

Supporting Information-III

(HPLC Spectral Data)

Constructing Chiral Bicyclo[3.2.1]octanes *via* Low-loading Organocatalysis

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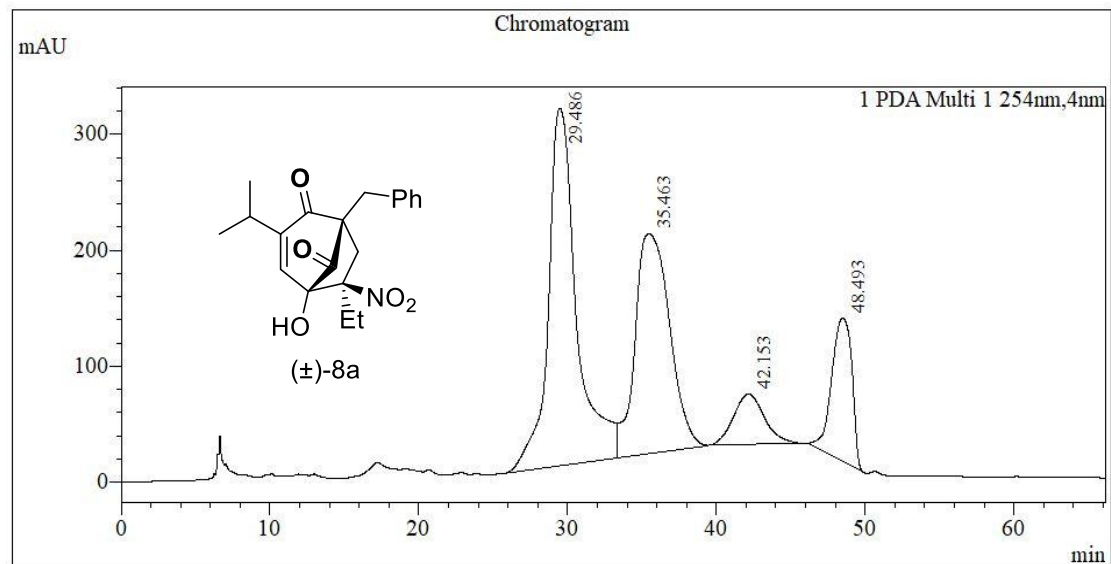
³Lead contact

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General Methods:

The enantiomeric excess (*ee*) of the tandem Michael/Henry annulation products **10** and **11** were determined by using chiral stationary phase HPLC using a Daicel Chiralpak IG or ID columns and hexane/2-propanol as the eluent. Retention times and solvent ratios are indicated in the respective entries.

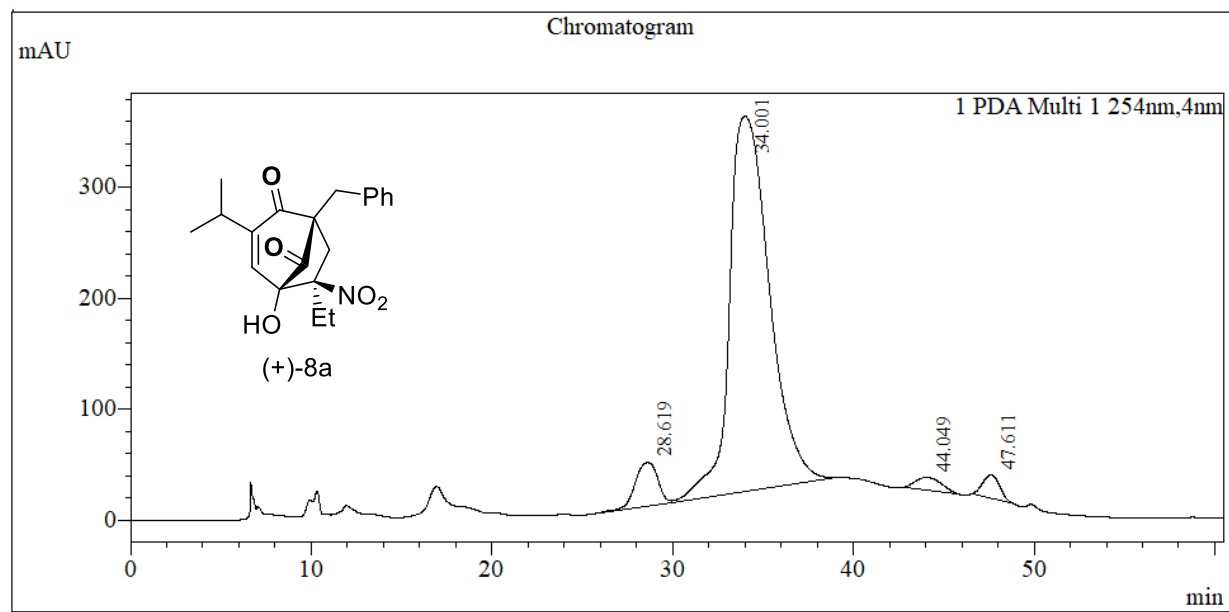
Racemic ($\pm$)-**8a** and ($\pm$)-**9a**:



Chiralpak IG, Hexane/ *i*-PrOH = 97:3, Flow Rate 0.5 mL/min, 254nm

Peak Table						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:29.486	29.486	40732504	308228	45.620	46.367
2	RT:35.463	35.463	30611512	189329	34.285	28.481
3	RT:42.153	42.153	6296059	43396	7.052	6.528
4	RT:48.493	48.493	11646150	123800	13.044	18.623

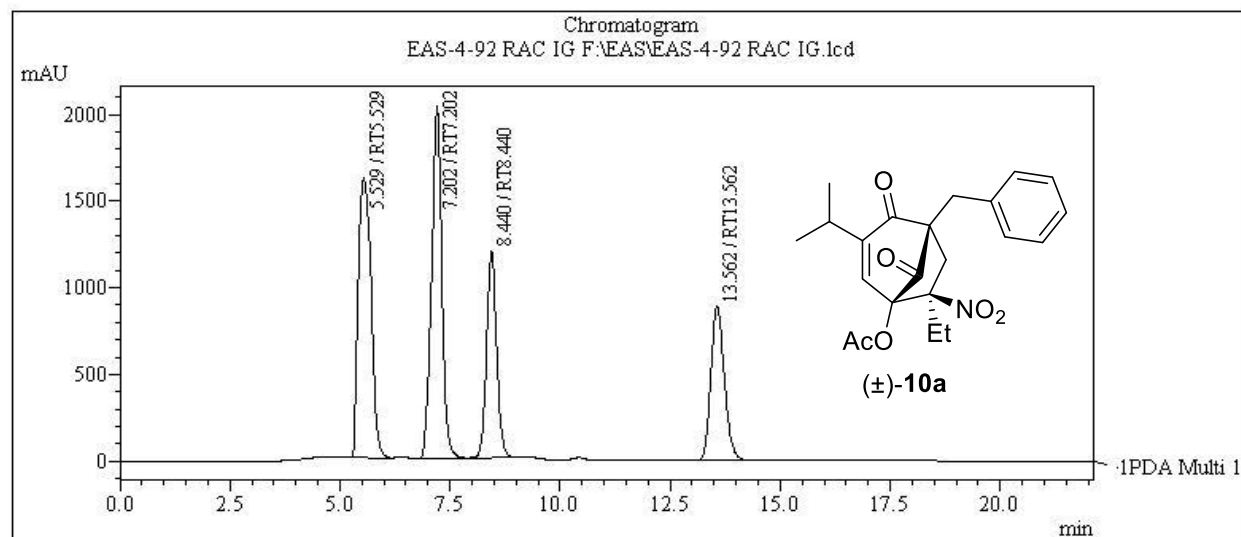
Chiral-(+)-8a and (+)-9a (Major: 88% *ee*; Minor: 12% *ee*):



Chiralpak IG, Hexane/ *i*-PrOH = 97:3, Flow Rate 0.5 mL/min., 254nm

Peak Table						
PDA Ch1 254nm						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:28.619	28.619	3363415	38860	5.790	9.490
2	RT:34.001	34.001	52240793	338409	89.937	82.645
3	RT:44.049	44.049	1091470	11113	1.879	2.714
4	RT:47.611	47.611	1390004	21090	2.393	5.151

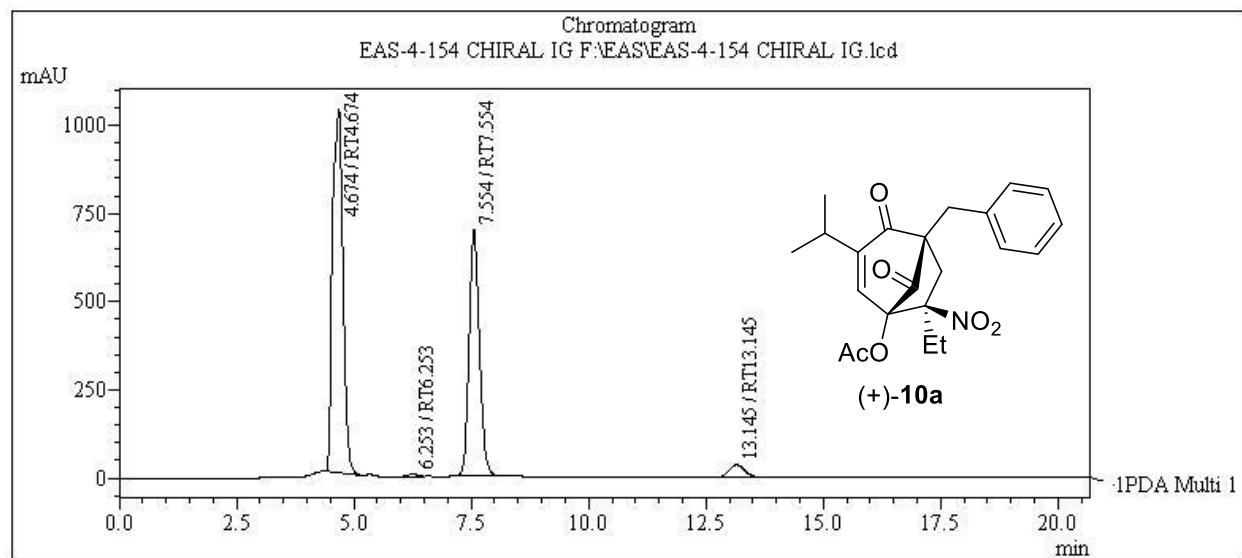
Racemic (±)-10a:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT5.529	5.529	32886777	1614223	31.652	28.173
2	RT7.202	7.202	33016150	2031520	31.776	35.456
3	RT8.440	8.440	18979177	1194414	18.266	20.846
4	RT13.562	13.562	19020056	889597	18.306	15.526

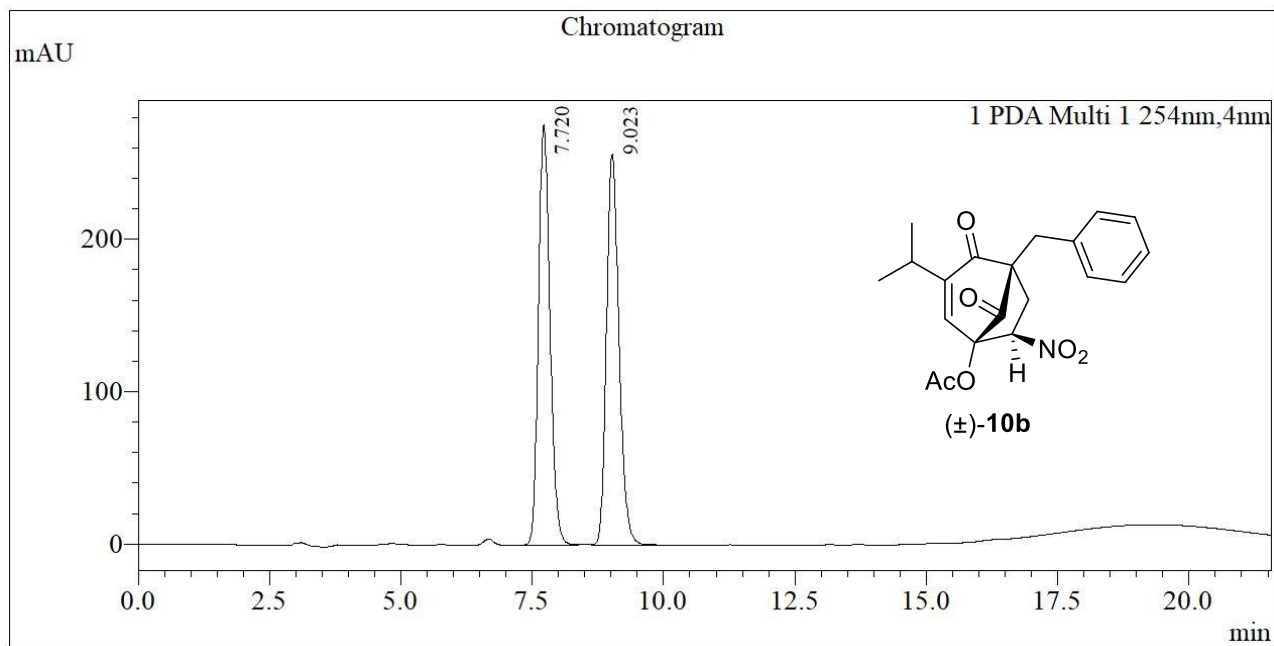
Chiral-(+)-10a (Major: 99% ee; Minor: 86% ee):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT4.674	4.674	15970869	1027683	58.023	58.148
2	RT6.253	6.253	89365	7434	0.325	0.421
3	RT7.554	7.554	10671625	697488	38.770	39.465
4	RT13.145	13.145	793429	34757	2.883	1.967

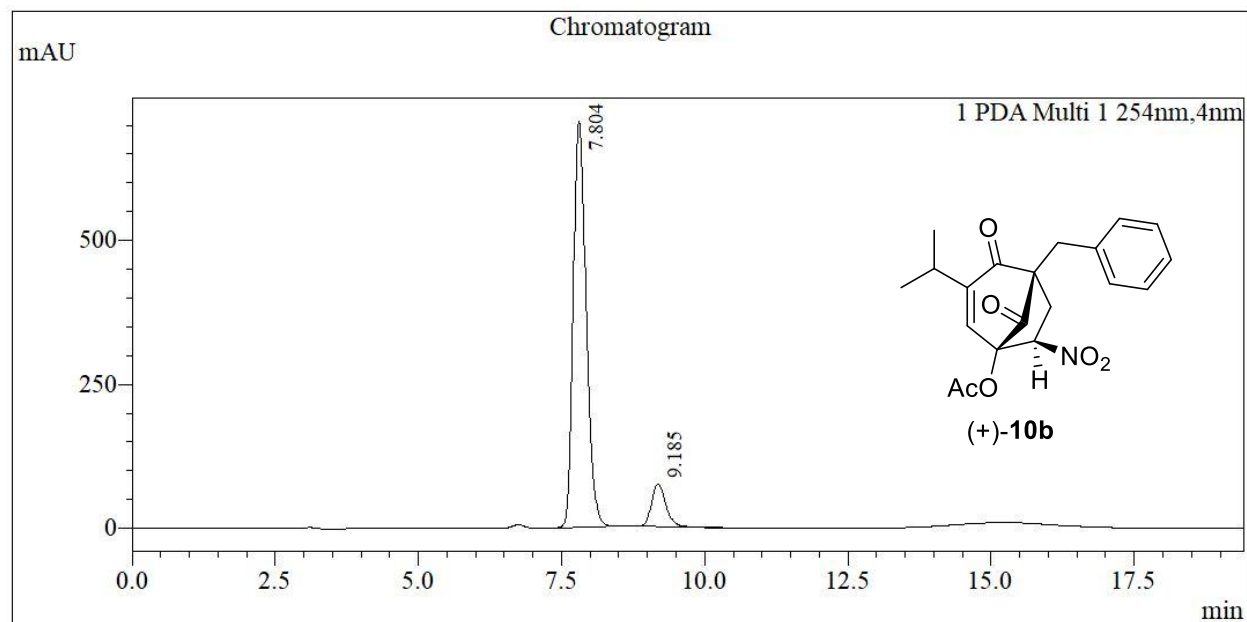
Racemic (±)-10b:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

Peak Table						
PDA Ch1 254nm						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:7.720	7.720	4234845	275969	49.875	51.857
2	RT:9.023	9.023	4256106	256203	50.125	48.143
Total			8490951	532172	100.000	100.000

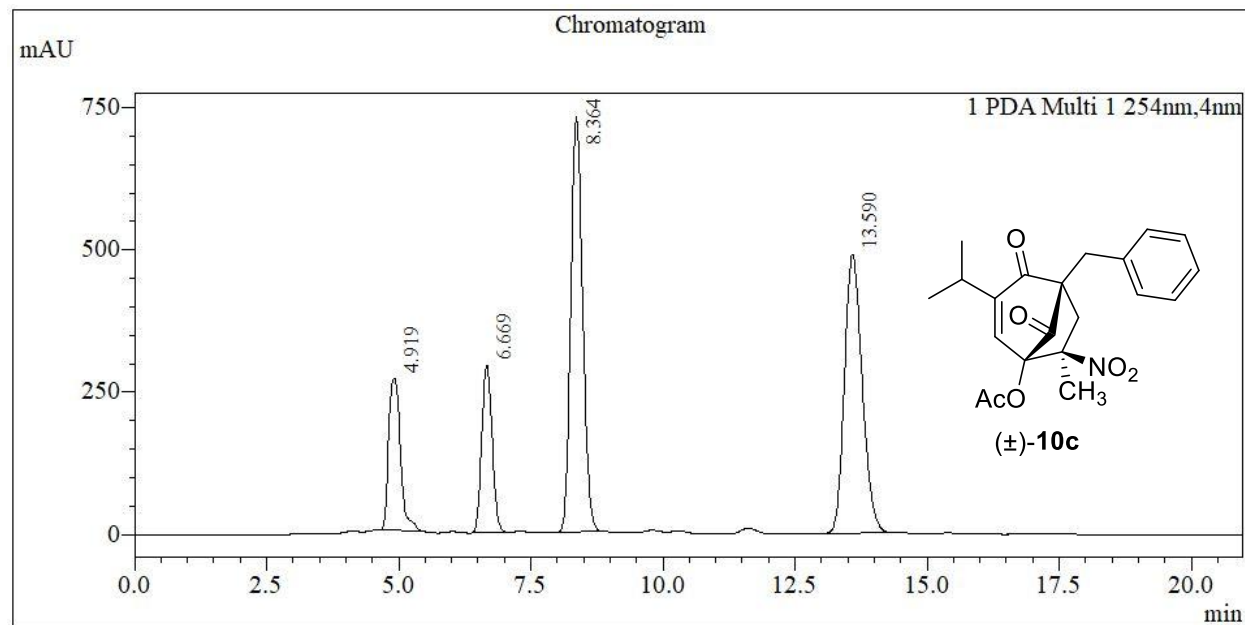
Chiral-(+)-10b (Major: 79% ee):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

Peak Table						
PDA Ch1 254nm						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:7.804	7.804	11088637	704992	89.519	90.479
2	RT:9.185	9.185	1298214	74184	10.481	9.521
Total			12386851	779175	100.000	100.000

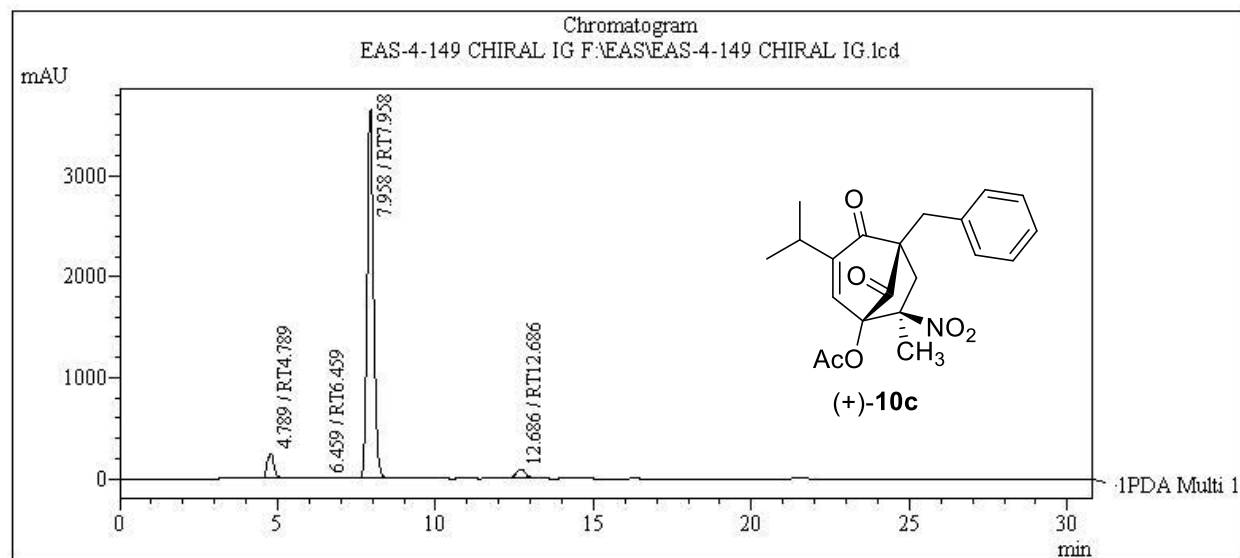
Racemic (±)-10c:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

Peak Table						
PDA Ch1 254nm						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:4.919	4.919	4186286	267457	13.450	15.022
2	RT:6.669	6.669	4046350	294111	13.000	16.519
3	RT:8.364	8.364	11469469	729471	36.849	40.973
4	RT:13.590	13.590	11423194	489350	36.701	27.486

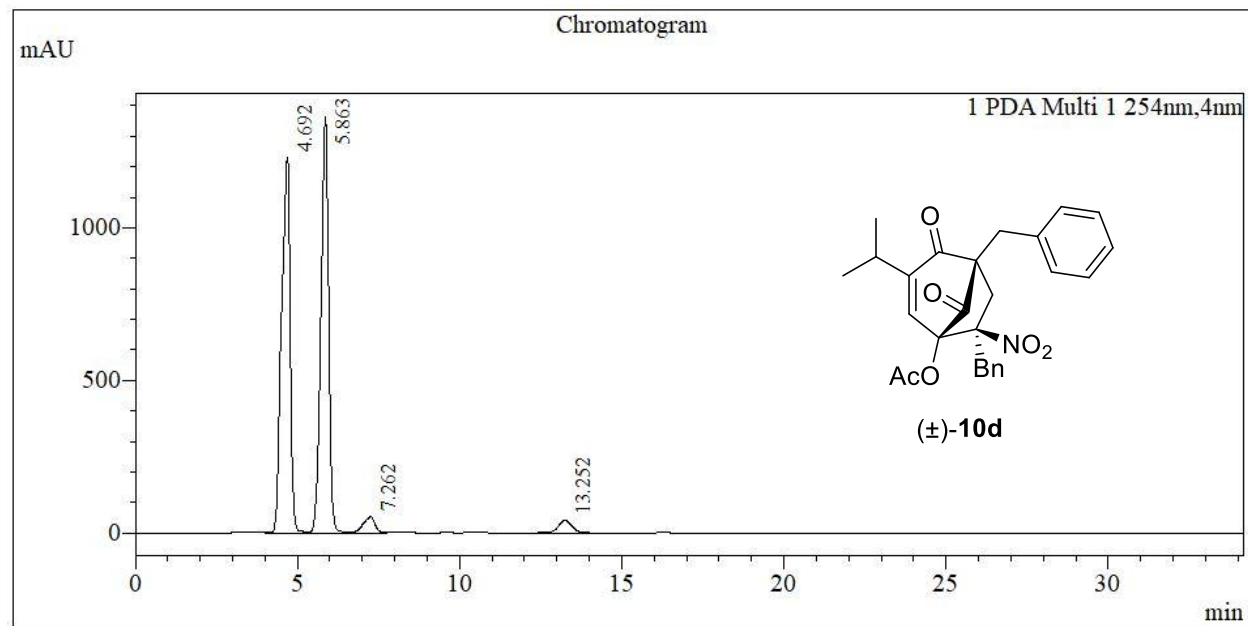
Chiral-(+)-10c (Major: 93% ee; Minor: 99% ee):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT4.789	4.789	3550242	242519	6.296	6.101
2	RT6.459	6.459	137611	9702	0.244	0.244
3	RT7.958	7.958	50965611	3635957	90.388	91.473
4	RT12.686	12.686	1731925	86709	3.072	2.181

