

[2.2]Paracyclophane-Based N-Heterocyclic Carbene as Efficient Catalyst or as Ligand of Copper Catalyst for Asymmetric α - Silylation of N-Tosylaldimines

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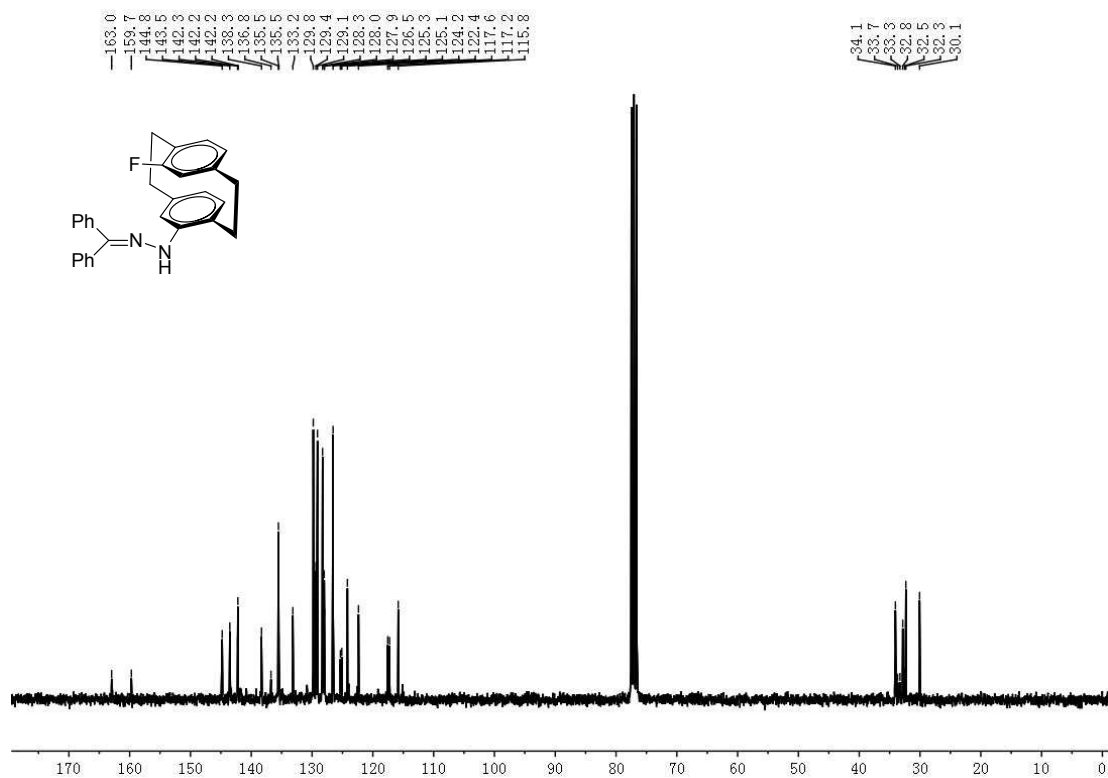
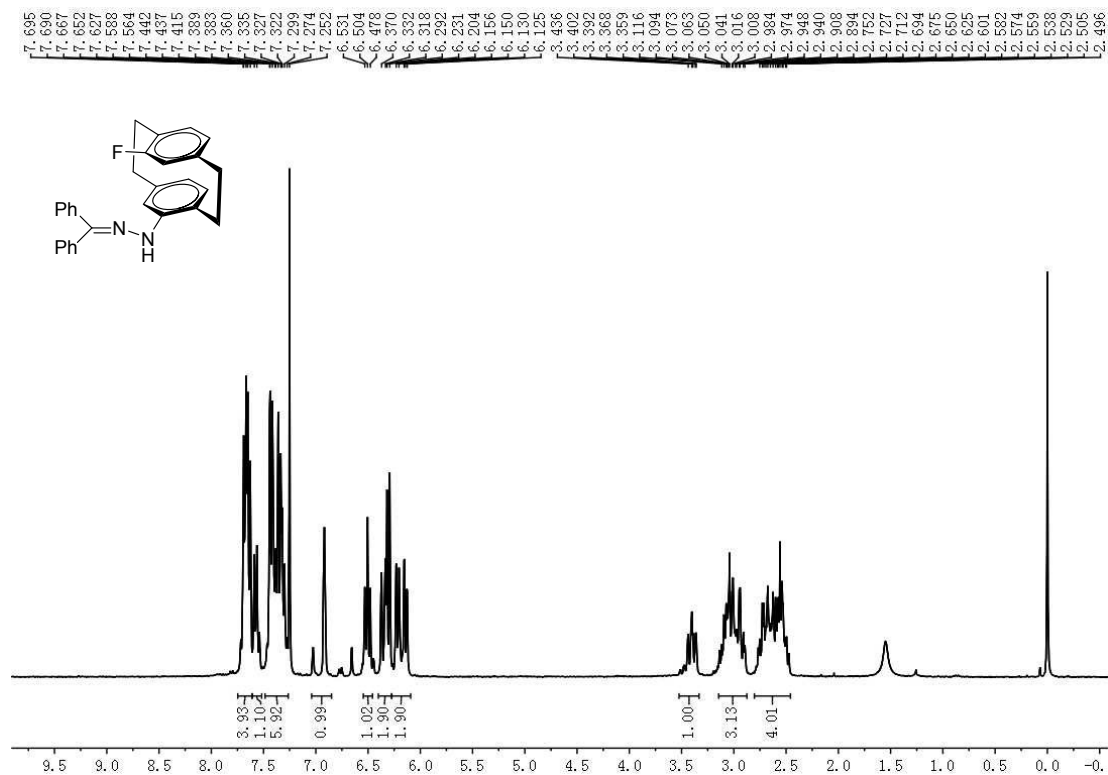
^c School of Chemistry and Chemical Engineering Hebei Normal University For Nationalities Higher Education Park, Chengde 0670000, China

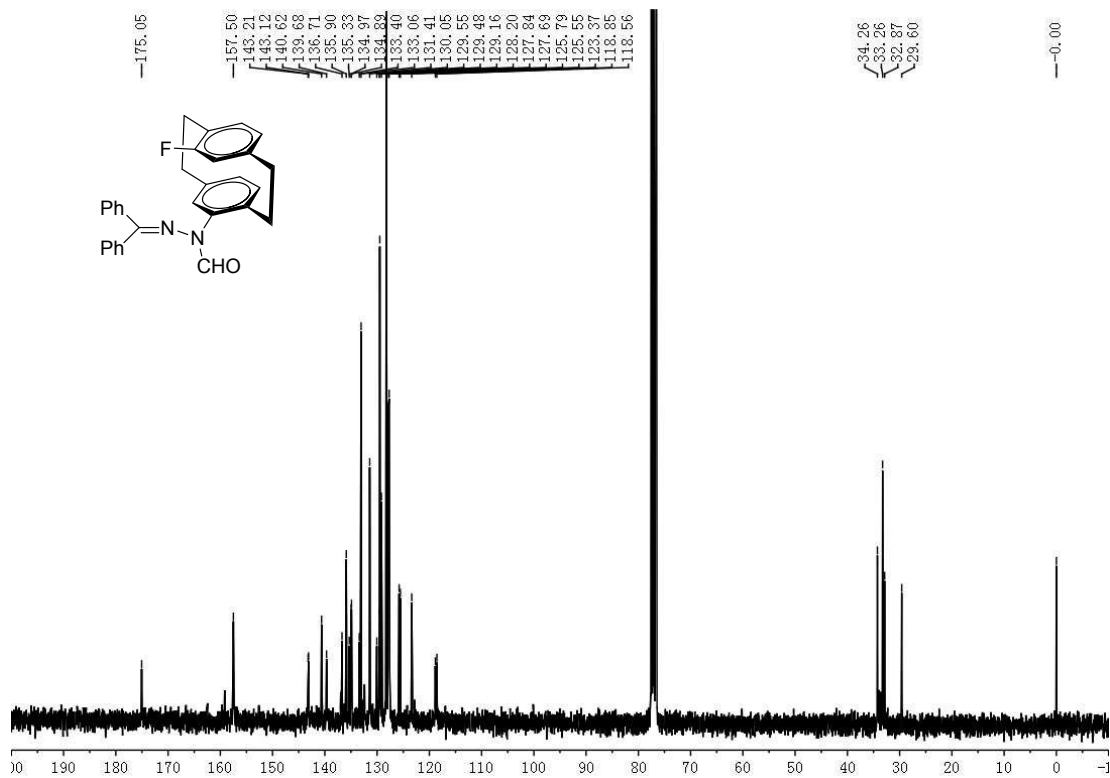
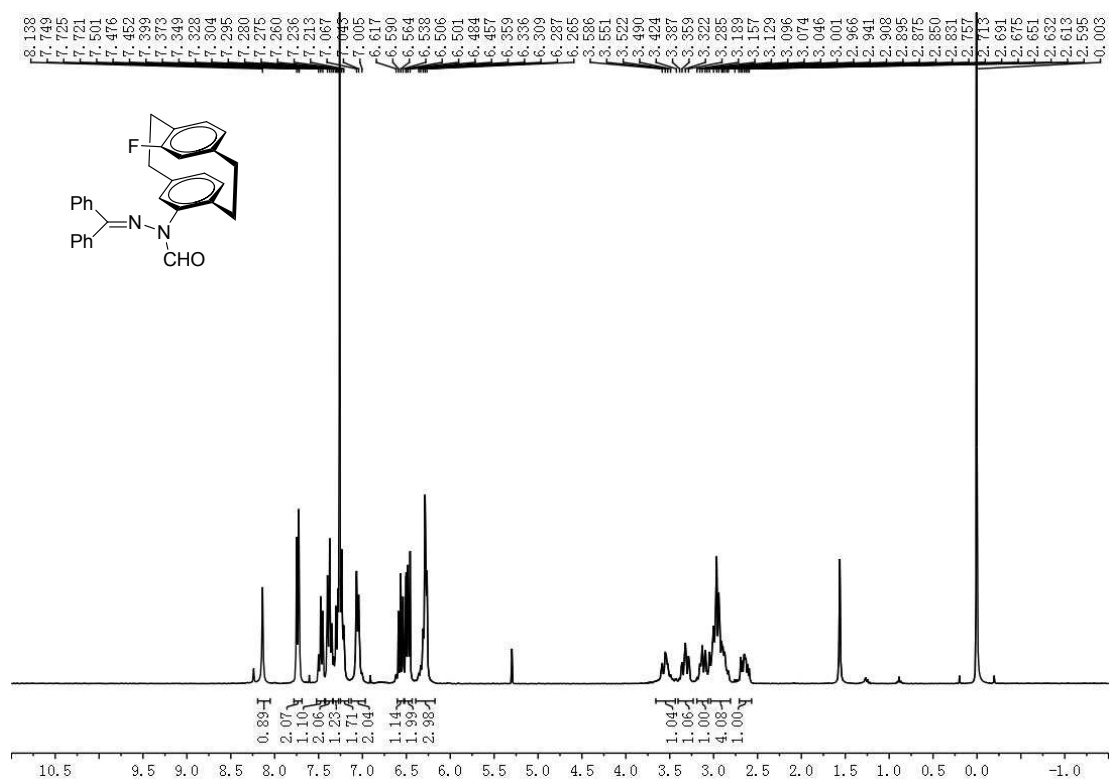
[†] These authors contributed equally to this work.

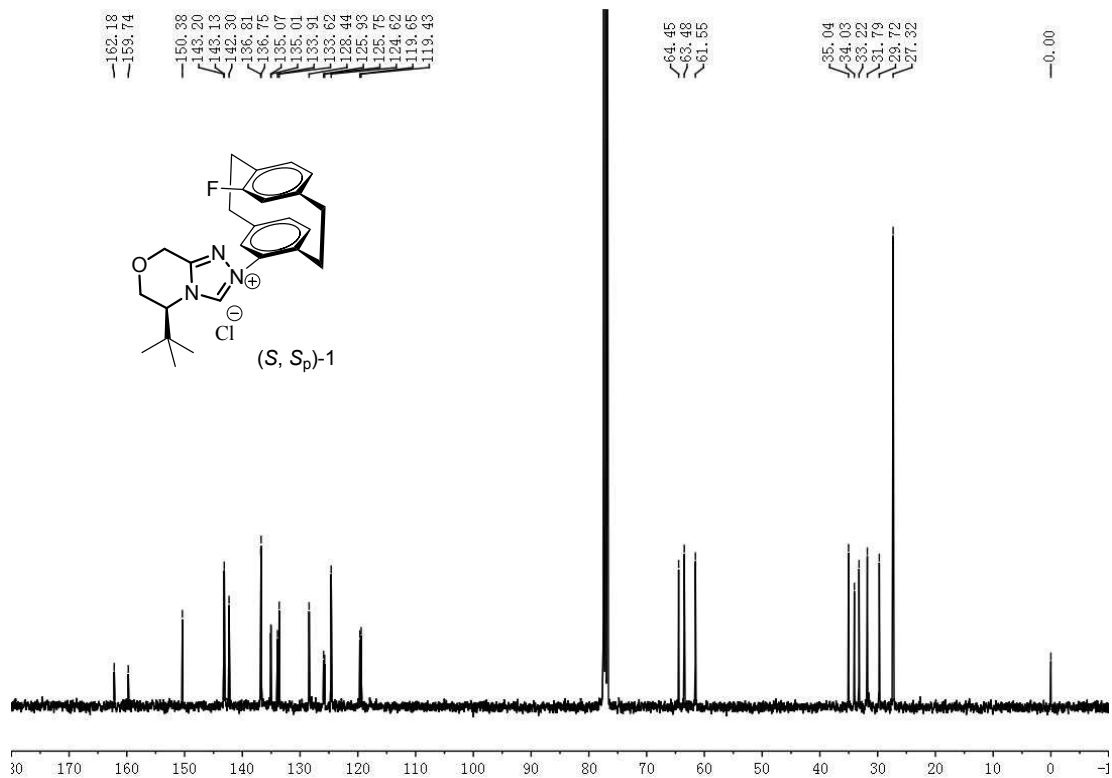
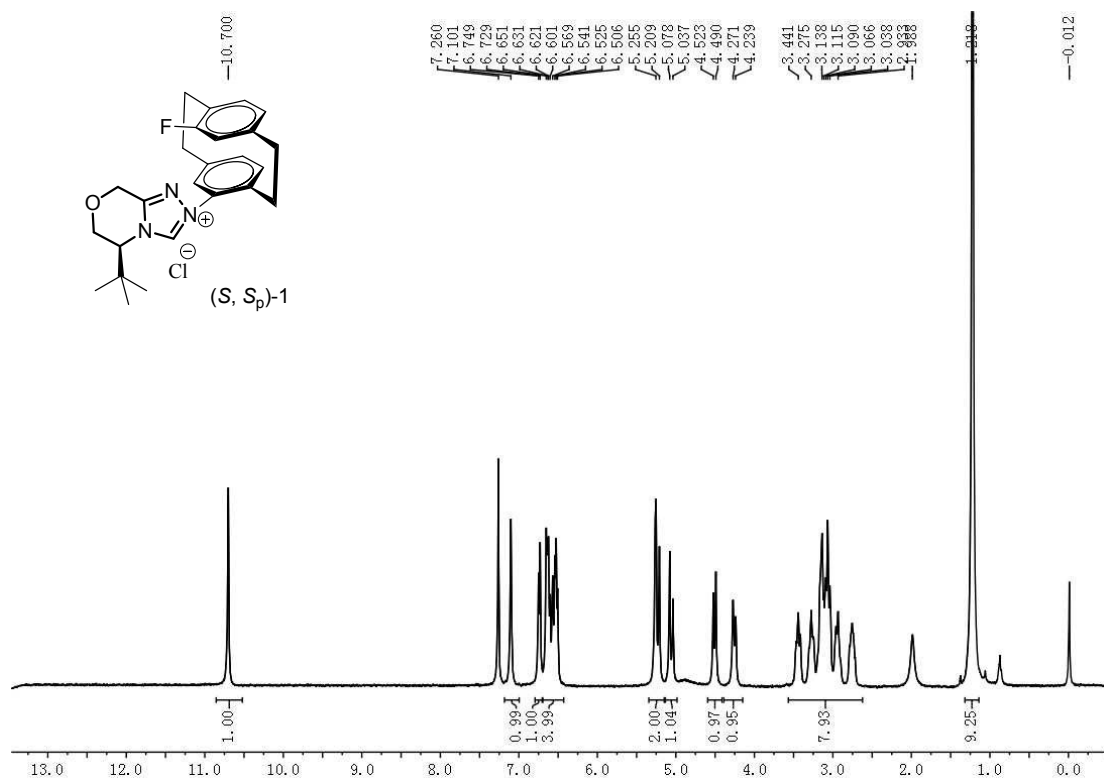
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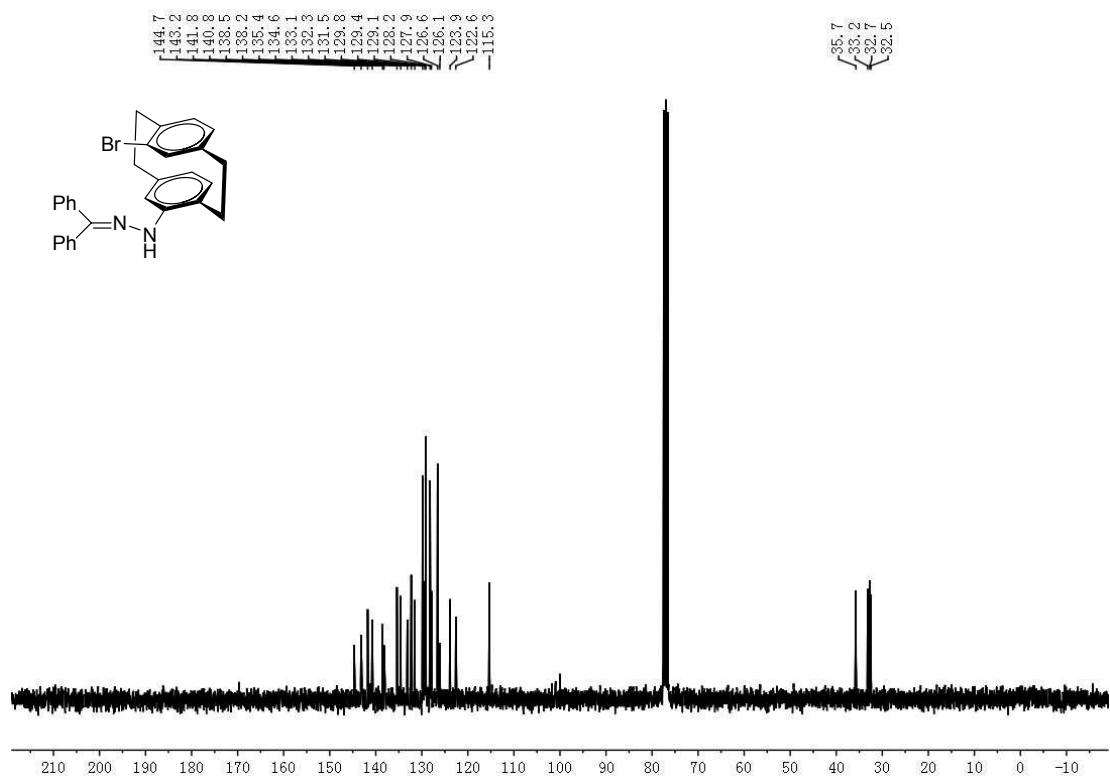
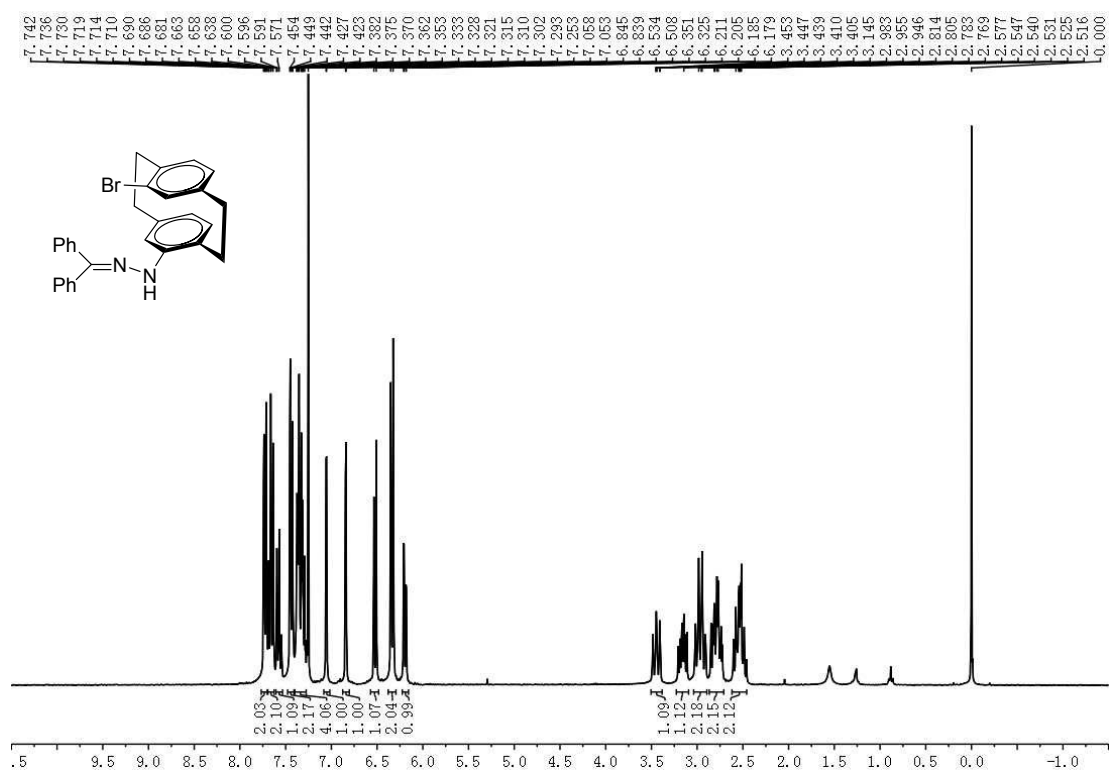
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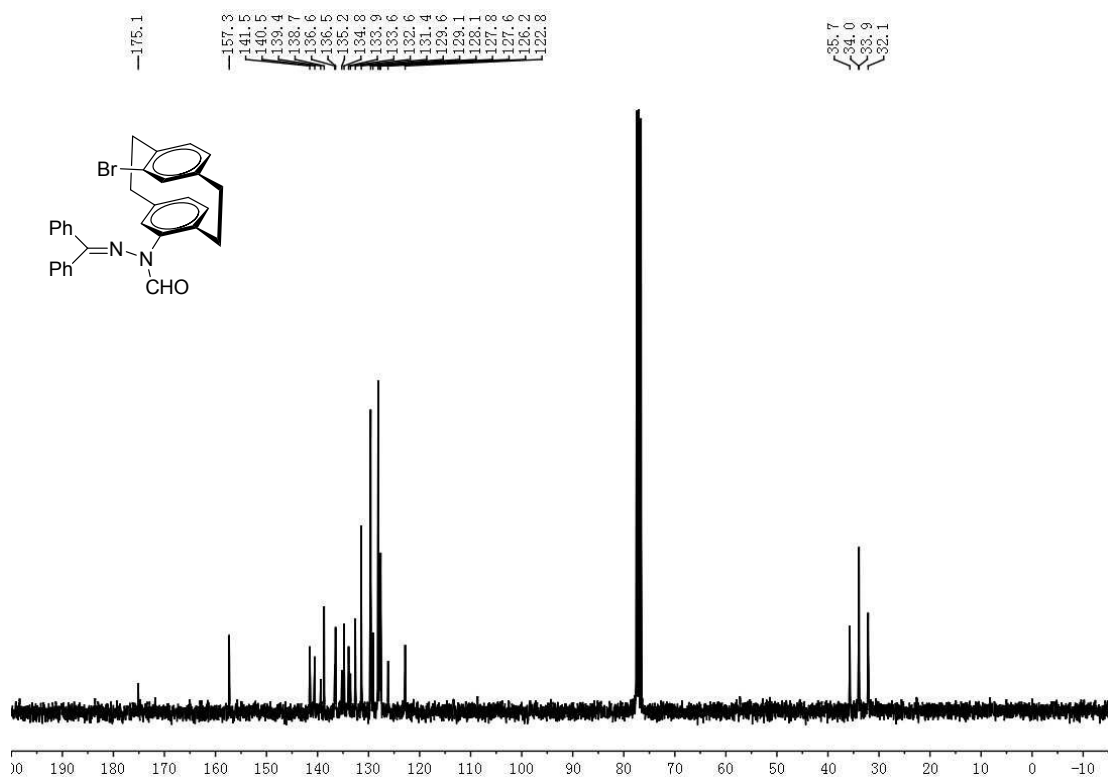
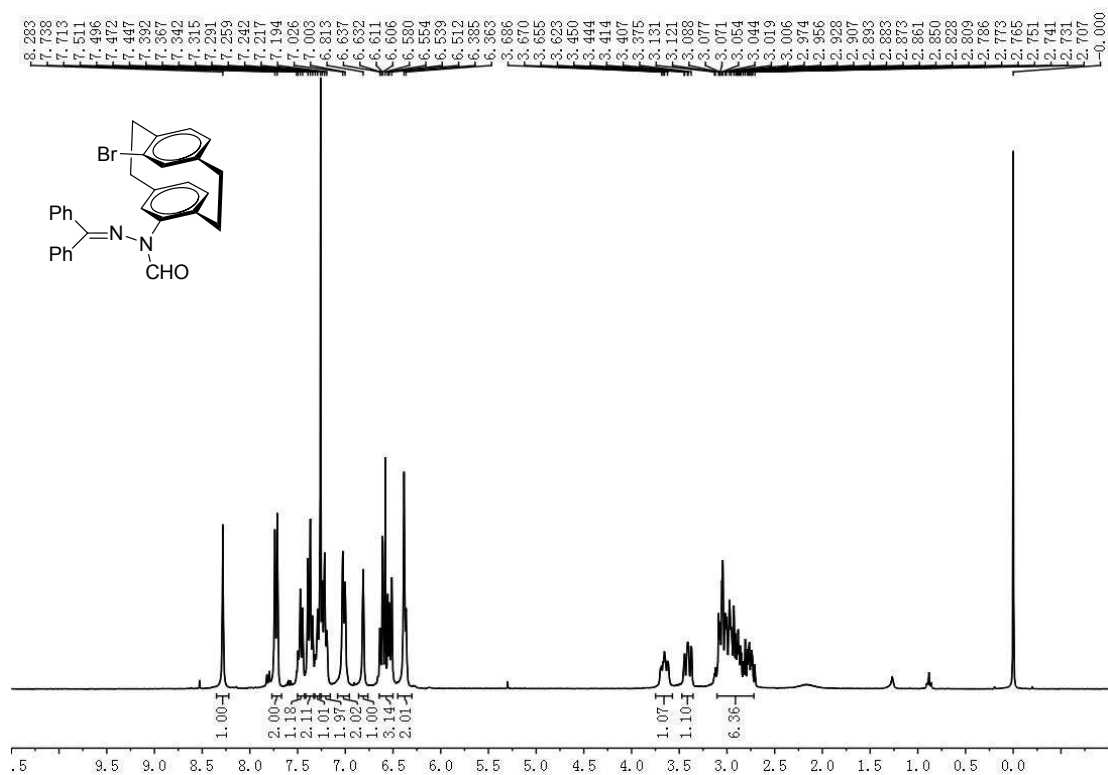
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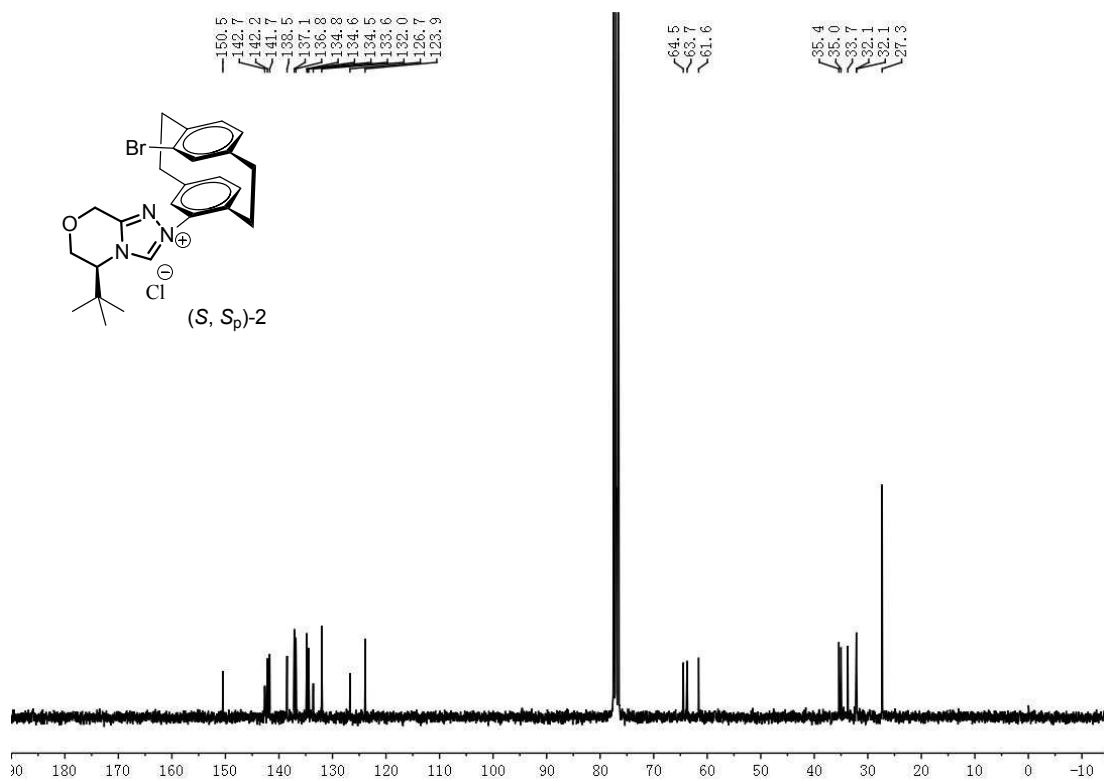
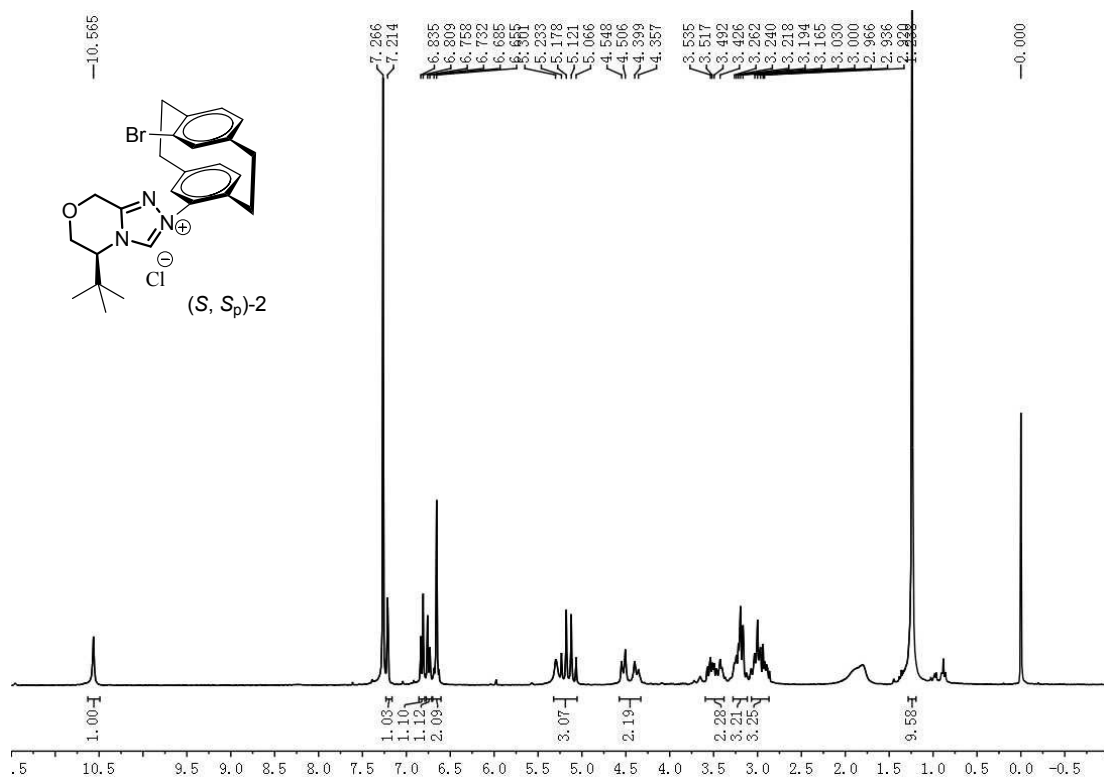


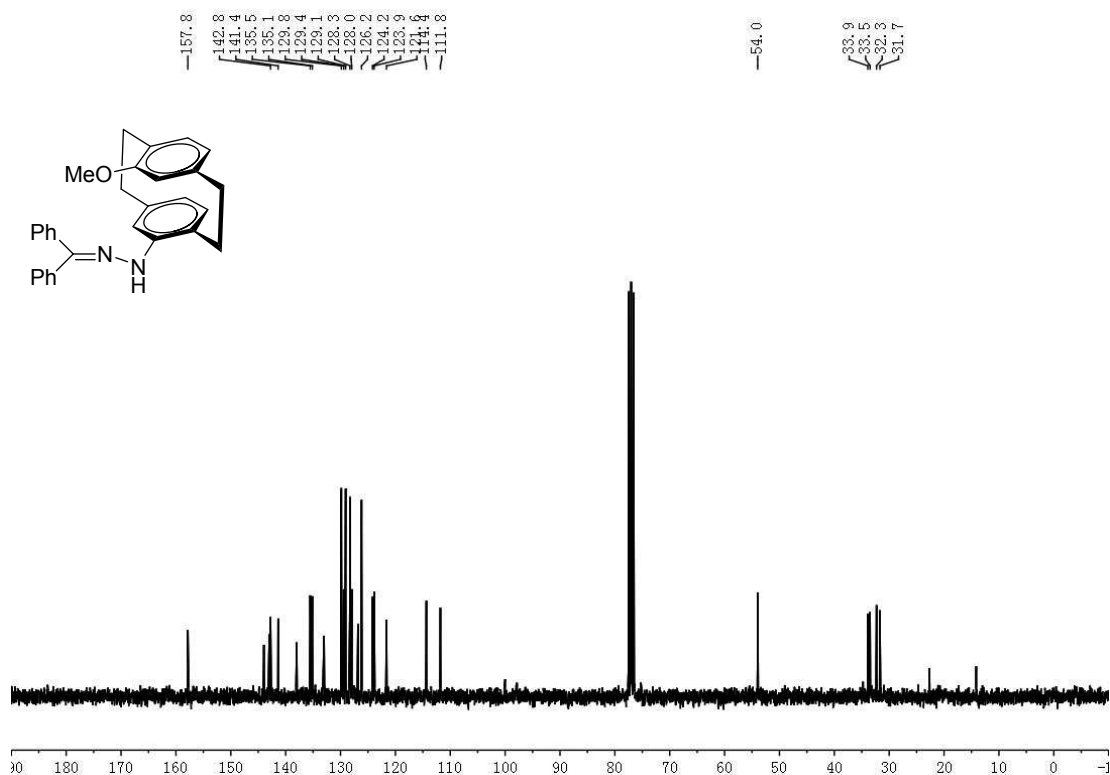
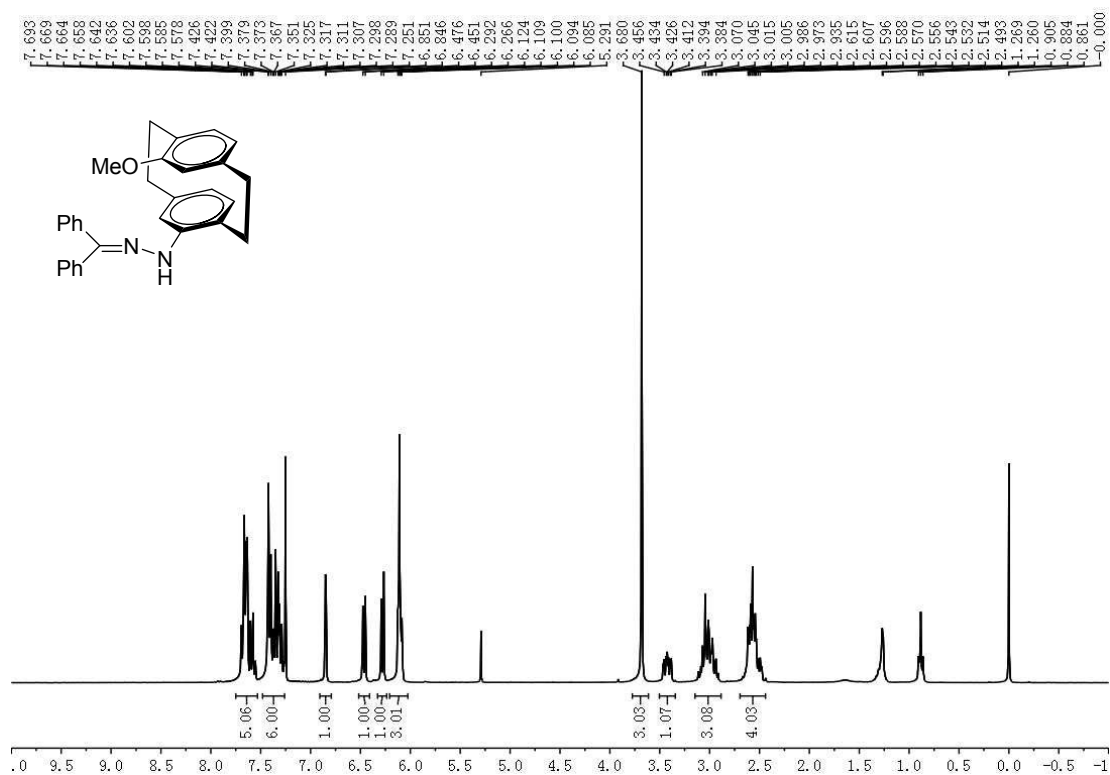


