, *J* = 8.1 Hz, 1H), 5.44 (dd, *J* = 4.4, 1.8 Hz, 1H), 4.66 - 4.61 (m, 1H), 3.75 (s, 3H), 3.49 - 3.42 (m, 1H), 3.40 - 3.33 (m, 1H), 1.84 (q, *J* = 6.4 Hz, 2H). **^{13}C NMR (100 MHz, DMSO-*d*$_6$)** δ 159.3, 147.4, 129.3, 117.9, 112.4, 111.2, 69.5, 55.0, 47.9, 38.2.

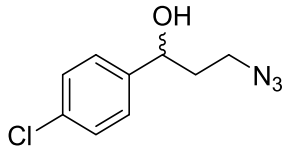
(*rac*)-3-azido-1-(4-fluorophenyl)propan-1-ol [(*rac*)-11c]



^{1}H NMR (400 MHz, DMSO-*d*$_6$) δ 7.39 - 7.35 (m, 2H), 7.17 - 7.11 (m, 2H), 5.45 (d, *J* = 4.6 Hz, 1H), 4.64 (dt, *J* = 7.5, 5.2 Hz, 1H), 3.46 - 3.40 (m, 1H), 3.36 - 3.31 (m, 1H), 1.81 (q, *J* = 7.2 Hz, 2H). **^{13}C NMR (100 MHz, DMSO-*d*$_6$)** δ 161.2 (d, *J* = 241.0 Hz), 141.7 (d, *J* = 2.8 Hz), 127.6 (d, *J* =

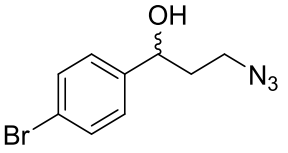
8.0 Hz), 114.8 (d, *J* = 21.0 Hz), 68.9, 47.8, 38.1.

(*rac*)-3-azido-1-(4-chlorophenyl)propan-1-ol [(*rac*)-12c]



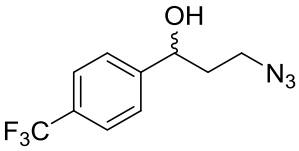
^{1}H NMR (400 MHz, **DMSO-*d*$_6$)** δ 7.39 - 7.35 (m, 4H), 5.52 (d, *J* = 4.6 Hz, 1H), 4.65 (td, *J* = 8.2, 4.9 Hz, 1H), 3.47 - 3.41 (m, 1H), 3.38 - 3.32 (m, 1H), 1.81 (q, *J* = 6.8 Hz, 2H). **^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 144.6, 131.4, 128.1, 127.6, 68.9, 47.7, 38.0.

(*rac*)-3-azido-1-(4-bromophenyl)propan-1-ol [(*rac*)-13c]



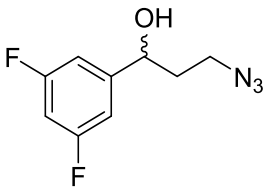
^{1}H NMR (400 MHz, **DMSO-*d*$_6$)** δ 7.51 (d, *J* = 8.4 Hz, 2H), 7.30 (d, *J* = 8.4 Hz, 2H), 5.51 (d, *J* = 4.7 Hz, 1H), 4.62 (dt, *J* = 6.8, 6.1 Hz, 1H), 3.47 - 3.40 (m, 1H), 3.39 - 3.32 (m, 1H), 1.80 (q, *J* = 6.8 Hz, 2H).**^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 145.0, 131.0, 128.0, 119.9, 68.9, 47.7, 38.0.

(*rac*)-3-azido-1-(4-(trifluoromethyl)phenyl)propan-1-ol [(*rac*)-14c]



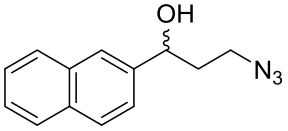
^{1}H NMR (400 MHz, **DMSO-*d*$_6$)** δ 7.67 (d, *J* = 8.0 Hz, 2H), 7.58 (d, *J* = 8.1 Hz, 2H), 5.69 (d, *J* = 4.6 Hz, 1H), 4.78 (dt, *J* = 8.0, 5.1 Hz, 1H), 3.52 - 3.46 (m, 1H), 3.42 - 3.36 (m, 1H), 1.91 - 1.81 (m, 2H). **^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 150.5, 127.9 (q, *J* = 31.0 Hz), 126.6 - 126.4 (m), 125.2 - 125.0 (m), 124.5 (q, *J* = 270.0 Hz), 69.2, 47.8, 38.1.

(*rac*)-3-azido-1-(3,5-difluorophenyl)propan-1-ol [(*rac*)-15c]



^{1}H NMR (400 MHz, **DMSO-*d*$_6$)** δ 7.09 - 7.04 (m, 3H), 5.66 (d, *J* = 4.9 Hz, 1H), 4.67 (dt, *J* = 8.7, 4.6 Hz, 1H), 3.47 - 3.42 (m, 1H), 3.40 - 3.37 (m, 1H), 1.90 - 1.74 (m, 2H). **^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 163.7 (d, *J* = 12.9 Hz), 161.2 (d, *J* = 13.0 Hz), 150.7 (t, *J* = 8.2 Hz), 108.8 (dd, *J* = 25.0, 7.0 Hz), 102.2 (t, *J* = 25.7 Hz), 68.7, 47.7, 37.7.

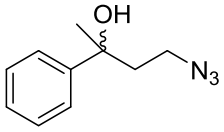
(*rac*)-3-azido-1-(naphthalen-2-yl)propan-1-ol [(*rac*)-16c]



^{1}H NMR (400 MHz, **DMSO-*d*$_6$)** δ 8.19 - 8.13 (m, 1H), 7.95 - 7.68 (m, 3H), 7.58 - 7.48 (m, 3H), 5.67 - 5.60 (m, 1H), 5.49 - 5.41 (m, 1H), 3.70 -

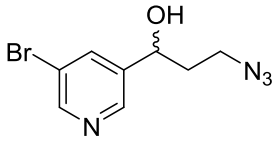
3.59 (m, 1H), 3.46 - 3.41 (m, 1H), 2.09 - 1.85 (m, 2H).**^{13}C NMR (100 MHz, DMSO-*d*$_6$)** δ 141.3, 133.4, 129.8, 128.8, 127.3, 126.0, 125.5, 123.2, 122.9, 66.4, 48.2, 37.7.

(*rac*)-4-azido-2-phenylbutan-2-ol [(*rac*)-17c]



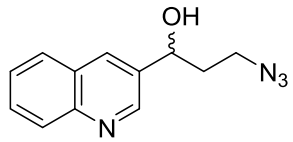
^{1}H NMR (400 MHz, DMSO-*d*$_6$) δ 7.46 - 7.44 (m, 2H), 7.31 (t, *J* = 7.4 Hz, 2H), 7.21 - 7.19 (m, 1H), 5.20 (s, 1H), 3.36 - 3.28 (m, 1H), 3.04 - 2.97 (m, 1H), 2.03 - 1.98 (m, 2H), 1.46 (s, 3H).**^{13}C NMR (100 MHz, DMSO-*d*$_6$)** δ 148.3, 127.9, 126.2, 124.8, 71.8, 46.9, 42.1, 30.5.

(*rac*)-3-azido-1-(5-bromopyridin-3-yl)propan-1-ol [(*rac*)-18c]



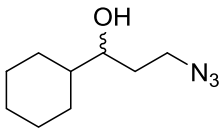
^{1}H NMR (400 MHz, DMSO-*d*$_6$) δ 8.56 (dd, *J* = 16.0, 2.3 Hz, 2H), 8.00 (t, *J* = 2.1 Hz, 1H), 5.72 (d, *J* = 4.8 Hz, 1H), 4.72 (dt, *J* = 7.9, 5.0 Hz, 1H), 3.50 - 3.45 (m, 1H), 3.43 - 3.38 (m, 1H), 1.90 - 1.85 (m, 2H).**^{13}C NMR (100 MHz, DMSO-*d*$_6$)** δ 148.9, 146.2, 143.1, 136.0, 120.2, 67.0, 47.6, 37.5.

(*rac*)-3-azido-1-(quinolin-3-yl)propan-1-ol [(*rac*)-19c]



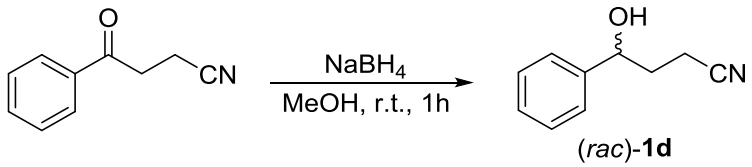
^{1}H NMR (400 MHz, DMSO-*d*$_6$) δ 8.95 (d, *J* = 2.2 Hz, 1H), 8.28 (d, *J* = 2.2 Hz, 1H), 8.03 (d, *J* = 8.4 Hz, 1H), 7.97 (dd, *J* = 8.2, 1.5 Hz, 1H), 7.71 (ddd, *J* = 8.4, 6.8, 1.5 Hz, 1H), 7.58 (ddd, *J* = 8.1, 6.8, 1.2 Hz, 1H), 5.80 (d, *J* = 4.6 Hz, 1H), 4.93 (dd, *J* = 11.2, 6.8 Hz, 1H), 3.58 - 3.50 (m, 1H), 3.47 - 3.41 (m, 1H), 2.00 (q, *J* = 6.7 Hz, 2H).**^{13}C NMR (100 MHz, DMSO-*d*$_6$)** δ 149.7, 147.0, 138.1, 132.1, 129.1, 128.7, 128.1, 127.5, 126.7, 67.8, 47.7, 37.6.

(*rac*) 3-azido-1-cyclohexylpropan-1-ol [(*rac*)-21c]



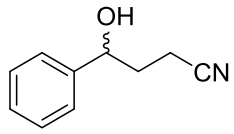
^{1}H NMR (400 MHz, DMSO-*d*$_6$) δ 4.47 (d, *J* = 5.9 Hz, 1H), 3.47 - 3.39 (m, 1H), 3.39 - 3.31 (m, 1H), 3.28 - 3.20 (m, 1H), 1.80 - 1.55 (m, 6H), 1.54 - 1.43 (m, 1H), 1.26 - 1.08 (m, 4H), 1.07 - 0.88 (m, 2H).**^{13}C NMR (100 MHz, DMSO-*d*$_6$)** δ 71.1, 48.2, 43.6, 32.8, 28.8, 27.8, 26.3, 26.0, 25.9.

Synthesis of racemic γ-cyanohydrin[24]:



To a 10-mL round-bottom flask, 159.2 mg (1.0 mmol) of 4-oxo-4-phenylbutanenitrile and 2 mL of methanol were added. The flask was cooled to 0 °C, followed by the addition of 45.4 mg (1.2 mmol) of $NaBH_4$. The reaction mixture was then stirred at room temperature for 1 h. Afterward, the methanol solvent was removed under reduced pressure, followed by the addition of 5 mL distilled water to the flask. The mixture was then extracted with ethyl acetate (3×5 mL) and saturated brine (twice). The organic layer was then dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to obtain the crude product. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl acetate = 2:1) to afford the racemic γ-cyanohydrin (*rac*)-**1d**.

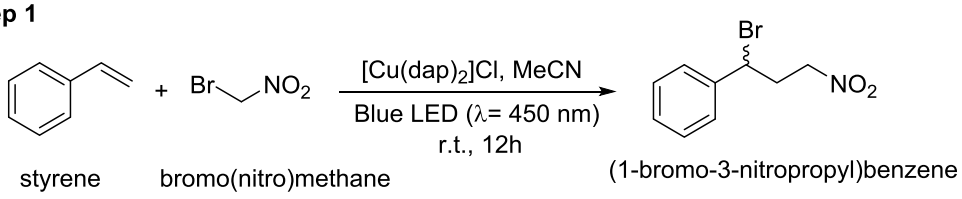
(*rac*)-4-hydroxy-4-phenylbutanenitrile [(*rac*)-1d]



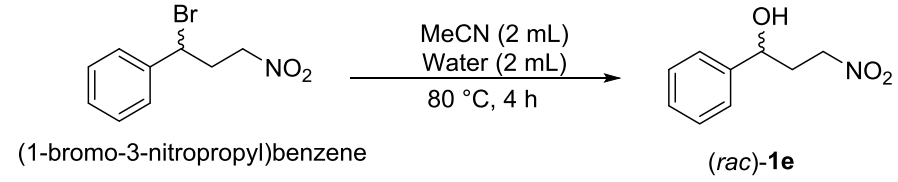
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 - 7.28 (m, 5H), 4.75 (dd, *J* = 8.1, 5.3 Hz, 1H), 2.81 (s, 1H), 2.50 - 2.43 (m, 1H), 2.37 - 2.29 (m, 1H), 2.01 - 1.94 (m, 2H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 142.8, 128.3, 127.6, 125.4, 119.7, 71.6, 33.8, 13.3.

Synthesis of racemic γ-nitroalcohol[25]:

Step 1

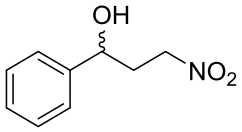


Step 2



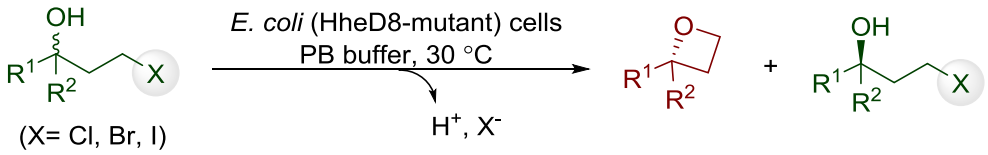
To a 10-mL round-bottom flask equipped with a magnetic stirring bar was charged with $[Cu(dap)_2]Cl$ (4.4 mg, 1 mol%, 0.01 equiv). Then dry MeCN (2 mL) was added under positive nitrogen atmosphere. Then 36 μL (0.5 mmol) of bromo(nitro)methane and 58 μL (0.5 mmol) styrene were added under nitrogen atmosphere. A Teflon sealed inlet for a glass rod was placed on the reaction tube, through which irradiation with $LED_{450\ nm}$ took place from above. The mixture was stirred in an aluminum block at room temperature for 12 h. Afterward, the reaction mixture was concentrated under reduced pressure to obtain the crude product. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl acetate = 5:1) to afford the intermediate (1-bromo-3-nitropropyl)benzene. Then a 25-mL pressure tube equipped with a magnetic stirring bar was charged with 122.0 mg (0.50 mmol) of (1-bromo-3-nitropropyl)benzene and a mixture of MeCN and water (1:1, 4.0 mL) was added. The reaction mixture was then refluxed at 80 °C for 4 h. Afterward, the reaction mixture was concentrated under reduced pressure to obtain the crude product. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl acetate = 2:1) to afford racemic γ-nitroalcohol (*rac*)-**1e**.

(*rac*)-3-nitro-1-phenylpropan-1-ol [(*rac*)-1e]



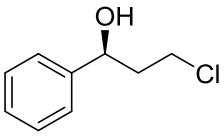
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.38 - 7.26 (m, 6H), 4.74 (dd, *J* = 8.3, 4.6 Hz, 1H), 4.54 - 4.48 (m, 1H), 4.41 - 4.36 (m, 1H), 3.42 (s, 1H), 2.37 - 2.27 (m, 2H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 142.8, 128.8, 128.2, 125.6, 72.3, 71.0, 35.8.

5. Biocatalytic enantioselective formation of oxetanes



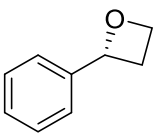
General procedure: In a 200 mL round-bottom flask, a resting cell suspension of *E. coli* (HheD8-M4) at a concentration of 10 g dcw/L was prepared in 100 mL of PB buffer (50 mM, pH 8.5). To this suspension, 2 mmol of γ-haloalcohol (*rac*)-**a** was added to a final concentration of 20 mM. The reaction mixture was then stirred at 30 °C. Upon completion of the enzymatic reaction, the mixture was subjected to extraction using ethyl acetate (3 × 70 mL). The organic phases were separated by centrifugation (8800 × *g*, 3 min), combined, dried over anhydrous Na_2SO_4, and evaporated at reduced pressure. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl acetate = 50:1 ~ 20:1; dichloromethaneethyl: ethyl acetate = 6:1 ~ 3:1) on silica gel to afford the desired chiral oxetane (*R*)-**b** and γ-haloalcohol (*S*)-**a**.

(*S*)-3-chloro-1-phenylpropan-1-ol [(*S*)-1a]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **1a** (2 mmol) and 10 g dcw/L *E.* coli (HheD8-M4) cells, 30 °C, reaction for 8 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-1a** as a white solid in 50% yield (179.6 mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.39 - 7.34 (m, 4H), 7.32 - 7.28 (m, 1H), 4.91 (dd, *J* = 8.5, 4.7 Hz, 1H), 3.75 - 3.69 (m, 1H), 3.54 (dt, *J* = 10.9, 5.9 Hz, 1H), 2.35 - 2.16 (m, 2H), 2.11 - 2.03 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 143.8, 128.7, 128.0, 125.9, 71.3, 41.8, 41.5. **$[\alpha]_D^{25}$** = -31.7 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated >99% *ee*: $t_{(S)}$ (major) = 44.8 min, $t_{(R)}$ (minor) = 48.7 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{12}ClO$ $[M+H]^+$: 171.0577, found: 171.0574. **m.p.**: 51.4-52.4 °C.

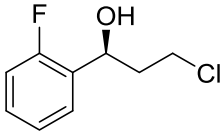
(*R*)-2-phenyloxetane [(*R*)-1b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **1a** (2 mmol) and 10 g dcw/L *E.* coli (HheD8-M4) cells, 30 °C, reaction for 8 h. The crude product was purified by flash column chromatography

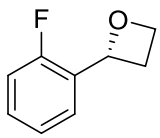
on silica gel (petroleum ether: ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-1b** as a light yellow liquid in 41% yield (117.0 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.48 - 7.45 (m, 2H), 7.41 (t, *J* = 7.2 Hz, 2H), 7.34 - 7.30 (m, 1H), 5.83 (t, *J* = 7.5 Hz, 1H), 4.85 (td, *J* = 8.0, 5.8 Hz, 1H), 4.68 (dt, *J* = 9.2, 5.8 Hz, 1H), 3.08 - 2.99 (m, 1H), 2.72 - 2.64 (m, 1H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) δ 143.6, 128.6, 127.9, 125.3, 83.0, 68.4, 30.8. **[α]$_D^{25}$** = + 174.91 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ = 210 nm) indicated 98% *ee*: $t_{(S)}$ (minor) = 10.1 min, $t_{(R)}$ (major) = 11.3 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}NaO$ $[M+Na]^+$: 157.0629, found: 157.0634.

(*S*)-3-chloro-1-(2-fluorophenyl)propan-1-ol [(*S*)-2a]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **2a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 6 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-2a** as a light yellow liquid in 49% yield (184.8 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.45 (t, *J* = 7.5 Hz, 1H), 7.27 (q, *J* = 5.8 Hz, 1H), 7.16 (t, *J* = 7.5 Hz, 1H), 7.03 (t, *J* = 11.1 Hz, 1H), 5.22 (dd, *J* = 8.6, 4.4 Hz, 1H), 3.78 - 3.71 (m, 1H), 3.61 (dt, *J* = 11.0, 5.9 Hz, 1H), 2.27 - 2.14 (m, 3H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) δ 159.8 (d, *J* = 245.0 Hz), 130.6 (d, *J* = 13.0 Hz), 129.4 (d, *J* = 8.0 Hz), 127.4 (d, *J* = 5.0 Hz), 124.6 (d, *J* = 3.0 Hz), 115.6 (d, *J* = 22.0 Hz), 65.9 (d, *J* = 3.0 Hz), 41.6, 40.2. **[α]$_D^{25}$** = - 35.44 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OD-H, 10% IPA in *n*-hexane, 1.0 ml/min, λ = 210 nm) indicated 98% *ee*: $t_{(S)}$ (major) = 5.7 min, $t_{(R)}$ (minor) = 6.4 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}ClFNaO$ $[M+Na]^+$: 211.0302, found: 211.0307.

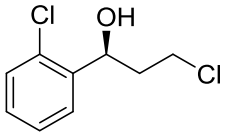
(*R*)-2-(2-fluorophenyl) oxetane [(*R*)-2b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **2a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 6 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-2b** as a light yellow liquid in 39% yield (118.4 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.66 (t, *J* = 7.5 Hz, 1H), 7.30 - 7.24 (m, 1H), 7.20 (t, *J* = 7.5 Hz, 1H), 6.05 (t, *J* = 7.6 Hz, 1H), 4.84 (td, *J* = 8.2, 6.3 Hz, 1H), 4.68 (dt, *J* = 9.2, 6.0 Hz, 1H), 3.13 - 3.05 (m, 1H), 2.70 - 2.61 (m, 1H). **^{13}C NMR (100 MHz**, **CDCl$_3$**)

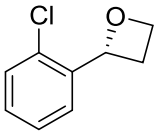
δ 159.3 (d, *J* = 244.0 Hz), 130.8 (d, *J* = 13.0 Hz), 129.2 (d, *J* = 8.0 Hz), 127.0 (d, *J* = 4.0 Hz), 124.3 (d, *J* = 4.0 Hz), 115.2 (d, *J* = 20.0 Hz), 77.8 (d, *J* = 4.0 Hz), 76.8, 30.0. **[α]$_D^{25}$** = + 148.42 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 98% *ee*: $t_{(S)}$ (minor) = 12.9 min, $t_{(R)}$ (major) = 15.3 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}FO$ $[M+Na]^+$: 153.0716, found: 153.0715.

(*S*)-3-chloro-1-(2-chlorophenyl)propan-1-ol [(*S*)-3a]



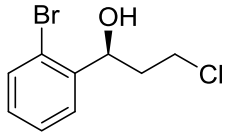
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **3a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-3a** as a light yellow liquid in 51% yield (212.1 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.57 (d, *J* = 7.7 Hz, 1H), 7.32 (q, *J* = 9.7 Hz, 2H), 7.23 (t, *J* = 7.5 Hz, 1H), 5.35 (d, *J* = 8.4 Hz, 1H), 3.84 - 3.77 (m, 1H), 3.69 (dt, *J* = 10.8, 5.2 Hz, 1H), 2.26 - 2.18 (m, 2H), 2.15 - 2.06 (m, 1H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) δ 141.2, 131.8, 129.7, 128.9, 127.3, 127.1, 68.1, 41.8, 39.8. **[α]$_D^{25}$** = - 56.66 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 94% *ee*: $t_{(R)}$ (minor) = 34.7 min, $t_{(S)}$ (major) = 36.7 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}Cl_2O$ $[M+H]^+$: 205.0187, found: 205.0194.

(*R*)-2-(2-chlorophenyl) oxetane[(*R*)-3b]



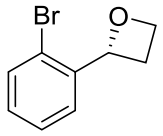
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **3a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-3b** as a colorless liquid in 43% yield (143.9 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.76 (d, *J* = 9.4 Hz, 1H), 7.37 - 7.31 (m, 2H), 7.23 (td, *J* = 7.6, 1.7 Hz, 1H), 6.02 (t, *J* = 7.5 Hz, 1H), 4.84 (td, *J* = 7.5, 6.0 Hz, 1H), 4.65 (dt, *J* = 9.1, 6.0 Hz, 1H), 3.23 - 3.15 (m, 1H), 2.55 - 2.45 (m, 1H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) δ 141.4, 130.4, 129.2, 128.5, 127.0, 126.0, 80.3, 68.6, 30.0. **[α]$_D^{25}$** = + 193.99 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 97% *ee*: $t_{(S)}$ (minor) = 11.1 min, $t_{(R)}$ (major) = 12.0 min. **HRMS** (**ESI**) *m/z*: calculated for C_9H_9ClNaO $[M+Na]^+$: 191.0240, found: 191.0233.

(*S*)-1-(2-bromophenyl)-3-chloropropan-1-ol [(*S*)-4a]



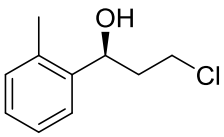
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **4a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-4a** as a light yellow liquid in 50% yield (248.8 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.53 (dd, *J* = 11.6, 9.4 Hz, 2H), 7.34 (, *J* = 7.9 Hz, 1H), 7.15 (t, *J* = 7.6 Hz, 1H), 5.28 (d, *J* = 7.6 Hz, 1H), 3.83 - 3.76 (m, 1H), 3.71 - 3.65 (m, 1H), 2.46 (s, 1H), 2.25 - 2.18 (m, 1H), 2.10 - 2.01 (m, 1H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) 142.8, 132.9, 129.2, 128.0, 127.3, 121.8, 70.3, 41.8, 39.8. **[α]$_D^{25}$** = -53.76 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 93% *ee*: $t_{(R)}$ (minor) = 36.5 min, $t_{(S)}$ (major) = 39.5 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}ClBrO$ $[M+H]^+$: 248.9682, found: 248.9682.

(*R*)-2-(2-bromophenyl) oxetane [(*R*)-4b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **4a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-4b** as a colorless liquid in 46% yield (196.3 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.76 (d, *J* = 7.6 Hz, 1H), 7.51 (d, *J* = 8.0 Hz, 1H), 7.40 (t, *J* = 7.5 Hz, 1H), 7.16 (t, *J* = 7.9 Hz, 1H), 5.94 (t, *J* = 7.5 Hz, 1H), 4.83 (td, *J* = 7.7, 6.0 Hz, 1H), 4.64 (dt, *J* = 9.1, 6.1 Hz, 1H), 3.26 - 3.18 (m, 1H), 2.52 - 2.44 (m, 1H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) δ 142.7, 132.4, 128.8, 127.6, 126.3, 119.7, 82.2, 68.39, 30.1. **[α]$_D^{25}$** = + 192.79 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 96% *ee*: $t_{(S)}$ (minor) = 11.4 min, $t_{(R)}$ (major) = 12.3 min. **HRMS** (**ESI**) *m/z*: calculated for C_9H_9BrNaO $[M+Na]^+$: 234.9734, found: 234.9737.

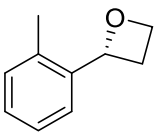
(*S*)-3-chloro-1-(o-tolyl)propan-1-ol [(*S*)-5a]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **5a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1 ~ 20:1) to

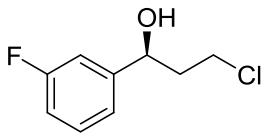
provide **(*S*)-5a** as a colorless liquid in 50% yield (185.6 mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.46 (d, *J* = 7.5 Hz, 1H), 7.26 - 7.14 (m, 3H), 5.16 (dd, *J* = 8.8, 3.9 Hz, 1H), 3.83 - 3.76 (m, 1H), 3.62 (dt, *J* = 10.8, 5.3 Hz, 1H), 2.35 (s, 3H), 2.13 - 2.00 (m, 2H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 142.0, 134.4, 130.6, 127.5, 126.4, 125.1, 67.4, 42.1, 40.5, 19.0. **$[\alpha]_D^{25}$** = - 46.64 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 93% *ee*: $t_{(S)}$ (major) = 37.8 min, $t_{(R)}$ (minor) = 40.7 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{13}ClNaO$ $[M+Na]^+$: 207.0553, found: 207.0558.

(*R*)-2-(o-tolyl) oxetane [(*R*)-5b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **5a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-5b** as a colorless liquid in 33% yield (98.7 mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.70 (d, *J* = 7.7 Hz, 1H), 7.30 (t, *J* = 7.4 Hz, 1H), 7.21 (t, *J* = 5.9 Hz, 1H), 7.14 (d, *J* = 7.6 Hz, 1H), 6.00 (t, *J* = 7.6 Hz, 1H), 4.86 (td, *J* = 7.9, 5.8 Hz, 1H), 4.65 (dt, *J* = 9.2, 5.8 Hz, 1H), 3.13 - 2.05 (m, 1H), 2.59 - 2.51 (m, 1H), 2.19 (s, 3H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 141.8, 133.4, 130.1, 127.3, 126.2, 124.1, 80.8, 68.2, 29.8, 18.5. **$[\alpha]_D^{25}$** = + 224.21 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 99% *ee*: $t_{(R)}$ (major) = 15.0 min, $t_{(S)}$ (minor) = 15.9 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{12}NaO$ $[M+Na]^+$: 171.0786, found: 171.0783.

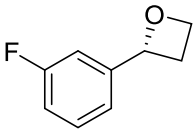
(*S*)-3-chloro-1-(3-fluorophenyl)propan-1-ol [(*S*)-6a]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **6a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 12 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-6a** as a light yellow liquid in 47% yield (179.4 mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.32 (q, *J* = 8.2 Hz, 1H), 7.09 (dd, *J* = 15.7, 7.8 Hz, 2H), 6.98 (t, *J* = 8.4 Hz, 1H), 4.93 (dd, *J* = 8.8 4.6 Hz, 1H), 3.76 - 3.70 (m, 1H), 3.54 (dt, *J* = 11.0, 5.8 Hz, 1H), 2.29 (s, 1H), 2.22 - 2.14 (m, 1H), 2.10 - 2.01 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 163.1 (d, *J* = 245.0 Hz), 146.5 (d, *J* = 6.0 Hz), 130.3 (d, *J* = 8.0 Hz), 121.4 (d, *J* = 3.0 Hz), 114.8 (d, *J* = 21.0 Hz), 112.8 (d, *J* = 22.0 Hz), 70.7, 41.6,

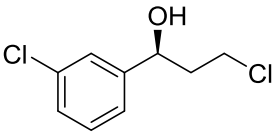
41.4. **[α]$_D^{25}$** = - 14.79 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 94% *ee*: $t_{(S)}$ (major) = 44.0 min, $t_{(R)}$ (minor) = 45.8 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}ClFO$ $[M+H]^+$: 189.0482, found: 189.0481.

(*R*)-2-(3-fluorophenyl) oxetane [(*R*)-6b]



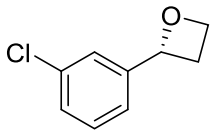
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **6a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 12 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-6b** as a light yellow liquid in 36% yield (108.7 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.34 (td, *J* = 7.8, 5.6 Hz, 1H), 7.17 (t, *J* = 8.2 Hz, 2H), 7.01 - 6.96 (m, 1H), 5.79 (t, *J* = 7.5 Hz, 1H), 4.83 (td, *J* = 8.0, 6.0 Hz, 1H), 4.66 (dt, *J* = 9.6, 5.8 Hz, 1H), 3.09 - 3.00 (m, 1H), 2.66 - 2.58 (m, 1H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) δ 163.2 (d, *J* = 245.0 Hz), 146.5 (d, *J* = 7.0 Hz), 130.2 (d, *J* = 8.0 Hz), 120.7 (d, *J* = 3.0 Hz), 114.6 (d, *J* = 21.0 Hz), 112.2 (d, *J* = 22.0 Hz), 82.2 (d, *J* = 2.0 Hz), 68.5, 30.7. **[α]$_D^{25}$** = + 165.88 (c = 1.00, CH_2Cl_2). HPLC analysis (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated >99% *ee*: $t_{(S)}$ (minor) = 14.7 min, $t_{(R)}$ (major) = 15.8 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}FO$ $[M+H]^+$: 153.0716, found: 157.0713.

(*S*)-3-chloro-1-(3-chlorophenyl)propan-1-ol [(*S*)-7a]



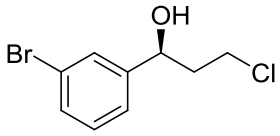
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **7a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 48 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-7a** as a light yellow liquid in 48% yield (196.0 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.35 (s, 1H), 7.30 - 7.24 (m, 2H), 7.21 (dd, *J* = 6.6, 2.1 Hz, 1H), 4.90 (dd, *J* = 8.7, 4.6 Hz, 1H), 3.74 - 3.68 (m, 1H), 3.53 (dt, *J* = 11, 5.7 Hz, 1H), 2.40 (s, 1H), 2.20 - 2.12 (m, 1H), 2.07 - 1.99 (m, 1H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) δ 145.9, 134.6, 130.0, 128.1, 126.0, 124.0, 70.7, 41.6, 41.4. **[α]$_D^{25}$** = - 21.68 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 93% *ee*: $t_{(S)}$ (major) = 43.8 min, $t_{(R)}$ (minor) = 49.2 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}Cl_2O$ $[M+H]^+$: 205.0187, found: 205.0188.

(*R*)-2-(3-chlorophenyl) oxetane [(*R*)-7b]



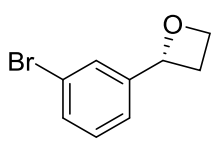
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **7a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 48 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-7b** as a light yellow liquid in 45% yield (150.9 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.45 (s, 1H), 7.33 - 7.25 (m, 3H), 5.77 (t, *J* = 7.5 Hz, 1H), 4.83 (td, *J* = 7.9, 5.8 Hz, 1H), 4.66 (dt, *J* = 9.2, 5.8 Hz, 1H), 3.08 - 3.00 (m, 1H), 2.66 - 2.57 (m, 1H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) δ 145.8, 134.6, 129.9, 127.9, 125.4, 123.3, 82.2, 68.5, 30.7. **[α]$_D^{25}$** = + 137.77 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 98% *ee*: $t_{(S)}$ (minor) = 14.4 min, $t_{(R)}$ (major) = 16.9 min. **HRMS** (**ESI**) *m/z*: calculated for C_9H_9ClNaO $[M+Na]^+$: 191.0240, found: 191.0236.

(*S*)-1-(3-bromophenyl)-3-chloropropan-1-ol [(*S*)-8a]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **8a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 48 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-8a** as a light yellow liquid in 50% yield (251.1 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.52 (s, 1H), 7.41 (d, *J* = 7.7 Hz, 1H), 7.24 (dt, *J* = 16.1, 10.3 Hz, 2H), 4.91 (dd, *J* = 8.8, 4.6 Hz, 1H), 3.76 - 3.70 (m, 1H), 3.54 (dt, *J* = 11.0, 5.7 Hz, 1H), 2.26 (s, 1H), 2.20 - 2.13 (m, 1H), 2.09 - 2.00 (m, 1H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) δ 146.2, 131.0, 130.4, 129.0, 124.5, 122.9, 70.7, 41.6, 41.4. **[α]$_D^{25}$** = - 16.69 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 92% *ee*: $t_{(S)}$ (major) = 48.0 min, $t_{(R)}$ (minor) = 54.6 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}ClBrNaO$ $[M+Na]^+$: 270.9501, found: 270.9504.

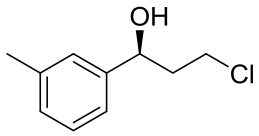
(*R*)-2-(3-bromophenyl)oxetane [(*R*)-8b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **8a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 48 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-8b** as

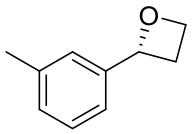
a light yellow liquid in 43% yield (182.5 mg). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.61 (s, 1H), 7.42 (d, *J* = 7.8 Hz, 1H), 7.33 (d, *J* = 7.6 Hz, 1H), 7.25 (t, *J* = 7.8 Hz, 1H), 5.77 (t, *J* = 7.5 Hz, 1H), 4.83 (td, *J* = 8.1, 6.0 Hz, 1H), 4.66 (dt, *J* = 9.2, 5.8 Hz, 1H), 3.07 - 3.00 (m, 1H), 2.65 - 2.56 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 146.0, 130.8, 130.2, 128.3, 123.8, 122.8, 82.1, 68.4, 30.7. **$[\alpha]_D^{25}$** = + 130.01 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 95% *ee*: $t_{(S)}$ (minor) = 14.8 min, $t_{(R)}$ (major) = 18.0 min. **HRMS** (**ESI**) *m/z*: calculated for C_9H_9BrNaO $[M+Na]^+$: 234.9734, found: 234.9741.

(*S*)-3-chloro-1-(m-tolyl)propan-1-ol [(*S*)-9a]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **9a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-9a** as a light yellow liquid in 51% yield (190.0 mg). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.26 (t, *J* = 7.4 Hz, 1H), 7.18 - 7.15 (m, 2H), 7.12 (d, *J* = 7.6 Hz, 1H), 4.90 (dd, *J* = 8.6, 4.6 Hz, 1H), 3.77 - 3.71 (m, 1H), 3.59 - 3.54 (m, 1H), 2.37 (s, 3H), 2.28 - 2.19 (m, 1H), 2.12 - 2.04 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 143.8, 138.5, 128.8, 128.7, 126.6, 123.0, 71.4, 41.9, 41.5, 21.6. **$[\alpha]_D^{25}$** = - 25.98 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 91% *ee*: $t_{(S)}$ (major) = 40.1 min, $t_{(R)}$ (minor) = 43.2 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{13}ClNaO$ $[M+Na]^+$: 207.0553, found: 207.0557.

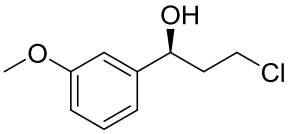
(*R*)-2-(m-tolyl)oxetane [(*R*)-9b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **9a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-9b** as a light yellow liquid in 34% yield (102.5 mg). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.29 (t, *J* = 7.7 Hz, 2H), 7.23 (d, J = 7.6 Hz, 1H), 7.13 (d, *J* = 7.4 Hz, 1H), 5.80 (t, *J* = 7.5 Hz, 1H), 4.84 (td, *J* = 8.4, 6.5 Hz, 1H), 4.67 (dt, *J* = 9.3, 5.8 Hz, 1H), 3.06 - 2.98 (m, 1H), 2.72 - 2.63 (m, 1H), 2.40 (s, 3H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 143.6, 138.3, 128.7, 128.5, 126.0, 122.4, 83.1, 68.4, 30.8, 21.6. **$[\alpha]_D^{25}$** = + 148.32 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ

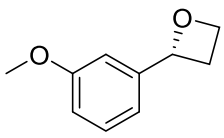
= 210 nm) indicated 99% *ee*: $t_{(S)}$ (minor) = 9.3 min, $t_{(R)}$ (major) = 10.8 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{12}NaO$ $[M+Na]^+$: 149.0966, found: 149.0961.

(*S*)-3-chloro-1-(3-methoxyphenyl)propan-1-ol [(*S*)-10a]



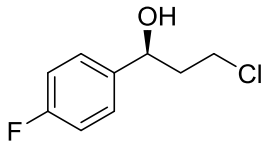
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **10a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 48 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-10a** as a light yellow liquid in 51% yield (206.9 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$**) δ 7.27 (t, *J* = 7.4 Hz, 1H), 6.92 (d, *J* = 8.8 Hz, 2H), 6.83 (d, *J* = 8.3 Hz, 1H), 4.90 (dd, *J* = 8.6, 4.8 Hz, 1H), 3.80 (s, 3H), 3.75 - 3.69 (m, 1H), 3.57 - 3.52 (m, 1H), 2.25 - 2.20 (m, 3H). **^{13}C NMR (100 MHz**, **$CDCl_3$**) δ 159.9, 145.5, 129.8, 118.1, 113.4, 111.3, 71.3, 55.4, 41.8, 41.4. **$[\alpha]_D^{25}$** = -19.79 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OD-H, 10% IPA in *n*-hexane, 1.0 ml/min, λ = 210 nm) indicated 91% *ee*: $t_{(S)}$ (major) = 11.9 min, $t_{(R)}$ (minor) = 13.8 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{14}ClO_2$ $[M+H]^+$: 201.0682, found: 201.0681.

(*R*)-2-(3-methoxyphenyl)oxetane [(*R*)-10b]



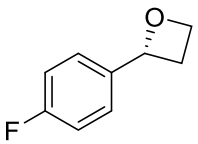
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **10a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 48 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-10b** as a light yellow liquid in 43% yield (140.9 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$**) δ 7.33 - 7.28 (m, 1H), 7.03 - 6.98 (m, 2H), 6.86 - 6.83 (m, 1H), 5.80 (t, *J* = 7.6 Hz, 1H), 4.86 - 4.80 (m, 1H), 4.69 - 4.64 (m, 1H), 3.84 (s, 1H), 3.07 - 2.98 (m, 1H), 2.70 - 2.61 (m, 1H). **^{13}C NMR (100 MHz**, **$CDCl_3$**) δ 159.9, 145.4, 129.7, 117.4, 113.5, 110.5, 82.9, 68.4, 55.4, 30.8. **$[\alpha]_D^{25}$** = + 133.21 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ = 210 nm) indicated 97% *ee*: $t_{(S)}$ (minor) = 14.1 min, $t_{(R)}$ (major) = 20.5 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{12}NaO_2$ $[M+Na]^+$: 187.0735, found: 187.0734.

(*S*)-3-chloro-1-(4-fluorophenyl)propan-1-ol [(*S*)-11a]



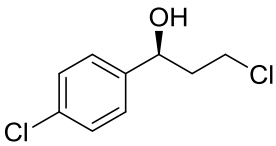
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **11a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 ℃, reaction for 12 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-11a** as a light yellow liquid in 52% yield (196.7 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.32 (dd, *J* = 8.6, 5.7 Hz, 2H), 7.04 (t, *J* = 8.6 Hz, 2H), 4.91 (dd, *J* = 8.6, 4.9 Hz, 1H), 3.74 - 3.68 (m, 1H), 3.52 (dt, *J* = 11.4, 5.8 Hz, 1H), 2.27 (s, 1H), 2.23 - 2.15 (m, 1H), 2.08 - 1.99 (m, 1H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) δ 162.4 (d, *J* = 244.0 Hz), 139.5 (d, *J* = 3.0 Hz) 127.6 (d, *J* = 8.0 Hz), 115.6 (d, *J* = 22.0 Hz), 70.7, 41.7, 41.5. **[α]$_D^{25}$** = - 32.31 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 93% *ee*: $t_{(S)}$ (major) = 42.8 min, $t_{(R)}$ (minor) = 47.9 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}ClFO$ $[M+H]^+$: 189.0482, found: 189.0488.

(*R*)-2-(4-fluorophenyl) oxetane [(*R*)-11b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **11a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 12 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-11b** as a light yellow liquid in 34% yield (103.7 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.42 (dd, *J* = 8.4, 5.6 Hz, 2H), 7.07 (t, *J* = 8.7 Hz, 2H), 5.78 (t, *J* = 7.5 Hz, 1H), 4.82 (td, *J* = 8.1, 6.0 Hz, 1H), 4.64 (dt, *J* = 9.3, 5.8 Hz, 1H), 3.05 - 2.97 (m, 1H), 2.69 - 2.60 (m, 1H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) δ 162.5 (d, *J* = 244.0 Hz), 139.4 (d, *J* = 4.0 Hz), 127.2 (d, *J* = 8.0 Hz), 115.5 (d, *J* = 21.0 Hz), 82.5, 68.2, 31.0. **[α]$_D^{25}$** = + 148.82 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated >99% *ee*: $t_{(S)}$ (minor) = 15.3 min, $t_{(R)}$ (major) = 17.2 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}FO$ $[M+H]^+$: 169.0420, found: 169.0419.

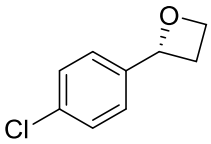
(*S*)-3-chloro-1-(4-chlorophenyl)propan-1-ol [(*S*)-12a]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **12a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 40:1 ~ 20:1) to provide

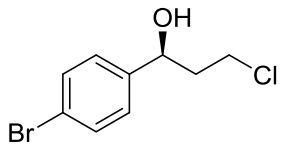
(*S*)-12a as a light yellow liquid in 50% yield (206.9 mg). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.33 (q, *J* = 8.6 Hz, 4H), 4.94 (dd, *J* = 8.6, 4.6 Hz, 1H), 3.78 - 3.72 (m, 1H), 3.55 (dt, *J* = 11.0, 5.8 Hz, 1H), 2.37 (s, 1H), 2.25 - 2.16 (m, 1H), 2.10 - 2.02 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 141.6, 132.4, 128.9, 127.3, 70.1, 42.4, 41.0. **$[\alpha]_D^{25}$** = - 13.09 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 93% *ee*: $t_{(S)}$ (major) = 51.1 min, $t_{(R)}$ (minor) = 54.3 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}Cl_2O$ $[M+H]^+$: 189.0482, found: 189.0488.

(*R*)-2-(4-chlorophenyl) oxetane [(*R*)-12b]



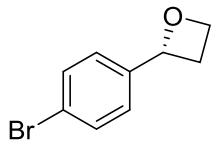
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **12a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-12b** as a light yellow liquid in 37% yield (126.2 mg). **^{1}H NMR (400 MHz, CDCl$_3$)** 7.36 (t, *J* = 8.0 Hz, 4H), 5.78 (t, *J* = 7.5 Hz, 1H), 4.82 (td, *J* = 8.0, 5.9 Hz, 1H), 4.64 (dt, *J* = 9.2, 5.8 Hz, 1H), 3.07 - 2.98 (m, 1H), 2.66 - 2.58 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 142.2, 133.6, 128.8, 126.8, 82.3, 68.4, 30.9. **$[\alpha]_D^{25}$** = + 160.69 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ = 210 nm) indicated >99% *ee*: $t_{(S)}$ (minor) = 8.3 min, $t_{(R)}$ (major) = 8.9 min. **HRMS** (**ESI**) *m/z*: calculated for C_9H_9ClNaO $[M+Na]^+$: 234.0410, found: 234.0409.

(*S*)-1-(4-bromophenyl)-3-chloropropan-1-ol [(*S*)-13a]



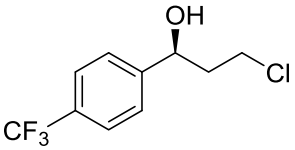
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **13a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C,, reaction for 48 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-13a** as a light yellow liquid in 50% yield (249.3 mg). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.48 (d, *J* = 8.3 Hz, 2H), 7.24 (d, *J* = 8.2 Hz, 2H), 4.92 (dd, *J* = 8.7, 4.6 Hz, 1H), 3.76 - 3.70 (m, 1H), 3.54 (dt, *J* = 11.0, 5.8 Hz, 1H), 2.22 - 1.99 (m, 3H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 142.8, 131.9, 127.6, 121.8, 70.5, 41.7, 41.4. **$[\alpha]_D^{25}$** = - 16.69 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OD-H, 10% IPA in *n*-hexane, 1.0 ml/min, λ = 210 nm) indicated 92% *ee*: $t_{(S)}$ (major) = 7.1 min, $t_{(R)}$ (minor) = 8.0 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}ClBrNaO$ $[M+Na]^+$: 270.9501, found: 270.9495.

(*R*)-2-(4-bromophenyl) oxetane [(*R*)-13b]



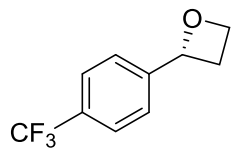
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **13a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 48 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-13b** as a light yellow liquid in 42% yield (178.6 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.51 (d, *J* = 8.2 Hz, 2H), 7.31 (d, *J* = 8.1 Hz, 2H), 5.76 (t, *J* = 7.5 Hz, 1H), 4.82 (td, *J* = 8.1, 6.1 Hz, 1H), 4.64 (dt, *J* = 9.3, 5.8 Hz, 1H), 3.06 - 2.98 (m, 1H), 2.65 - 2.56 (m, 1H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) δ 142.7, 131.7, 127.0, 121.7, 82.3, 68.4, 30.8. **$[\alpha]_D^{25}$** = + 129.74 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 98% *ee*: $t_{(S)}$ (minor) = 15.9 min, $t_{(R)}$ (major) = 17.7 min. **HRMS** (**ESI**) *m/z*: calculated for C_9H_9BrNaO $[M+Na]^+$: 234.9734, found: 234.9733.

(*S*)-3-chloro-1-(4-(trifluoromethyl)phenyl)propan-1-ol [(*S*)-14a]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 10 mM **14a** (1 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 82 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-14a** as a light yellow liquid in 53% yield (125.6 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.62 (d, *J* = 8.0 Hz, 2H), 7.49 (d, *J* = 7.9 Hz, 2H), 5.04 (dd, *J* = 9.0, 4.2 Hz, 1H), 3.80 - 3.74 (m, 1H), 3.57 (dt, *J* = 11.1, 5.6 Hz, 1H), 2.25 - 2.03 (m, 3H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) δ 147.8, 130.2 (d, *J* = 32.0 Hz), 126.2, 125.7 (q, *J* = 4.0, Hz), 124.2 (d, *J* = 271.0 Hz), 70.8, 41.5 (d, *J* = 4.0 Hz). **$[\alpha]_D^{25}$** = - 10.39 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ = 210 nm) indicated 86% *ee*: $t_{(S)}$ (major) = 9.2 min, $t_{(R)}$ (minor) = 10.4 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{10}ClF_3KO$ $[M+K]^+$: 277.0009, found: 277.0006.

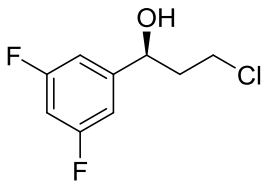
(*R*)-2-(4-(trifluoromethyl)phenyl)oxetane [(*R*)-14b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 10 mM **14a** (1 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 82 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 50:1 ~ 40:1)

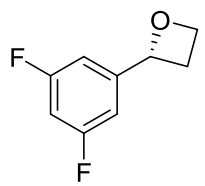
to provide **(*R*)-14b** as a light yellow liquid in 37% yield (74.1 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$**) δ 7.65 (d, *J* = 8.1 Hz, 2H), 7.54 (d, *J* = 8.1 Hz, 2H), 5.86 (t, *J* = 7.6 Hz, 1H), 4.86 (td, *J* = 8.0, 6.0 Hz, 1H), 4.68 (dt, *J* = 9.2, 5.8 Hz, 1H), 3.13 - 3.04 (m, 1H), 2.65 - 2.57 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 147.7, 129.9 (q, *J* = 32.0 Hz), 125.6 (q, *J* = 3.0 Hz), 125.4, 124.2 (q, *J* = 256.0 Hz), 82.5, 68.6, 30.7. **$[\alpha]_D^{25}$** = + 99.32 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ = 210 nm) indicated 93% *ee*: $t_{(S)}$ (minor) = 6.5 min, $t_{(R)}$ (major) = 7.0 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{10}F_3NaO$ $[M+Na]^+$: 203.0684, found: 203.0688.

(*S*)-3-chloro-1-(3,5-difluorophenyl)propan-1-ol [(*S*)-15a]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **15a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 12 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-15a** as a colorless liquid in 51% yield (211.6 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$**) δ 6.89 (dd, *J* = 6.6, 2.2 Hz, 2H), 6.74 - 6.69 (m, 1H), 4.94 (dd, *J* = 8.8, 4.4 Hz, 1H), 3.77 - 3.71 (m, 1H), 3.56 (dt, *J* = 11.1, 5.6 Hz, 1H), 2.46 (s, 1H), 2.19 - 2.10 (m, 1H), 2.08 - 2.00 (m, 1H). **^{13}C NMR (100 MHz**, **$CDCl_3$**) 163.3 (dd, *J* = 248.0, 12.0 Hz), 148.0 (t, *J* = 9.0 Hz), 108.7(dd, *J* = 18.0, 7.0 Hz), 103.2 (t, *J* = 25.0 Hz), 70.4 (t, *J* = 2.0 Hz), 41.4 (d, *J* = 7.0 Hz). **$[\alpha]_D^{25}$** = - 10.79 (c = 1.00, CH_2Cl_2). **HPLC analysis** (AD-H, 5% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 92% *ee*: $t_{(R)}$ (minor) = 9.3 min, $t_{(S)}$ (major) = 10.7 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_9ClF_2KO$ $[M+K]^+$: 244.9947, found: 244.9952.

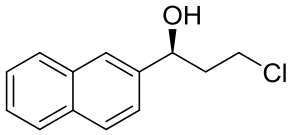
(*R*)-2-(3,5-difluorophenyl)oxetane [(*R*)-15b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **15a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 12 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-15b** as a light yellow liquid in 32% yield (110.4 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$**) δ 6.94 (dt, *J* = 6.3, 2.0 Hz, 2H), 6.72 (tt, *J* = 8.9, 2.4 Hz, 1H), 5.75 (t, *J* = 7.5 Hz, 1H), 4.82 (td, *J* = 8.0, 5.9 Hz, 1H), 4.65 (dt, *J* = 9.2, 5.9 Hz, 1H), 3.10 - 3.02 (m, 1H), 2.62 - 2.53 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 163.4 (dd, *J* = 247.0, 12.0 Hz), 148.0 (t, *J* = 9.0 Hz), 107.8 (dd, *J* = 19.0, 8.0

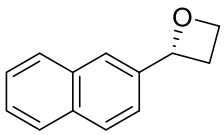
Hz), 103.0 (t, *J* = 25.0 Hz), 81.7, 68.6, 30.6. **[α]$_D^{25}$** = + 153.59 (c = 1.00, CH_2Cl_2). **HPLC analysis** (IA-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 98% *ee*: $t_{(R)}$ (major) = 12.5 min, $t_{(S)}$ (minor) = 13.9 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_9F_2O$ $[M+H]^+$: 171.0625, found: 171.0621.

(*S*)-3-chloro-1-(naphthalen-2-yl)propan-1-ol [(*S*)-16a]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **16a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M3) cells, 30 °C, reaction for 82 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-16a** as a light yellow liquid in 50% yield (219.5 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 8.13 (d, *J* = 8.2 Hz, 1H), 7.89 (d, *J* = 7.3 Hz, 1H), 7.81 (d, *J* = 8.2 Hz, 1H), 7.68 (d, *J* = 7.1 Hz, 1H), 7.52 (dt, *J* = 24.7, 5.2 Hz, 3H), 5.77 (dd, *J* = 8.8, 3.5 Hz, 1H), 3.94 (td, *J* = 9.6, 5.1 Hz, 1H), 3.70 (dt, *J* = 15.7, 1.3 Hz, 1H), 2.38 - 2.23 (m, 2H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) δ 139.6, 133.9, 130.1, 129.1, 128., 126.4, 125.9, 125.6, 123.0, 122.8, 68.0, 42.4, 40.8. **[α]$_D^{25}$** = - 51.66 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ = 210 nm) indicated 96% *ee*: $t_{(S)}$ (major) = 16.1 min, $t_{(R)}$ (minor) = 17.7 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{13}H_{14}ClO$ $[M+H]^+$: 221.0733, found: 221.0735.

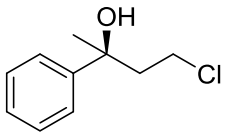
(*R*)-2-(naphthalen-2-yl)oxetane [(*R*)-16b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **16a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M3) cells, 30 °C, reaction for 82 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-16b** as a light yellow solid in 37% yield (137.4 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.94 - 7.91 (m, 1H), 7.88 (d, *J* = 7.1 Hz, 1H), 7.83 (d, *J* = 8.3 Hz, 1H), 7.70 - 7.67 (m, 1H), 7.59 (t, *J* = 7.7 Hz, 1H), 7.54 - 7.51 (m, 2H), 6.51 (t, *J* = 7.6 Hz, 1H), 4.98 (td, *J* = 7.9, 5.8 Hz, 1H), 4.75 (dt, *J* = 9.1, 5.9 Hz, 1H), 3.34 - 3.26 (m, 1H), 2.74 - 2.66 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 139.2, 133.6, 129.0, 128.9, 127.7, 126.1, 125.7, 125.7, 122.8, 121.4, 80.8, 68.7, 30.1. **[α]$_D^{25}$** = + 266.21 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ = 210 nm) indicated >99%

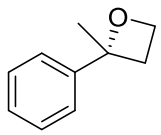
ee: $t_{(S)}$ (minor) = 9.7 min, $t_{(R)}$ (major) = 10.5 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{13}H_{13}O$ $[M+H]^+$: 185.0966, found: 185.0970. **m.p.**: 65.5 - 66.7 °C.

(*S*)-4-chloro-2-phenylbutan-2-ol [(*S*)-17a]



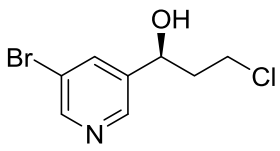
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **18a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 1.5 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-17a** as a light yellow liquid in 49% yield (179.5 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.42 (d, *J* = 7.0 Hz, 2H), 7.36 (t, *J* = 7.1 Hz, 2H), 7.27 (t, *J* = 7.3 Hz, 1H), 3.58 - 3.51 (m, 1H), 3.37 - 3.30 (m, 1H), 2.33 - 2.28 (m, 2H), 1.60 (s, 3H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) δ 146.4, 128.6, 127.2, 124.7, 74.5, 46.7, 40.6, 31.0. **$[\alpha]_D^{25}$** = - 13.99 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated >99% *ee*: $t_{(S)}$ (major) = 30.4 min, $t_{(R)}$ (minor) = 33.8 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{13}ClKO$ $[M+K]^+$: 223.0292, found: 223.0290.

(*R*)-2-methyl-2-phenyloxetane [(*R*)-17b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **17a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 ℃, reaction for 1.5 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-17b** as a light yellow liquid in 36% yield (107.7 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.44 - 7.37 (m, 4H), 7.30 - 7.26 (m, 1H), 4.65 (dt, *J* = 8.6, 6.3 Hz, 1H), 4.55 (dt, *J* = 8.8, 6.5 Hz, 1H), 2.86 - 2.73 (m, 2H), 1.76 (s, 3H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 148.2, 128.3, 126.7, 123.6, 86.6, 64.6, 35.6, 30.8. **$[\alpha]_D^{25}$** = + 107.92 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated >99% *ee*: $t_{(S)}$ (minor) = 11.0 min, $t_{(R)}$ (major) = 13.8 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{13}O$ $[M+H]^+$: 149.0966, found: 149.0963.

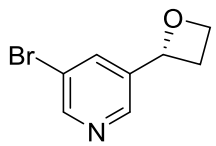
(*S*)-1-(5-bromopyridin-3-yl)-3-chloropropan-1-ol [(*S*)-18a]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **18a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 77 h. The crude product was purified by

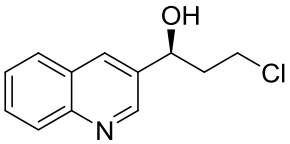
flash column chromatography on silica gel (dichloromethane : ethyl acetate = 6:1) to provide **(*S*)-18a** as a light yellow liquid in 50% yield (250.0 mg). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 8.41 (d, *J* = 2.1 Hz, 1H), 8.32 (d, *J* = 1.9 Hz, 1H), 7.87 (t, *J* = 2.0 Hz, 1H), 4.94 (dd, *J* = 9.1, 4.0 Hz, 1H), 4.77 (s, 1H), 3.79 - 3.73 (m, 1H), 3.56 (dt, *J* = 11.1, 5.4 Hz, 1H), 2.18 - 2.09 (m, 1H), 2.05 - 1.96 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 149.5, 145.3, 142.0, 136.8, 121.2, 67.5, 41.4, 41.3. **[α]$_D^{25}$** = - 12.09 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OJ-H, 5% IPA in *n*-hexane, 1.0 ml/min, λ = 210 nm) indicated 89% *ee*: $t_{(S)}$ (major) = 14.1 min, $t_{(R)}$ (minor) = 16.2 min. **HRMS** (**ESI**) *m/z*: calculated for $C_8H_{10}BrClNO$ $[M+H]^+$: 249.9634, found: 249.9639.

(*R*)-3-bromo-5-(oxetan-2-yl) pyridine [(*R*)-18b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **18a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 77 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 8:1 ~ 6:1) to provide **(*R*)-18b** as a light yellow liquid in 42% yield (178.5 mg). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 8.59 (t, *J* = 1.8 Hz, 1H), 8.49 (s, 1H), 7.97 (q, *J* = 1.8 Hz, 1H), 5.80 (t, *J* = 7.0 Hz, 1H), 4.87 - 4.81 (m, 1H), 4.69 - 4.64 (m, 1H), 3.12 - 3.03 (m, 1H), 2.67 - 2.58 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** 150.3, 145.2, 140.8, 135.8, 121.1, 79.8, 68.8, 30.5. **[α]$_D^{25}$** = + 104.03 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OB-H, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 97% *ee*: $t_{(S)}$ (minor) = 33.1 min, $t_{(R)}$ (major) = 35.8 min. **HRMS** (**ESI**) *m/z*: calculated for C_8H_9BrNO $[M+H]^+$: 213.9868, found: 213.9864.

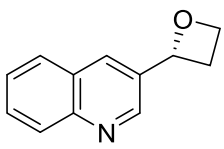
(S)-3-chloro-1-(quinolin-3-yl)propan-1-ol [(*S*)-19a]



Prepared according to the general procedure: 100 mL PB buffer (200 mM, pH 8.5) containing 10 mM **19a** (1 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 48 h. The crude product was purified by flash column chromatography on silica gel (dichloromethane: ethyl acetate = 4:1 ~ 3:1) to provide **(*S*)-19a** as a white solid in 48% yield (105.9 mg). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 8.65 (d, *J* = 2.2 Hz, 1H), 8.05 (s, 1H), 7.96 (d, *J* = 8.4 Hz, 1H), 7.70 (d, *J* = 8.2 Hz, 1H), 7.64 - 7.60 (m, 1H), 7.51 - 7.47 (m, 1H), 5.10 (dd, *J* = 8.9, 4.2 Hz, 1H), 3.83 - 3.77 (m, 1H), 3.56 (dt, *J* = 10.9, 5.6 Hz, 1H), 2.28 - 2.20 (m, 1H), 2.10 - 2.02 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 149.0, 147.2, 137.0, 133.2, 129.7, 128.6, 127.9, 127.8, 127.1, 68.6, 41.7, 41.4. **[α]$_D^{25}$** =

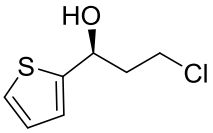
- 22.38 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OD-H, 10% IPA in *n*-hexane, 1.0 ml/min, λ = 210 nm) indicated 97% *ee*: $t_{(S)}$ (major) = 16.3 min, $t_{(R)}$ (minor) = 17.8 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{12}H_{13}ClNO$ $[M+H]^+$: 222.0686, found: 222.0691. **m.p.**: 70.2 - 72.3 °C.

(*R*)-3-(oxetan-2-yl)quinoline [(*R*)-19b]



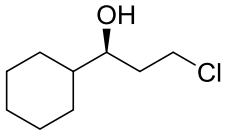
Prepared according to the general procedure: 100 mL PB buffer (200 mM, pH 8.5) containing 10 mM **19a** (1 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 48 h. The crude product was purified by flash column chromatography on silica gel (dichloromethane: ethyl acetate = 6:1 ~ 4:1) to provide **(*R*)-19b** as a light yellow in 44% yield (82.2 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 8.95 (d, *J* = 2.2 Hz, 1H), 8.22 (d, *J* = 2.1 Hz, 1H), 8.11 (d, *J* = 8.5 Hz, 1H), 7.83 (d, *J* = 8.2 Hz, 1H), 7.72 - 7.68 (m, 1H), 7.56 - 7.52 (m, 1H), 6.01 (t, *J* = 7.5 Hz, 1H), 4.90 (td, *J* = 8.0, 5.9 Hz, 1H), 4.74 (dt, *J* = 9.3, 5.8 Hz, 1H), 3.18 - 3.09 (m, 1H), 2.78 - 2.69 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 148.6, 147.8, 136.2, 132.4, 129.6, 129.3, 128.0, 127.8, 127.0, 81.0, 68.7, 30.7. **$[\alpha]_D^{25}$** = + 139.30 (c = 1.00, CH_2Cl_2). **HPLC analysis** (AD-H, 5% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 96% *ee*: $t_{(S)}$ (minor) = 39.3 min, $t_{(R)}$ (major) = 41.3 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{12}H_{12}NO$ $[M+H]^+$: 186.0919, found: 186.0921.

(*S*)-3-chloro-1-(thiophen-2-yl)propan-1-ol [(*S*)-20a]



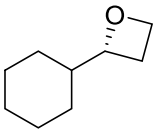
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **20a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 ℃, reaction for 12 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-20a** as a light yellow liquid in 50% yield (179.0 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.27 (dd, *J* = 4.9, 1.4 Hz, 1H), 7.02 - 6.97 (m, 2H), 5.20 (dd, *J* = 8.5, 5.1 Hz, 1H), 3.77 - 3.71 (m, 1H), 3.58 (dt, *J* = 16.9, 2.1 Hz, 1H), 2.35 - 2.28 (m, 1H), 2.23 - 2.15 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 147.5, 126.9, 125.1, 124.2, 67.2, 41.6. **$[\alpha]_D^{25}$** = - 36.78 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 2% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated > 99% *ee*: $t_{(S)}$ (major) = 28.1 min, $t_{(R)}$ (minor) = 30.2 min. **HRMS** (**ESI**) *m/z*: calculated for $C_7H_{10}ClOS$ $[M+H]^+$: 177.0141, found: 177.0138.

(*S*)-3-chloro-1-cyclohexylpropan-1-ol [(*S*)-21a]



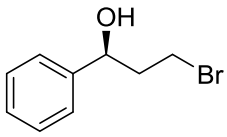
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 10 mM **21a** (1 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 60 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-21a** as a light yellow liquid in 48% yield (85.4 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$)** δ 3.72 - 3.68 (m, 2H), 3.61 - 3.56 (m, 1H), 1.96 - 1.74 (m, 5H), 1.69 - 1.63 (m, 2H), 1.61 (s, 1H), 1.37 - 0.95 (m, 6H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 73.1, 43.5, 42.6, 36.9, 29.7, 28.4, 27.0, 26.3, 25.4. **$[\alpha]_D^{25}$** = - 28.10 (c = 1.00, CH_2Cl_2). **GC analysis** (CYCLODEX-B, 110 ℃ for 85 min) indicated >99% *ee*: $t_{(S)}$ (major) = 72.2 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{17}ClNaO$ $[M+Na]^+$: 199.0866, found: 199.0875.

(*R*)-2-cyclohexyloxetane [(*R*)-21b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 10 mM **21a** (1 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 60 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate =50:1 ~ 40:1) to provide the **(*R*)-21b** as a light yellow liquid in 35% yield (48.9 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$)** δ 4.65 (td, *J* = 8.0, 5.8 Hz, 1H), 4.50 - 4.41 (m, 2H), 2.60 - 2.51 (m, 1H), 2.42 - 2.33 (m, 1H), 1.89 - 1.85 (m, 1H), 1.77 - 1.57 (m, 5H), 1.30 - 1.12 (m, 3H), 0.91 - 0.77 (m, 2H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 86.8, 68.3, 44.8, 27.6, 26.6, 26.2, 25.8, 25.6. G**C analysis** (Rt-bDEXcst, 80 ℃ for 45 min) indicated >99% *ee*: $t_{(R)}$ (major) = 35.9 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{17}O$ $[M+H]^+$: 141.1279, found: 141.1281.

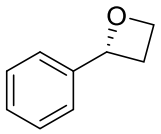
(*S*)-3-bromo-1-phenylpropan-1-ol [(*S*)-22a]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **17a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 6 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-22a** as a white solid in 50% yield (212.4 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$)** δ 7.37 (d, *J* = 4.3 Hz, 4H), 7.33 - 7.28 (m, 1H), 4.93 (dd, *J* = 8.3, 4.6 Hz, 1H), 3.62 - 3.56 (m, 1H), 3.42 (dt, *J* = 10.0, 6.1 Hz,

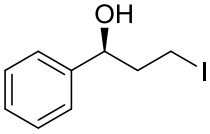
1H), 2.37 - 2.28 (m, 1H), 2.22 - 2.13 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 143.7, 128.8, 128.1, 125.9, 72.4, 41.7, 30.4. **[α]$_D^{25}$** = - 9.59 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OD-H, 10% IPA in *n*-hexane, 1.0 ml/min, λ = 210 nm) indicated >99% *ee*: $t_{(S)}$ (major) = 7.3 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}BrKO$ [M+Na]$^+$: 252.9630, found: 252.9640. **mp.**: 55.5 - 56.2 ºC.

(*R*)-2-phenyloxetane [(*R*)-1b] from 22a



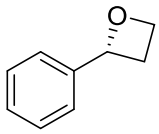
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 8.5) containing 20 mM **22a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 ℃, reaction for 6 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-1b** as a light yellow liquid in 30% yield (80.9 mg). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.46 (d, *J* = 6.9 Hz, 2H), 7.40 (t, *J* = 7.4 Hz, 2H), 7.31 (t, *J* = 7.2 Hz, 1H), 5.83 (t, *J* = 7.5 Hz, 1H), 4.85 (td, *J* = 8.0, 5.8 Hz, 1H), 4.67 (dt, *J* = 9.3, 5.8 Hz, 1H), 3.08 - 2.99 (m, 1H), 2.72 - 2.64 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 143.6, 128.5, 127.8, 125.3, 83.0, 68.3, 30.8. **[α]$_D^{25}$** = + 161.58 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ = 210 nm) indicated 92% *ee*: $t_{(S)}$ (minor) = 10.0 min, $t_{(R)}$ (major) = 11.2 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}NaO$ [M+Na]$^+$: 157.0629, found: 157.0629.

(*S*)-3-iodo-1-phenylpropan-1-ol [(*S*)-23a]



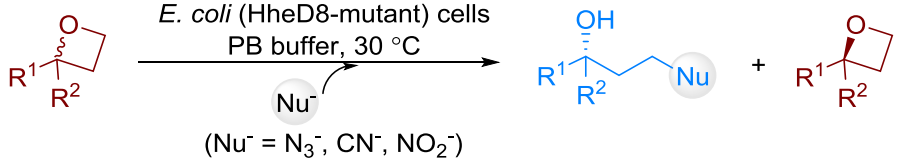
Prepared according to the general procedure: 100 mL Gly-NaOH buffer (300 mM, pH 9.5) containing 20 mM **23a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 1.5 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 40:1 ~ 20:1) to provide **(*S*)-23a** as a white solid in 47.9% yield (251.3 mg). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.39 - 7.34 (m, 4H), 7.32 - 7.29 (m, 1H), 4.79 (dd, *J* = 8.1, 4.9 Hz, 1H), 3.32 - 3.26 (m, 1H), 3.19 - 3.14 (m, 1H), 2.29 - 2.10 (m, 2H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 143.5, 128.8, 128.0, 125.9, 74.2, 42.3, 2.9. **[α]$_D^{25}$** = - 0.20 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OD-H, 10% IPA in *n*-hexane, 1.0 ml/min, λ = 210 nm) indicated >99% *ee*: $t_{(S)}$ (major) = 7.6 min, $t_{(R)}$ (minor) = 9.3 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}NaIO$ [M+Na]$^+$: 284.9752, found: 284.9743. **m.p.**: 44.6 - 45.3 °C.

(*R*)-2-phenyloxetane [(*R*)-1b] from 23a



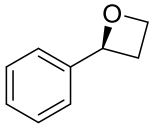
Prepared according to the general procedure: 100 mL Gly-NaOH buffer (300 mM, pH 9.5) containing 20 mM **23a** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 1.5 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 50:1 ~ 40:1) to provide **(*R*)-1b** as a light yellow liquid in 39% yield (107.1 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$**) δ 7.48 - 7.45 (m, 2H), 7.43 - 7.39 (m, 2H), 7.34 - 7.30 (m, 1H), 5.83 (t, *J* = 7.5 Hz, 1H), 4.85 (td, *J* = 8.0, 5.8 Hz, 1H), 4.68 (dt, *J* = 9.2, 5.8 Hz, 1H), 3.08 - 3.00 (m, 1H), 2.73 - 2.64 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 143.6, 128.6, 127.9, 125.3, 83.0, 68.3, 30.8. **$[\alpha]_D^{25}$** = + 173.18 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ = 210 nm) indicated 93% *ee*: $t_{(S)}$ (minor) = 11.0 min, $t_{(R)}$ (major) = 12.2 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}O$ $[M+H]^+$: 135.0810, found: 135.0812.

6. Biocatalytic enantioselective ring-opening of oxetanes



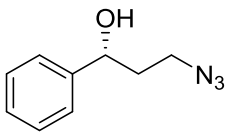
General procedure: In a 200 mL round-bottom flask, a resting cell suspension of *E. coli* (HheD8-M4) at a concentration of 10 g dcw/L was prepared in 100 mL of PB buffer (50 mM, pH 7.5). To this suspension, 2 mmol of oxetane (*rac*)-**b** and 2 mmol of NaN_3 were added to a final concentration of 20 mM. The reaction mixture was then stirred at 30 °C. Upon completion of the enzymatic reaction, the mixture was subjected to extraction using ethyl acetate (3 × 70 mL). The organic phases were separated by centrifugation (8800 × *g*, 3 min), combined, dried over anhydrous Na_2SO_4, and evaporated at reduced pressure. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl acetate = 50:1 ~ 1:1) on silica gel to afford the desired chiral oxetane (*S*)-**b** and γ-azidoalcohol (*R*)-**c**.

(*S*)-2-phenyloxetane [(*S*)-1b] (Ring opening by azide)



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **1b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E.* coli (HheD8-M4) cells, 30 °C, reaction for 10 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1) to provide (*S*)-**1b** as a light yellow liquid in 33% yield (88.1 mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.50 - 7.45 (m, 2H), 7.42 (t, *J* = 7.5 Hz, 2H), 7.36 - 7.30 (m, 1H), 5.84 (t, *J* = 7.5 Hz, 1H), 4.85 (td, *J* = 8.0, 5.9 Hz, 1H), 4.68 (dt, *J* = 9.3, 5.7 Hz, 1H), 3.08 - 2.99 (m, 1H), 2.74 - 2.64 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 143.6, 128.5, 127.9, 125.3, 82.9, 68.3, 30.8. **$[\alpha]_D^{25}$** = -173.88 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ =210 nm) indicated >99% *ee*: $t_{(S)}$ (major) = 10.0 min, $t_{(R)}$ (minor) = 11.3 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}O$ $[M+H]^+$: 135.0810, found: 135.0806.

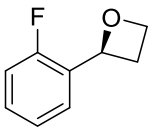
(*R*)-3-azido-1-phenylpropan-1-ol [(*R*)-1c]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **1b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E.* coli (HheD8-M4) cells, 30 °C, reaction for 10 h. The crude product was

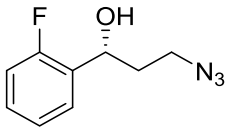
purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1 ~ 10:1) to provide (*R*)-**1c** as a light yellow liquid in 47% yield (165.1 mg). **^{1}H NMR (400 MHz**, **DMSO-*d*$_6$)** δ 7.40 - 7.31 (m, 4H), 7.30 - 7.20 (m, 1H), 5.45 (d, *J* = 4.4 Hz, 1H), 4.66 (q, *J* = 5.9 Hz, 1H), 3.51 - 3.41 (m, 1H), 3.41 - 3.32 (m, 1H), 1.85 (q, *J* = 7.5 Hz, 2H).**^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 145.7, 128.2, 127.0, 125.8, 69.6, 47.9, 38.2. **[α]$_D^{25}$** = + 26.68 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ =210 nm) indicated 97% *ee*: $t_{(S)}$ (minor) = 15.3 min, $t_{(R)}$ (major) = 16.6 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}N_3NaO$ $[M+Na]^+$: 200.0800, found: 200.0803.

(*S*)-2-(2-fluorophenyl)oxetane [(*S*)-2b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **2b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 10 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1) to provide (*S*)-**2b** as a light yellow liquid in 35% yield (106.8 mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.67 (td, *J* = 7.5, 2.0 Hz, 1H), 7.32 - 7.18 (m, 2H), 7.07 - 6.99 (m, 1H), 6.06 (t, *J* = 7.6 Hz, 1H), 4.85 (td, *J* = 7.8, 5.8 Hz, 1H), 4.69 (dt, *J* = 9.2, 5.9 Hz, 1H), 3.15 - 3.04 (m, 1H), 2.72 - 2.62 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 159.3 (d, *J* = 246.3 Hz), 130.8 (d, *J* = 13.6 Hz), 129.2 (d, *J* = 8.0 Hz), 126.9 (d, *J* = 4.5 Hz), 124.3 (d, *J* = 3.5 Hz), 115.2 (d, *J* = 20.7 Hz), 77.7, 68.9, 29.9. **[α]$_D^{25}$** = -135.20 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated >99% *ee*: $t_{(S)}$ (major) = 12.9 min, $t_{(R)}$ (minor) = 16.5 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}FO$ $[M+H]^+$: 153.0716, found: 153.0712.

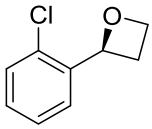
(*R*)-3-azido-1-(2-fluorophenyl)propan-1-ol [(*R*)-2c]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **2b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 10 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1 ~ 10:1) to provide (*R*)-**2c** as a light yellow liquid in 48% yield (186.4 mg). **^{1}H NMR (400 MHz**, **DMSO-*d*$_6$)** δ 7.52 (td, *J* = 7.6, 1.8 Hz, 1H), 7.32 - 7.27 (m, 1H), 7.20 (t, *J* = 7.5 Hz, 1H), 7.13 (t, *J* = 10.5 Hz, 1H), 5.54 (d, *J* = 4.8 Hz, 1H), 4.95 (dt, *J* = 8.1, 4.9 Hz, 1H), 3.53 - 3.37 (m, 2H), 1.92

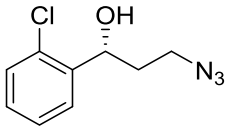
- 1.74 (m, 2H). **^{13}C NMR (100 MHz, DMSO-*d*$_6$)** δ 158.9 (d, *J* = 243.3 Hz), 132.3 (d, *J* = 13.7 Hz), 128.8 (d, *J* = 8.2 Hz), 127.5 (d, *J* = 4.7 Hz), 124.5 (d, *J* = 3.3 Hz), 115.0 (d, *J* = 21.7 Hz), 63.2, 47.6, 36.9. **[α]$_D^{25}$** = + 68.15 (c = 1.00, CH_2Cl_2). **HPLC analysis** (IH, 3% IPA in *n*-hexane, 0.5 ml/min, λ =210 nm) indicated 98% *ee*: $t_{(R)}$ (major) = 26.9 min, $t_{(S)}$ (minor) = 28.1 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}FN_3NaO$ $[M+Na]^+$: 218.0706, found: 218.0701.

(*S*)-2-(2-chlorophenyl)oxetane [(*S*)-3b]



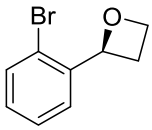
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **3b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 37 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1) to provide (*S*)-**3b** as a yellow liquid in 42% yield (141.7 mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.77 (d, *J* = 7.6 Hz, 1H), 7.38 - 7.30 (m, 2H), 7.23 (td, *J* = 6.4, 1.0 Hz, 1H), 6.02 (t, *J* = 7.5 Hz, 1H), 4.84 (td, *J* = 6.4, 5.2 Hz, 1H), 4.65 (dt, *J* = 9.2, 6.1 Hz, 1H), 3.24 - 3.14 (m, 1H), 2.56 - 2.46 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 141.3, 130.3, 129.1, 128.4, 126.9, 125.9, 80.2, 68.5, 29.9. **[α]$_D^{25}$** = -207.95 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 92% *ee*: $t_{(S)}$ (major) = 11.1 min, $t_{(R)}$ (minor) = 11.9 min. **HRMS** (**ESI**) *m/z*: calculated for C_9H_9ClNaO $[M+Na]^+$: 191.0240, found: 191.0245.

(*R*)-3-azido-1-(2-chlorophenyl)propan-1-ol [(*R*)-3c]



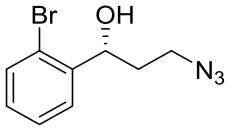
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **3b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 37 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1 ~ 10:1) to provide (*R*)-**3c** as a light yellow liquid in 48% yield (204.9 mg). **^{1}H NMR (400 MHz, DMSO-*d*$_6$)** δ 7.62 (d, *J* = 7.5 Hz, 1H), 7.39 - 7.34 (m, 2H), 7.29 - 7.24 (m, 1H), 5.61 (d, *J* = 4.3 Hz, 1H), 5.02 (dt, *J* = 9.6, 3.8 Hz, 1H), 3.53 - 3.42 (m, 2H), 1.95 - 1.84 (m, 1H), 1.74 - 1.64 (m, 1H). **^{13}C NMR (100 MHz, DMSO-*d*$_6$)** δ 143.0, 130.4, 129.0, 128.6, 127.5, 127.4, 66.0, 47.7, 36.6. **[α]$_D^{25}$** = + 78.34 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ =210 nm) indicated 94% *ee*: $t_{(R)}$ (major) = 43.1 min, $t_{(S)}$ (minor) = 45.6 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}ClN_3NaO$ $[M+Na]^+$: 234.0410, found: 234.0409.

(*S*)-2-(2-bromophenyl)oxetane [(*S*)-4b]



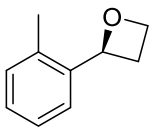
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **4b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 60 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1) to provide (*S*)-**4b** as a light yellow liquid in 48% yield (204.8 mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.76 (d, *J* = 7.7 Hz, 1H), 7.51 (d, *J* = 7.9 Hz, 1H), 7.40 (t, *J* = 7.5 Hz, 1H), 7.16 (t, *J* = 7.8 Hz, 1H), 5.94 (t, *J* = 7.5 Hz, 1H), 4.83 (td, *J* = 8.5, 6.6 Hz, 1H), 4.64 (dt, *J* = 9.1, 6.1 Hz, 1H), 3.27 - 3.17 (m, 1H), 2.53 - 2.43 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 142.9, 132.4, 128.8, 127.6, 126.3, 119.7, 82.1, 68.4, 30.1. **$[\alpha]_D^{25}$** = -169.48 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 93% *ee*: $t_{(S)}$ (major) = 11.5 min, $t_{(R)}$ (minor) = 12.3 min. **HRMS** (**ESI**) *m/z*: calculated for C_9H_9BrNaO $[M+Na]^+$: 234.9734, found: 234.9739.

(*R*)-3-azido-1-(2-bromophenyl)propan-1-ol [(*R*)-4c]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **4b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 60 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1 ~ 10:1) to provide (*R*)-**4c** as a light yellow liquid in 44% yield (222.8 mg). **^{1}H NMR (400 MHz**, **DMSO-d_6)** δ 7.58 (dd, *J* = 28.3, 9.6 Hz, 2H), 7.40 (t, *J* = 7.5 Hz, 1H), 7.19 (t, *J* = 7.8 Hz, 1H), 5.67 (d, *J* = 4.8 Hz, 1H), 4.97 (dt, *J* = 9.8, d3.6 Hz, 1H), 3.55 - 3.43 (m, 2H), 1.97 - 1.85 (m, 1H), 1.73 - 1.62 (m, 1H). **^{13}C NMR (100 MHz**, **DMSO-d_6)** δ 144.5, 132.3, 128.9, 127.9, 127.8, 120.9, 68.3, 47.7, 36.7. **$[\alpha]_D^{25}$** = + 84.24 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ =210 nm) indicated 91% *ee*: $t_{(R)}$ (major) = 12.7 min, $t_{(S)}$ (minor) = 13.7 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}BrN_3NaO$ $[M+Na]^+$: 277.9905, found: 277.9909.

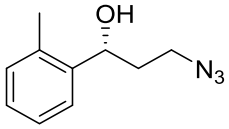
(*S*)-2-(*o*-tolyl)oxetane [(*S*)-5b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **5b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 33 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1) to

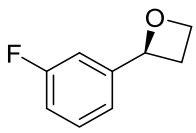
provide (*S*)-**5b** as a yellow liquid in 30% yield (91.5 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$)** δ 7.72 (d, *J* = 7.6 Hz, 1H), 7.32 (t, *J* = 7.9 Hz, 1H), 7.22 (t, *J* = 7.4 Hz, 1H), 7.16 (d, *J* = 7.5 Hz, 1H), 6.01 (t, *J* = 7.6 Hz, 1H), 4.87 (td, *J* = 8.1, 6.4 Hz, 1H), 4.66 (dt, *J* = 9.3, 5.8 Hz, 1H), 3.15 - 3.06 (m, 1H), 2.61 - 2.51 (m, 1H), 2.20 (s, 3H). **^{13}C NMR (100 MHz**, **$CDCl_3$)** δ 141.7, 133.3, 130.0, 127.2, 126.1, 124.0, 80.6, 68.1, 29.7, 18.4. **$[\alpha]_D^{25}$** = -173.68 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 97% *ee*: $t_{(R)}$ (minor)= 14.4 min, $t_{(S)}$ (major) = 15.1 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{13}O$ $[M+H]^+$: 149.0966, found: 149.0968.

(*R*)-3-azido-1-(o-tolyl)propan-1-ol [(*R*)-5c]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **5b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 33 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1 ~ 10:1) to provide (*R*)-**5c** as a light yellow liquid in 44% yield (173.3 mg). **^{1}H NMR (400 MHz**, **DMSO-d_6)** δ 7.47 (d, *J* = 7.6 Hz, 1H), 7.22 - 7.18 (m, 1H), 7.16 - 7.10 (m, 2H), 5.32 (d, *J* = 4.5 Hz, 1H), 4.87 (dt, *J* = 8.7, 4.2 Hz, 1H), 3.57 - 3.40 (m, 2H), 2.30 (s, 3H), 1.86 - 1.69 (m, 2H). **^{13}C NMR (100 MHz**, **DMSO-d_6)** δ 143.8, 133.7, 130.0, 126.6, 126.0, 125.4, 66.0, 48.1, 37.0, 18.6. **$[\alpha]_D^{25}$** = + 40.97 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ =210 nm) indicated 97% *ee*: $t_{(S)}$ (minor)= 13.0 min, $t_{(R)}$ (major) = 14.1 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{13}N_3NaO$ $[M+Na]^+$: 214.0956, found: 214.0949.

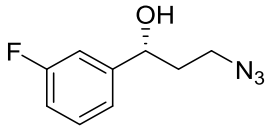
(*S*)-2-(3-fluorophenyl)oxetane [(*S*)-6b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **6b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 12 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1) to provide (*S*)-**6b** as a light yellow liquid in 38% yield (115.7 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$)** δ 7.34 (td, *J* = 7.9, 5.9 Hz, 1H), 7.20 - 7.15 (m, 2H), 6.98 (td, *J* = 8.2, 2.6 Hz, 1H), 5.79 (t, *J* = 7.5 Hz, 1H), 4.83 (td, *J* = 8.2, 6.2z, 1H), 4.66 (dt, *J* = 9.3, 5.8 Hz, 1H), 3.08 – 3.00 (m, 1H), 2.66 - 2.57 (m, 1H). **^{13}C NMR (100 MHz**, **$CDCl_3$)** δ 163.2 (d, *J* = 246.0 Hz), 146.5 (d, *J* = 6.9 Hz), 130.2 (d, *J* = 8.1 Hz), 120.7 (d, *J* = 2.9 Hz), 114.6 (d, *J* = 21.3 Hz), 112.2 (d, *J* = 21.8 Hz), 82.2, 68.4, 30.7. **$[\alpha]_D^{25}$** = -

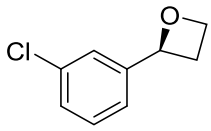
169.88 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 99% *ee*: $t_{(S)}$ (major) = 14.4 min, $t_{(R)}$ (minor) = 15.2 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}FO$ $[M+H]^+$: 153.0716, found: 153.0718.

(*R*)-3-azido-1-(3-fluorophenyl)propan-1-ol [(*R*)-6c]



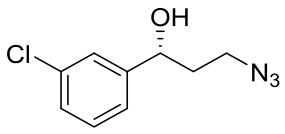
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **6b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 12 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1 ~ 10:1) to provide (*R*)-**6c** as a light yellow liquid in 47% yield (183.6 mg). **^{1}H NMR (400 MHz**, **DMSO-*d*$_6$)** δ 7.37 (dd, *J* = 14.2, 8.2 Hz, 1H), 7.20 - 7.12 (m, 2H), 7.05 (td, *J* = 8.8, 2.6 Hz, 1H), 5.54 (d, *J* = 4.8 Hz, 1H), 4.66 (dt, *J* = 8.9, 5.0 Hz, 1H), 3.49 - 3.40 (m, 1H), 3.39 - 3.33 (m, 1H), 1.90 - 1.75 (m, 2H). **^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 162.3 (d, *J* = 243.2 Hz), 148.8 (d, *J* = 6.6 Hz), 130.1 (d, *J* = 8.1 Hz), 121.7 (d, *J* = 2.6 Hz), 113.6 (d, *J* = 21.0 Hz), 112.3 (d, *J* = 21.6 Hz), 68.9, 47.7, 37.9. **$[\alpha]_D^{25}$** = + 28.98 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ =210 nm) indicated >99% *ee*: $t_{(S)}$ (minor)= 52.4 min, $t_{(R)}$ (major) = 58.7 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}FN_3O$ $[M+H]^+$: 196.0886, found: 196.0892.

(*S*)-2-(3-chlorophenyl)oxetane [(*S*)-7b]



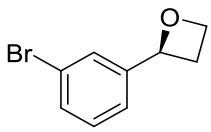
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **7b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1) to provide (*S*)-**7b** as a light yellow liquid in 46% yield (167.2 mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.46 (s, 1H), 7.33 - 7.23 (m, 3H), 5.76 (t, *J* = 7.5 Hz, 1H), 4.81 (td, *J* = 8.2, 6.1 Hz, 1H), 4.64 (dt, *J* = 9.2, 6.0 Hz, 1H), 3.07 - 2.97 (m, 1H), 2.65 - 2.54 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 145.8, 134.4, 129.8, 127.8, 125.3, 123.2, 82.0, 68.3, 30.6. **$[\alpha]_D^{25}$** = -151.90 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexanes, 0.5 ml/min, λ = 210 nm) indicated 94% *ee*: $t_{(S)}$ (major) = 14.2 min, $t_{(R)}$ (minor) = 16.6 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}ClO$ $[M+H]^+$: 169.0420, found: 169.0419.

(*R*)-3-azido-1-(3-chlorophenyl)propan-1-ol [(*R*)-7c]



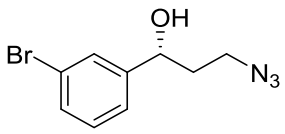
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **7b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1 ~ 10:1) to provide (*R*)-**7c** as a light yellow liquid in 47% yield (212.0 mg). **^{1}H NMR (400 MHz**, **DMSO-*d*$_6$)** δ 7.39 - 7.34 (m, 2H), 7.31 - 7.28 (m, 2H), 5.54 (d, *J* = 4.7 Hz, 1H), 4.64 (dt, *J* = 8.8, 4.8 Hz, 1H), 3.50 - 3.38 (m, 1H), 3.40 - 3.30 (m, 2H), 1.89 - 1.74 (m, 2H). **^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 148.3, 133.1, 130.0, 126.8, 125.6, 124.4, 69.0, 47.8, 38.0. **$[\alpha]_D^{25}$** = + 26.08 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ =210 nm) indicated 97% *ee*: $t_{(S)}$ (minor)= 13.7 min, $t_{(R)}$ (major) = 14.8 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}ClN_3O$ $[M+H]^+$: 212.0591, found: 212.0589.

(*S*)-2-(3-bromophenyl)oxetane [(*S*)-8b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **8b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 23 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1) to provide (*S*)-**8b** as a light yellow liquid in 48% yield (204.1 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$)** δ 7.60 (s, 1H), 7.40 (dd, *J* = 8.0, 1.8 Hz, 1H), 7.30 (d, *J* = 7.6 Hz, 1H), 7.22 (t, *J* = 7.8 Hz, 1H), 5.74 (t, *J* = 7.5 Hz, 1H), 4.80 (td, *J* = 7.0, 5.4 Hz, 1H), 4.62 (dt, *J* = 9.3, 5.8 Hz, 1H), 3.07 - 2.94 (m, 1H), 2.65 - 2.51 (m, 1H). **^{13}C NMR (100 MHz**, **$CDCl_3$)** δ 146.0, 130.7, 130.1, 128.2, 123.7, 122.7, 81.9, 68.3, 30.6. **$[\alpha]_D^{25}$** = -121.31 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 95% *ee*: $t_{(S)}$ (major) = 14.7 min, $t_{(R)}$ (minor) = 17.9 min. **HRMS** (**ESI**) *m/z*: calculated for C_9H_9BrNaO $[M+Na]^+$: 234.9734, found: 234.9728.

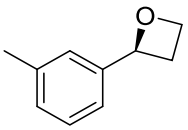
(*R*)-3-azido-1-(3-bromophenyl)propan-1-ol [(*R*)-8c]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **8b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 23 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate

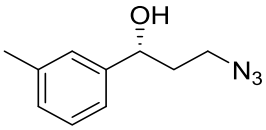
= 30:1 ~ 10:1) to provide (*R*)-**8c** as a light yellow liquid in 48% yield (245.1 mg). **^{1}H NMR (400 MHz**, **DMSO-*d*$_6$)** δ 7.53 (s, 1H), 7.43 (d, *J* = 7.6 Hz, 1H), 7.35 - 7.26 (m, 2H), 5.54 (d, *J* = 4.7 Hz, 1H), 4.63 (dt, *J* = 8.8, 4.9 Hz, 1H), 3.49 - 3.39 (m, 1H), 3.39 - 3.31 (m, 1H), 1.88 - 1.74 (m, 2H). **^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 148.5, 130.4, 129.7, 128.4, 124.8, 121.6, 68.9, 47.7, 37.9. **[α]$_D^{25}$** = + 22.78 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ =210 nm) indicated 95% *ee*: $t_{(S)}$ (minor)= 13.9 min, $t_{(R)}$ (major) = 15.2 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}BrN_3NaO$ $[M+Na]^+$: 277.9905, found: 277.9906.

(*S*)-2-(*m*-tolyl)oxetane [(*S*)-9b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **9b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1) to provide (*S*)-**9b** as a light yellow liquid in 37% yield (114.2 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$)** δ 7.39 - 7.35 (m, 2H), 7.31 (d, *J* = 7.7 Hz, 1H), 7.20 (d, *J* = 7.4 Hz, 1H), 5.87 (t, *J* = 7.6 Hz, 1H), 4.91 (td, *J* = 8.2, 6.0 Hz, 1H), 4.74 (dt, *J* = 9.3, 5.7 Hz, 1H), 3.12 - 3.04 (m, 1H), 2.78 - 2.70 (m, 1H), 2.47 (s, 3H). **^{13}C NMR (100 MHz**, **$CDCl_3$)** δ 143.5, 138.2, 128.6, 128.4, 125.9, 122.3, 83.0, 68.2, 30.7, 21.5. **[α]$_D^{25}$** = -118.21 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ = 210 nm) indicated 94% *ee*: $t_{(S)}$ (major) = 9.1 min, $t_{(R)}$ (minor) = 10.6 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{12}NaO$ $[M+Na]^+$: 171.0786, found: 171.0785.

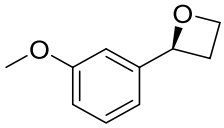
(*R*)-3-azido-1-(*m*-tolyl)propan-1-ol [(*R*)-9c]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **9b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1 ~ 10:1) to provide (*R*)-**9c** as a yellow liquid in 48% yield (190.4 mg). **^{1}H NMR (400 MHz**, **DMSO-*d*$_6$)** δ 7.21 (t, *J* = 7.5 Hz, 1H), 7.13 (t, *J* = 10.5 Hz, 2H), 7.05 (d, *J* = 7.4 Hz, 1H), 5.36 (d, *J* = 4.5 Hz, 1H), 4.59 (dt, *J* = 7.1, 5.6 Hz, 1H), 3.48 - 3.39 (m, 1H), 3.37 - 3.31 (m, 1H), 2.30 (s, 3H), 1.81 (q, *J* = 6.9 Hz, 2H). **^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 145.6, 137.2, 128.1, 127.6, 126.3, 122.8, 69.5, 47.9, 38.2, 21.2. **[α]$_D^{25}$** = + 22.78 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3,

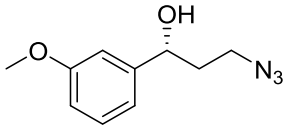
3% IPA in *n*-hexane, 0.7 ml/min, λ =210 nm) indicated 98% *ee*: $t_{(S)}$ (minor)= 14.0 min, $t_{(R)}$ (major) = 15.2 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{13}N_3NaO$ $[M+Na]^+$: 214.0956, found: 214.0963.

(*S*)-2-(3-methoxyphenyl)oxetane [(*S*)-10b]



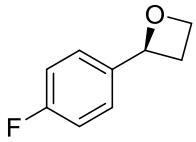
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **10b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1) to provide (*S*)-**10b** as a colorless liquid in 42% yield (136.8 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$)** δ 7.31 (t, *J* = 7.9 Hz, 1H), 7.06 - 6.97 (m, 2H), 6.85 (ddd, *J* = 8.2, 2.7, 1.1 Hz, 1H), 5.80 (t, *J* = 7.5 Hz, 1H), 4.83 (td, *J* = 8.1, 6.0 Hz, 1H), 4.66 (dt, *J* = 9.2, 5.8 Hz, 1H), 3.84 (s, 3H), 3.07 - 2.97 (m, 1H), 2.70 - 2.60 (m, 1H). **^{13}C NMR (100 MHz**, **$CDCl_3$)** δ 159.9, 145.4, 129.6, 117.3, 113.4, 110.5, 82.8, 68.3, 55.3, 30.7. **$[\alpha]_D^{25}$** = -120.02 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ = 210 nm) indicated 95% *ee*: $t_{(S)}$ (major) = 14.2 min, $t_{(R)}$ (minor) = 20.6 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{12}NaO_2$ $[M+Na]^+$: 187.0735, found: 187.0739.

(*R*)-3-azido-1-(3-methoxyphenyl)propan-1-ol [(*R*)-10c]



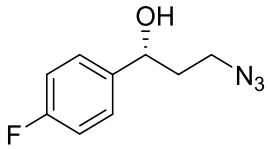
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **10b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1 ~ 10:1) to provide (*R*)-**10c** as a light yellow liquid in 43% yield (178.5 mg). **^{1}H NMR (400 MHz**, **DMSO-d_6)** δ 7.25 (t, *J* = 7.8 Hz, 1H), 6.98 - 6.87 (m, 2H), 6.81 (dd, *J* = 8.2, 2.7 Hz, 1H), 5.44 (d, *J* = 4.5 Hz, 1H), 4.63 (q, *J* = 5.7 Hz, 1H), 3.75 (s, 3H), 3.49 - 3.41 (m, 1H), 3.40 - 3.31 (m, 1H), 1.84 (q, *J* = 6.8 Hz, 2H). **^{13}C NMR (100 MHz**, **DMSO-d_6)** δ 159.3, 147.4, 129.3, 117.9, 112.4, 111.2, 69.5, 55.0, 47.9, 38.2. **$[\alpha]_D^{25}$** = + 30.79 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ =210 nm) indicated 95% *ee*: $t_{(S)}$ (minor)= 26.4 min, $t_{(R)}$ (major) = 28.3 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{13}N_3NaO_2$ $[M+Na]^+$: 230.0905, found: 230.0907.

(*S*)-2-(4-fluorophenyl)oxetane [(*S*)-11b]



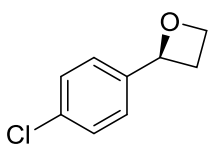
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **11b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 16 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1) to provide (*S*)-**11b** as a yellow liquid in 36% yield (109.9 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$)** δ 7.48 - 7.36 (m, 2H), 7.07 (t, *J* = 8.7 Hz, 2H), 5.78 (t, *J* = 7.5 Hz, 1H), 4.82 (td, *J* = 8.0, 6.2 Hz, 1H), 4.64 (dt, *J* = 9.3, 5.7 Hz, 1H), 3.07 - 2.94 (m, 1H), 2.70 - 2.57 (m, 1H). **^{13}C NMR (100 MHz**, **$CDCl_3$)** δ 162.5 (d, *J* = 245.9 Hz), 139.4 (d, *J* = 3.1 Hz), 127.2 (d, *J* = 8.1 Hz), 115.4 (d, *J* = 21.4 Hz), 82.4, 68.2, 30.9. **$[\alpha]_D^{25}$** = -148.89 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 99% *ee*: $t_{(S)}$ (major) = 15.2 min, $t_{(R)}$ (minor) = 17.2 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}FO$ $[M+H]^+$: 157.0716, found: 157.0712.

(*R*)-3-azido-1-(4-fluorophenyl)propan-1-ol [(*R*)-11c]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **11b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 16 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1 ~ 10:1) to provide (*R*)-**11c** as a light yellow liquid in 50% yield (194.1 mg). **^{1}H NMR (400 MHz**, **DMSO-d_6)** δ 7.37 (dd, *J* = 8.4, 5.7 Hz, 2H), 7.14 (t, *J* = 8.8 Hz, 2H), 5.46 (d, *J* = 4.5 Hz, 1H), 4.64 (q, *J* = 6.5 Hz, 1H), 3.48 - 3.39 (m, 1H), 3.39 - 3.30 (m, 1H), 1.81 (q, *J* = 6.7 Hz, 2H). **^{13}C NMR (100 MHz**, **DMSO-d_6)** δ 161.2 (d, *J* = 242.2 Hz), 141.8 (d, *J* = 3.0 Hz), 127.6 (d, *J* = 8.0 Hz), 114.8 (d, *J* = 21.0 Hz), 68.9, 47.8, 38.1. **$[\alpha]_D^{25}$** = + 31.28 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ =210 nm) indicated 98% *ee*: $t_{(S)}$ (minor)= 13.9 min, $t_{(R)}$ (major) = 15.3 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}FN_3O$ $[M+H]^+$: 196.0886, found: 196.0885.

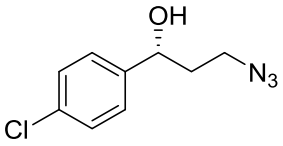
(*S*)-2-(4-chlorophenyl)oxetane [(*S*)-12b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **12b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 11 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl

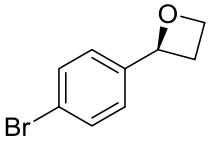
acetate = 30:1) to provide (*S*)-**12b** as a light yellow liquid in 45% yield (164.4 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$)** δ 7.39 - 7.29 (m, 4H), 5.76 (t, *J* = 7.5 Hz, 1H), 4.80 (td, *J* = 8.0, 5.8 Hz, 1H), 4.62 (dt, *J* = 9.2, 5.8 Hz, 1H), 3.04 - 2.95 (m, 1H), 2.63 - 2.54 (m, 1H).**^{13}C NMR (100 MHz**, **$CDCl_3$)** δ 142.1, 133.4, 128.6, 126.6, 82.1, 68.2, 30.7. **$[\alpha]_D^{25}$** = -144.40 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ = 210 nm) indicated 97% *ee*: $t_{(S)}$ (major) = 8.3 min, $t_{(R)}$ (minor) = 8.9 min. **HRMS** (**ESI**) *m/z*: calculated for C_9H_9ClNaO $[M+Na]^+$: 191.0240, found: 191.0241.

(*R*)-3-azido-1-(4-chlorophenyl)propan-1-ol [(*R*)-12c]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **12b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 11 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1 ~ 10:1) to provide (*R*)-**12c** as a light yellow liquid in 48% yield (216.7 mg). **^{1}H NMR (400 MHz**, **DMSO-d_6)** δ 7.37 (d, *J* = 2.2 Hz, 4H), 5.54 (d, *J* = 4.7 Hz, 1H), 4.67 (q, *J* = 6.2 Hz, 1H), 3.51 - 3.41 (m, 1H), 3.41 - 3.30 (m, 1H), 1.83 (q, *J* = 6.4 Hz, 2H). **^{13}C NMR (100 MHz**, **DMSO-d_6)** δ 144.6, 131.5, 128.1, 127.6, 68.9, 47.8, 38.1. **$[\alpha]_D^{25}$** = + 21.69 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ =210 nm) indicated 99% *ee*: $t_{(S)}$ (minor)= 15.2 min, $t_{(R)}$ (major) = 16.5 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}ClN_3O$ $[M+H]^+$: 212.0591, found: 212.0594.

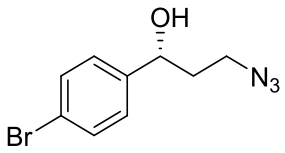
(*S*)-2-(4-bromophenyl)oxetane [(*S*)-13b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **13b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 26 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1) to provide (*S*)-**13b** as a light yellow liquid in 42% yield (177.9mg). **^{1}H NMR (400 MHz**, **$CDCl_3$)** δ 7.55 - 7.47 (m, 2H), 7.35 - 7.27 (m, 2H), 5.75 (t, *J* = 7.5 Hz, 1H), 4.82 (td, *J* = 8.0, 5.8 Hz, 1H), 4.64 (dt, *J* = 9.3, 5.8 Hz, 1H), 3.08 - 2.95 (m, 1H), 2.66 - 2.53 (m, 1H).**^{13}C NMR (100 MHz**, **$CDCl_3$)** δ 142.7, 131.6, 127.0, 121.6, 82.2, 68.3, 30.8. **$[\alpha]_D^{25}$** = -129.83 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 98% *ee*:

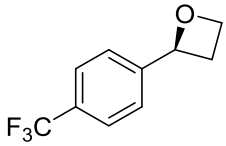
$t_{(S)}$ (major) = 16.0 min, $t_{(R)}$ (minor) = 17.8 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{10}BrO$ $[M+H]^+$: 212.9915, found: 212.9915.

(*R*)-3-azido-1-(4-bromophenyl)propan-1-ol [(*R*)-13c]



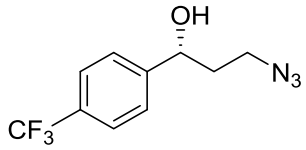
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **13b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 26 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1 ~ 10:1) to provide (*R*)-**13c** as a light yellow liquid in 47% yield (240.0 mg). **^{1}H NMR (400 MHz**, **DMSO-*d*$_6$)** δ 7.51 (dd, *J* = 8.4, 1.5 Hz, 2H), 7.31 (d, *J* = 7.6 Hz, 2H), 5.52 (d, *J* = 4.6 Hz, 1H), 4.64 (q, *J* = 5.9 Hz, 1H), 3.49 - 3.40 (m, 1H), 3.40 - 3.31 (m, 1H), 1.81 (q, *J* = 6.8 Hz, 2H).**^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 145.0, 131.0, 128.0, 119.9, 68.9, 47.7, 38.0. **$[\alpha]_D^{25}$** = + 28.68 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ =210 nm) indicated 98% *ee*: $t_{(S)}$ (minor)= 17.2 min, $t_{(R)}$ (major) = 18.3 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}BrN_3O$ $[M+H]^+$: 256.0085, found: 256.0080.

(*S*)-2-(4-(trifluoromethyl)phenyl)oxetane [(*S*)-14b]



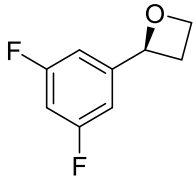
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 5 mM **14b** (0.5 mmol), 5 mM **NaN_3** (0.5 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 45 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1) to provide (*S*)-**14b** as a light yellow liquid in 49% yield (52.0 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$)** δ 7.64 (d, *J* = 8.0 Hz, 2H), 7.54 (d, *J* = 8.1 Hz, 2H), 5.86 (t, *J* = 7.6 Hz, 1H), 4.85 (td, *J* = 8.0, 6.0 Hz, 1H), 4.67 (dt, *J* = 9.2, 5.5 Hz, 1H), 3.13 - 3.02 (m, 1H), 2.66 - 2.55 (m, 1H).**^{13}C NMR (100 MHz**, **$CDCl_3$)** δ 147.8, 129.9 (q, *J* = 32.0 Hz), 125.6 (q, *J* = 4.0 Hz), 125.3 , 124.3 (q, *J* = 270.0 Hz), 82.1, 68.5, 30.7. **$[\alpha]_D^{25}$** = -94.33 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ = 210 nm) indicated 86% *ee*: $t_{(S)}$ (major) = 6.6 min, $t_{(R)}$ (minor) = 7.0 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{10}F_3O$ $[M+H]^+$: 203.0684, found: 203.0683.

(*R*)-3-azido-1-(4-(trifluoromethyl)phenyl)propan-1-ol [(*R*)-14c]



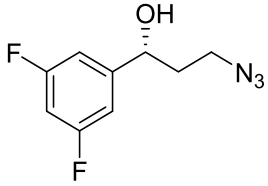
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 5 mM **14b** (0.5 mmol), 5 mM **NaN_3** (0.5 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 45 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1 ~ 10:1) to provide (*R*)-**14c** as a light yellow liquid in 41% yield (53.5 mg). **^{1}H NMR (400 MHz**, **DMSO-*d*$_6$)** δ 7.69 (d, *J* = 8.1 Hz, 2H), 7.57 (d, *J* = 8.0 Hz, 2H), 5.63 (d, *J* = 3.8 Hz, 1H), 4.73 (t, *J* = 6.7 Hz, 1H), 3.51 - 3.42 (m, 1H), 3.40 - 3.35 (m, 1H), 1.89 - 1.78 (m, 2H).**^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 150.4, 127.6 (q, *J* = 32.0 Hz), 126.5, 125.0 (q, *J* = 4.0 Hz), 124.4 (d, *J* = 270.0 Hz), 69.0, 47.7, 37.9. **$[\alpha]_D^{25}$** = + 17.49 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ =210 nm) indicated 94% *ee*: $t_{(S)}$ (minor)= 10.5 min, $t_{(R)}$ (major) = 11.3 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{11}F_3N_3O$ $[M+H]^+$: 246.0854, found: 246.0860.

(*S*)-2-(3,5-difluorophenyl)oxetane [(*S*)-15b]



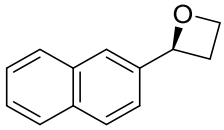
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **15b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 16 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1) to provide (*S*)-**15b** as a light yellow liquid in 42% yield (158.7mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 6.94 (dd, *J* = 8.6, 2.2 Hz, 2H), 6.71 (td, *J* = 8.9, 2.2 Hz, 1H), 5.75 (t, *J* = 7.5 Hz, 1H), 4.82 (td, *J* = 8.2, 6.0 Hz, 1H), 4.65 (dt, *J* = 9.3, 6.0 Hz, 1H), 3.10 - 3.02 (m, 1H), 2.61 - 2.53 (m, 1H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 163.3 (dd, *J* = 247.0, 12.0 Hz), 148.0 (t, *J* = 8.0 Hz), 107.8 (dd, *J* = 27.0, 4.0 Hz), 103.0 (td, *J* = 25.0, 6.0 Hz), 81.7, 68.6, 30.6. **$[\alpha]_D^{25}$** = -142.89 (c = 1.00, CH_2Cl_2). **HPLC analysis** (IA-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated >99% *ee*: $t_{(R)}$ (minor) = 13.0 min, $t_{(S)}$ (major) = 13.8 min,. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_8F_2NaO$ $[M+Na]^+$: 193.0441, found: 193.0444.

(*R*)-3-azido-1-(3,5-difluorophenyl)propan-1-ol [(*R*)-15c]



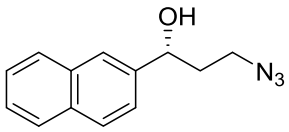
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **15b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 16 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1 ~ 15:1) to provide (*R*)-**15c** as a light yellow liquid in 43% yield (203.5 mg). **^{1}H NMR (400 MHz**, **DMSO-*d*$_6$)** δ 7.14 - 6.95 (m, 3H), 5.68 (d, *J* = 4.8 Hz, 1H), 4.67 (dt, *J* = 8.9, 4.6 Hz, 1H), 3.49- 3.41 (m, 1H), 3.40 - 3.32 (m, 1H), 1.91 - 1.73 (m, 2H).**^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 162.4 (dd, *J* = 246.0, 13.0 Hz), 150.7 (t, *J* = 8.2 Hz), 108.7 (dd, *J* = 18.0, 6.0 Hz), 102.2 (t, *J* = 25.9 Hz), 68.6 (t, *J* = 2.2 Hz), 47.6, 37.6. **[α]$_D^{25}$** = + 27.28 (c = 1.00, CH_2Cl_2). **HPLC analysis** (IC-3, 1% IPA in *n*-hexane, 0.5 ml/min, λ =210 nm) indicated >99% *ee*: $t_{(S)}$ (minor)= 31.6 min, $t_{(R)}$ (major) = 35.1 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_9F_2N_3NaO$ $[M+Na]^+$: 236.0611, found: 236.0612.

(*S*)-2-(naphthalen-2-yl)oxetane [(*S*)-16b]



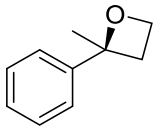
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 5 mM **16b** (0.5 mmol), 5 mM **NaN_3** (0.5 mmol) and 10 g dcw/L *E*. coli (HheD8-M3) cells, 30 °C, reaction for 45 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1) to provide (*S*)-**16b** as a light yellow liquid in 35% yield (31.9mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.95 - 7.89 (m, 1H), 7.86 (dt, *J* = 7.0, 1.3 Hz, 1H), 7.82 (d, *J* = 8.2 Hz, 1H), 7.70 - 7.64 (m, 1H), 7.60 - 7.55 (m, 1H), 7.54 - 7.49 (m, 2H), 6.50 (t, *J* = 7.6 Hz, 1H), 4.97 (td, *J* = 8.1, 6.0 Hz, 1H), 4.74 (dt, *J* = 9.0, 6.0 Hz, 1H), 3.35 - 3.25 (m, 1H), 2.75 - 2.64 (m, 1H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 139.2, 133.7, 129.1, 129.0, 127.7, 126.1, 125.8, 125.7, 122.8, 121.5, 80.9, 68.8, 30.2. **[α]$_D^{25}$** = -288.19 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ = 210 nm) indicated 98% *ee*: $t_{(S)}$ (major) = 9.7 min, $t_{(R)}$ (minor) = 10.5 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{13}H_{13}O$ $[M+H]^+$: 185.0966, found: 185.0966.

(*R*)-3-azido-1-(naphthalen-2-yl)propan-1-ol [(*R*)-16c]



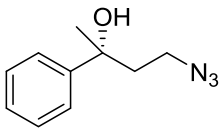
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 5 mM **16b** (0.5 mmol), 5 mM **NaN_3** (0.5 mmol) and 10 g dcw/L *E*. coli (HheD8-M3) cells, 30 ℃, reaction for 45 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 40:1 ~ 15:1) to provide (*R*)-**16c** as a light yellow liquid in 43% yield (49.3 mg). **^{1}H NMR (400 MHz**, **DMSO-*d*$_6$)** δ 8.13 (d, *J* = 8.2 Hz, 1H), 7.94 (d, *J* = 7.5 Hz, 1H), 7.82 (d, *J* = 8.2 Hz, 1H), 7.67 (d, *J* = 7.0 Hz, 1H), 7.59 - 7.47 (m, 3H), 5.60 (t, *J* = 3.1 Hz, 1H), 5.42 (dd, *J* = 8.6, 4.0 Hz, 1H), 3.68 - 3.58 (m, 1H), 3.55 - 3.45 (m, 1H), 2.06 - 1.96 (m, 1H), 1.94 - 1.82 (m, 1H).**^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 141.3, 133.3, 129.8, 128.7, 127.3, 126.0, 125.5, 123.1, 122.8, 66.4, 48.2, 37.6. **$[\alpha]_D^{25}$** = + 54.46 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ =210 nm) indicated 95% *ee*: $t_{(S)}$ (minor)= 18.6 min, $t_{(R)}$ (major) = 21.2 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{13}H_{14}N_3O$ $[M+H]^+$: 228.1137, found: 228.1135.

(*S*)-2-methyl-2-phenyloxetane [(*S*)-17b]



Prepared according to the general procedure: 100 mL Gly-NaOH buffer (300 mM, pH 9.5) containing 5 mM **17b** (0.5 mmol), 15 mM **NaN_3** (1.5 mmol) and 30 g dcw/L *E*. coli (HheD8-M7) cells, 30 ℃, reaction for 14 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 80:1) to provide (*S*)-**17b** as a light yellow liquid in 27% yield (21.8mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.44 - 7.37 (m, 4H), 7.30 - 7.26 (m, 1H), 4.65 (ddd, *J* = 12.5, 6.6, 5.9 Hz, 1H), 4.55 (ddd, *J* = 12.8, 6.8, 5.8 Hz, 1H), 2.86 - 2.73 (m, 2H), 1.76 (s, 3H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 148.3, 128.3, 126.7, 123.7, 86.7, 64.6, 35.6, 30.8. **$[\alpha]_D^{25}$** = -99.54 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ = 210 nm) indicated 85% *ee*: $t_{(S)}$ (major) = 6.7 min, $t_{(R)}$ (minor) = 7.7 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{13}O$ $[M+H]^+$: 149.0966, found: 149.0964.

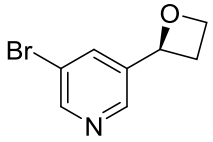
(*R*)-4-azido-2-phenylbutan-2-ol [(*R*)-17c]



Prepared according to the general procedure: 100 mL Gly-NaOH buffer (300 mM, pH 9.5) containing 5 mM **17b** (0.5 mmol), 15 mM **NaN_3** (1.5 mmol) and 30 g dcw/L *E*. coli (HheD8-M7) cells, 30 ℃, reaction for 14 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate

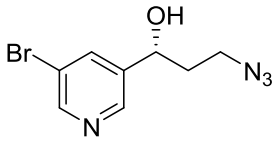
= 80:1 ~ 15:1) to provide (*R*)-**17c** as a light yellow liquid in 39% yield (39.8 mg). **^{1}H NMR (400 MHz**, **DMSO-*d*$_6$)** δ 7.46 - 7.44 (m, 2H), 7.31 (t, *J* = 7.4 Hz, 2H), 7.21 - 7.19 (m, 1H), 5.20 (s, 1H), 3.36 - 3.28 (m, 1H), 3.04 - 2.97 (m, 1H), 2.03 - 1.98 (m, 2H), 1.46 (s, 3H).**^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 148.3, 127.9, 126.2, 124.8, 71.8, 46.9, 42.1, 30.5. **[α]$_D^{25}$** = + 8.79 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ =210 nm) indicated >99% *ee*: $t_{(S)}$ (minor)= 11.3 min, $t_{(R)}$ (major) = 11.8 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{13}H_{14}N_3NaO$ $[M+Na]^+$: 214.0956, found: 214.0961.

(*S*)-3-bromo-5-(oxetan-2-yl)pyridine [(*S*)-18b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 6.5) containing 20 mM **18b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 26 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 10:1) to provide (*S*)-**18b** as a light yellow liquid in 45% yield (190.6mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.58 (d, *J* = 2.2 Hz, 1H), 8.48 (d, *J* = 1.8 Hz, 1H), 7.95 (t, *J* = 2.0 Hz, 1H), 5.79 (t, *J* = 7.5 Hz, 1H), 4.83 (td, *J* = 8.0, 6.0 Hz, 1H), 4.65 (dt, *J* = 9.2, 5.9 Hz, 1H), 3.10 - 3.02 (m, 1H), 2.66 - 2.57 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 150.3, 145.2, 140.7, 135.7, 121.1, 79.8, 68.7, 30.5. **[α]$_D^{25}$** = -99.15 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OB-H, 1% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 99% *ee*: $t_{(S)}$ (major) = 33.0 min, $t_{(R)}$ (minor) = 36.2 min. **HRMS** (**ESI**) *m/z*: calculated for C_8H_9BrNO $[M+H]^+$: 213.9868, found: 213.9871.

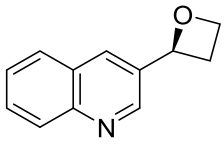
(*R*)-3-azido-1-(5-bromopyridin-3-yl)propan-1-ol [(*R*)-18c]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 6.5) containing 20 mM **18b** (2 mmol), 20 mM **NaN_3** (2 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 26 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 10:1 ~ 3:1) to provide (*R*)-**18c** as a light yellow liquid in 48% yield (246.0 mg). **^{1}H NMR (400 MHz**, **DMSO-*d*$_6$)** δ 8.56 (dd, *J* = 16.0, 2.3 Hz, 2H), 8.00 (t, *J* = 2.1 Hz, 1H), 5.72 (d, *J* = 4.8 Hz, 1H), 4.72 (dt, *J* = 7.9, 5.0 Hz, 1H), 3.50 - 3.45 (m, 1H), 3.43 - 3.38 (m, 1H), 1.90 - 1.85 (m, 2H).**^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 148.9, 146.2, 143.1, 136.0, 120.2, 67.0, 47.6, 37.5. **[α]$_D^{25}$** = + 20.79 (c = 1.00, CH_2Cl_2). **HPLC analysis** (AD-H, 3% IPA in

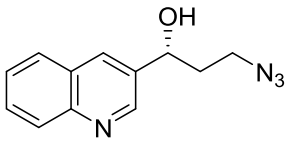
n-hexane, 0.5 ml/min, λ =210 nm) indicated 98% *ee*: $t_{(R)}$ (major) = 69.0 min, $t_{(S)}$ (minor)= 97.9 min. **HRMS** (**ESI**) *m/z*: calculated for $C_8H_{10}N_4BrO$ $[M+H]^+$: 257.0038, found: 257.0042

(*S*)-3-(oxetan-2-yl)quinoline [(*S*)-19b]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 6.5) containing 10 mM **19b** (1 mmol), 10 mM **NaN_3** (1 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 30 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 10:1) to provide (*S*)-**19b** as a light yellow liquid in 46% yield (81.5mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 8.94 (d, *J* = 2.2 Hz, 1H), 8.21 (d, *J* = 2.1 Hz, 1H), 8.11 (d, *J* = 8.5 Hz, 1H), 7.83 (dd, *J* = 8.2, 1.5 Hz, 1H), 7.70 (ddd, *J* = 8.4, 6.8, 1.4 Hz, 1H), 7.54 (ddd, *J* = 8.2, 6.9, 1.3 Hz, 1H), 6.01 (t, *J* = 7.5 Hz, 1H), 4.90 (td, *J* = 7.9, 5.8 Hz, 1H), 4.74 (dt, *J* = 9.2, 5.9 Hz, 1H), 3.17 - 3.09 (m, 1H), 2.78 - 2.69 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 148.7, 148.0, 136.2, 132.3, 129.5, 129.4, 128.0, 127.8, 127.0, 81.0, 68.7, 30.7. **$[\alpha]_D^{25}$** = -158.32 (c = 1.00, CH_2Cl_2). **HPLC analysis** (AD-H, 5% IPA in *n*-hexane, 0.5 ml/min, λ = 210 nm) indicated 95% *ee*: $t_{(S)}$ (major) = 39.0 min, $t_{(R)}$ (minor) = 41.6 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{12}H_{12}NO$ $[M+H]^+$: 186.0919, found: 186.0920.

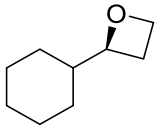
(*R*)-3-azido-1-(quinolin-3-yl)propan-1-ol [(*R*)-19c]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 6.5) containing 10 mM **19b** (1 mmol), 10 mM **NaN_3** (1 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 30 h. The crude product was purified by flash column chromatography on silica gel (dichloromethane : ethyl acetate = 10:1 ~ 3:1) to provide (*R*)-**19c** as a light yellow liquid in 49% yield (107.0 mg). **^{1}H NMR (400 MHz**, **DMSO-*d*$_6$)** δ 8.95 (d, *J* = 2.2 Hz, 1H), 8.28 (d, *J* = 2.2 Hz, 1H), 8.03 (d, *J* = 8.4 Hz, 1H), 7.97 (dd, *J* = 8.2, 1.5 Hz, 1H), 7.71 (ddd, *J* = 8.4, 6.8, 1.5 Hz, 1H), 7.58 (ddd, *J* = 8.1, 6.8, 1.2 Hz, 1H), 5.80 (d, *J* = 4.6 Hz, 1H), 4.93 (dd, *J* = 11.2, 6.8 Hz, 1H), 3.58 - 3.50 (m, 1H), 3.47 - 3.41 (m, 1H), 2.00 (q, *J* = 6.7 Hz, 2H).**^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 149.8, 147.1, 138.2, 132.1, 129.1, 128.7, 128.1, 127.6, 126.7, 67.8, 47.8, 37.7. **$[\alpha]_D^{25}$** = + 23.70 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OJ-H, 10% IPA in *n*-hexane, 1.0 ml/min, λ =210 nm)

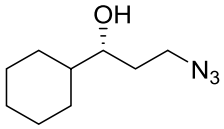
indicated >99% *ee*: $t_{(R)}$ (major) = 15.7 min, $t_{(S)}$ (minor)= 18.6 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{12}H_{12}N_4NaO$ $[M+Na]^+$: 251.0909, found: 251.0911.

(*S*)-2-cyclohexyloxetane [(*S*)-21b]



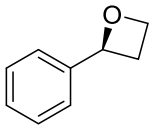
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 6.0) containing 5 mM **21b** (0.5 mmol), 15 mM **NaN_3** (1.5 mmol) and 30 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 96 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether: ethyl acetate = 50 : 1) to provide (*S*)-**21b** as a light yellow liquid in 32% yield (23.1mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 4.65 (td, *J* = 7.9, 5.7 Hz, 1H), 4.54 - 4.37 (m, 2H), 2.62 - 2.50 (m, 1H), 2.45 - 2.32 (m, 1H), 1.94 - 1.82 (m, 1H), 1.78 - 1.56 (m, 5H), 1.31 - 1.11 (m, 3H), 0.92 - 0.77 (m, 2H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 86.8, 68.3, 44.8, 27.6, 26.6, 26.2, 25.8, 25.6. **$[\alpha]_D^{25}$** = +6.00 (c = 1.00, CH_2Cl_2). **GC analysis (**Rt-bDEXcst, 80℃ for 45 min) indicated 89% *ee*: $t_{(S)}$ (major)= 33.0 min, $t_{(R)}$ (minor)= 36.0 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{16}NaO$ $[M+Na]^+$: 163.1099, found: 163.1096.

(*R*)-3-azido-1-cyclohexylpropan-1-ol [(*R*)-21c]



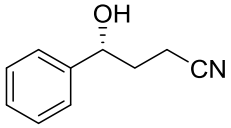
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 6.0) containing 5 mM **21b** (0.5 mmol), 15 mM **NaN_3** (1.5 mmol) and 30 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 96 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 50:1 ~ 15:1) to provide (*R*)-**21c** as a colorless liquid in 43% yield (39.7 mg). **^{1}H NMR (400 MHz**, **DMSO-*d*$_6$)** δ 4.47 (d, *J* = 5.9 Hz, 1H), 3.46 - 3.39 (m, 1H), 3.37 - 3.34 (m, 1H), 3.27 - 3.21 (m, 1H), 1.78 - 1.57 (m, 6H), 1.52 - 1.48 (m, 1H), 1.26 - 1.07 (m, 4H), 1.05 - 0.87 (m, 2H).**^{13}C NMR (100 MHz**, **DMSO-*d*$_6$)** δ 71.1, 48.2, 43.6, 32.7, 28.7, 27.7, 26.3, 26.0, 25.9. **$[\alpha]_D^{25}$** = - 20.00 (c = 0.5, CH_2Cl_2). **GC analysis (**Rt-bDEXcst, 140℃ for 60 min) indicated 97% *ee*: $t_{(S)}$ (minor)= 49.3 min, $t_{(R)}$ (major)= 50.5 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{17}N_3NaO$ $[M+Na]^+$: 206.1269, found: 206.1264.

(*S*)-2-phenyloxetane [(*S*)-1b] (Ring opening by <u>cyanide</u>)



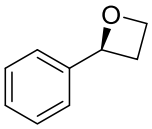
Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **1b** (2 mmol), 40 mM **mandelonitrile** (4 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 22 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1) to provide (*S*)-**1b** as a light yellow liquid in 37% yield (98.1 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$**) δ 7.50 - 7.45 (m, 2H), 7.42 (t, *J* = 7.7 Hz, 2H), 7.36 - 7.30 (m, 1H), 5.84 (t, *J* = 7.5 Hz, 1H), 4.85 (td, *J* = 8.1, 5.9 Hz, 1H), 4.68 (dt, *J* = 9.3, 5.8 Hz, 1H), 3.09 - 2.99 (m, 1H), 2.74 - 2.64 (m, 1H). **^{13}C NMR (100 MHz**, **CDCl$_3$**) δ 143.6, 128.6, 127.9, 125.3, 83.0, 68.3, 30.8. **[α]$_D^{25}$** = -167.16 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ =210 nm) indicated 97% *ee*: $t_{(S)}$ (major) = 9.8 min, $t_{(R)}$ (minor) = 11.0 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}O$ $[M+H]^+$: 135.0810, found: 135.0811.

(*R*)-4-hydroxy-4-phenylbutanenitrile [(*R*)-1d]



Prepared according to the general procedure: 100 mL PB buffer (50 mM, pH 7.5) containing 20 mM **1b** (2 mmol), 40 mM **mandelonitrile** (4 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 22 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1 ~ 2:1) to provide (*R*)-**1d** as a light yellow liquid in 46% yield (147.6 mg). **^{1}H NMR (400 MHz**, **CDCl$_3$)** δ 7.38 - 7.28 (m, 5H), 4.75 (dd, *J* = 8.1, 5.3 Hz, 1H), 2.81 (s, 1H), 2.50 - 2.43 (m, 1H), 2.37 - 2.29 (m, 1H), 2.01 - 1.94 (m, 2H). **^{13}C NMR (100 MHz**, **CDCl$_3$)** δ 143.0, 128.7, 128.1, 125.7, 119.8, 72.1, 34.2, 13.7. **[α]$_D^{25}$** = + 12.79 (c = 1.00, CH_2Cl_2). **HPLC analysis** (IH, 5% IPA in *n*-hexane, 0.5 ml/min, λ =210 nm) indicated >99% *ee*: $t_{(S)}$ (minor)= 58.5 min, $t_{(R)}$ (major) = 61.6 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{11}NNaO$ $[M+Na]^+$: 184.0738, found: 184.0740.

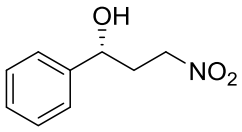
(*S*)-2-phenyloxetane [(*S*)-1b] (Ring opening by <u>nitrite</u>)



Prepared according to the general procedure: 200 mL PB buffer (50 mM, pH 7.5) containing 40 mM **1b** (8 mmol), 40 mM **$NaNO_2$** (8 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1) to provide (*S*)-**1b** as a light yellow liquid in 43% yield (459.1 mg). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.51 - 7.45 (m, 2H),

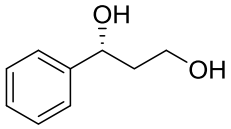
7.42 (t, *J* = 7.6 Hz, 2H), 7.36 - 7.30 (m, 1H), 5.84 (t, *J* = 7.5 Hz, 1H), 4.85 (td, *J* = 8.0, 5.8 Hz, 1H), 4.68 (dt, *J* = 9.2, 5.8 Hz, 1H), 3.09 - 2.99 (m, 1H), 2.74 - 2.63 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 143.6, 128.5, 127.9, 125.3, 83.0, 68.3, 30.8. **$[\alpha]_D^{25}$** = -161.94 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ =210 nm) indicated >99% *ee*: $t_{(S)}$ (major) = 10.1 min, $t_{(R)}$ (minor) = 11.4 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}O$ $[M+H]^+$: 135.0810, found: 135.0810.

(*R*)-3-nitro-1-phenylpropan-1-ol [(*R*)-1e]



Prepared according to the general procedure: 200 mL PB buffer (50 mM, pH 7.5) containing 40 mM **1b** (8 mmol), 40 mM **$NaNO_2$** (8 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1 ~ 2:1) to provide (*R*)-**1e** as a yellow liquid in 23% yield (327.2 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$)** δ 7.38 - 7.26 (m, 5H), 4.74 (dd, *J* = 8.3, 4.6 Hz, 1H), 4.54 - 4.48 (m, 1H), 4.41 - 4.36 (m, 1H), 3.42 (s, 1H), 2.37 - 2.27 (m, 2H).**^{13}C NMR (100 MHz**, **$CDCl_3$)** δ 142.9, 128.9, 128.3, 125.6, 72.4, 71.1, 35.9. **$[\alpha]_D^{25}$** = + 50.78 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OD-H, 10% IPA in *n*-hexane, 0.5 ml/min, λ =210 nm) indicated >99% *ee*: $t_{(S)}$ (minor)= 29.0 min, $t_{(R)}$ (major) = 39.8 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{11}NNaO_3$ $[M+Na]^+$: 204.0637, found: 204.0642.

(*R*)-1-phenylpropane-1,3-diol [(*R*)-1f]



Prepared according to the general procedure: 200 mL PB buffer (50 mM, pH 7.5) containing 40 mM **1b** (8 mmol), 40 mM **$NaNO_2$** (8 mmol) and 10 g dcw/L *E*. coli (HheD8-M4) cells, 30 °C, reaction for 24 h. The crude product was purified by flash column chromatography on silica gel (petroleum ether : ethyl acetate = 30:1 ~ 0:1) to provide (*R*)-**1f** as a light yellow liquid in 19% yield (232.1 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$)** δ 7.37 - 7.23 (m, 5H), 4.85 (dd, *J* = 8.7, 3.9 Hz, 1H), 3.70 - 3.77 (m, 2H), 3.64 (s, 2H), 1.93 - 1.83 (m, 2H).**^{13}C NMR (100 MHz**, **$CDCl_3$)** δ 144.4, 128.5, 127.5, 125.7, 73.6, 60.9, 40.4. **$[\alpha]_D^{25}$** = + 43.09 (c = 1.00, CH_2Cl_2). **HPLC analysis** (IH, 12% IPA in *n*-hexane, 0.8 ml/min, λ =210 nm) indicated 88% *ee*: $t_{(S)}$ (minor)= 11.9 min, $t_{(R)}$ (major) = 13.4 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{12}NaO_2$ $[M+Na]^+$: 175.0735, found: 175.0732.

7. Large-scale reactions

Large-scale reaction for the enantioselective dehalogenation of (*rac*)-**1a**:

In a 250 mL round-bottom flask, a resting cell suspension of *E. coli* (HheD8-M4) at a concentration of 10 g dcw/L was prepared in 100 mL of PB buffer (200 mM, pH 8.5). To the suspension, 20 mL of *n*-hexane was added, followed by 3.412 g (20 mmol) of γ-haloalcohol (*rac*)-**1a** dissolved in 2 mL of DMSO to achieve a final concentration of 200 mM. The reaction mixture was then stirred at 30 °C, and the pH was adjusted at 8.5±0.1 using a pH stat and 5 M NaOH as the alkaline solution. Upon completion of the enzymatic reaction after 33 h, the reaction mixture was subjected to extraction with ethyl acetate (3 × 90 mL). The organic phases were separated by centrifugation (8800 × *g*, 3 min), combined, dried over anhydrous Na_2SO_4, and evaporated at reduced pressure. The resulting mixture was purified by flash chromatography (petroleum ether : ethyl acetate = 50:1 ~ 20:1) on silica gel to afford the desired chiral oxetane (*R*)-**1b** with 1.183 g (44% yield, >99% e.e.) and chiral γ-haloalcohol (*S*)-**1a** with 1.700 g (49% yield, 97% e.e.).

Large-scale reaction for the enantioselective ring-opening of (*rac*)-**1b**:

In a 250 mL round-bottom flask, a resting cell suspension of *E. coli* (HheD8-M4) at a concentration of 10 g dcw/L was prepared in 100 mL of PB buffer (300 mM, pH 7.0). To the suspension, 20 mL of *n*-hexane was added, followed by 2.683 g (20 mmol) of oxetane (*rac*)-**1b** dissolved in 2 mL of DMSO and 1.302 g (20 mmol) of NaN_3. The reaction mixture was then stirred at 30 °C for 39 h. Upon completion of the enzymatic reaction, the reaction mixture was subjected to extraction with ethyl acetate (3 × 90 mL). The organic phases were separated by centrifugation (8800 × *g*, 3 min), combined, dried over anhydrous Na_2SO_4, and evaporated at reduced pressure. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl acetate = 50:1 ~ 15:1) on silica gel to afford the desired chiral γ-azidoalcohol (*R*)-**1c** with 1.597 g (45% yield, >99% e.e.) and chiral oxetane (*S*)-**1b** with 1.046 g (39% yield, 97% e.e.).

8. Biocatalytic cascades

General procedure: In a 200 mL round-bottom flask, a resting cell suspension of *E. coli* (HheD8-M4) at a concentration of 10 g dcw/L was prepared in 100 mL of PB buffer (50 mM, pH 7.5). To this suspension, 2 mmol of oxetane (*rac*)-**a** and 2 mmol of NaN_3 were added to a final concentration of 20 mM. The reaction mixture was then stirred at 30 °C. Upon completion of the

enzymatic reaction, the mixture was subjected to extraction using ethyl acetate (3 × 70 mL). The organic phases were separated by centrifugation (8800 × *g*, 3 min), combined, dried over anhydrous Na_2SO_4, and evaporated at reduced pressure. The resulting mixture was purified by flash chromatography (*n*-hexane: dichloromethane: ethyl acetate = 6:2:1) on silica gel to afford the desired chiral γ-azidoalcohol (*R*)-**c** and γ-haloalcohol (*S*)-**a**.

Substrate	T (h)	Isolated products	
(*rac*)-**1a**	8	(*R*)-**1c** (167.4 mg) (47% yield, >99 e.e.)	(*S*)-**1a** (171.0 mg) (50% yield, >99 e.e.)
(*rac*)-**6a**	12	(*R*)-**6c** (184.3 mg) (47% yield, >99 e.e.)	(*S*)-**6a** (187.2 mg) (49% yield, >99 e.e.)
(*rac*)-**7a**	48	(*R*)-**7c** (200.3 mg) (47% yield, >99 e.e.)	(*S*)-**7a** (204.1 mg) (50% yield, >99 e.e.)