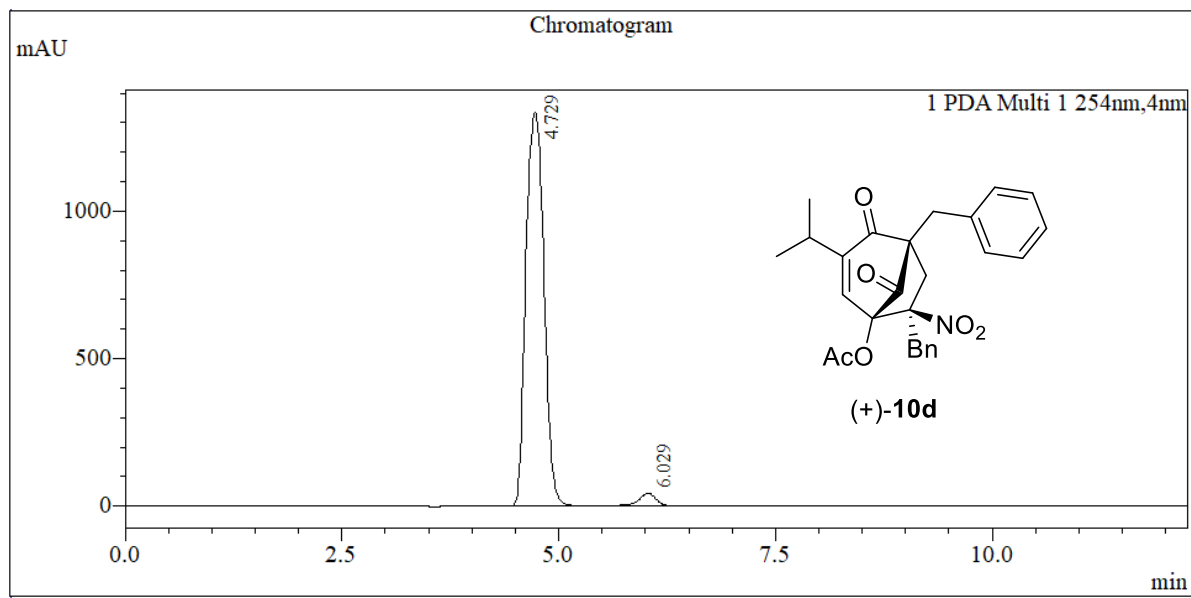
Racemic ($\pm$)-10d:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

Peak Table						
PDA Ch1 254nm						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:4.692	4.692	22630472	1232457	47.245	45.830
2	RT:5.863	5.863	22644529	1362462	47.274	50.664
3	RT:7.262	7.262	1371933	53634	2.864	1.994
4	RT:13.252	13.252	1253233	40652	2.616	1.512

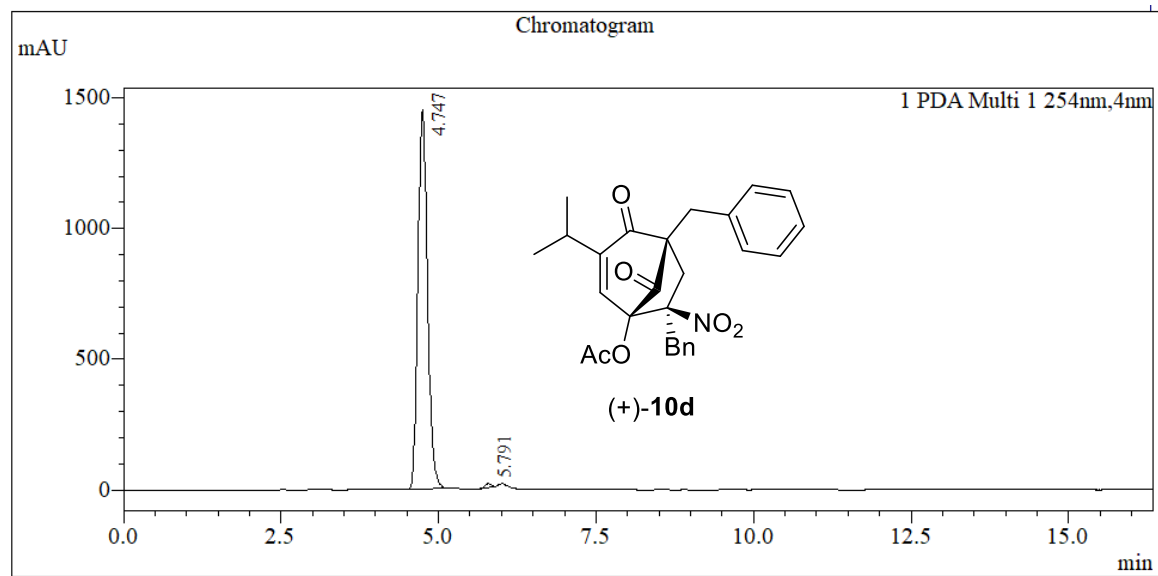
Chiral-(+)-10d (Major: 94% ee under the 10 mol% of catalyst 3g):



Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

Peak Table						
PDA Ch1 254nm						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:4.729	4.729	19307562	1333102	96.994	96.823
2	RT:6.029	6.029	598296	43738	3.006	3.177
Total			19905859	1376840	100.000	100.000

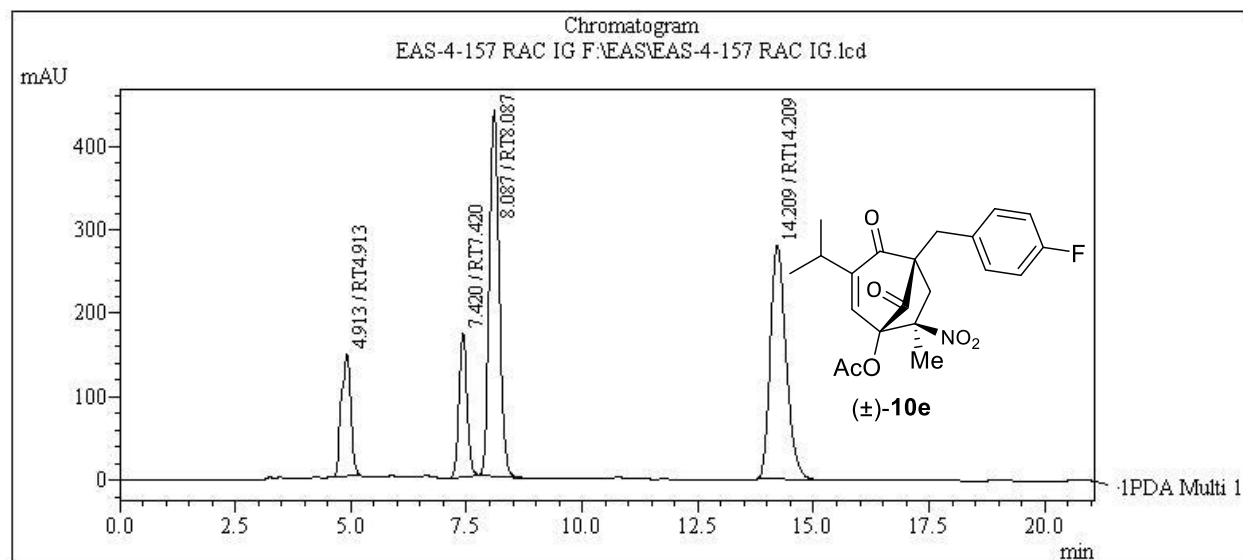
Chiral-(+)-10d (Major: 98.7% ee under the 1 mol% of catalyst 3g):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

Peak Table						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:4.747	4.747	15380753	1447997	99.383	99.018
2	RT:5.791	5.791	95417	14357	0.617	0.982
Total			15476170	1462354	100.000	100.000

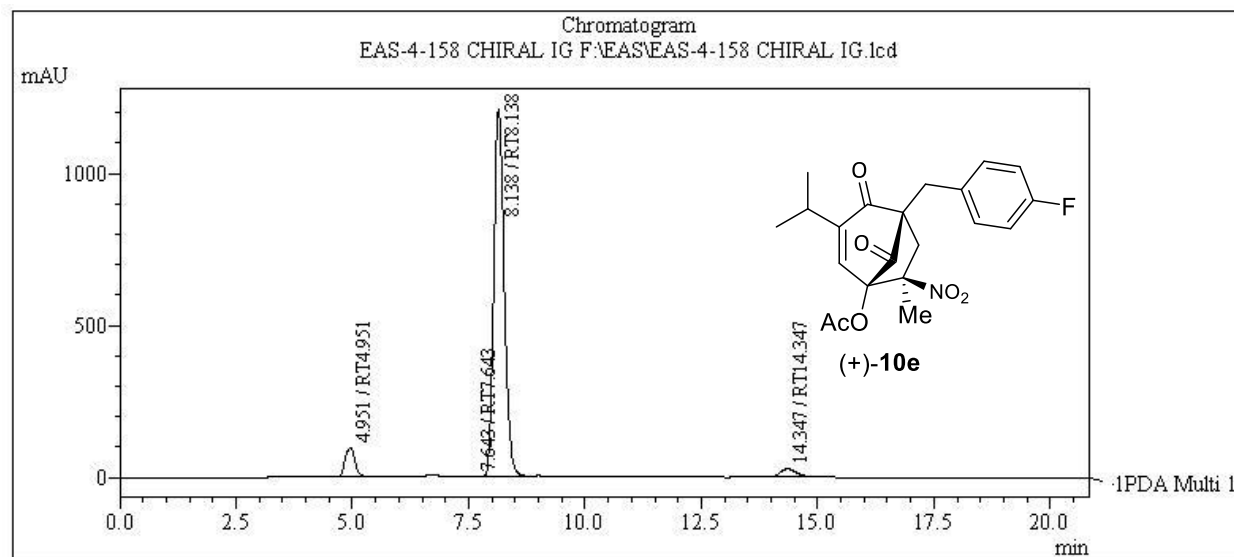
Racemic (±)-10e:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 0.8 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT4.913	4.913	2076062	146093	12.029	14.131
2	RT7.420	7.420	2048758	170661	11.871	16.508
3	RT8.087	8.087	6489541	436975	37.602	42.267
4	RT14.209	14.209	6643933	280106	38.497	27.094

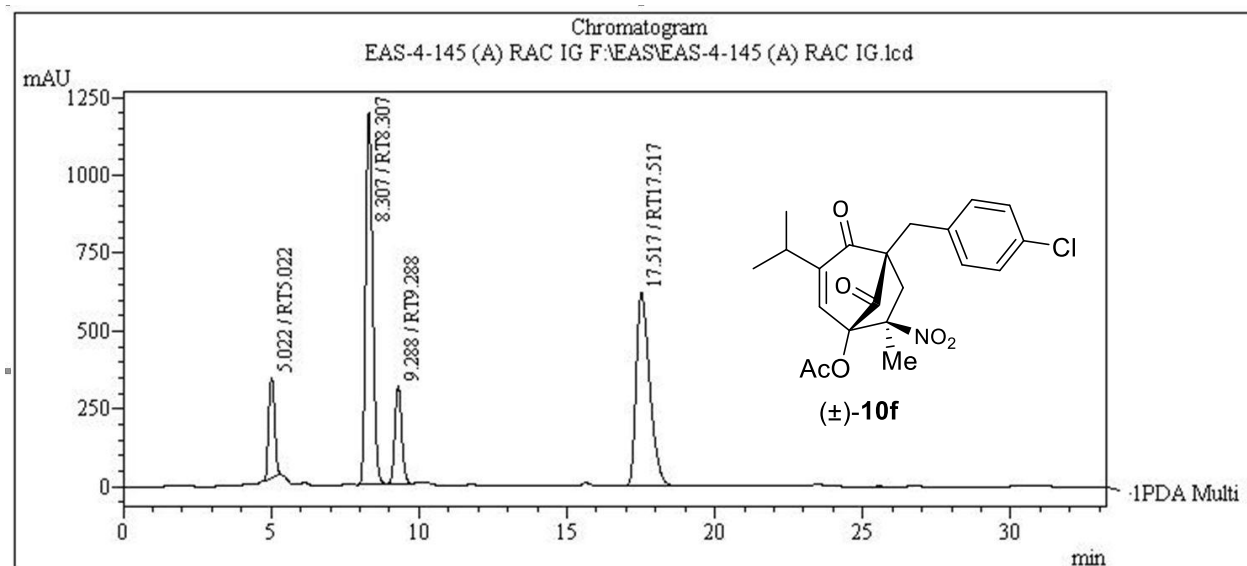
Chiral-(+)-10e (Major: 94% ee; Minor: 96% ee):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 0.8 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT4.951	4.951	1350479	93573	6.486	7.054
2	RT7.643	7.643	27542	1929	0.132	0.145
3	RT8.138	8.138	18892460	1205934	90.733	90.913
4	RT14.347	14.347	551538	25034	2.649	1.887

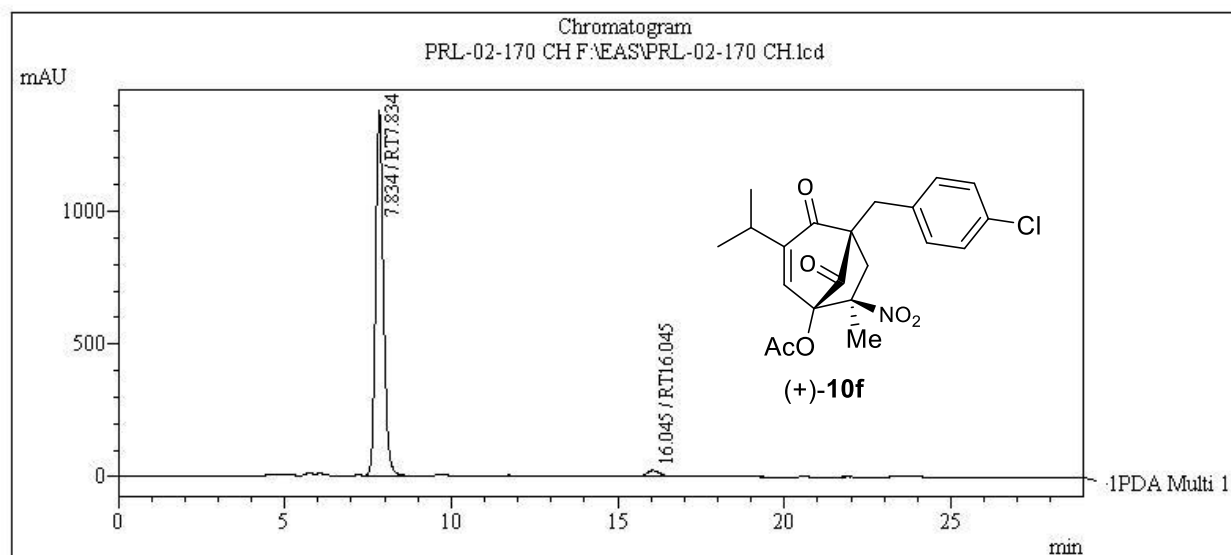
Racemic (±)-10f:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 0.7 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT5.022	5.022	4682255	323002	9.548	13.204
2	RT8.307	8.307	19683459	1193003	40.137	48.768
3	RT9.288	9.288	5030889	311134	10.259	12.719
4	RT17.517	17.517	19644198	619158	40.057	25.310

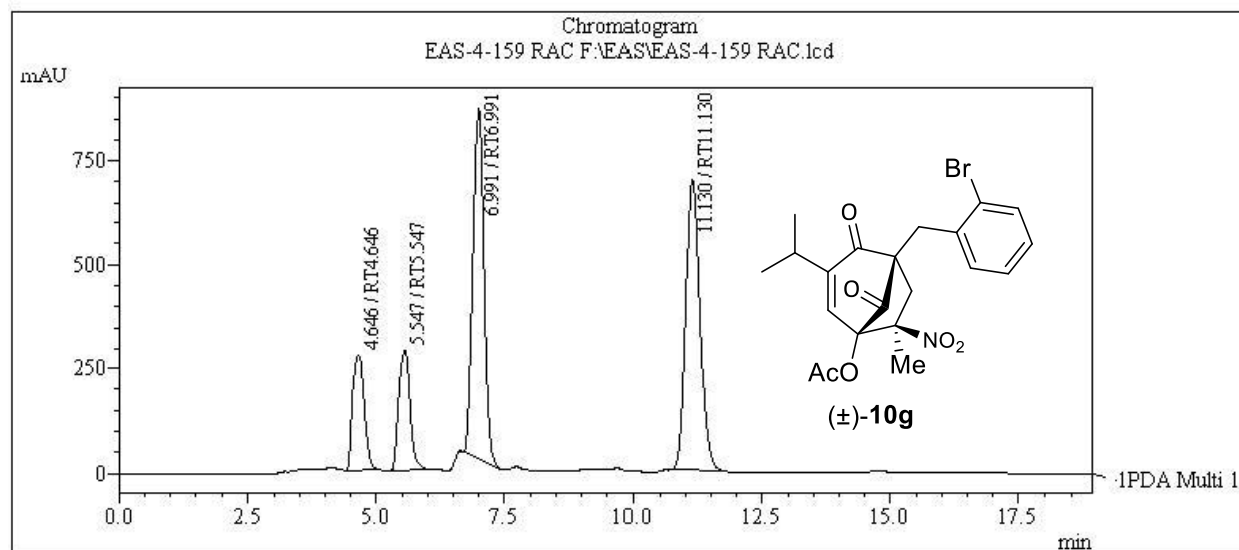
Chiral-(+)-10f (Major: 95% *ee*):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 0.7 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT7.834	7.834	22717166	1374251	97.753	98.467
2	RT16.045	16.045	522114	21391	2.247	1.533
Total			23239280	1395642	100.000	100.000

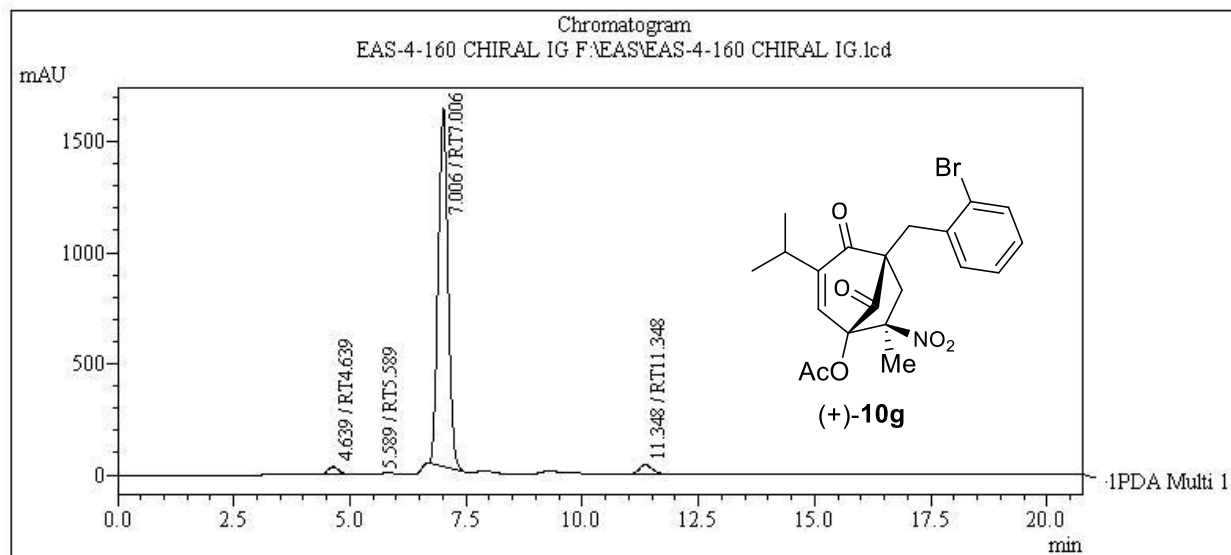
Racemic (±)-10g:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 0.8 mL/min, 254 nm

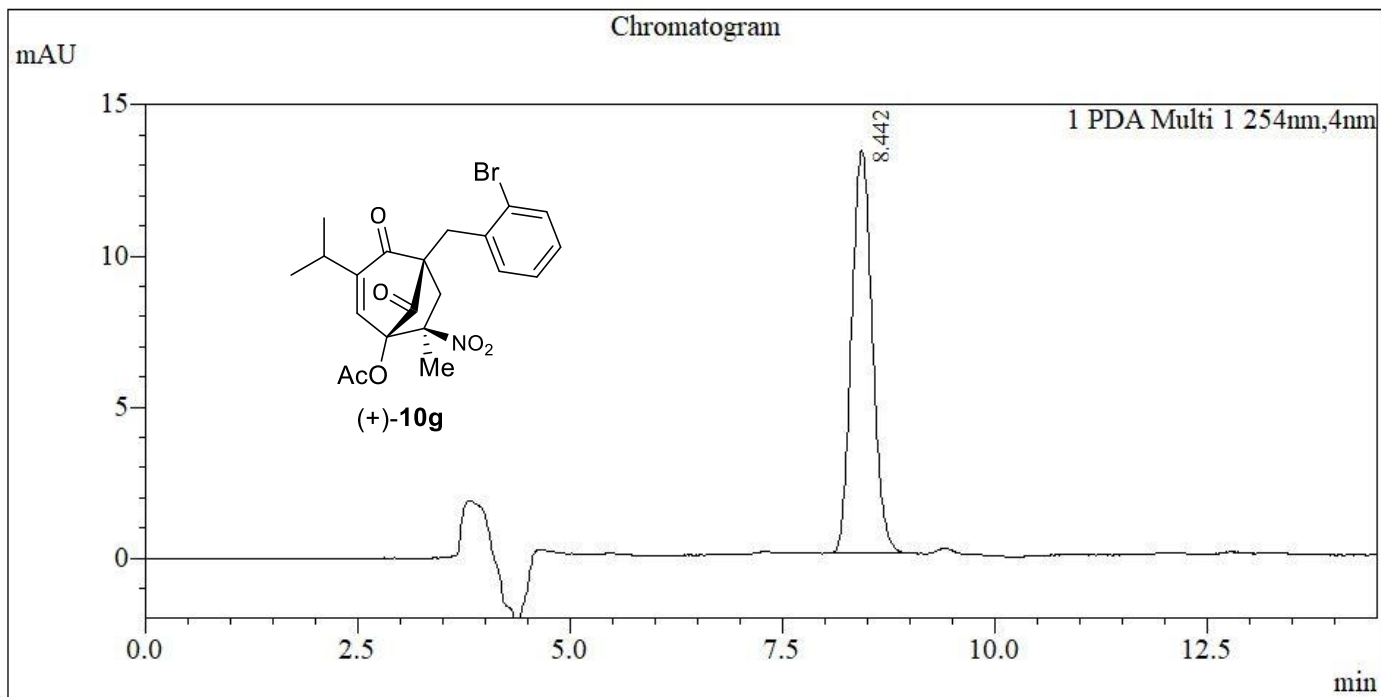
PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT4.646	4.646	4324539	275715	12.415	13.116
2	RT5.547	5.547	4386971	288030	12.595	13.702
3	RT6.991	6.991	12565482	839095	36.074	39.916
4	RT11.130	11.130	13555287	699294	38.916	33.266

Chiral-(+)-10g (Major: 93% ee; Minor: 99% ee):



PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT4.639	4.639	492579	33214	1.965	1.972
2	RT5.589	5.589	2397	17	0.010	0.001
3	RT7.006	7.006	23737855	1609417	94.691	95.550
4	RT11.348	11.348	835833	41719	3.334	2.477

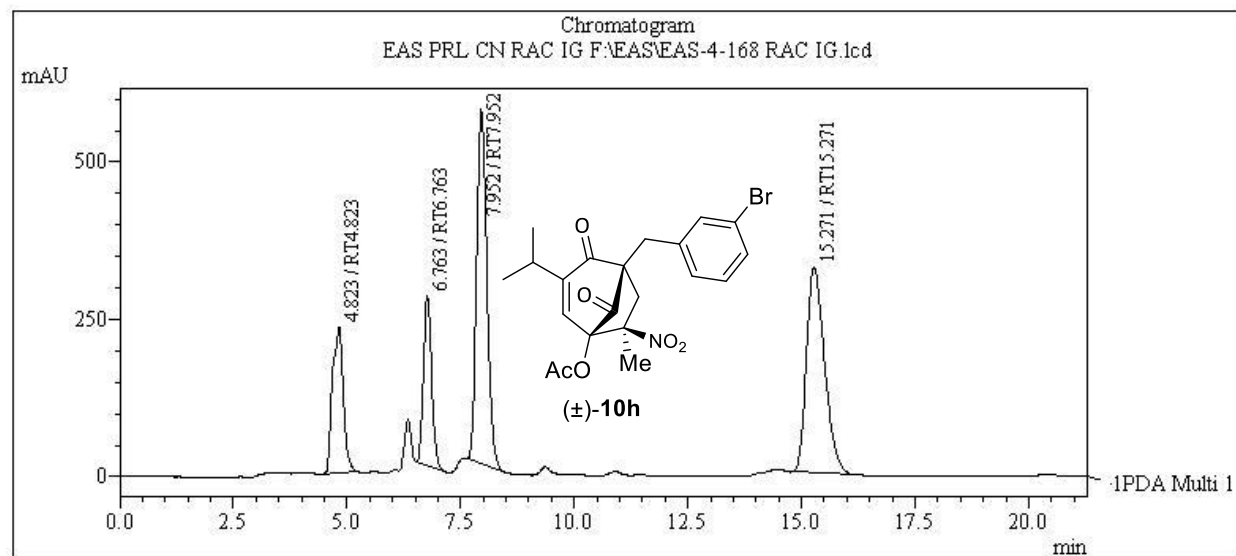
Chiral-(+)-**10g** (Major: >99% *ee*; Crystal):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 0.8 mL/min 254 nm.