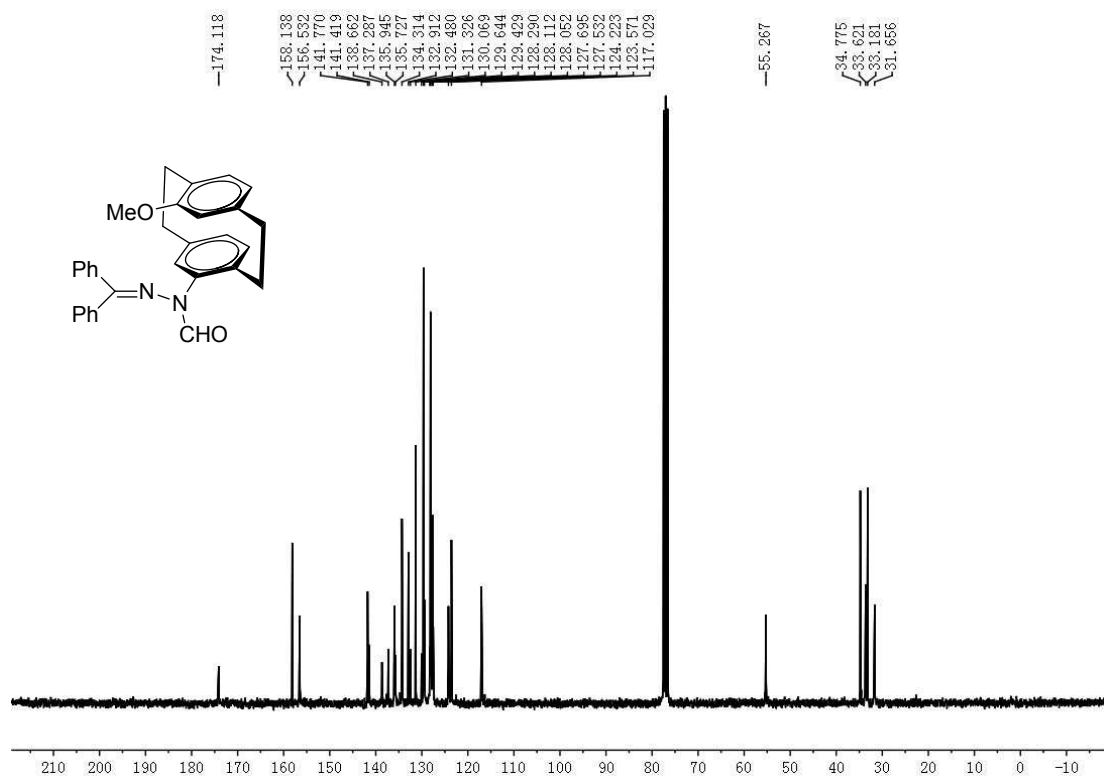
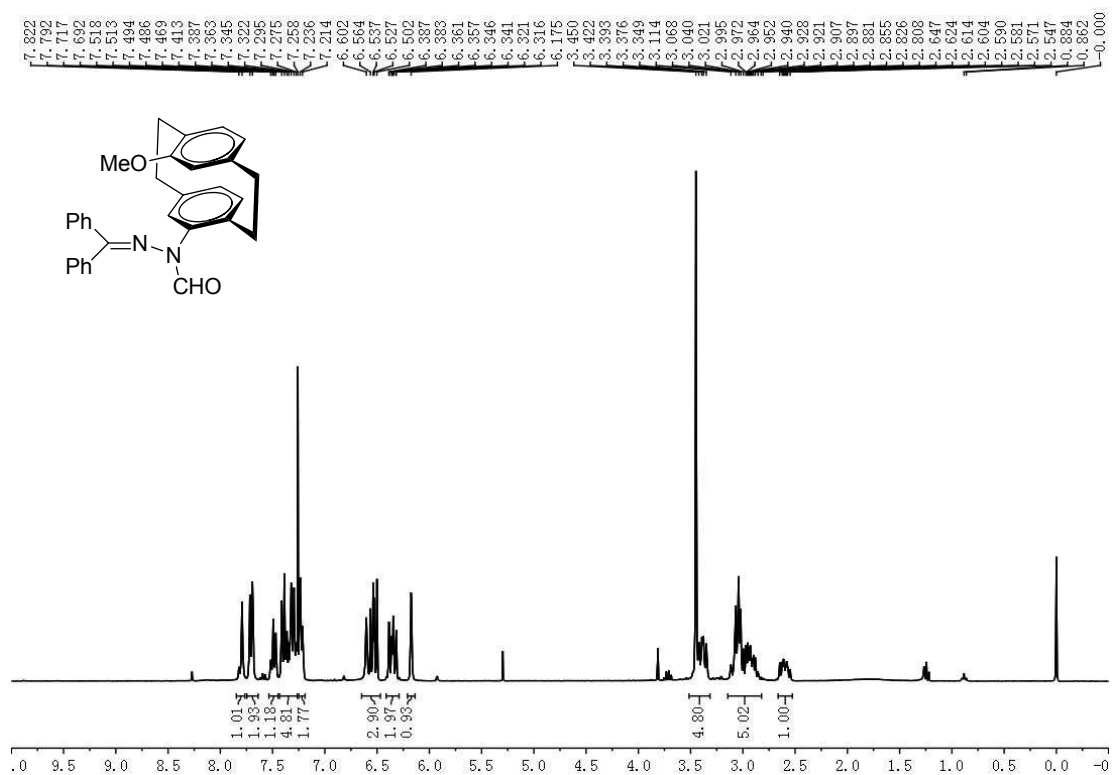


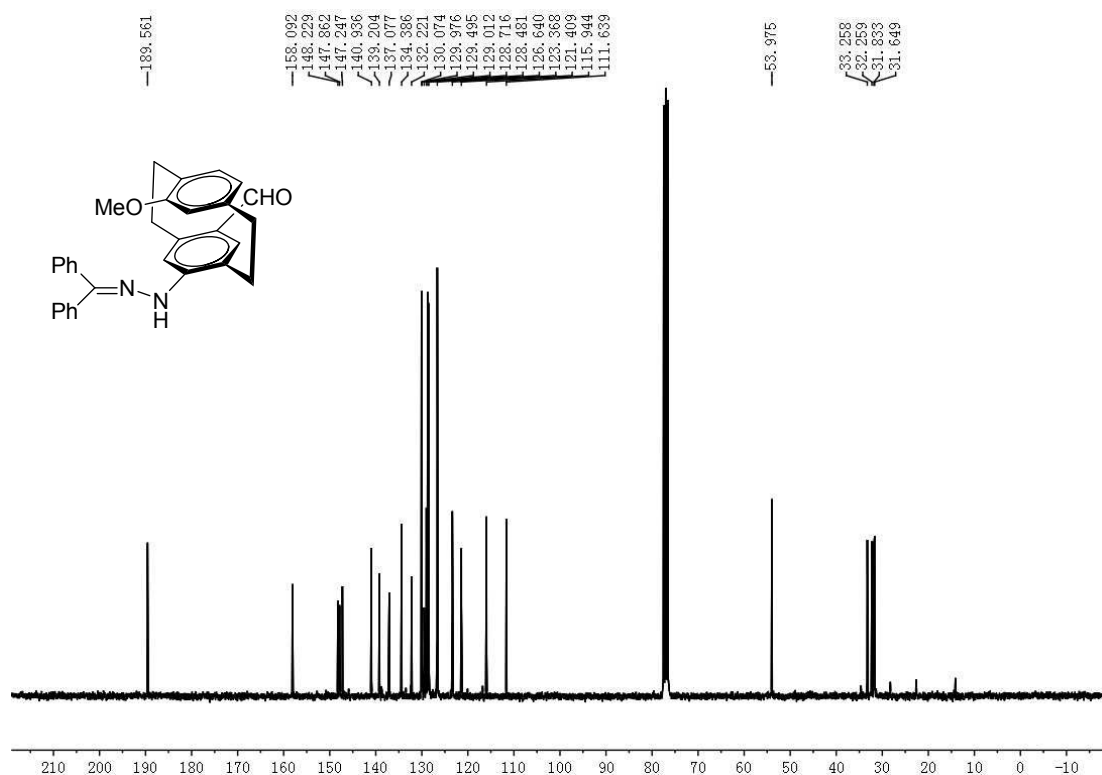


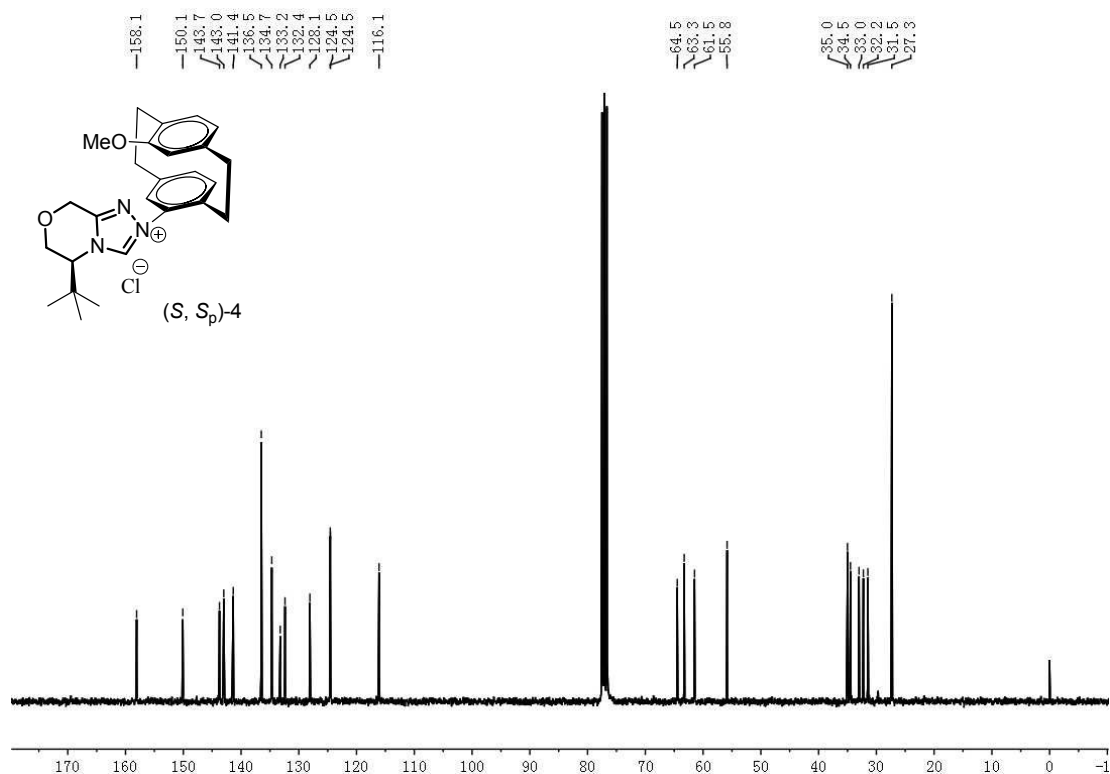
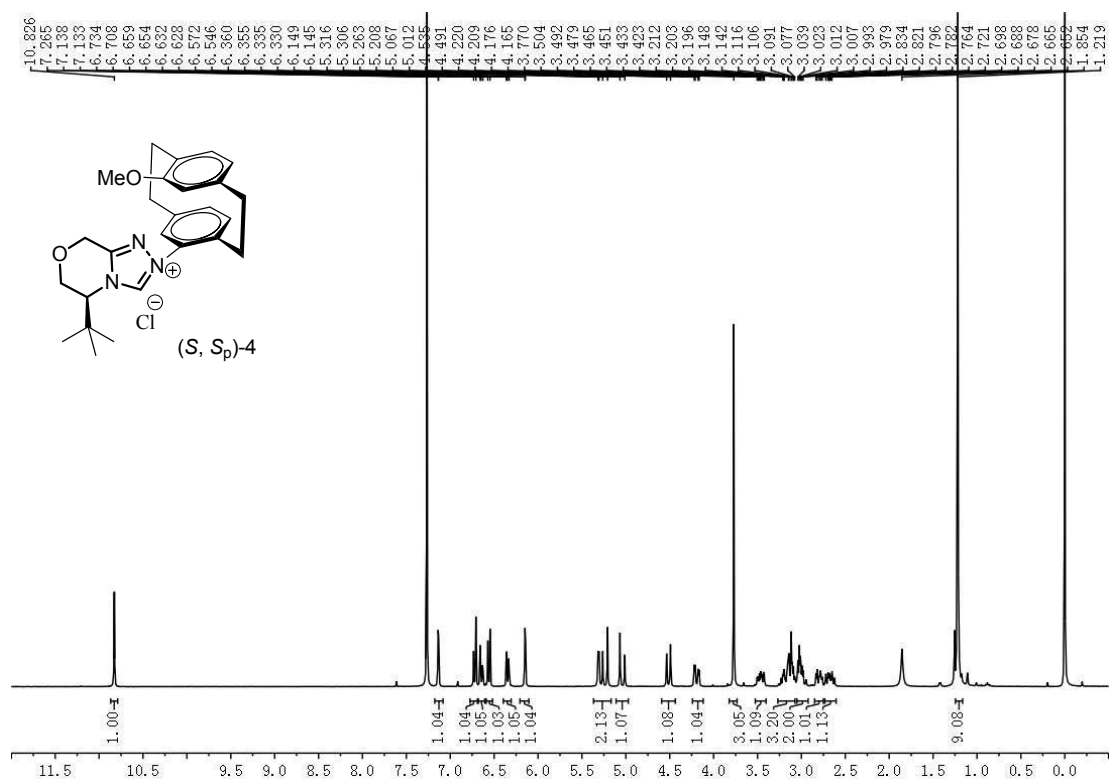


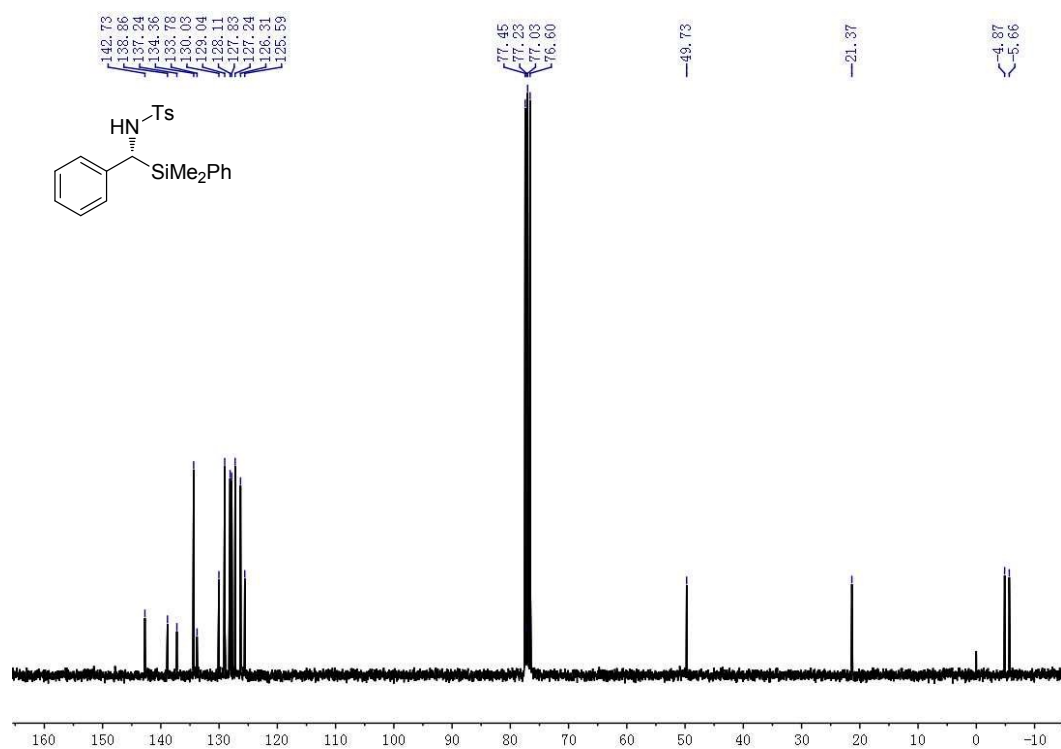
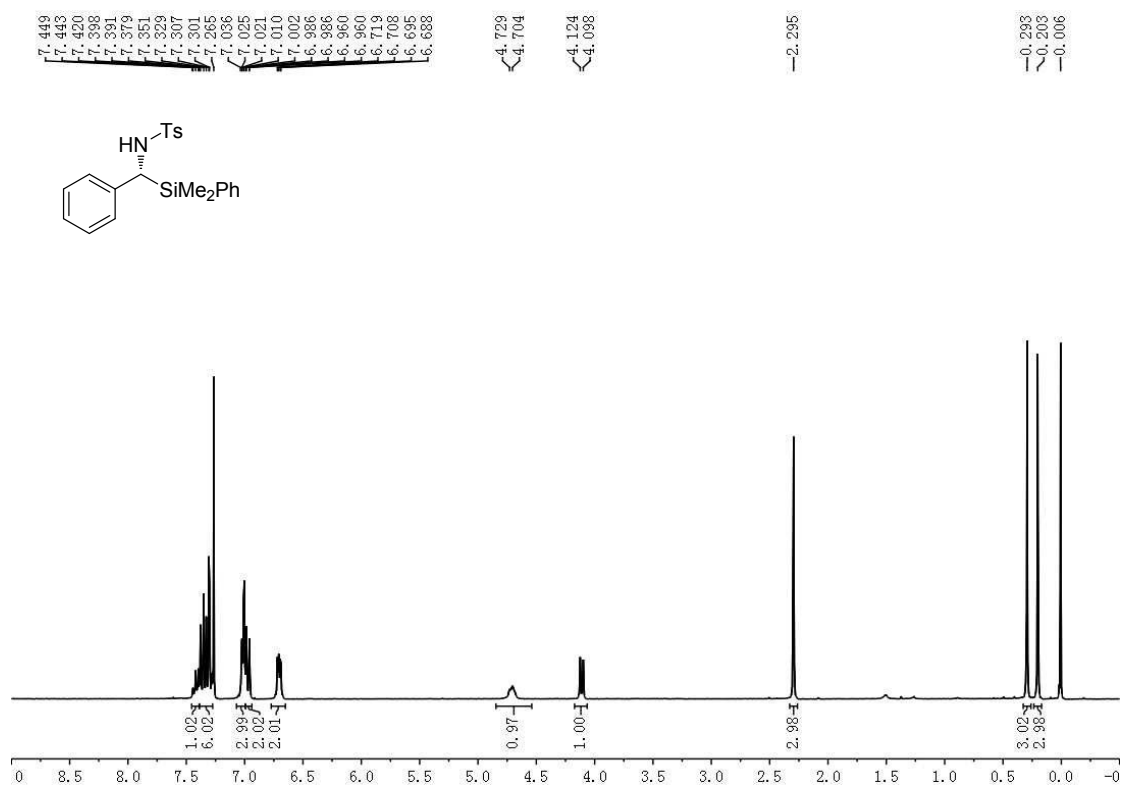


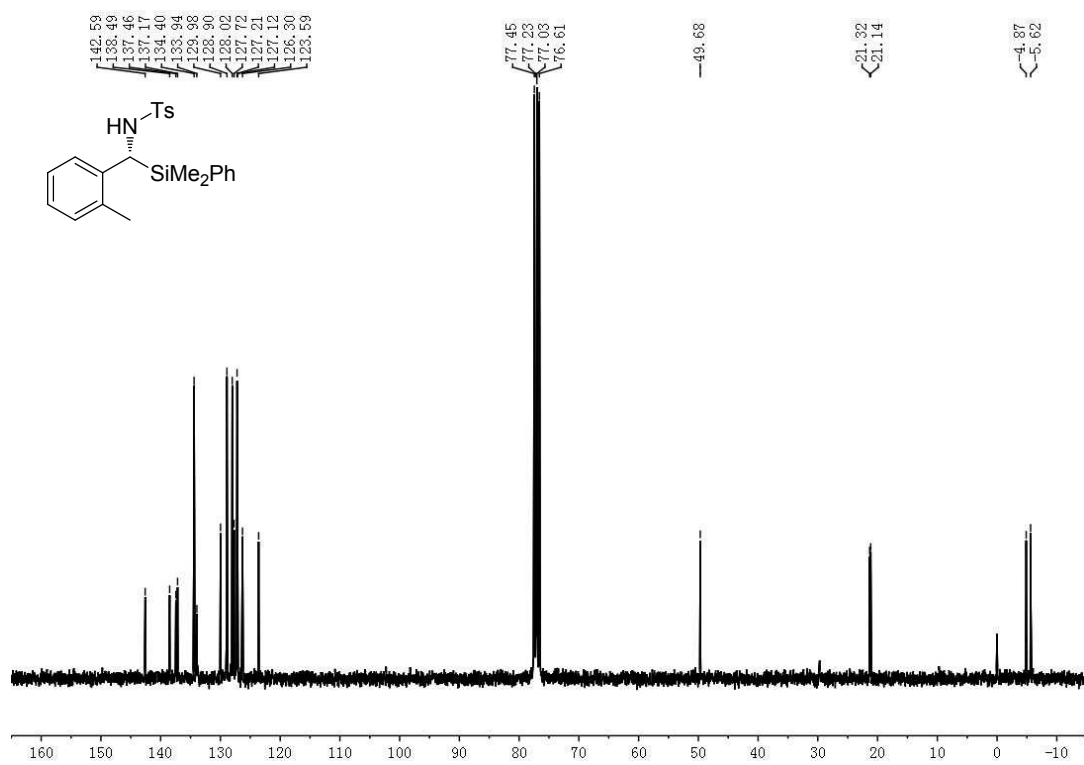
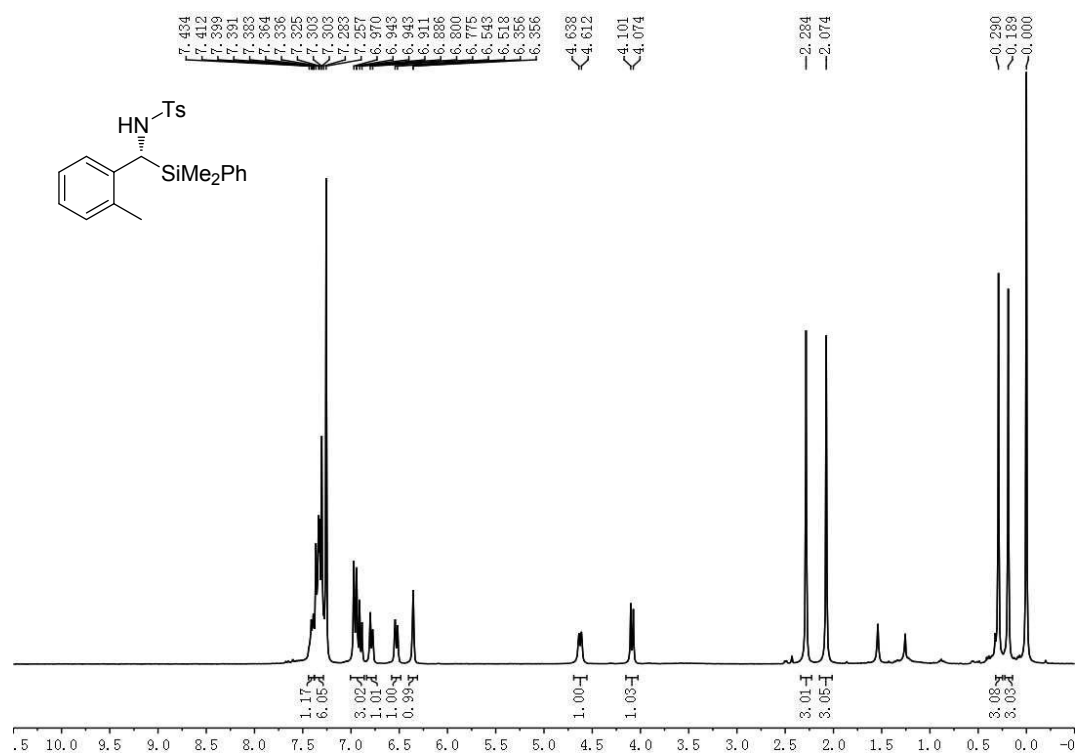


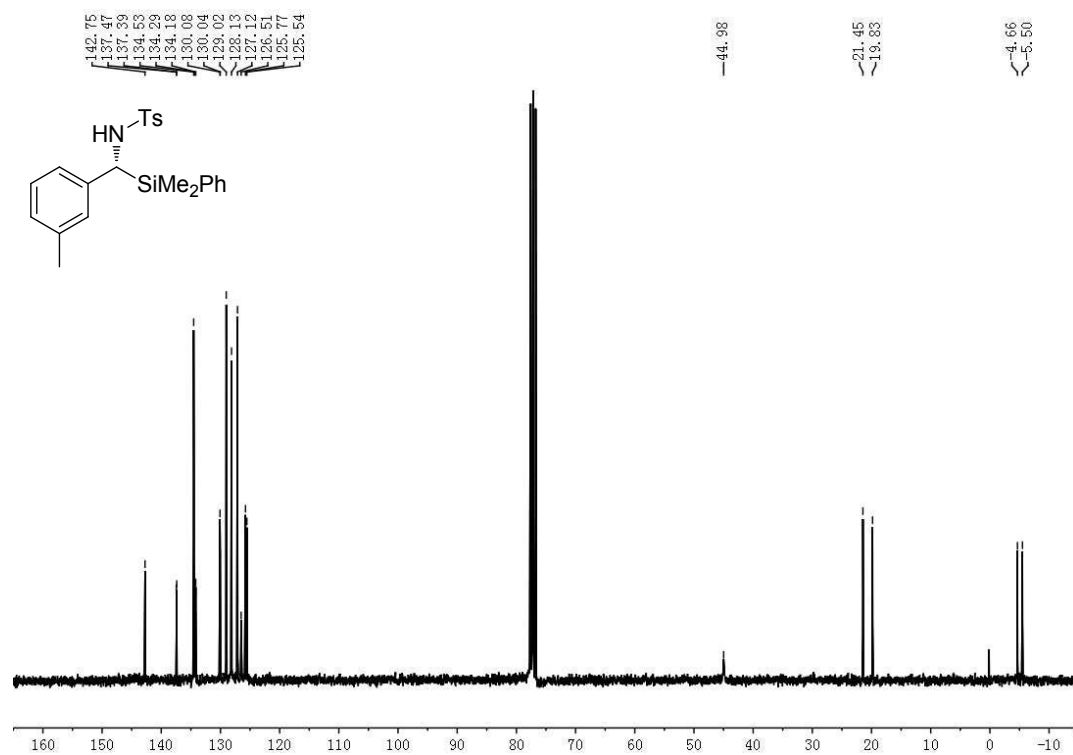
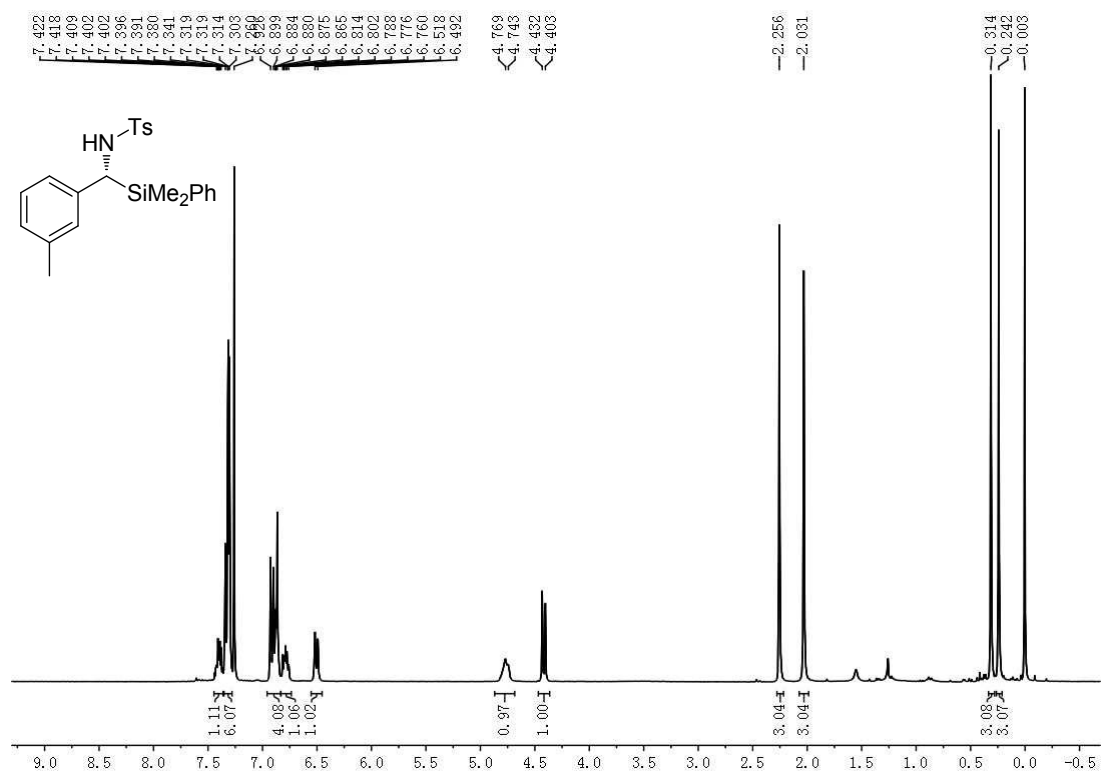


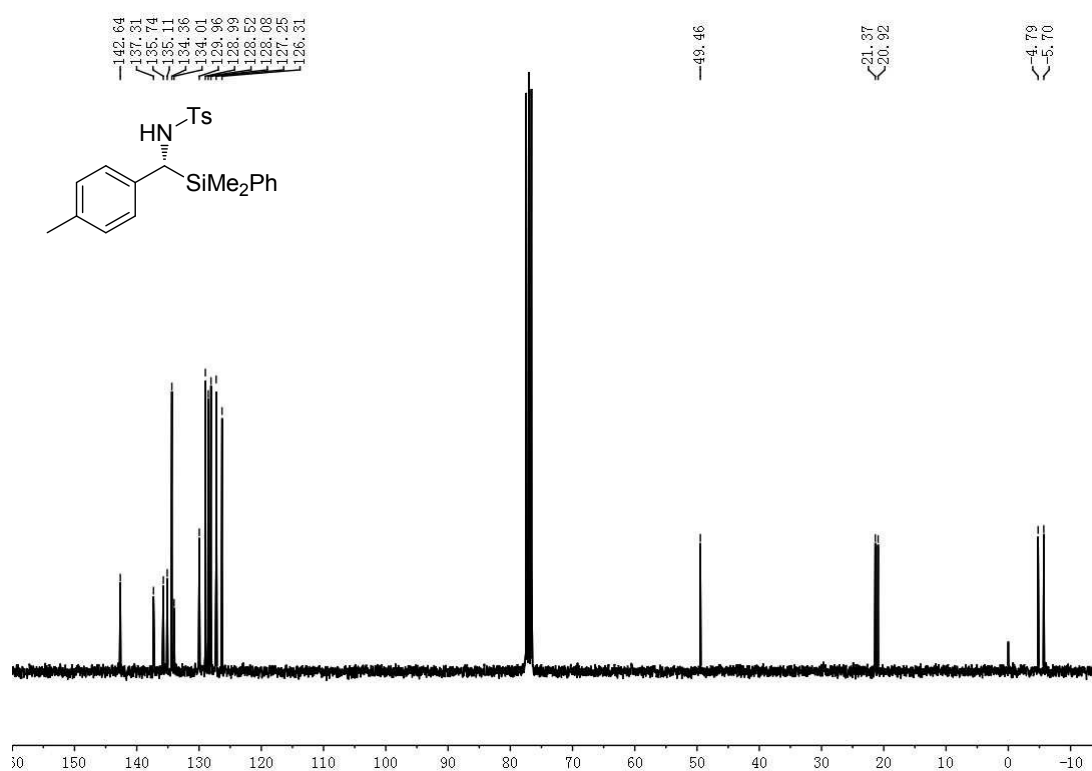
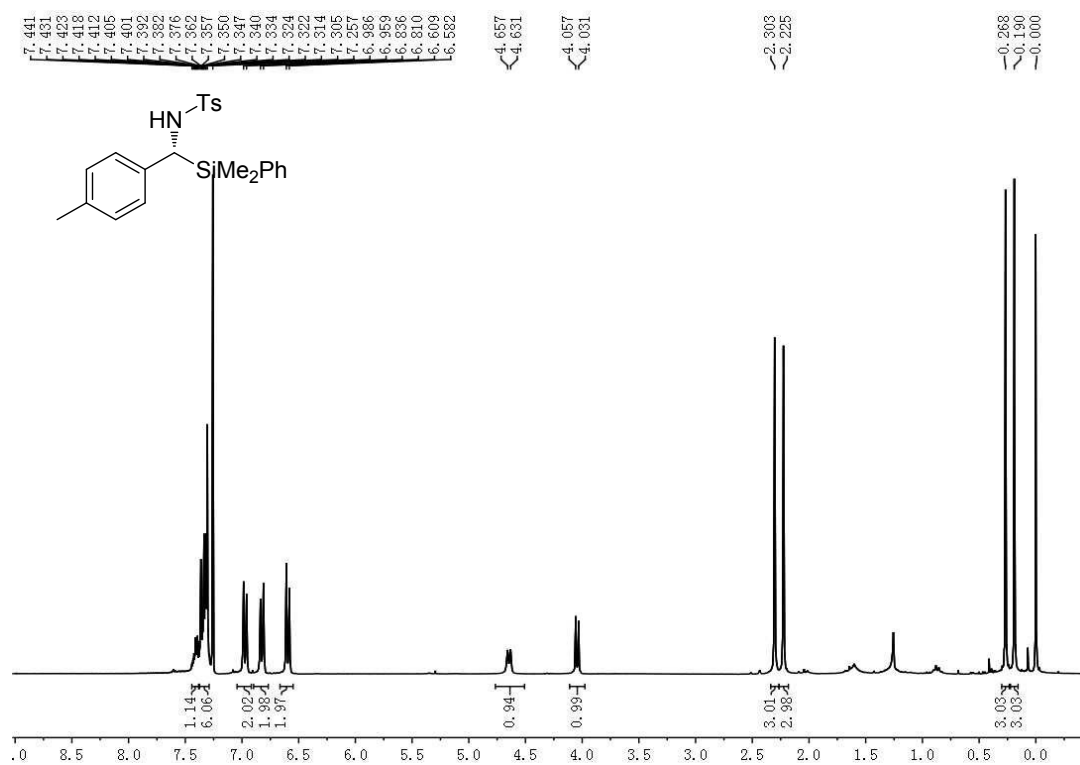