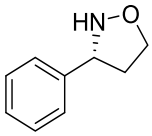
9. Transformations of chiral products

Synthesis of (*R*)-**1aa** from (*S*)-**1a**:

To a 50-mL round-bottom flask cooled with an ice bath, 264.2 mg (2.0 mmol) of tert-butyl *N*-hydroxycarbarnate was added, followed by the addition of 5 mL of anhydrous *N*, *N*-dimethylformamide (DMF). Then, 88.0 mg (2.2 mmol) of NaH was added, and the mixture was stirred for 30 min. Subsequently, 0.5 mL of anhydrous DMF containing 170.6 mg (1.0 mmol) of (*S*)-**1a** was added dropwise to the reaction mixture. The temperature was then gradually raised to 25 °C and the reaction was allowed to proceed for 72 h. Upon completion, the reaction mixture was quenched with saturated NH_4Cl solution and extracted thrice with ethyl acetate 3 × 5 mL. The organic layers were then separated, combined, and washed thrice with saturated brine. The organic phase was then dried over anhydrous Na_2SO_4, concentrated under vacuum, and purified by flash chromatography (petroleum ether: ethyl acetate = 15:1) to give the intermediate. Next, the intermediate was dissolved in 20 mL of dichloromethane (DCM) while cooling in an ice bath. Then, 208.5 μL (1.5 mmol) of triethylamine (Et_3N) was added, and the mixture was stirred for 10 min. Subsequently, 68 μL (0.87 mmol) of methanesulfonyl chloride was added dropwise, and the reaction was continued for 2 h. Following the reaction, the mixture was diluted with 10 mL of DCM and washed three times with saturated brine. The organic phases were then separated and concentrated under reduced pressure to yield a crude intermediate product. Finally, the crude

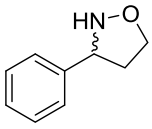
intermediate was dissolved in 20 mL of DCM at room temperature (25 °C). To this, 2.2 mL of trifluoroacetic acid (TFA) was added, and the mixture was stirred for 1 h. The reaction mixture was concentrated under reduced pressure, and the residue was redissolved in 10 mL of DCM. The solution was then washed three times with saturated $NaHCO_3$ aqueous solution, dried over anhydrous Na_2SO_4, and then concentrated again under reduced pressure. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl acetate = 15:1) on silica gel to afford the desired chiral produt (*R*)-**1aa** as a light yellow solid. The (*rac*)-**1aa** was synthesized from (*rac*)-**1a** according to the same procedures and used as a standard for chiral HPLC analysis.

(*R*)-3-phenylisoxazolidine [(*R*)-1aa]



Light yellow solid in 64% yield (96.4 mg). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.39 - 7.32 (m, 4H), 7.30 - 7.25 (m, 1H), 5.32 (s, 1H), 4.50 - 4.45 (m, 1H), 4.10 - 3.99 (m, 2H), 2.72 - 2.62 (m, 1H), 2.34 - 2.24 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 140.0, 128.8, 127.7, 127.0, 70.8, 63.5, 37.8. **$[\alpha]_D^{25}$** = - 12.59 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OJ-H, 10% IPA in *n*-hexane, 1.0 ml/min, 210 nm) indicated 92% *ee*: $t_{(S)}$ (minor) = 15.0 min, $t_{(R)}$ (major) = 17.5 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{12}NO$ $[M+H]^+$: 159.0919, found: 159.0917. **m.p.**: 31.3 - 32.7 °C.

(*rac*)-3-phenylisoxazolidine [(*rac*)-1aa]



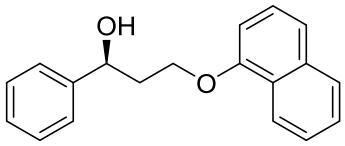
^{1}H NMR (400 MHz, CDCl$_3$) δ 7.40 - 7.33 (m, 4H), 7.30 - 7.26 (m, 1H), 5.10 (s, 1H), 4.47 (t, *J* = 6.3 Hz, 1H), 4.08 - 4.00 (m, 2H), 2.71 - 2.62 (m, 1H), 2.33 - 2.24 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 140.1, 128.7, 127.8, 126.9, 70.8, 63.5, 37.7.

Synthesis of (*S*)-**1ab** from (*S*)-**1a**:

To a 10-mL round-bottom flask, 82.9 mg (0.60 mmol) of anhydrous K_2CO_3 was added, followed by the addition of 1 mL of anhydrous DMF and 72.3 mg (0.5 mmol) of 1-naphthol. Afterward, the reaction temperature was increased to 70 °C, followed by the dropwise addition of 85.3 mg (0.5 mmol) of (*S*)-**1a**. The reaction was stirred for 12 hours, and subsequently quenched by adding 1 mL of distilled water. Equal volume of ethyl acetate was used to extract the mixture three times. The organic layers were then separated, combined, and washed thrice with saturated brine. The organic phase was then dried over anhydrous Na_2SO_4, and concentrated under reduced pressure to

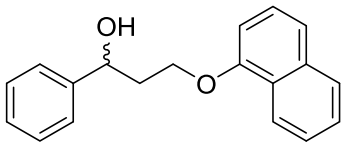
yield the crude product. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl acetate = 15:1) on silica gel to afford the desired chiral produt (*S*)-**1ab** as a light pink solid. The (*rac*)-**1ab** was synthesized from (*rac*)-**1a** according to the same procedures and used as a standard for chiral HPLC analysis.

(*S*)-3-(naphthalen-1-yloxy)-1-phenylpropan-1-ol [(*S*)-1ab]



Light pink solid in 78% yield (108.9 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$**) δ 8.28 - 8.25 (m, 1H), 7.84 - 7.81 (m, 1H), 7.54 - 7.48 (m, 2H), 7.46 - 7.43 (m, 3H), 7.40 - 7.35 (m, 3H), 7.34 - 7.29 (m, 1H), 6.81 (d, *J* = 7.6 Hz, 1H), 5.15 (q, *J* = 4.9 Hz, 1H), 4.38 - 4.32 (m, 1H), 4.23 - 4.18 (m, 1H), 2.47 - 2.40 (m, 1H), 2.37 - 2.30 (m, 2H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 154.5, 144.3, 134.6, 128.7, 127.8, 127.7, 126.5, 126.0, 126.0, 125.6, 125.4, 121.9, 120.5, 104.8, 72.3, 65.4, 38.6. **$[\alpha]_D^{25}$** = + 25.58 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, 210 nm) indicated 97% *ee*: $t_{(S)}$ (major) = 21.4 min, $t_{(R)}$ (minor) = 23.7 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{19}H_{18}NaO_2$ $[M+Na]^+$: 301.1204, found: 301.1211. **m.p.**: 69.4 - 71.3 °C.

(*rac*)-3-(naphthalen-1-yloxy)-1-phenylpropan-1-ol [(*rac*)-1ab]



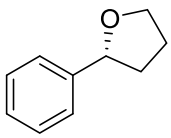
^{1}H NMR (400 MHz, **$CDCl_3$**) δ 8.34 - 8.32 (m, 1H), 7.88 - 7.86 (m, 1H), 7.59 - 7.53 (m, 2H), 7.50 (d, *J* = 8.2 Hz, 1H), 7.47 - 7.39 (m, 5H), 7.37 - 7.33 (m, 1H), 6.82 (d, *J* = 7.6 Hz, 1H), 5.13 (dd, *J* = 8.2, 5.0 Hz, 1H), 4.36 - 4.31 (m, 1H), 4.20 - 4.15 (m, 1H), 2.66 (s, 1H), 2.46 - 2.29 (m, 2H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 154.5, 144.2, 134.5, 128.6, 127.7, 127.6, 126.5, 126.0, 125.9, 125.6, 125.3, 121.9, 120.4, 104.8, 72.0, 65.3, 38.5.

Synthesis of (*R*)-**1ba** from (*R*)-**1b**:

To a wellstirred suspension of 200.0 mg (5.0 mmol) of NaH in dry diglyme (1 mL) was added 660.0 mg (3.0 mmol) of trimethylsulfoxonium iodide at room temperature. The mixture was gently heated to 125 °C, and 67.2 mg (0.5 mmol) of chiral oxetane (*R*)-**1b** in diglyme (0.5 mL) was added dropwise to the reaction mixture. The reaction mixture was stirred at 125 °C for 0.5 h, cooled, carefully quenched with distilled water, and extracted four times with equal volume of *n*-hexane. The combined extracts were washed with saturated brine, dried over anhydrous Na_2SO_4 and

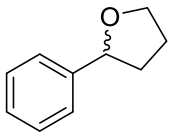
concentrated under reduced pressure to yield the crude product. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl acetate = 50:1) on silica gel to afford the desired chiral produt (*R*)-**1ba** as a light yellow liquid. The (*rac*)-**1ba** was synthesized from (*rac*)-**1b** according to the same procedures and used as a standard for chiral HPLC analysis.

(*R*)-2-phenyltetrahydrofuran [(*R*)-1ba]



Light yellow liquid in 73% yield (54.4 mg). **^{1}H NMR (400 MHz**, **$CDCl_3$**) δ 7.37 - 7.34 (m, 4H), 7.31 - 7.27 (m, 1H), 4.93 (t, *J* = 7.2 Hz, 1H), 4.13 (dt, *J* = 8.3, 6.9 Hz, 1H), 3.97 (td, *J* = 7.8, 6.4 Hz, 1H), 2.40 - 2.32 (m, 1H), 2.08 - 2.00 (m, 2H), 1.88 - 1.79 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 143.5, 128.4, 127.2, 125.7, 80.8, 68.8, 34.7, 26.1. **$[\alpha]_D^{25}$** = + 34.27 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OD-H, 8% IPA in *n*-hexane, 0.8 ml/min, 210 nm) indicated 92% *ee*: $t_{(R)}$ (major) = 6.2 min, $t_{(S)}$ (minor) = 8.0 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{13}O$ $[M+H]^+$: 149.0966, found: 149.0960.

(*rac*)-2-phenyltetrahydrofuran [(*rac*)-1ba]

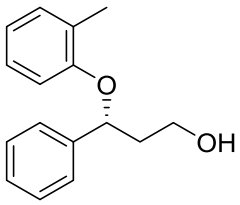


^{1}H NMR (400 MHz, **$CDCl_3$**) δ 7.35 (d, *J* = 4.3 Hz, 4H), 7.30 - 7.24 (m, 1H), 4.91 (t, *J* = 7.2 Hz, 1H), 4.12 (q, *J* = 7.4 Hz, 1H), 3.96 (q, *J* = 7.3 Hz, 1H), 2.38 - 2.30 (m, 1H), 2.08 - 1.97 (m, 2H), 1.86 - 1.77 (m, 1H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 143.5, 128.4, 127.2, 125.7, 80.8, 68.8, 34.7, 26.1.

Synthesis of (*R*)-**1bb** from (*R*)-**1b**:

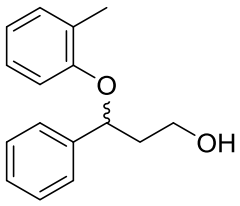
To a 10 mL round-bottom flask under argon, a solution of 149.5 mg (0.45 mmol) tris(2-methylphenyl)borate (CAS: 2665-12-5) in 1.0 mL of tetrahydrofuran (THF) was added, followed by the addition of 40.3 mg (0.3 mmol) oxetane (*R*)-**1b** in 0.5 mL of THF. The reaction mixture was stirred at 50 °C for 1 h. After evaporation of the solvent, the resulting mixture was then purified by flash chromatography (petroleum ether: ethyl acetate: DCM= 15:1:1) on silica gel, to give the desired chiral produt (*R*)-**1bb** as a white solid. The (*rac*)-**1bb** was synthesized from (*rac*)-**1b** according to the same procedures and used as a standard for chiral HPLC analysis.

(*R*)-3-phenyl-3-(o-tolyloxy)propan-1-ol [(*R*)-1bb]



White solid in 54% yield (38.0 mg). **^{1}H NMR (400 MHz, CDCl$_3$)** δ 7.37 - 7.31 (m, 4H), 7.27 - 7.23 (m, 1H), 7.13 (d, *J* = 7.3 Hz, 1H), 6.97 (t, *J* = 7.8 Hz, 0H), 6.79 (t, *J* = 7.4 Hz, 1H), 6.63 (d, *J* = 8.2 Hz, 0H), 5.40 (dd, *J* = 8.6, 4.2 Hz, 1H), 3.93 - 3.87 (m, 1H), 3.84 - 3.78 (m, 1H), 2.33 (s, 3H), 2.30 - 2.22 (m, 1H), 2.16 - 2.08 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 155.8, 141.7, 130.8, 128.8, 127.7, 126.9, 126.8, 125.8, 120.6, 112.9, 77.8, 60.0, 41.4, 16.8. **$[\alpha]_D^{25}$** = - 19.19 (c = 1.00, CH_2Cl_2). **HPLC analysis** (AD-H, 5% IPA in *n*-hexane, 1.0 ml/min, 210 nm) indicated 83% *ee*: $t_{(R)}$ (major) = 9.0 min, $t_{(S)}$ (minor) = 13.5 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{16}H_{18}NaO_2$ $[M+Na]^+$: 265.1204, found: 265.1210. **m.p.**: 49.7 - 51.4 °C.

(*rac*)-3-phenyl-3-(o-tolyloxy)propan-1-ol [(*rac*)-1bb]



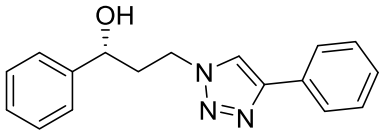
^{1}H NMR (400 MHz, CDCl$_3$) δ 7.38 - 7.32 (m, 4H), 7.29 - 7.24 (m, 1H), 7.14 (d, *J* = 7.3 Hz, 1H), 6.98 (t, *J* = 8.7 Hz, 1H), 6.81 (t, *J* = 7.3 Hz, 1H), 6.65 (d, *J* = 8.2 Hz, 1H), 5.42 (dd, *J* = 8.6, 4.2 Hz, 1H), 3.93 - 3.88 (m, 1H), 3.84 - 3.79 (m, 1H), 2.35 (s, 3H), 2.31 - 2.23 (m, 1H), 2.18 - 2.09 (m, 1H). **^{13}C NMR (100 MHz, CDCl$_3$)** δ 155.8, 141.7, 130.8, 128.8, 127.7, 126.9, 126.7, 125.8, 120.6, 112.9, 77.7, 60.0, 41.4, 16.8.

Synthesis of (*R*)-**1ca** from (*R*)-**1c**:

To 50-mL round-bottom flask was added 181.1 mg (1.02 mmol) of γ-azidoalcohol (*R*)-**1c** and 225 μL (2.04 mmol) of ethynylbenzene. $CuSO_4 \cdot 5H_2O$ (3.7 mg, 0.01 mmol) was weighed into a 10-mL round-bottom flask along with sodium ascorbate (11.4 mg, 0.06 mmol) and dissolved in 5.0 mL distilled H_2O. To this solution was added MonoPhos (3.8 mg, 0.01 mmol) and the solution was stirred at room temperature for 15 min. The solution in the 10-mL round-bottom flask was added to the roundbottom flask (with stirring) and a further 10.0 mL of water was added to the mixture. The reaction mixture was stirred at room temperature overnight (approximately 14 h). Afterwards, 10.0 mL of ice-cold distilled water was added to the mixture, followed by extraction with equal volume of DCM for three times. The combined extracts were washed with saturated brine, dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to yield the crude product. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl

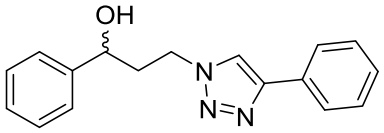
acetate= 2:1) on silica gel to afford the desired chiral produt (*R*)-**1ca** as a white solid. The (*rac*)-**1ca** was synthesized from (*rac*)-**1c** according to the same procedures and used as a standard for chiral HPLC analysis.

(*R*)-1-phenyl-3-(4-phenyl-1H-1,2,3-triazol-1-yl)propan-1-ol [(*R*)-1ca]



White solid in 89% yield (255.1 mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.76 - 7.74 (m, 3H), 7.39 - 7.23 (m, 8H), 4.66 (dd, *J* = 7.7, 5.7 Hz, 1H), 4.60 - 4.53 (m, 1H), 4.49 - 4.43 (m, 1H), 3.37 (s, 1H), 2.30 (dt, *J* = 7.7, 6.3 Hz, 2H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 147.7, 143.6, 130.5, 128.9, 128.7, 128.3, 127.9, 125.8, 125.7, 120.4, 70.8, 47.3, 39.2. **$[\alpha]_D^{25}$** = + 7.10 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OD-H, 20% IPA in *n*-hexane, 0.5 ml/min, λ= 210 nm) indicated >99% *ee*: $t_{(S)}$ (minor) = 26.4 min, $t_{(R)}$ (major) = 37.9 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{17}H_{18}N_3O$ $[M+H]^+$: 280.1450, found: 280.1456. **m.p.**: 117.2 ~ 120.0 °C.

(*rac*)-1-phenyl-3-(4-phenyl-1H-1,2,3-triazol-1-yl)propan-1-ol [(*rac*)-1ca]



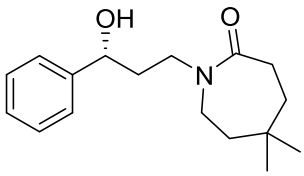
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.76 - 7.74 (m, 3H), 7.39 - 7.24 (m, 8H), 4.67 (dd, *J* = 7.6, 5.6 Hz, 1H), 4.59 - 4.52 (m, 1H), 4.47 - 4.41 (m, 1H), 3.90 (s, 1H), 2.29 (q, *J* = 6.8 Hz, 2H). **^{13}C NMR (100 MHz**, **$CDCl_3$**) δ 147.6, 143.7, 130.4, 128.9, 128.6, 128.2, 127.8, 125.7, 125.7, 120.4, 70.6, 47.2, 39.2.

Synthesis of (*R*)-**1cb** from (*R*)-**1c**:

To a 50-mL round-bottom flask, 104.2 mg (0.83 mmol) of 4,4-dimethylcyclohexan-1-one and 8 mL of anhydrous DCM were added. The flask was cooled to -78 °C, followed by the addition of 2 mL (16.21 mmol) of $BF_3{\cdot}OEt_2$, and then stirred for 30 minutes. Subsequently, a solution of 186.6 mg (1.05 mmol) γ-azidoalcohol (*R*)-**1c** in 2.0 mL of anhydrous DCM was cooled to 0 °C and then added dropwise to the above round-bottom flask. The reaction temperature was then slowly increased to room temperature and allowed to proceed for 24 h. The reaction mixture was concentrated under vacuum to yield a viscous brown liquid. Next, 10 mL of 15% (w/v) aqueous KOH solution was added to the crude product, and the mixture was stirred for 1 h. Equal volume of DCM was used to extract the mixture three times. The organic layers were separated, combined,

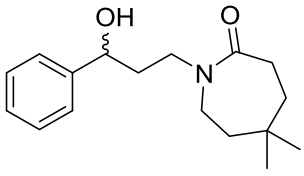
and washed with distilled water followed by saturated brine. The organic phase was dried over anhydrous Na_2SO_4 and concentrated under reduced pressure. The resultant mixture was further purified by flash chromatography (DCM: ethyl acetate = 2:1) on silica gel to afford the desired chiral product (*R*)-**1cb** as an orange liquid. The (*rac*)-**1cb** was synthesized from (*rac*)-**1c** according to the same procedures and used as a standard for chiral HPLC analysis.

(*R*)-1-(3-hydroxy-3-phenylpropyl)-5,5-dimethylazepan-2-one [(*R*)-1cb]



Yellow oil in 88% yield (256.3 mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.35 - 7.29 (m, 4H), 7.23 (q, *J* = 6.3 Hz, 1H), 4.81 (d, *J* = 3.9 Hz, 1H), 4.54 (dt, *J* = 10.5, 3.4 Hz, 1H), 4.09 (ddd, *J* = 15.0, 11.3, 4.3 Hz, 1H), 3.28 (s, 2H), 3.05 (dt, *J* = 14.2, 4.5 Hz, 1H), 2.54 - 2.40 (m, 2H), 1.93 - 1.84 (m, 1H), 1.80 - 1.71 (m, 1H), 1.52 - 1.36 (m, 4H), 0.96 (d, *J* = 7.6 Hz, 6H). **^{13}C NMR (100 MHz, $CDCl_3$)** δ 177.3, 144.2, 128.3, 127.1, 125.7, 69.8, 45.4, 45.3, 41.0, 37.6, 36.2, 32.5, 32.3. **$[\alpha]_D^{25}$** = - 2.00 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OJ-H, 10% IPA in *n*-hexane, 1.0 ml/min, λ= 214 nm) indicated >99% *ee*: $t_{(S)}$ (minor) = 8.1 min, $t_{(R)}$ (major) = 8.9 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{17}H_{25}NNaO_2$ $[M+Na]^+$: 298.1783, found: 298.1789. **m.p.**: 65.3 - 71.2 °C.

(*rac*)-1-(3-hydroxy-3-phenylpropyl)-5,5-dimethylazepan-2-one [(*rac*)-1cb]



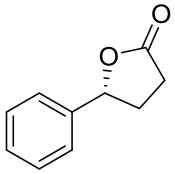
^{1}H NMR (400 MHz, $CDCl_3$) δ 7.35 -7.28 (m, 4H), 7.23 - 7.19 (m, 1H), 4.87 (dt, *J* = 3.9 Hz, 1H), 4.53 (dt, *J* = 10.2, 3.4 Hz, 1H), 4.05 (ddd, *J* = 14.5, 10.8, 4.6 Hz, 1H), 3.27 (s, 2H), 3.05 (dt, *J* = 14.7, 4.0 Hz, 1H), 2.51 - 2.38 (m, 2H), 1.92 - 1.84 (m, 1H), 1.79 - 1.71 (m, 1H), 1.48 - 1.39 (m, 4H), 0.95 (d, *J* = 7.2 Hz, 6H).**^{13}C NMR (100 MHz, $CDCl_3$)** δ 177.2, 144.1, 128.2, 127.0, 125.6, 69.7, 45.3, 45.2, 40.9, 37.6, 36.1, 32.4, 32.2.

Synthesis of (*R*)-**1da** from (*R*)-**1d**:

To a 10-mL round-bottom flask, 52.6 mg (0.33 mmol) γ-cyanoalcohol (*R*)-**1d** and 1.1 mL of 3 M aqueous NaOH solution were added. After the addition of 1.0 mL of 30% (w/v) H_2O_2, the solution was heated to 70 °C and allowed to proceed for 2 h. After cooling the flask to room temperature, 10.0 mL of distilled water was added to quench the reaction. The reaction mixture was extracted 20 mL of DCM. The aqueous phase was separated, followed by the addition of 6 M HCl solution

until the pH reached between 2-3. Then the reaction mixture was extracted with DCM (3 × 10 mL). The combined organic layers were dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to yield the crude product. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl acetate = 2:1) on silica gel to afford the desired chiral produt (*R*)-**1da** as a colorless liquid. The (*rac*)-**1da** was obtained from commercial suppliers and used as a standard for chiral HPLC analysis.

(*R*)-5-phenyldihydrofuran-2(3H)-one [(*R*)-1da]

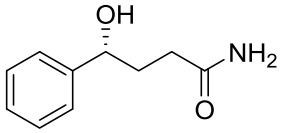


Colorless oil in 73% yield (38.8 mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.41 - 7.32 (m, 5H), 5.50 (dd, J = 8.1, 5.8 Hz, 1H), 2.69 - 2.62 (m, 3H), 2.22 - 2.15 (m, 1H).**^{13}C NMR (100 MHz**, **$CDCl_3$**) δ 177.1, 139.4, 128.8, 128.5, 125.4, 81.3, 31.1, 29.1. **$[\alpha]_D^{25}$** = + 17.19 (c = 1.00, CH_2Cl_2). **HPLC analysis** (IH, 10% IPA in *n*-hexane, 1.0 ml/min, λ= 210 nm) indicated >99% *ee*: $t_{(S)}$ (minor) = 24.5 min, $t_{(R)}$ (major) = 28.3 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{10}NaO_2$ $[M+Na]^+$: 185.0578, found: 185.0581.

Synthesis of (*R*)-**1db** from (*R*)-**1d**:

To a 10-mL round-bottom flask, 71.8 mg (0.45 mmol) of γ-cyanoalcohol (*R*)-**1d**, 150 μL of 30% (w/v) H_2O_2 and 2.0 mL of 25% (w/v) $NH_3 \cdot H_2O$ were added. The reaction mixture was allowed to stitr at room temperature for 12 h. Afterwards, 15 mL methanol was added to the reaction and dried over anhydrous Na_2SO_4 .Then the mixture were filtered and concentrated under reduced pressure to yield the crude product. The resulting mixture was purified by flash chromatography (methanol: ethyl acetate = 1:10) on silica gel to afford the desired chiral produt (*R*)-**1db** as a colorless liquid. The (*rac*)-**1db** was synthesized from (*rac*)-**1d** according to the same procedures and used as a standard for chiral HPLC analysis.

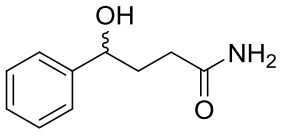
(*R*)-4-hydroxy-4-phenylbutanamide [(*R*)-1db]



Colorless liquid in 54% yield (42.9 mg). **^{1}H NMR (400 MHz, CD_3OD)** δ 7.37 - 7.30 (m, 4H), 7.26 - 7.22 (m, 1H), 4.91 (s, 3H), 4.65 (t, *J* = 6.6 Hz, 1H), 2.30 - 2.22 (m, 2H), 2.03 - 1.96 (m, 2H).**^{13}C NMR (100 MHz**, **CD_3OD**) δ 178.8, 145.9, 129.3, 128.3, 127.0, 74.3, 35.9, 32.8. **$[\alpha]_D^{25}$** = + 34.69 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OJ-H, 10% IPA in *n*-hexane, 1.0 ml/min, λ= 210 nm)

indicated >99% *ee*: $t_{(R)}$ (major) = 15.8 min, $t_{(S)}$ (minor) = 18.1 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{10}H_{13}NNaO_2$ $[M+Na]^+$: 202.0844, found: 202.0850.

(*rac*)-4-hydroxy-4-phenylbutanamide [(*rac*)-1db]

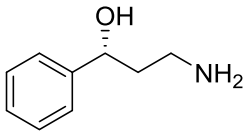


^{1}H NMR (400 MHz, CD_3OD) δ 7.41 - 7.35 (m, 4H), 7.30 - 7.26 (m, 1H), 5.00 (s, 3H), 4.69 (t, *J* = 6.5 Hz, 1H), 2.34 - 2.29 (m, 2H), 2.01 (q, *J* = 7.4 Hz, 2H).**^{13}C NMR (100 MHz**, **CD_3OD**) δ 178.6, 145.6, 129.2, 128.2, 126.8, 74.1, 35.7, 32.7.

Synthesis of (*R*)-**1ea** from (*R*)-**1e**:

To a stirred solution of γ-nitroalcohol (*R*)-**1e** (58.7 mg, 0.32 mmol) in MeOH (10 mL), 51.3 mg of Pd/C (10 mol%) was added. The mixture was stirred at room temperature for 6 h under a hydrogen balloon. Afterward, the reaction mixture was filtered through a pad of Celite, which was then washed with 30 mL of MeOH. The filtrate was dried over anhydrous Na_2SO_4 and concentrated, giving the desired chiral product (*R*)-**1ea** as a colorless liquid. The (*rac*)-**1ea** was obtained from commercial suppliers and used as a standard for chiral HPLC analysis.

(*R*)-3-amino-1-phenylpropan-1-ol [(*R*)-1ea]



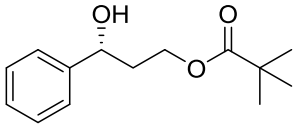
Colorless liquid in 92% yield (45.3 mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.43- 7.37 (m, 4H), 7.34 - 7.28 (m, 1H), 4.88 (dd, *J* = 7.9, 4.4 Hz, 1H), 3.63 (s, 3H), 2.99 - 2.94 (m, 1H), 2.92 - 2.88 (m, 1H), 1.88 - 1.78 (m, 2H).**^{13}C NMR (100 MHz**, **$CDCl_3$**) δ145.1, 128.4, 127.1, 125.7, 75.2, 40.4, 39.7. **$[\alpha]_D^{25}$** = + 78.25 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OB-H, 8% IPA in *n*-hexane, 1.0 ml/min, λ= 210 nm) indicated >99% *ee*: $t_{(S)}$ (minor) = 23.6 min, $t_{(R)}$ (major) = 41.9 min. **HRMS** (**ESI**) *m/z*: calculated for $C_9H_{13}NNaO$ $[M+Na]^+$: 174.0895, found: 174.0896.

Synthesis of (*R*)-**1fa** from (*R*)-**1f**:

To a 10-mL round-bottom flask, 47.5 mg (0.31 mmol) of γ-diol (*R*)-**1f**, 1 mL of DCM, and 150 μL (1.08 mmol) of Et_3N were added. The flask was cooled to 0 °C, followed by dropwise addition of 50 μL (0.41 mmol) of pivaloyl chloride. The reaction mixture was then stirred at room temperature for 6 h. Afterward, the reaction mixture was quenched with 2 mL of distilled water, extracted with

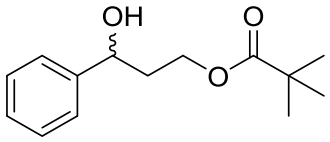
DCM (3 × 2 mL), and washed with saturated brine. The organic layer was then dried over anhydrous Na_2SO_4 and concentrated under reduced pressure to obtain the crude product. The resulting mixture was purified by flash chromatography (petroleum ether: ethyl acetate = 10:1) to afford the desired chiral product (*R*)-**1fa** as a colorless liquid. The (*rac*)-**1fa** was synthesized from (*rac*)-**1f** according to the same procedures and used as a standard for chiral HPLC analysis.

(*R*)-3-hydroxy-3-phenylpropyl pivalate [(*R*)-1fa]



Colorless liquid in 83% yield (61.4 mg). **^{1}H NMR (400 MHz, $CDCl_3$)** δ 7.38 - 7.33 (m, 4H), 7.30 - 7.27 (m, 1H), 4.76 (dd, *J* = 8.3, 5.0 Hz, 1H), 4.30 (ddd, *J* = 13.1, 7.6, 5.5 Hz, 1H), 4.08 (dt, *J* = 11.2, 5.8 Hz, 1H), 2.59 (s, 1H), 2.12 - 1.98 (m, 2H), 1.21 (s, 9H). **^{13}C NMR (100 MHz**, **$CDCl_3$**) δ178.9, 144.0, 128.7, 127.8, 125.8, 71.4, 61.6, 38.9, 38.2, 27.3. **$[\alpha]_D^{25}$** = + 9.80 (c = 1.00, CH_2Cl_2). **HPLC analysis** (OX-3, 3% IPA in *n*-hexane, 0.7 ml/min, λ= 210 nm) indicated 87.8% *ee*: $t_{(S)}$ (minor) = 24.1 min, $t_{(R)}$ (major) = 25.4 min. **HRMS** (**ESI**) *m/z*: calculated for $C_{14}H_{20}NaO_3$ $[M+Na]^+$: 259.1310, found: 259.1317.

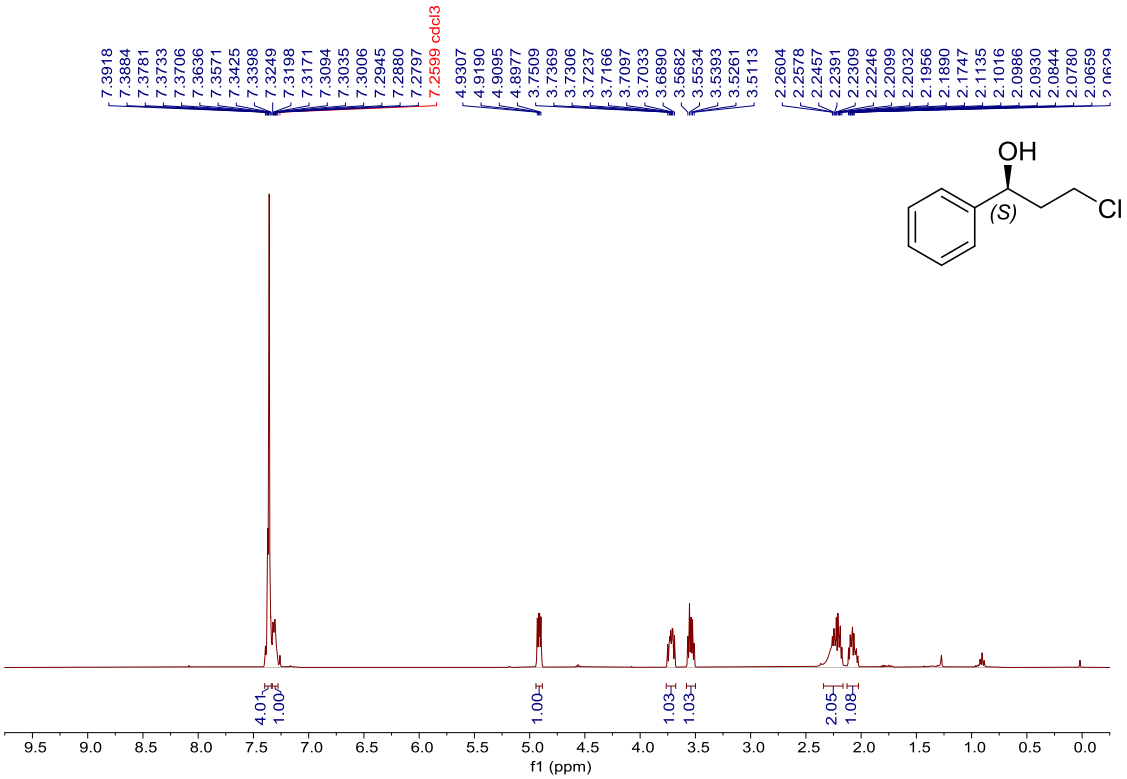
(*rac*)-3-hydroxy-3-phenylpropyl pivalate [(*rac*)-1fa]

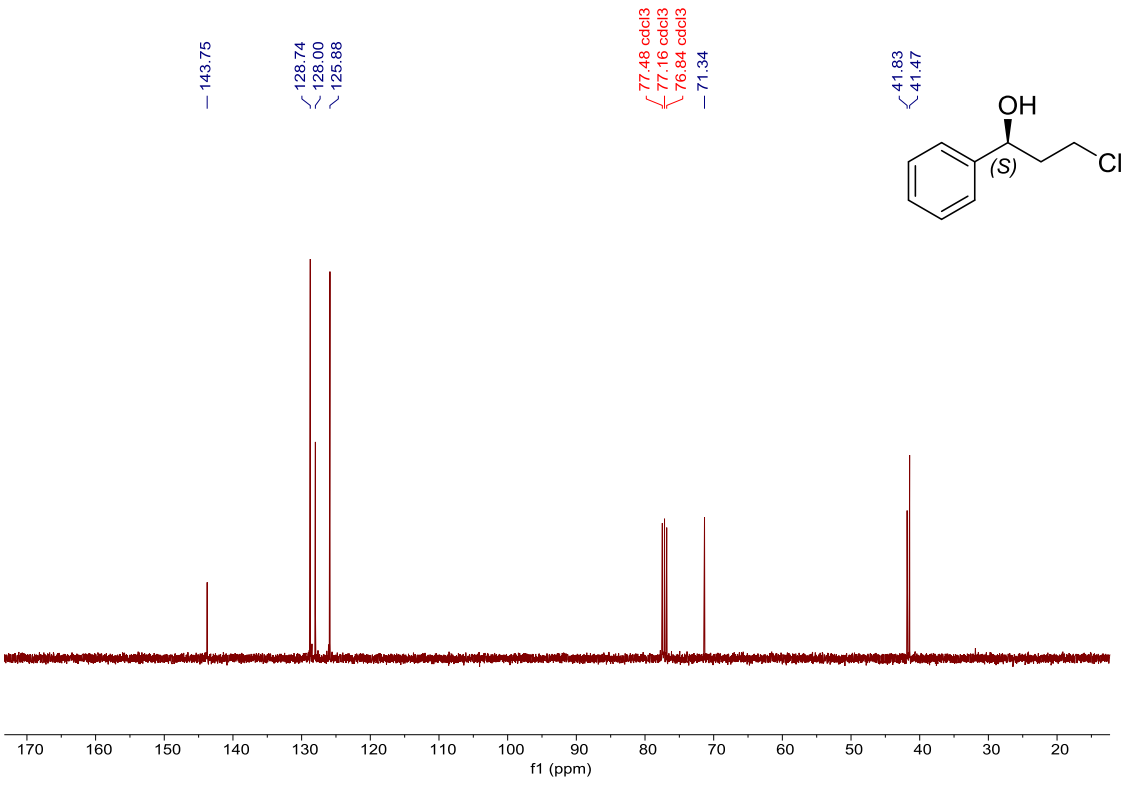


^{1}H NMR (400 MHz, $CDCl_3$) δ 7.37 - 7.27 (m, 5H), 4.76 (dd, *J* = 8.2, 5.0 Hz, 1H), 4.29 (ddd, *J* = 13.1, 7.6, 5.5 Hz, 1H), 4.07 (dt, *J* = 11.2, 5.9 Hz, 1H), 2.84 (s, 1H), 2.12 - 1.96 (m, 2H), 1.21 (s, 9H). **^{13}C NMR (100 MHz**, **$CDCl_3$**) δ 178.9, 144.0, 128.6, 127.7, 125.8, 71.3, 61.6, 38.8, 38.1, 27.2.

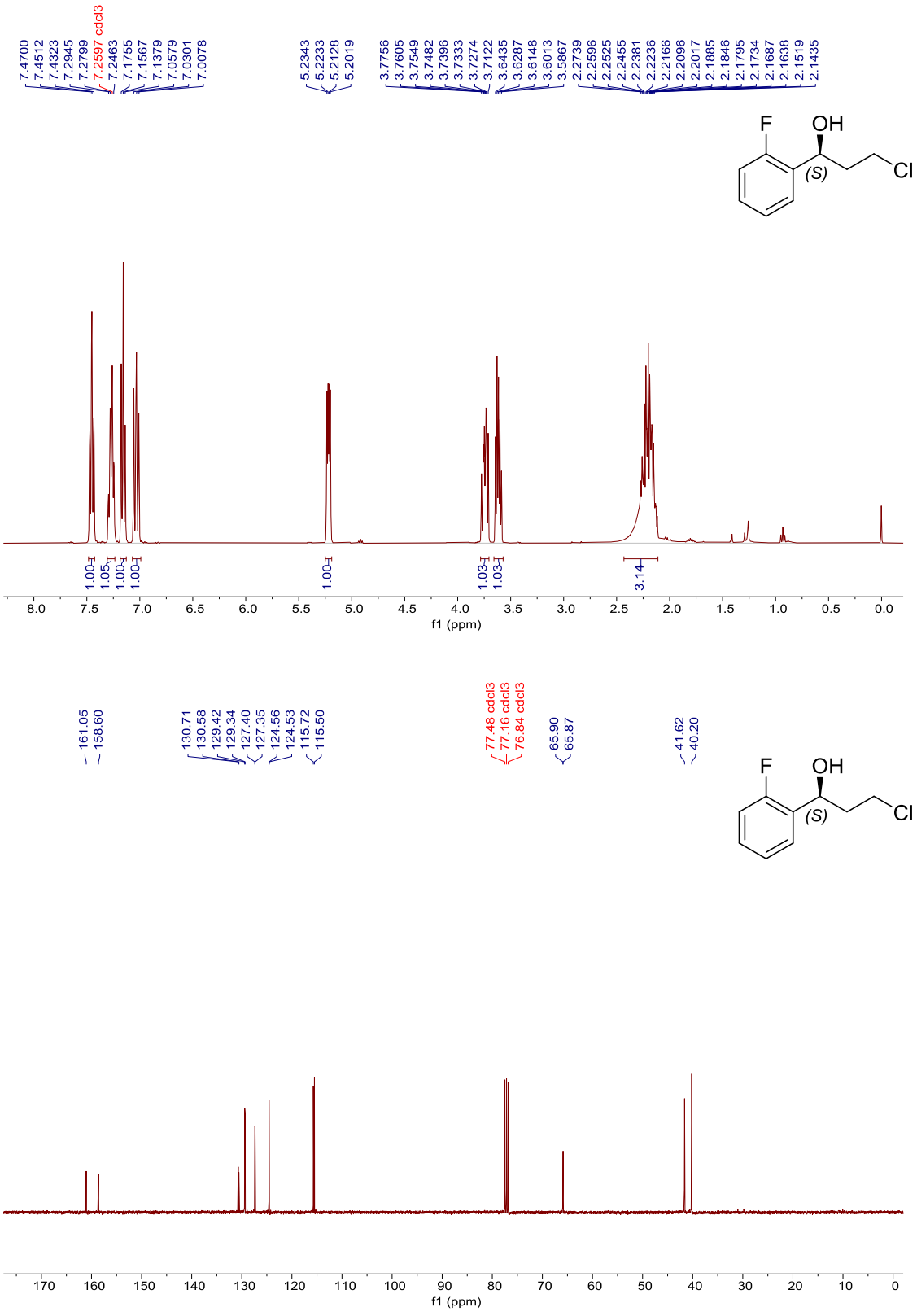
10. Copies of NMR spectra

(*S*)-3-chloro-1-phenylpropan-1-ol [(*S*)-1a]

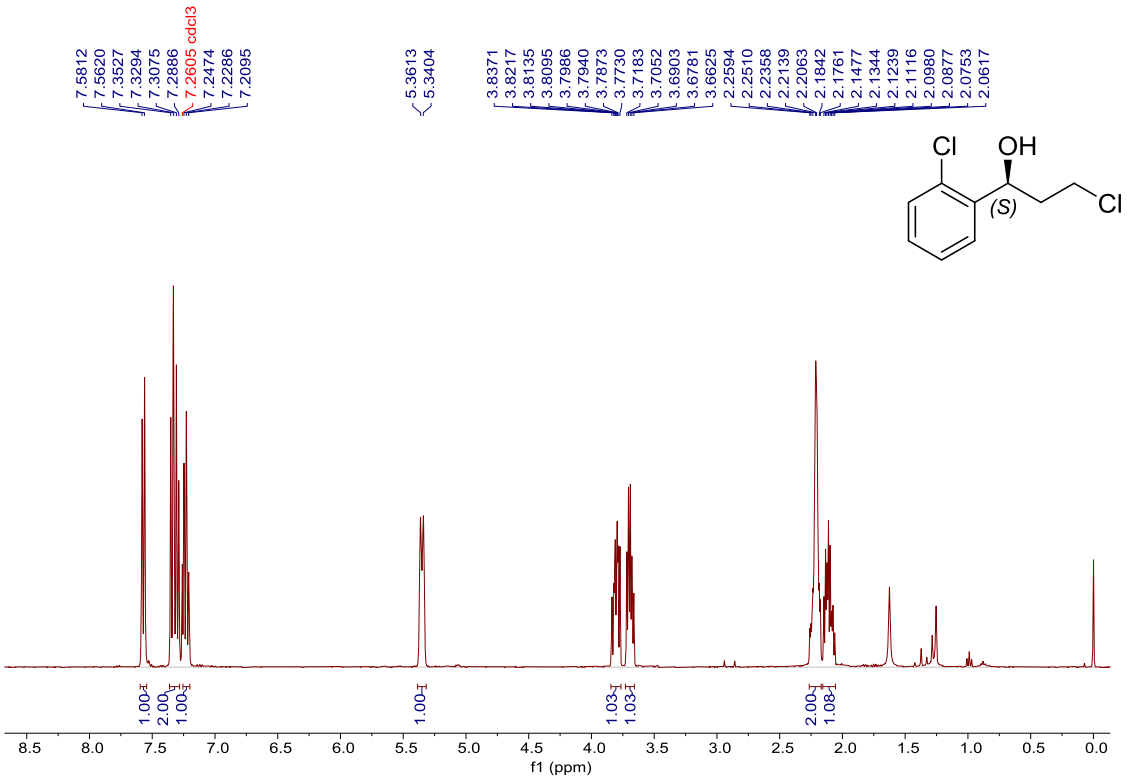


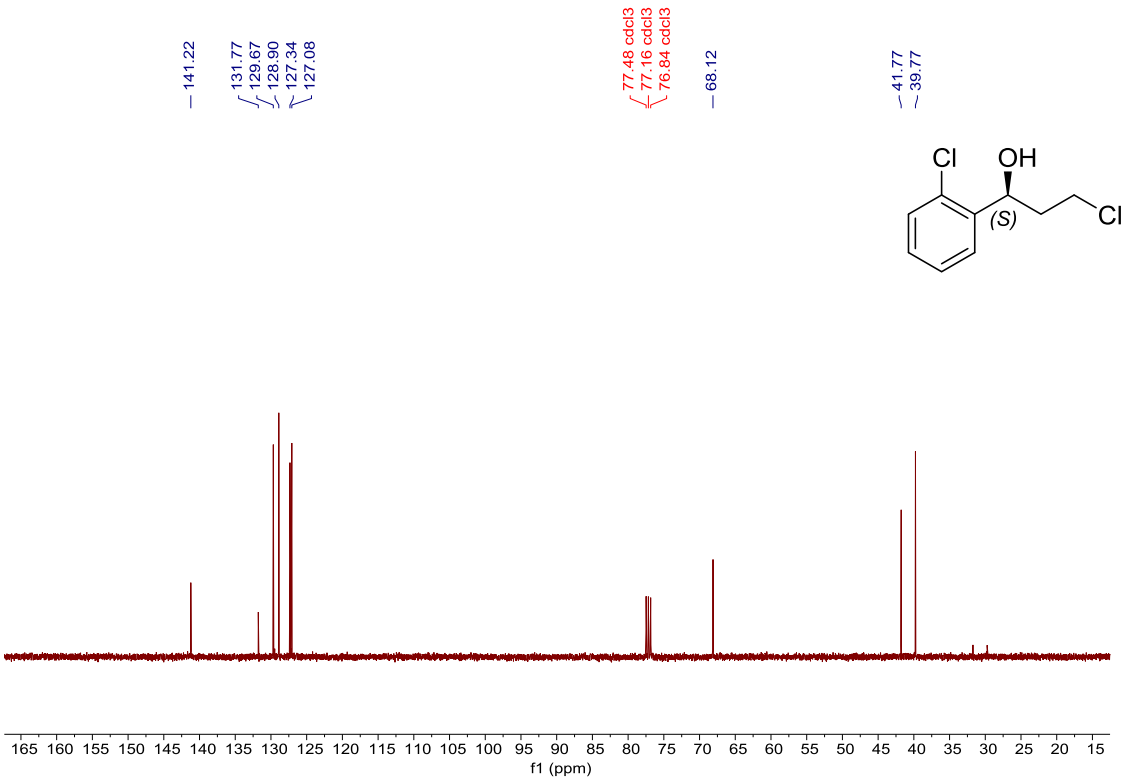


(*S*)-3-chloro-1-(2-fluorophenyl)propan-1-ol [(*S*)-2a]

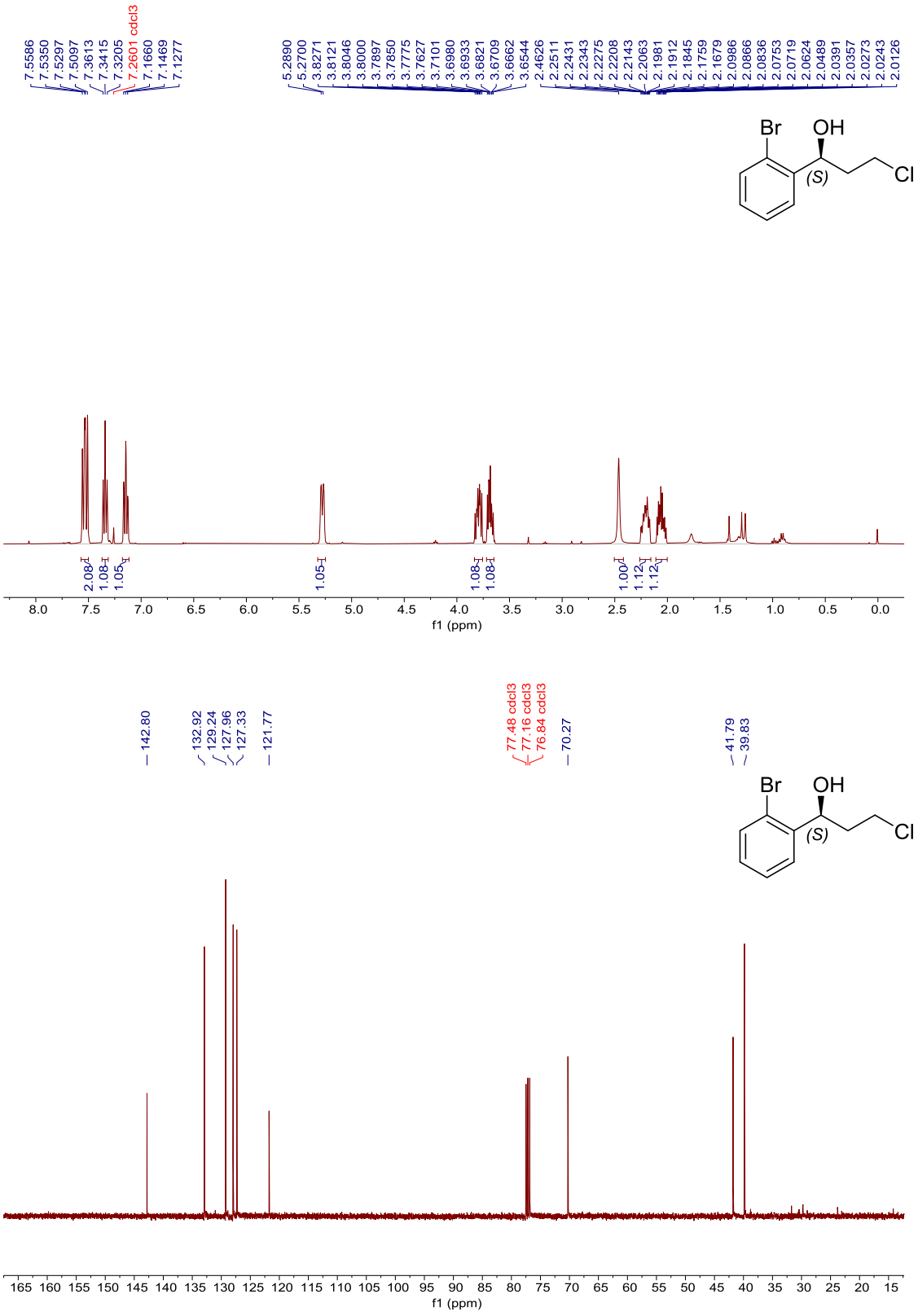


(*S*)-3-chloro-1-(2-chlorophenyl)propan-1-ol [(*S*)-3a]

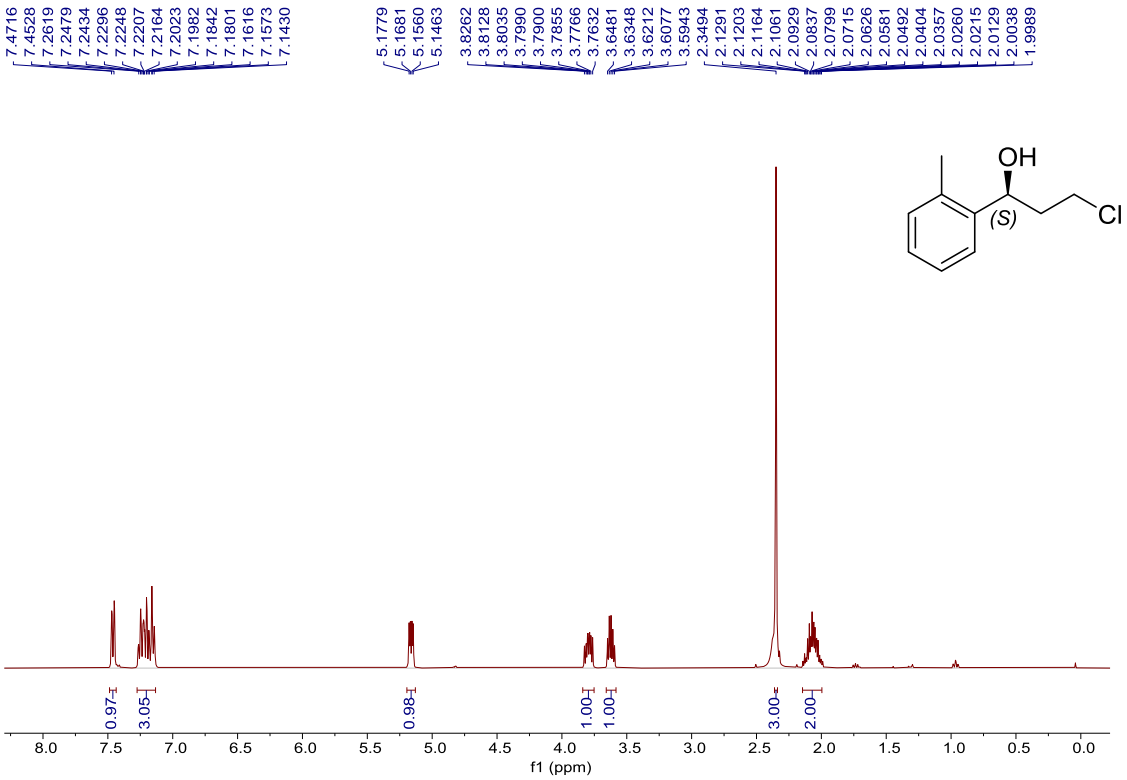


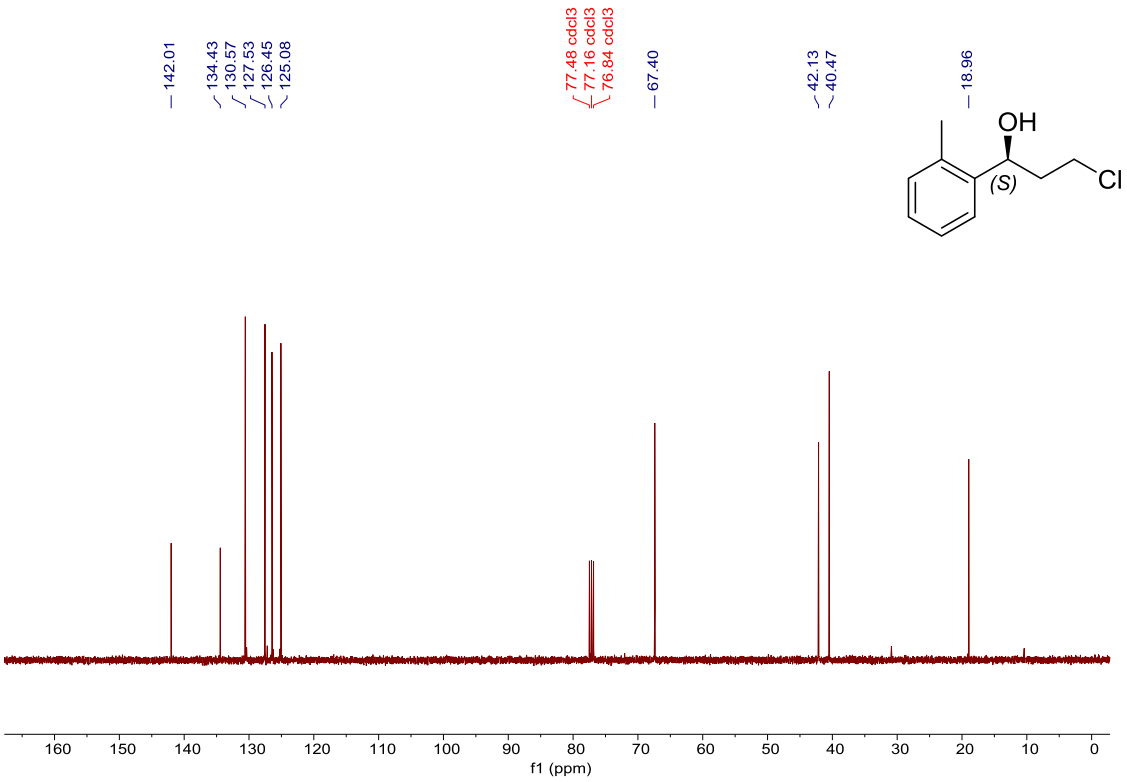


(*S*)-1-(2-bromophenyl)-3-chloropropan-1-ol [(*S*)-4a]

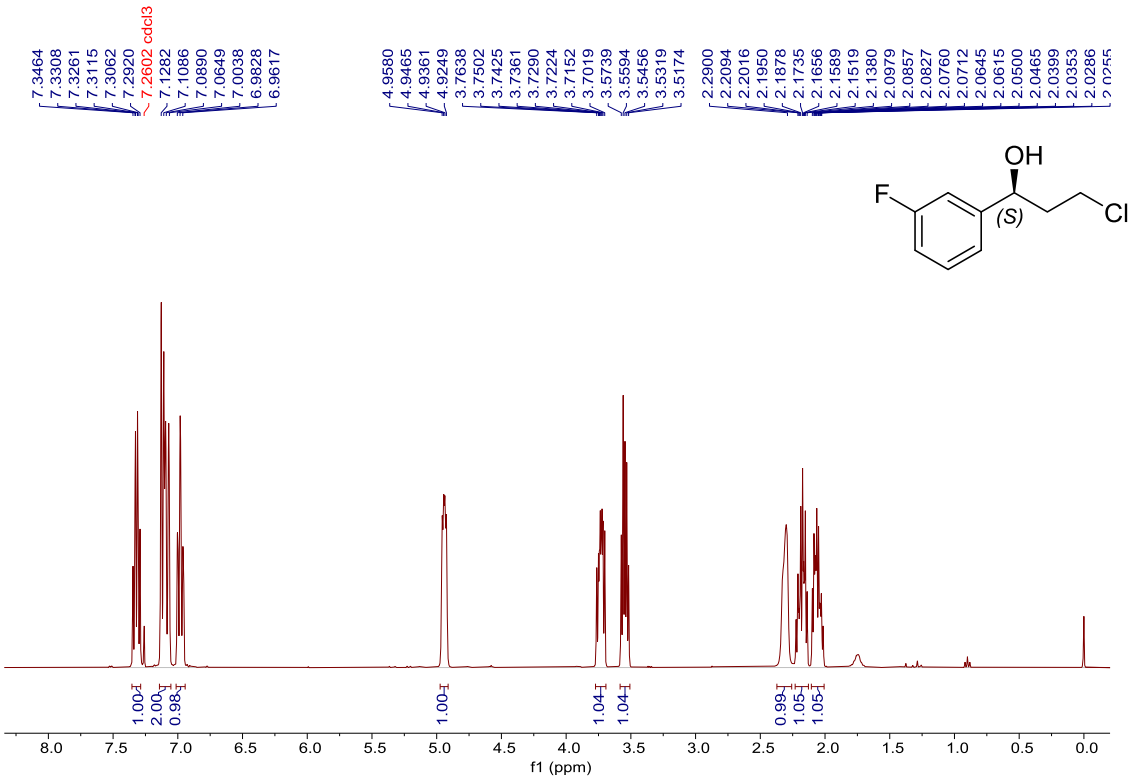


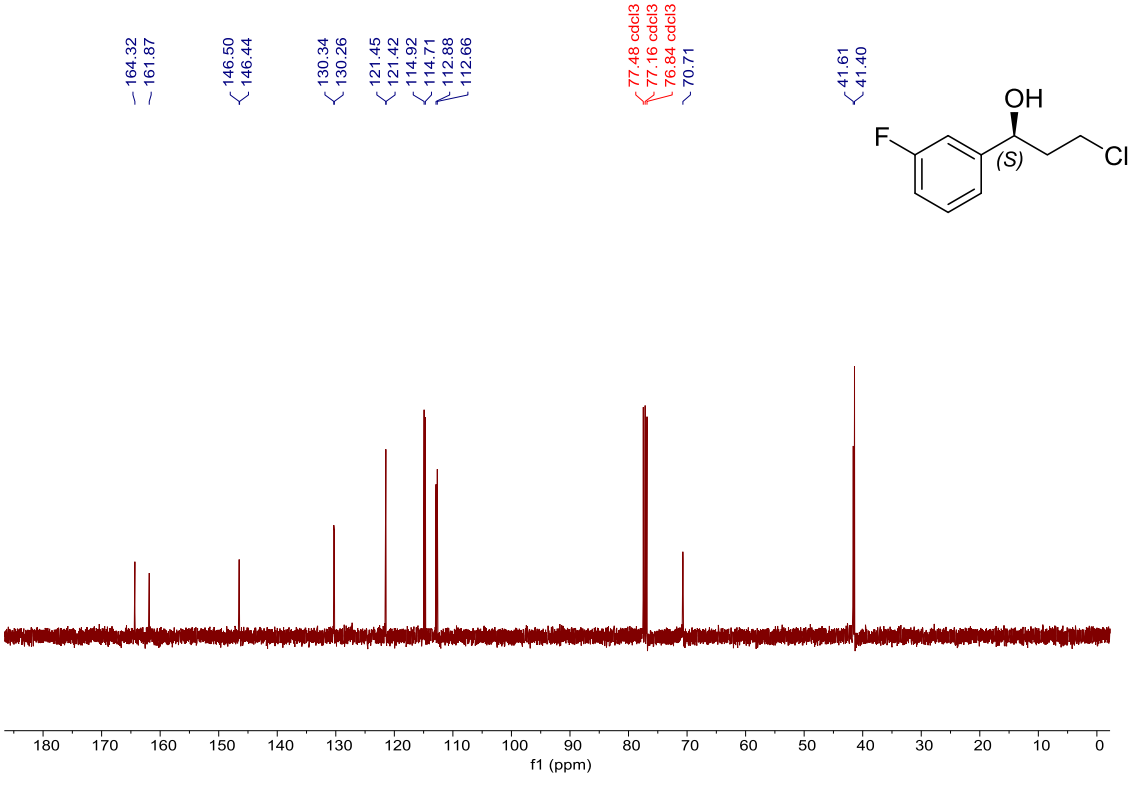
(*S*)-3-chloro-1-(o-tolyl)propan-1-ol [(*S*)-5a]



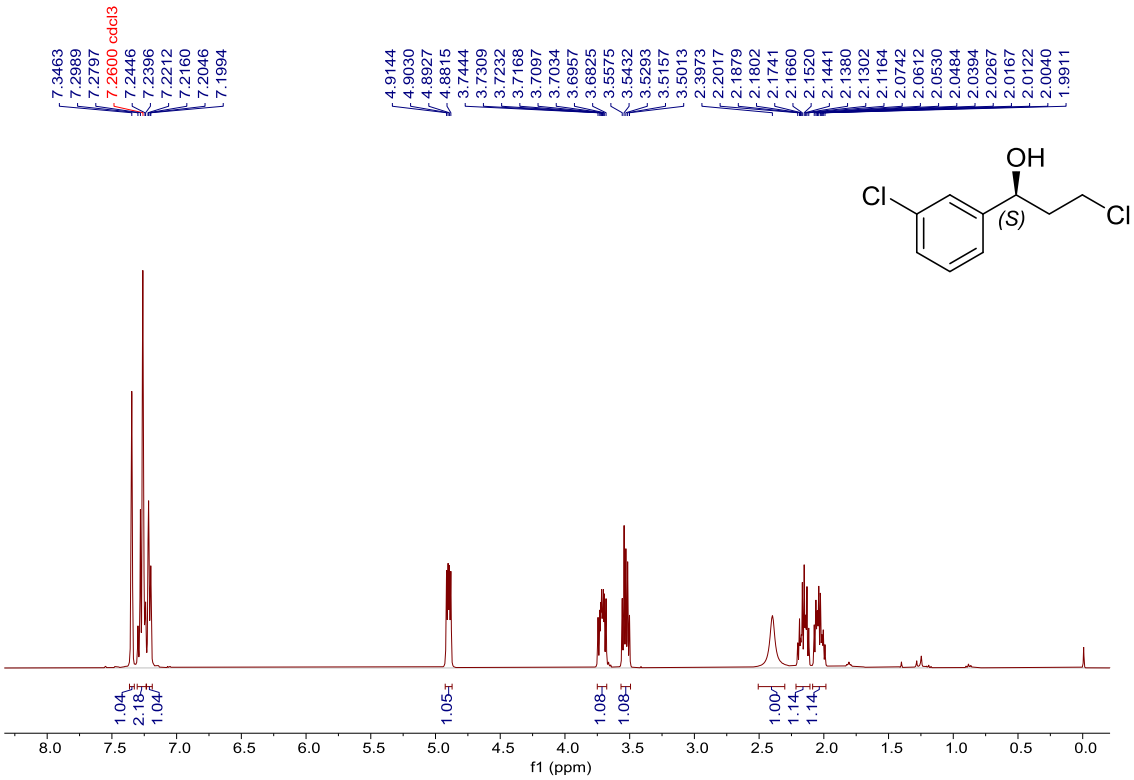


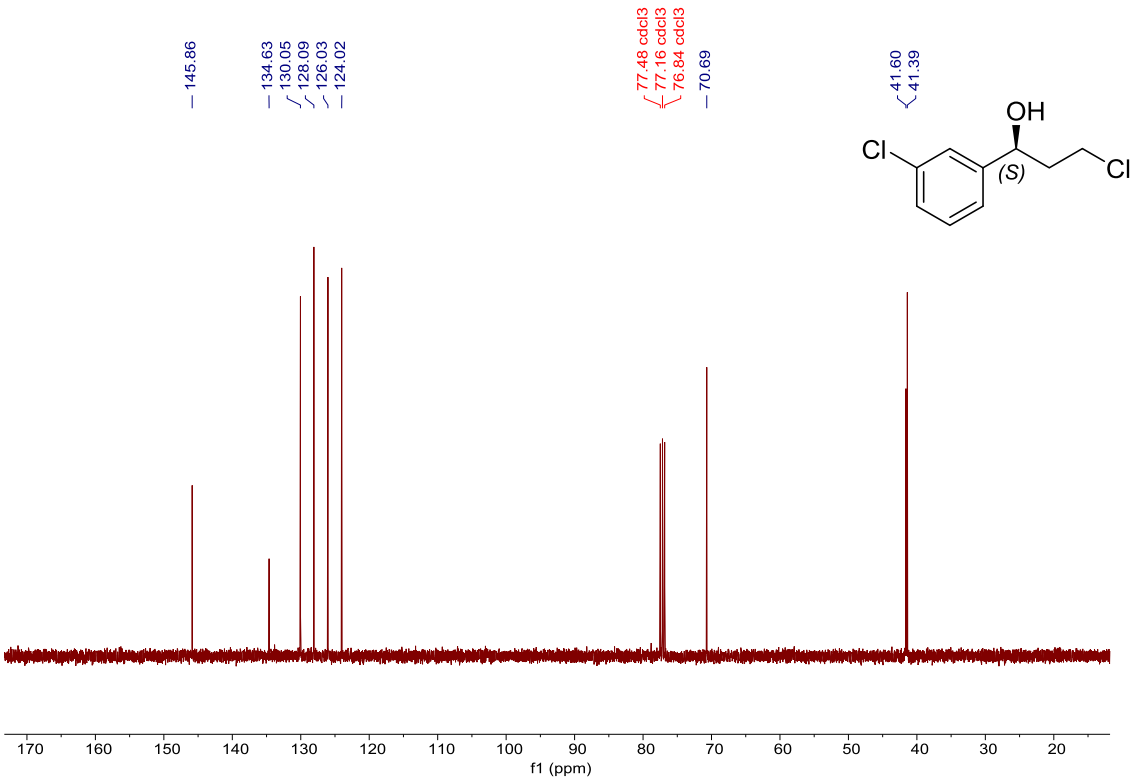
(*S*)-3-chloro-1-(3-fluorophenyl)propan-1-ol [(*S*)-6a]



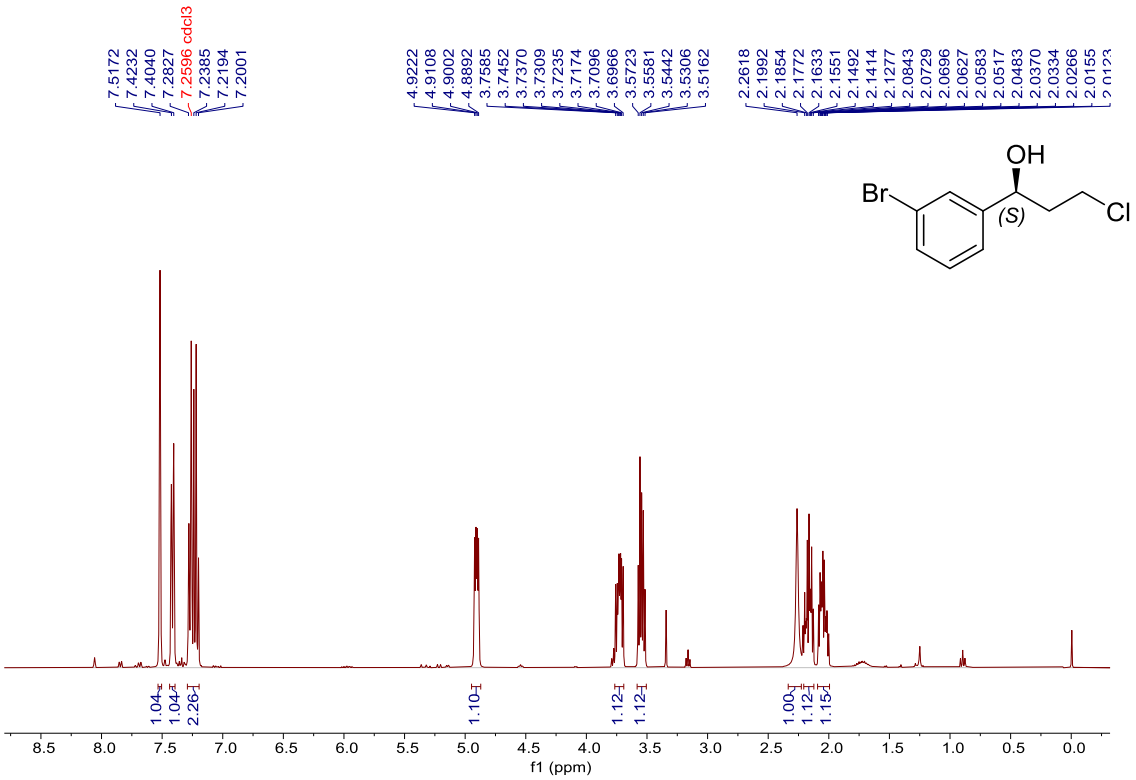


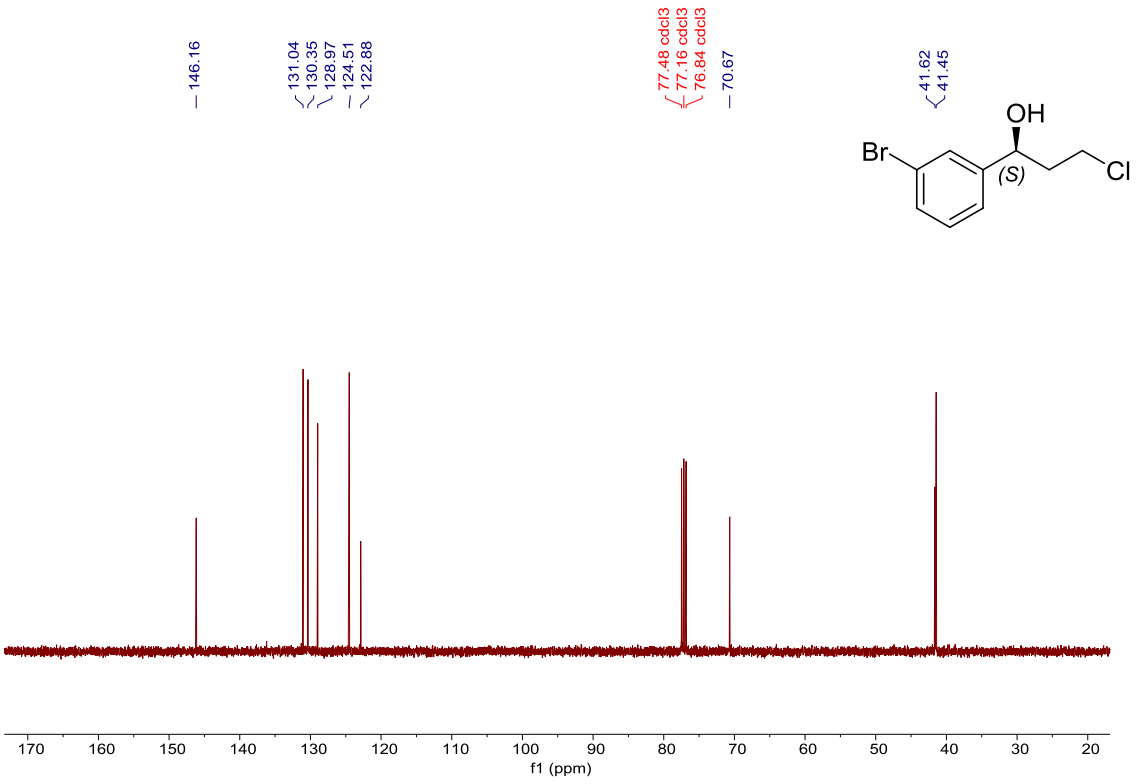
(*S*)-3-chloro-1-(3-chlorophenyl)propan-1-ol [(*S*)-7a]



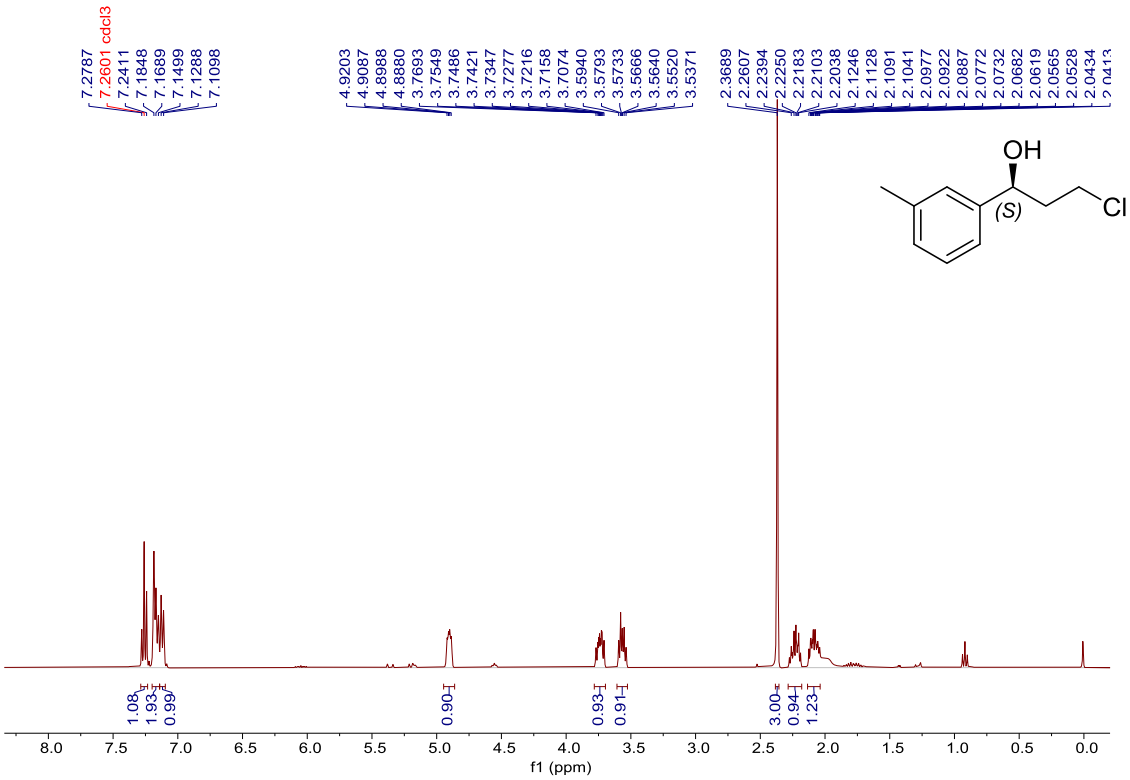


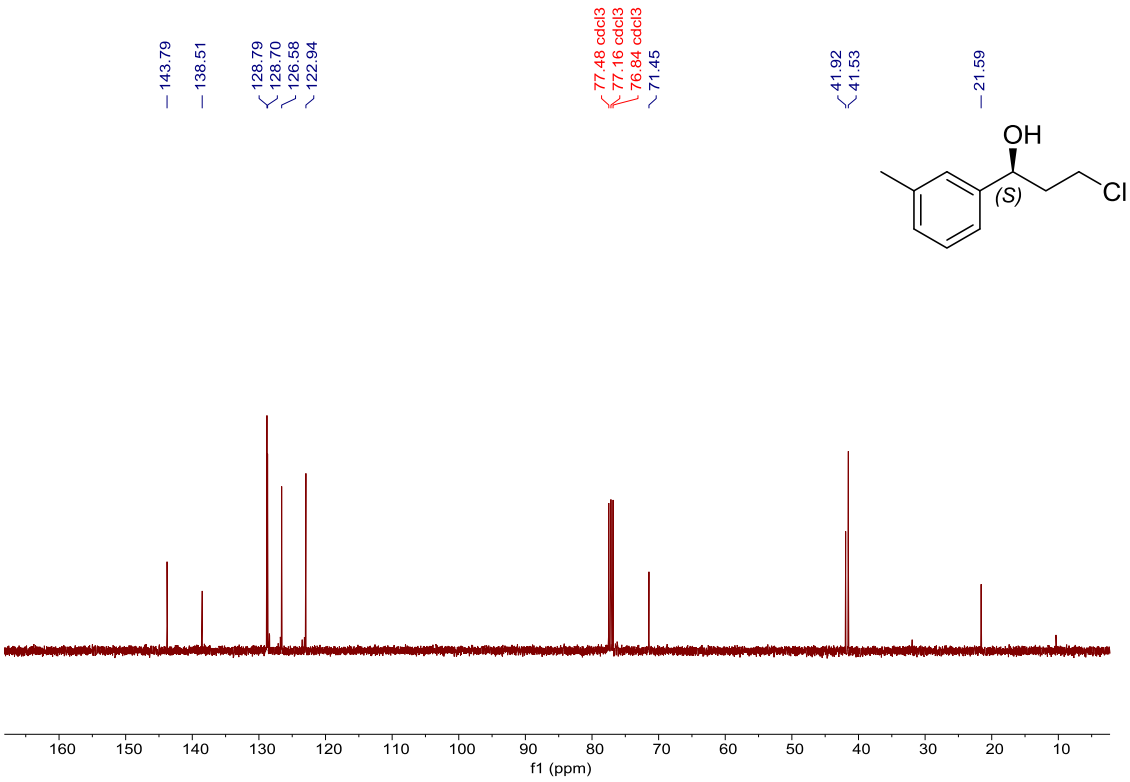
(*S*)-1-(3-bromophenyl)-3-chloropropan-1-ol [(*S*)-8a]



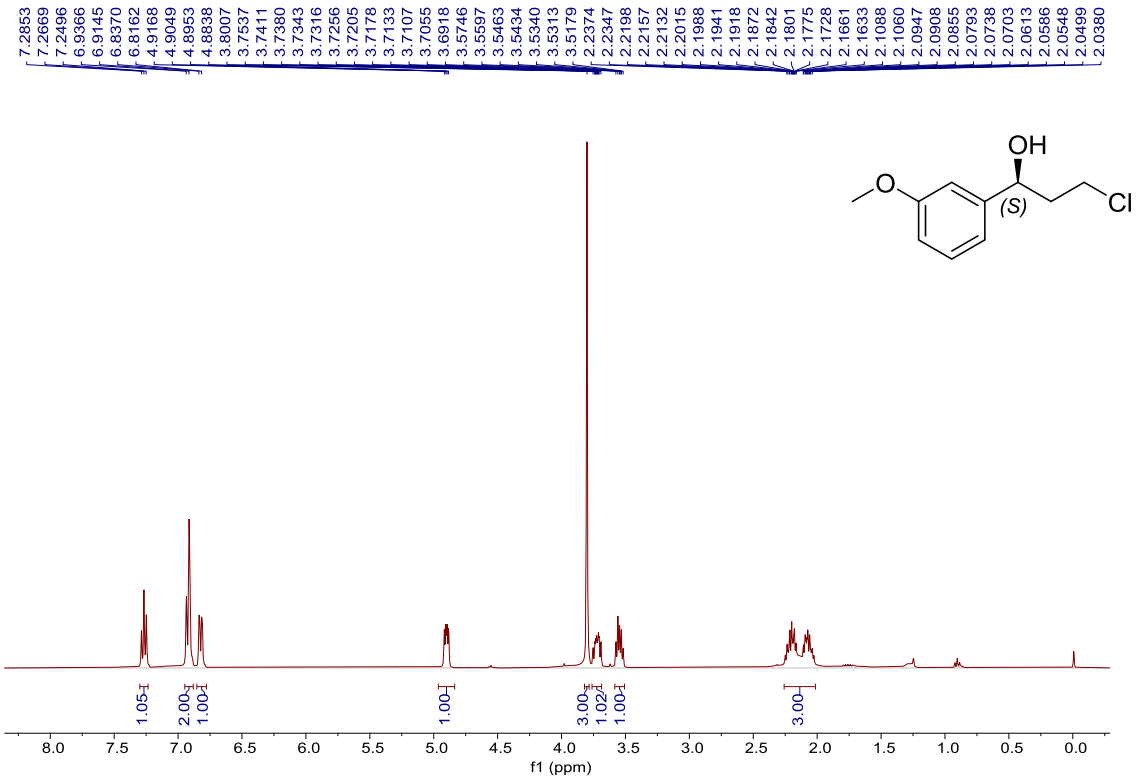


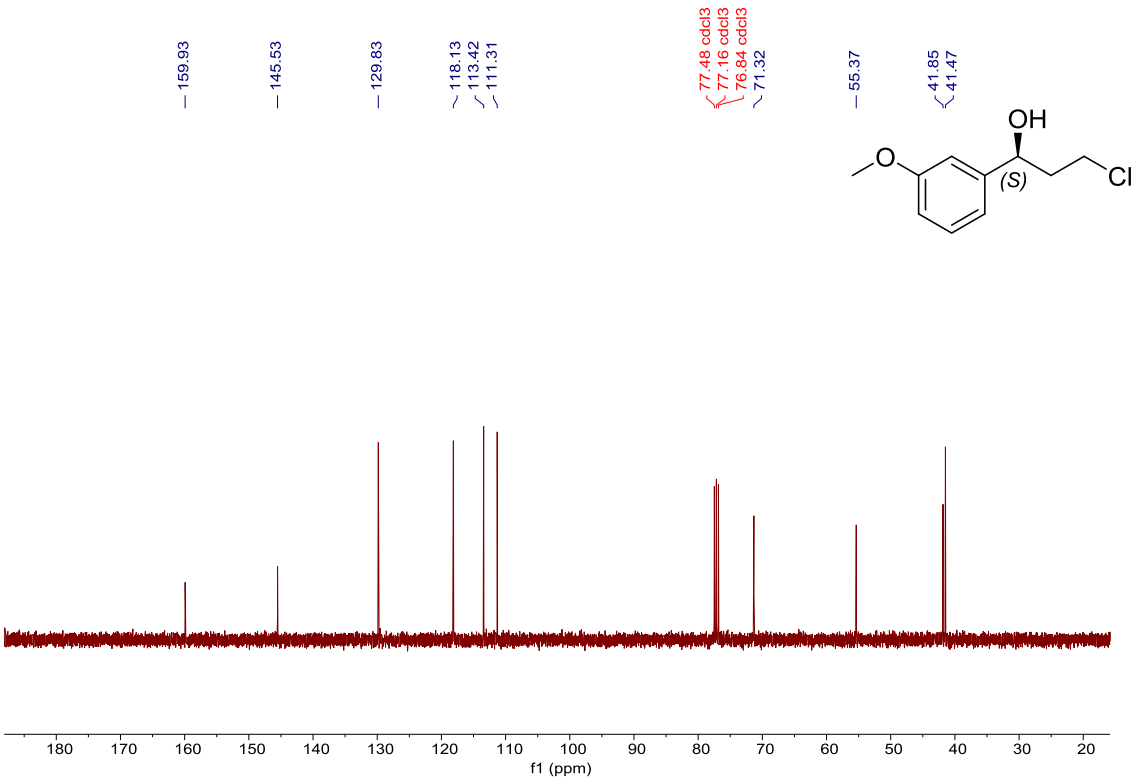
(*S*)-3-chloro-1-(m-tolyl)propan-1-ol [(*S*)-9a]



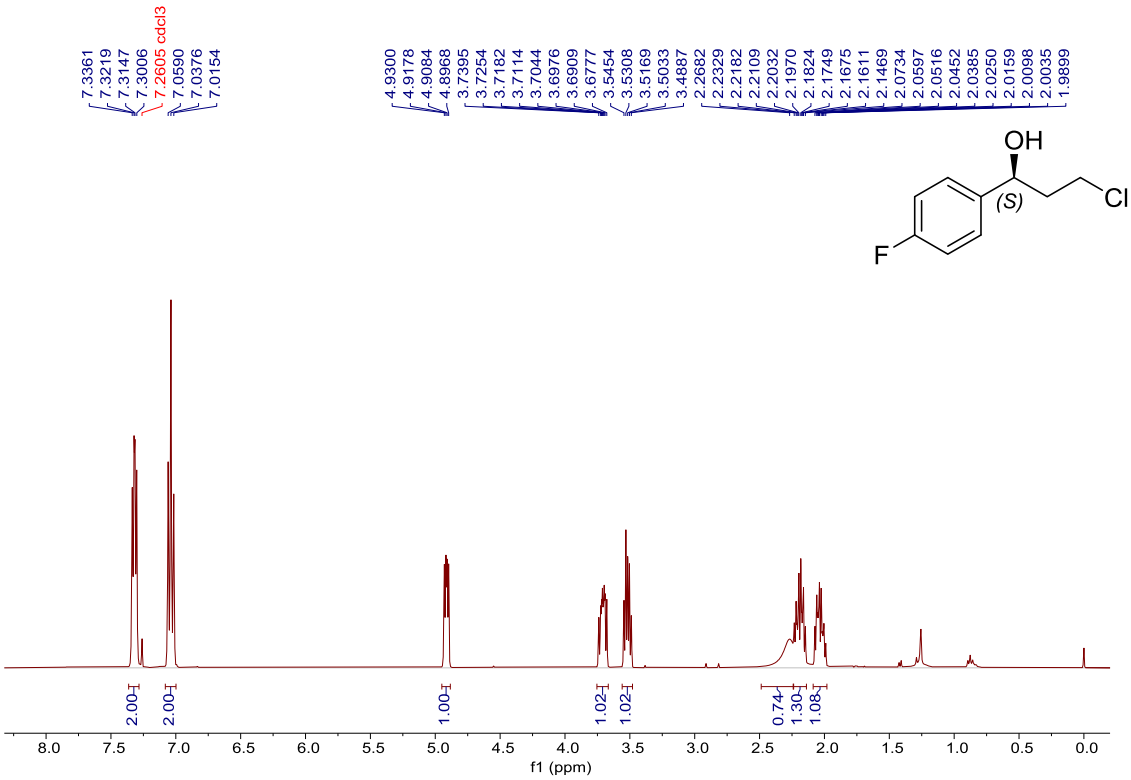


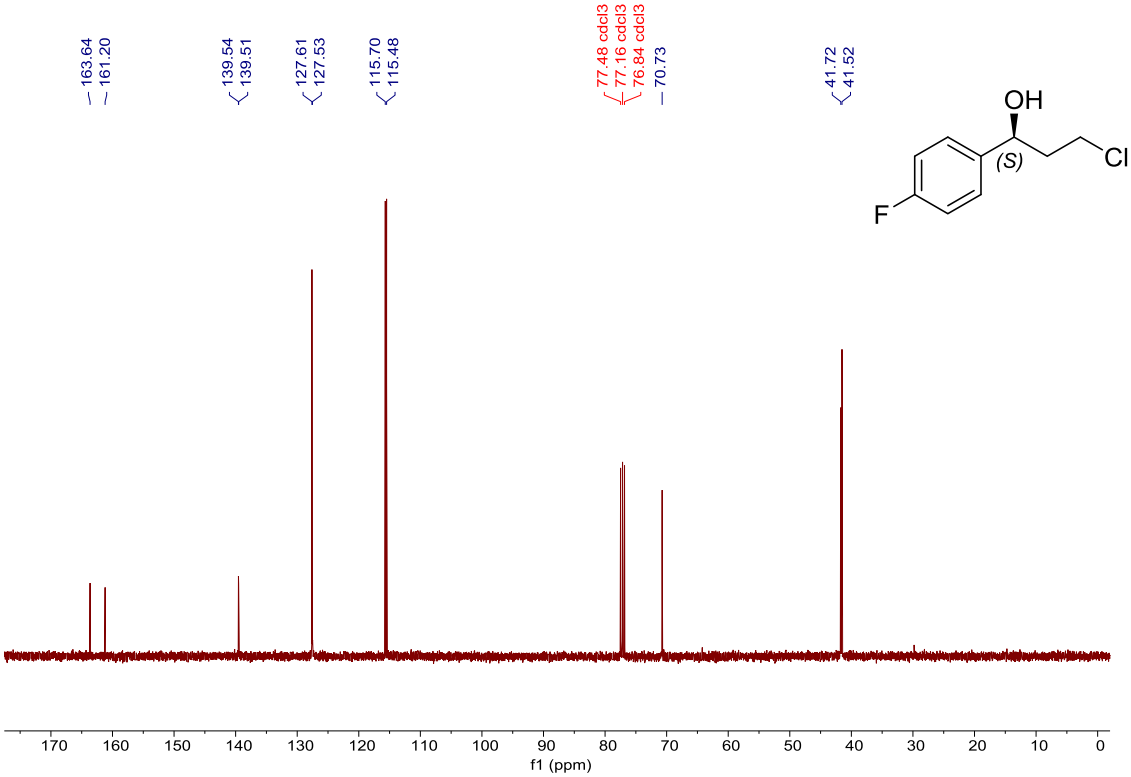
(*S*)-3-chloro-1-(3-methoxyphenyl)propan-1-ol [(*S*)-10a]



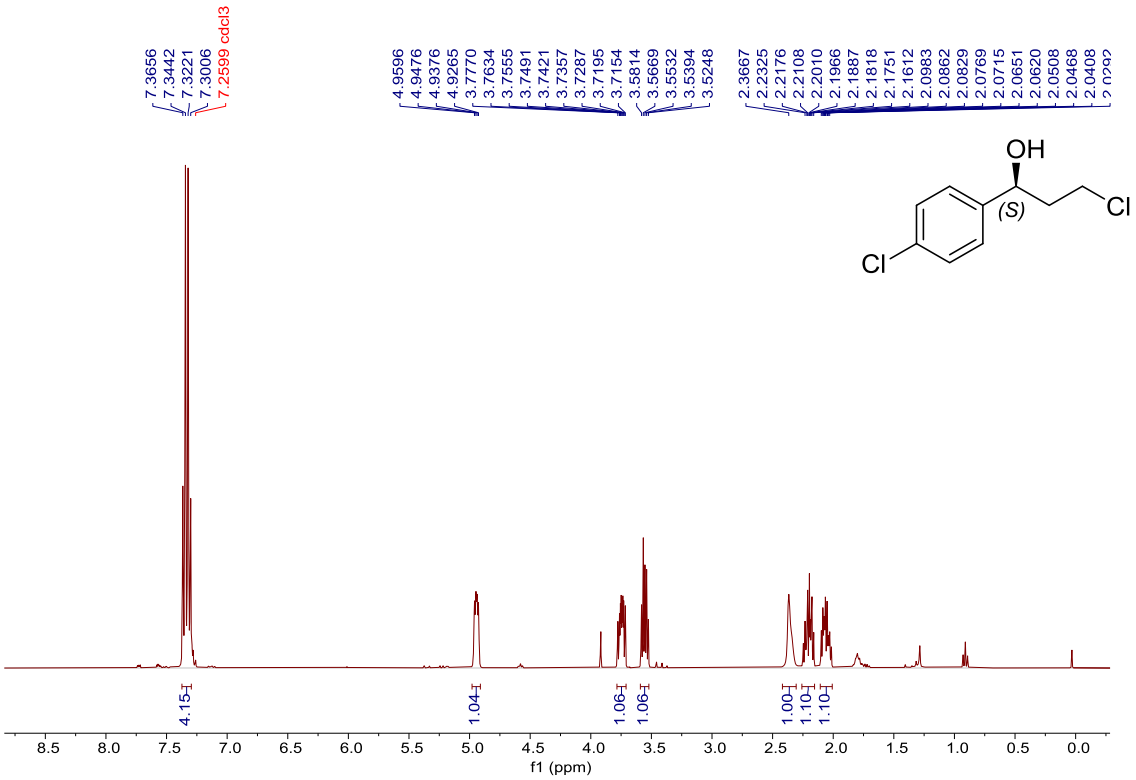


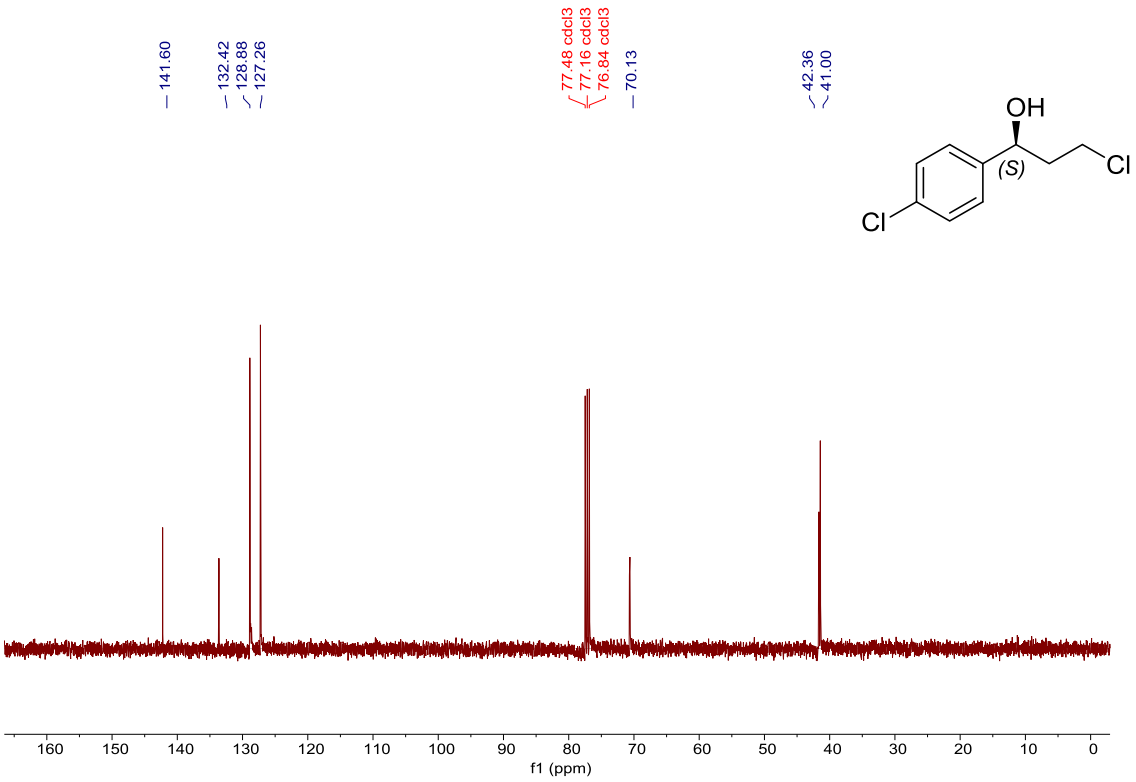
(*S*)-3-chloro-1-(4-fluorophenyl)propan-1-ol [(*S*)-11a]



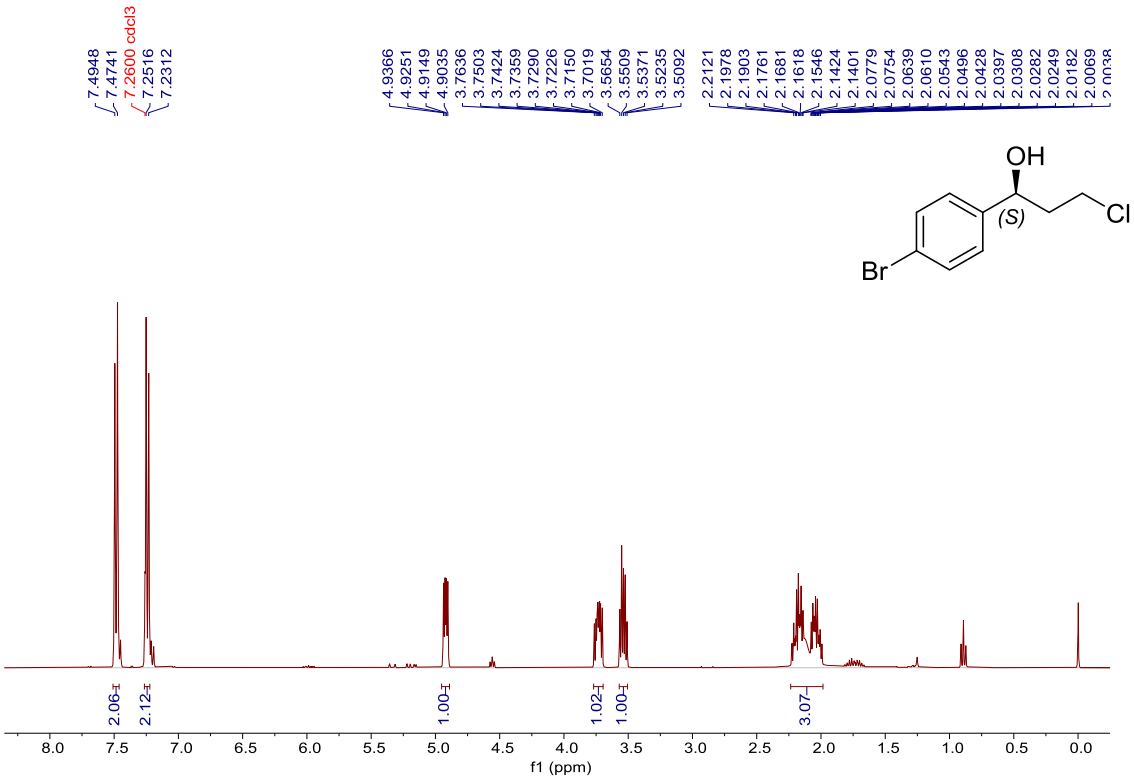


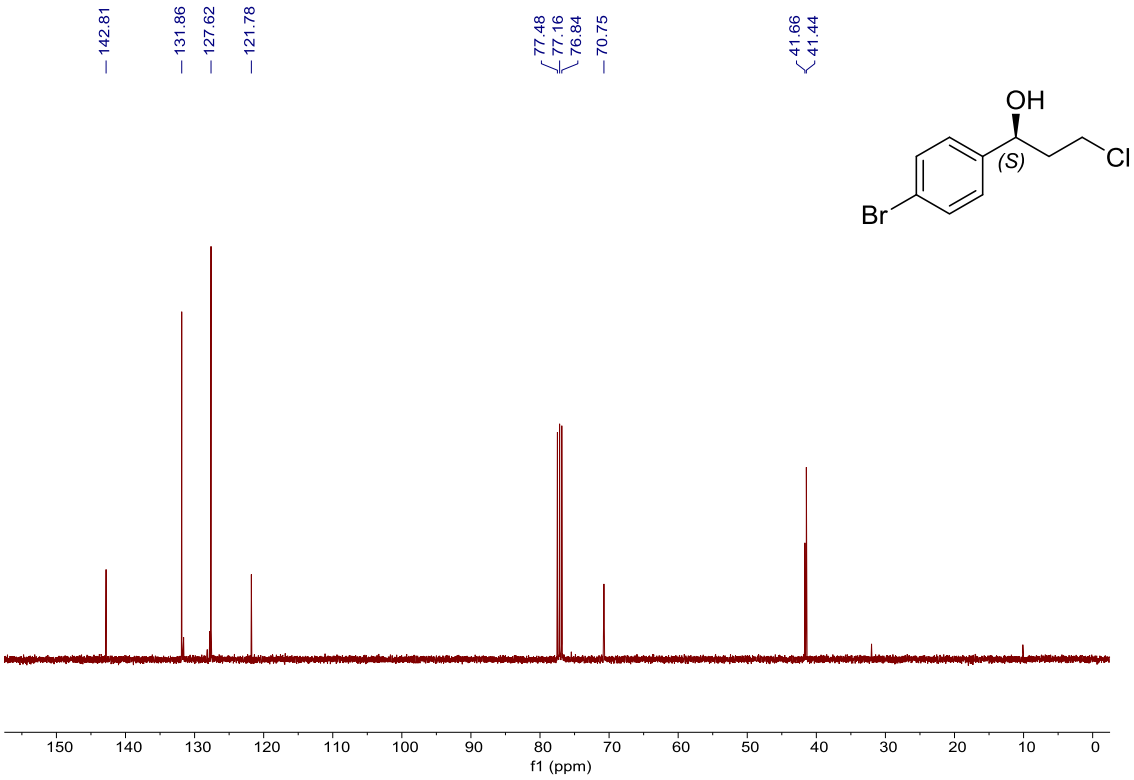
(*S*)-3-chloro-1-(4-chlorophenyl)propan-1-ol [(*S*)-12a]



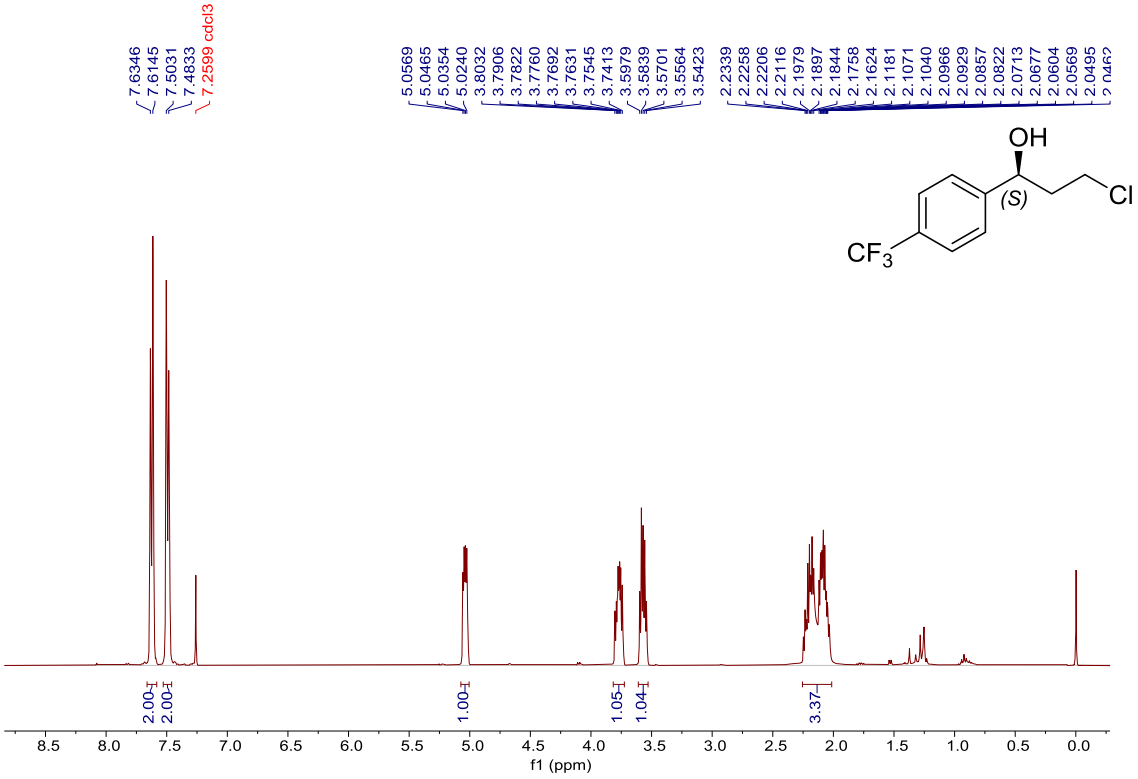


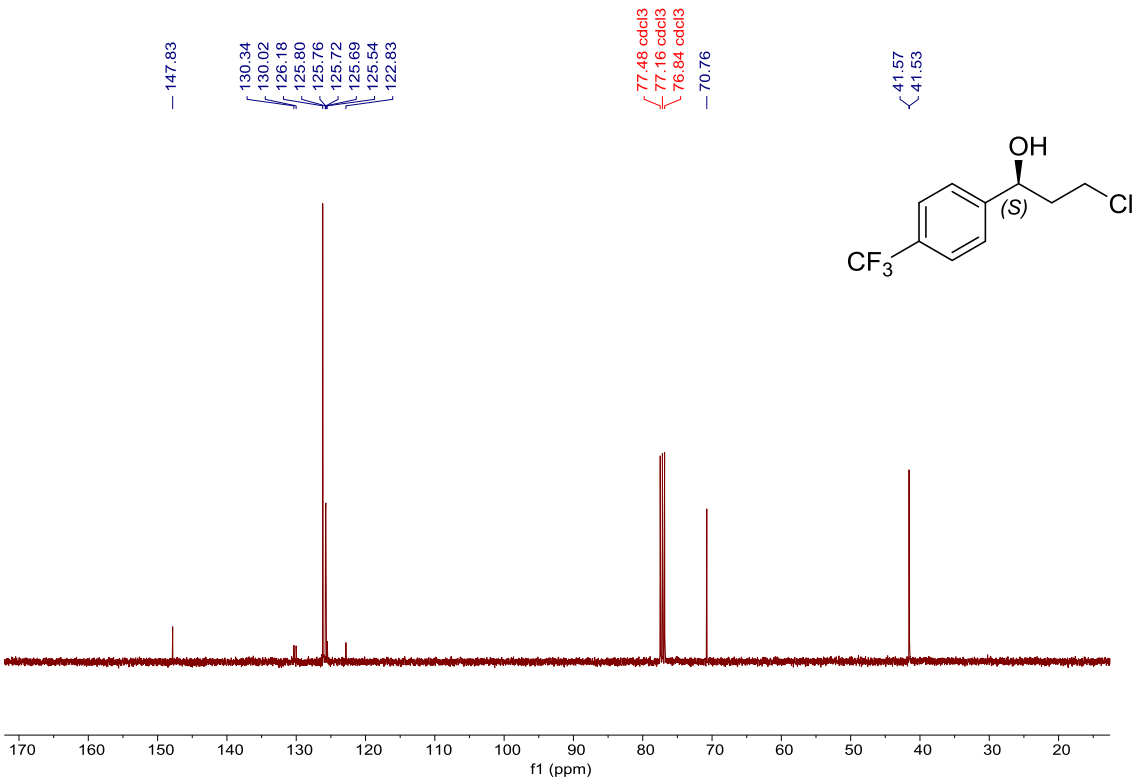
(*S*)-1-(4-bromophenyl)-3-chloropropan-1-ol [(*S*)-13a]



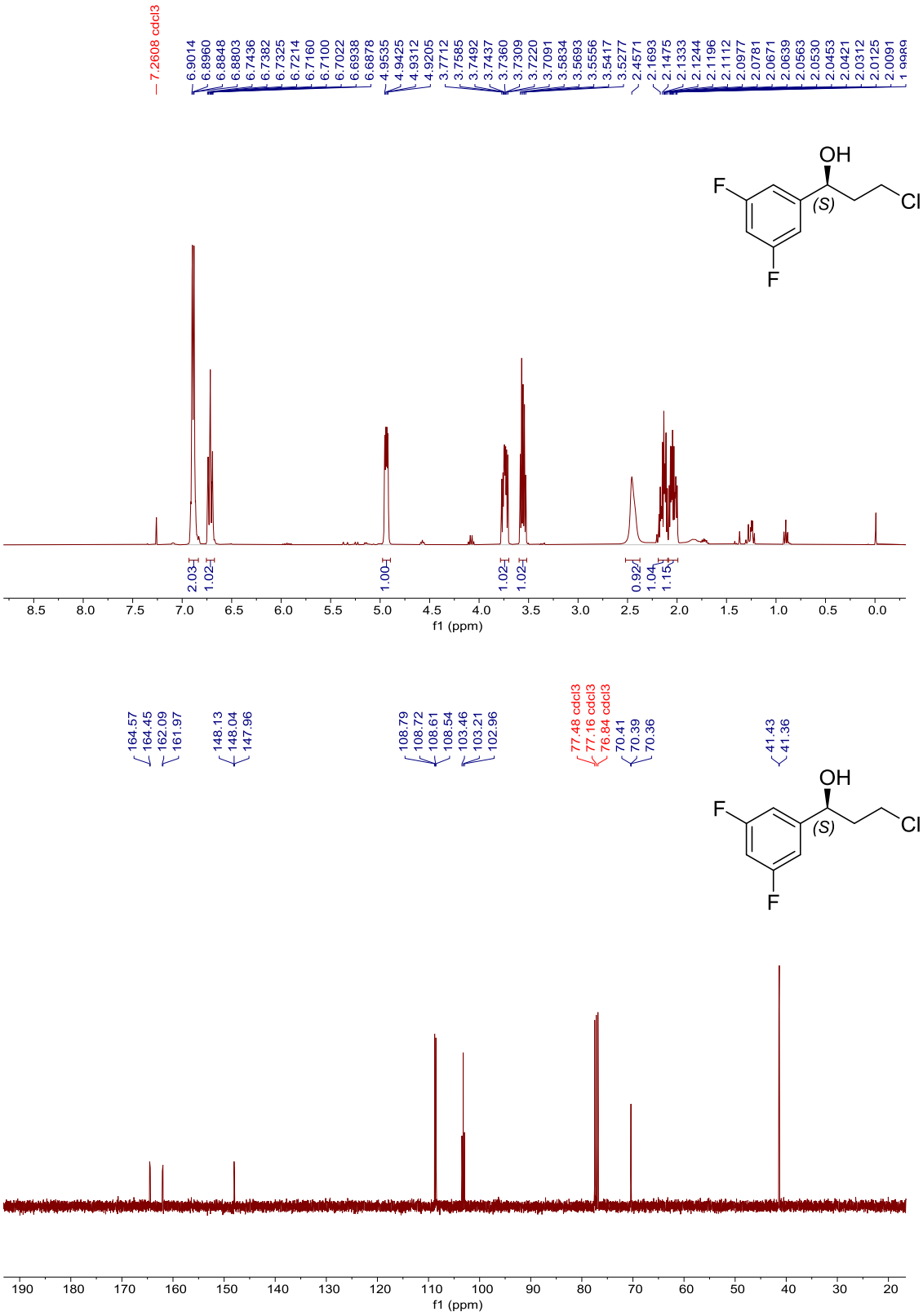


(*S*)-3-chloro-1-(4-(trifluoromethyl)phenyl)propan-1-ol [(*S*)-14a]

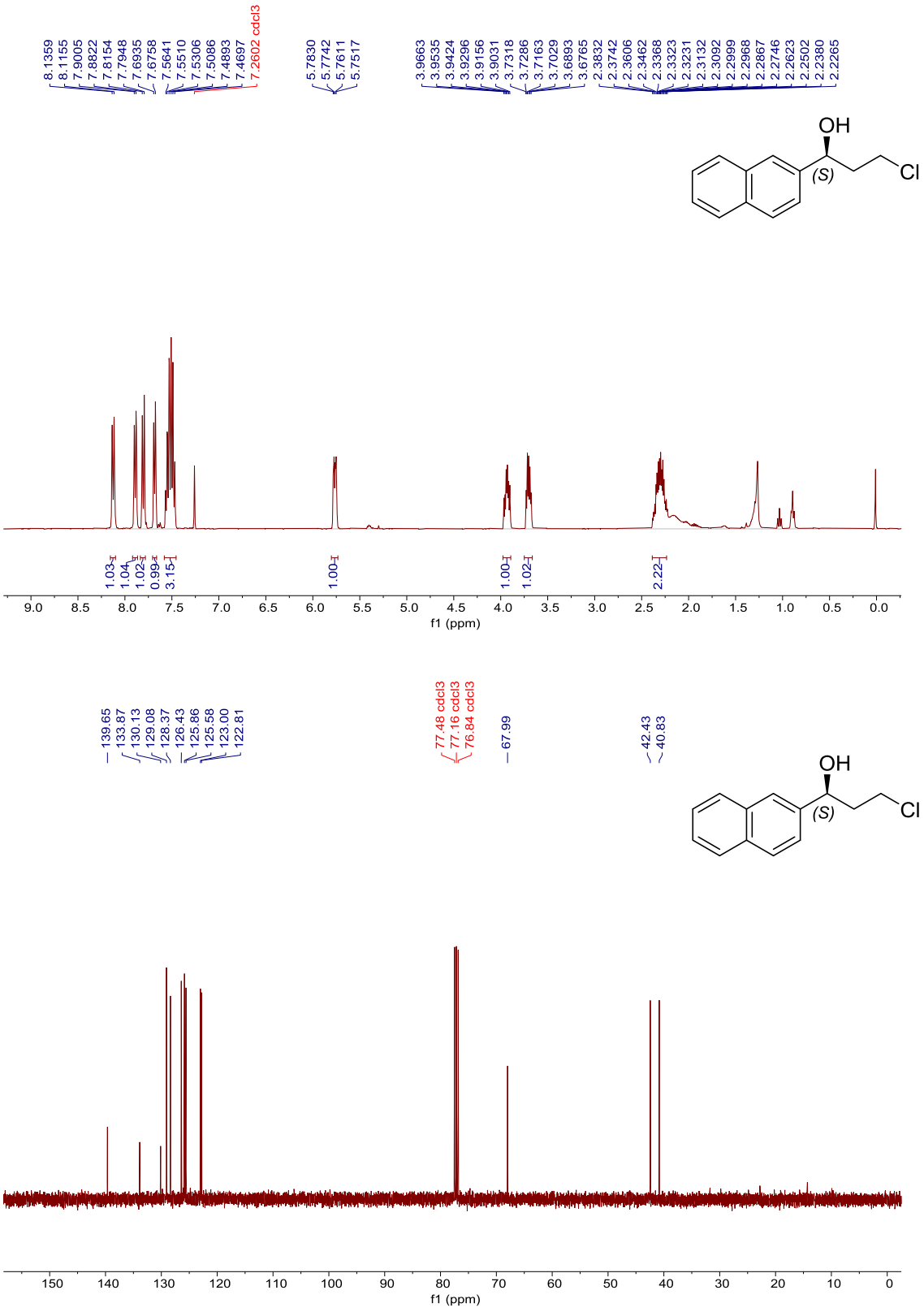




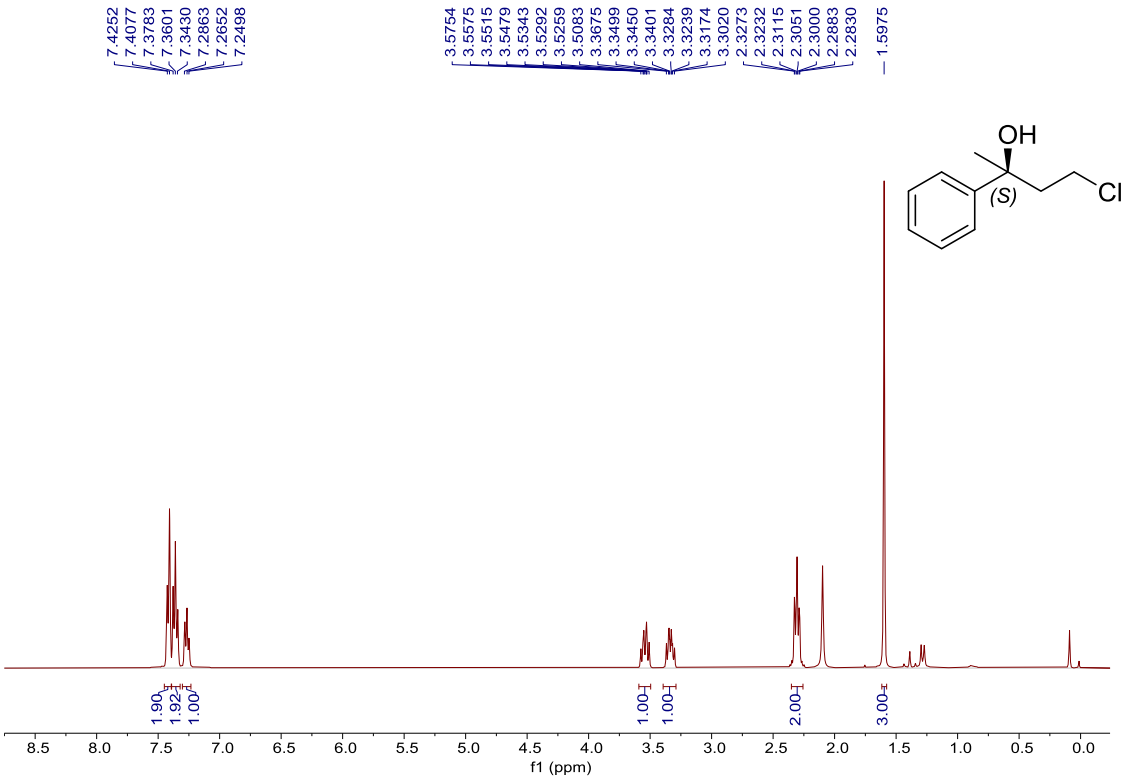
(*S*)-3-chloro-1-(3,5-difluorophenyl)propan-1-ol [(*S*)-15a]

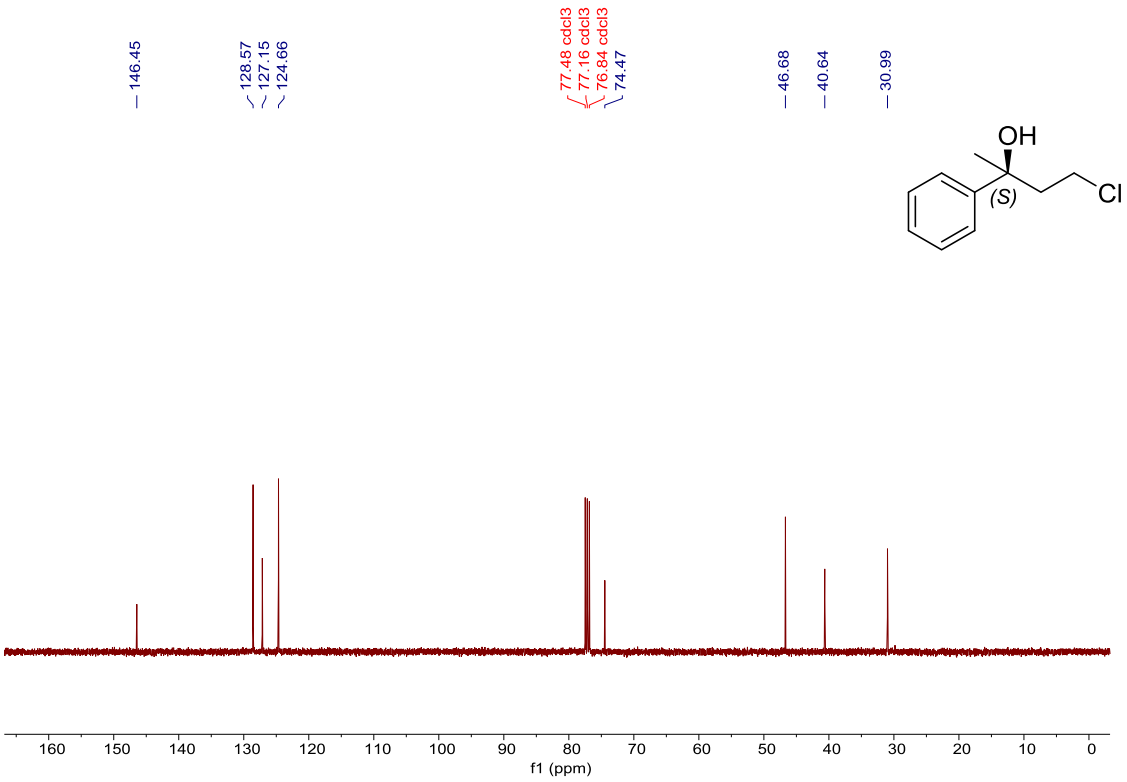


(*S*)-3-chloro-1-(naphthalen-2-yl)propan-1-ol [(*S*)-16a]

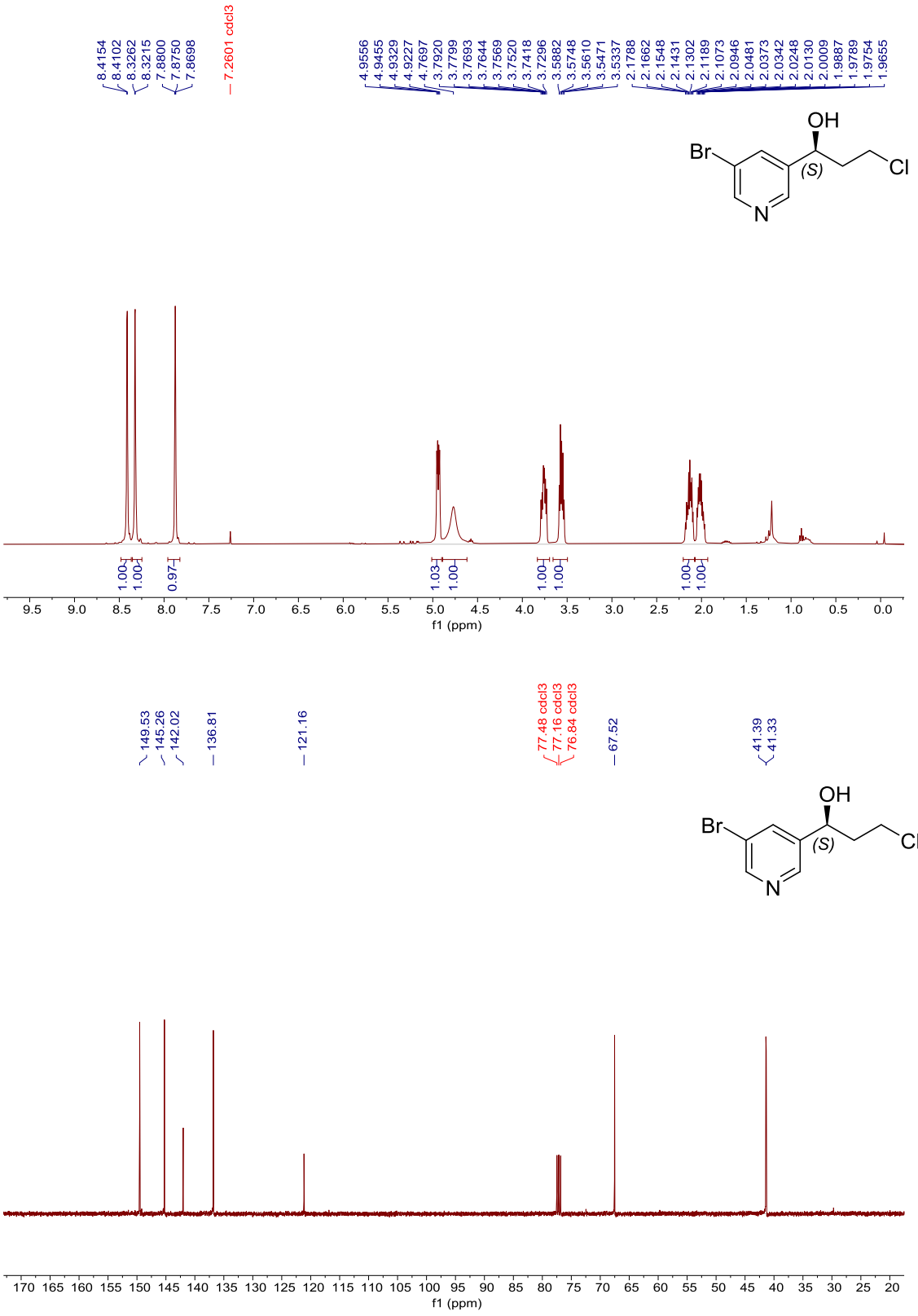


(*S*)-4-chloro-2-phenylbutan-2-ol [(*S*)-17a]

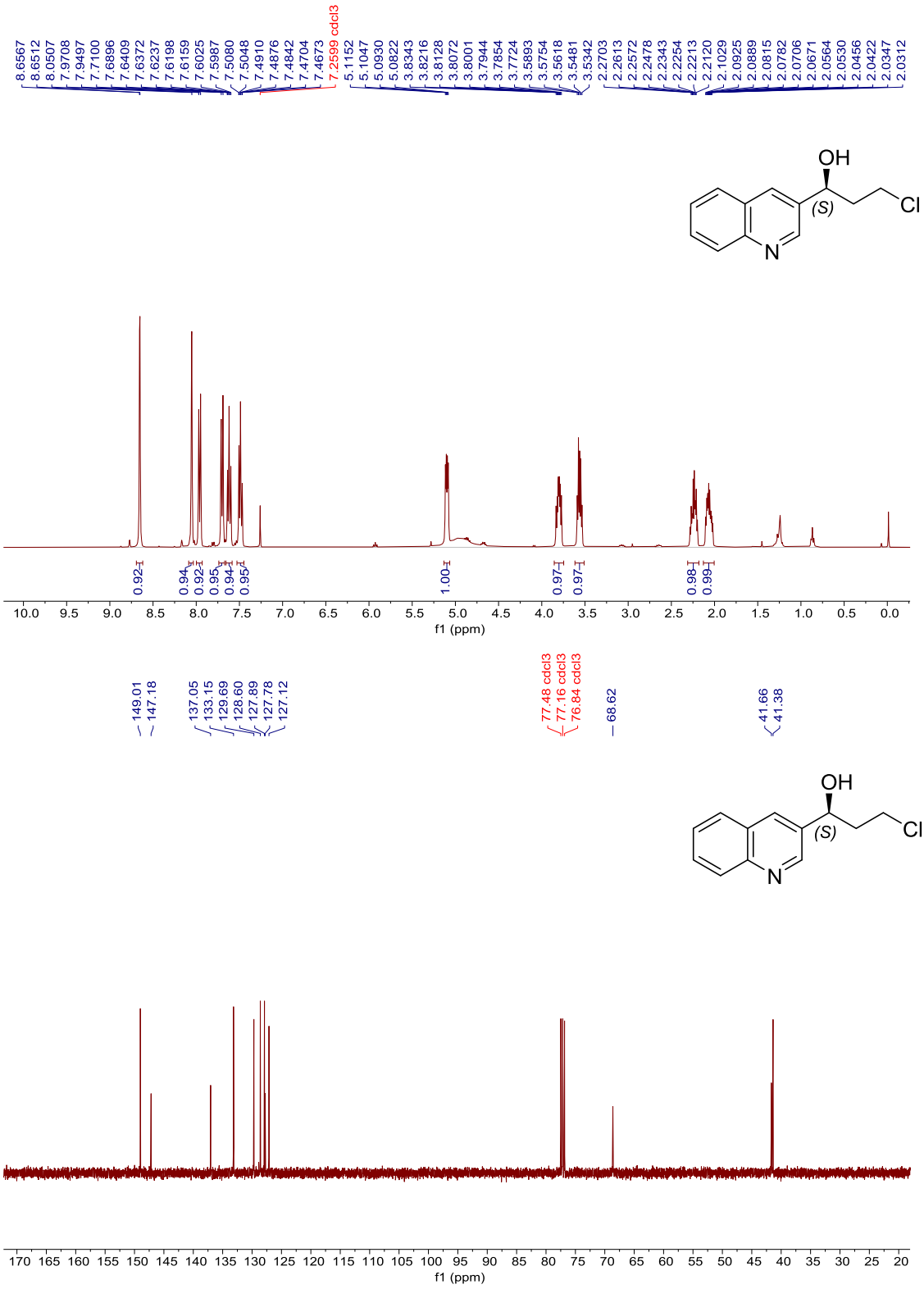




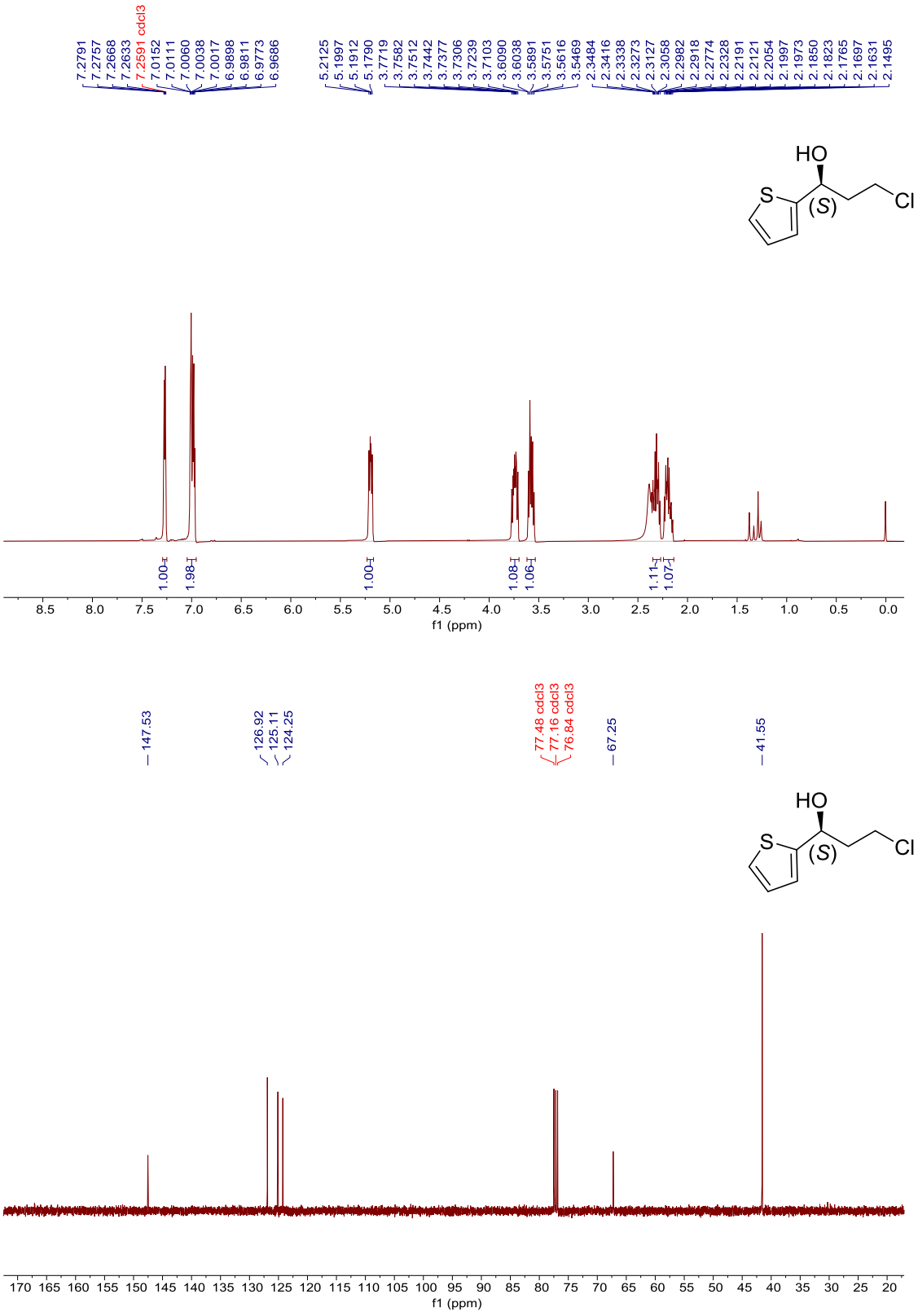
(*S*)-1-(5-bromopyridin-3-yl)-3-chloropropan-1-o [(*S*)-18a]



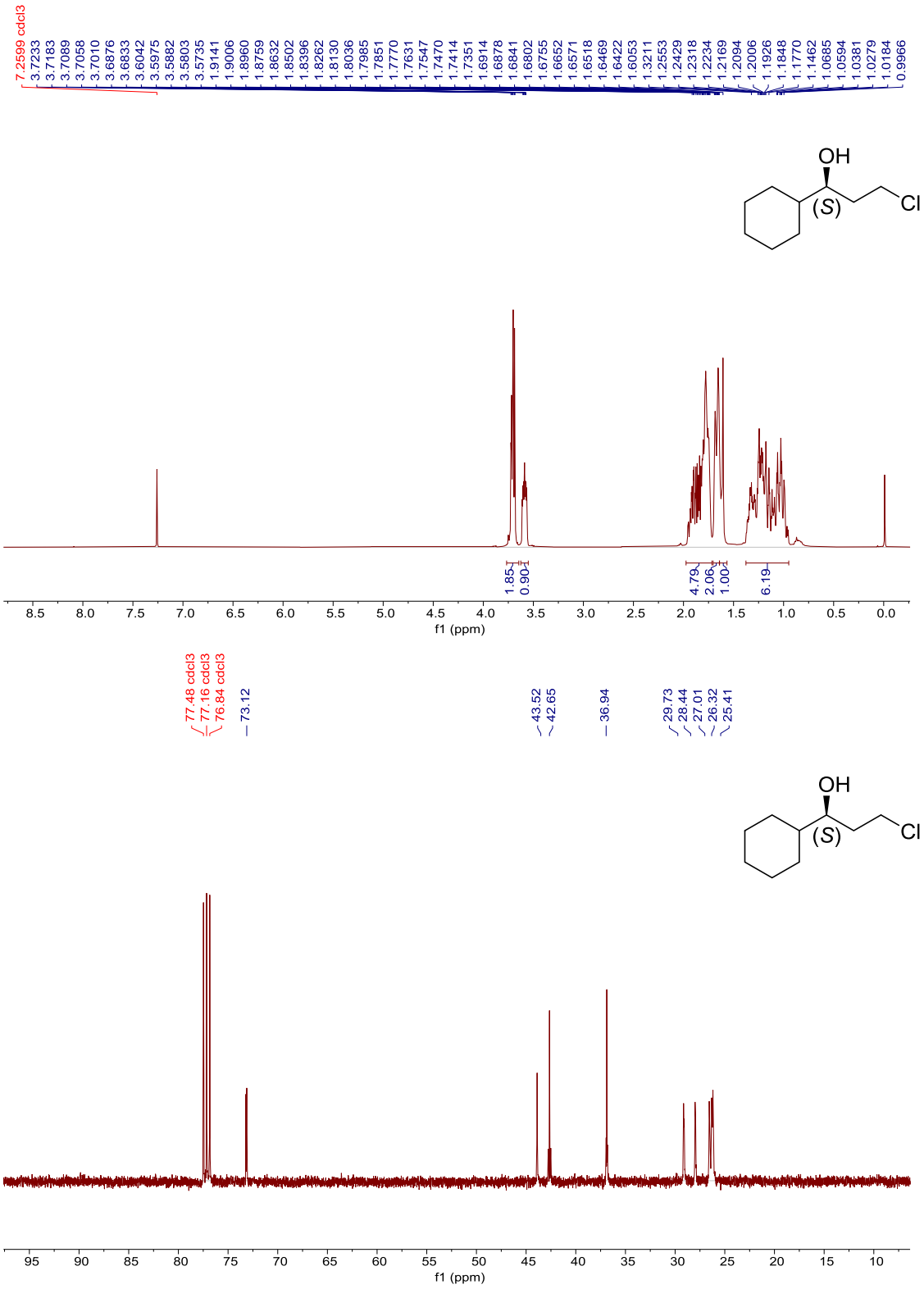
(*S*)-3-chloro-1-(quinolin-3-yl)propan-1-ol [(*S*)-19a]



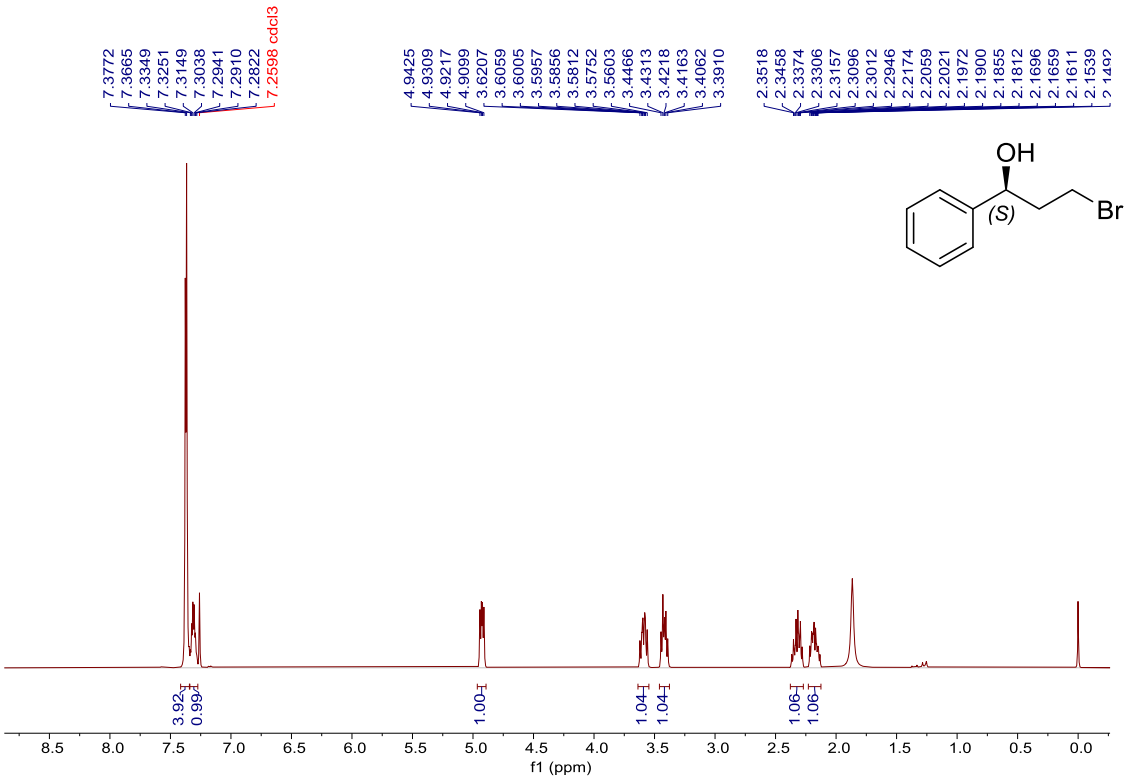
(*S*)-3-chloro-1-(thiophen-2-yl)propan-1-ol [(*S*)-20a]