Peak Table						
PDA Ch1 254nm						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:8.442	8.442	226759	13349	100.000	100.000
Total			226759	13349	100.000	100.000

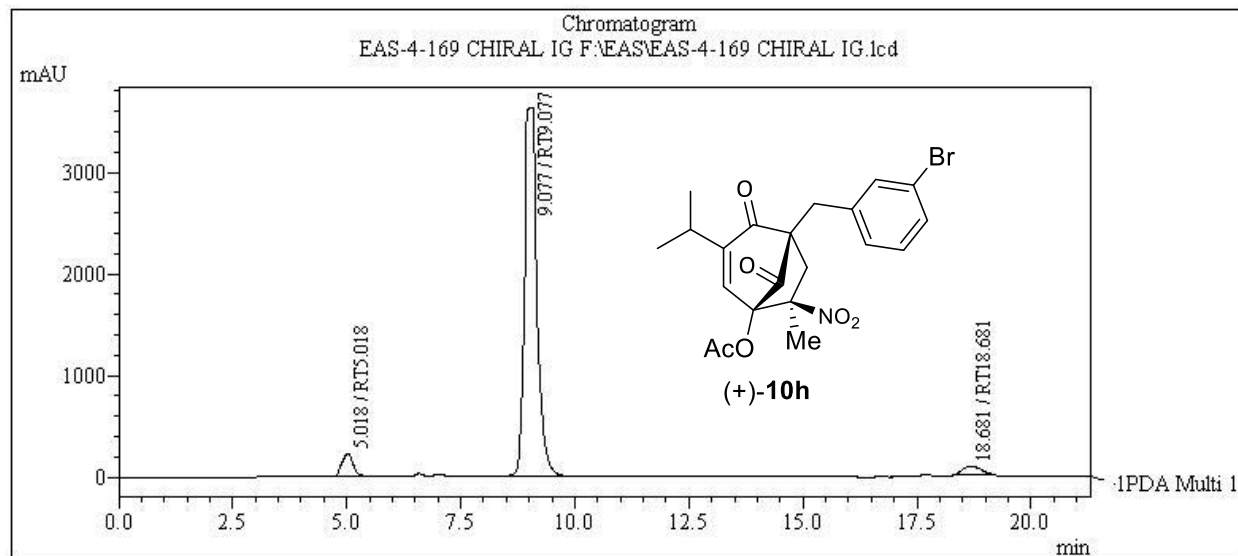
Racemic (±)-10h:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 0.7 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT4.823	4.823	3863040	232206	15.373	16.694
2	RT6.763	6.763	3387427	270390	13.481	19.439
3	RT7.952	7.952	8842433	562650	35.189	40.450
4	RT15.271	15.271	9035250	325737	35.957	23.418

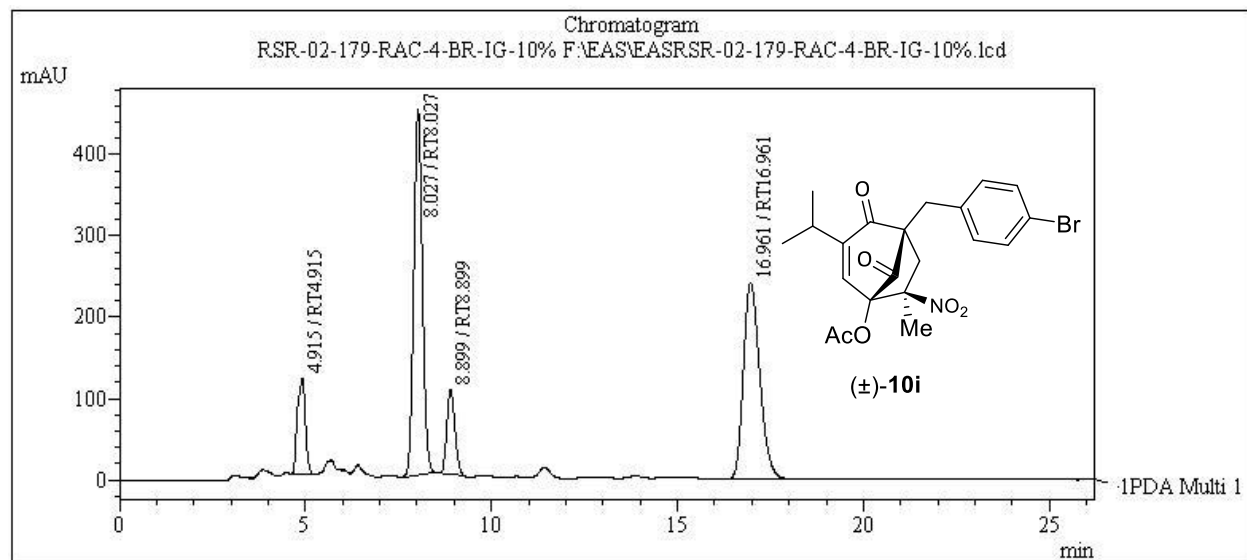
Chiral-(+)-10h (Major: 93% ee; Minor: 99% ee):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 0.7 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT5.018	5.018	3564866	220568	4.722	5.628
2	RT9.077	9.077	69460031	3611313	92.006	92.152
3	RT18.681	18.681	2469978	86987	3.272	2.220
Total			75494875	3918869	100.000	100.000

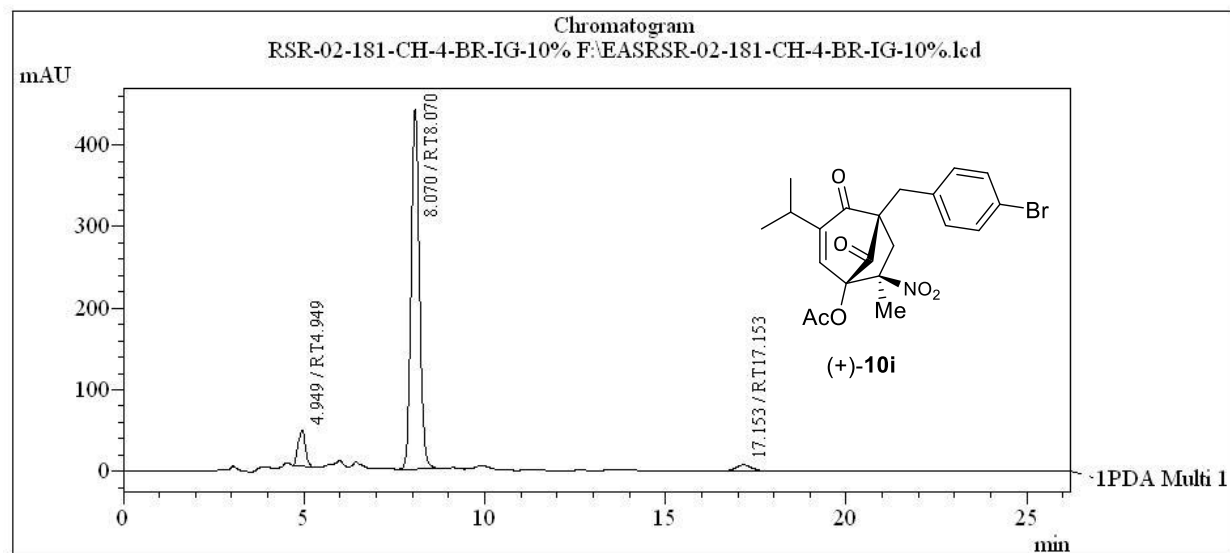
Racemic (±)-10i:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT4.915	4.915	1728664	117371	9.693	12.866
2	RT8.027	8.027	7171124	448183	40.209	49.130
3	RT8.899	8.899	1578625	104901	8.852	11.499
4	RT16.961	16.961	7356031	241785	41.246	26.505

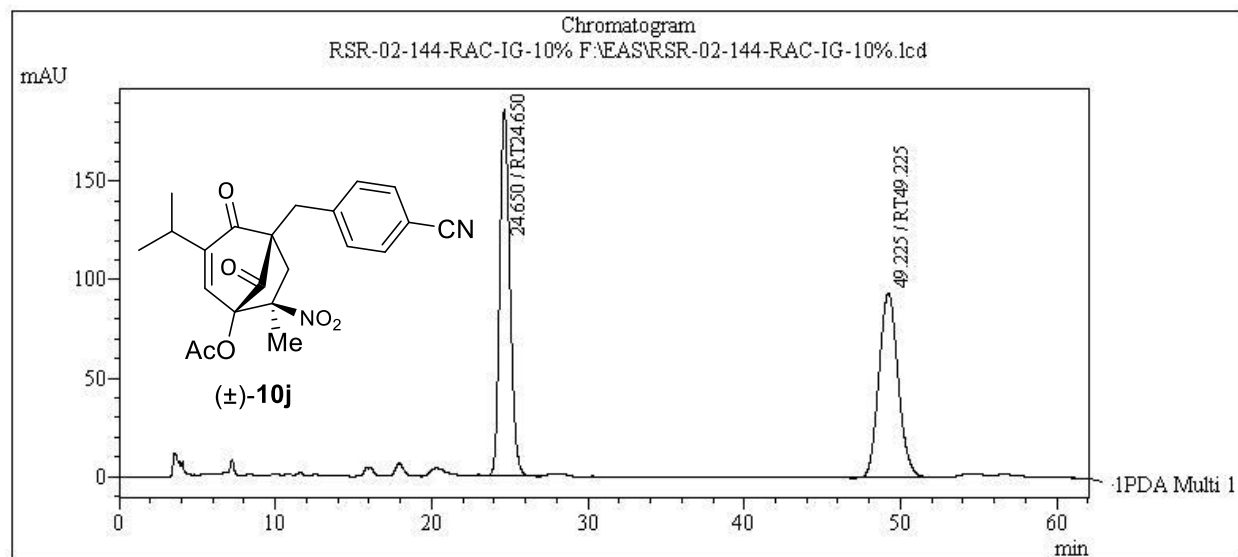
Chiral-(+)-10i (Major: 94% ee; Minor: 99% ee):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT4.949	4.949	621528	43568	7.877	8.857
2	RT8.070	8.070	7044990	440804	89.287	89.609
3	RT17.153	17.153	223743	7548	2.836	1.534
Total			7890260	491921	100.000	100.000

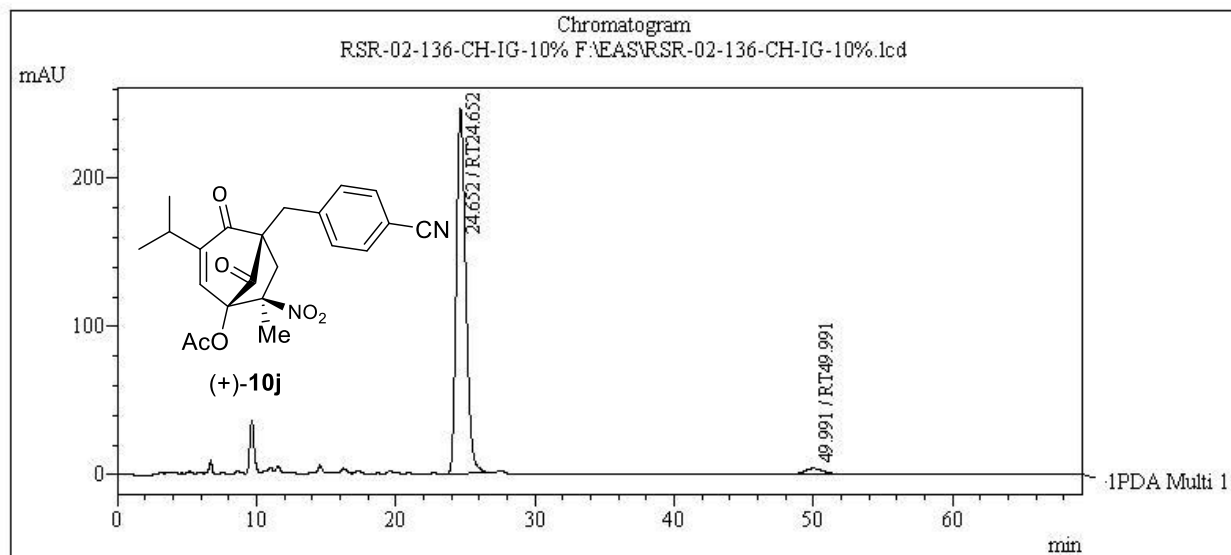
Racemic (±)-10j:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT24.650	24.650	8457256	185873	51.293	66.446
2	RT49.225	49.225	8030779	93864	48.707	33.554
Total			16488035	279737	100.000	100.000

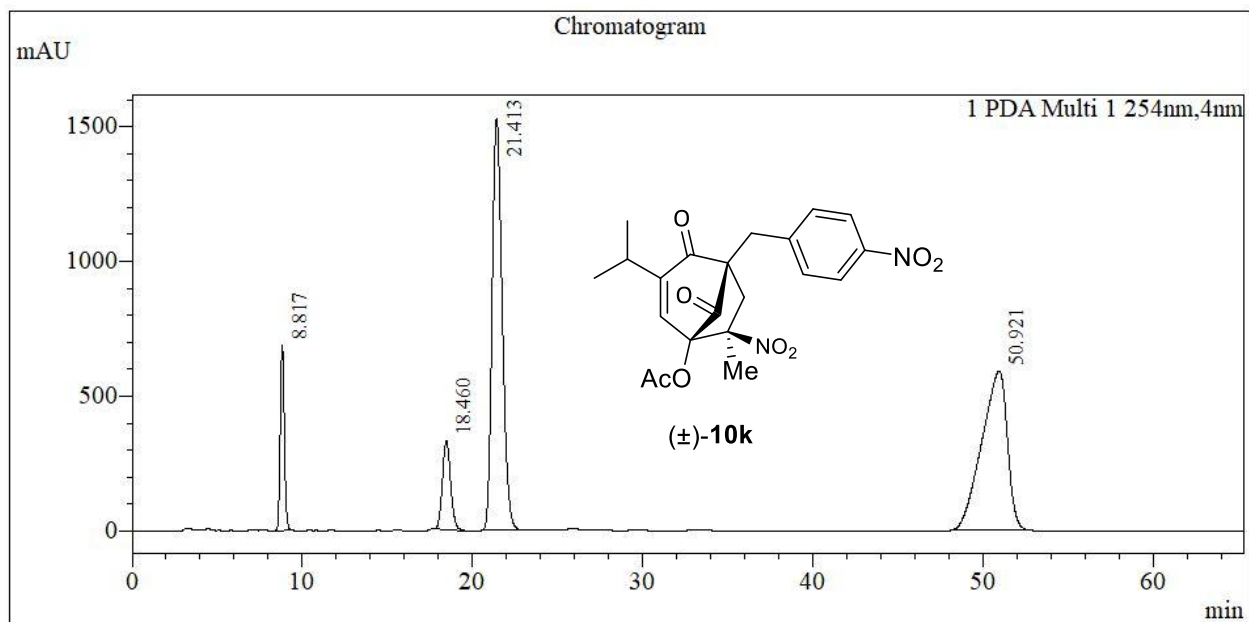
Chiral-(+)-10j (Major: 94% ee):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT24.652	24.652	11693863	246396	97.318	98.504
2	RT49.991	49.991	322233	3742	2.682	1.496
Total			12016096	250138	100.000	100.000

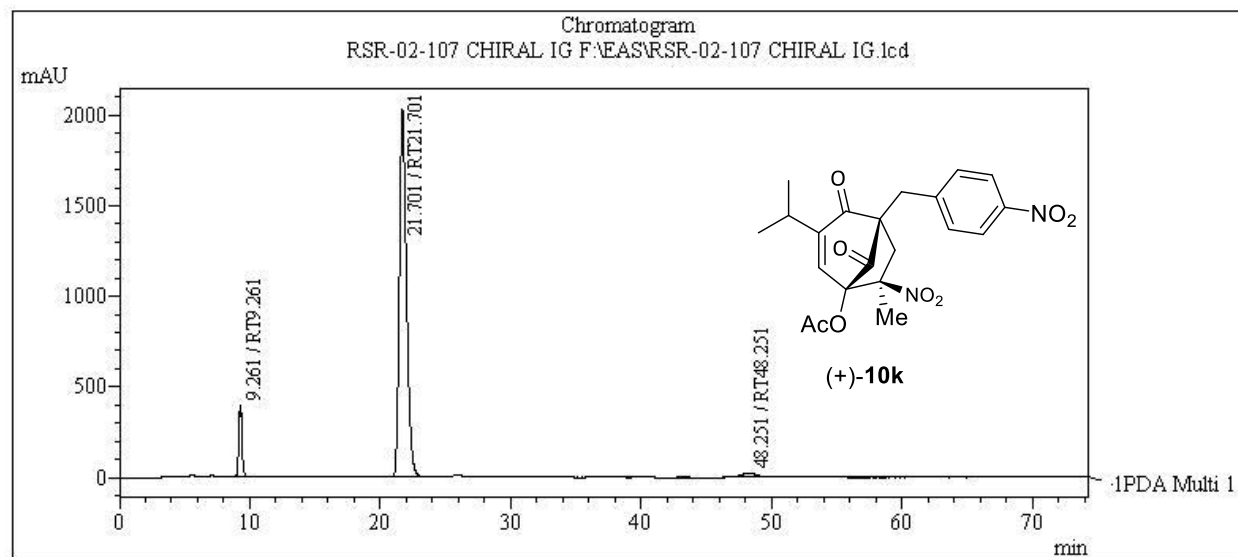
Racemic (±)-10k:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

Peak Table						
PDA Ch1 254nm						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:8.817	8.817	11413203	687309	7.769	21.950
2	RT:18.460	18.460	11139751	328165	7.583	10.480
3	RT:21.413	21.413	62812153	1526433	42.756	48.748
4	RT:50.921	50.921	61542826	589355	41.892	18.822

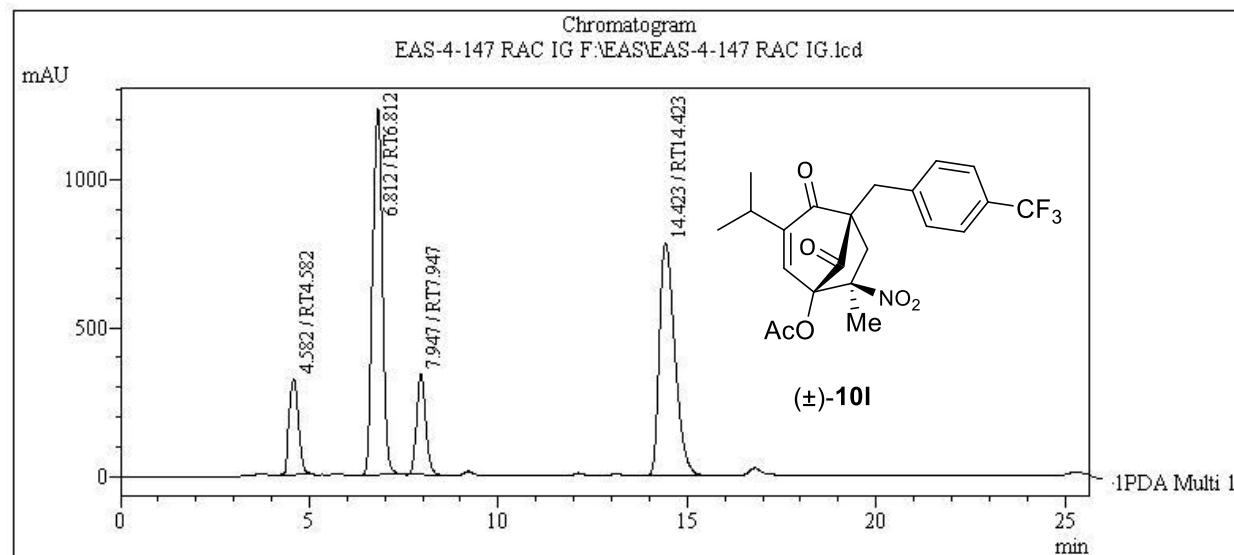
Chiral-(+)-10k (Major: 95% *ee*; Minor: >99% *ee*):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT9.261	9.261	6798152	396574	7.989	16.234
2	RT21.701	21.701	76390077	2021975	89.768	82.770
3	RT48.251	48.251	1908967	24333	2.243	0.996
Total			85097196	2442882	100.000	100.000

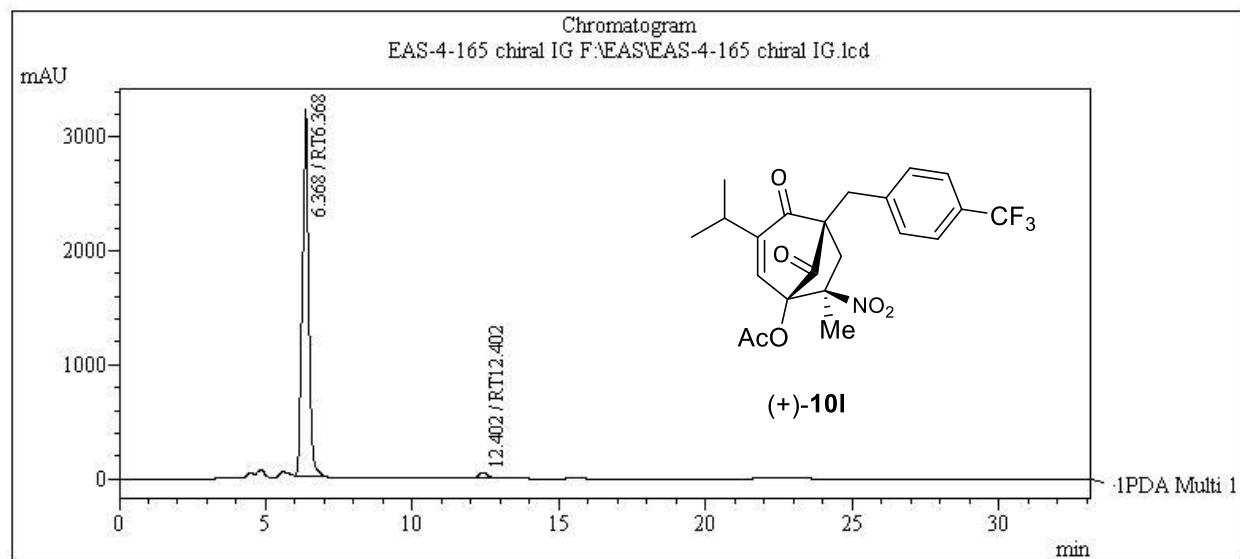
Racemic (±)-10I:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT4.582	4.582	5594773	322572	10.050	12.065
2	RT6.812	6.812	22168494	1229055	39.823	45.968
3	RT7.947	7.947	5673312	338772	10.191	12.670
4	RT14.423	14.423	22231437	783313	39.936	29.297

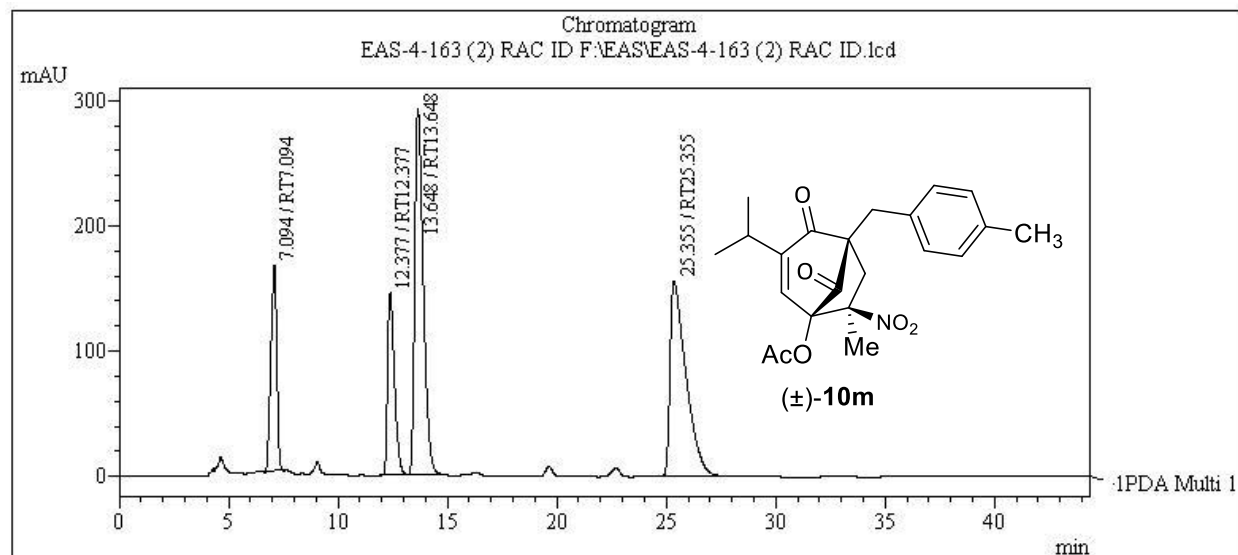
Chiral-(+)-10l (Major: 95% ee):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT6.368	6.368	47001103	3208372	97.770	98.451
2	RT12.402	12.402	1072104	50468	2.230	1.549
Total			48073206	3258840	100.000	100.000