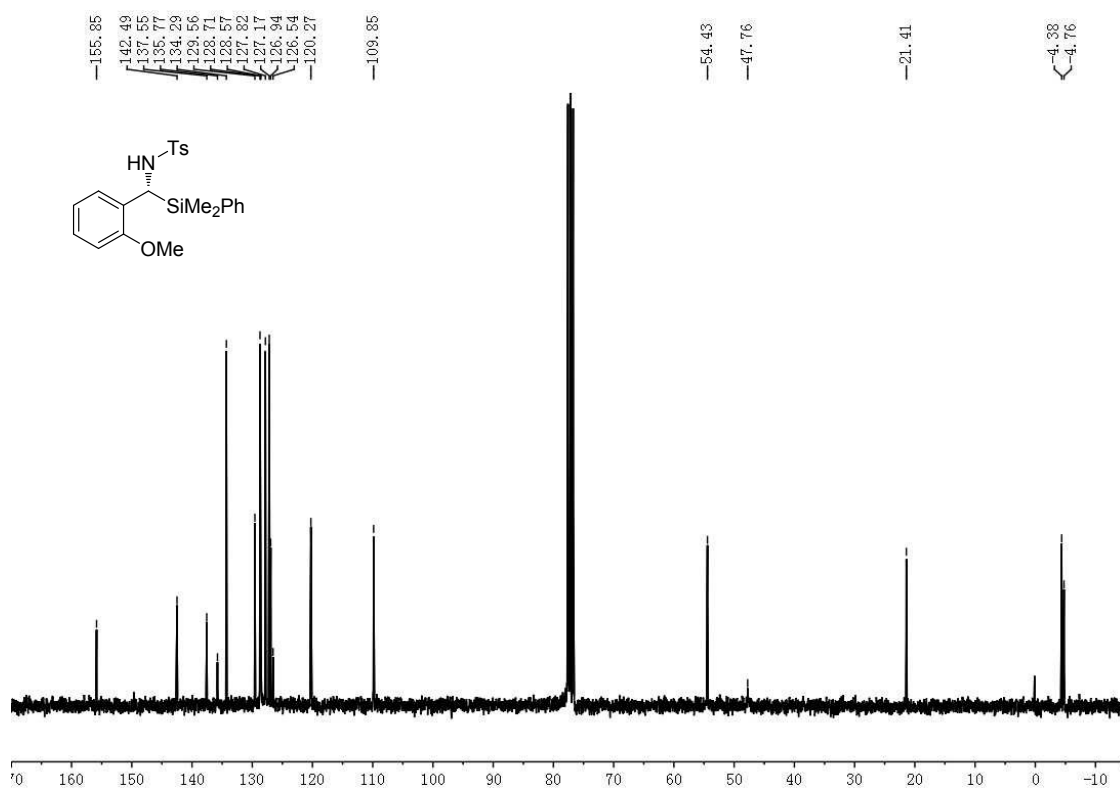
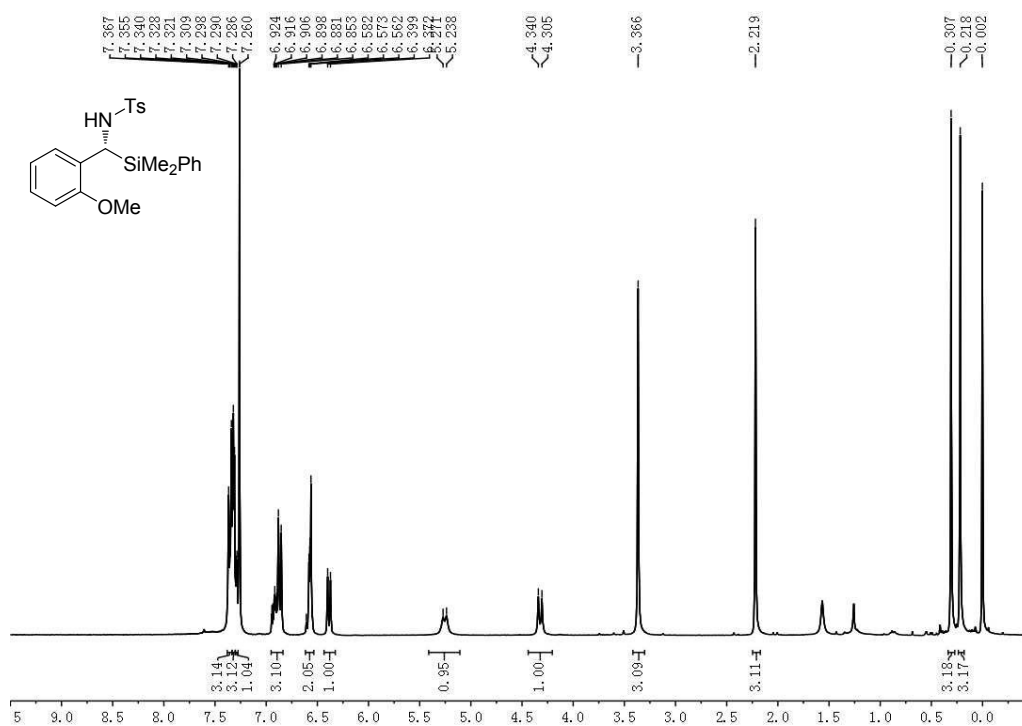


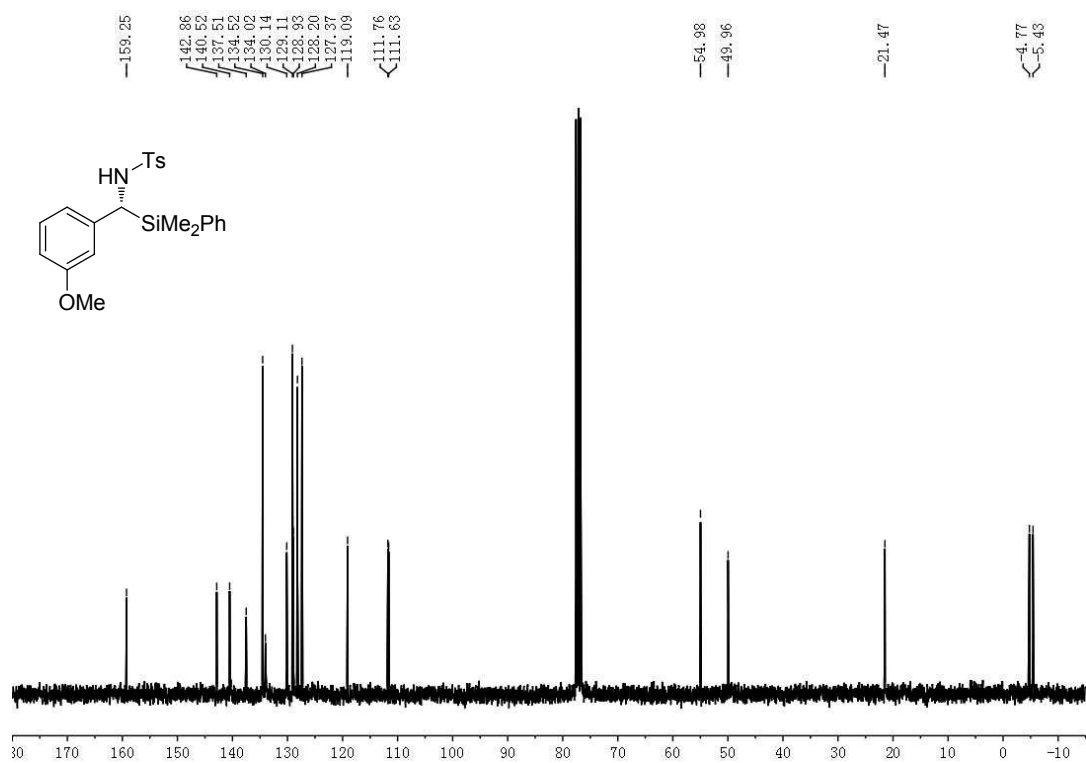
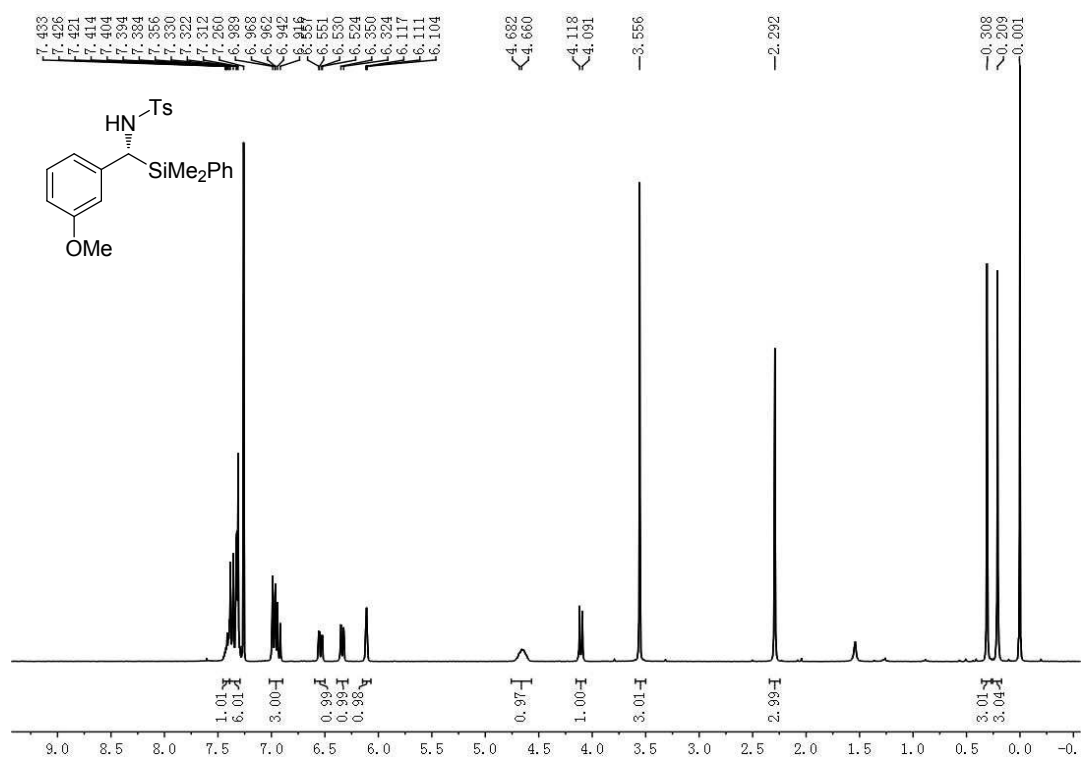


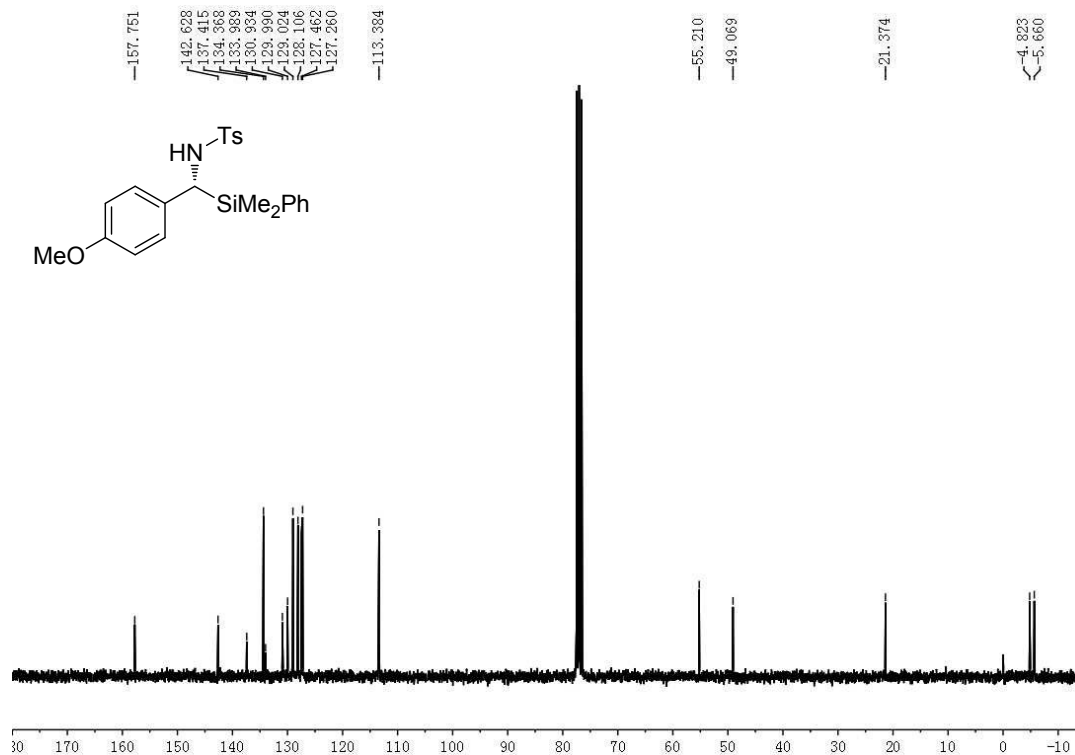
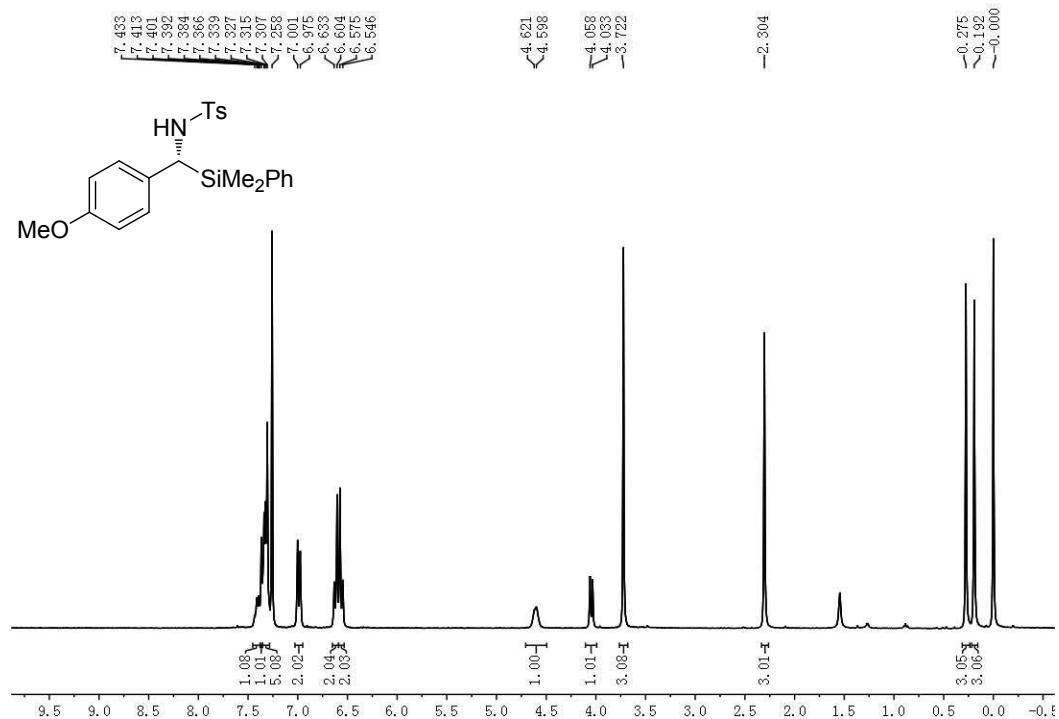


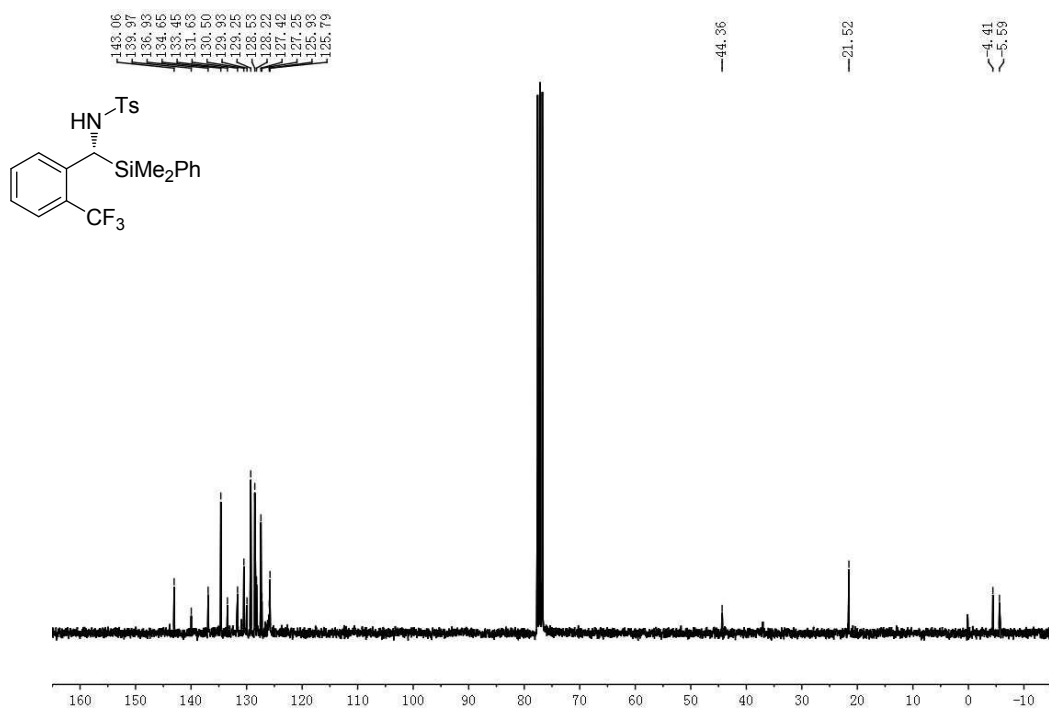
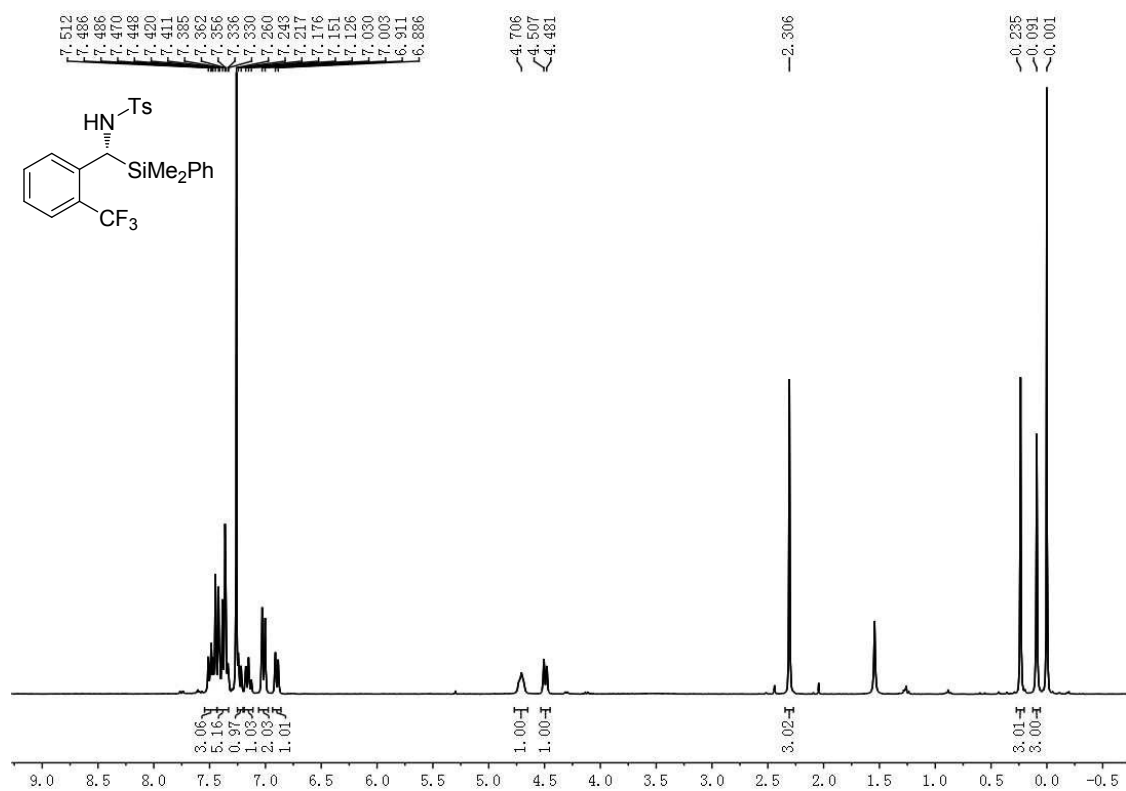


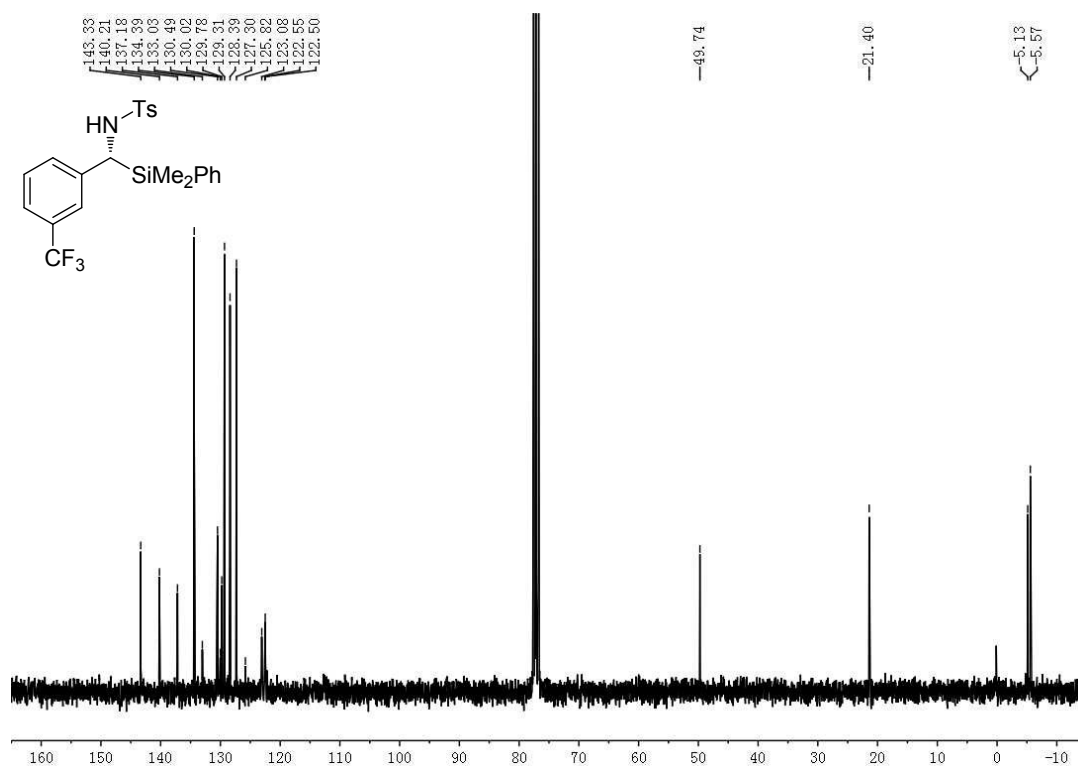
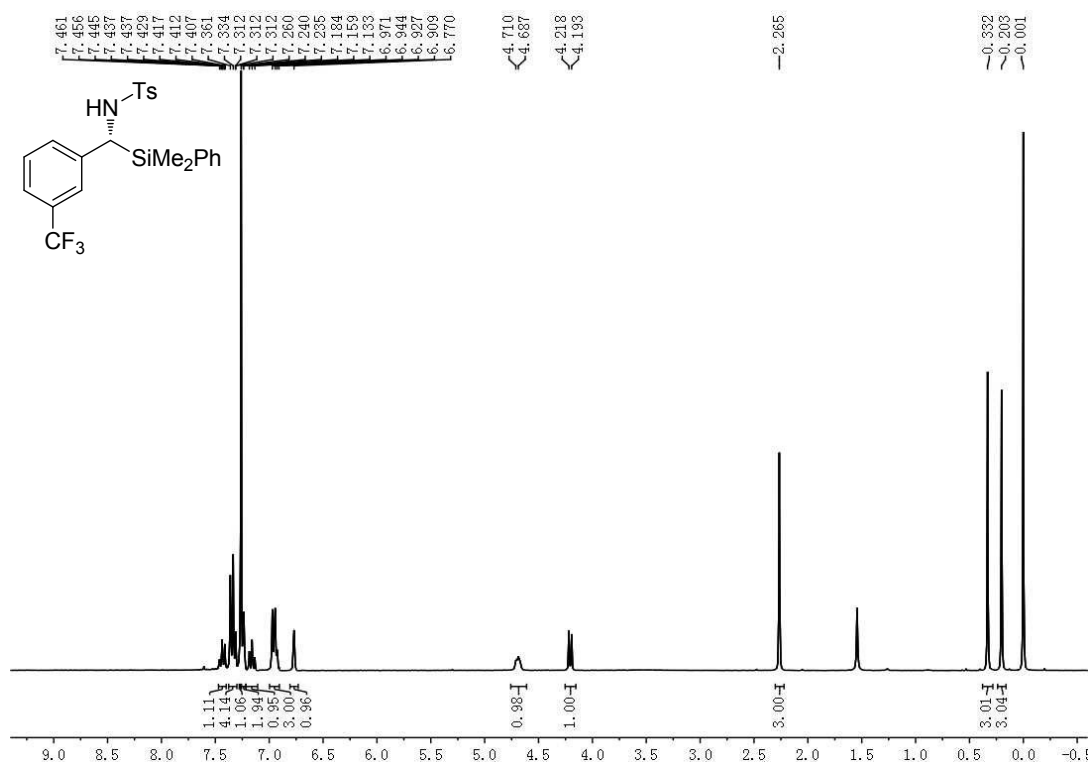


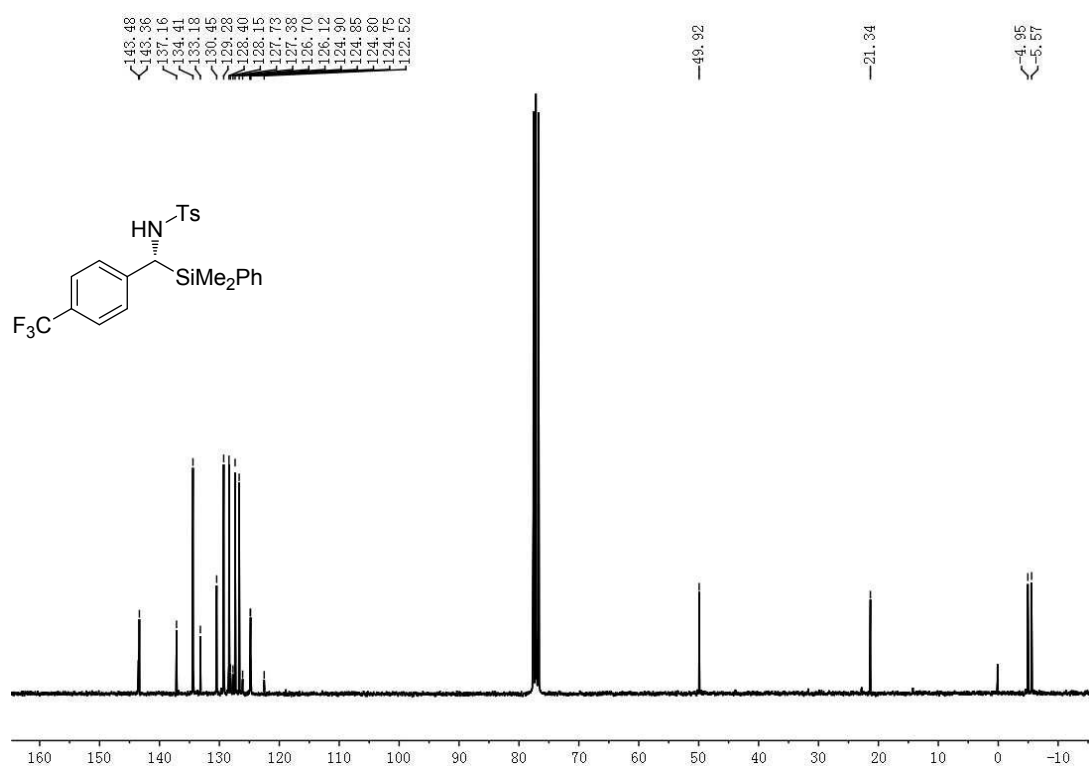
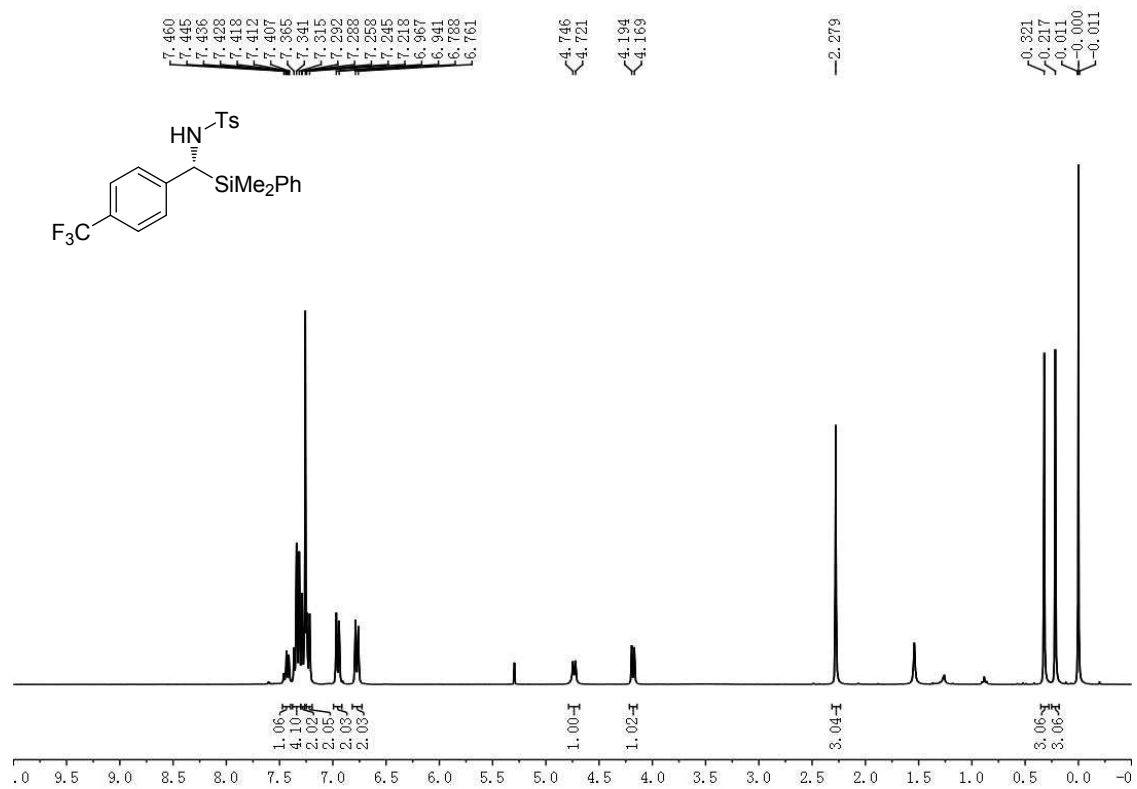


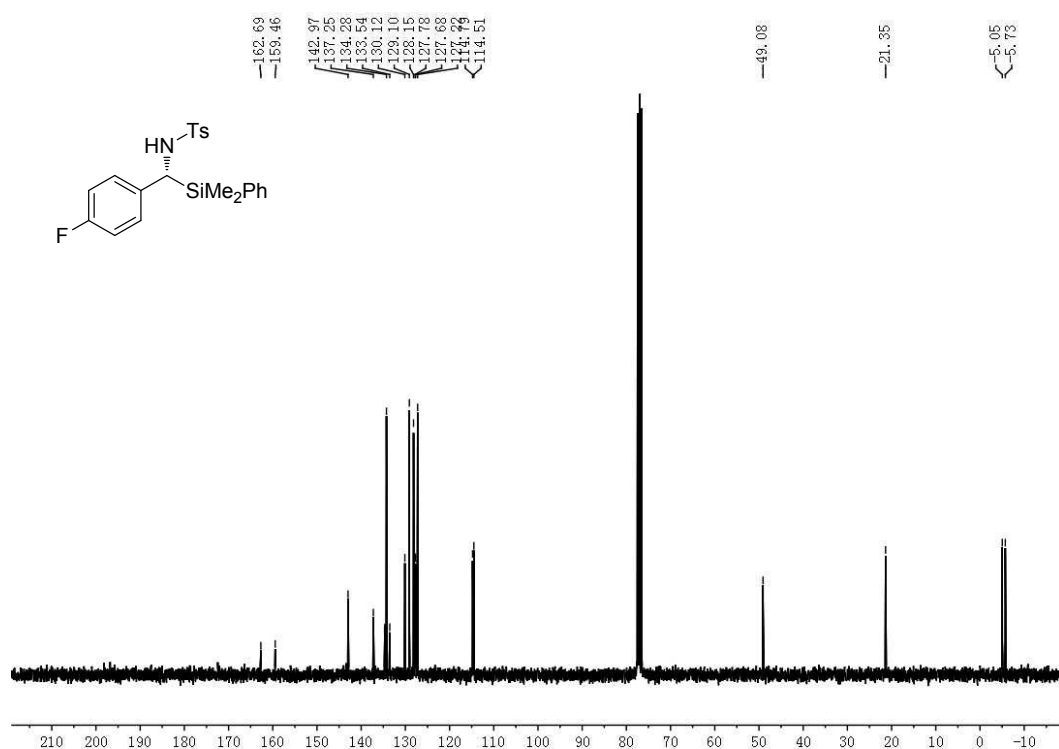
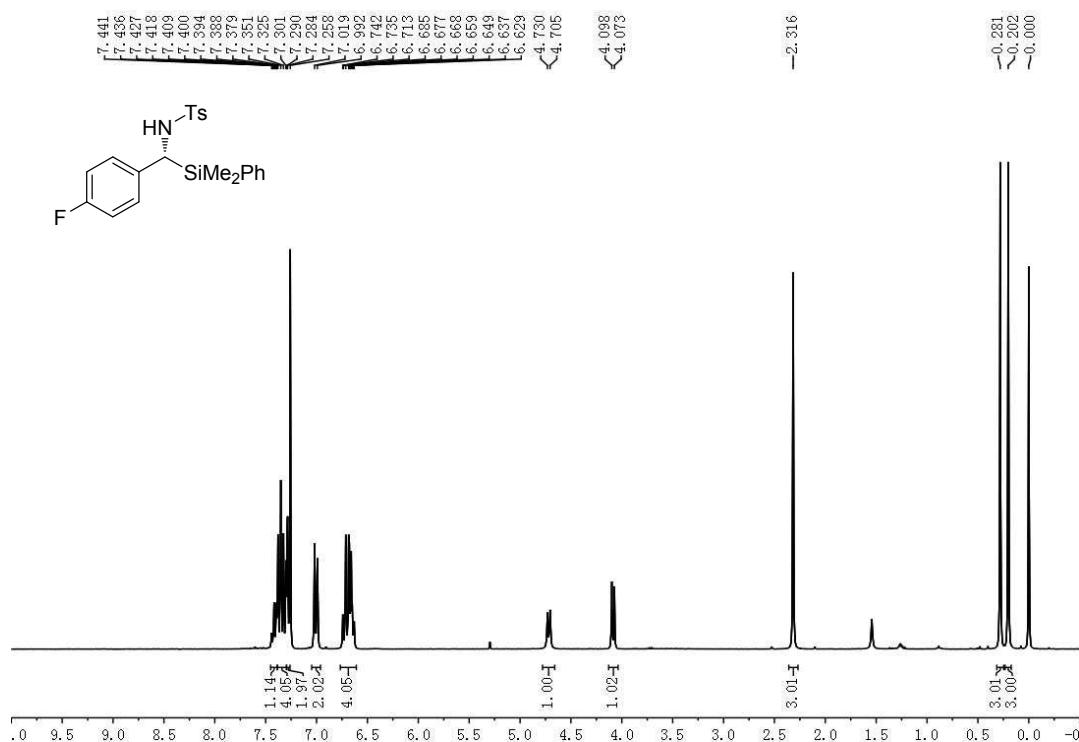