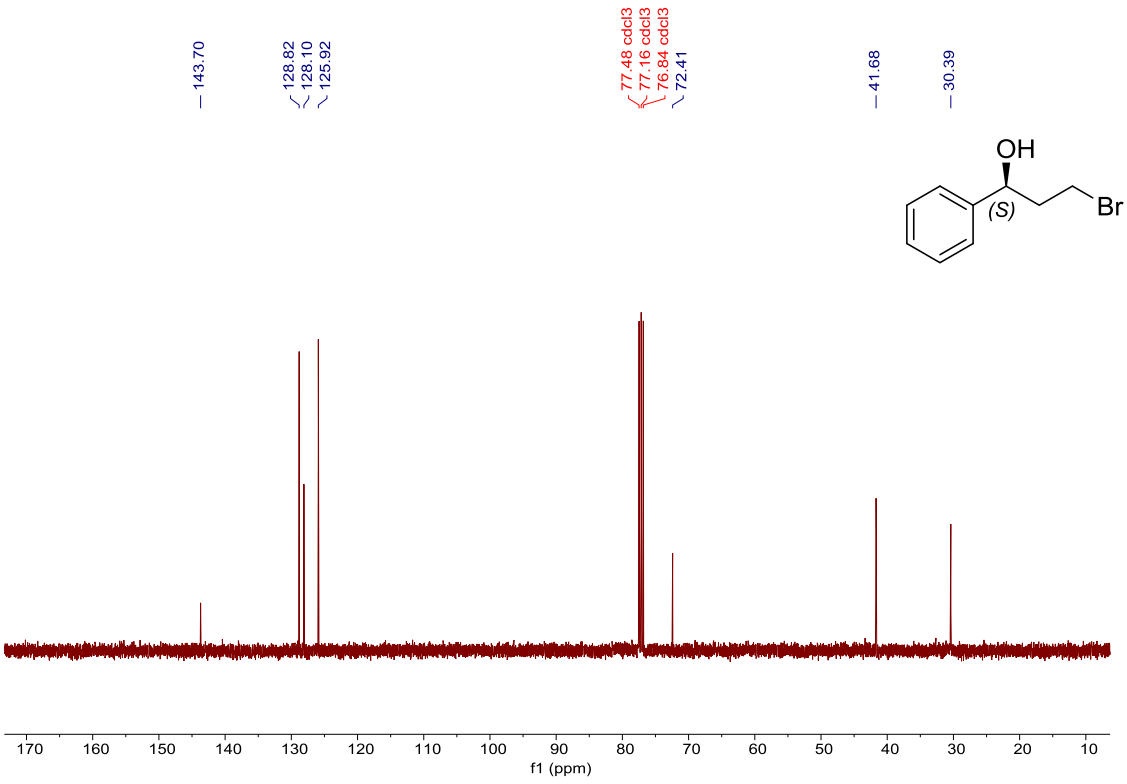


(*S*)-3-chloro-1-cyclohexylpropan-1-ol [(*S*)-21a]

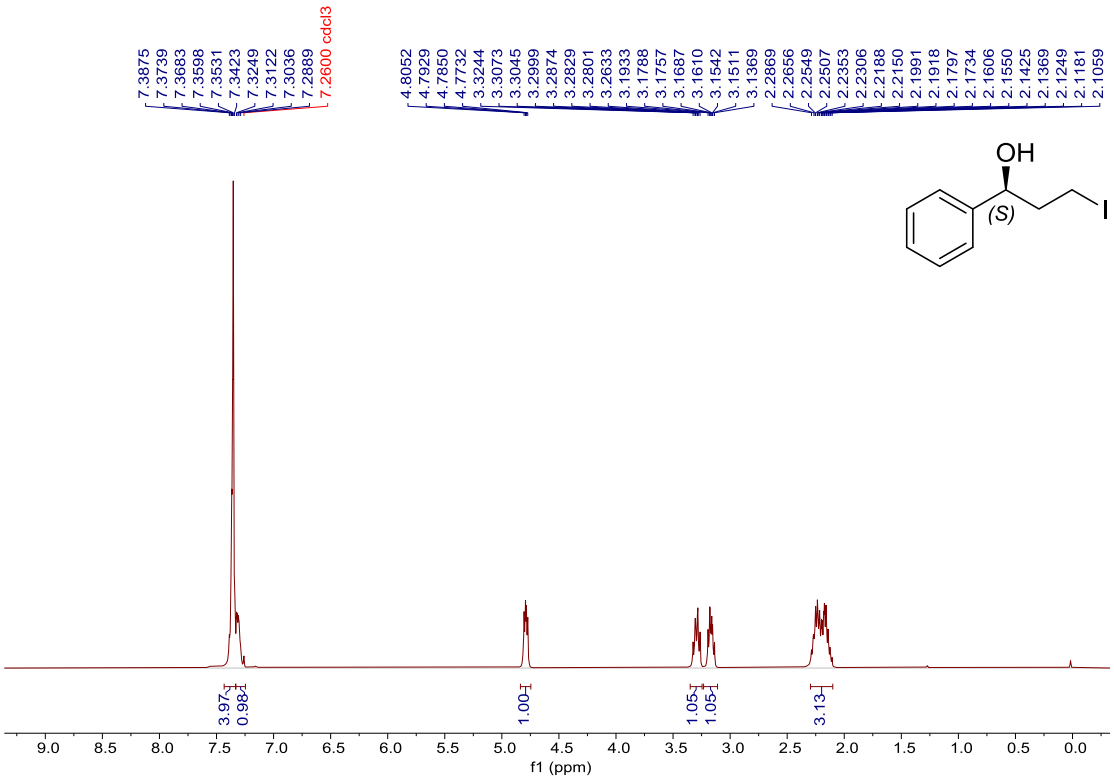


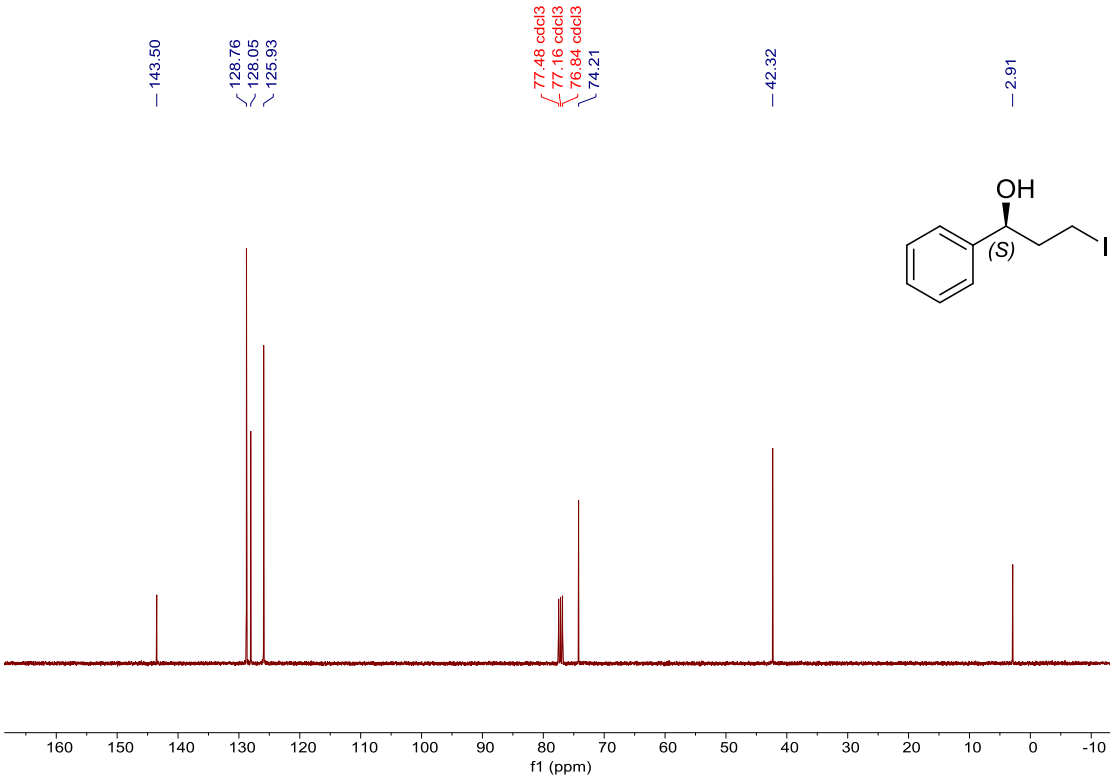
(*S*)-3-bromo-1-phenylpropan-1-ol [(*S*)-22a]



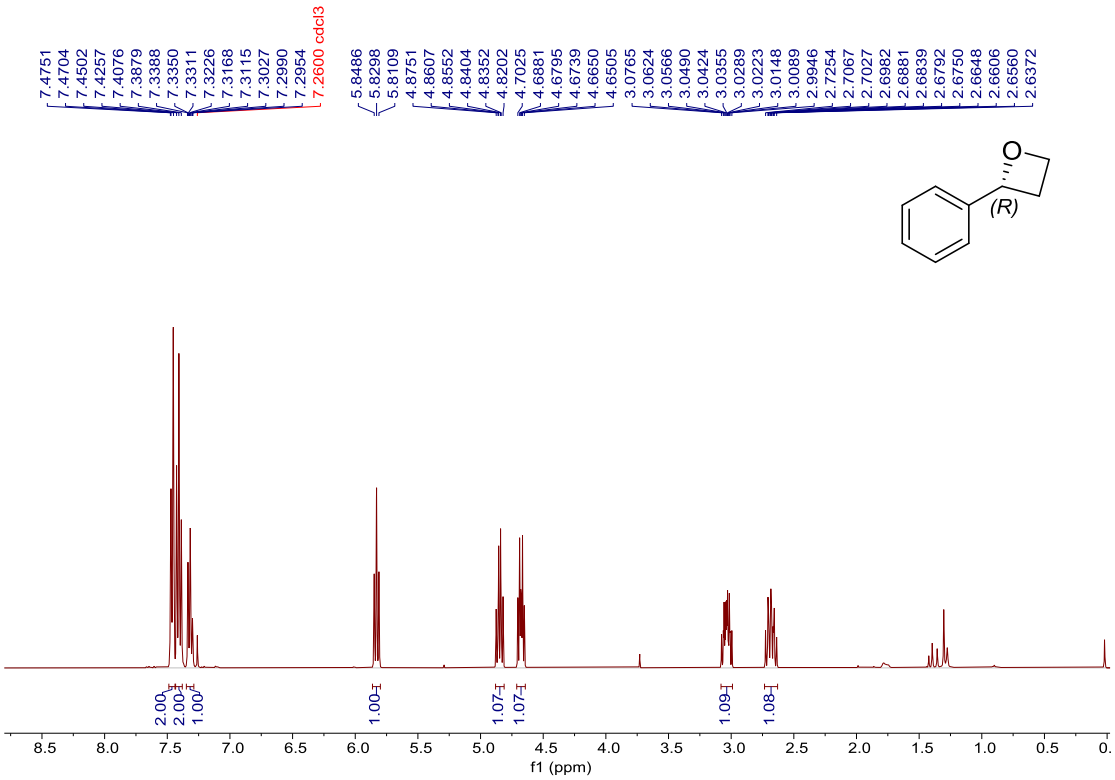


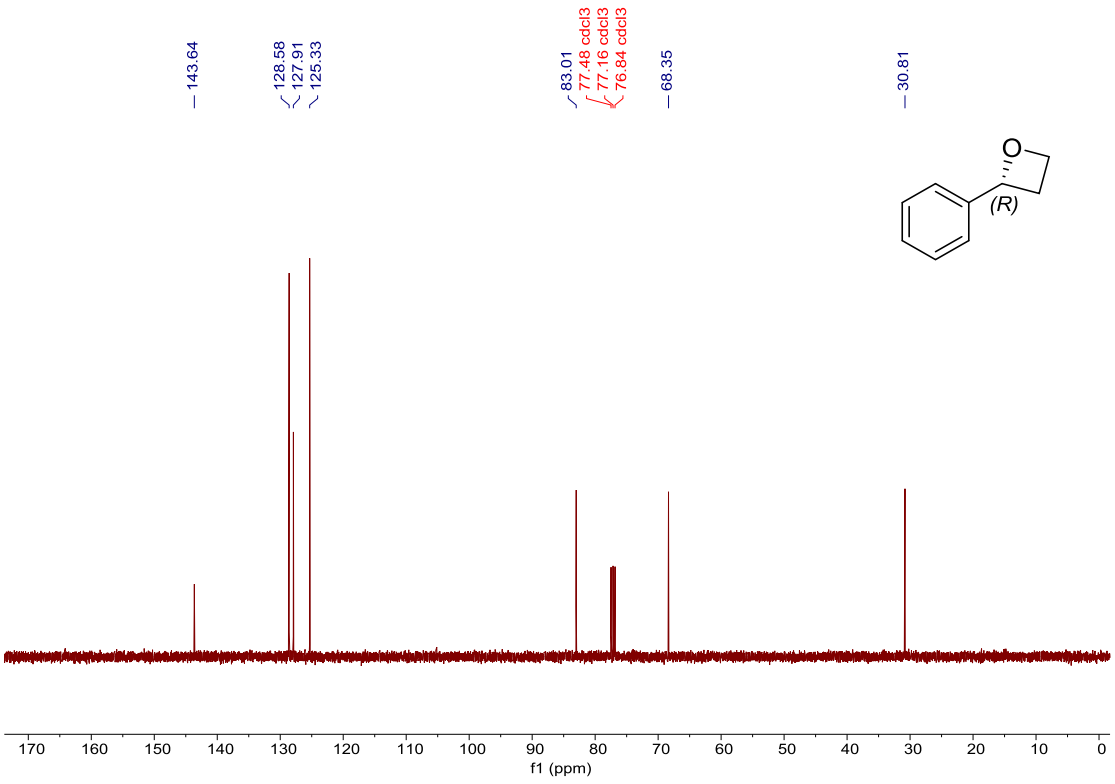
(*S*)-3-iodo-1-phenylpropan-1-ol [(*S*)-23a]



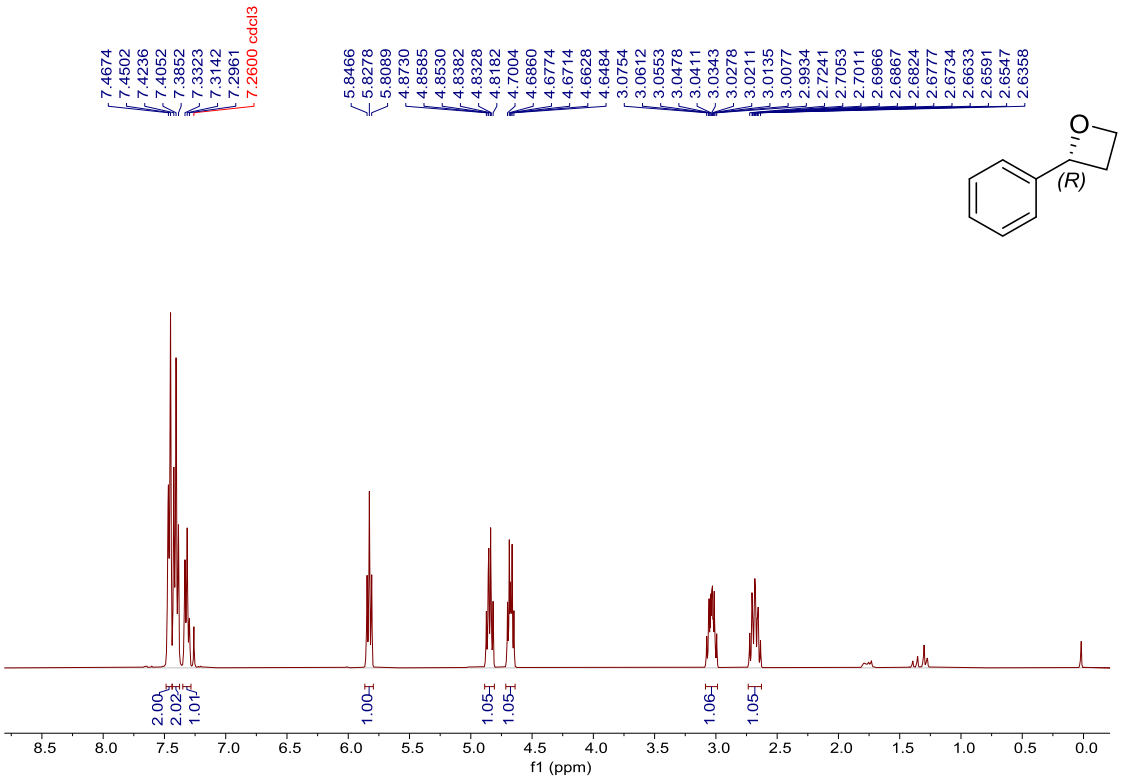


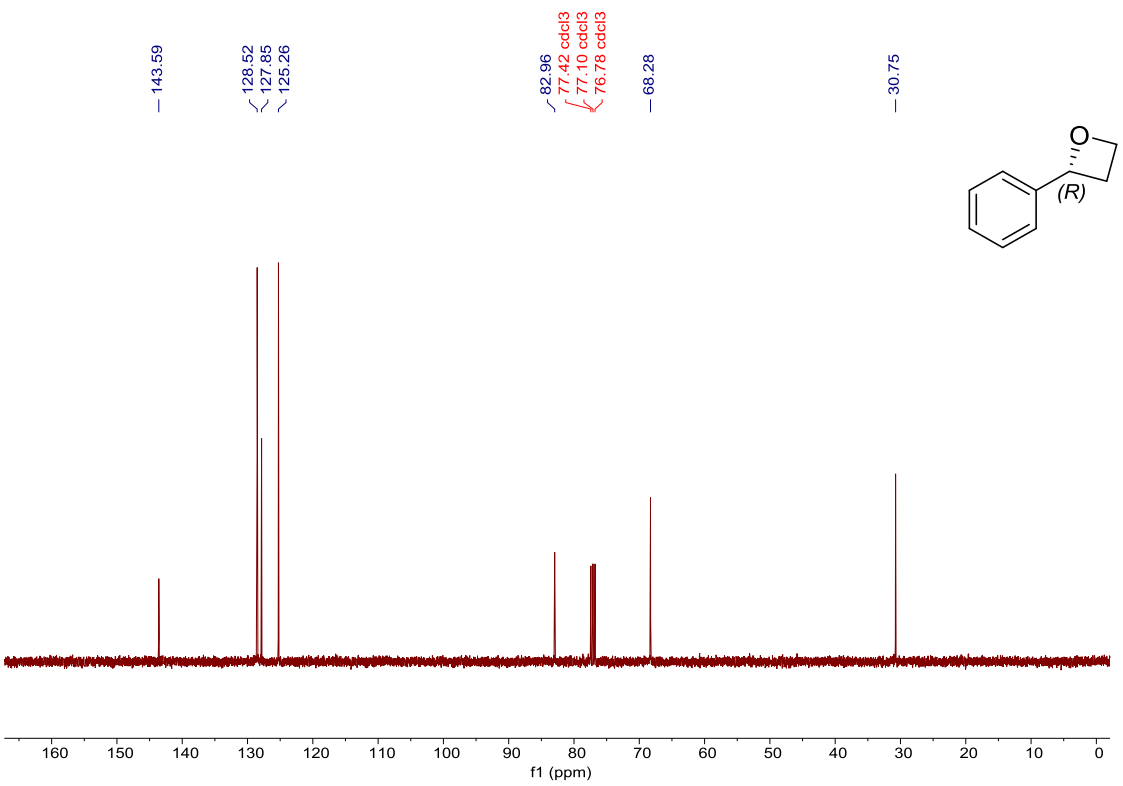
(*R*)-2-phenyloxetane [(*R*)-1b] from 1a



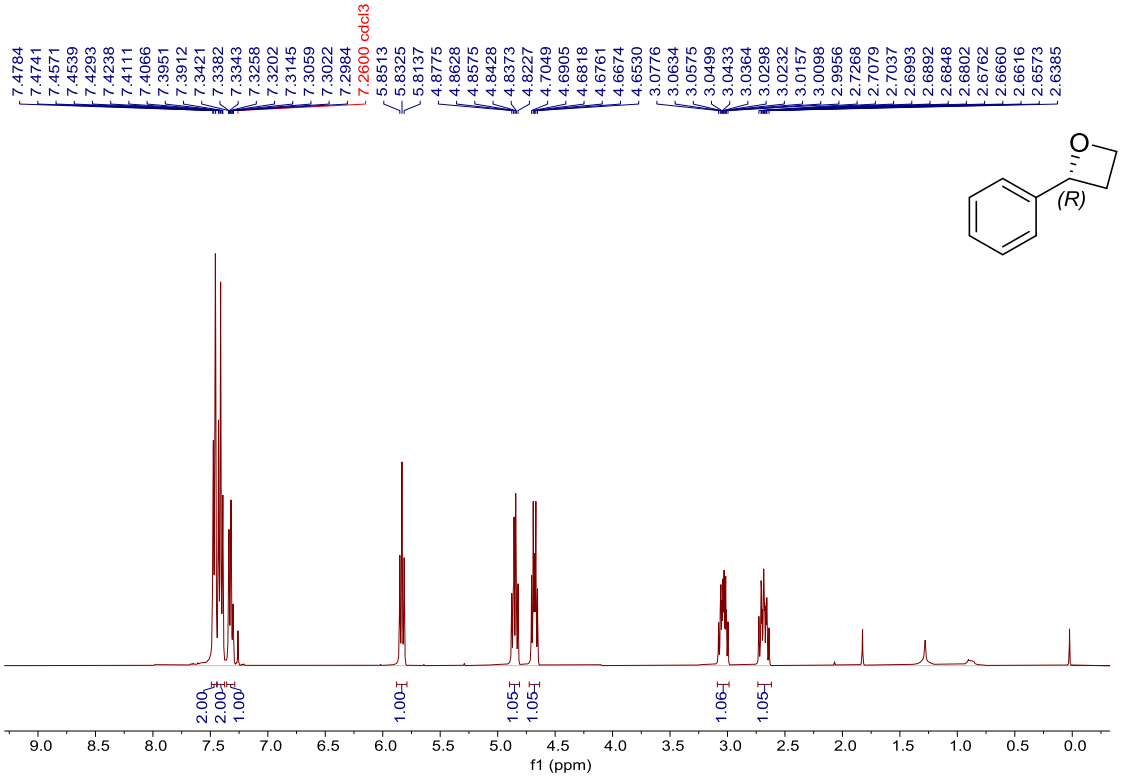


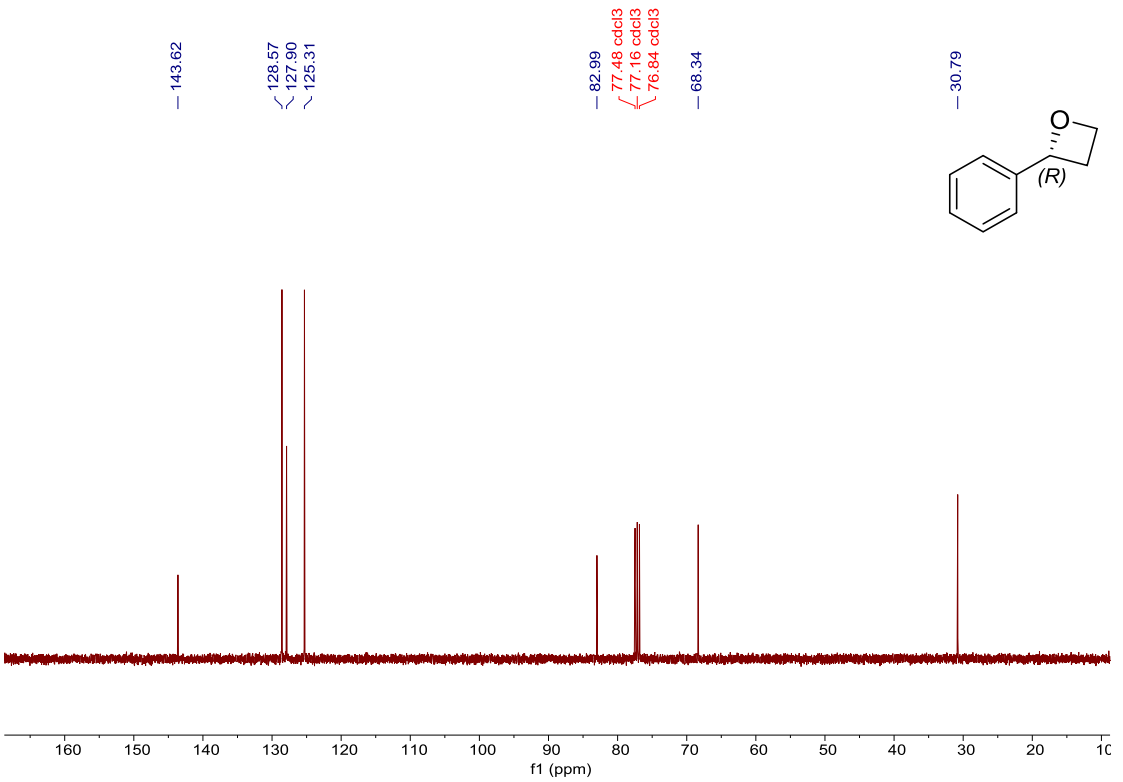
(*R*)-2-phenyloxetane [(*R*)-1b] from 22a



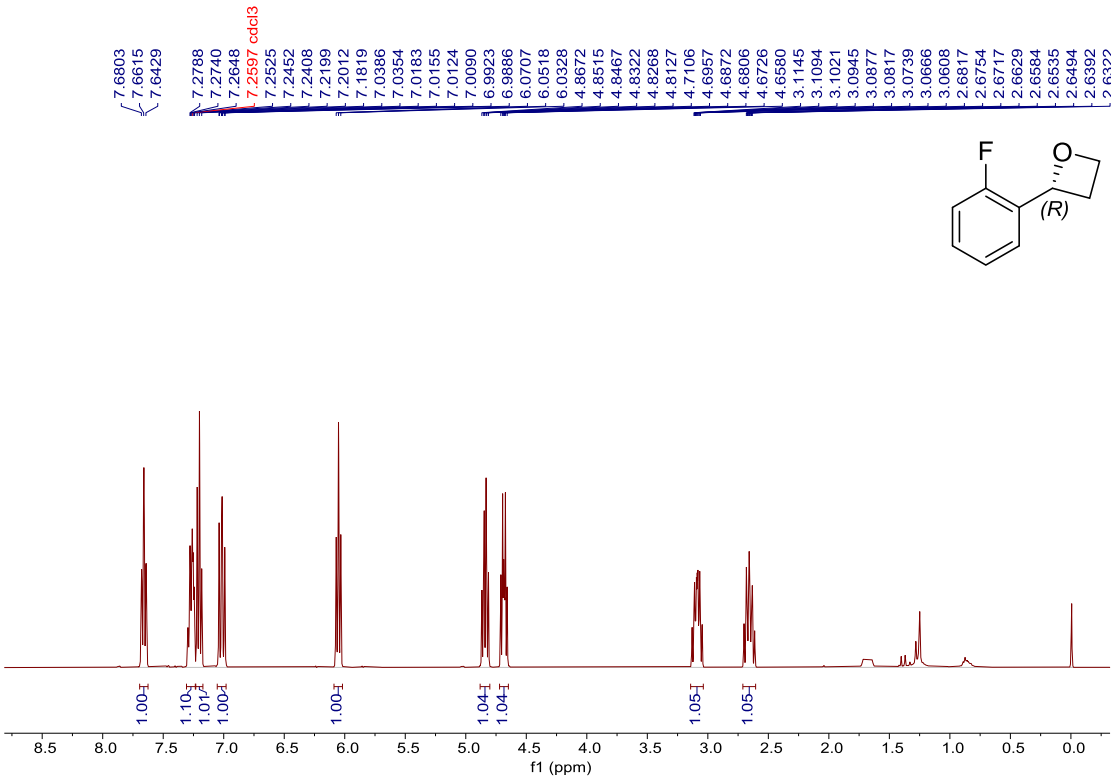


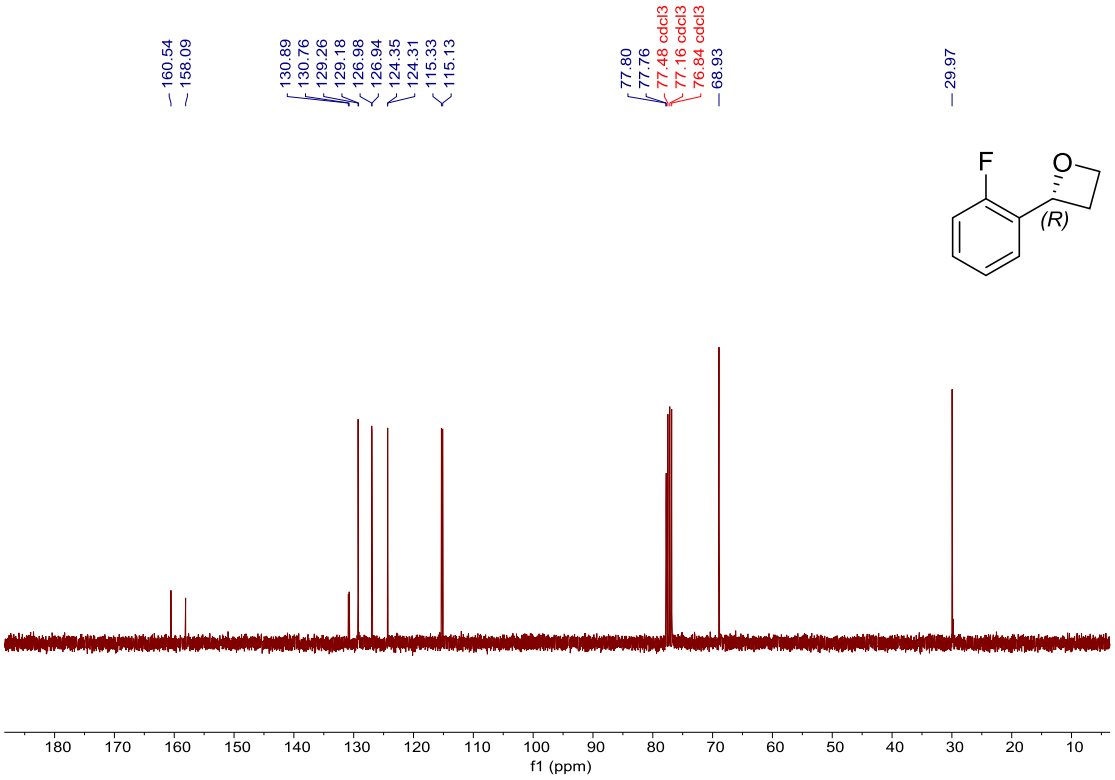
(*R*)-2-phenyloxetane [(*R*)-1b] from 23a



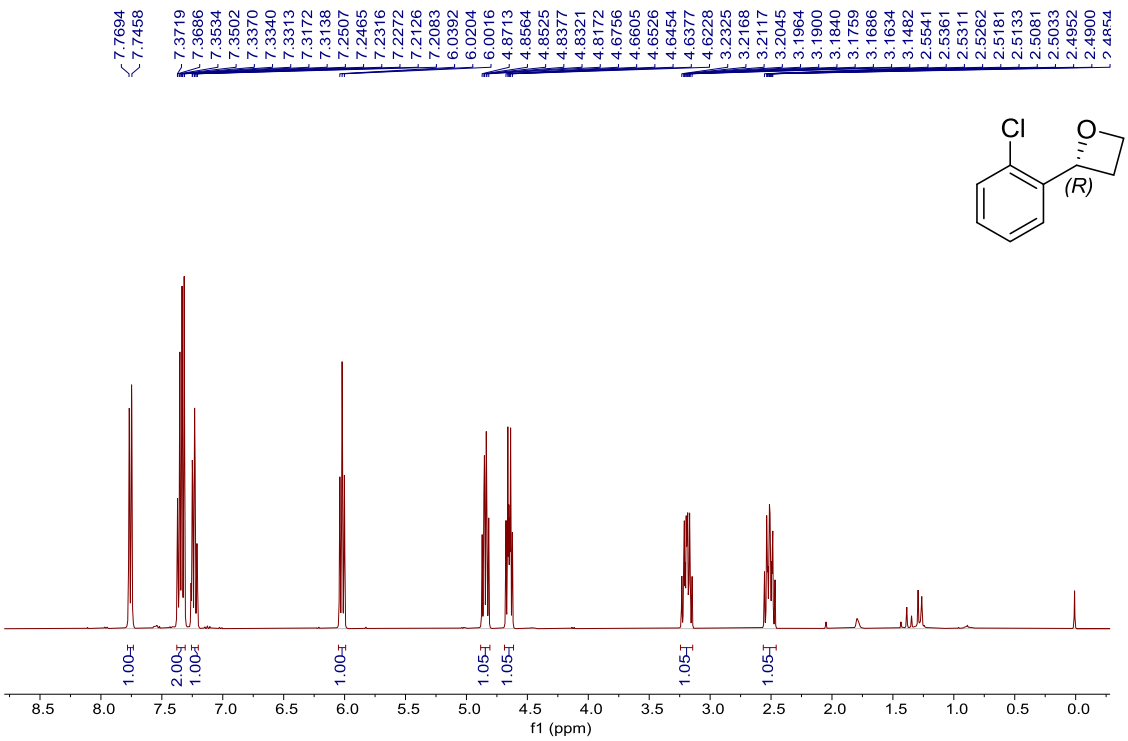


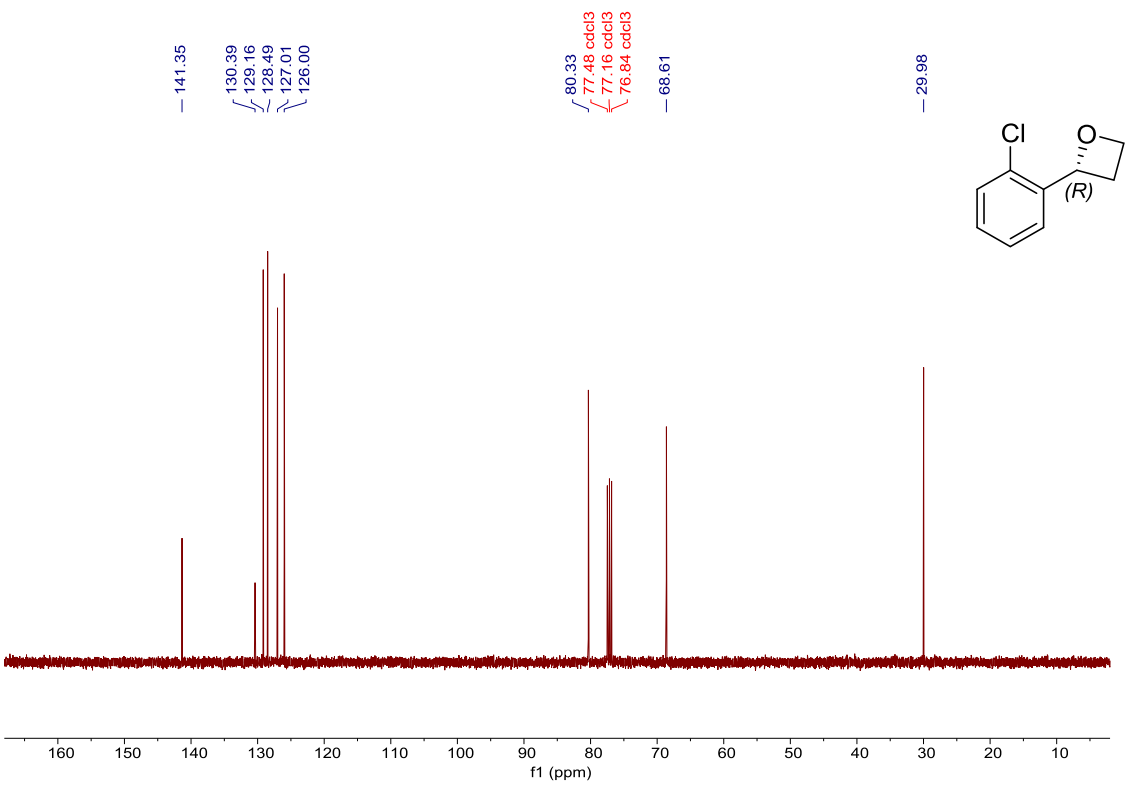
(*R*)-2-(2-fluorophenyl) oxetane [(*R*)-2b]



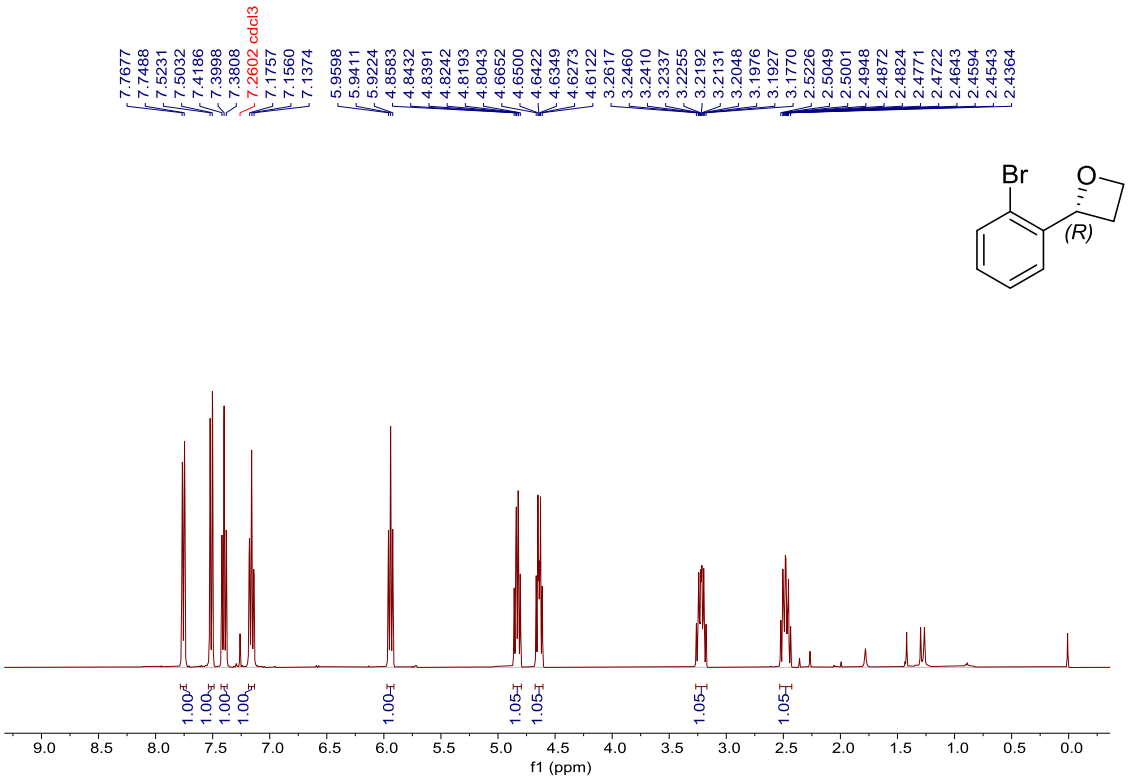


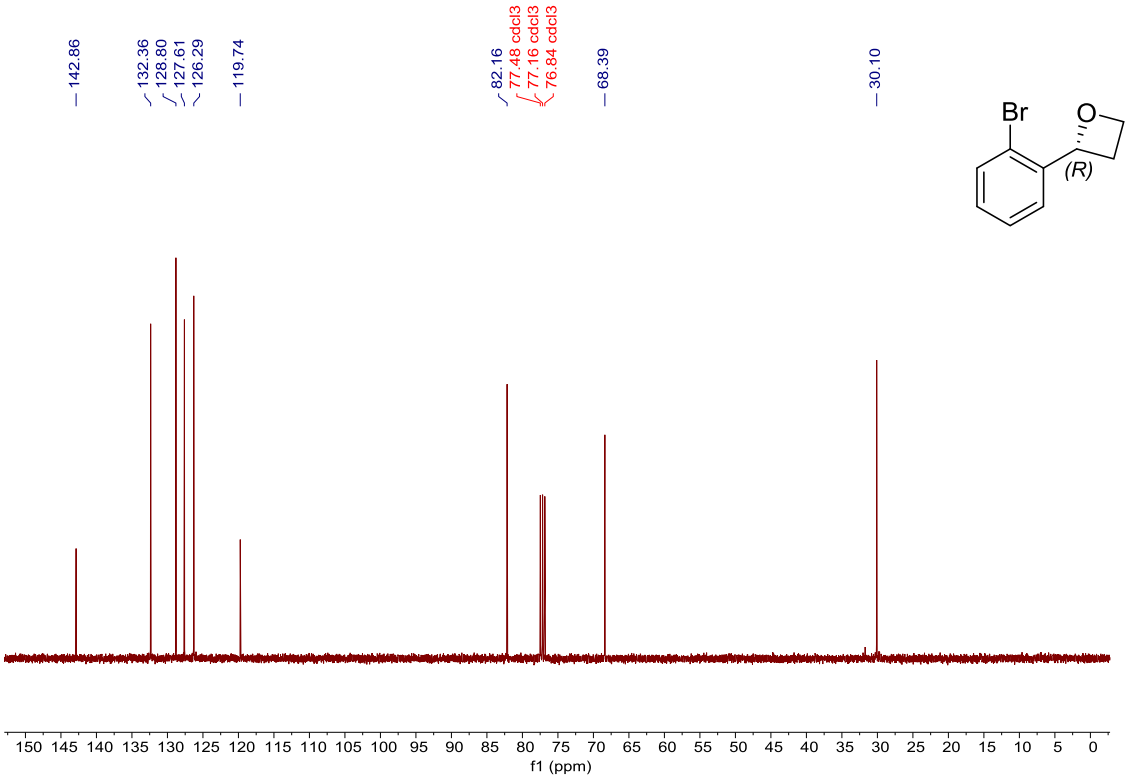
(*R*)-2-(2-chlorophenyl) oxetane[(*R*)-3b]



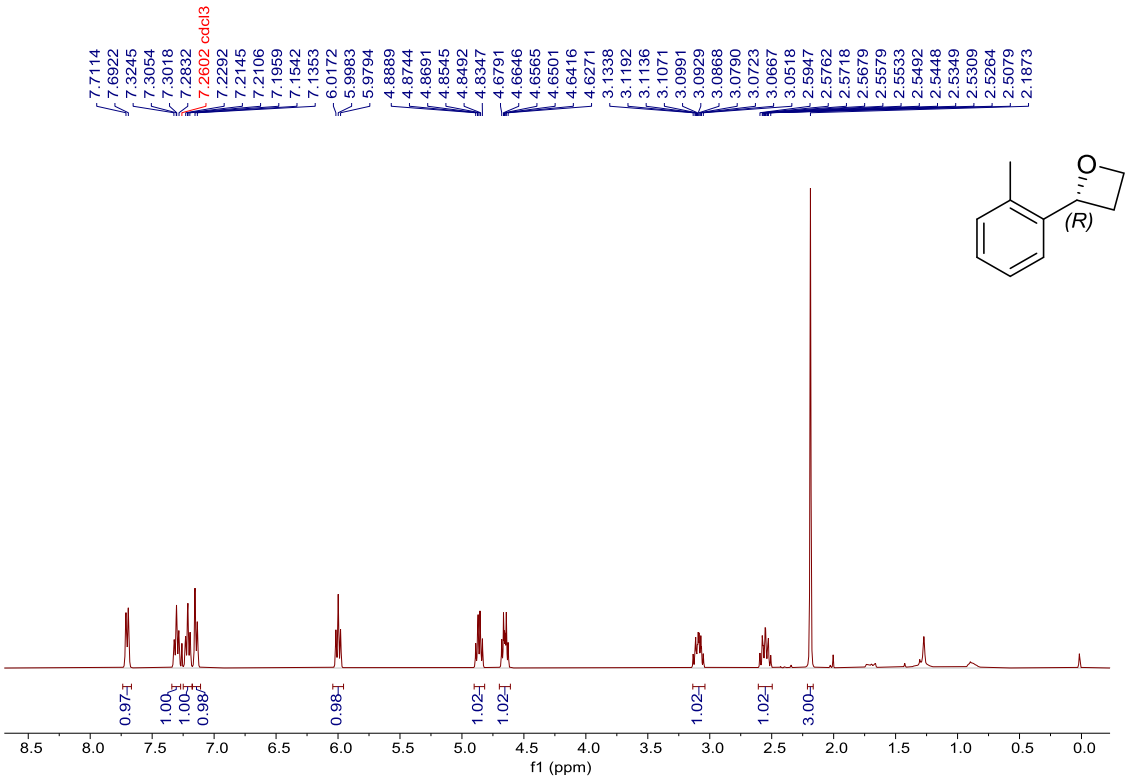


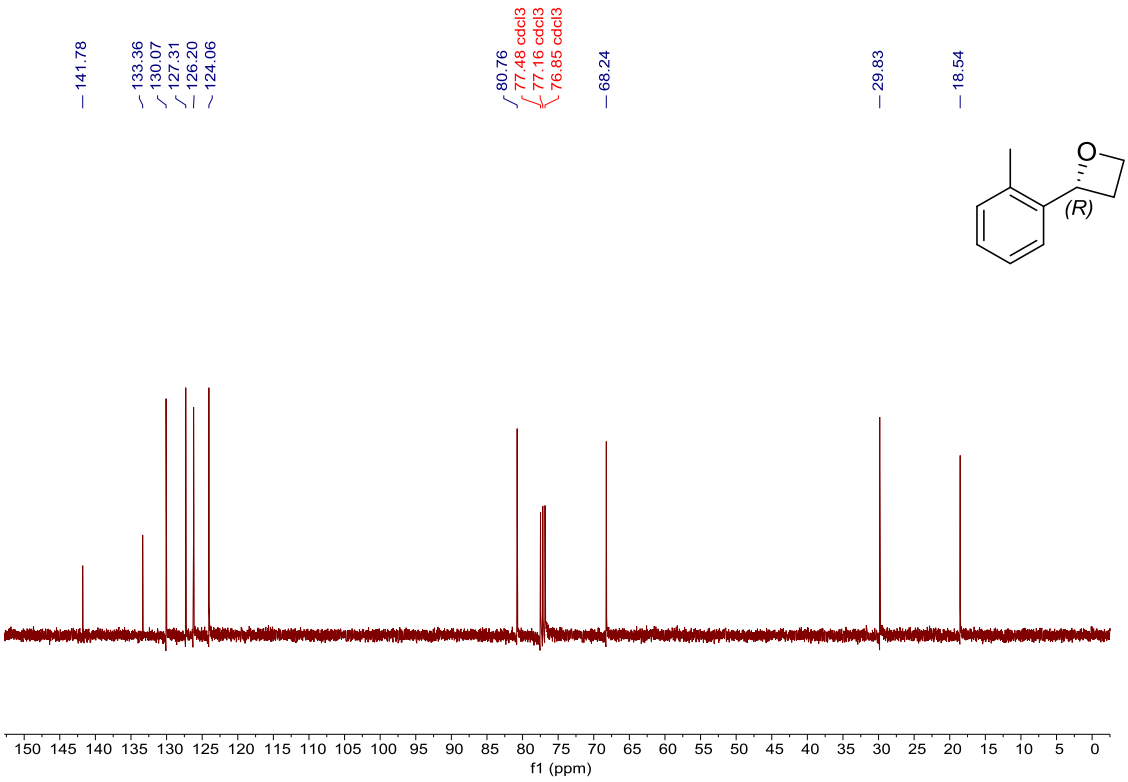
(*R*)-2-(2-bromophenyl) oxetane [(*R*)-4b]



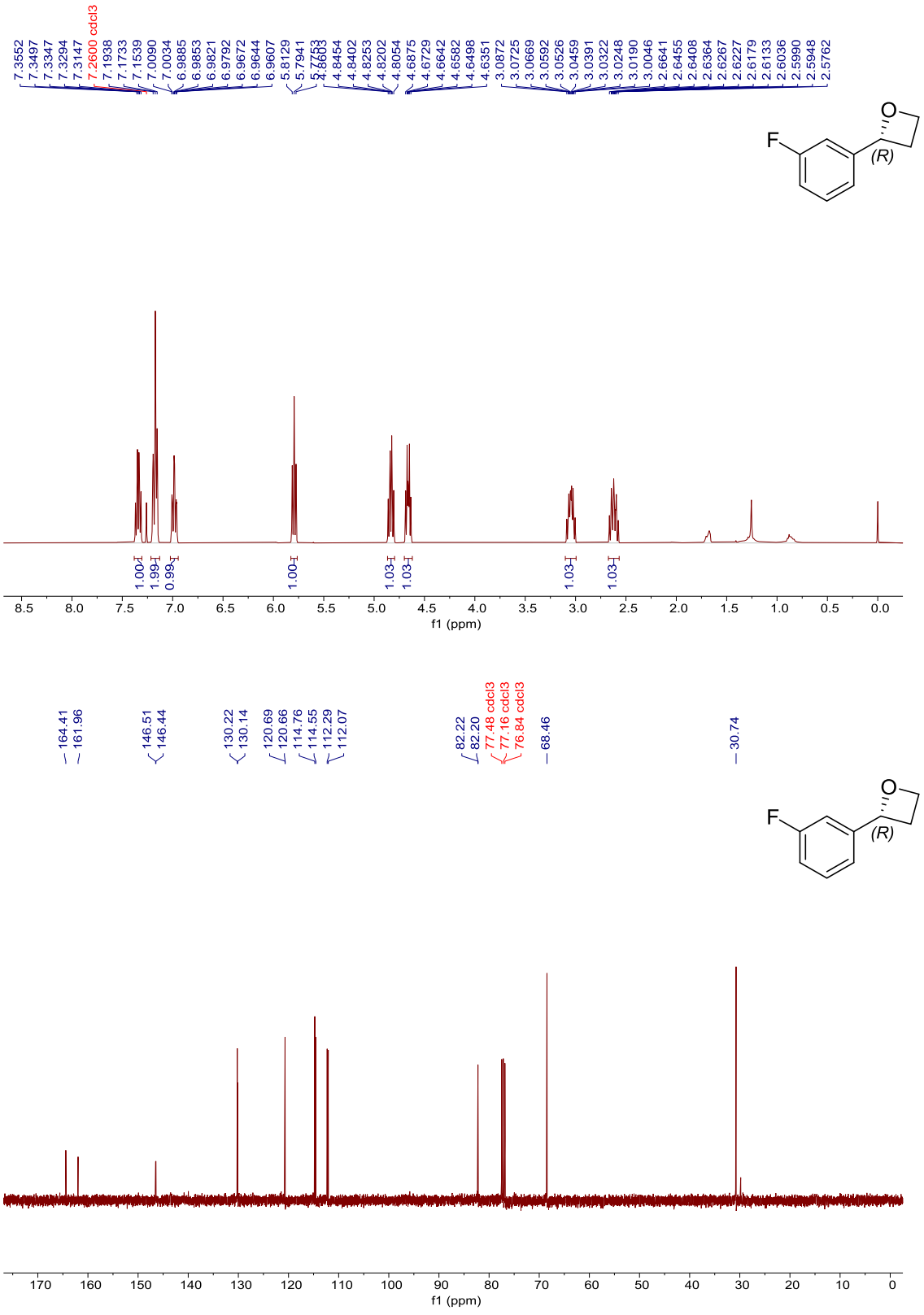


(*R*)-2-(o-tolyl) oxetane [(*R*)-5b]

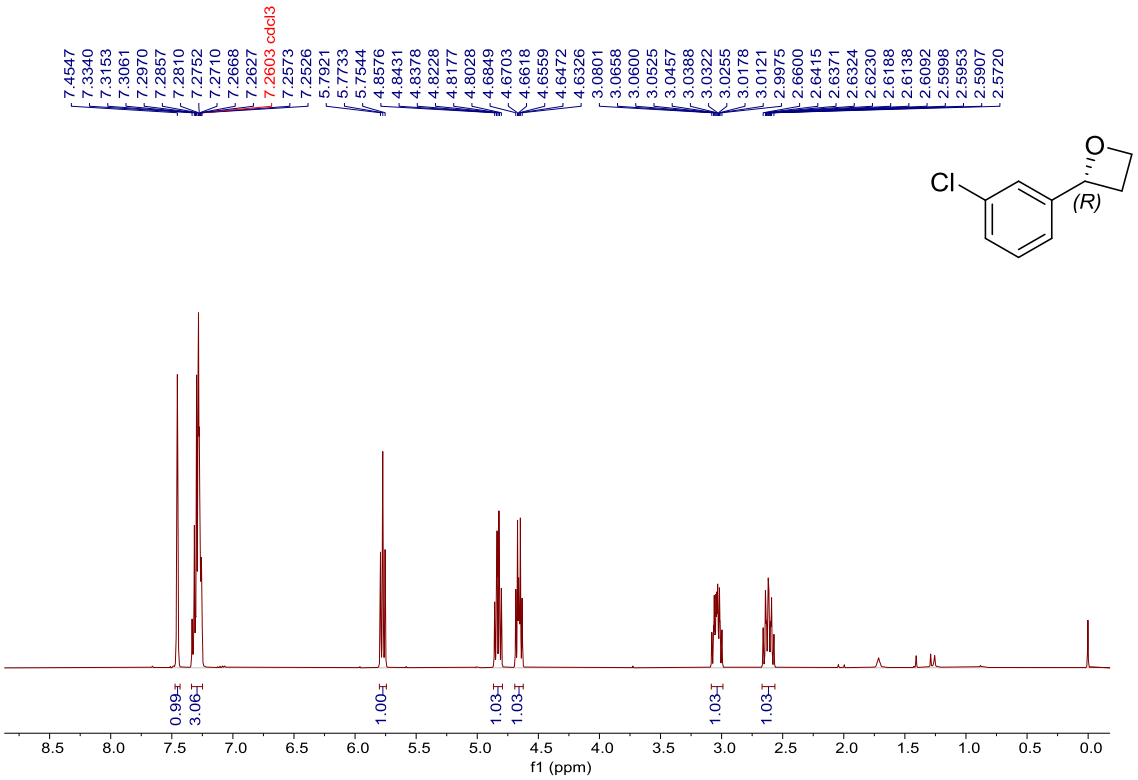


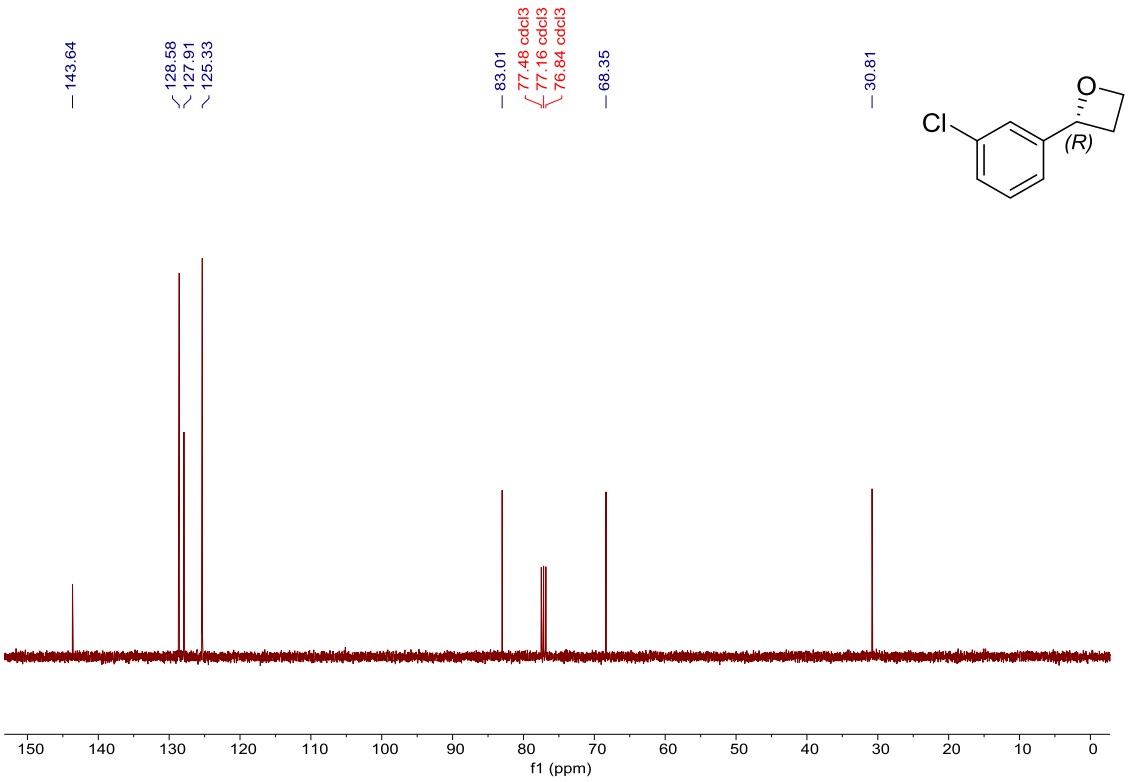


(*R*)-2-(3-fluorophenyl) oxetane [(*R*)-6b]

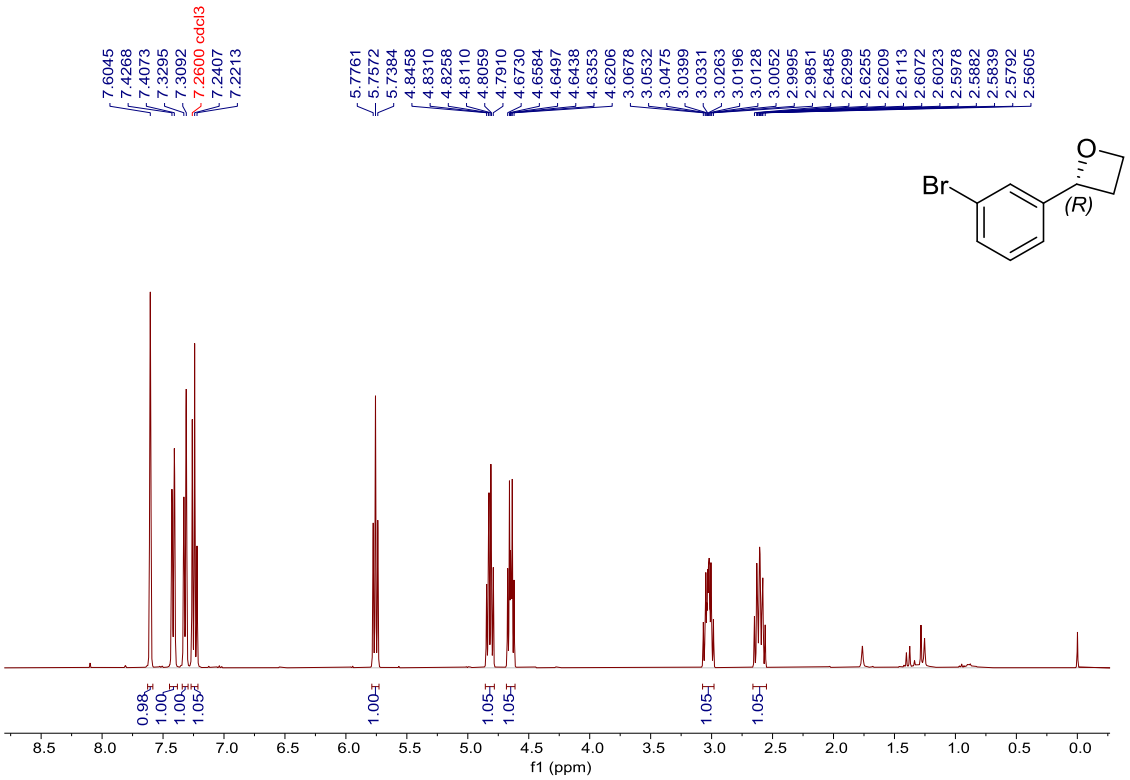


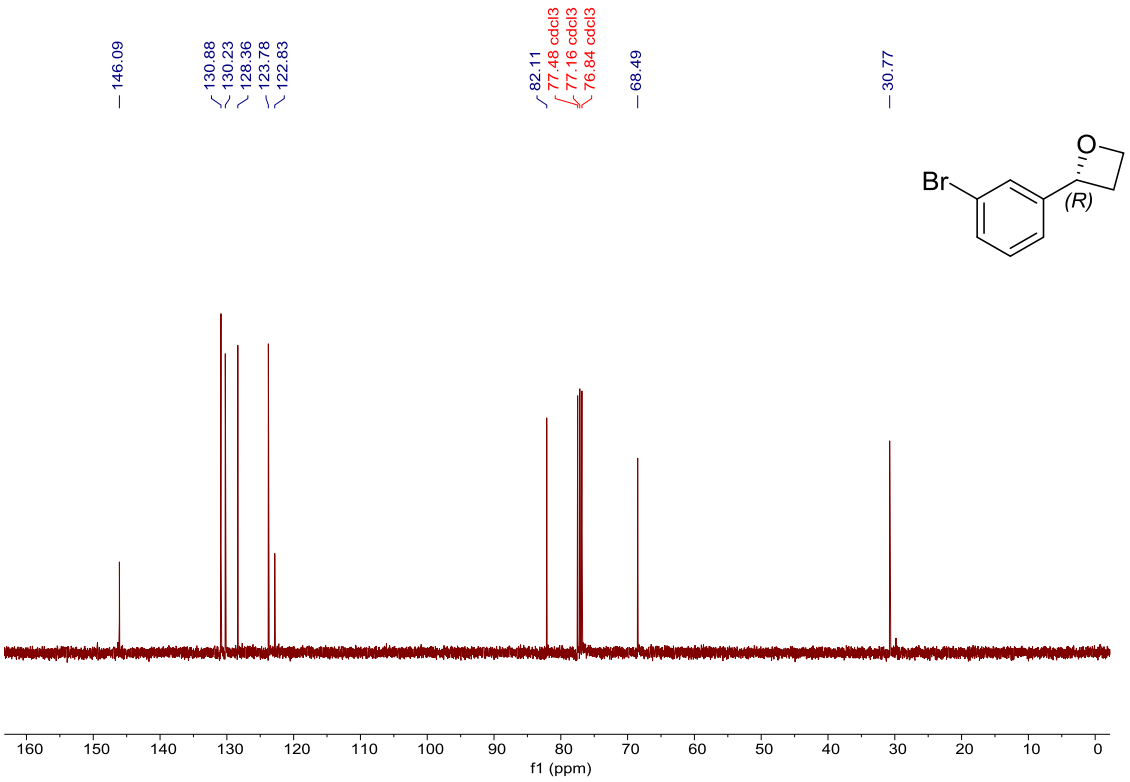
(*R*)-2-(3-chlorophenyl) oxetane [(*R*)-7b]



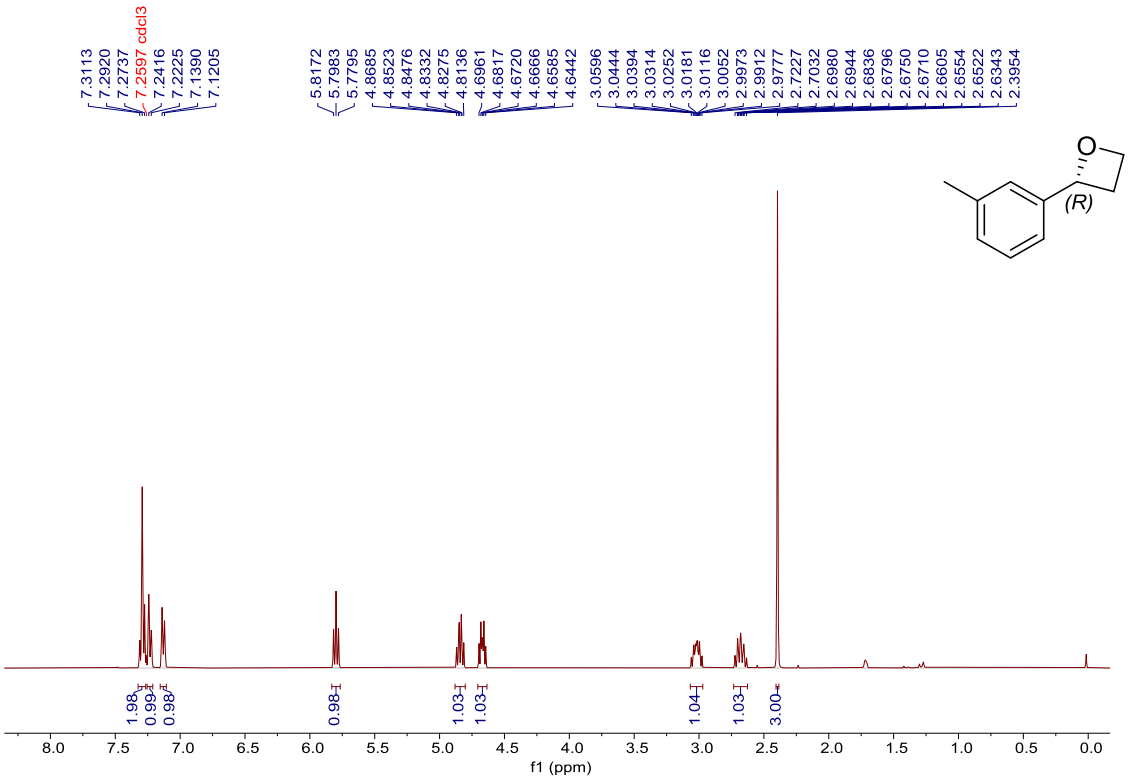


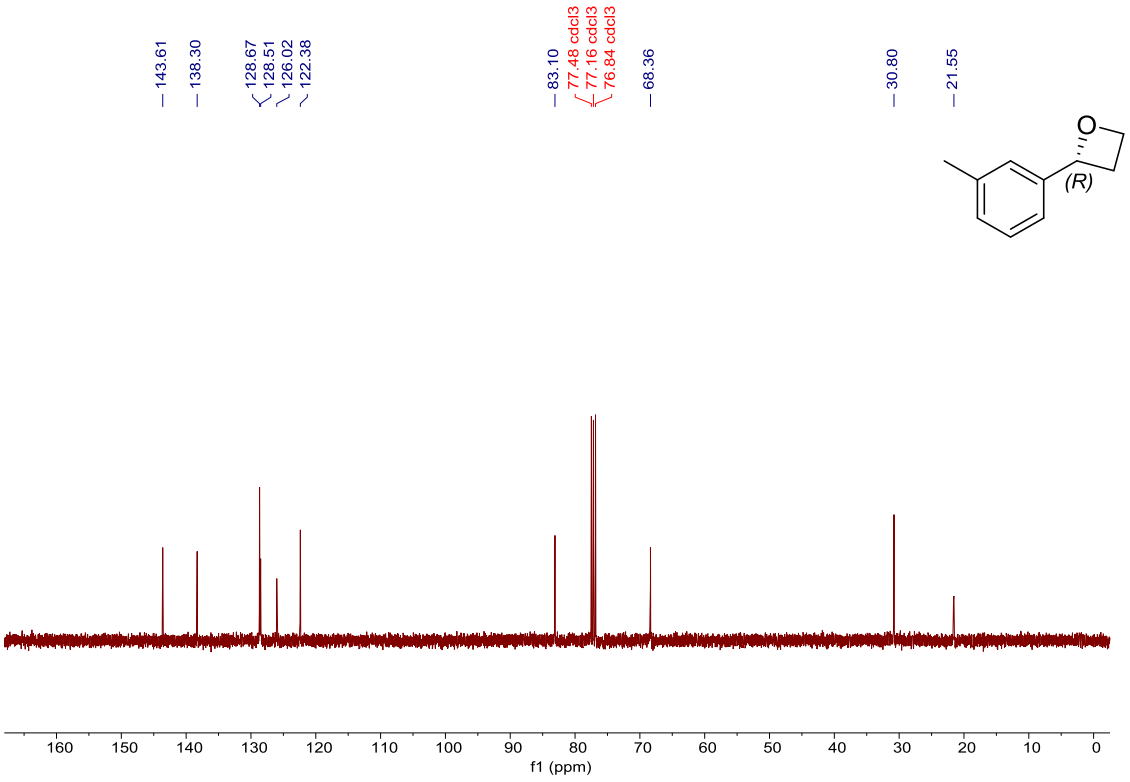
(*R*)-2-(3-bromophenyl)oxetane [(*R*)-8b]



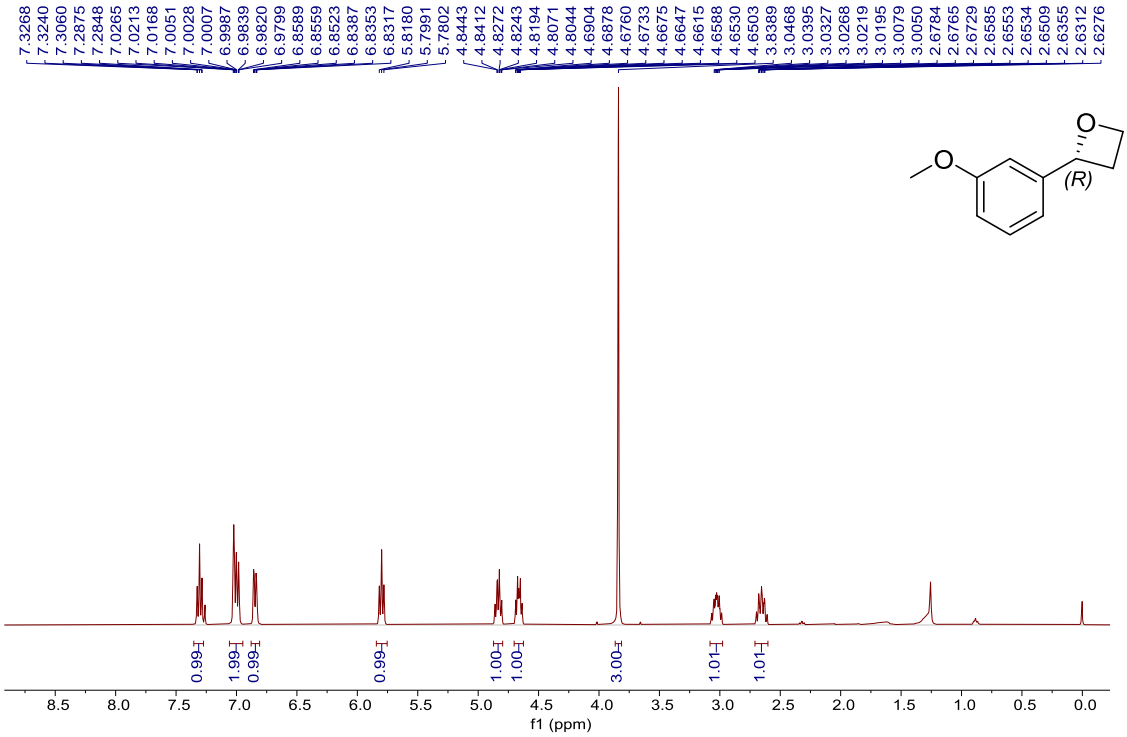


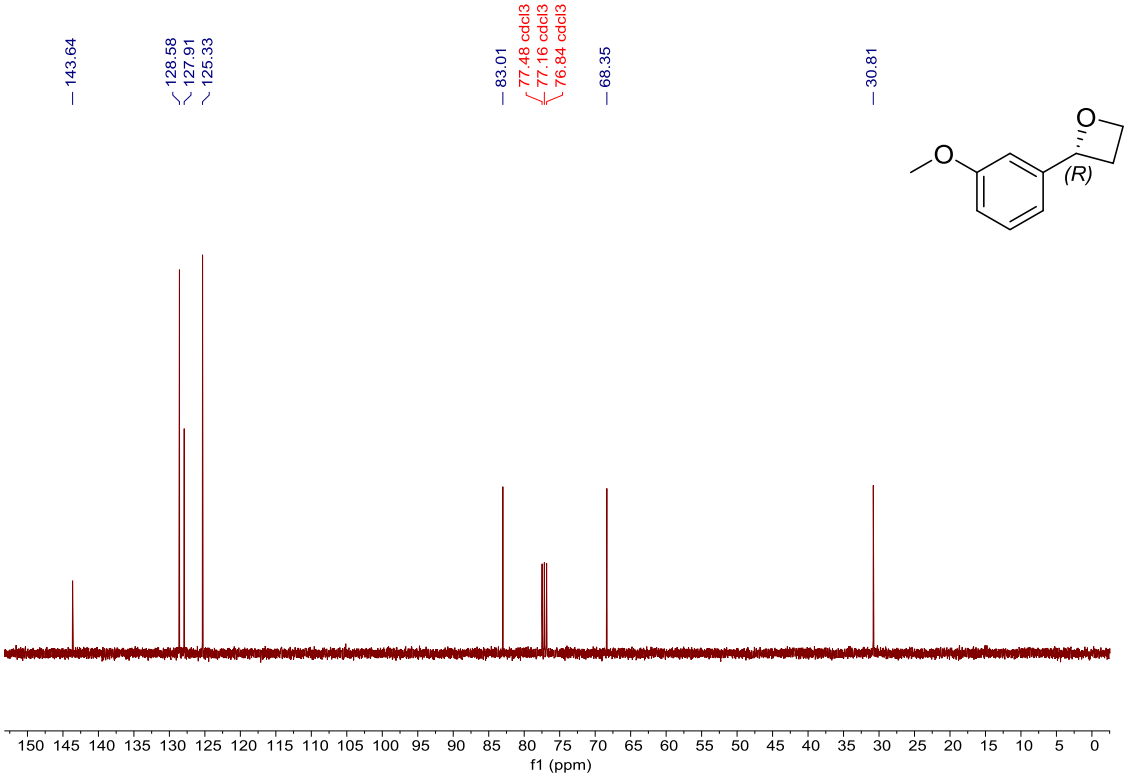
(*R*)-2-(m-tolyl)oxetane [(*R*)-9b]



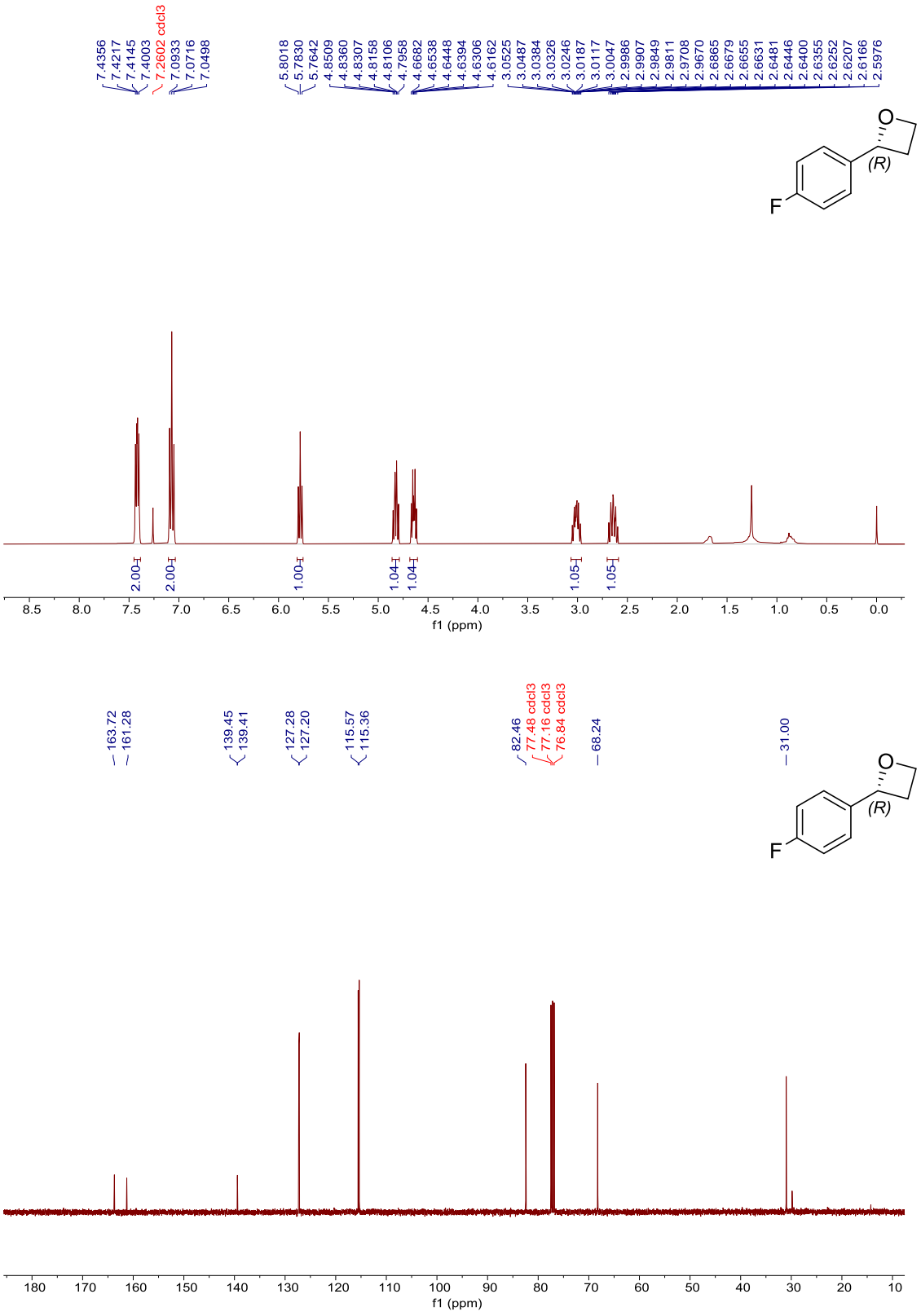


(*R*)-2-(3-methoxyphenyl)oxetane [(*R*)-10b]

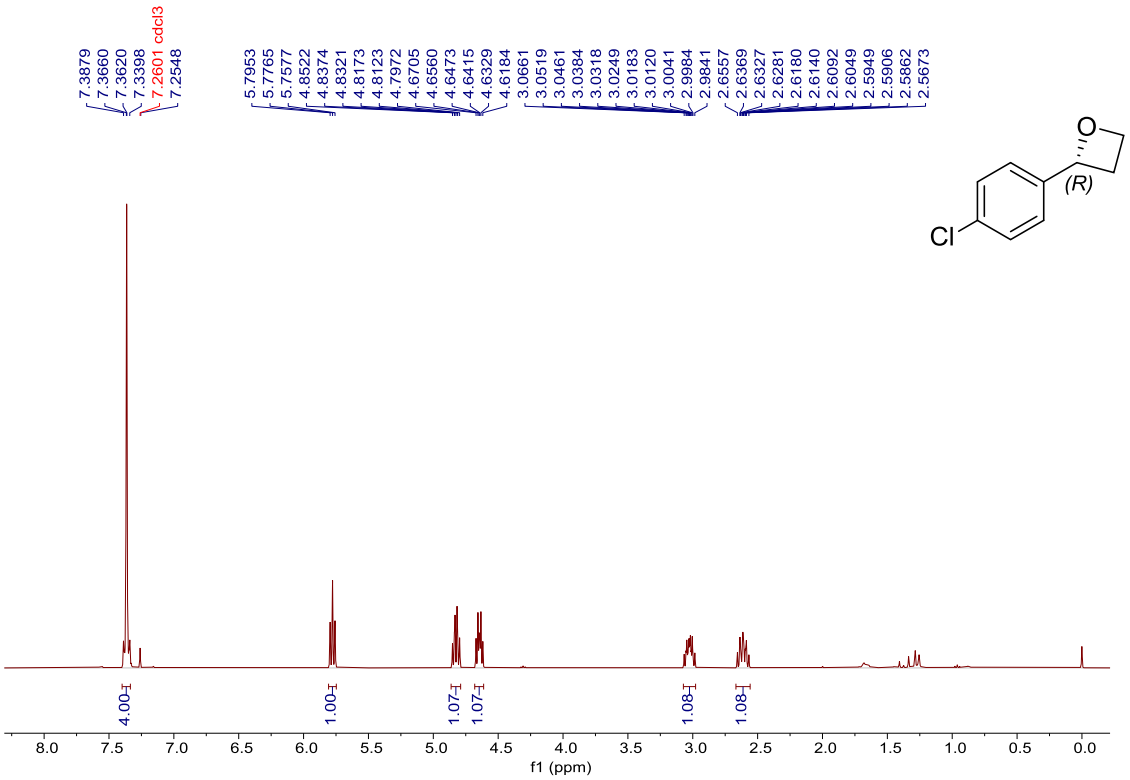


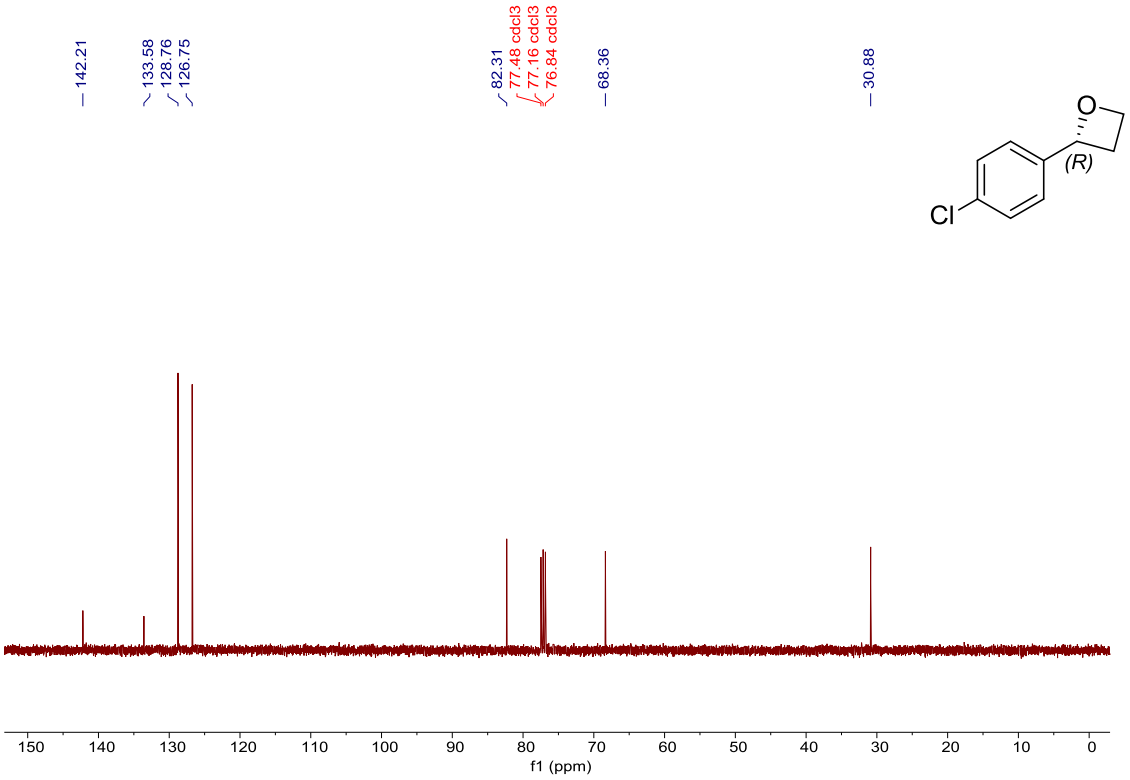


(*R*)-2-(4-fluorophenyl) oxetane [(*R*)-11b]

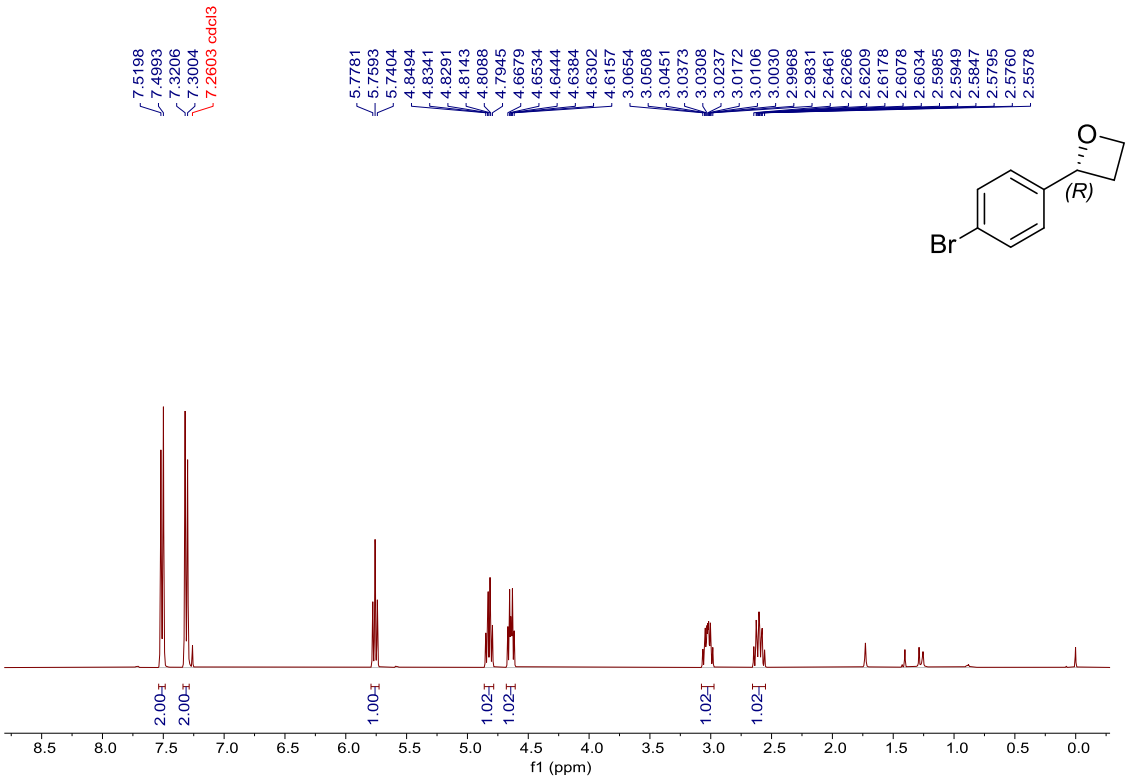


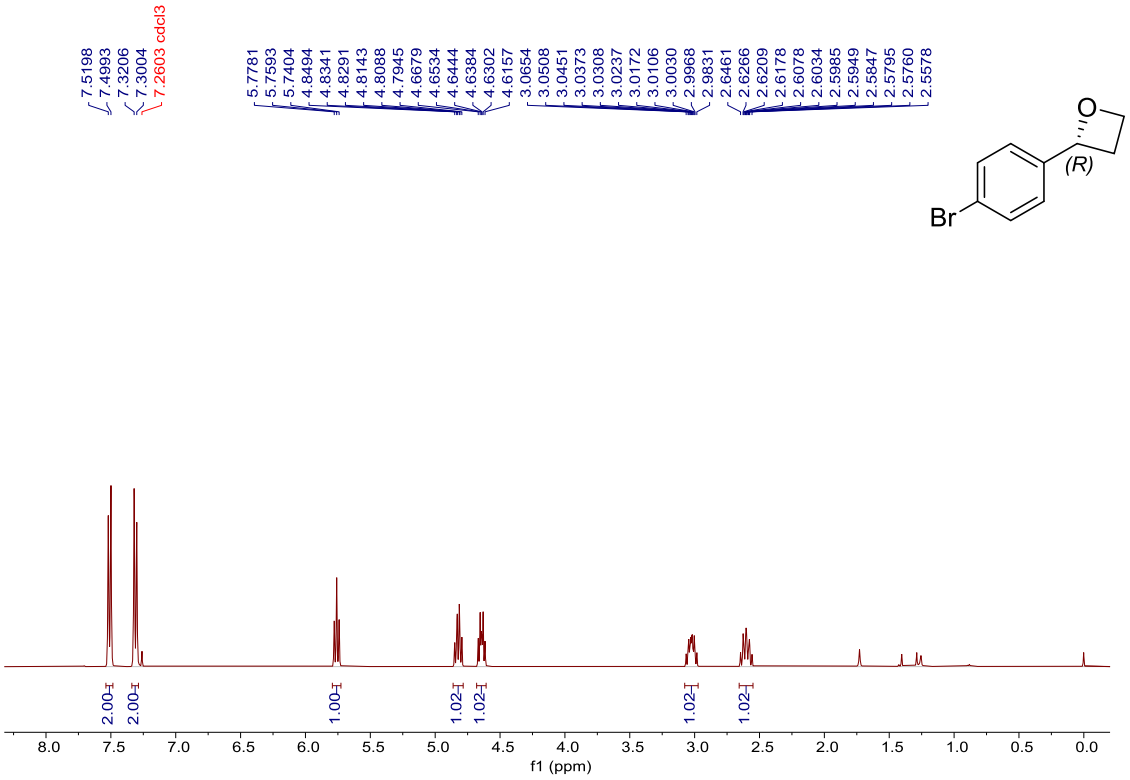
(*R*)-2-(4-chlorophenyl) oxetane [(*R*)-12b]



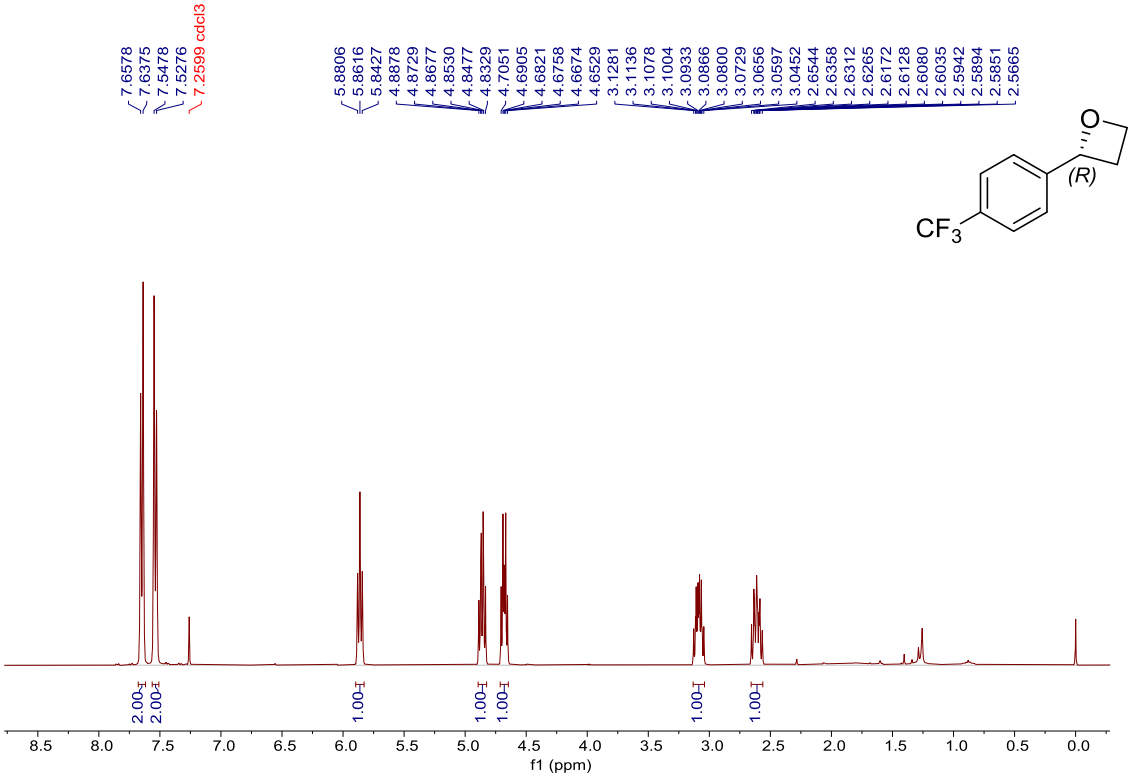


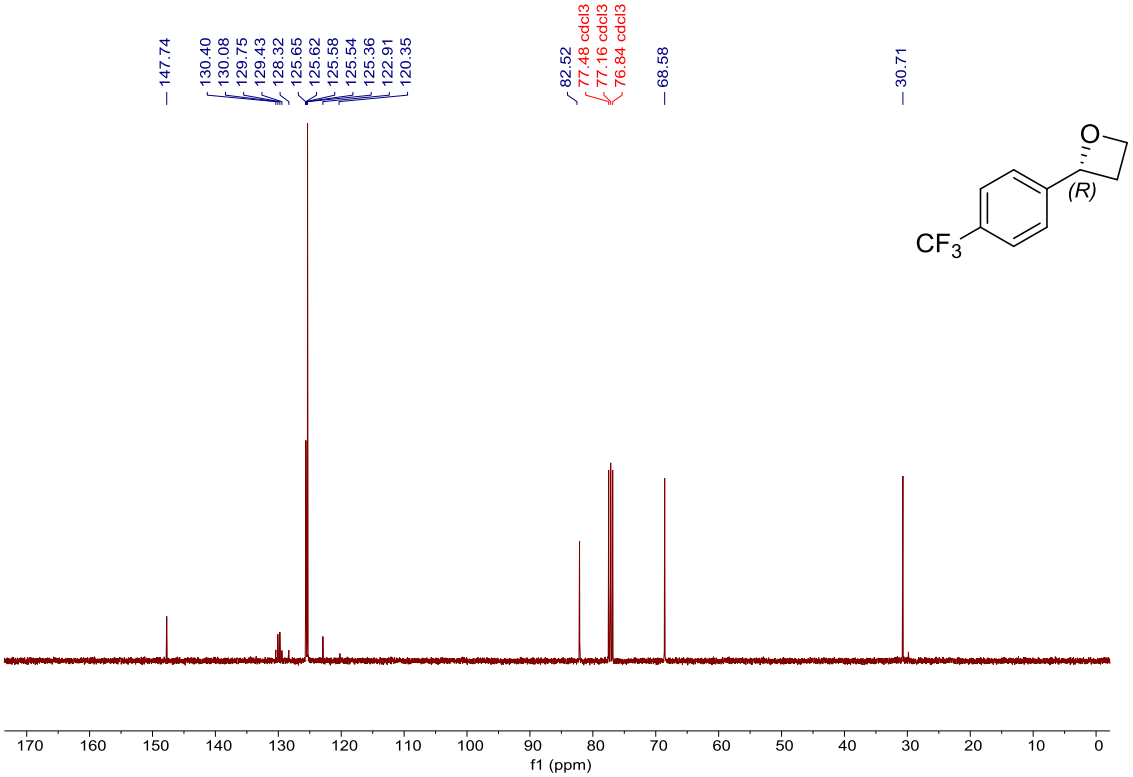
(*R*)-2-(4-bromophenyl) oxetane [(*R*)-13b]



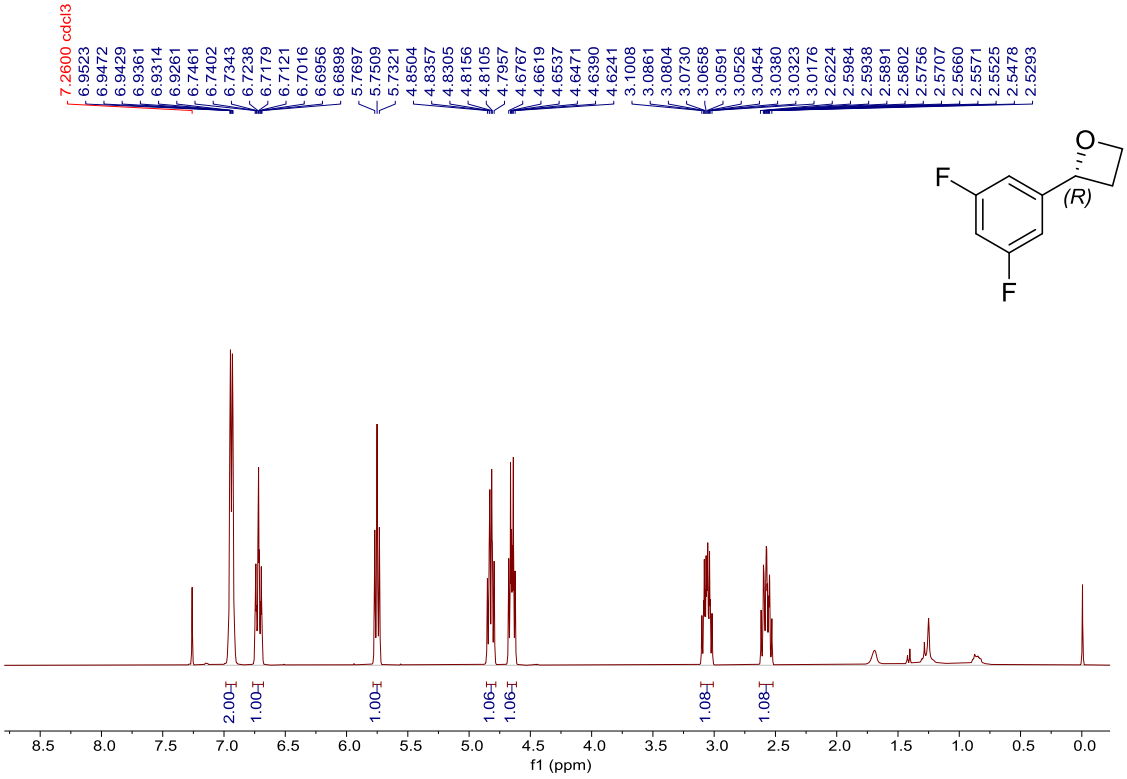


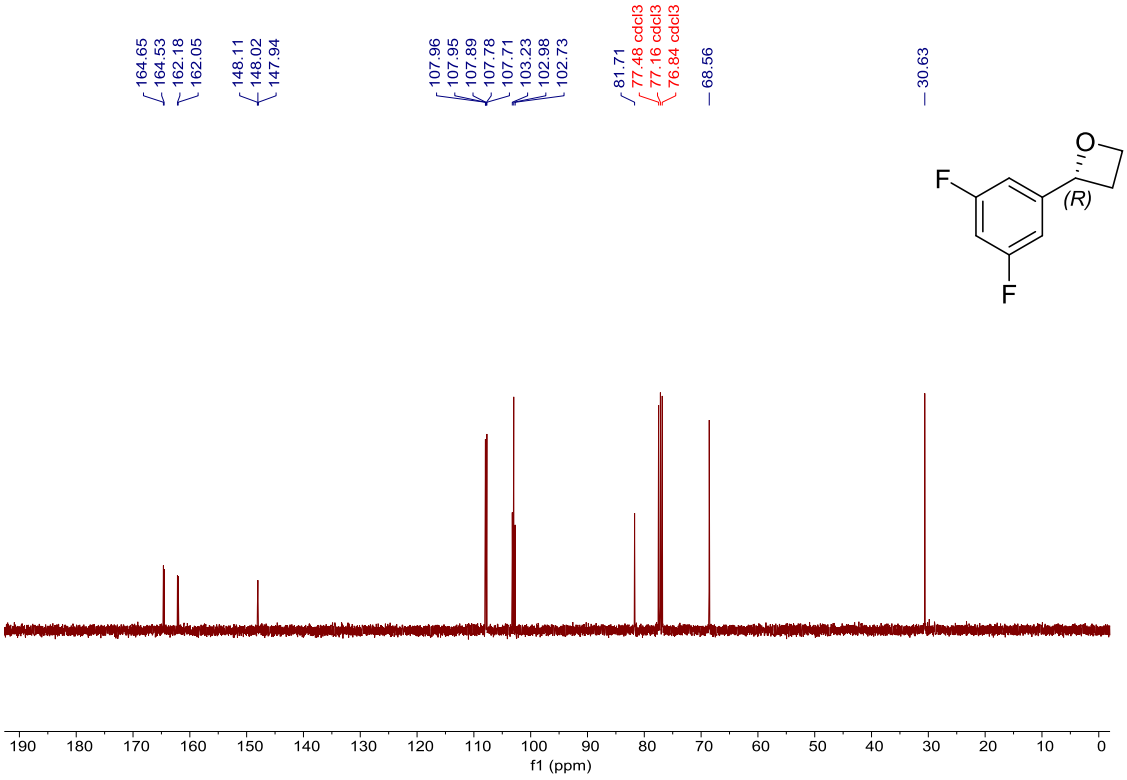
(*R*)-2-(4-(trifluoromethyl)phenyl)oxetane [(*R*)-14b]



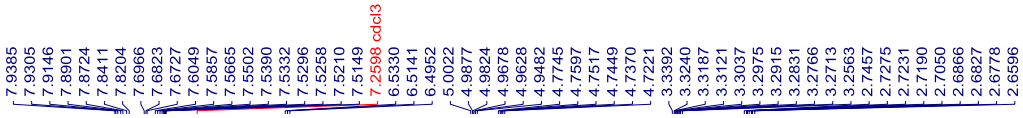


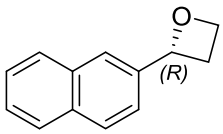
(*R*)-2-(3, 5-difluorophenyl)oxetane [(*R*)-15b]

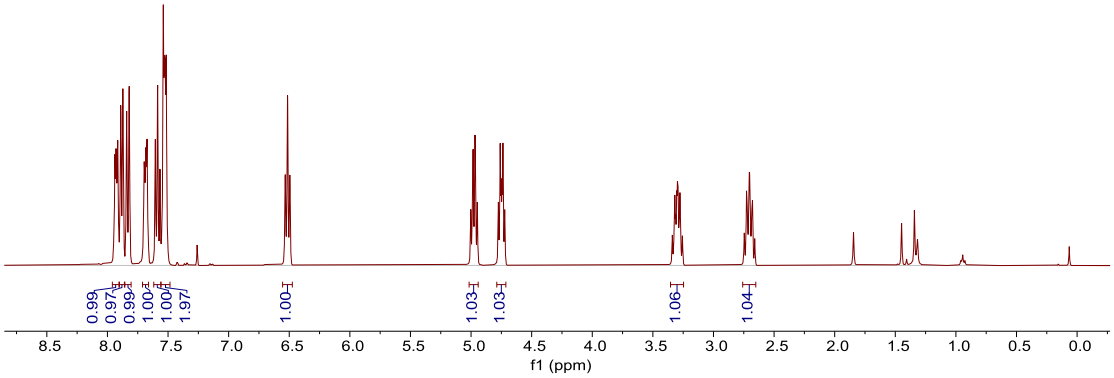


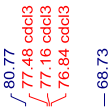


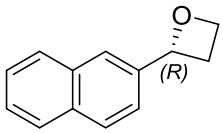
(*R*)-2-(naphthalen-2-yl)oxetane [(*R*)-16b]

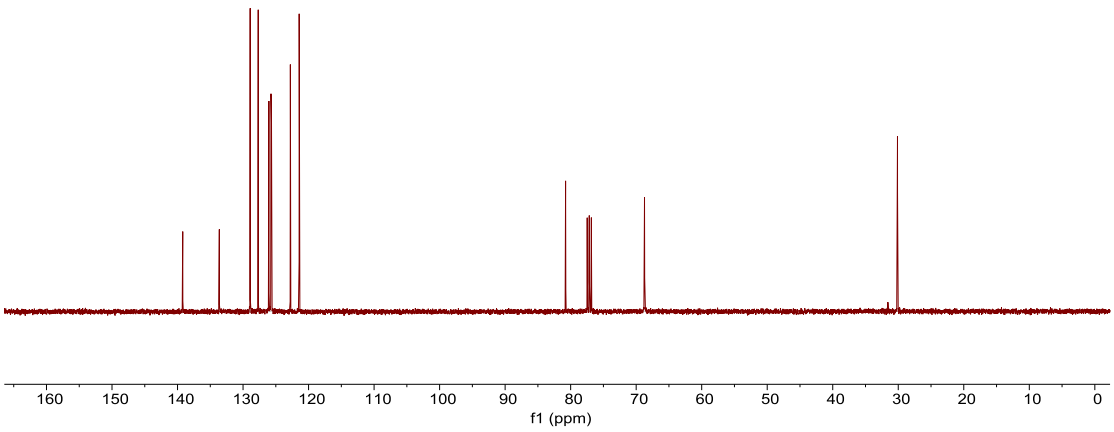




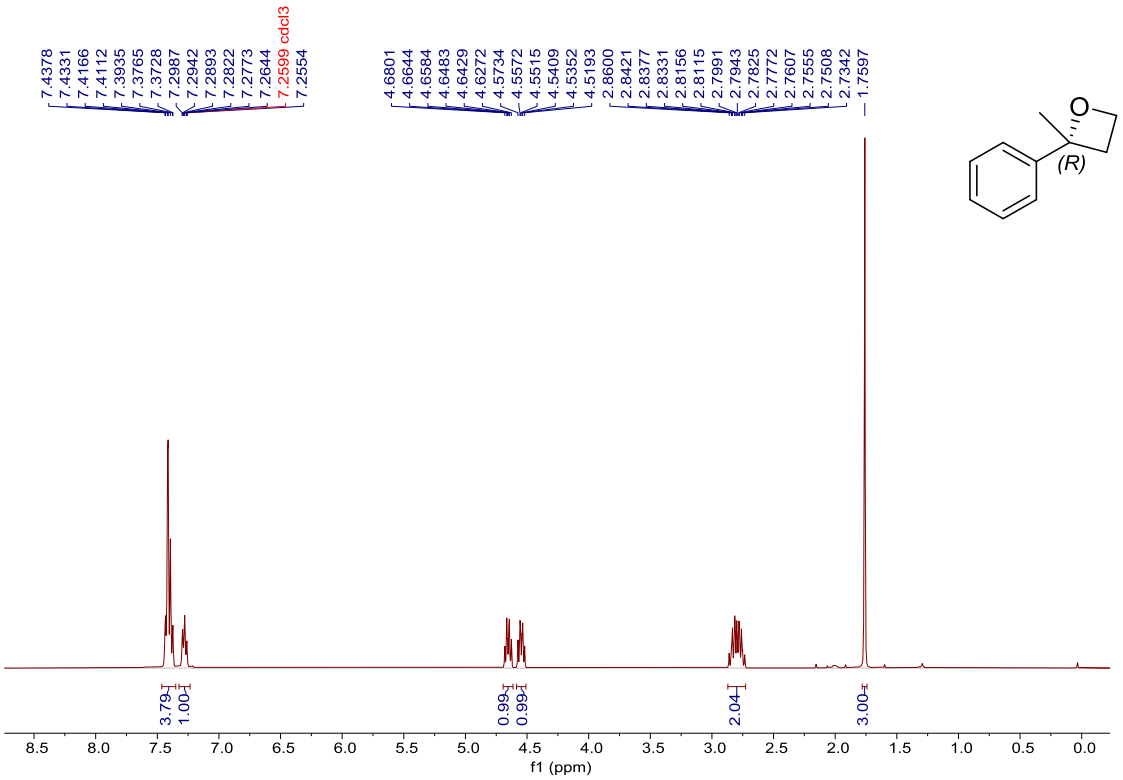


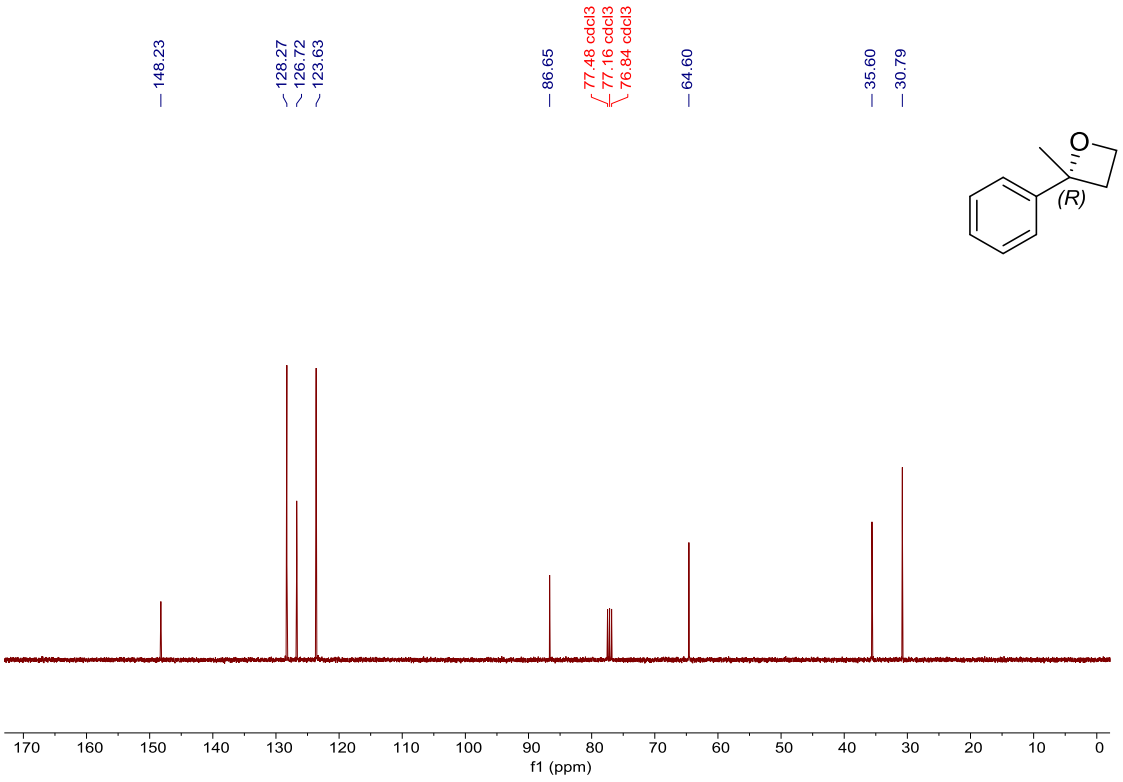




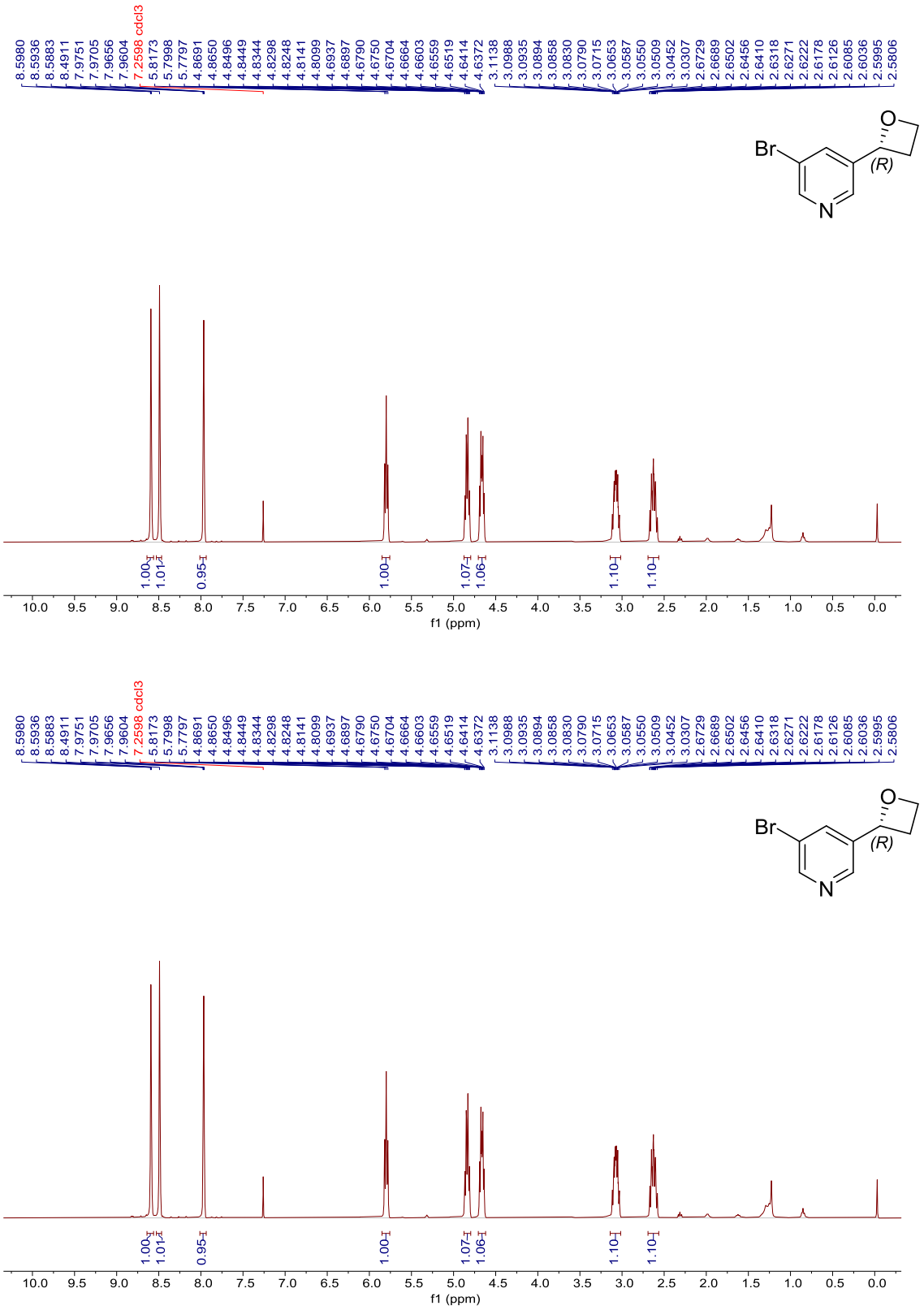


(*R*)-2-methyl-2-phenyloxetane [(*R*)-17b]





(*R*)-3-bromo-5-(oxetan-2-yl)pyridine [(*R*)-18b]



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2.5806
Br
O
(R)
N
1.00
1.01
0.95
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1.07
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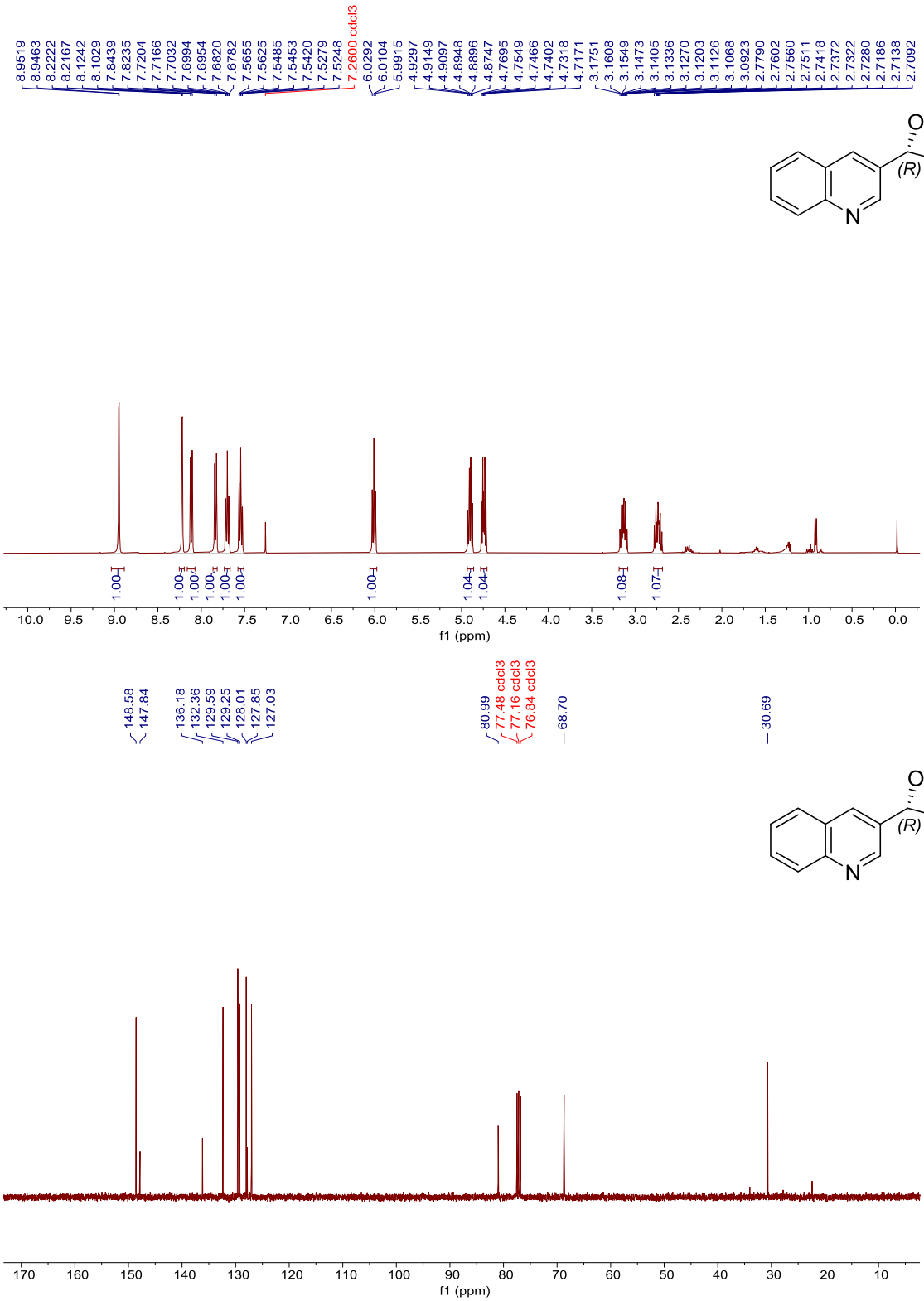
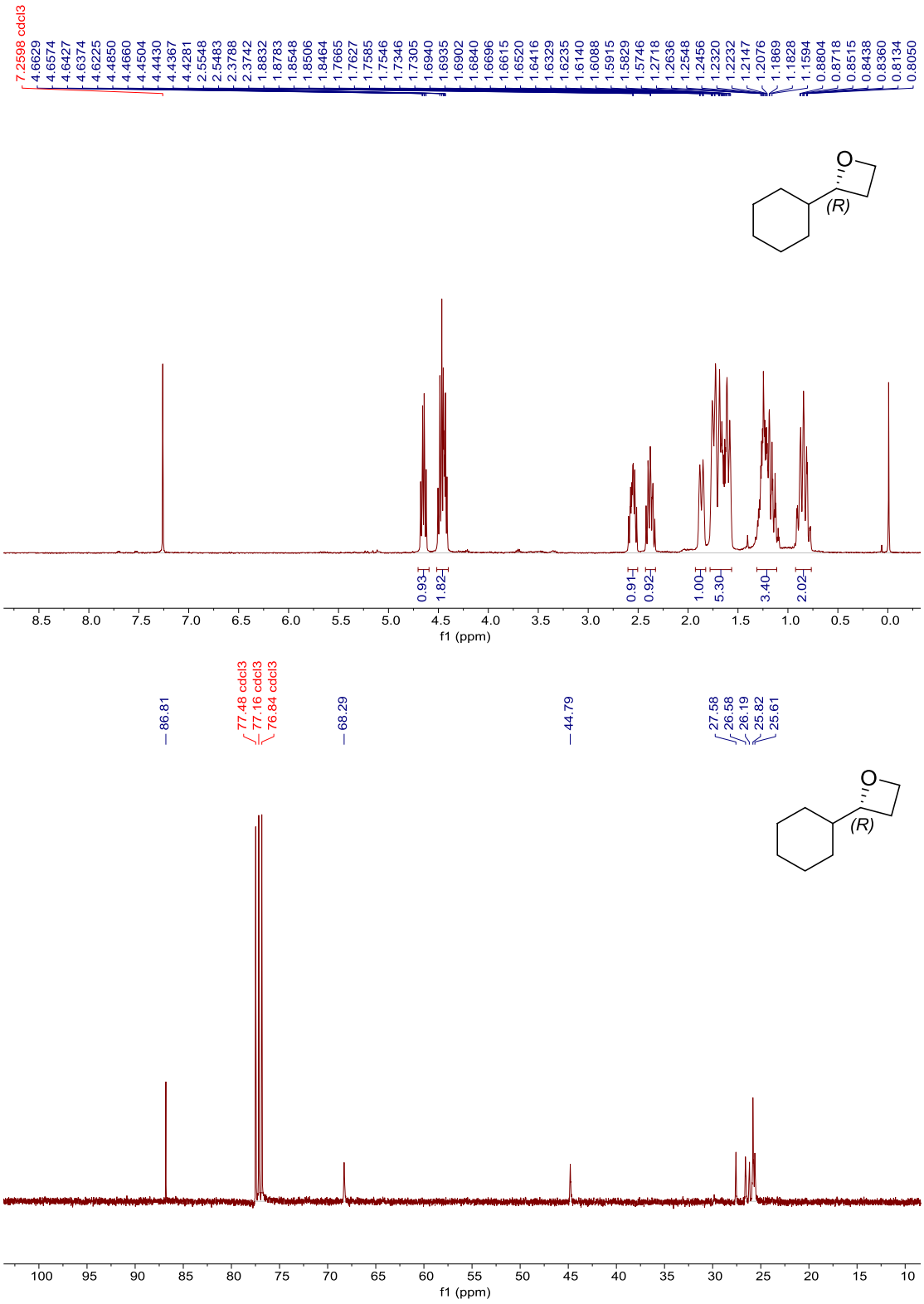
1.10
1.10
10.0 9.5 9.0 8.5 8.0 7.5 7.0 6.5 6.0 5.5 5.0 4.5 4.0 3.5 3.0 2.5 2.0 1.5 1.0 0.5 0.0
f1 (ppm)

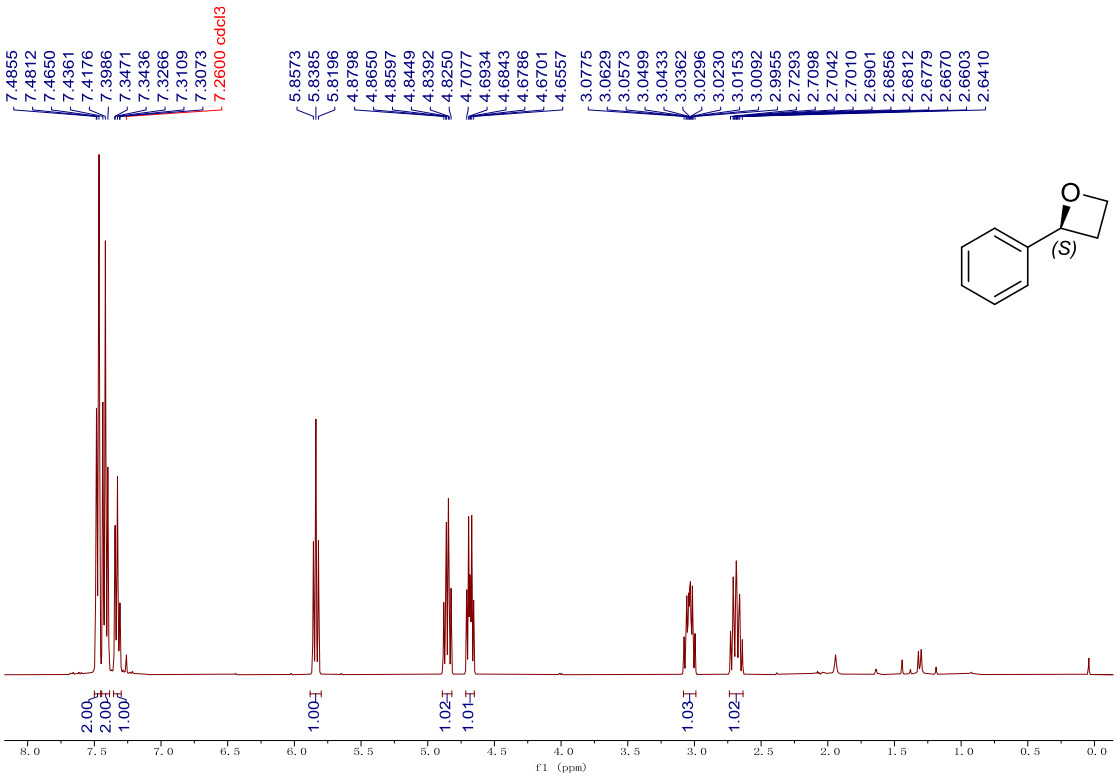
(*R*)-3-bromo-5-(oxetan-2-yl)pyridine [(*R*)-19b]

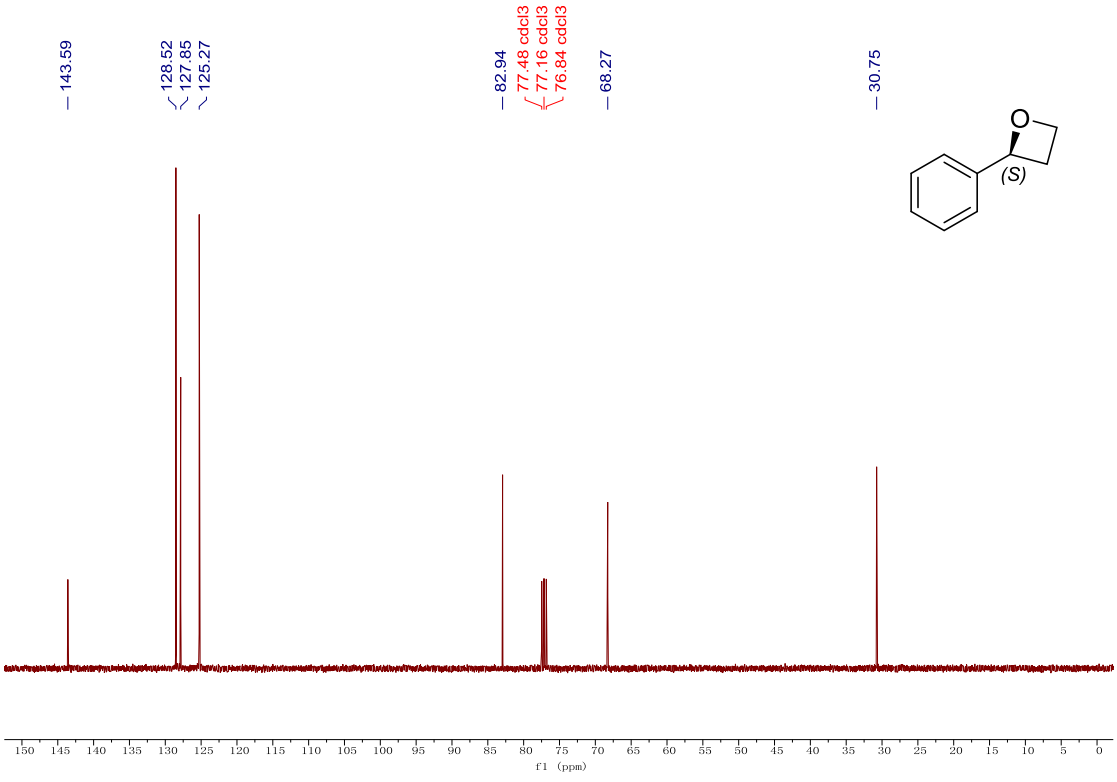


(*R*)-2-cyclohexyloxetane [(*R*)-21b]

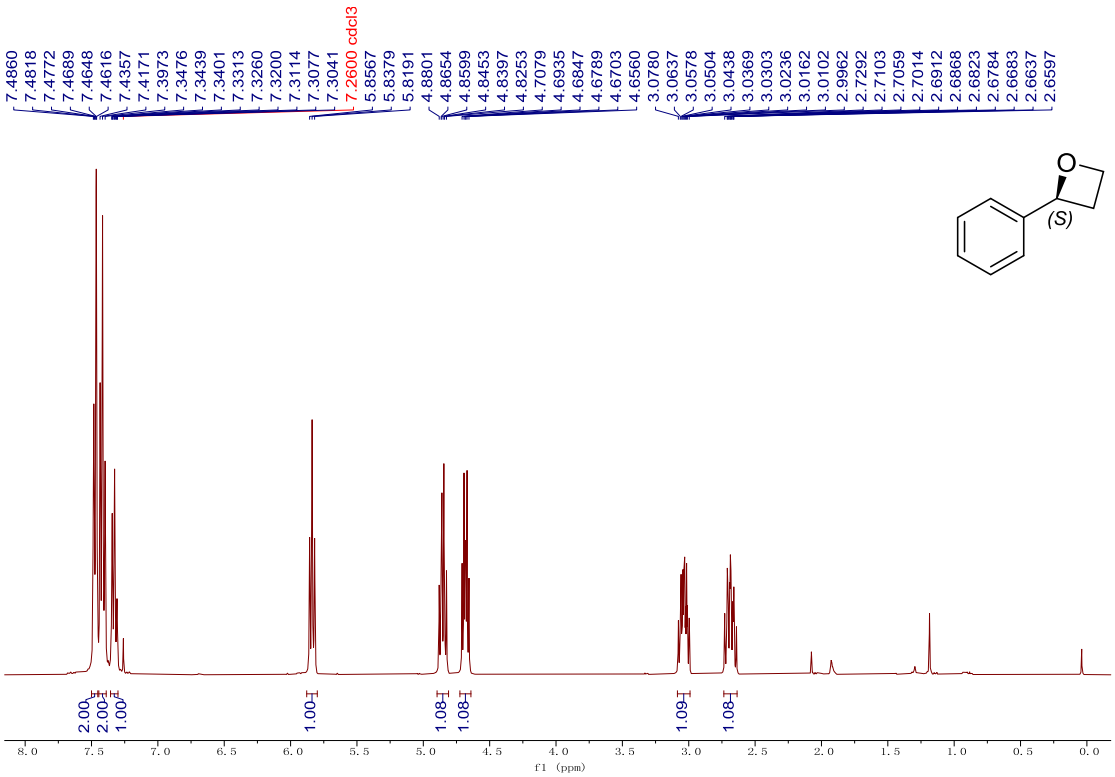


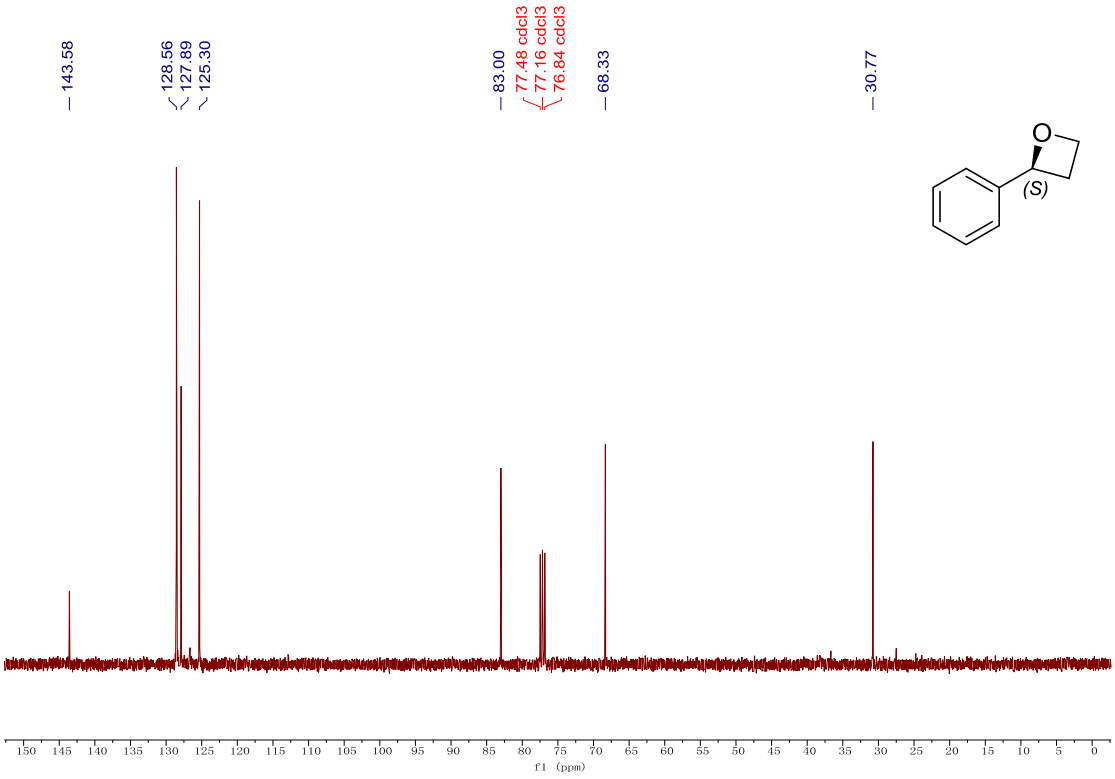
(*S*)-2-phenyloxetane [(*S*)-1b] (Ring opening by <u>azide</u>)



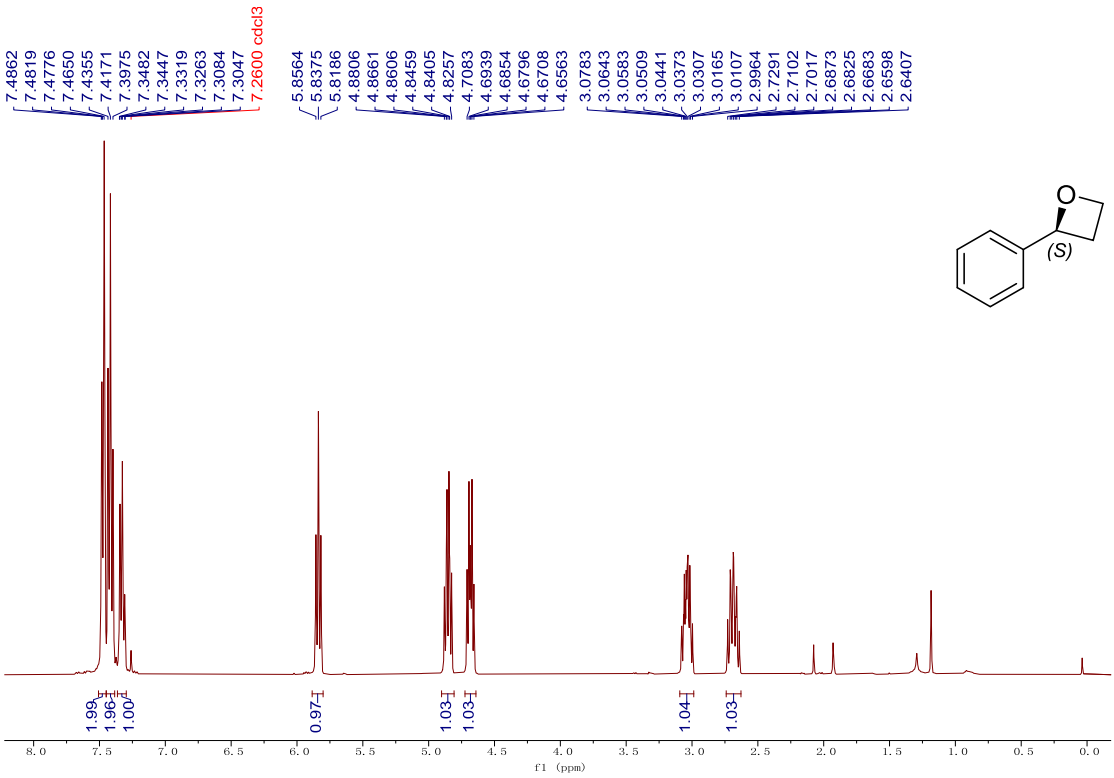


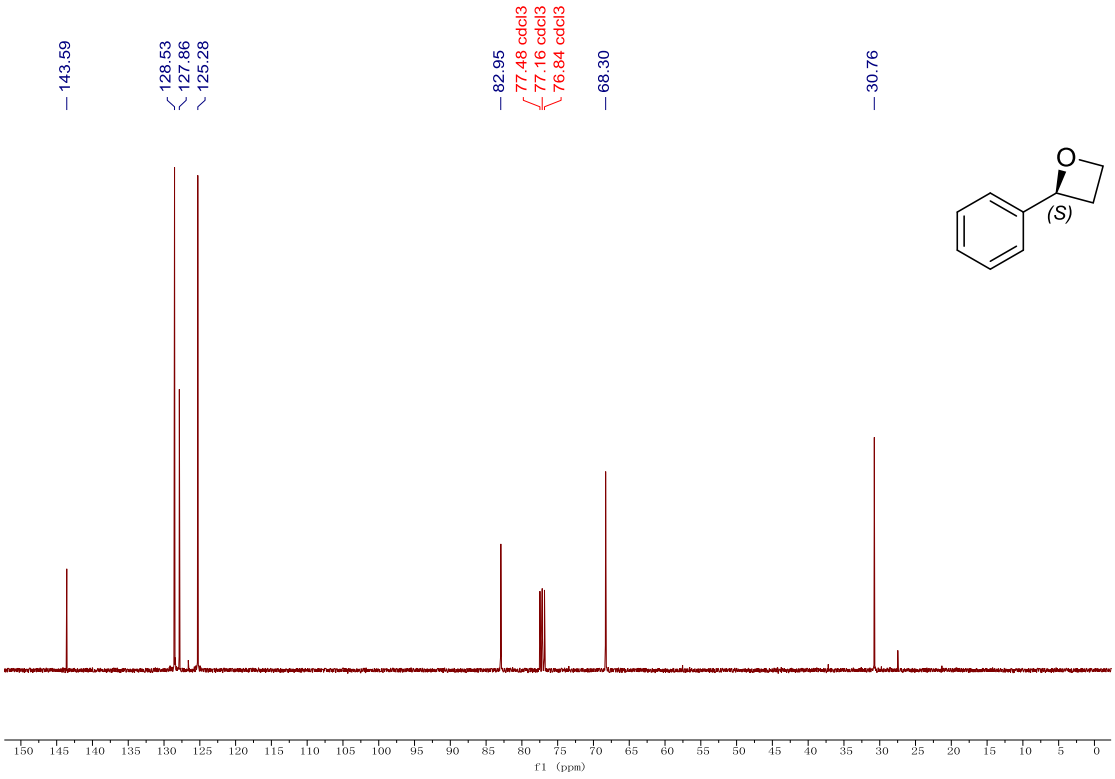
(*S*)-2-phenyloxetane [(*S*)-1b] (Ring opening by <u>cyanide</u>)