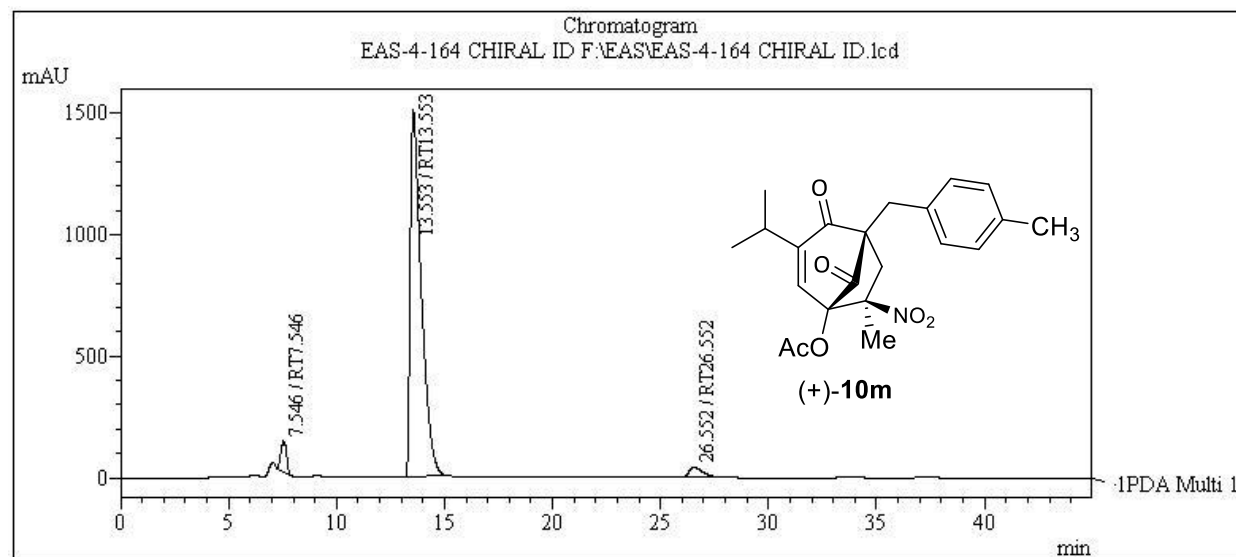
Racemic (±)-10m:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 95:5, Flow Rate 0.8 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT7.094	7.094	3107257	164012	14.143	21.714
2	RT12.377	12.377	3148592	144830	14.331	19.175
3	RT13.648	13.648	7885125	290723	35.891	38.490
4	RT25.355	25.355	7828788	155754	35.634	20.621

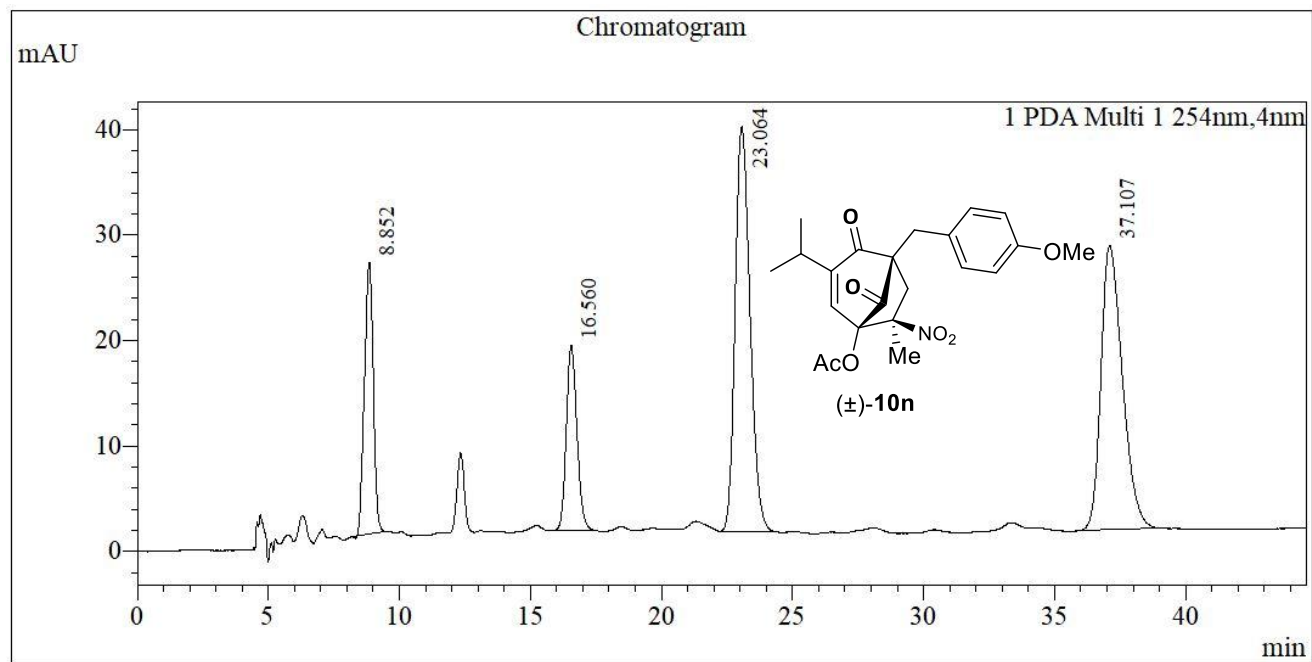
Chiral-(+)-10m (Major: 94% *ee*; Minor: >99% *ee*):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 95:5, Flow Rate 0.8 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT7.546	7.546	2375276	126806	4.080	7.565
2	RT13.553	13.553	54155179	1509184	93.015	90.037
3	RT26.552	26.552	1691259	40187	2.905	2.398
Total			58221715	1676177	100.000	100.000

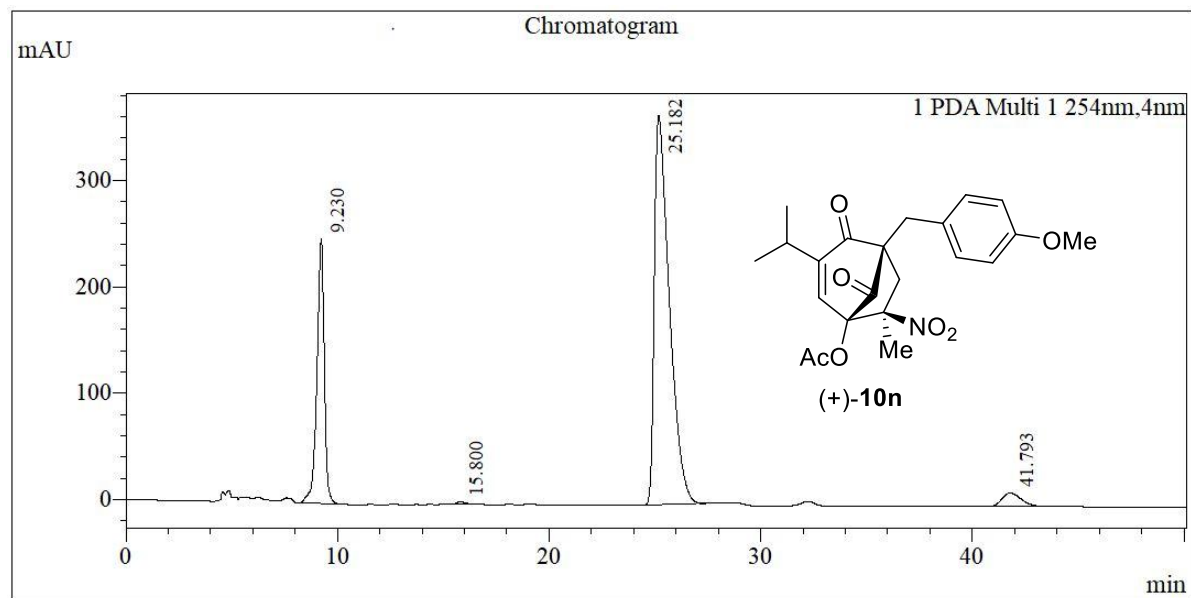
Racemic (±)-10n:



Daicel Chiralpak ID, Hexane/ *i*-PrOH = 95:5, Flow Rate 0.7 mL/min, 254 nm

Peak Table						
PDA Ch1 254nm						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:8.852	8.852	605456	25818	14.564	23.754
2	RT:16.560	16.560	497921	17541	11.977	16.139
3	RT:23.064	23.064	1518051	38404	36.516	35.335
4	RT:37.107	37.107	1535822	26924	36.943	24.772
Total			4157251	108687	100.000	100.000

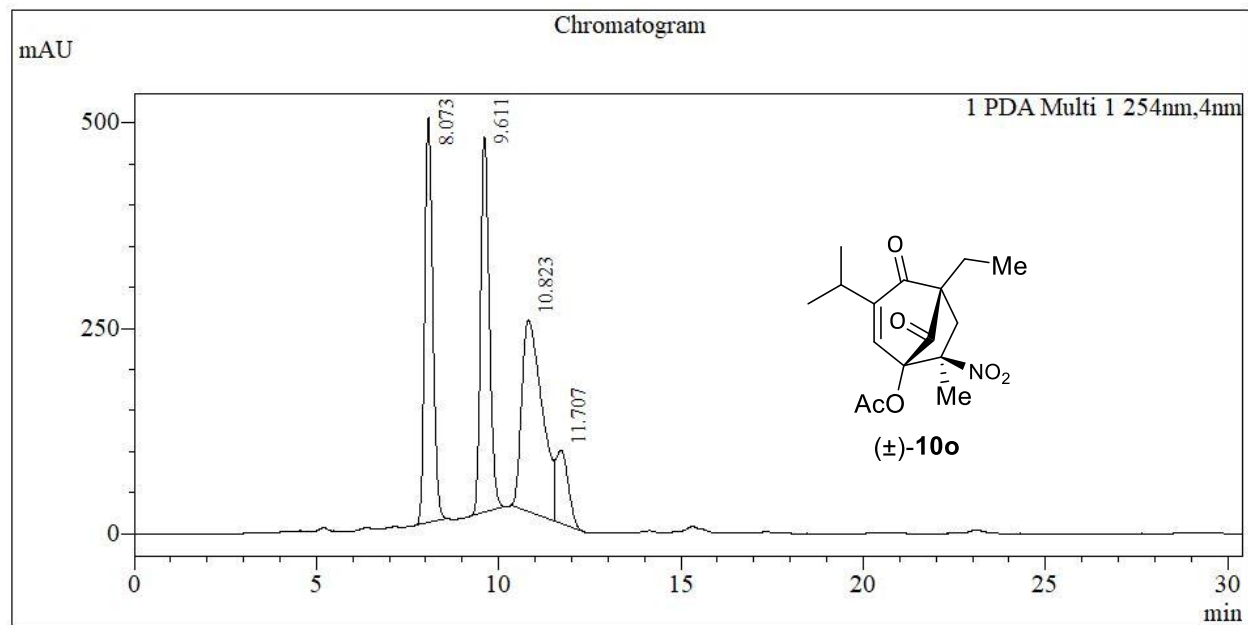
Chiral-(+)-10n (Major: 91% ee; Minor: >98% ee):



Chiralpak ID, Hexane/ *i*-PrOH = 95:05, Flow Rate 0.7 mL/min 254 nm

Peak Table						
PDA Ch1 254nm						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:9.230	9.230	6048357	249268	24.205	39.552
2	RT:15.800	15.800	61762	2241	0.247	0.356
3	RT:25.182	25.182	18060611	365858	72.276	58.052
4	RT:41.793	41.793	817646	12862	3.272	2.041
Total			24988376	630228	100.000	100.000

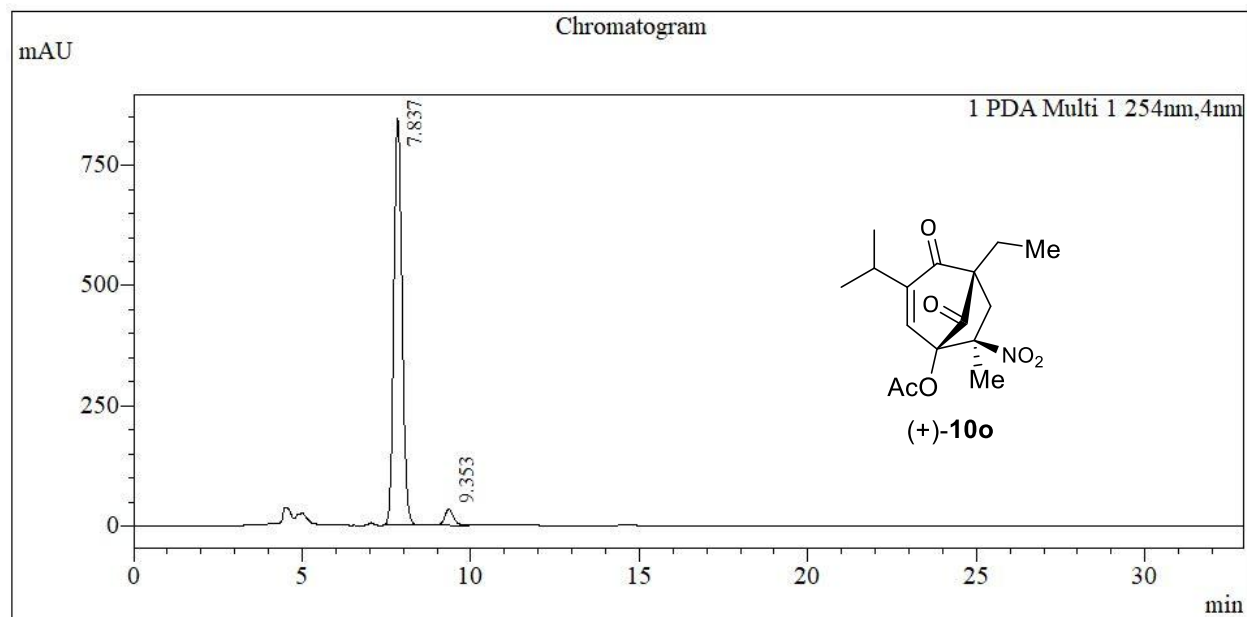
Racemic (±)-10o:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

Peak Table						
PDA Ch1 254nm						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:8.073	8.073	7574120	492881	28.632	38.781
2	RT:9.611	9.611	7591160	456693	28.697	35.933
3	RT:10.823	10.823	9126721	232530	34.502	18.296
4	RT:11.707	11.707	2160881	88839	8.169	6.990

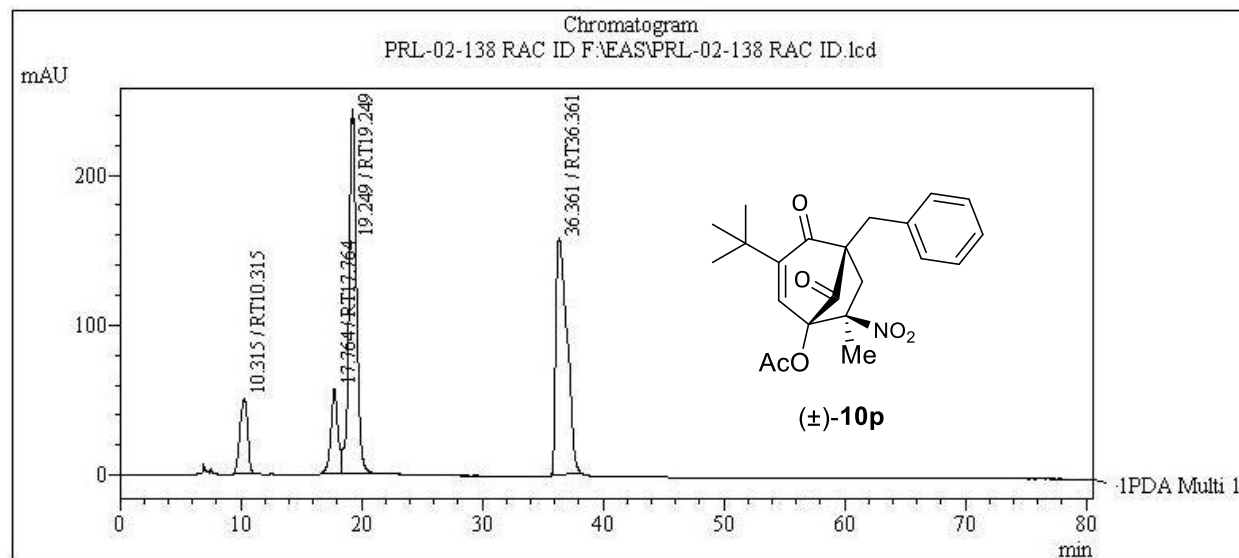
Chiral-(+)-10o (Major: 92% ee):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

Peak Table							
PDA Ch1 254nm							
Peak#	Name	Ret. Time	Area	Height	Area%	Height%	
1	RT:7.837	7.837	14380123	845269	95.888	96.208	
2	RT:9.353	9.353	616643	33313	4.112	3.792	
Total			14996767	878582	100.000	100.000	

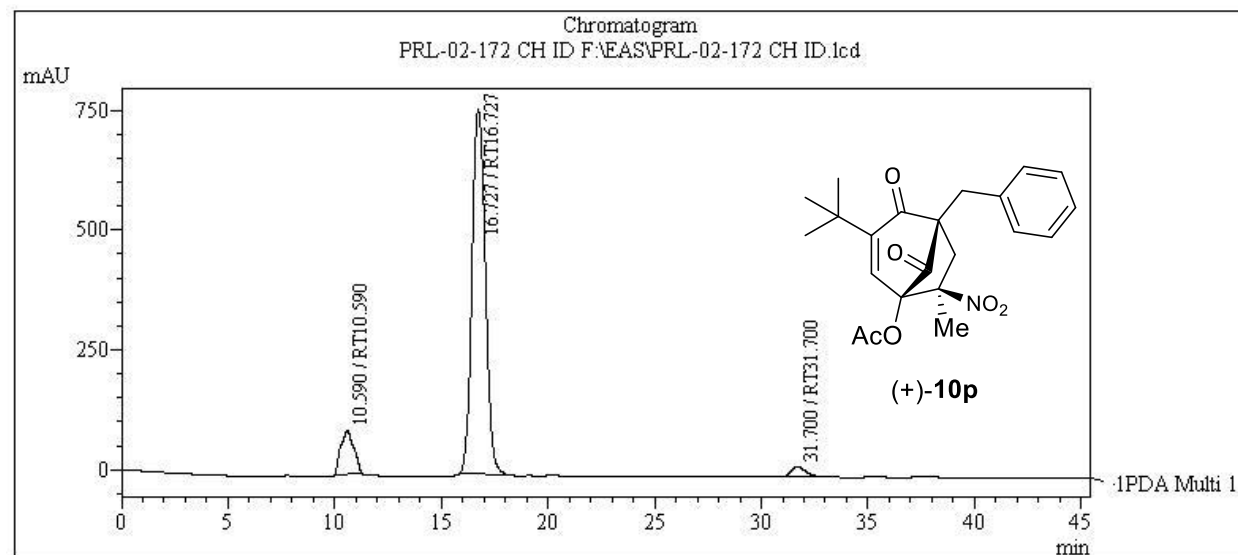
Racemic (±)-10p:



Daicel Chiralpak ID, Hexane/ *i*-PrOH = 95:5, Flow Rate 0.5 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT10.315	10.315	2196101	49571	8.764	9.773
2	RT17.764	17.764	2321624	56329	9.265	11.105
3	RT19.249	19.249	10293851	242726	41.081	47.852
4	RT36.361	36.361	10245978	158620	40.890	31.271

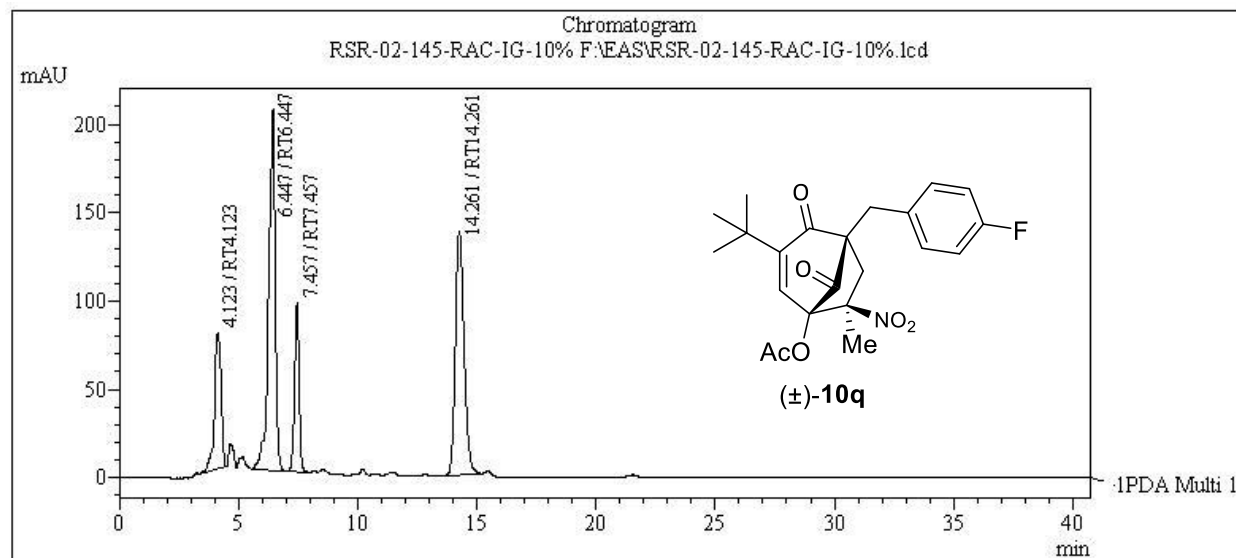
Chiral-(+)-10p (Major: 95% ee; Minor: >99% ee):



Daicel Chiralpak ID, Hexane/ *i*-PrOH = 95:5, Flow Rate 0.5 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT10.590	10.590	3907911	92236	10.280	10.573
2	RT16.727	16.727	33216666	760248	87.378	87.146
3	RT31.700	31.700	890218	19903	2.342	2.281
Total			38014794	872388	100.000	100.000

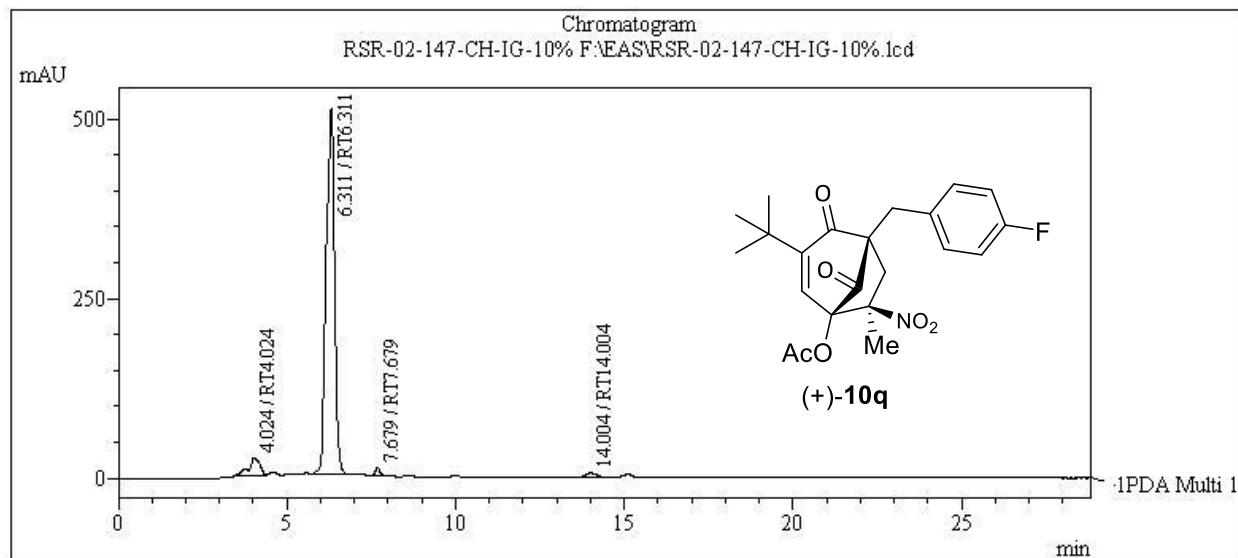
Racemic (±)-10q:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT4.123	4.123	1514417	76739	14.791	14.907
2	RT6.447	6.447	3941586	204208	38.496	39.668
3	RT7.457	7.457	1265836	95825	12.363	18.614
4	RT14.261	14.261	3517173	138018	34.351	26.811

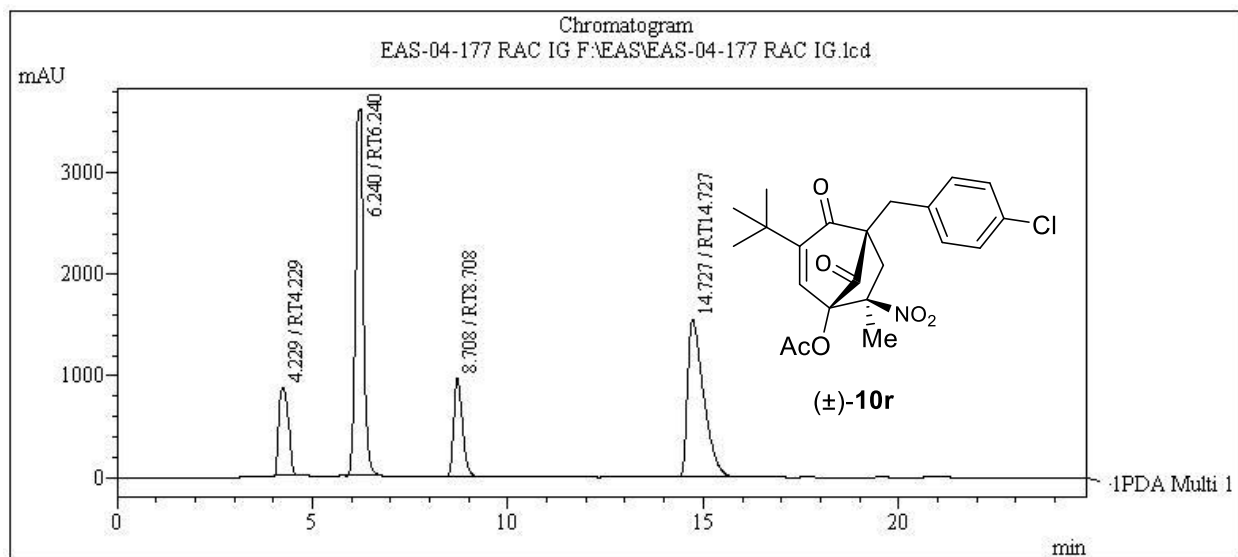
Chiral-(+)-10q (Major: 97% ee; Minor: 69% ee):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT4.024	4.024	550592	23922	5.759	4.363
2	RT6.311	6.311	8787840	508070	91.922	92.657
3	RT7.679	7.679	98959	10822	1.035	1.974
4	RT14.004	14.004	122673	5523	1.283	1.007