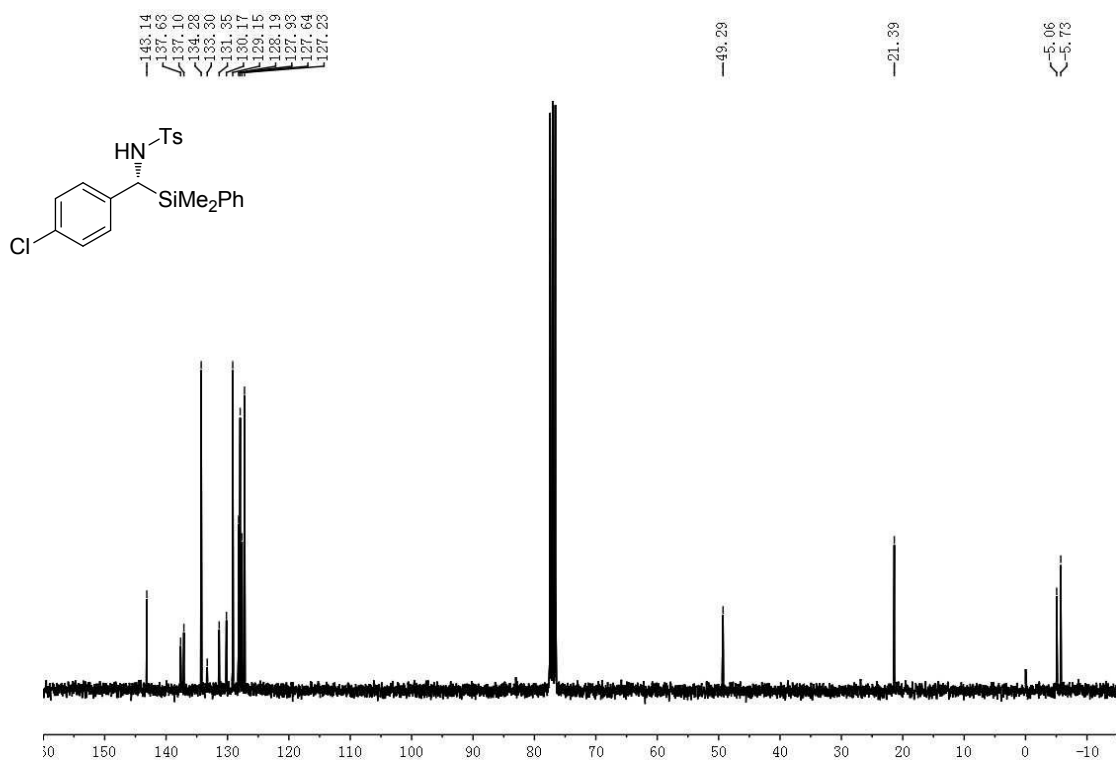
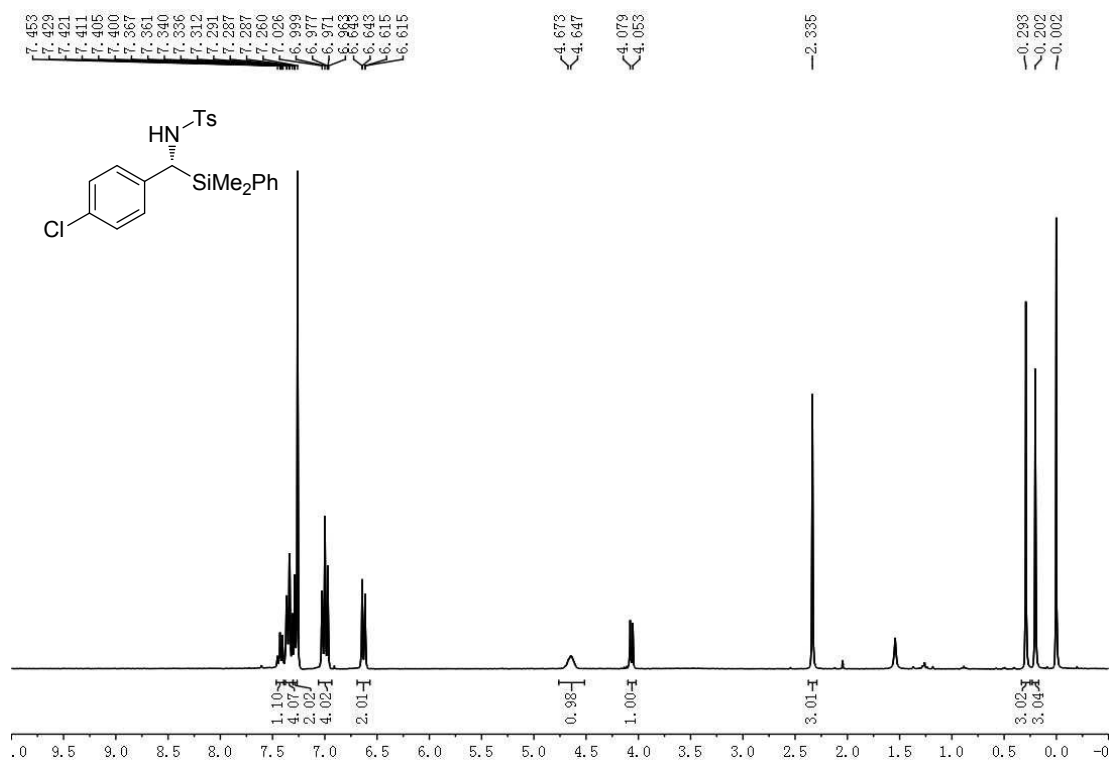


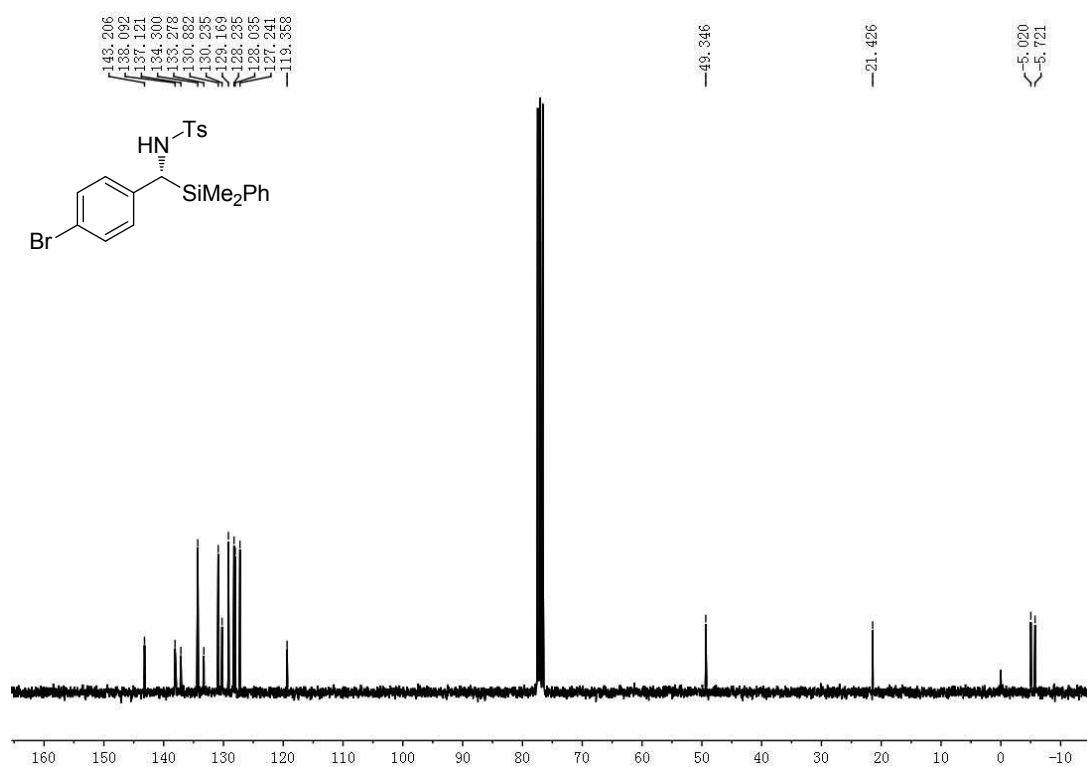
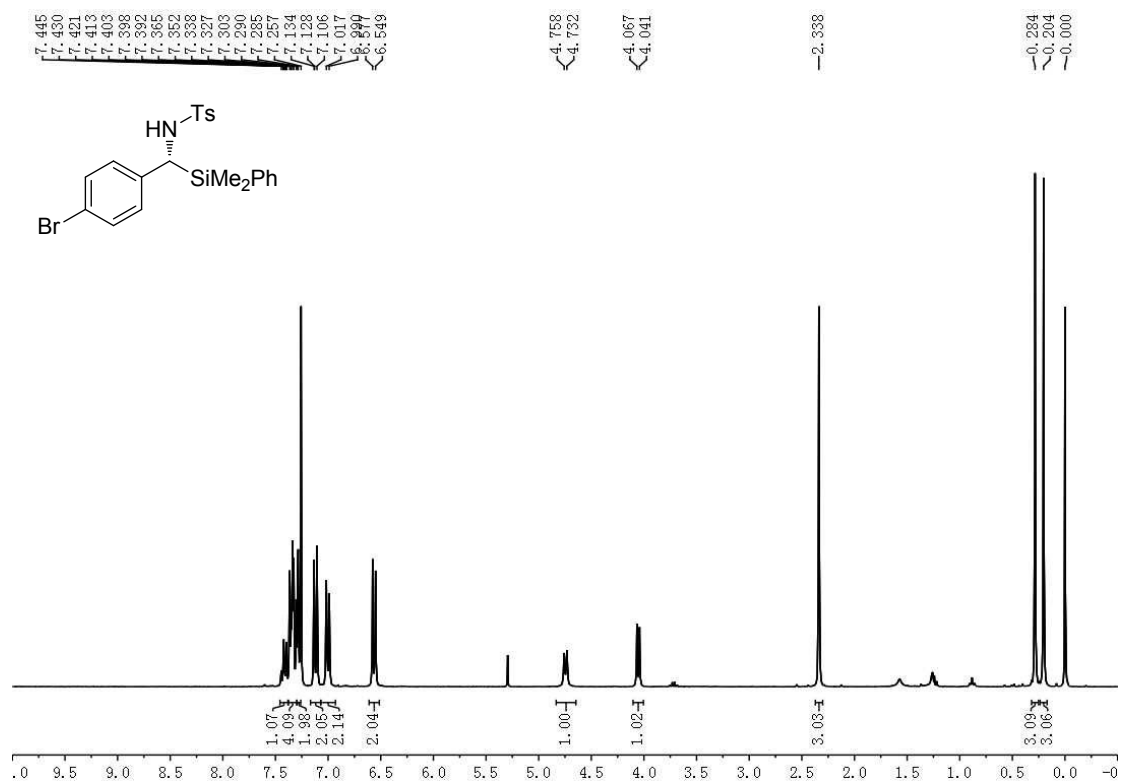


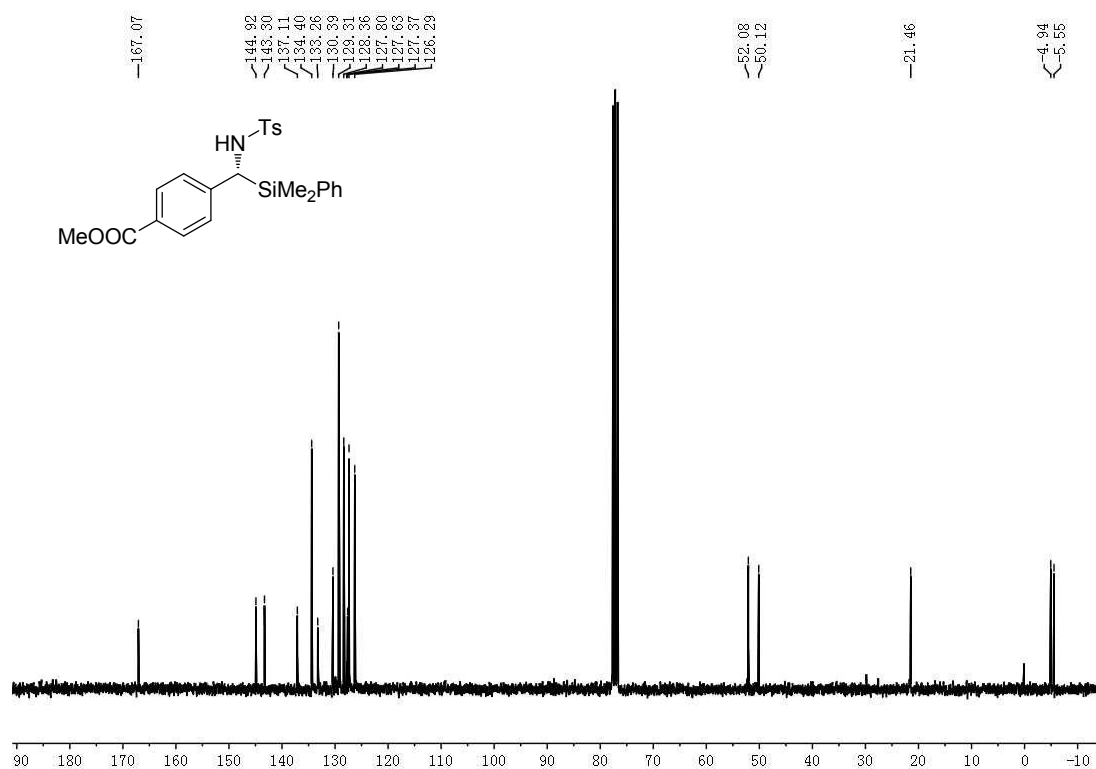
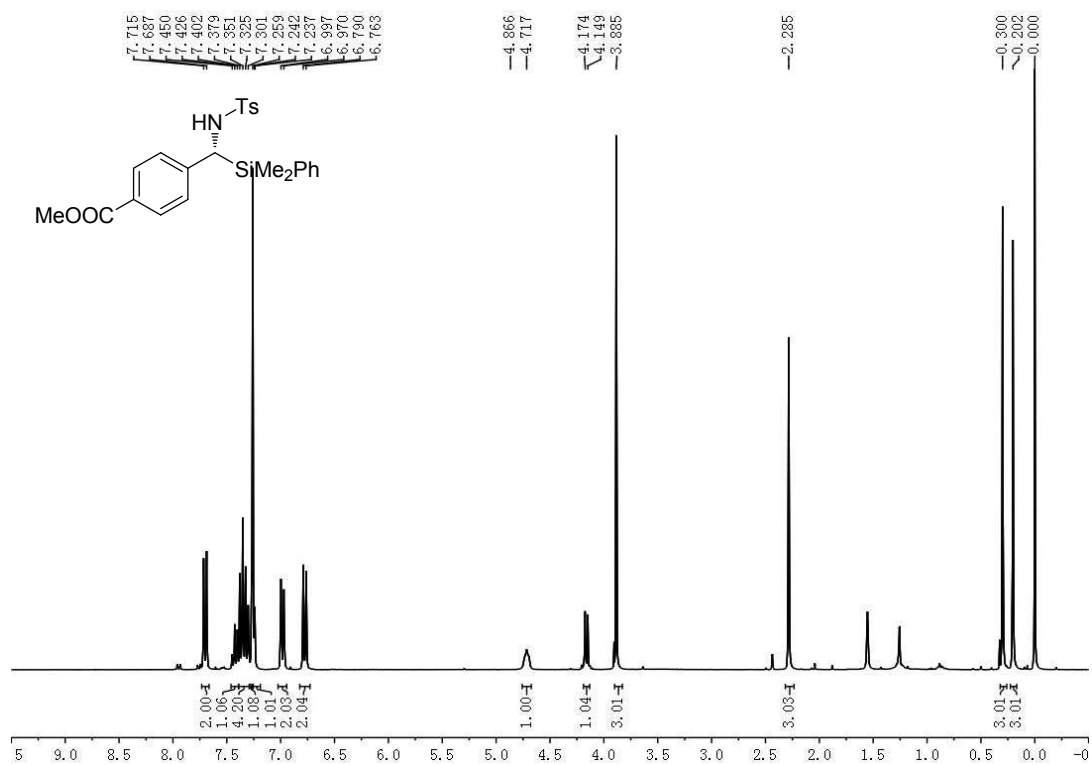


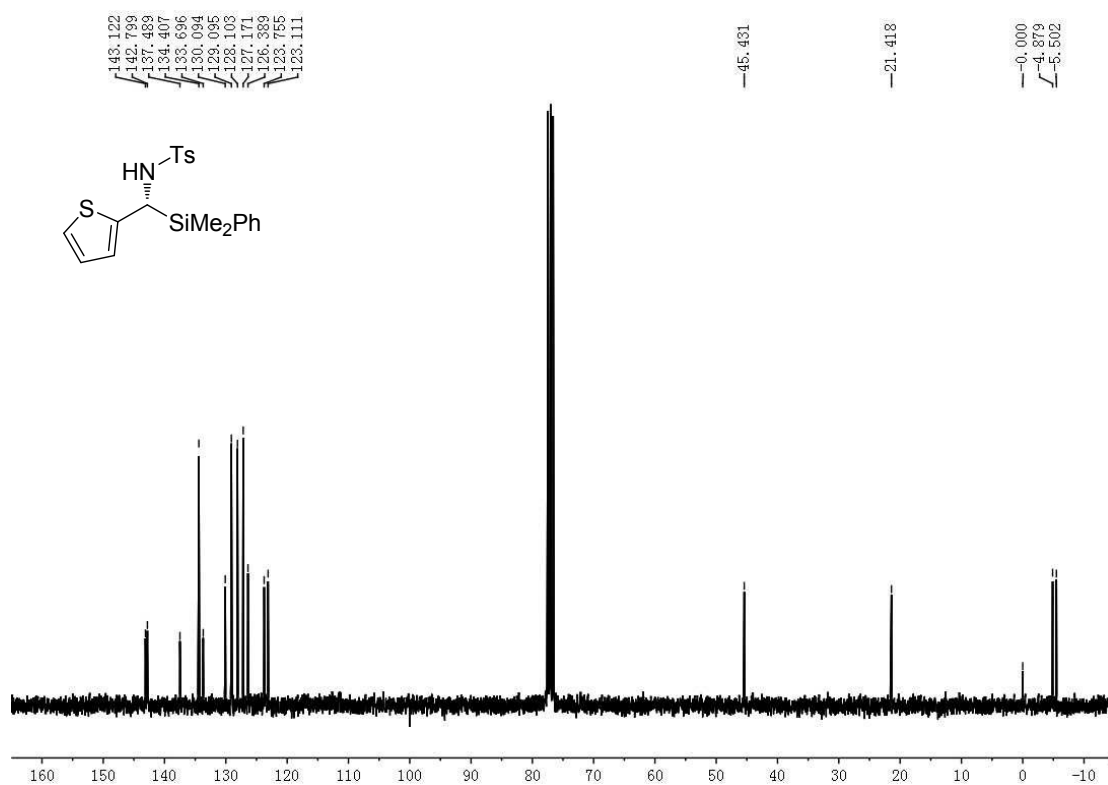
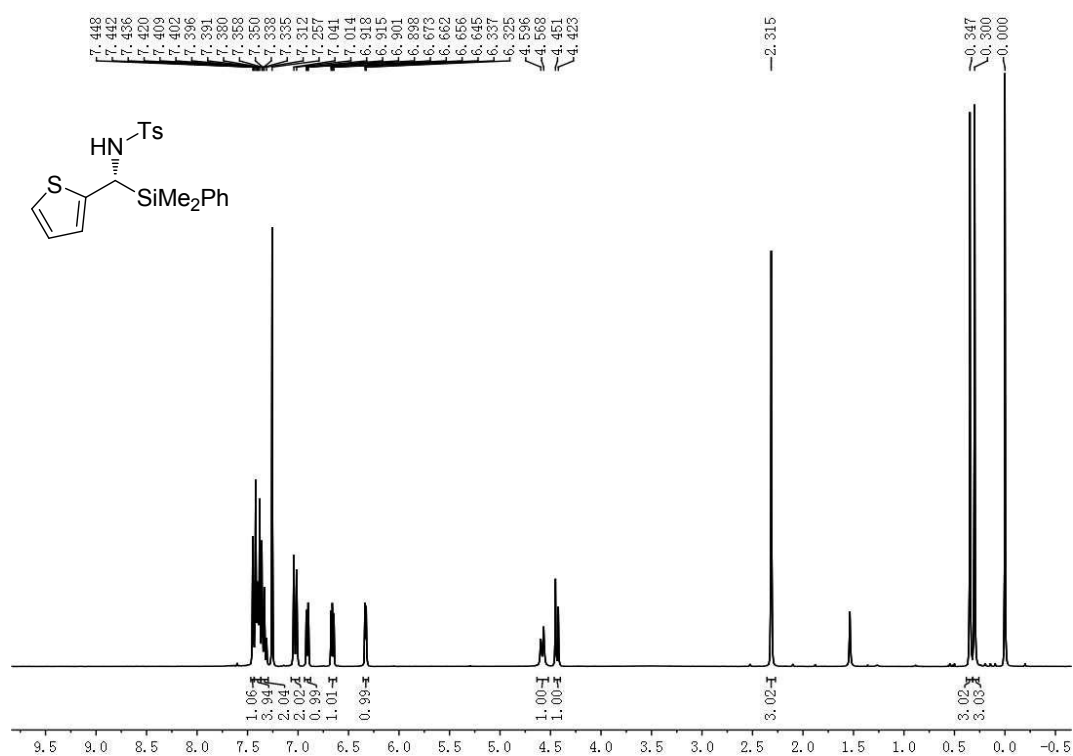


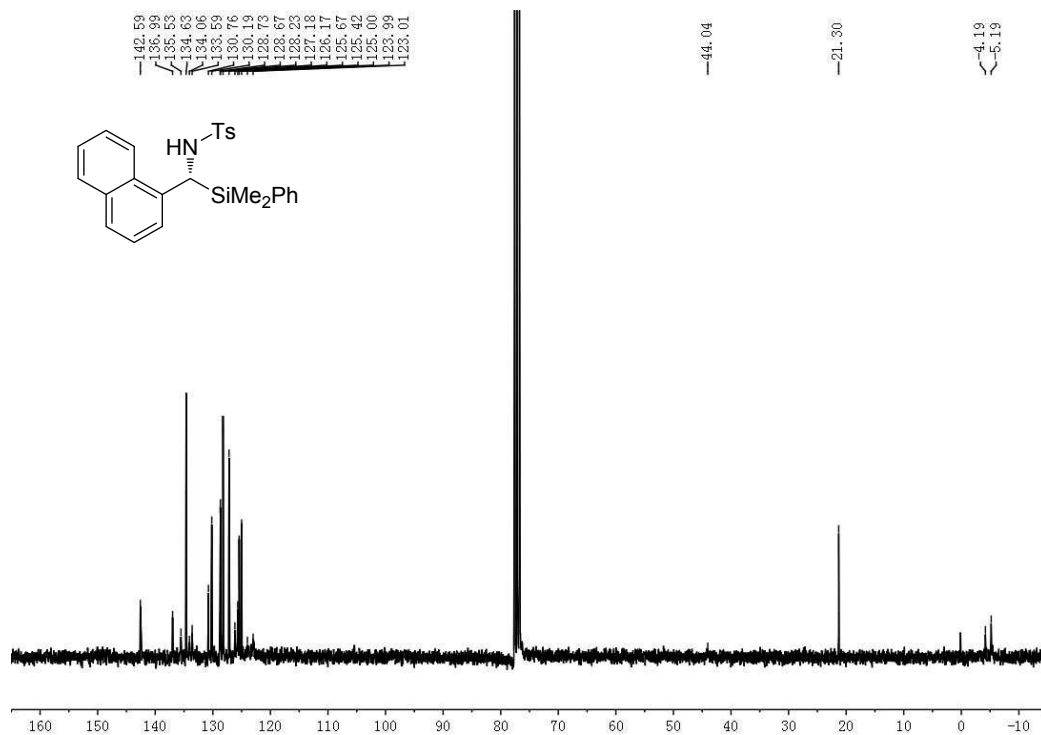
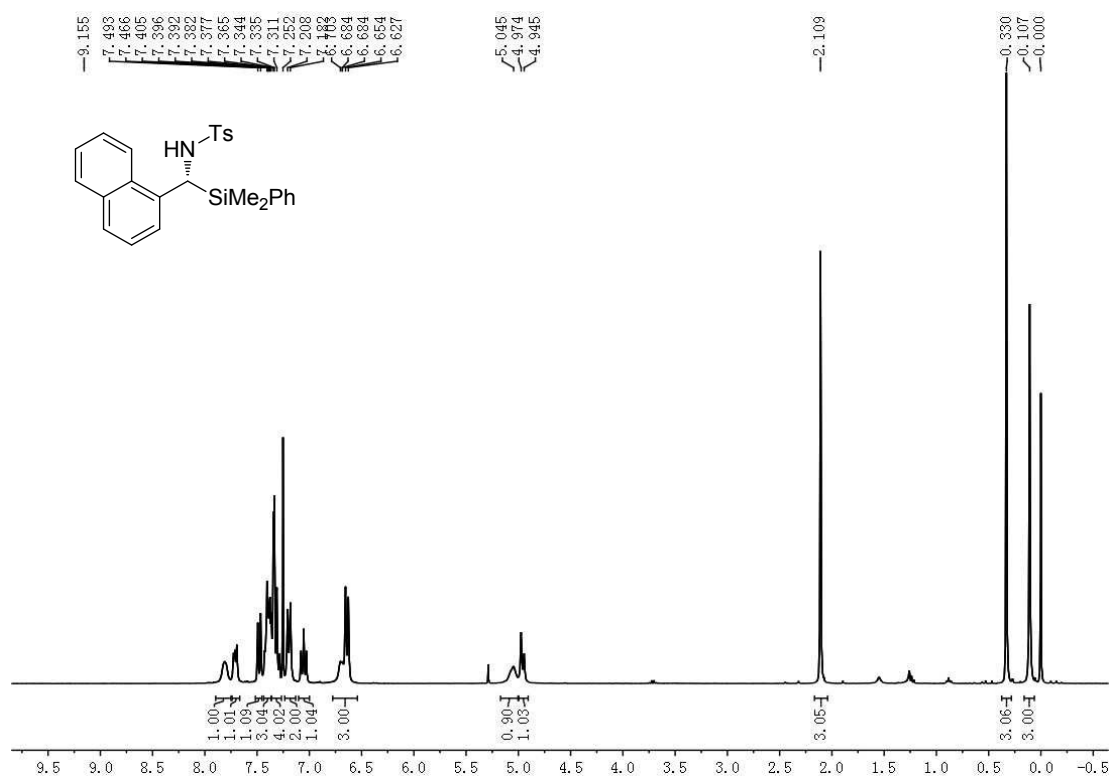


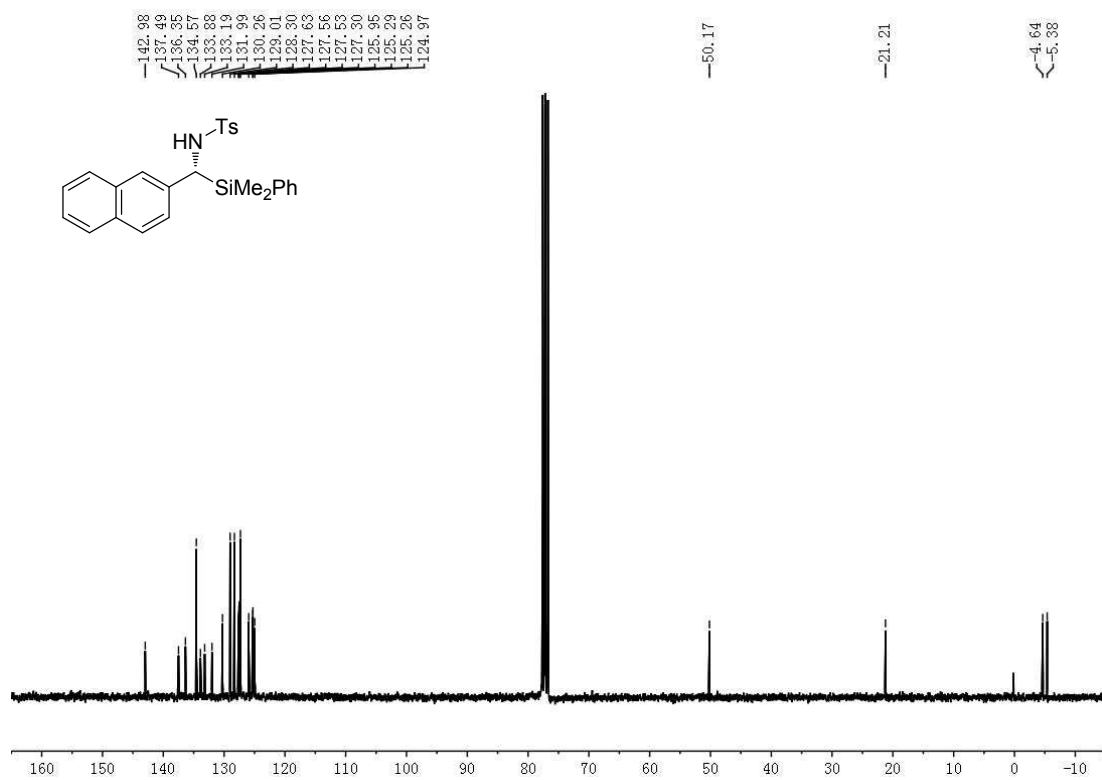
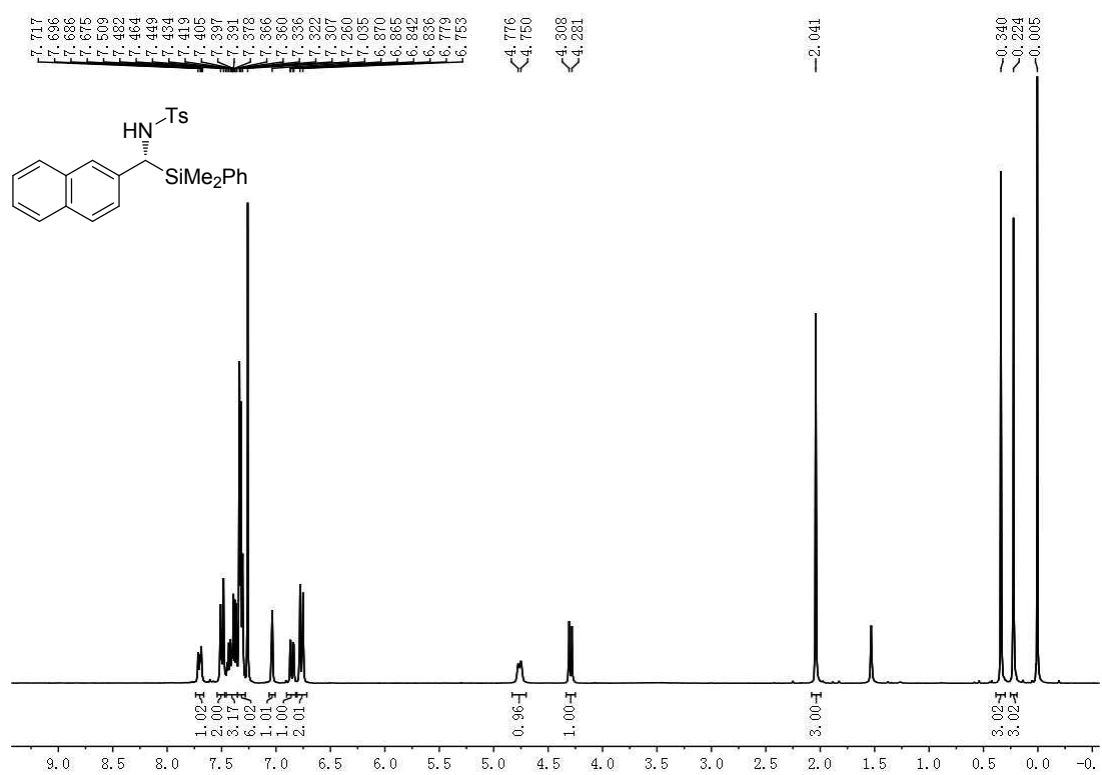


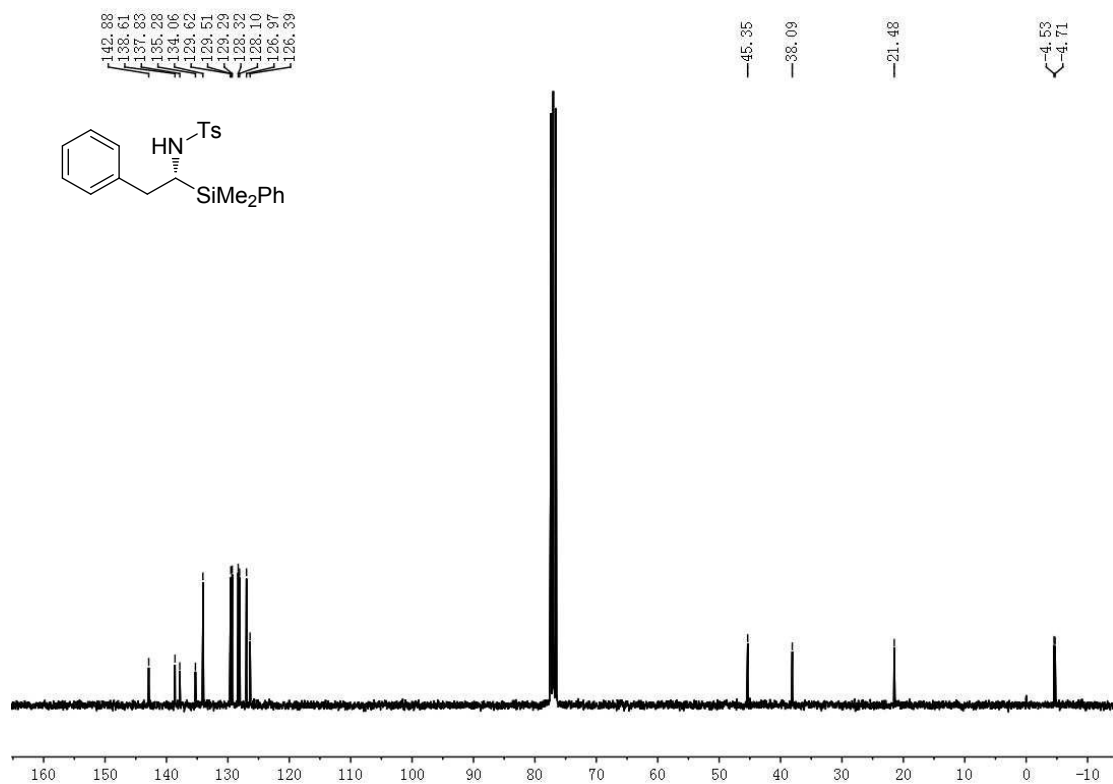
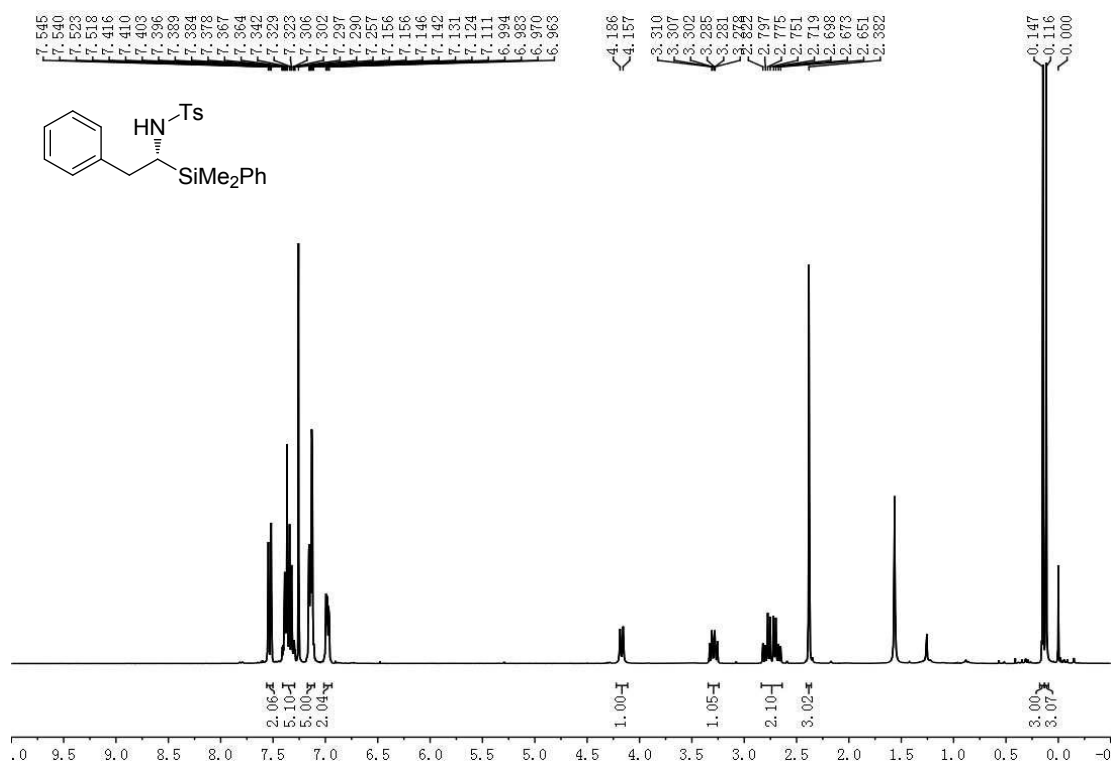


