

Supporting Information

Organocatalytic Enantioselective *aza*-Friedel-Crafts Alkylation of β -Naphthols and Isatin-Derived Ketimines via Takemoto- Type Catalyst

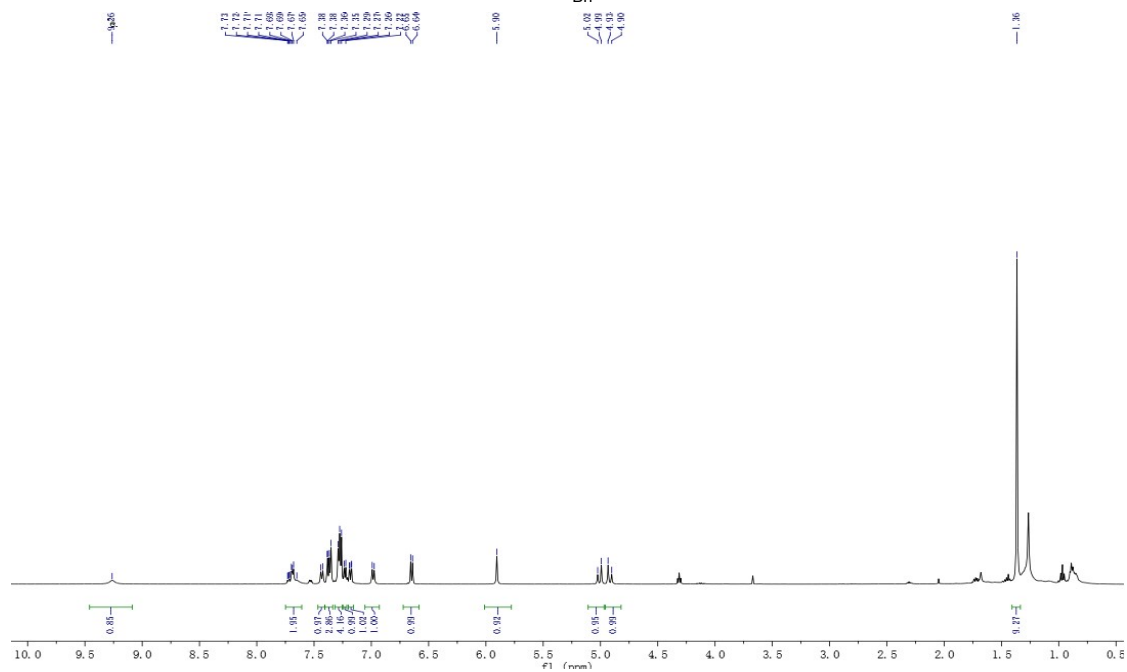
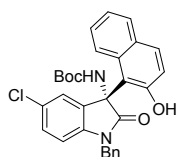
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^a*Department of Pharmacy, Jilin Medical University, Jilin, Jilin 132013, China*

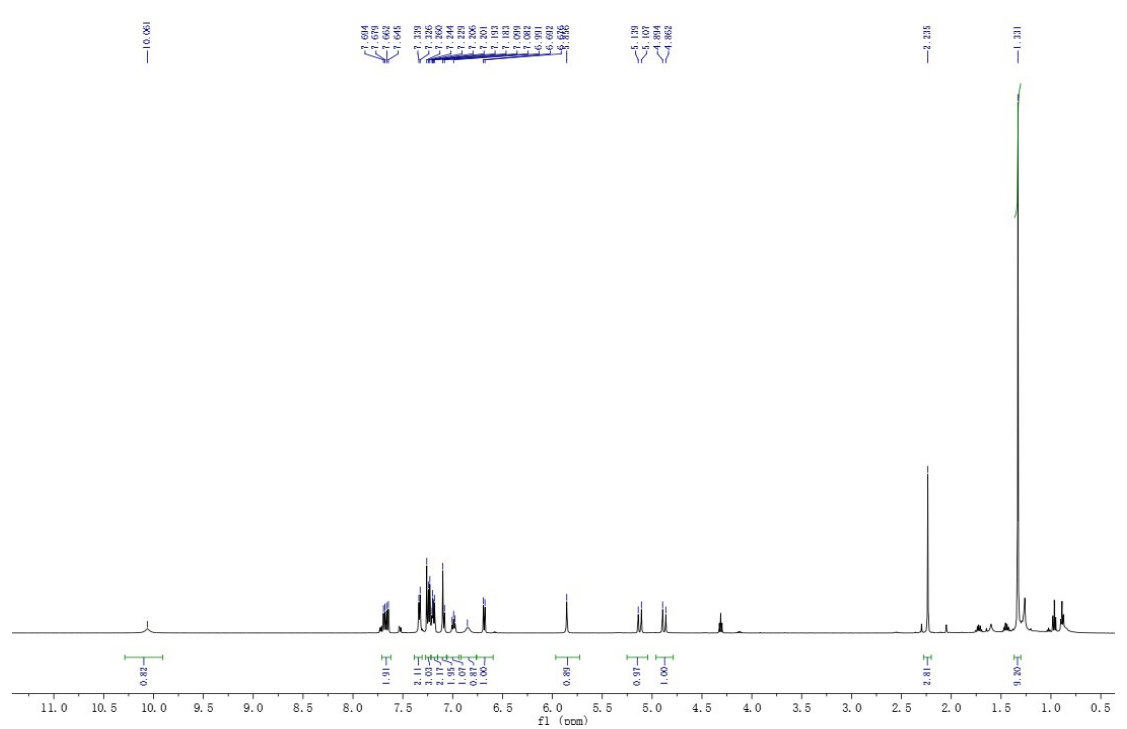
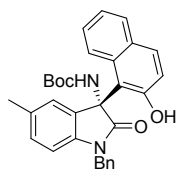
^b*Department of Pharmacy, Yanbian University, Yanji, Jilin 133000, China)*

¹ H NMR and ¹³ C NMR spectra.....	S2-S19
HPLC trace.....	S20-S42

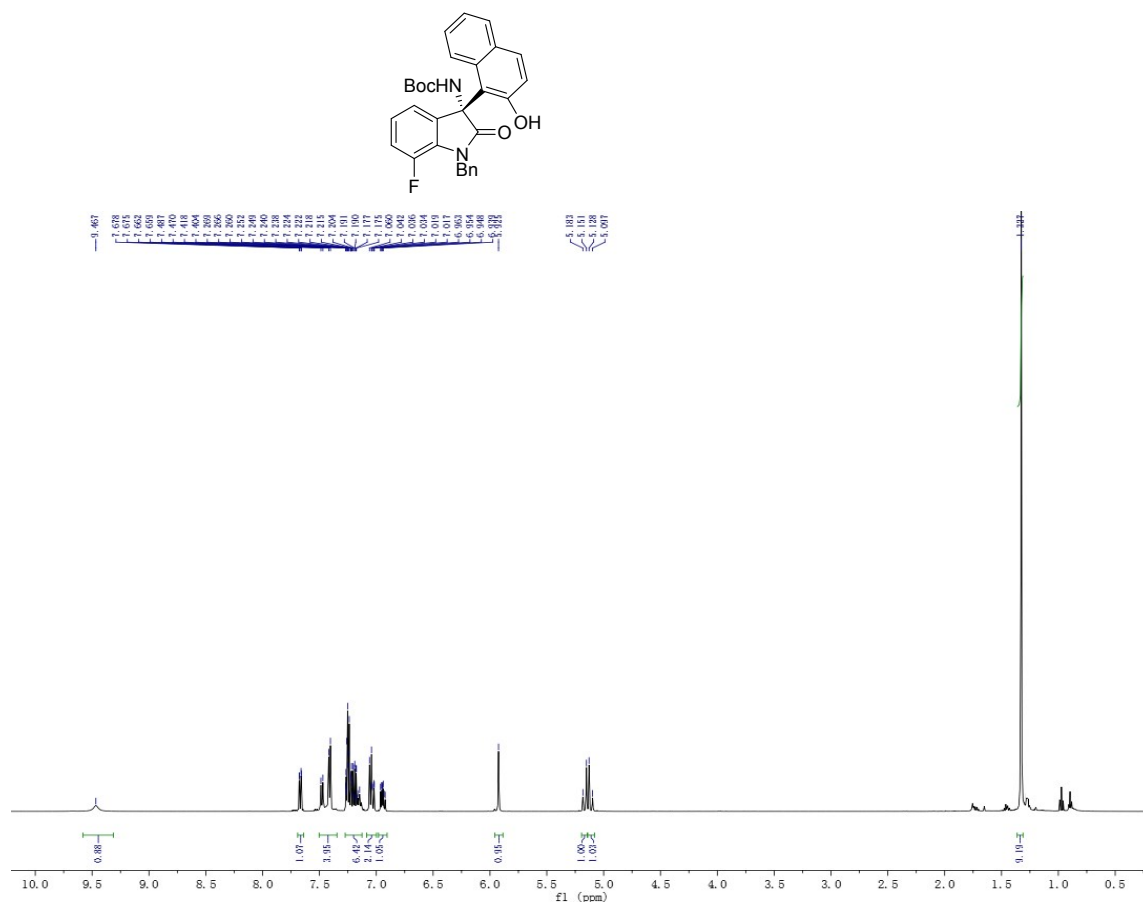
¹H NMR of 4c



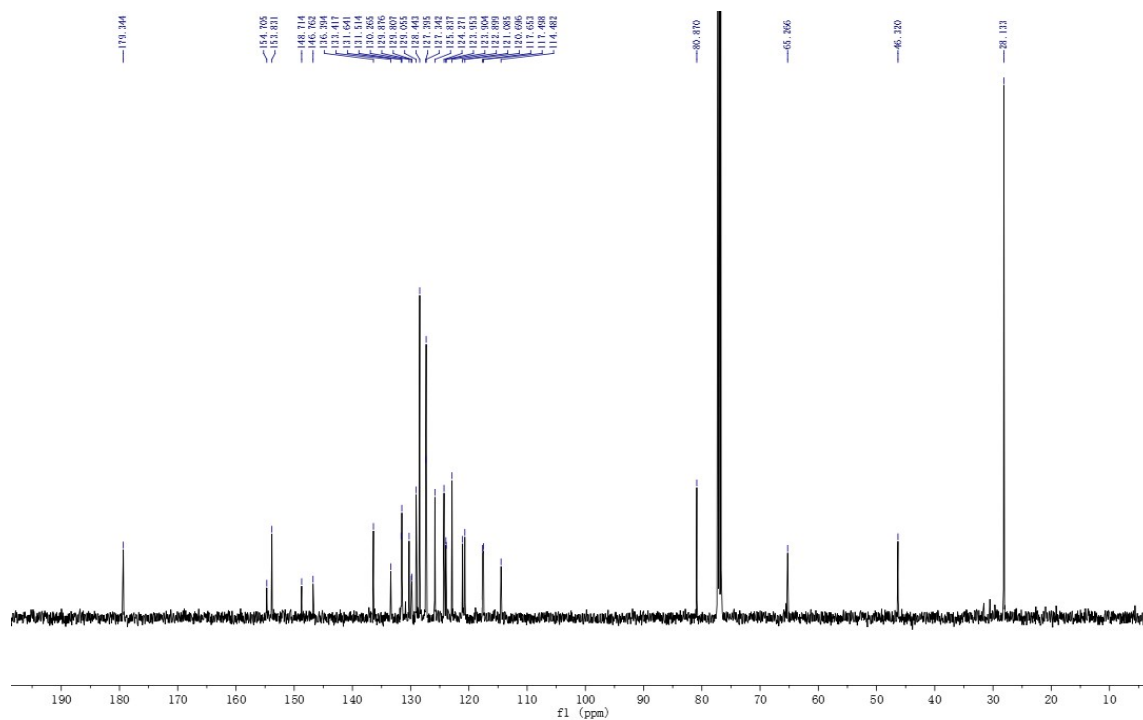
¹H NMR of 4d



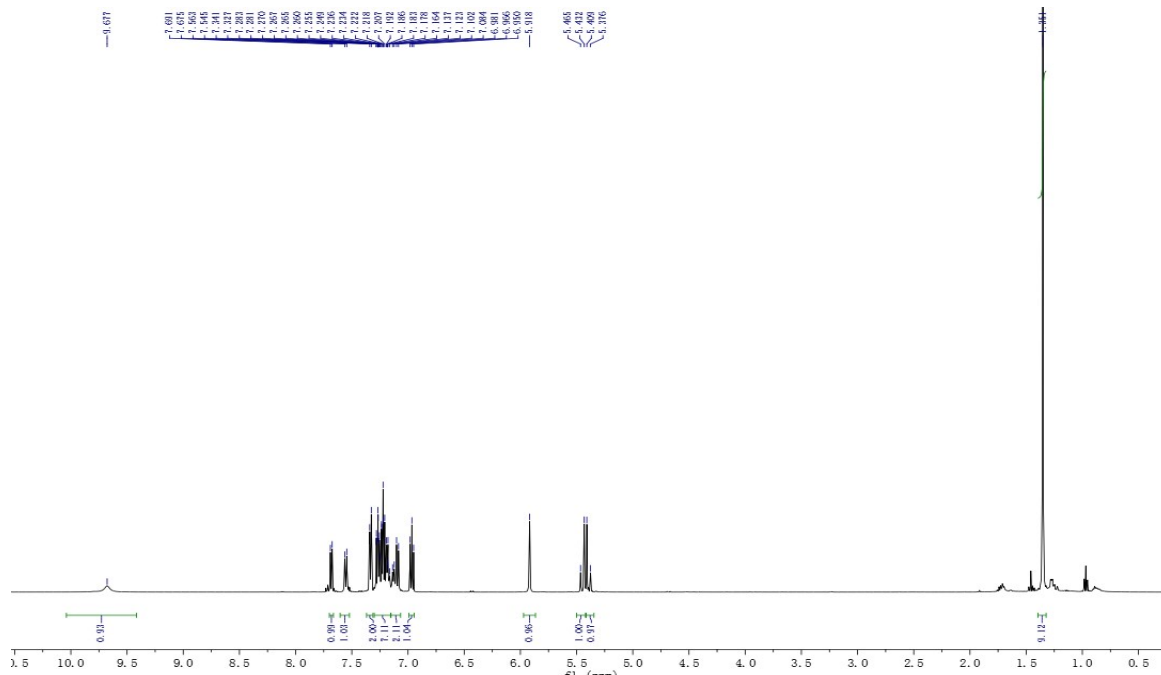
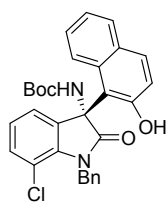
¹H NMR of 4f



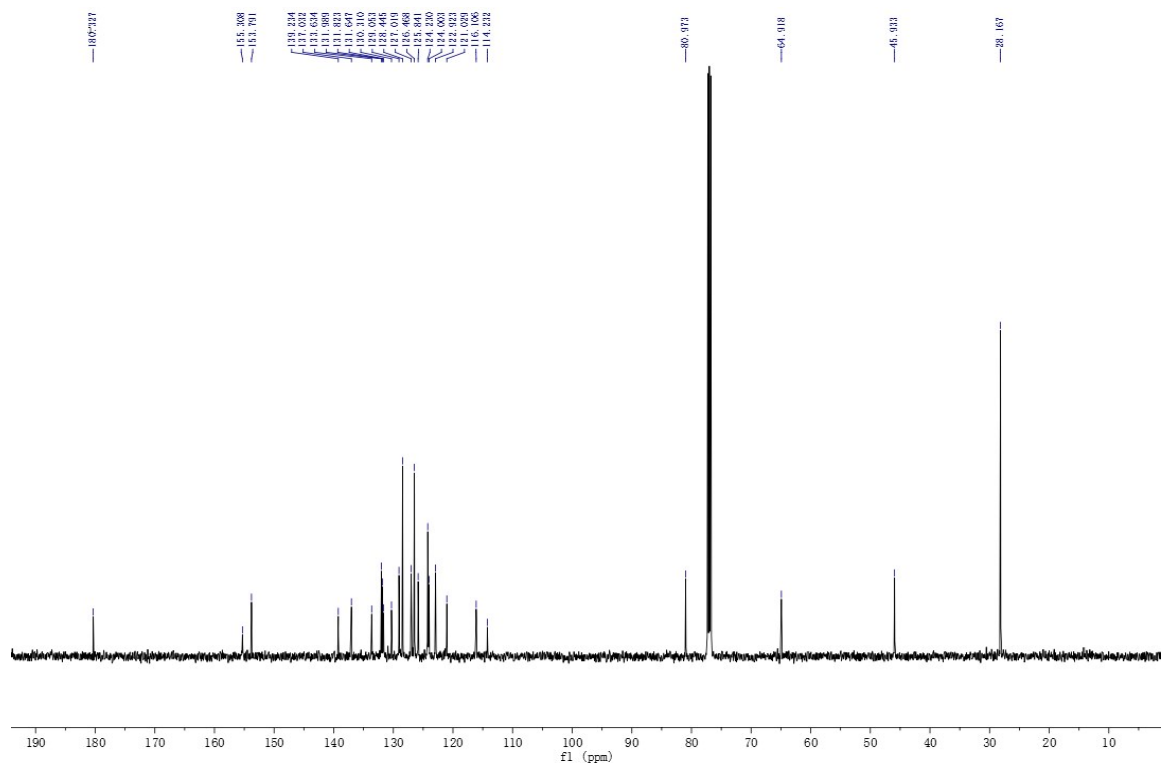
¹³C NMR of 4f



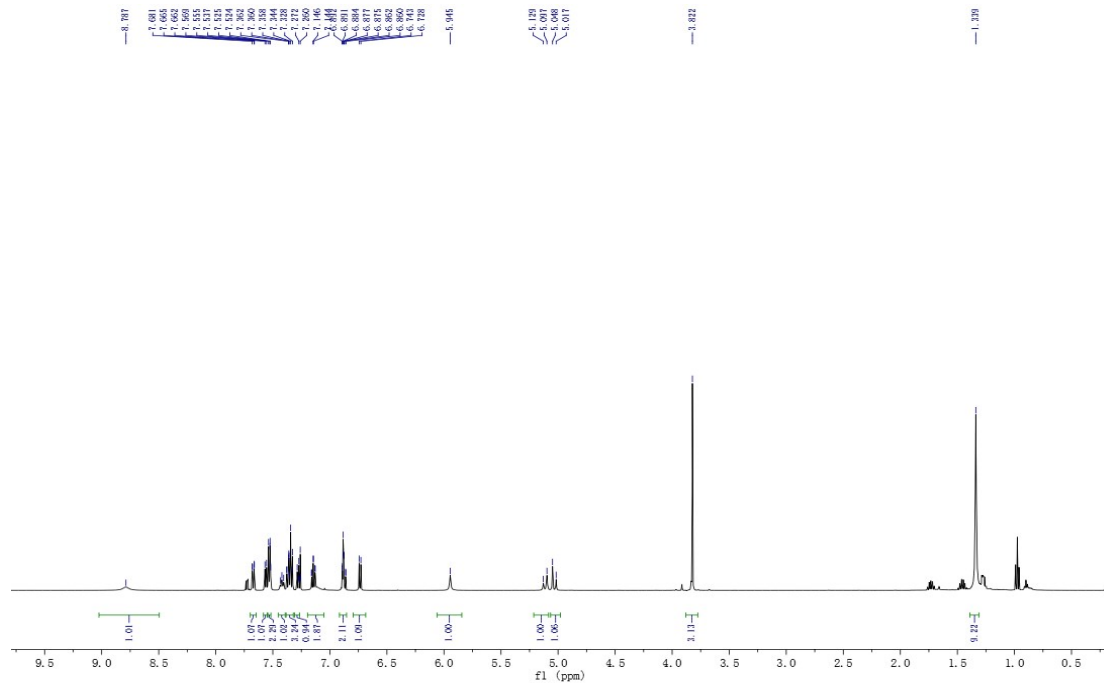
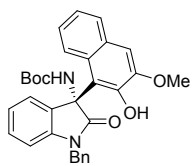
¹H NMR of 4g