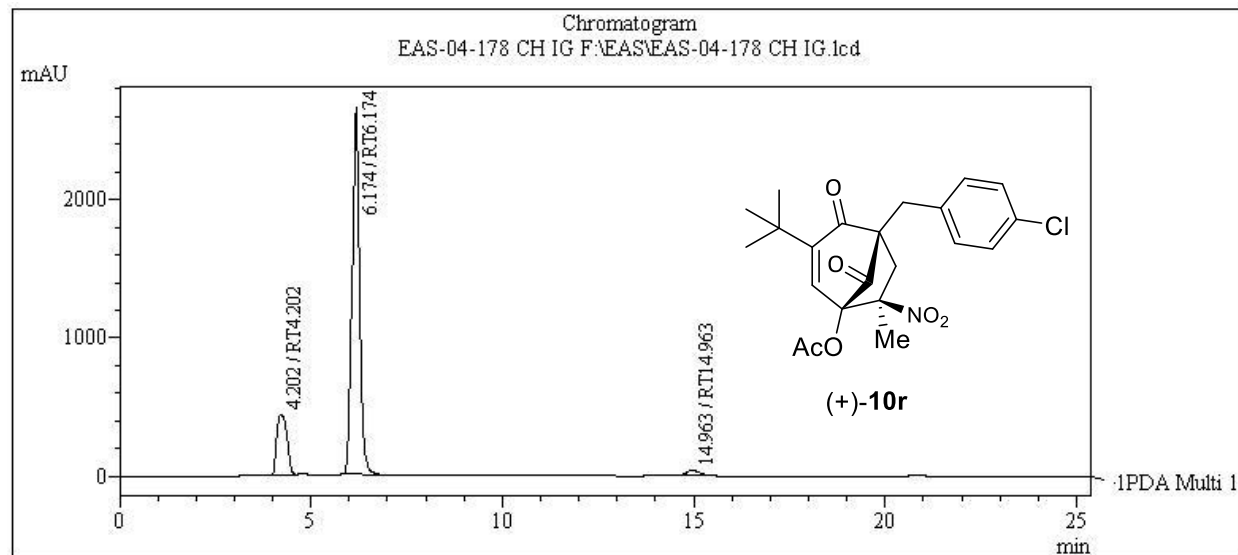
Racemic (±)-10r:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT4.229	4.229	14710687	866225	11.918	12.423
2	RT6.240	6.240	50145254	3597626	40.626	51.596
3	RT8.708	8.708	14783517	963286	11.977	13.815
4	RT14.727	14.727	43792136	1545523	35.479	22.165

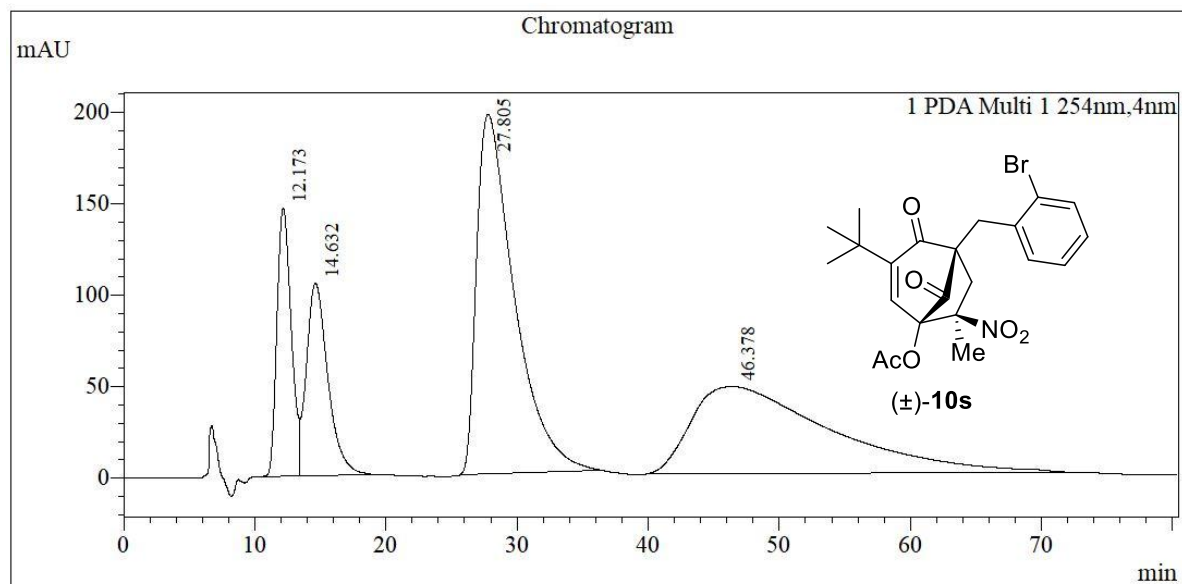
Chiral-(+)-10r (Major: 94% ee; Minor: >99% ee):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT4.202	4.202	8060049	434733	17.973	13.916
2	RT6.174	6.174	35792389	2648936	79.813	84.796
3	RT14.963	14.963	992598	40213	2.213	1.287
Total			44844937	3123882	100.000	100.000

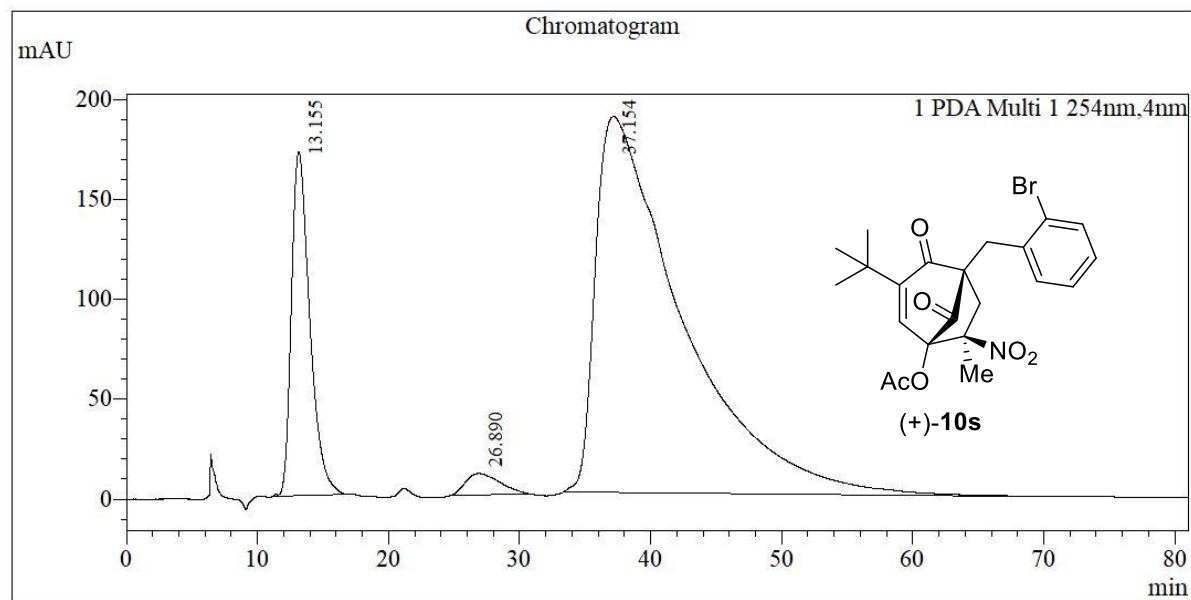
Racemic (±)-**10s**



Chiralpak OJ-H, Hexane/ *i*-PrOH = 97:03, Flow Rate 0.5 mL/min 254 nm

Peak Table						
PDA Ch1 254nm						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:12.173	12.173	11150649	146537	11.385	29.530
2	RT:14.632	14.632	12047632	105538	12.301	21.268
3	RT:27.805	27.805	39206837	196511	40.030	39.601
4	RT:46.378	46.378	35537492	47638	36.284	9.600
Total			97942610	496224	100.000	100.000

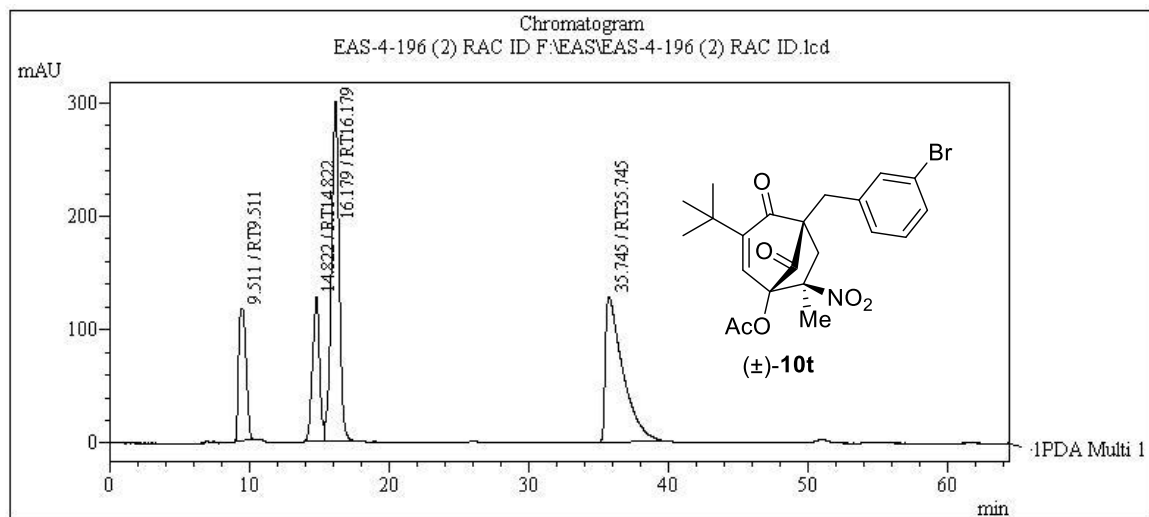
Chiral-(+)-10s (Major: 96% ee; Minor: 99% ee):



Chiralpak OJ-H, Hexane/ *i*-PrOH = 97:03, Flow Rate 0.5 mL/min 254 nm

Peak Table						
PDA Ch1 254nm						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:13.155	13.155	16754285	171982	15.924	46.409
2	RT:26.890	26.890	1909842	10568	1.815	2.852
3	RT:37.154	37.154	86547708	188030	82.260	50.739
Total			105211835	370580	100.000	100.000

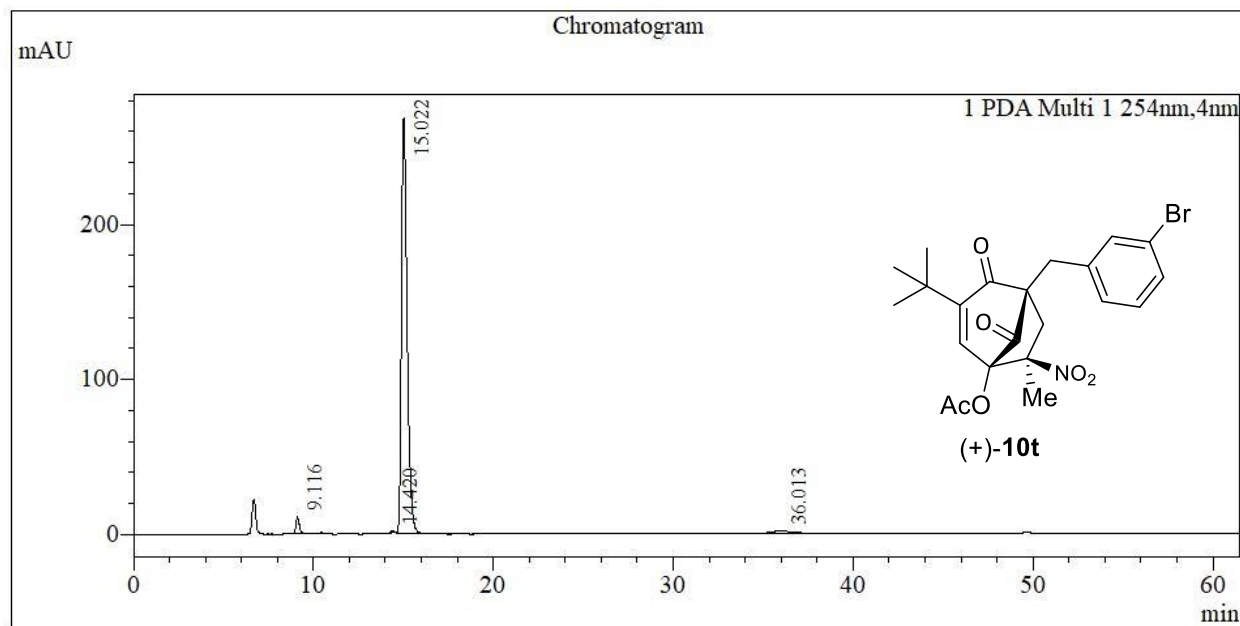
Racemic (±)-10t:



Chiralpak ID, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT9.511	9.511	4337405	116988	13.808	17.414
2	RT14.822	14.822	4440594	127900	14.136	19.038
3	RT16.179	16.179	11561687	298830	36.806	44.481
4	RT35.745	35.745	11073034	128095	35.250	19.067

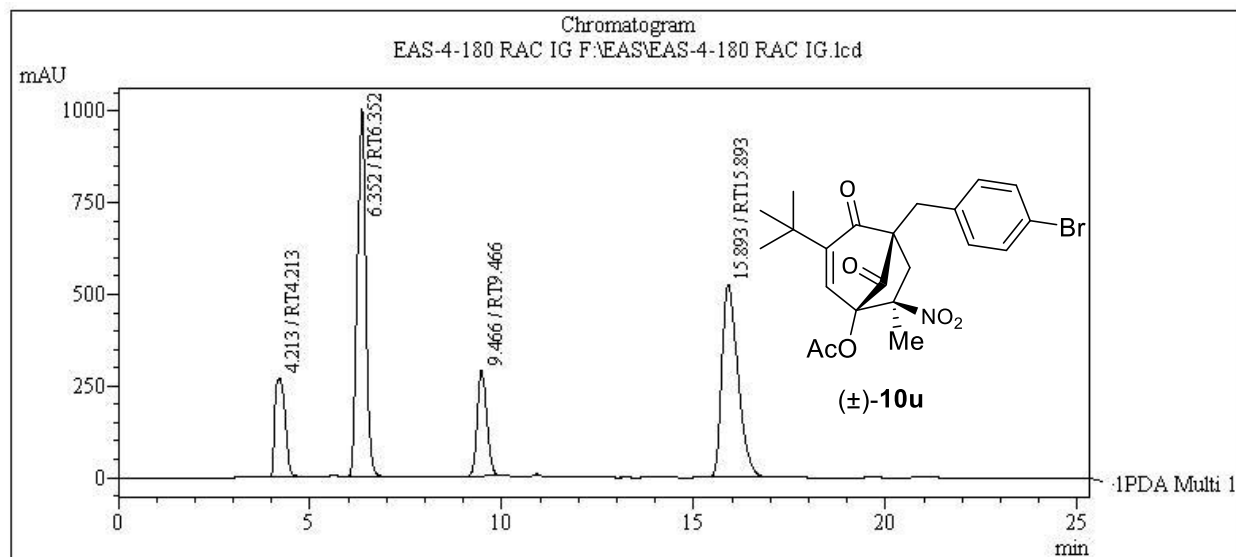
Chiral-(+)-10t (Major: 95% ee; Minor: 84% ee):



Daicel Chiralpak ID, Hexane/ *i*-PrOH = 95:5, Flow Rate 0.5 mL/min, 254 nm

Peak Table						
PDA Ch1 254nm						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:9.116	9.116	133881	10639	2.188	3.779
2	RT:14.420	14.420	11514	1006	0.188	0.357
3	RT:15.022	15.022	5841930	268300	95.463	95.311
4	RT:36.013	36.013	132268	1556	2.161	0.553

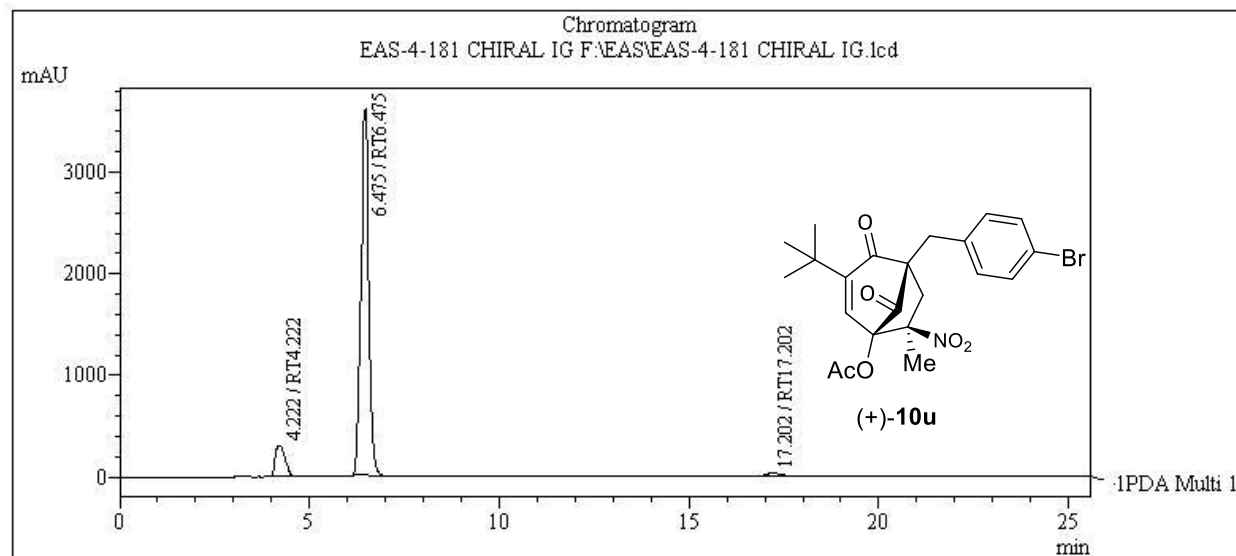
Racemic (±)-10u:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT4.213	4.213	4967386	268682	12.243	12.918
2	RT6.352	6.352	15461243	1000615	38.107	48.108
3	RT9.466	9.466	4990784	287821	12.301	13.838
4	RT15.893	15.893	15153864	522814	37.349	25.136

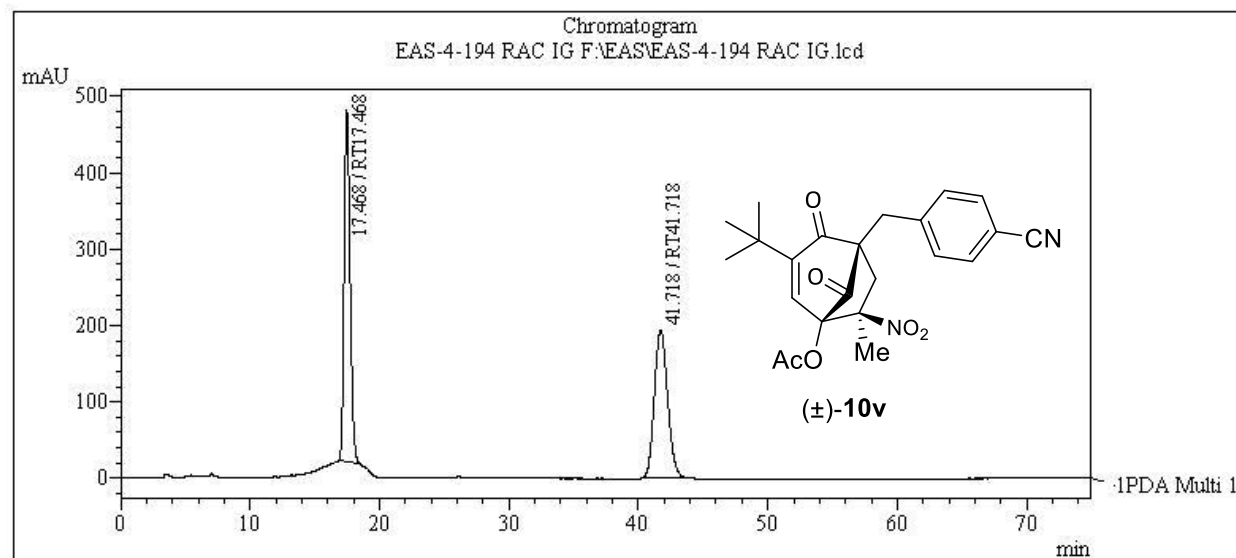
Chiral-(+)-10u (Major: 96% ee; Minor: >99% ee):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT4.222	4.222	5230227	298974	9.139	7.601
2	RT6.475	6.475	50978712	3599878	89.079	91.525
3	RT17.202	17.202	1019634	34365	1.782	0.874
Total			57228573	3933218	100.000	100.000

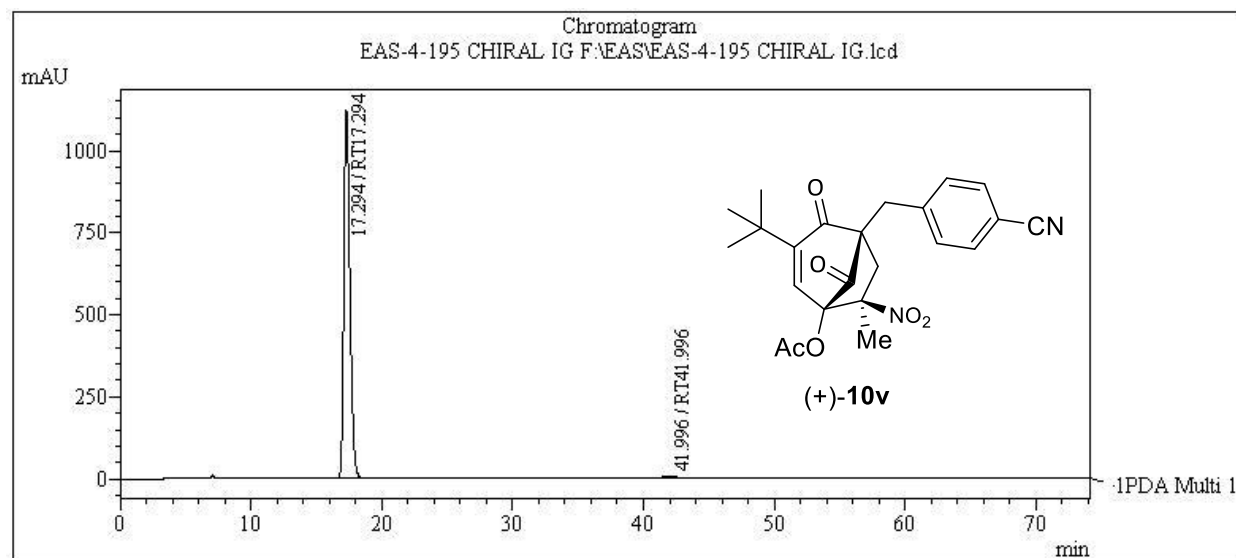
Racemic (±)-10v:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT17.468	17.468	14752755	460181	51.636	70.284
2	RT41.718	41.718	13817782	194561	48.364	29.716
Total			28570538	654742	100.000	100.000

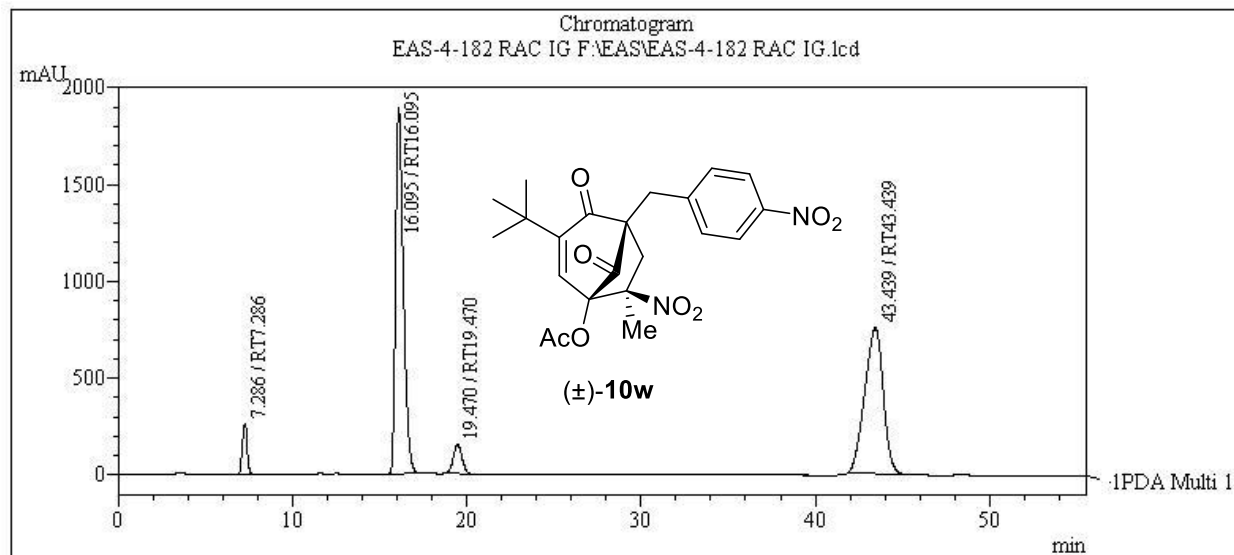
Chiral-(+)-10v (Major: 97% ee):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT17.294	17.294	35929211	1118272	98.599	99.289
2	RT41.996	41.996	510435	8006	1.401	0.711
Total			36439646	1126278	100.000	100.000