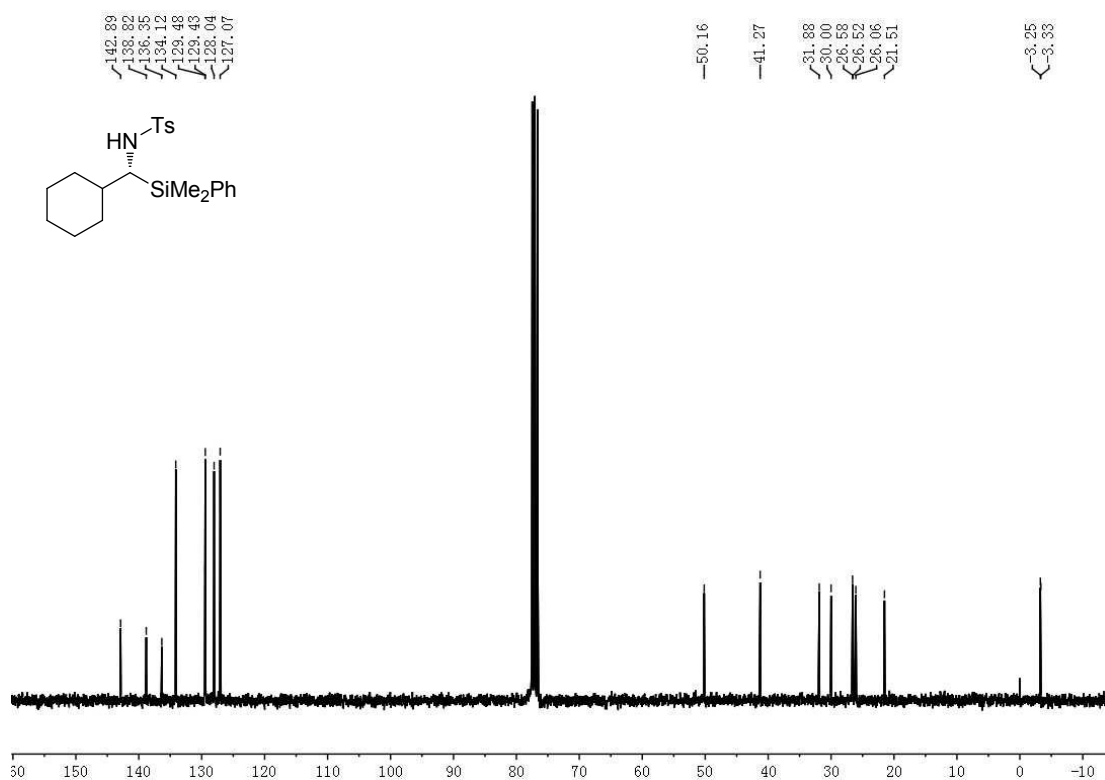
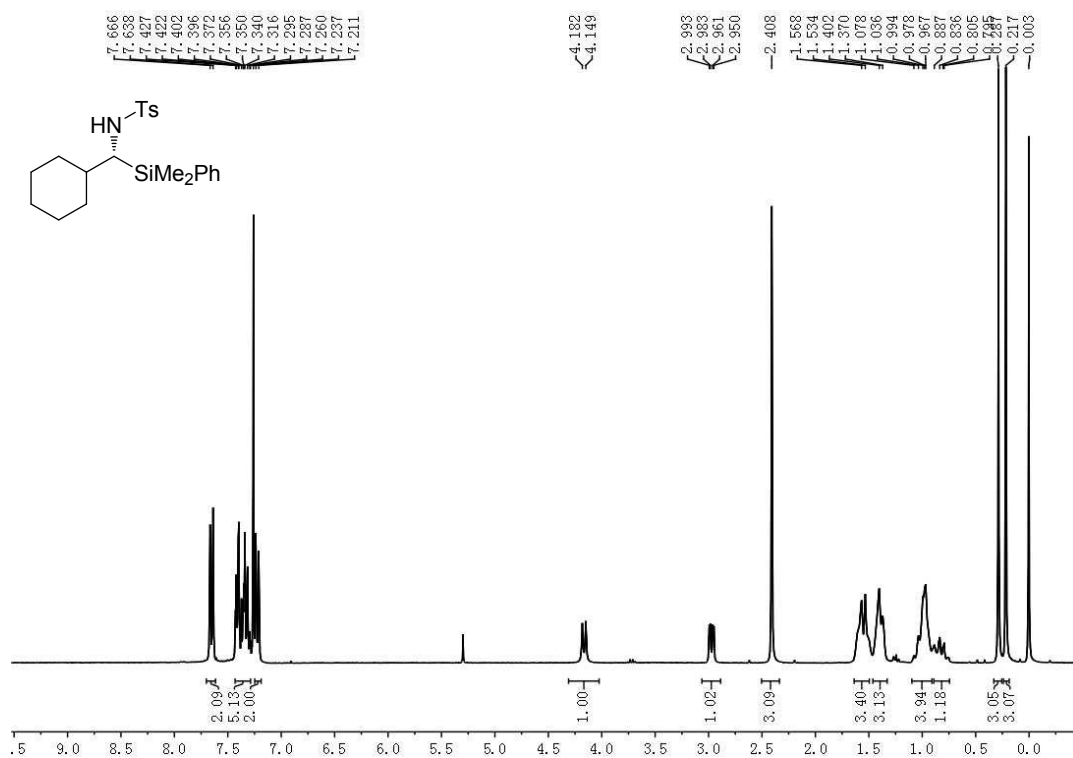


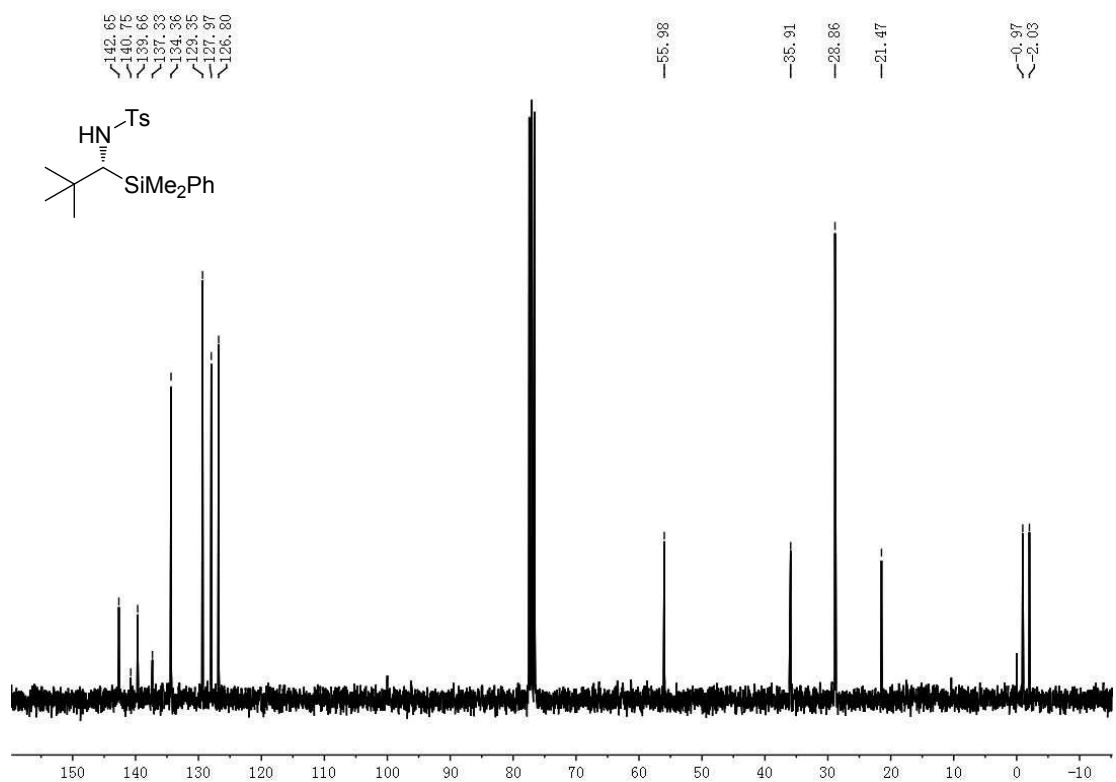
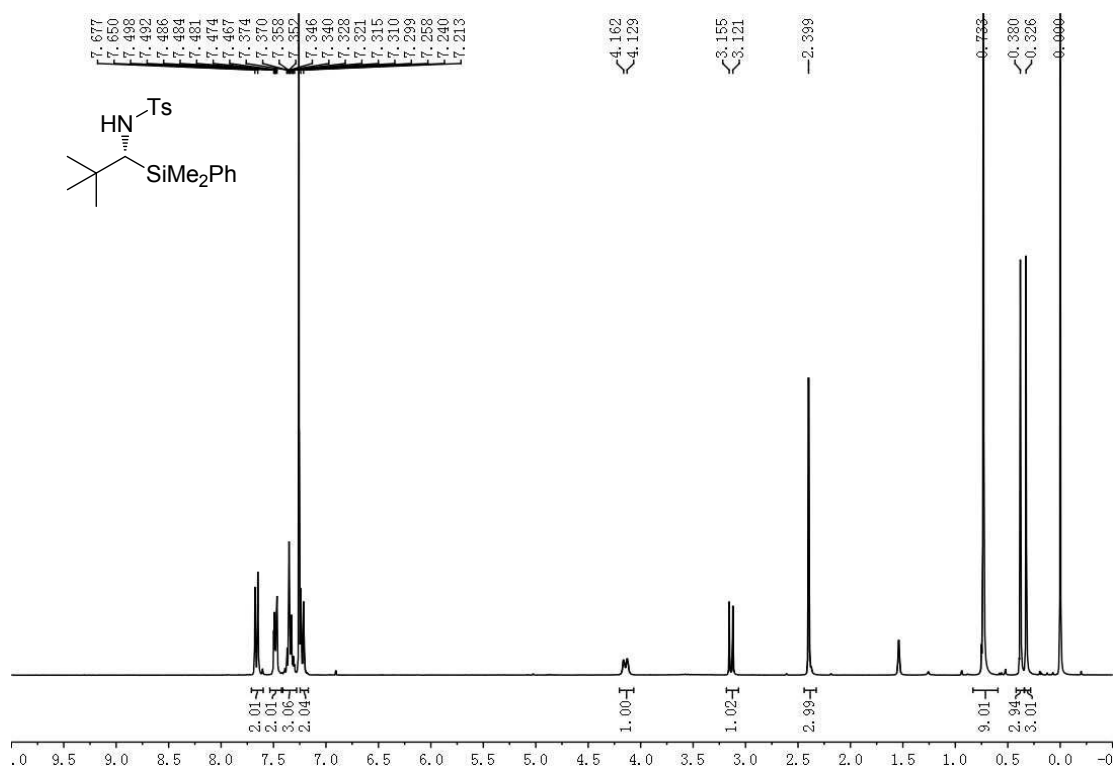






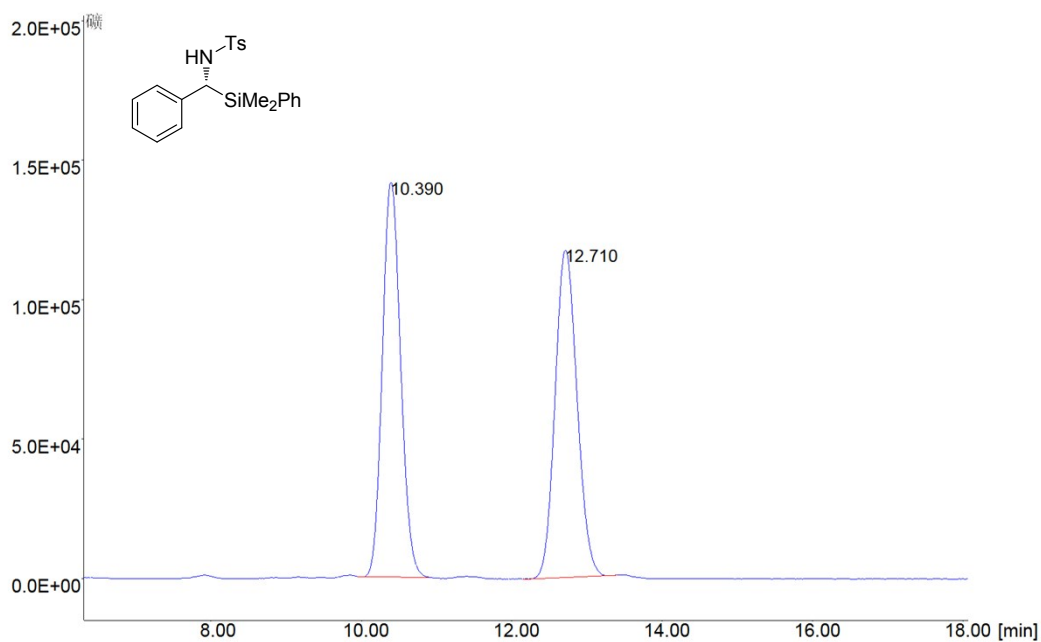




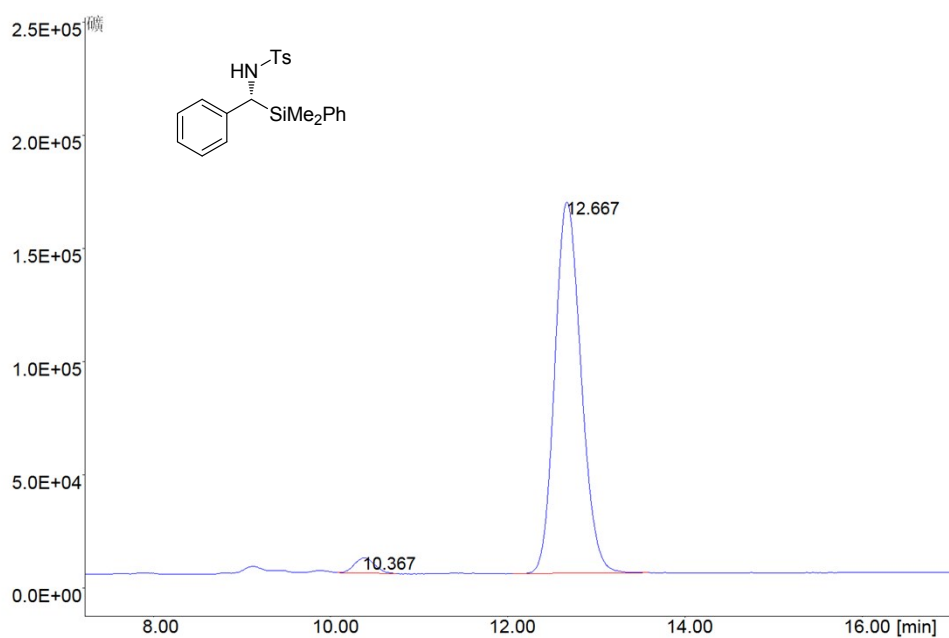


2. HPLC spectra

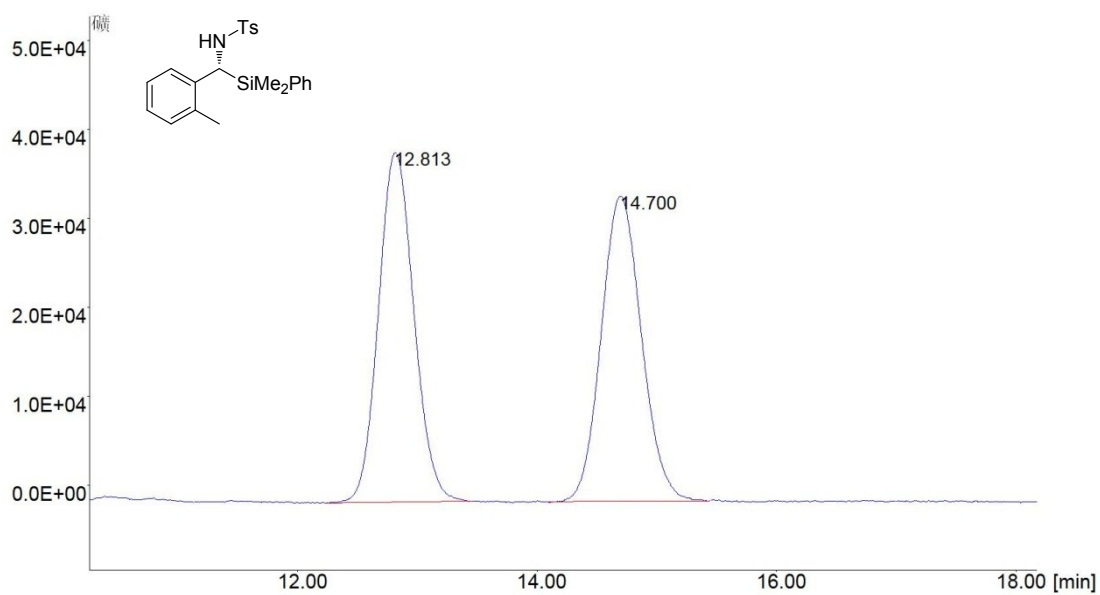
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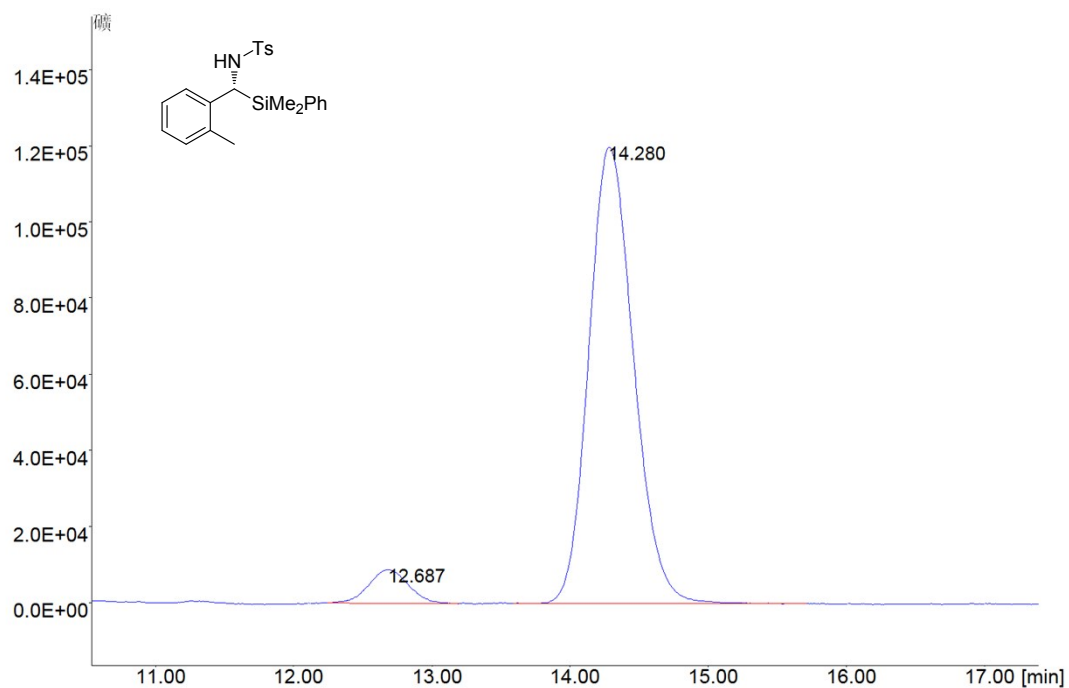
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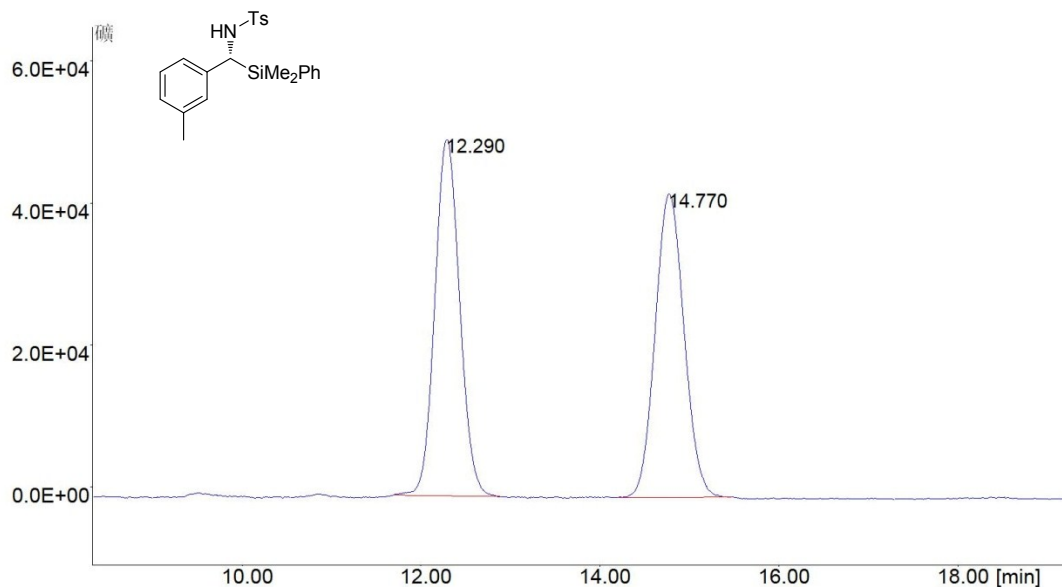
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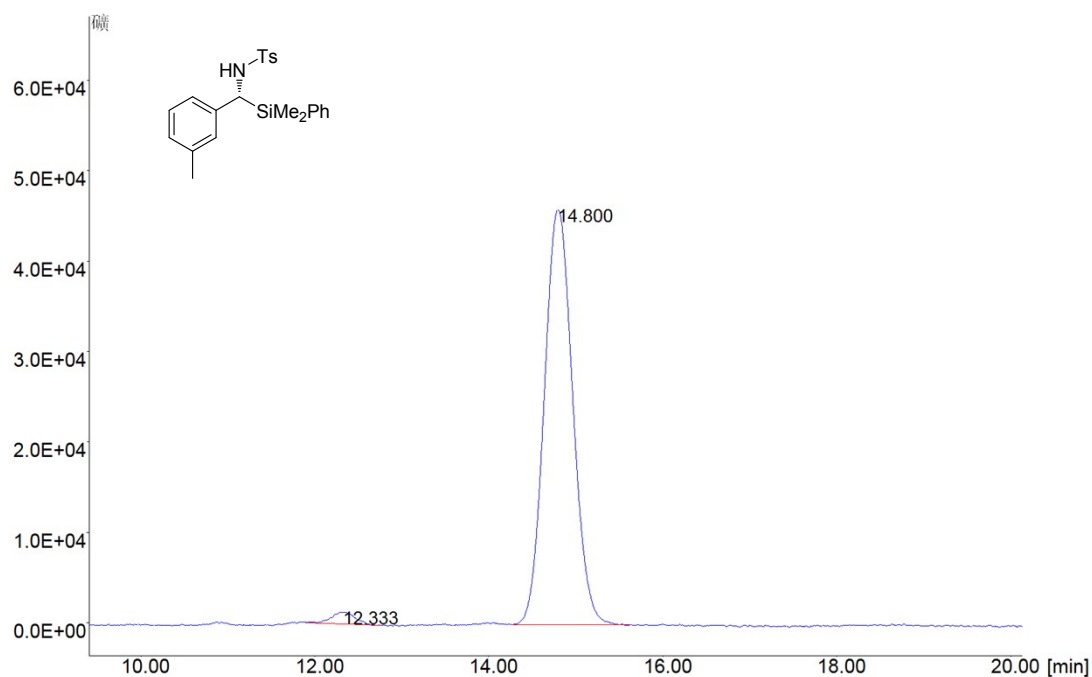
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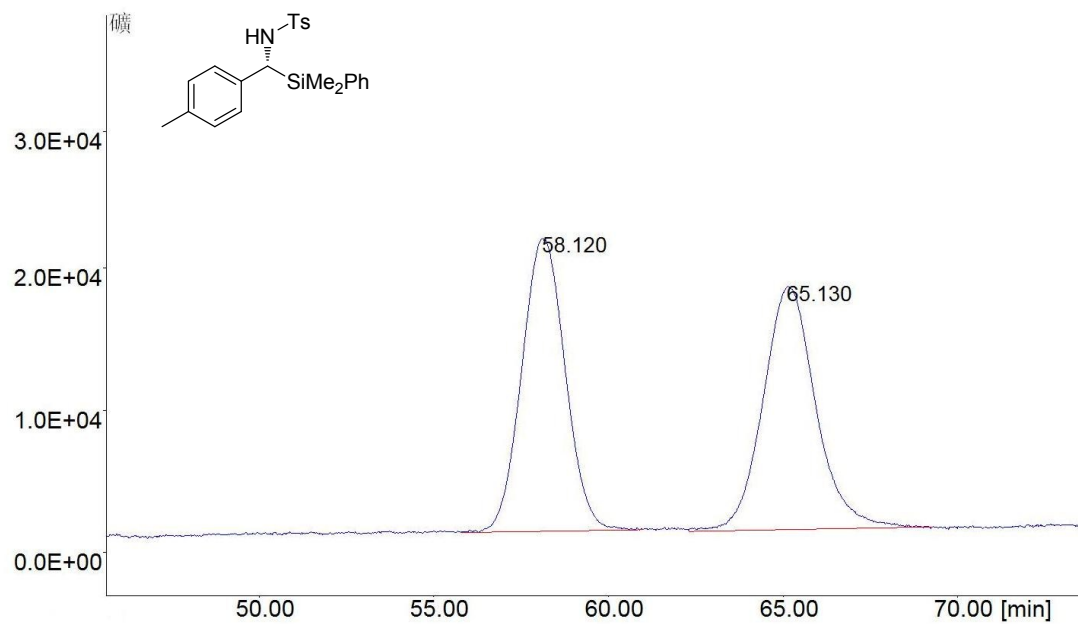
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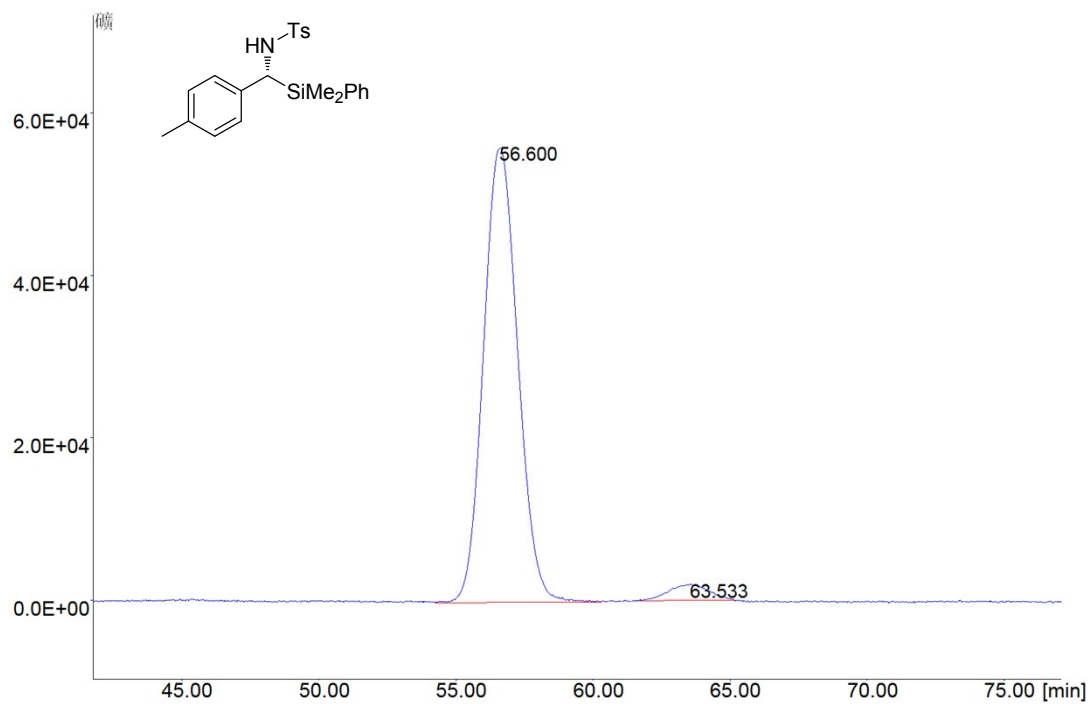
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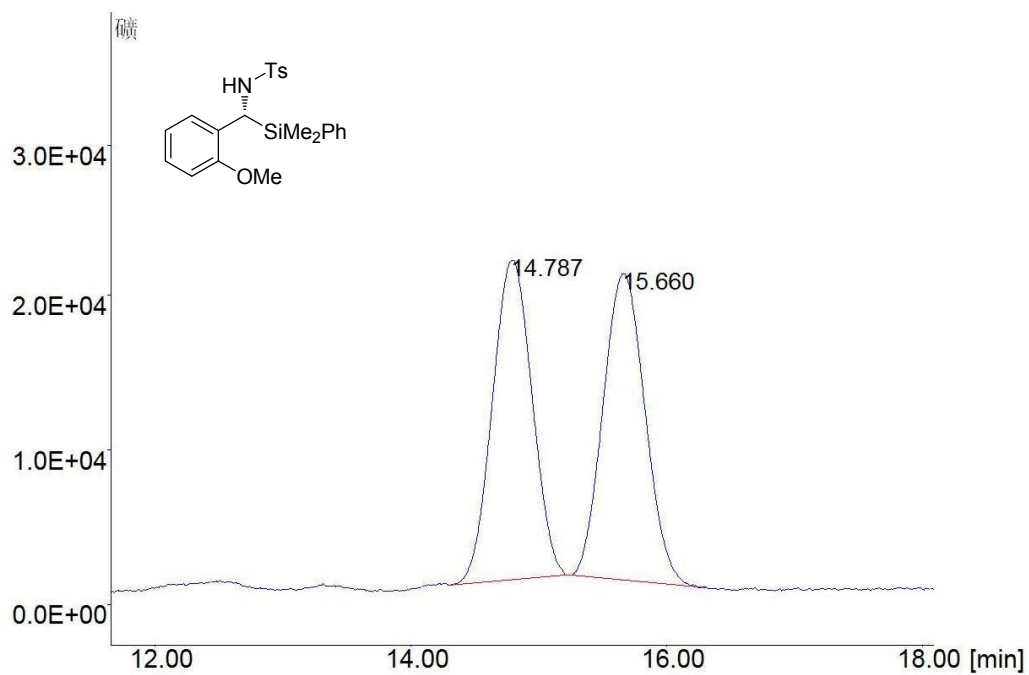
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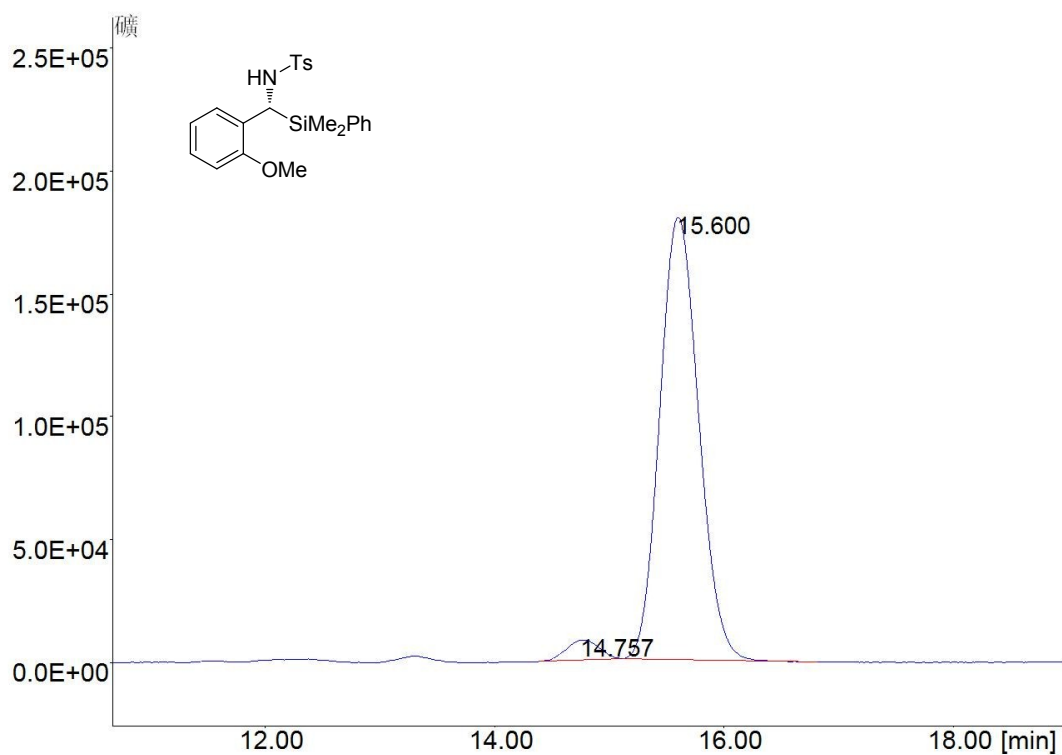
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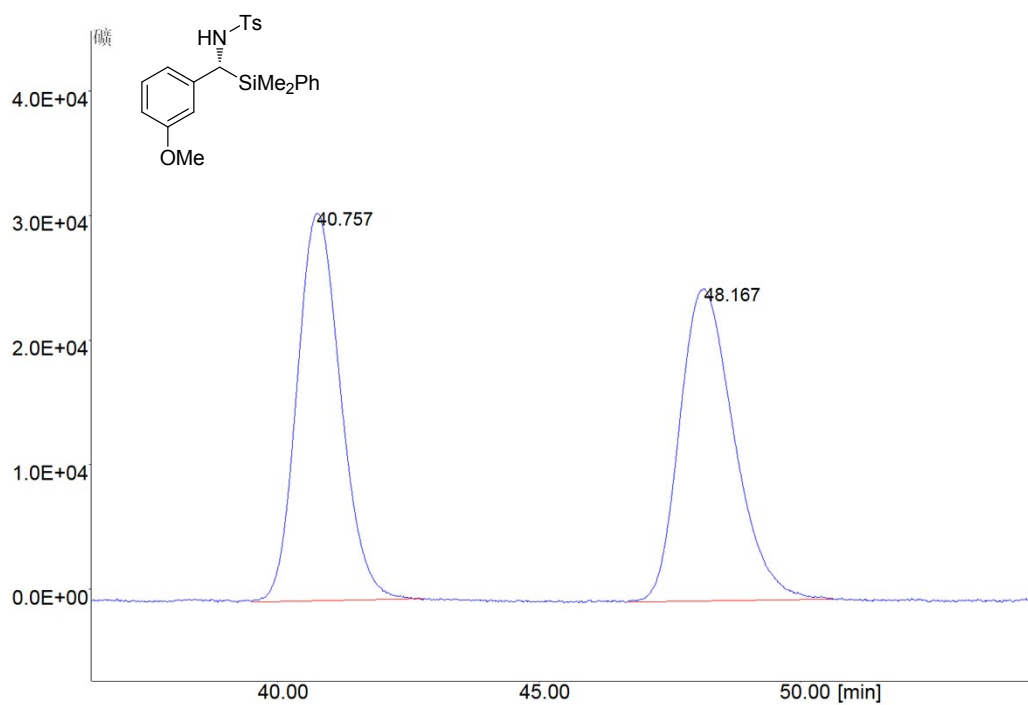
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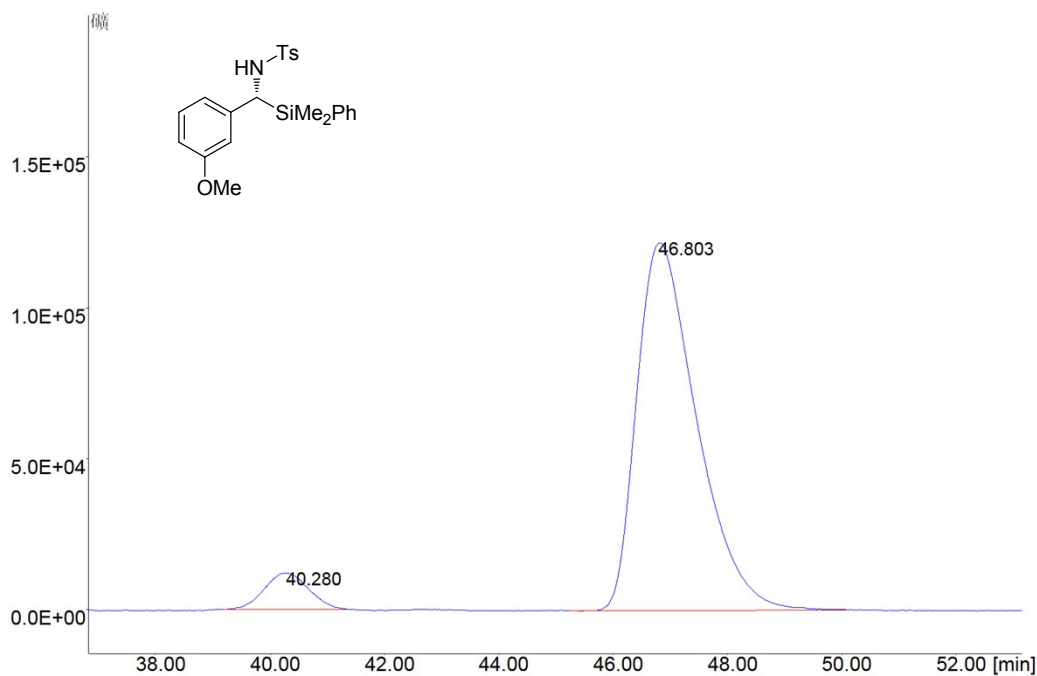
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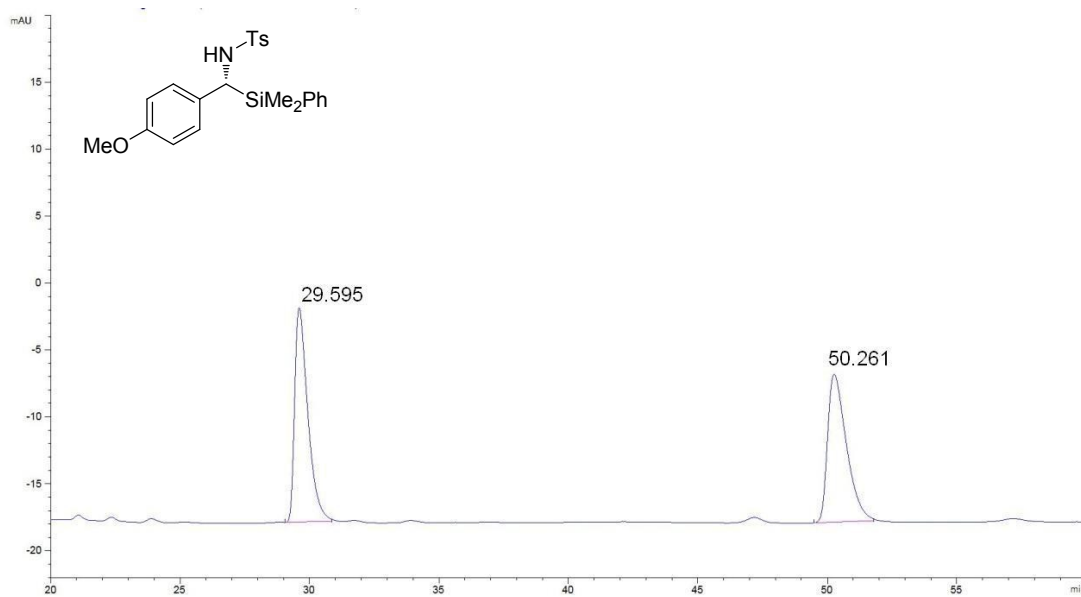
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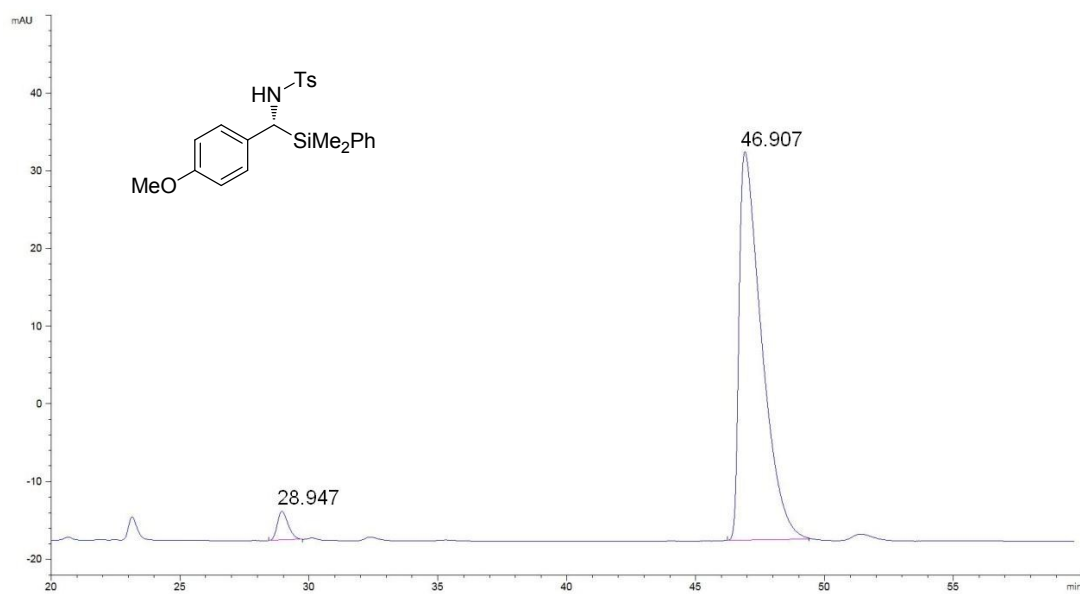
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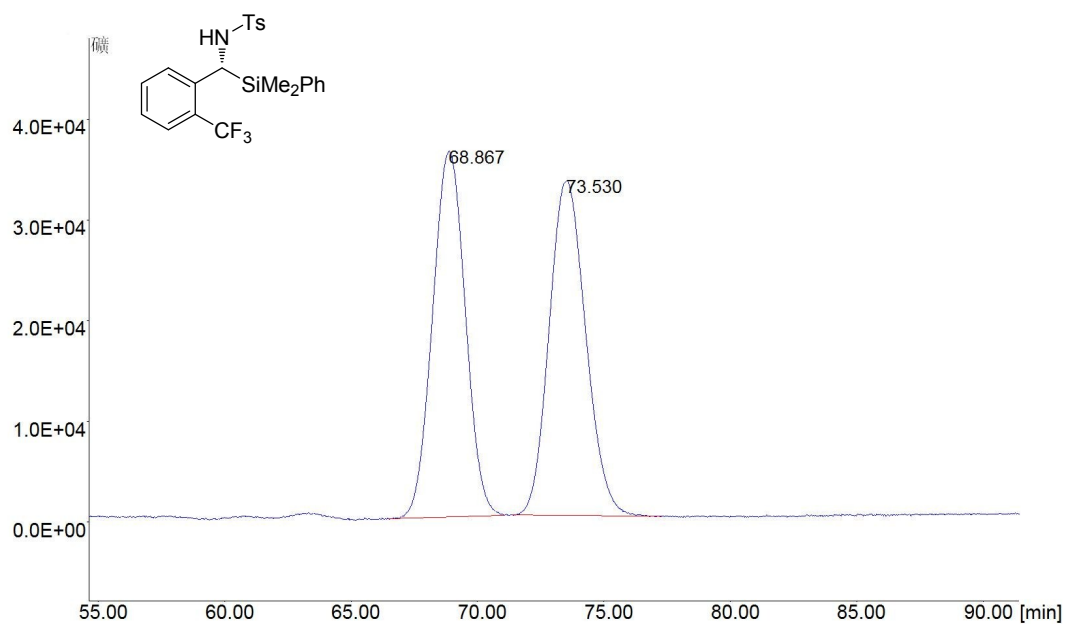
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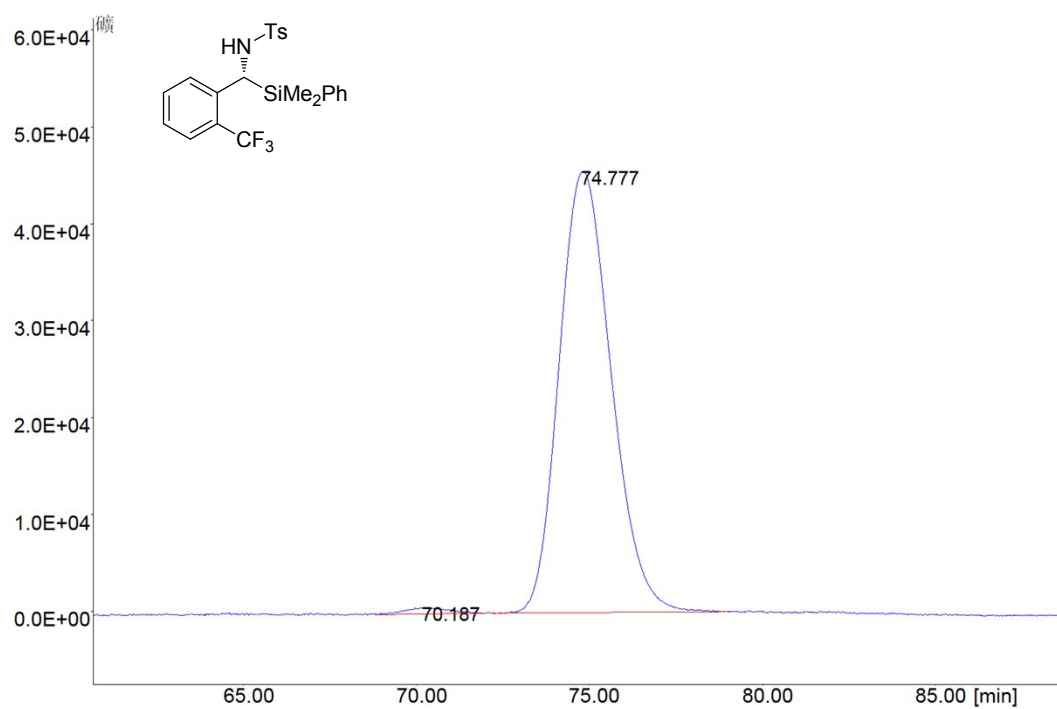
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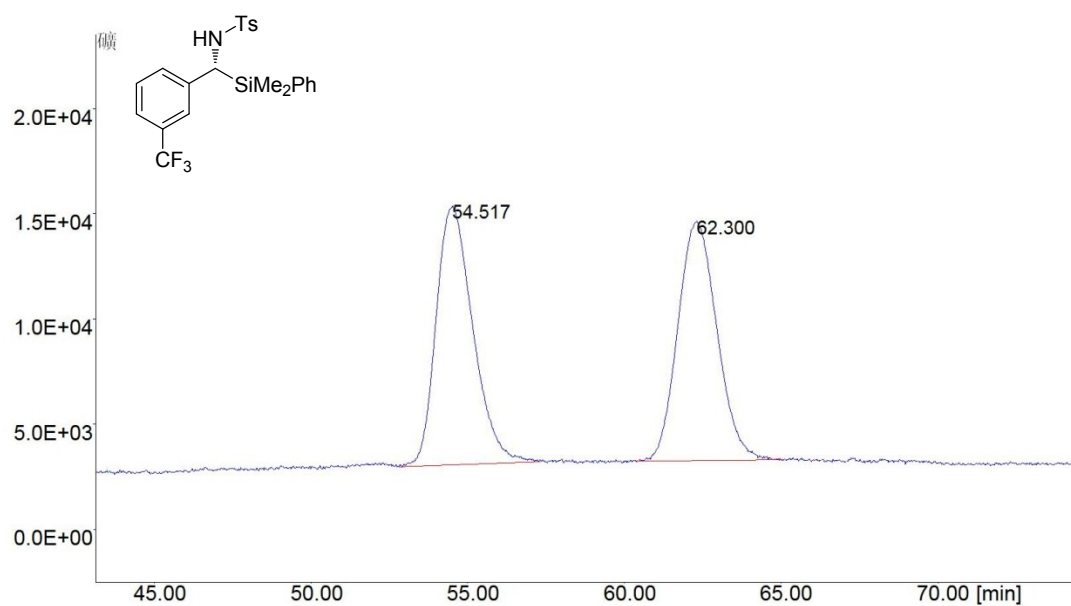
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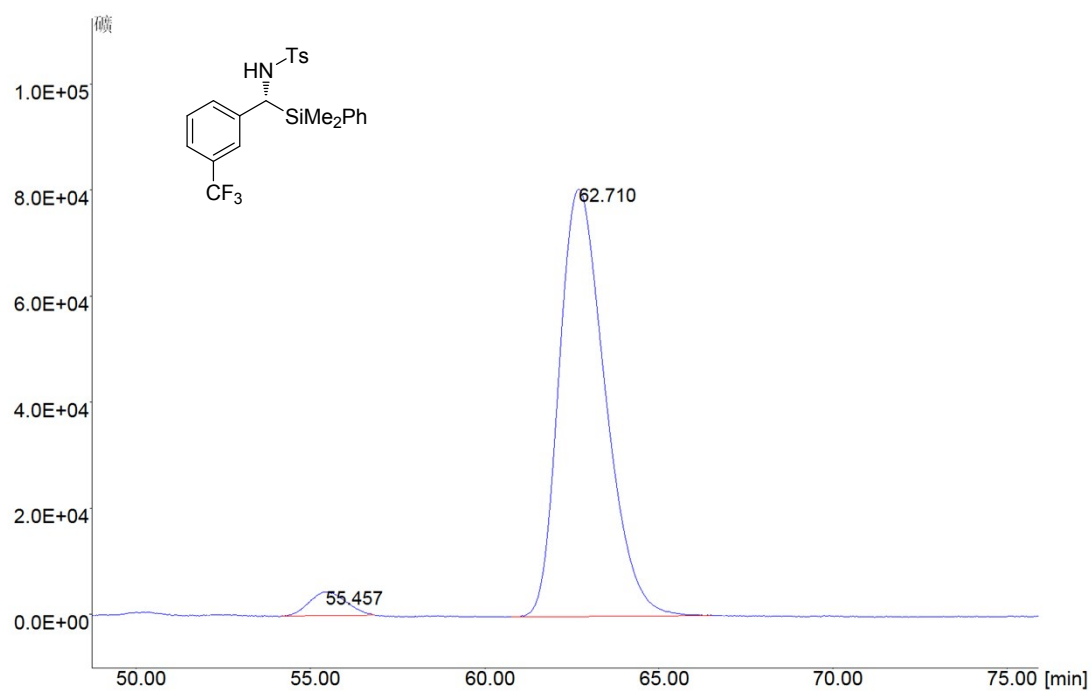
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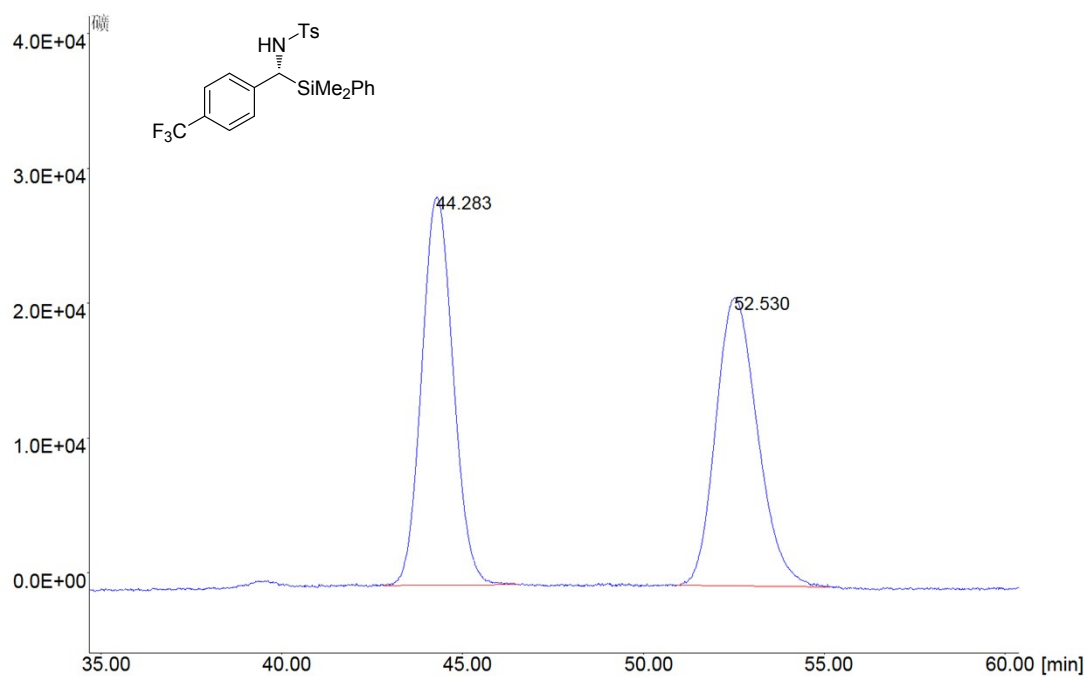
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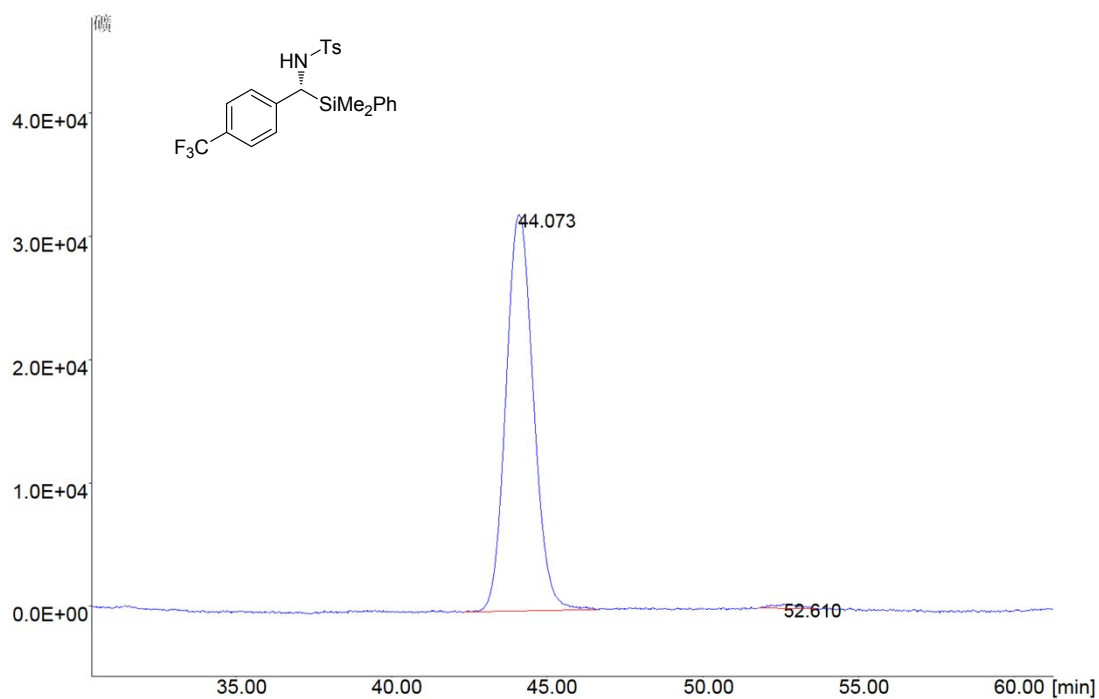
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1	54.517	12319	988752.431	50.351
2	62.300	11402	974984.513	49.649