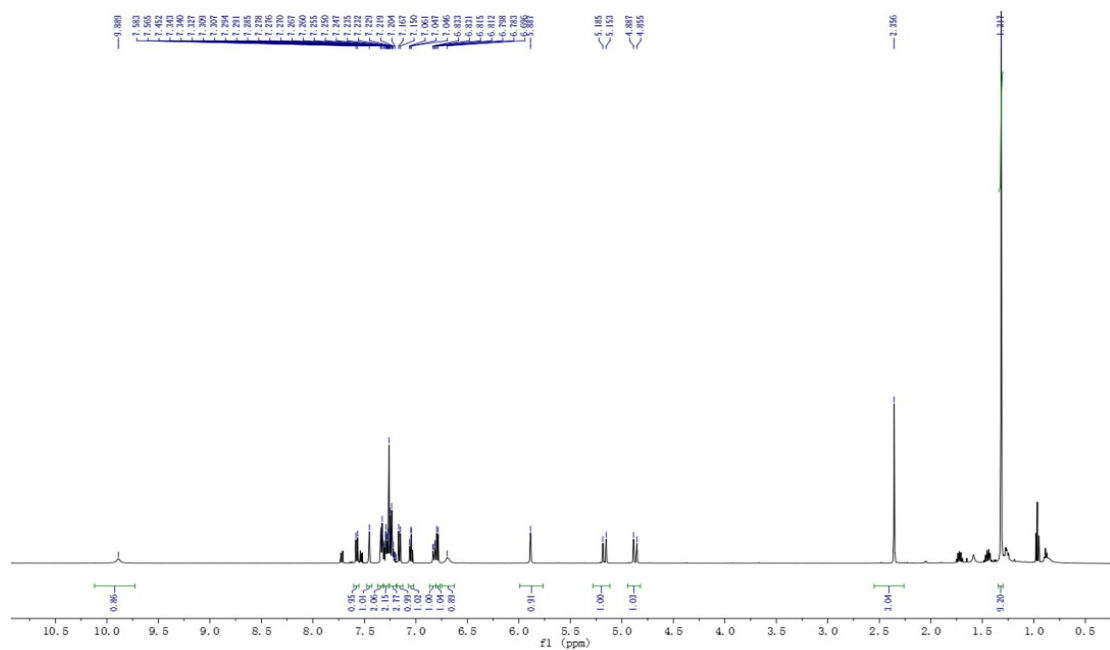
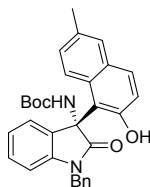
¹³C NMR of 4g



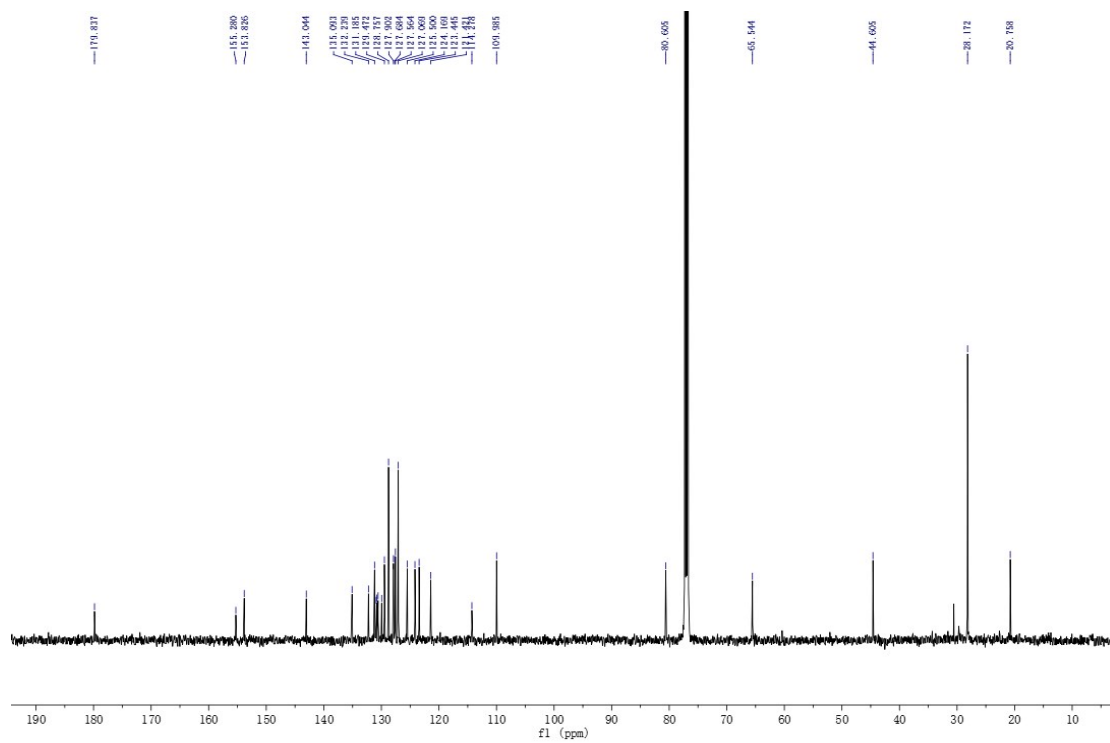
¹H NMR of **4k**



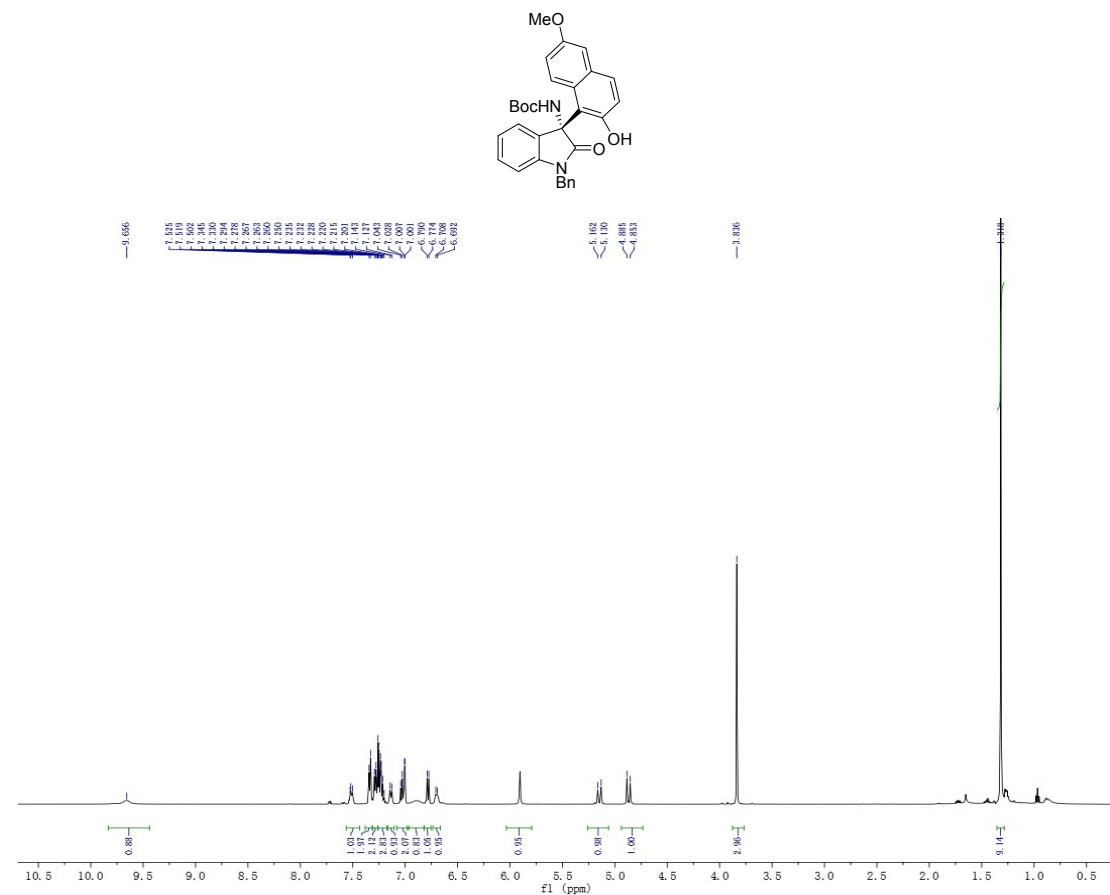
¹H NMR of **4l**



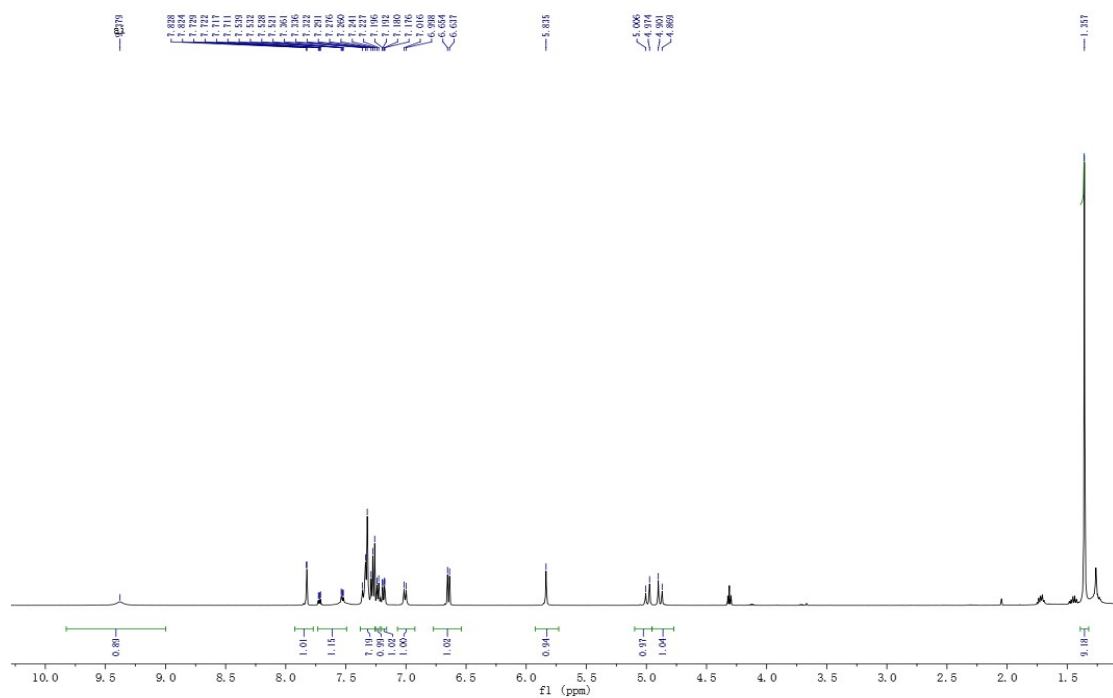
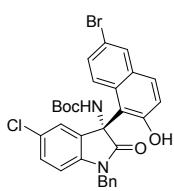
¹³C NMR of 4l



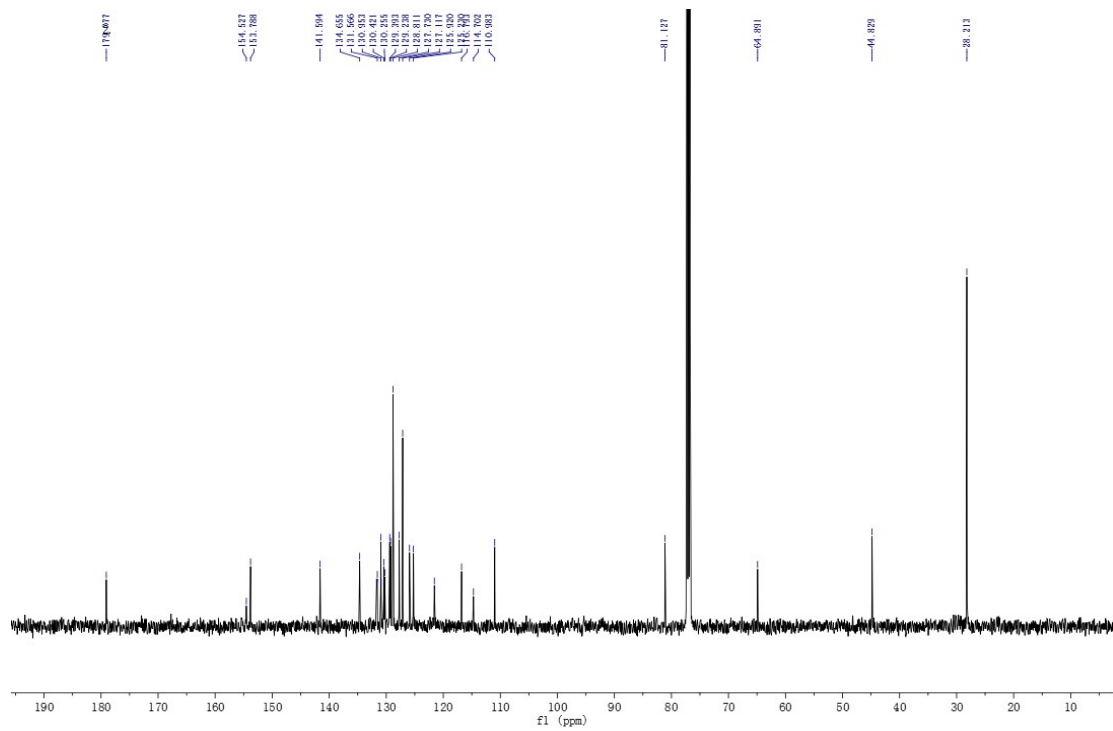
¹H NMR of 4m



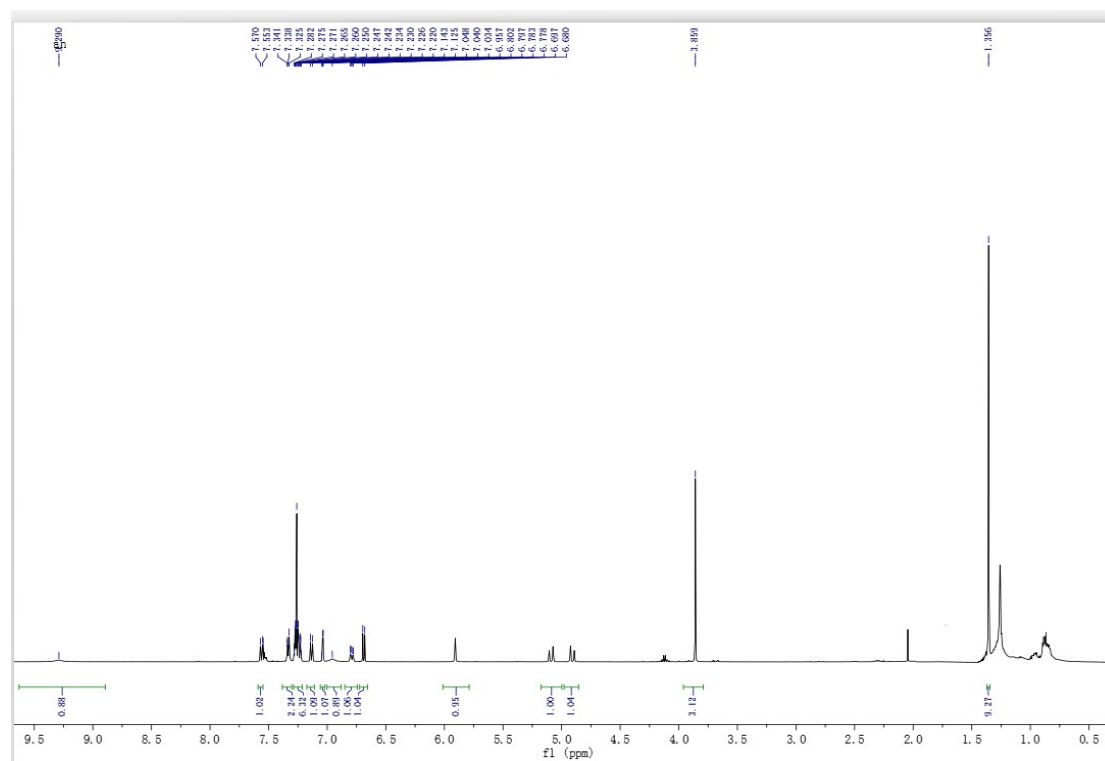
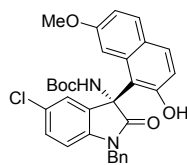
¹H NMR of 4p



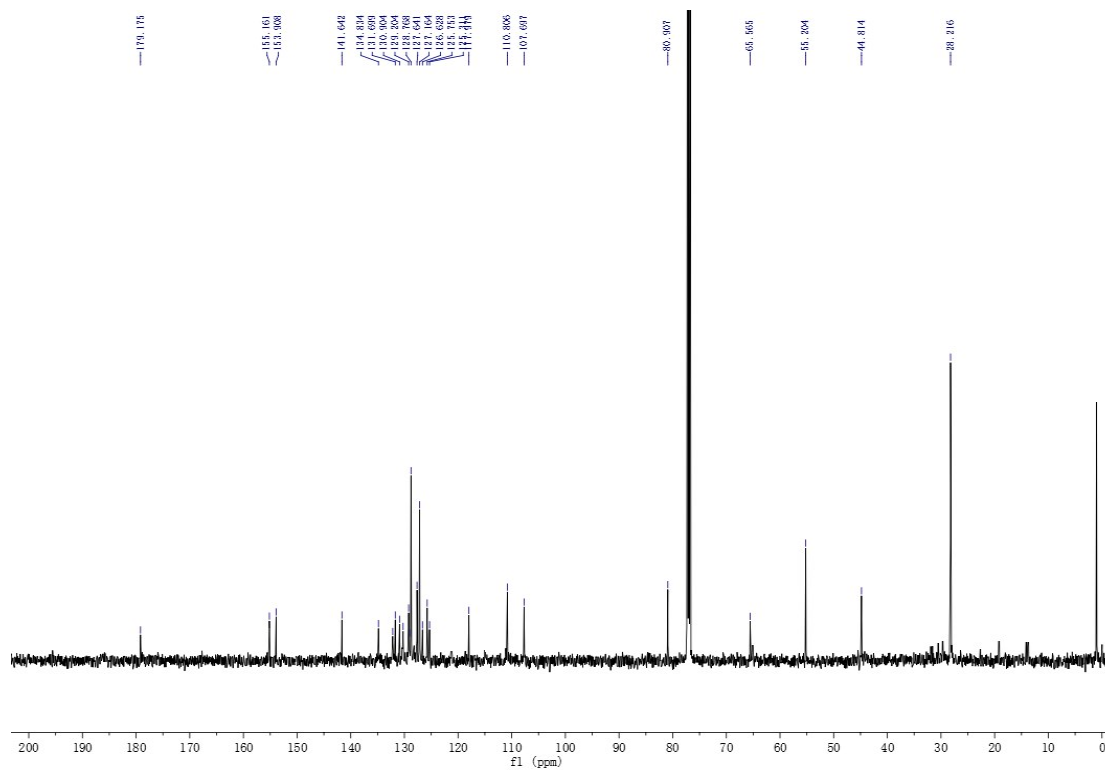
¹³C NMR of 4p



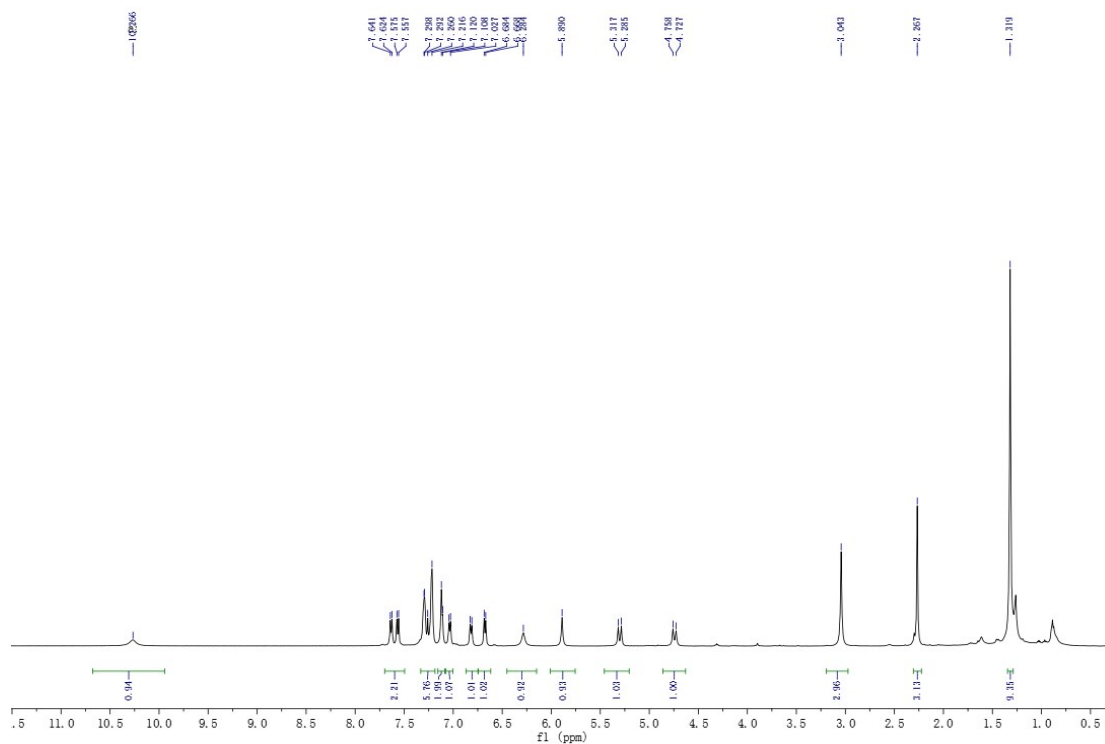
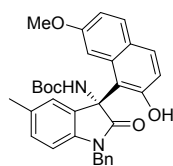
¹H NMR of 4q