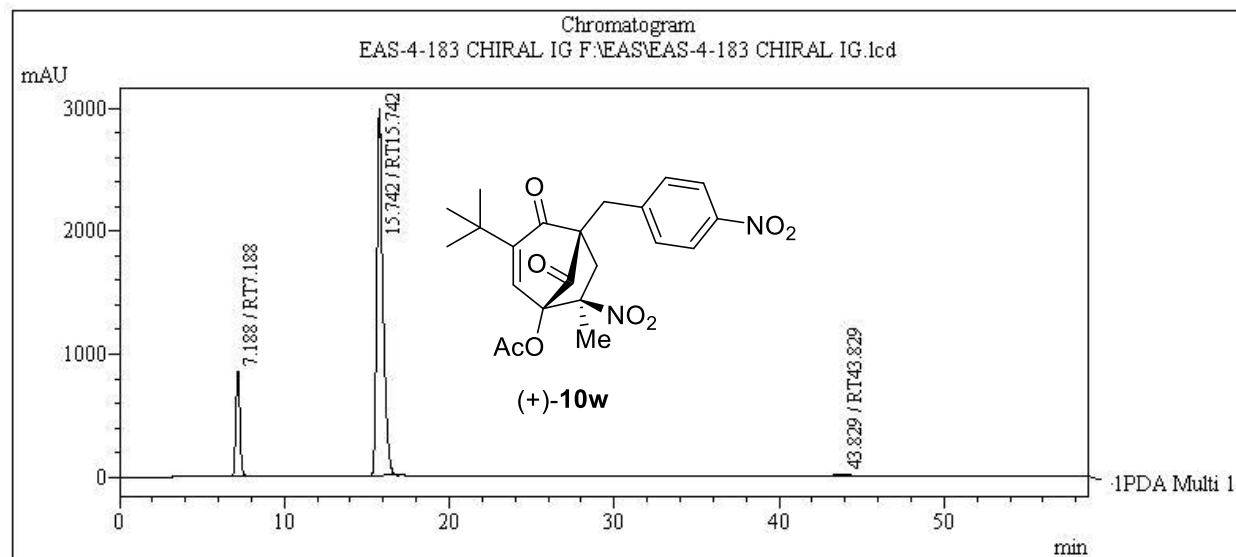
Racemic (±)-10w:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT7.286	7.286	4999730	263883	4.010	8.643
2	RT16.095	16.095	58599230	1886188	46.993	61.778
3	RT19.470	19.470	5279271	150347	4.234	4.924
4	RT43.439	43.439	55818469	752731	44.763	24.654

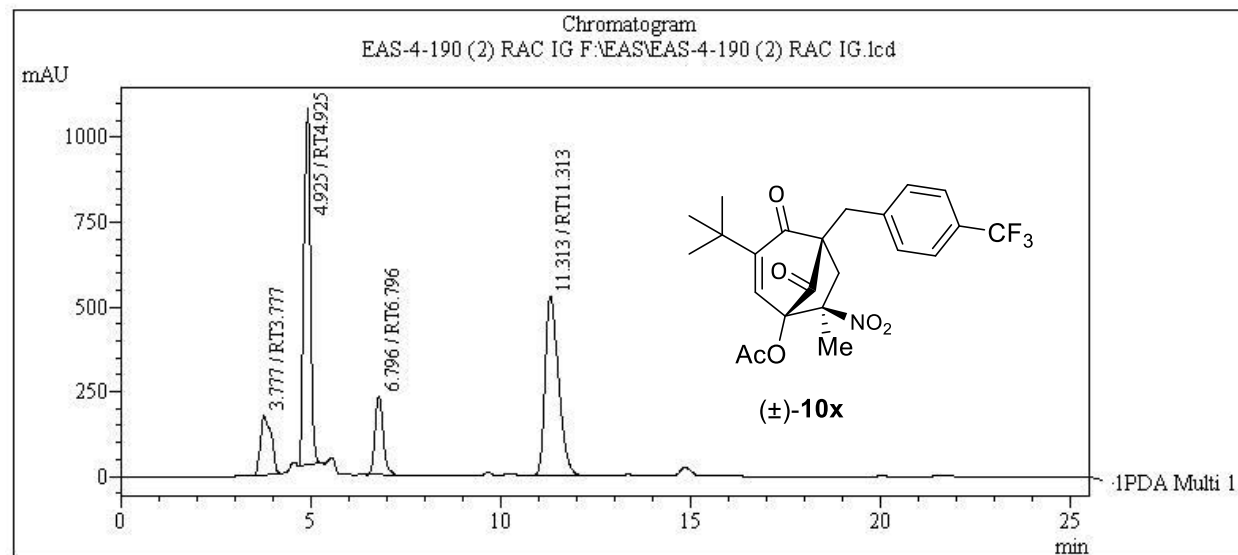
Chiral-(+)-10w (Major: 98% ee; Minor: 99% ee):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT7.188	7.188	14664306	846239	15.928	22.019
2	RT15.742	15.742	76629399	2983539	83.231	77.631
3	RT43.829	43.829	774693	13453	0.841	0.350
Total			92068397	3843232	100.000	100.000

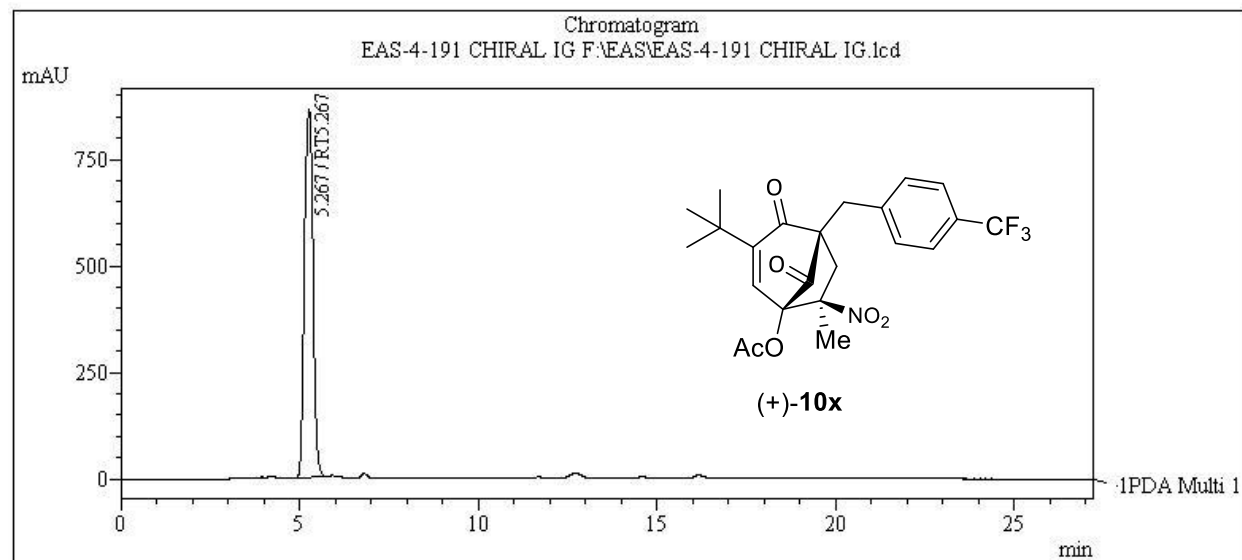
Racemic (±)-10x:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT3.777	3.777	3374001	174643	10.331	8.802
2	RT4.925	4.925	12917690	1050372	39.553	52.936
3	RT6.796	6.796	3345749	231166	10.244	11.650
4	RT11.313	11.313	13021705	528057	39.872	26.613

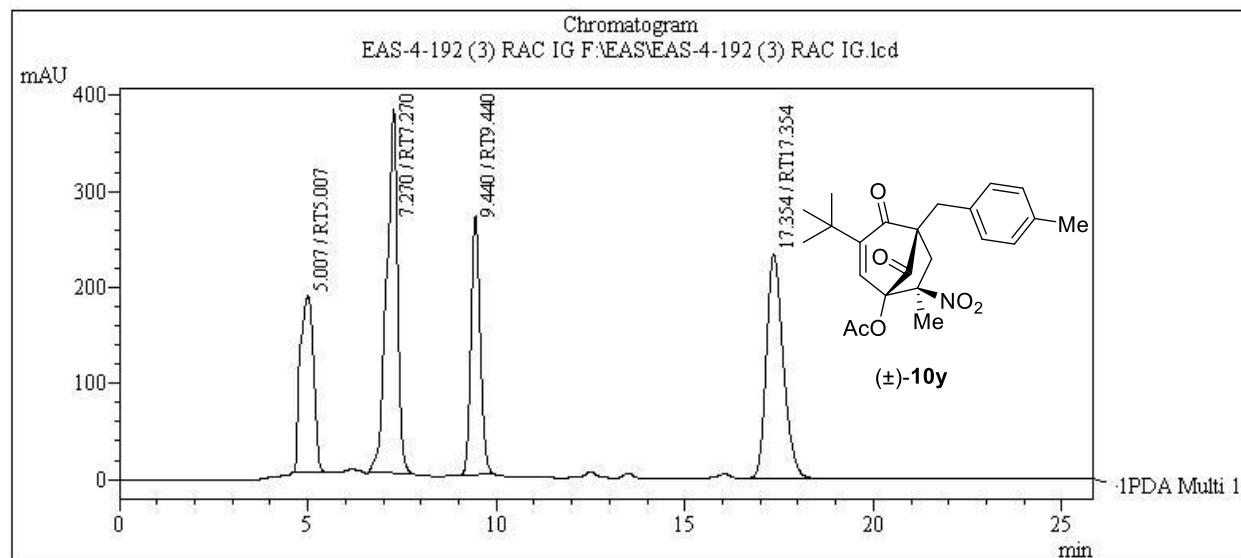
Chiral-(+)-10x (Major: >99% *ee*):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT5.267	5.267	14410267	860982	100.000	100.000
Total			14410267	860982	100.000	100.000

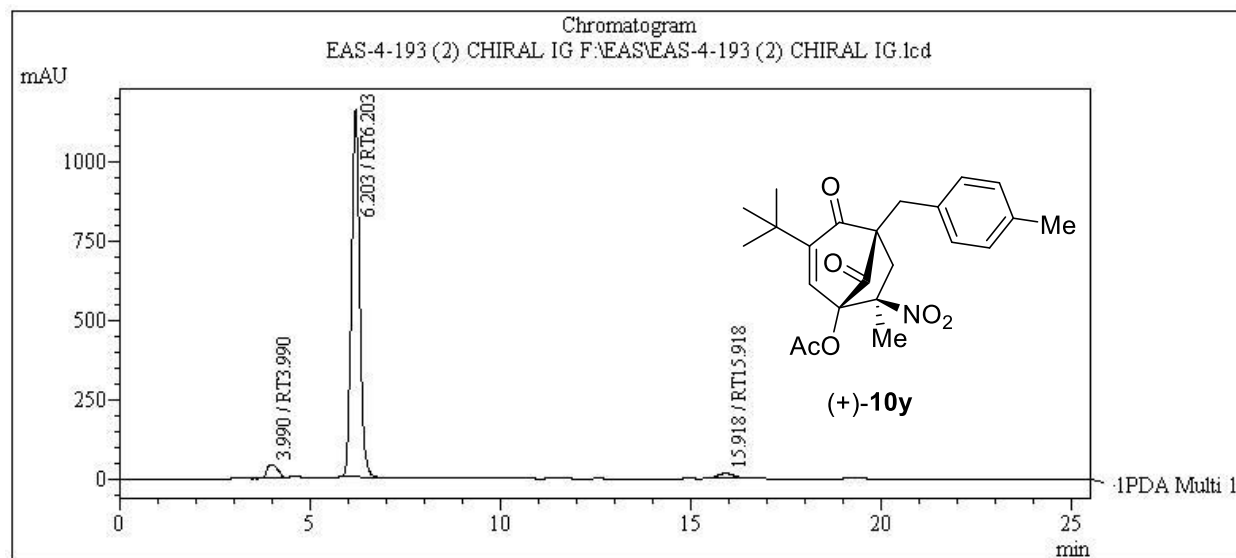
Racemic (±)-10y:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT5.007	5.007	4553699	183425	18.927	17.255
2	RT7.270	7.270	7631635	378292	31.719	35.586
3	RT9.440	9.440	4617839	268461	19.193	25.254
4	RT17.354	17.354	7256736	232848	30.161	21.904

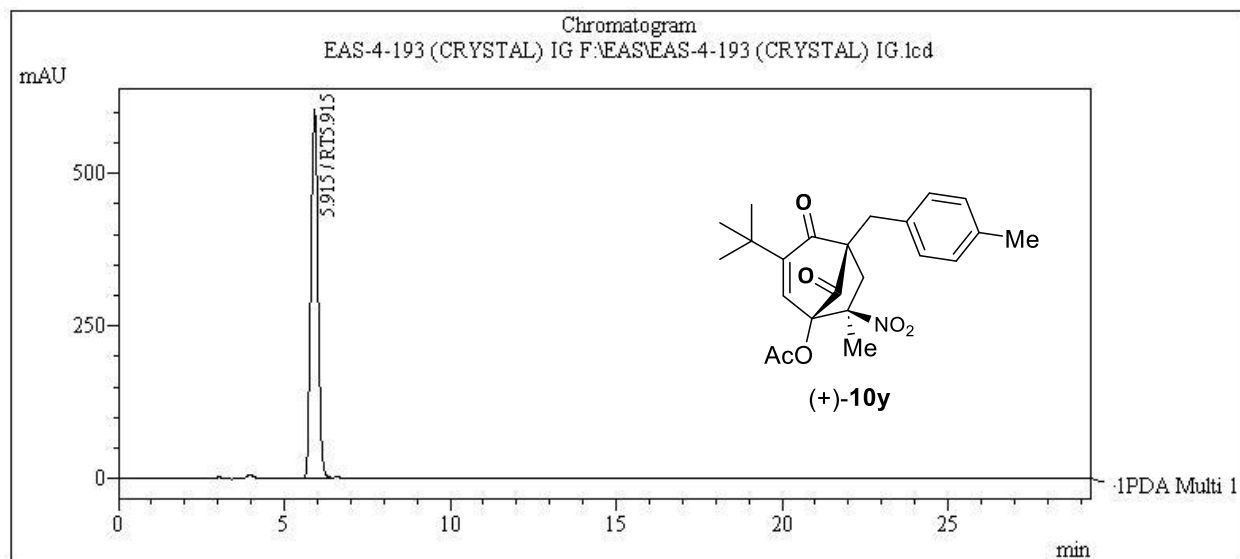
Chiral-(+)-10y (Major: 95% ee; Minor: 99% ee):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT3.990	3.990	824989	42218	4.430	3.474
2	RT6.203	6.203	17407887	1158284	93.471	95.319
3	RT15.918	15.918	391004	14670	2.099	1.207
Total			18623880	1215172	100.000	100.000

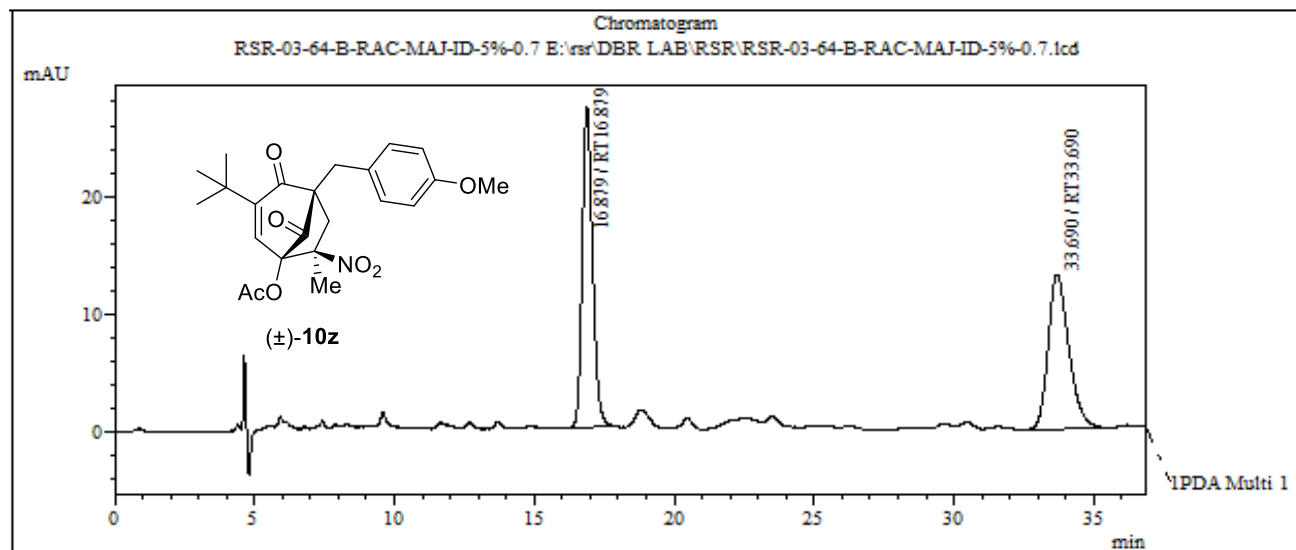
Chiral-(+)-10y (Major: 99% ee) for Crystal:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT5.915	5.915	8998474	602059	100.000	100.000
Total			8998474	602059	100.000	100.000

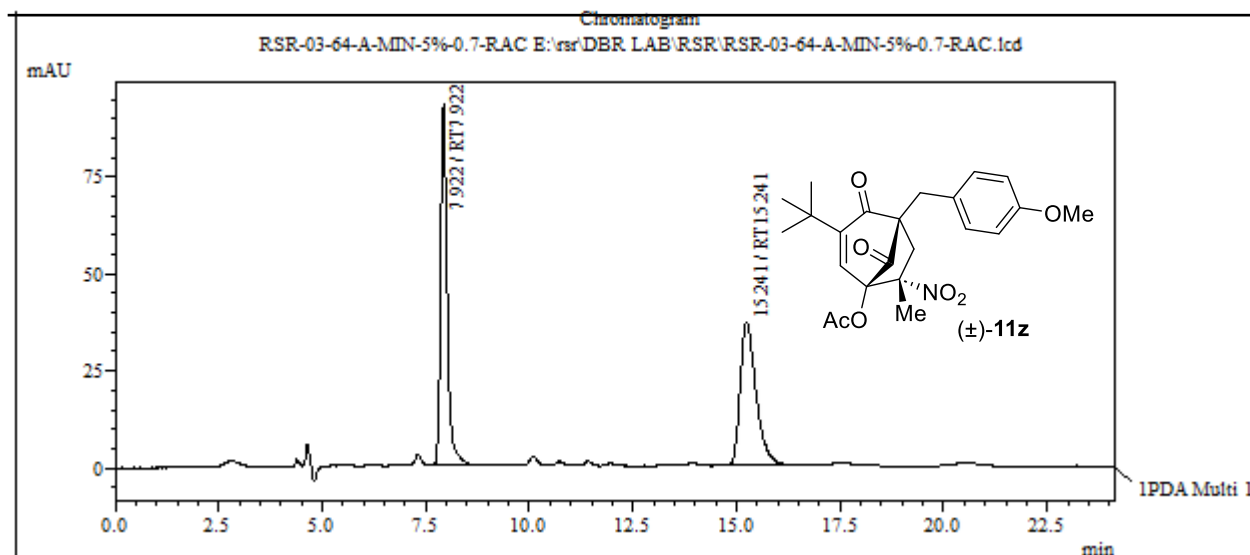
Racemic (±)-10z [major isomer]:



Chiralpak IG, Hexane/ *i*-PrOH = 95:5, Flow Rate 0.7 mL/min, 254nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT16.879	16.879	697382	27160	51.146	67.550
2	RT33.690	33.690	666138	13047	48.854	32.450
Total			1363520	40207	100.000	100.000

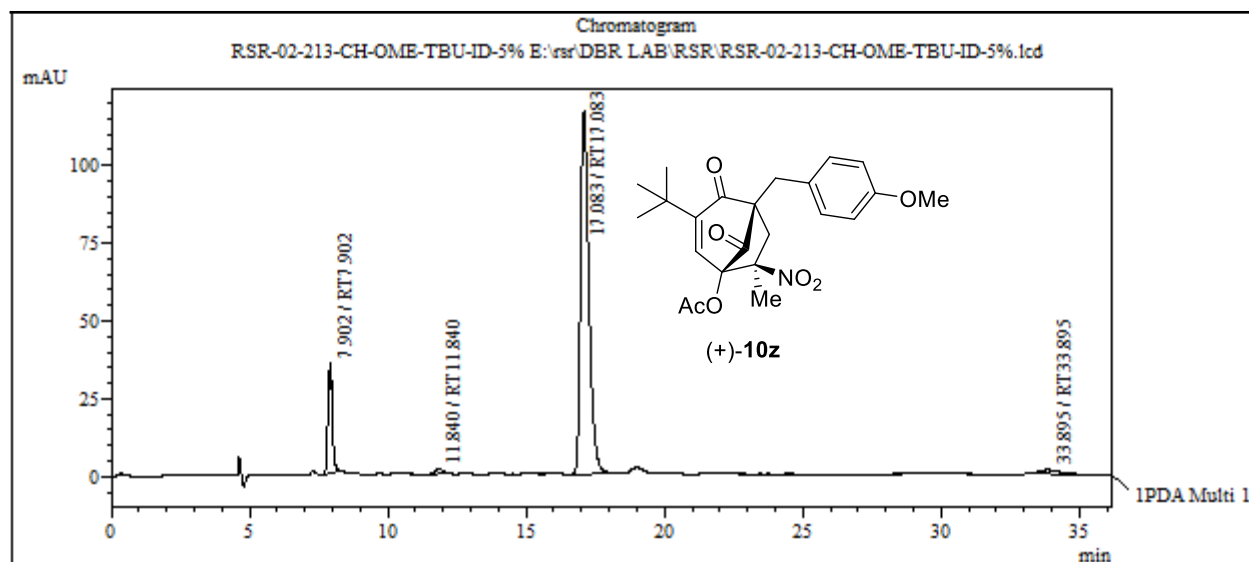
Racemic ($\pm$)-11z [minor isomer]:



Chiralpak IG, Hexane/ *i*-PrOH = 95:5, Flow Rate 0.7 mL/min, 254nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT7.922	7.922	1011210	93036	50.556	71.514
2	RT15.241	15.241	988983	37060	49.444	28.486
Total			2000192	130095	100.000	100.000

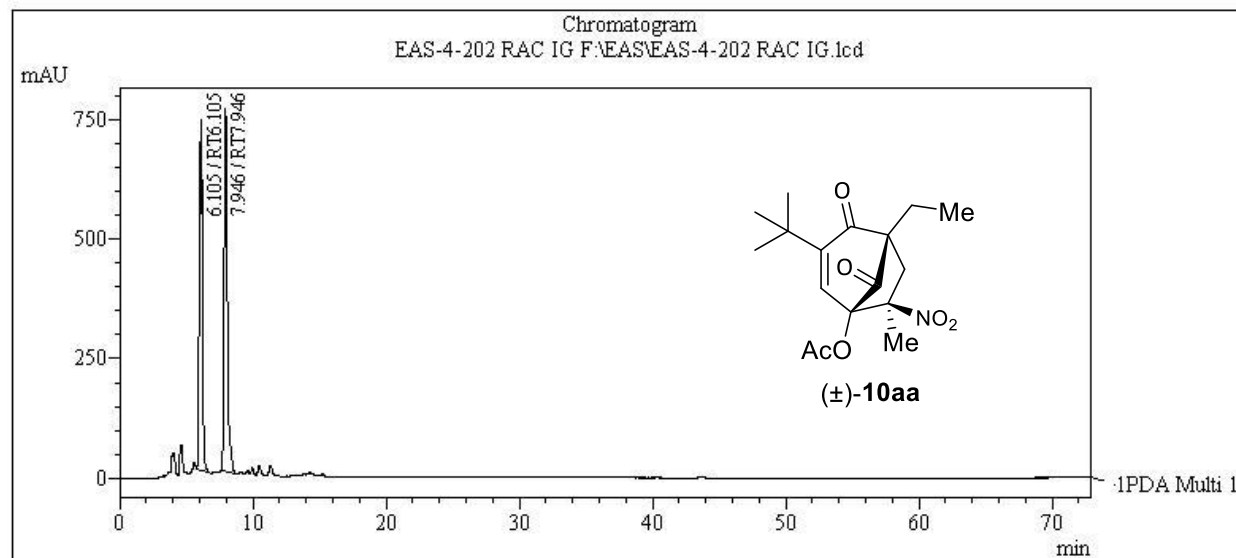
Chiral-(+)-10z (Major: 95% ee; Minor: 84% ee):