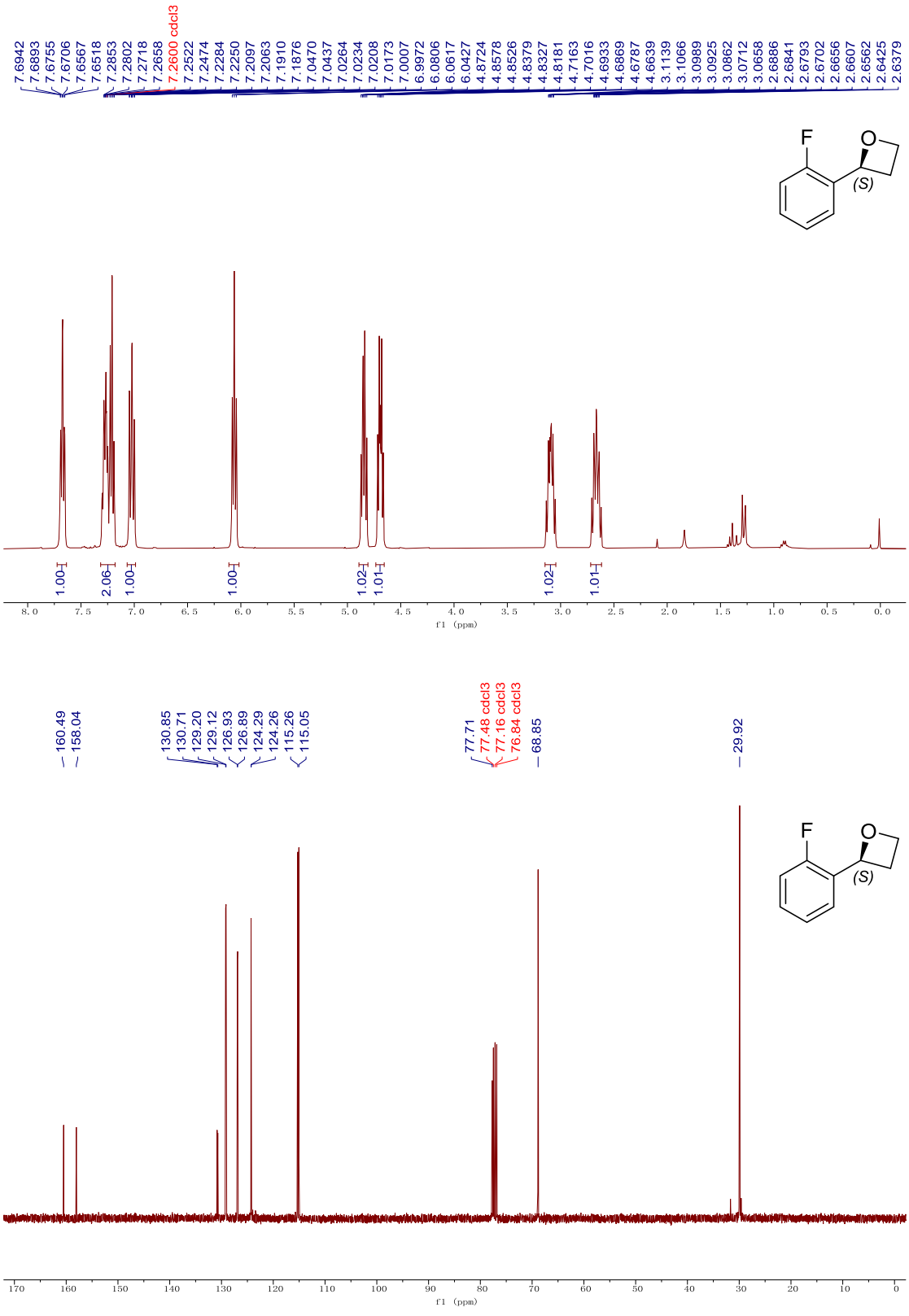


(*S*)-2-phenyloxetane [(*S*)-1b] (Ring opening by <u>nitrite</u>)

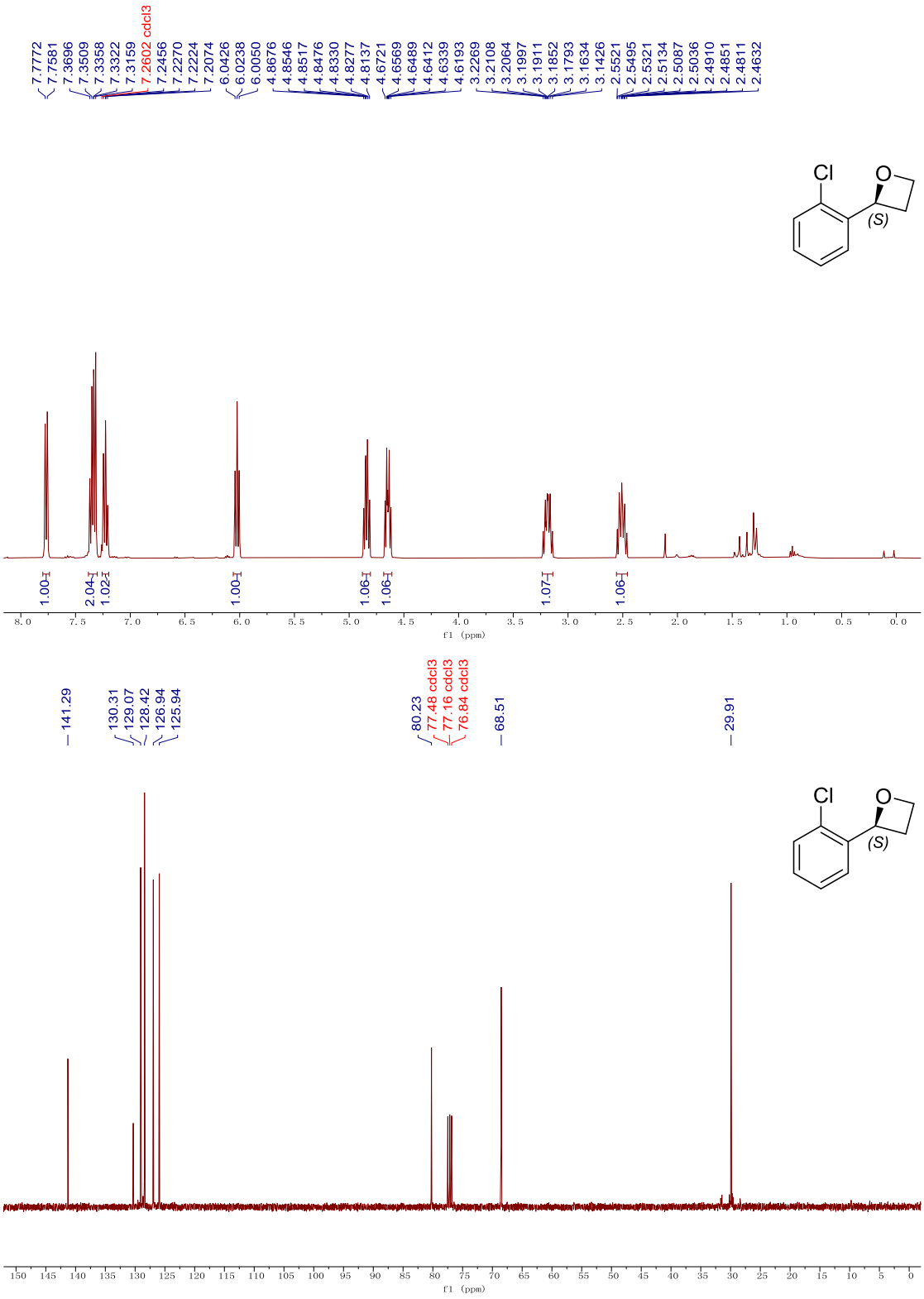




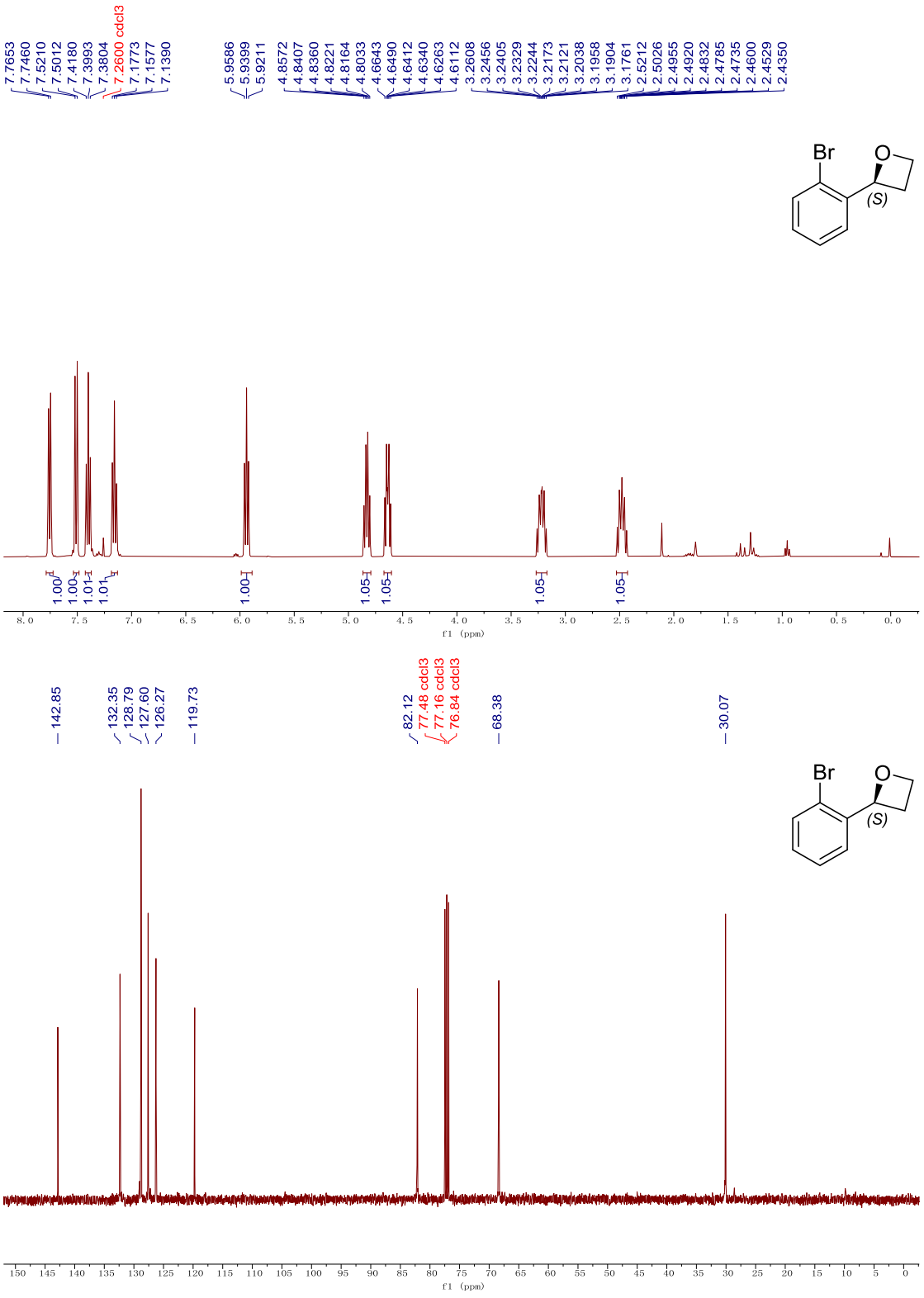
(*S*)-2-(2-fluorophenyl)oxetane [(*S*)-2b]



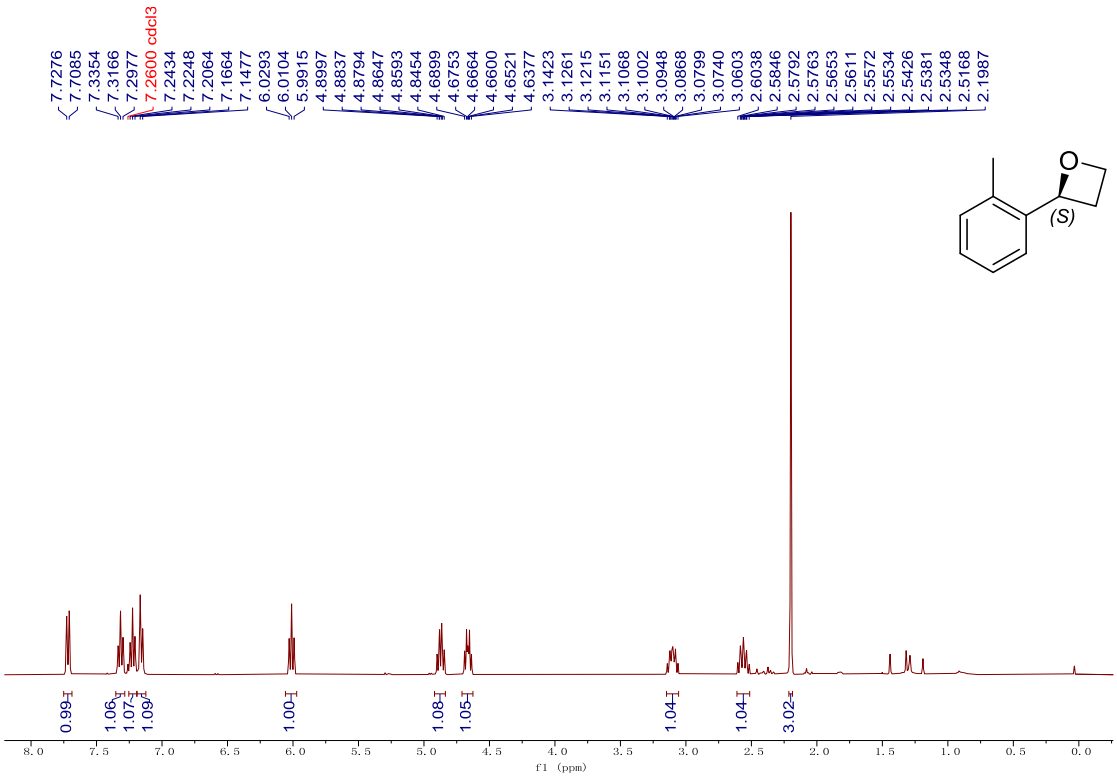
(*S*)-2-(2-chlorophenyl)oxetane [(*S*)-3b]

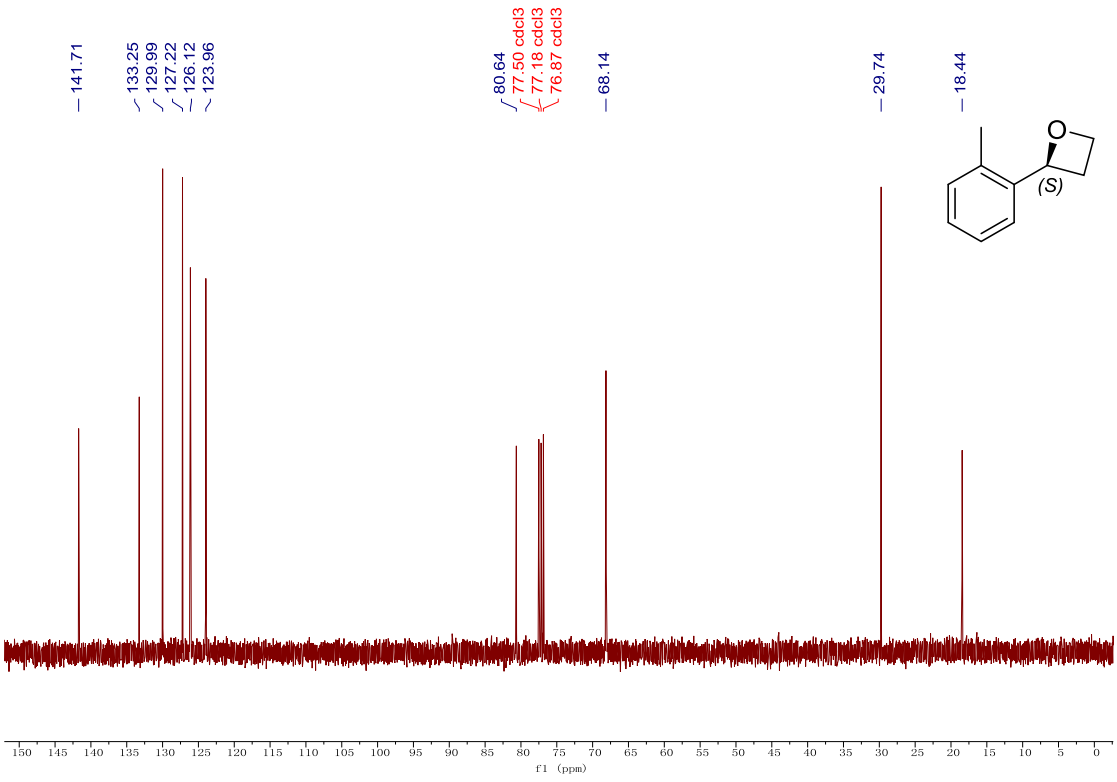


(*S*)-2-(2-bromophenyl)oxetane [(*S*)-4b]

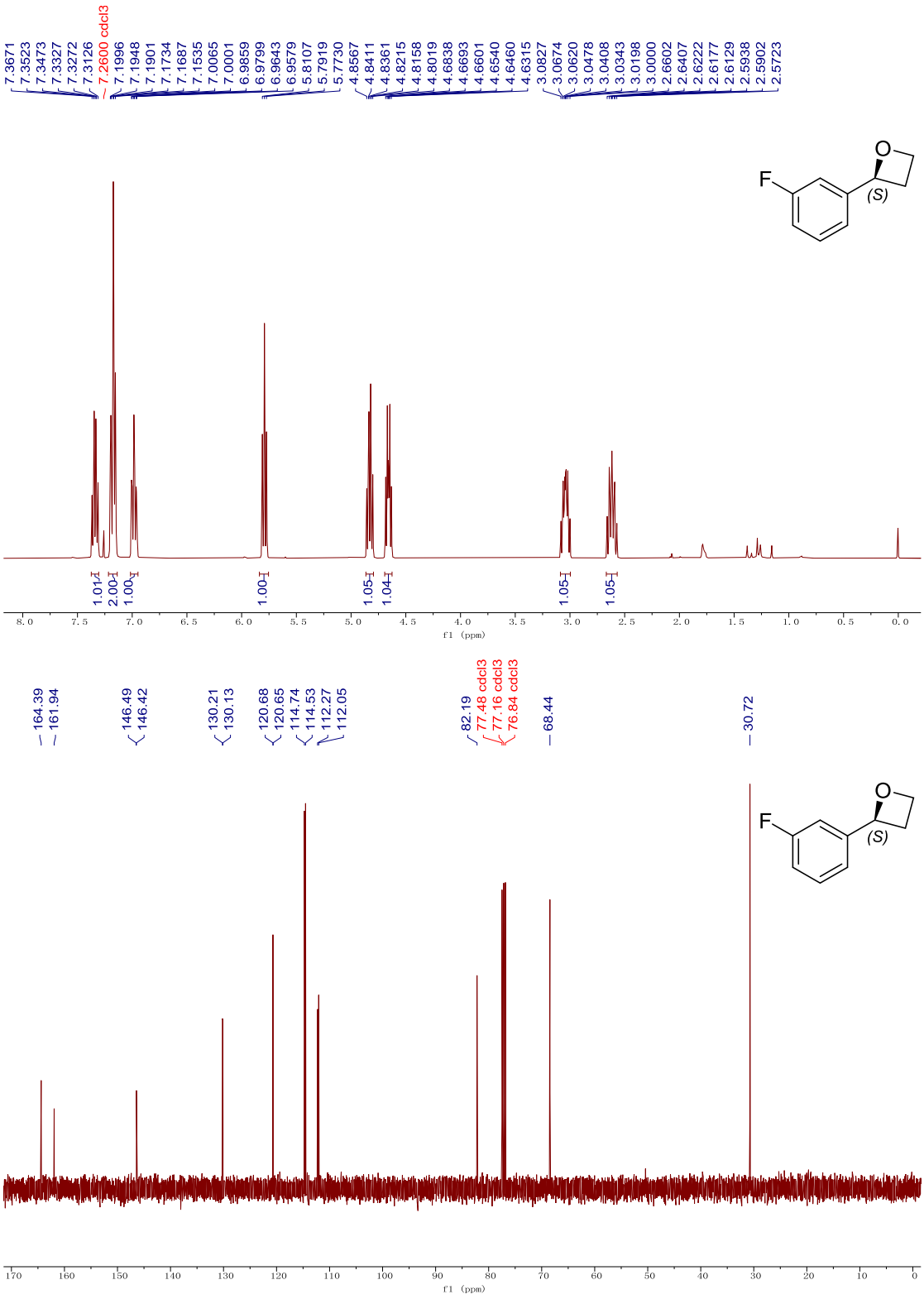


(*S*)-2-(o-tolyl)oxetane [(*S*)-5b]

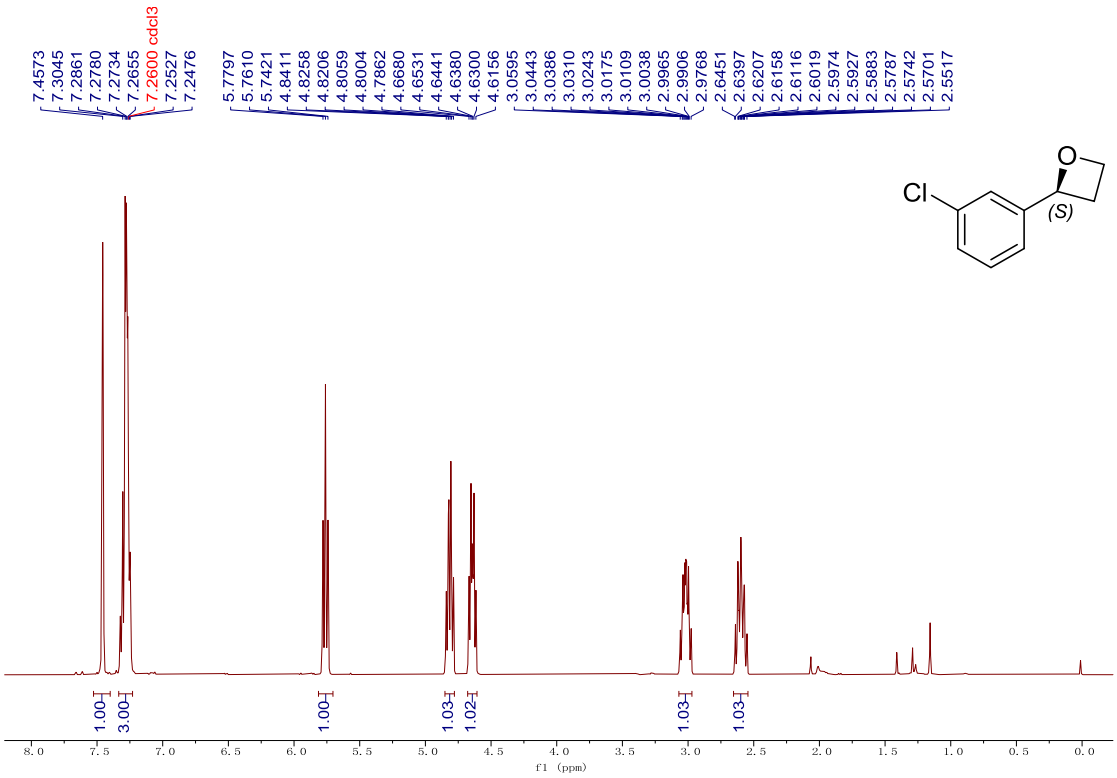


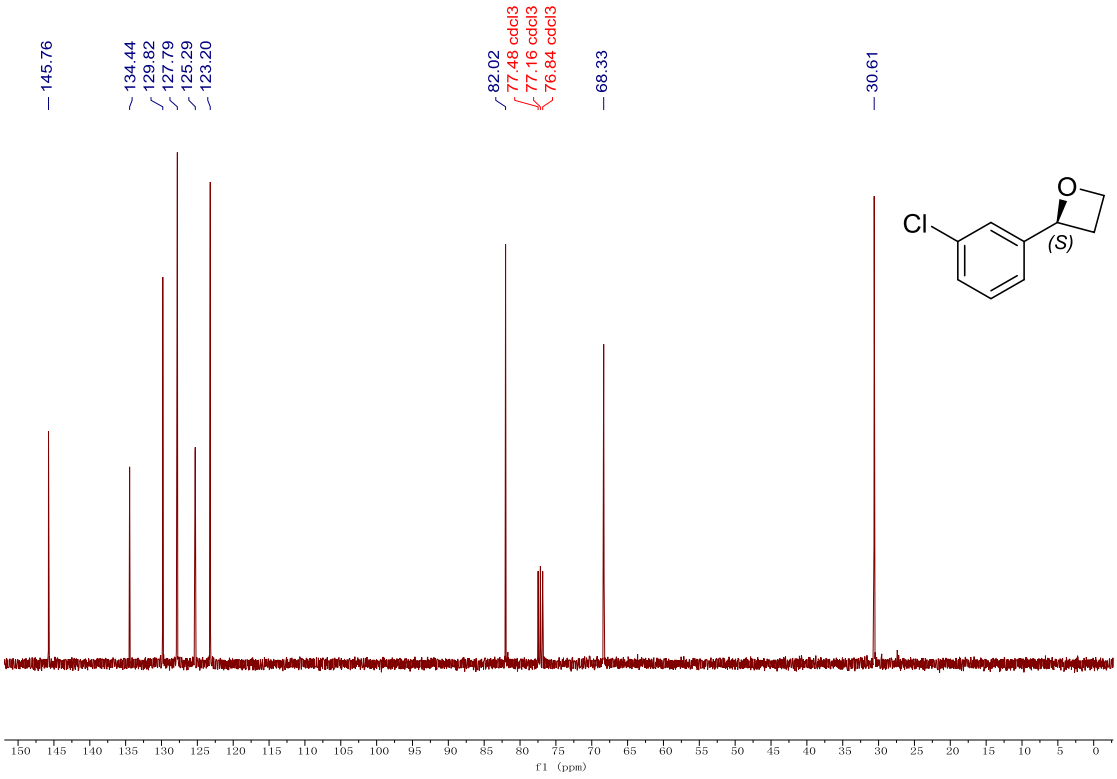


(*S*)-2-(3-fluorophenyl)oxetane [(*S*)-6b]

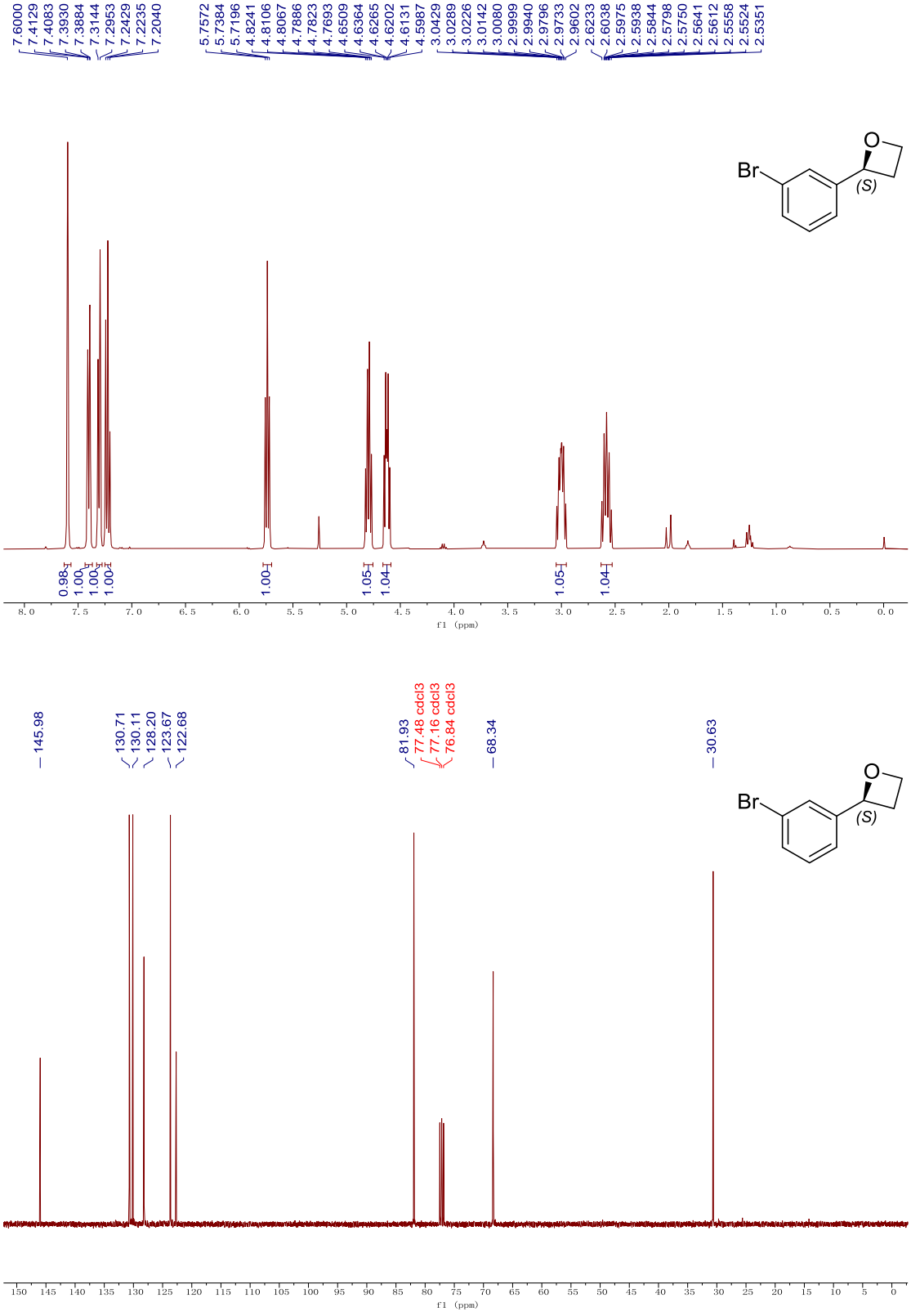


(*S*)-2-(3-chlorophenyl)oxetane [(*S*)-7b]

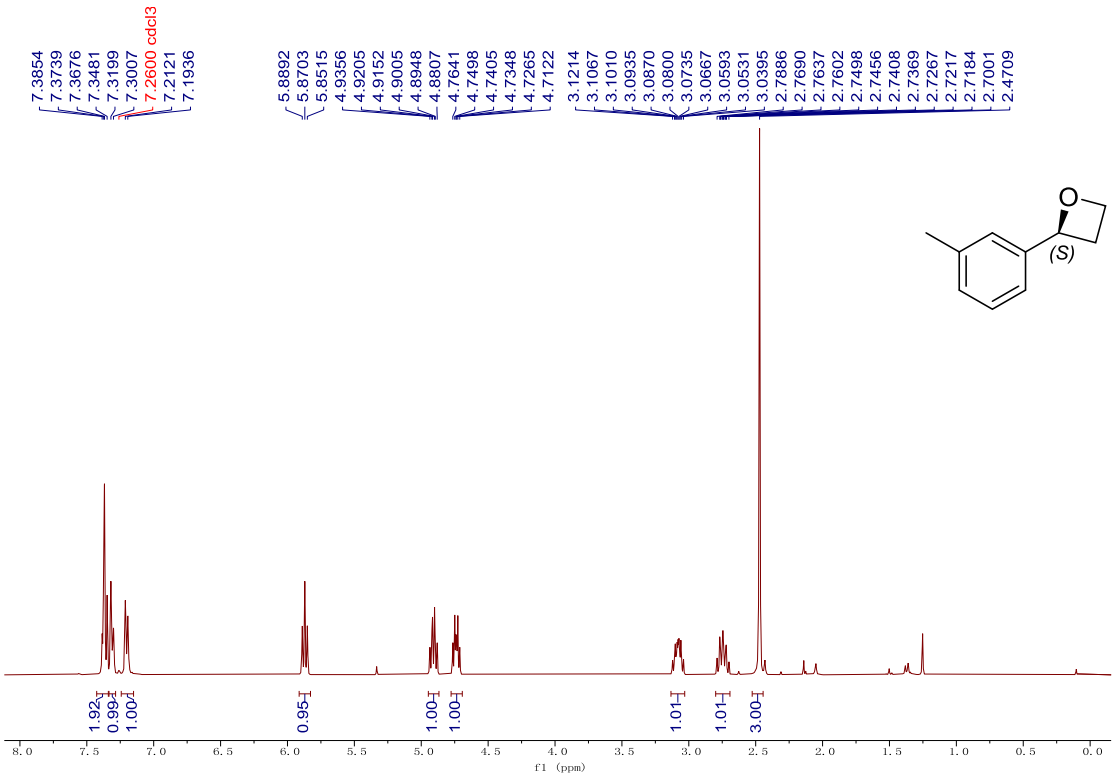


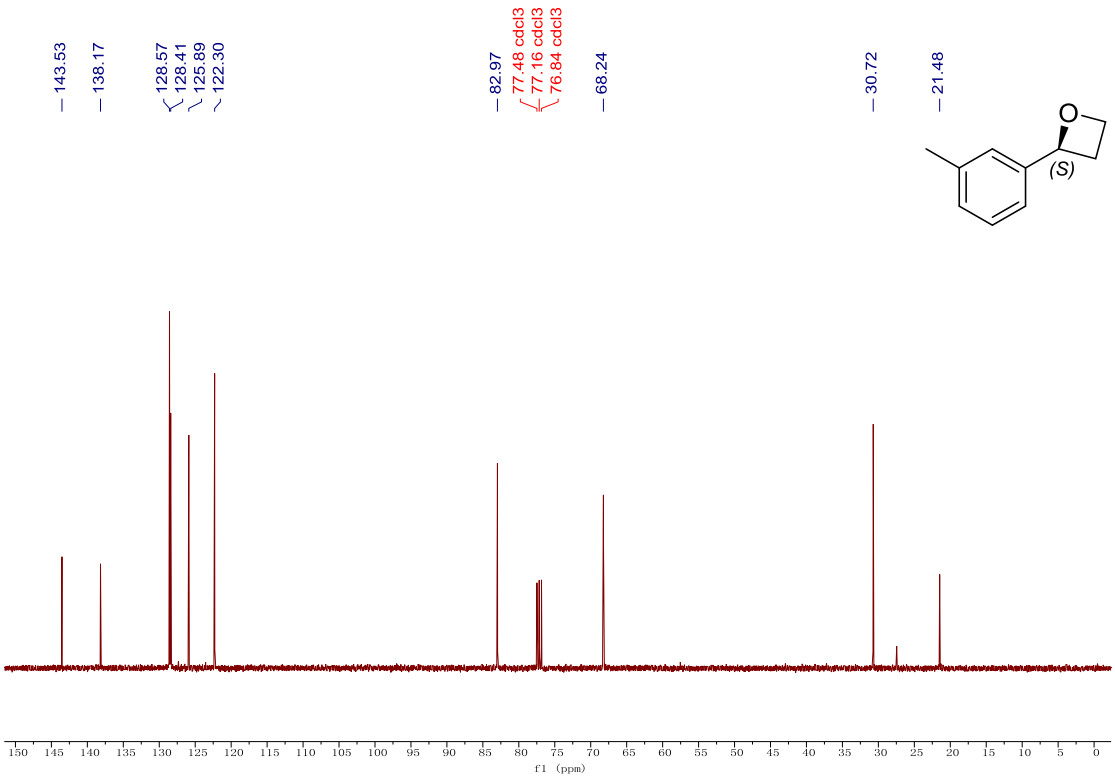


(*S*)-2-(3-bromophenyl)oxetane [(*S*)-8b]

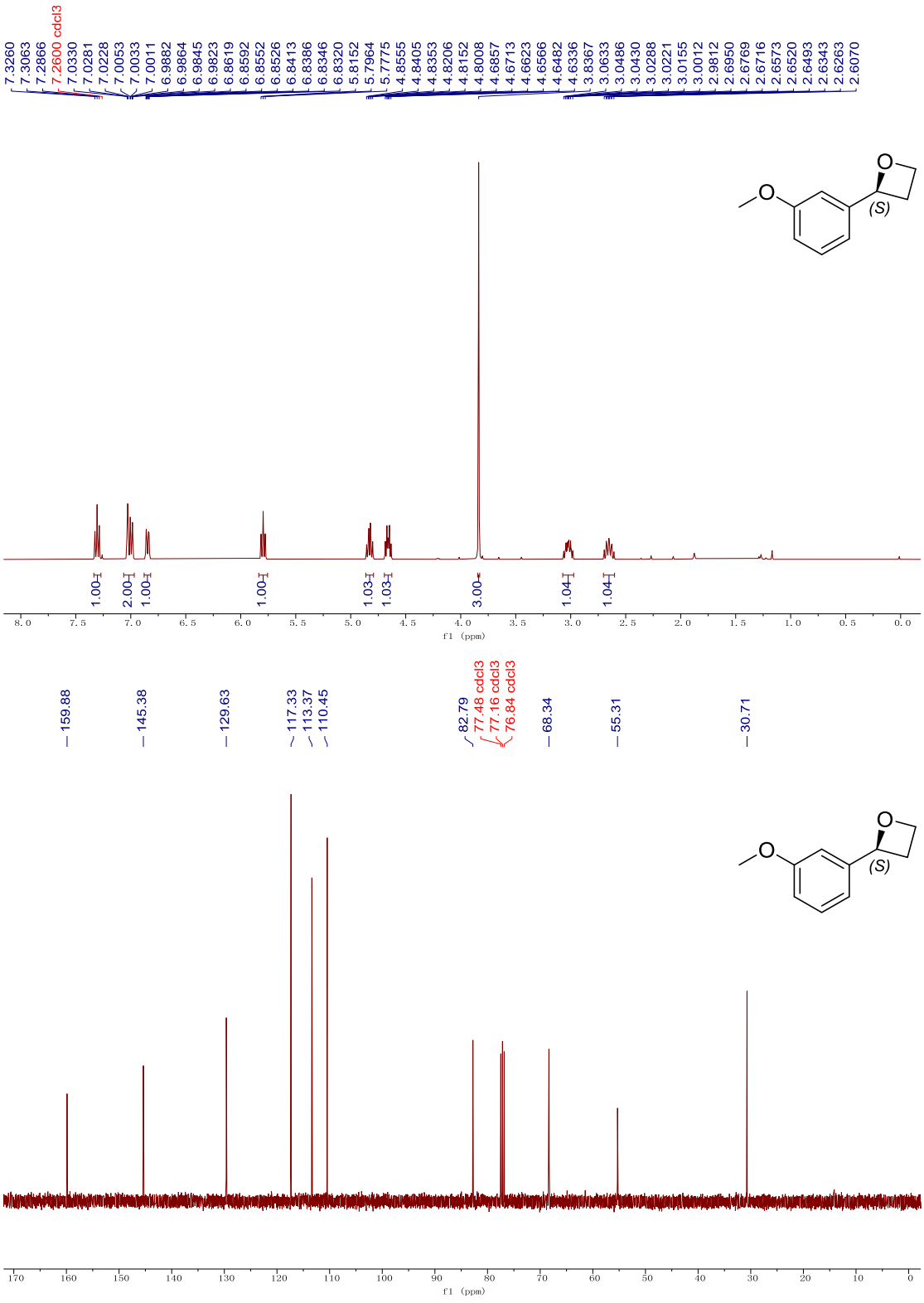


(*S*)-2-(*m*-tolyl)oxetane [(*S*)-9b]

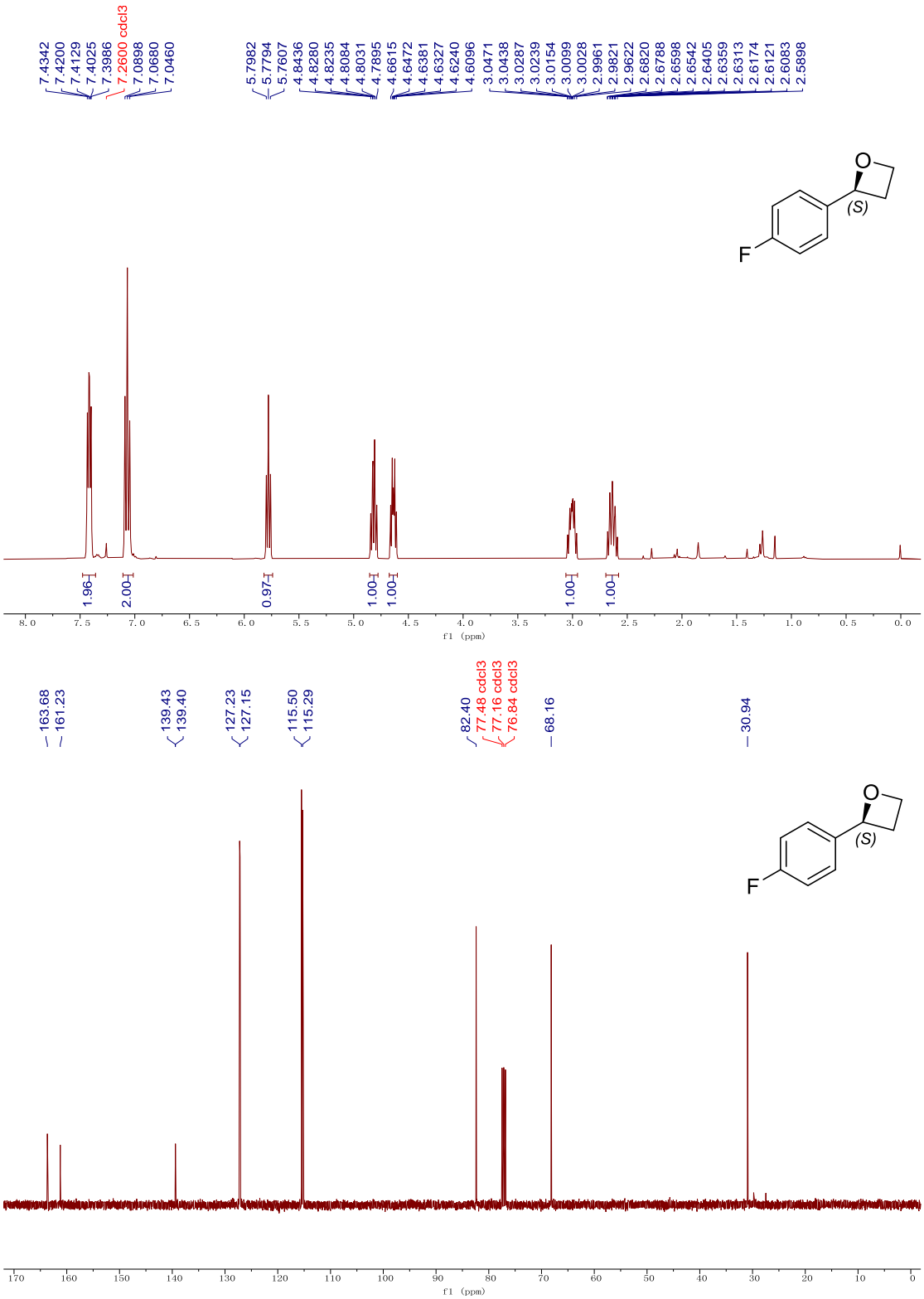




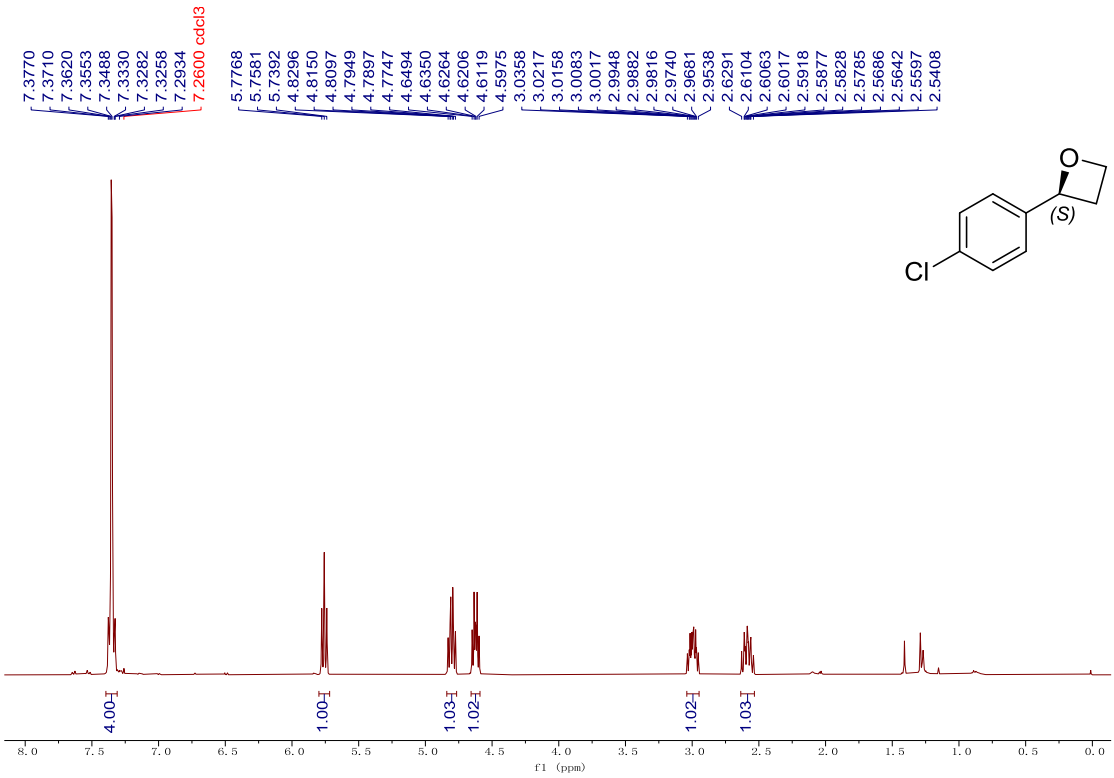
(*S*)-2-(3-methoxyphenyl)oxetane [(*S*)-10b]

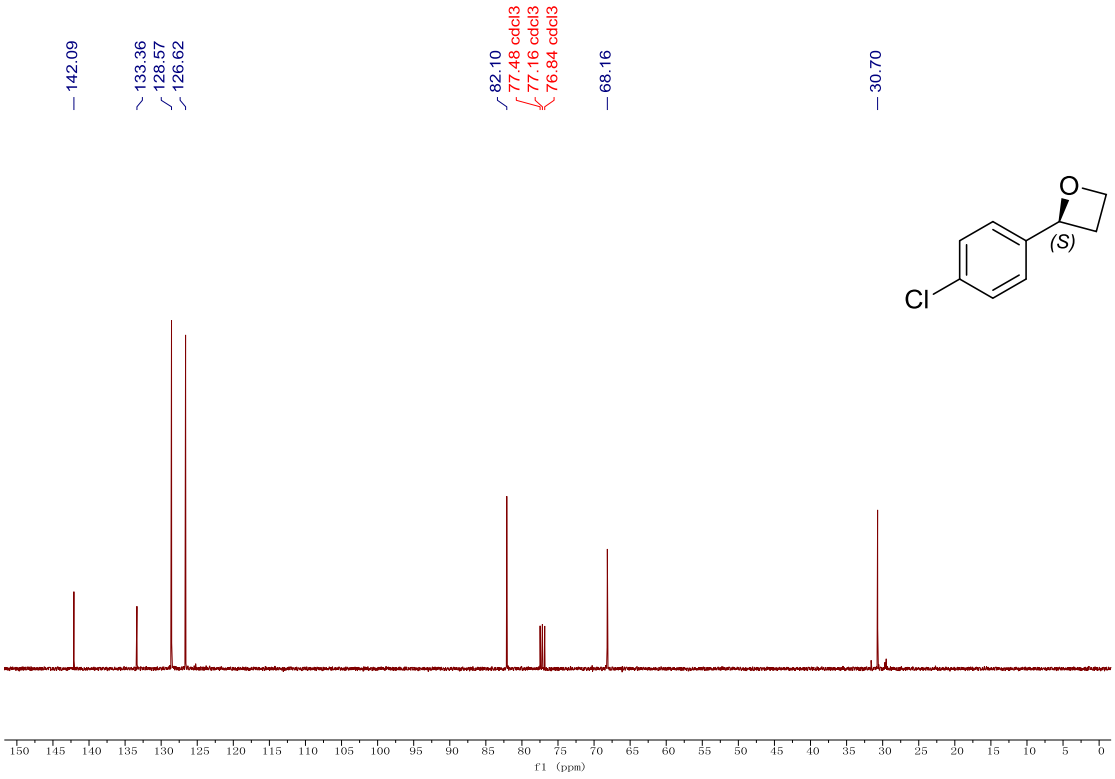


(*S*)-2-(4-fluorophenyl)oxetane [(*S*)-11b]

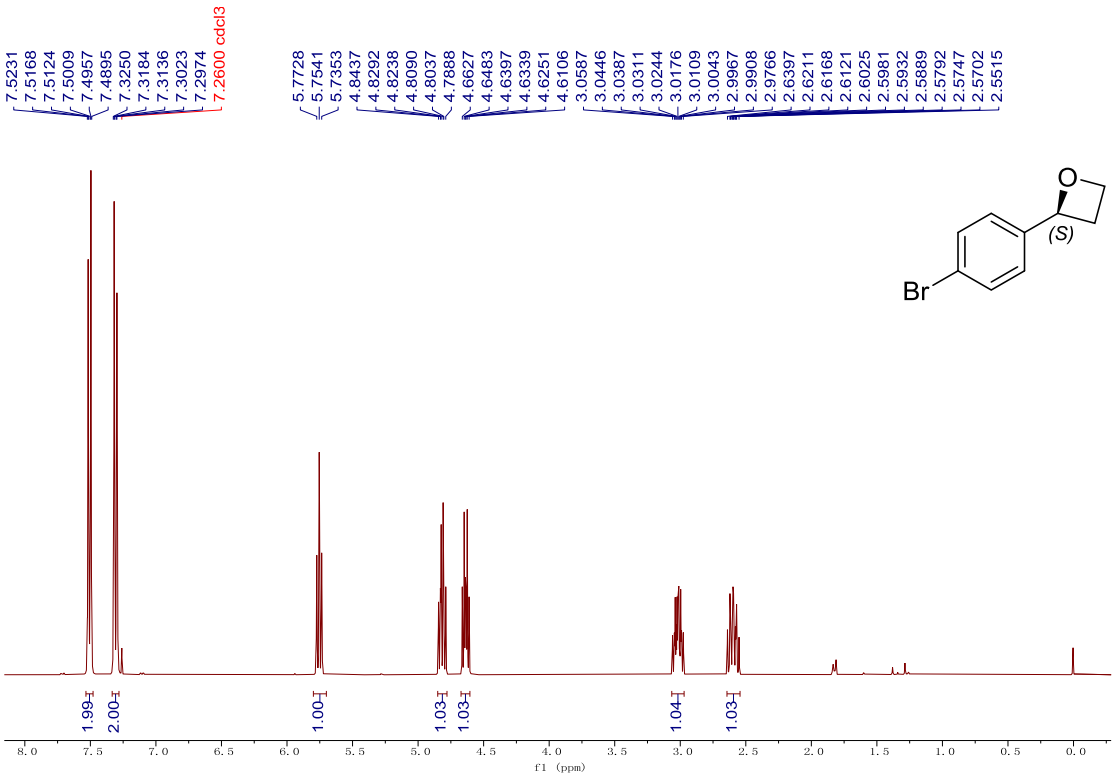


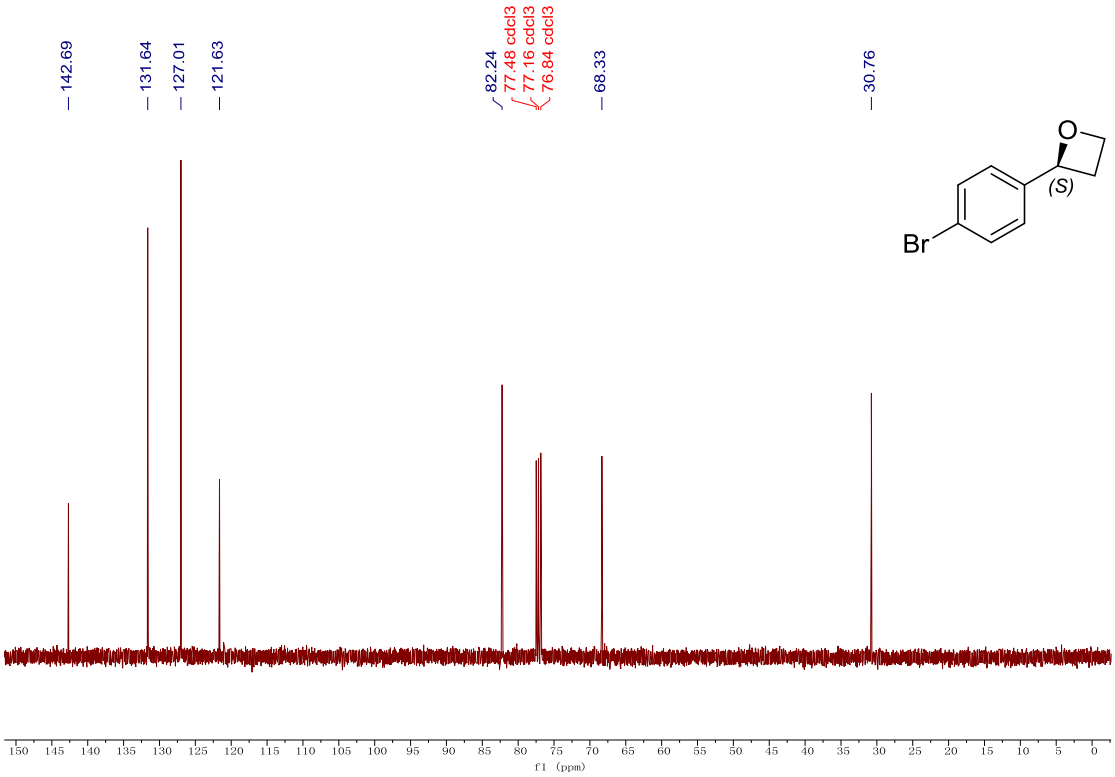
(*S*)-2-(4-chlorophenyl)oxetane [(*S*)-12b]



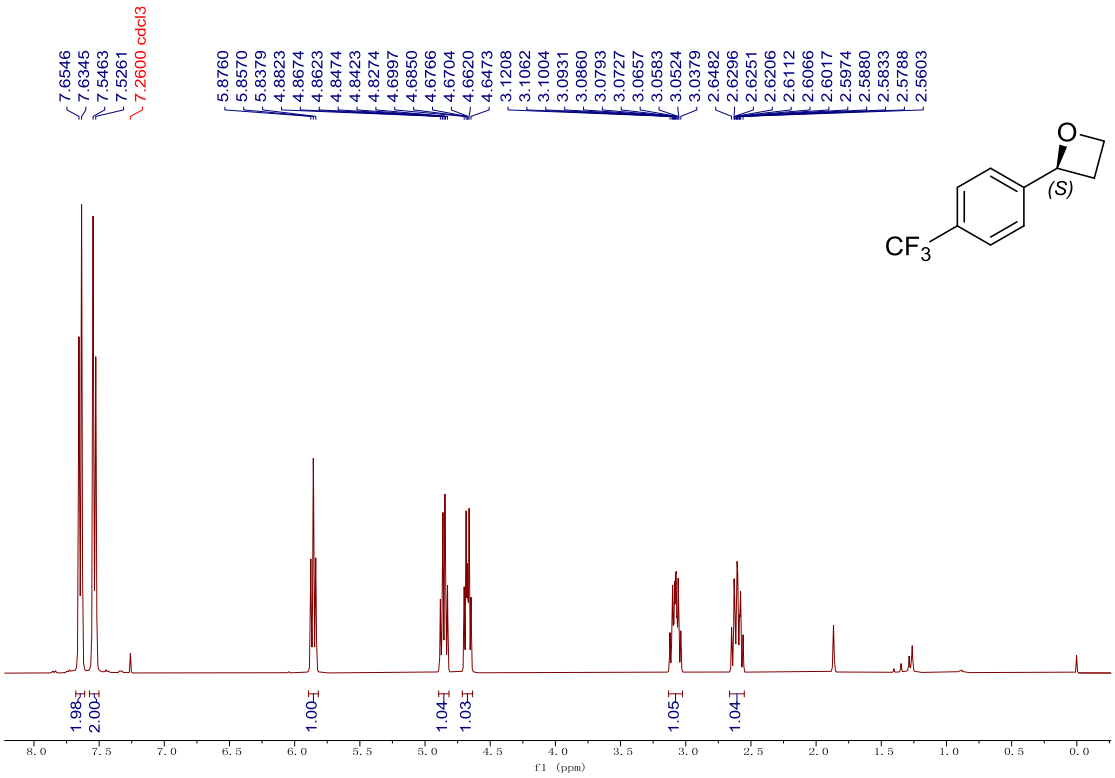


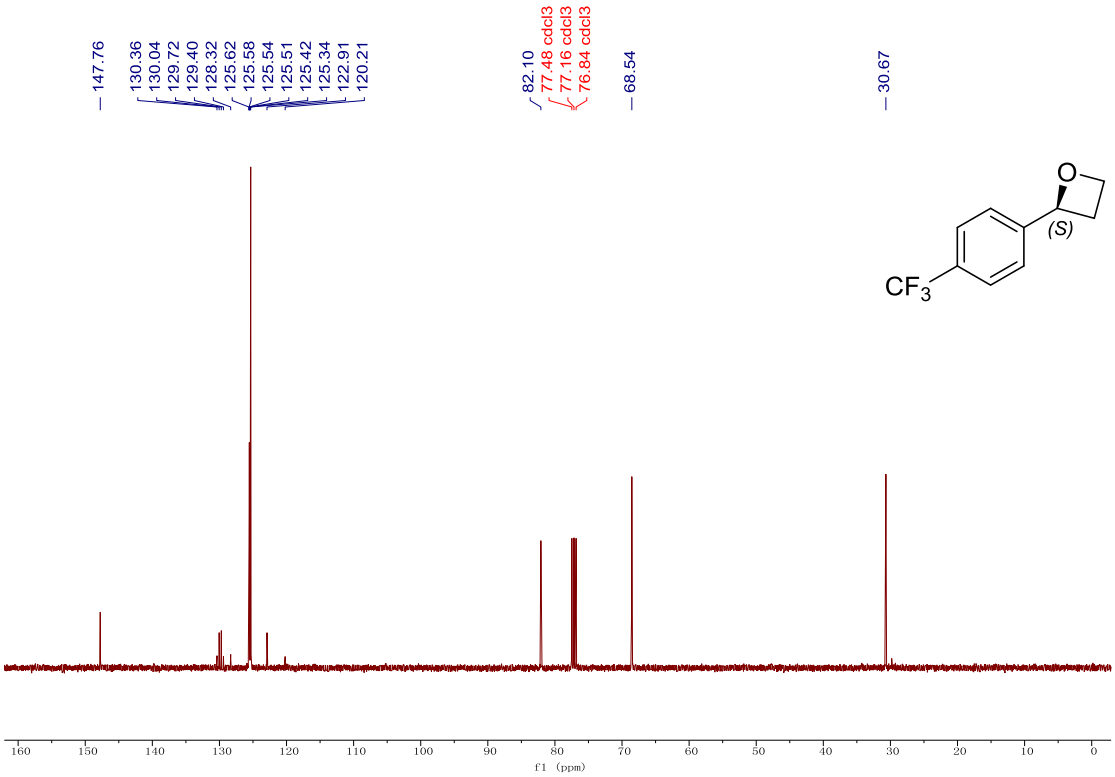
(*S*)-2-(4-bromophenyl)oxetane [(*S*)-13b]



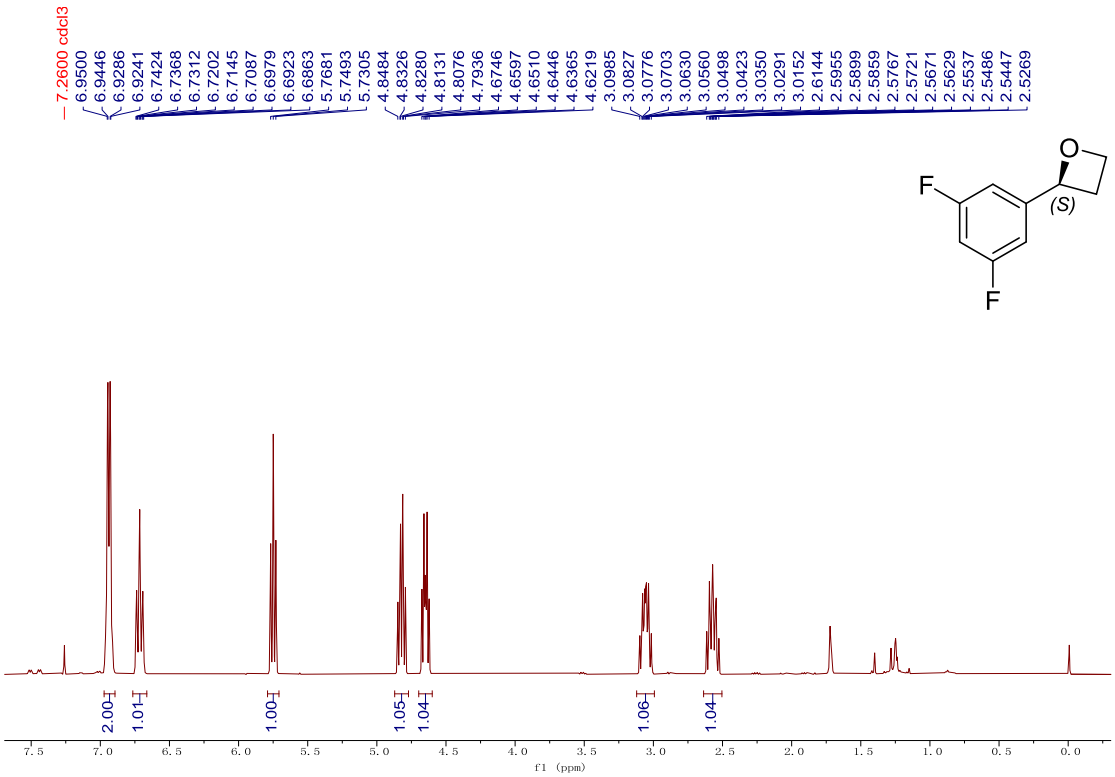


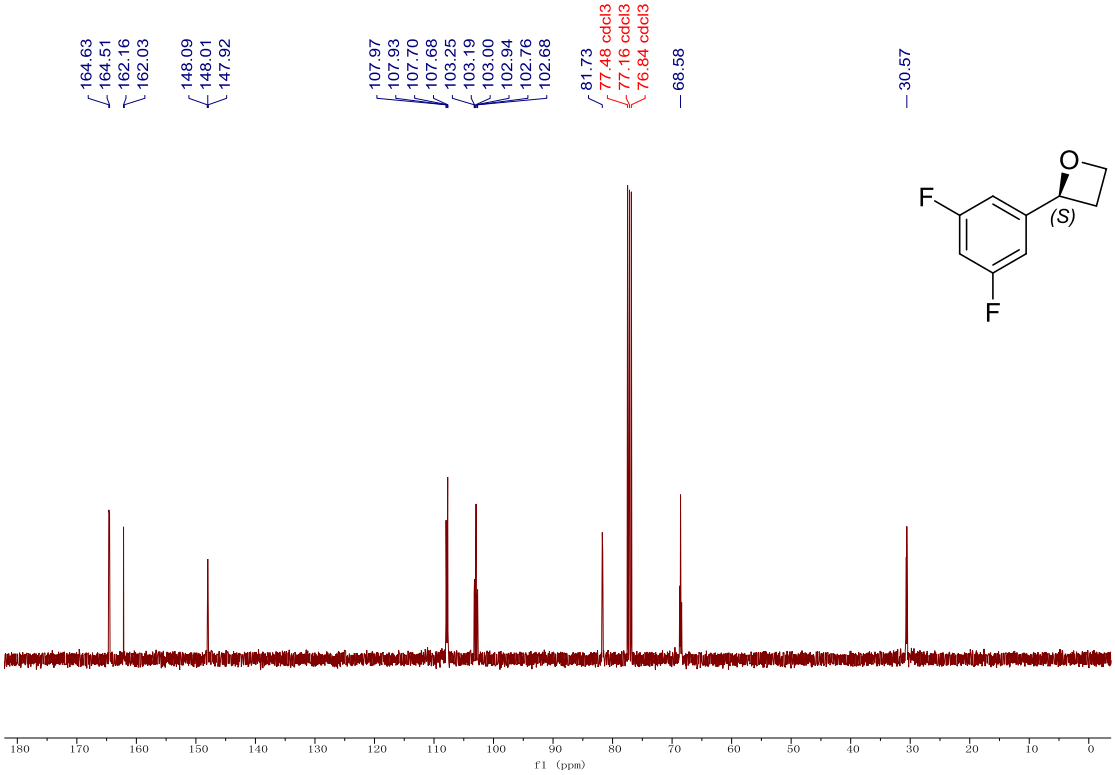
(*S*)-2-(4-(trifluoromethyl)phenyl)oxetane [(*S*)-14b]



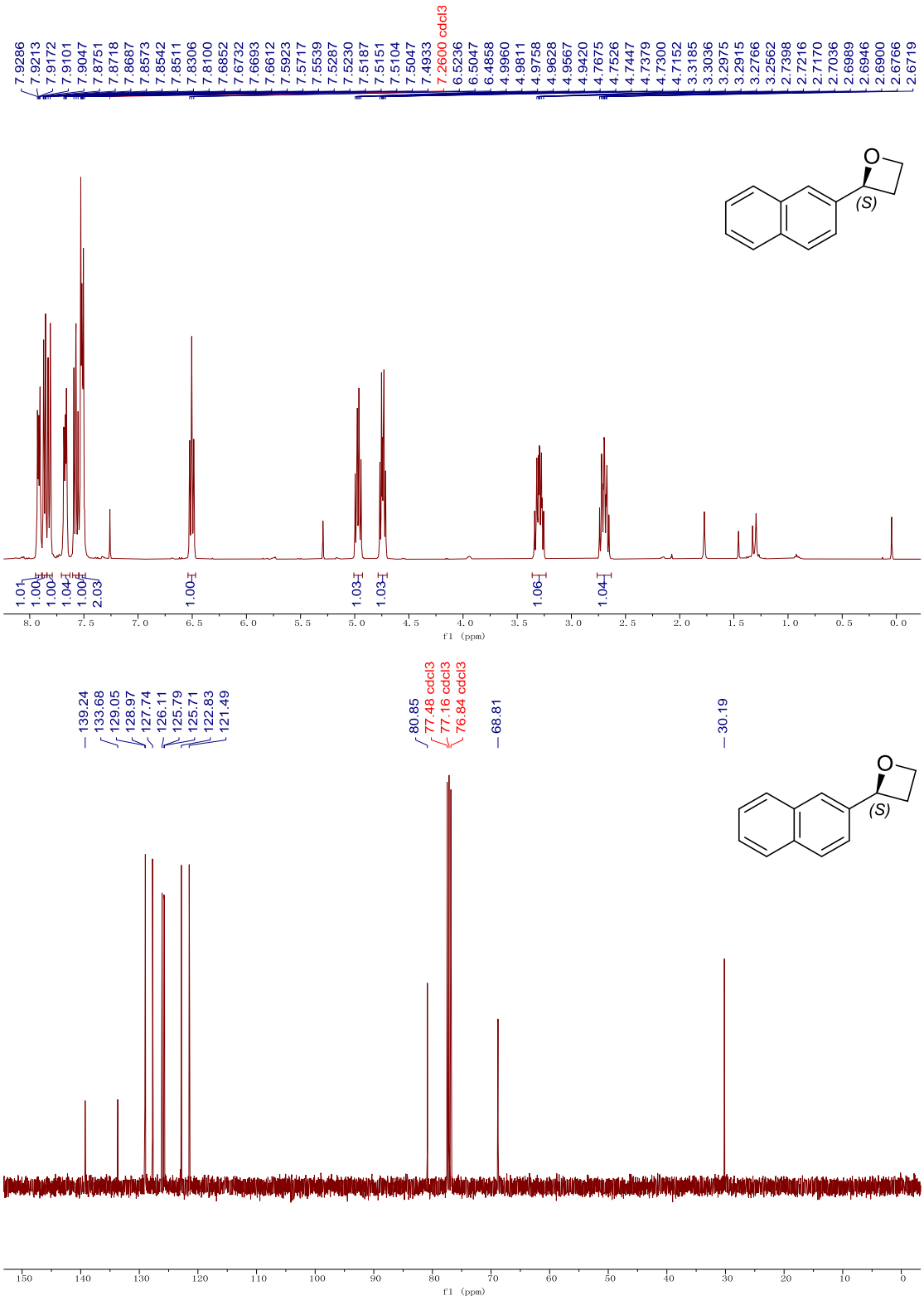


(*S*)-2-(3,5-difluorophenyl)oxetane [(*S*)-15b]

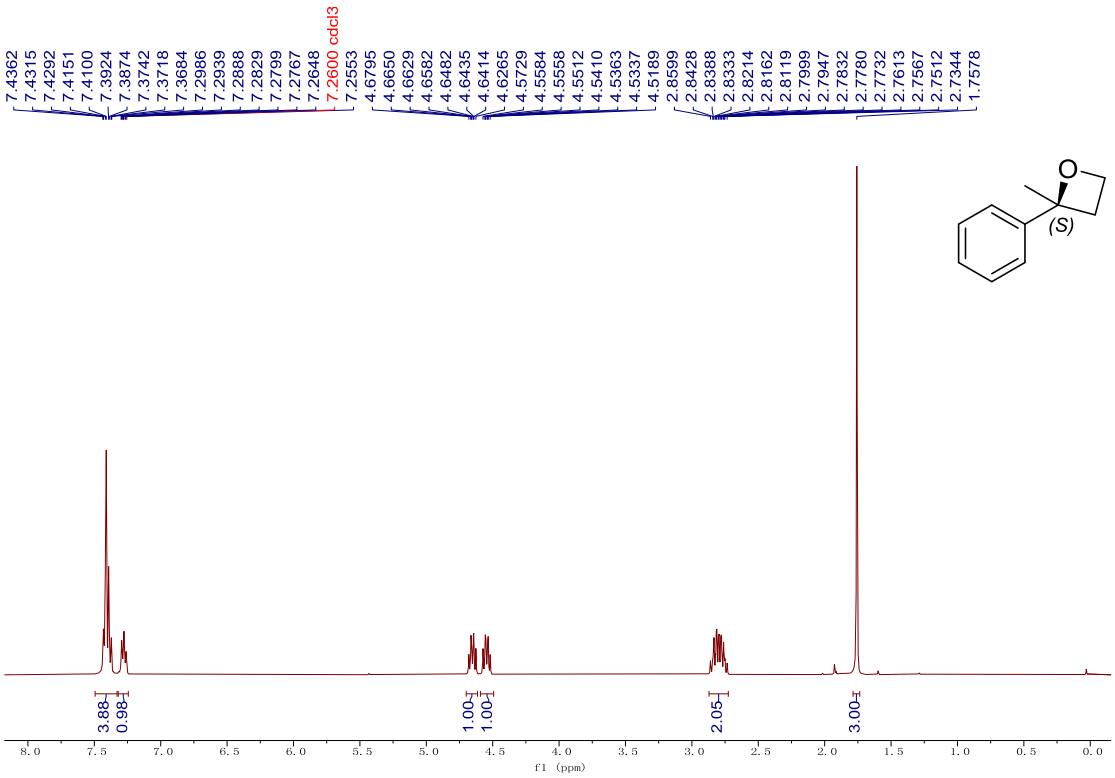


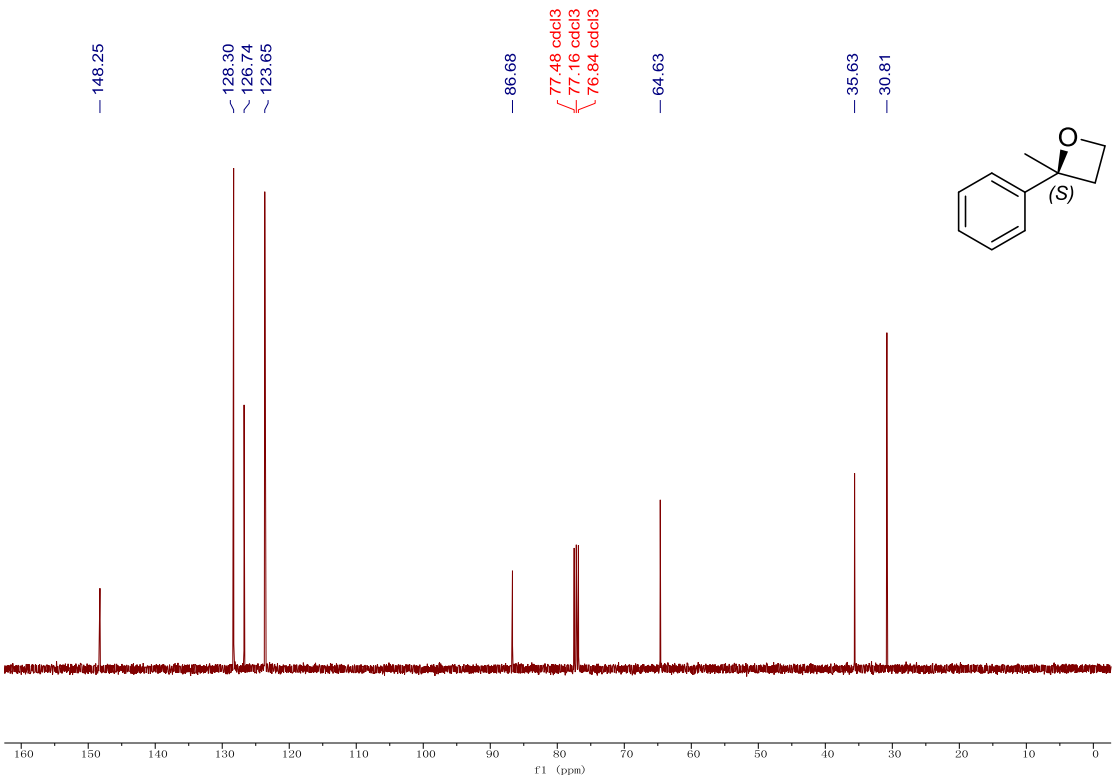


(*S*)-2-(naphthalen-2-yl)oxetane [(*S*)-16b]

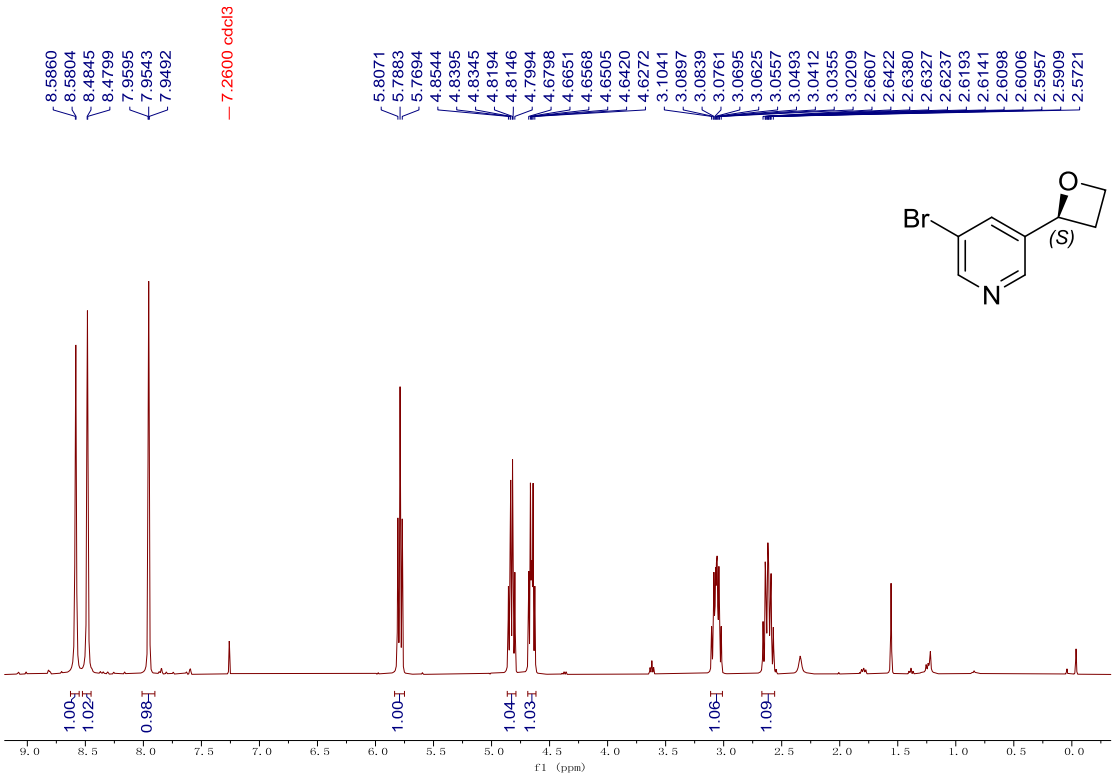


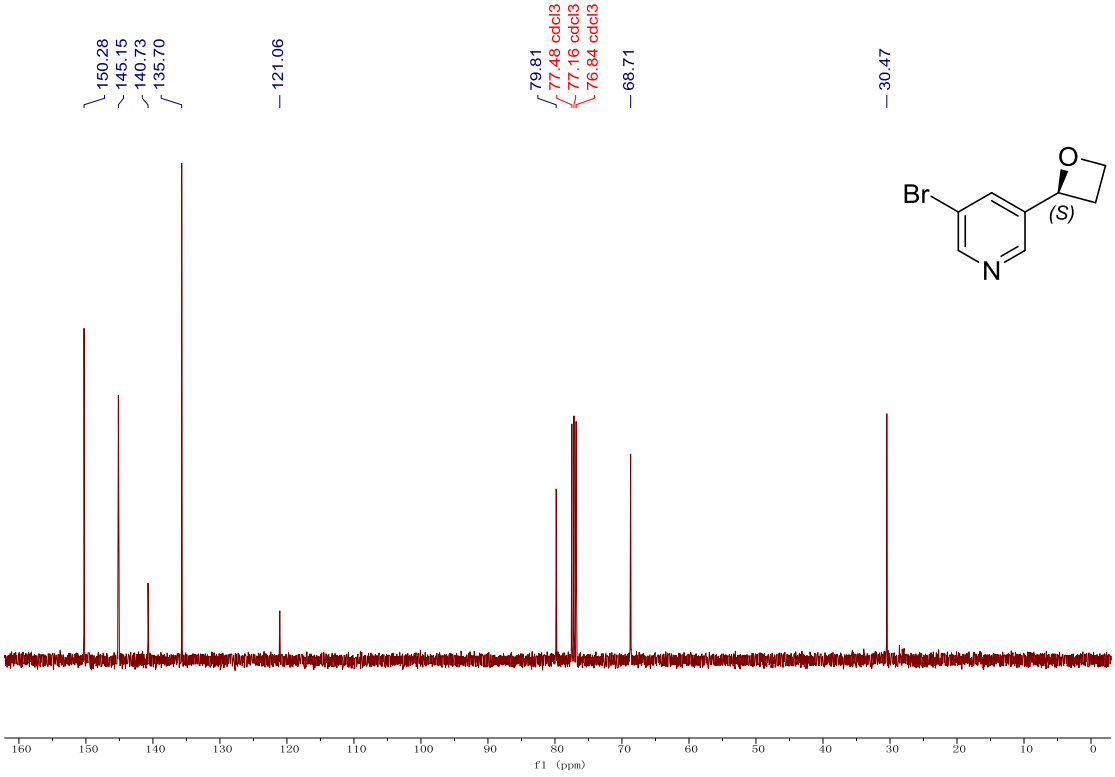
(*S*)-2-methyl-2-phenyloxetane [(*S*)-17b]



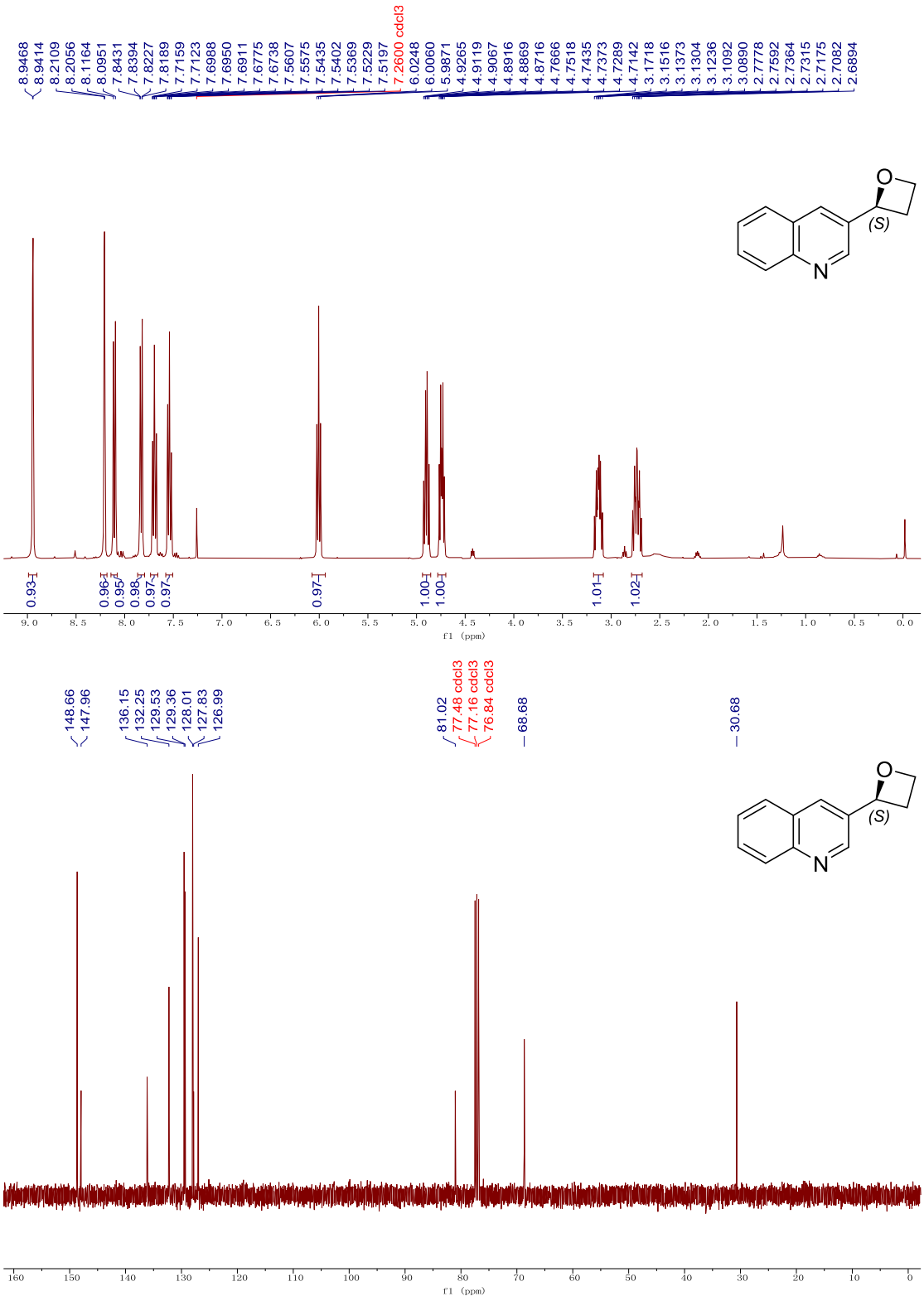


(*S*)-3-bromo-5-(oxetan-2-yl)pyridine [(*S*)-18b]

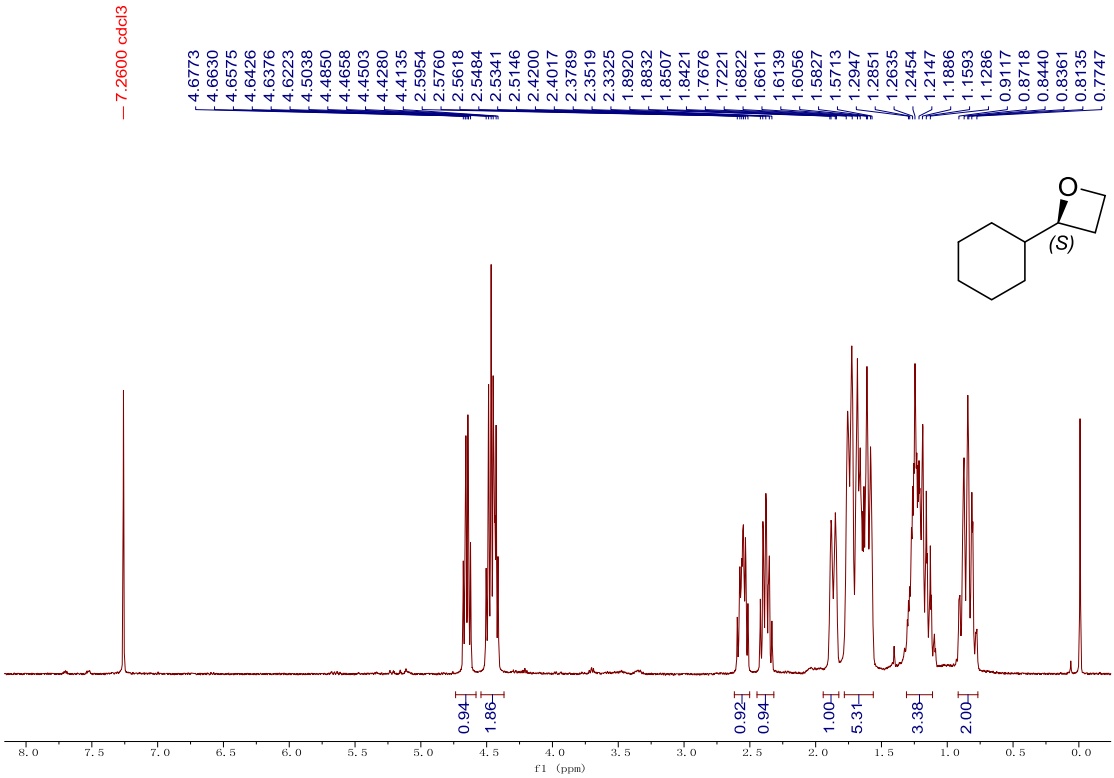


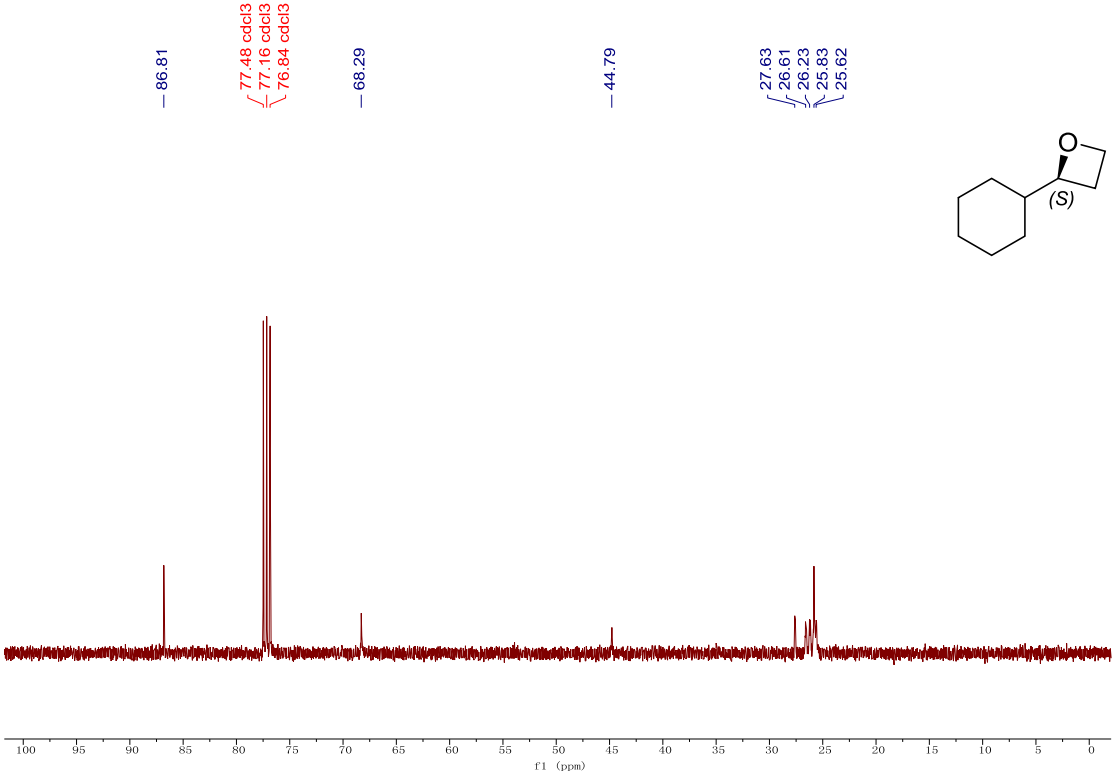


(*S*)-3-(oxetan-2-yl)quinoline [(*S*)-19b]

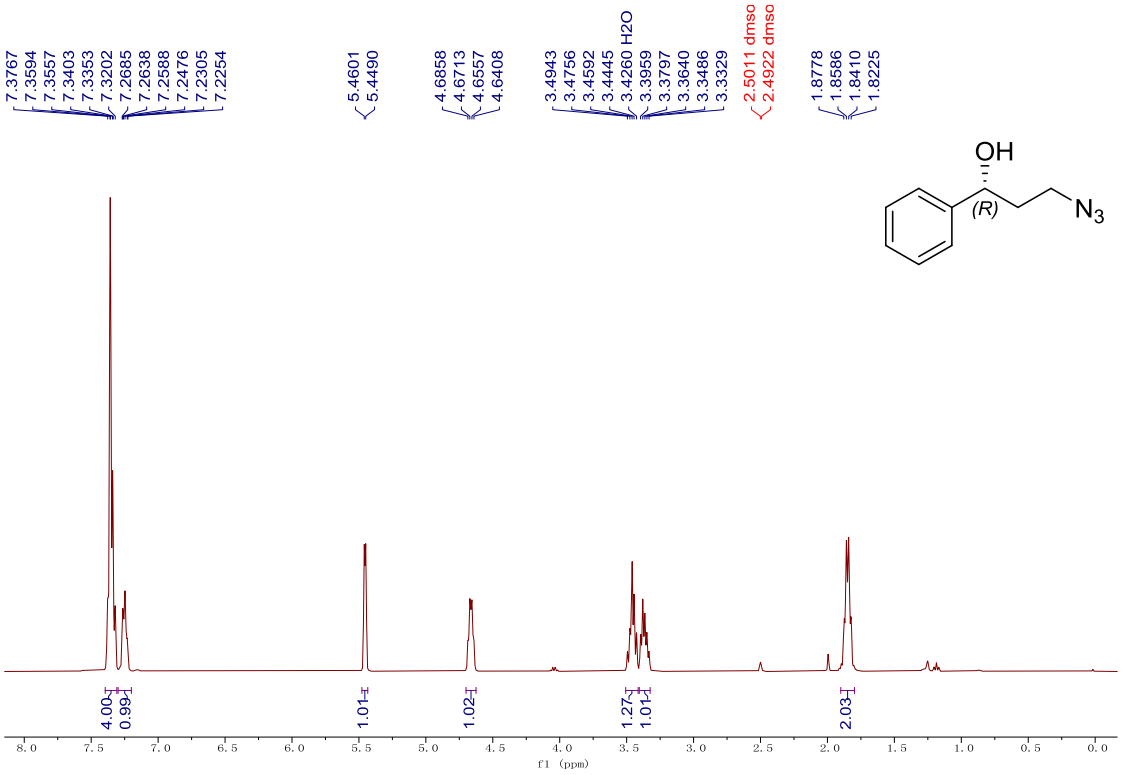


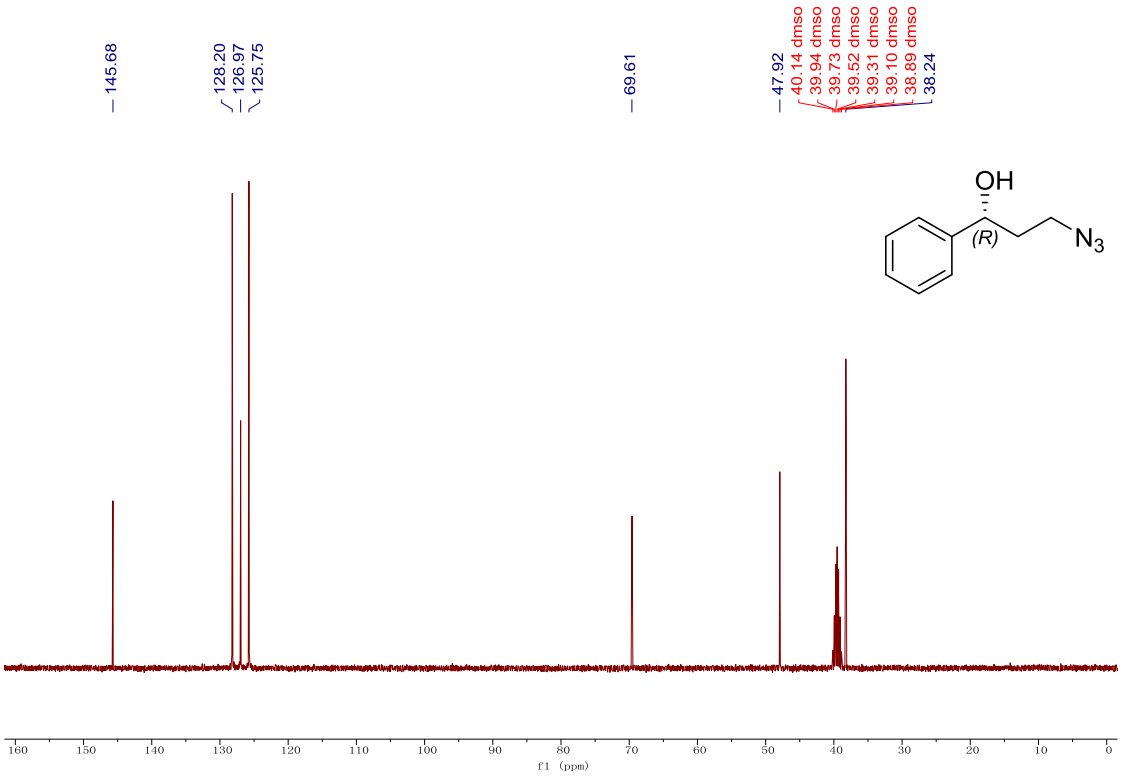
(*S*)-2-cyclohexyloxetane [(*S*)-21b]



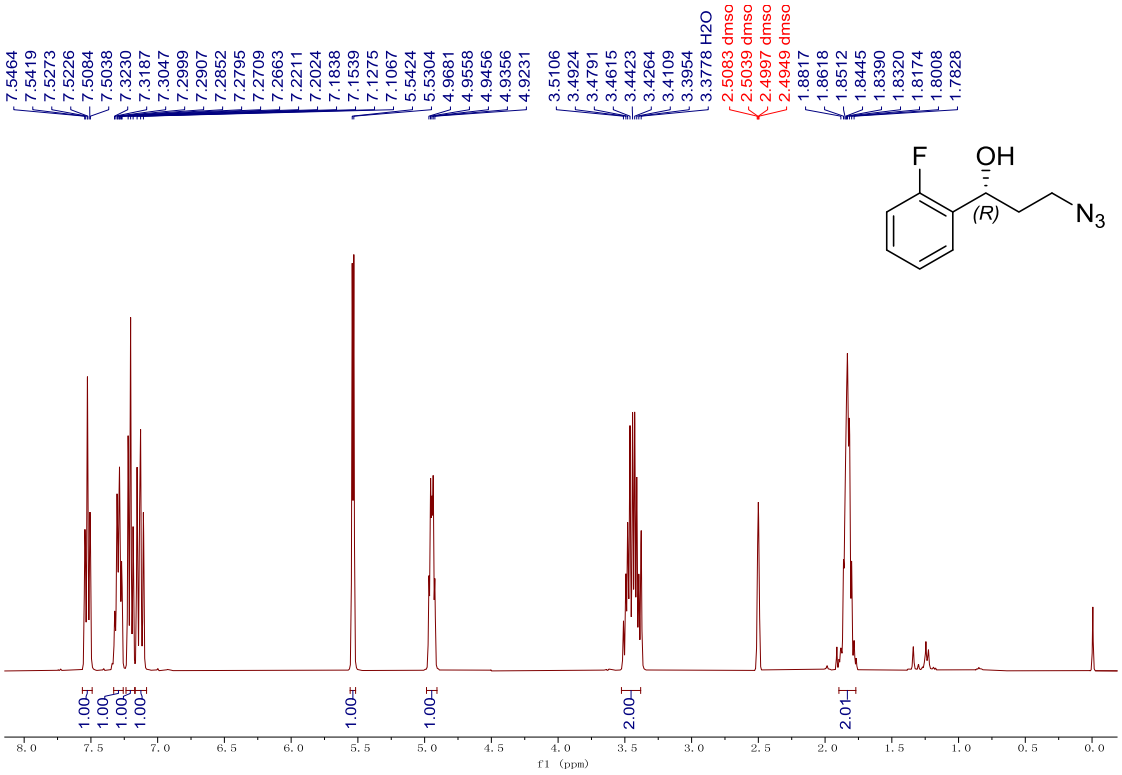


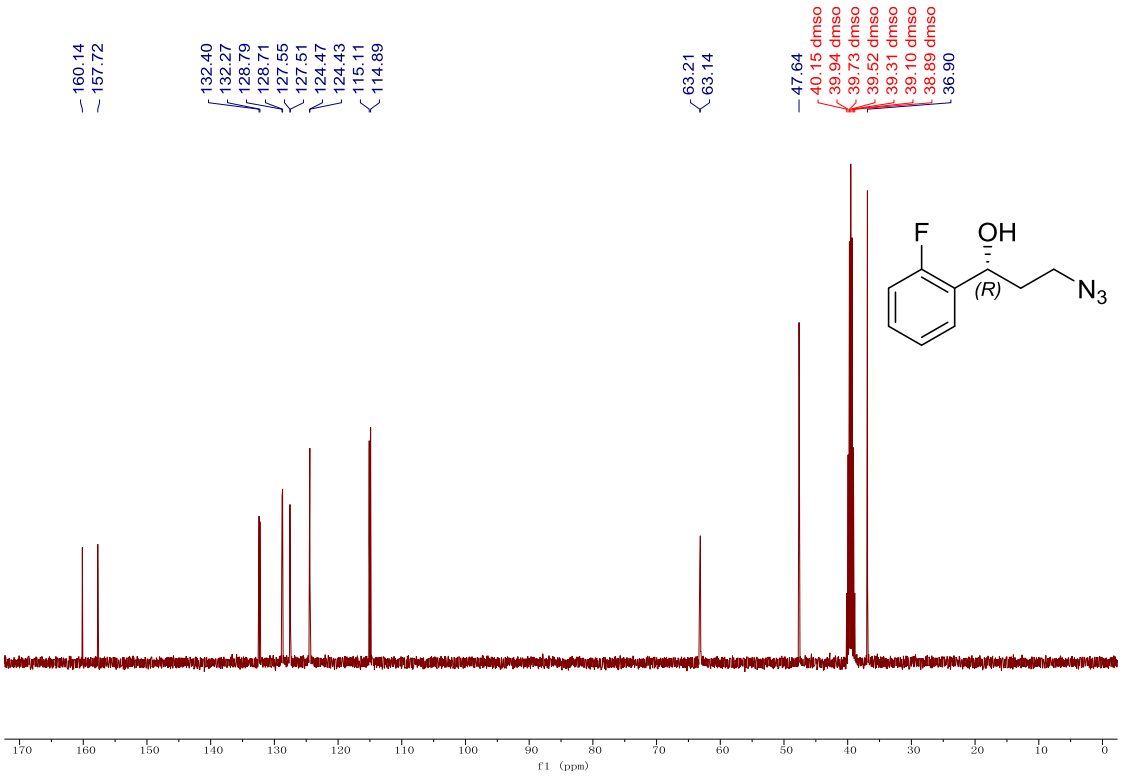
(*R*)-3-azido-1-phenylpropan-1-ol [(*R*)-1c]



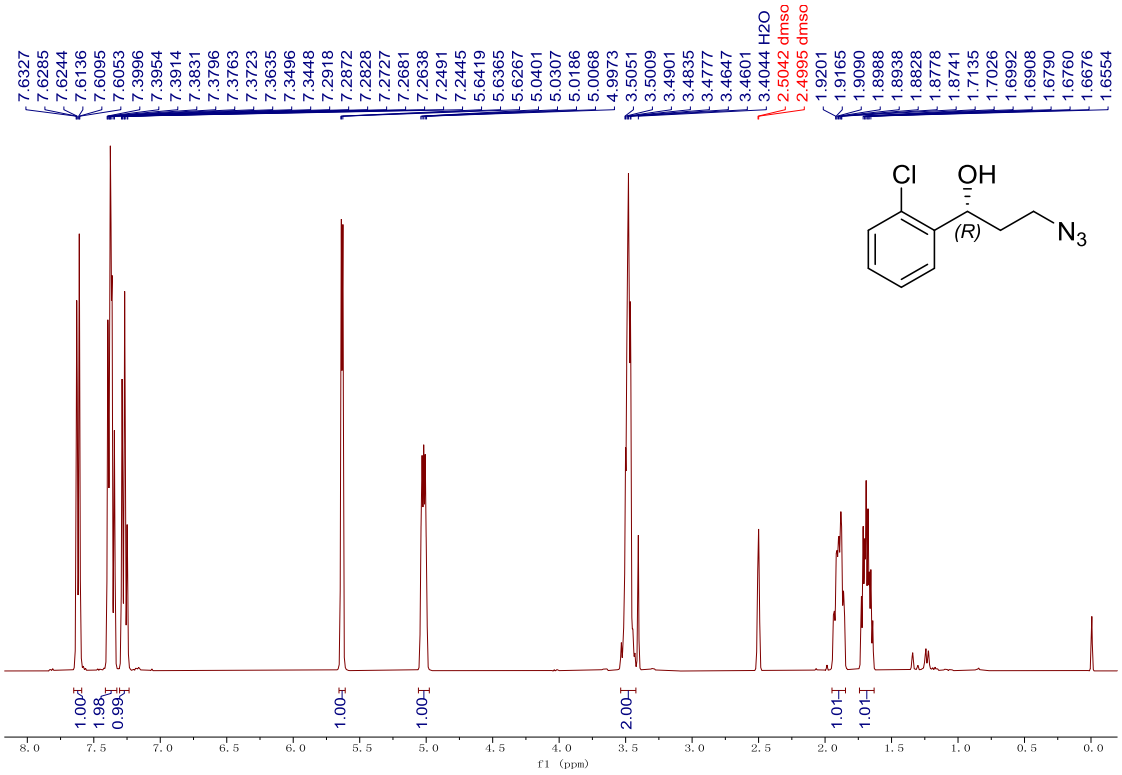


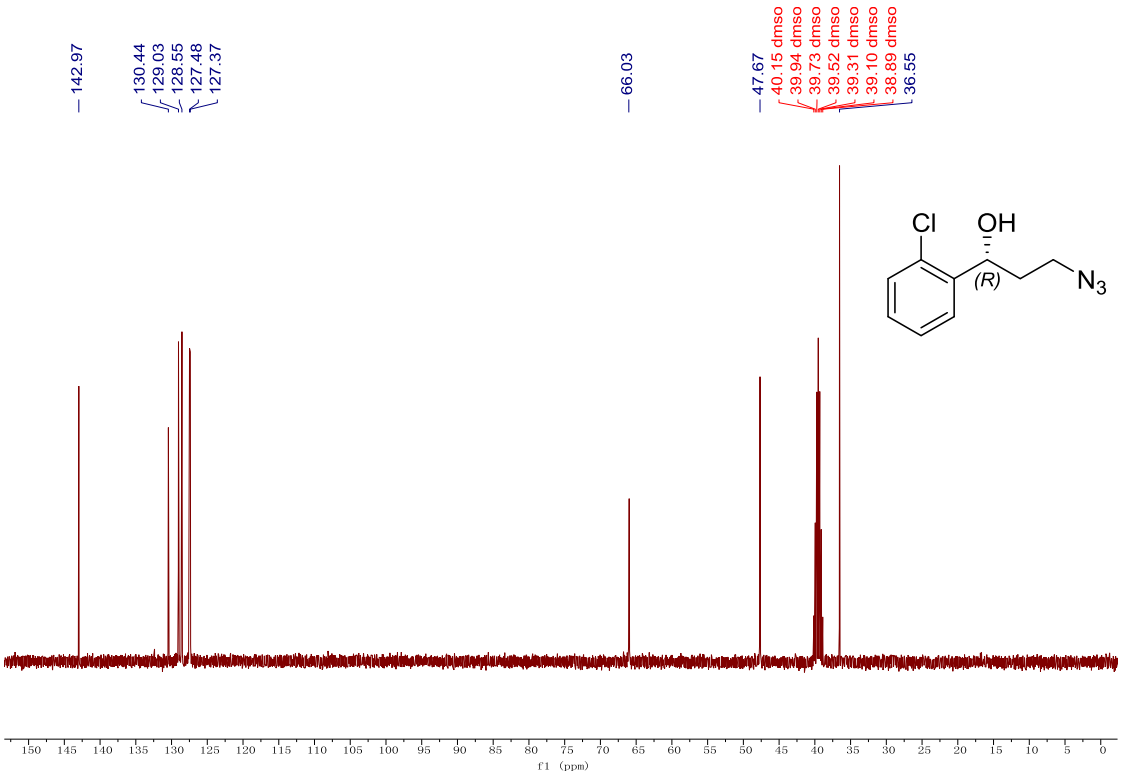
(*R*)-3-azido-1-(2-fluorophenyl)propan-1-ol [(*R*)-2c]



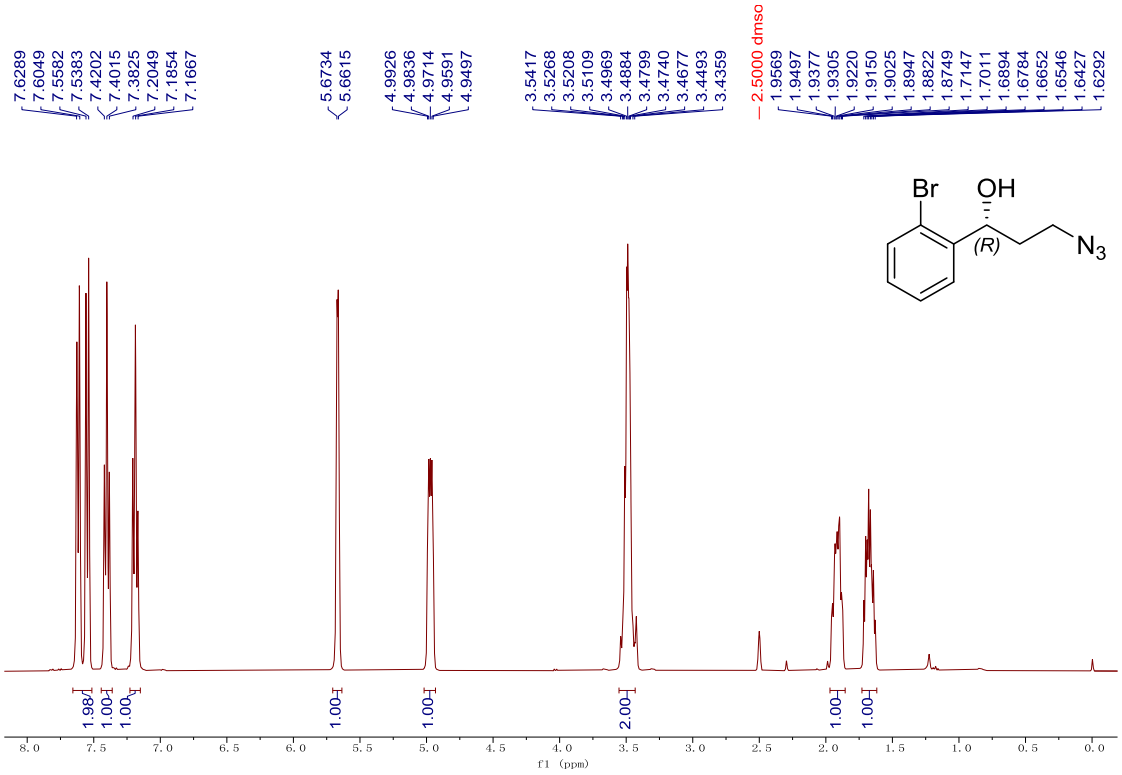


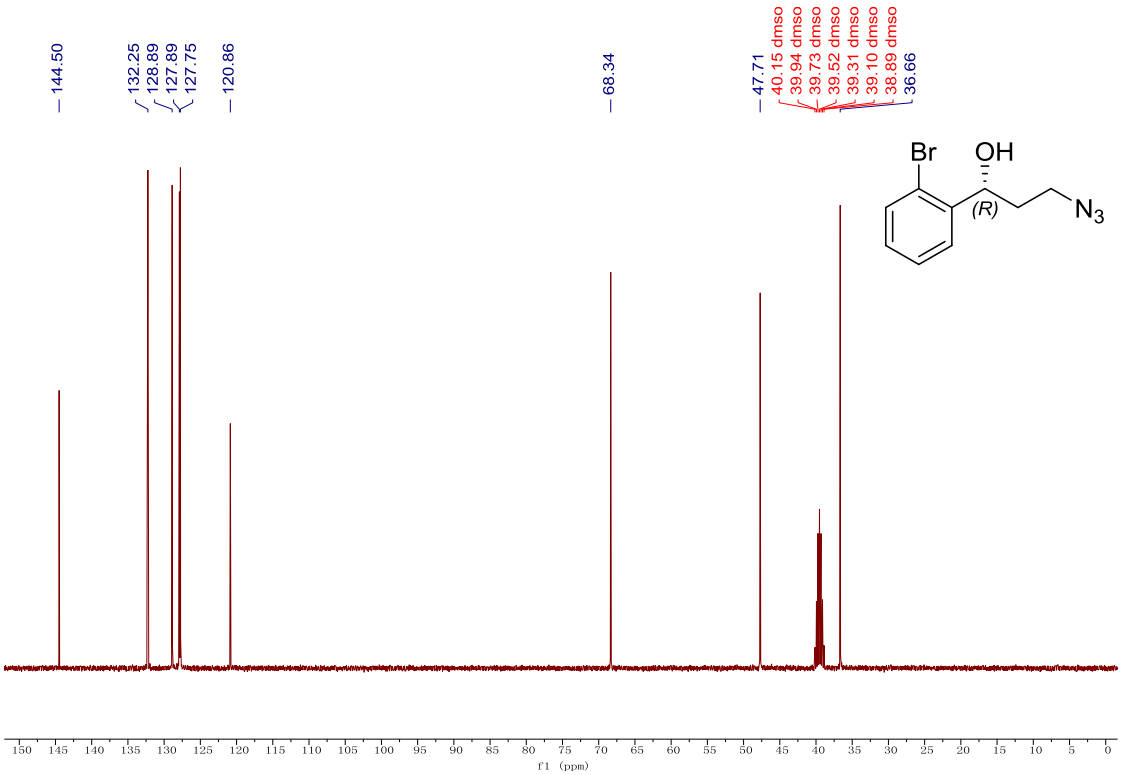
(*R*)-3-azido-1-(2-chlorophenyl)propan-1-ol [(*R*)-3c]



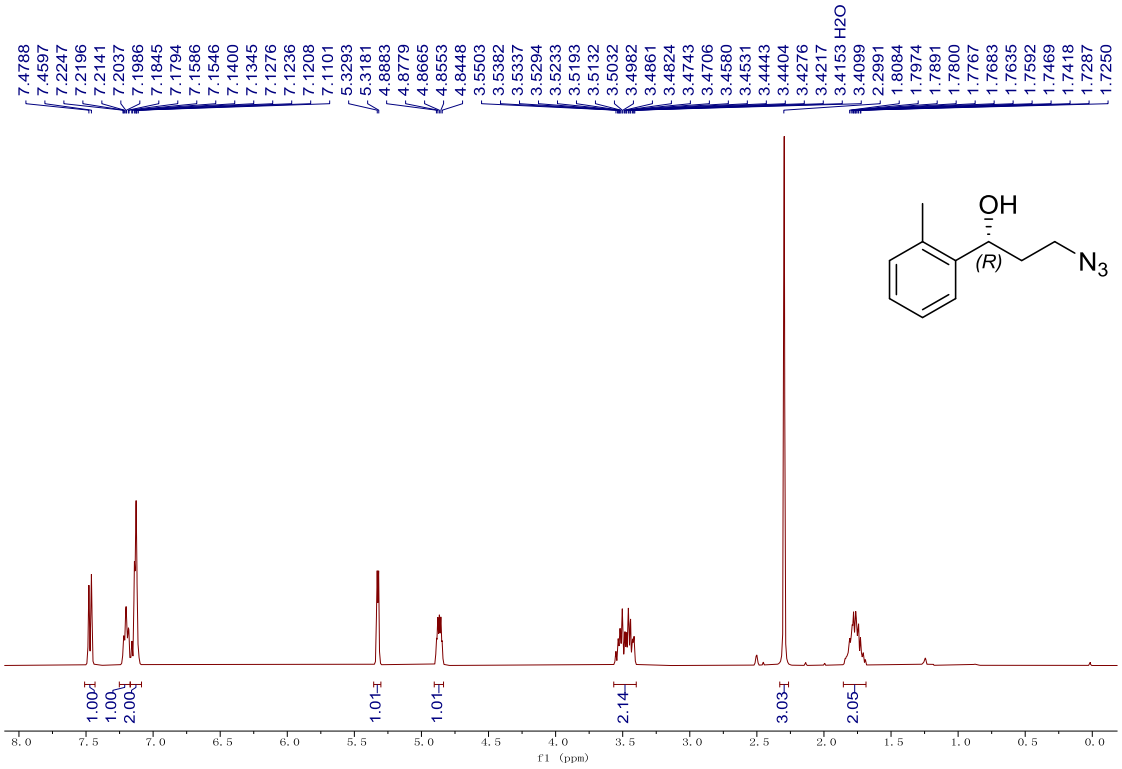


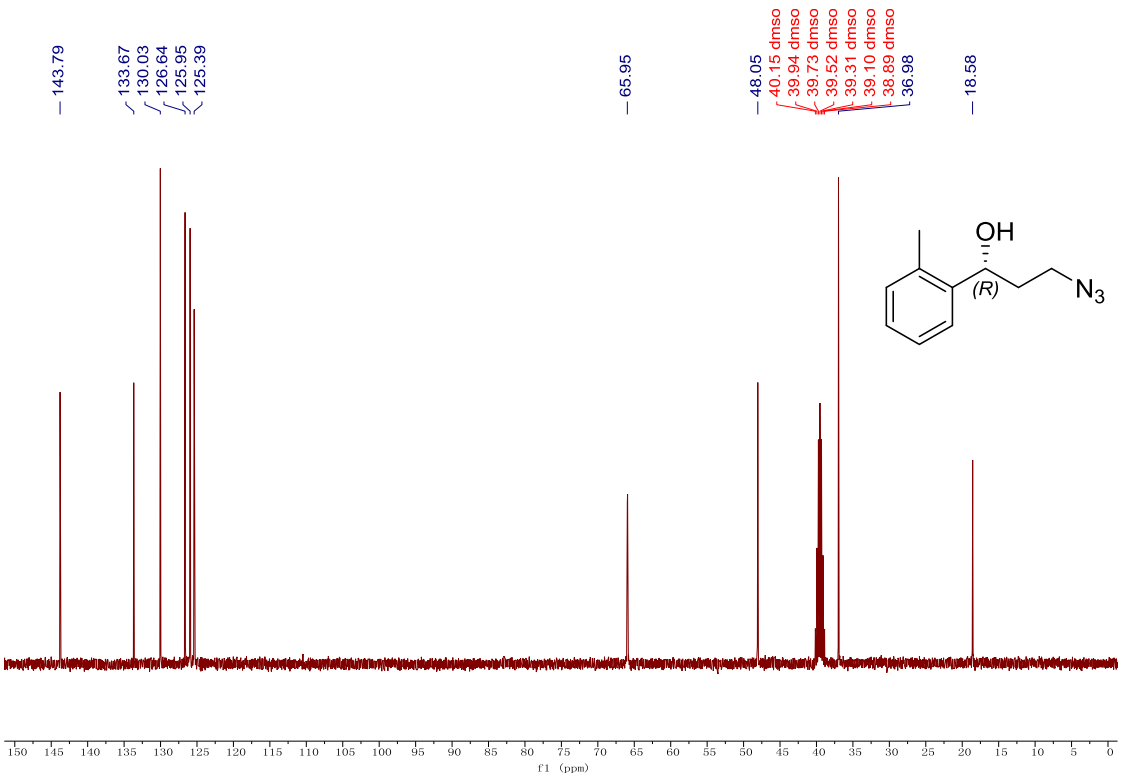
(*R*)-3-azido-1-(2-bromophenyl)propan-1-ol [(*R*)-4c]



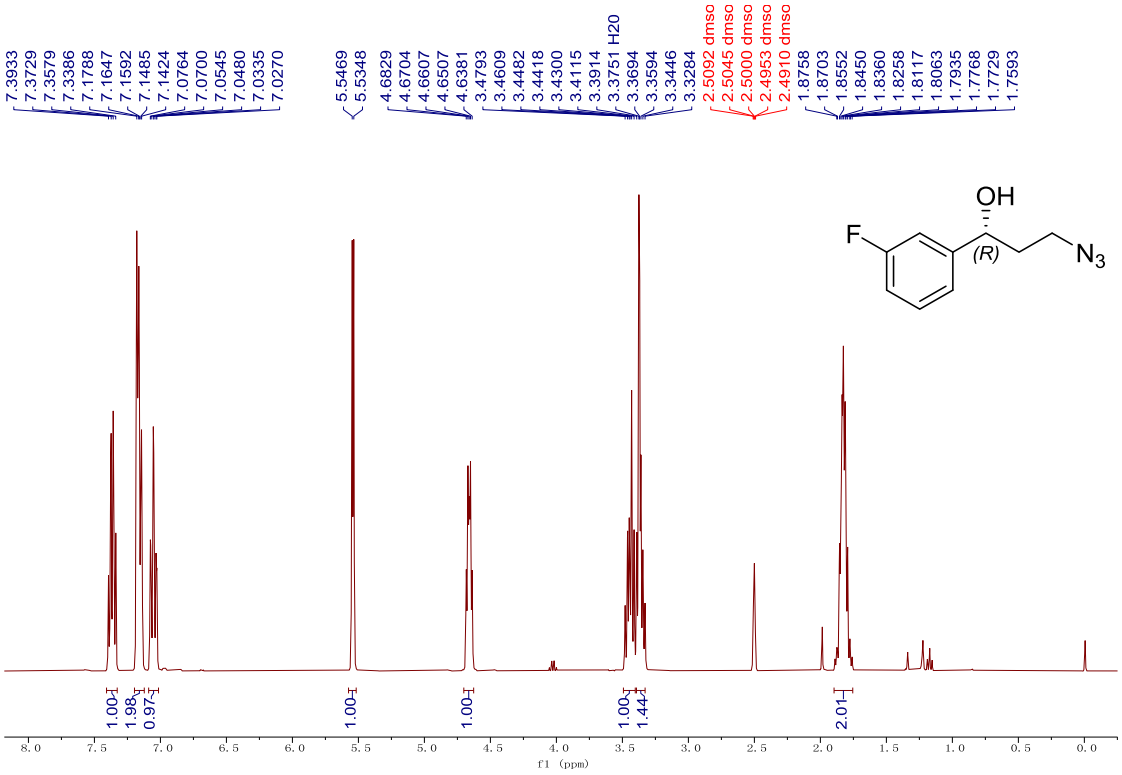


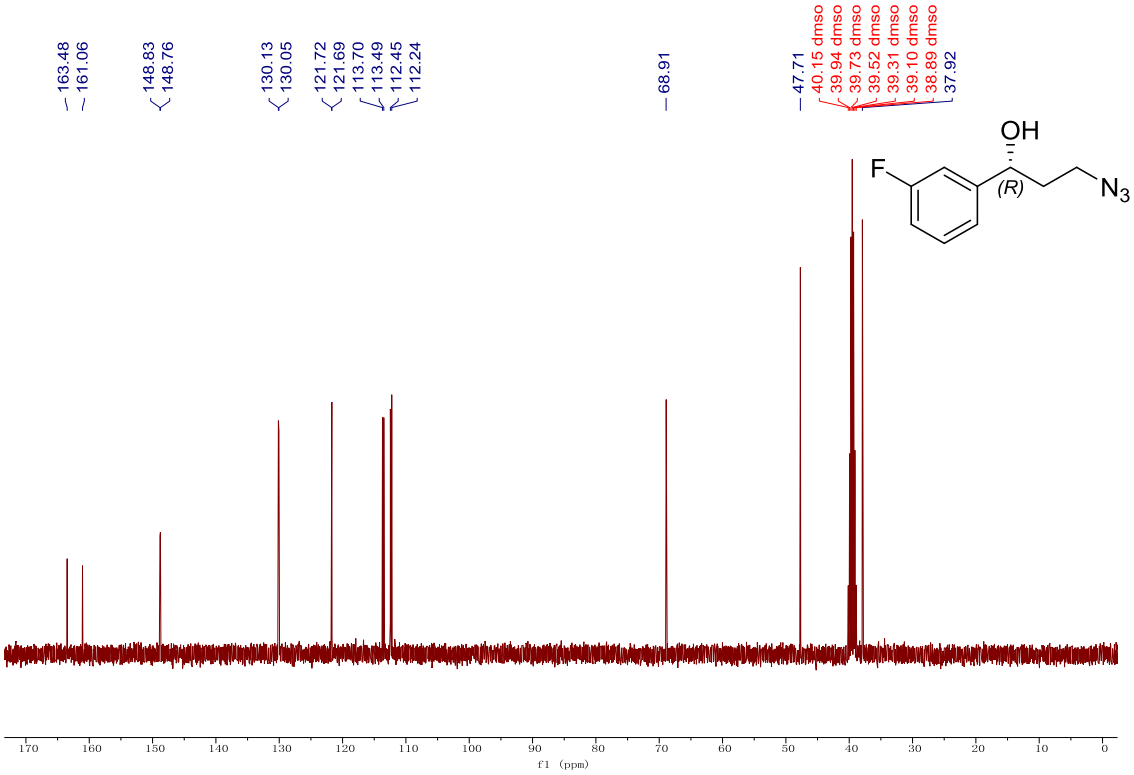
(*R*)-3-azido-1-(o-tolyl)propan-1-ol [(*R*)-5c]



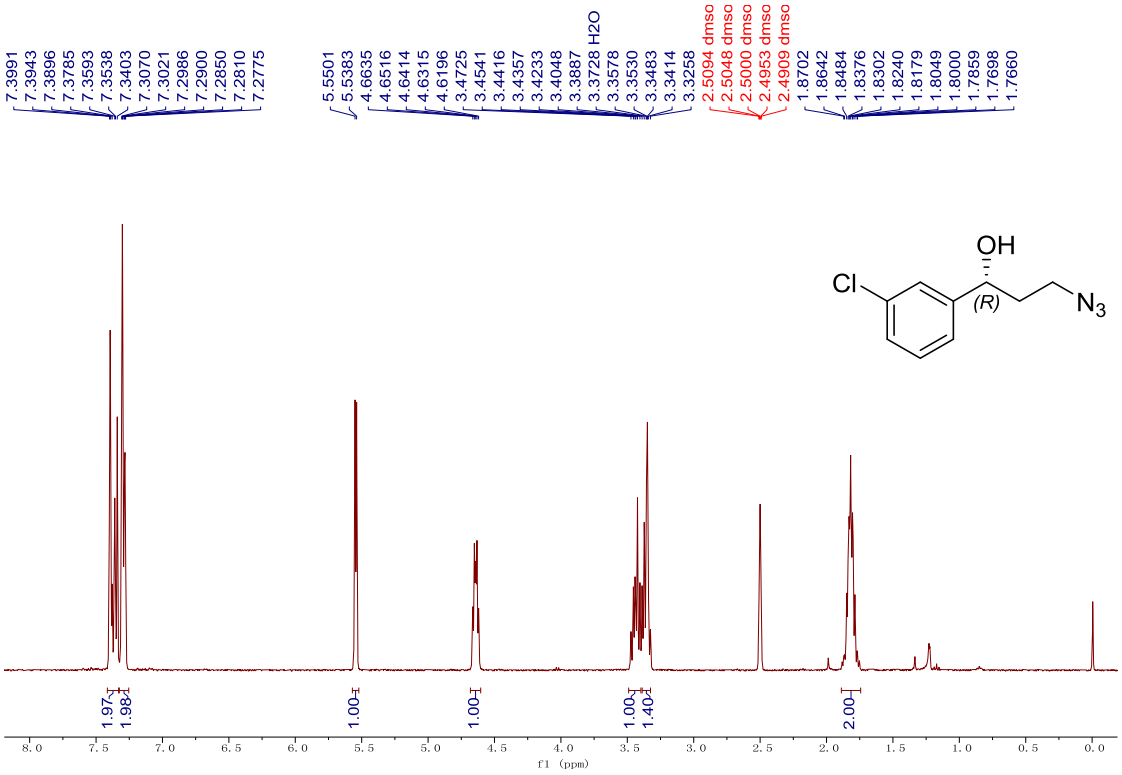


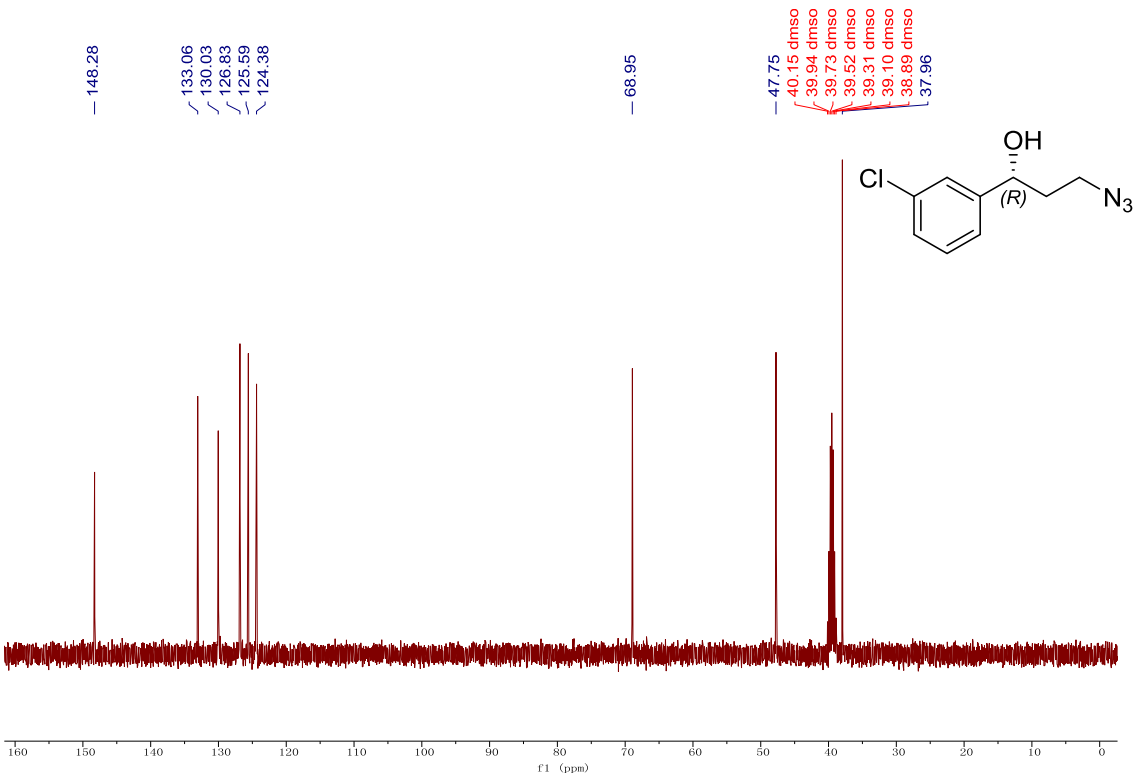
(*R*)-3-azido-1-(3-fluorophenyl)propan-1-ol [(*R*)-6c]



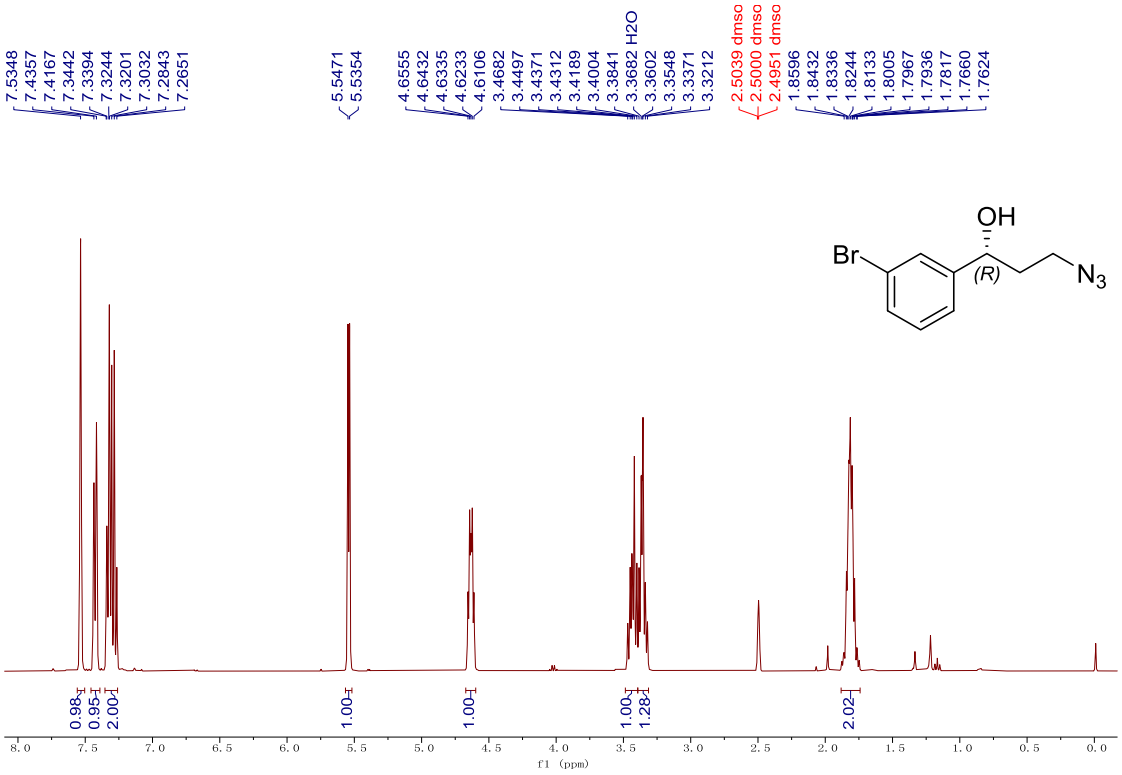


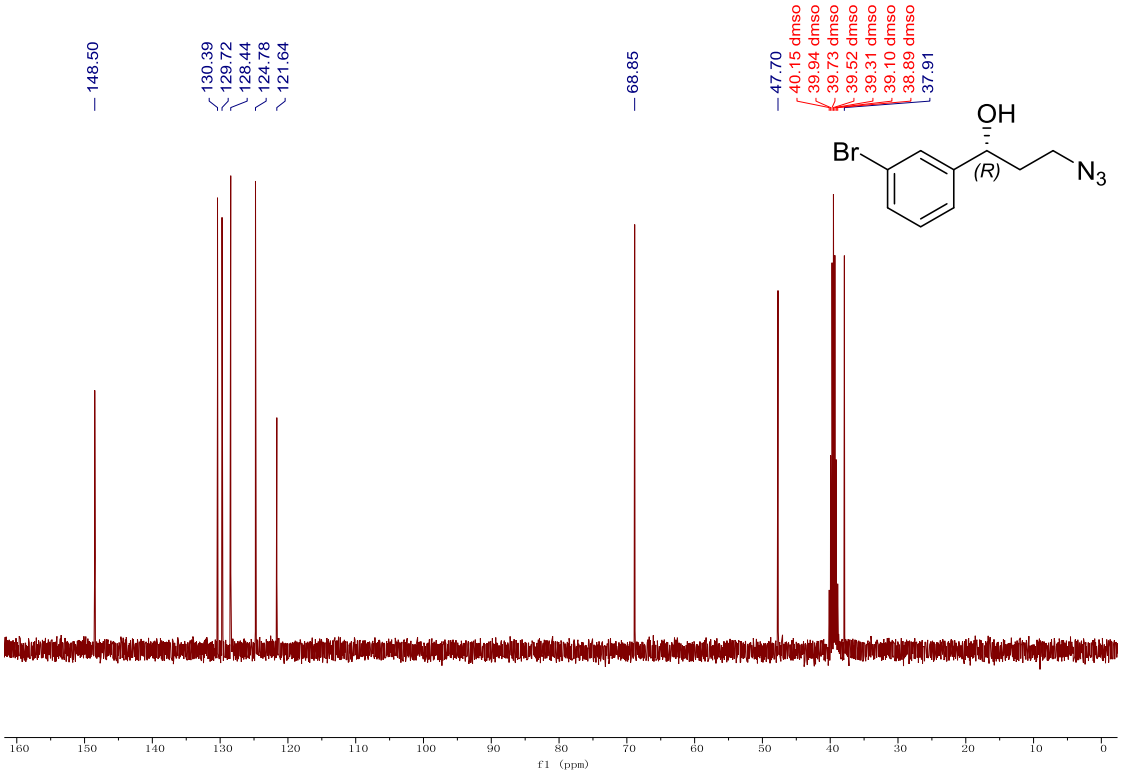
(*R*)-3-azido-1-(3-chlorophenyl)propan-1-ol [(*R*)-7c]