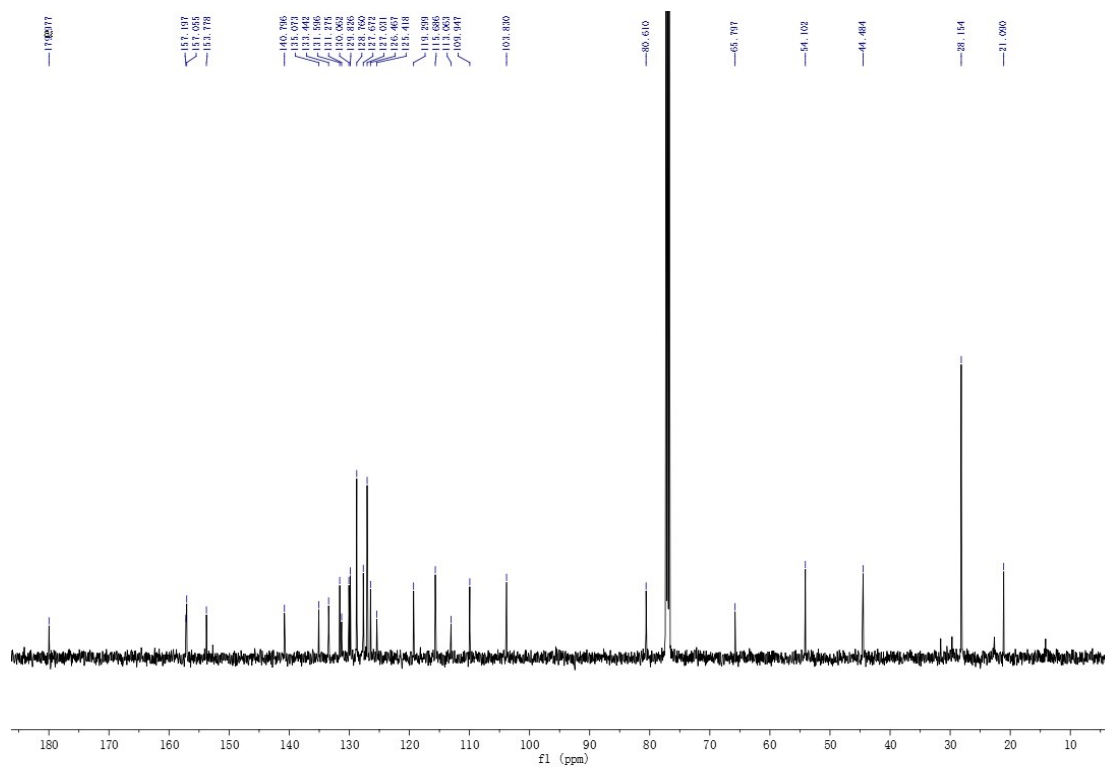
¹³C NMR of 4q



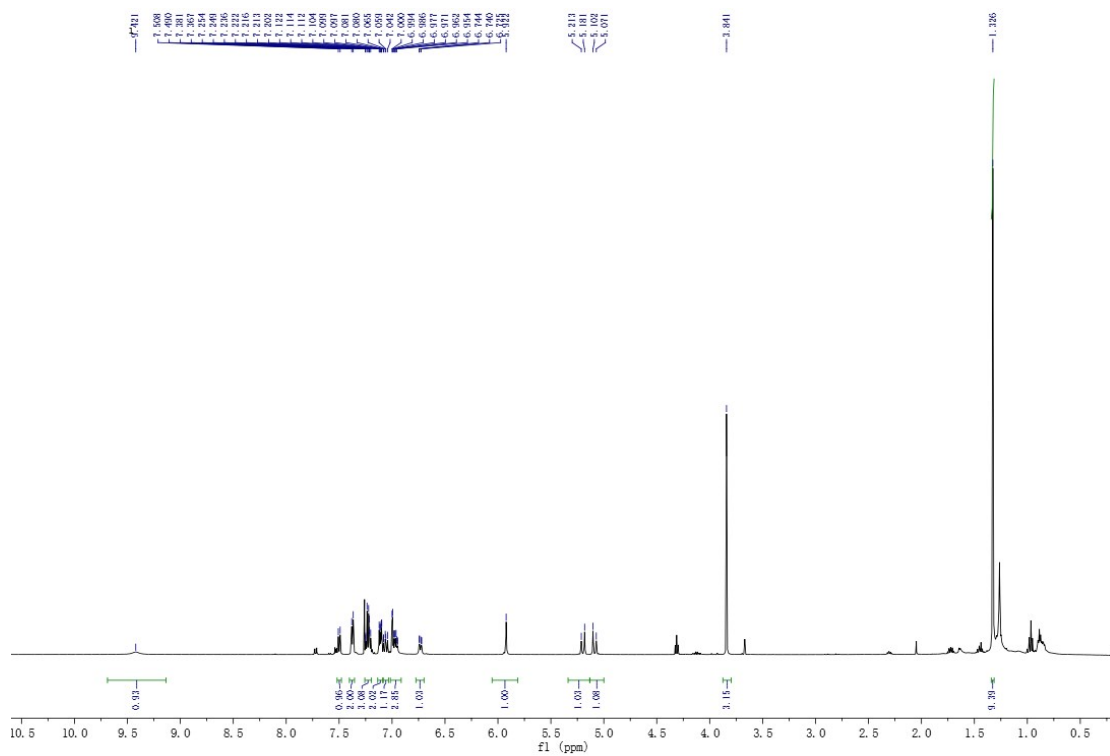
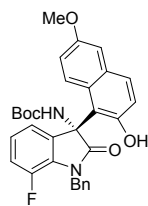
¹H NMR of **4r**



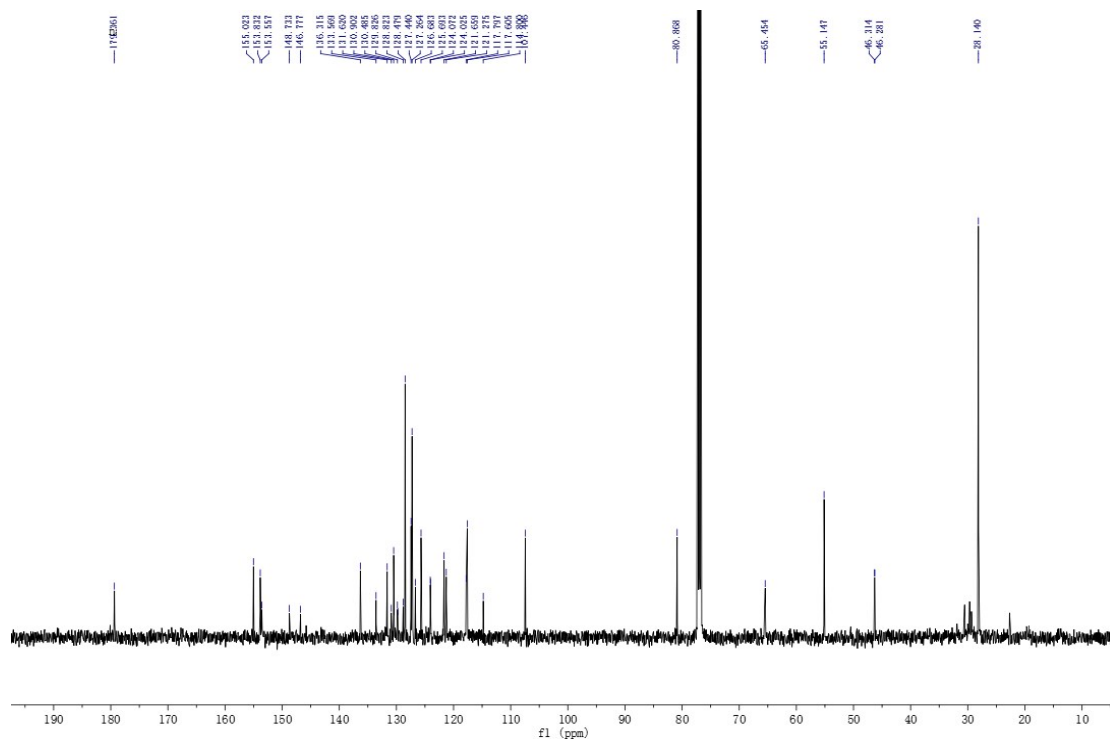
¹³C NMR of **4r**



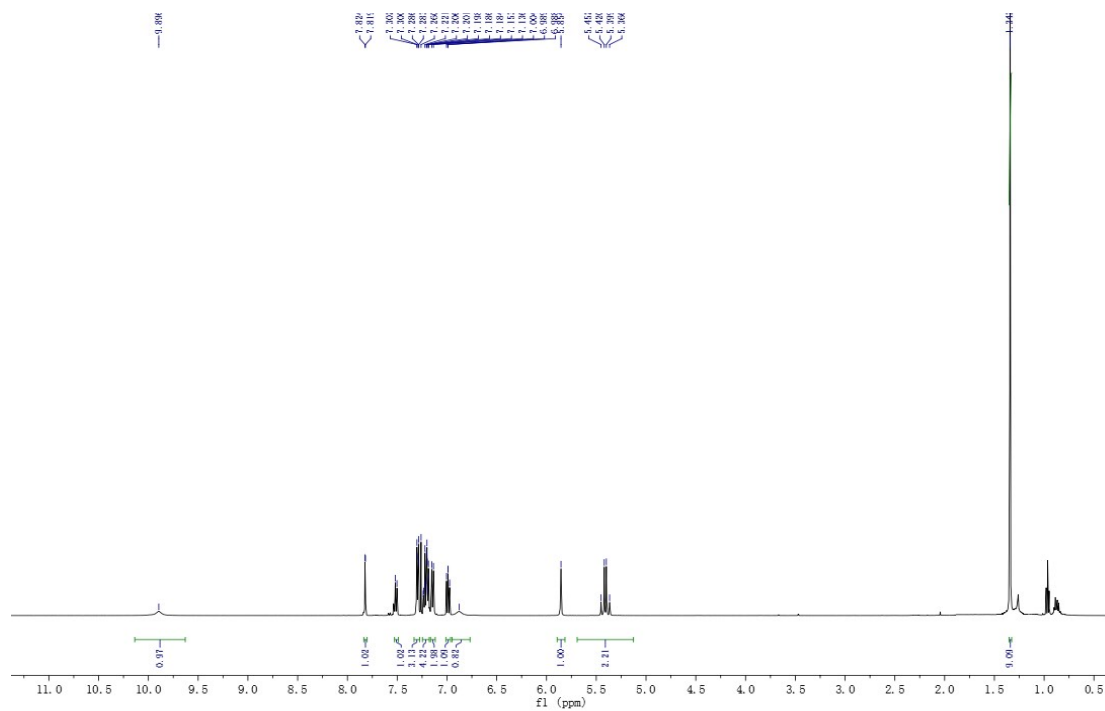
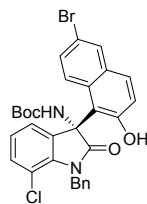
¹H NMR of 4u



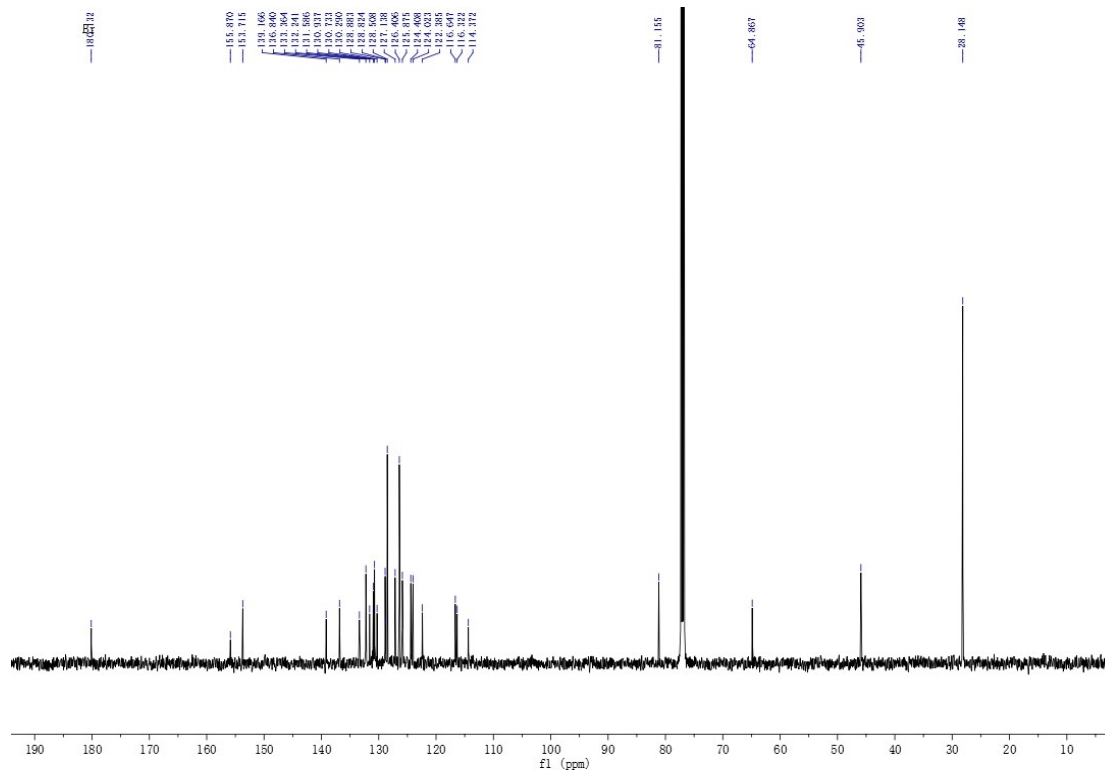
¹³C NMR of 4u



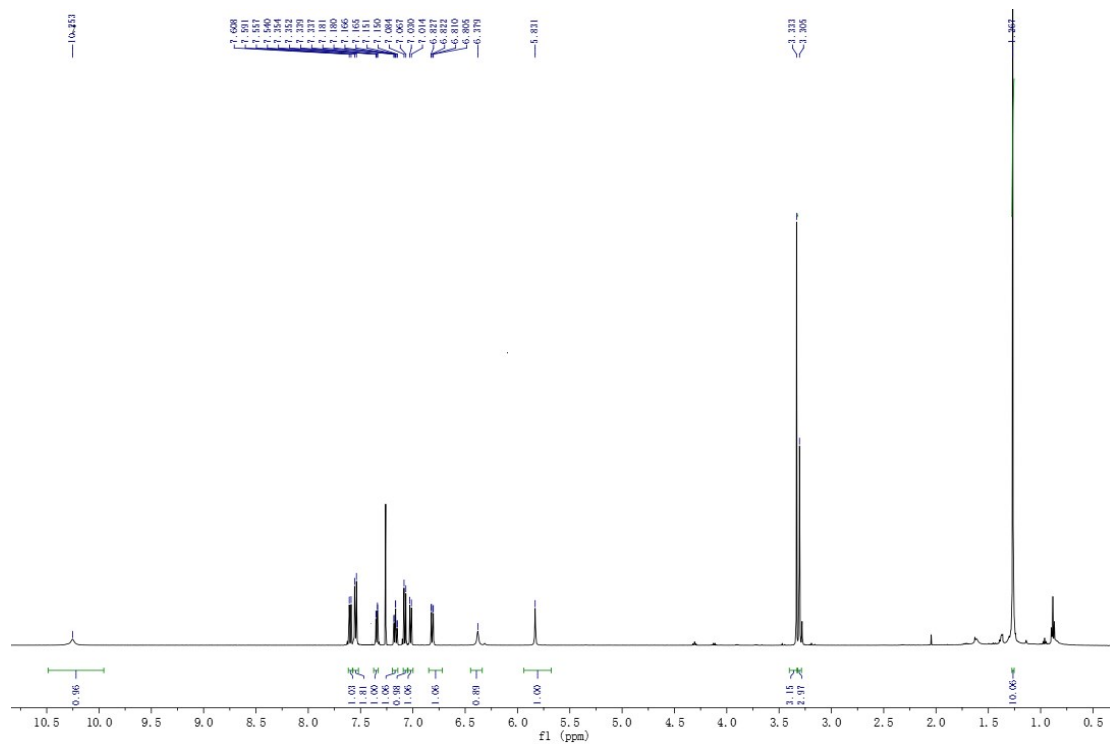
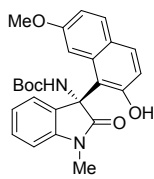
¹H NMR of 4v