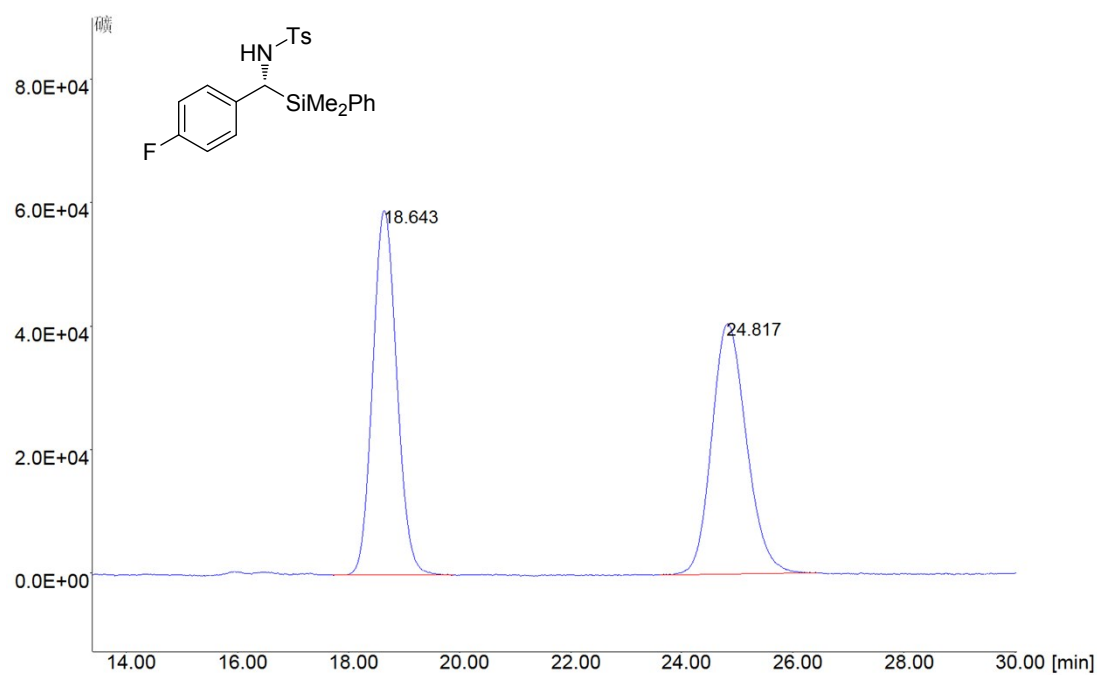
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	55.457	4465	324132.473	4.228
2	62.710	80638	7341701.490	95.772



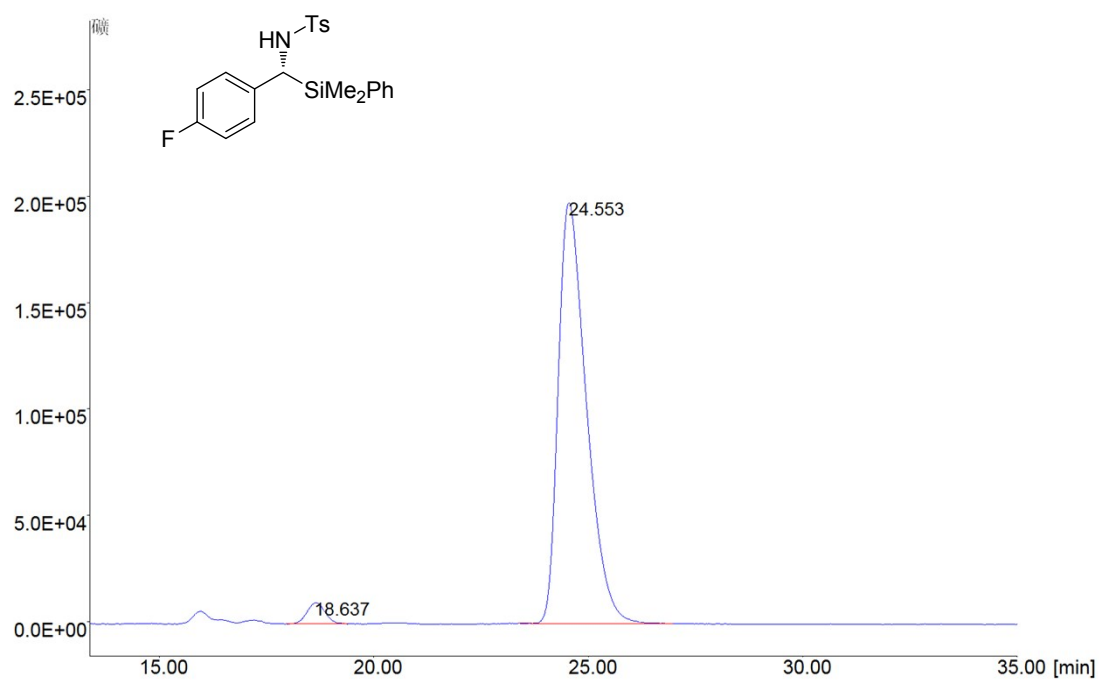
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	44.283	28805	1722121.439	50.267
2	52.530	21393	1703848.423	49.733



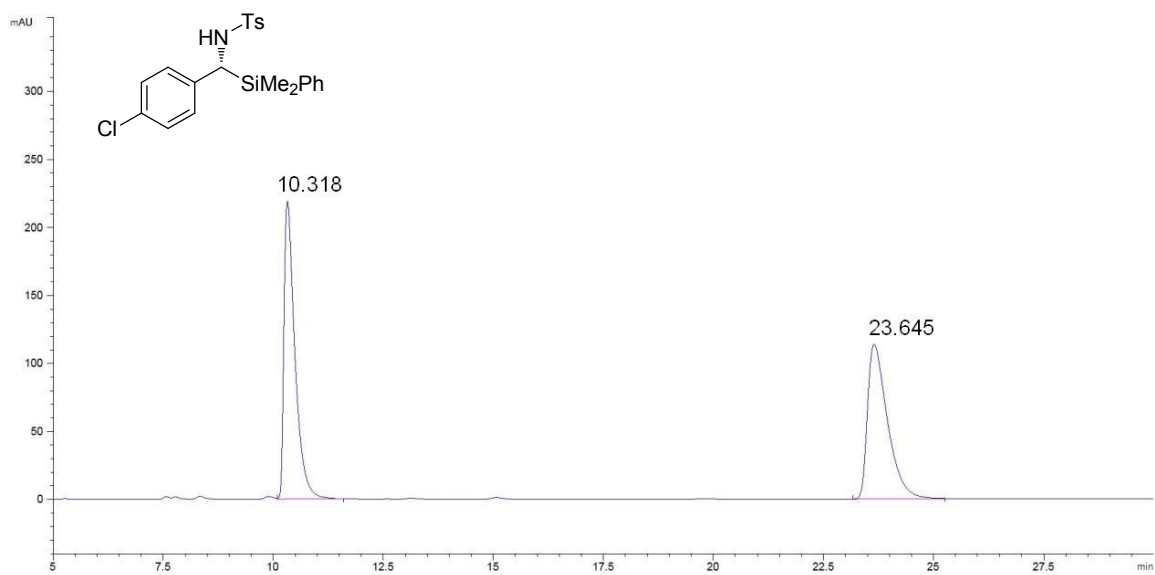
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	44.073	32172	1939769.962	99.160
2	52.610	356	16430.112	0.840



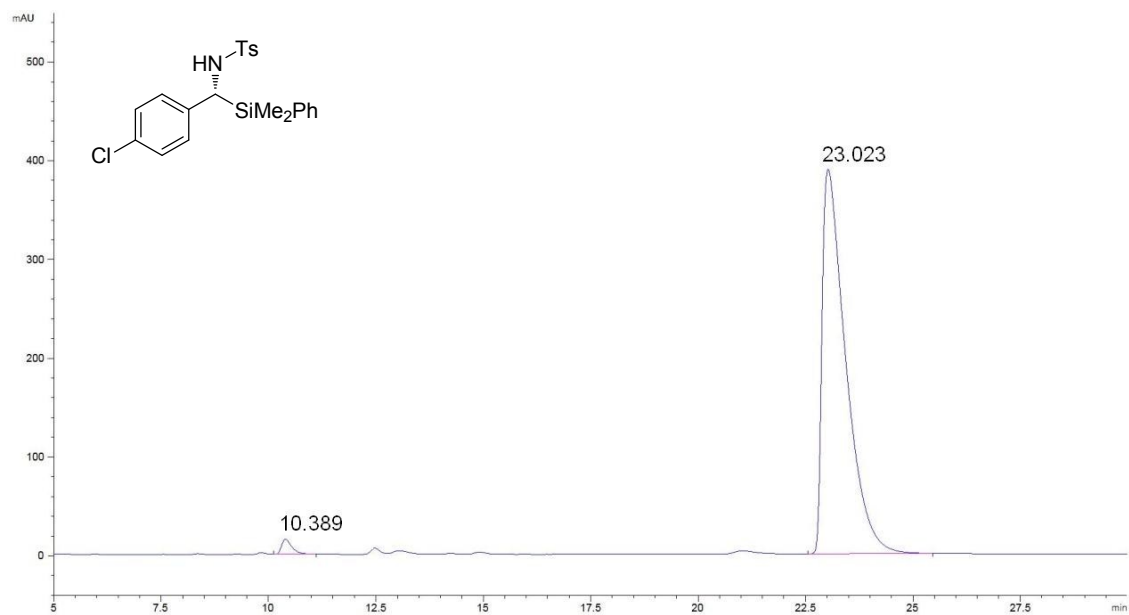
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	18.643	59003	1749395.685	50.028
2	24.817	40558	1747467.276	49.972



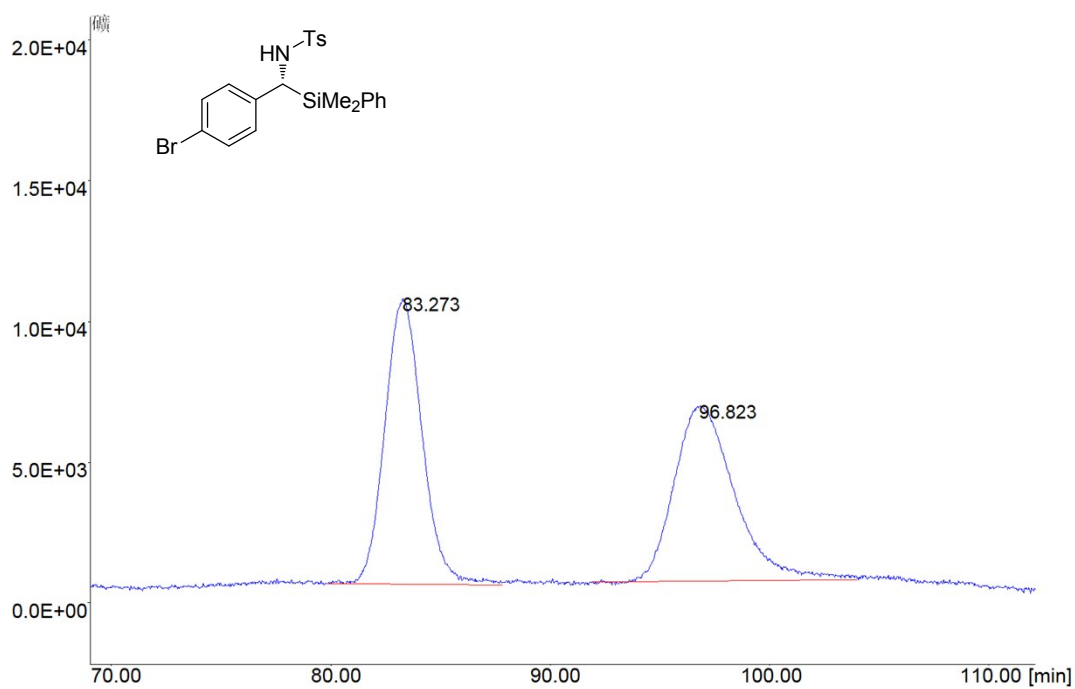
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	18.637	9788	283847.111	3.090
2	24.553	197457	8901833.983	96.910



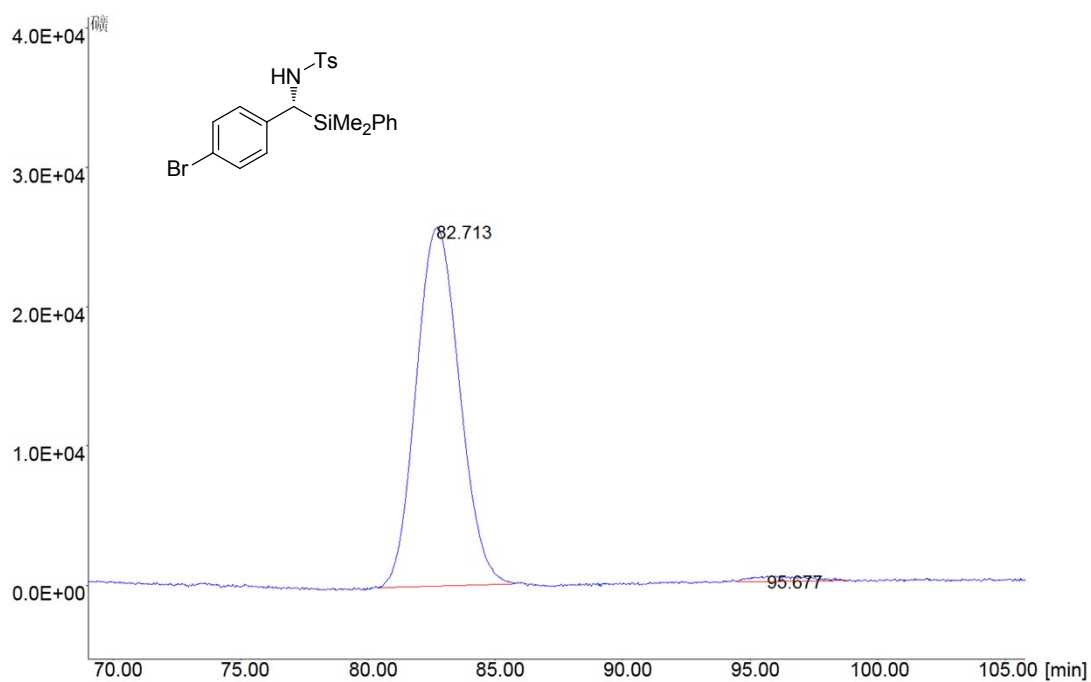
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	10.318	219.18790	3802.24683	51.4258
2	23.645	113.88053	3591.40942	48.5742



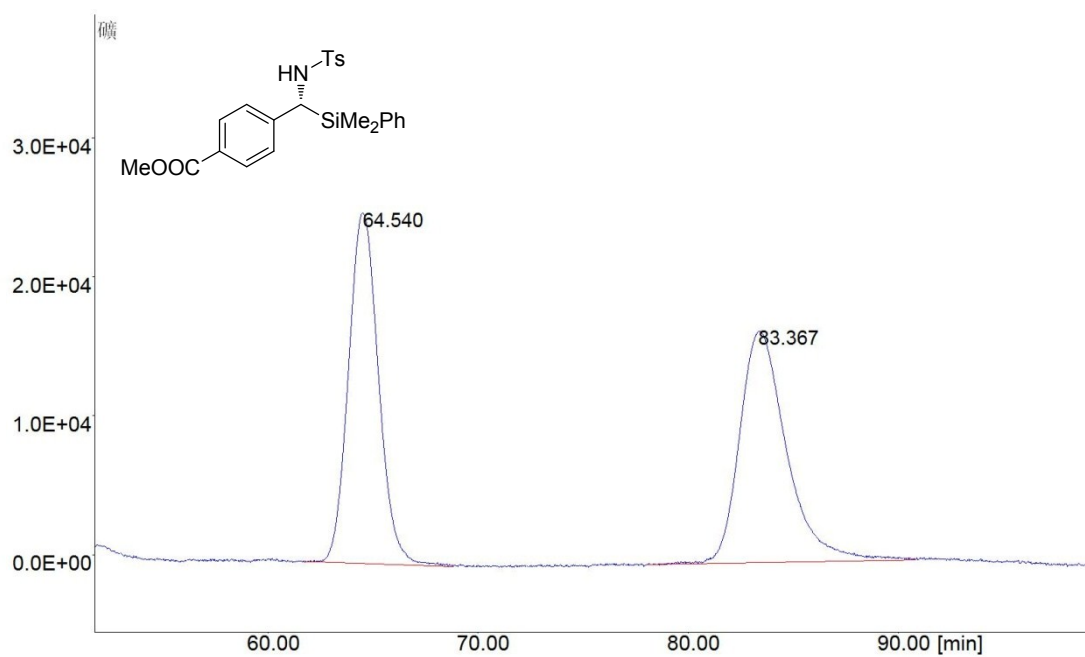
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	10.389	15.47091	262.26102	1.7333
2	23.023	389.55618	1.48683e4	98.2667