Chiralpak IG, Hexane/ *i*-PrOH = 95:5, Flow Rate 0.7 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT7.902	7.902	369517	35013	12.626	22.619
2	RT11.840	11.840	31822	1726	1.087	1.115
3	RT17.083	17.083	2462867	116733	84.151	75.412
4	RT33.895	33.895	62521	1322	2.136	0.854
Total			2926727	154793	100.000	100.000

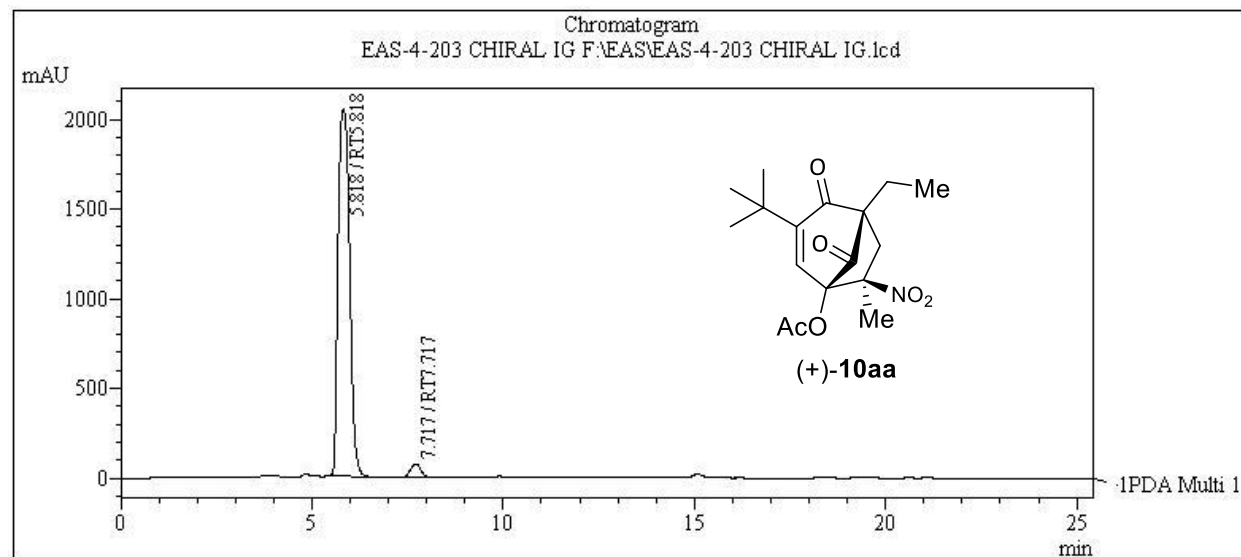
Racemic (±)-10aa:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT6.105	6.105	11388600	735087	47.212	49.167
2	RT7.946	7.946	12733808	760003	52.788	50.833
Total			24122408	1495090	100.000	100.000

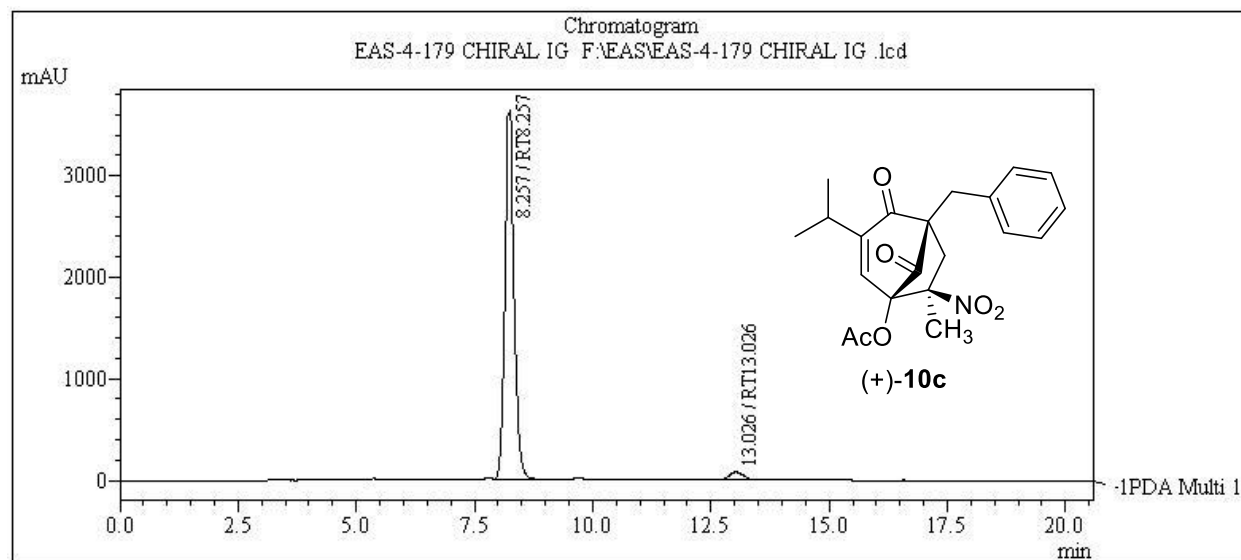
Chiral-(+)-10aa (Major: 94% ee):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT5.818	5.818	42364681	2042047	97.137	96.680
2	RT7.717	7.717	1248436	70128	2.863	3.320
Total			43613117	2112175	100.000	100.000

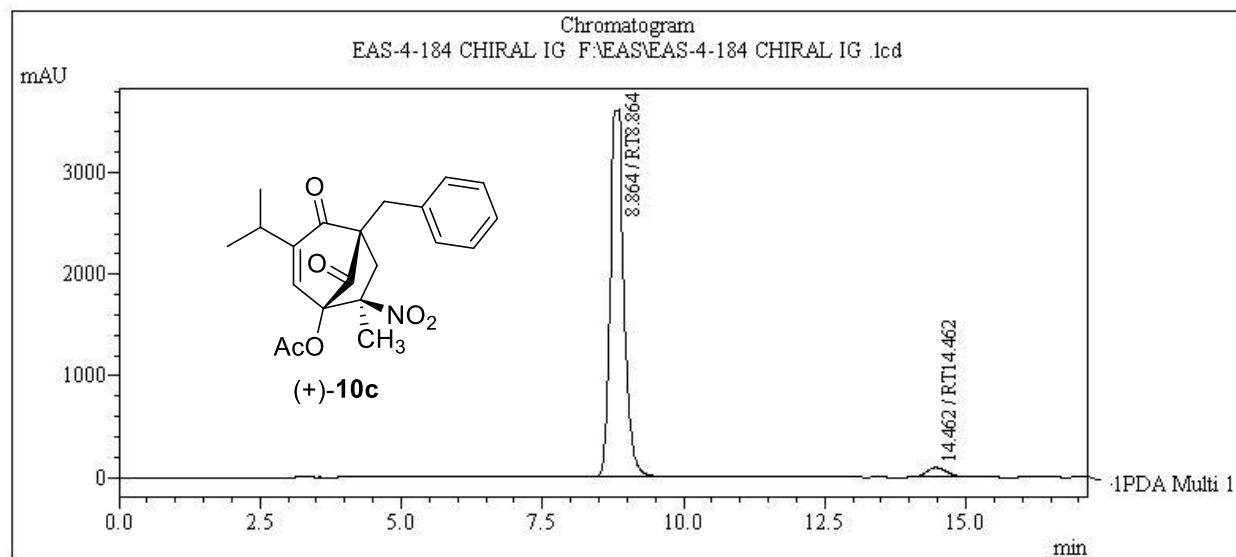
Chiral-(+)-10c (Major: 94% *ee* under the 0.5 mol% of catalyst 3g):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT8.257	8.257	48850696	3623402	97.186	97.993
2	RT13.026	13.026	1414358	74219	2.814	2.007
Total			50265054	3697621	100.000	100.000

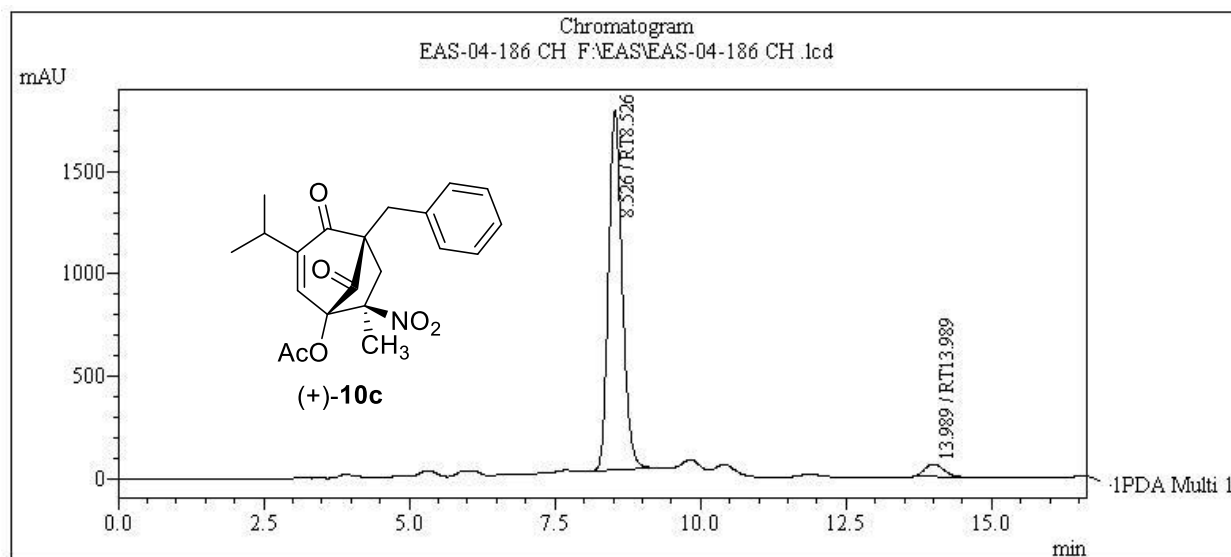
Chiral-(+)-10c (Major: 93% *ee* under the 0.1 mol% of catalyst 3g):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT8.864	8.864	60712462	3607040	96.721	97.605
2	RT14.462	14.462	2058546	88509	3.279	2.395
Total			62771008	3695549	100.000	100.000

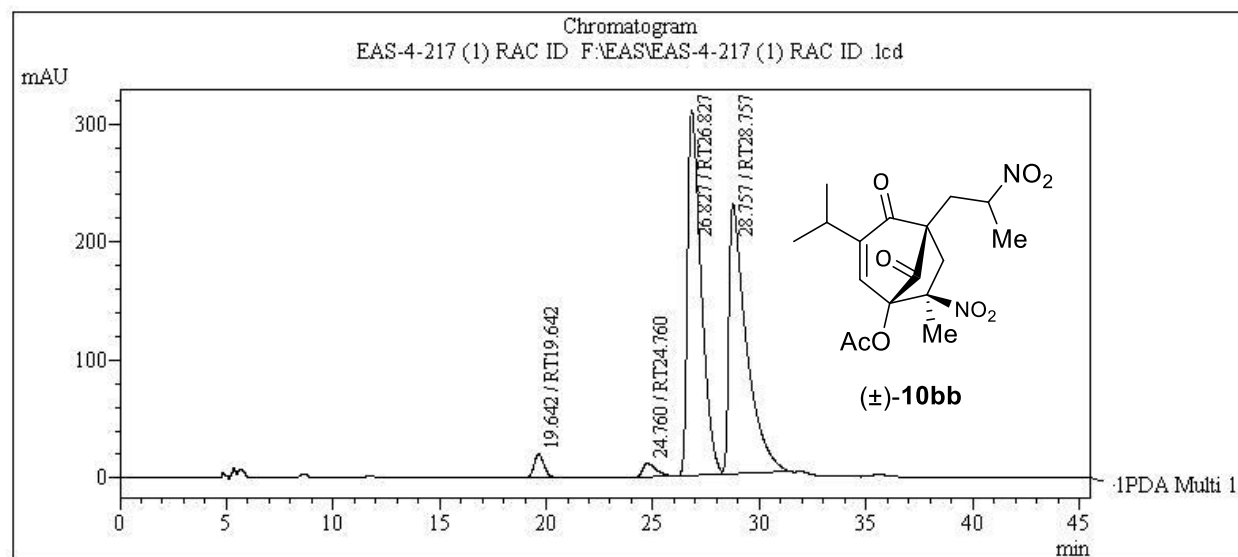
Chiral-(+)-10c (Major: 91% *ee* under the 0.05 mol% of catalyst 3g):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT8.526	8.526	28701969	1754073	95.433	96.616
2	RT13.989	13.989	1373529	61428	4.567	3.384
Total			30075497	1815501	100.000	100.000

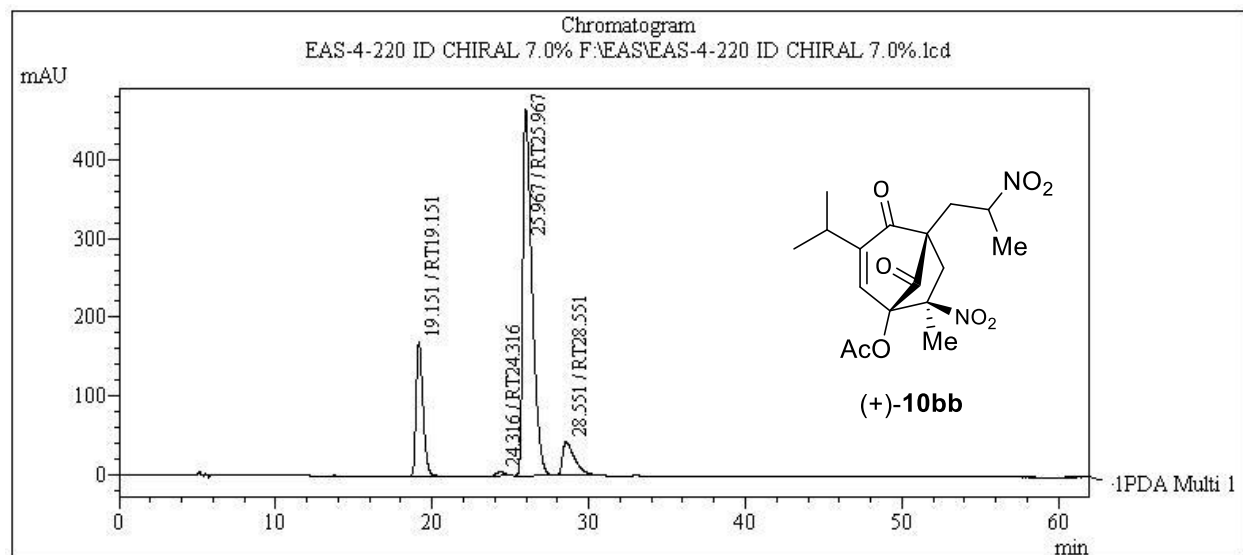
Racemic (±)-10bb:



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT19.642	19.642	625361	19780	2.226	3.474
2	RT24.760	24.760	505163	11276	1.798	1.980
3	RT26.827	26.827	13782207	309367	49.056	54.338
4	RT28.757	28.757	13182231	228919	46.920	40.208

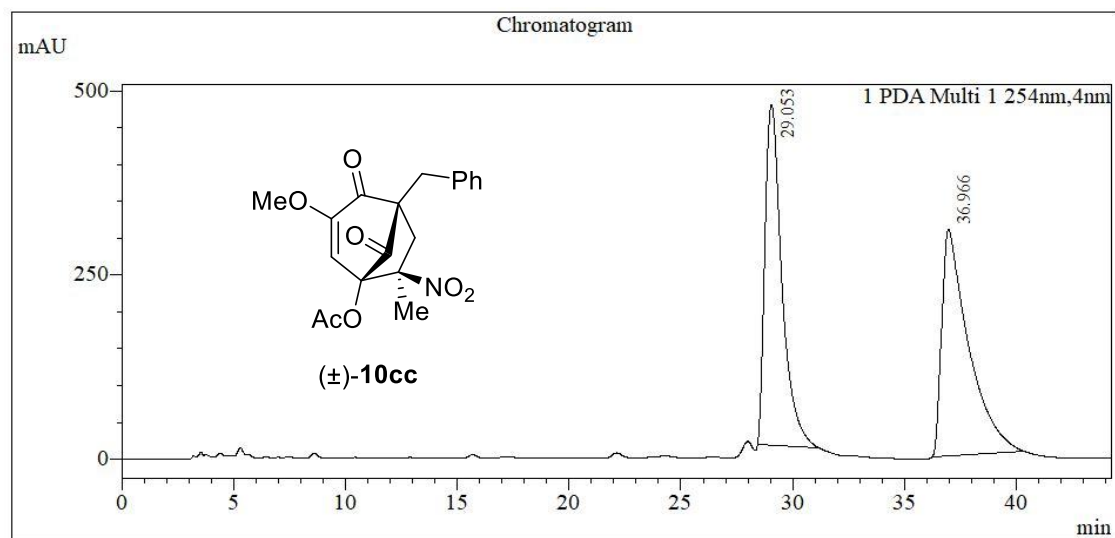
Chiral-(+)-10bb (Major: 79% *ee*; Minor: 93% *ee* and 3.9:1 *dr*):



Daicel Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT19.151	19.151	5191438	170231	19.441	25.009
2	RT24.316	24.316	195742	4997	0.733	0.734
3	RT25.967	25.967	19121626	463689	71.608	68.121
4	RT28.551	28.551	2194223	41764	8.217	6.136

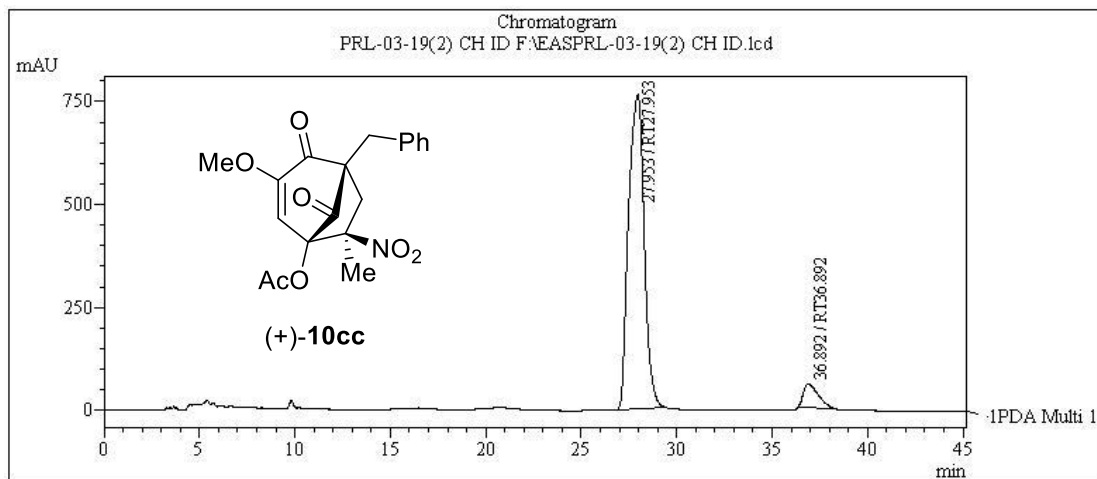
Racemic (±)-**10cc**:



Chiralpak ID, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min 254 nm

Peak Table						
PDA Ch1 254nm						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:29.053	29.053	24312581	461762	48.674	60.008
2	RT:36.966	36.966	25637756	307739	51.326	39.992
Total			49950337	769501	100.000	100.000

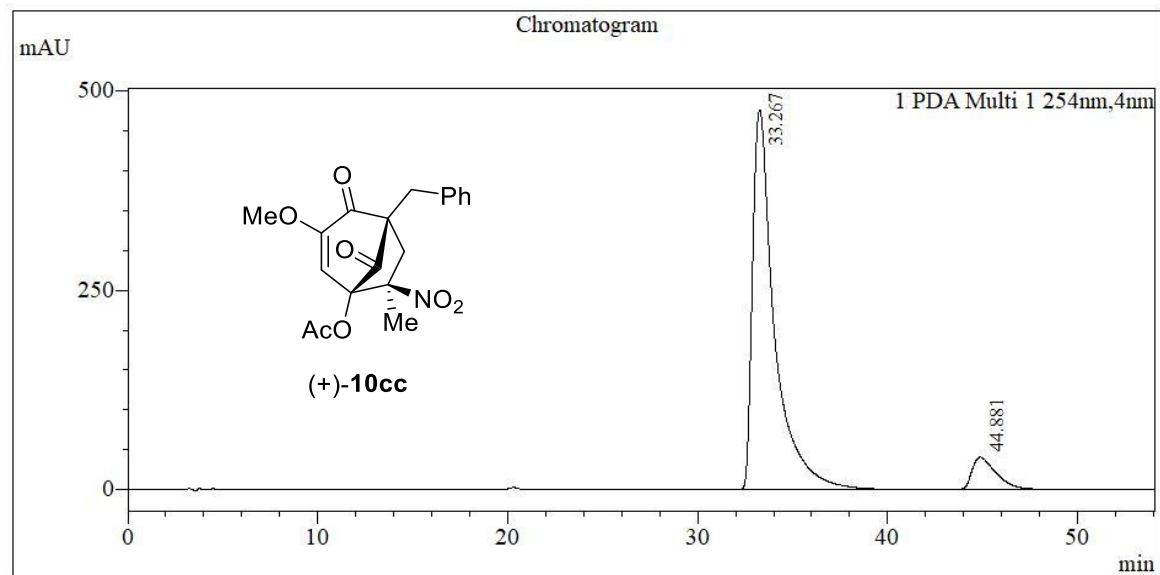
Chiral (+)-**10cc** (Major: 87% *ee* obtained under the 1.0 mol% catalyst **3g** loading):



Chiralpak ID, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT27.953	27.953	43587476	764156	93.396	92.982
2	RT36.892	36.892	3082122	57673	6.604	7.018
Total			46669598	821829	100.000	100.000

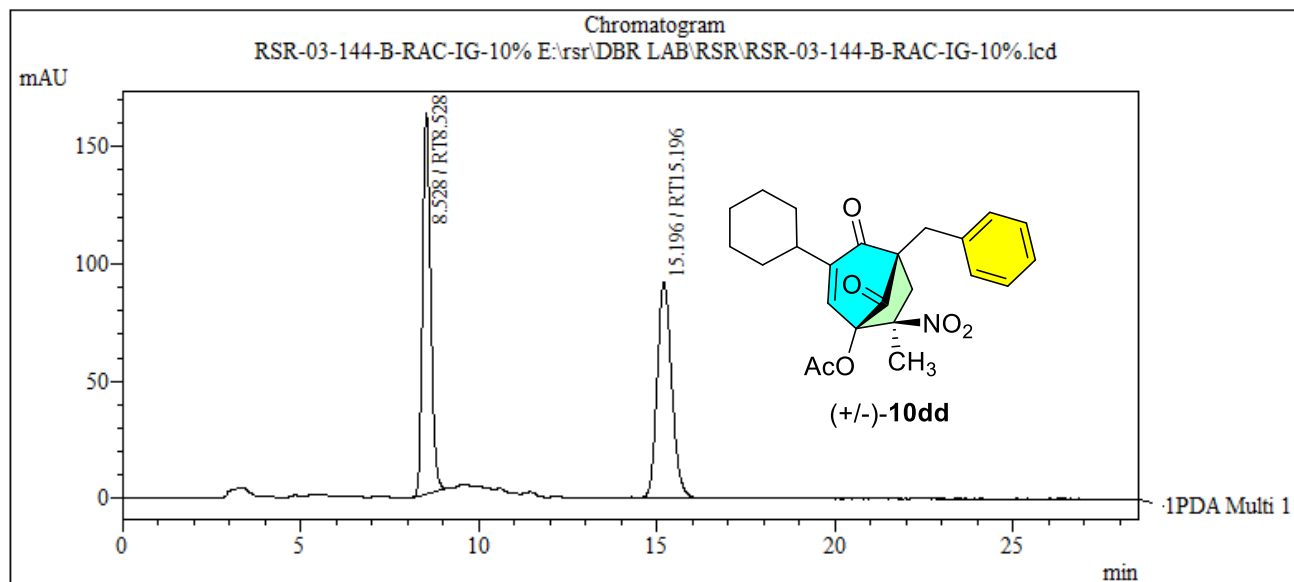
Chiral (+)-**10cc** (Major: 83% *ee* obtained under the 0.1 mol% catalyst **3g** loading):



Chiralpak ID, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min 254 nm

Peak Table						
Peak#	Name	Ret. Time	Area	Height	Area%	Height%
1	RT:33.267	33.267	38200843	475291	91.620	92.199
2	RT:44.881	44.881	3493819	40216	8.380	7.801
Total			41694662	515507	100.000	100.000