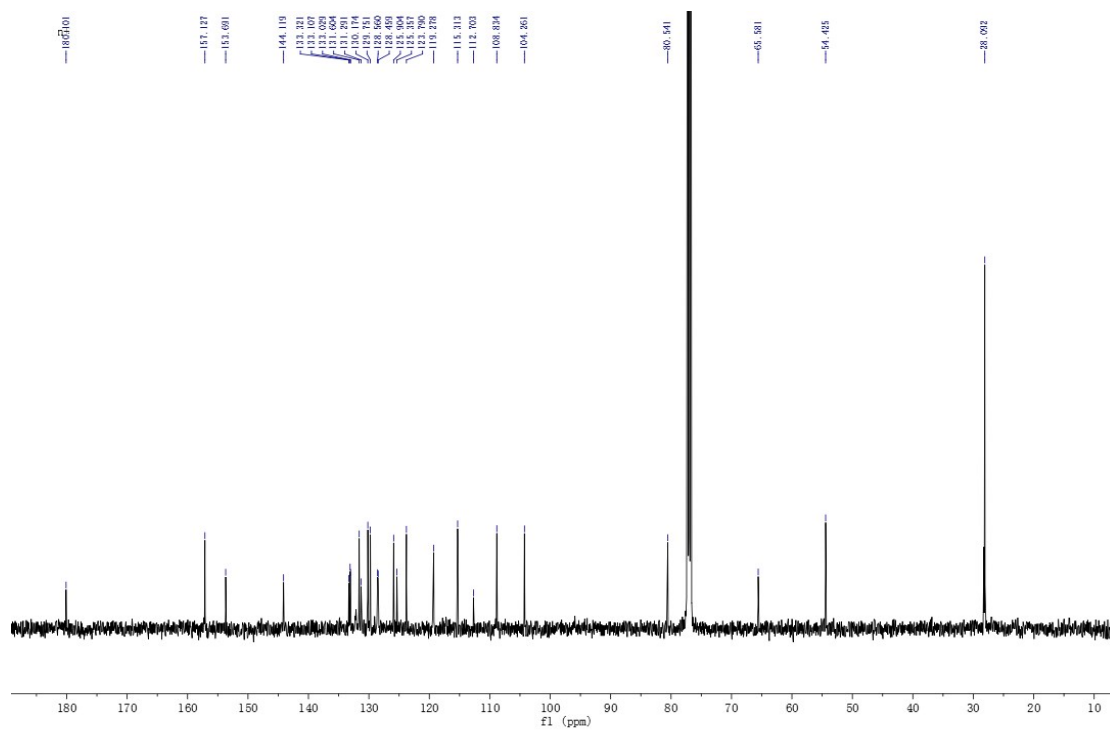
¹³C NMR of 4v



¹H NMR of 4w

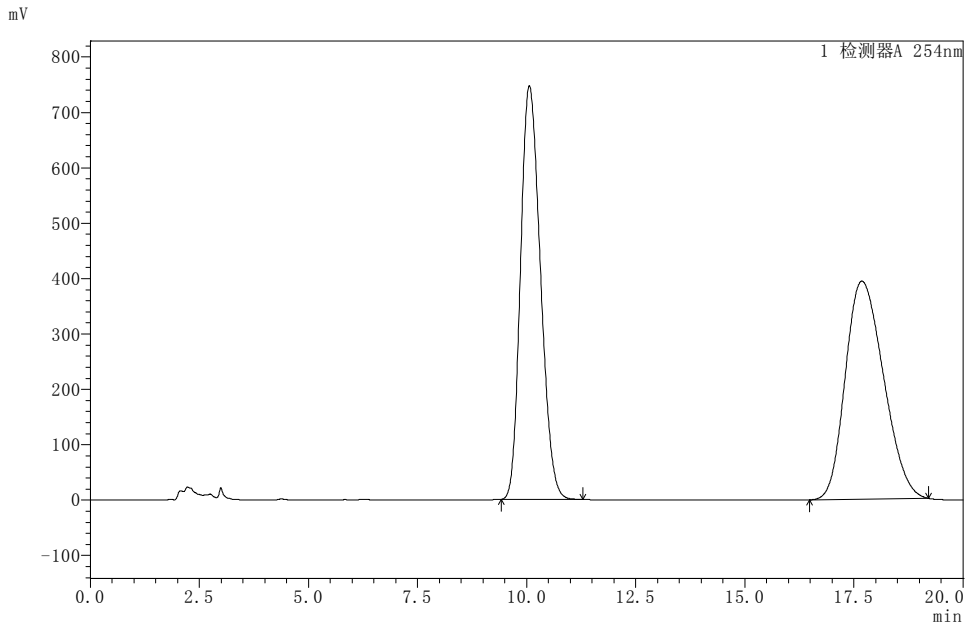


¹³C NMR of 4w



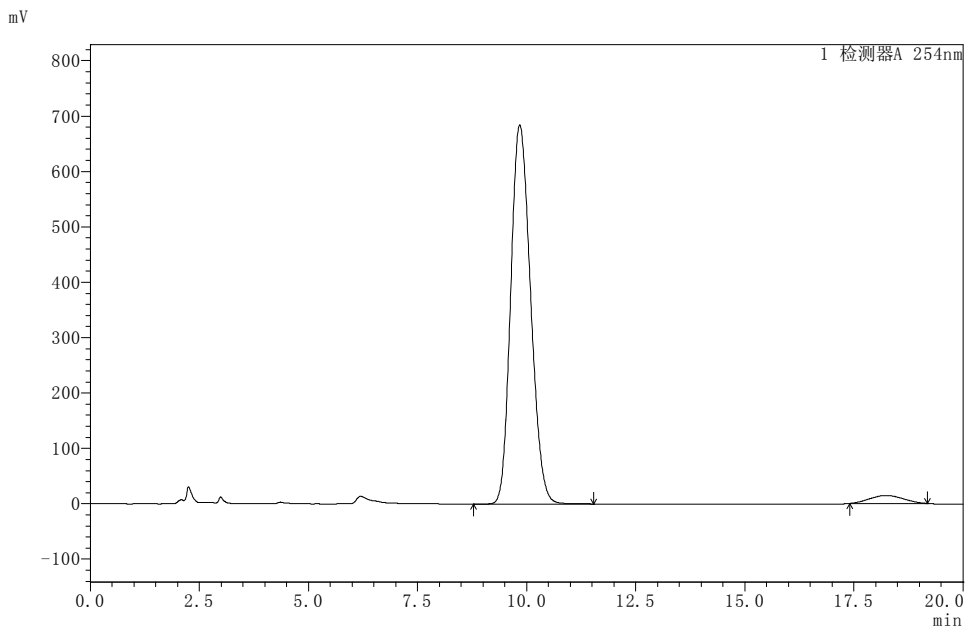
HPLC trace

4a-racemic



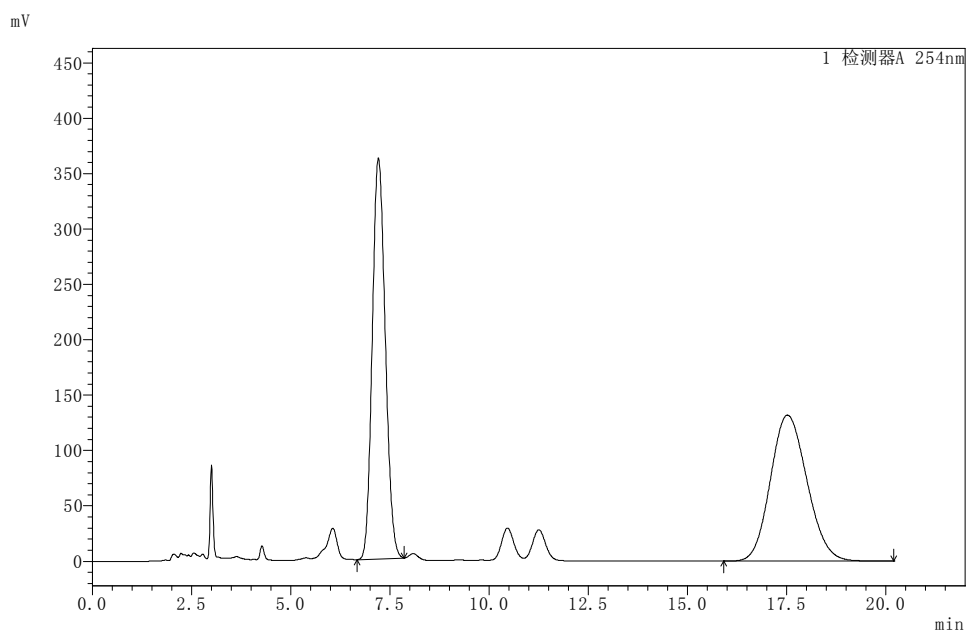
	Retention time	Area	Height	Area%
1	10.064	23754816	746927	49.750
2	17.686	23993670	393904	50.250
Total		47748486	1140831	100.000

4a



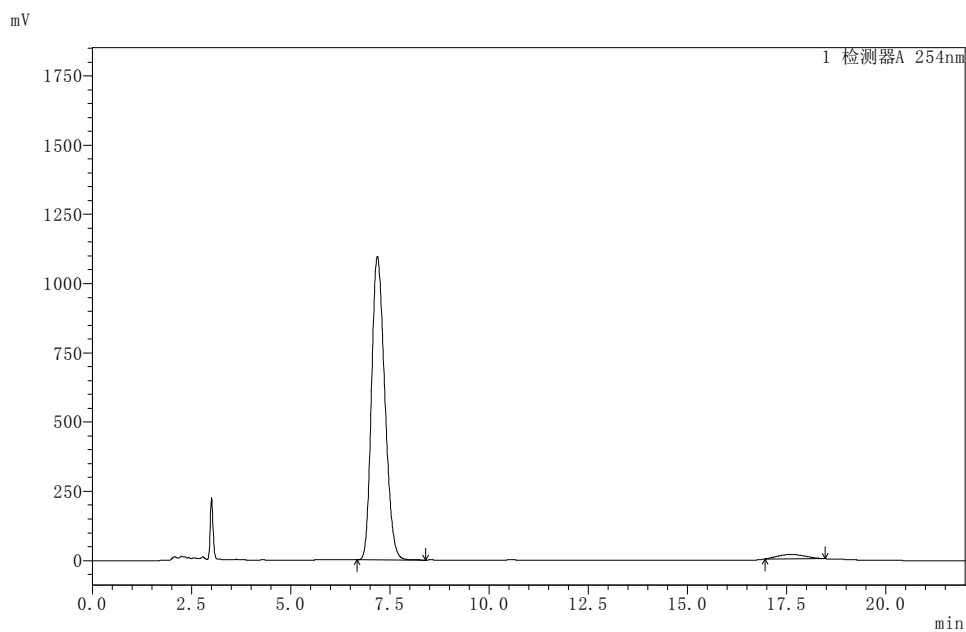
	Retention time	Area	Height	Area%
1	9.844	21634839	684388	96.537
2	18.241	776198	14468	3.463
Total		22411037	698856	100.000

4b-racemic



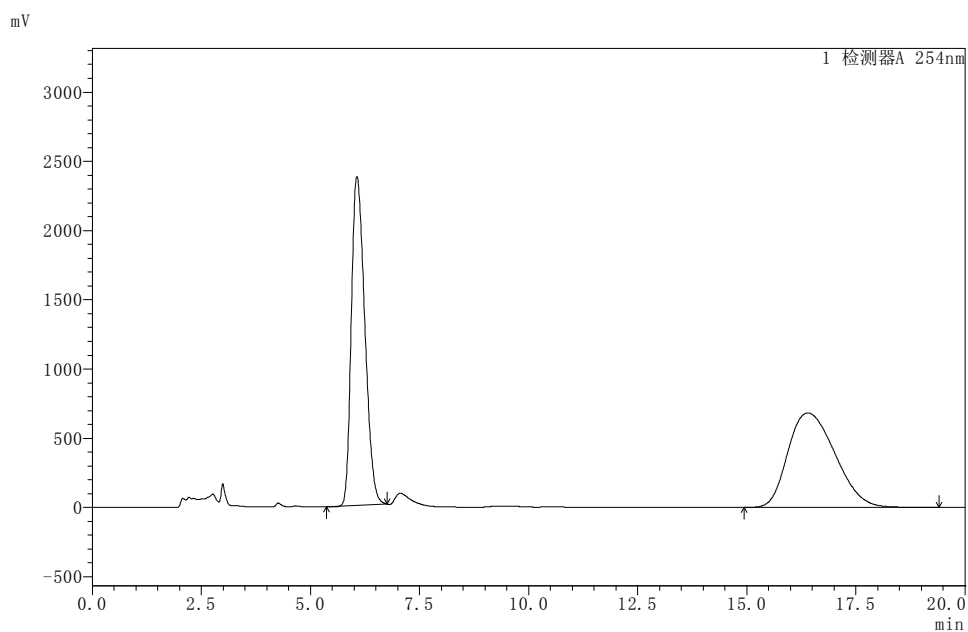
	Retention time	Area	Height	Area%
1	7.215	8260935	362186	49.382
2	17.528	8467705	131867	50.618
Total		16728640	494054	100.000

4b



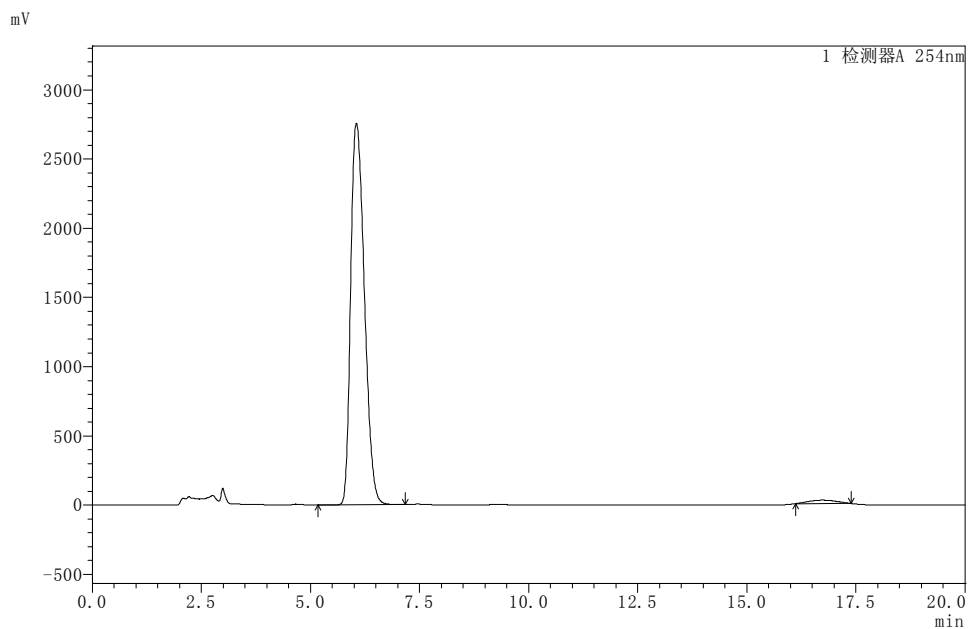
	Retention time	Area	Height	Area%
1	7.189	25493912	1095440	97.057
2	17.618	772934	15822	2.943
Total		26266847	1111261	100.000

4c-racemic



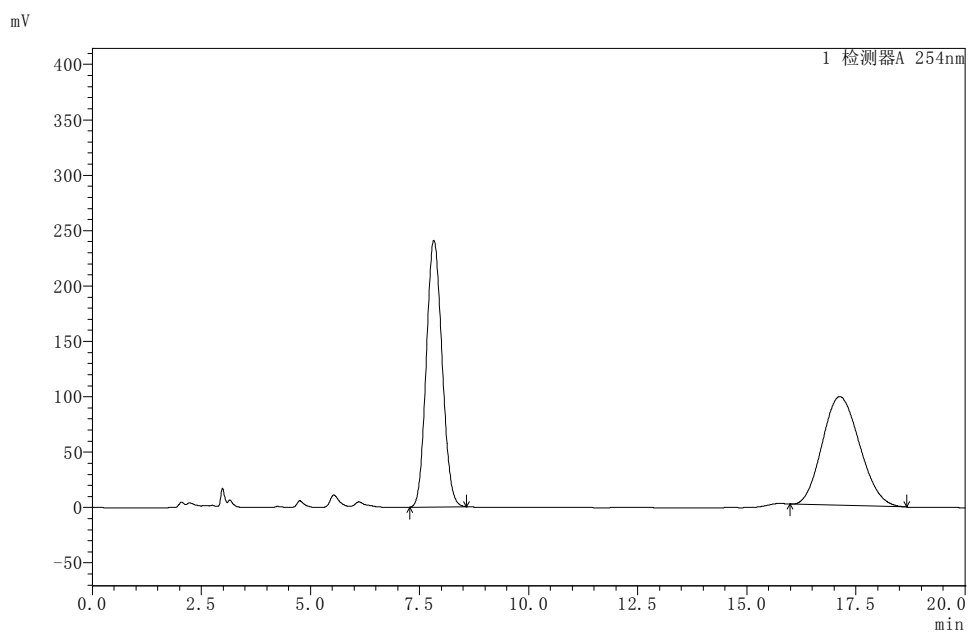
	Retention time	Area	Height	Area%
1	6.068	51173493	2376374	49.938
2	16.401	51300320	682096	50.062
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4c



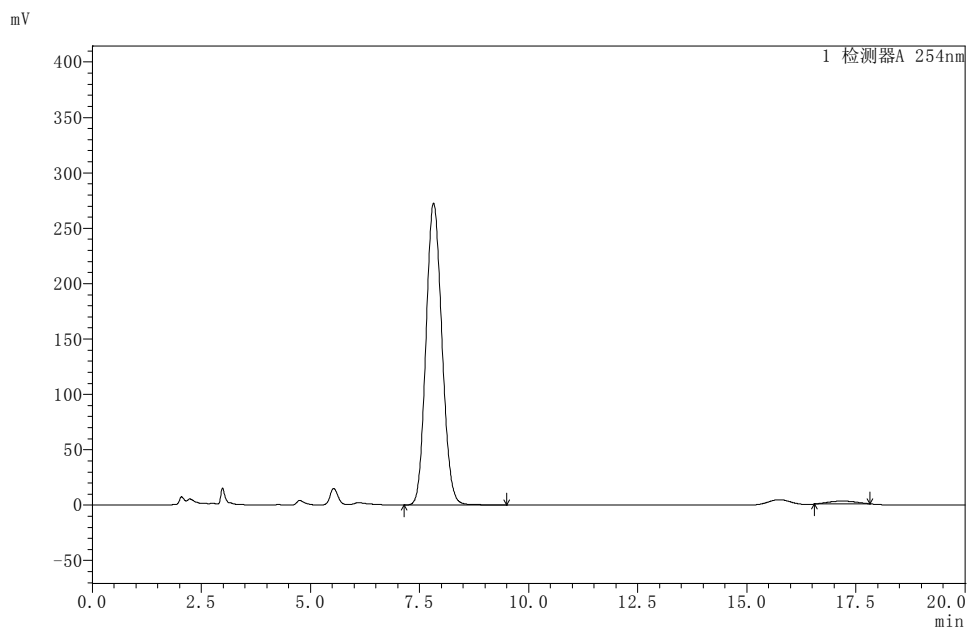
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1	6.055	60166576	2754601	98.195
2	16.738	1106054	24699	1.805
Total		61272630	2779300	100.000

4d-racemic



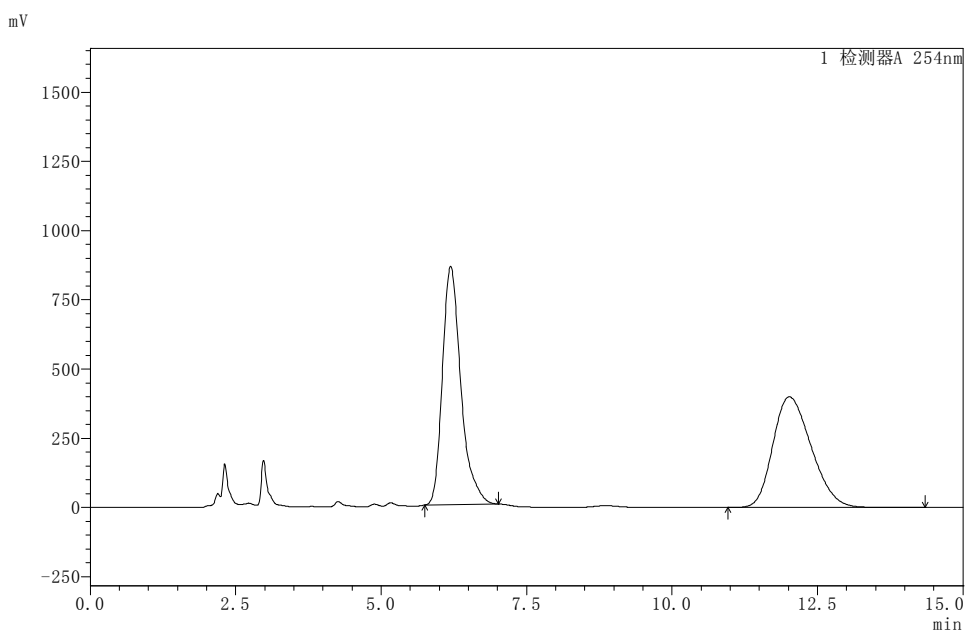
	Retention time	Area	Height	Area%
1	7.830	6062370	240895	50.809
2	17.133	5869339	98224	49.191
Total		11931709	339119	100.000