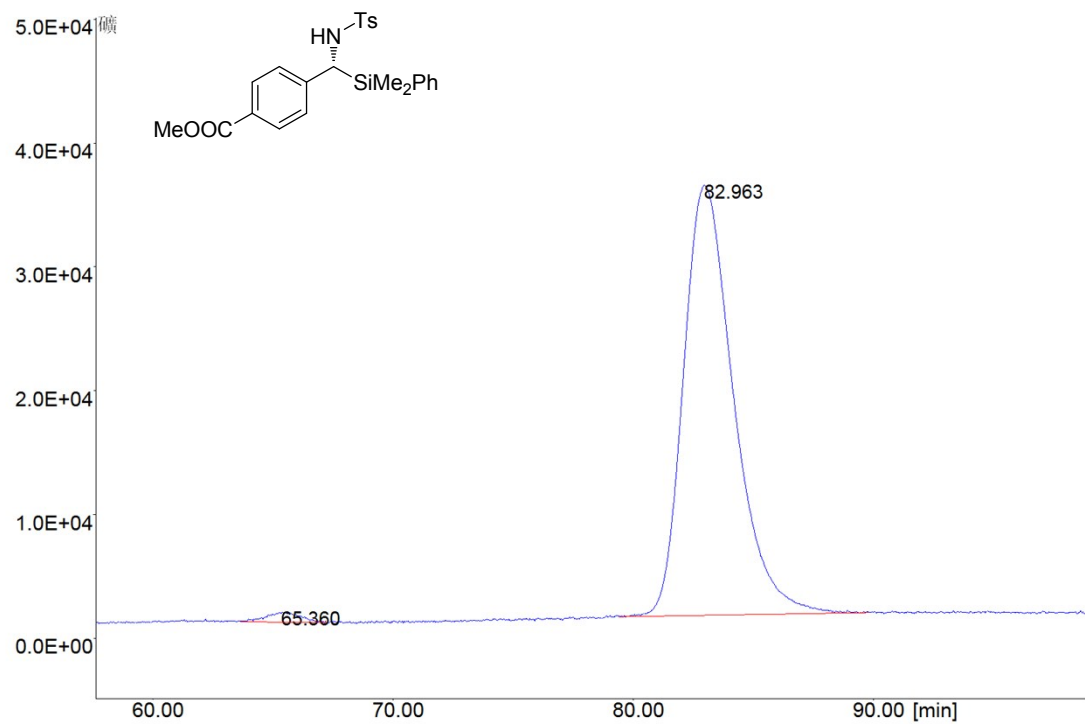
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	83.273	10163	1182877.942	50.240
2	96.823	6235	1171570.441	49.760



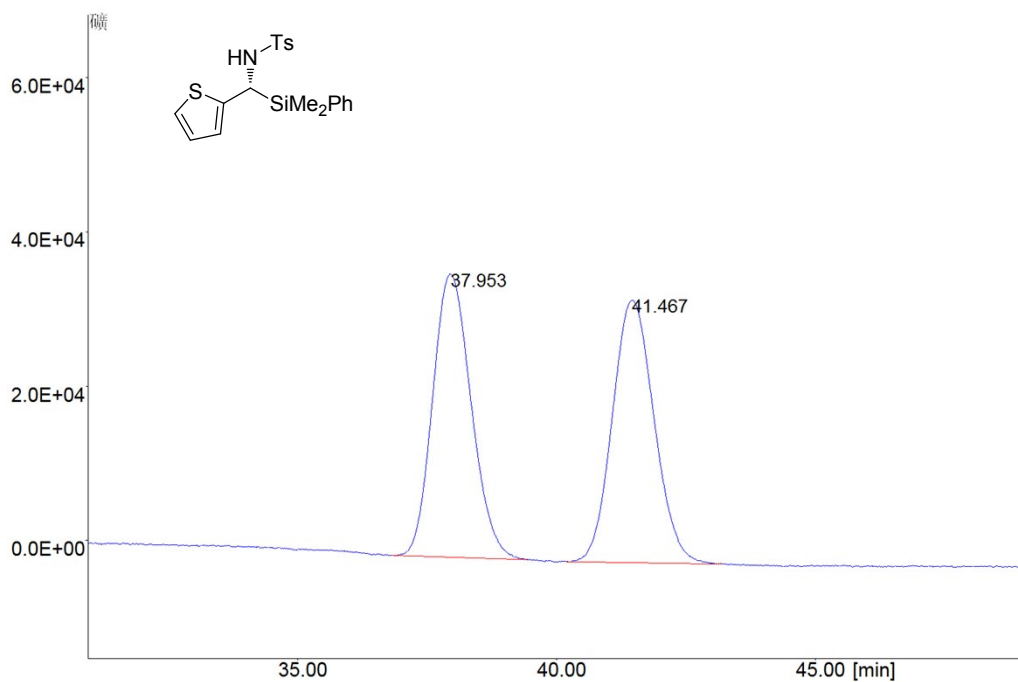
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	82.713	25801	3013624.286	98.431
2	95.677	386	48036.846	1.569



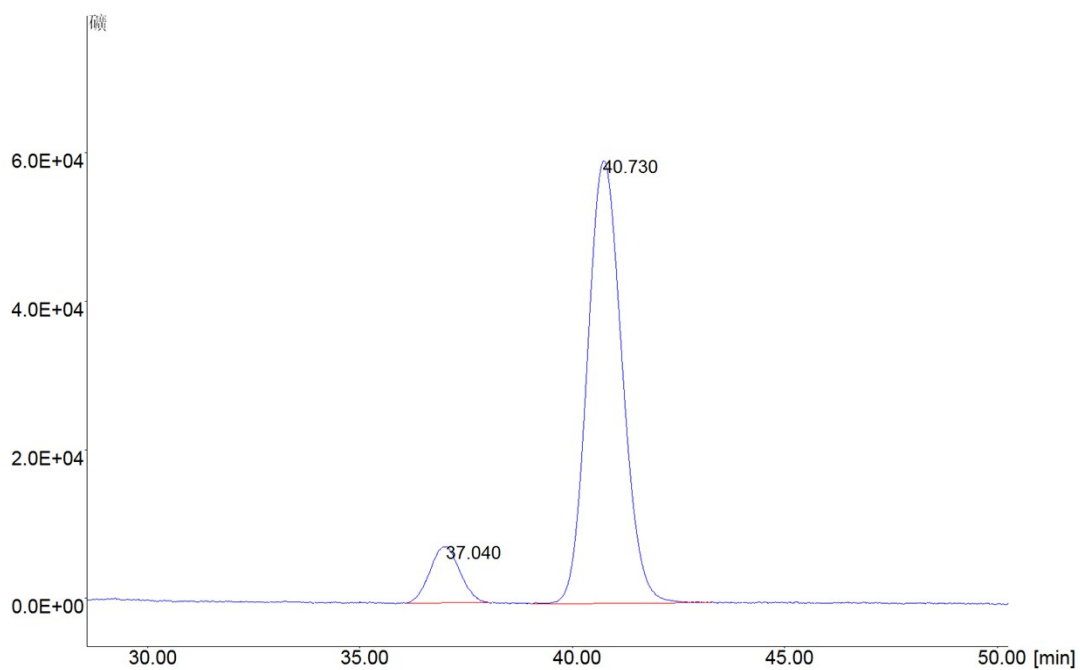
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	64.540	25227	2478493.272	49.223
2	83.367	16685	2556789.771	50.777



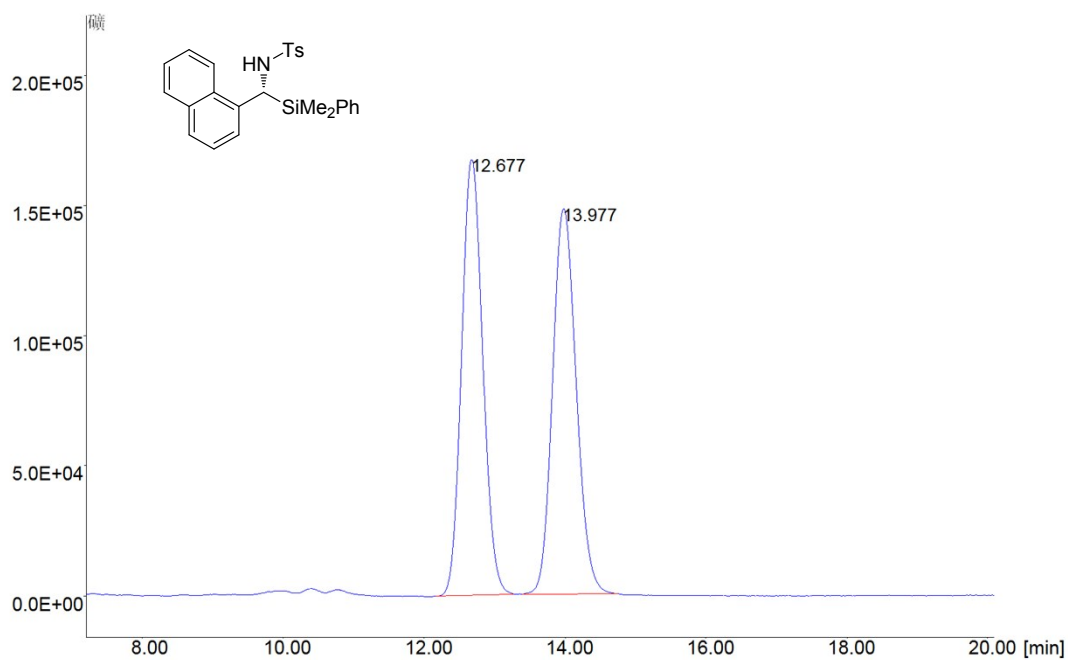
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	65.360	789	71219.016	1.411
2	82.963	34756	4976402.941	98.589



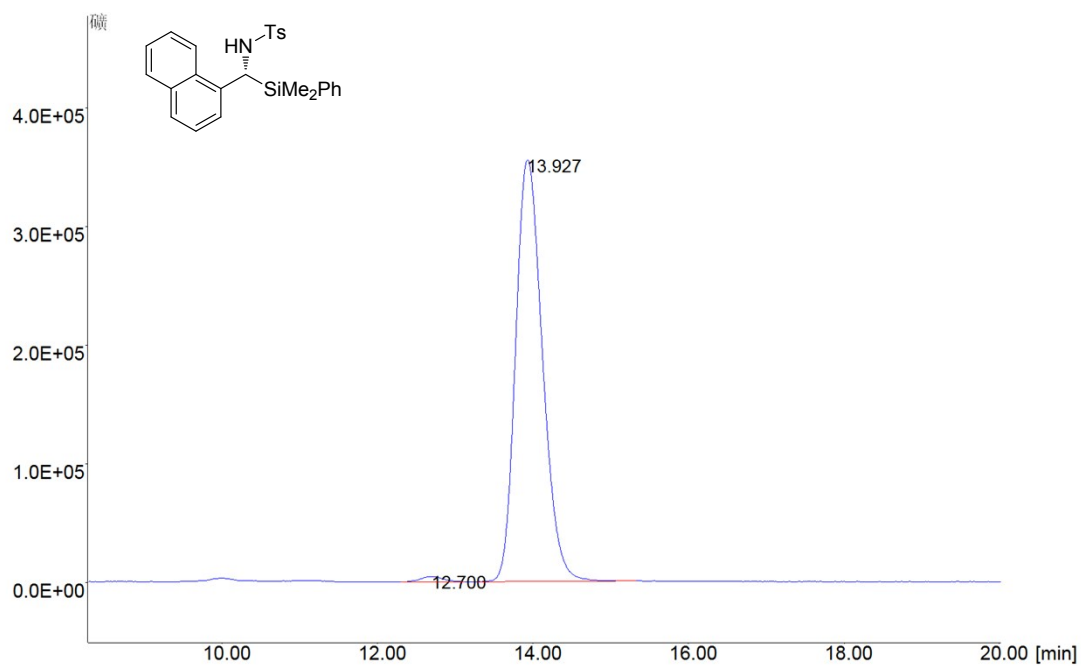
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	37.953	36695	1872958.013	49.764
2	41.467	34039	1890700.419	50.236



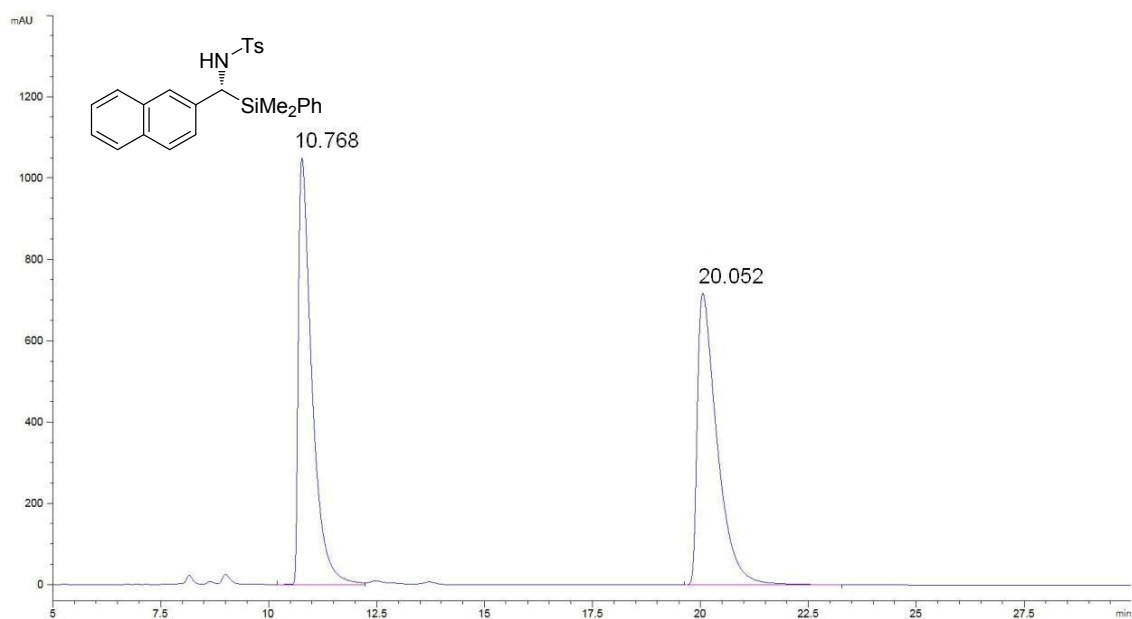
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	37.040	7604	370004.400	9.973
2	40.730	59644	3339910.179	90.027



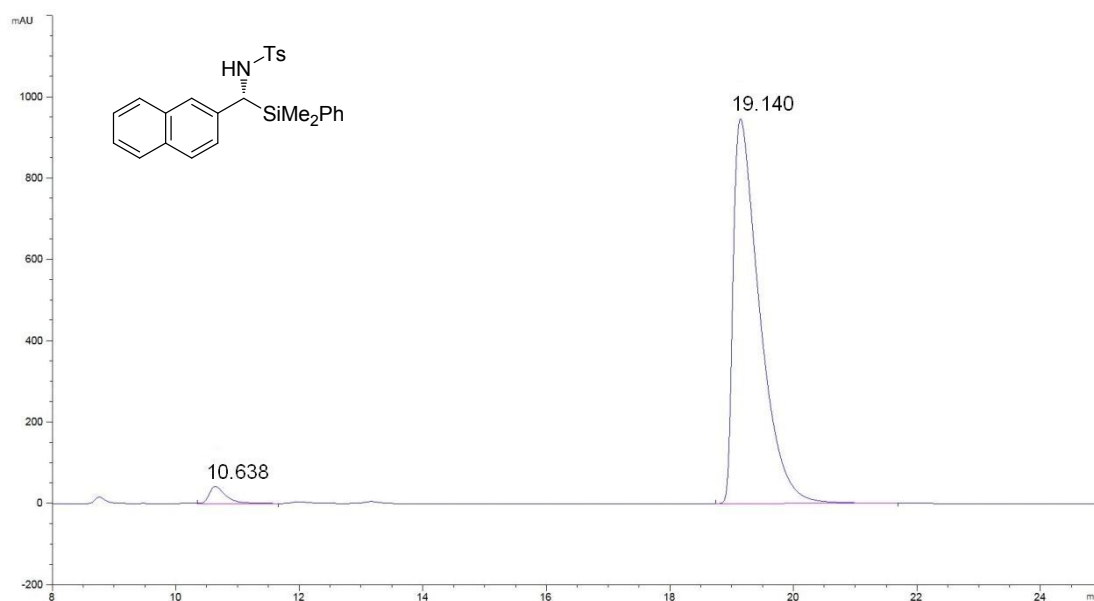
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	12.677	167546	3417984.400	50.154
2	13.977	148049	3397059.510	49.846



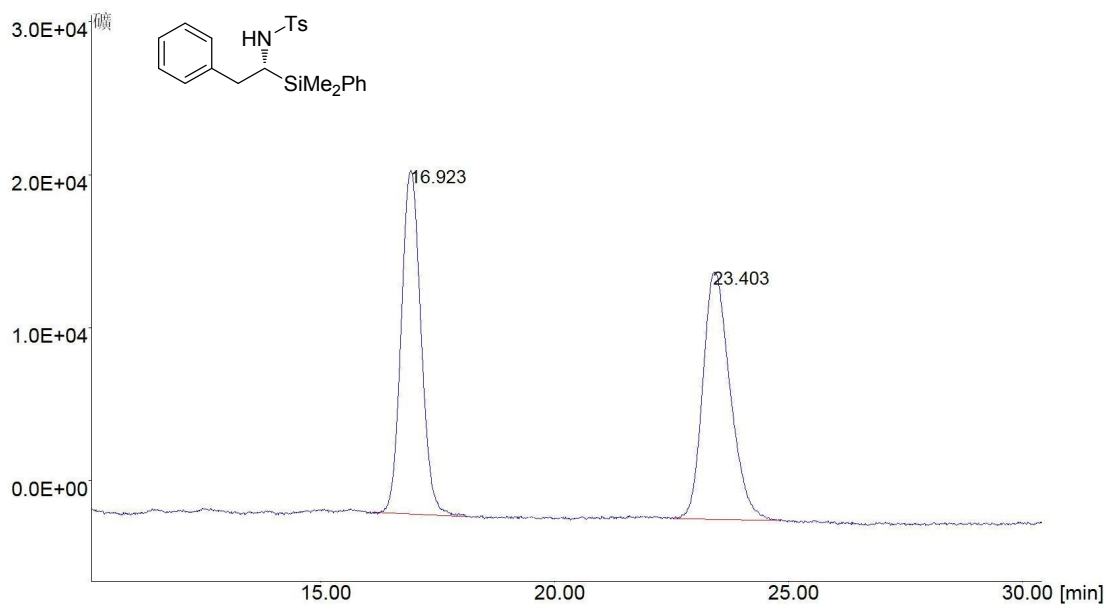
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	12.700	4411	85726.928	1.013
2	13.927	355050	8374263.382	98.987



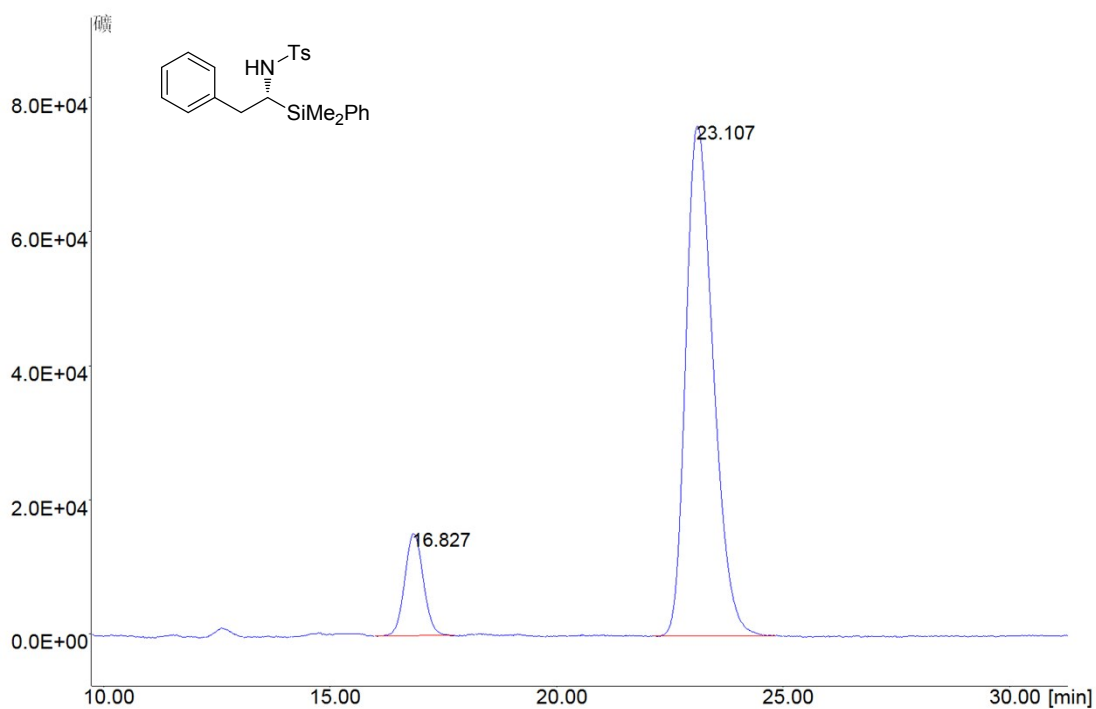
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	10.768	1050.05835	2.30558e4	50.1319
2	20.052	717.49396	2.29344e4	49.8681



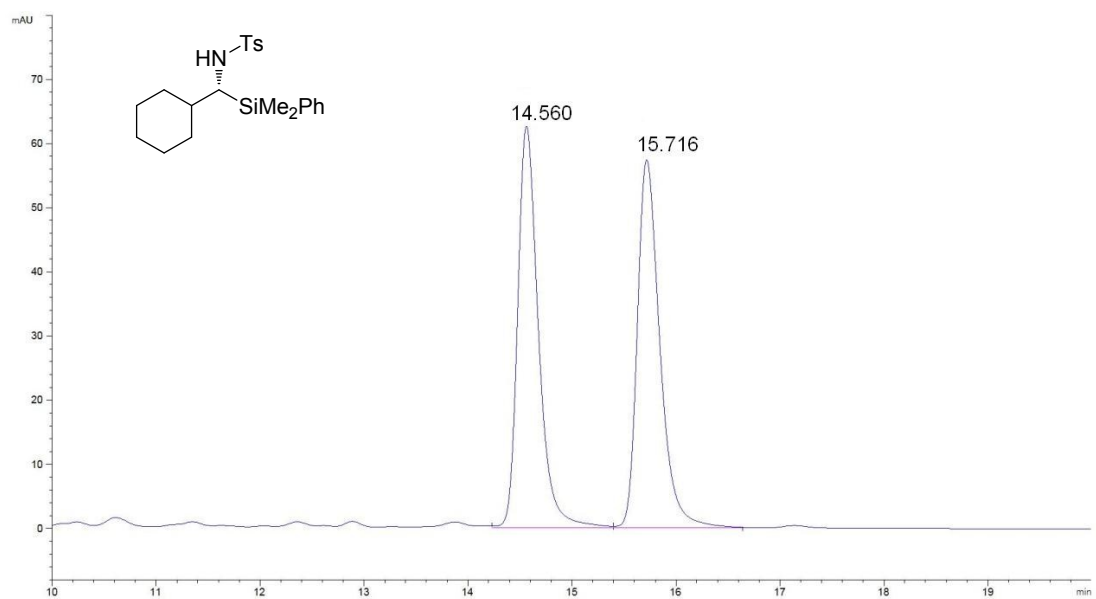
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	10.638	42.26868	795.02203	2.7457
2	19.140	945.76691	2.81602e4	97.2543



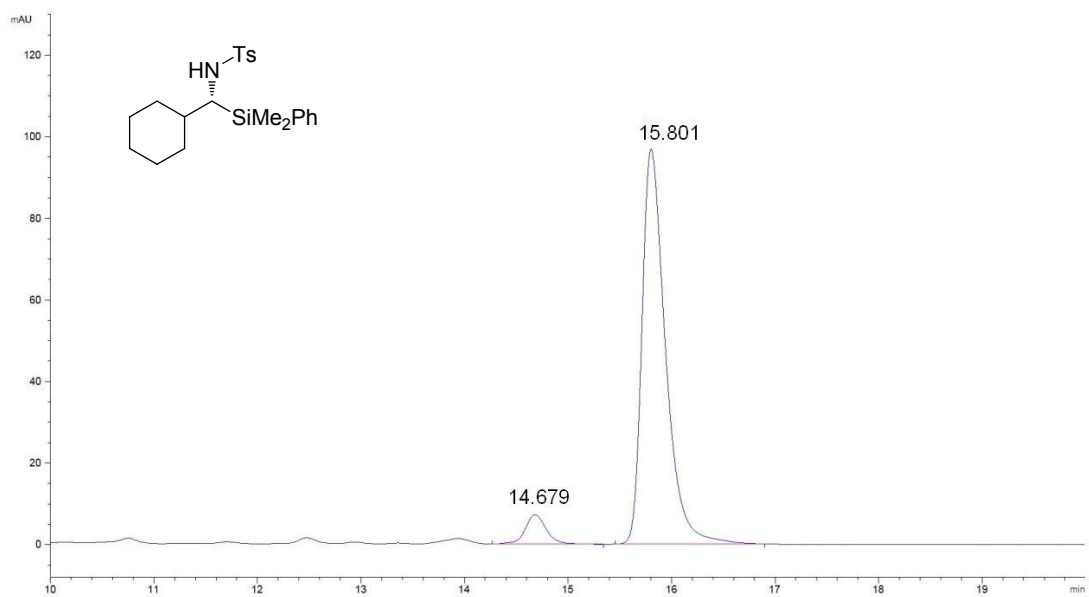
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	16.923	22458	647468.625	49.942
2	23.403	16156	648967.918	50.058



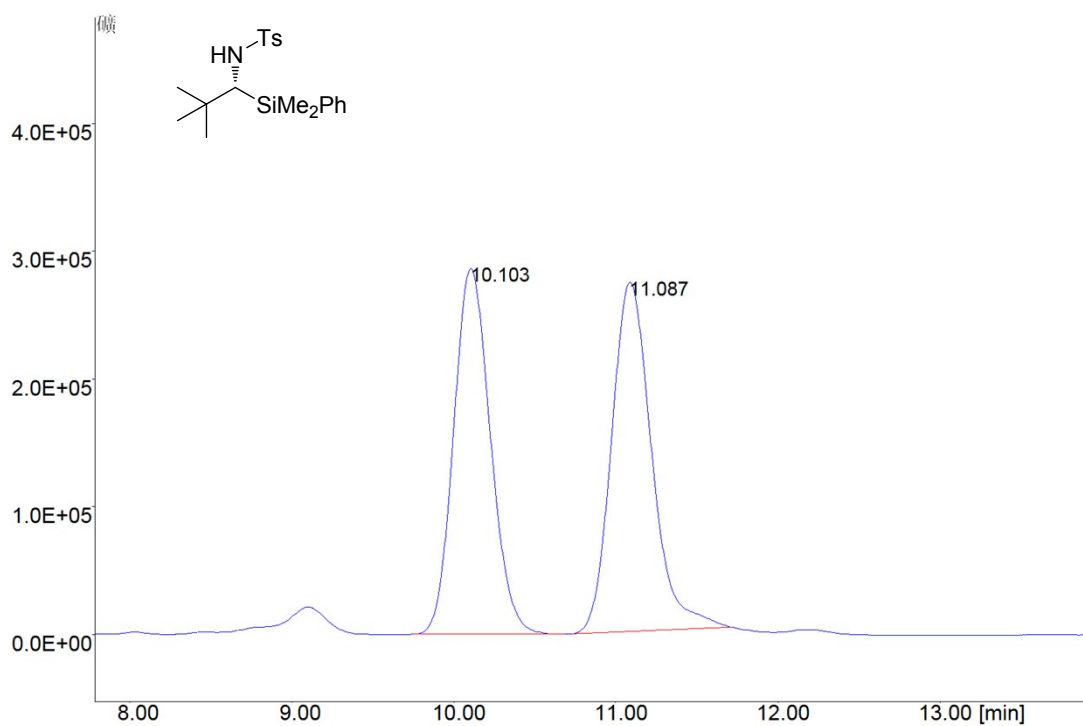
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	16.827	15251	426098.276	11.920
2	23.107	76047	3148469.702	88.080



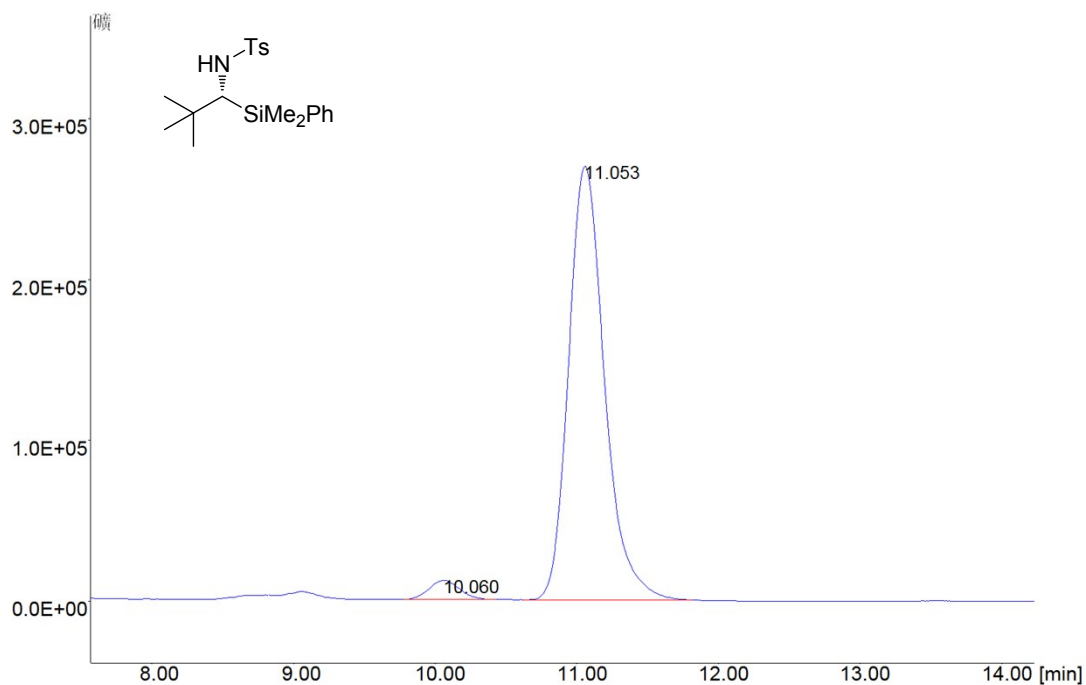
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	14.560	62.57856	867.55164	50.0487
2	15.716	57.39616	865.86218	49.9513



Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	14.679	7.25691	104.37693	6.3697
2	15.801	96.88275	1534.27222	93.6303

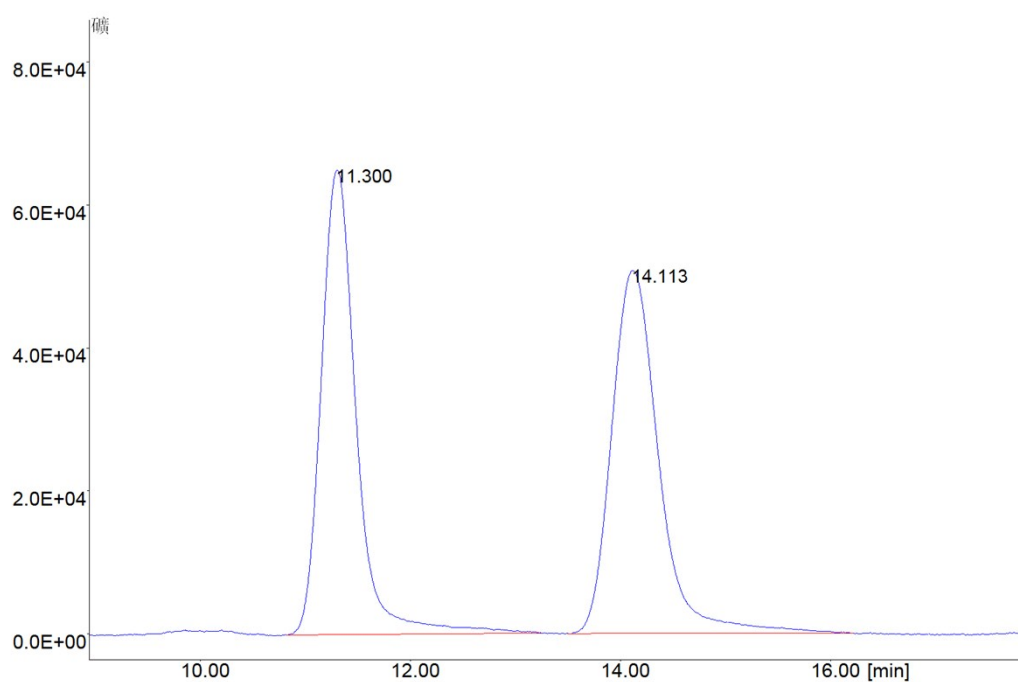


Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	10.103	286442	4513540.713	48.968
2	11.087	273145	4703785.400	51.032

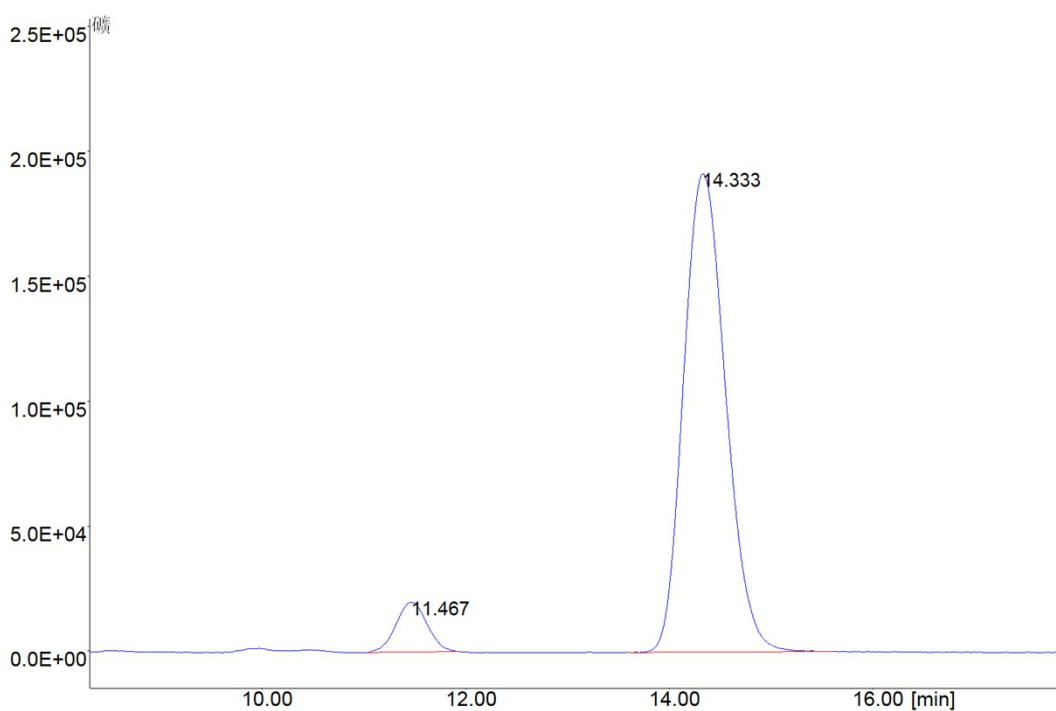


Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	10.060	11683	171829.257	3.530
2	11.053	269585	4696041.464	96.470