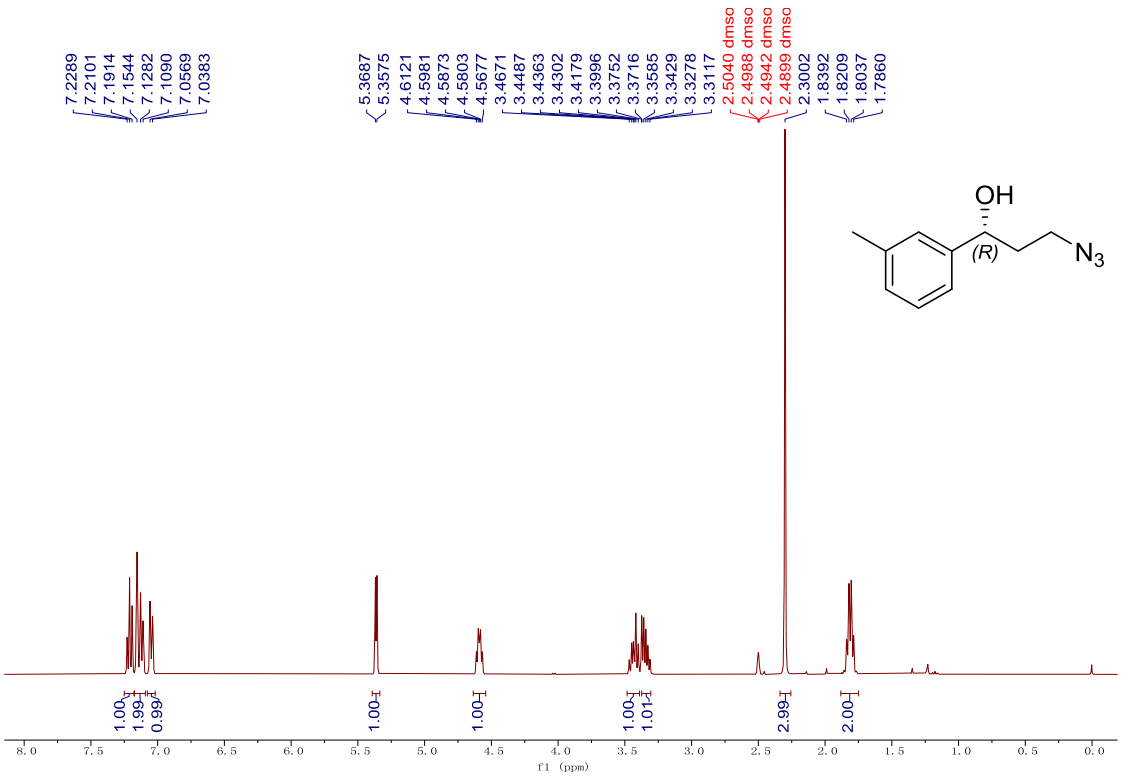


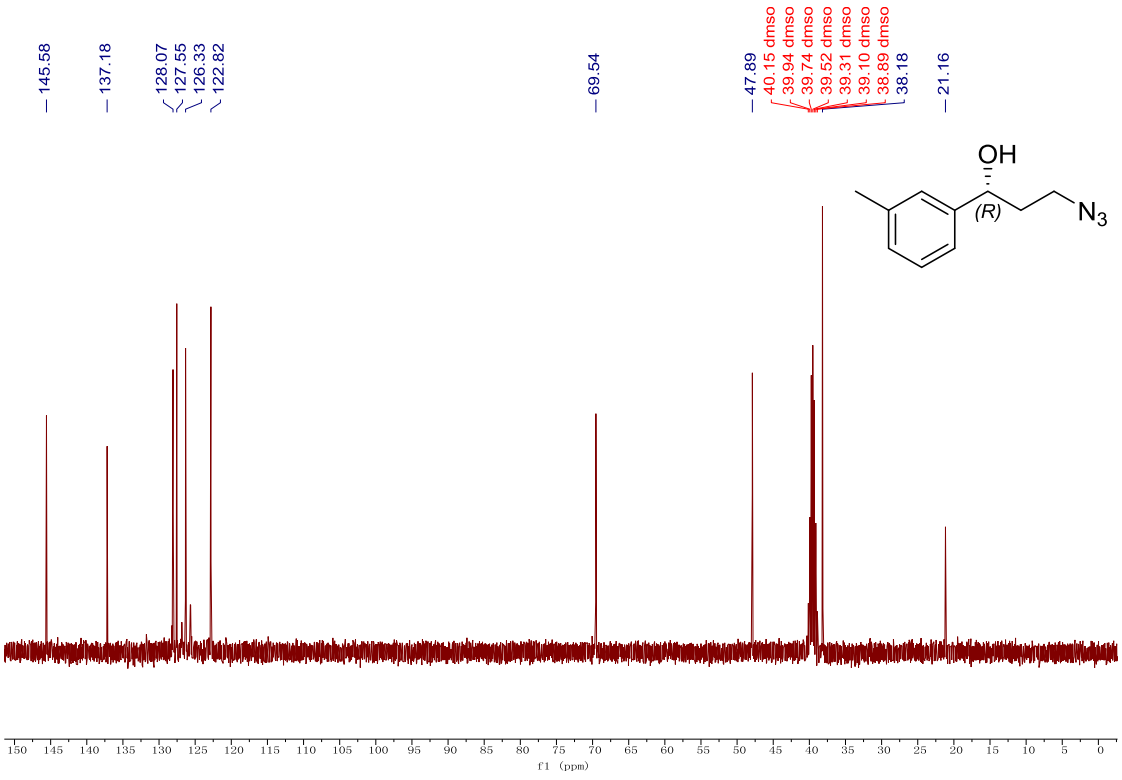
(*R*)-3-azido-1-(3-bromophenyl)propan-1-ol [(*R*)-8c]



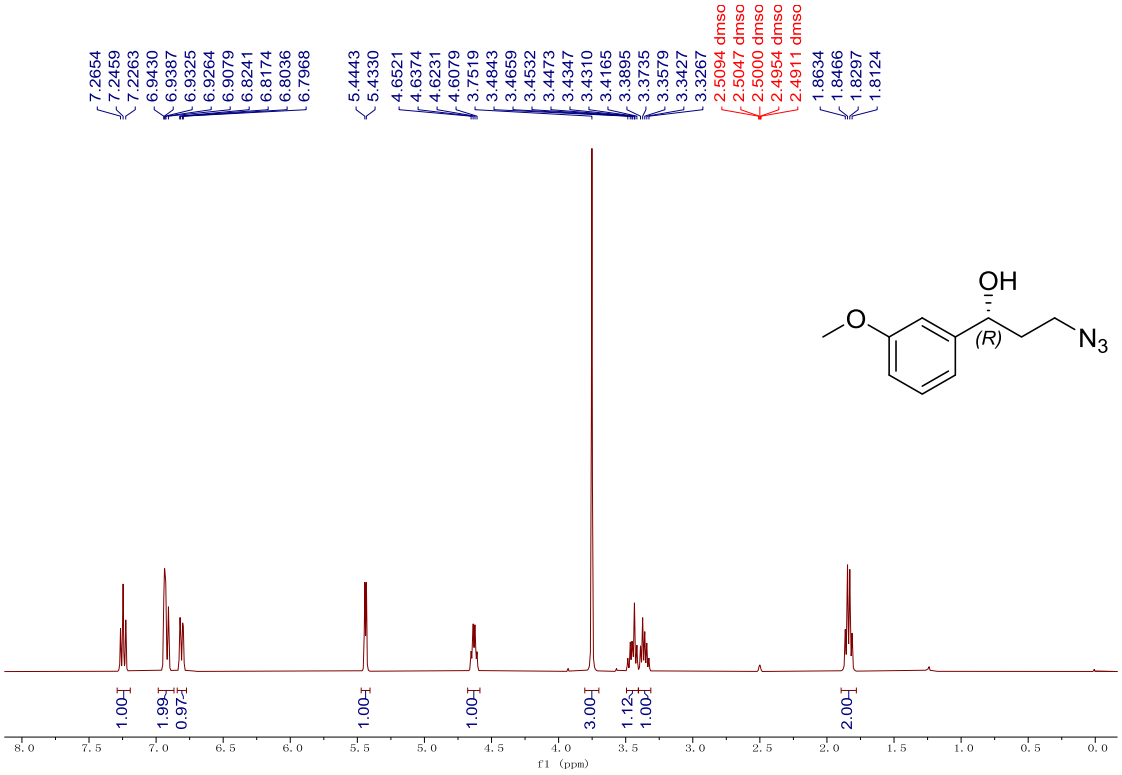


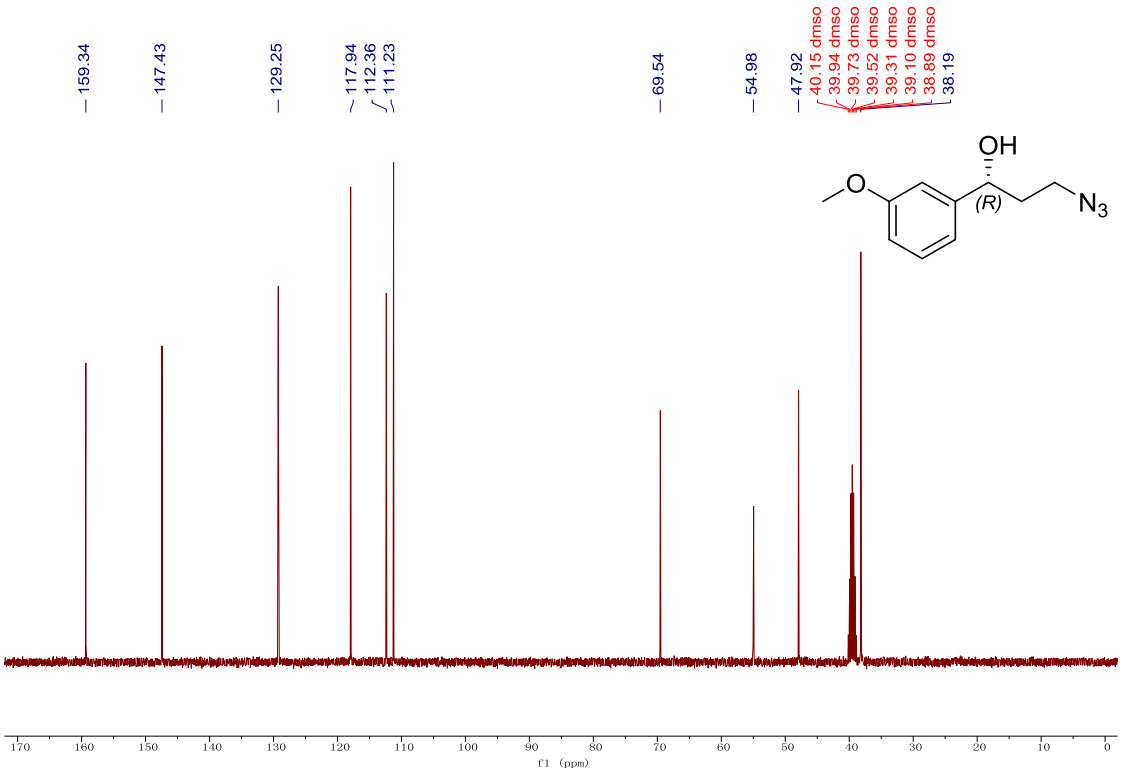
(*R*)-3-azido-1-(m-tolyl)propan-1-ol [(*R*)-9c]



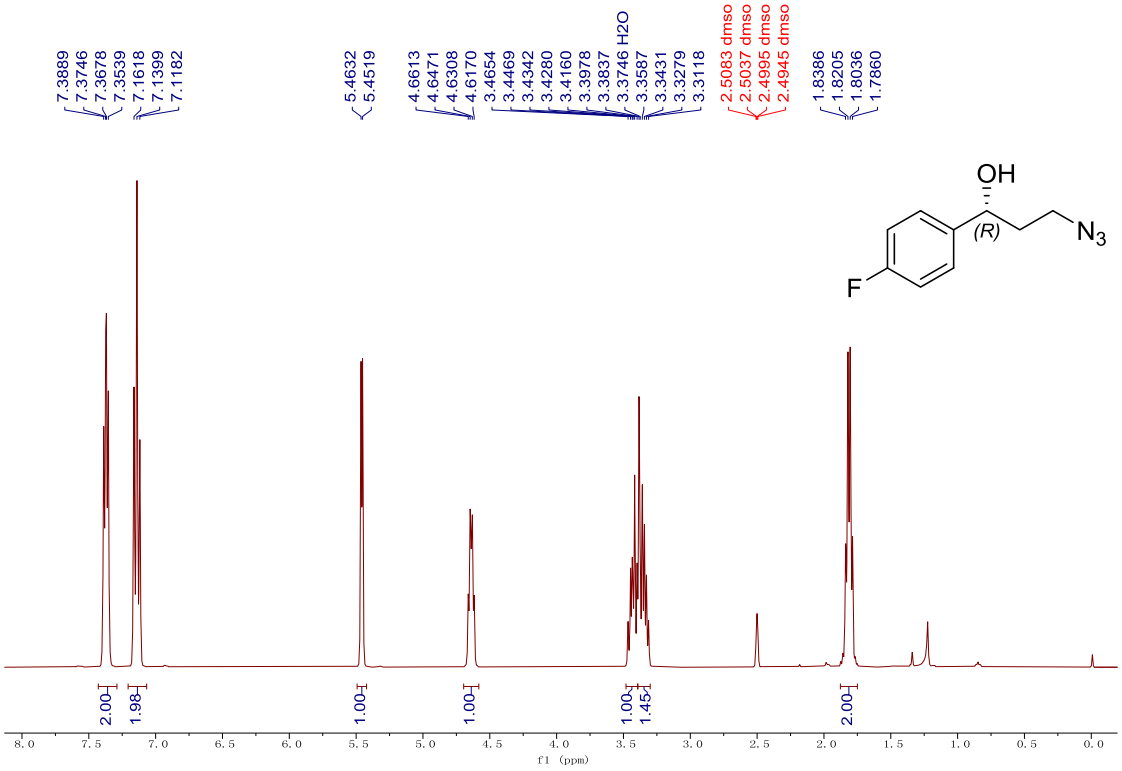


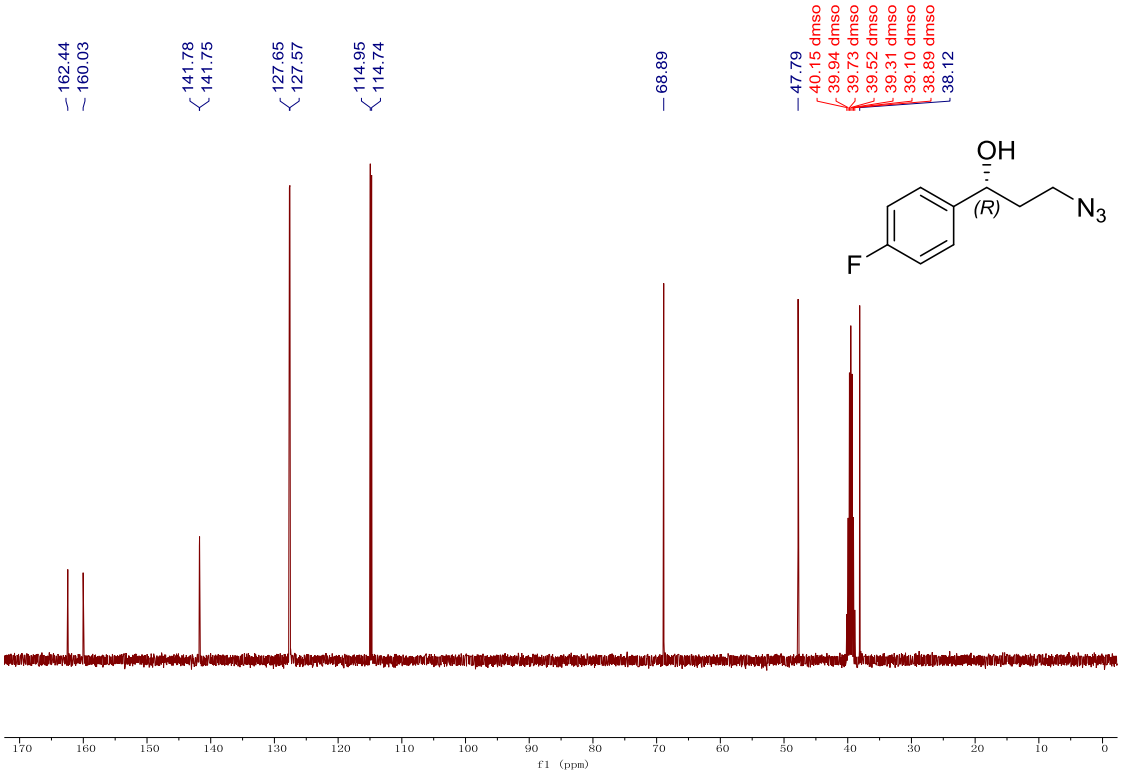
(*R*)-3-azido-1-(3-methoxyphenyl)propan-1-ol [(*R*)-10c]



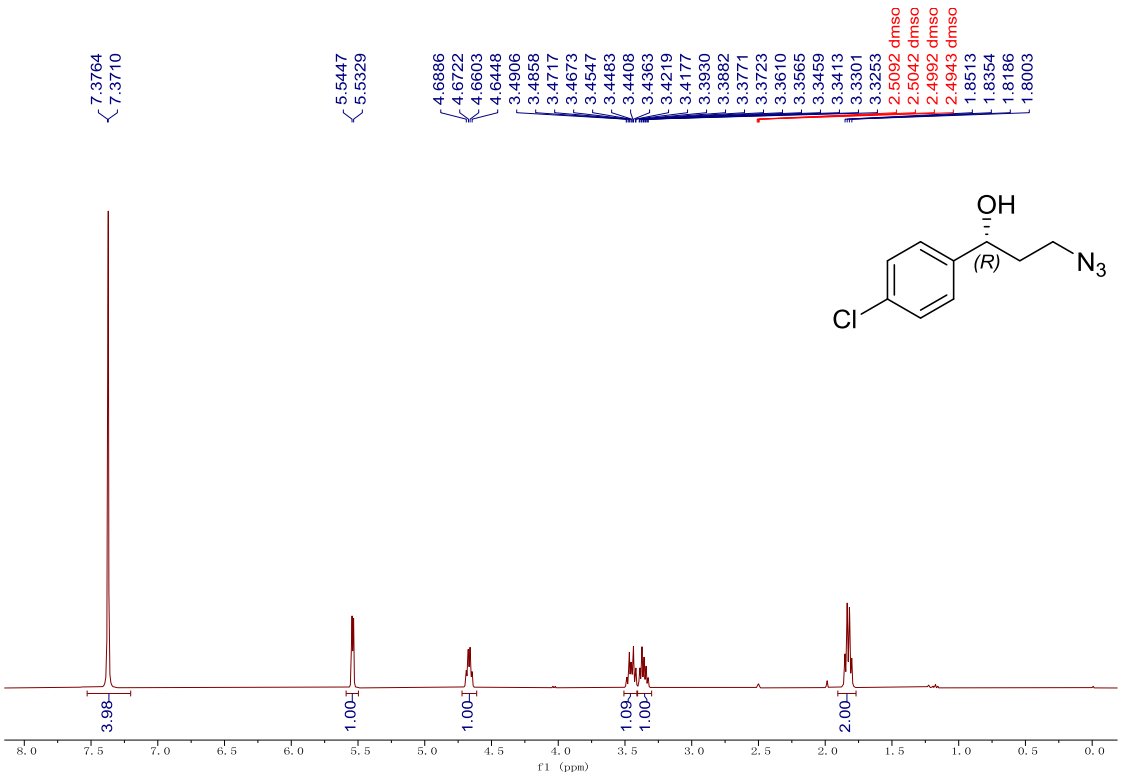


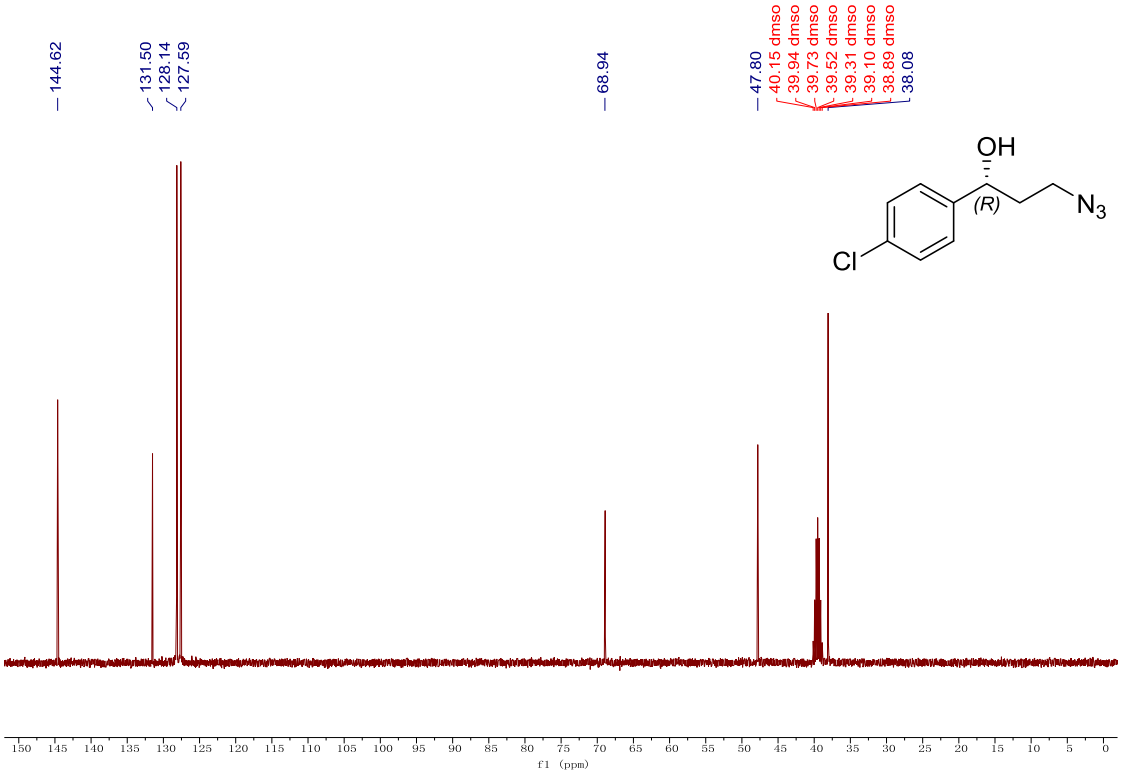
(*R*)-3-azido-1-(4-fluorophenyl)propan-1-ol [(*R*)-11c]



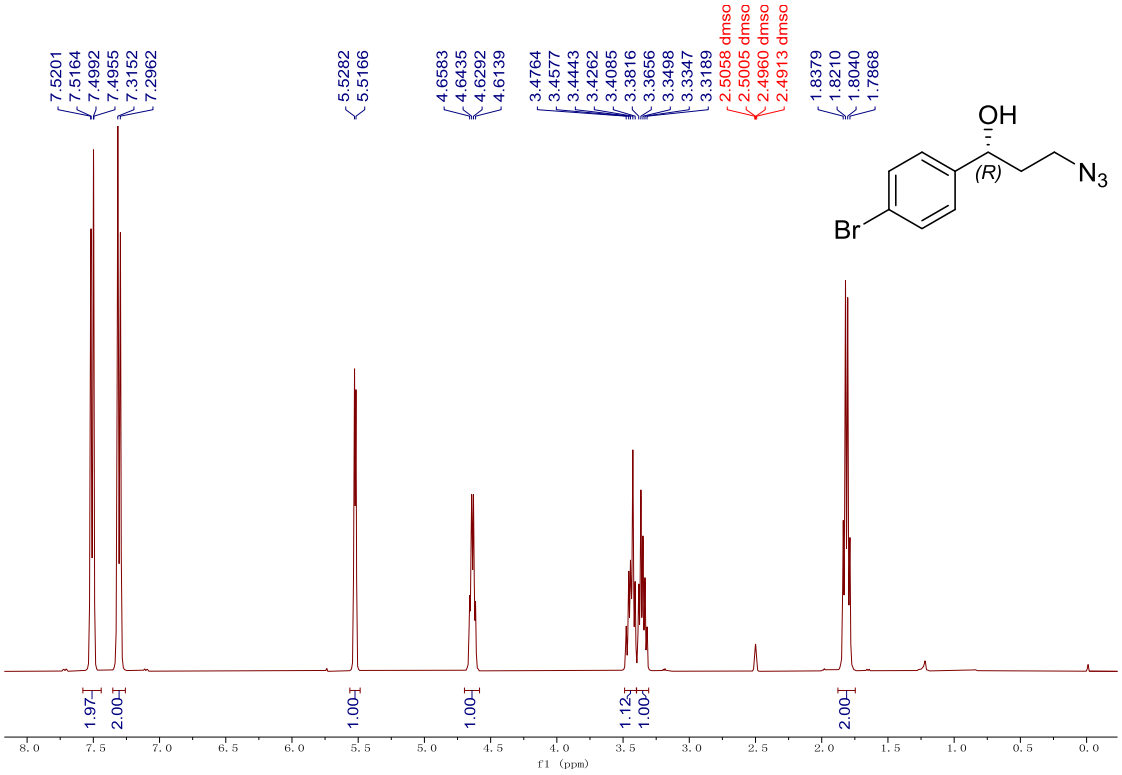


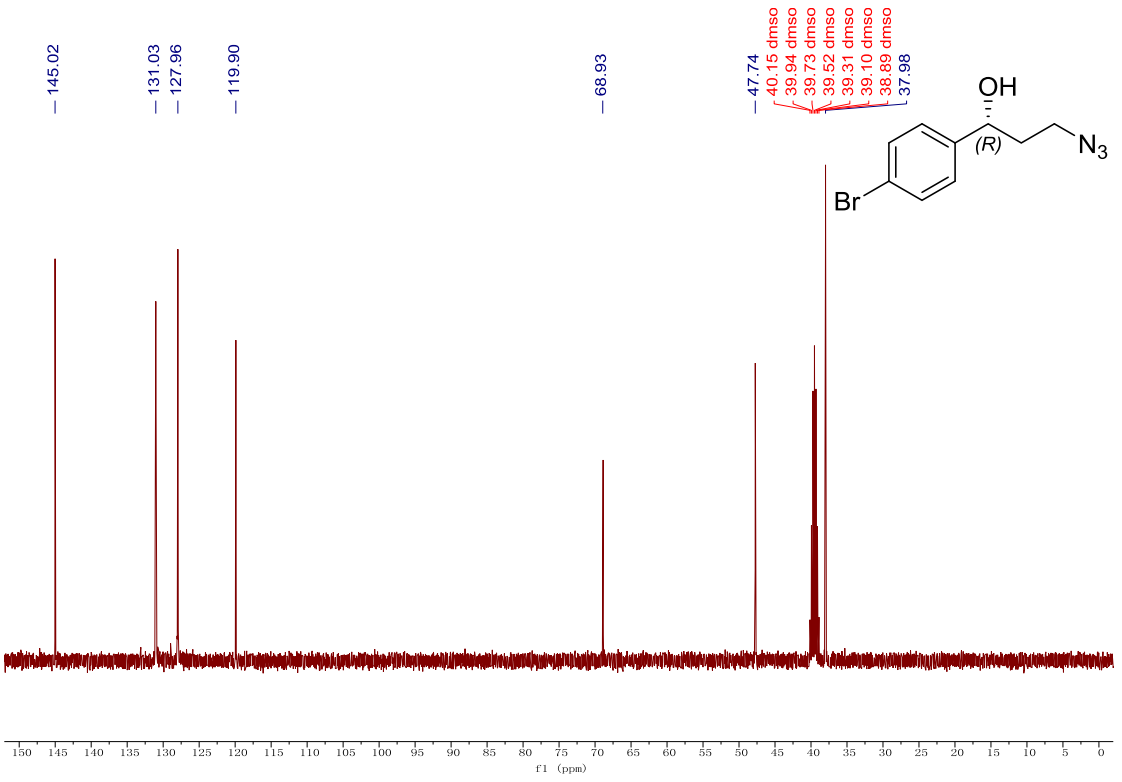
(*R*)-3-azido-1-(4-chlorophenyl)propan-1-ol [(*R*)-12c]



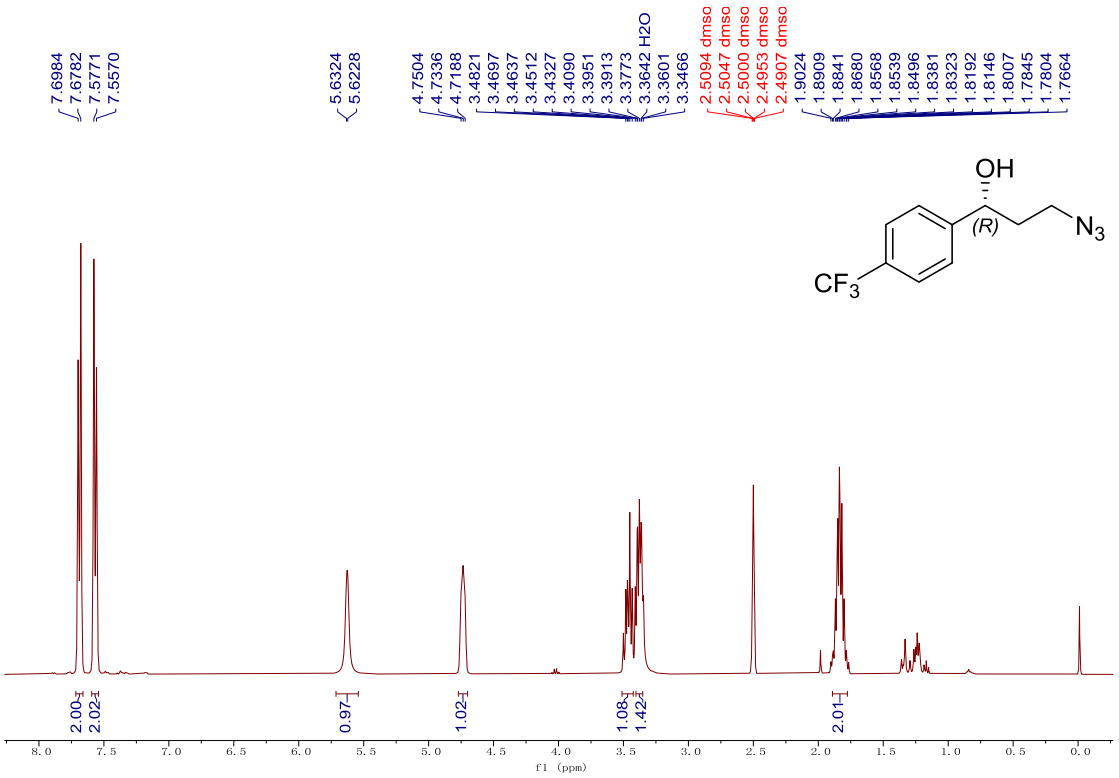


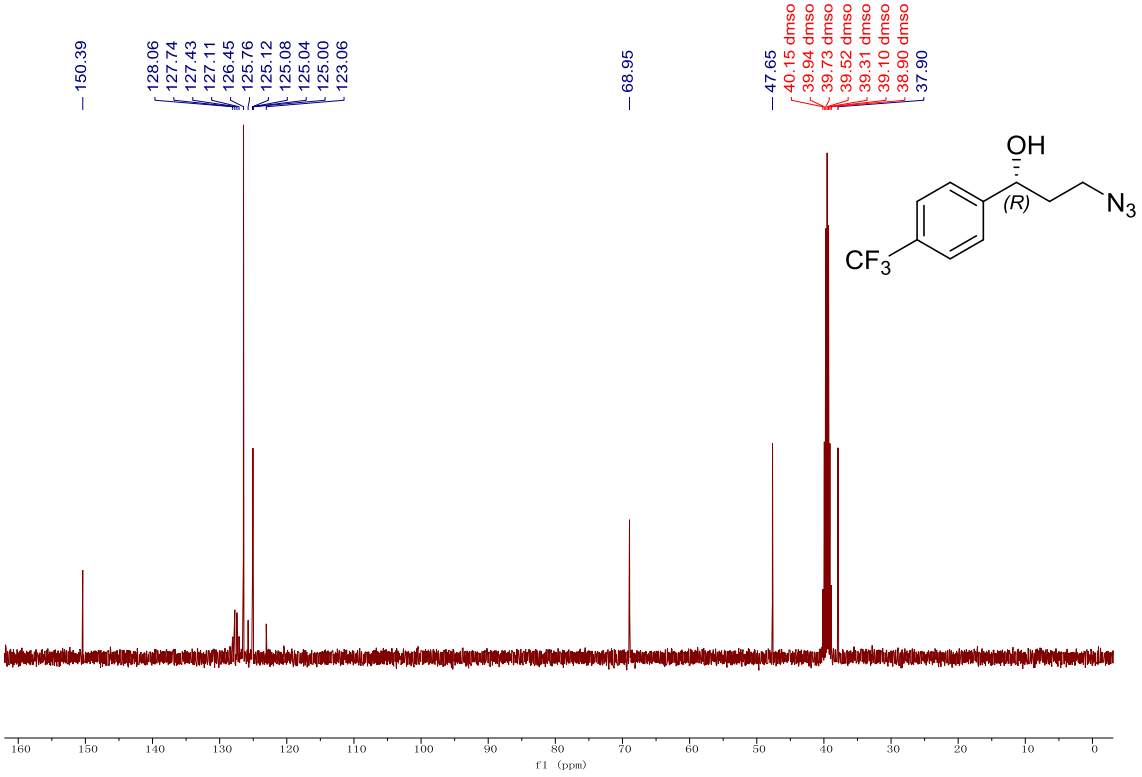
(*R*)-3-azido-1-(4-bromophenyl)propan-1-ol [(*R*)-13c]



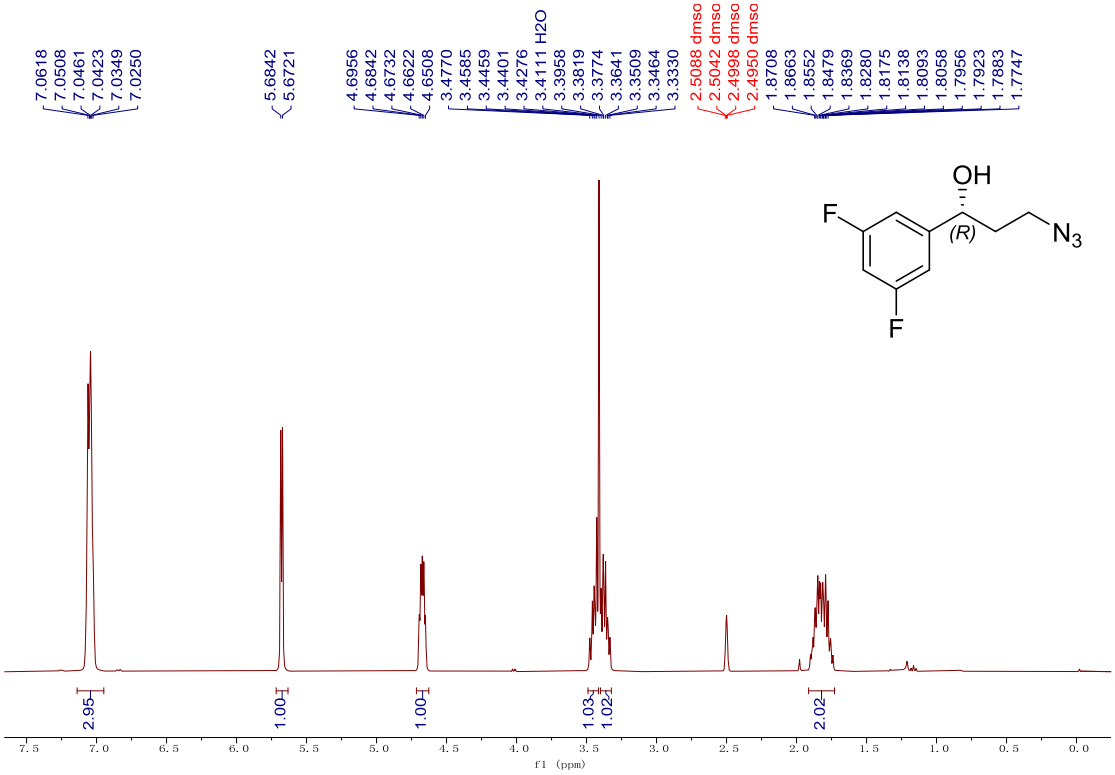


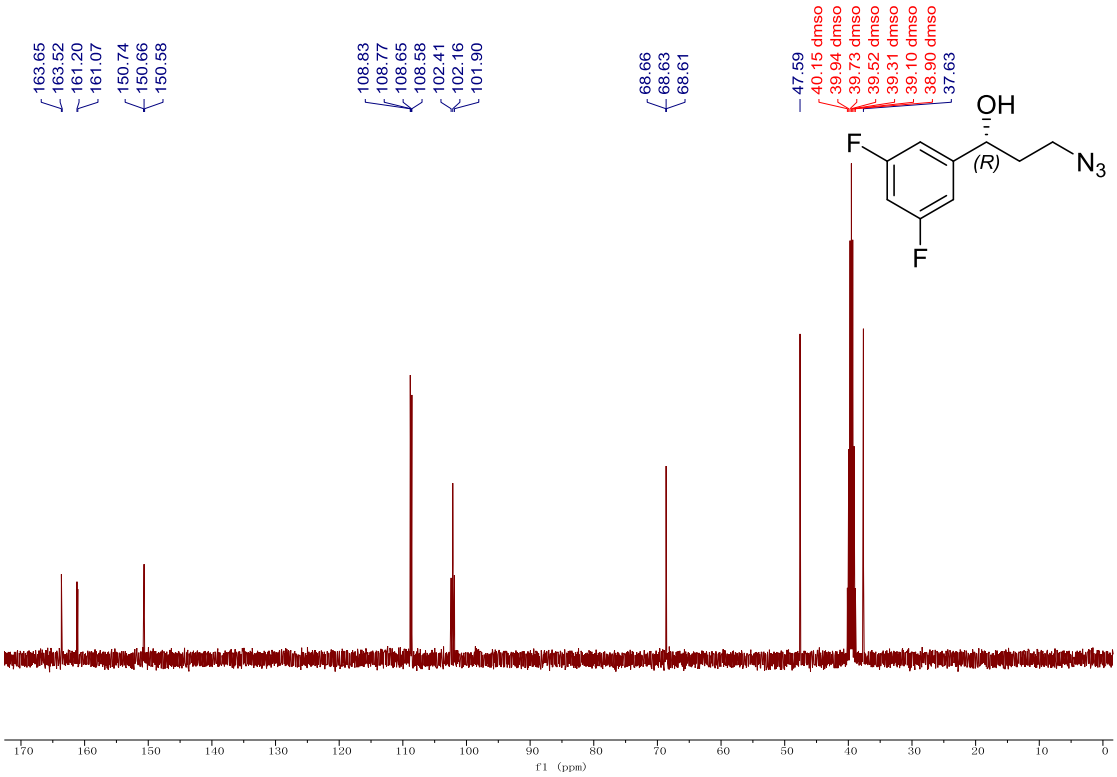
(*R*)-3-azido-1-(4-(trifluoromethyl)phenyl)propan-1-ol [(*R*)-14c]



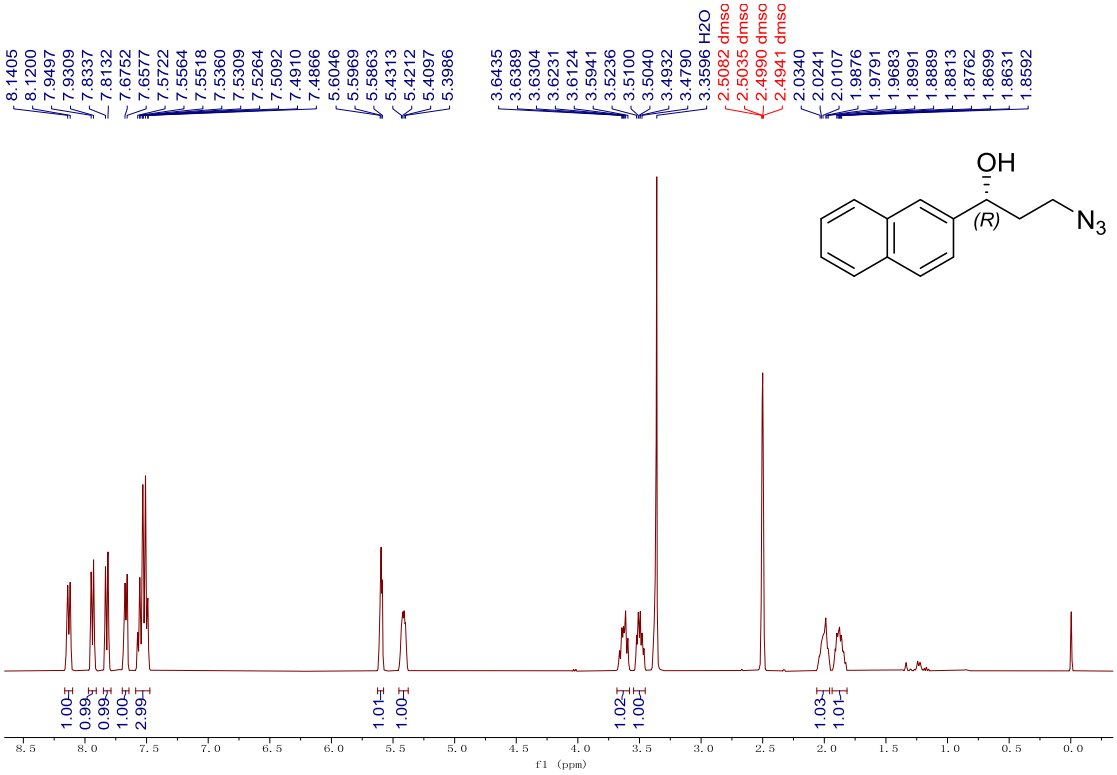


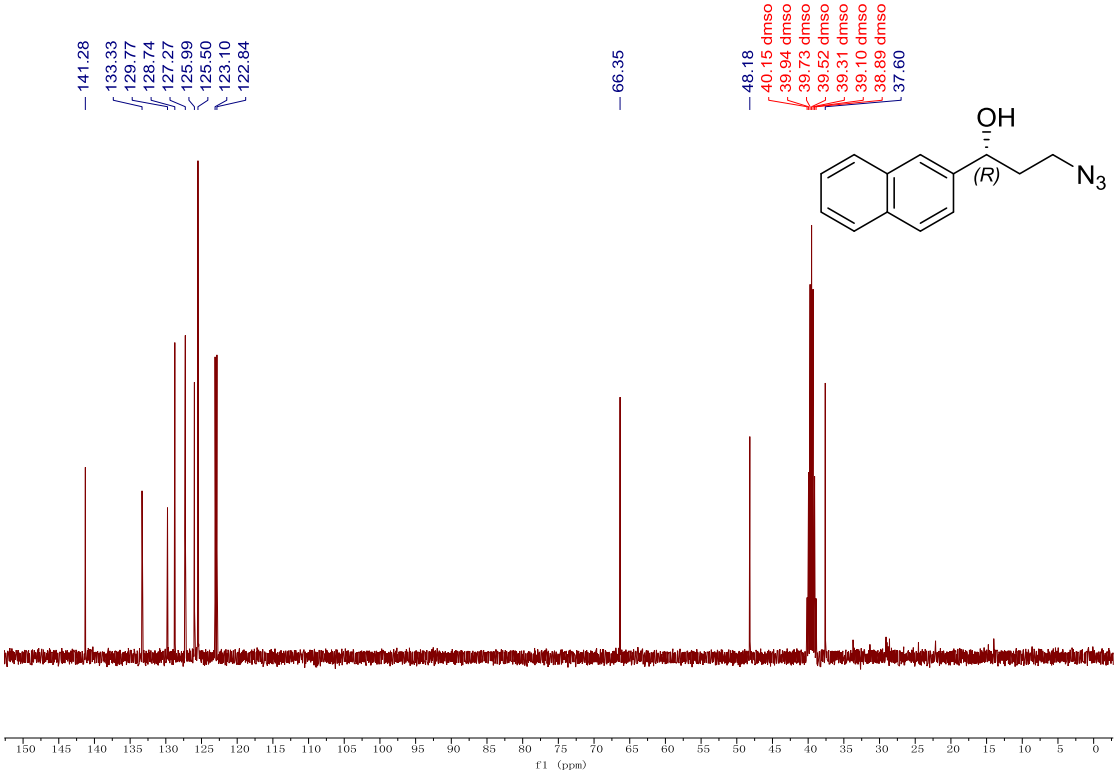
(*R*)-3-azido-1-(3,5-difluorophenyl)propan-1-ol [(*R*)-15c]



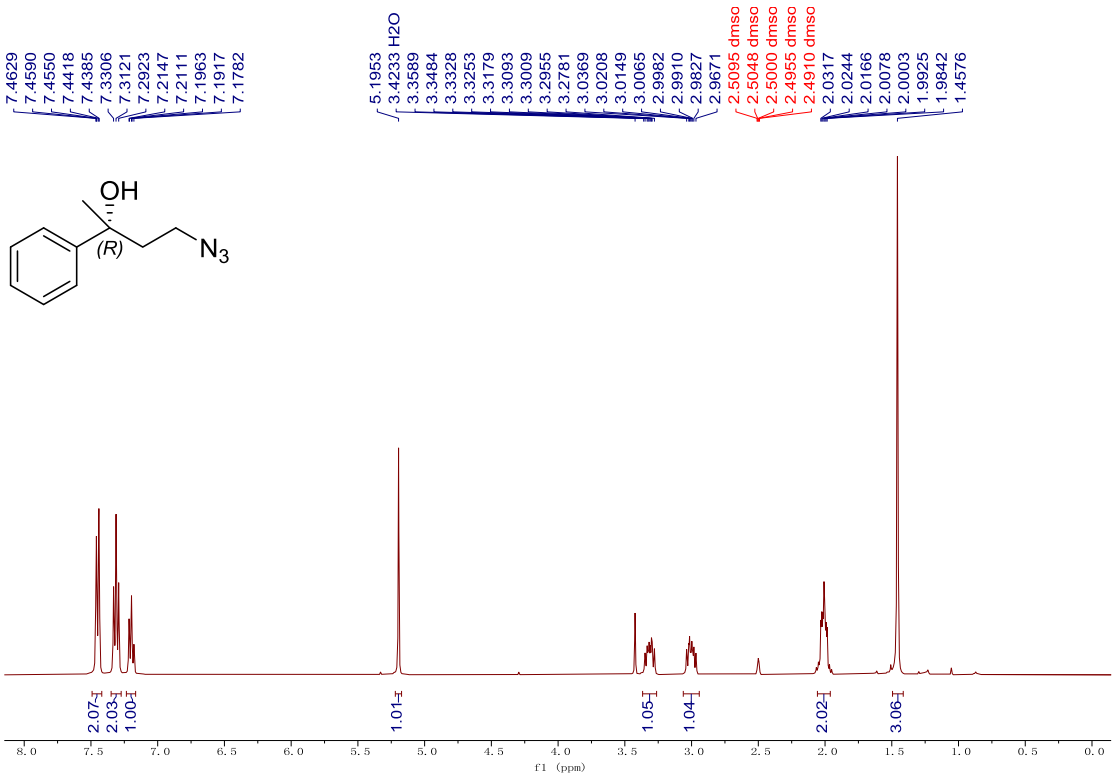


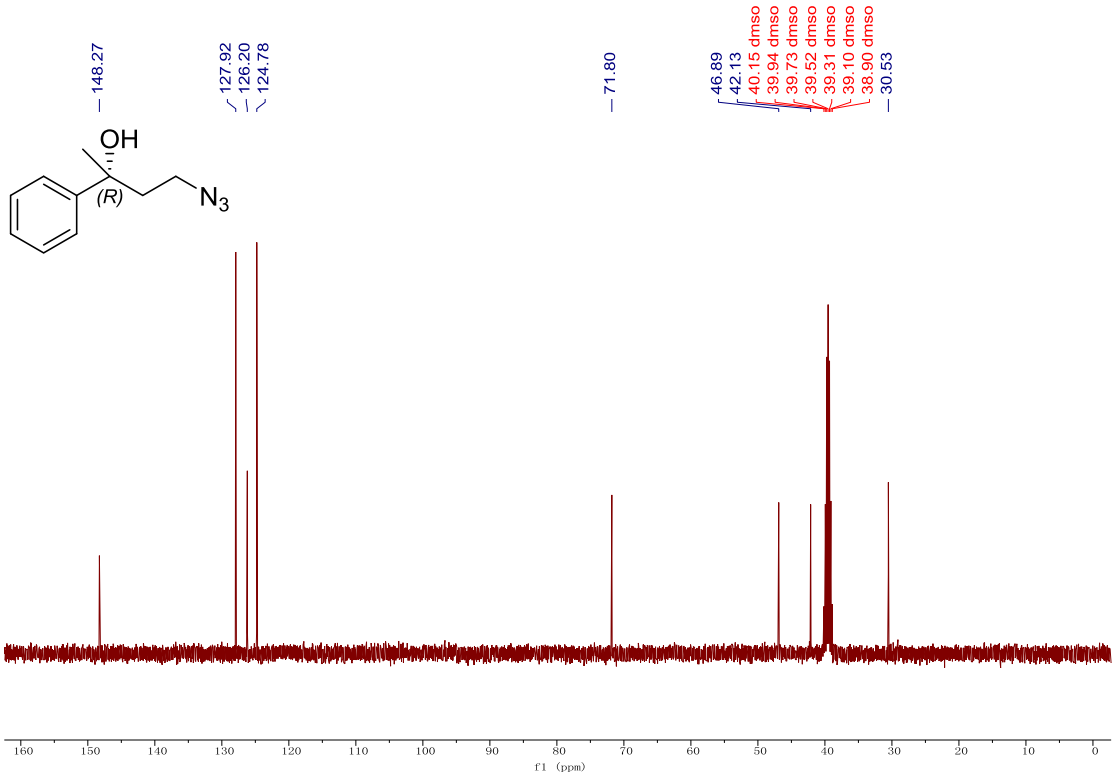
(*R*)-3-azido-1-(naphthalen-2-yl)propan-1-ol [(*R*)-16c]



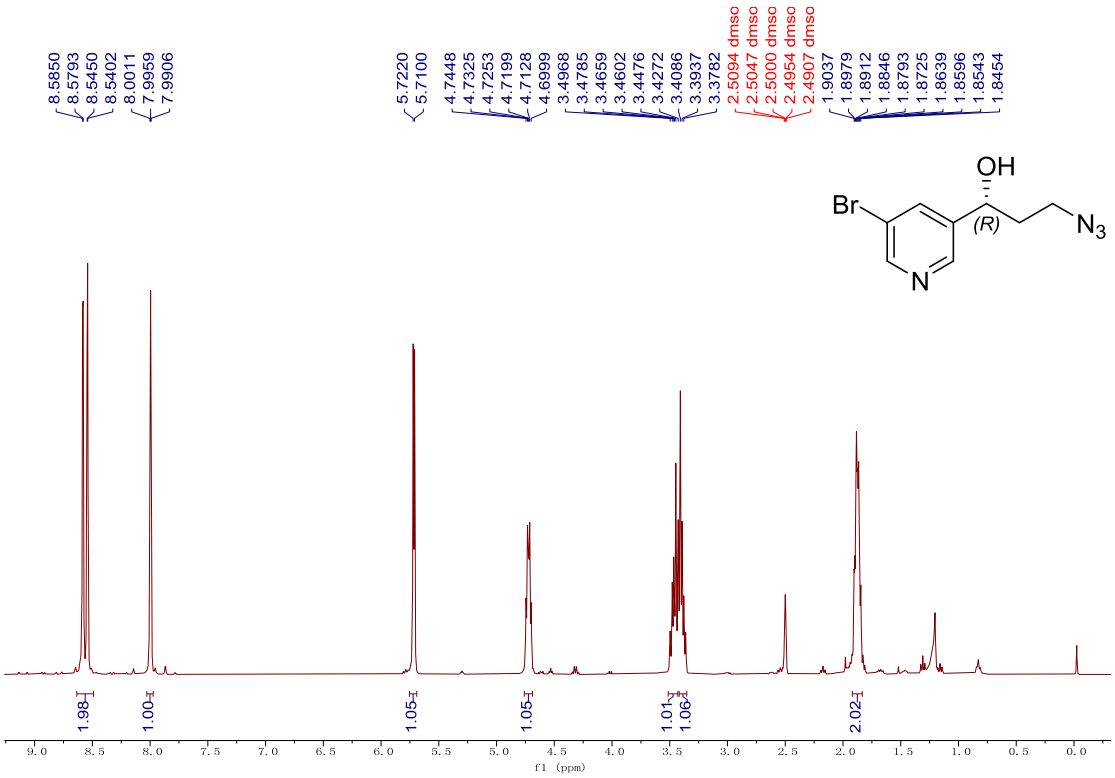


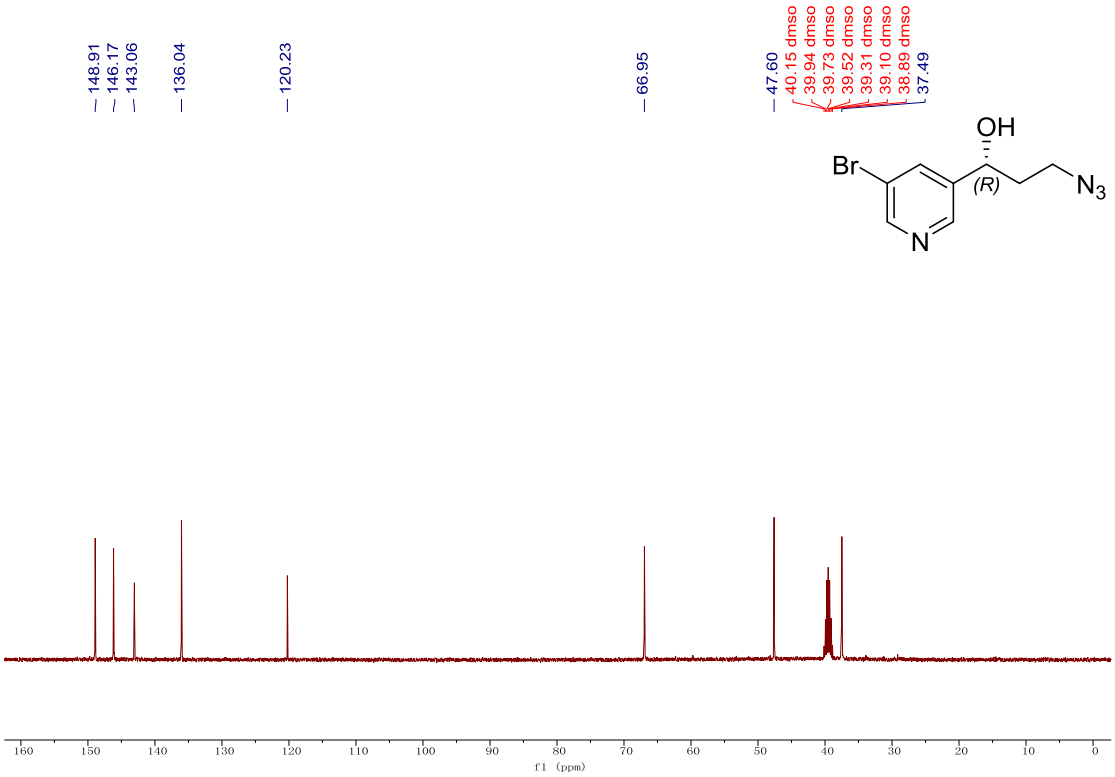
(*R*)-4-azido-2-phenylbutan-2-ol [(*R*)-17c]



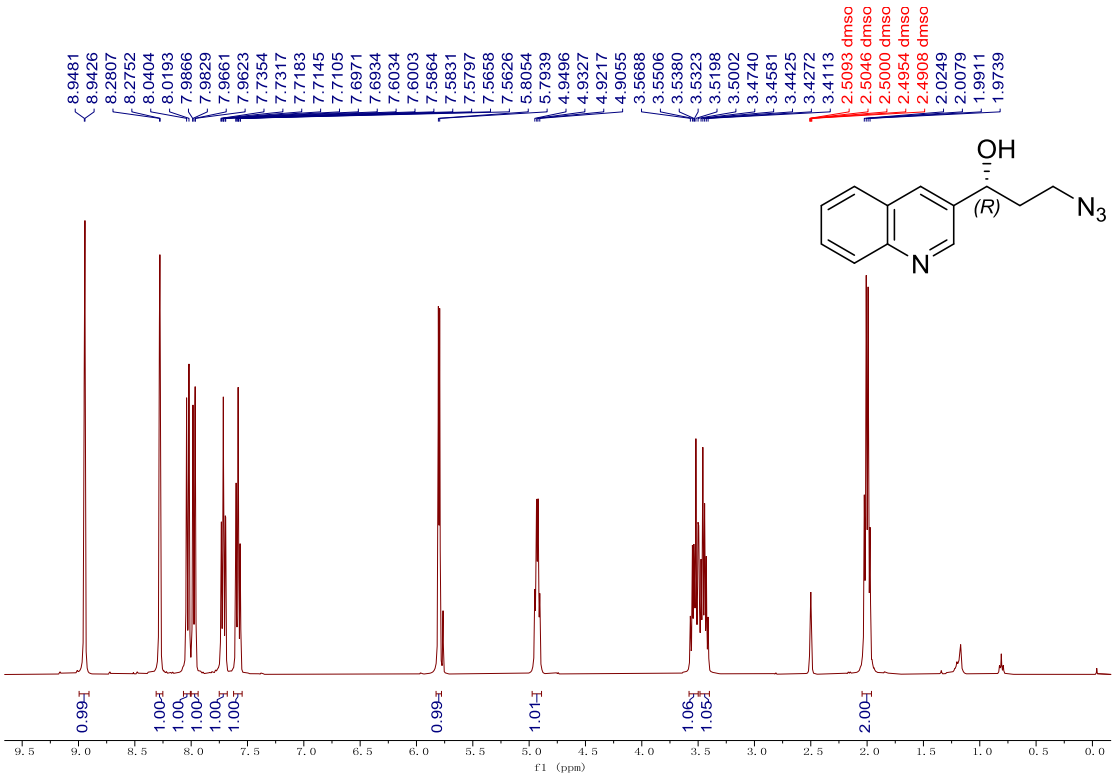


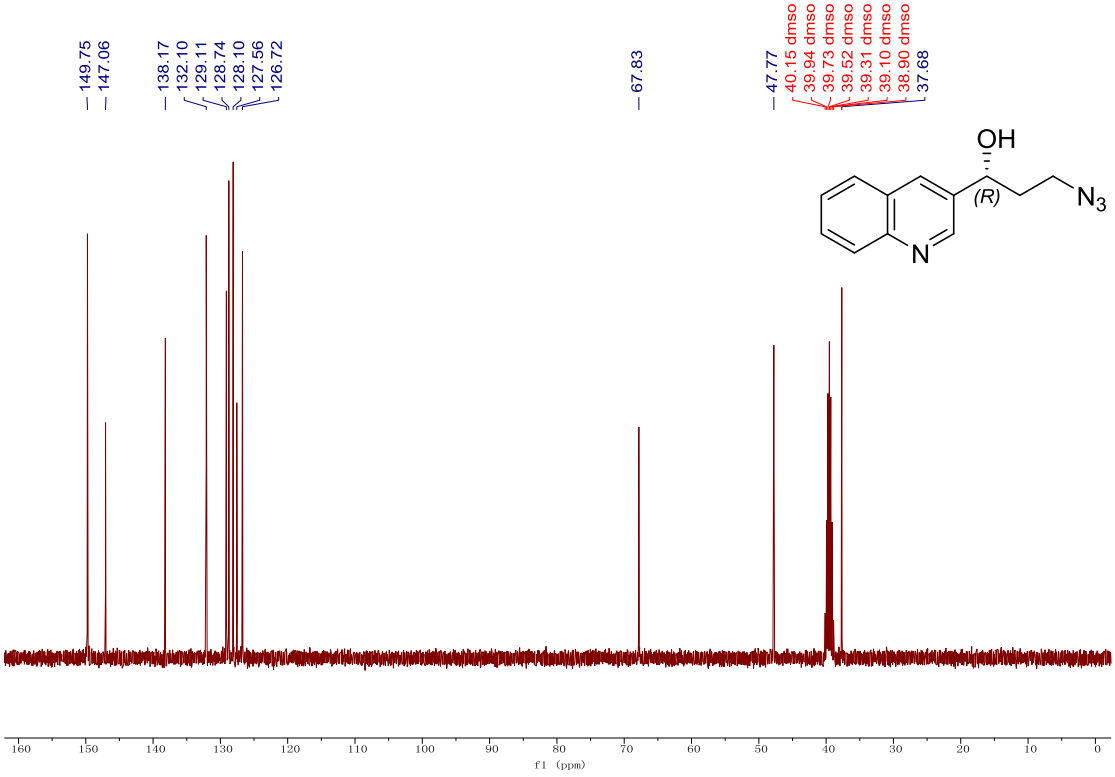
(*R*)-3-azido-1-(5-bromopyridin-3-yl)propan-1-ol [(*R*)-18c]



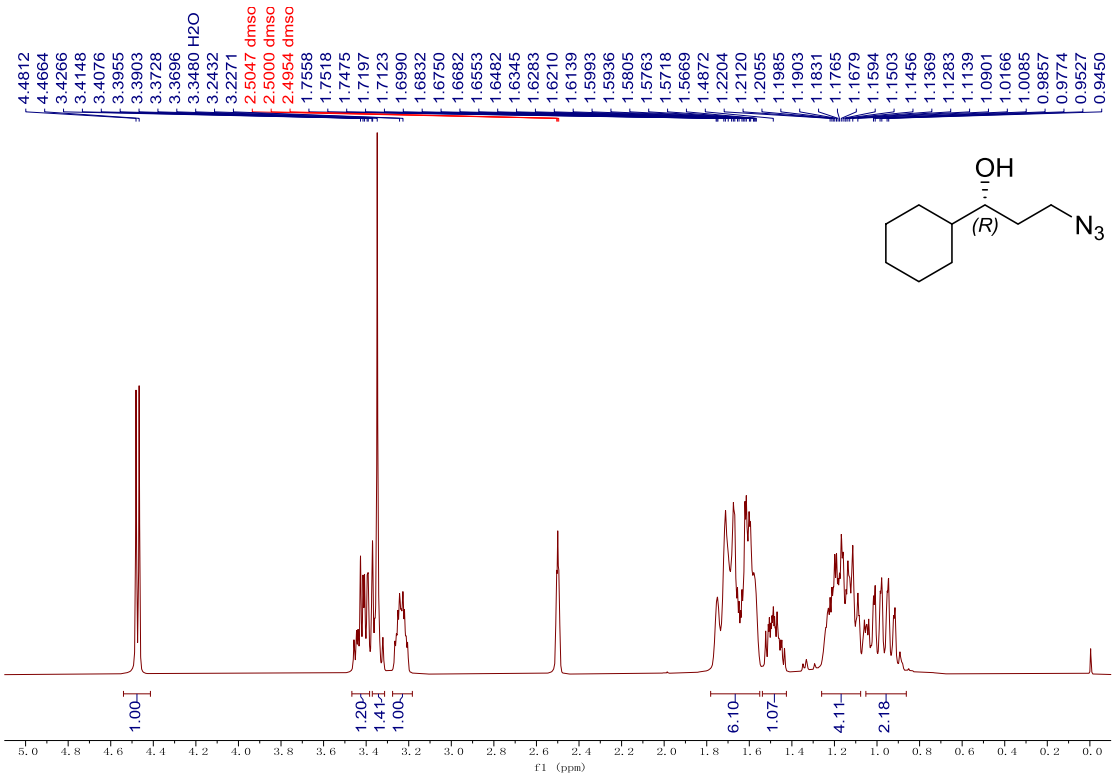


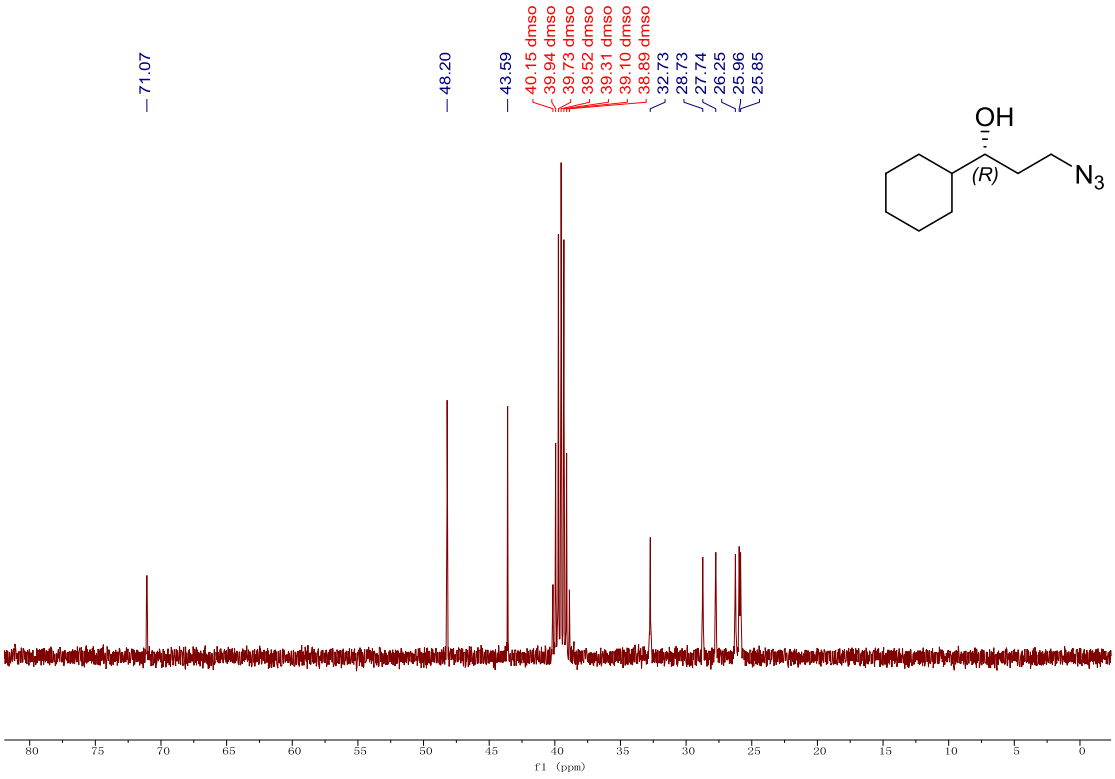
(*R*)-3-azido-1-(quinolin-3-yl)propan-1-ol [(*R*)-19c]



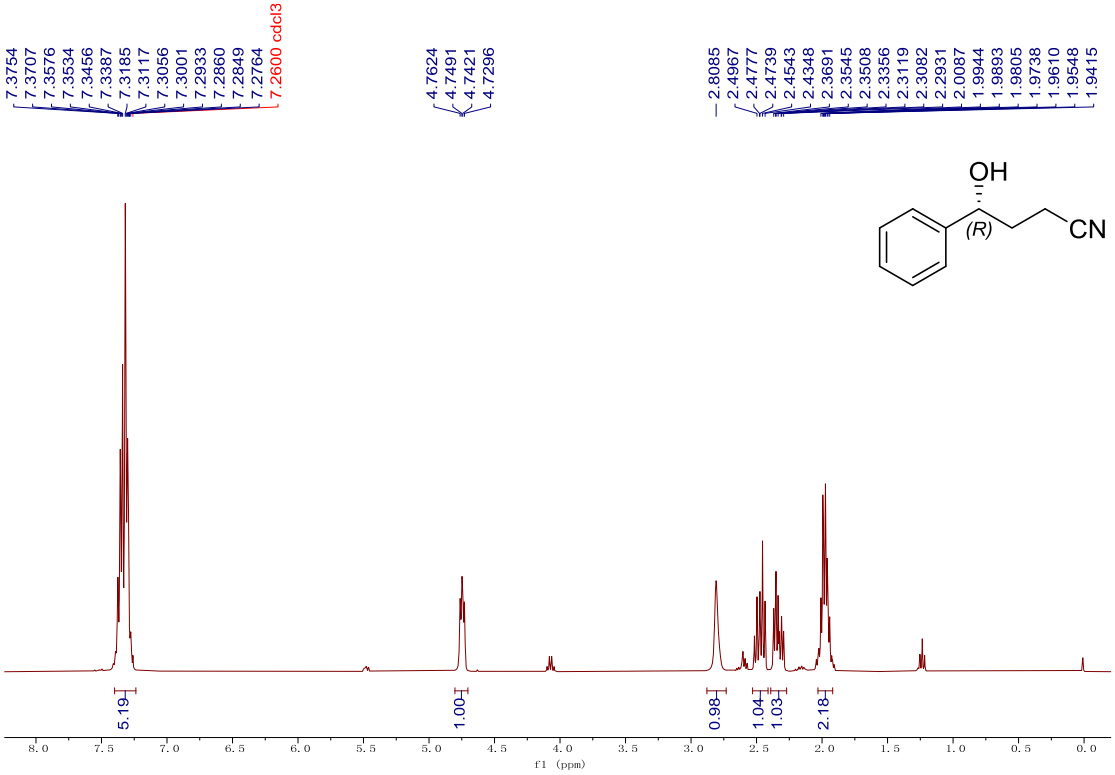


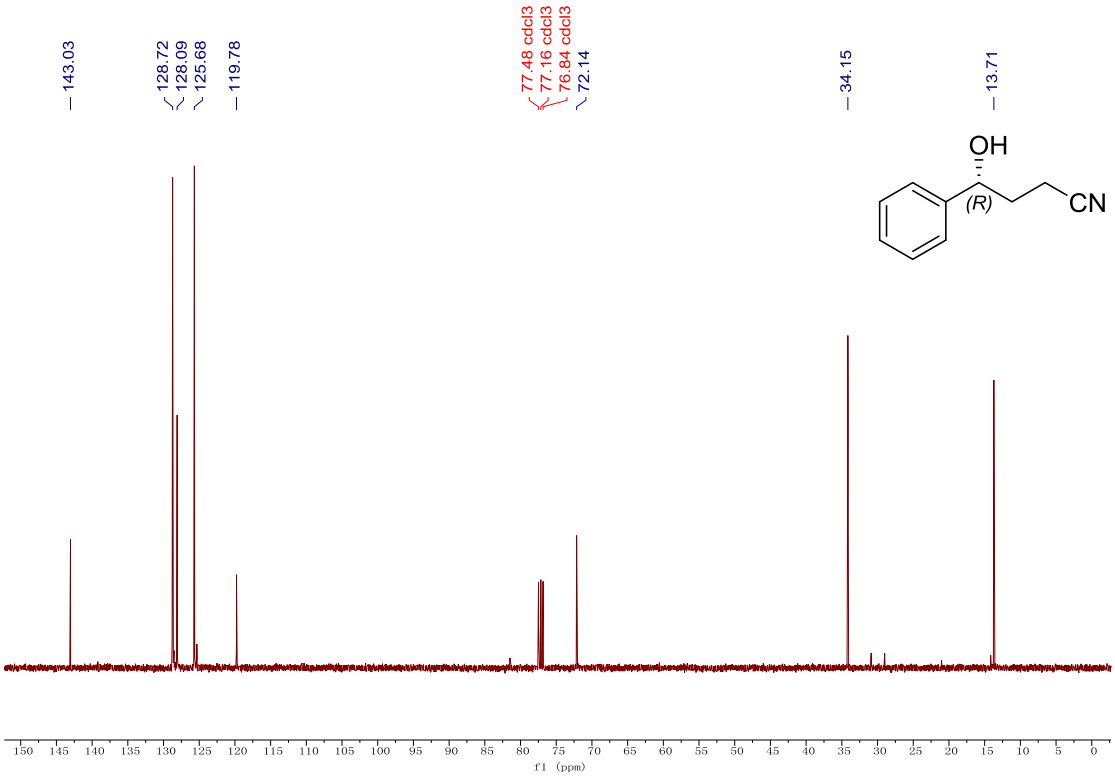
(*R*)-3-azido-1-cyclohexylpropan-1-ol [(*R*)-21c]



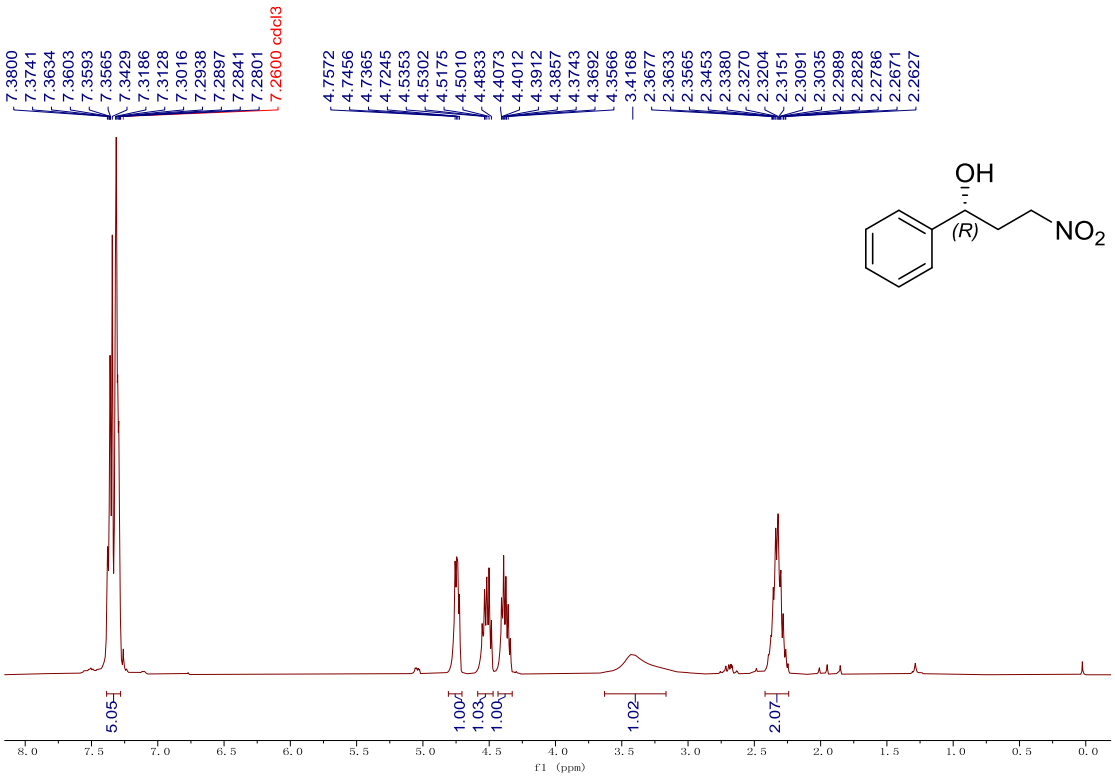


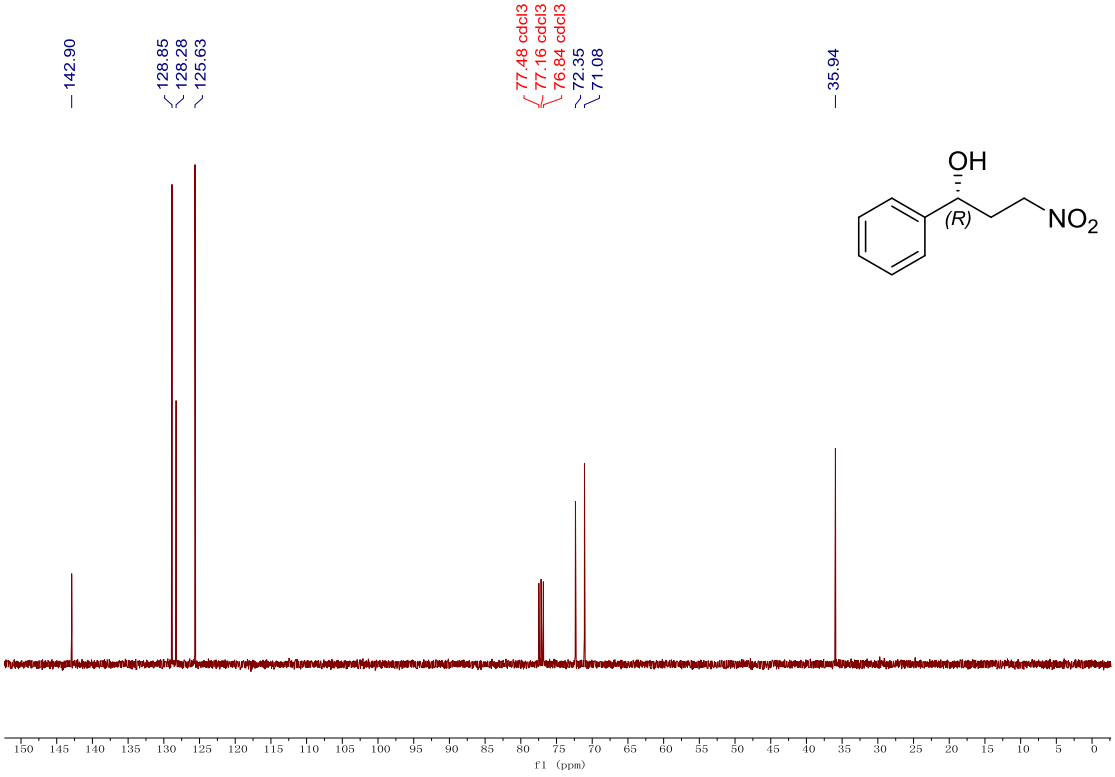
(*R*)-4-hydroxy-4-phenylbutanenitrile [(*R*)-1d]



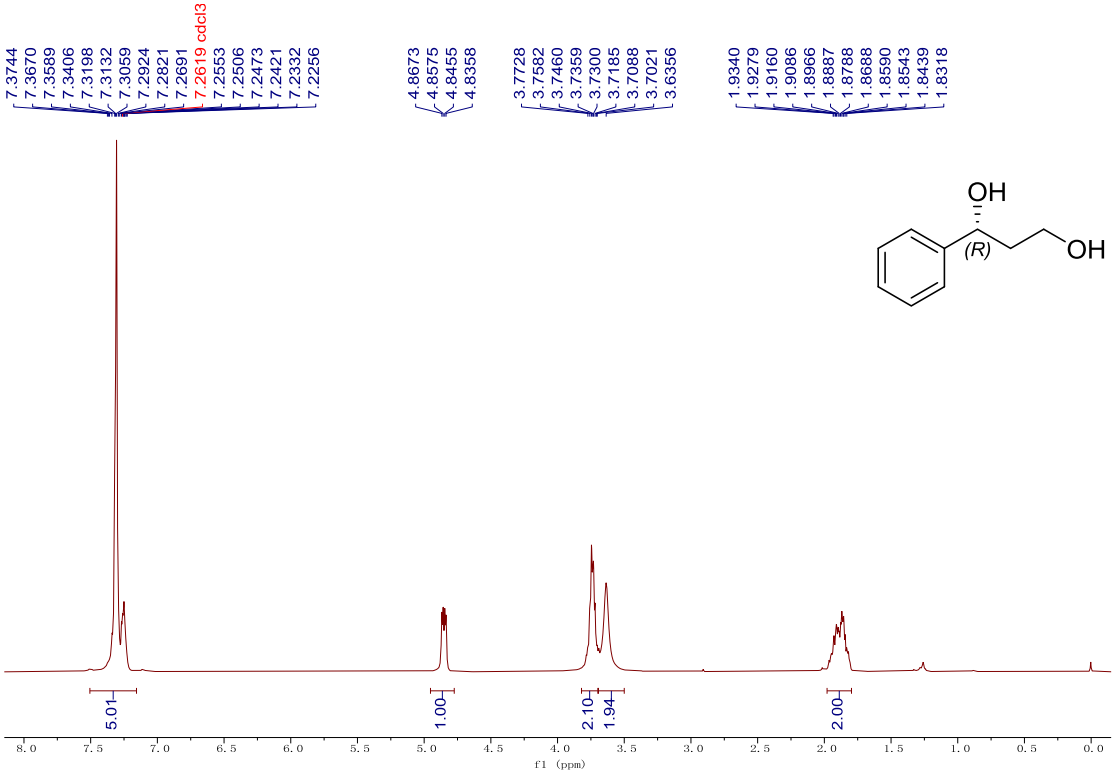


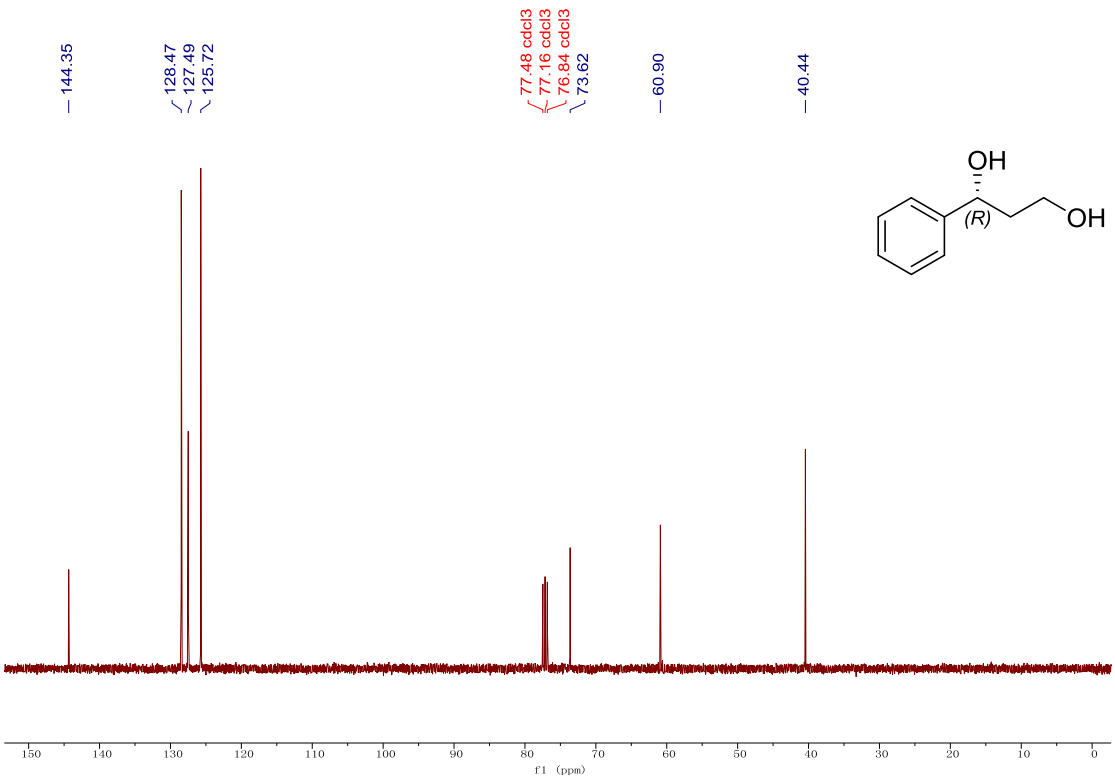
(*R*)-3-nitro-1-phenylpropan-1-ol [(*R*)-1e]



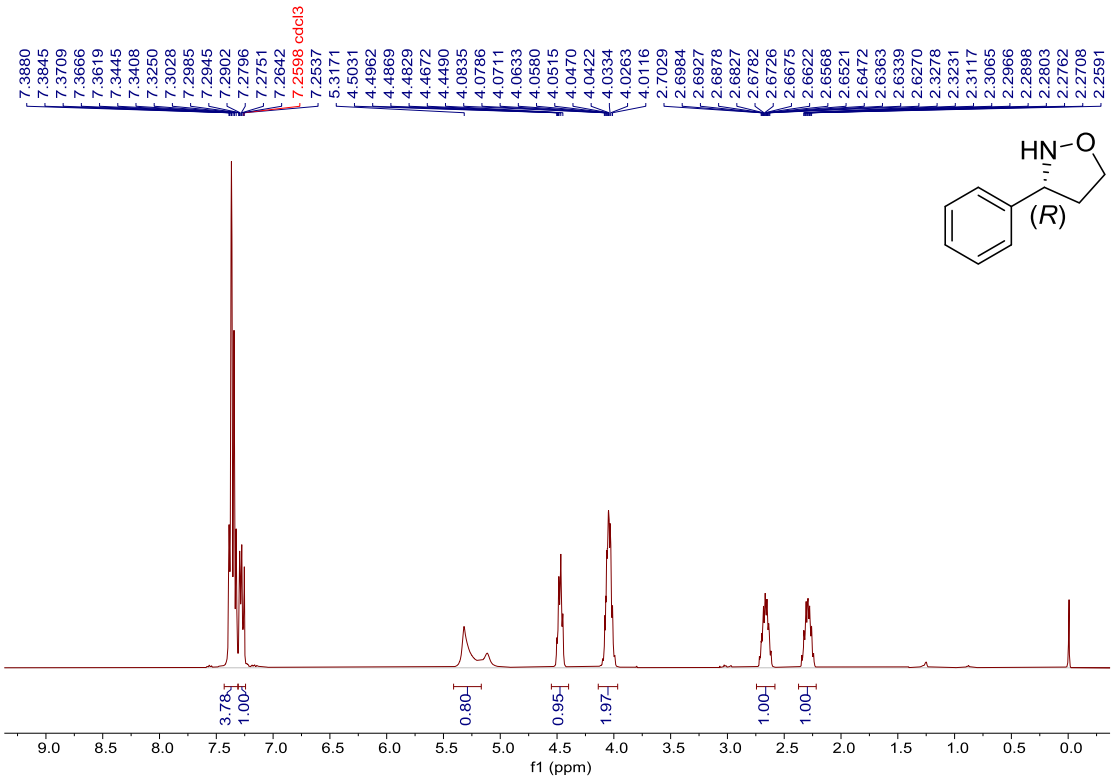


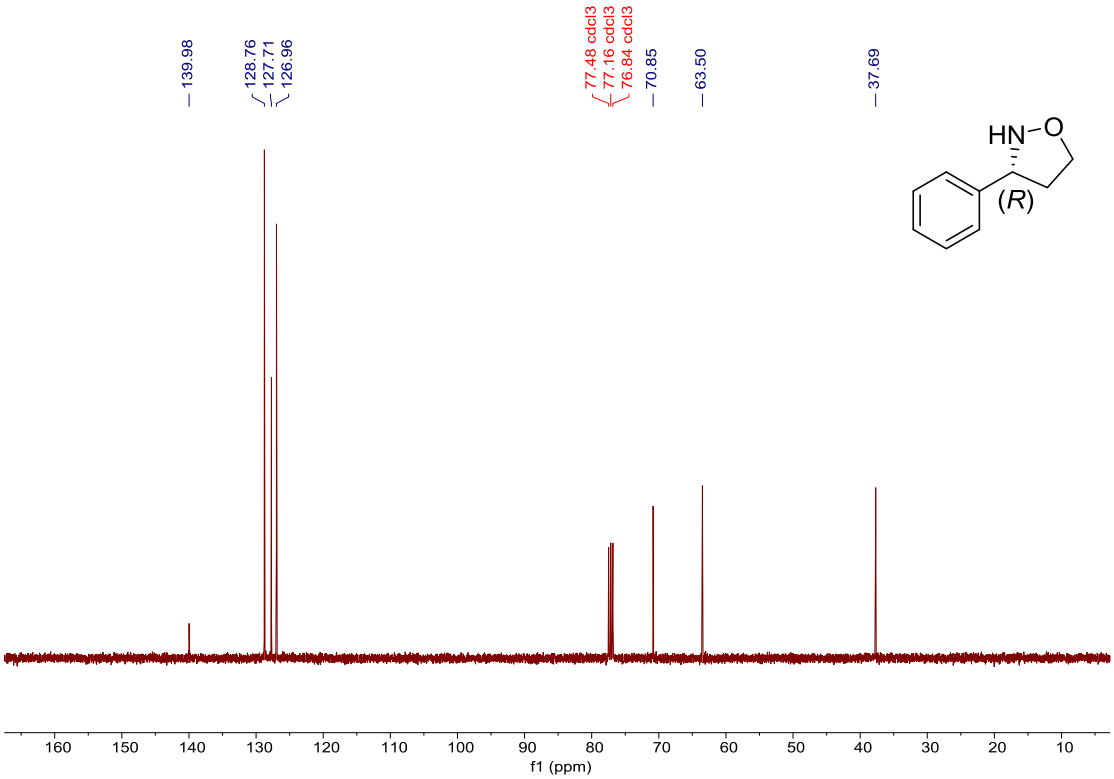
(*R*)-1-phenylpropane-1,3-diol [(*R*)-1f]



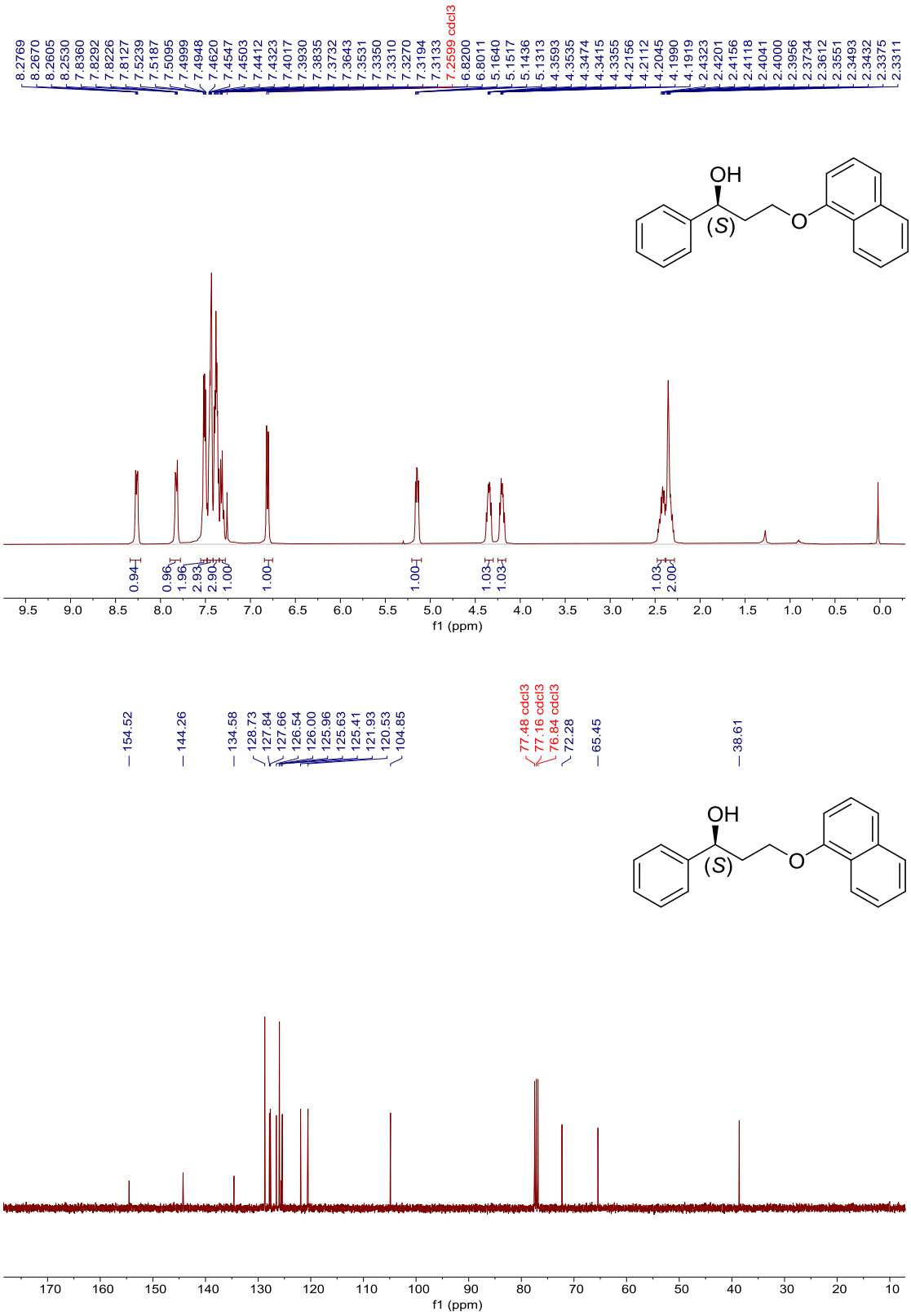


(*R*)-3-phenylisoxazolidine [(*R*)-1aa]

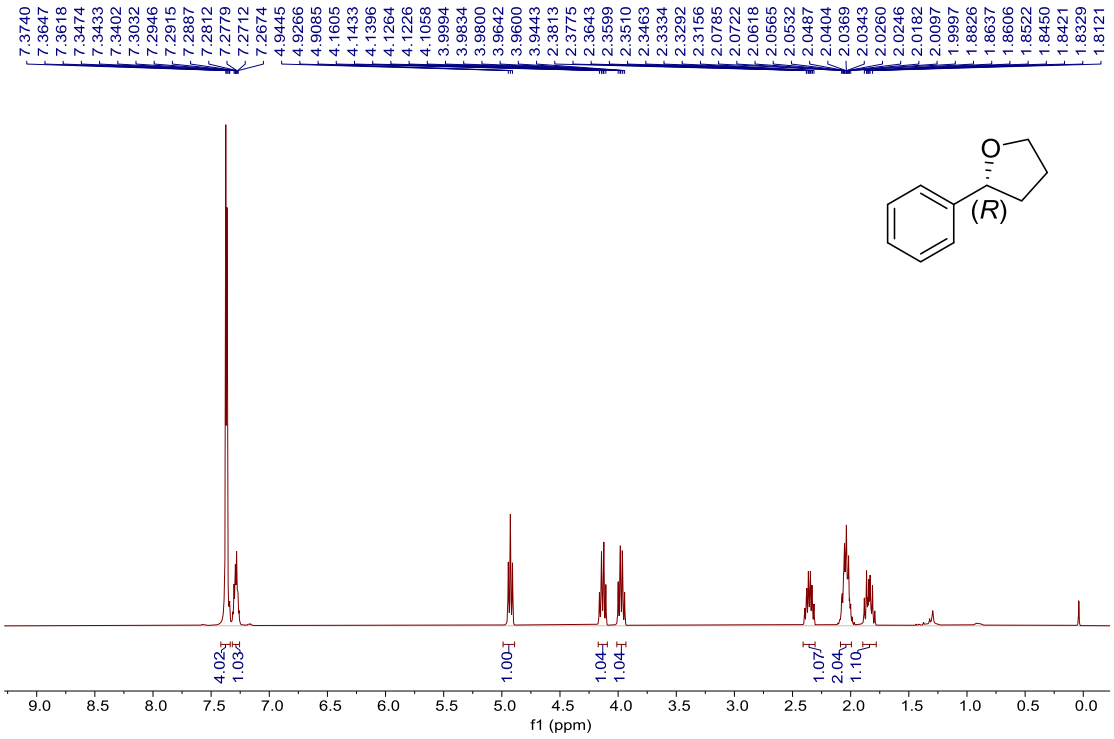


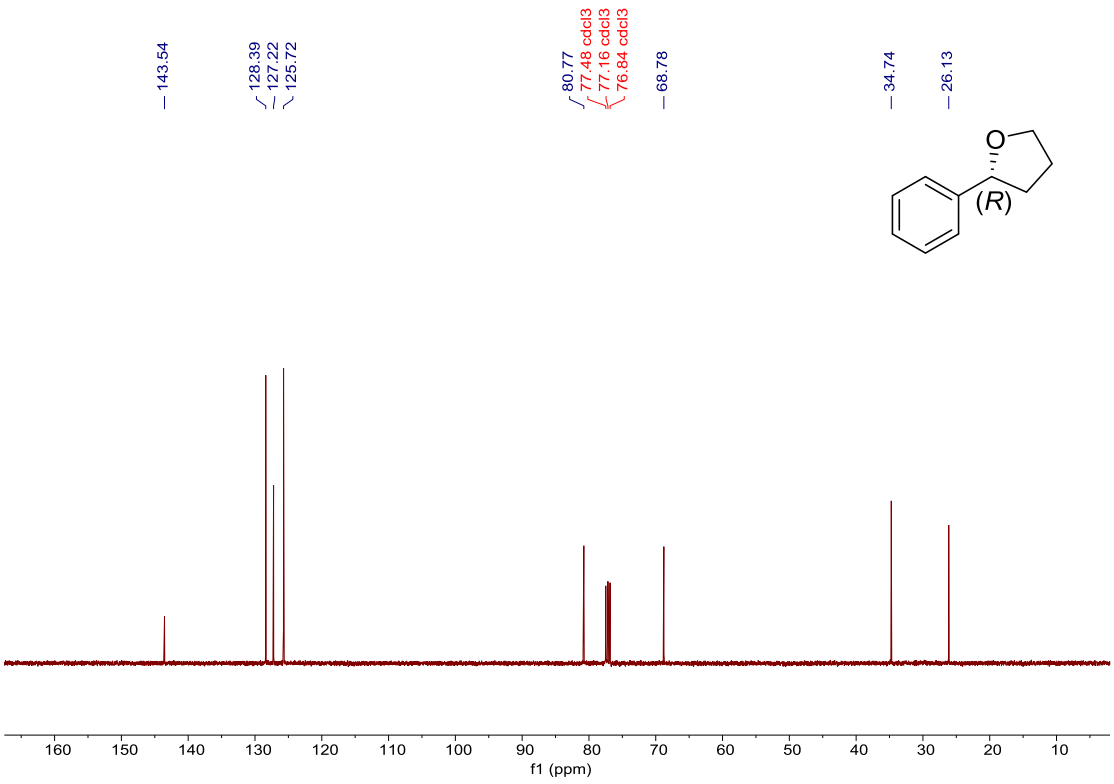


(*S*)-3-(naphthalen-1-yloxy)-1-phenylpropan-1-ol [(*S*)-1ab]

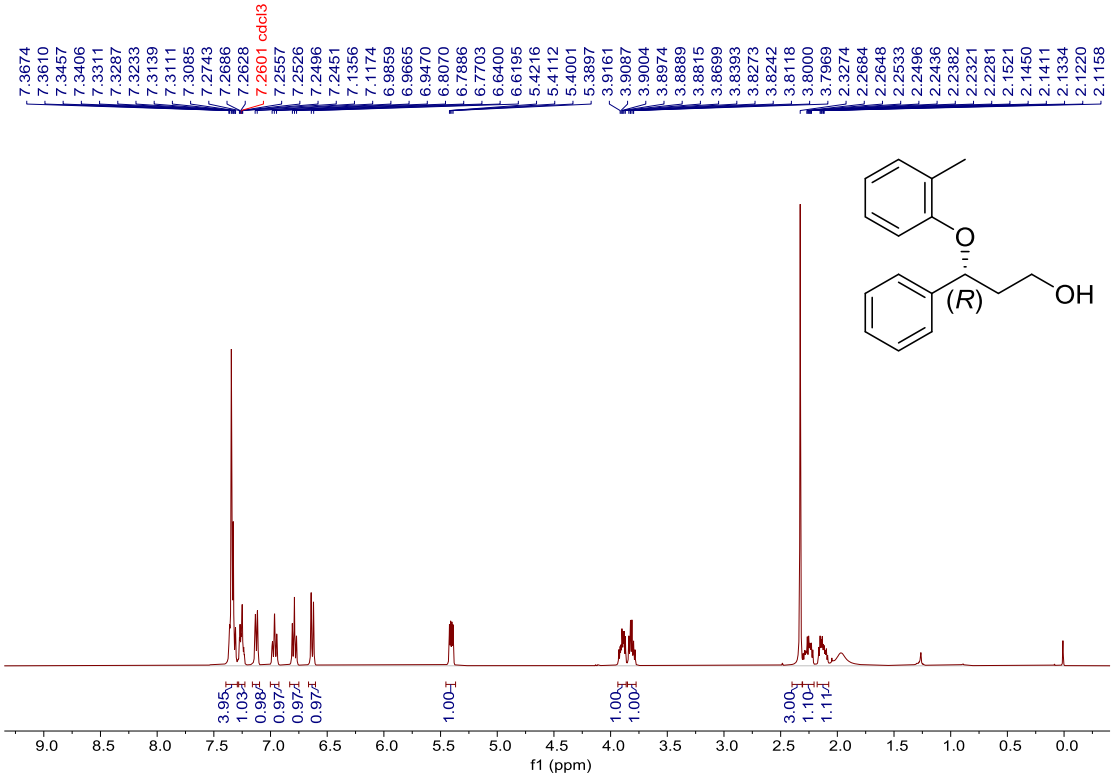


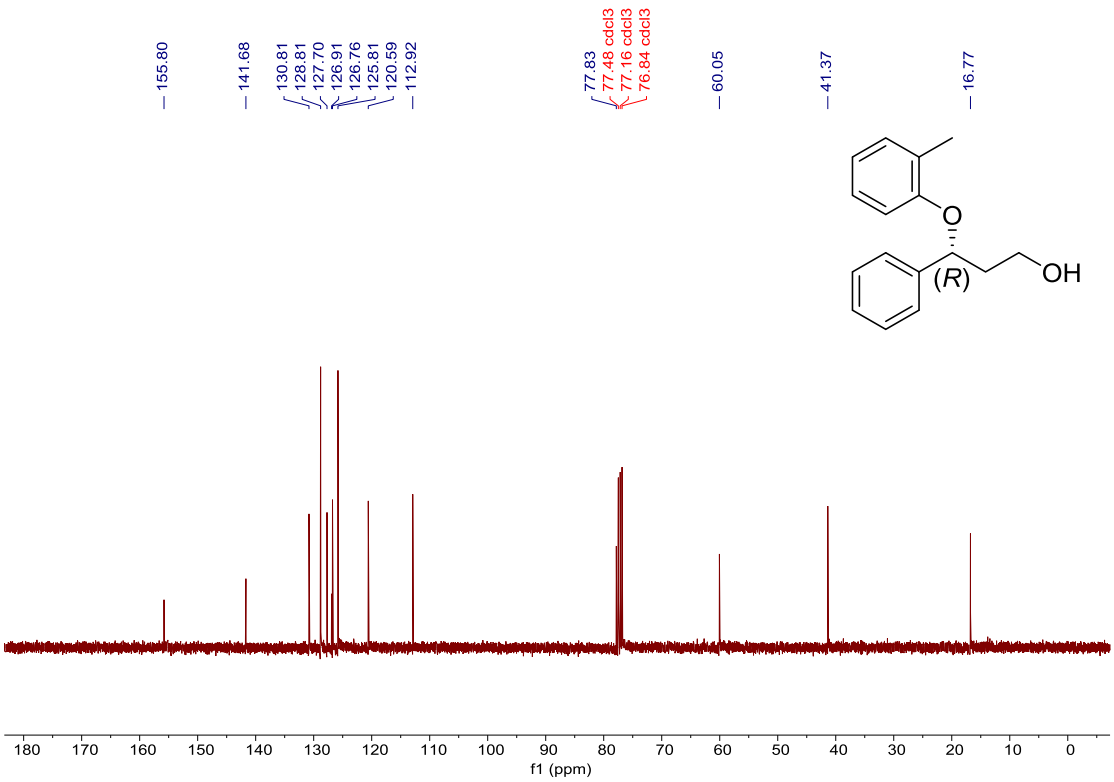
(*R*)-2-phenyltetrahydrofuran [(*R*)-1ba]



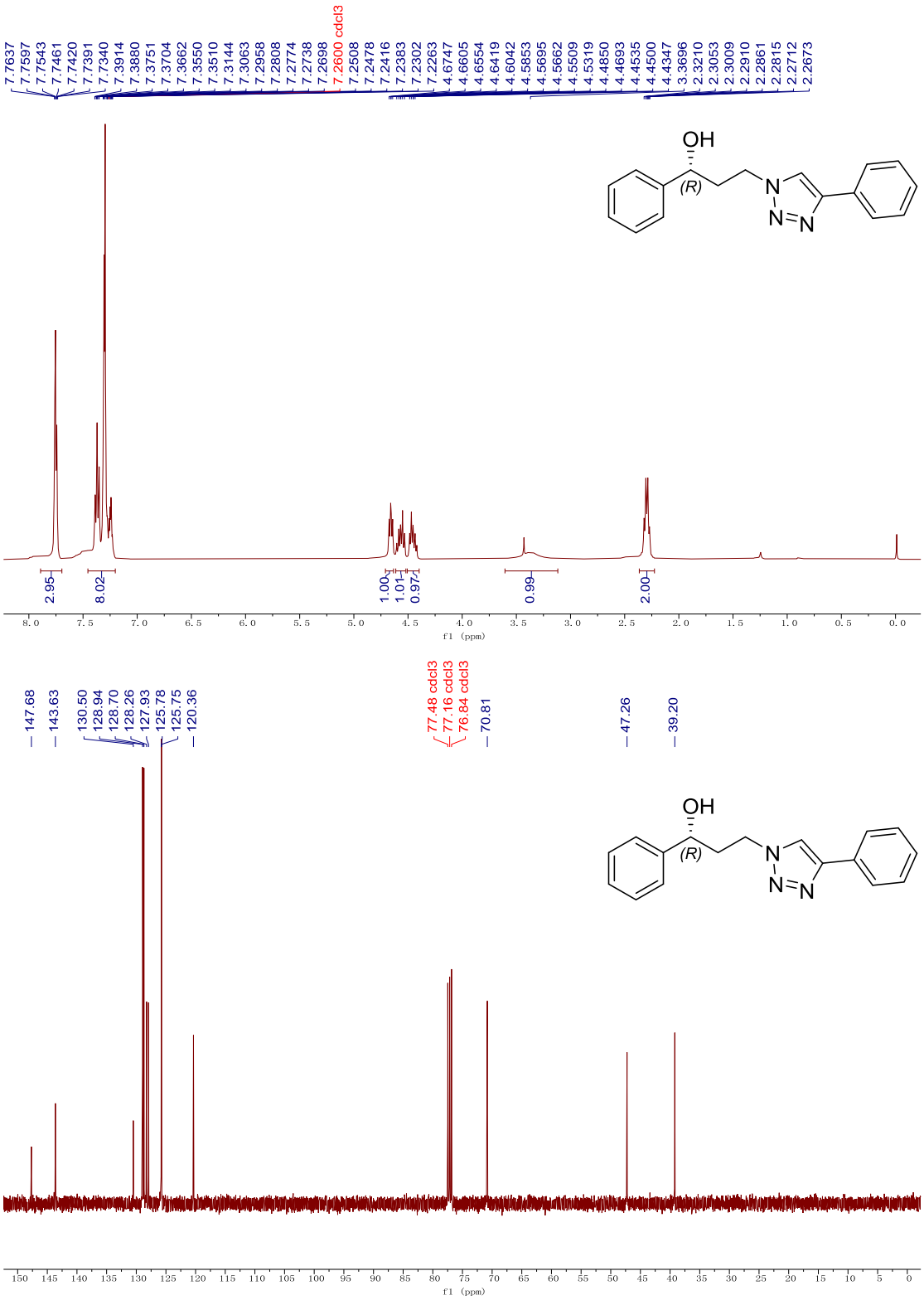


(*R*)-3-phenyl-3-(o-tolyloxy)propan-1-ol [(*R*)-1bb]

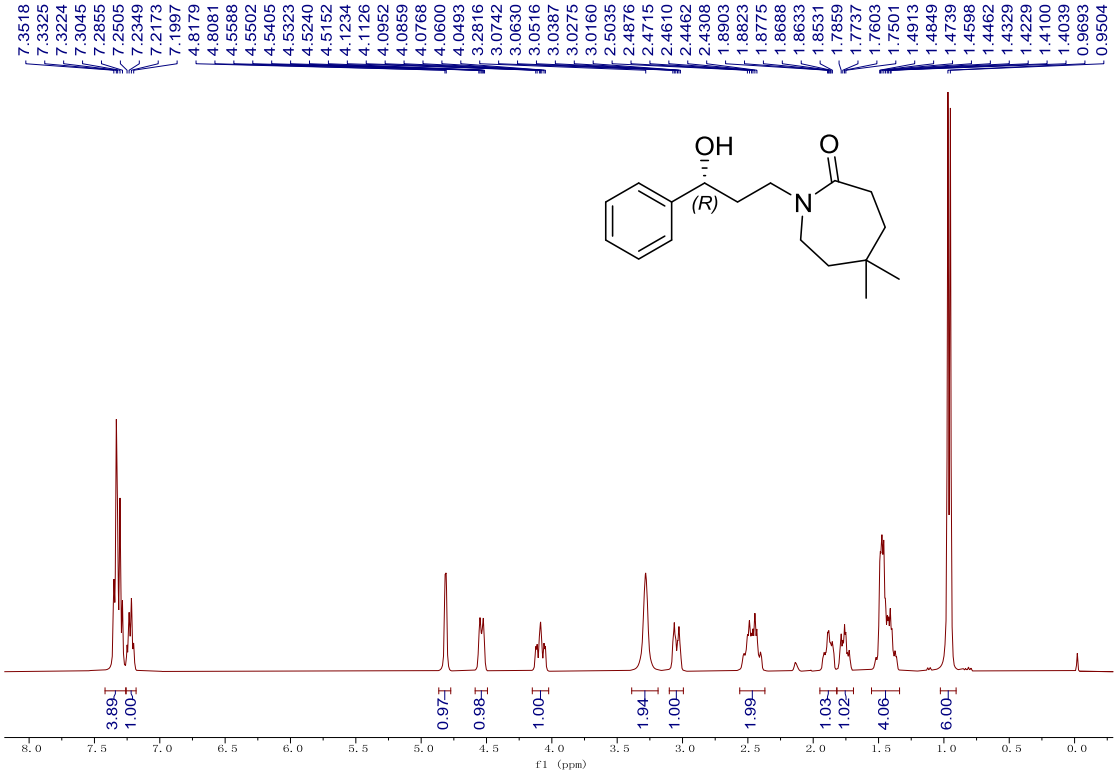


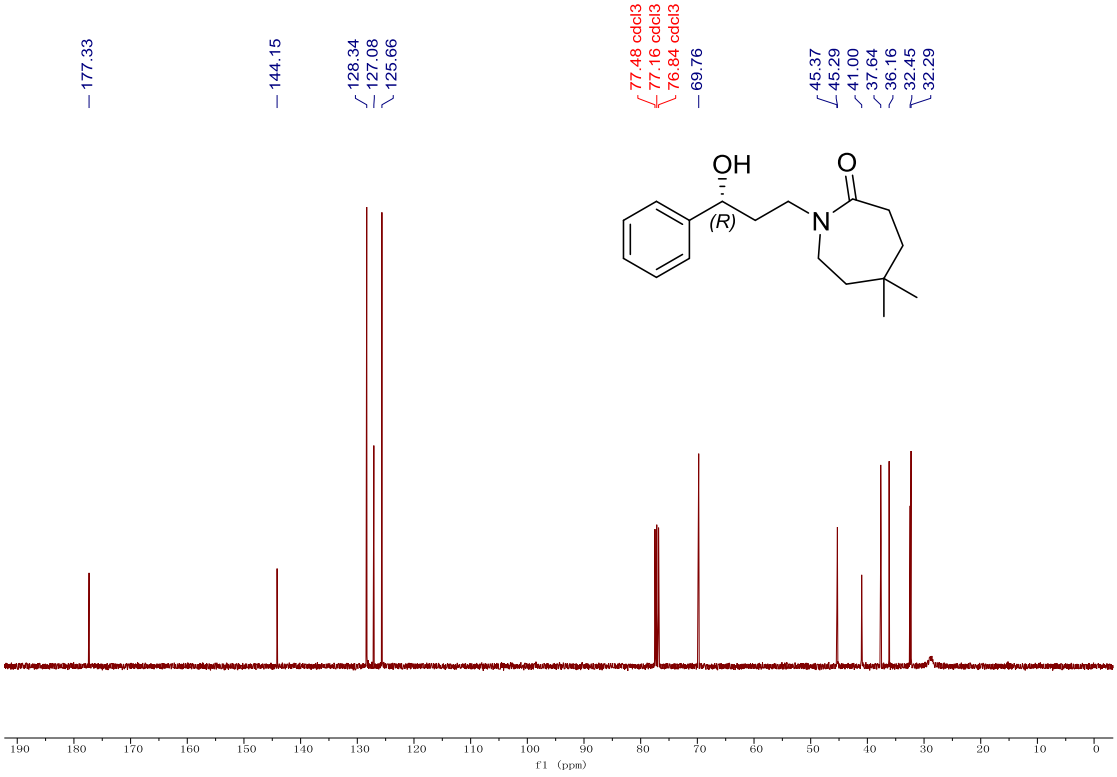


(*R*)-1-phenyl-3-(4-phenyl-1H-1,2,3-triazol-1-yl)propan-1-ol [(*R*)-1ca]

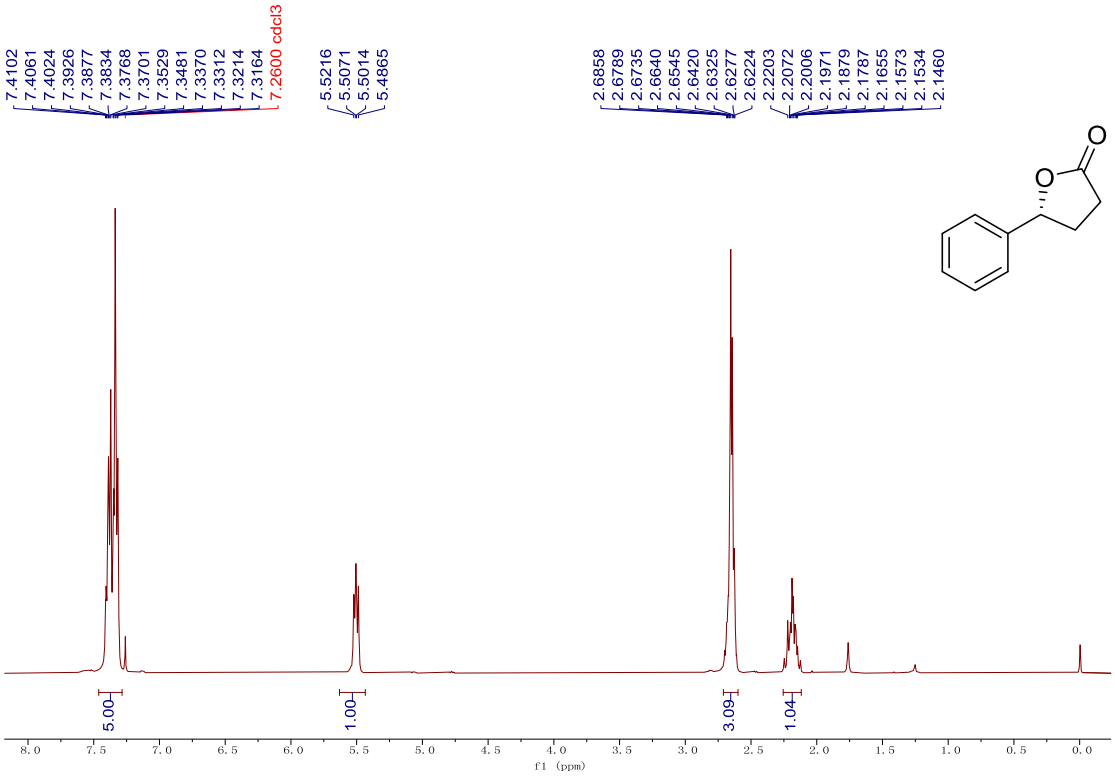


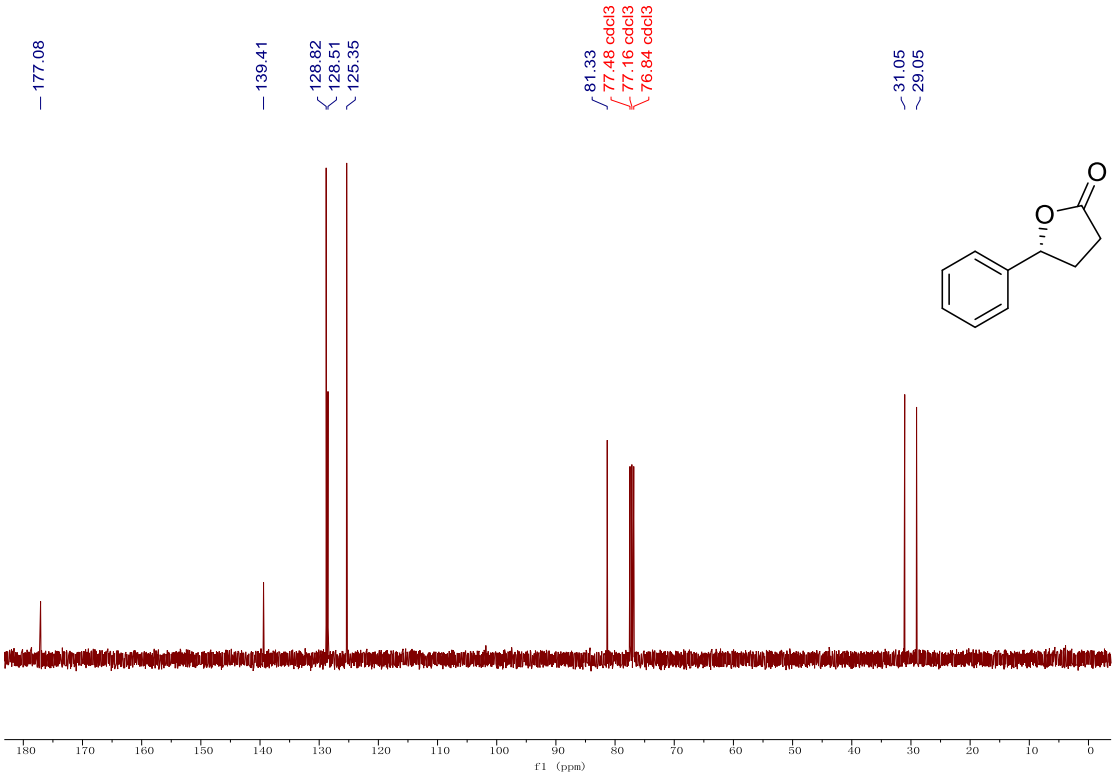
(*R*)-1-(3-hydroxy-3-phenylpropyl)-5,5-dimethylazepan-2-one [(*R*)-1cb]



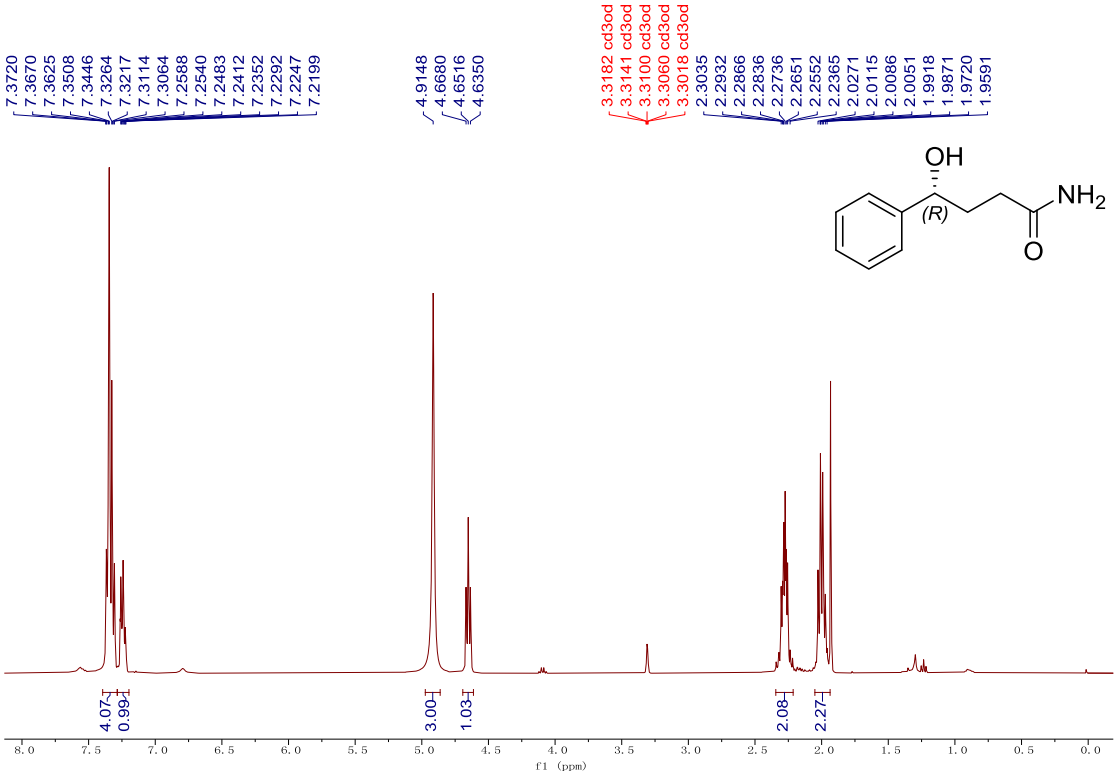


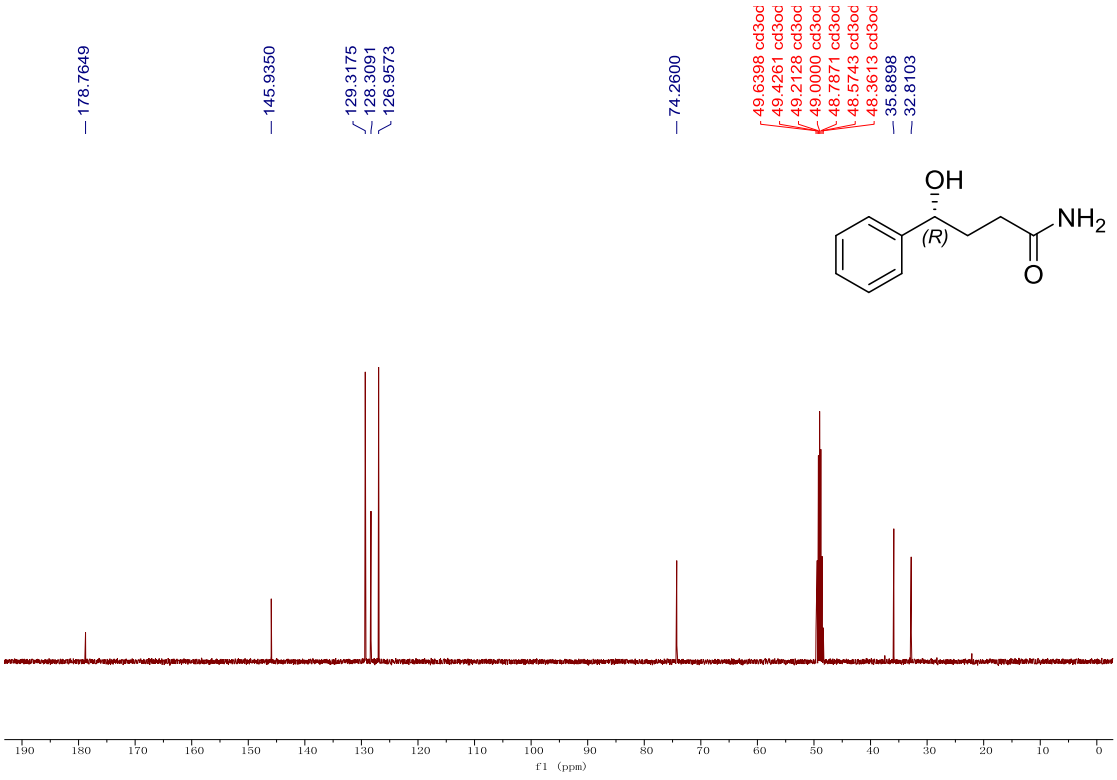
(*R*)-5-phenyldihydrofuran-2(3H)-one [(*R*)-1da]



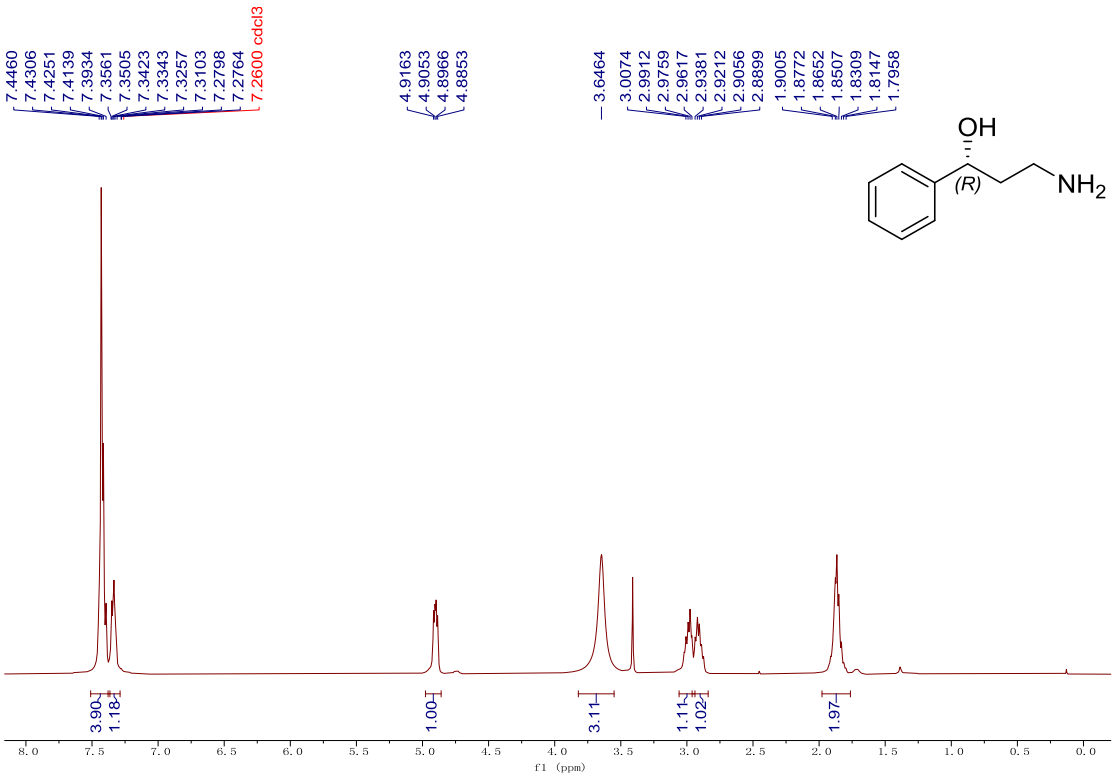


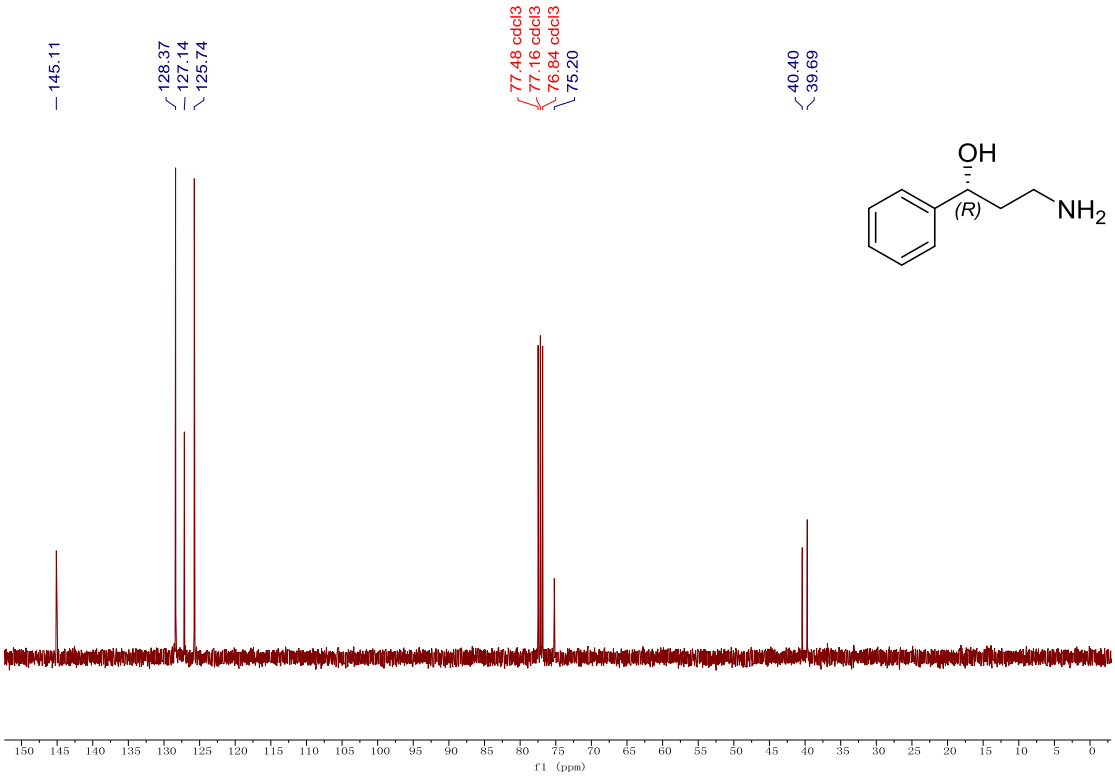
(*R*)-4-hydroxy-4-phenylbutanamide [(*R*)-1db]



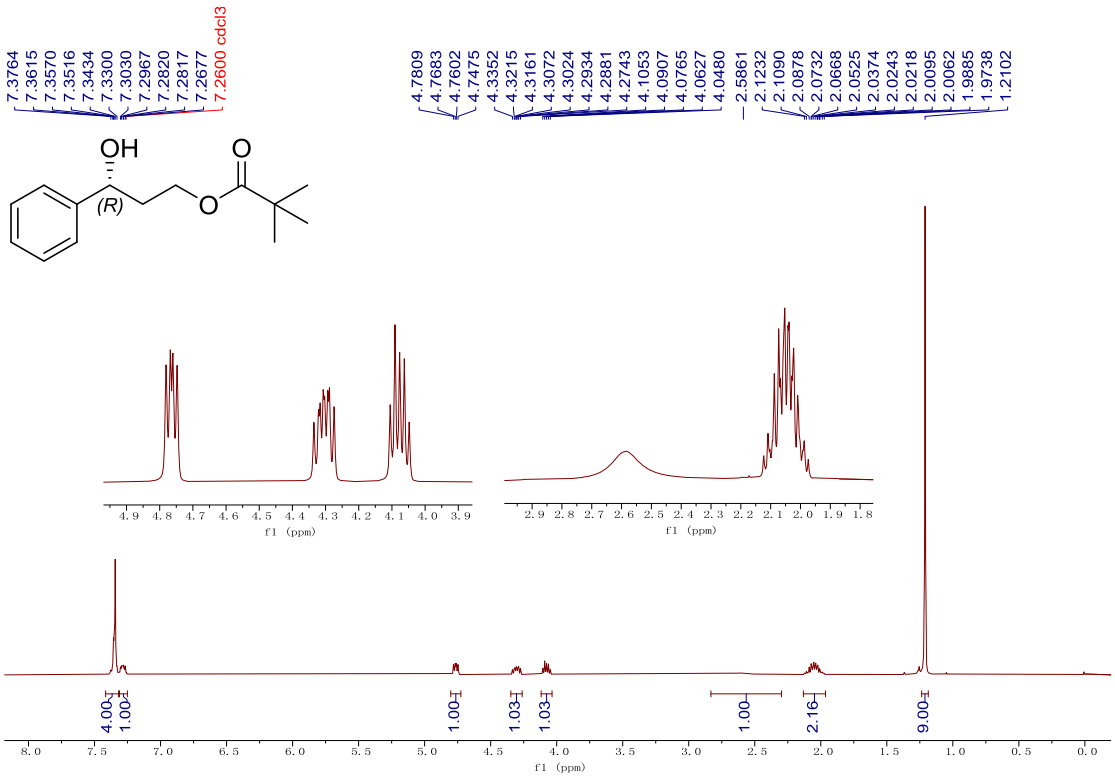


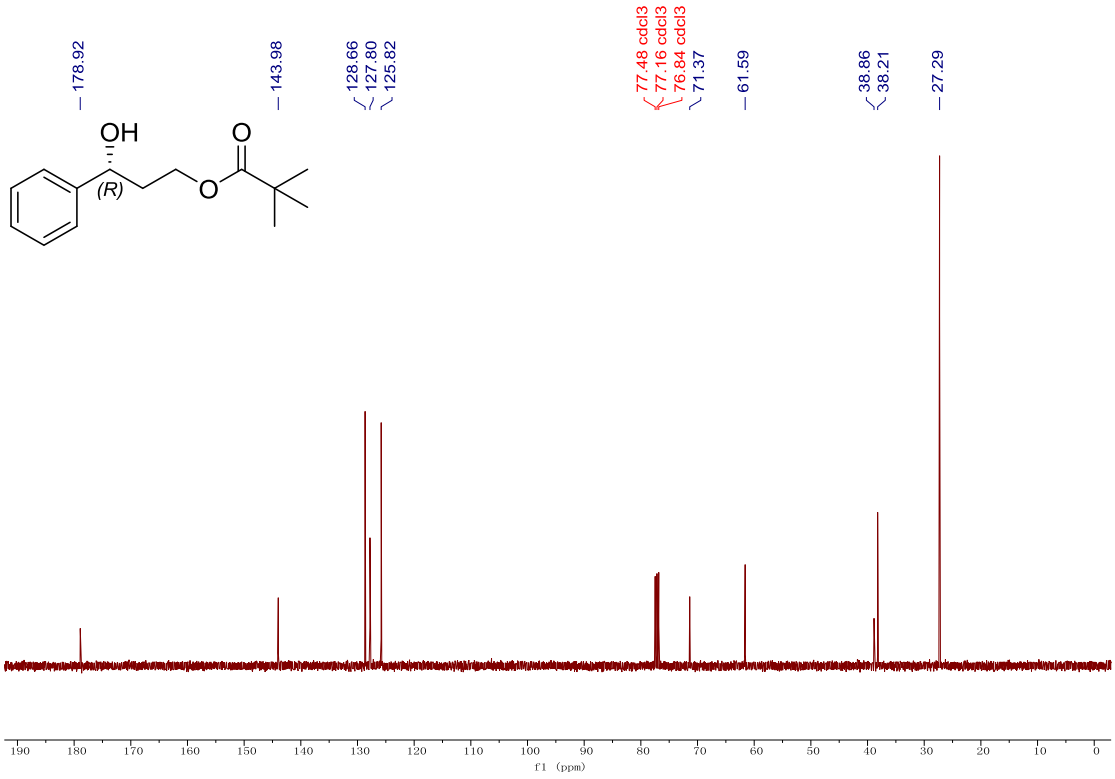
(*R*)-3-amino-1-phenylpropan-1-ol [(*R*)-1ea]





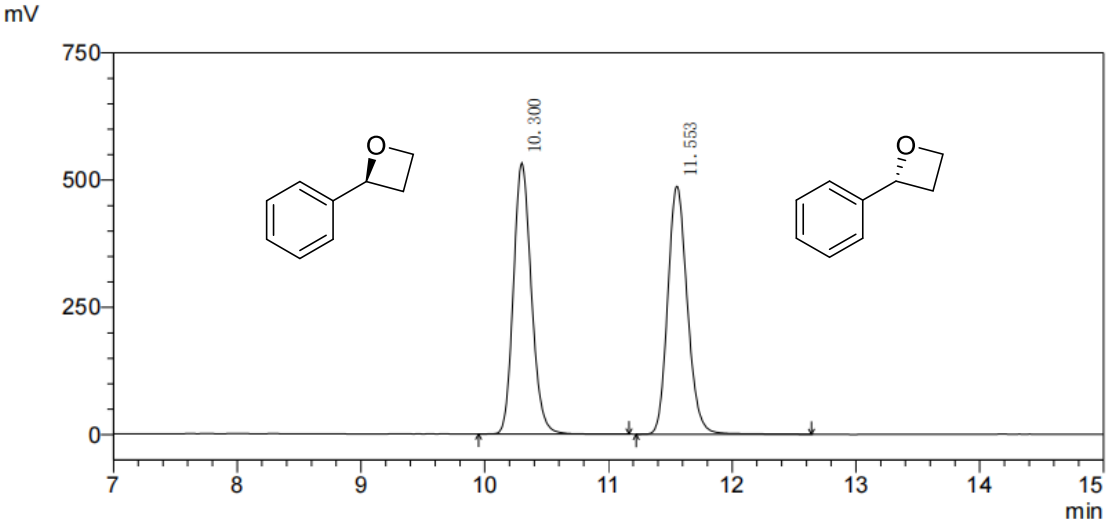
(*R*)-3-hydroxy-3-phenylpropyl pivalate [(*R*)-1fa]





11. Chiral HPLC/GC Traces

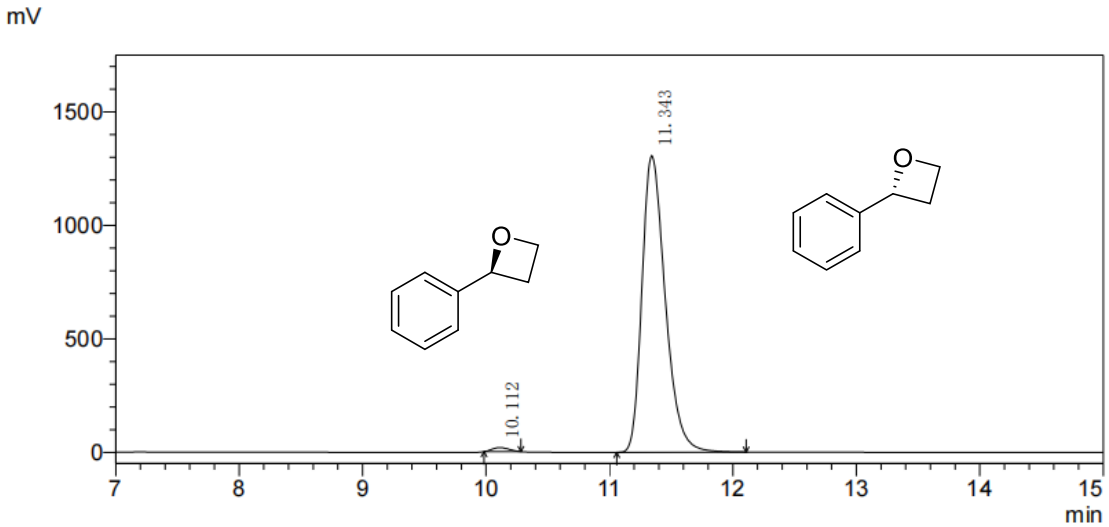
Chemical synthesized (*rac*)-**1b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	10.300	5360586	532422	49.946
2	11.553	5372125	487092	50.054

Enzymatic synthesized (*R*)-**1b**

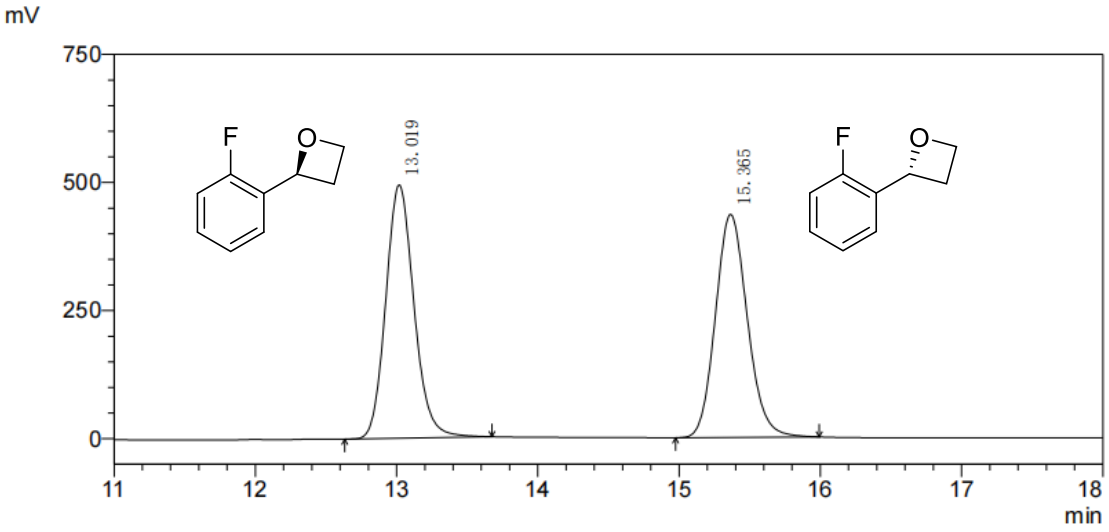


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	10.112	167593	17743	0.969
2	11.343	17132548	1306991	99.031

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/i-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 10.1 min, $t_{(R)}$ = 11.3 min.