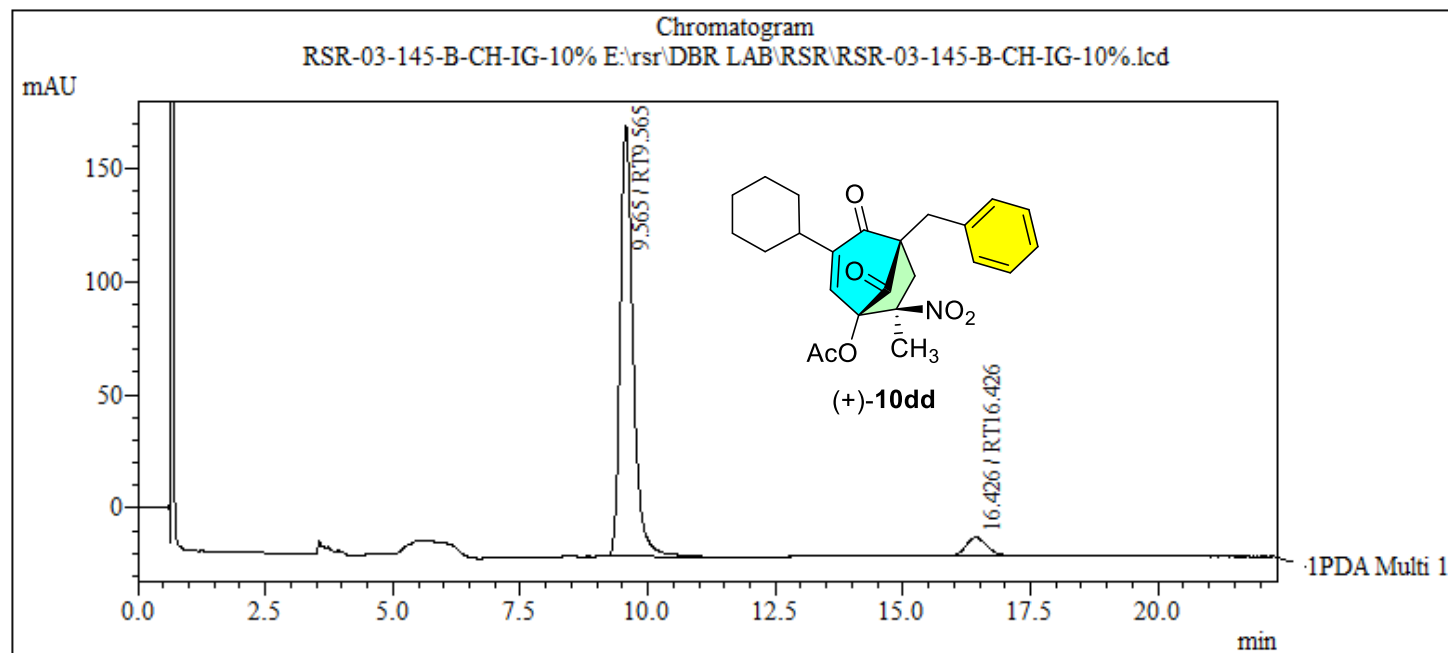
Racemic ($\pm$)-10dd [Major Isomer]:



Chiralpak IG, Hexane/*i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT8.528	8.528	2581184	162187	49.754	63.769
2	RT15.196	15.196	2606695	92146	50.246	36.231
Total			5187879	254333	100.000	100.000

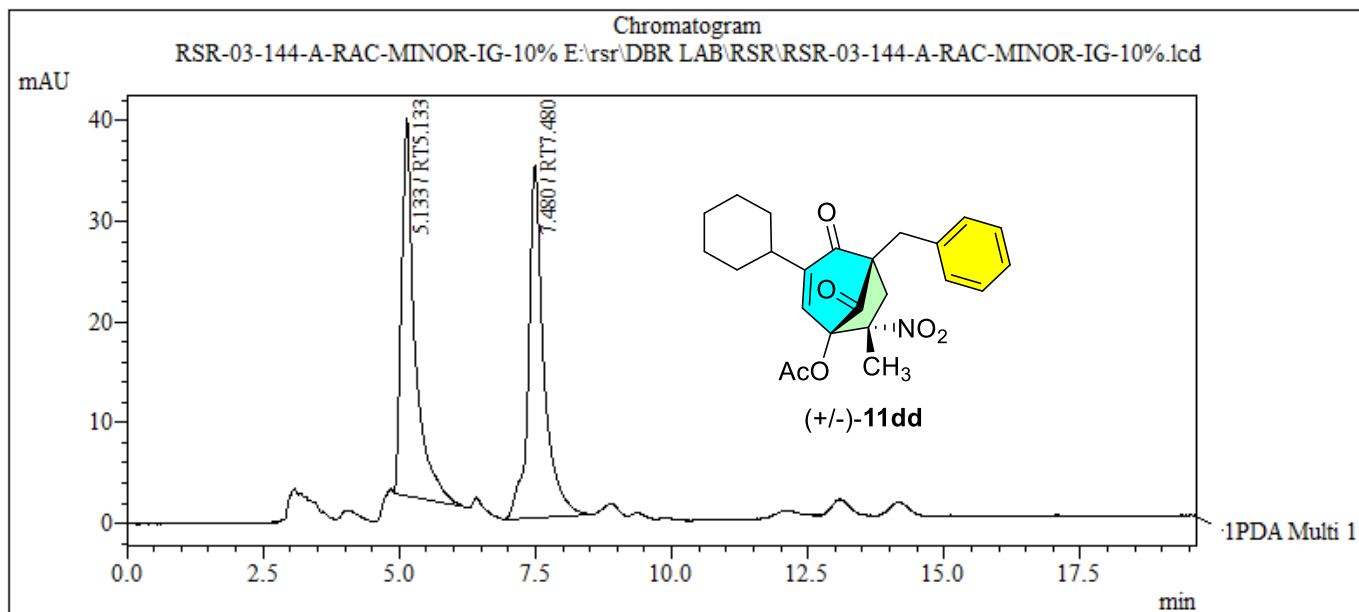
Chiral (+)-10dd [Major Isomer: 87% ee]:



Chiralpak IG, Hexane/*i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT9.565	9.565	3359732	190077	93.644	95.934
2	RT16.426	16.426	228026	8055	6.356	4.066
Total			3587758	198132	100.000	100.000

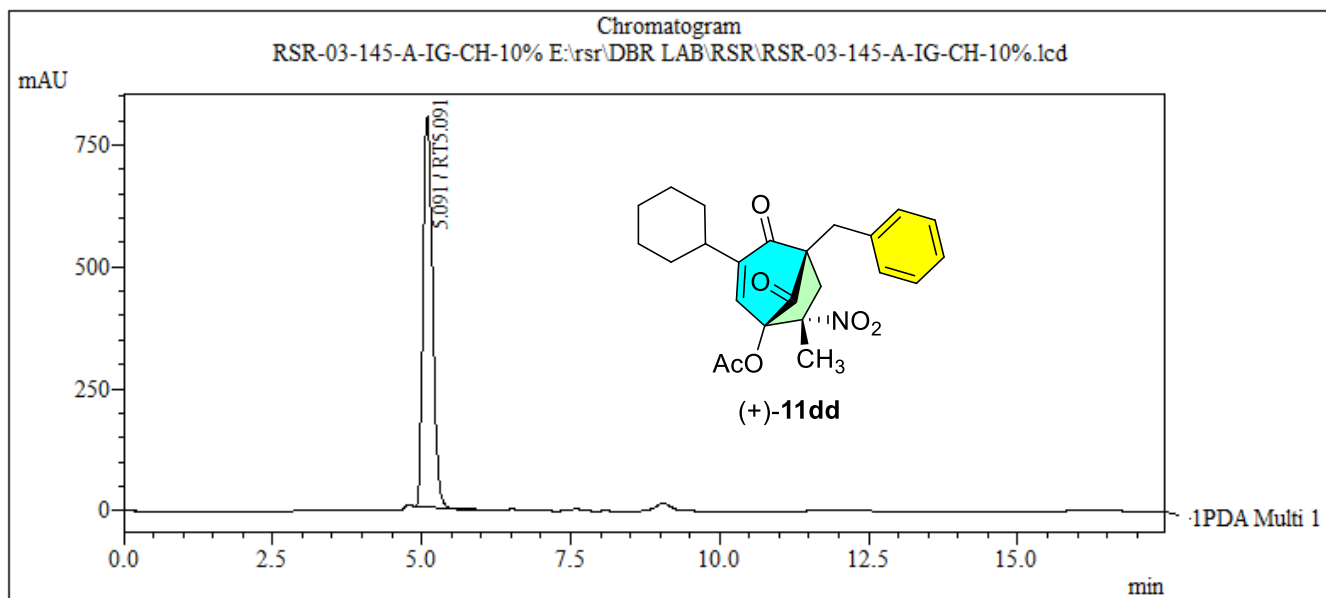
Racemic (±)-11dd [Minor Isomer]:



Chiralpak IG, Hexane/*i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT5.133	5.133	644271	37419	48.348	51.726
2	RT7.480	7.480	688300	34921	51.652	48.274
Total			1332572	72340	100.000	100.000

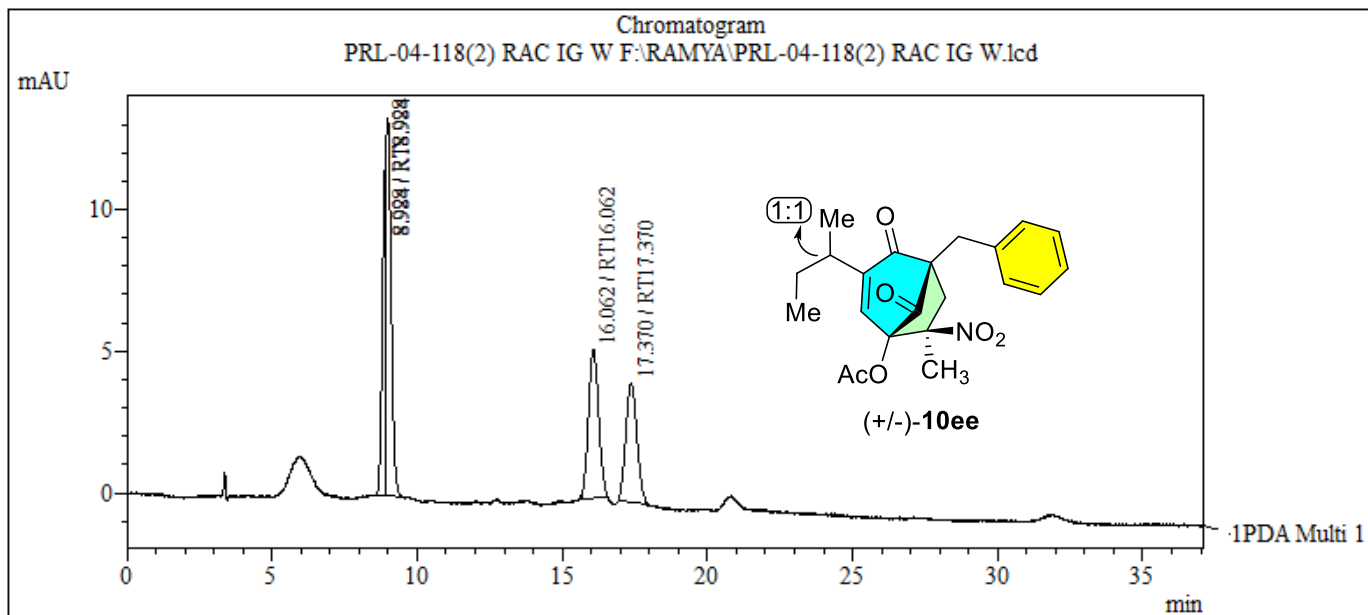
Chiral (+)-11dd [Minor : 99.9%ee]:



Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT5.091	5.091	8926544	800197	100.000	100.000
Total			8926544	800197	100.000	100.000

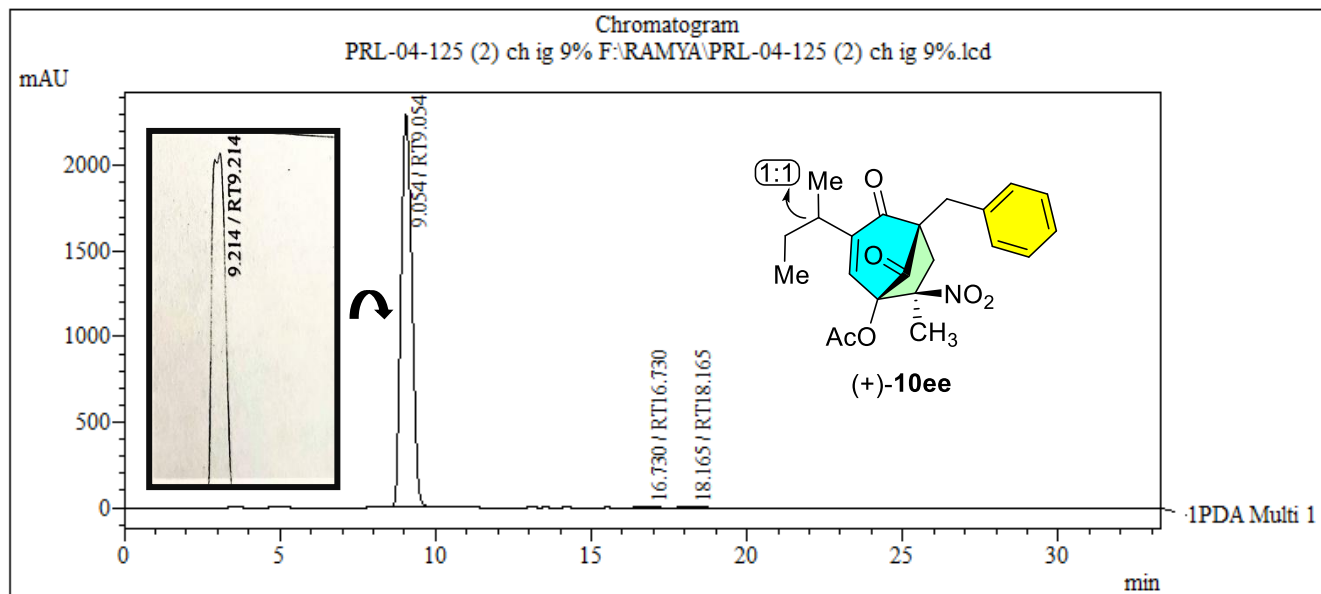
Racemic ($\pm$)-10ee [Major Isomer for 1:1 *dr*]:



Chiralpak IG, Hexane/*i*-PrOH = 91:9, Flow Rate 0.9 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT8.984	8.984	258146	13294	51.651	58.355
2	RT16.062	16.062	128618	5236	25.735	22.986
3	RT17.370	17.370	113025	4251	22.615	18.659
Total			499789	22781	100.000	100.000

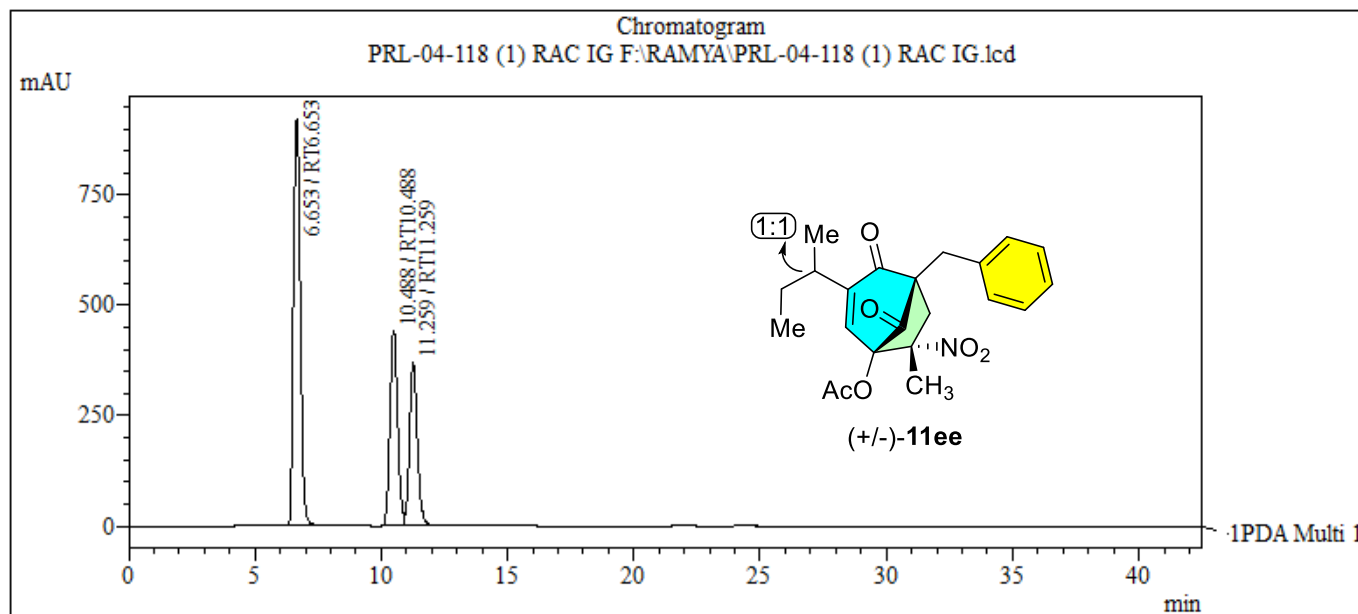
Chiral (+)-10ee (Major Isomer: 98% *ee* and 98% *ee* for 1:1 *dr*):



Chiralpak IG, Hexane/*i*-PrOH = 91:9, Flow Rate 0.9 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT9.054	9.054	54696336	2291686	99.147	99.318
2	RT16.730	16.730	250685	8803	0.454	0.381
3	RT18.165	18.165	219915	6937	0.399	0.301
Total			55166935	2307425	100.000	100.000

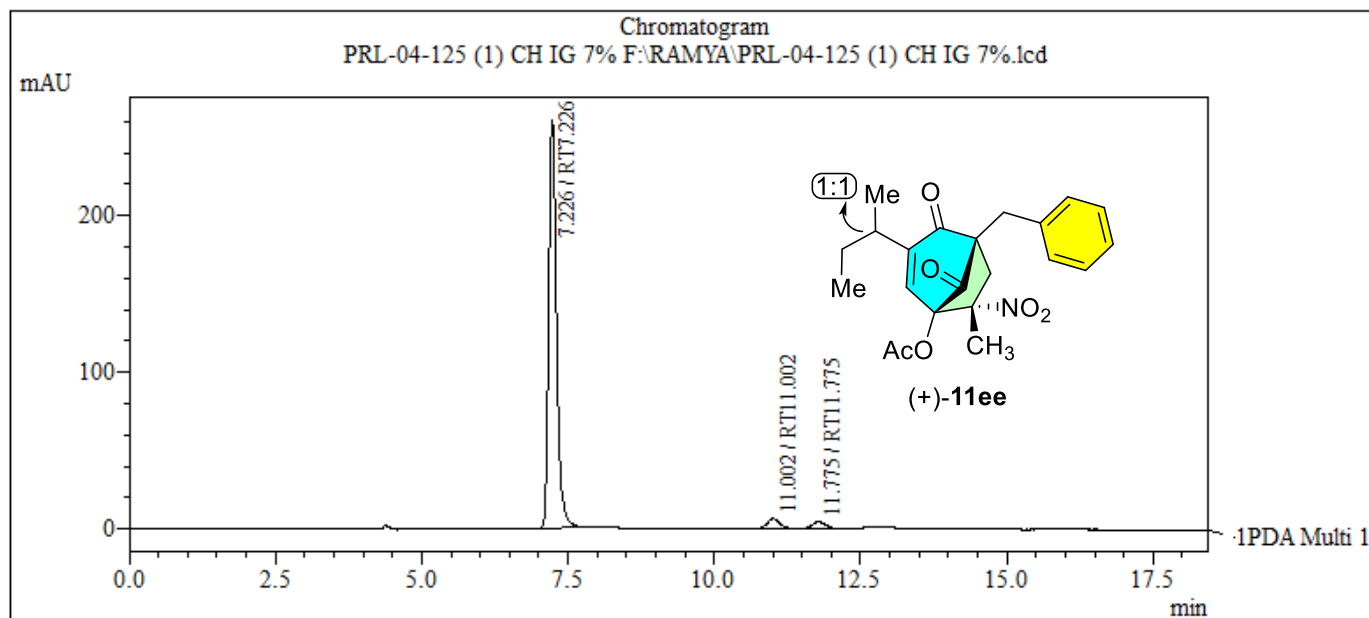
Racemic ($\pm$)-11ee [Minor Isomer for 1:1 *dr*]:



Chiralpak IG, Hexane/ *i*-PrOH = 93:7, Flow Rate 0.7 mL/min, 254nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT6.653	6.653	17404440	918211	50.192	53.100
2	RT10.488	10.488	9350595	442596	26.966	25.595
3	RT11.259	11.259	7920727	368418	22.842	21.305
Total			34675763	1729225	100.000	100.000

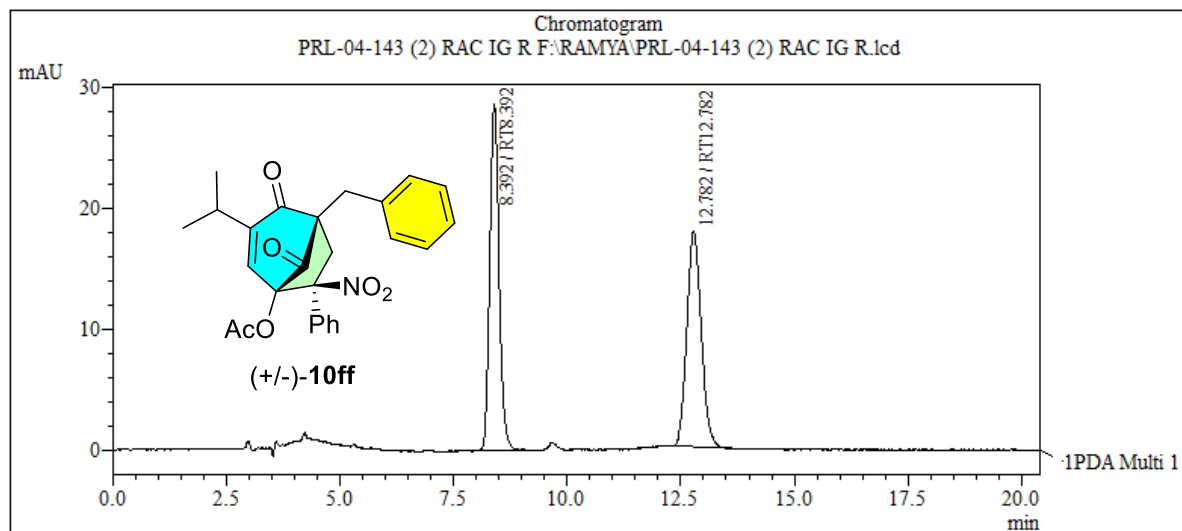
Chiral (+)-11ee (Minor Isomer: 85% ee and 88% ee for 1:1 dr):



Chiralpak IG, Hexane/*i*-PrOH = 93:7, Flow Rate 0.7 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT7.226	7.226	2404275	259623	93.279	95.936
2	RT11.002	11.002	98153	6442	3.808	2.380
3	RT11.775	11.775	75090	4556	2.913	1.684
Total			2577518	270621	100.000	100.000

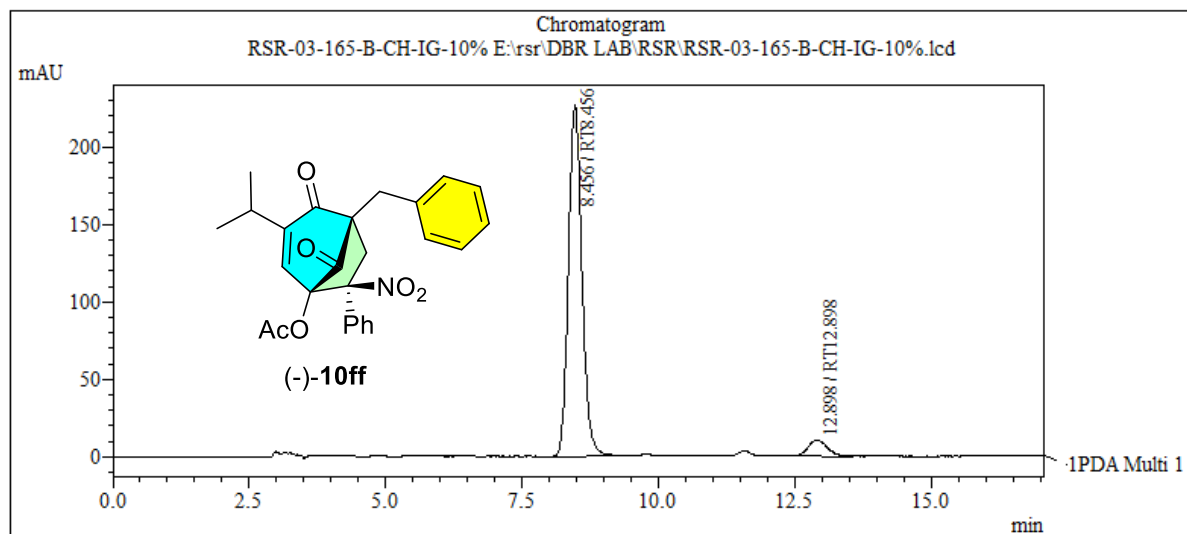
Racemic ($\pm$)-10ff [major isomer]:



Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
PDA Ch1 254nm 4nm						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT8.392	8.392	403256	28552	50.580	61.560
2	RT12.782	12.782	394008	17829	49.420	38.440
Total			797264	46381	100.000	100.000

Chiral (-)-10ff [Major Isomer: 88% ee]:



Chiralpak IG, Hexane/ *i*-PrOH = 90:10, Flow Rate 1.0 mL/min, 254 nm

PeakTable						
Peak#	Name	Ret. Time	Area	Height	Area %	Height %
1	RT8.456	8.456	3925009	226468	93.881	95.576
2	RT12.898	12.898	255840	10482	6.119	4.424
Total			4180848	236950	100.000	100.000