4d



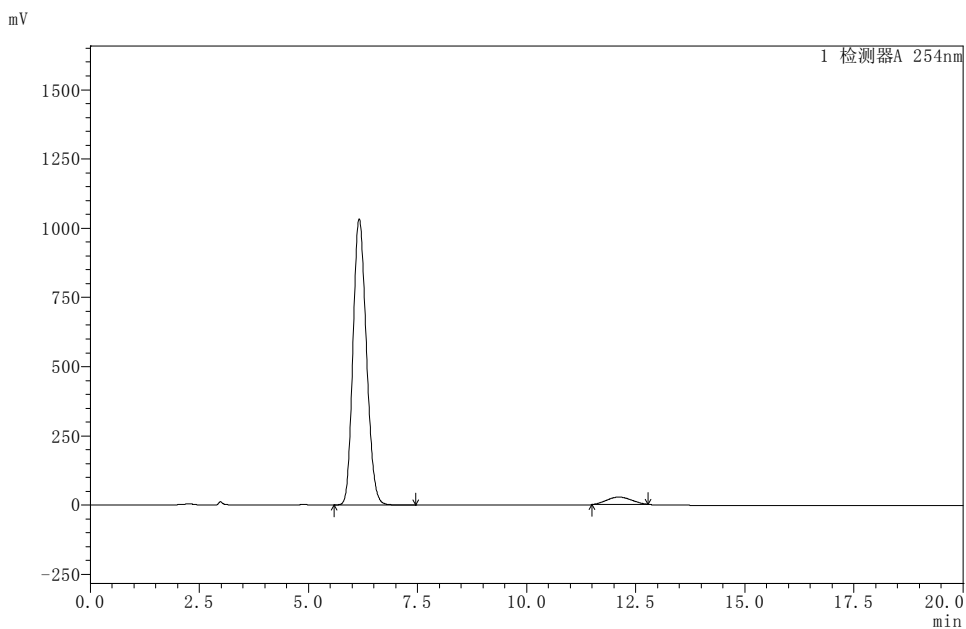
	Retention time	Area	Height	Area%
1	7.823	6940496	272535	98.691
2	17.186	92056	2561	1.309
Total		7032552	275096	100.000

4e-racemic



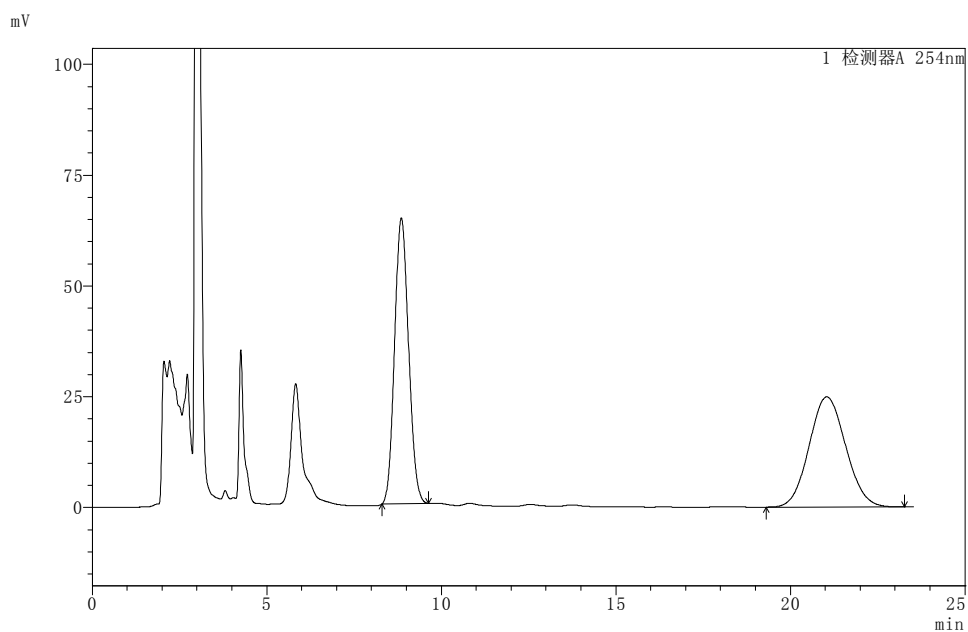
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1	6.196	19017583	859909	50.956
2	12.018	18303693	399619	49.044
Total		37321276	1259528	100.000

4e



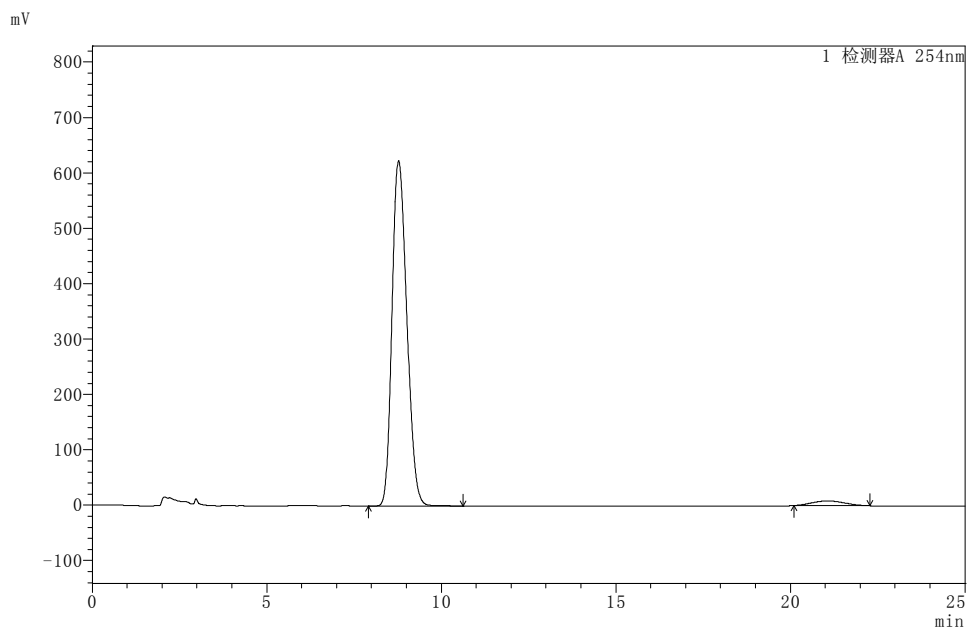
	Retention time	Area	Height	Area%
1	6.164	22144341	1033873	95.461
2	12.116	1052949	26724	4.539
Total		23197290	1060596	100.000

4f-racemic



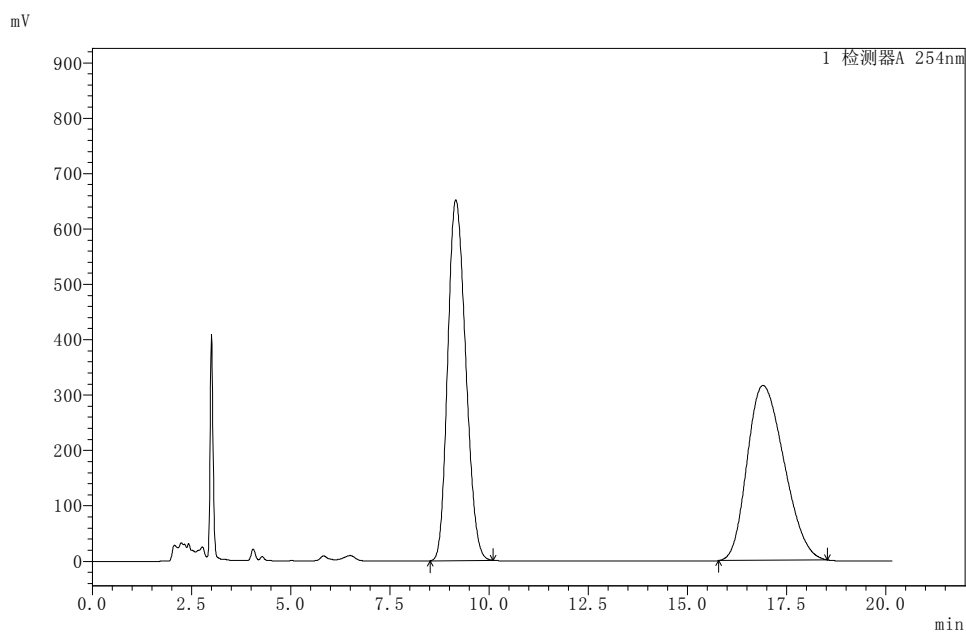
	Retention time	Area	Height	Area%
1	8.855	1803520	64533	49.865
2	21.044	1813295	24881	50.135
Total		3616815	89414	100.000

4f



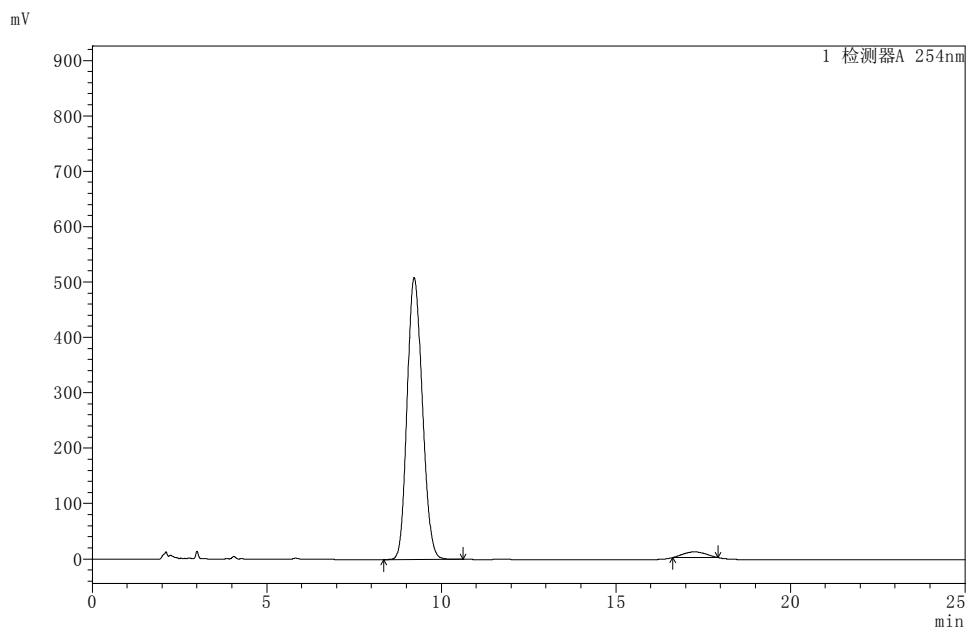
	Retention time	Area	Height	Area%
1	8.777	18393941	623390	97.070
2	21.070	555127	8496	2.930
Total		18949068	631887	100.000

4g-racemic



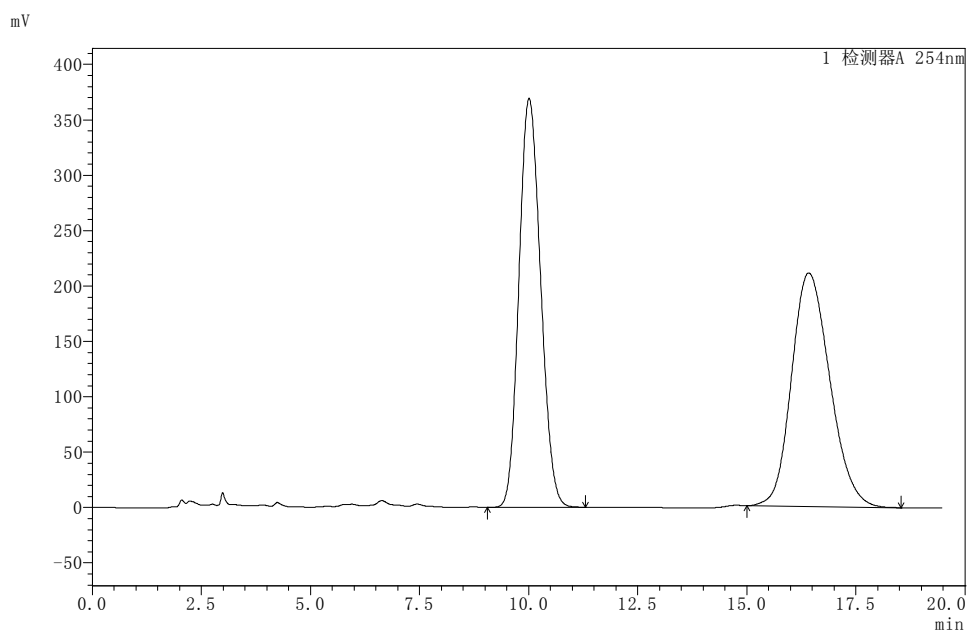
	Retention time	Area	Height	Area%
1	9.167	20500754	651248	50.095
2	16.912	20422928	315700	49.905
Total		40923682	966948	100.000

4g



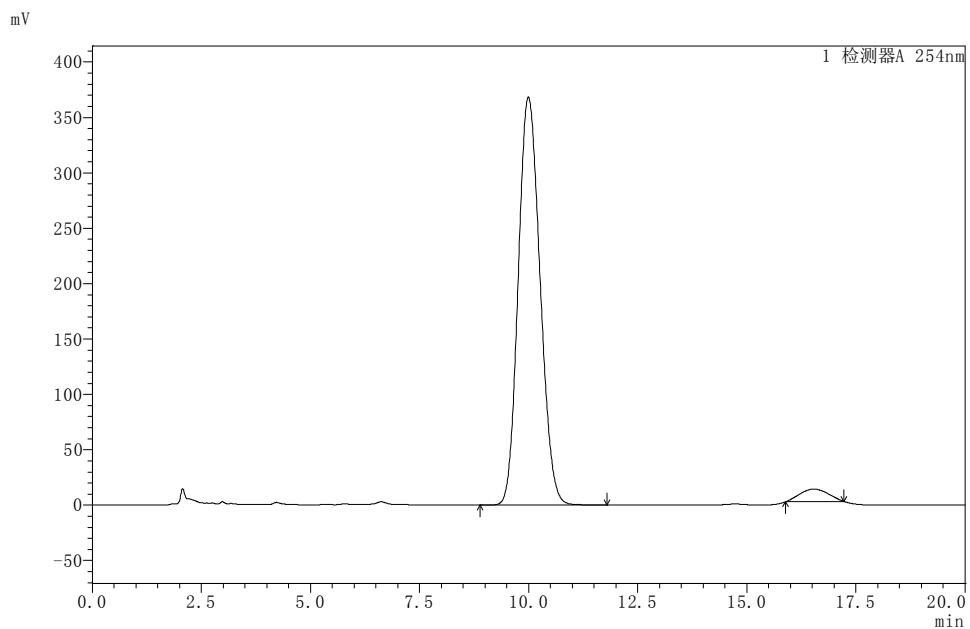
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1	9.224	15640424	509037	97.074
2	17.254	471413	12514	2.926
Total		16111837	521551	100.000

4h-racemic



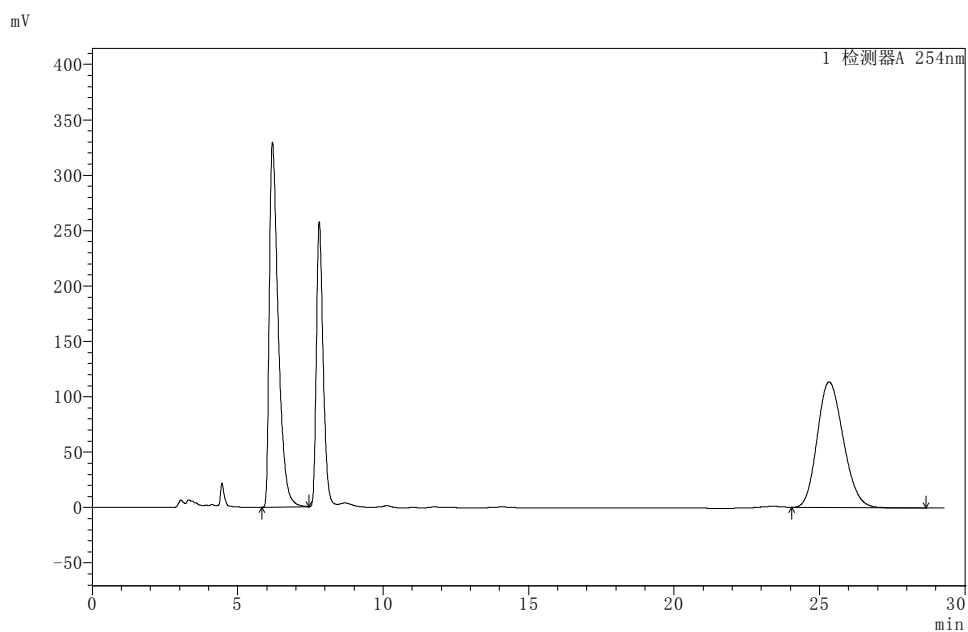
	Retention time	Area	Height	Area%
1	10.012	12758180	369165	49.718
2	16.422	12902679	211012	50.282
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4h



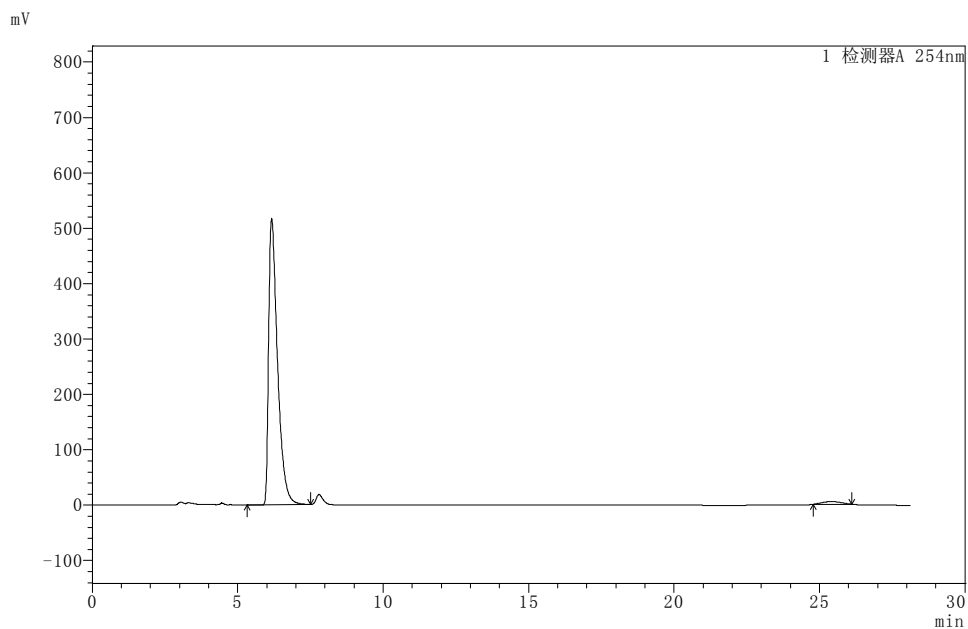
	Retention time	Area	Height	Area%
1	9.996	12813961	368444	96.138
2	16.542	514739	11336	3.862
Total		13328701	379780	100.000