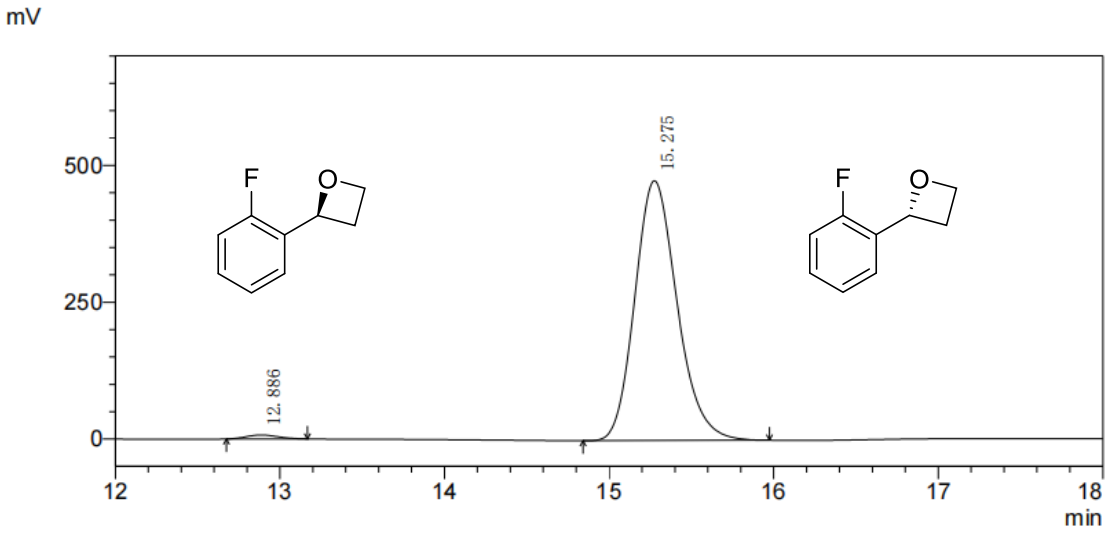
Chemical synthesized (*rac*)-**2b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	13.019	6873612	494730	50.145
2	15.365	6833943	435465	49.855

Enzymatic synthesized (*R*)-**2b**

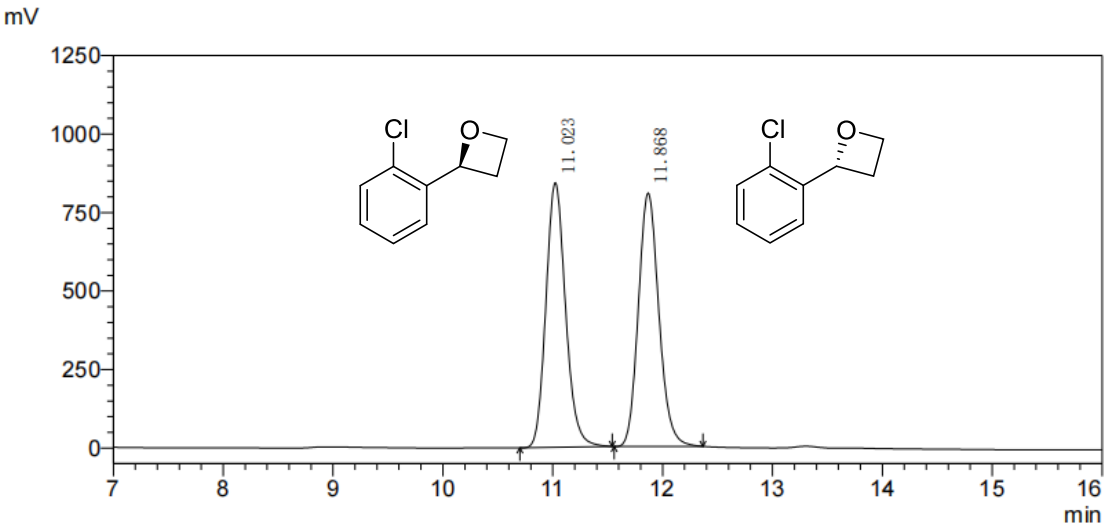


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	12.886	97710	7238	1.141
2	15.275	8467016	474839	98.859

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/i-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 12.9 min, $t_{(R)}$ = 15.3 min.

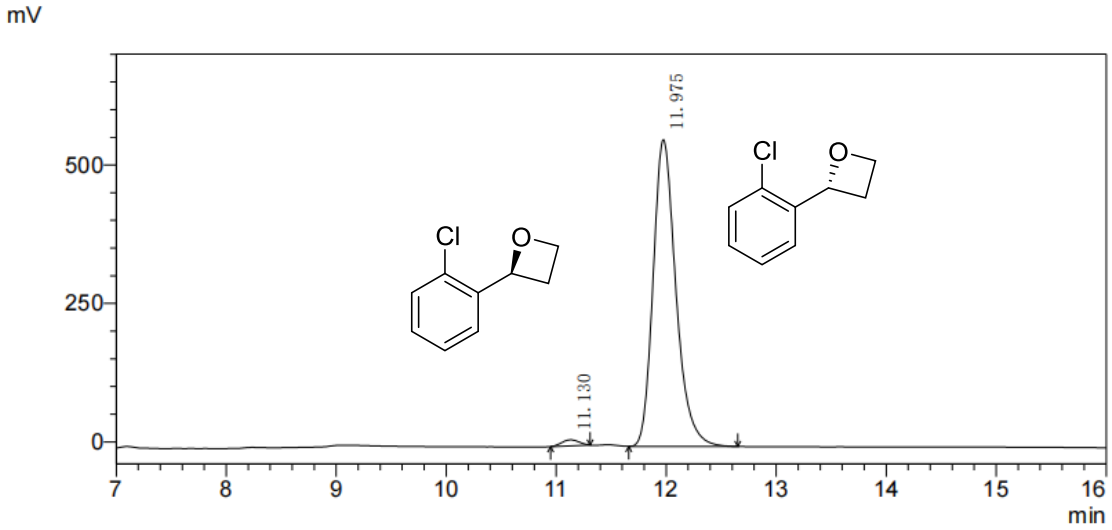
Chemical synthesized (*rac*)-**3b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	11.023	10477966	842802	50.015
2	11.868	10471835	807073	49.985

Enzymatic synthesized (*R*)-**3b**

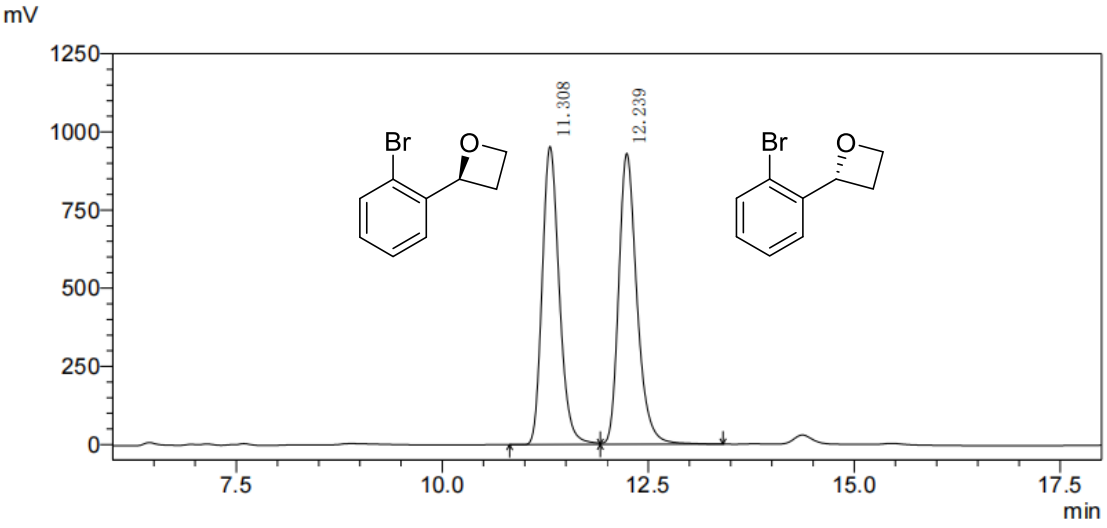


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	11.130	118531	10775	1.463
2	11.975	7981297	553990	98.537

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/i-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 11.1 min, $t_{(R)}$ = 12.0 min.

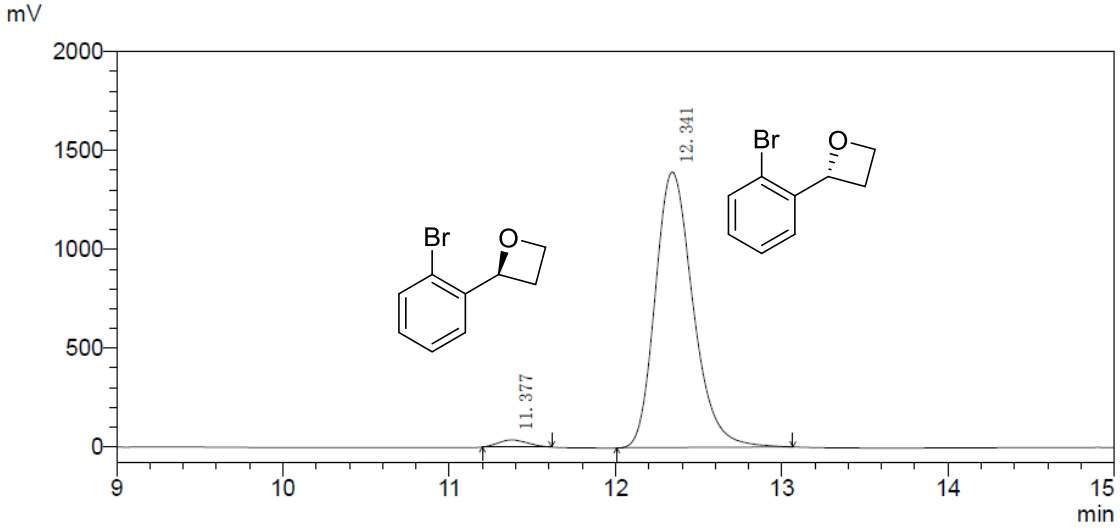
Chemical synthesized (*rac*)-**4b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	11.308	13680017	952846	48.911
2	12.239	14289030	930444	51.089

Enzymatic synthesized (*R*)-**4b**

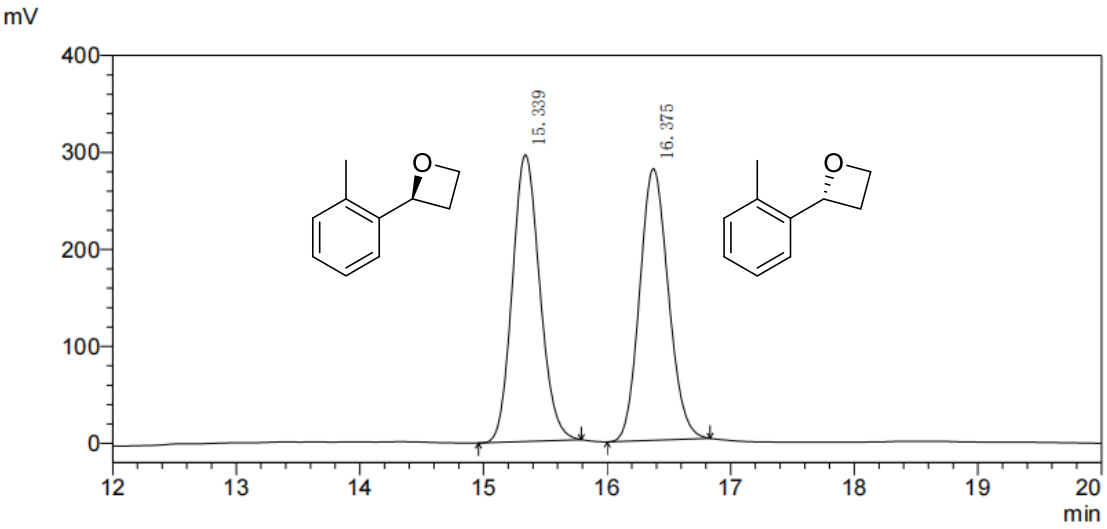


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	11.377	435422	35585	1.935
2	12.341	22070085	1395365	98.065

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/i-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 11.4 min, $t_{(R)}$ = 12.3 min.

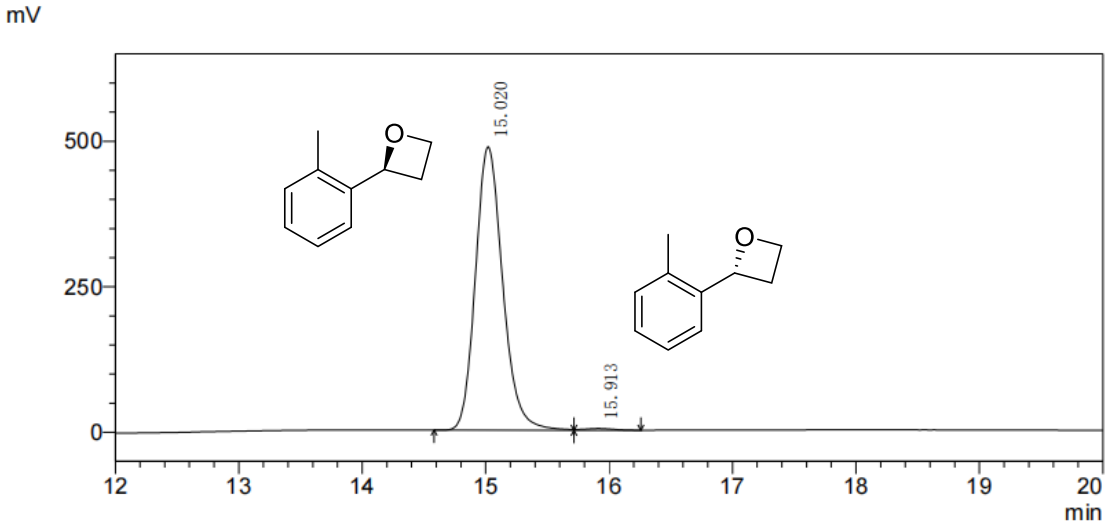
Chemical synthesized (*rac*)-**5b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.339	4557692	295629	50.171
2	16.375	4526543	280296	49.829

Enzymatic synthesized (*R*)-**5b**

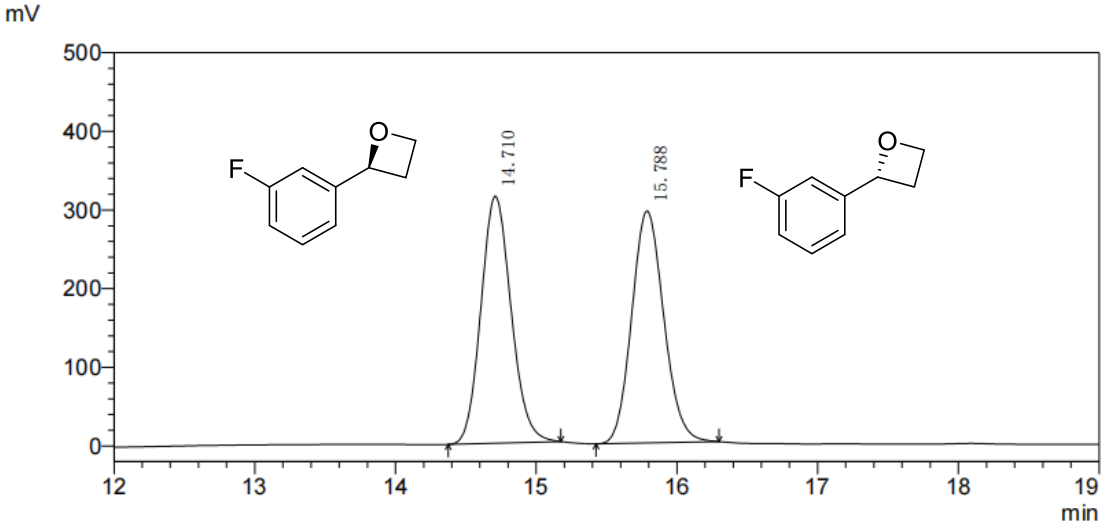


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.020	7469458	486657	99.376
2	15.913	46869	2909	0.624

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/i-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(R)}$ = 15.0 min, $t_{(S)}$ = 15.9 min.

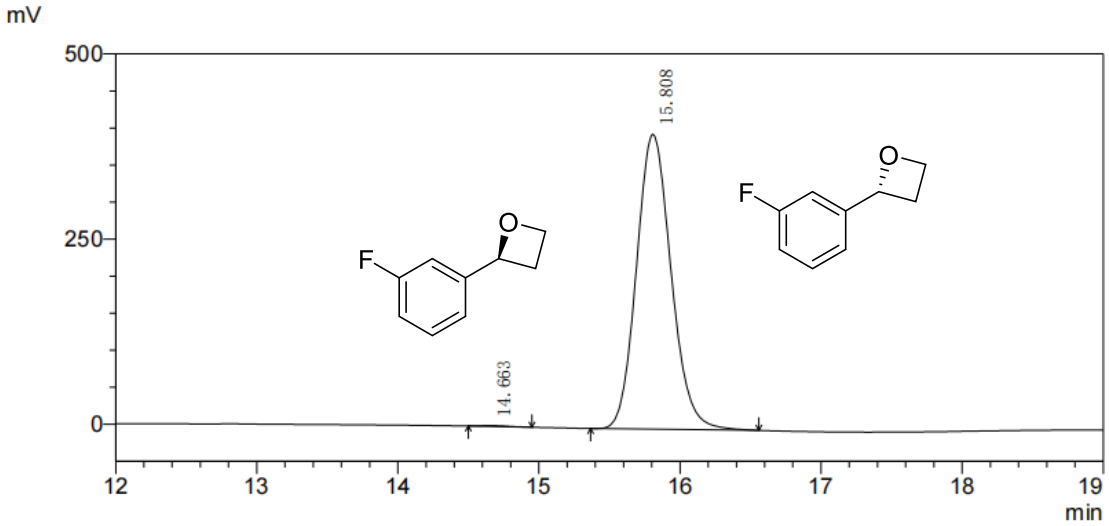
Chemical synthesized (*rac*)-**6b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.710	4685654	314313	50.058
2	15.788	4674777	294836	49.942

Enzymatic synthesized (*R*)-**6b**

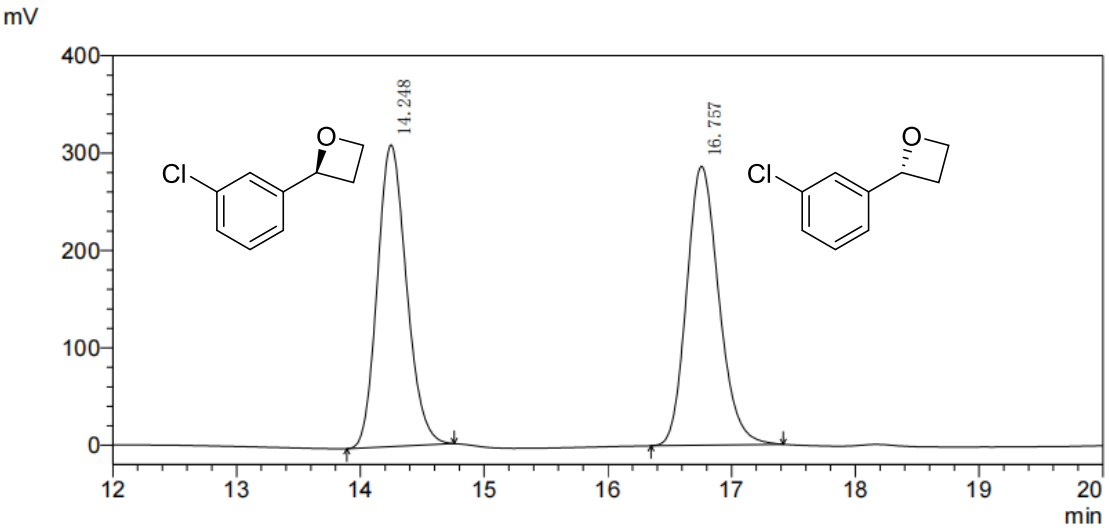


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.663	13409	987	0.197
2	15.808	6797786	398108	99.803

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/i-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 14.7 min, $t_{(R)}$ = 15.8 min.

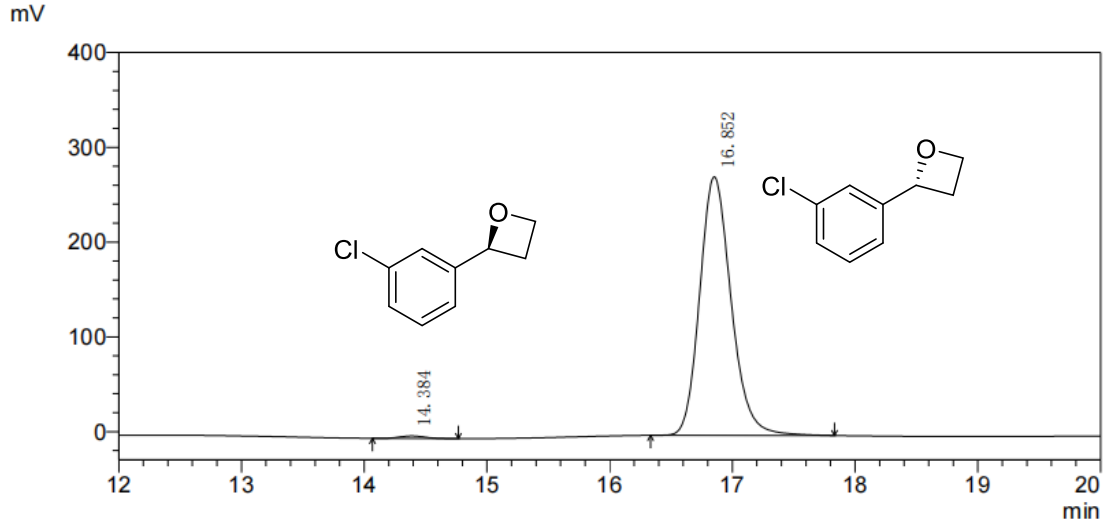
Chemical synthesized (*rac*)-**7b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.248	5071931	309698	49.402
2	16.757	5194628	286570	50.598

Enzymatic synthesized (*R*)-**7b**

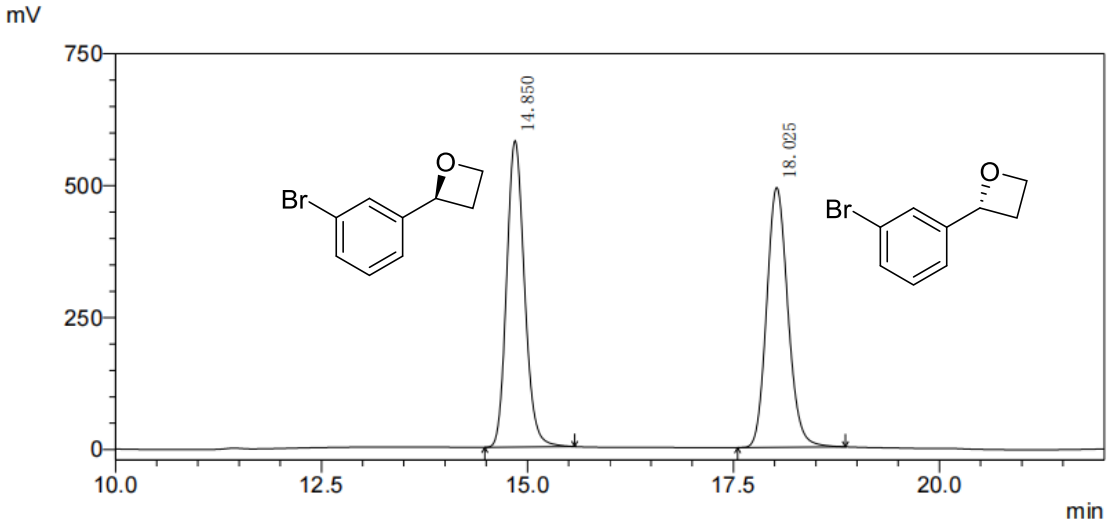


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.384	38653	2672	0.789
2	16.852	4862444	272960	99.211

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/i-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 14.4 min, $t_{(R)}$ = 16.9 min.

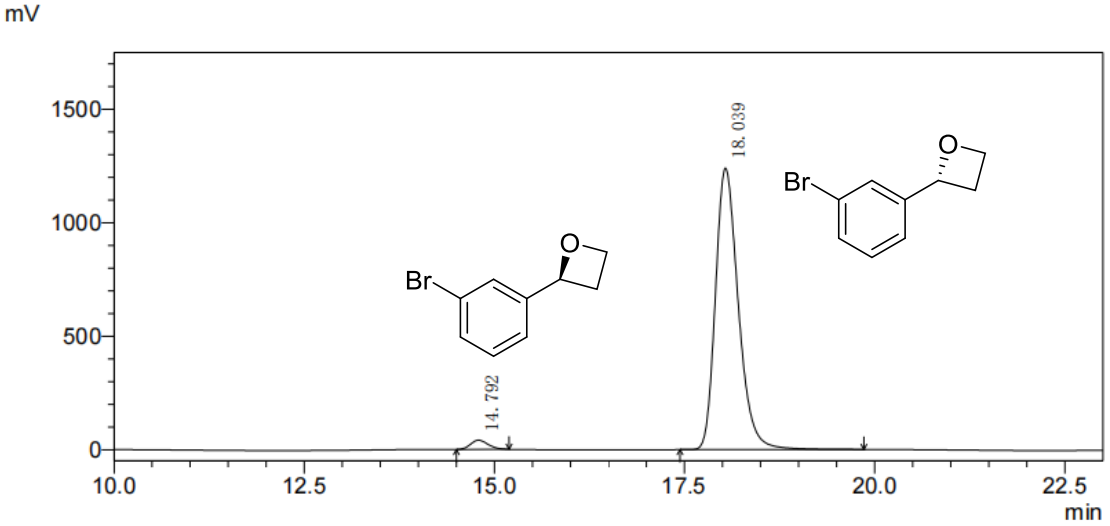
Chemical synthesized (*rac*)-**8b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.850	8738172	580656	49.772
2	18.025	8818386	492475	50.228

Enzymatic synthesized (*R*)-**8b**

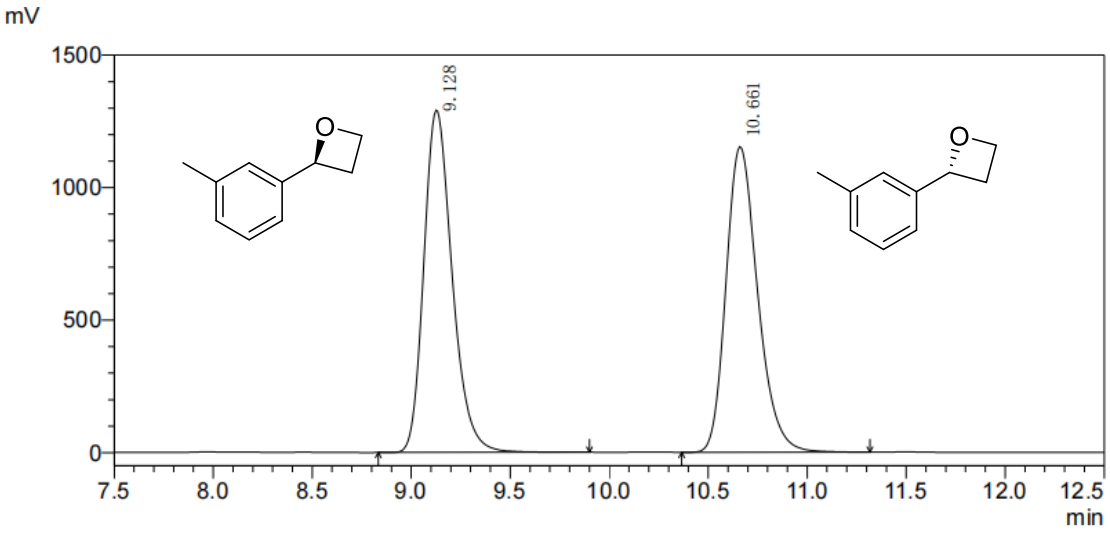


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.792	651484	40578	2.453
2	18.039	25907514	1240476	97.547

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/i-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 14.8 min, $t_{(R)}$ = 18.0 min.

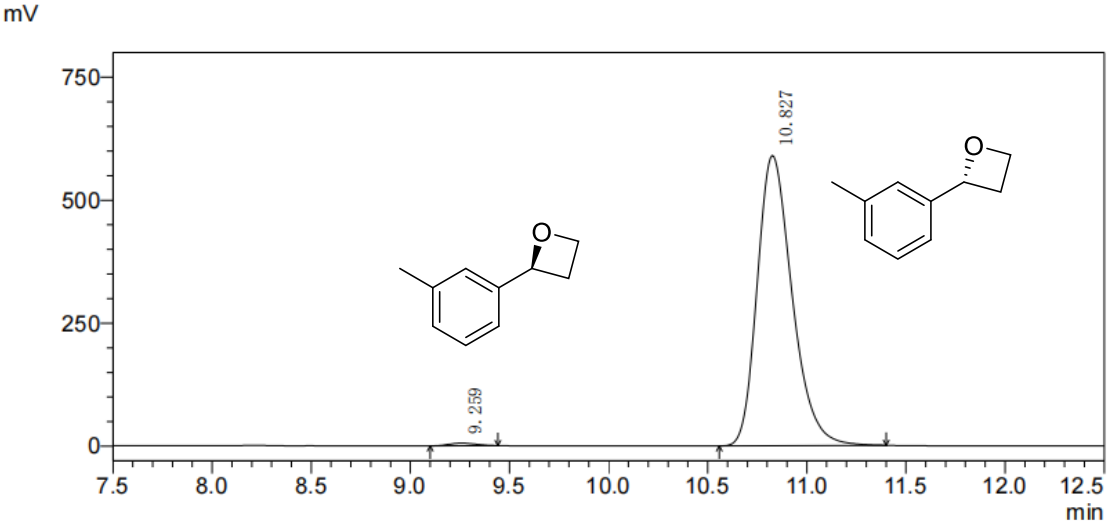
Chemical synthesized (*rac*)-**9b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	9.128	12828043	1292176	49.921
2	10.661	12868475	1153061	50.079

Enzymatic synthesized (*R*)-**9b**

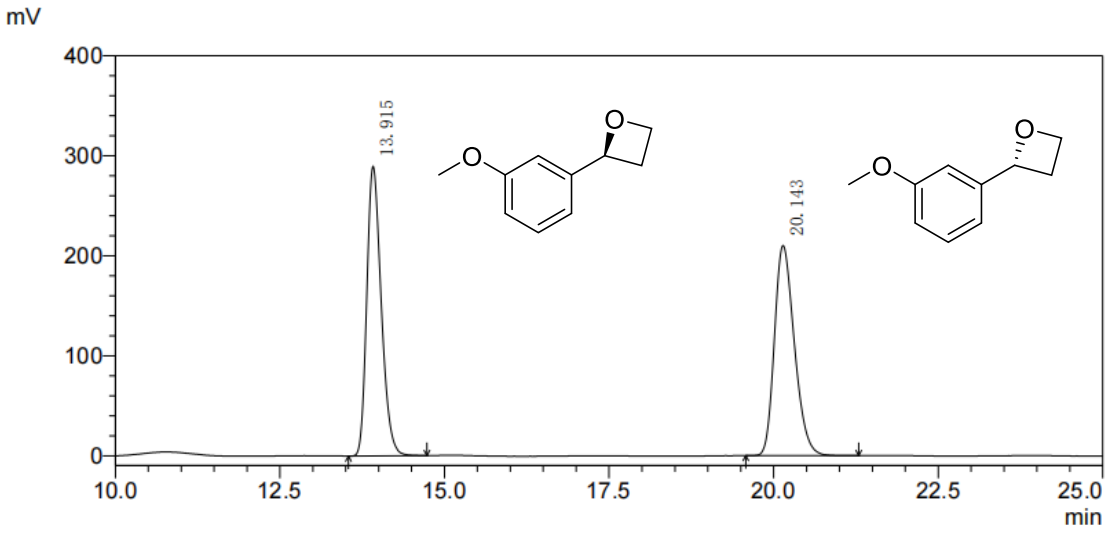


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	9.259	51142	5351	0.704
2	10.827	7214380	590021	99.296

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/i-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 9.3 min, $t_{(R)}$ = 10.8 min.

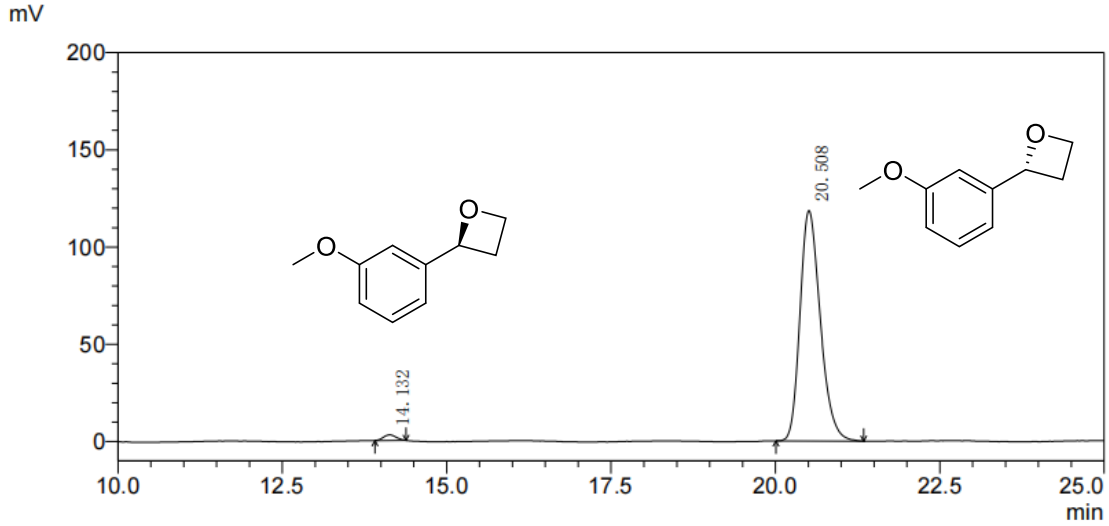
Chemical synthesized (*rac*)-**10b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	13.915	4392816	289673	49.937
2	20.143	4403967	210165	50.063

Enzymatic synthesized (*R*)-**10b**

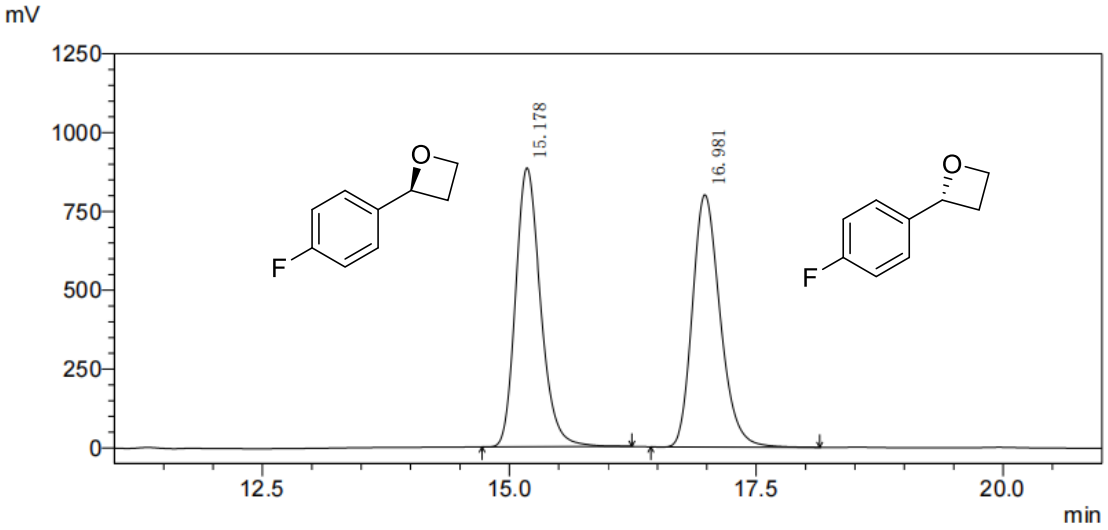


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.132	39118	2913	1.512
2	20.508	2547915	118524	98.488

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/i-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 14.1 min, $t_{(R)}$ = 20.5 min.

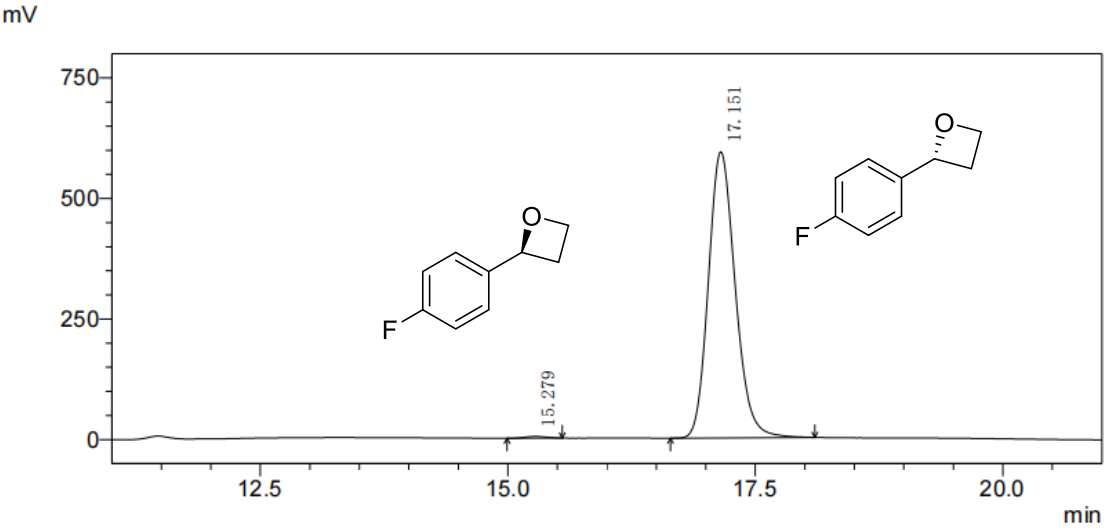
Chemical synthesized (*rac*)-**11b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.178	15574056	884420	49.968
2	16.981	15594051	800141	50.032

Enzymatic synthesized (*R*)-**11b**

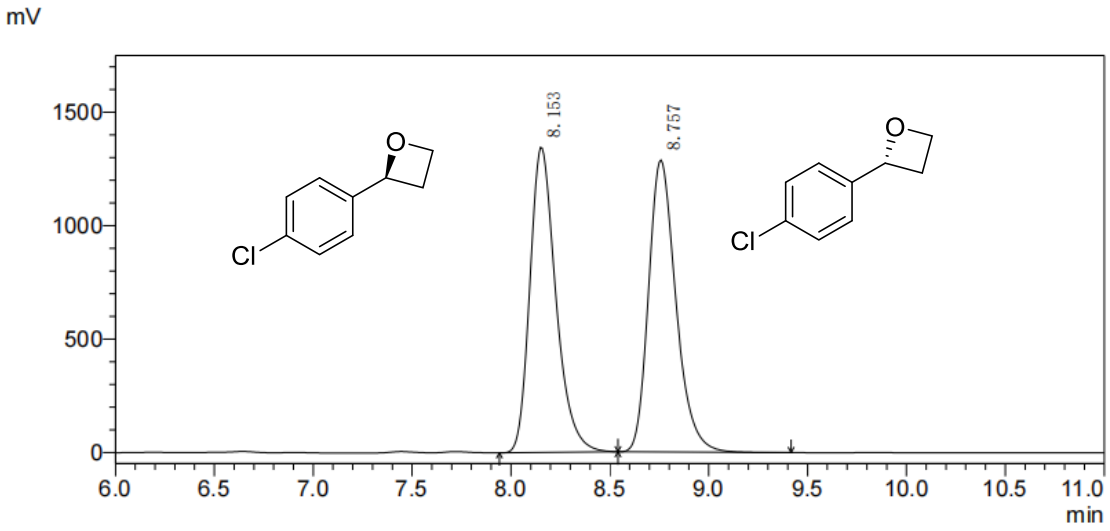


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.279	53961	3636	0.481
2	17.151	11156067	593498	99.519

Chiral HPLC analysis: Diacel Chiralpak OX-3, n-hexane/i-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 15.3 min, $t_{(R)}$ = 17.2 min.

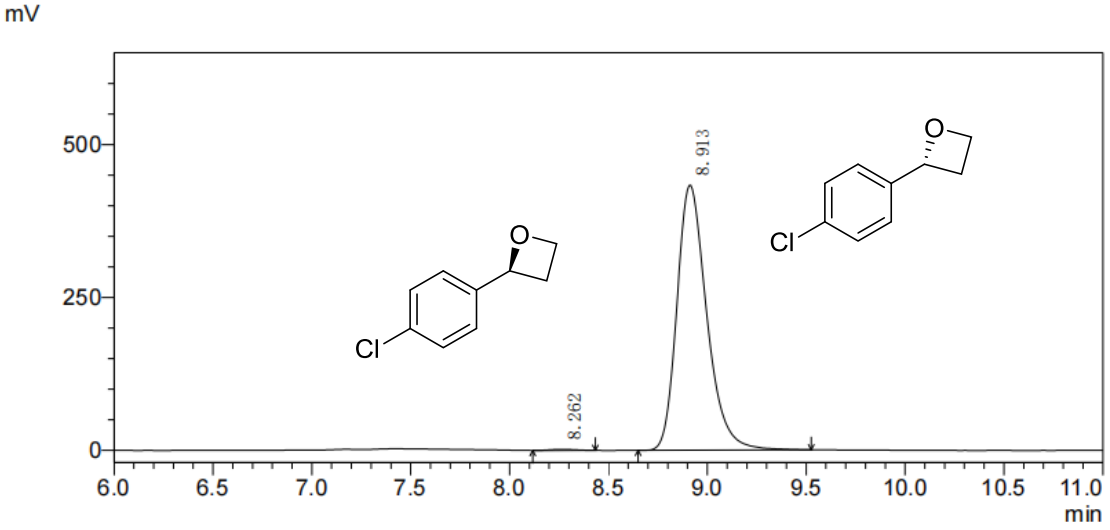
Chemical synthesized (*rac*)-**12b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	8.153	12371846	1346303	49.976
2	8.757	12383649	1287291	50.024

Enzymatic synthesized (*R*)-**12b**

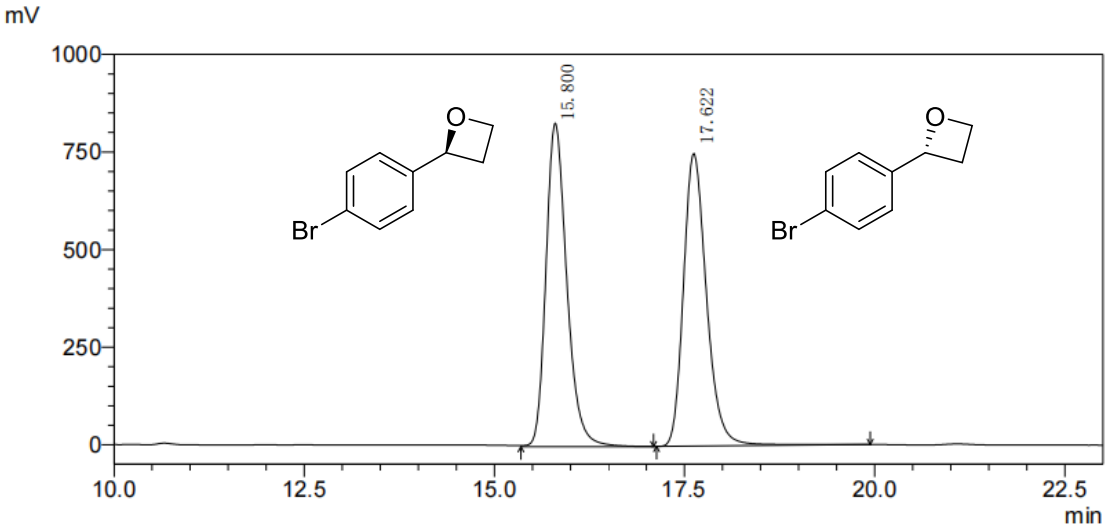


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	8.262	14945	1670	0.327
2	8.913	4557735	432774	99.673

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/i-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 8.3 min, $t_{(R)}$ = 8.9 min.

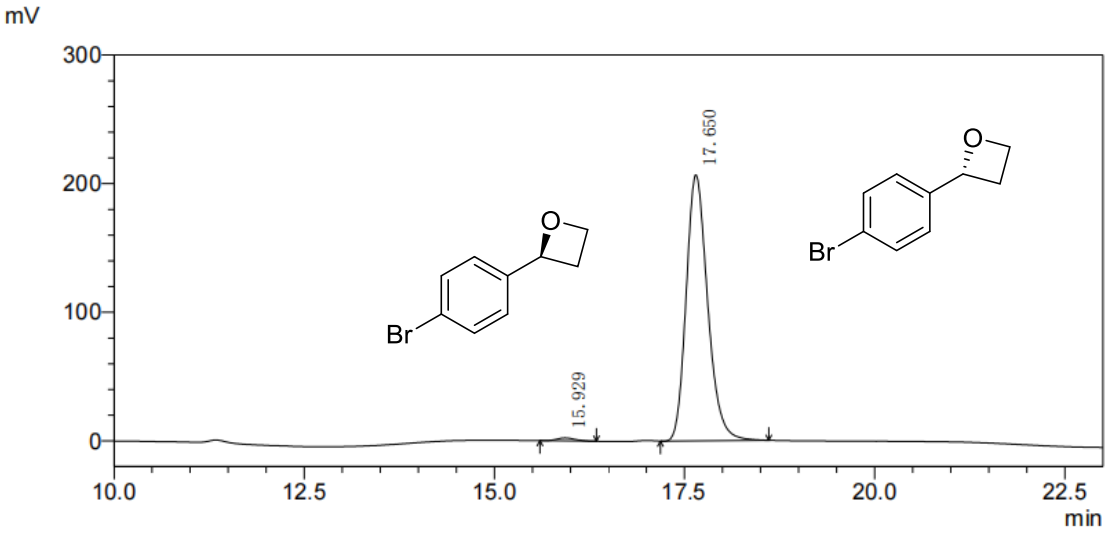
Chemical synthesized (*rac*)-**13b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.800	15794861	828061	49.964
2	17.622	15817622	749364	50.036

Enzymatic synthesized (*R*)-**13b**

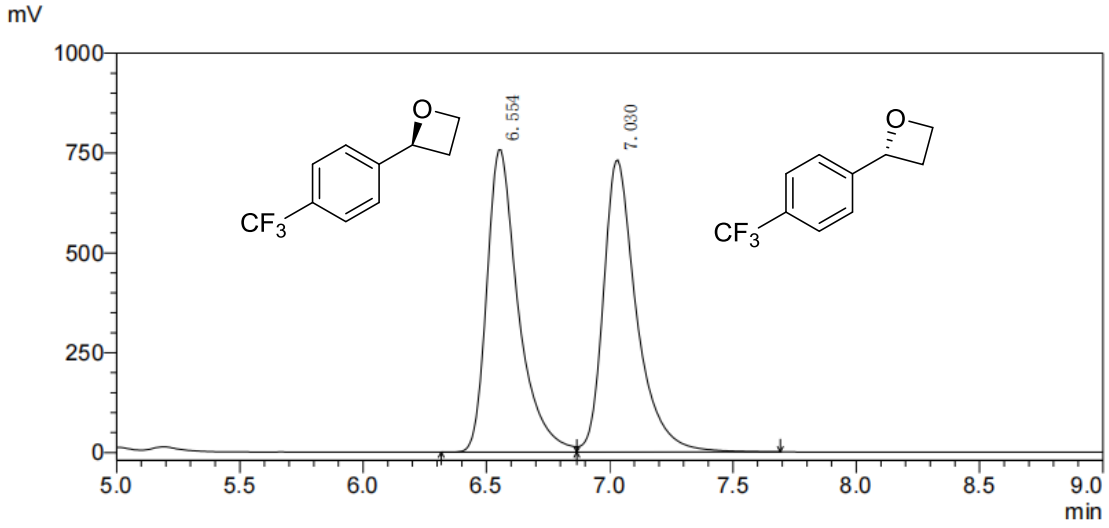


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.929	40308	2366	0.981
2	17.650	4066469	206855	99.019

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/i-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 15.9 min, $t_{(R)}$ = 17.7 min.

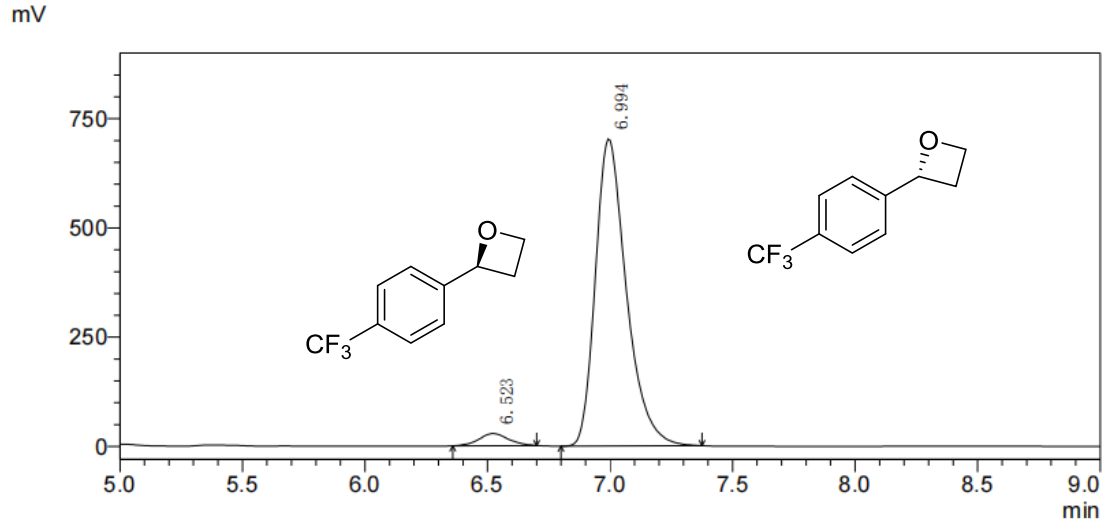
Chemical synthesized (*rac*)-**14b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	6.554	6706285	757087	49.538
2	7.030	6831275	731356	50.462

Enzymatic synthesized (*R*)-**14b**

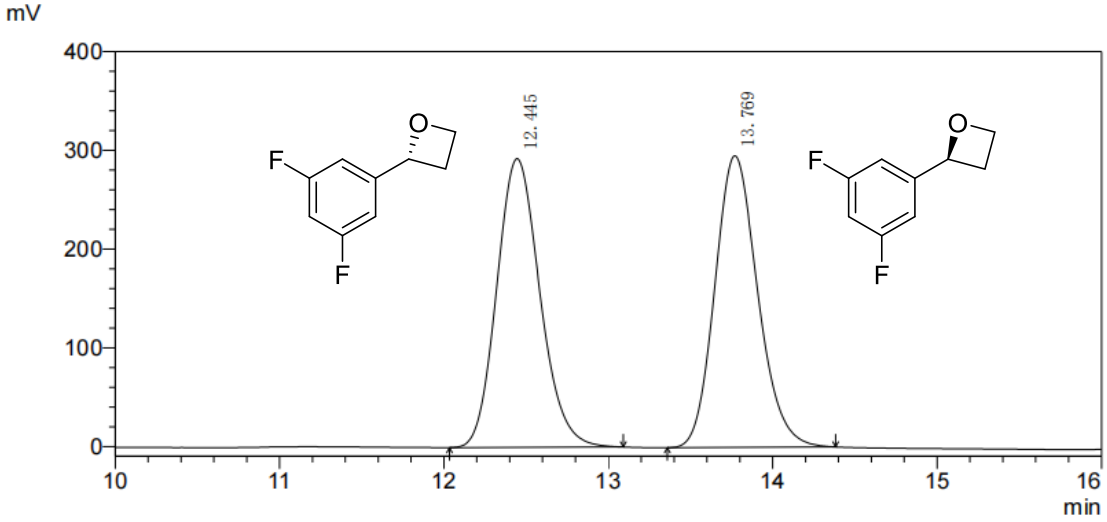


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	6.523	234064	27946	3.641
2	6.994	6194052	702525	96.359

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm. $t_{(S)}$ = 6.5 min, $t_{(R)}$ = 7.0 min.

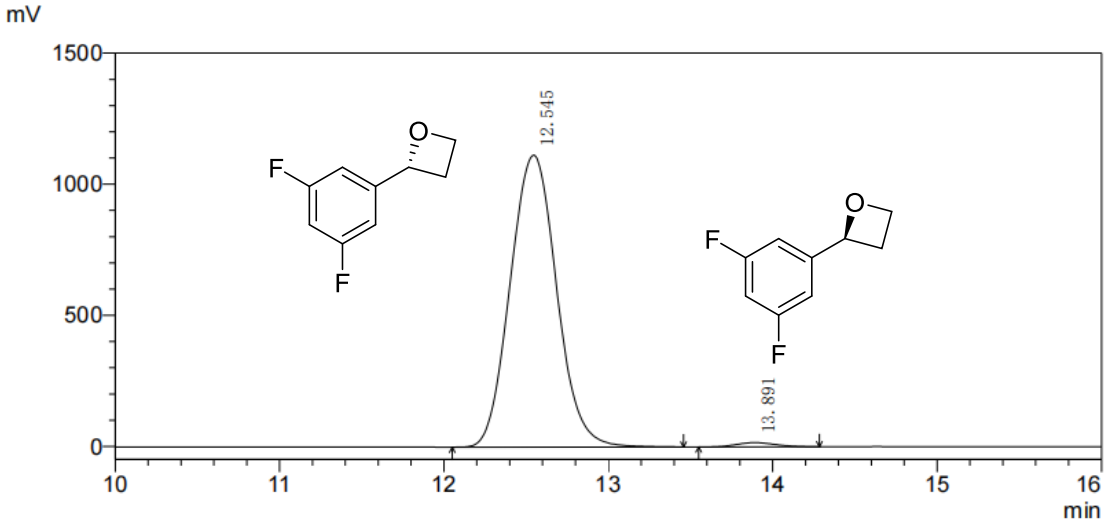
Chemical synthesized (*rac*)-**15b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	12.445	5334535	292511	49.881
2	13.769	5360025	295561	50.119

Enzymatic synthesized (*R*)-**15b**

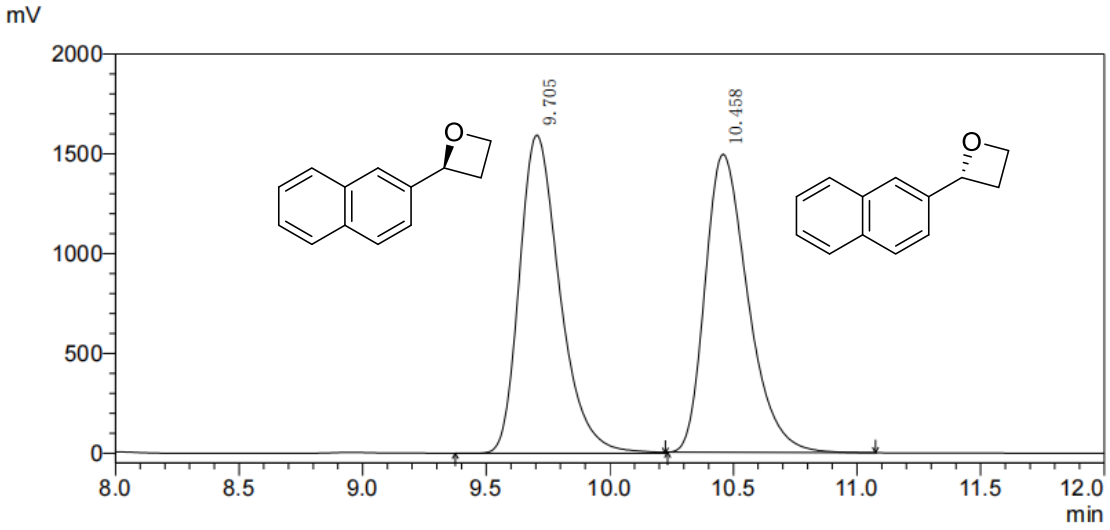


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	12.545	21901931	1113279	98.765
2	13.891	273945	16388	1.235

Chiral HPLC analysis: Diacel Chiralpak IA-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm. $t_{(R)}$ = 12.5 min, $t_{(S)}$ = 13.9 min.

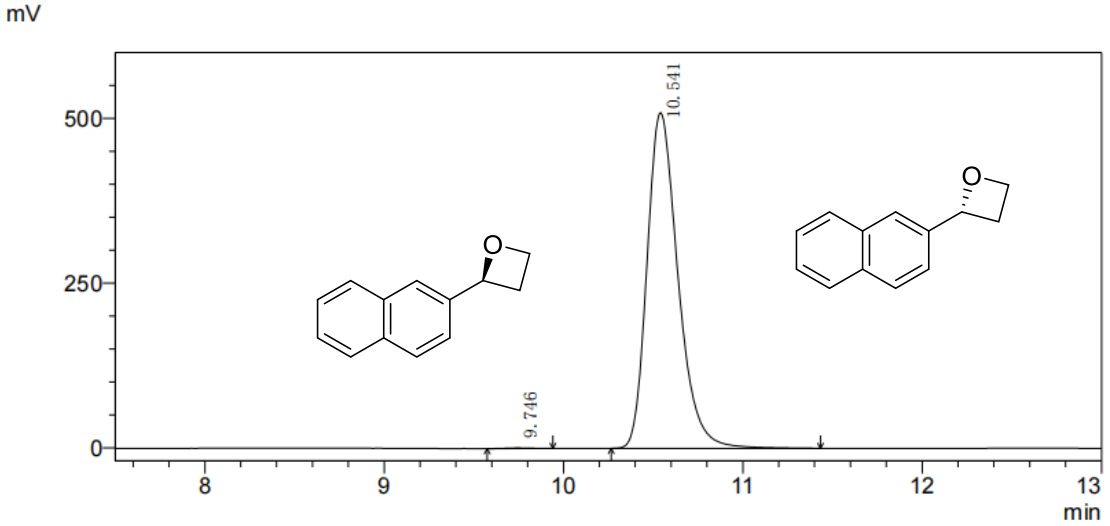
Chemical synthesized (*rac*)-**16b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	9.705	18172670	1595119	50.191
2	10.458	18034694	1494464	49.809

Enzymatic synthesized (*R*)-**16b**

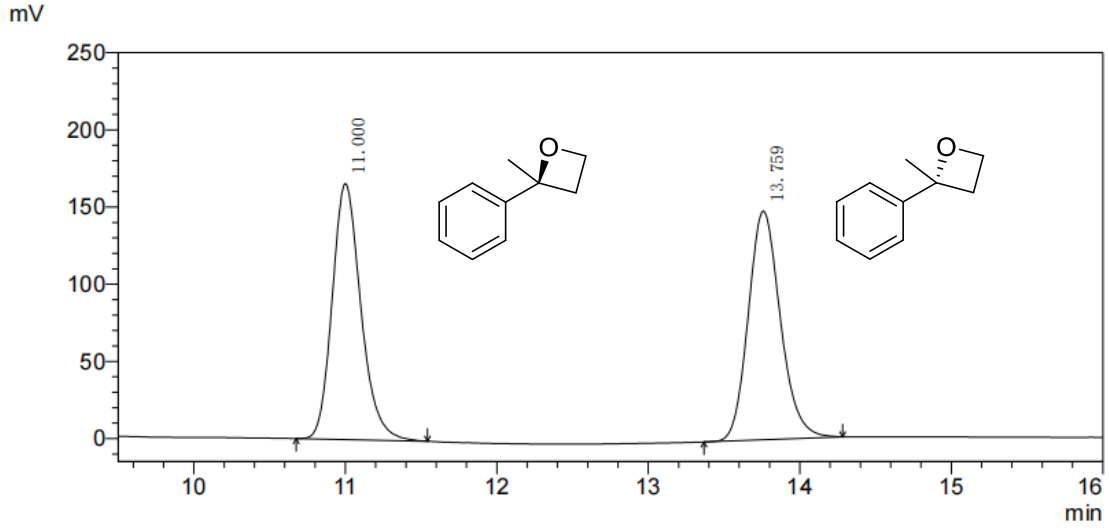


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	9.746	8436	840	0.138
2	10.541	6110915	509757	99.862

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm. $t_{(S)}$ = 9.7 min, $t_{(R)}$ = 10.5 min.

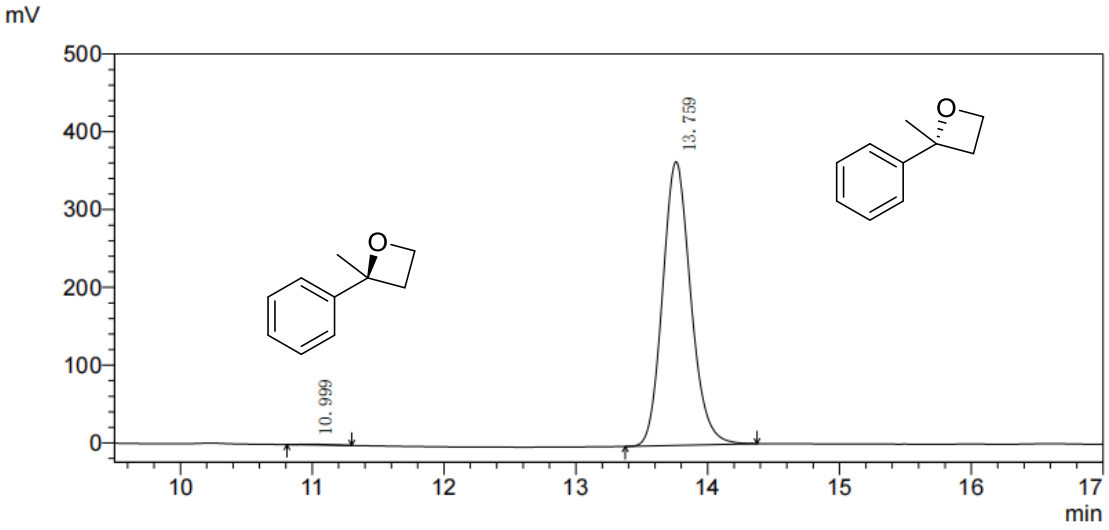
Chemical synthesized (*rac*)-**17b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	11.000	2181178	165876	49.984
2	13.759	2182556	148316	50.016

Enzymatic synthesized (*R*)-**17b**

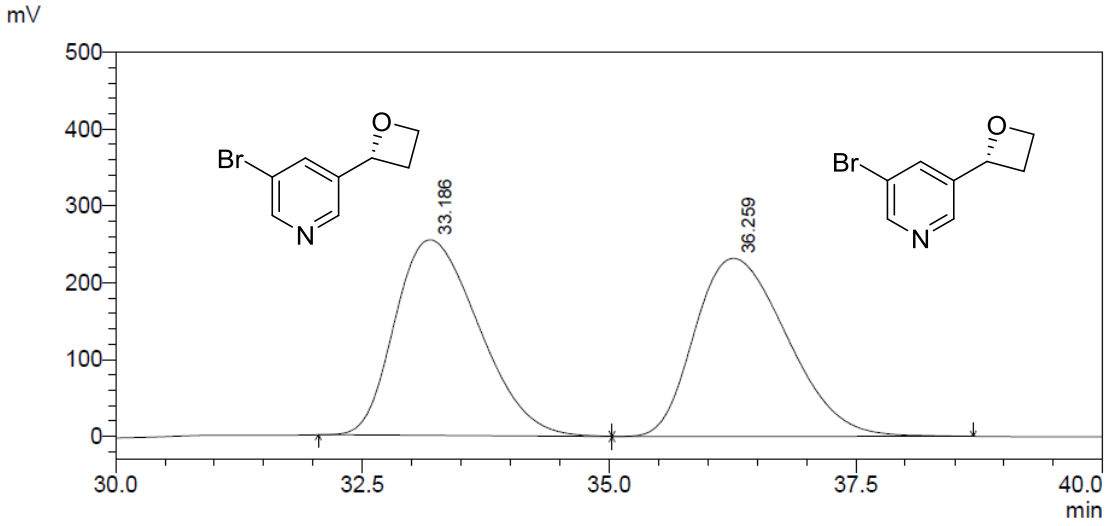


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	10.999	12545	857	0.230
2	13.759	5433345	364819	99.770

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm. $t_{(S)}$ = 11.0 min, $t_{(R)}$ = 13.8 min.

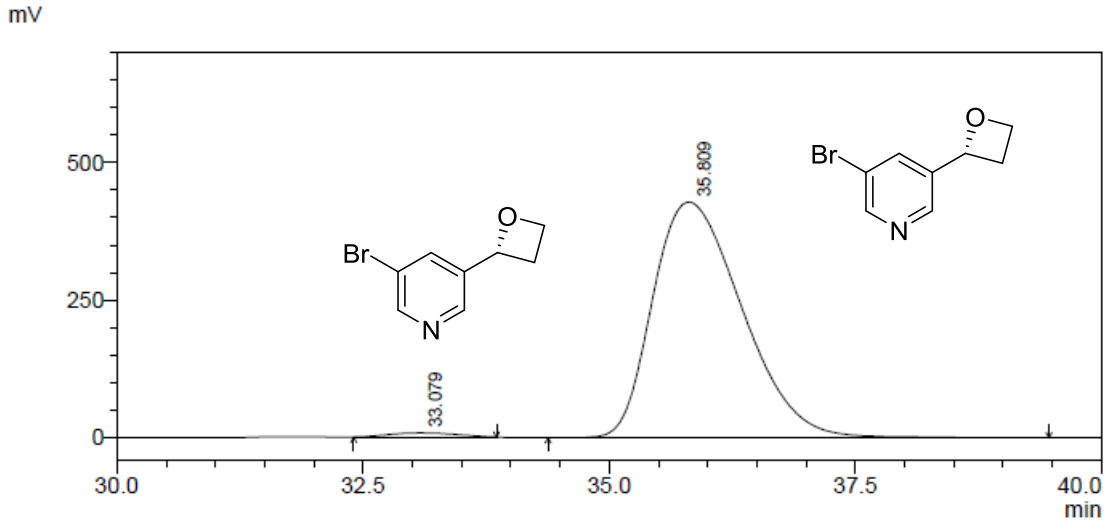
Chemical synthesized (*rac*)-**18b**



PDA_210nm

ID#	Rt. Time	Area	Height	Area%
1	33.186	15091005	254835	49.929
2	36.259	15133746	232002	50.071

Enzymatic synthesized (*R*)-**18b**

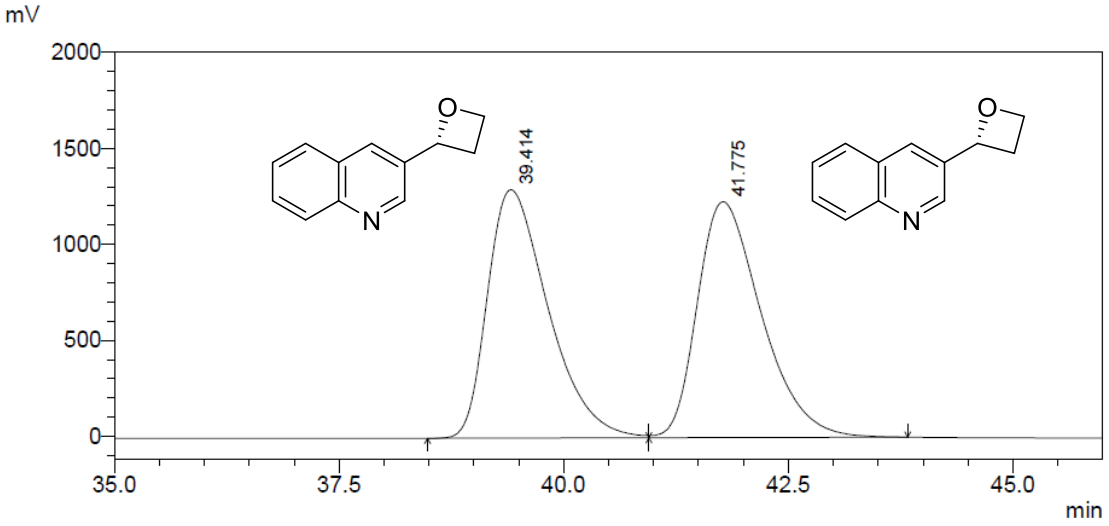


PDA_210nm

ID#	Rt. Time	Area	Height	Area%
1	33.079	364895	7586	1.331
2	35.809	27048154	428316	98.669

Chiral HPLC analysis: Diacel Chiralpak OB-H, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm. $t_{(S)}$ = 33.1 min, $t_{(R)}$ = 35.8 min.

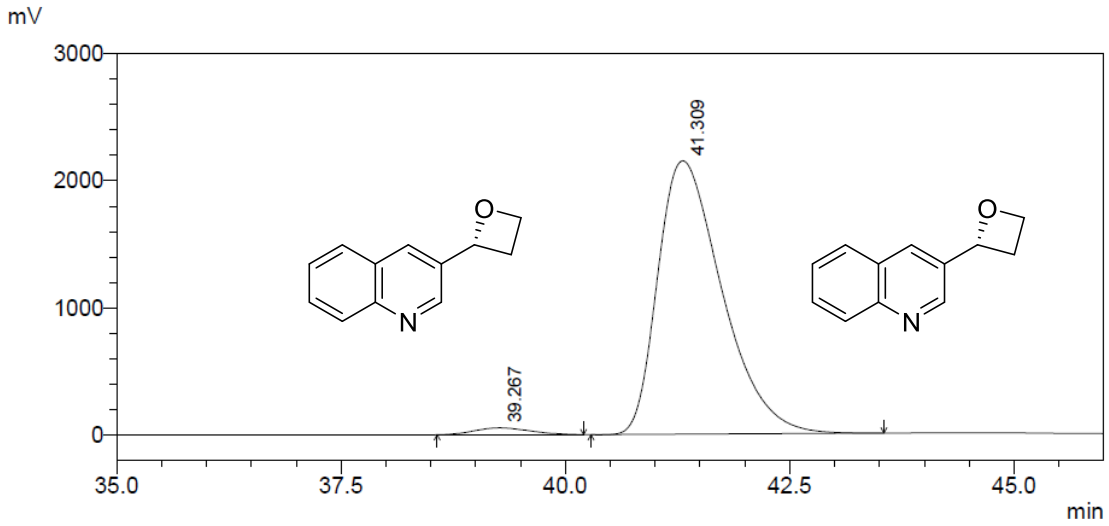
Chemical synthesized (*rac*)-**19b**



PDA_210nm

ID#	Rt. Time	Area	Height	Area%
1	39.414	60781337	1293276	49.923
2	41.775	60968364	1227764	50.077

Enzymatic synthesized (*R*)-**19b**

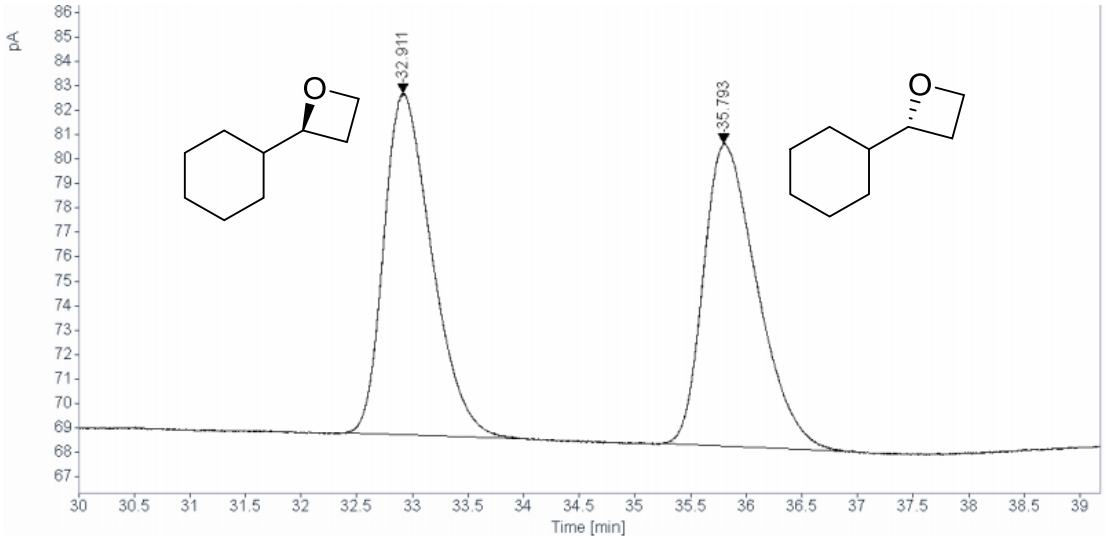


PDA_210nm

ID#	Rt. Time	Area	Height	Area%
1	39.267	2320262	53883	2.117
2	41.309	107264534	2152504	97.883

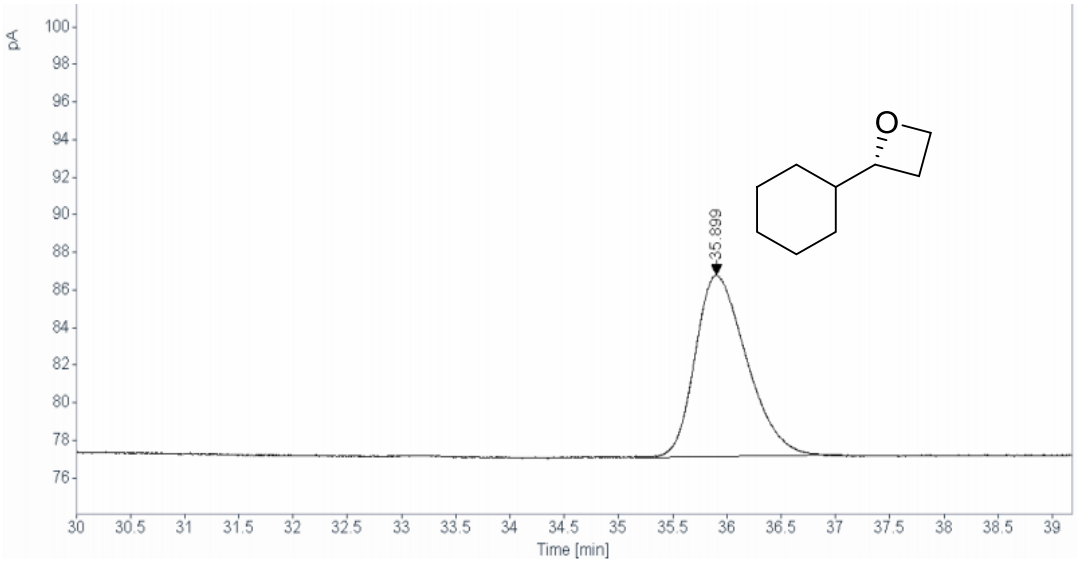
Chiral HPLC analysis: Diacel Chiralpak AD-H, *n*-hexane/*i*-PrOH = 95/5, flow rate 0.5 mL/min, λ = 210 nm. $t_{(S)}$ = 39.3 min, $t_{(R)}$ = 41.3 min.

Chemical synthesized (*rac*)-**21b**



ID#	Ret. Time	Area	Height	Area%	Resolution
1	32.911	420.903	14.020	50.148	
1	35.793	418.413	12.422	49.852	3.468

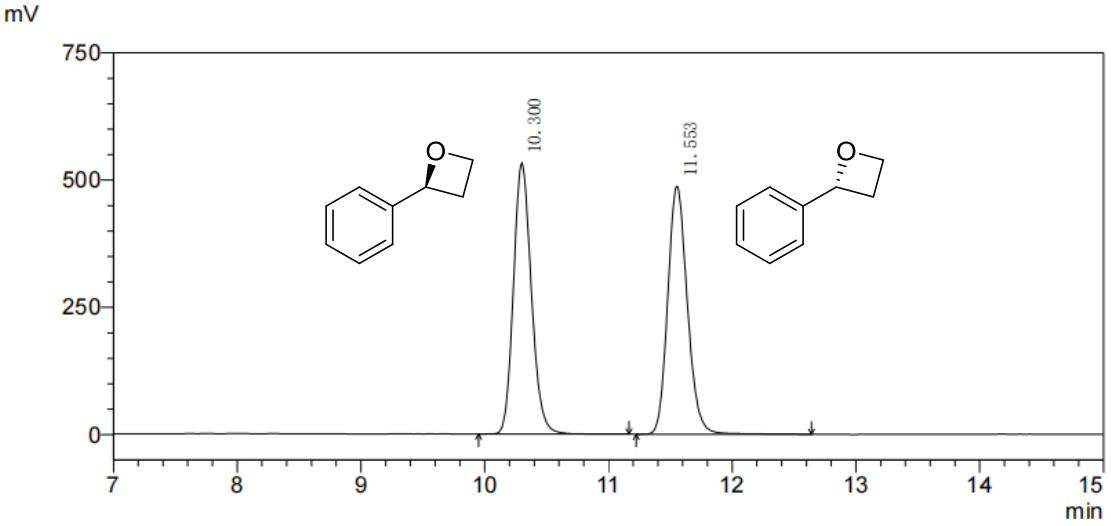
Enzymatic synthesized (*R*)-**22b**



ID#	Ret. Time	Area	Height	Area%	Resolution
2	35.899	319.265	9.684	100.000	

Chiral GC analysis: Rt-bDEXcst (RESTEK), 80 ℃ for 45 min, $t_{(S)}$ = 32.9 min, $t_{(R)}$ = 35.9 min.

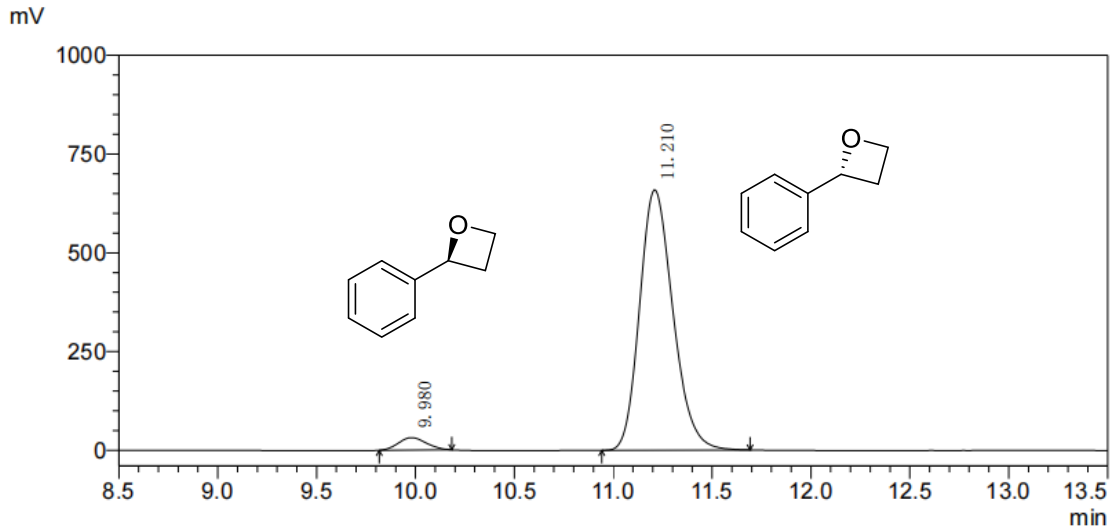
Chemical synthesized (*rac*)-**1b from 22a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	10.300	5360586	532422	49.946
2	11.553	5372125	487092	50.054

Enzymatic synthesized (*R*)-**1b from 22a**

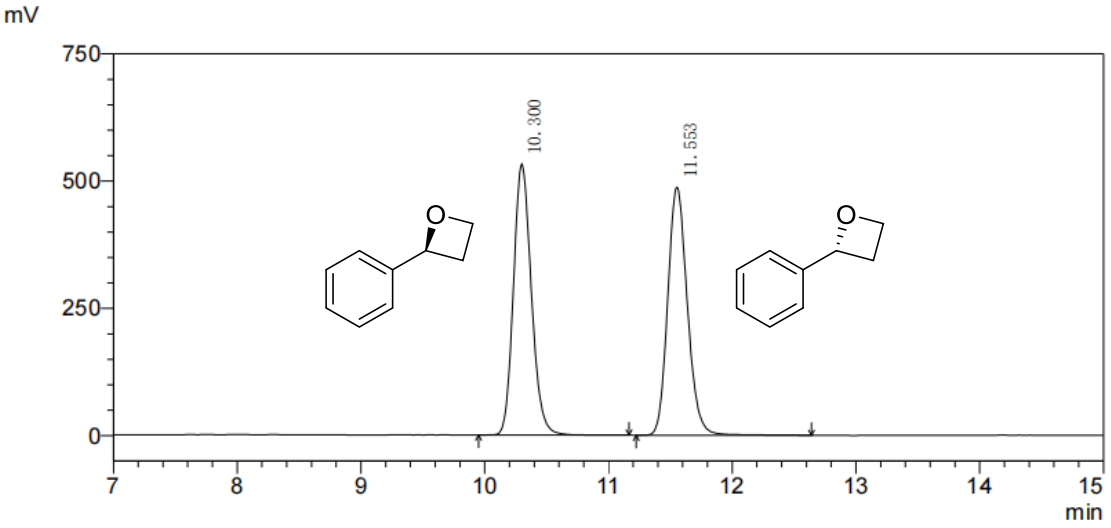


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	9.980	309572	31377	3.854
2	11.210	7722247	659815	96.146

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm. $t_{(S)}$ = 10.0 min, $t_{(R)}$ = 11.2 min.

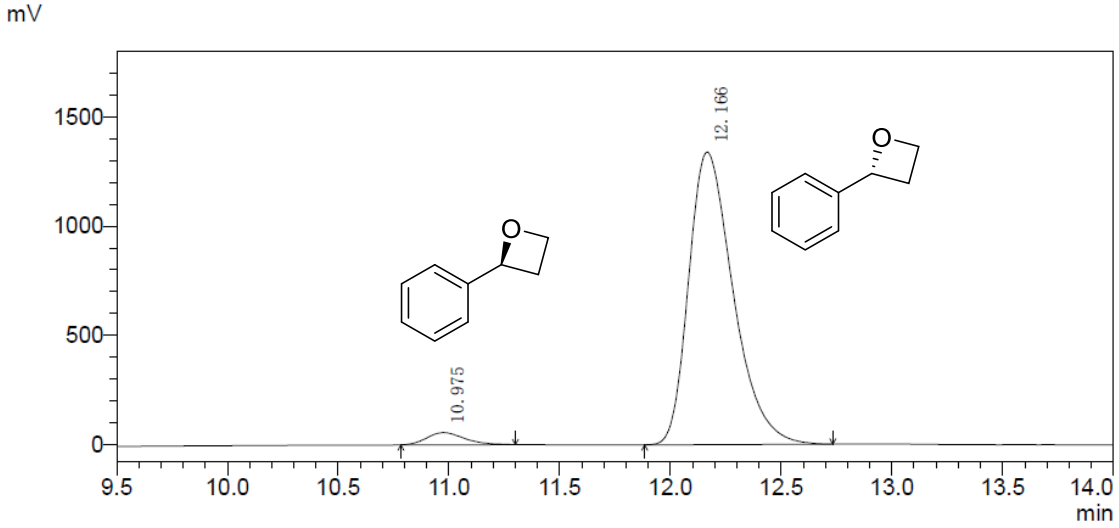
Chemical synthesized (*rac*)-**1b from 23a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	10.300	5360586	532422	49.946
2	11.553	5372125	487092	50.054

Enzymatic synthesized (*R*)-**1b from 23a**

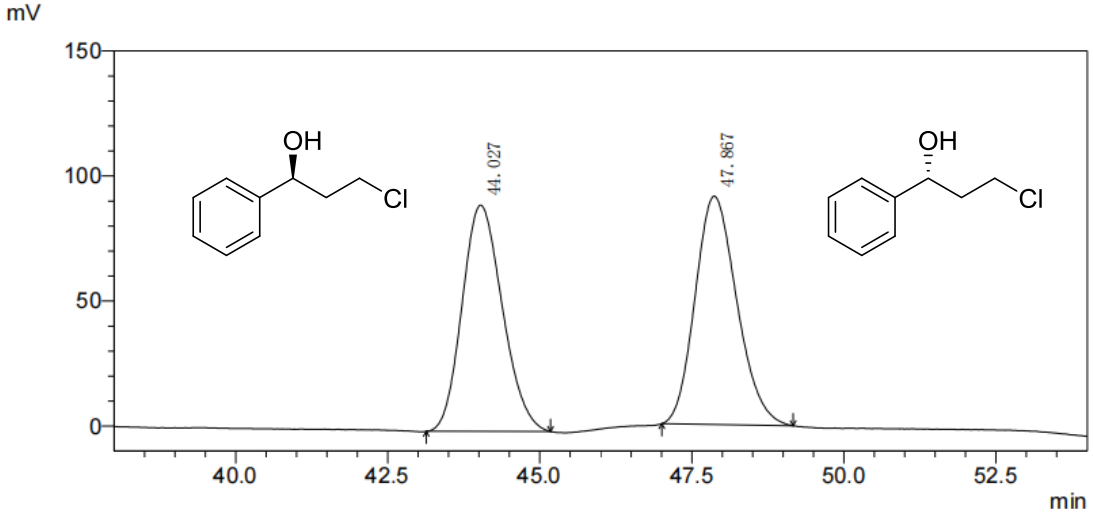


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	10.975	662397	56075	3.410
2	12.166	18765120	1342199	96.590

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm. $t_{(S)}$ = 11.0 min, $t_{(R)}$ = 12.2 min.

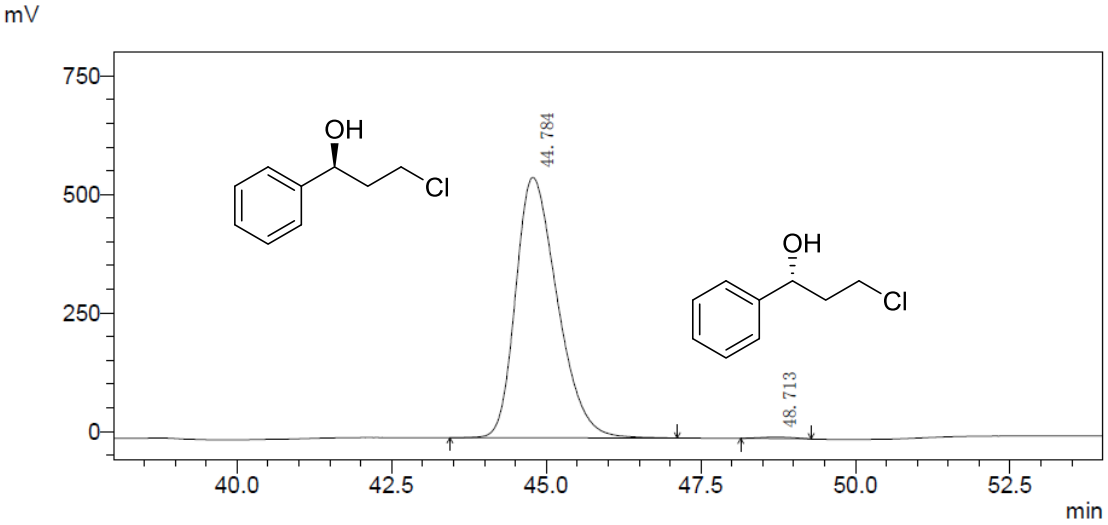
Chemical synthesized (*rac*)-**1a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	44.027	4170848	90440	48.911
2	47.867	4356621	91297	51.089

Enzymatic synthesized (*S*)-**1a**

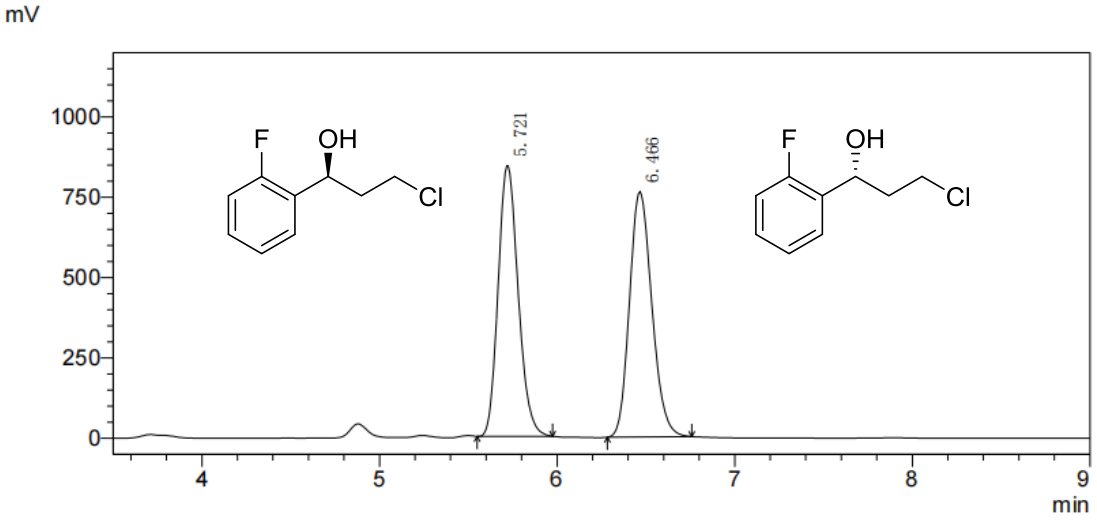


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	44.784	25792192	549589	99.542
2	48.713	118781	3121	0.458

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 44.8 min, $t_{(R)}$ = 48.7 min.

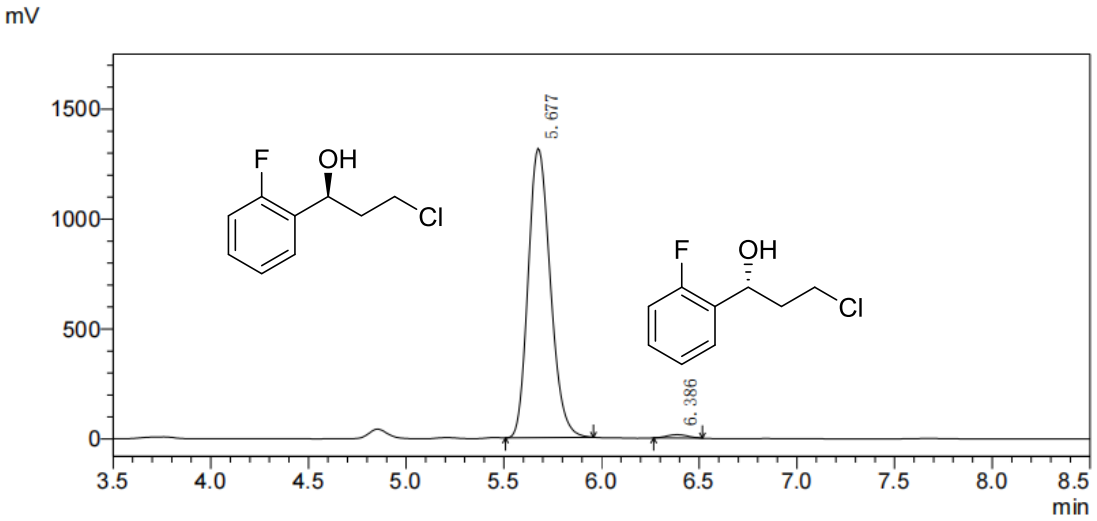
Chemical synthesized (*rac*)-**2a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	5.721	6592144	842409	49.654
2	6.466	6684094	763639	50.346

Enzymatic synthesized (*S*)-**2a**

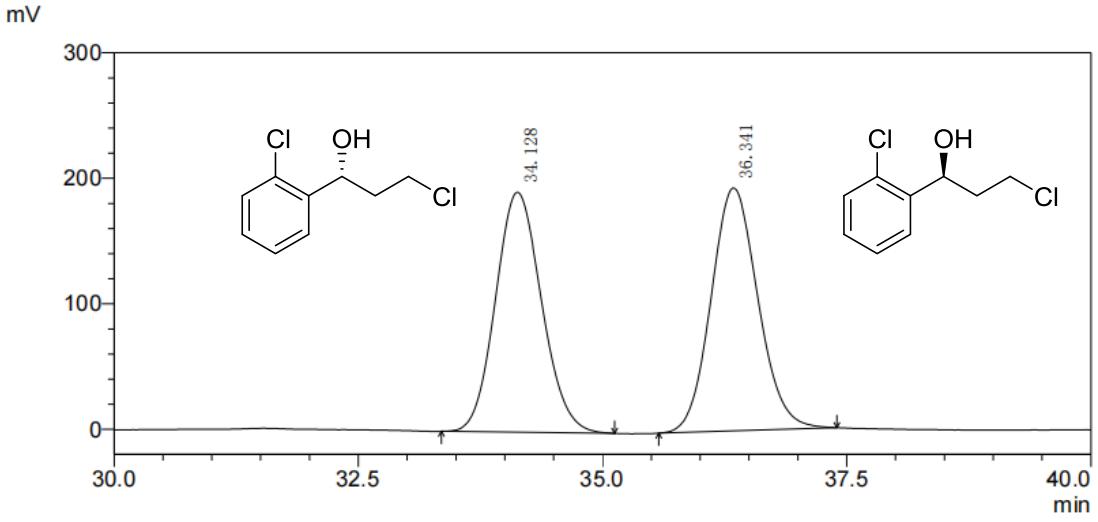


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	5.677	10452211	1315327	98.915
2	6.386	114640	15245	1.085

Chiral HPLC analysis: Diacel Chiralpak OD-H, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 210 nm, $t_{(S)}$ = 5.7 min, $t_{(R)}$ = 6.4 min.

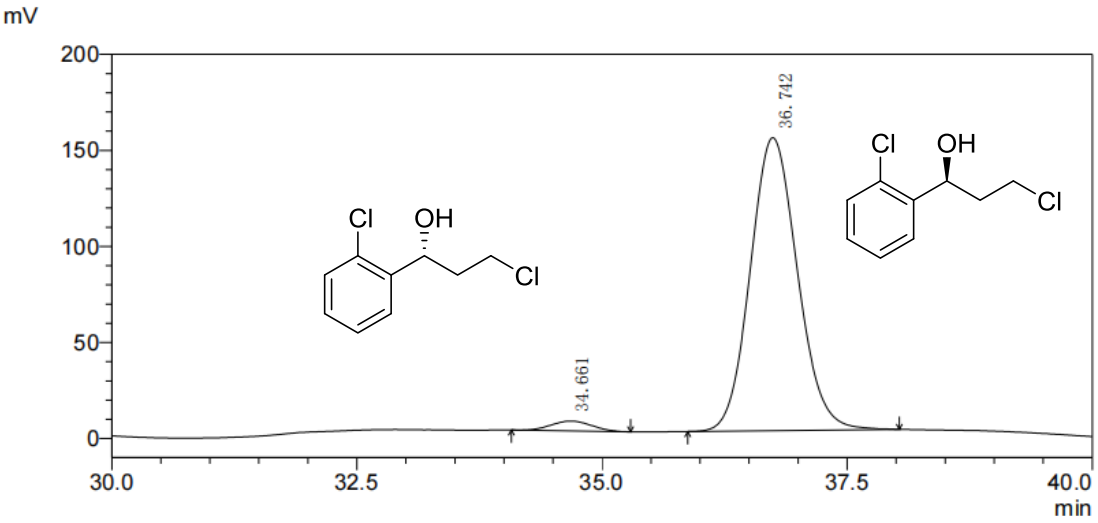
Chemical synthesized (*rac*)-**3a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	34.128	6279753	191176	49.277
2	36.341	6464133	193514	50.723

Enzymatic synthesized (*S*)-**3a**

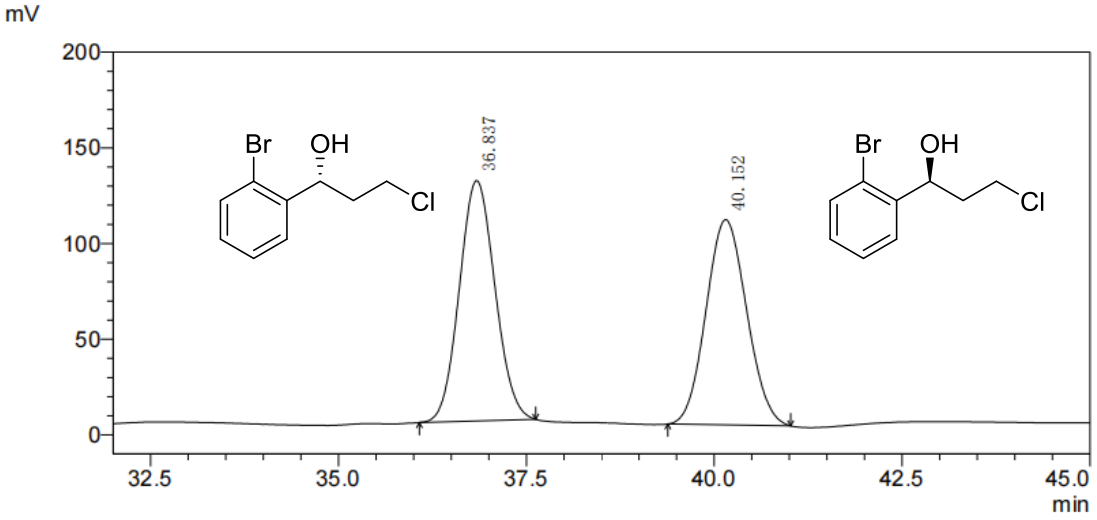


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	34.661	148102	5090	2.823
2	36.742	5098305	152580	97.177

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(R)}$ = 34.7 min, $t_{(S)}$ = 36.7 min.

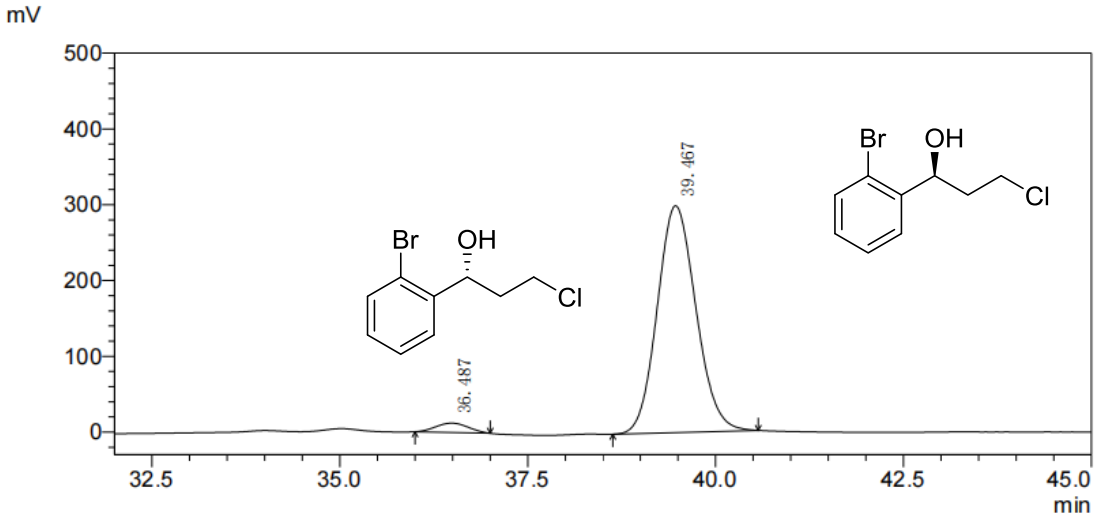
Chemical synthesized (*rac*)-**4a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	36.837	4144476	125617	50.650
2	40.152	4038095	107240	49.350

Enzymatic synthesized (*S*)-**4a**

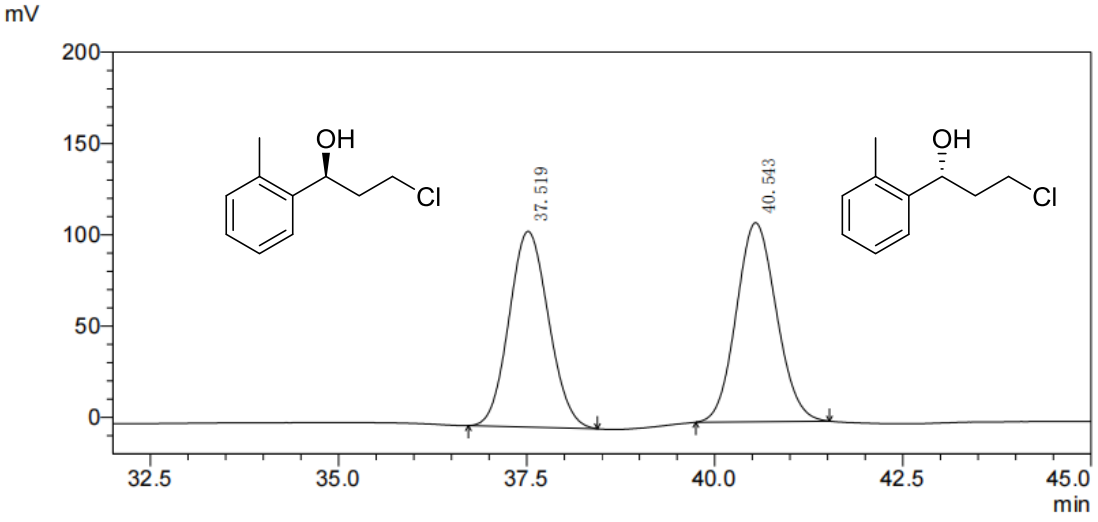


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	36.487	370934	12385	3.341
2	39.467	10731262	299359	96.659

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(R)}$ = 36.5 min, $t_{(S)}$ = 39.5 min.

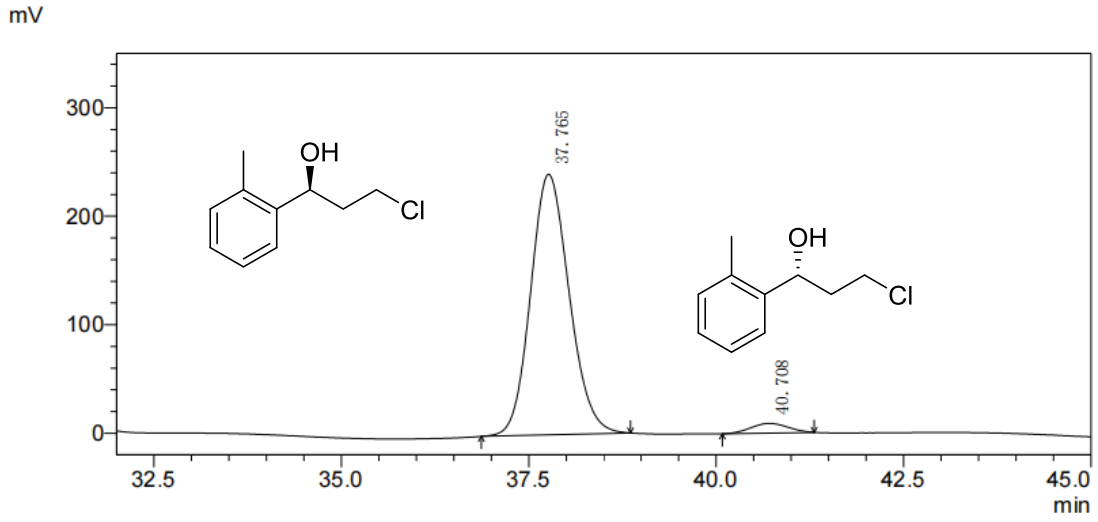
Chemical synthesized (*rac*)-**5a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	37.519	3919814	107123	49.188
2	40.543	4049266	108941	50.812

Enzymatic synthesized (*S*)-**5a**

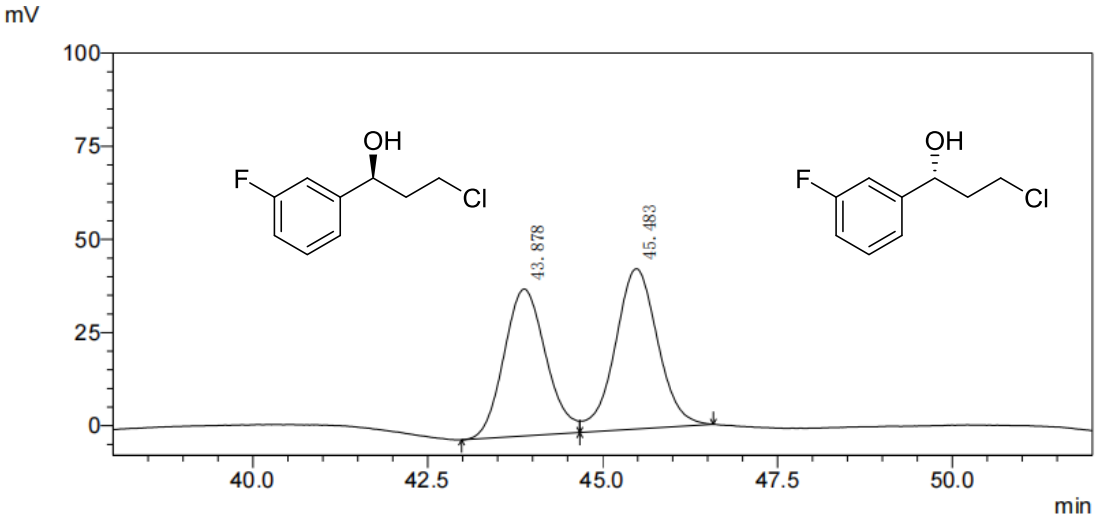


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	37.765	8604714	240169	96.560
2	40.708	306501	8886	3.440

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 37.8 min, $t_{(R)}$ = 40.7 min.

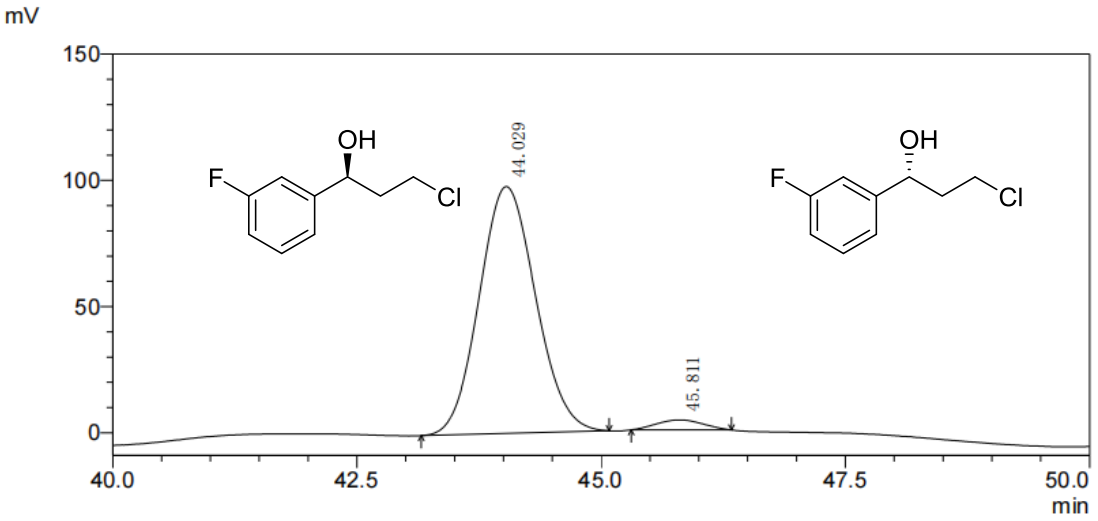
Chemical synthesized (*rac*)-**6a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	43.878	1640174	39450	47.347
2	45.483	1823950	43025	52.653

Enzymatic synthesized (*S*)-**6a**

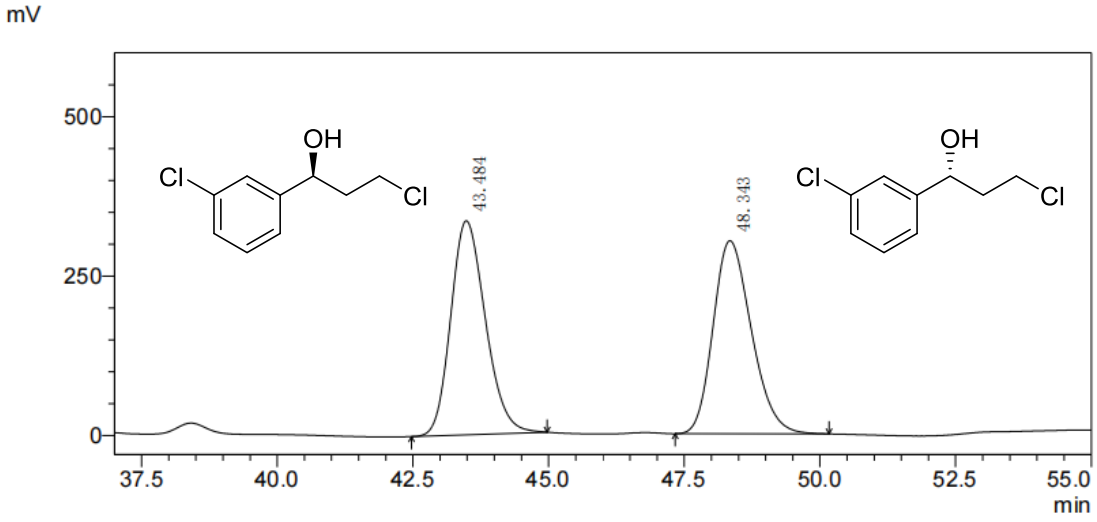


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	44.029	3930510	97801	96.804
2	45.811	129779	3915	3.196

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 44.0 min, $t_{(R)}$ = 45.8 min.

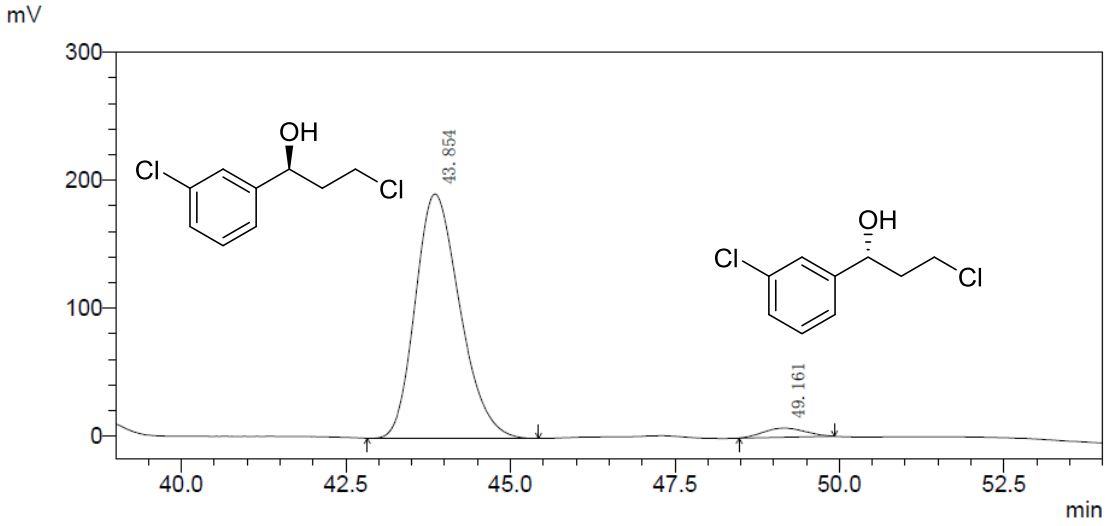
Chemical synthesized (*rac*)-**7a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	43.484	14910958	335534	50.069
2	48.343	14869975	302683	49.931

Enzymatic synthesized (*S*)-**7a**

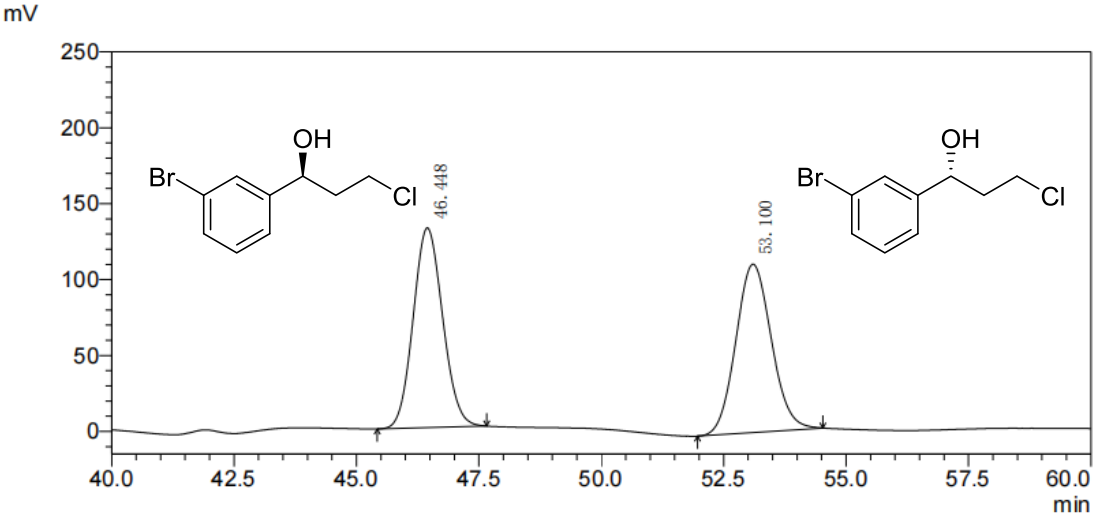


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	43.854	9008485	191053	96.615
2	49.161	315597	7192	3.385

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 43.8 min, $t_{(R)}$ = 49.2 min.

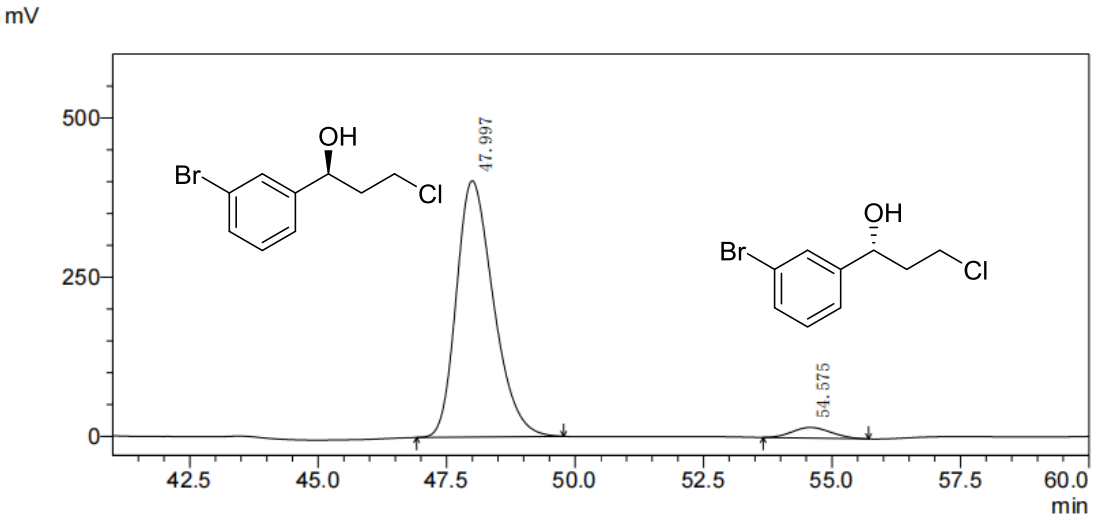
Chemical synthesized (*rac*)-**8a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	46.448	5522598	131641	49.653
2	53.100	5599756	110957	50.347

Enzymatic synthesized (*S*)-**8a**

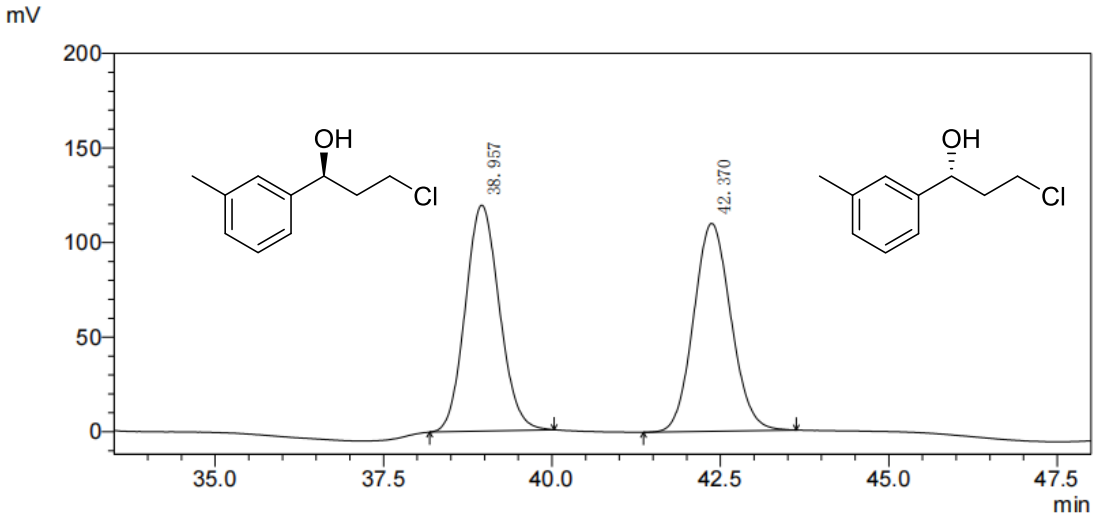


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	47.997	20204529	402273	95.835
2	54.575	878137	16663	4.165

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 48.0 min, $t_{(R)}$ = 54.6 min.

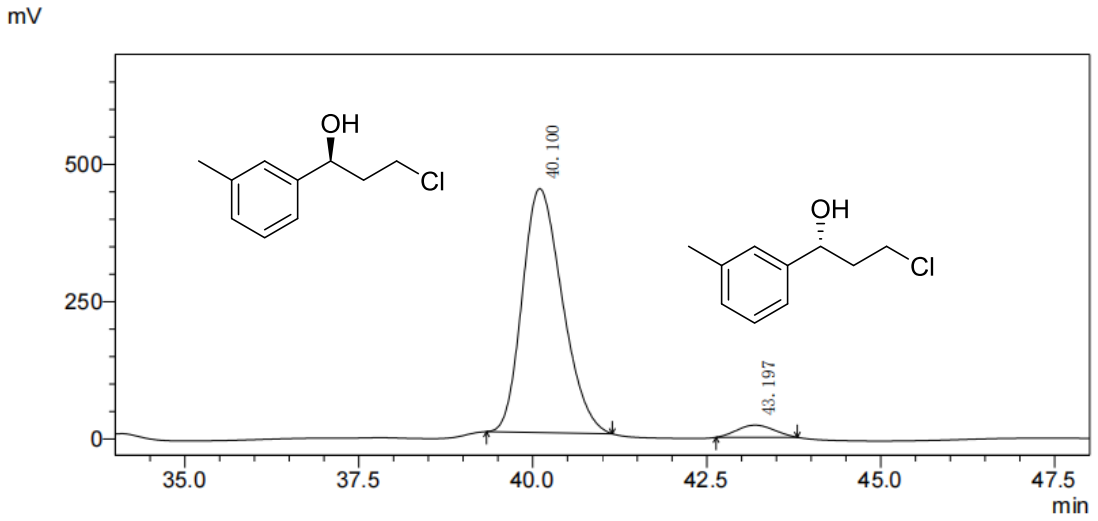
Chemical synthesized (*rac*)-**9a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	38.957	4212505	119440	49.839
2	42.370	4239719	109891	50.161

Enzymatic synthesized (*S*)-**9a**

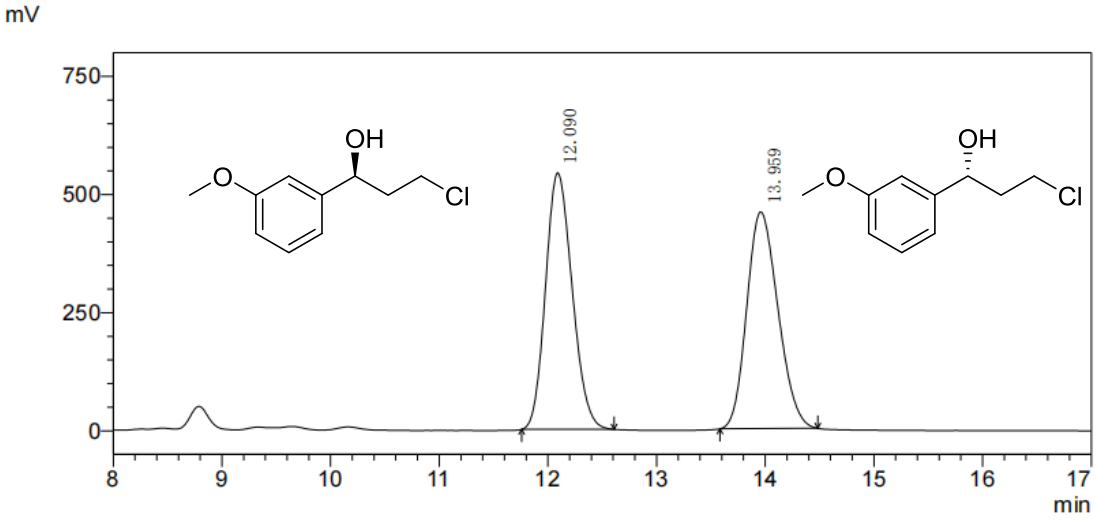


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	40.100	17812647	444013	95.620
2	43.197	816026	22089	4.380

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 40.1 min, $t_{(R)}$ = 43.2 min.

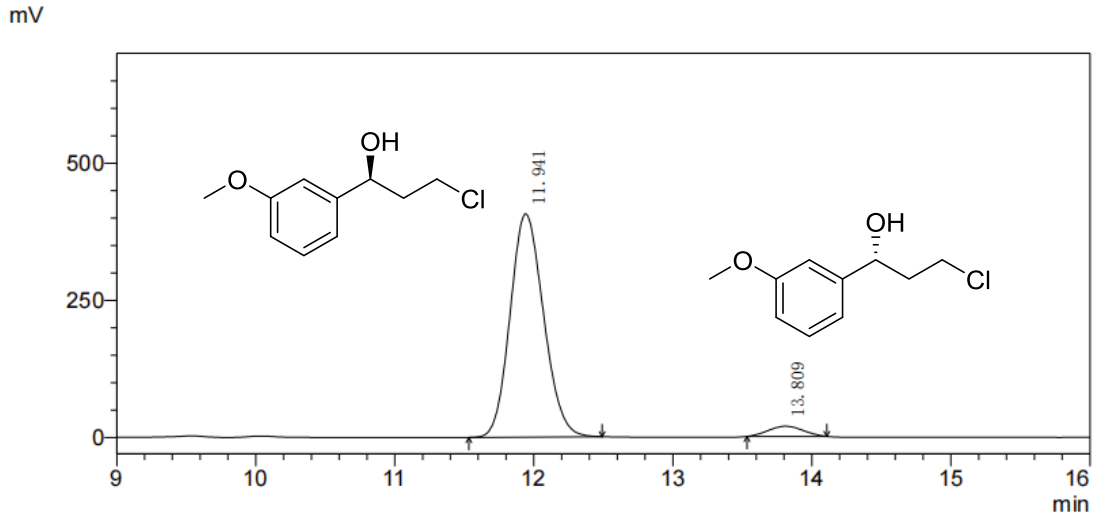
Chemical synthesized (*rac*)-**10a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	12.090	9259966	542740	50.274
2	13.959	9158901	458506	49.726

Enzymatic synthesized (*S*)-**10a**

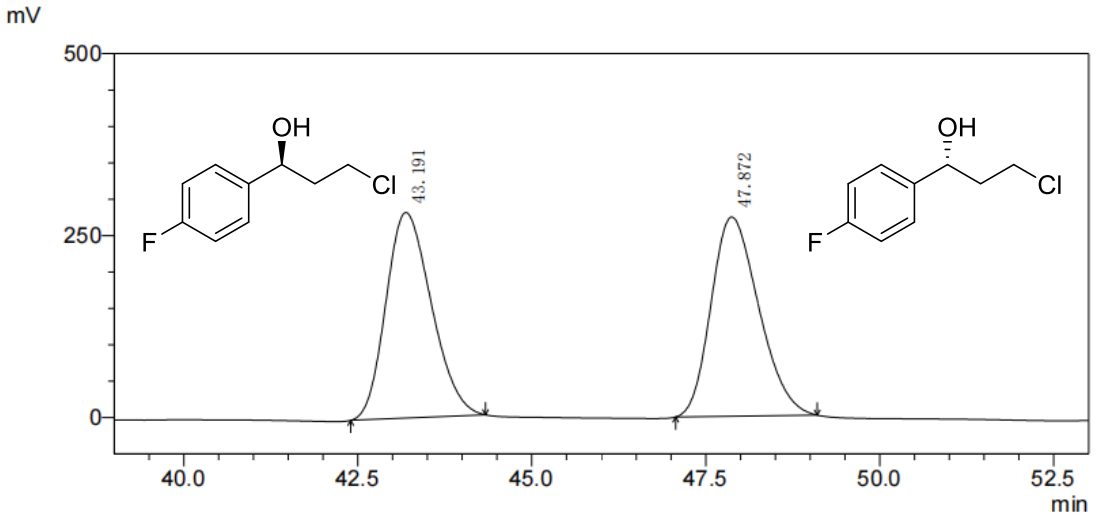


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	11.941	6808404	406954	95.485
2	13.809	321906	18565	4.515

Chiral HPLC analysis: Diacel Chiralpak OD-H, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 210 nm, $t_{(S)}$ = 11.9 min, $t_{(R)}$ = 13.8 min.

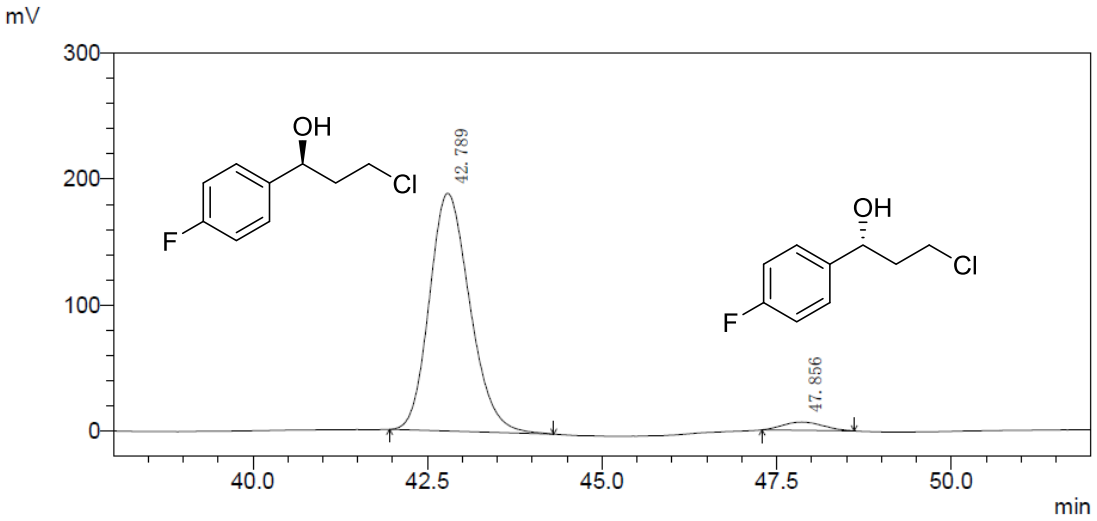
Chemical synthesized (*rac*)-**11a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	43.191	12831821	282362	49.596
2	47.872	13041054	273620	50.404

Enzymatic synthesized (*S*)-**11a**

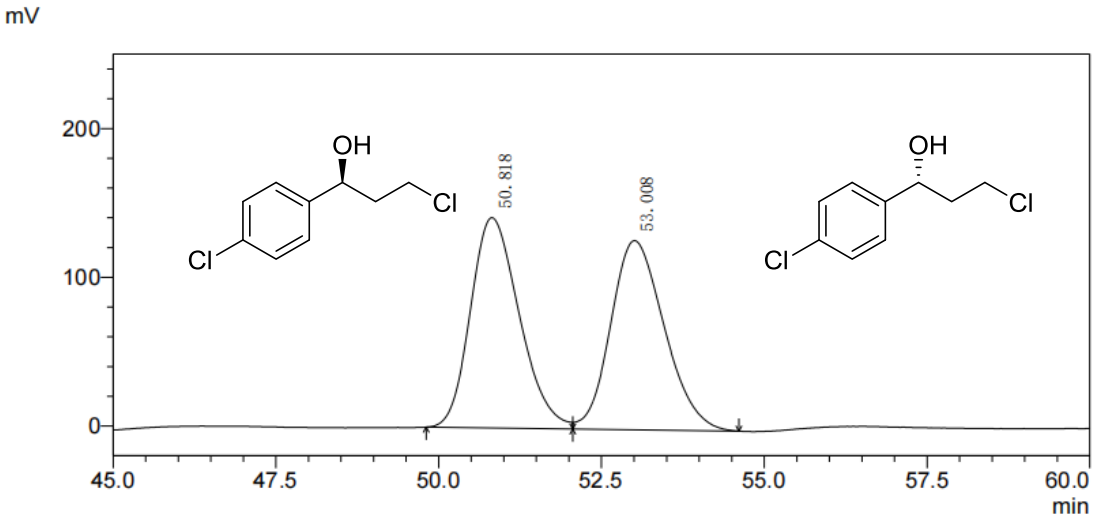


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	42.789	7622547	188856	96.670
2	47.856	262610	6579	3.330

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 42.8 min, $t_{(R)}$ = 47.9 min.

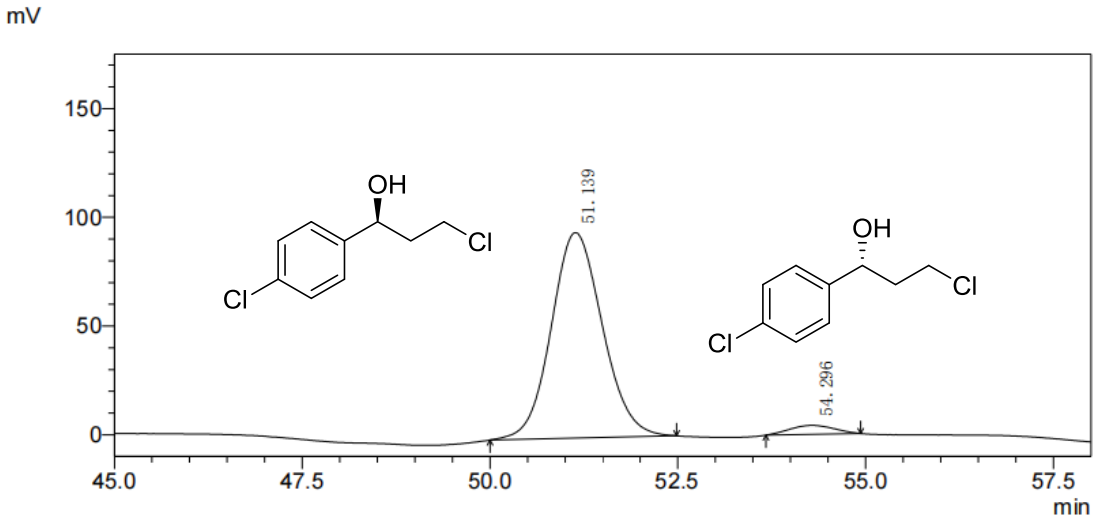
Chemical synthesized (*rac*)-**12a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	50.818	7354674	141389	50.268
2	53.008	7276120	127150	49.732

Enzymatic synthesized (*S*)-**12a**

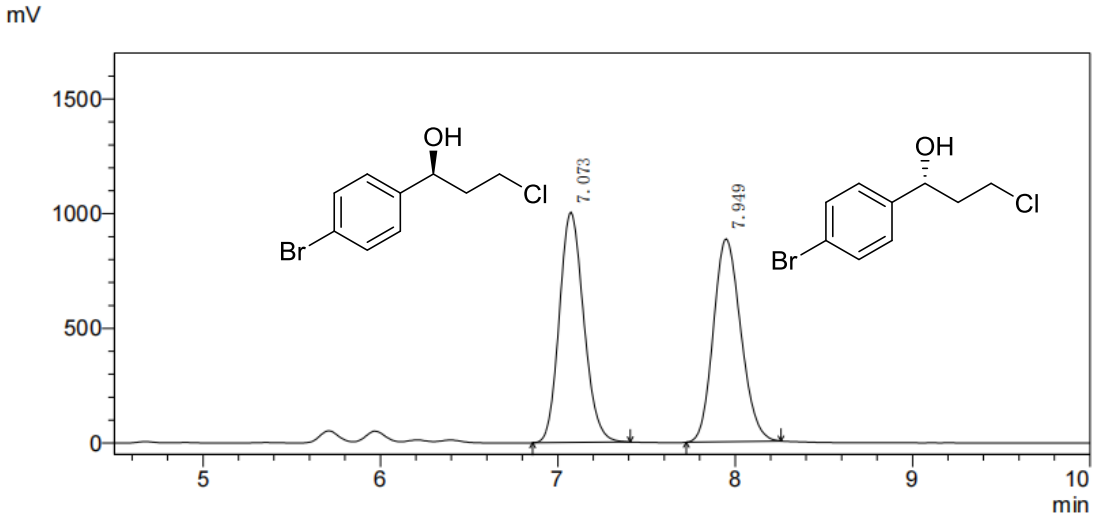


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	51.139	4481146	94464	96.397
2	54.296	167486	4082	3.603

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 51.1 min, $t_{(R)}$ = 54.3 min.

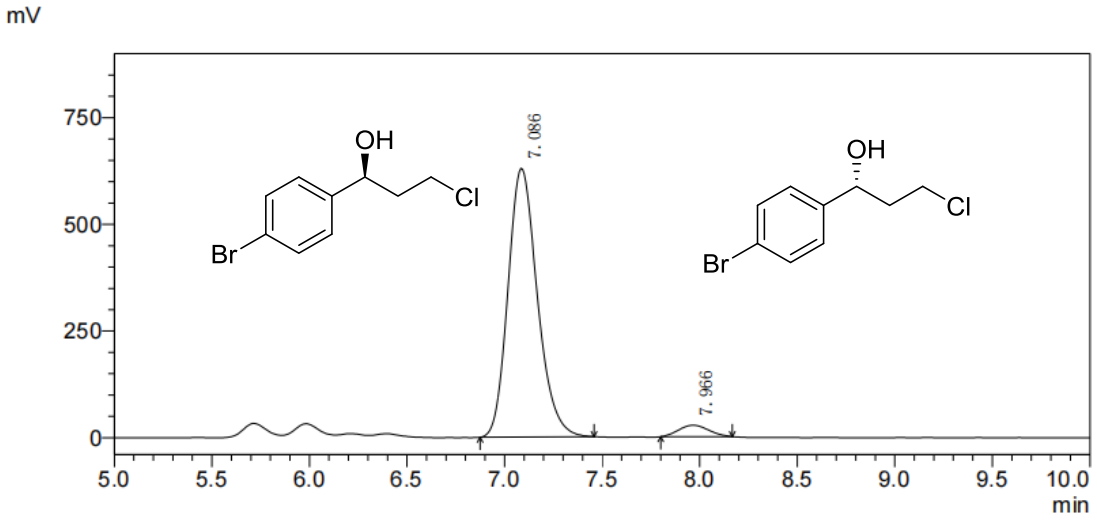
Chemical synthesized (*rac*)-**13a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	7.073	9615969	1003581	50.201
2	7.949	9539085	884114	49.799

Enzymatic synthesized (*S*)-**13a**

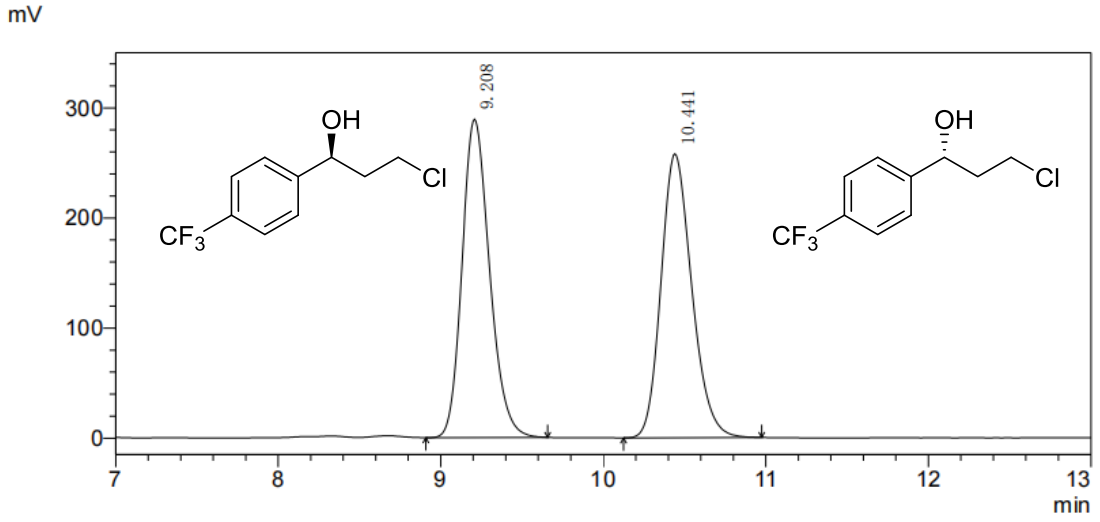


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	7.086	6591918	629680	95.867
2	7.966	284204	26757	4.133

Chiral HPLC analysis: Diacel Chiralpak OD-H, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 210 nm, $t_{(S)}$ = 7.1 min, $t_{(R)}$ = 8.0 min.

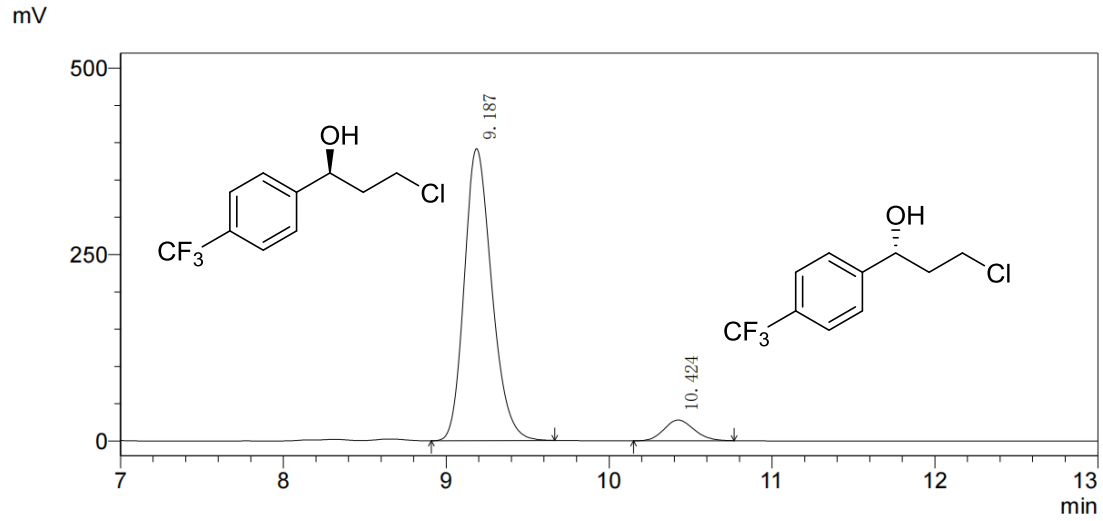
Chemical synthesized (*rac*)-**14a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	9.208	3405433	289261	50.024
2	10.441	3402131	257769	49.976

Enzymatic synthesized (*S*)-**14a**

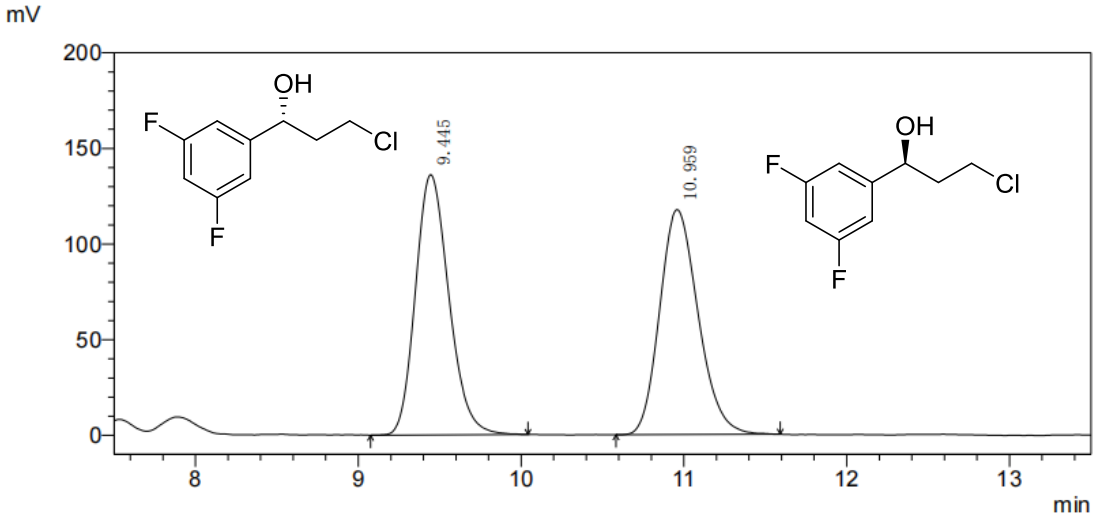


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	9.187	4616016	391588	92.795
2	10.424	358394	27895	7.205

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 9.2 min, $t_{(R)}$ = 10.4 min.

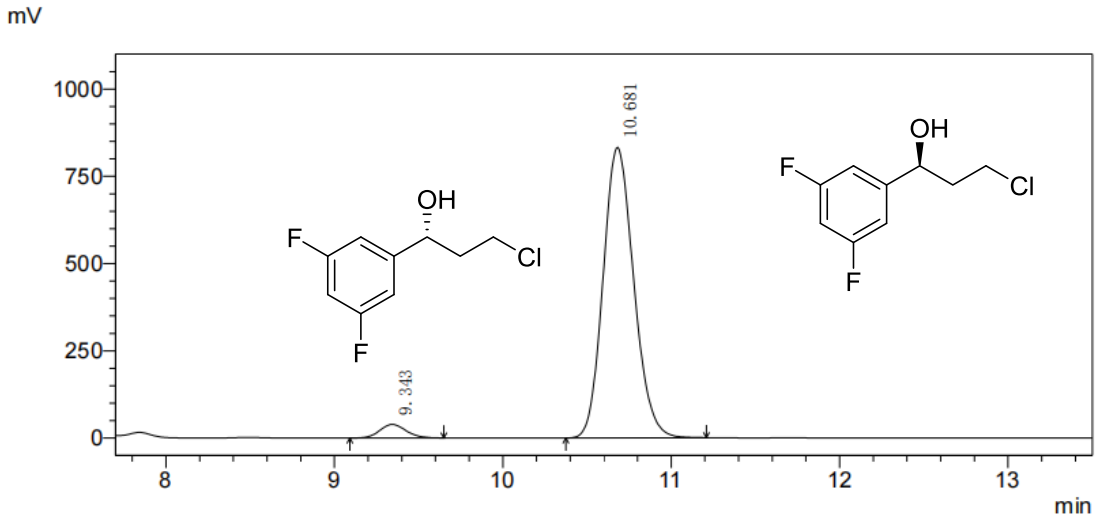
Chemical synthesized (*rac*)-**15a**



PDA 214nm

ID#	Rt. Time	Area	Height	Area %
1	9.443	107719	7565	49.673
2	10.958	109137	6571	50.327

Enzymatic synthesized (*S*)-**15a**

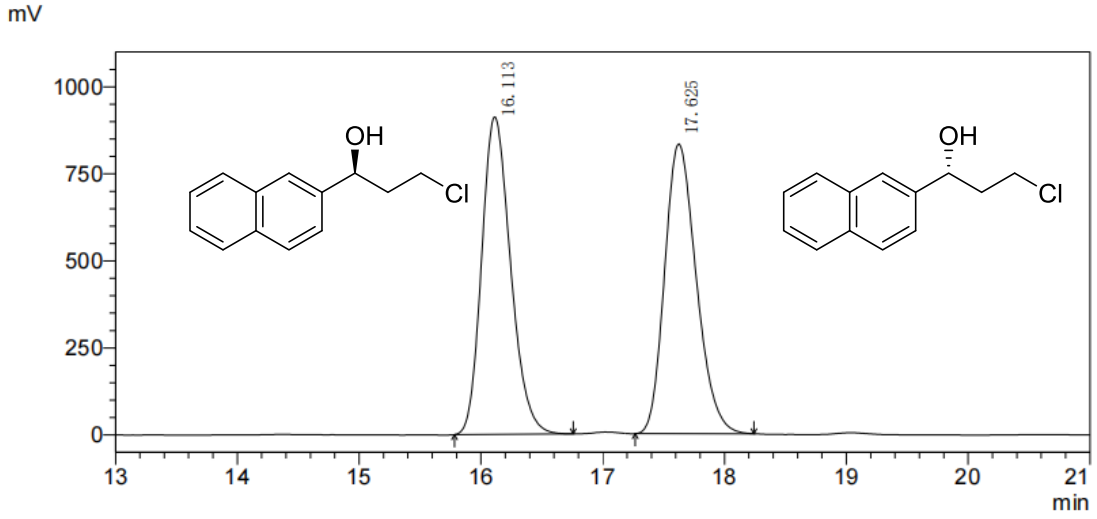


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	9.343	424182	38899	3.873
2	10.681	10528943	831972	96.127

Chiral HPLC analysis: Diacel Chiralpak AD-H, *n*-hexane/*i*-PrOH = 95/5, flow rate 0.5 mL/min, λ = 210 nm, $t_{(R)}$ = 9.3 min, $t_{(S)}$ = 10.7 min.

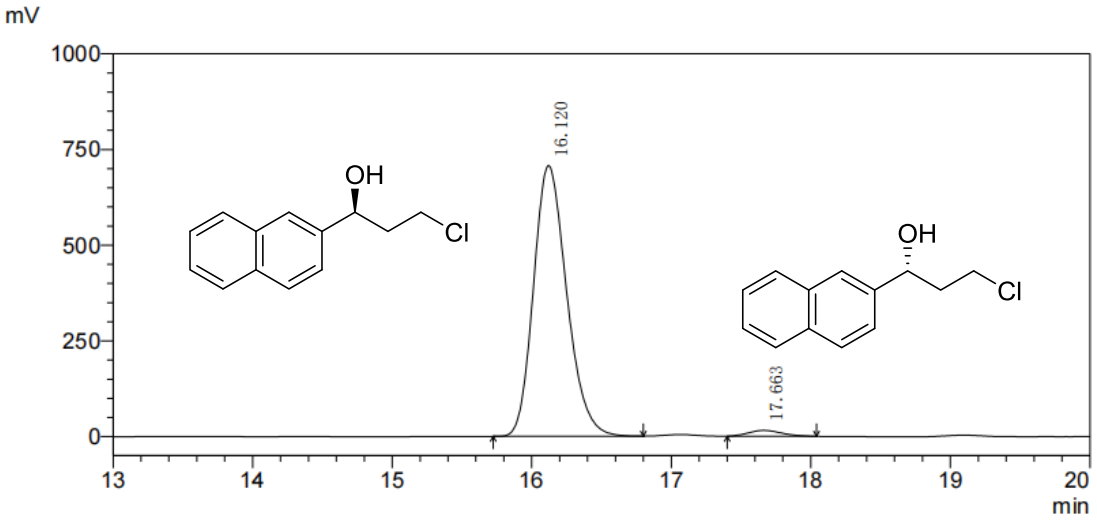
Chemical synthesized (*rac*)-**16a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	16.113	15060137	911913	50.018
2	17.625	15049309	832034	49.982

Enzymatic synthesized (*S*)-**16a**

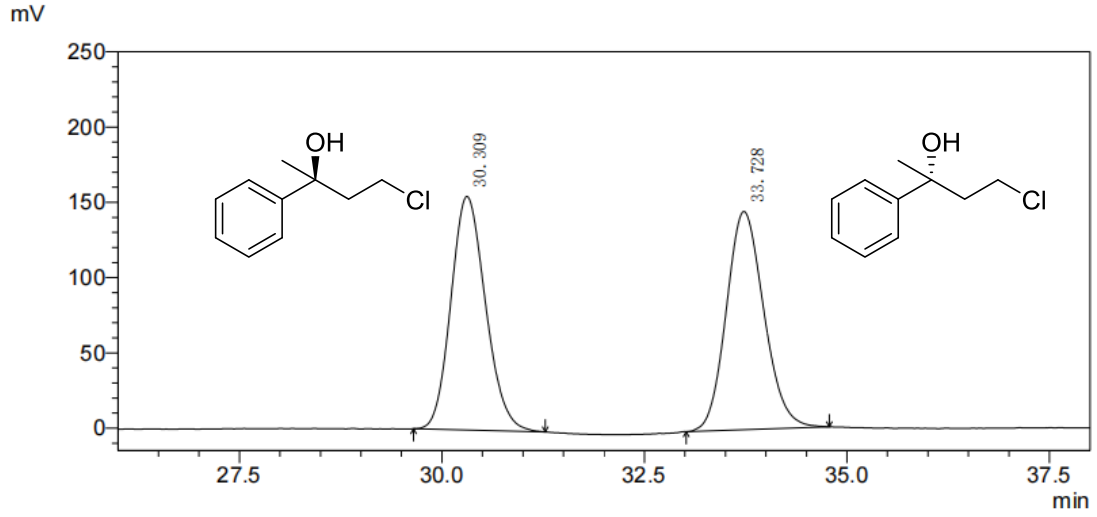


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	16.120	11691594	707301	97.852
2	17.663	256644	15384	2.148

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 16.1 min, $t_{(R)}$ = 17.7 min.

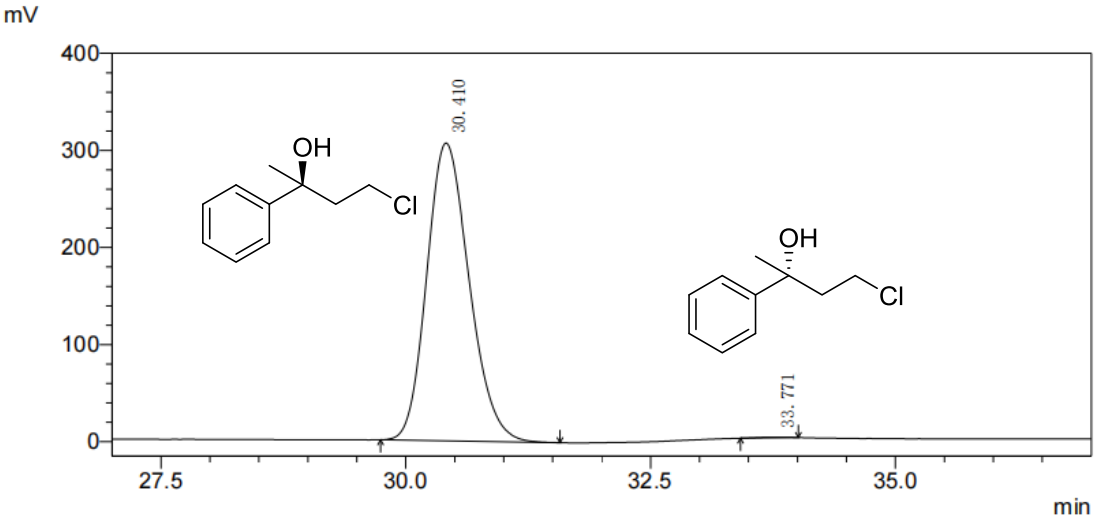
Chemical synthesized (*rac*)-**17a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	30.309	4623106	155207	49.697
2	33.728	4679505	144950	50.303

Enzymatic synthesized (*S*)-**17a**

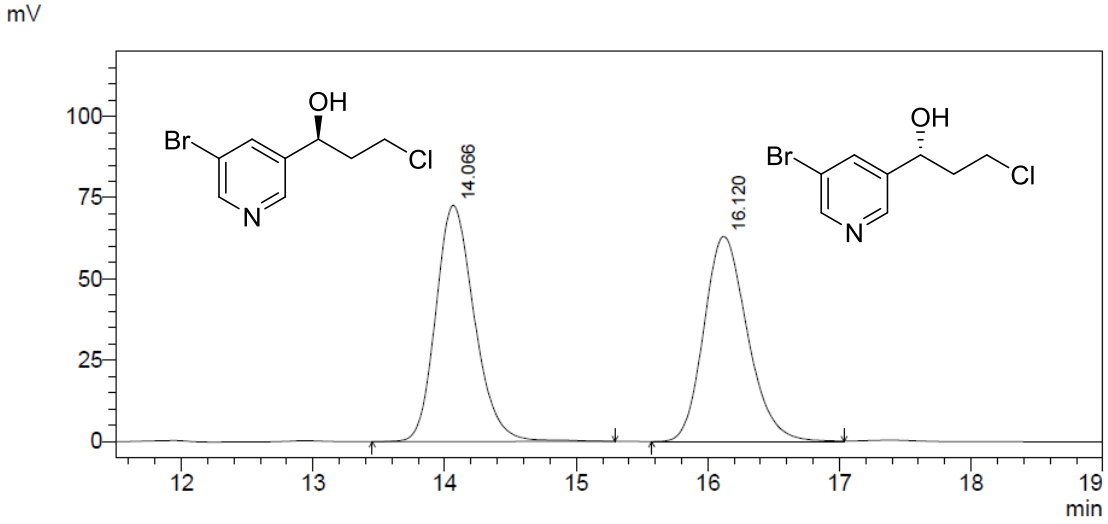


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	30.410	9251269	306687	99.849
2	33.771	14014	657	0.151

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 30.4 min, $t_{(R)}$ = 33.8 min.

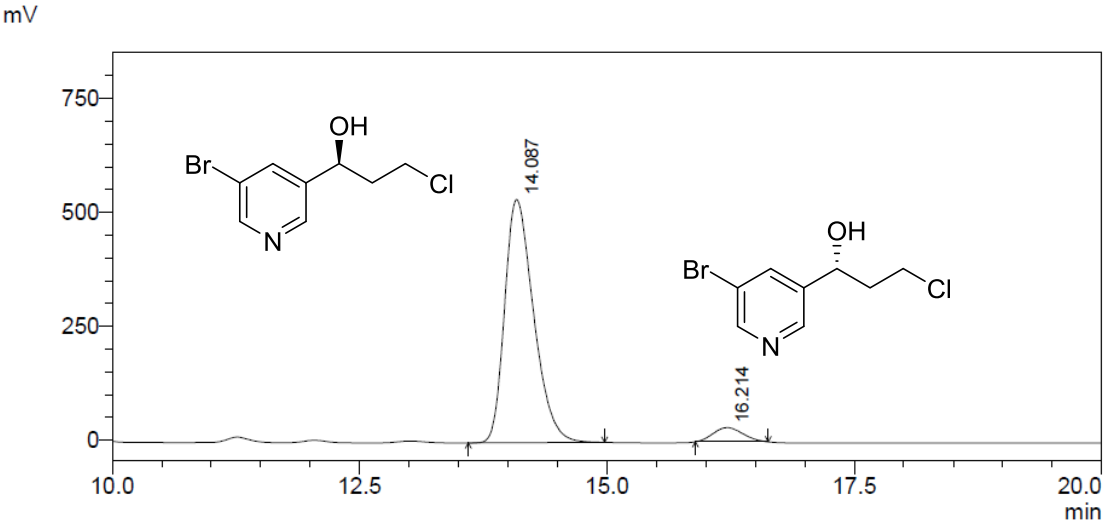
Chemical synthesized (*rac*)-**18a**



PDA_210nm

ID#	Rt. Time	Area	Height	Area%
1	14.066	1486534	72703	50.506
2	16.120	1456738	63135	49.494

Enzymatic synthesized (*S*)-**18a**

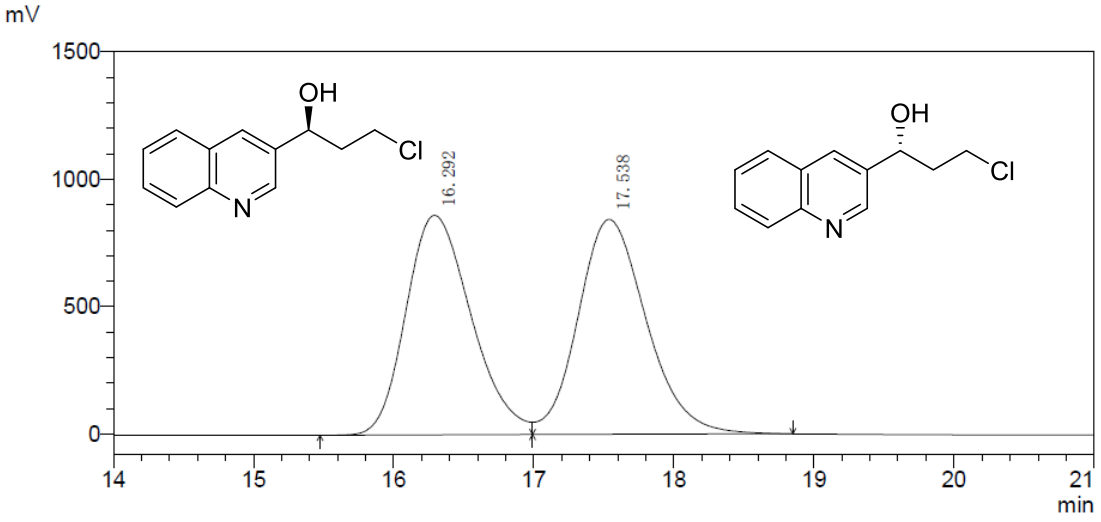


PDA_210nm

ID#	Rt. Time	Area	Height	Area%
1	14.087	10890307	533487	94.340
2	16.214	653336	31126	5.660

Chiral HPLC analysis: Diacel Chiralpak OJ-H, *n*-hexane/*i*-PrOH = 95/5, flow rate 1.0 mL/min, λ = 210 nm, $t_{(S)}$ = 14.1 min, $t_{(R)}$ = 16.2 min.

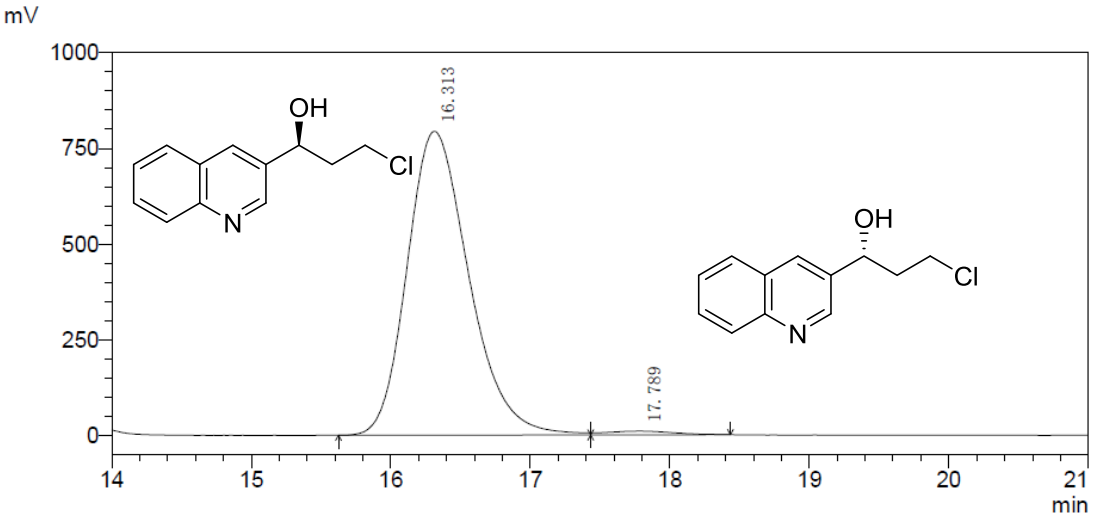
Chemical synthesized (*rac*)-**19a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	16.292	27907744	861485	49.385
2	17.538	28602498	843190	50.615

Enzymatic synthesized (*S*)-**19a**

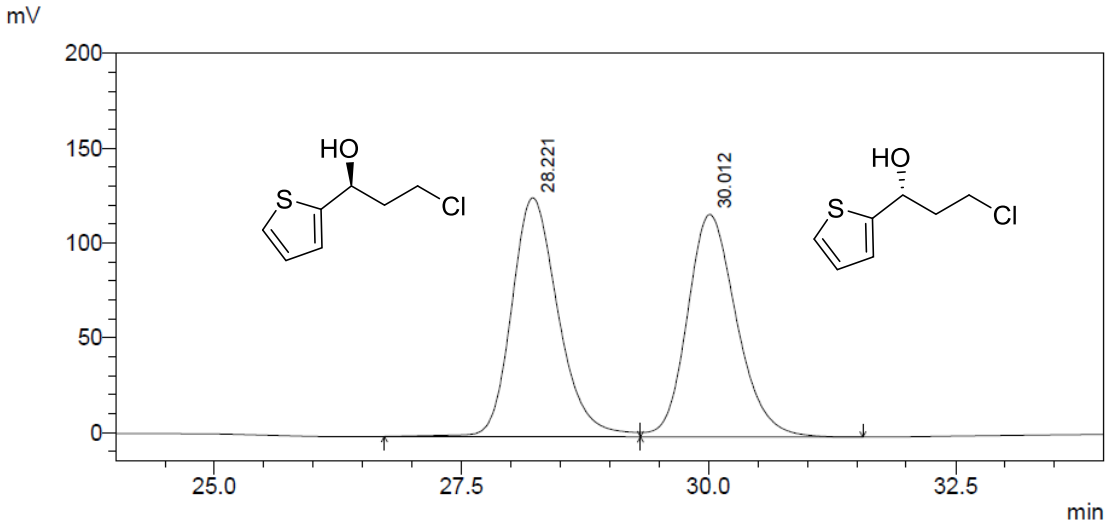


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	16.313	24453210	793448	98.672
2	17.789	329064	9653	1.328

Chiral HPLC analysis: Diacel Chiralpak OD-H, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 210 nm, $t_{(S)}$ = 16.3 min, $t_{(R)}$ = 17.8 min.

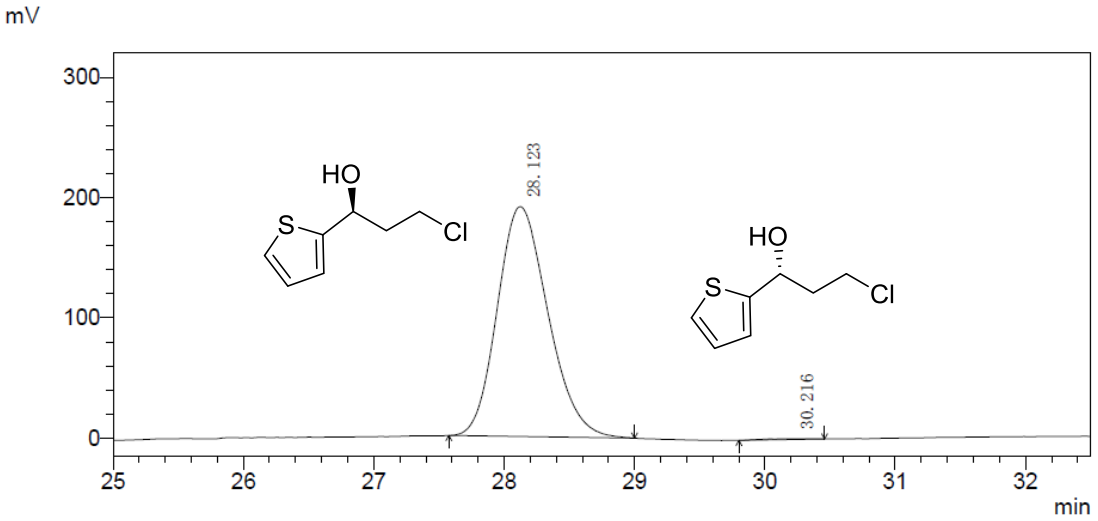
Chemical synthesized (*rac*)-**20a**



PDA_210nm

ID#	Rt. Time	Area	Height	Area%
1	28.221	4139076	125958	50.407
2	30.012	4072170	117311	49.593

Enzymatic synthesized (*S*)-**20a**

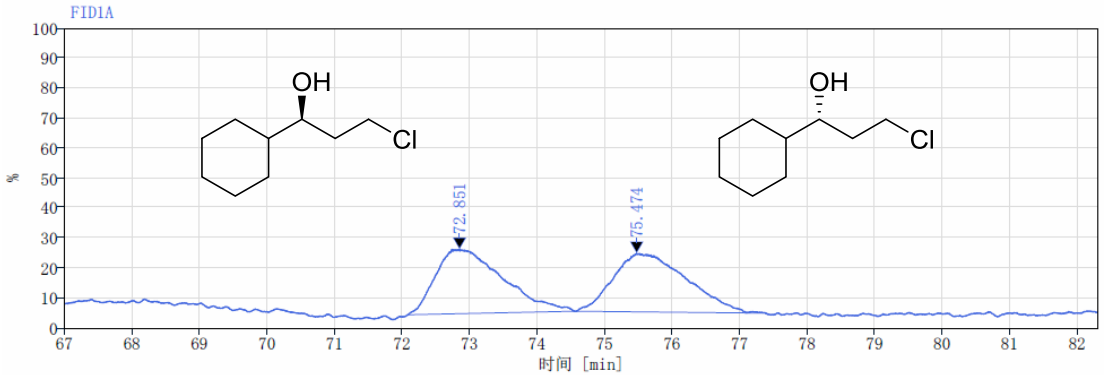


PDA_210nm

ID#	Rt. Time	Area	Height	Area %
1	28.123	5163009	190880	99.689
2	30.216	16082	675	0.311

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 98/2, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 28.1 min, $t_{(R)}$ = 30.2 min.

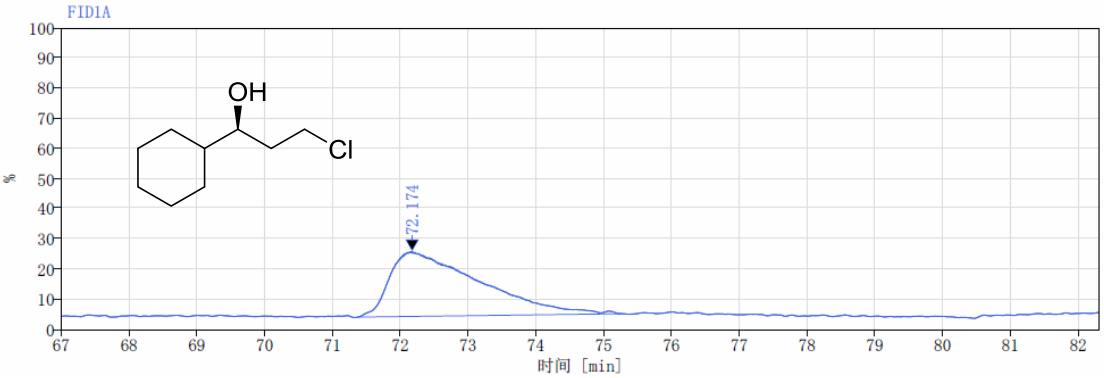
Chemical synthesized (*rac*)-**21a**



FID1A

RT. Time [min]	Area	Area%
72.851	239.03	50.18
75.474	237.33	49.82
Total	**476.36**	

Enzymatic synthesized (*S*)-**21a**

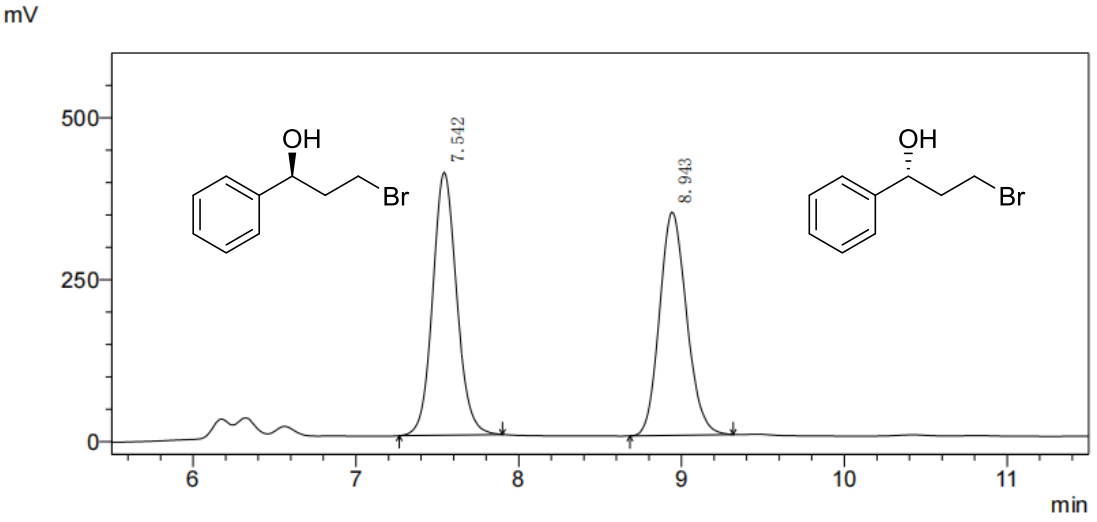


FID1A

RT. Time [min]	Area	Area%
72.174	800.98	100.00
Total	**800.98**	

Chiral GC analysis: CYCLODEX-B, 110 °C for 85 min, $t_{(S)}$ = 72.2 min, $t_{(R)}$ = 75.5 min..

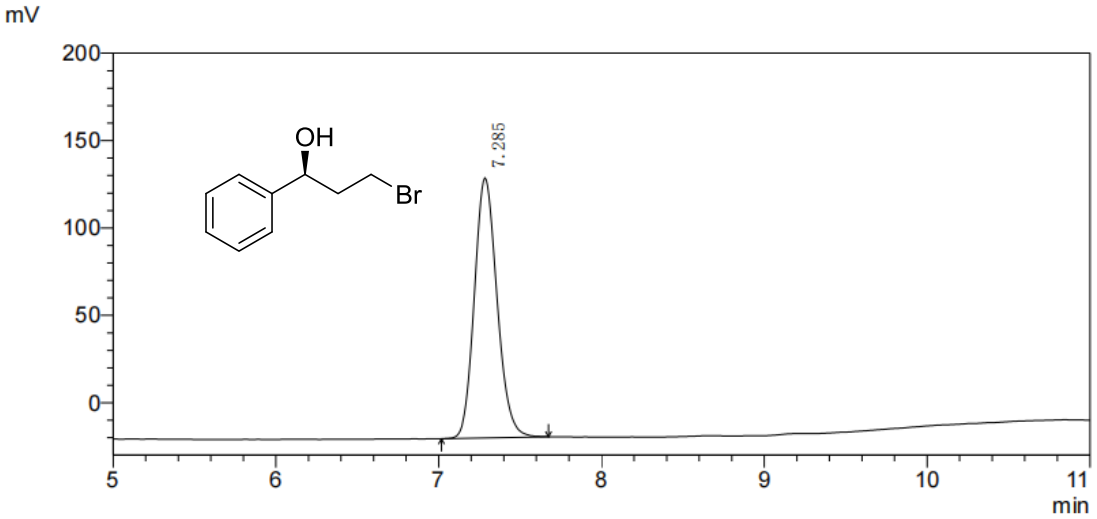
Chemical synthesized (*rac*)-**22a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	7.542	4166331	405994	50.972
2	8.943	4007396	344770	49.028

Enzymatic synthesized (*S*)-**22a**

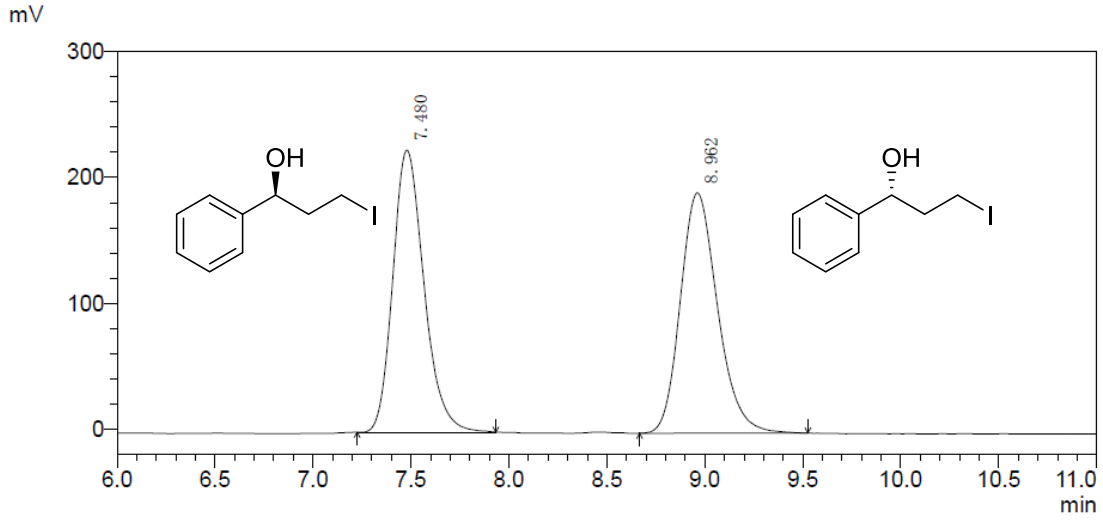


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	7.285	1435713	148674	100.000

Chiral HPLC analysis: Diacel Chiralpak OD-H, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 210 nm, $t_{(S)}$ = 7.3 min, $t_{(R)}$ = 8.9 min..

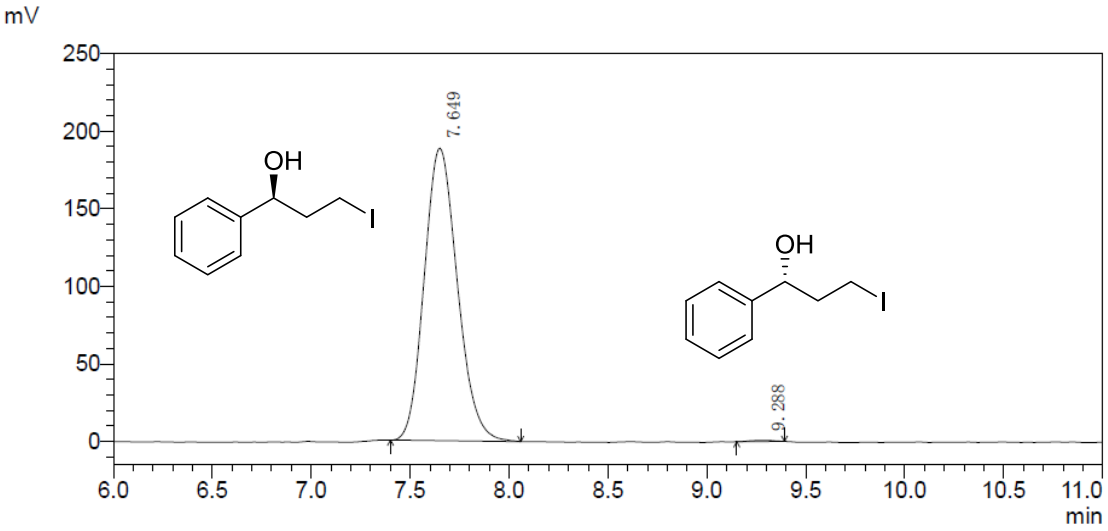
Chemical synthesized (*rac*)-**23a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	7.480	2482882	224111	49.626
2	8.962	2520308	190948	50.374

Enzymatic synthesized (*S*)-**23a**

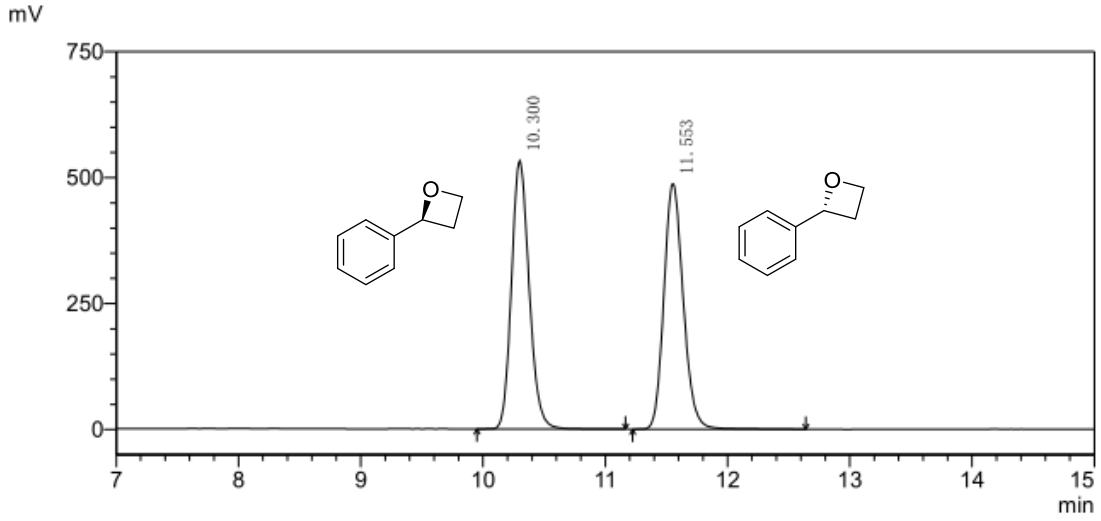


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	7.649	2193218	188775	99.709
2	9.288	6399	861	0.291

Chiral HPLC analysis: Diacel Chiralpak OD-H, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 210 nm, $t_{(S)}$ = 7.6 min, $t_{(R)}$ = 9.3 min.

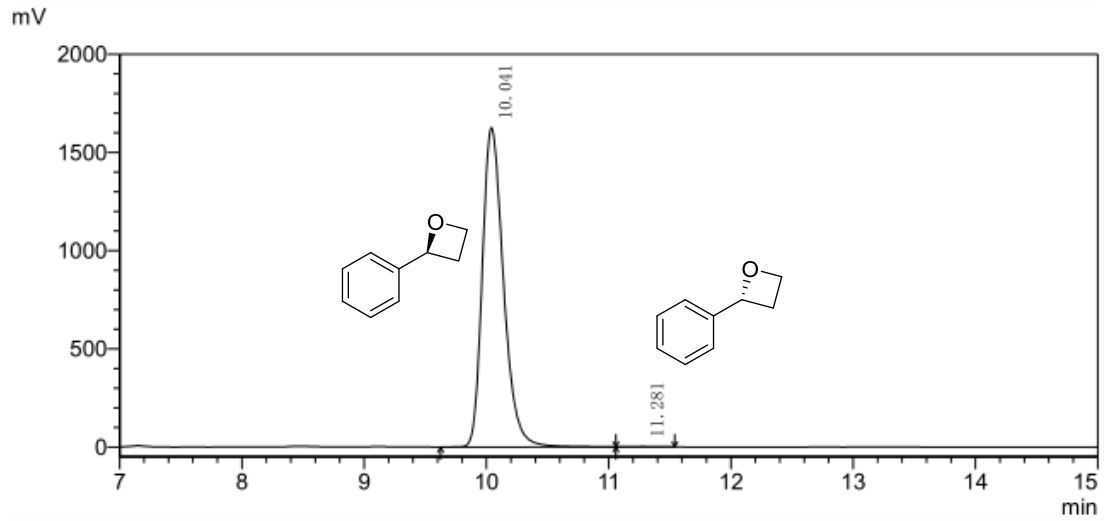
Chemical synthesized (*rac*)-**1b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	10.300	5360586	532422	49.946
2	11.553	5372125	487092	50.054

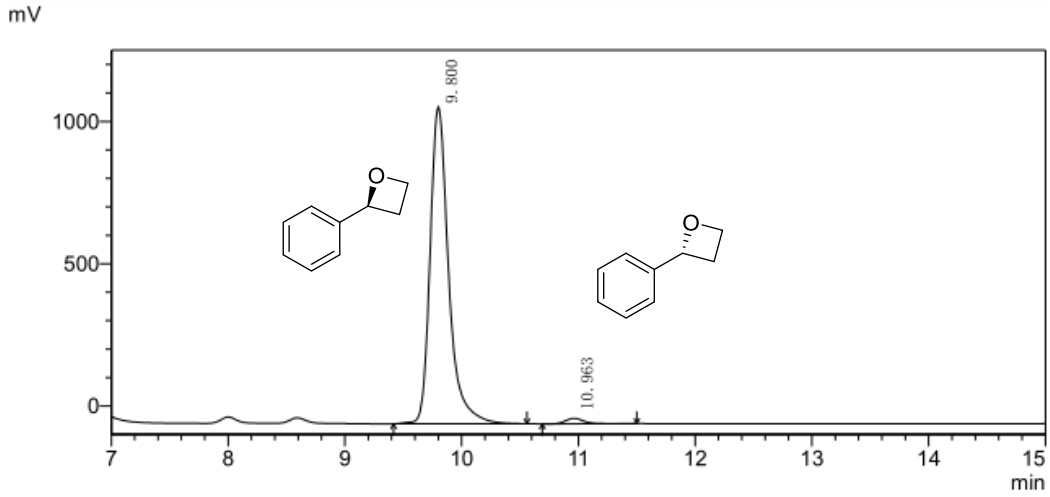
Enzymatic synthesized (*S*)-**1b (Ring opening by azide)**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	10.041	19606794	1626792	99.939
2	11.281	11935	936	0.061

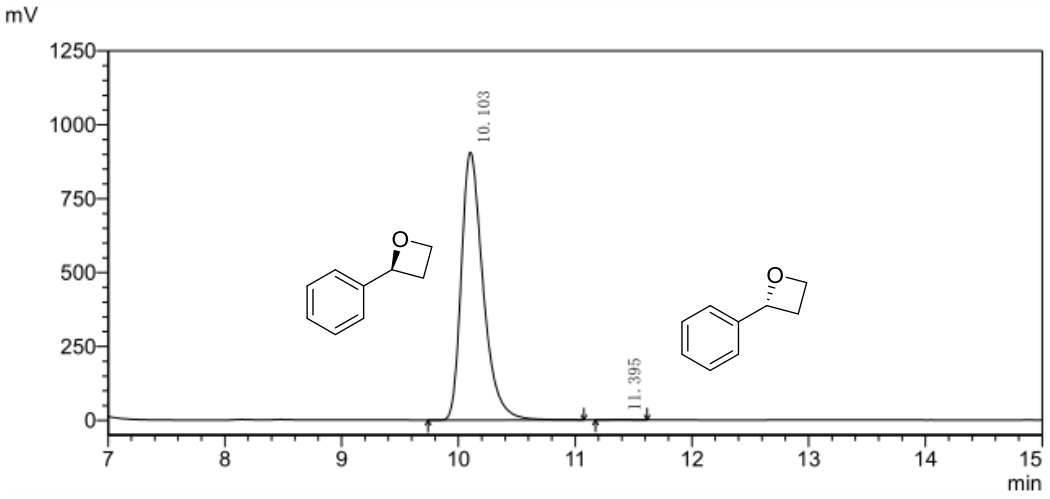
Enzymatic synthesized (*S*)-**1b (Ring opening by cyanide)**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	9.800	12263093	1113429	98.375
2	10.963	202626	18943	1.625

Enzymatic synthesized (*S*)-**1b (Ring opening by nitirte)**

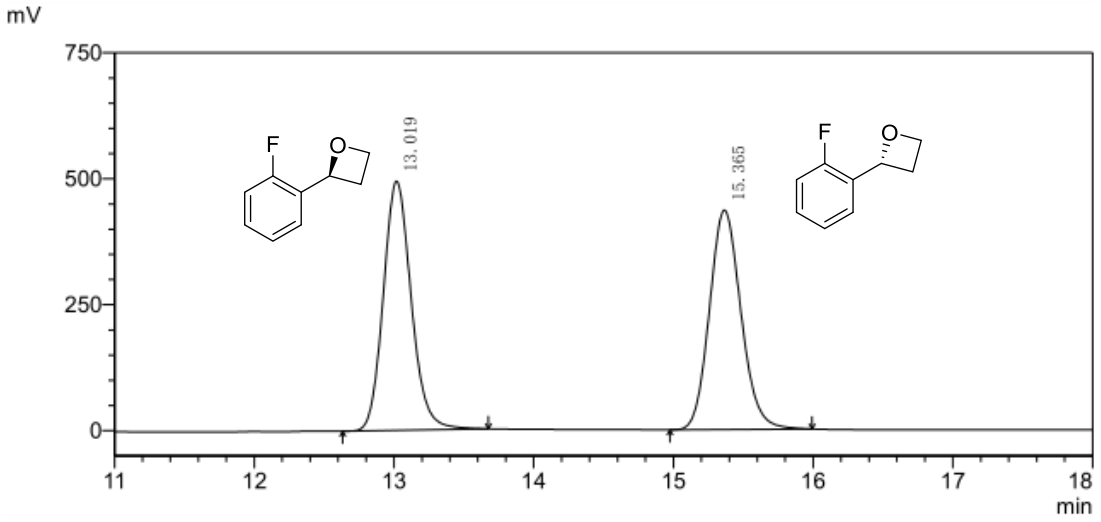


PDA 210nm

	Rt. Time	Area	Height	Area %
1	10.103	11745755	905468	99.926
2	11.395	8656	694	0.074

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 10.3 min, $t_{(R)}$ = 11.6 min.

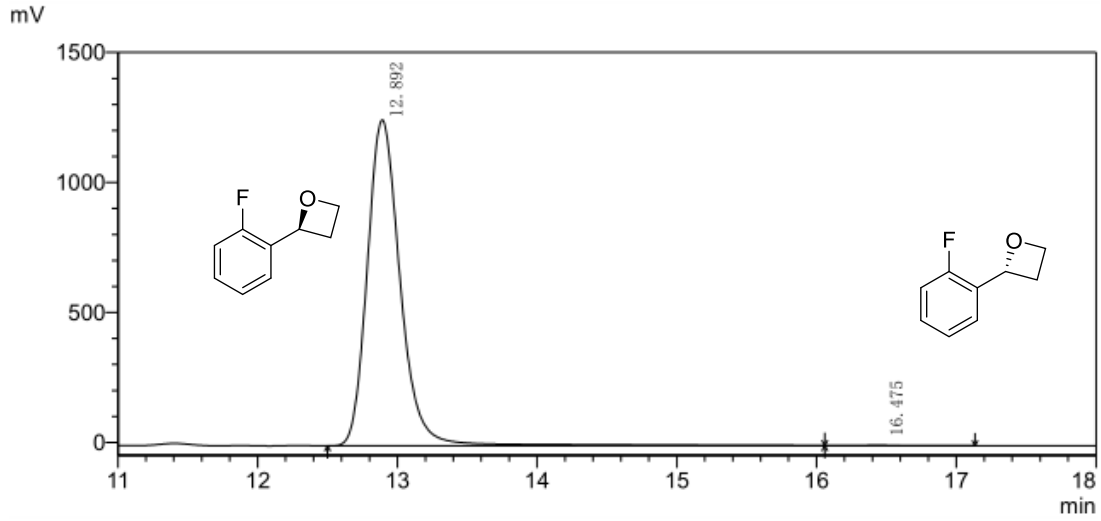
Chemical synthesized (*rac*)-**2b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	13.019	6873612	494730	50.145
2	15.365	6833943	435465	49.855

Enzymatic synthesized (*S*)-**2b**

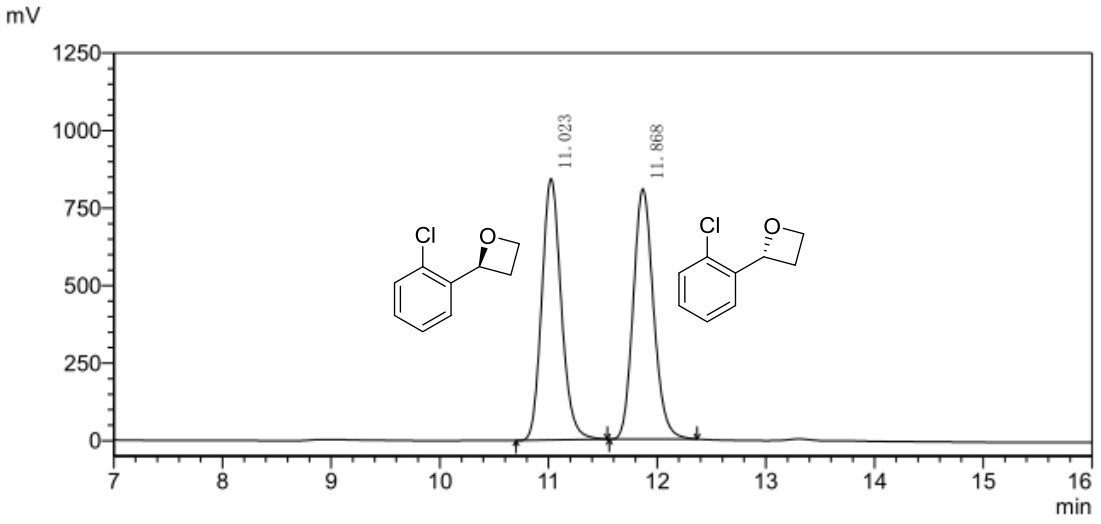


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	12.892	20768180	1254039	99.902
2	16.475	20278	649	0.098

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 12.9 min, $t_{(R)}$ = 16.5 min.

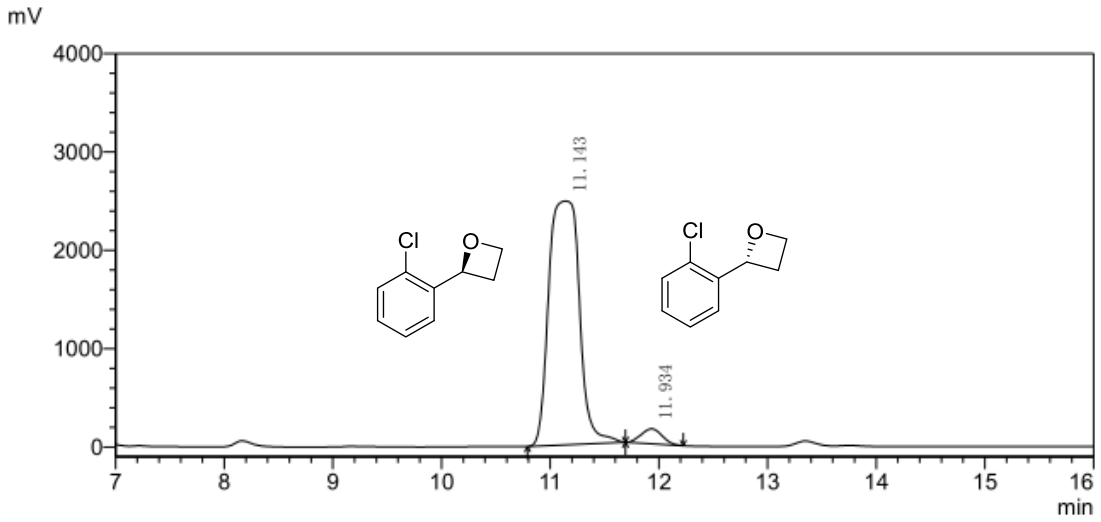
Chemical synthesized (*rac*)-**3b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	11.023	10477966	842802	50.015
2	11.868	10471835	807073	49.985

Enzymatic synthesized (*S*)-**3b**

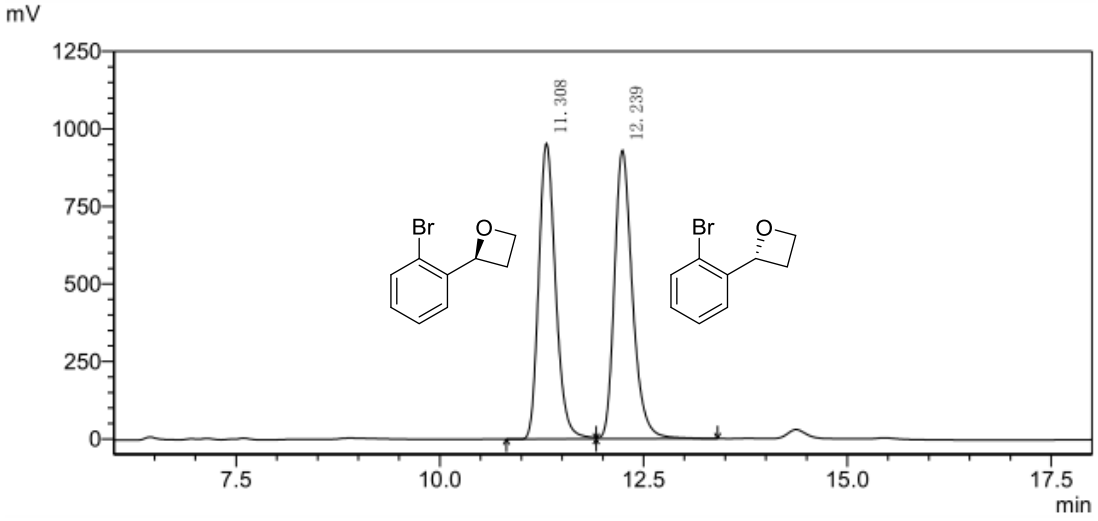


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	11.143	48580461	2480612	95.915
2	11.934	2068838	153675	4.085

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 11.1 min, $t_{(R)}$ = 11.9 min.

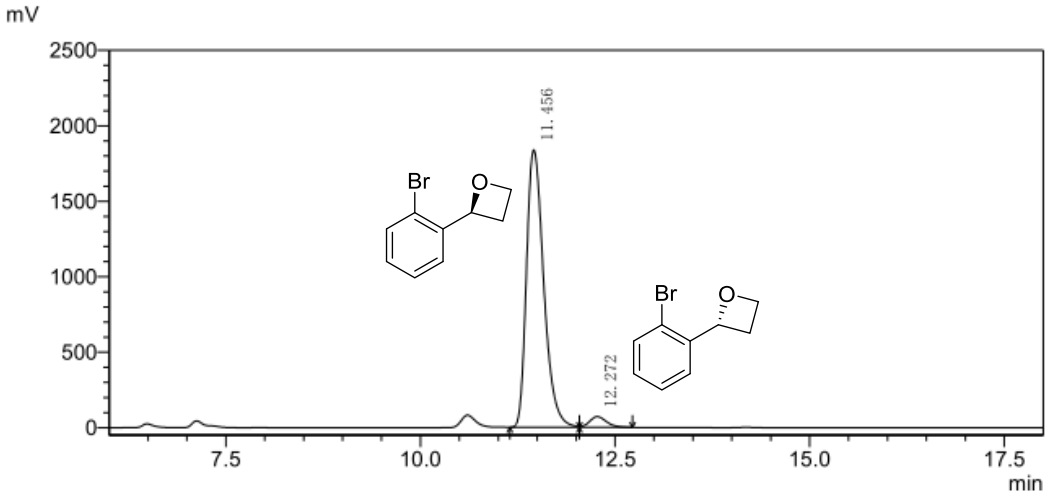
Chemical synthesized (*rac*)-**4b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	11.308	13680017	952846	48.911
2	12.239	14289030	930444	51.089

Enzymatic synthesized (*S*)-**4b**

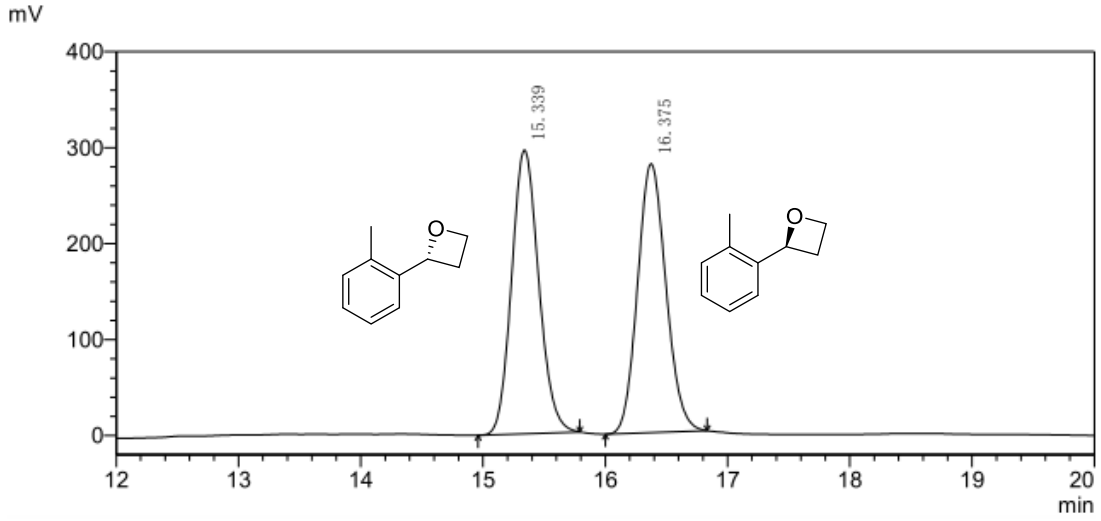


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	11.456	28335546	1837646	96.298
2	12.272	1089384	71537	3.702

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 11.5 min, $t_{(R)}$ = 12.3 min.

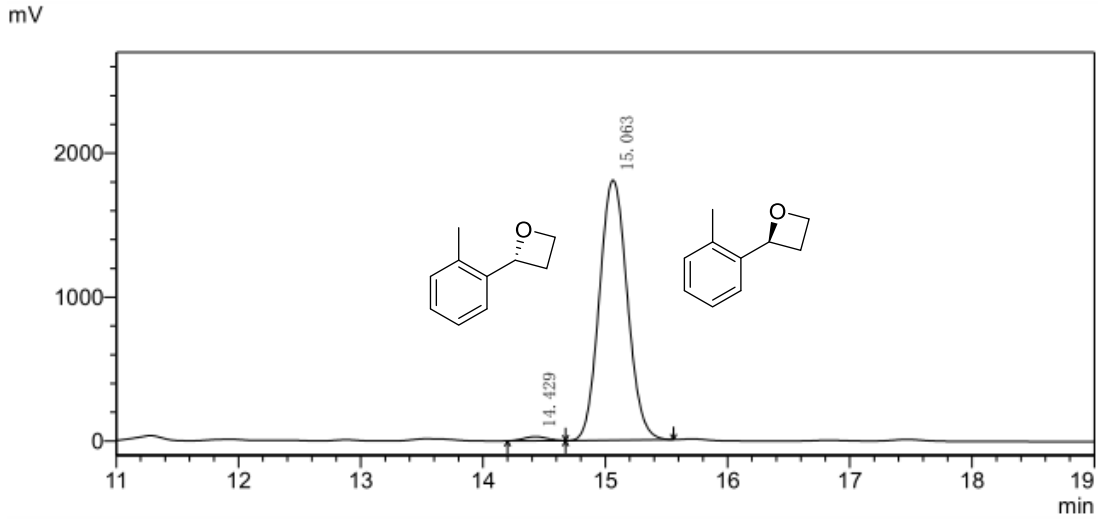
Chemical synthesized (*rac*)-**5b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.339	4557692	295629	50.171
2	16.375	4526543	280296	49.829

Enzymatic synthesized (*S*)-**5b**

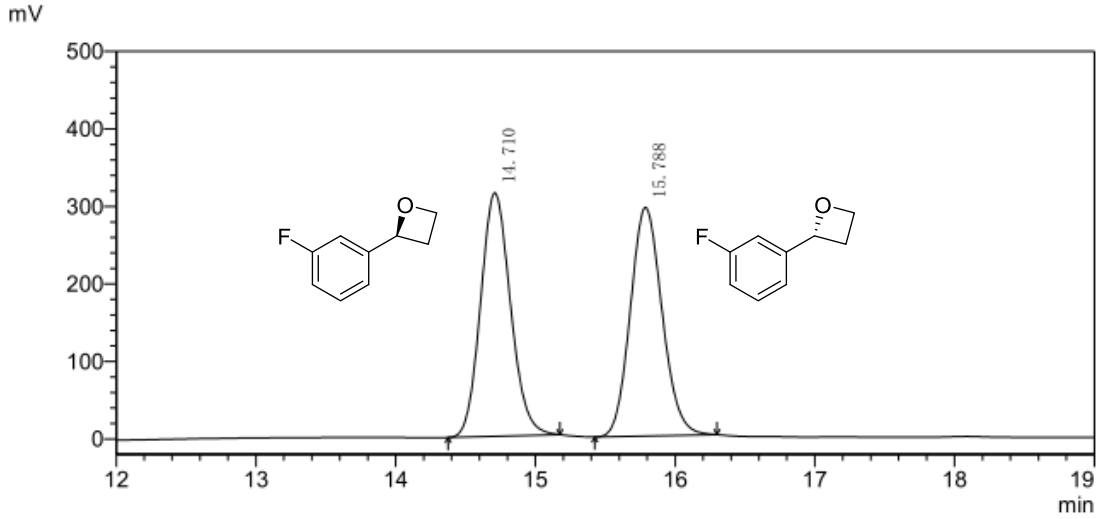


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.429	380662	28250	1.308
2	15.063	28728727	1806388	98.692

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(R)}$ = 14.4 min, $t_{(S)}$ = 15.1 min.

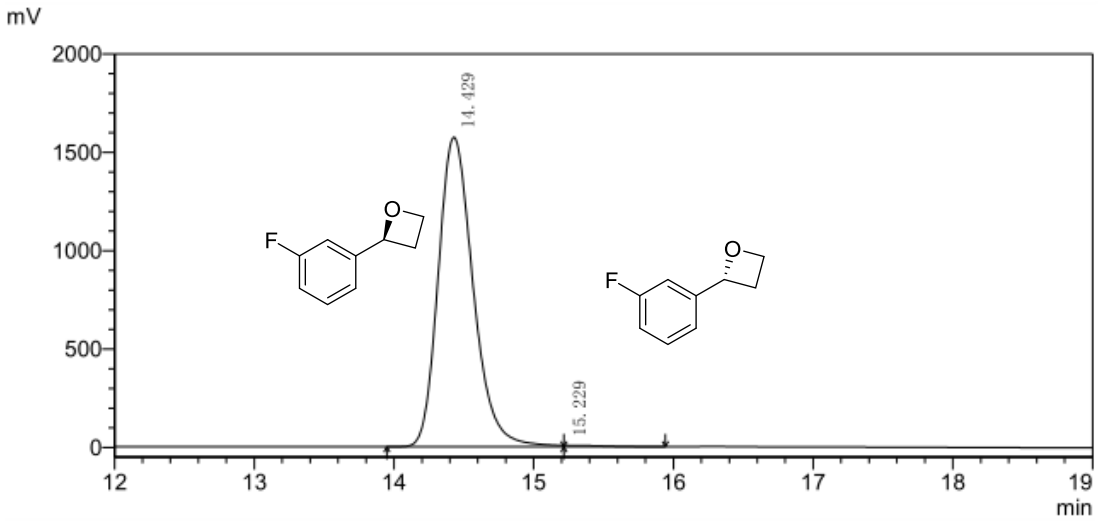
Chemical synthesized (*rac*)-**6b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.710	4685654	314313	50.058
2	15.788	4674777	294836	49.942

Enzymatic synthesized (*S*)-**6b**

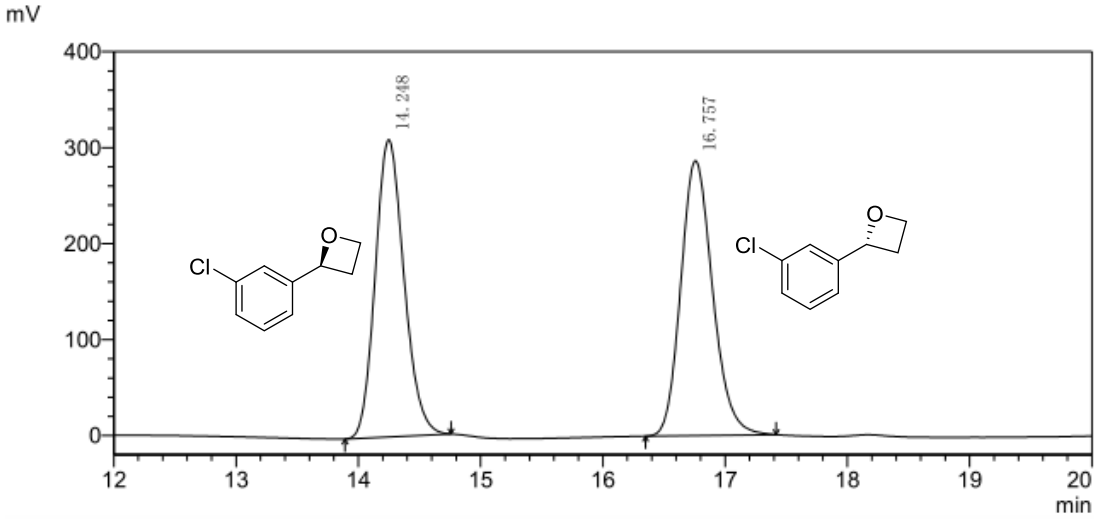


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.429	27367970	1573438	99.591
2	15.229	112367	6415	0.409

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 14.4 min, $t_{(R)}$ = 15.2 min.

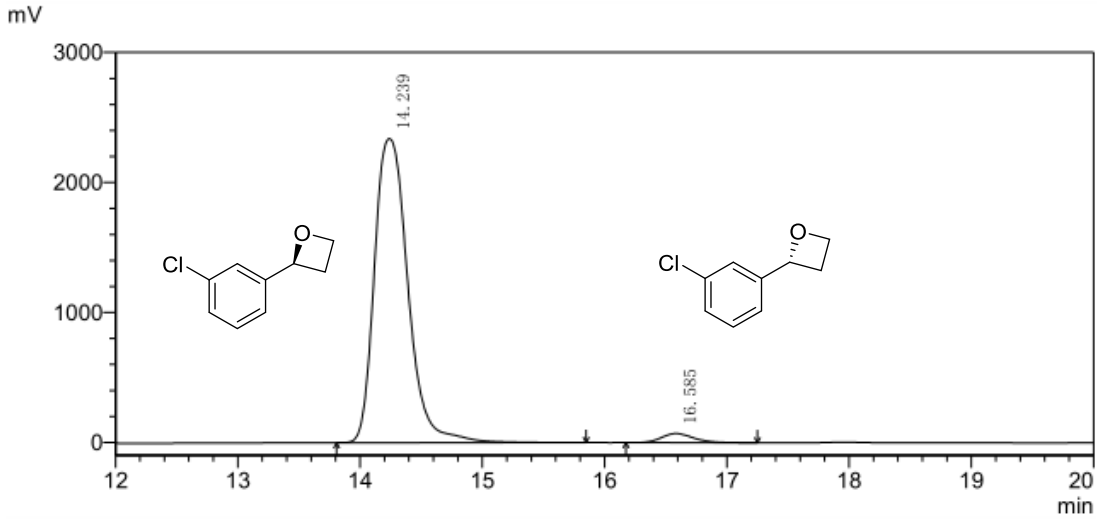
Chemical synthesized (*rac*)-**7b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.248	5071931	309698	49.402
2	16.757	5194628	286570	50.598

Enzymatic synthesized (*S*)-**7b**

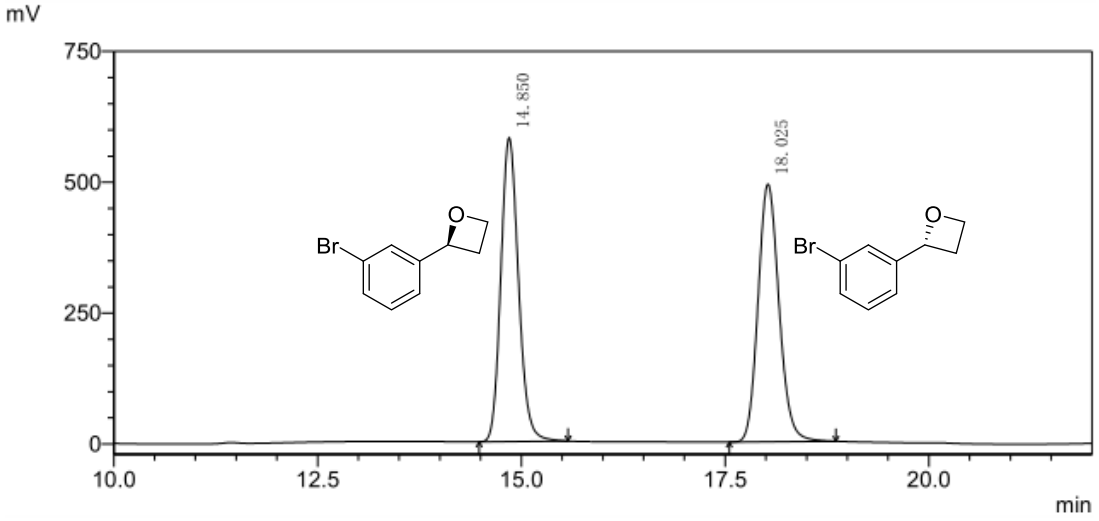


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.239	44557843	2338876	97.168
2	16.585	1298751	70430	2.832

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 14.2 min, $t_{(R)}$ = 16.6 min.

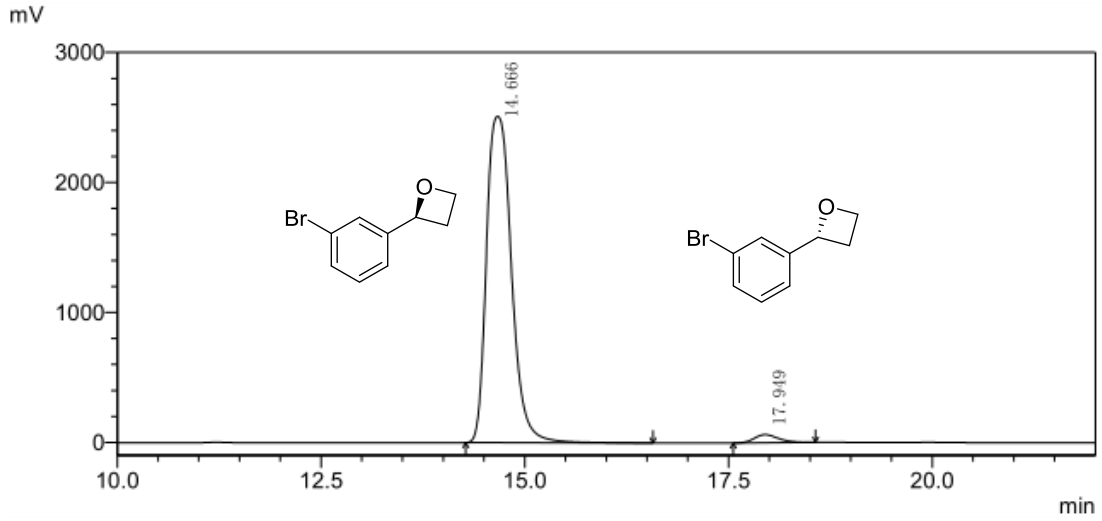
Chemical synthesized (*rac*)-**8b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.850	8738172	580656	49.772
2	18.025	8818386	492475	50.228

Enzymatic synthesized (*S*)-**8b**

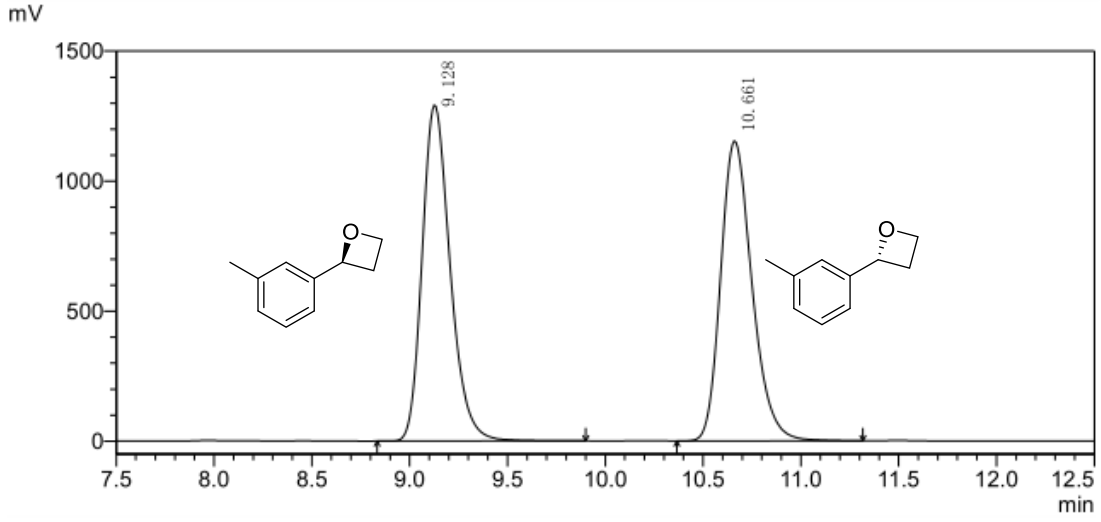


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.666	53549061	2510287	97.641
2	17.949	1293685	62586	2.359

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 14.7 min, $t_{(R)}$ = 17.9 min.

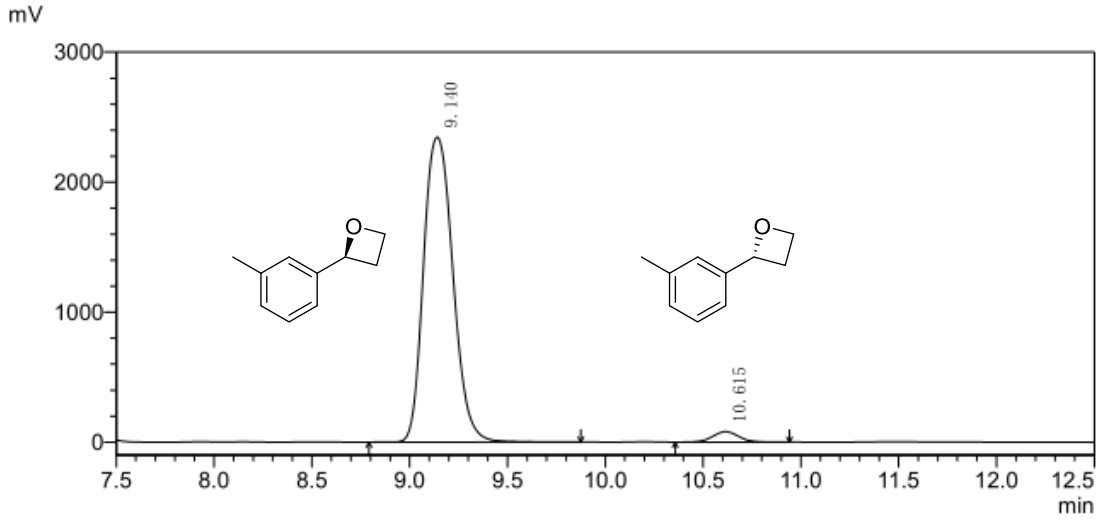
Chemical synthesized (*rac*)-**9b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	9.128	12828043	1292176	49.921
2	10.661	12868475	1153061	50.079

Enzymatic synthesized (*S*)-**9b**

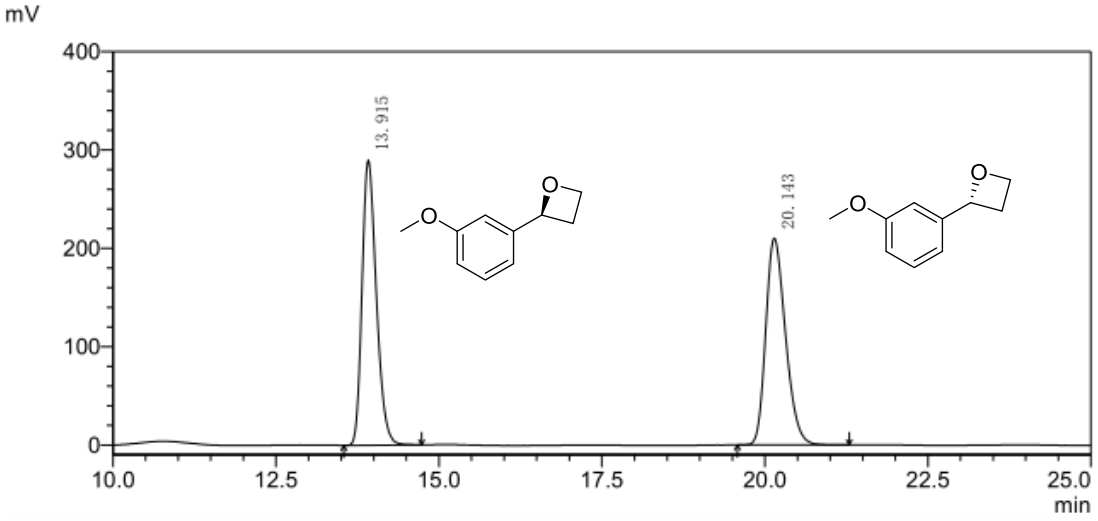


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	9.140	24440703	2345540	96.955
2	10.615	767634	81325	3.045

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 9.1 min, $t_{(R)}$ = 10.6 min.

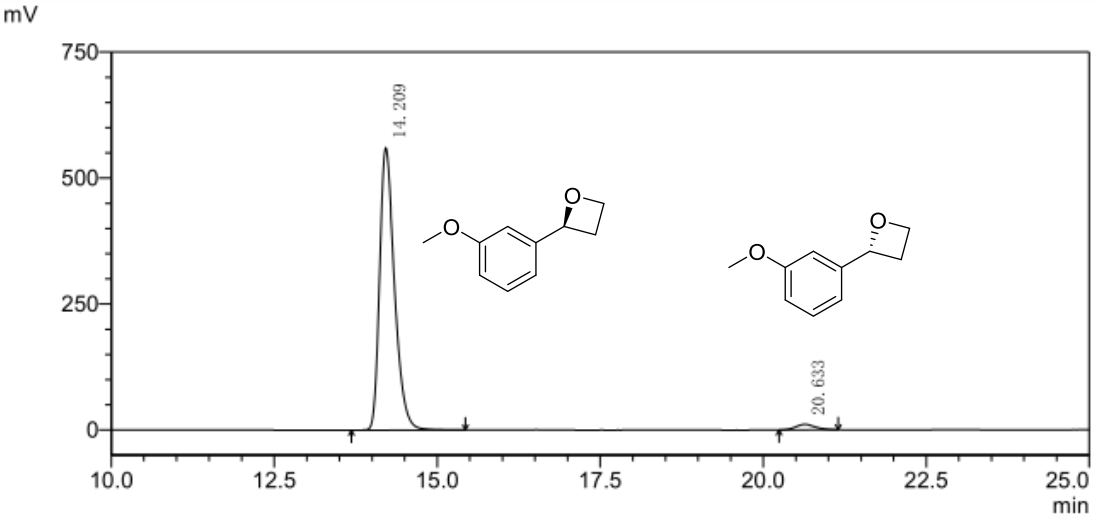
Chemical synthesized (*rac*)-**10b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	13.915	4392816	289673	49.937
2	20.143	4403967	210165	50.063

Enzymatic synthesized (*S*)-**10b**

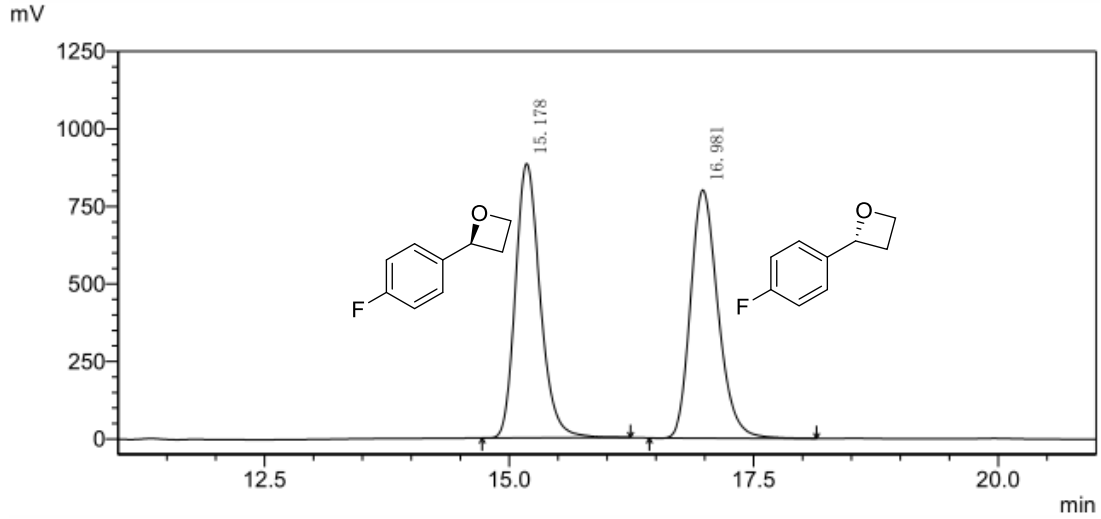


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.209	8931756	559931	97.546
2	20.633	224701	10833	2.454

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 14.2 min, $t_{(R)}$ = 20.6 min.

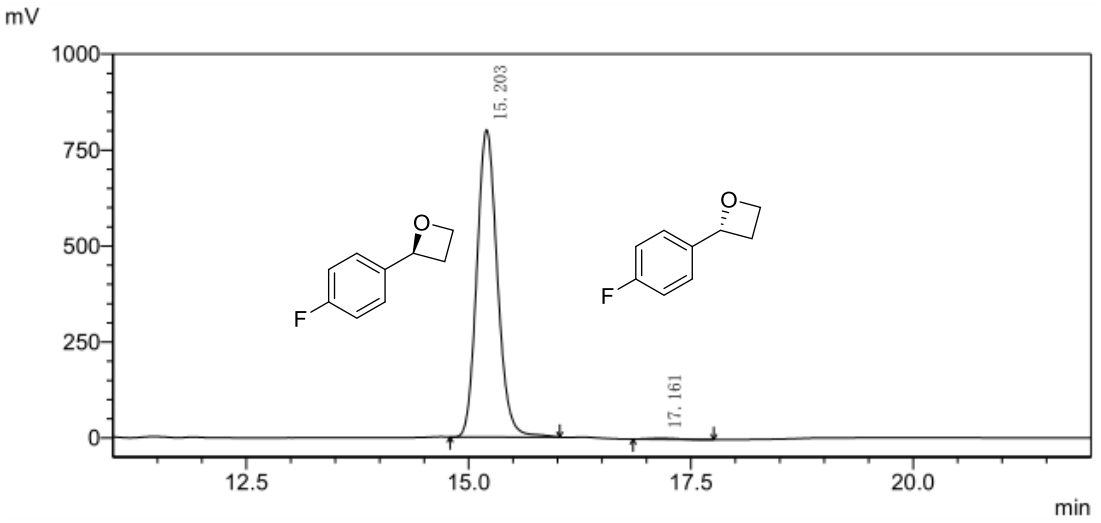
Chemical synthesized (*rac*)-**11b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.178	15574056	884420	49.968
2	16.981	15594051	800141	50.032

Enzymatic synthesized (*S*)-**11b**

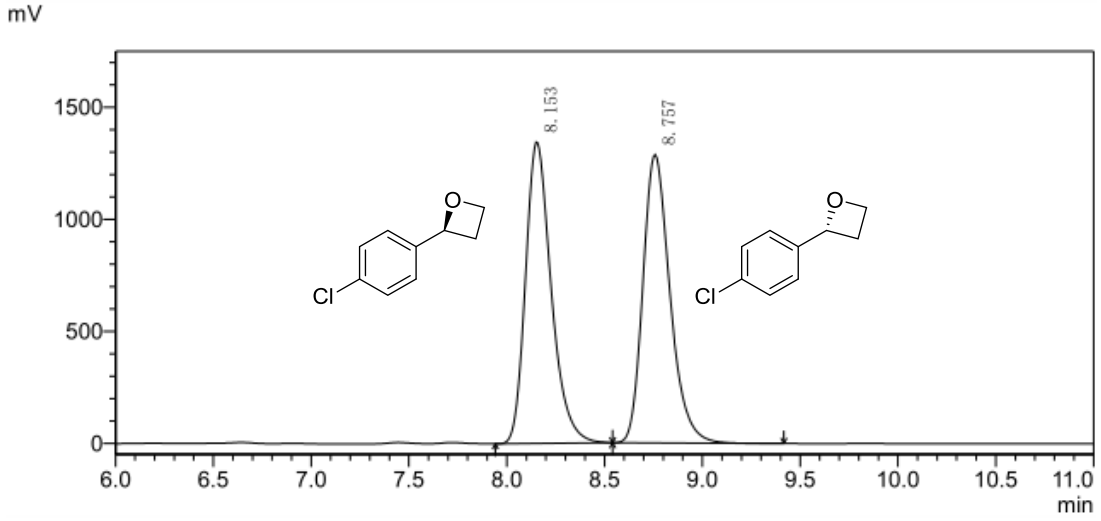


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.203	12847589	800715	99.536
2	17.161	59830	2765	0.464

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 15.2 min, $t_{(R)}$ = 17.2 min.

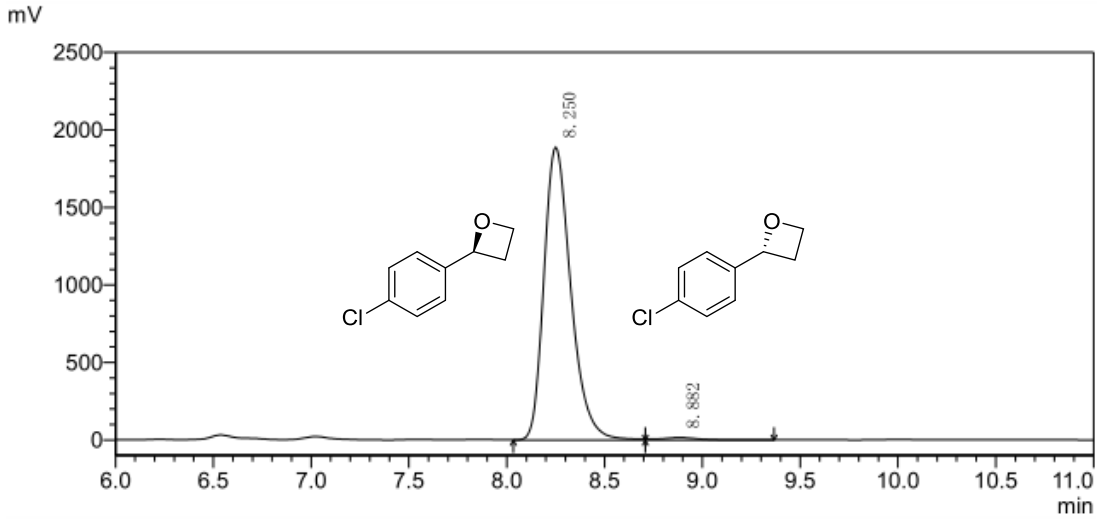
Chemical synthesized (*rac*)-**12b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	8.153	12371846	1346303	49.976
2	8.757	12383649	1287291	50.024

Enzymatic synthesized (*S*)-**12b**

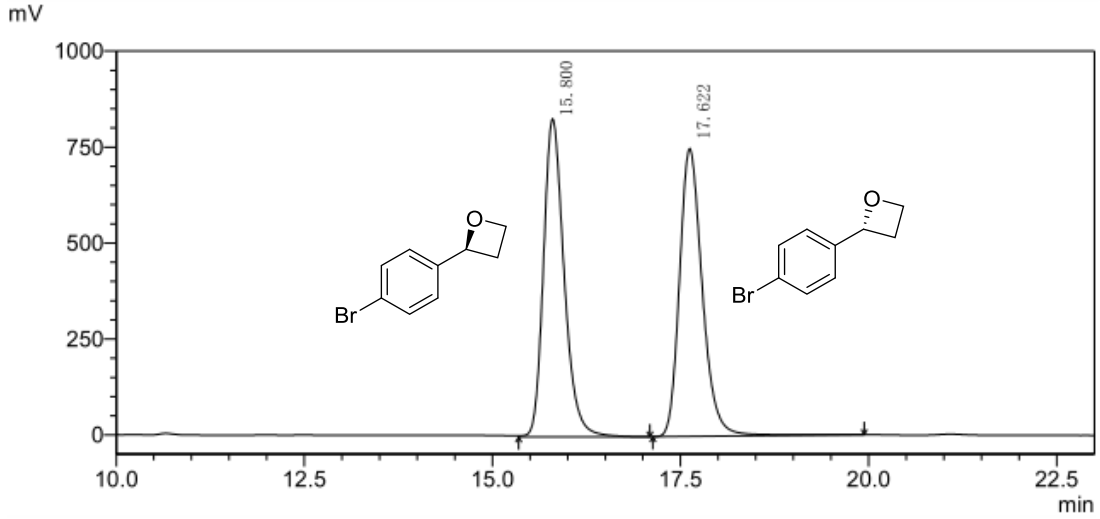


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	8.250	18068994	1890426	98.636
2	8.882	249906	16913	1.364

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 8.3 min, $t_{(R)}$ = 8.9 min.

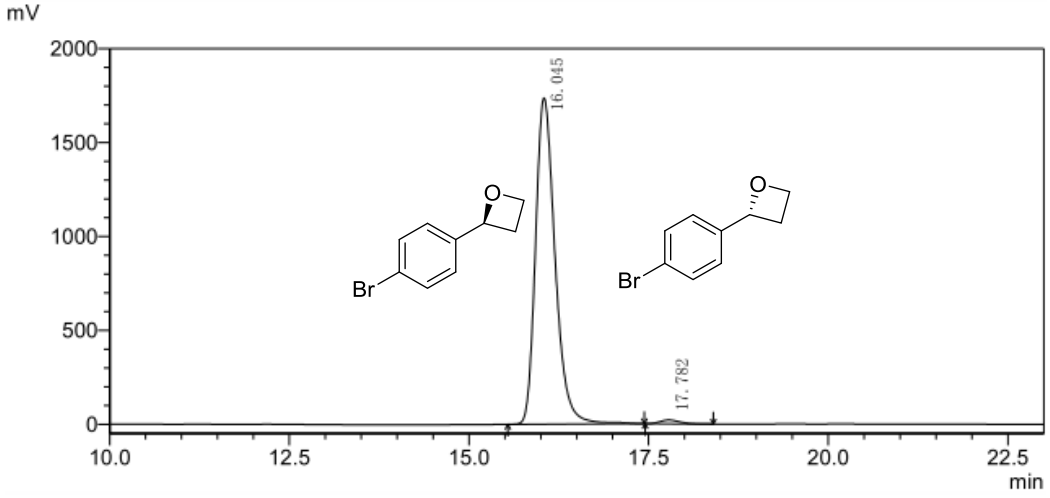
Chemical synthesized (*rac*)-**13b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.800	15794861	828061	49.964
2	17.622	15817622	749364	50.036

Enzymatic synthesized (*S*)-**13b**

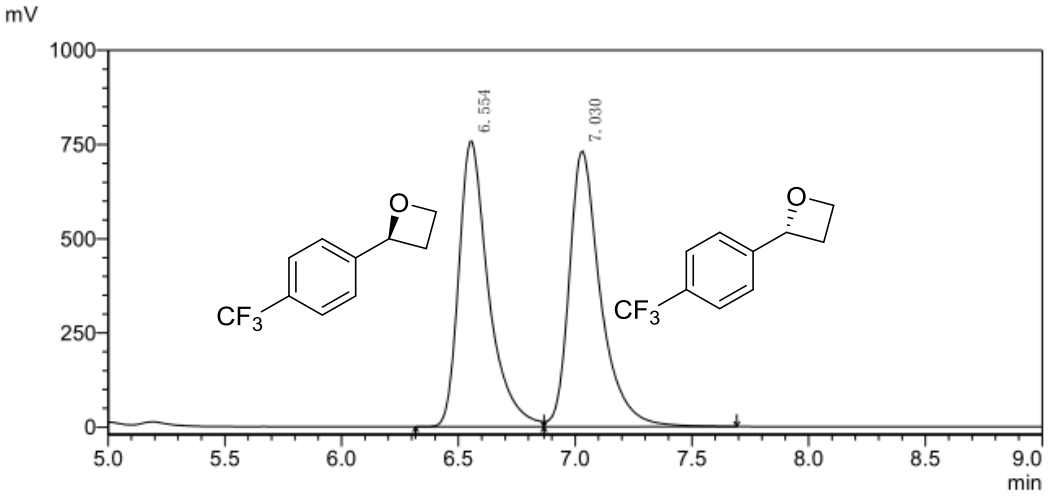


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	16.045	32895217	1737839	98.866
2	17.782	377243	19964	1.134

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 16.0 min, $t_{(R)}$ = 17.8 min.

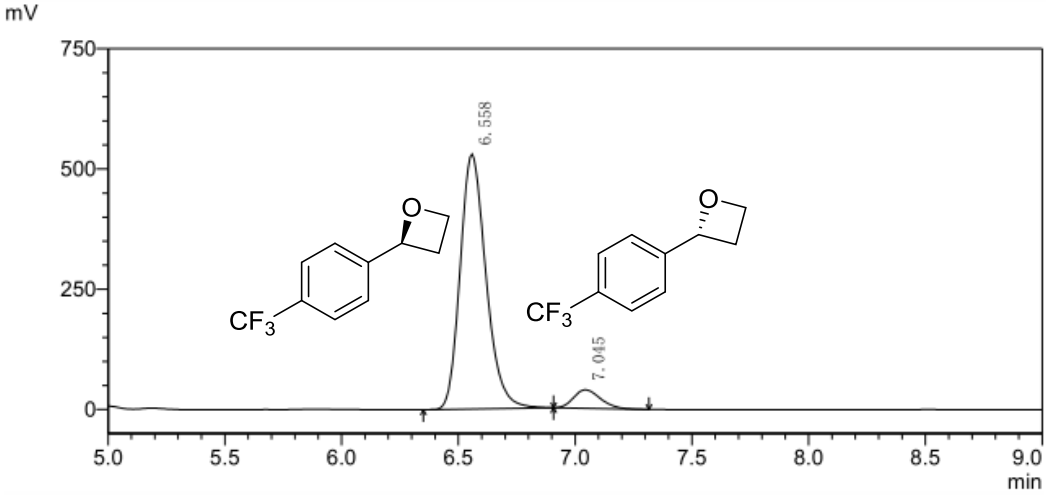
Chemical synthesized (*rac*)-**14b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	6.554	6706285	757087	49.538
2	7.030	6831275	731356	50.462

Enzymatic synthesized (*S*)-**14b**

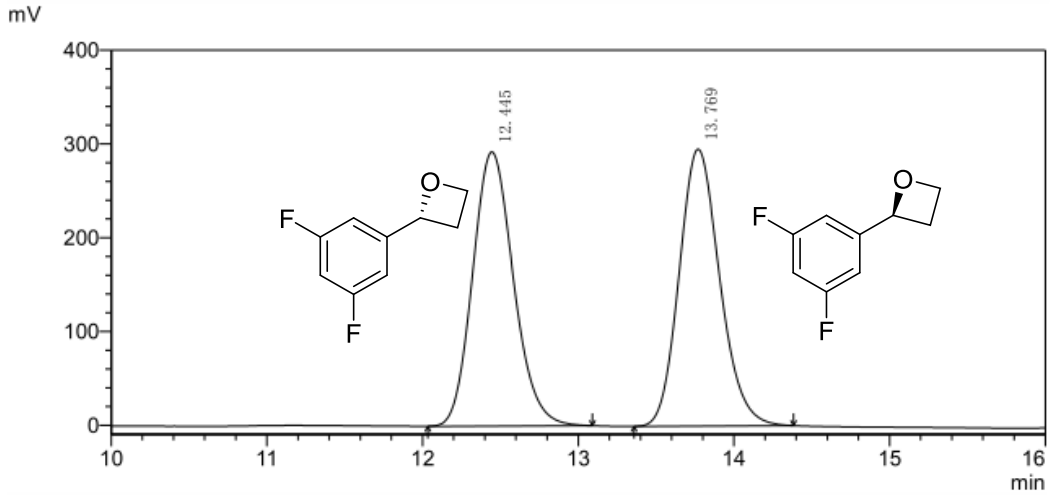


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	6.558	4086378	529900	92.941
2	7.045	310367	38572	7.059

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 6.6 min, $t_{(R)}$ = 7.0 min.

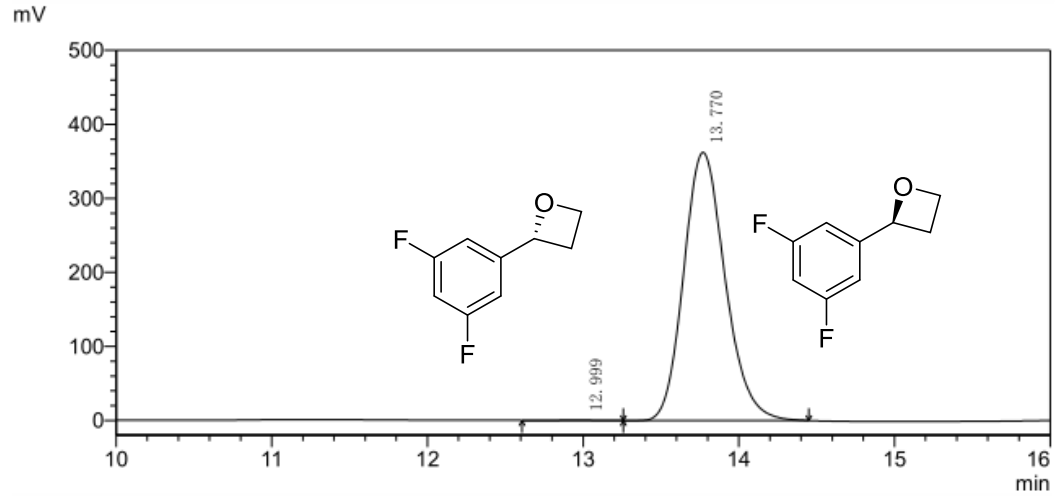
Chemical synthesized (*rac*)-**15b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	12.445	5334535	292511	49.881
2	13.769	5360025	295561	50.119

Enzymatic synthesized (*S*)-**15b**

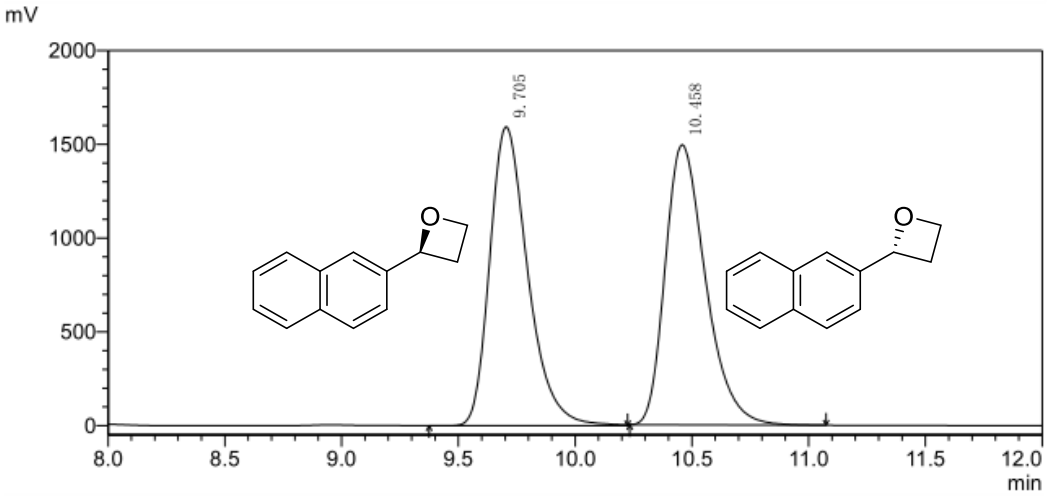


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	12.999	5299	324	0.079
2	13.770	6730235	362487	99.921

Chiral HPLC analysis: Diacel Chiralpak IA-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(R)}$ = 13.0 min, $t_{(S)}$ = 13.8 min.

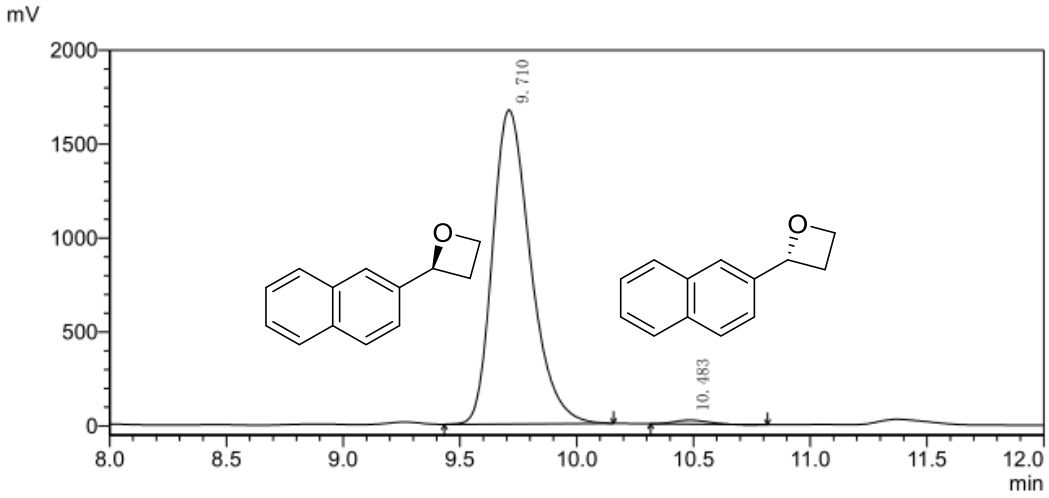
Chemical synthesized (*rac*)-**16b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	9.705	18172670	1595119	50.191
2	10.458	18034694	1494464	49.809

Enzymatic synthesized (*S*)-**16b**

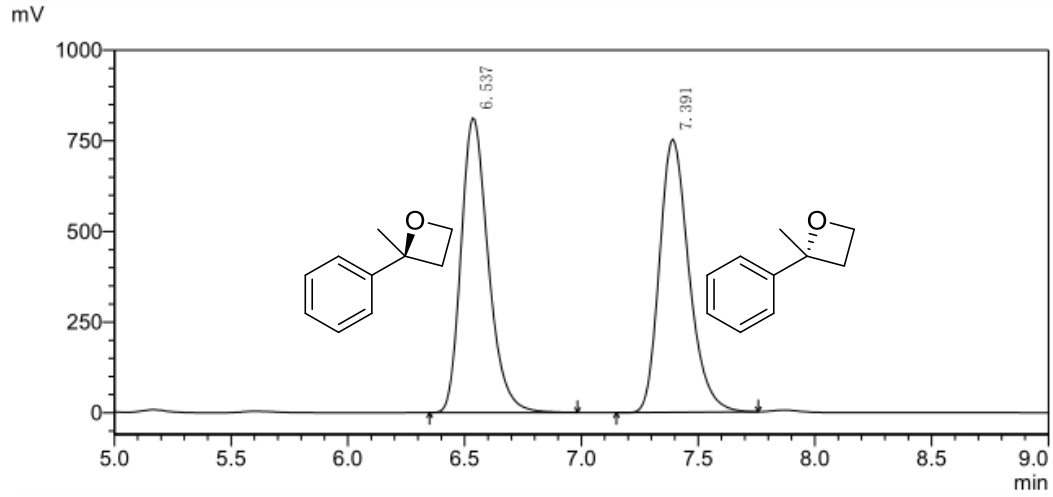


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	9.710	18920836	1674031	98.958
2	10.483	199256	20438	1.042

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 9.7min, $t_{(R)}$ = 10.5 min.

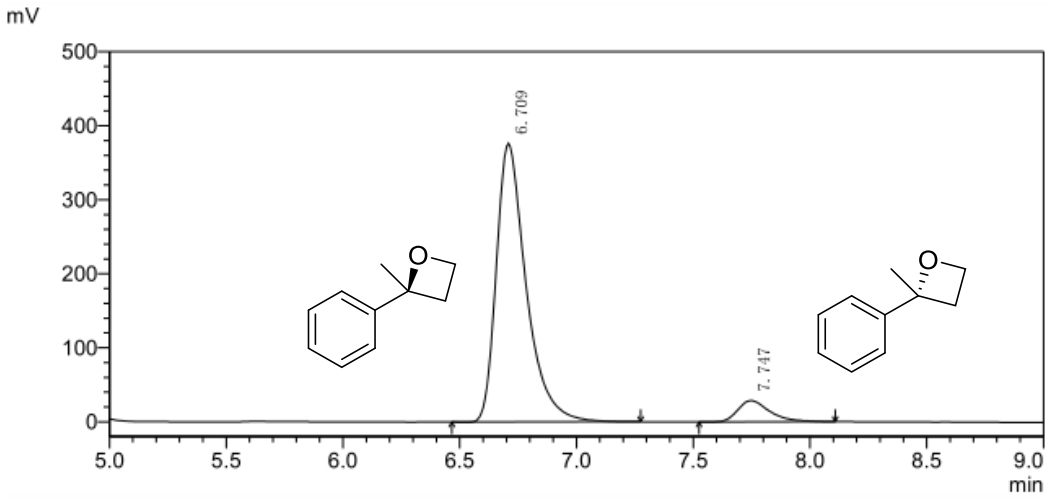
Chemical synthesized (*rac*)-**17b**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	6.537	6588941	812221	49.880
2	7.391	6620696	753042	50.120

Enzymatic synthesized (*S*)-**17b**

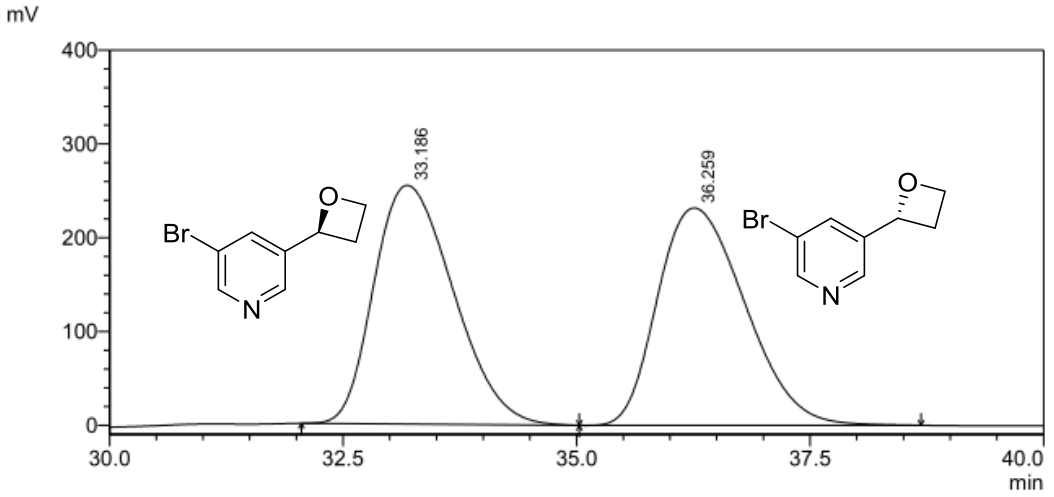


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	6.709	3342630	376632	92.483
2	7.747	271691	28673	7.517

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 6.7min, $t_{(R)}$ = 7.7 min.

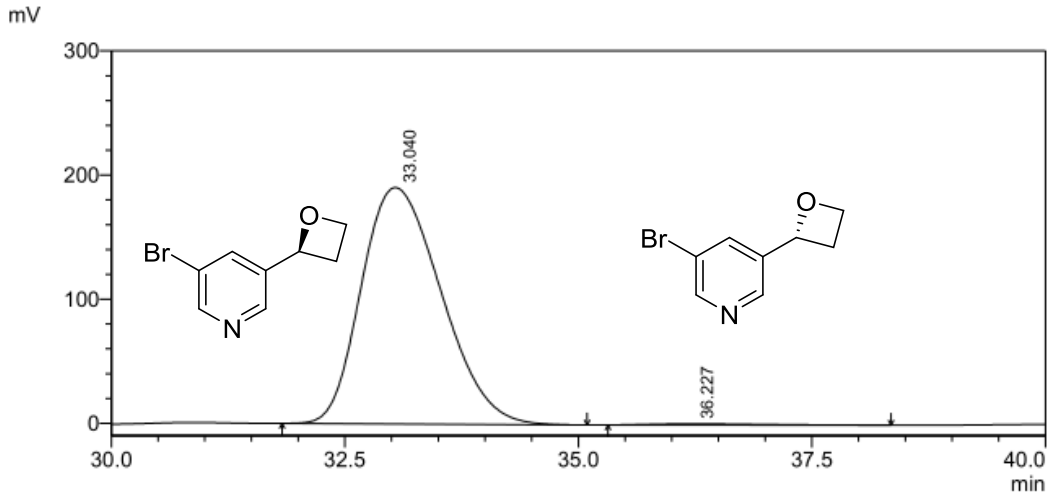
Chemical synthesized (*rac*)-**18b**



PDA_210nm

ID#	Rt. Time	Area	Height	Area%
1	33.186	15091005	254835	49.929
2	36.259	15133746	232002	50.071

Enzymatic synthesized (*S*)-**18b**

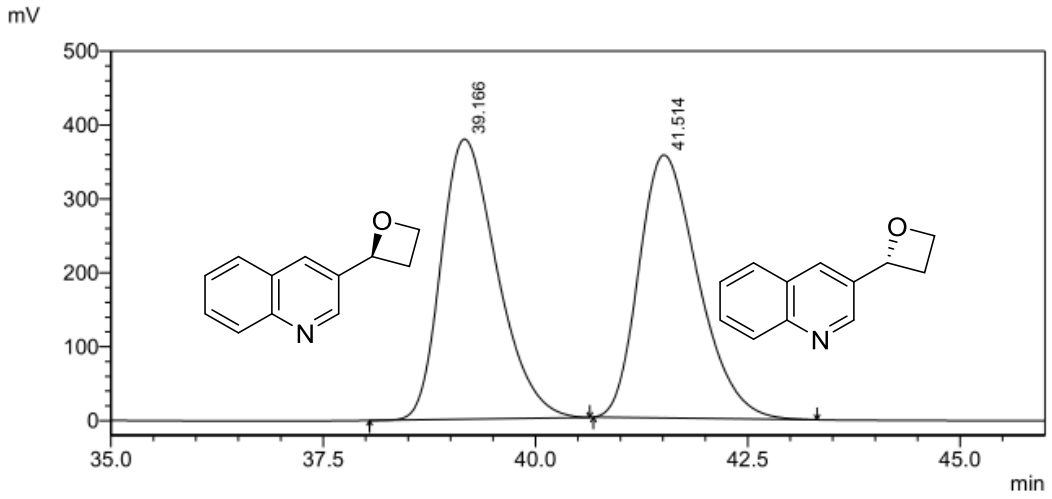


PDA_210nm

ID#	Rt. Time	Area	Height	Area%
1	33.040	11336617	190408	99.294
2	36.227	80559	928	0.706

Chiral HPLC analysis: Diacel Chiralpak OB-H, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 33.0min, $t_{(R)}$ = 36.2 min.

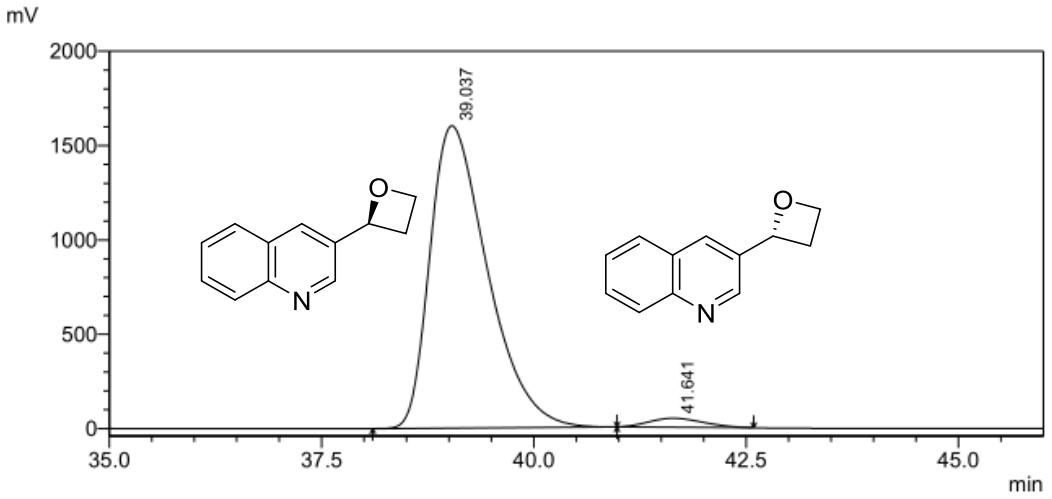
Chemical synthesized (*rac*)-**19b**



PDA_210nm

ID#	Rt. Time	Area	Height	Area%
1	39.166	17357537	378902	50.098
2	41.514	17289425	355845	49.902

Enzymatic synthesized (*S*)-**19b**

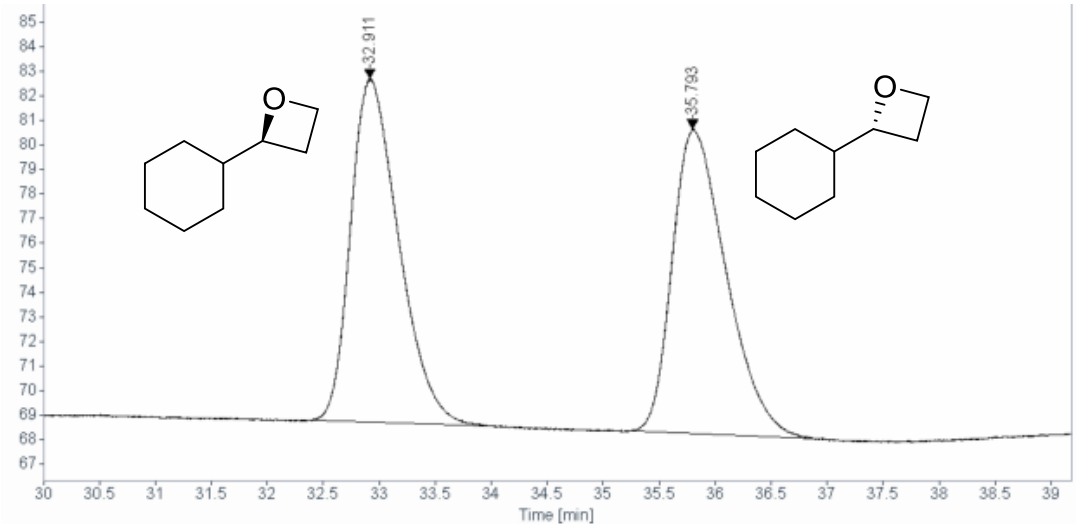


PDA_210nm

ID#	Rt. Time	Area	Height	Area%
1	39.037	75491883	1602047	97.271
2	41.641	2117897	47352	2.729

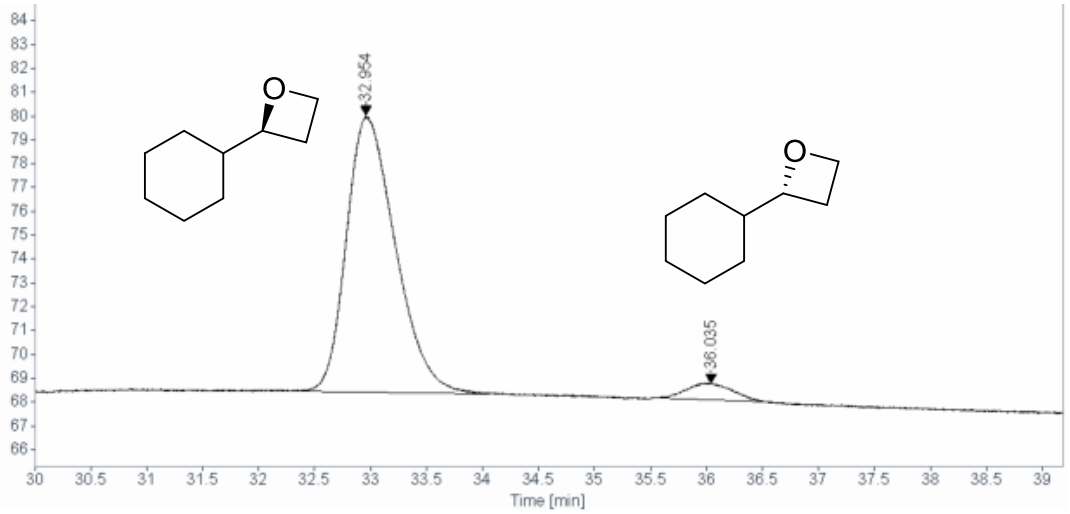
Chiral HPLC analysis: Diacel Chiralpak AD-H, *n*-hexane/*i*-PrOH = 95/5, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 39.0 min, $t_{(R)}$ = 41.6 min.

Chemical synthesized (*rac*)-**21b**



ID#	Ret. Time	Area	Height	Area%	Resolution
1	32.911	420.903	14.020	50.148	
1	35.793	418.413	12.422	49.852	3.468

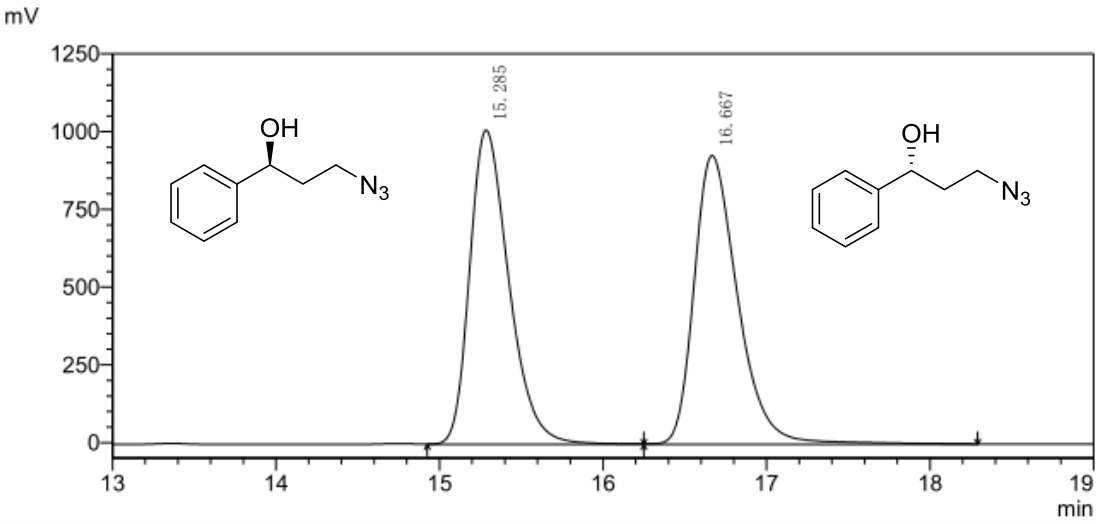
Enzymatic synthesized (*S*)-**21b**



ID#	Ret. Time	Area	Height	Area%	Resolution
1	32.954	353.312	11.617	94.490	
1	36.035	20.602	0.709	5.510	3.879

Chiral GC analysis: Rt-bDEXcst (RESTEK), 80℃ for 45 min, $t_{(S)}$ = 33.0 min, $t_{(R)}$ = 36.0 min.

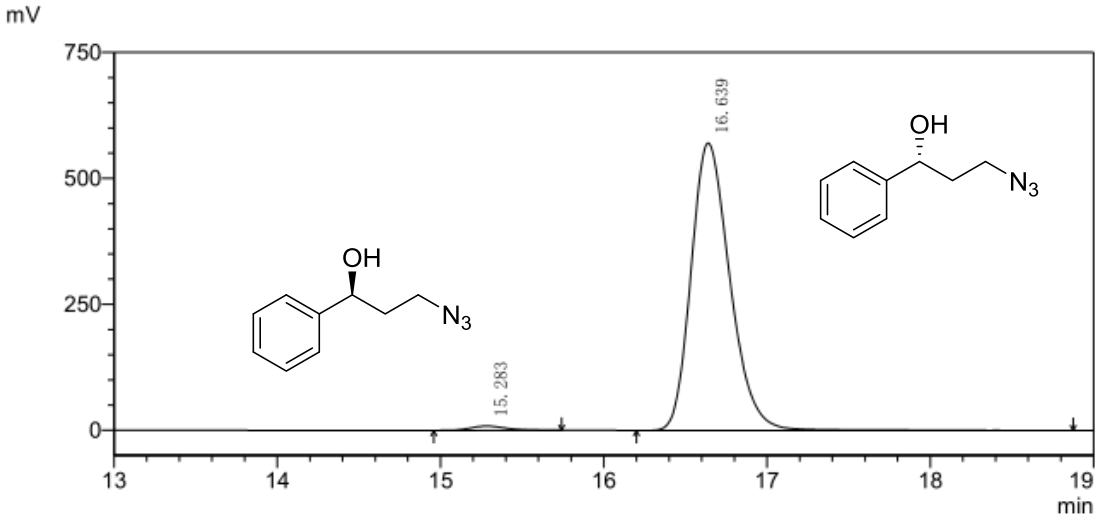
Chemical synthesized (*rac*)-**1c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.285	16871725	1011036	49.343
2	16.667	17320955	929151	50.657

Enzymatic synthesized (*R*)-**1c**

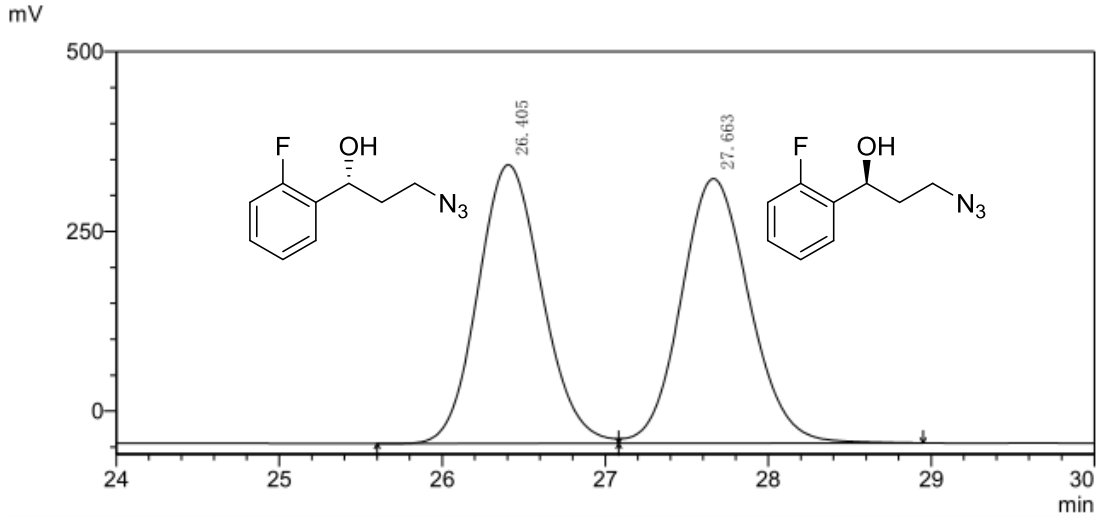


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.283	125756	8561	1.314
2	16.639	9447869	570375	98.686

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 15.3 min, $t_{(R)}$ = 16.6 min.

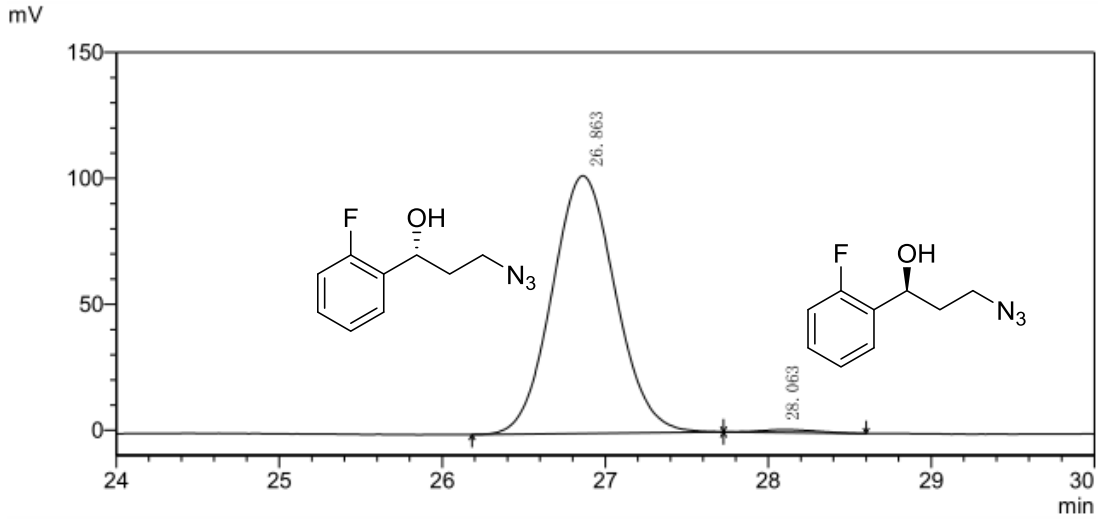
Chemical synthesized (*rac*)-**2c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	26.405	10579814	387621	49.693
2	27.663	10710724	367992	50.307

Enzymatic synthesized (*R*)-**2c**

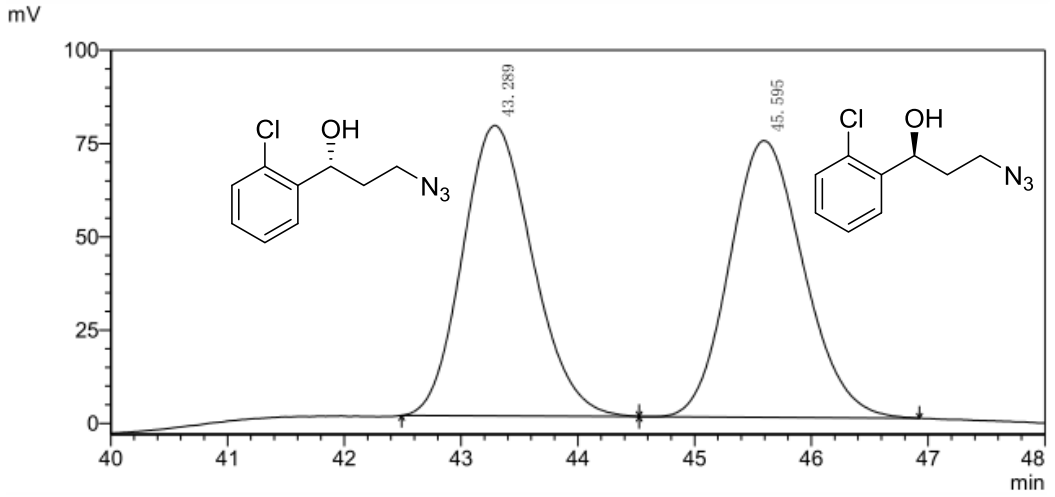


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	26.863	2766975	102209	99.037
2	28.063	26914	1086	0.963

Chiral HPLC analysis: Diacel Chiralpak IH, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.5 mL/min, λ = 210 nm, $t_{(R)}$ = 26.9 min, $t_{(S)}$ = 28.1 min.

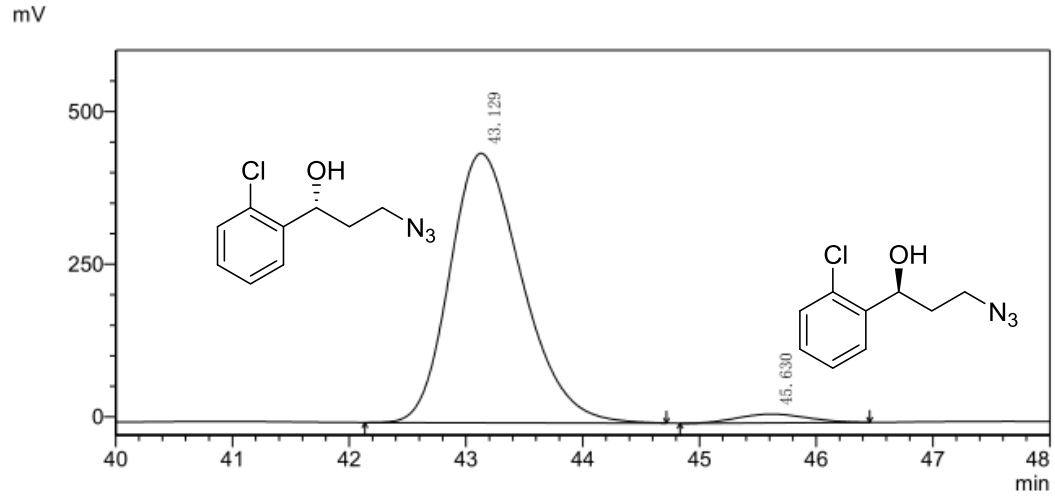
Chemical synthesized (*rac*)-**3c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	43.289	3252104	77836	49.732
2	45.595	3287177	74134	50.268

Enzymatic synthesized (*R*)-**3c**

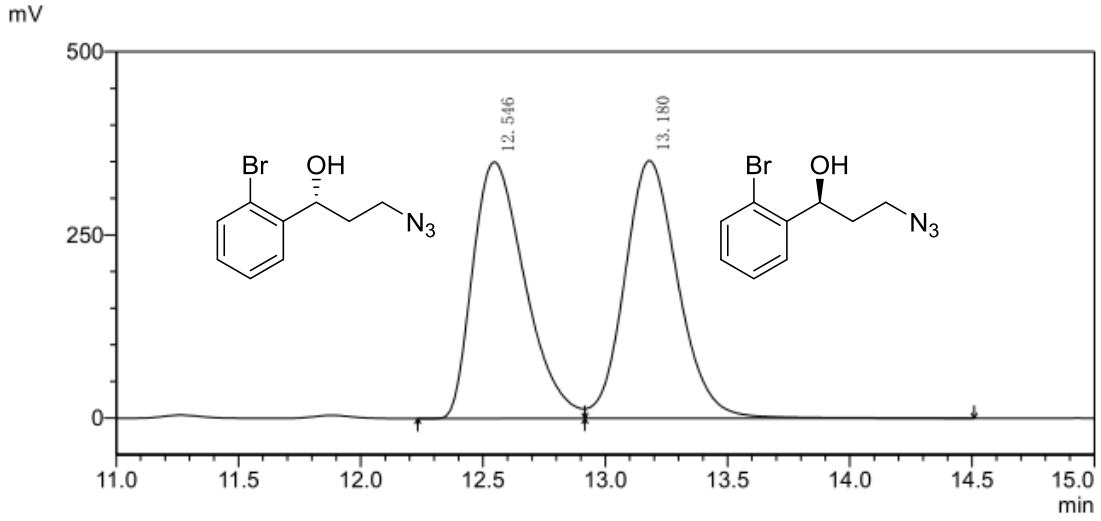


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	43.129	18999374	440991	96.977
2	45.630	592223	14225	3.023

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(R)}$ = 43.1 min, $t_{(S)}$ = 45.6 min.