4i-racemic



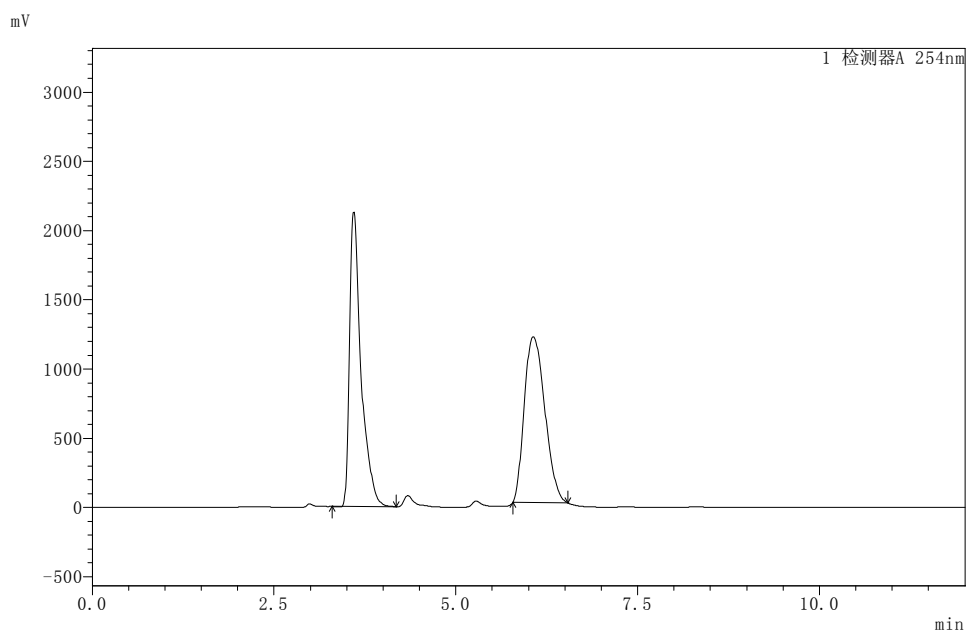
	Retention time	Area	Height	Area%
1	6.199	7046497	329341	49.894
2	25.333	7076553	113497	50.106
Total		14123049	442838	100.000

4i



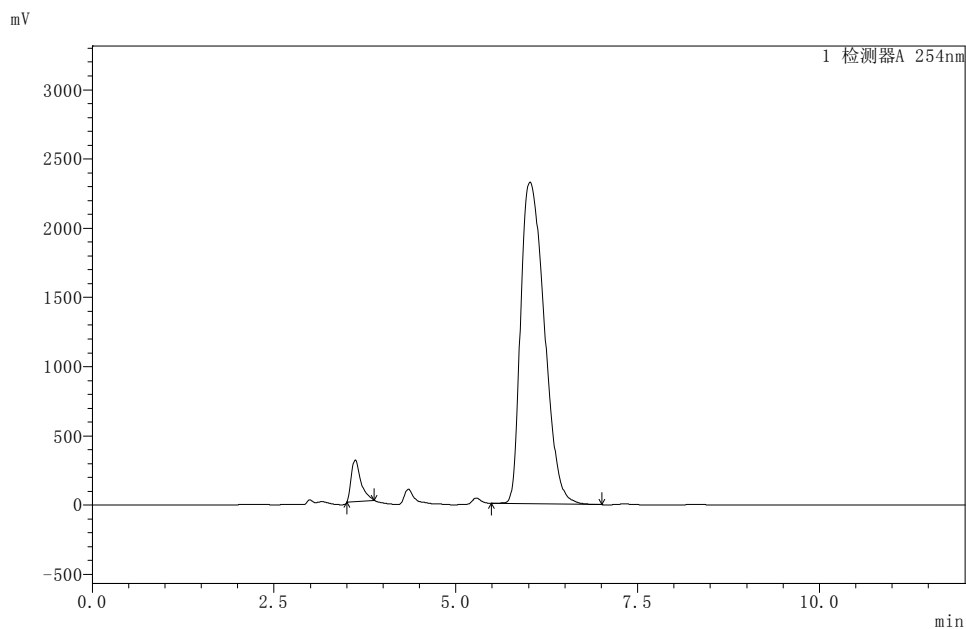
	Retention time	Area	Height	Area%
1	6.170	10975630	517856	98.026
2	25.414	221055	4798	1.974
Total		11196685	522654	100.000

4j-racemic



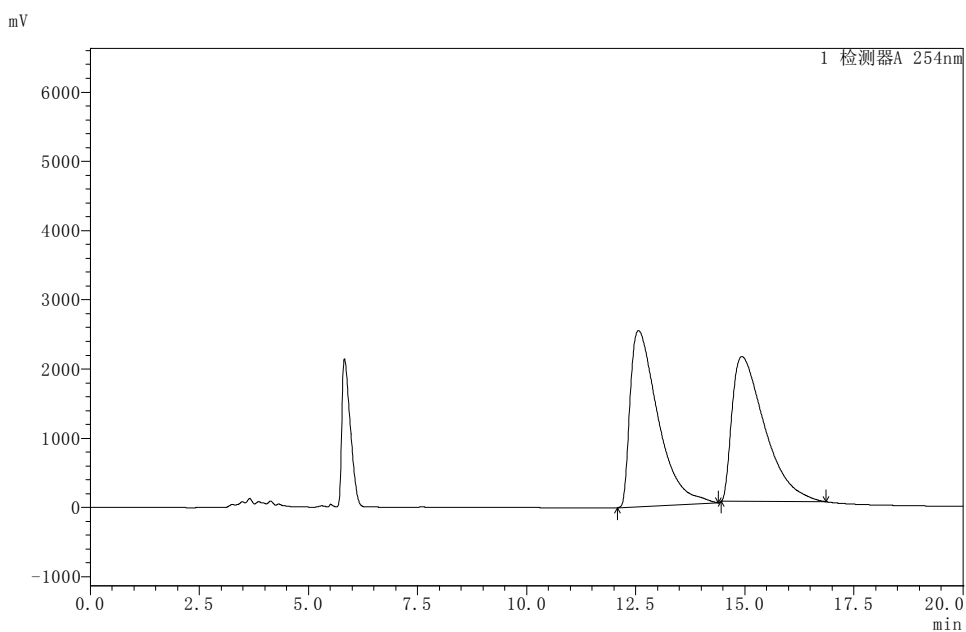
	Retention time	Area	Height	Area%
1	3.596	23433187	2126002	49.802
2	6.065	23619604	1198254	50.198
Total		47052790	3324257	100.000

4j



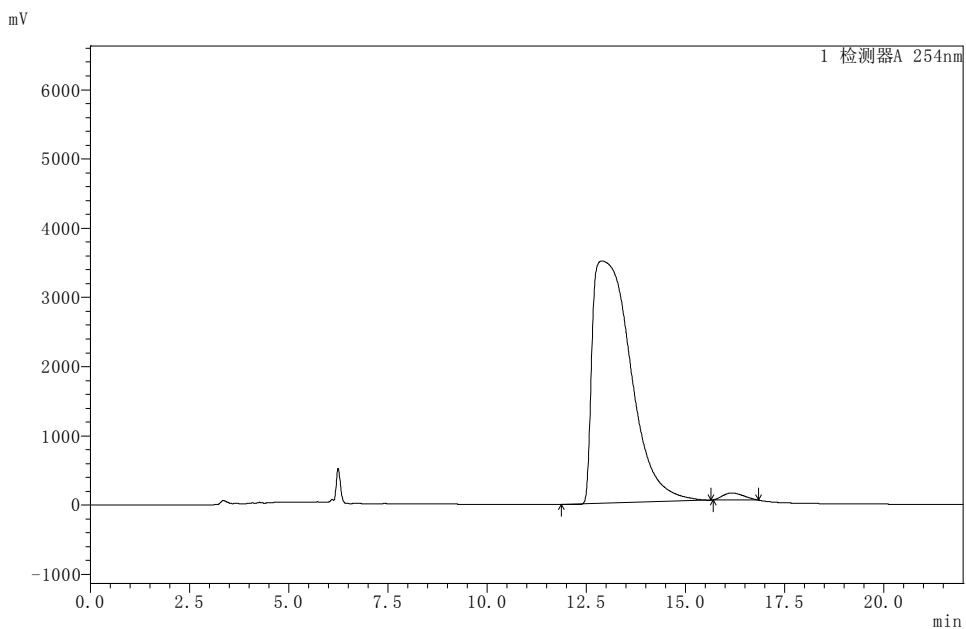
	Retention time	Area	Height	Area%
1	3.615	2762783	301024	4.997
2	6.018	52521941	2324327	95.003
Total		55284724	2625351	100.000

4k-racemic



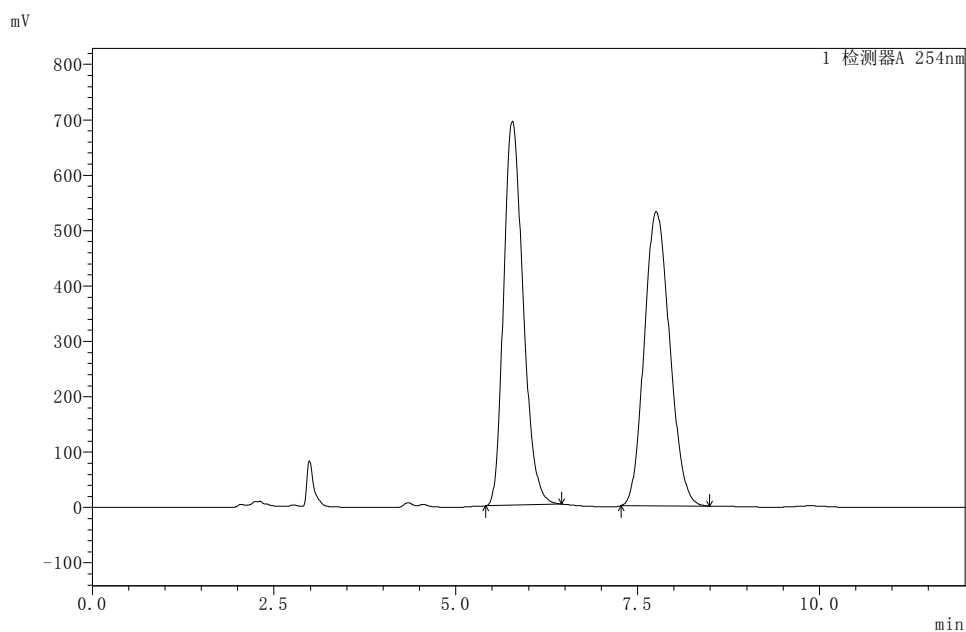
	Retention time	Area	Height	Area%
1	12.567	113256761	2544949	50.847
2	14.937	109481558	2094785	49.153
Total		222738319	4639734	100.000

4k



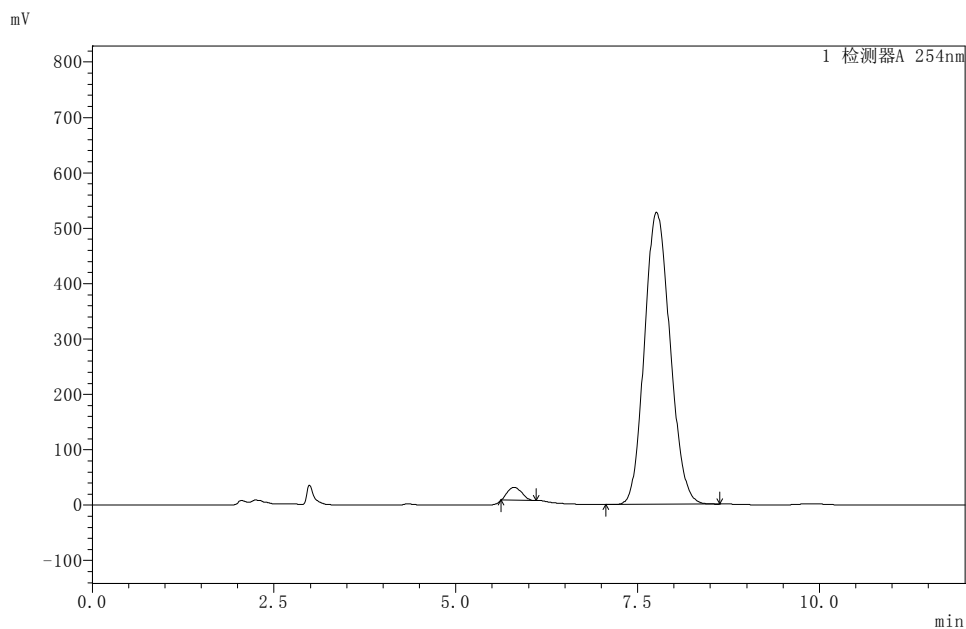
	Retention time	Area	Height	Area%
1	12.901	235634327	3498405	98.534
2	16.177	3505799	101469	1.466
Total		239140126	3599873	100.000

4I-racemic



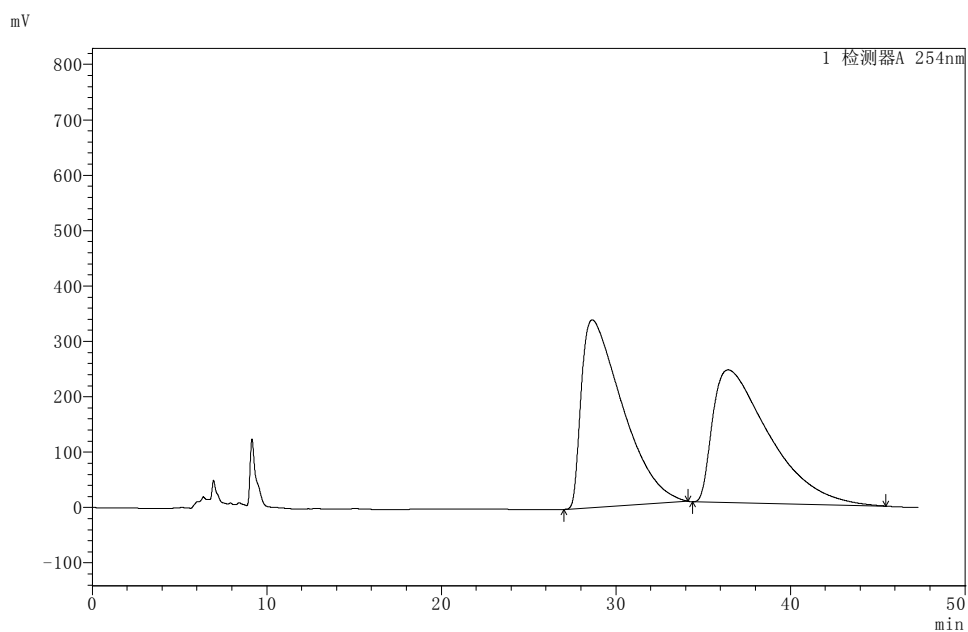
	Retention time	Area	Height	Area%
1	5.777	12981475	693659	50.039
2	7.756	12961362	531443	49.961
Total		25942837	1225102	100.000

4I



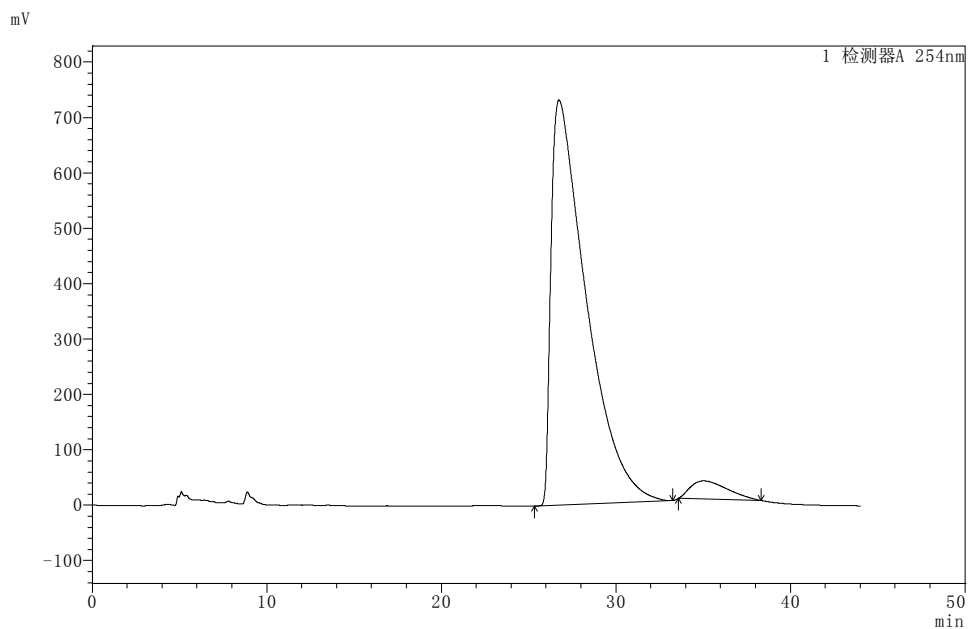
	Retention time	Area	Height	Area%
1	5.801	316336	23211	2.388
2	7.760	12931066	527665	97.612
Total		13247403	550876	100.000

4m-racemic



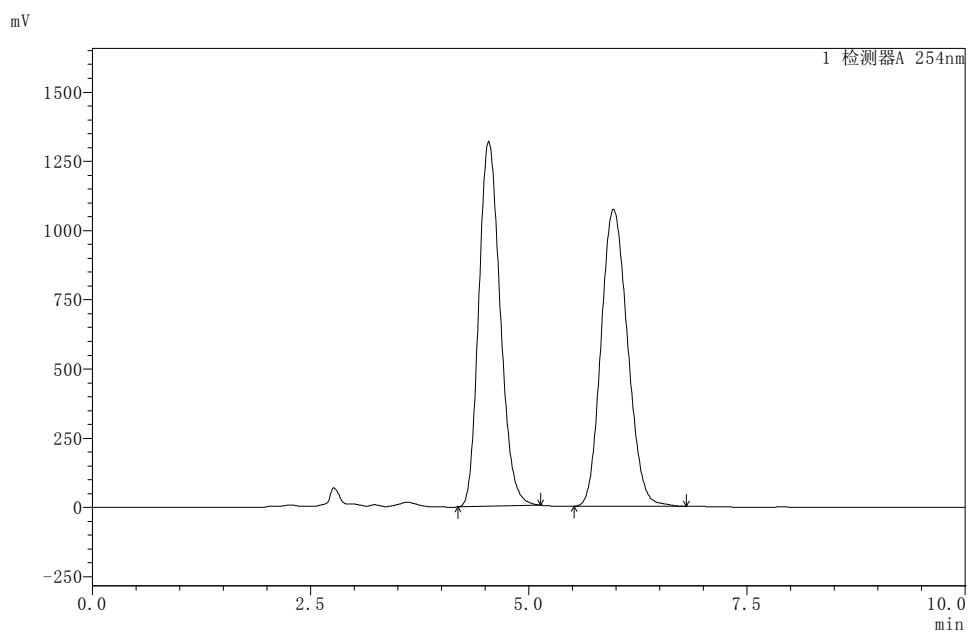
	Retention time	Area	Height	Area%
1	28.647	55578097	338980	50.587
2	36.438	54287287	239694	49.413
Total		109865384	578674	100.000

4m



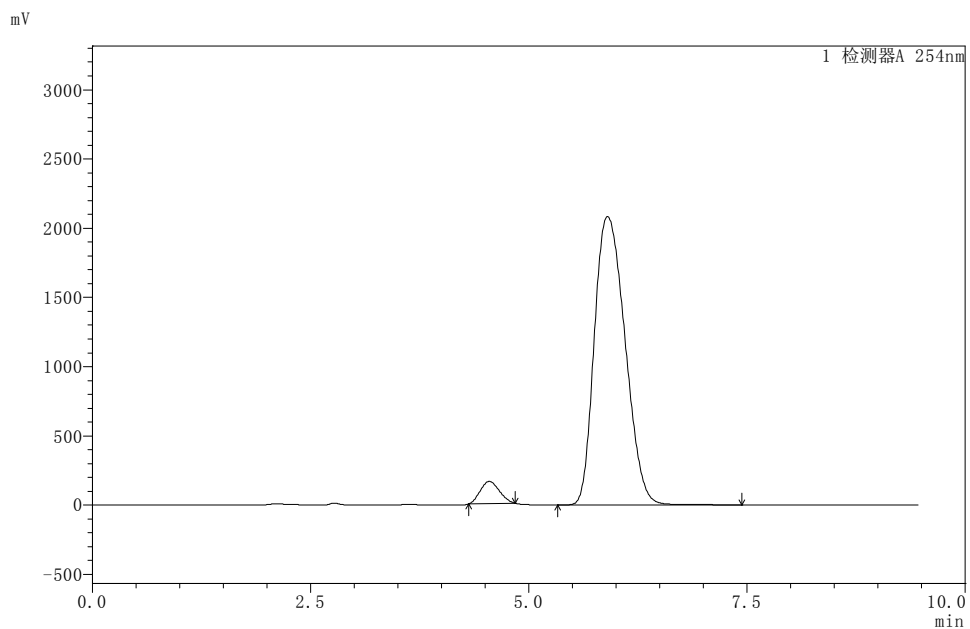
	Retention time	Area	Height	Area%
1	26.748	102633981	731241	95.547
2	35.032	4783628	32739	4.453
Total		107417609	763980	100.000