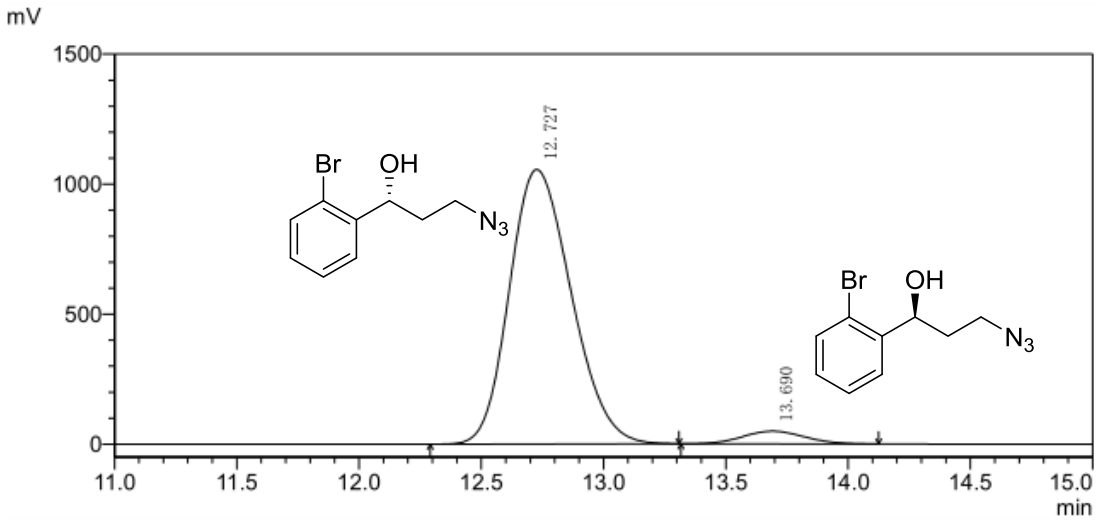
Chemical synthesized (*rac*)-**4c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	12.546	5202604	349802	49.281
2	13.180	5354390	351855	50.719

Enzymatic synthesized (*R*)-**4c**

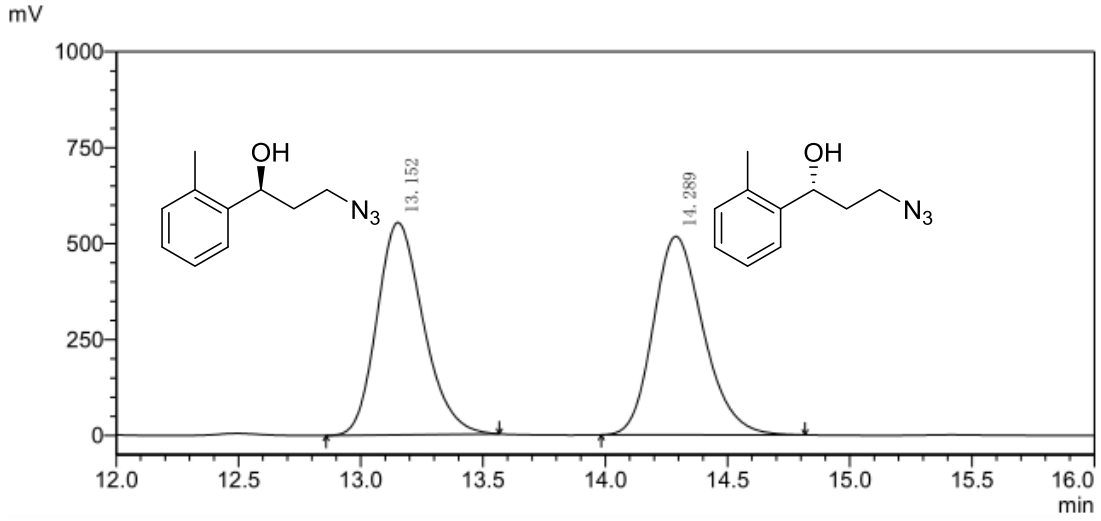


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	12.727	18601283	1055810	95.549
2	13.690	866503	48851	4.451

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(R)}$ = 12.7 min, $t_{(S)}$ = 13.7 min.

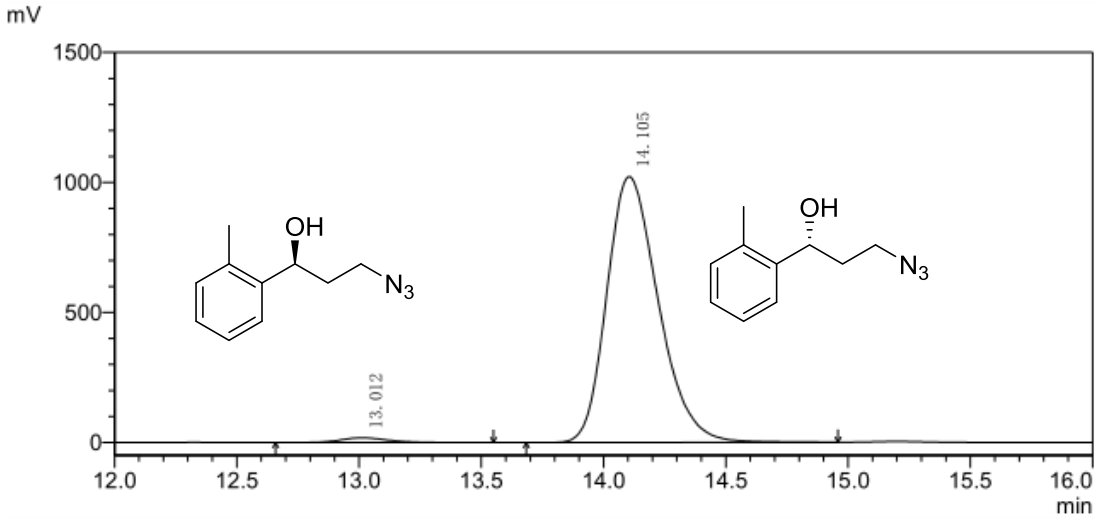
Chemical synthesized (*rac*)-**5c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	13.152	7305302	553682	49.752
2	14.289	7378269	517180	50.248

Enzymatic synthesized (*R*)-**5c**

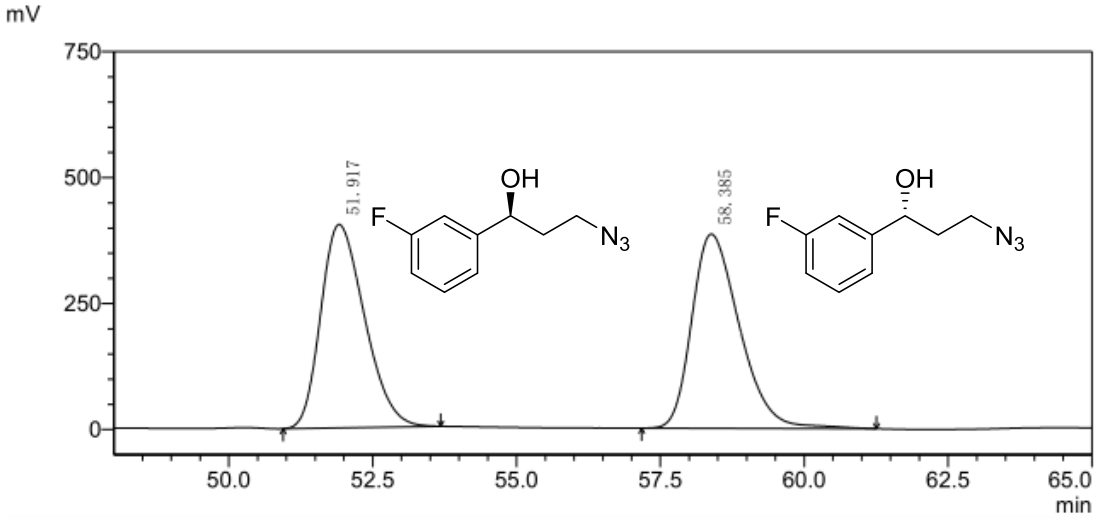


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	13.012	243869	18328	1.601
2	14.105	14986855	1021777	98.399

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 13.0 min, $t_{(R)}$ = 14.1 min.

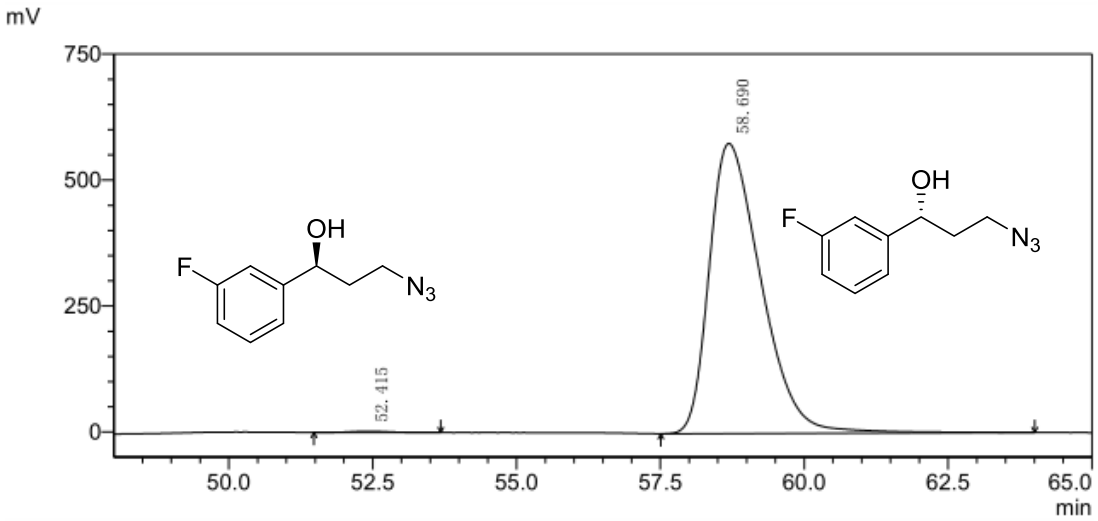
Chemical synthesized (*rac*)-**6c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	51.917	21405810	403687	49.041
2	58.385	22242570	385396	50.959

Enzymatic synthesized (*R*)-**6c**

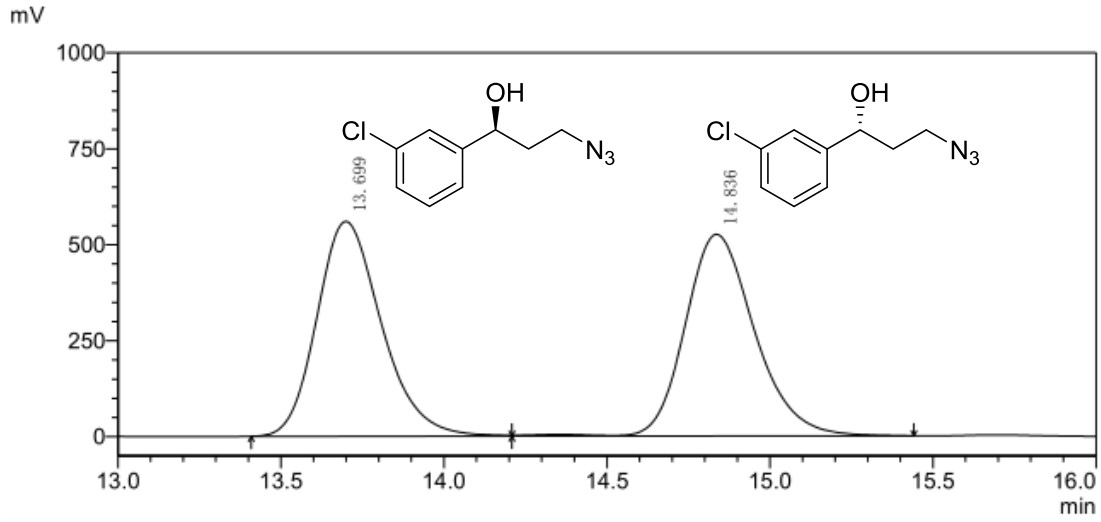


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	52.415	112396	2468	0.310
2	58.690	36193336	575719	99.690

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 52.4 min, $t_{(R)}$ = 58.7 min.

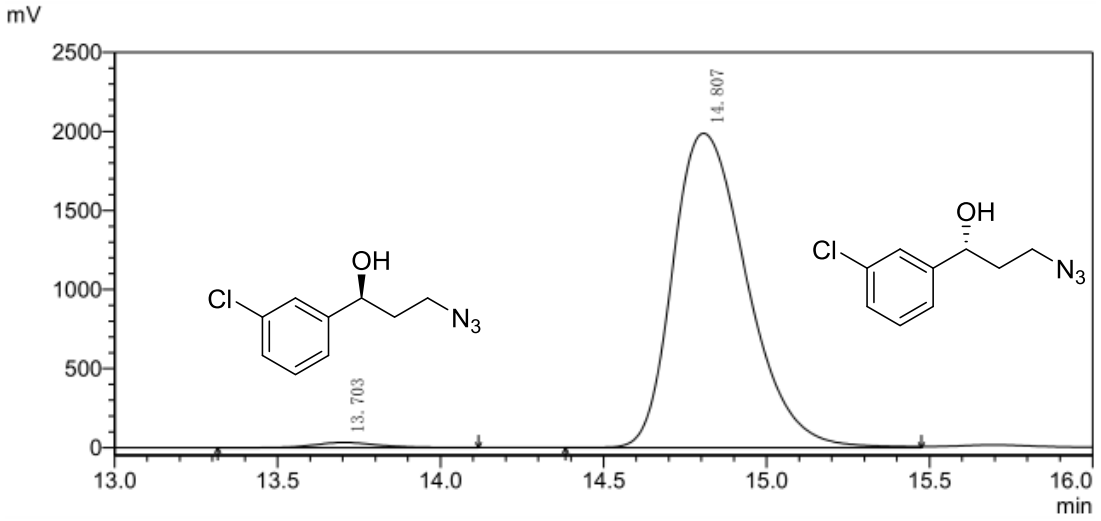
Chemical synthesized (*rac*)-**7c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	13.699	7730658	559909	49.800
2	14.836	7792621	525288	50.200

Enzymatic synthesized (*R*)-**7c**

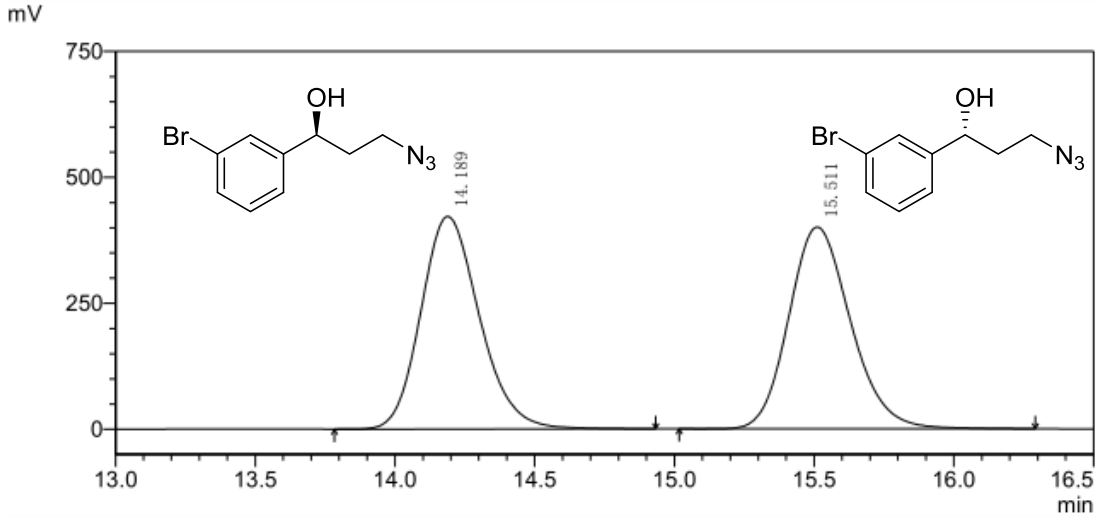


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	13.703	446579	32574	1.399
2	14.807	31468747	1989490	98.601

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 13.7 min, $t_{(R)}$ = 14.8 min.

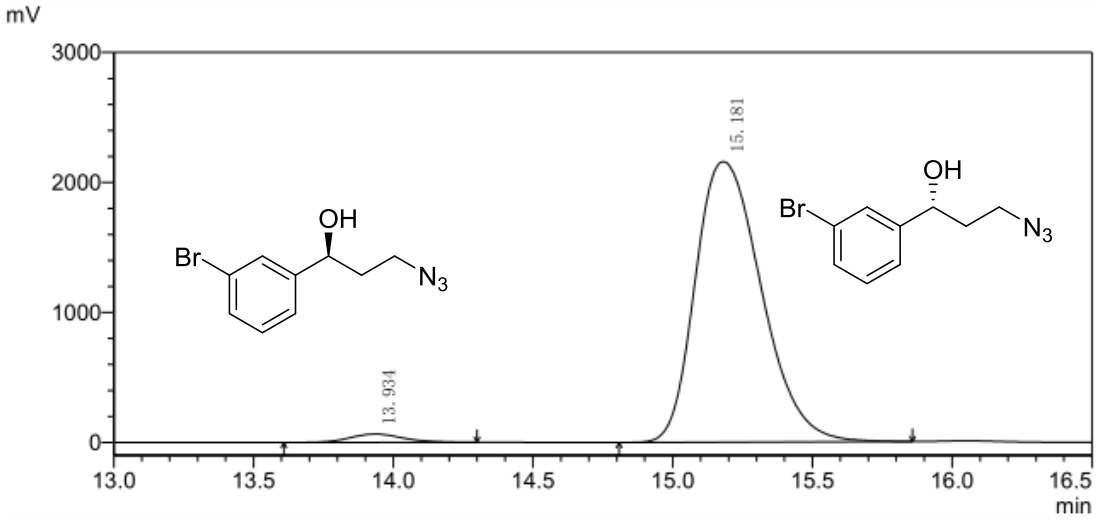
Chemical synthesized (*rac*)-**8c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.189	6155375	421981	49.948
2	15.511	6168110	400508	50.052

Enzymatic synthesized (*R*)-**8c**

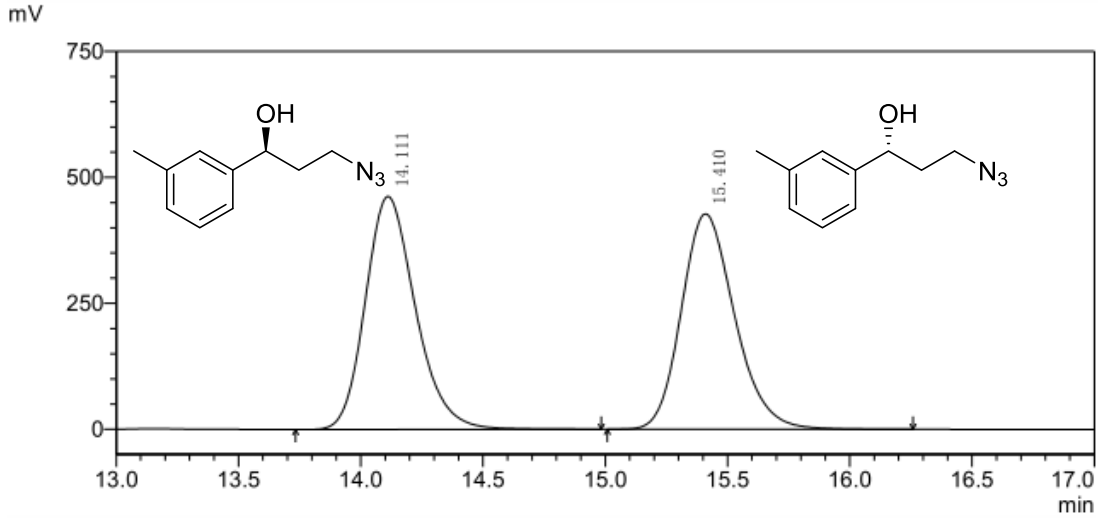


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	13.934	853502	64333	2.344
2	15.181	35559398	2157690	97.656

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 13.9 min, $t_{(R)}$ = 15.2 min.

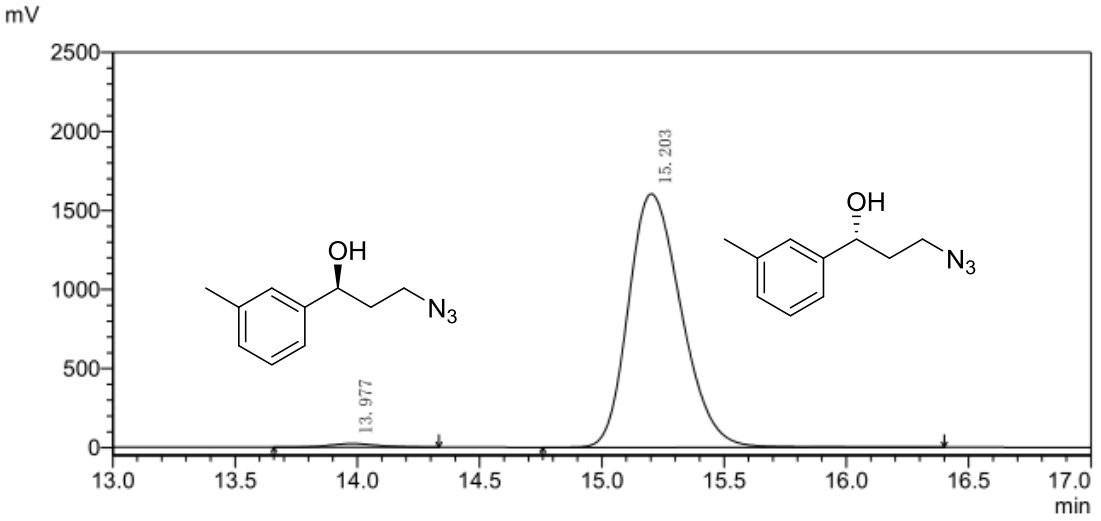
Chemical synthesized (*rac*)-**9c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	14.111	6592387	462362	50.388
2	15.410	6490960	427539	49.612

Enzymatic synthesized (*R*)-**9c**

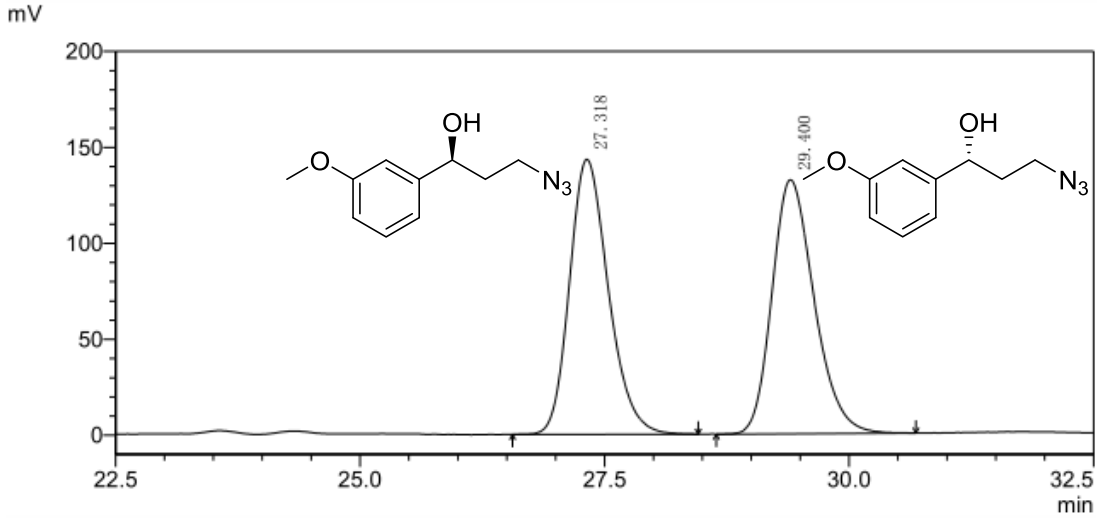


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	13.977	303757	22525	1.245
2	15.203	24103982	1603325	98.755

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 14.0 min, $t_{(R)}$ = 15.2 min.

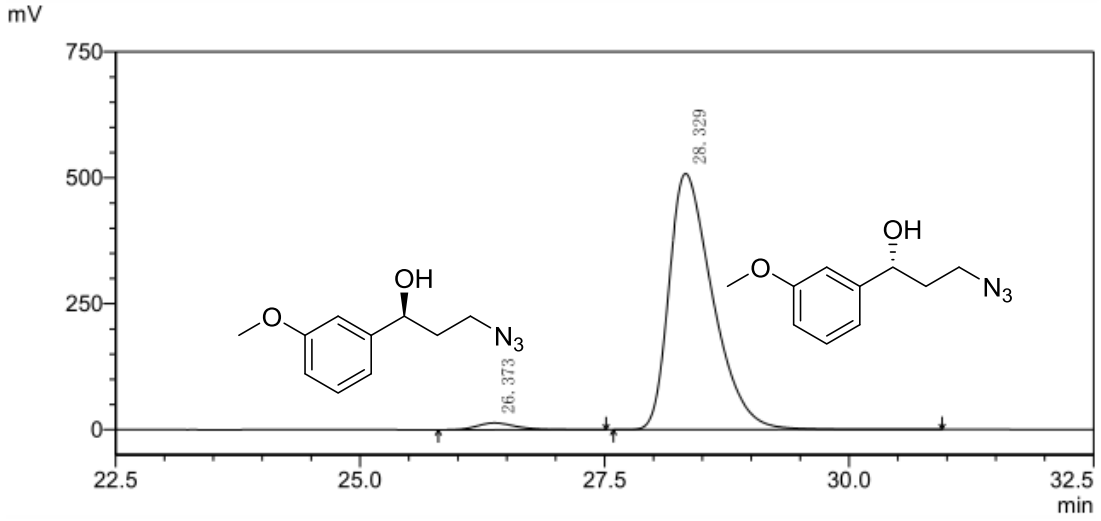
Chemical synthesized (*rac*)-**10c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	27.318	3964716	143300	50.001
2	29.400	3964626	132354	49.999

Enzymatic synthesized (*R*)-**10c**

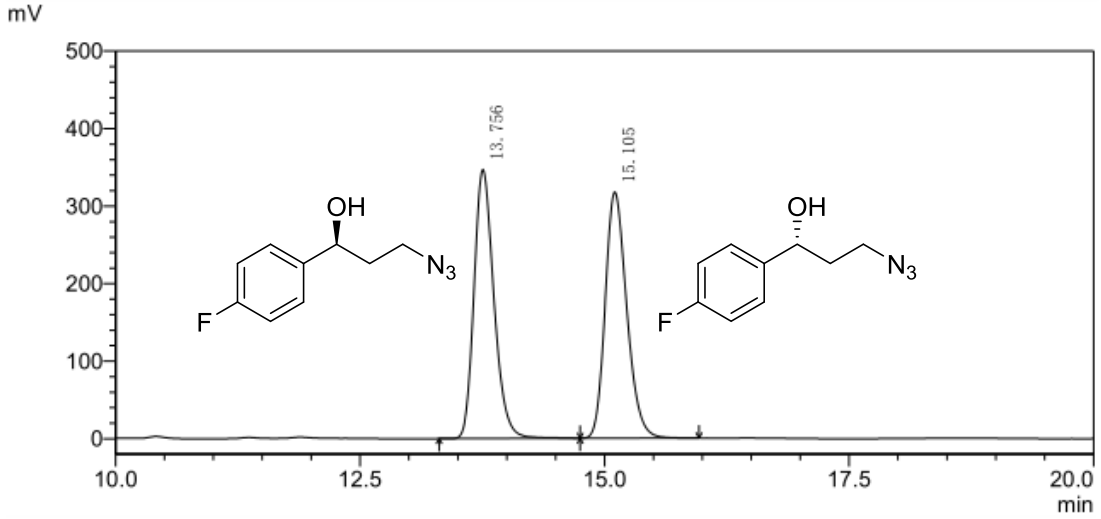


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	26.373	383770	13605	2.370
2	28.329	15808227	508359	97.630

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 26.4 min, $t_{(R)}$ = 28.3 min.

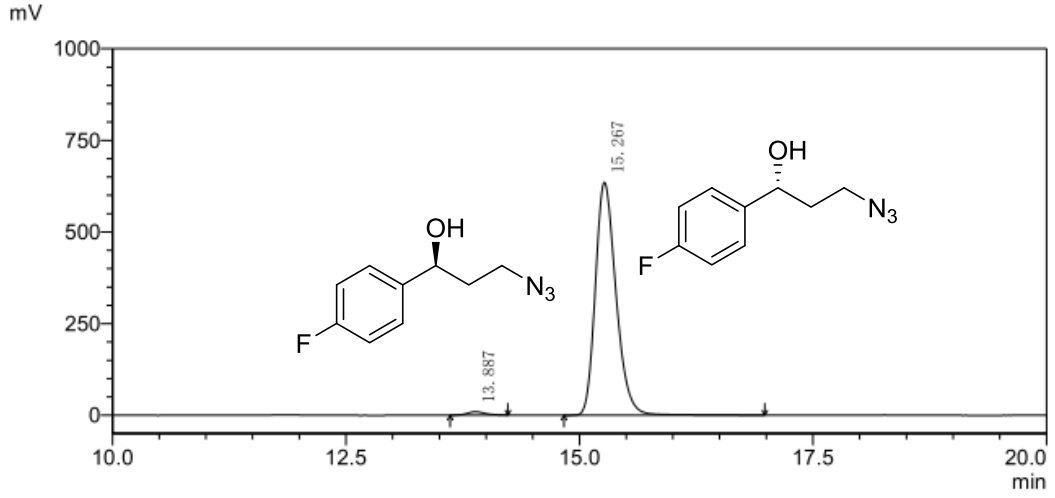
Chemical synthesized (*rac*)-**11c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	13.756	4907942	347039	50.139
2	15.105	4880796	317530	49.861

Enzymatic synthesized (*R*)-**11c**

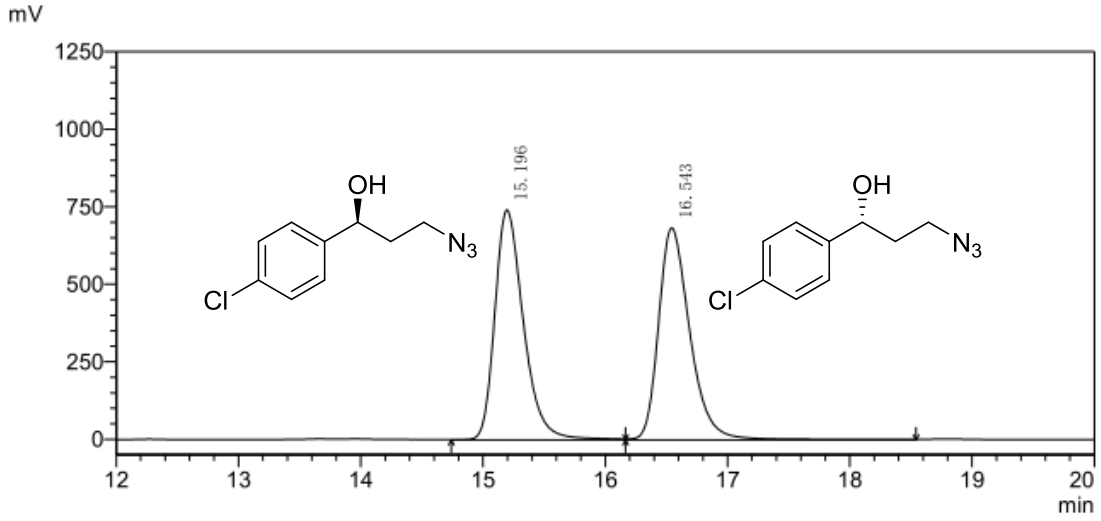


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	13.887	122169	9082	1.234
2	15.267	9781308	635883	98.766

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 13.9 min, $t_{(R)}$ = 15.3 min.

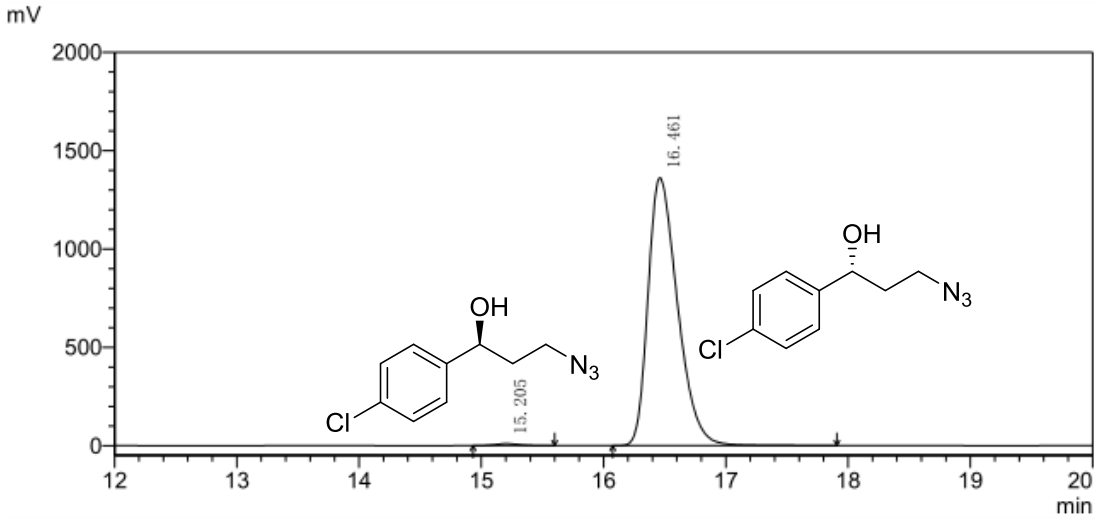
Chemical synthesized (*rac*)-**12c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.196	12146888	741169	49.820
2	16.543	12234509	683865	50.180

Enzymatic synthesized (*R*)-**12c**

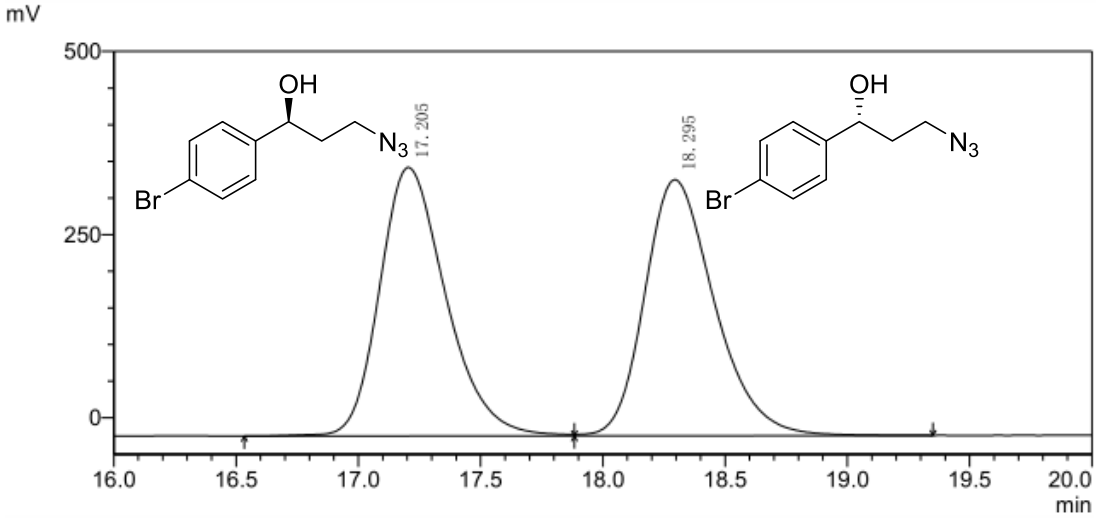


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.205	132884	9690	0.577
2	16.461	22885461	1362110	99.423

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 15.2 min, $t_{(R)}$ = 16.5 min

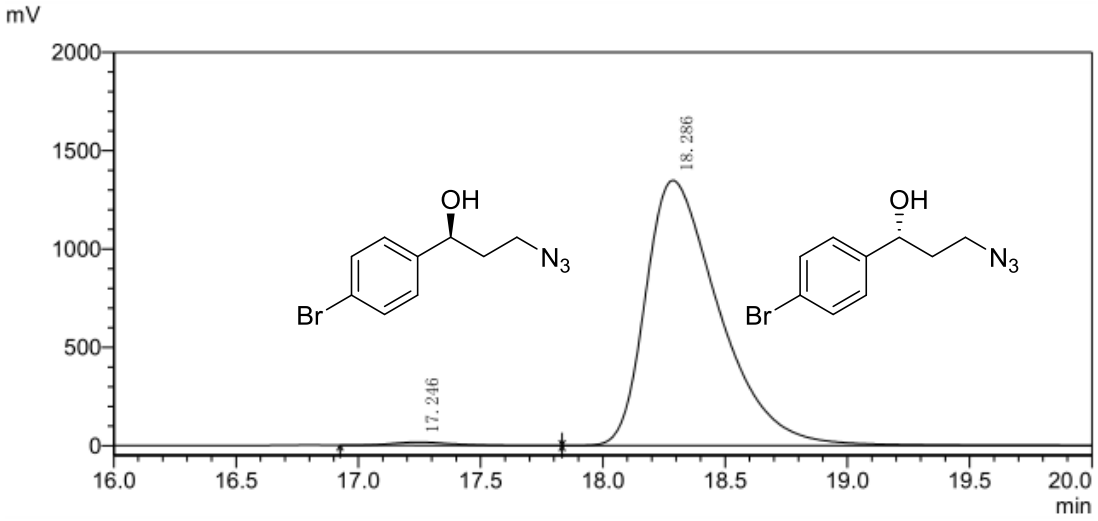
Chemical synthesized (*rac*)-**13c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	17.205	6919173	366335	49.960
2	18.295	6930194	349361	50.040

Enzymatic synthesized (*R*)-**13c**

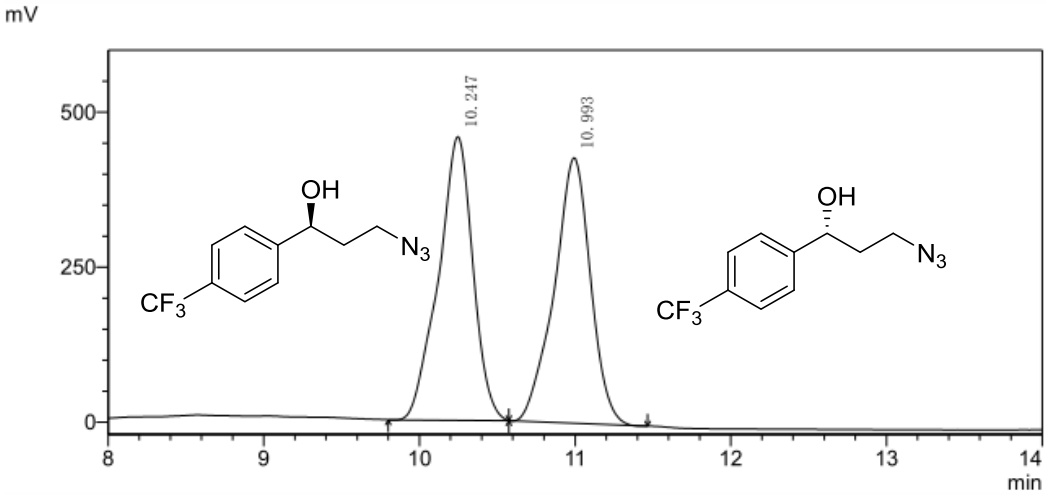


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	17.246	272574	16226	0.954
2	18.286	28286737	1348590	99.046

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 17.2 min, $t_{(R)}$ = 18.3 min.

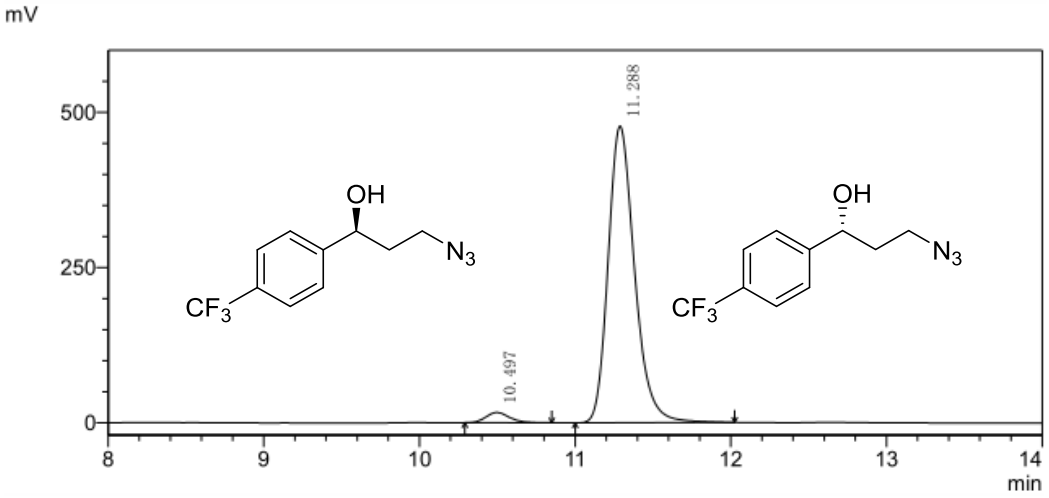
Chemical synthesized (*rac*)-**14c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	10.247	7041135	457518	50.279
2	10.993	6963029	428514	49.721

Enzymatic synthesized (*R*)-**14c**

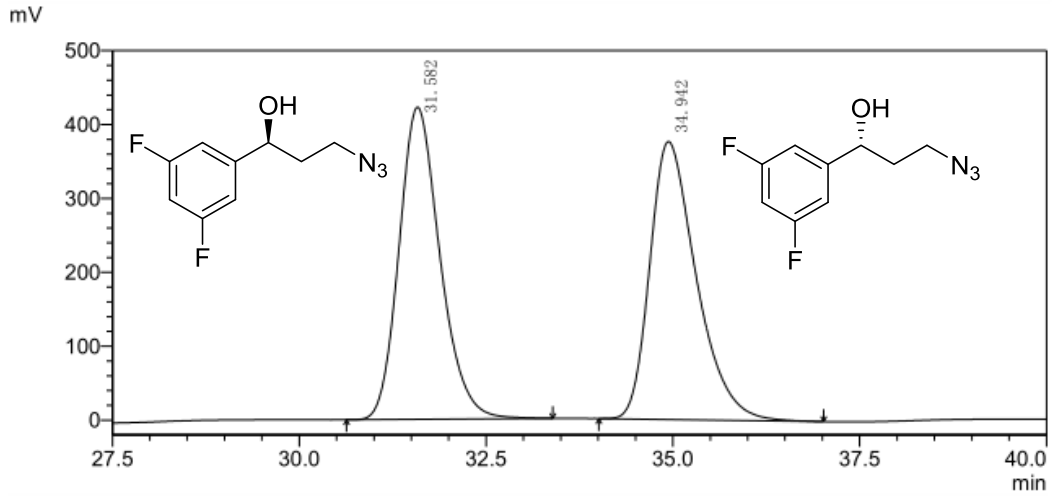


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	10.497	176586	16435	3.040
2	11.288	5631517	477758	96.960

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 10.5 min, $t_{(R)}$ = 11.3 min.

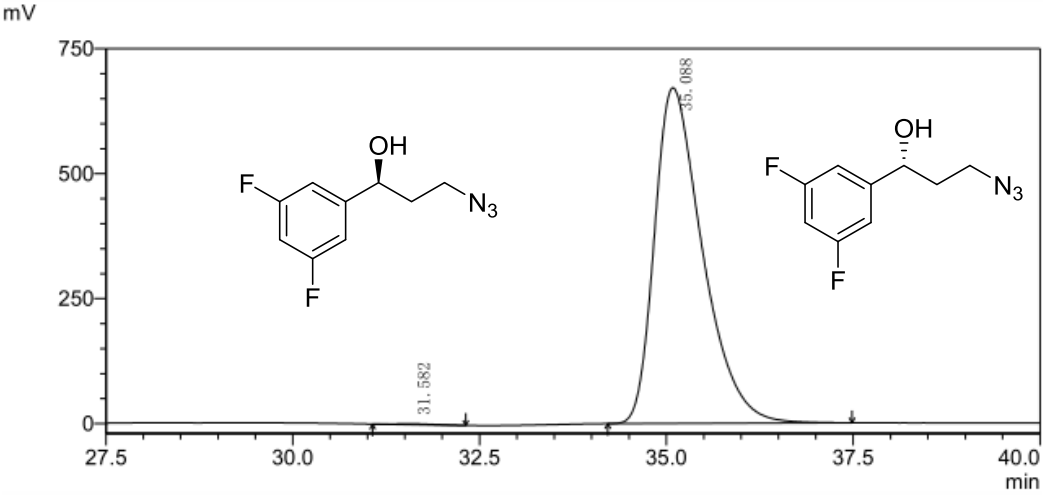
Chemical synthesized (*rac*)-**15c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	31.582	16130955	422414	49.757
2	34.942	16288482	376141	50.243

Enzymatic synthesized (*R*)-**15c**

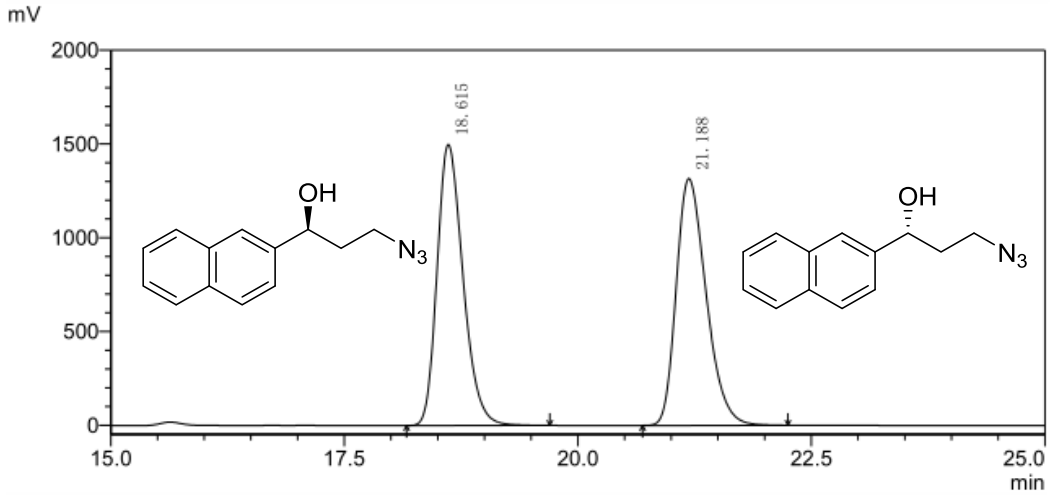


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	31.582	51602	1564	0.171
2	35.088	30087794	671517	99.829

Chiral HPLC analysis: Diacel Chiralpak IC-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 31.6 min, $t_{(R)}$ = 35.1 min.

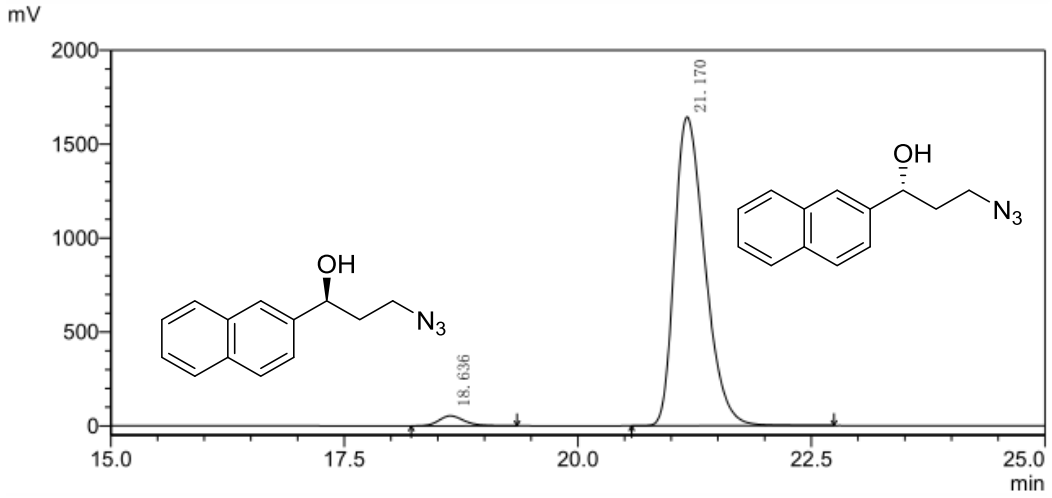
Chemical synthesized (*rac*)-**16c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	18.615	29131191	1499239	49.864
2	21.188	29289635	1316056	50.136

Enzymatic synthesized (*R*)-**16c**

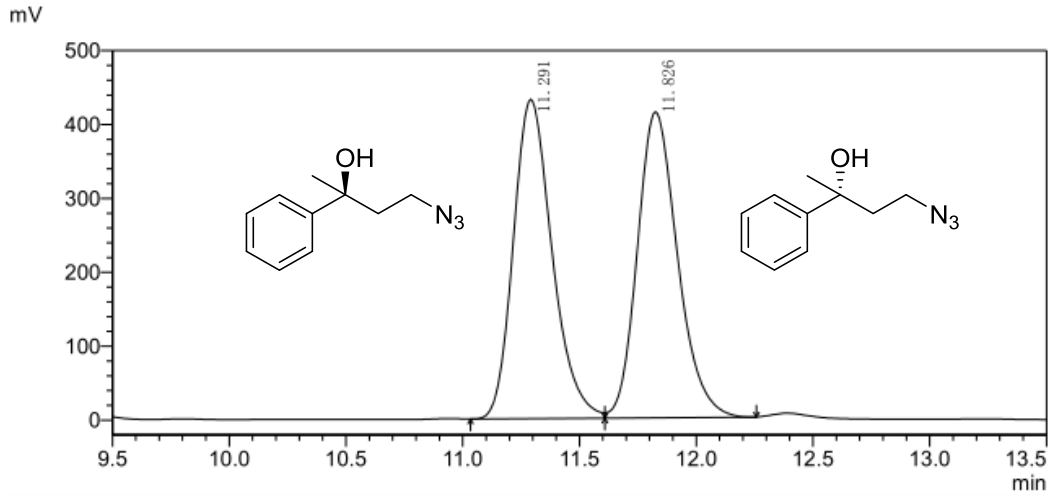


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	18.636	1016616	53705	2.662
2	21.170	37168720	1645436	97.338

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 18.6 min, $t_{(R)}$ = 21.2 min.

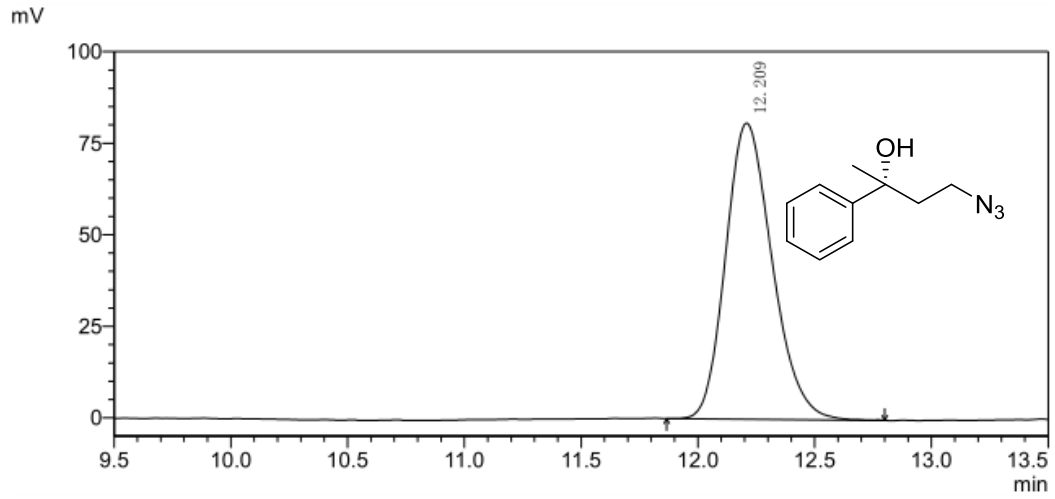
Chemical synthesized (*rac*)-**17c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	11.291	4985016	431984	50.117
2	11.826	4961745	413995	49.883

Enzymatic synthesized (*R*)-**17c**

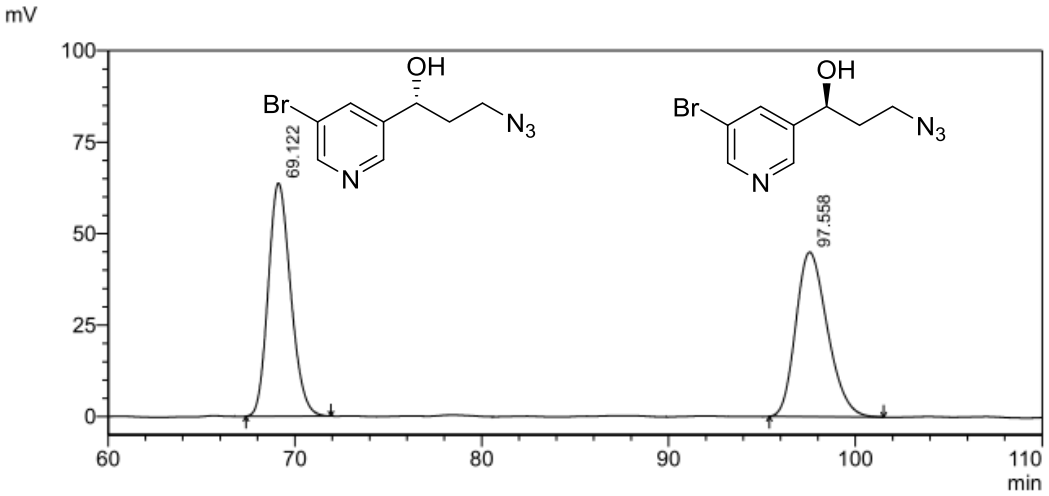


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	12.209	1121724	80920	100.000

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 11.3 min, $t_{(R)}$ = 11.8 min.

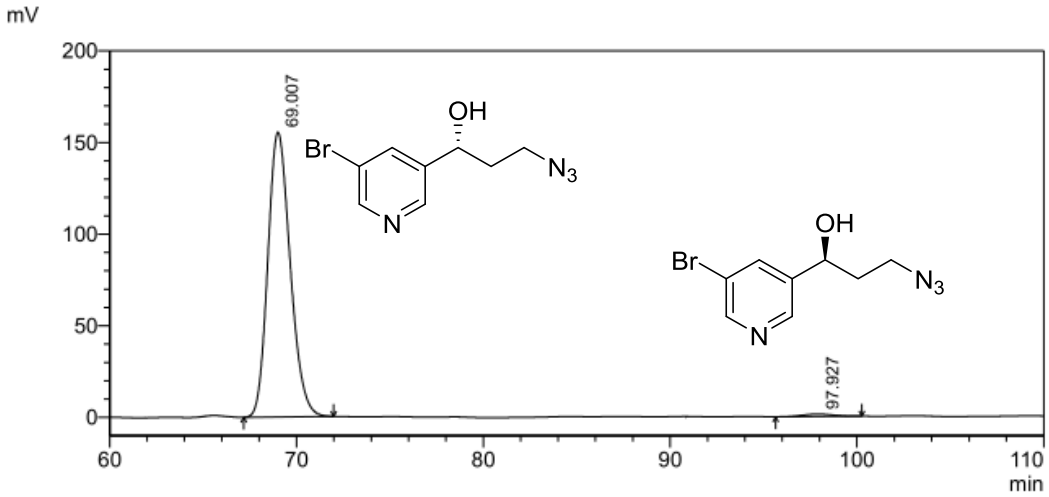
Chemical synthesized (*rac*)-**18c**



PDA_210nm

ID#	Rt. Time	Area	Height	Area%
1	69.122	5334531	63713	50.190
2	97.558	5294046	44928	49.810

Enzymatic synthesized (*R*)-**18c**

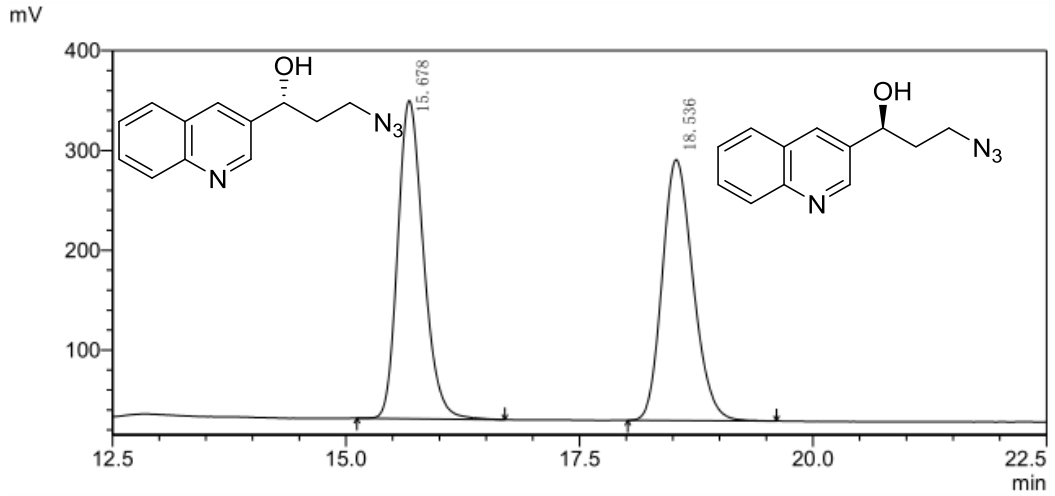


PDA_210nm

ID#	Rt. Time	Area	Height	Area%
1	69.007	12956498	155416	98.890
2	97.927	145367	1283	1.110

Chiral HPLC analysis: Diacel Chiralpak AD-H, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.5 mL/min, λ = 210 nm, $t_{(R)}$ = 69.0 min, $t_{(S)}$ = 97.9 min.

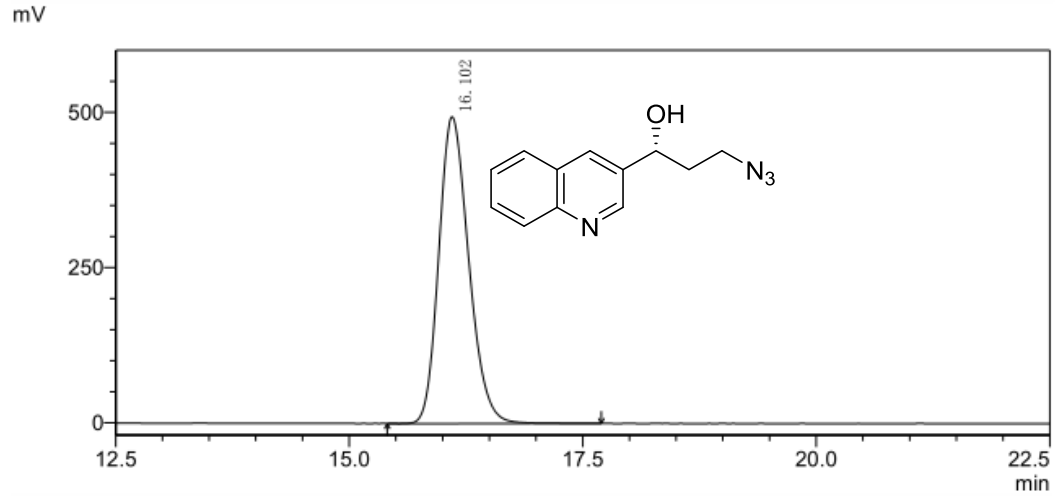
Chemical synthesized (*rac*)-**19c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.678	6077806	318889	50.359
2	18.536	5991119	261455	49.641

Enzymatic synthesized (*R*)-**19c**

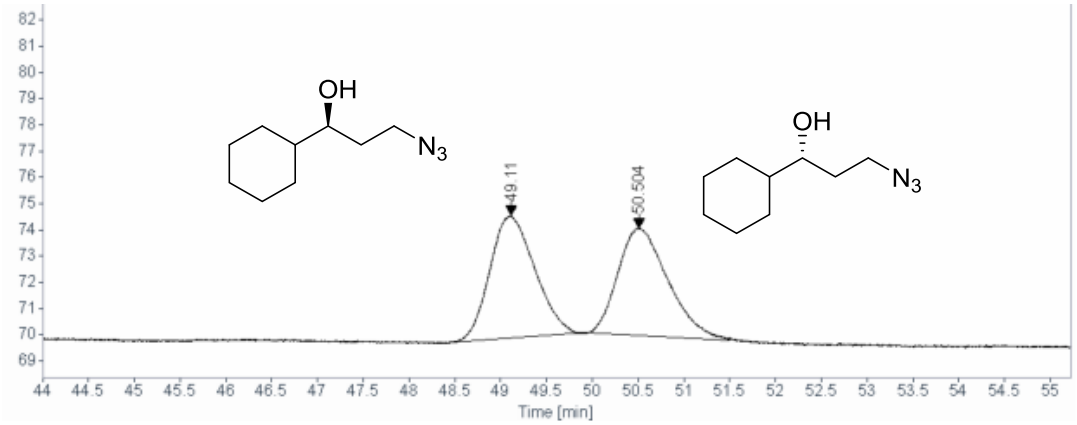


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	16.102	11049415	494090	100.000

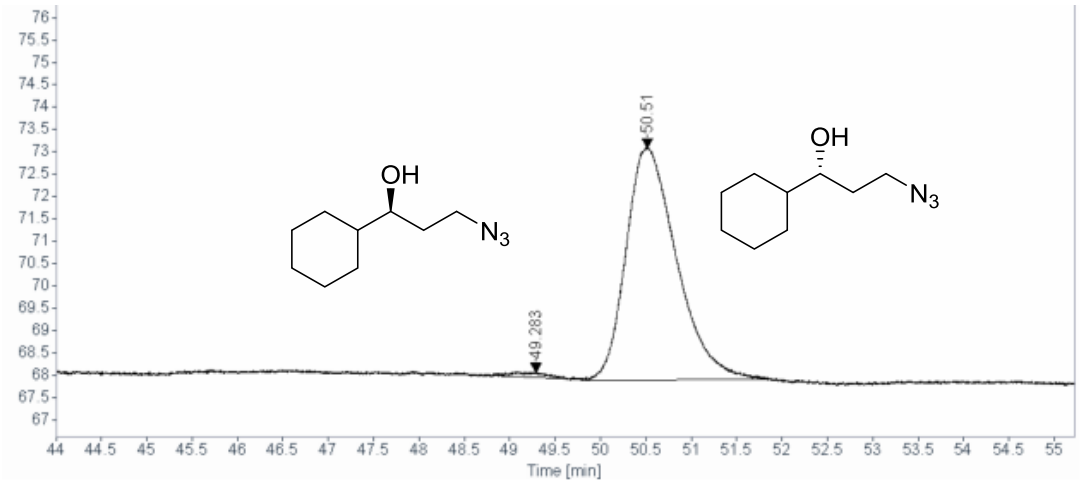
Chiral HPLC analysis: Diacel Chiralpak OJ-H, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 210 nm, $t_{(R)}$ = 15.7 min, $t_{(S)}$ = 18.6 min.

Chemical synthesized (*rac*)-**21c**



ID#	Ret. Time	Area	Height	Area%	Resolution
1	49.110	161.409	4.702	50.686	
1	50.504	157.040	4.116	49.314	1.453

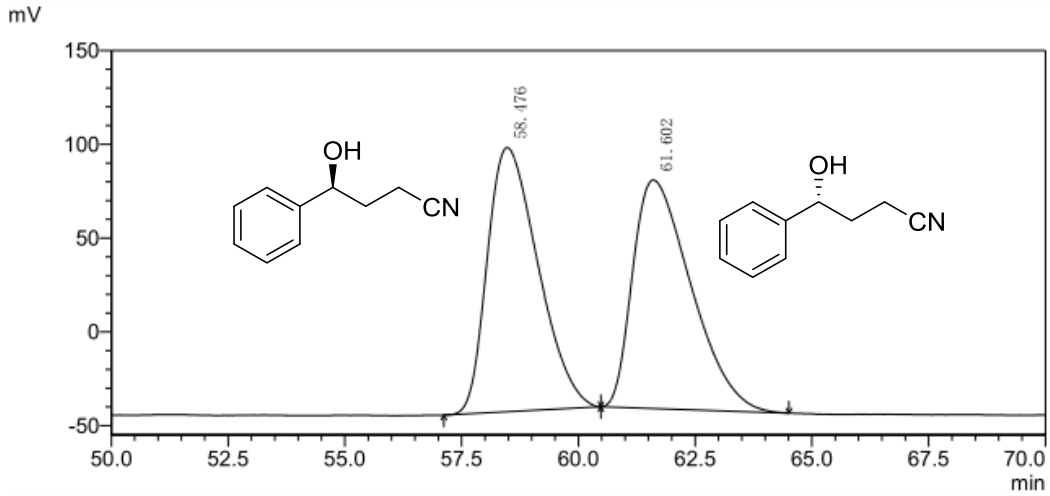
Enzymatic synthesized (*R*)-**21c**



ID#	Ret. Time	Area	Height	Area%	Resolution
1	49.283	3.351	0.122	1.619	
1	50.510	203.651	5.209	98.381	2.011

Chiral GC analysis: Rt-bDEXcst (RESTEK), 140℃ for 60 min, $t_{(S)}$ = 49.3 min, $t_{(R)}$ = 50.5 min.

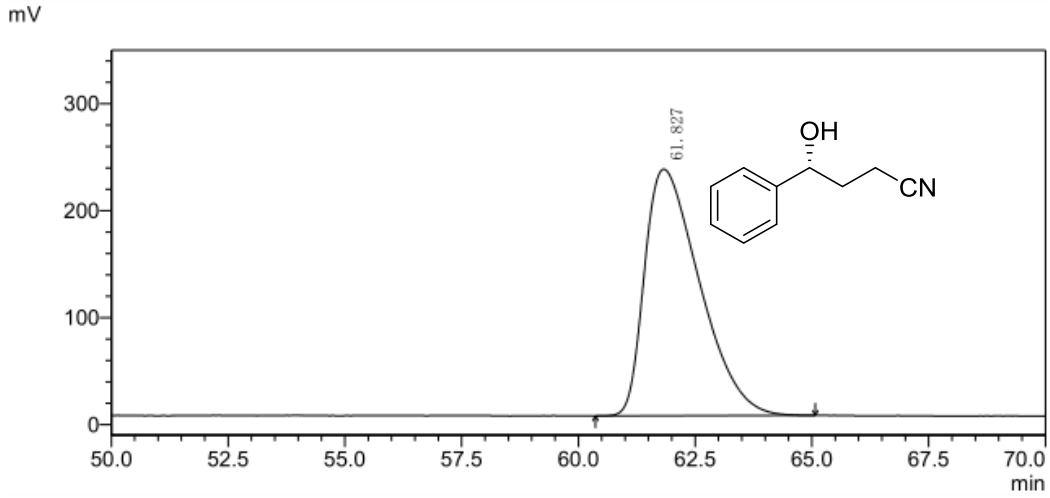
Chemical synthesized (*rac*)-**1d**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	58.476	10637947	140902	50.097
2	61.602	10596558	121889	49.903

Enzymatic synthesized (*R*)-**1d**

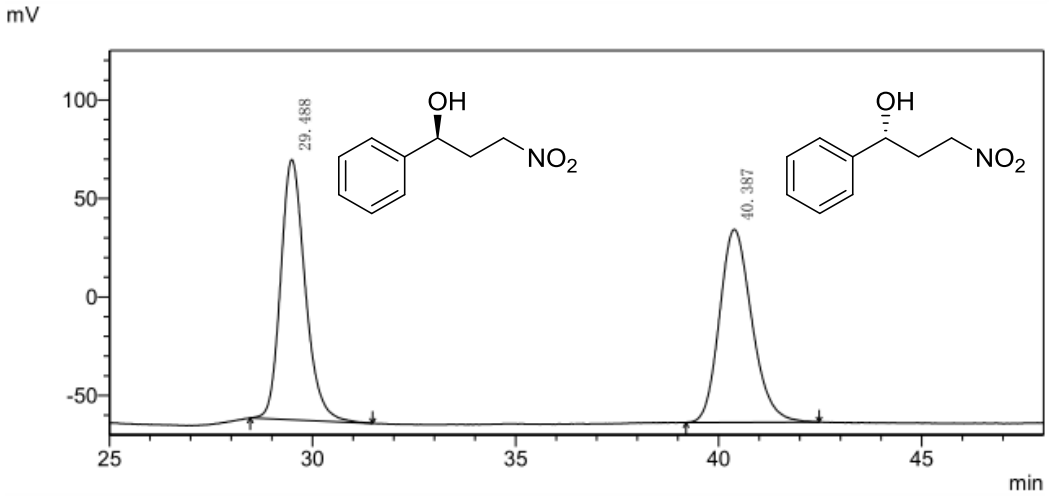


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	61.827	18937936	230662	100.000

Chiral HPLC analysis: Diacel Chiralpak IH, *n*-hexane/*i*-PrOH = 95/5, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 58.5 min, $t_{(R)}$ = 61.6 min.

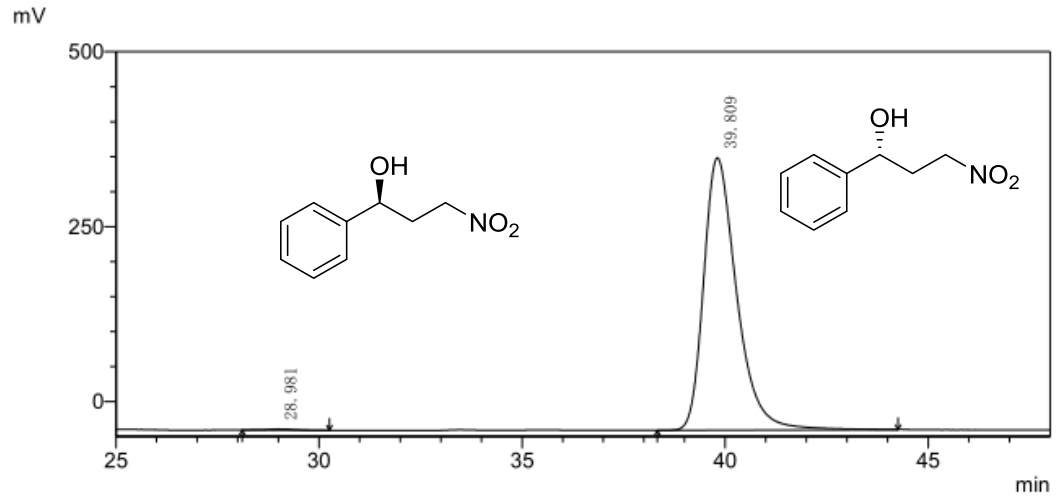
Chemical synthesized (*rac*)-**1e**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	29.488	5550856	132029	50.508
2	40.387	5439114	97871	49.492

Enzymatic synthesized (*R*)-**1e**

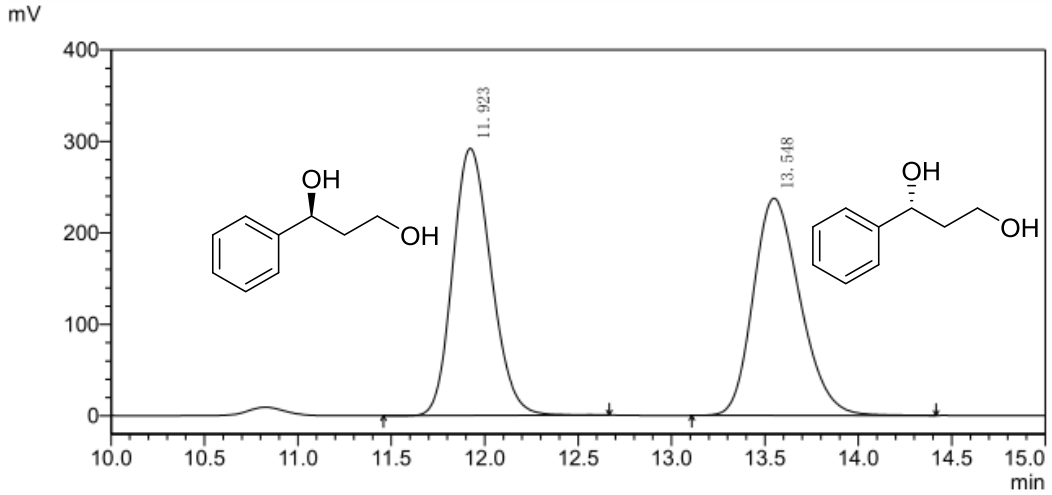


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	28.981	61374	1496	0.278
2	39.809	22040794	389193	99.722

Chiral HPLC analysis: Diacel Chiralpak OD-H, *n*-hexane/*i*-PrOH = 90/10, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 29.0 min, $t_{(R)}$ = 39.8 min.

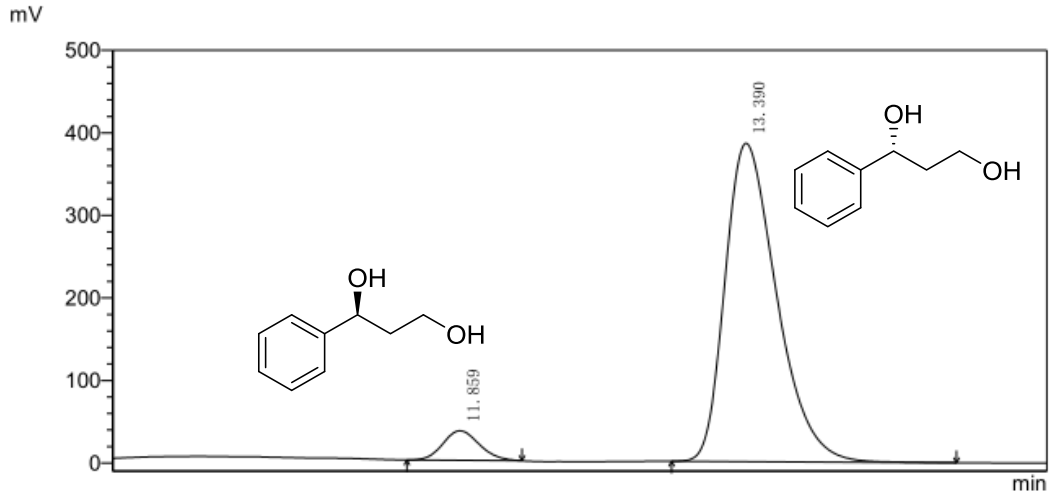
Commercial (*rac*)-**1f**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	11.923	4156934	292071	50.082
2	13.548	4143269	237429	49.918

Enzymatic synthesized (*R*)-**1f**

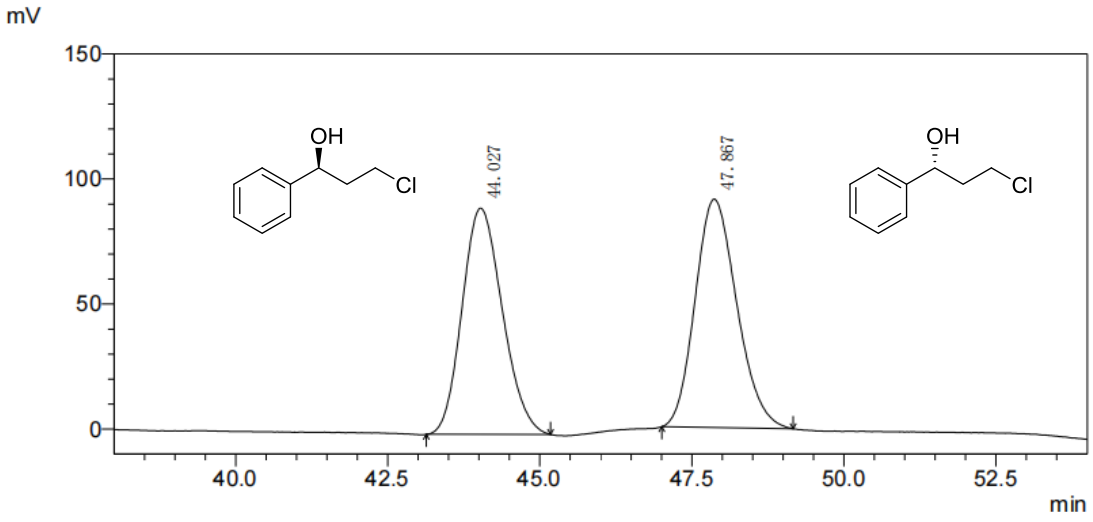


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	11.859	488436	35889	6.184
2	13.390	7410335	385932	93.816

Chiral HPLC analysis: Diacel Chiralpak IH, *n*-hexane/*i*-PrOH = 88/12, flow rate 0.8 mL/min, λ = 210 nm, $t_{(S)}$ = 11.9 min, $t_{(R)}$ = 13.4 min.

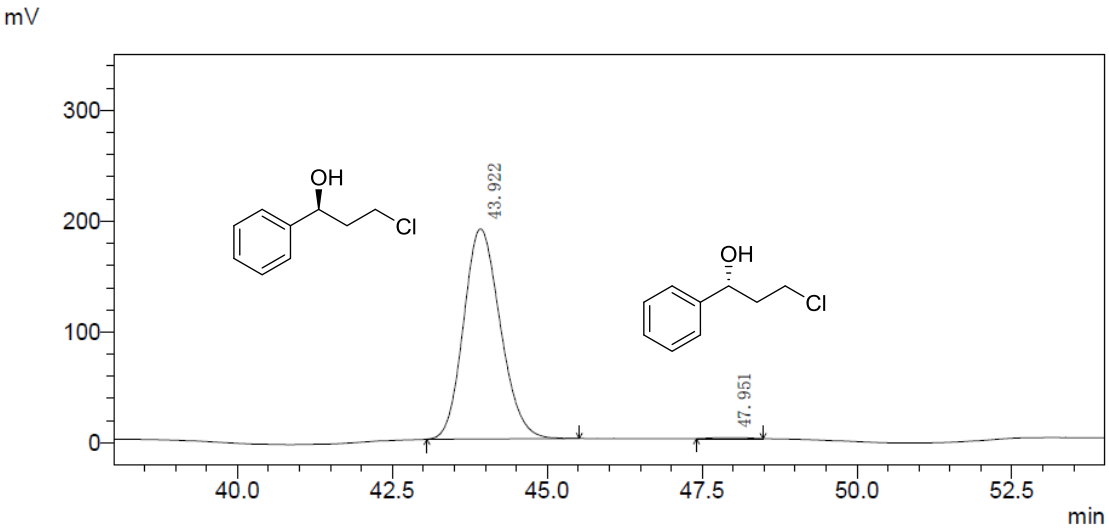
Chemical synthesized (*rac*)-**1a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	44.027	4170848	90440	48.911
2	47.867	4356621	91297	51.089

Enzymatic synthesized (*S*)-**1a** by biocatalytic cascade

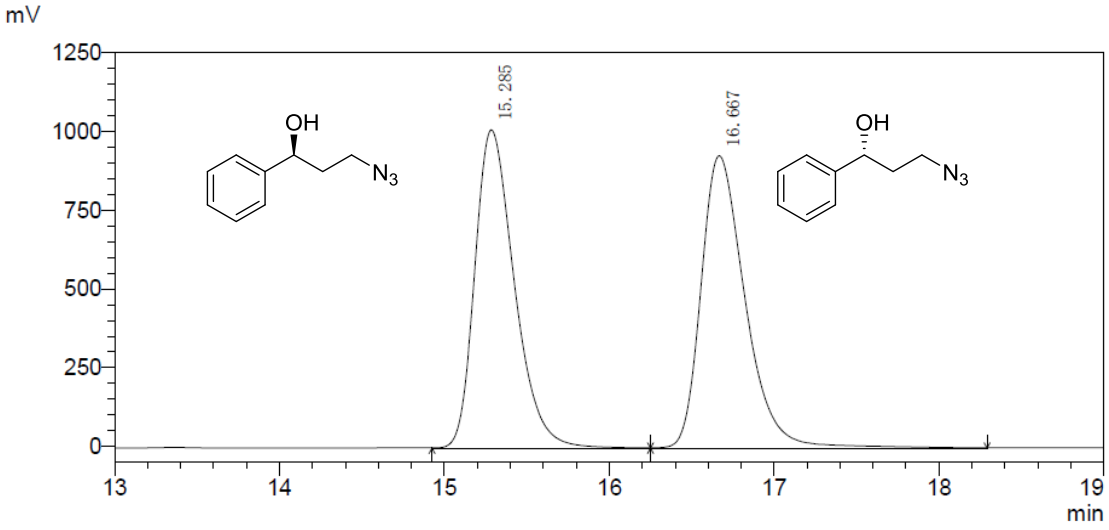


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	43.922	7825443	189627	99.520
2	47.951	37735	1033	0.480

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 43.9 min, $t_{(R)}$ = 48.0 min.

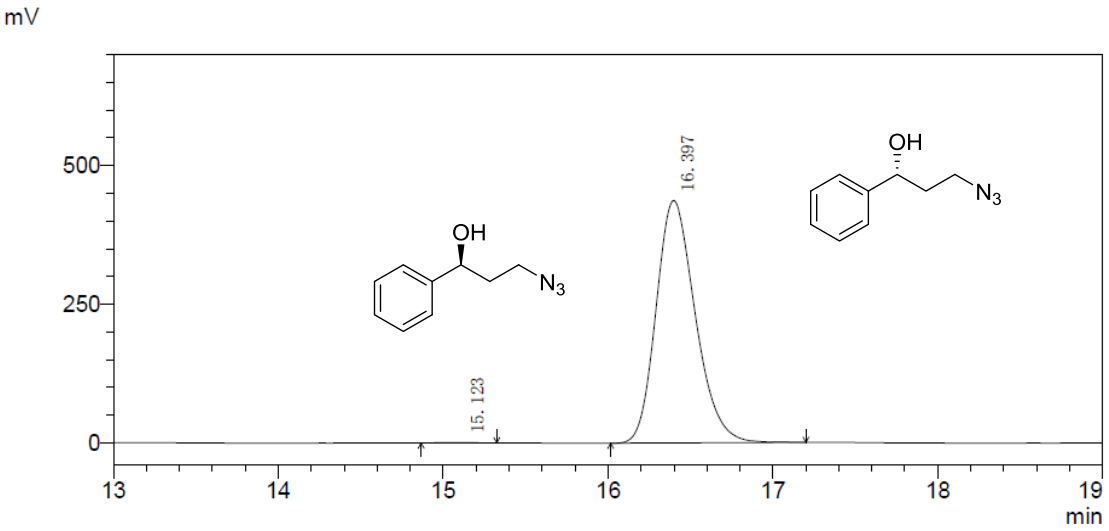
Chemical synthesized (*rac*)-**1c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.285	16871725	1011036	49.343
2	16.667	17320955	929151	50.657

Enzymatic synthesized (*R*)-**1c** by biocatalytic cascade

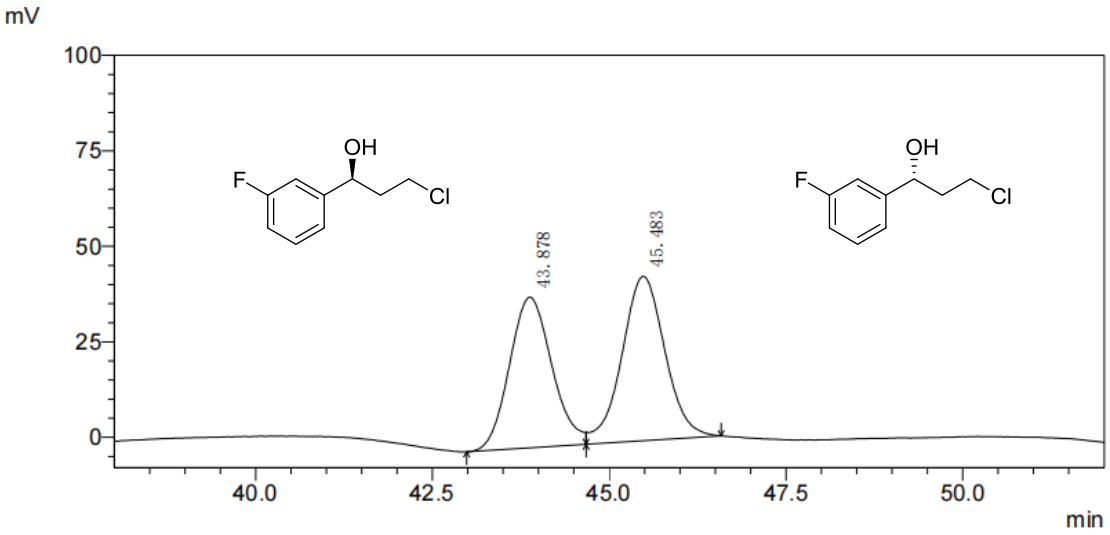


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.123	5265	342	0.073
2	16.397	7235612	437411	99.927

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 15.1 min, $t_{(R)}$ = 16.4 min.

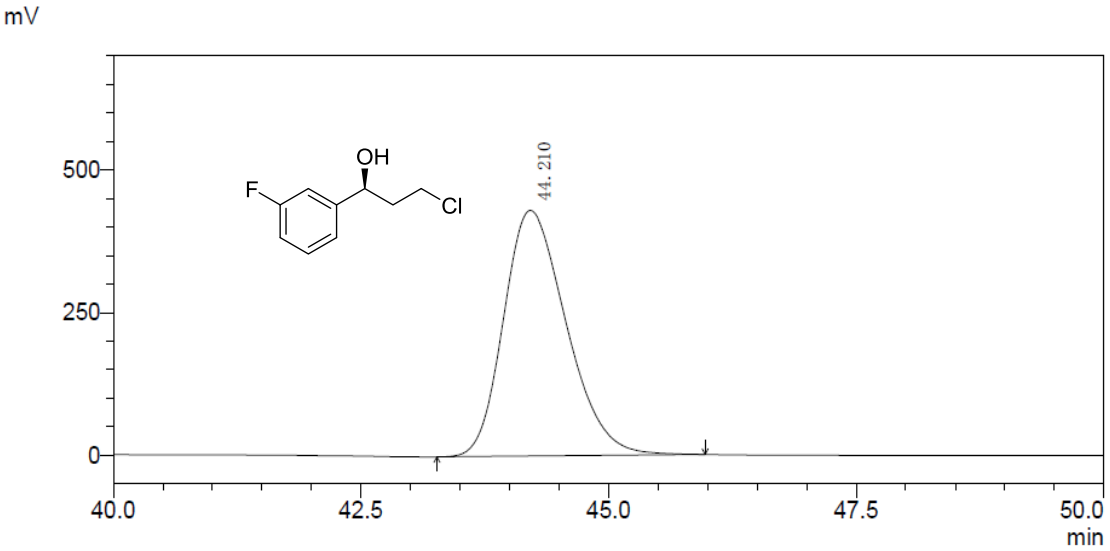
Chemical synthesized (*rac*)-**6a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	43.878	1640174	39450	47.347
2	45.483	1823950	43025	52.653

Enzymatic synthesized (*S*)-**6a** by biocatalytic cascade

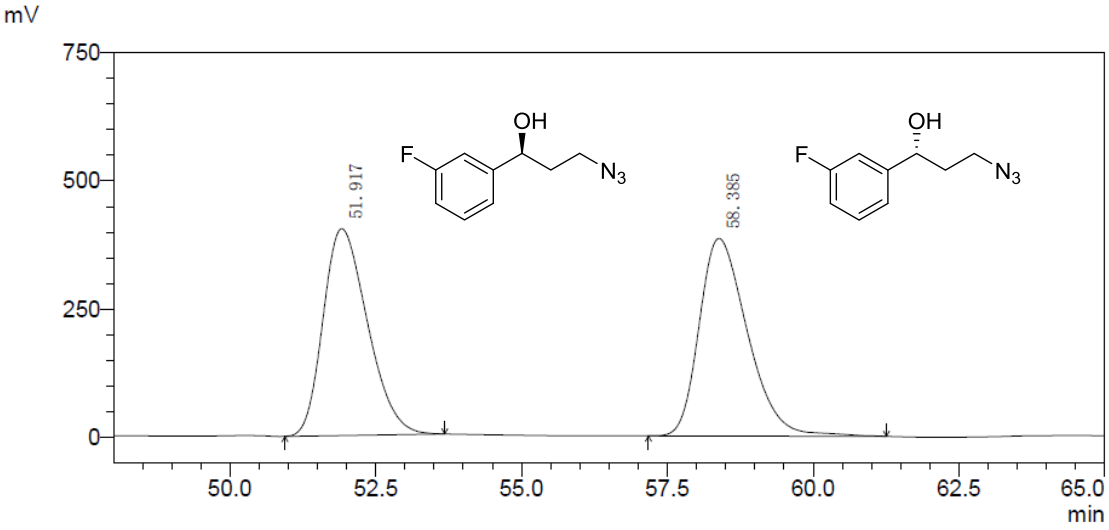


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	44.210	18961655	430762	100.000

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 44.2 min.

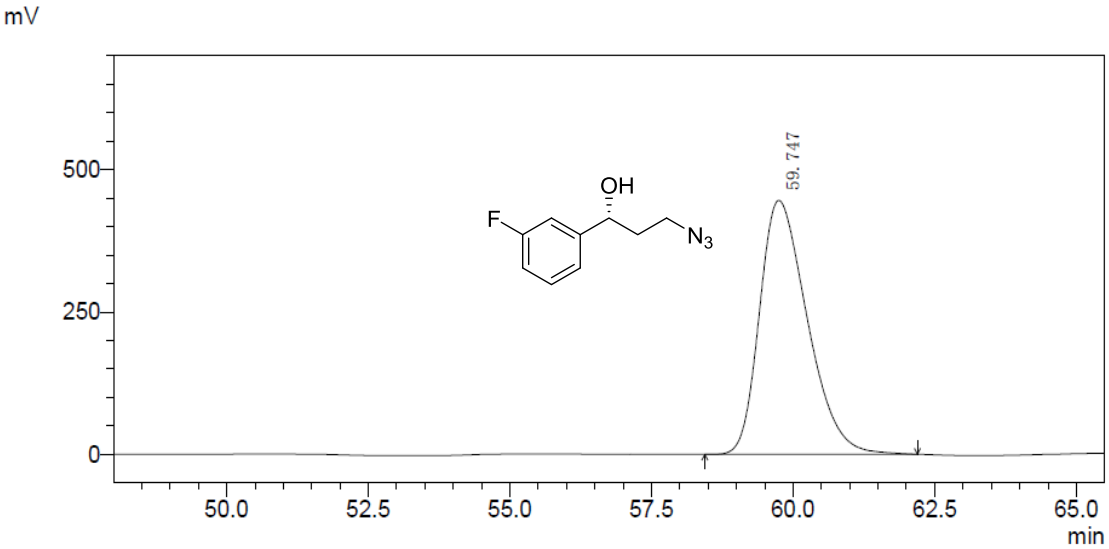
Chemical synthesized (*rac*)-**6c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	51.917	21405810	403687	49.041
2	58.385	22242570	385396	50.959

Enzymatic synthesized (*R*)-**6c** <u>by biocatalytic cascade</u>

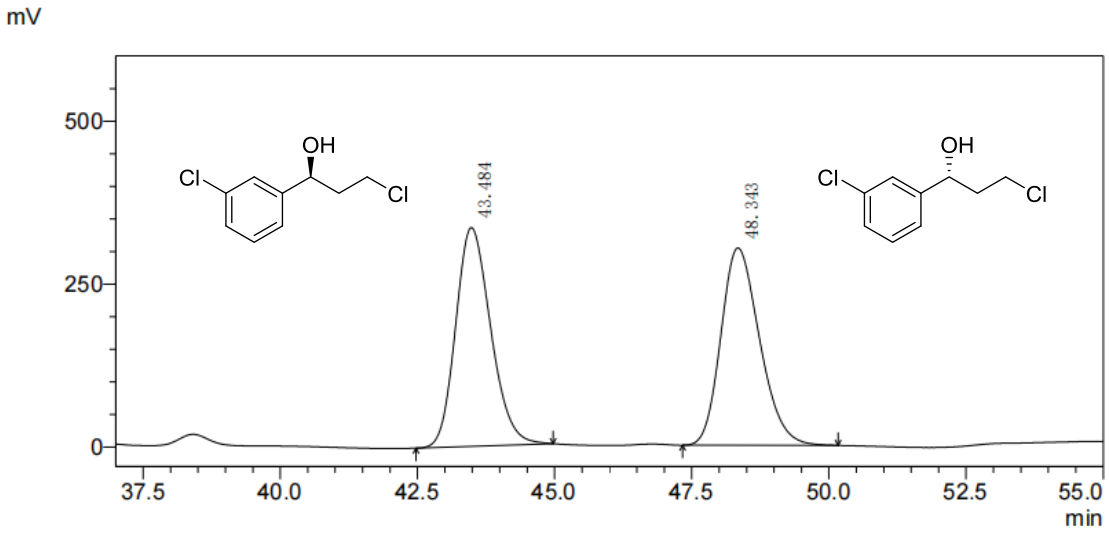


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	59.747	26158933	445998	100.000

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(R)}$ = 59.7 min.

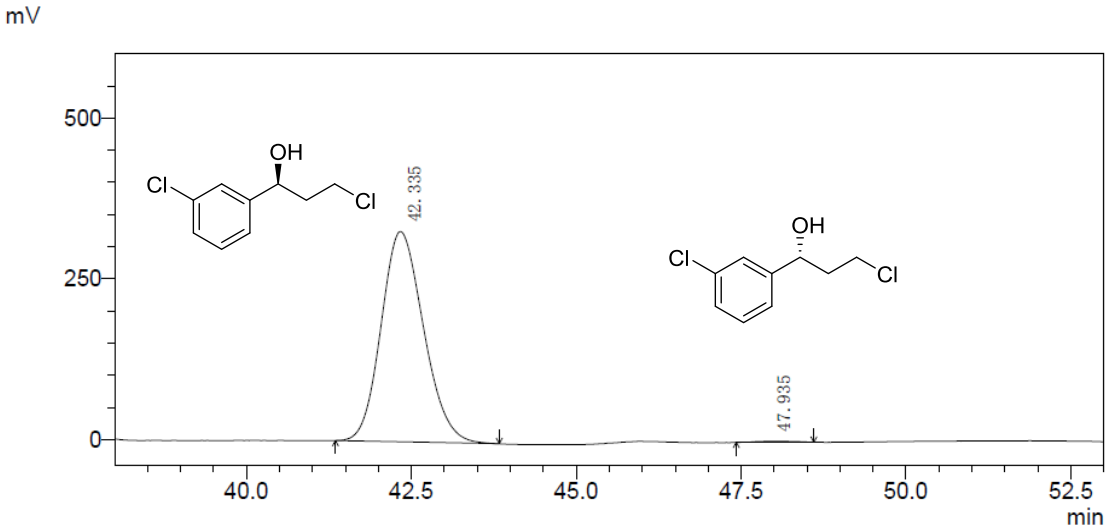
Chemical synthesized (*rac*)-**7a**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	43.484	14910958	335534	50.069
2	48.343	14869975	302683	49.931

Enzymatic synthesized (*S*)-**7a** by biocatalytic cascade

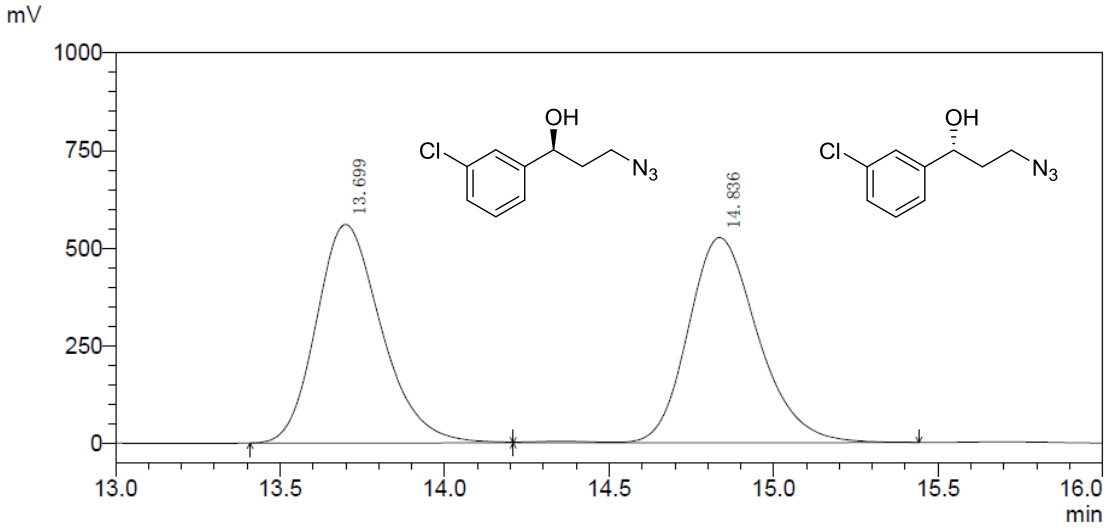


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	42.335	14649208	326818	99.591
2	47.935	60100	1908	0.409

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 99/1, flow rate 0.5 mL/min, λ = 210 nm, $t_{(S)}$ = 42.3 min, $t_{(R)}$ = 47.9 min.

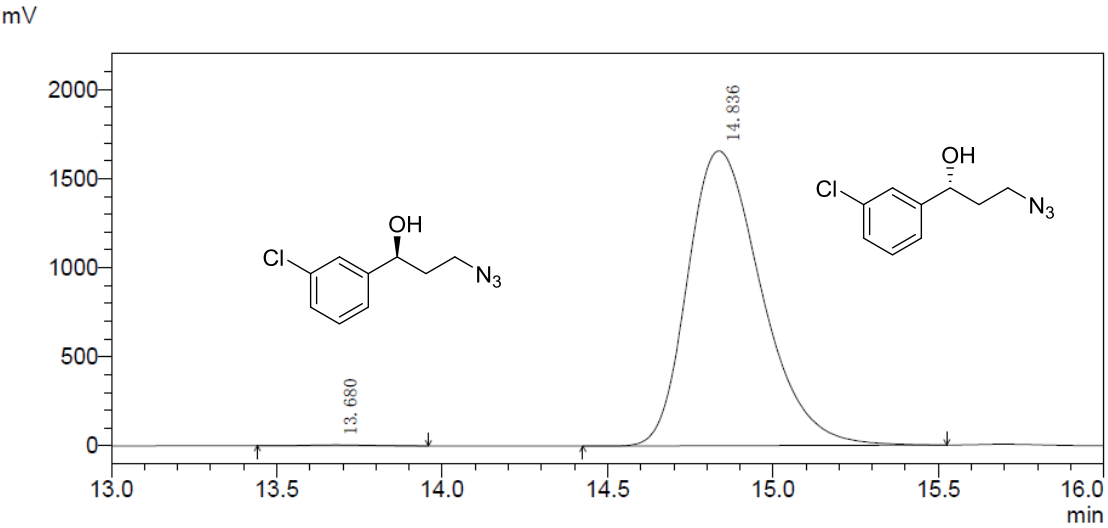
Chemical synthesized (*rac*)-**7c**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	13.699	7730658	559909	49.800
2	14.836	7792621	525288	50.200

Enzymatic synthesized (*R*)-**7c** by biocatalytic cascade

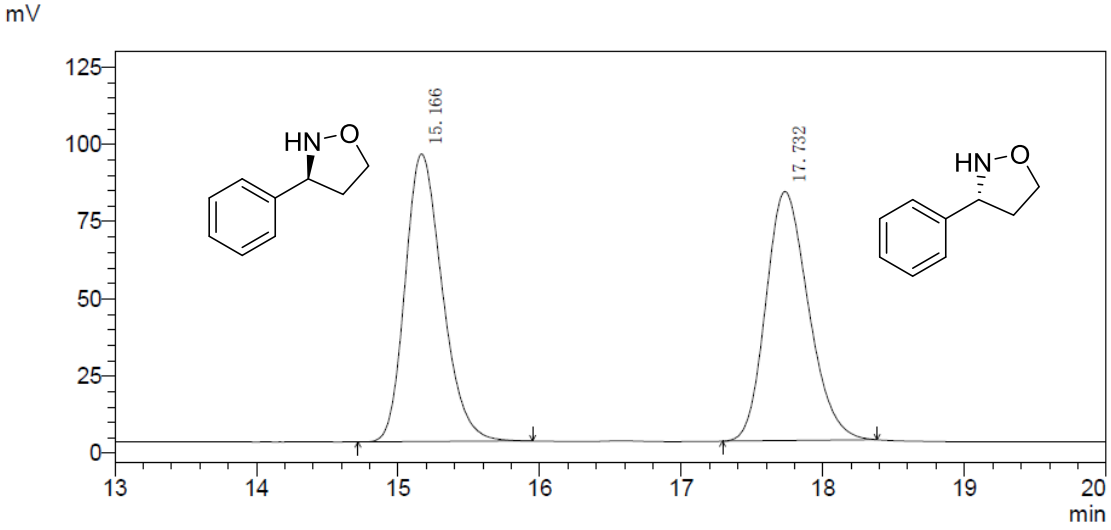


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	13.680	53678	4685	0.209
2	14.836	25653639	1653177	99.791

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 13.7 min, $t_{(R)}$ = 14.8 min.

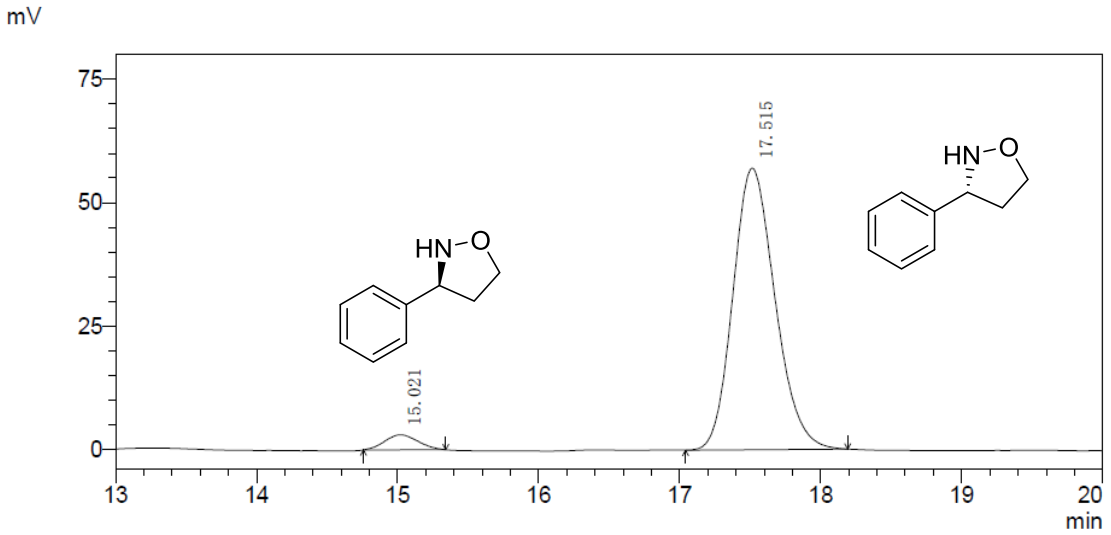
Chemical synthesized (*rac*)-**1aa**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.166	1699329	93161	50.146
2	17.732	1689463	80657	49.854

Enzymatic synthesized (*R*)-**1aa**

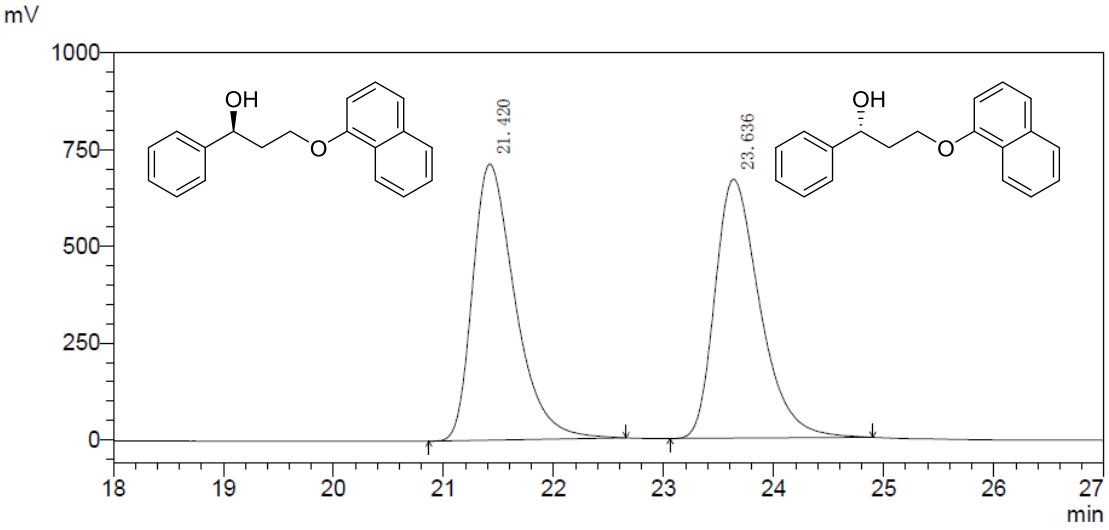


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.021	49883	3037	4.039
2	17.515	1185229	57057	95.961

Chiral HPLC analysis: Diacel Chiralpak OJ-H, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 210 nm, $t_{(S)}$ = 15.0 min, $t_{(R)}$ = 17.5 min.

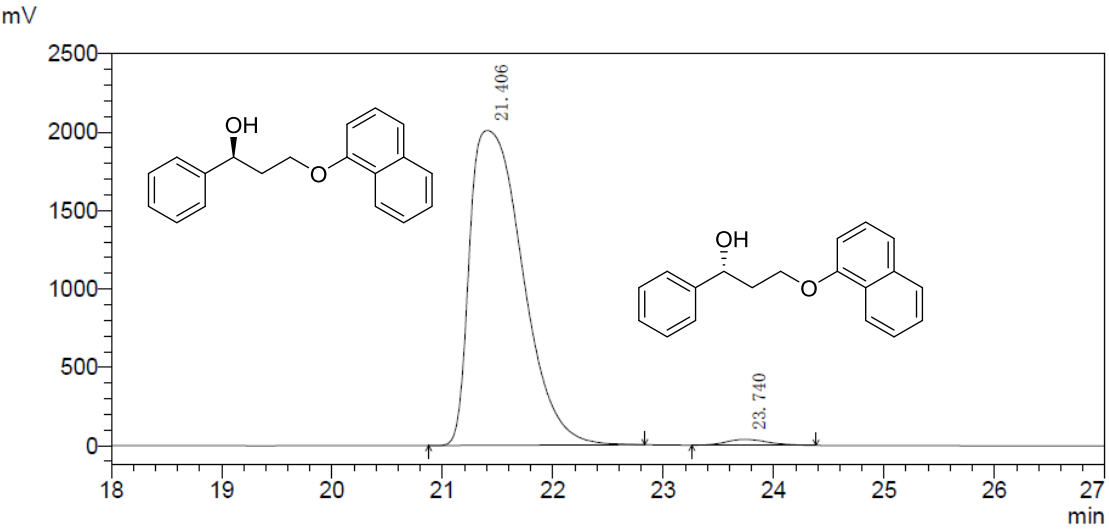
Chemical synthesized (*rac*)-**1ab**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	21.420	19097565	713506	50.117
2	23.636	19008421	669229	49.883

Enzymatic synthesized (*S*)-**1ab**

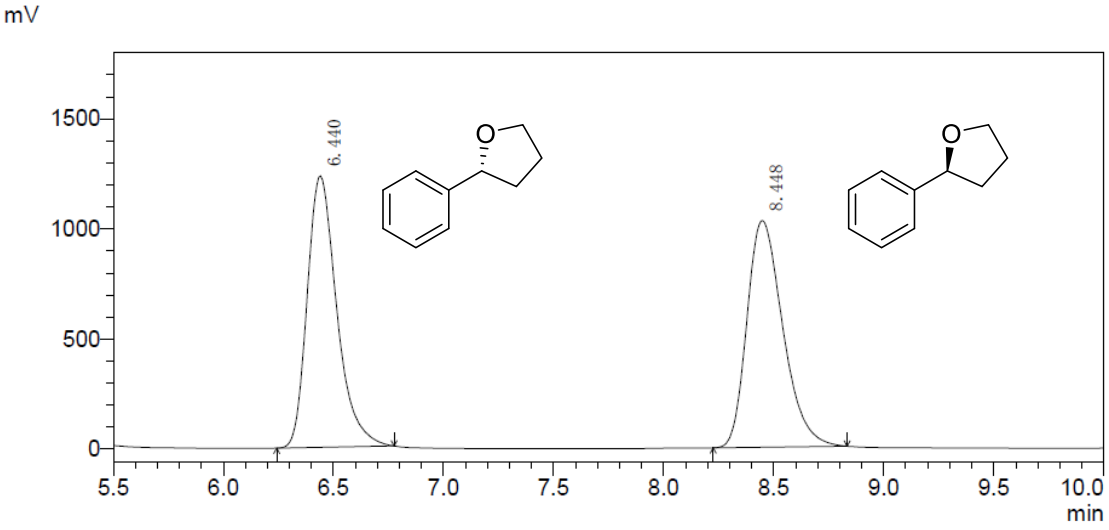


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	21.406	66945044	2008535	98.544
2	23.740	988981	37912	1.456

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 21.4 min, $t_{(R)}$ = 23.7 min.

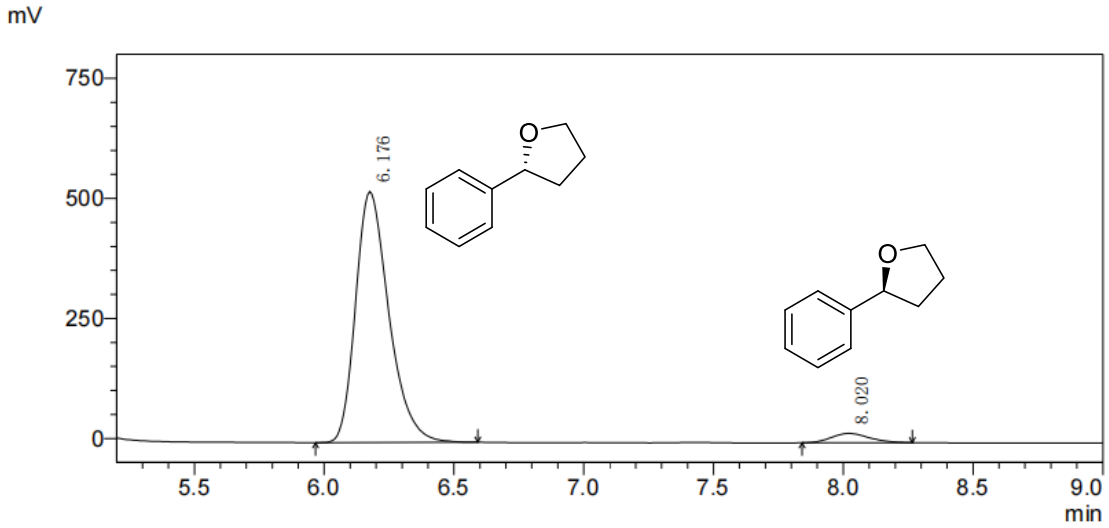
Chemical synthesized (*rac*)-**1ba**



PDA 214nm

ID#	Rt. Time	Area	Height	Area %
1	6.440	11512592	1232992	49.620
2	8.448	11689064	1030364	50.380

Enzymatic synthesized (*R*)-**1ba**

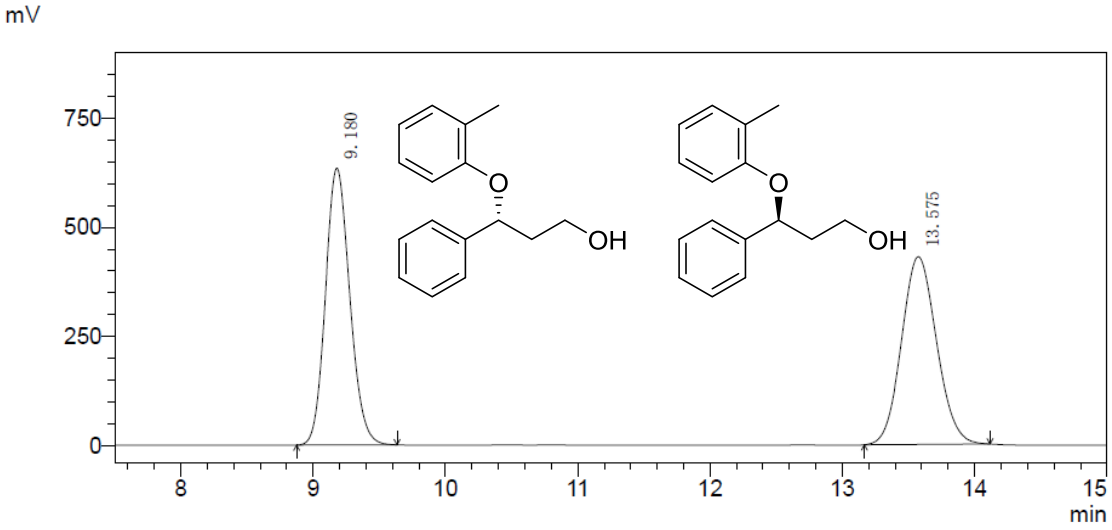


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	6.176	4659847	522569	95.982
2	8.020	195046	19283	4.018

Chiral HPLC analysis: Diacel Chiralpak OD-H, *n*-hexane/*i*-PrOH = 92/8, flow rate 0.8 mL/min, λ = 210 nm, $t_{(R)}$ = 6.2 min, $t_{(S)}$ = 8.0 min.

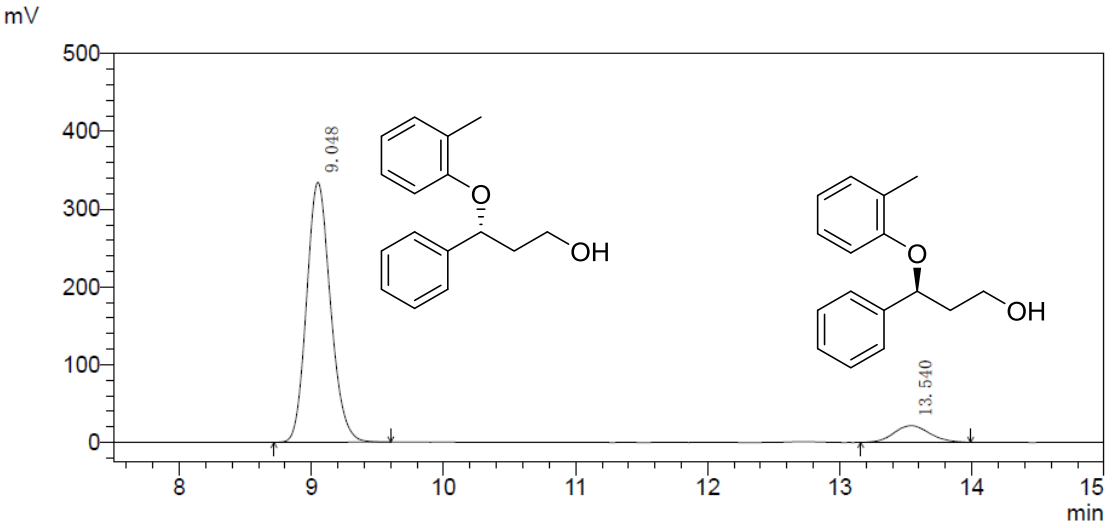
Chemical synthesized (*rac*)-**1bb**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	9.180	8128125	634385	50.685
2	13.575	7908465	430466	49.315

Enzymatic synthesized (*R*)-**1bb**

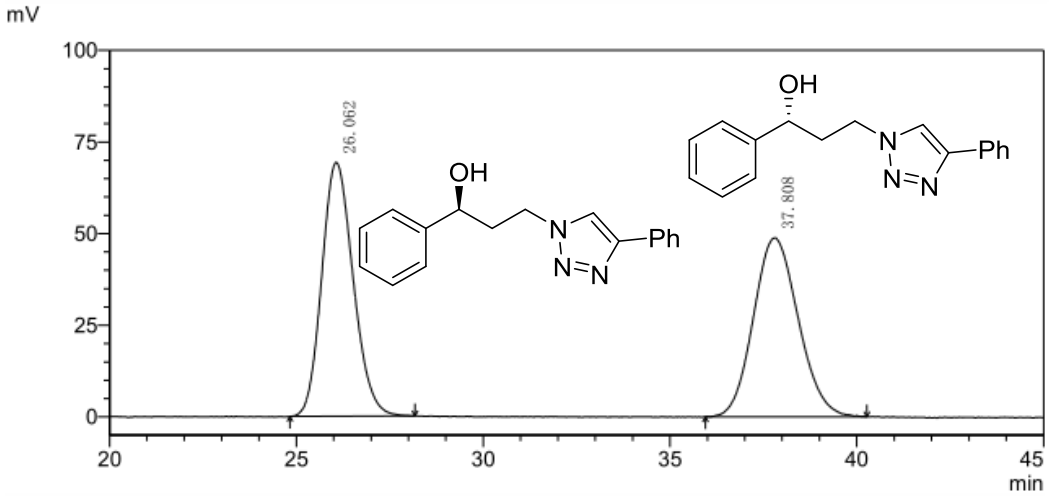


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	9.048	4224257	334366	91.236
2	13.540	405753	21497	8.764

Chiral HPLC analysis: Diacel Chiralpak AD-H, *n*-hexane/*i*-PrOH = 95/5, flow rate 1.0 mL/min, λ = 210 nm, $t_{(R)}$ = 9.0 min, $t_{(S)}$ = 13.5 min.

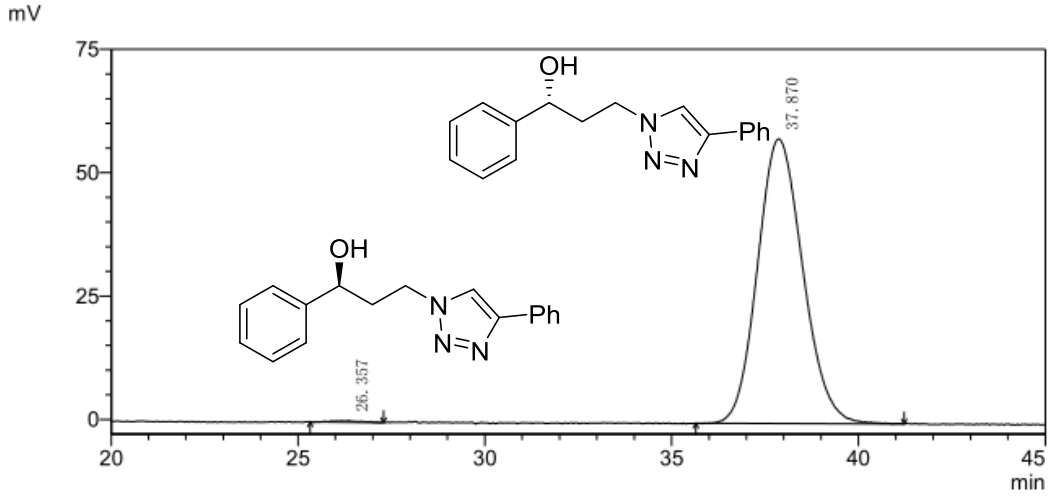
Chemical synthesized (*rac*)-**1ca**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	26.062	4047576	69250	49.779
2	37.808	4083466	48852	50.221

Enzymatic synthesized (*R*)-**1ca**

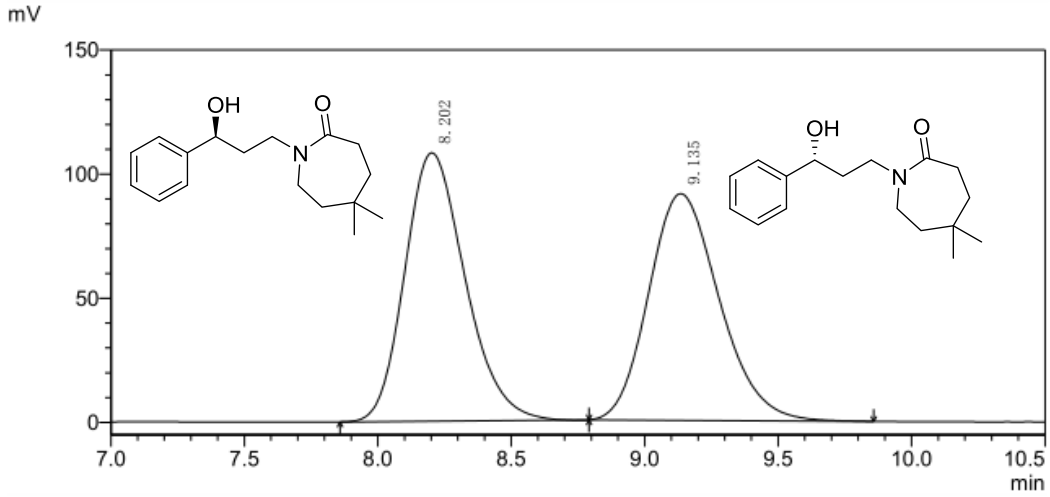


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	26.357	14918	343	0.306
2	37.870	4868031	57658	99.694

Chiral HPLC analysis: Diacel Chiralpak OD-H, *n*-hexane/*i*-PrOH = 80/20, flow rate 1.0 mL/min, λ = 210 nm, $t_{(S)}$ = 26.4 min, $t_{(R)}$ = 37.9 min.

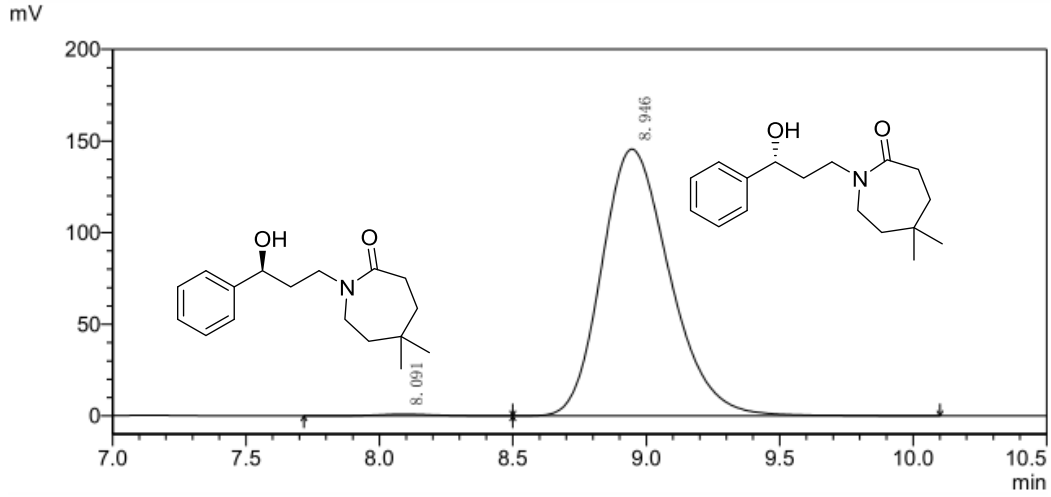
Chemical synthesized (*rac*)-**1cb**



PDA 214nm

ID#	Rt. Time	Area	Height	Area %
1	8.202	1701266	108087	50.253
2	9.135	1684116	91359	49.747

Enzymatic synthesized (*R*)-**1cb**

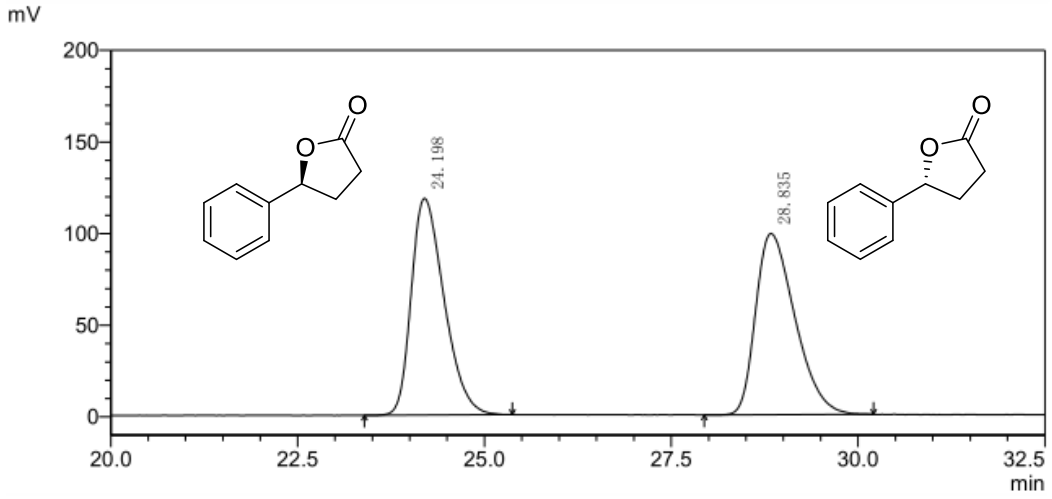


PDA 214nm

ID#	Rt. Time	Area	Height	Area %
1	8.091	12891	874	0.496
2	8.946	2587698	145460	99.504

Chiral HPLC analysis: Diacel Chiralpak OJ-H, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 214 nm, $t_{(S)}$ = 8.1 min, $t_{(R)}$ = 8.9 min.

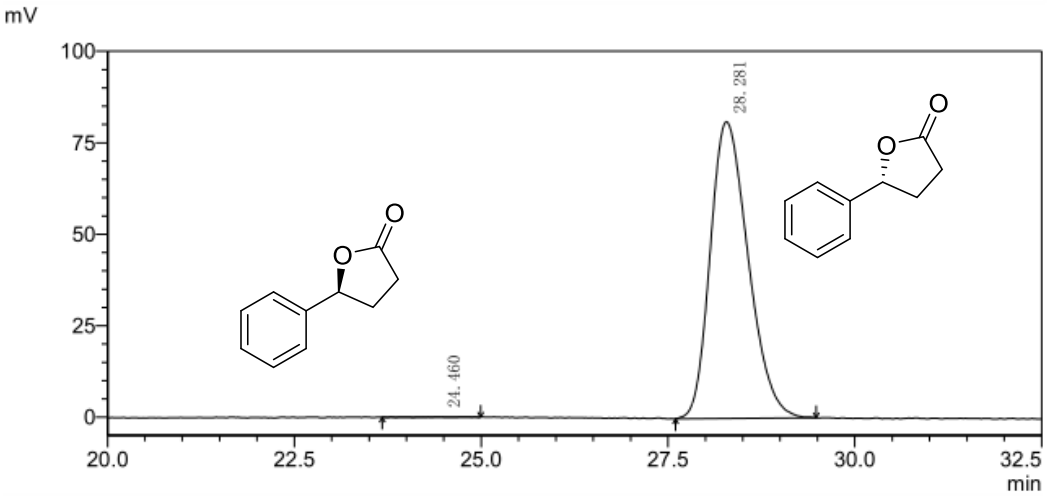
Commercial (*rac*)-**1da**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	24.198	3620948	118225	49.986
2	28.835	3622928	98870	50.014

Enzymatic synthesized (*R*)-**1da**

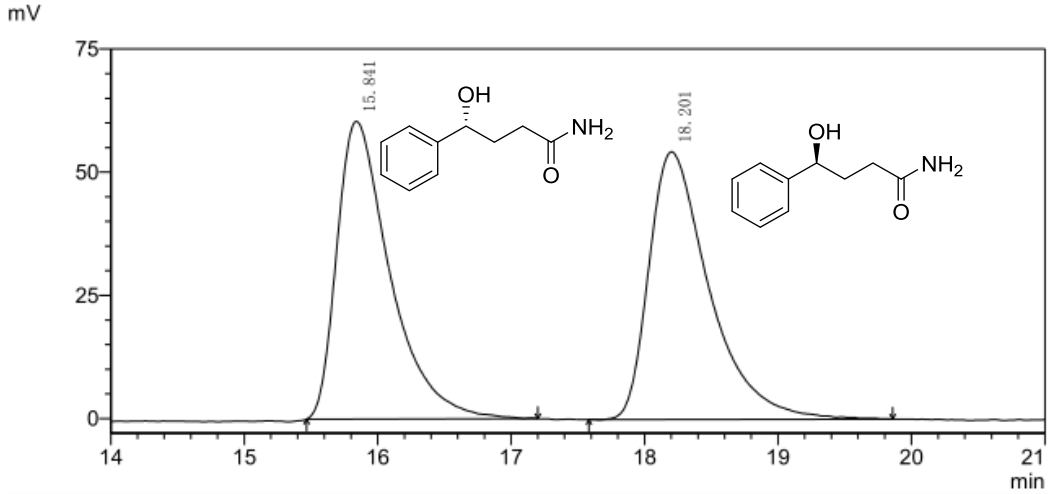


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	24.460	169	90	0.006
2	28.281	2865498	81064	99.994

Chiral HPLC analysis: Diacel Chiralpak IH, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 210 nm, $t_{(S)}$ = 24.5 min, $t_{(R)}$ = 28.3 min.

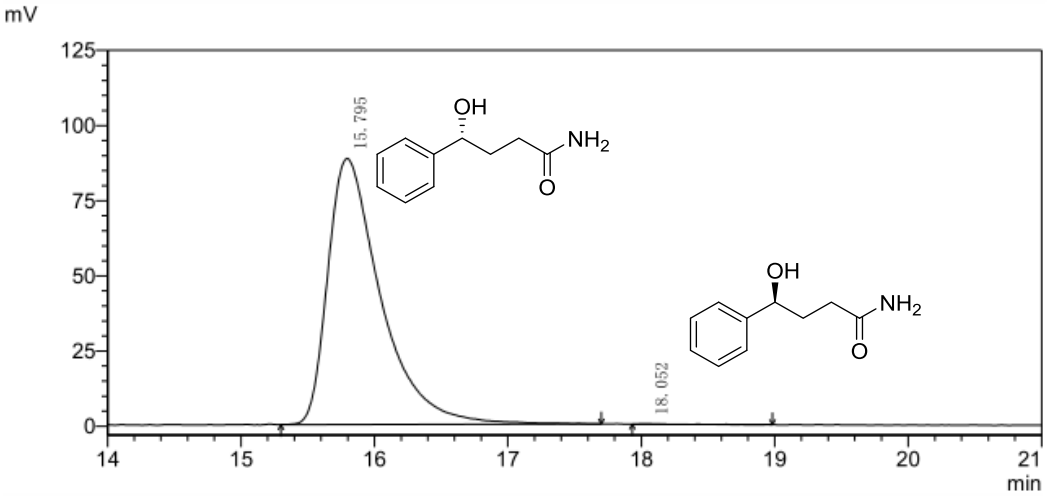
Chemical synthesized (*rac*)-**1db**



PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.841	1673790	60421	49.431
2	18.201	1712303	54361	50.569

Enzymatic synthesized (*R*)-**1db**

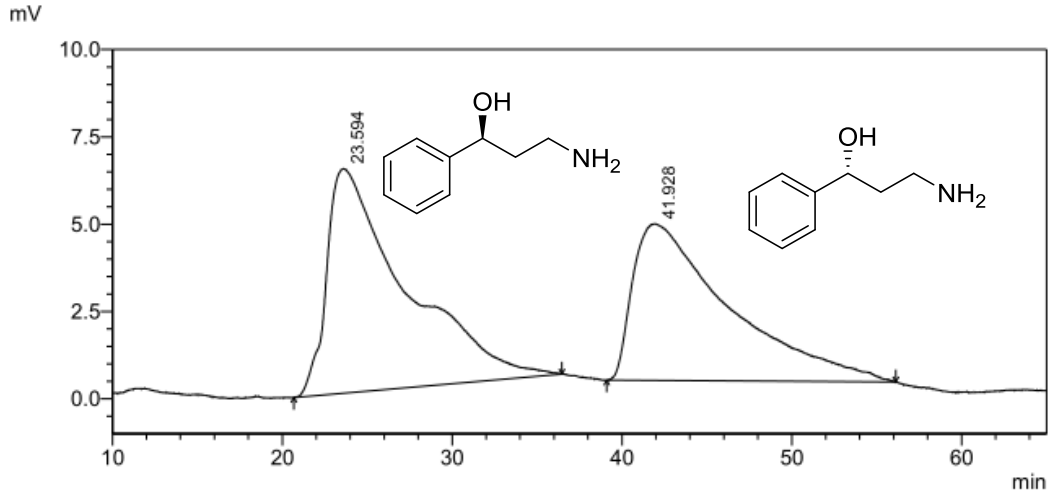


PDA 210nm

ID#	Rt. Time	Area	Height	Area %
1	15.795	2441965	88405	99.946
2	18.052	1309	112	0.054

Chiral HPLC analysis: Diacel Chiralpak OJ-H, *n*-hexane/*i*-PrOH = 90/10, flow rate 1.0 mL/min, λ = 210 nm, $t_{(R)}$ = 15.8 min, $t_{(S)}$ = 18.1 min.

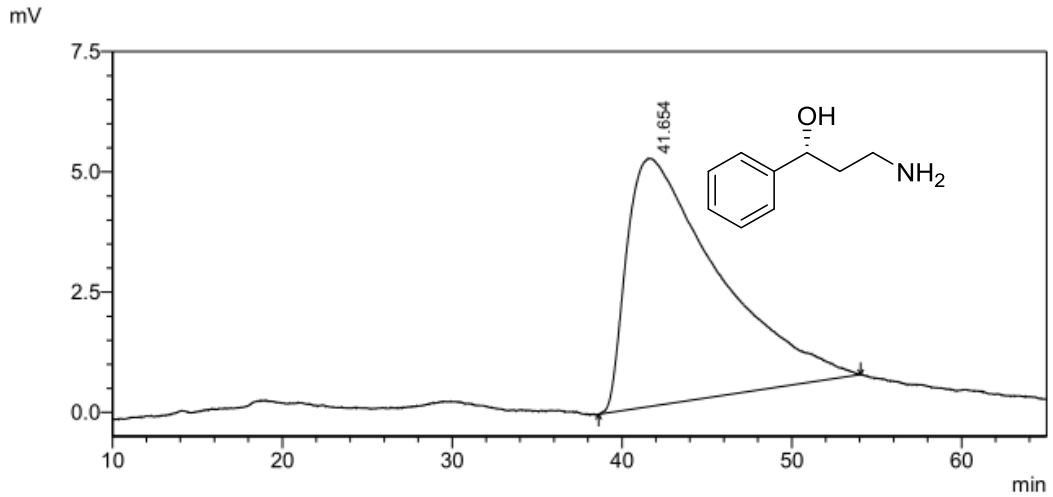
Commercial (*rac*)-**1ea**



PDA 210nm

ID#	Rt. Time	Area	Height	Area%
1	23.594	2057883	6422	53.899
2	41.928	1760161	4476	46.101

Enzymatic synthesized (*R*)-**1ea**

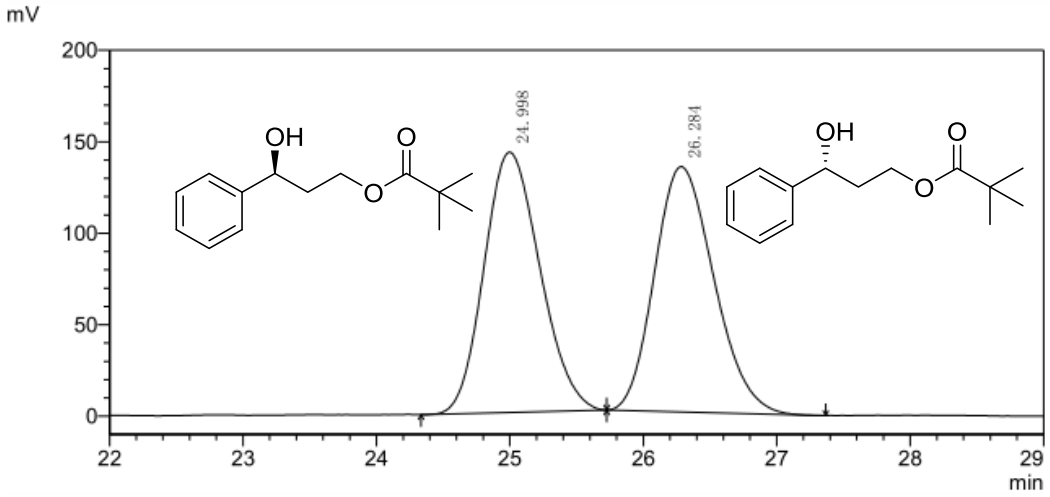


PDA 210nm

ID#	Rt. Time	Area	Height	Area%
1	41.654	1935689	5152	100.000

Chiral HPLC analysis: Diacel Chiralpak OB-H, *n*-hexane/*i*-PrOH = 92/8, flow rate 1.0 mL/min, λ = 210 nm, $t_{(S)}$ = 23.6 min, $t_{(R)}$ = 41.9 min.

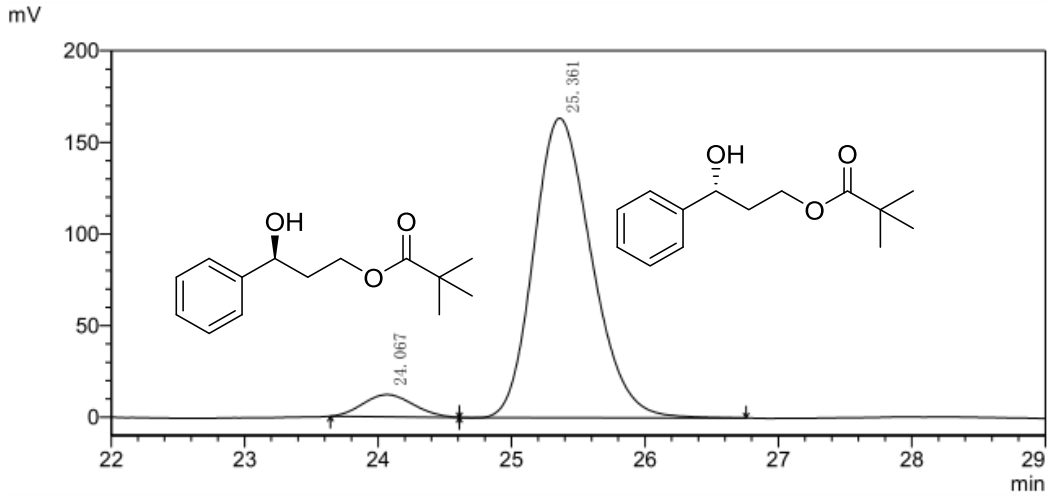
Chemical synthesized (*rac*)-**1fa**



PDA_210nm

ID#	Rt. Time	Area	Height	Area %
1	24.998	4142909	142252	49.956
2	26.284	4150284	134051	50.044

Enzymatic synthesized (*R*)-**1fa**



PDA_210nm

ID#	Rt. Time	Area	Height	Area %
1	24.067	316187	12062	6.029
2	25.361	4928503	163412	93.971

Chiral HPLC analysis: Diacel Chiralpak OX-3, *n*-hexane/*i*-PrOH = 97/3, flow rate 0.7 mL/min, λ = 210 nm, $t_{(S)}$ = 24.1 min, $t_{(R)}$ = 25.4 min.

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