4n-racemic



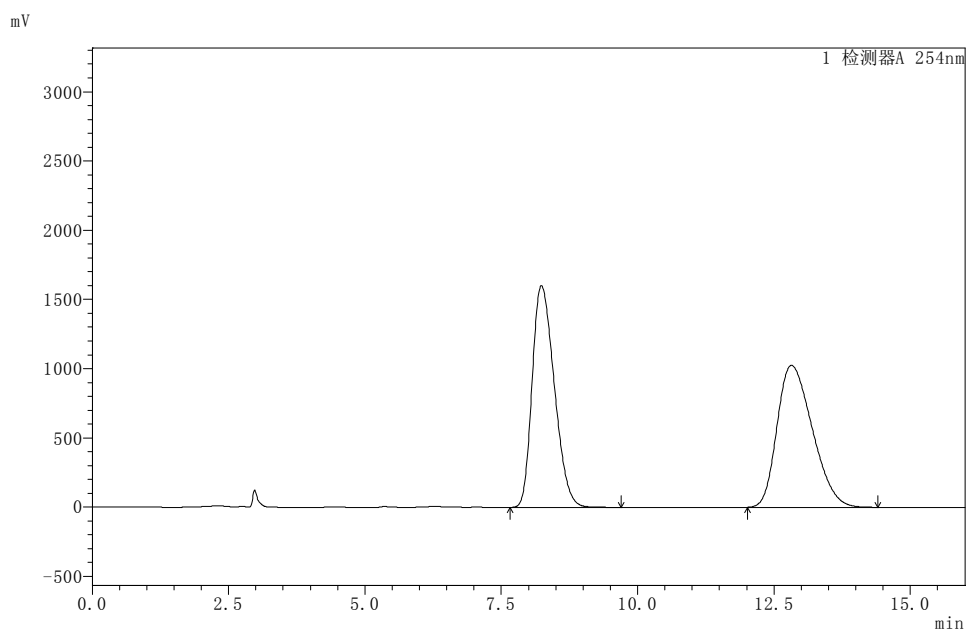
	Retention time	Area	Height	Area%
1	4.543	22495179	1318303	49.757
2	5.972	22715102	1072257	50.243
Total		45210281	2390560	100.000

4n



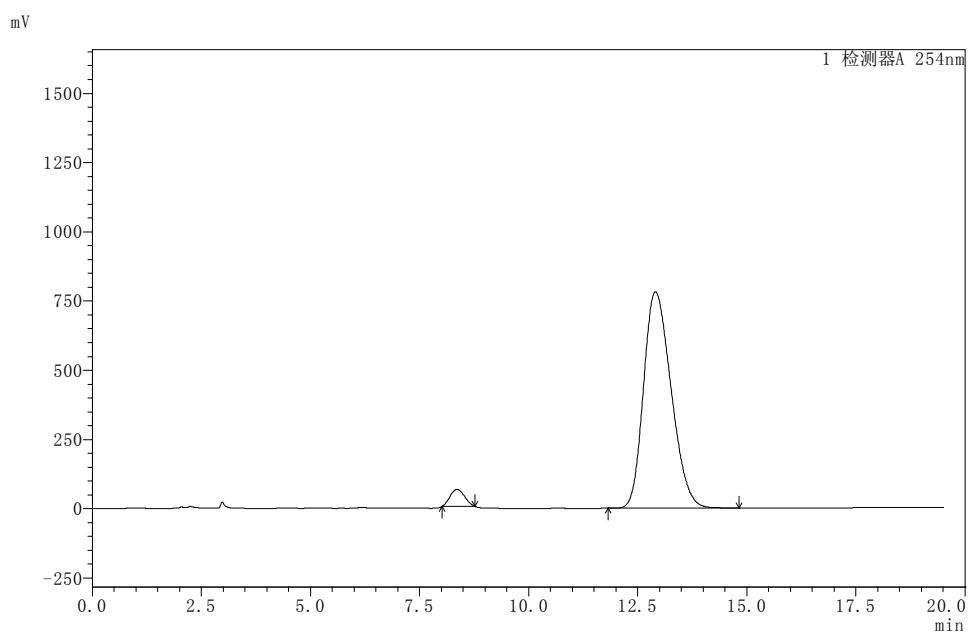
	Retention time	Area	Height	Area%
1	4.550	2497273	160426	4.467
2	5.905	50975815	2084326	95.533
Total		53473088	2244752	100.000

4o-racemic



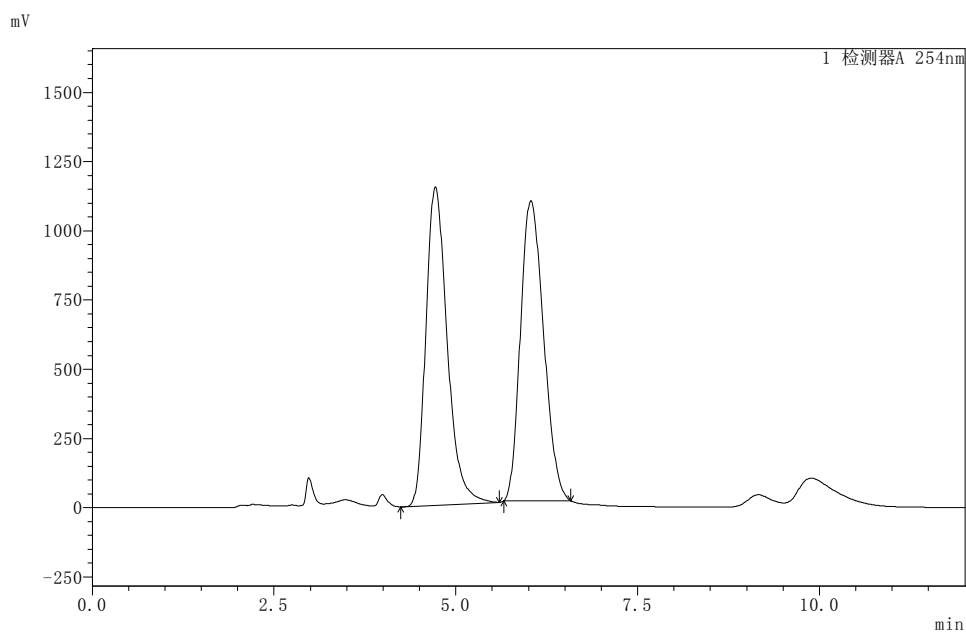
	Retention time	Area	Height	Area%
1	8.236	45363245	1601737	49.585
2	12.822	46122249	1025398	50.415
Total		91485494	2627135	100.000

4o



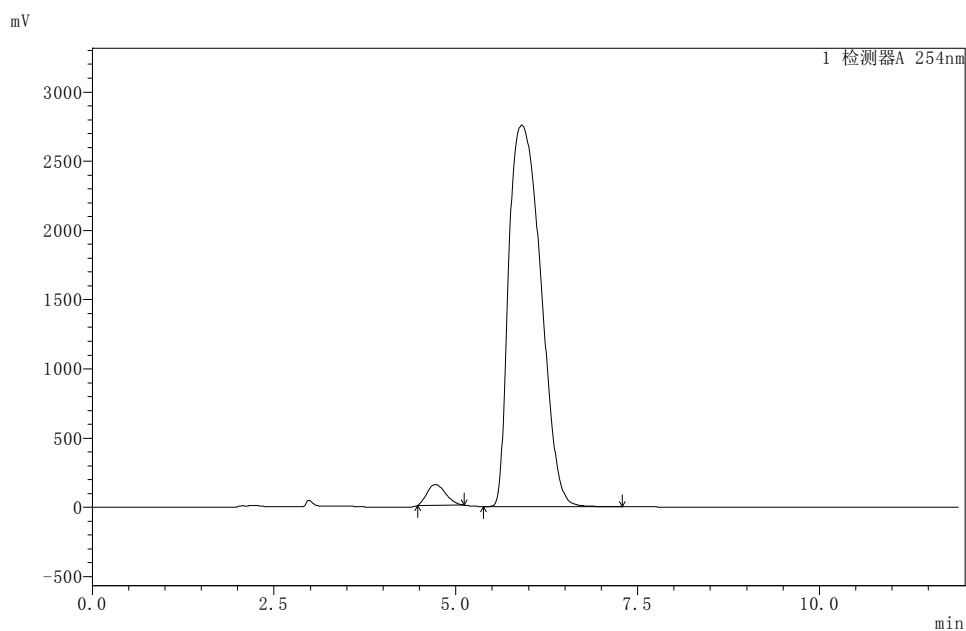
	Retention time	Area	Height	Area%
1	8.361	1416619	61655	3.962
2	12.908	34336086	781656	96.038
Total		35752705	843311	100.000

4p-racemic



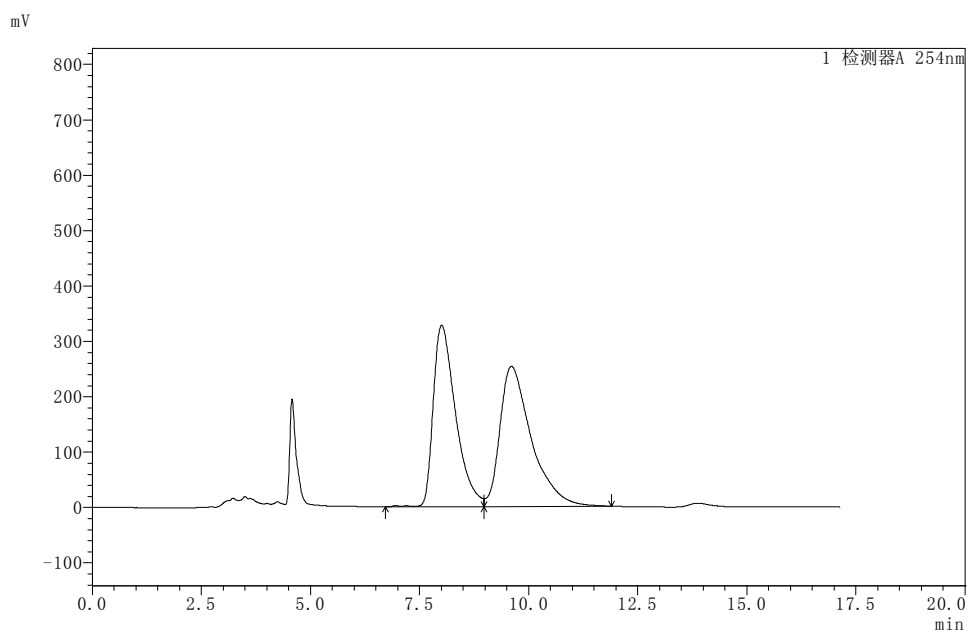
	Retention time	Area	Height	Area%
1	4.718	23461191	1150135	49.432
2	6.031	24000701	1083743	50.568
Total		47461893	2233879	100.000

4p



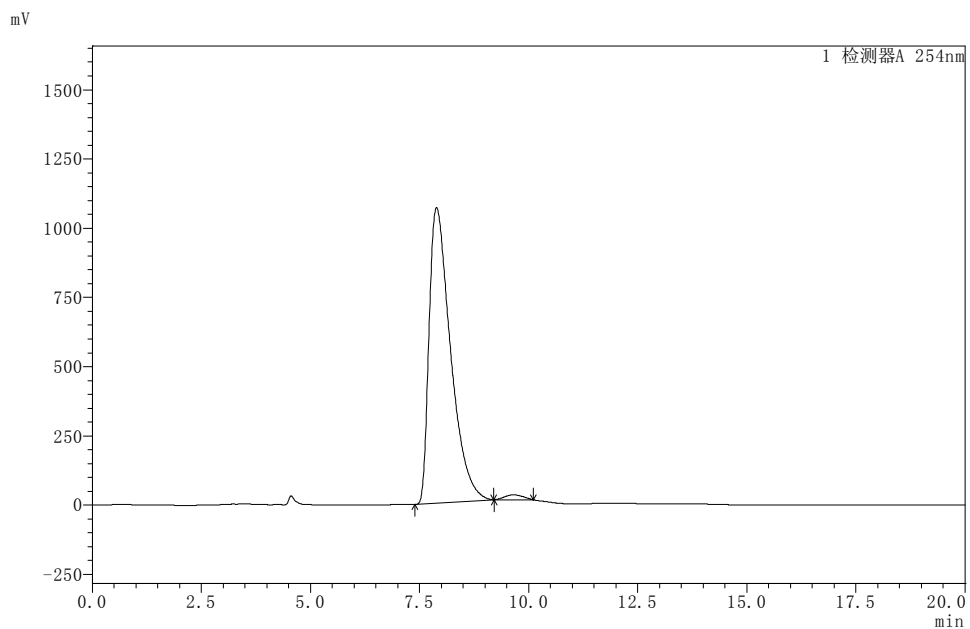
	Retention time	Area	Height	Area%
1	4.720	2594691	150195	2.990
2	5.907	84184284	2754902	97.010
Total		86778975	2905097	100.000

4q-racemic



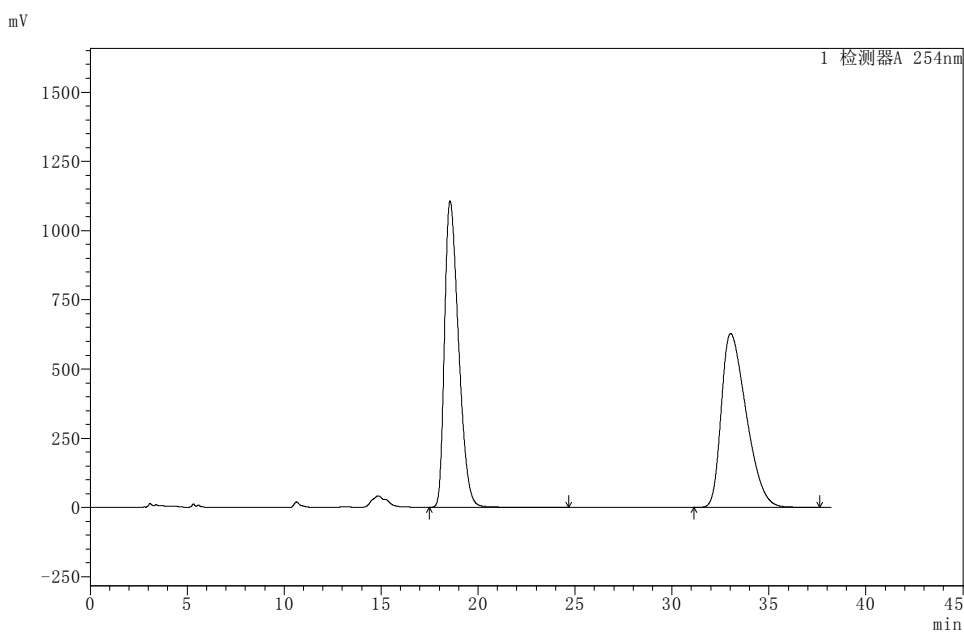
	Retention time	Area	Height	Area%
1	8.009	11976614	328028	49.042
2	9.609	12444523	253356	50.958
Total		24421137	581384	100.000

4q



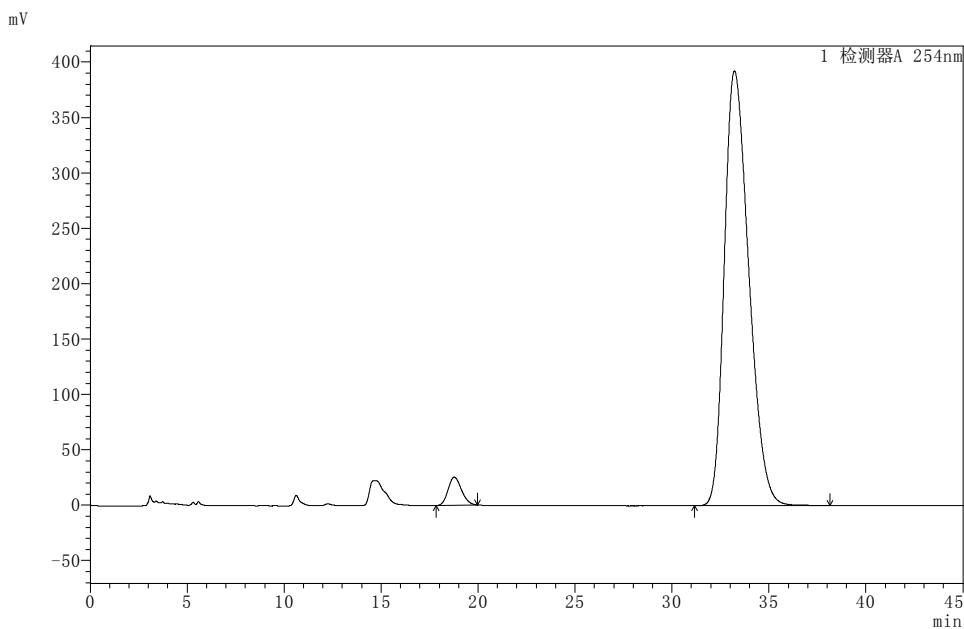
	Retention time	Area	Height	Area%
1	7.892	36552546	1068951	98.593
2	9.658	521455	17643	1.407
Total		37074001	1086593	100.000

4r-racemic



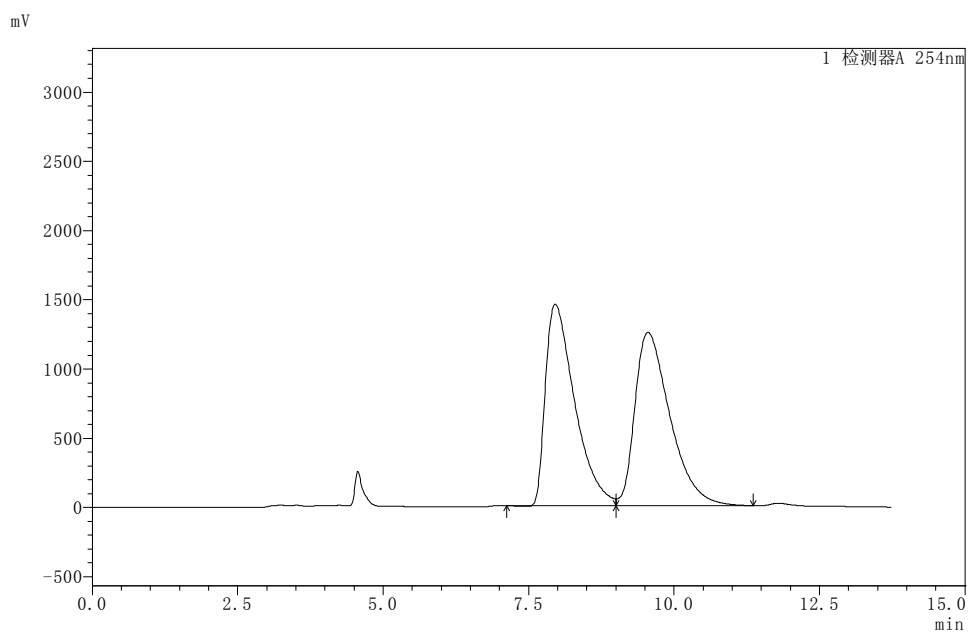
	Retention time	Area	Height	Area%
1	18.560	55608378	1106191	49.725
2	33.027	56223154	627980	50.275
Total		111831532	1734171	100.000

4r



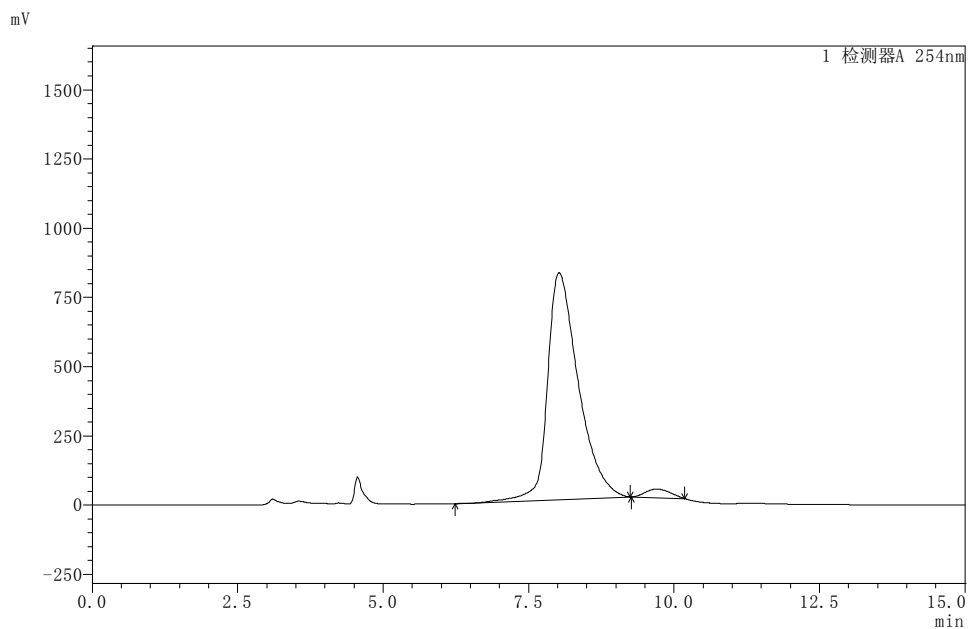
	Retention time	Area	Height	Area%
1	18.777	1227599	25559	3.447
2	33.223	34385877	392549	96.553
Total		35613476	418108	100.000

4s-racemic



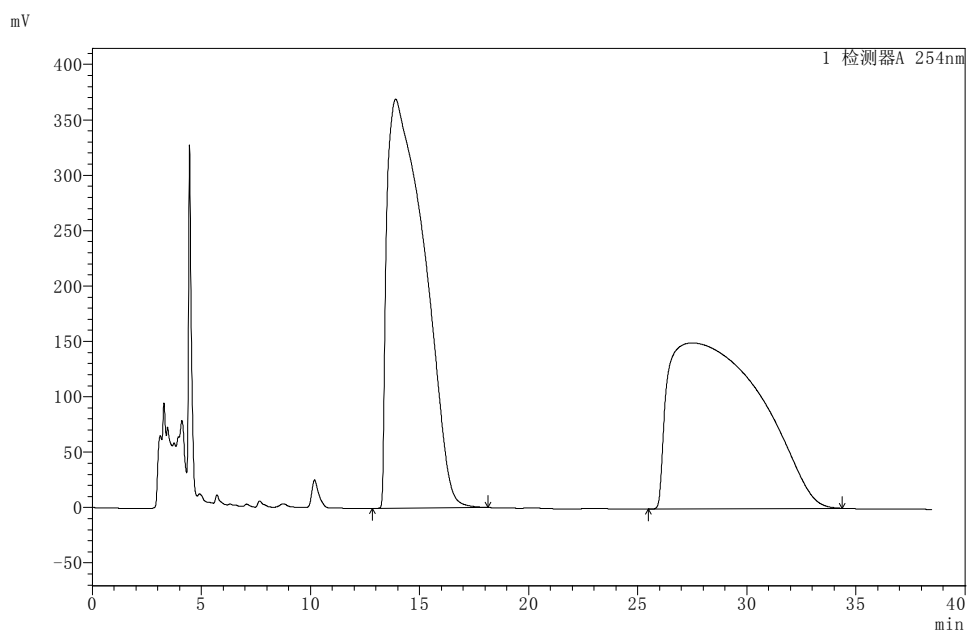
	Retention time	Area	Height	Area%
1	7.959	51012797	1456167	49.154
2	9.553	52769208	1253153	50.846
Total		103782004	2709320	100.000

4s



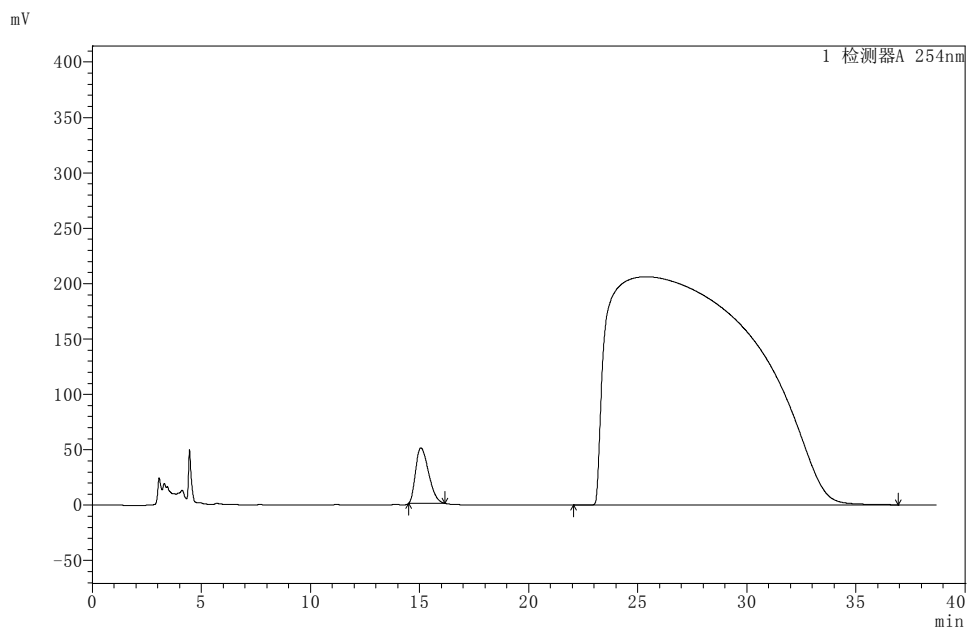
	Retention time	Area	Height	Area%
1	8.026	30229458	819798	97.050
2	9.705	918969	31134	2.950
Total		31148427	850932	100.000

4t-racemic



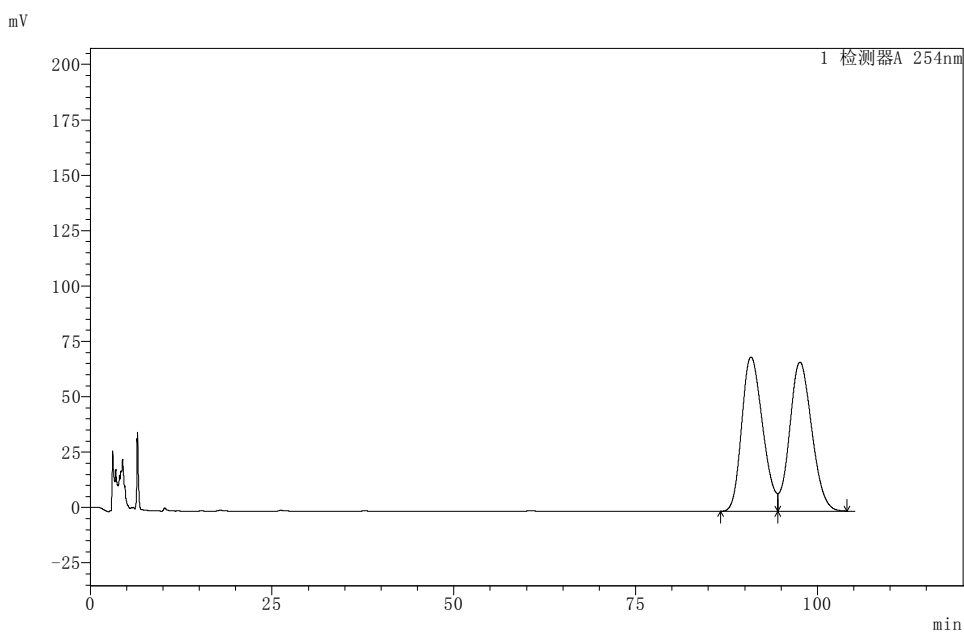
	Retention time	Area	Height	Area%
1	13.912	43791001	369173	49.513
2	27.514	44652812	149804	50.487
Total		88443813	518977	100.000

4t



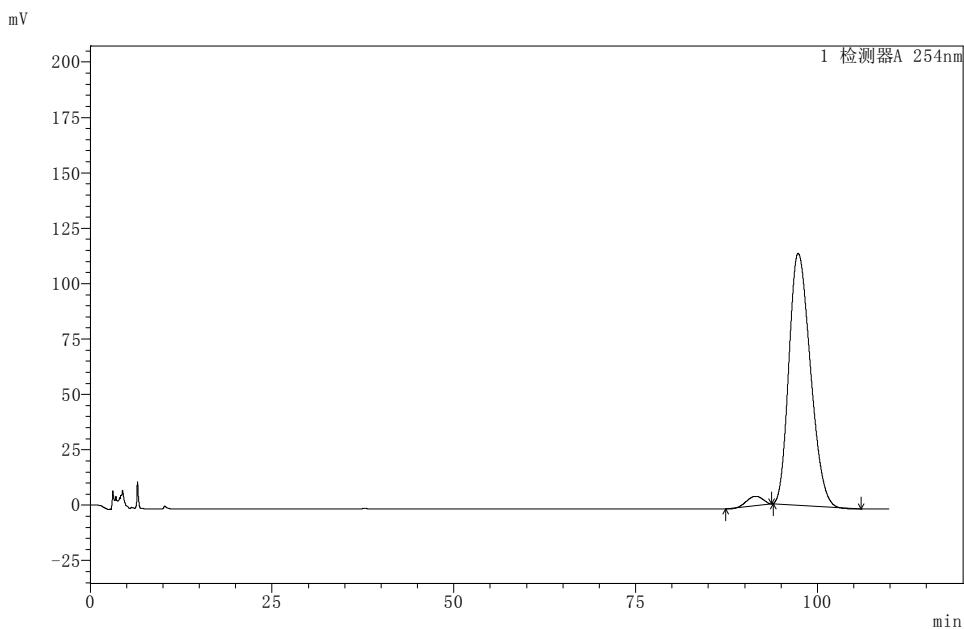
	Retention time	Area	Height	Area%
1	15.069	1973486	50088	1.997
2	25.384	96849093	206126	98.003
Total		98822579	256214	100.000

4u-racemic



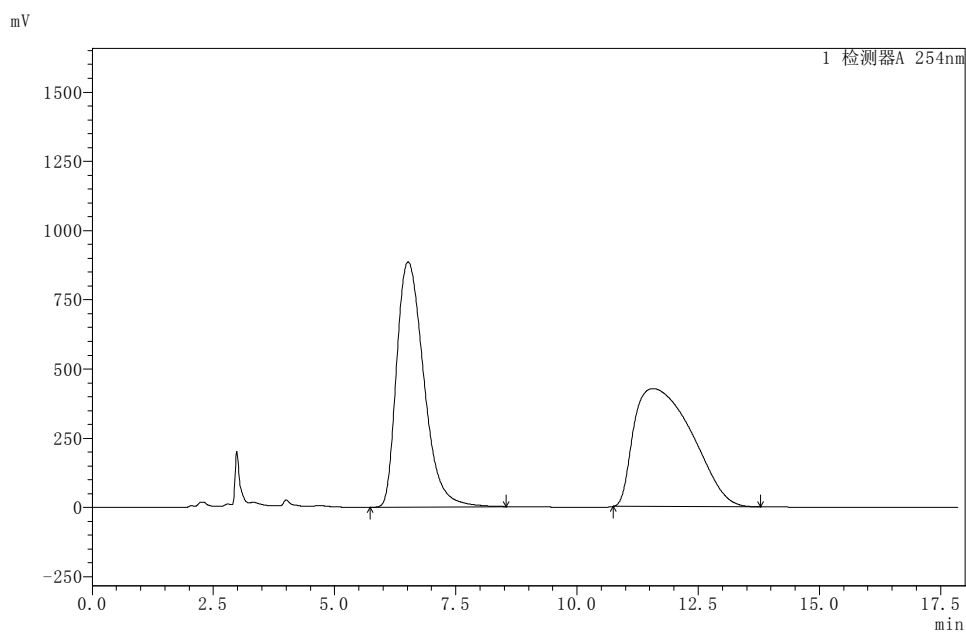
	Retention time	Area	Height	Area%
1	90.870	13976110	69652	49.523
2	97.608	14245505	67289	50.477
Total		28221615	136941	100.000

4u



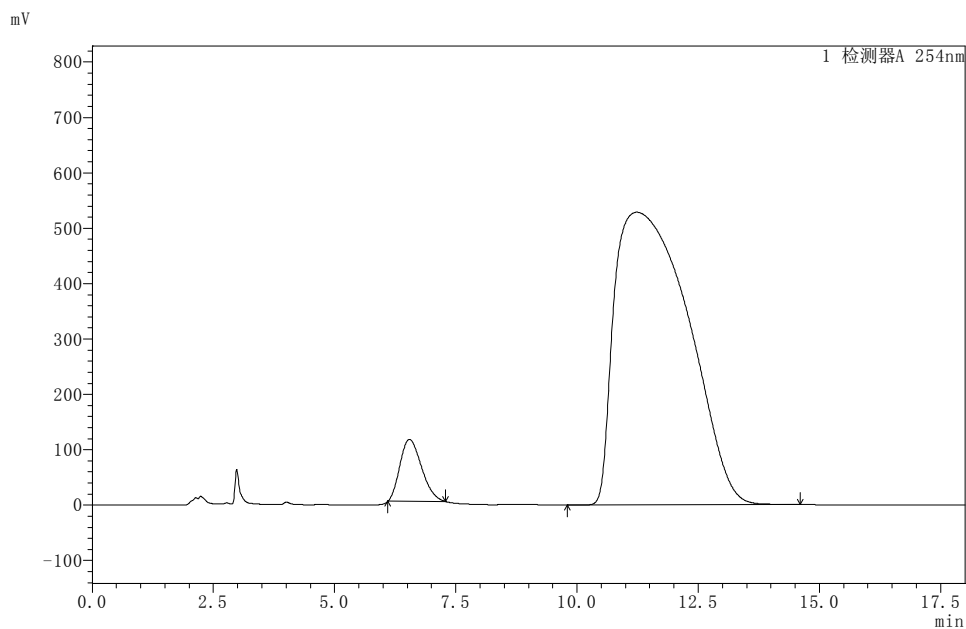
	Retention time	Area	Height	Area%
1	91.475	572746	4290	2.394
2	97.354	23350011	113635	97.606
Total		23922757	117925	100.000

4v-racemic



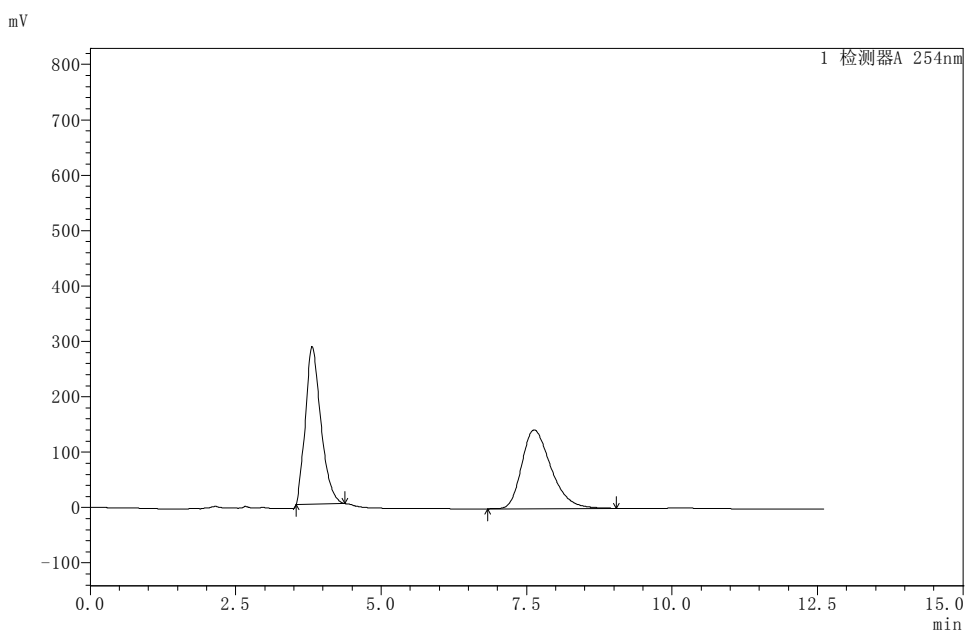
	Retention time	Area	Height	Area%
1	6.516	34485065	885477	49.177
2	11.566	35639223	425966	50.823
Total		70124288	1311442	100.000

4v



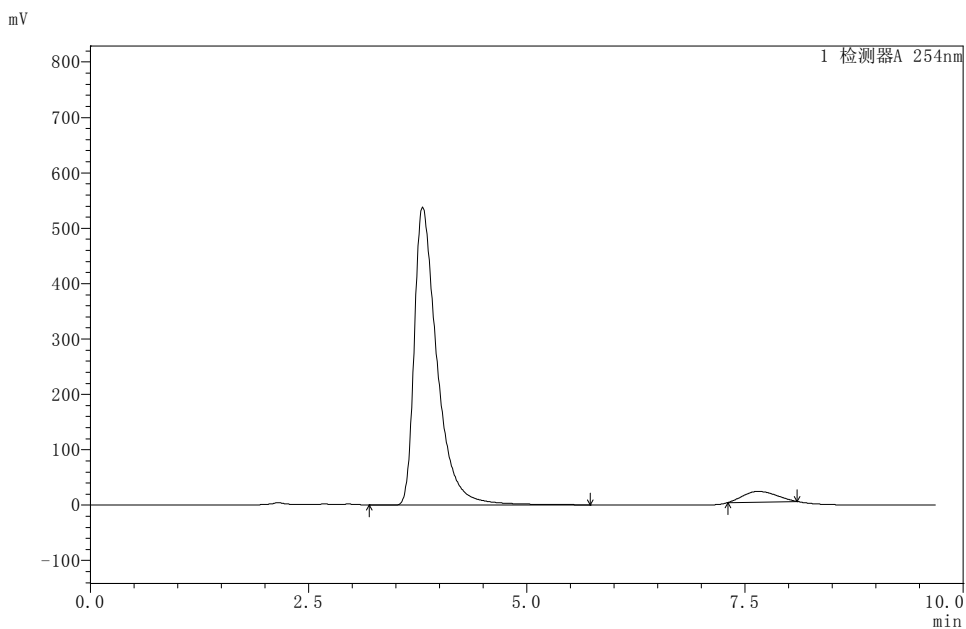
	Retention time	Area	Height	Area%
1	6.544	2878554	111826	4.833
2	11.234	56685979	528284	95.167
Total		59564533	640110	100.000

4w-racemic



	Retention time	Area	Height	Area%
1	3.814	5188732	284902	50.512
2	7.631	5083544	142152	49.488
Total		10272276	427055	100.000

4w



	Retention time	Area	Height	Area%
1	3.809	9714409	537609	95.028
2	7.660	508262	19173	4.972
Total		10222671	556782	100.000