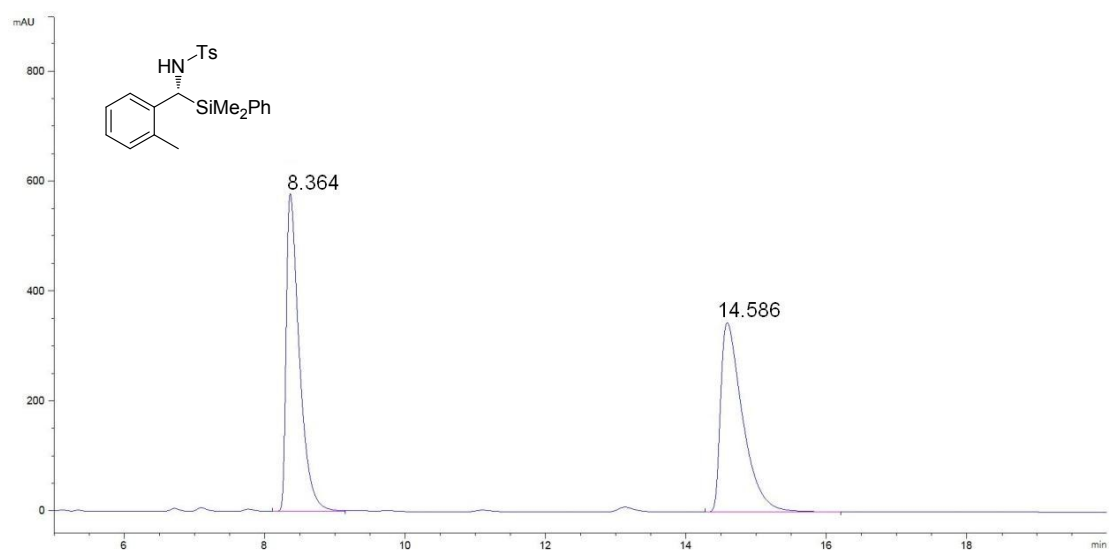
Organic catalysis



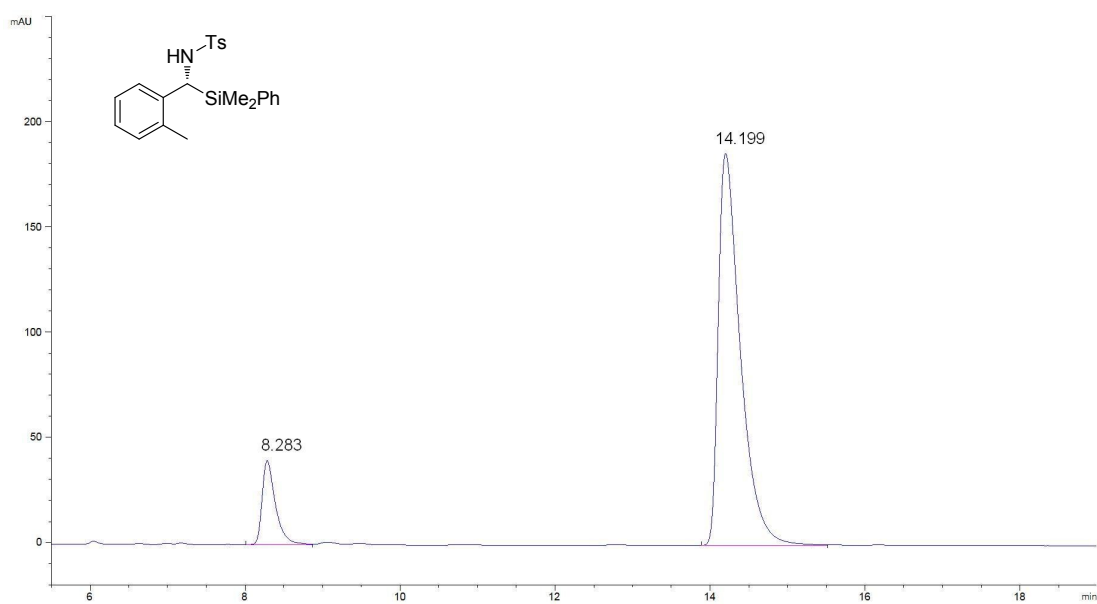
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	11.300	64916	1485036.095	48.666
2	14.113	50770	1566421.757	51.334



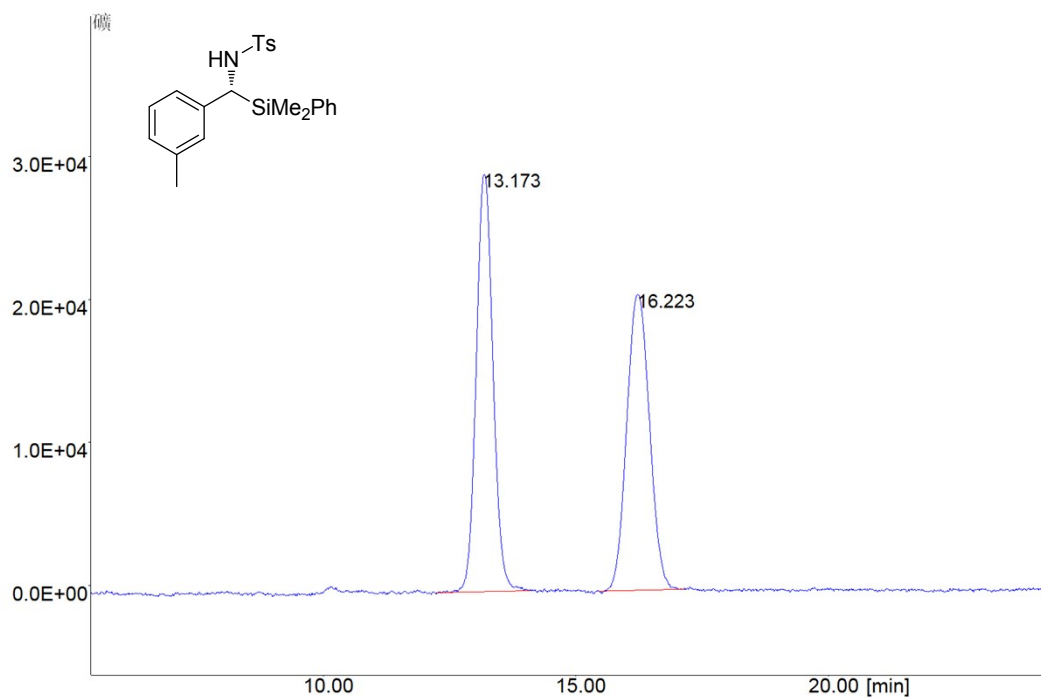
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	11.467	19894	418290.680	7.148
2	14.333	191367	5433669.463	92.852



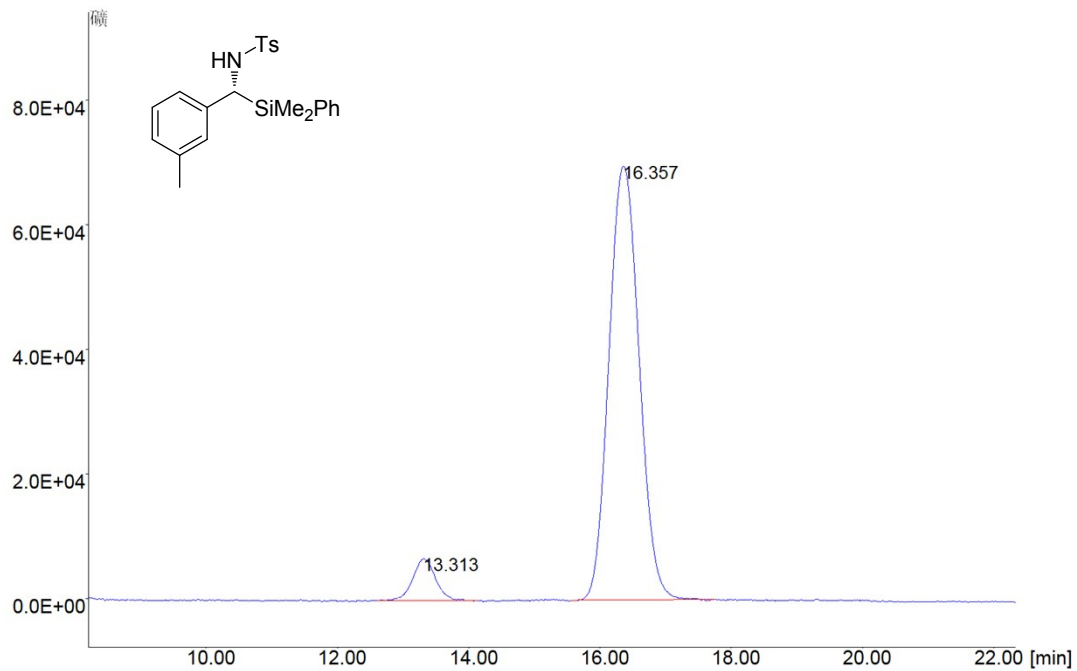
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	8.364	578.58008	7523.37109	50.0255
2	14.586	344.72247	7515.68848	49.9745



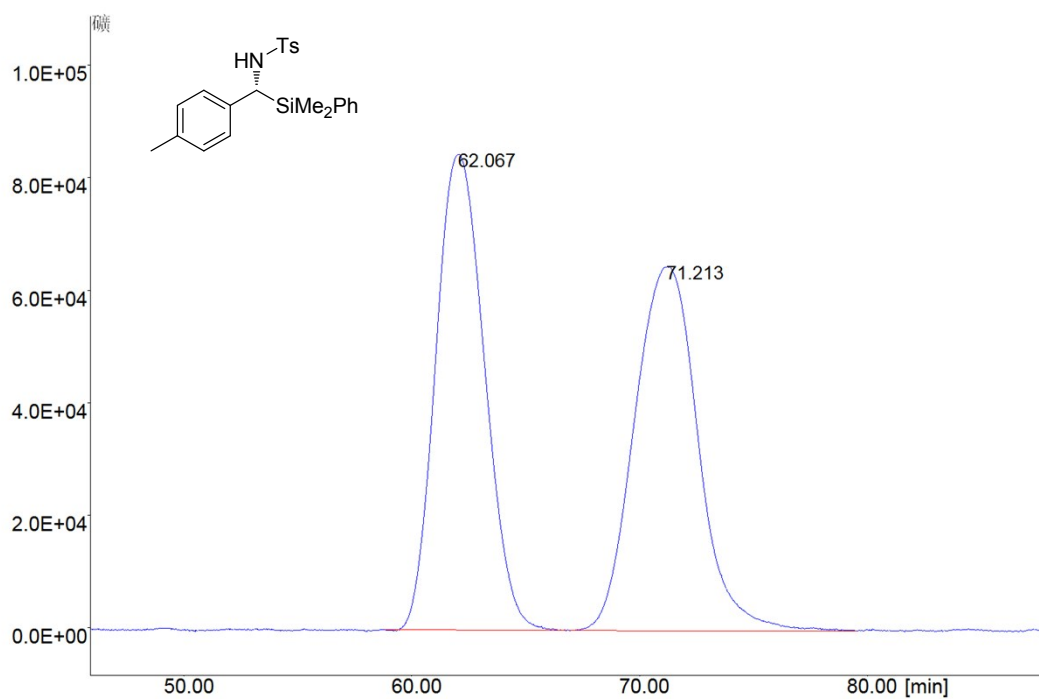
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	8.283	39.92366	479.69824	11.5137
2	14.199	186.33968	3686.61694	88.4863



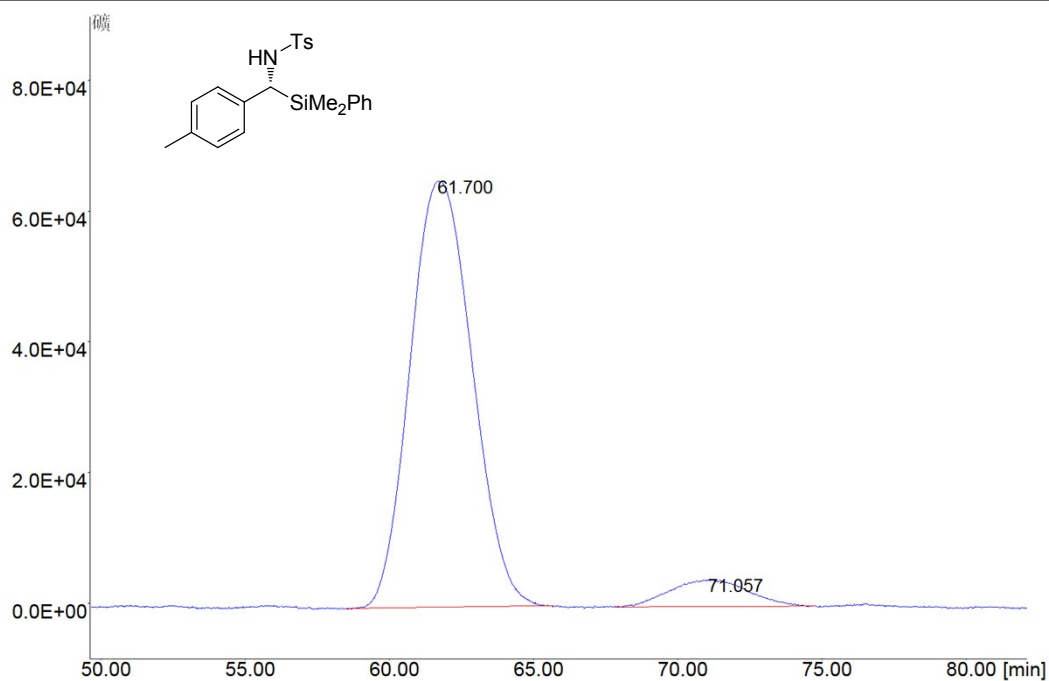
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	13.173	29120	655879.741	50.780
2	16.223	20658	635742.193	49.220



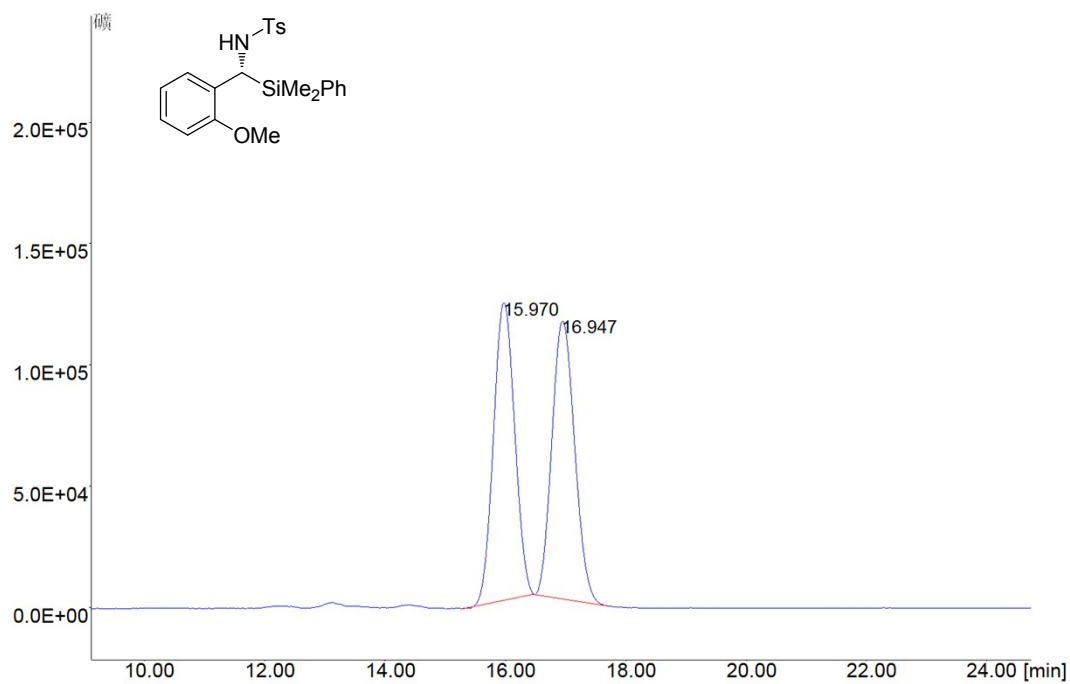
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	13.313	6730	160821.964	6.825
2	16.357	69615	2195575.316	93.175



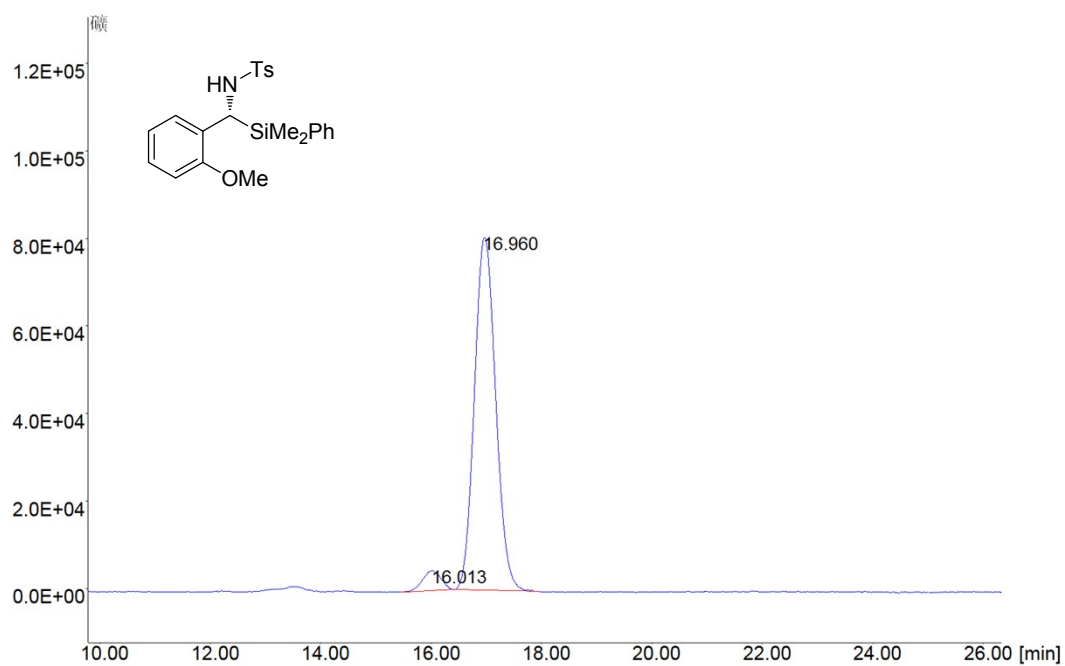
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	62.067	84580	12432874.609	49.894
2	71.213	64720	12485656.974	50.106



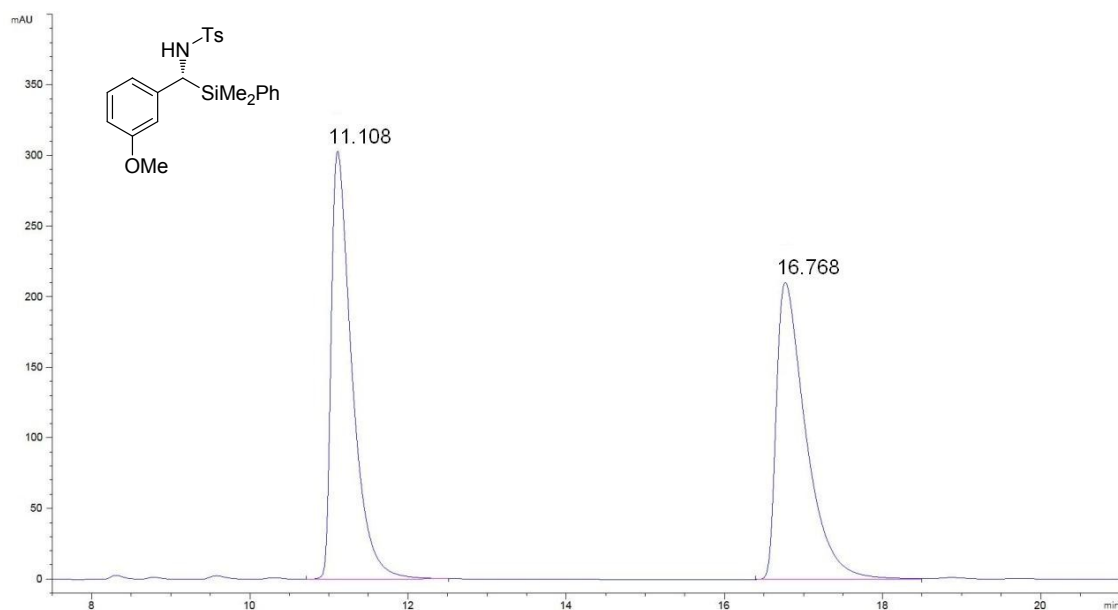
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	61.700	65306	9711584.017	92.743
2	71.057	4090	759911.322	7.257



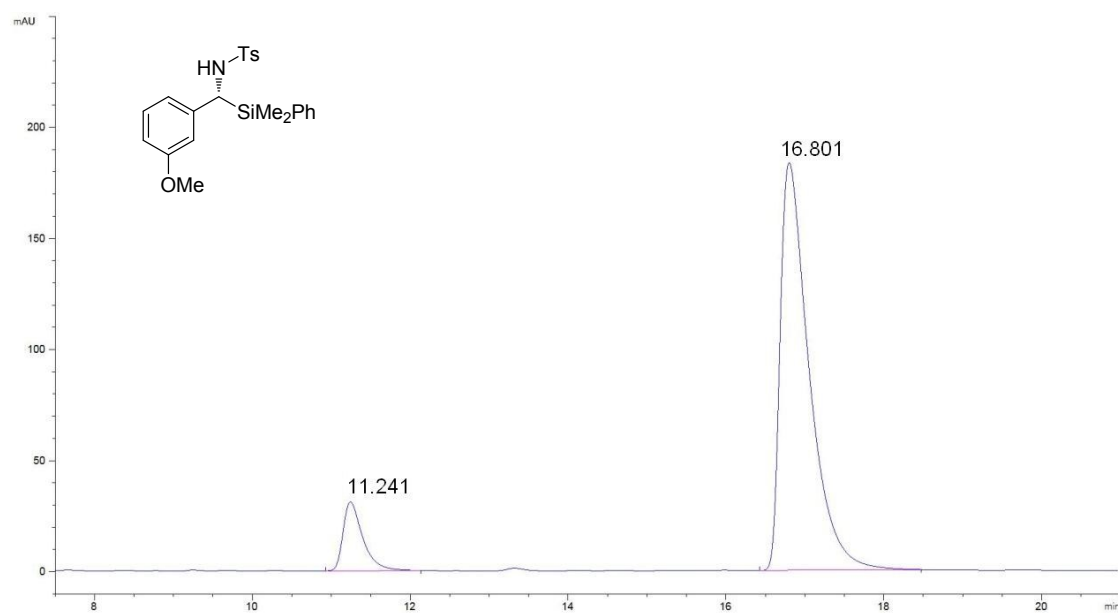
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	15.970	122468	2944721.820	49.898
2	16.947	114461	2956797.040	50.102



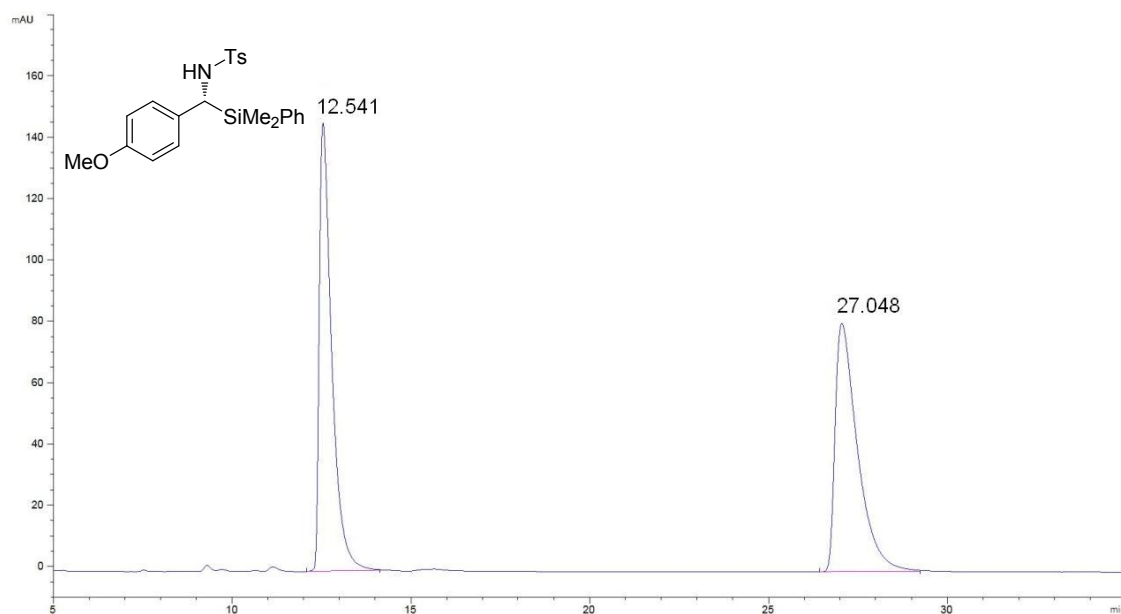
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	16.013	4508	103543.006	4.666
2	16.960	80512	2115389.892	95.334



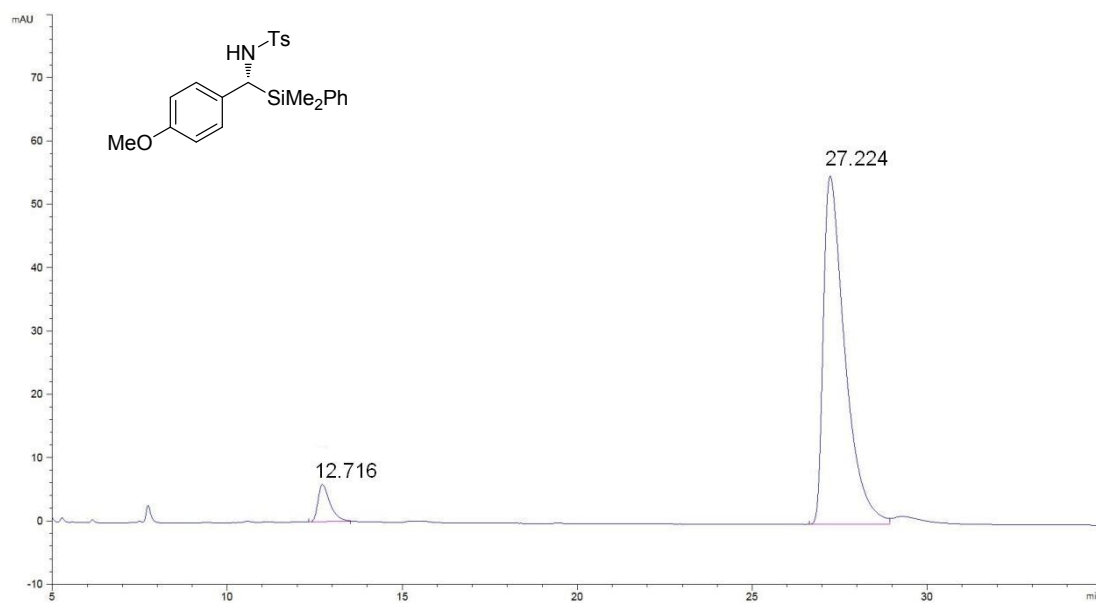
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	11.108	303.13278	5535.83447	50.2923
2	16.768	210.55183	5471.49219	49.7077



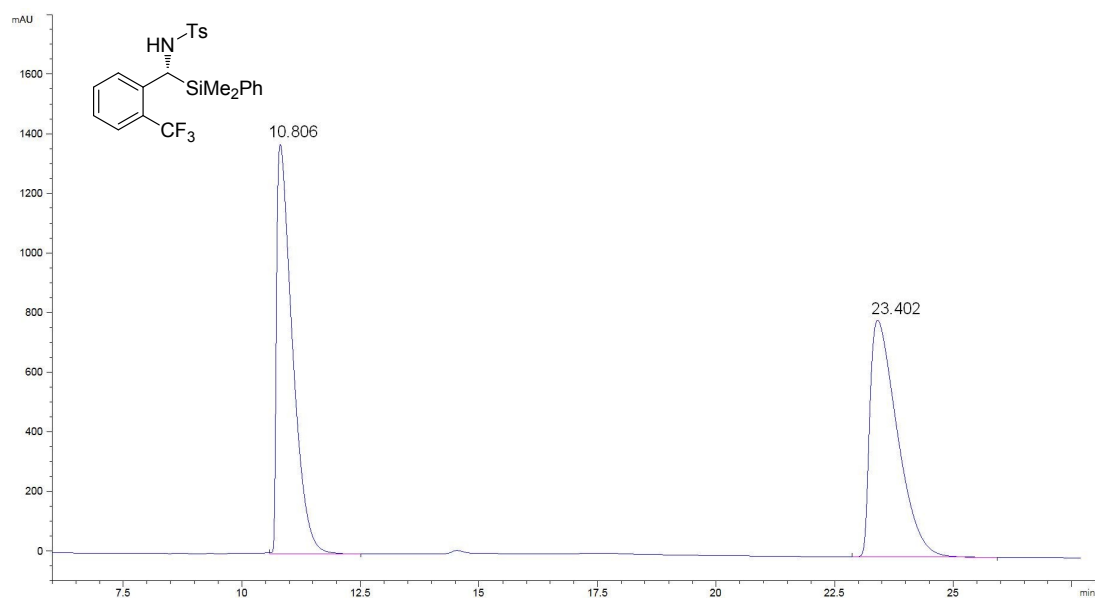
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	11.241	31.05992	544.13257	10.4146
2	16.801	183.60138	4680.59326	89.5854



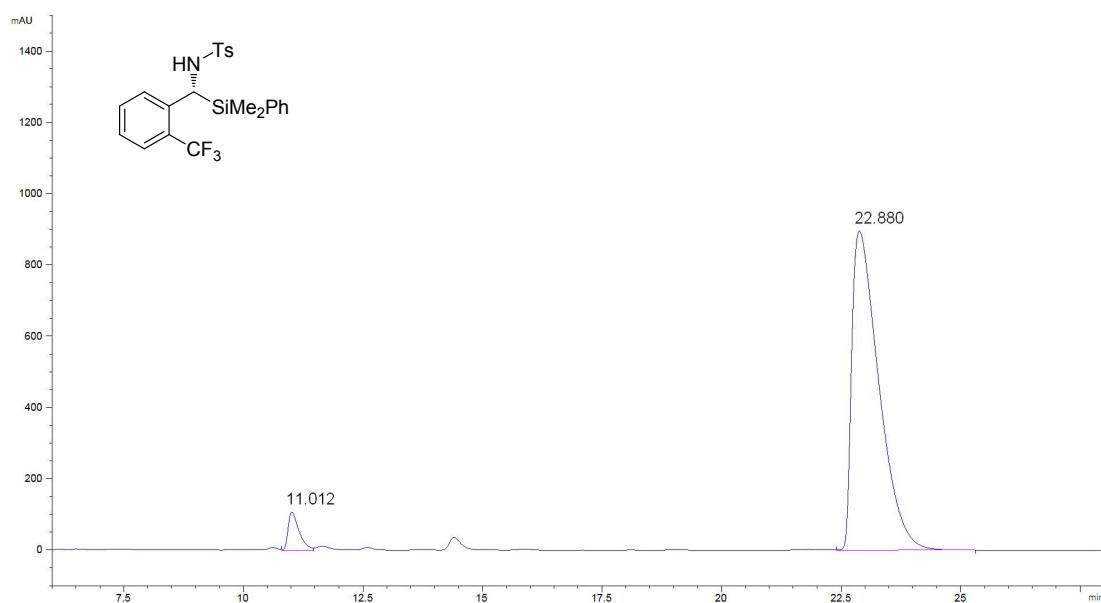
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	12.541	146.11563	3541.69580	50.1946
2	27.048	81.01926	3514.23340	49.8054



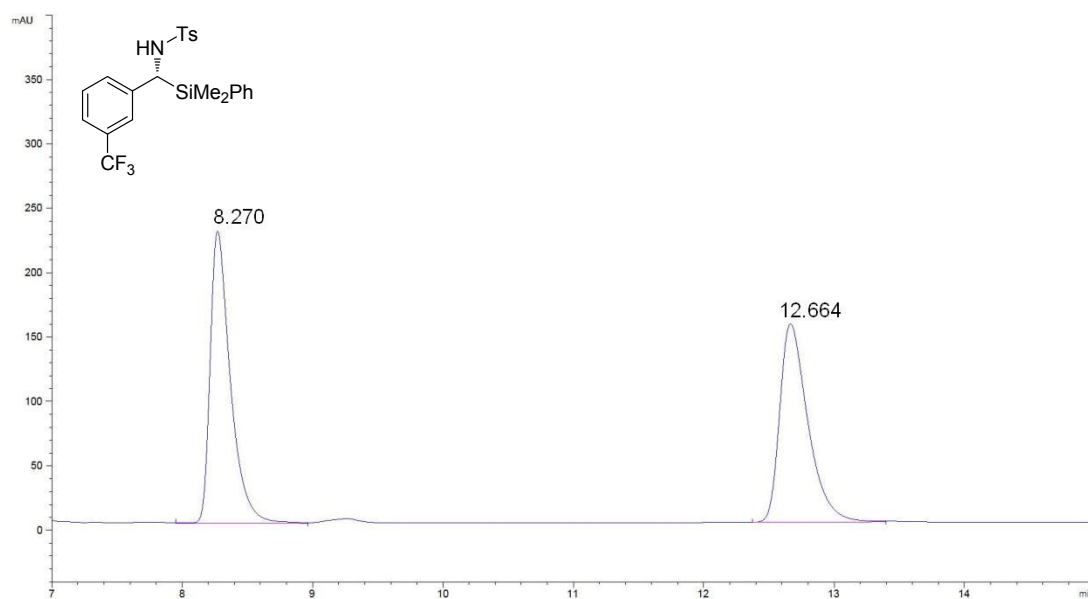
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	12.716	5.88158	141.85957	5.6815
2	27.224	54.99292	2355.02563	94.3185



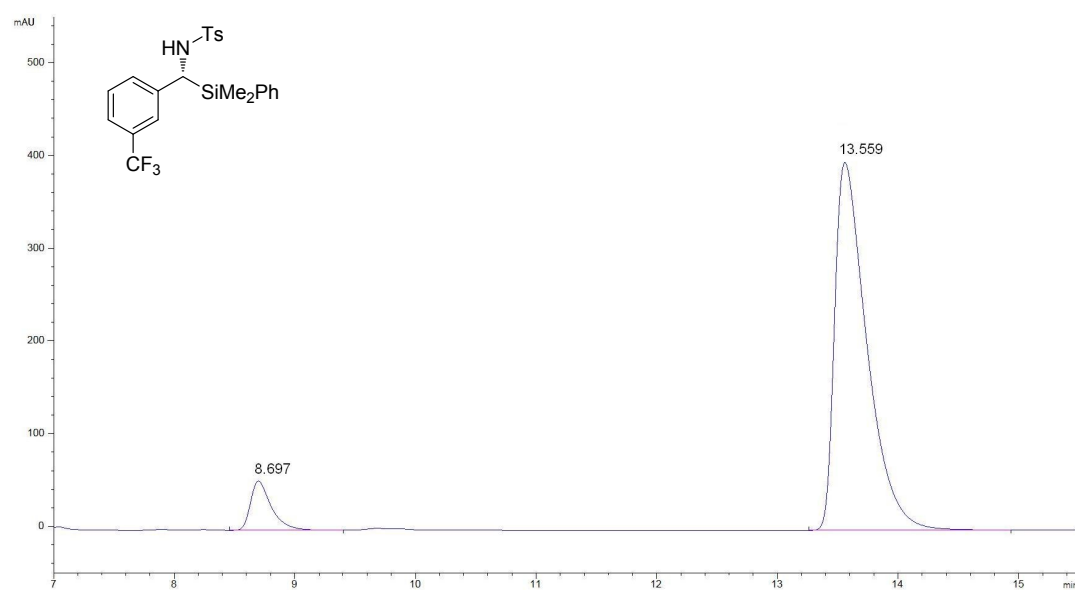
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	10.806	1374.34656	3.18851e4	50.0258
2	23.402	794.45648	3.18523e4	49.9742



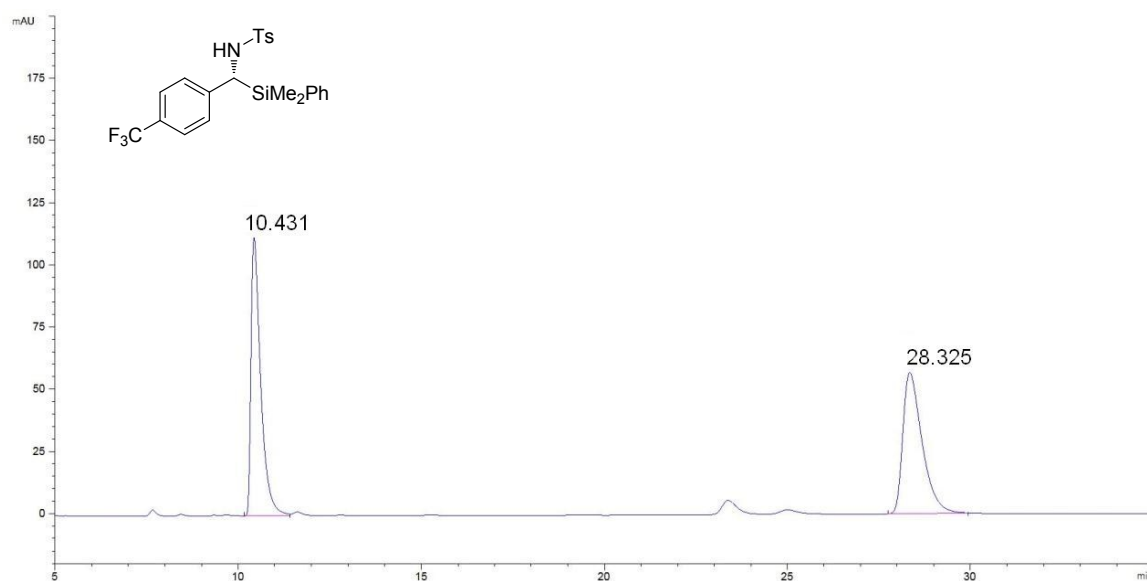
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	11.012	106.99941	1695.86316	4.6035
2	22.880	895.44635	3.51425e4	95.3965



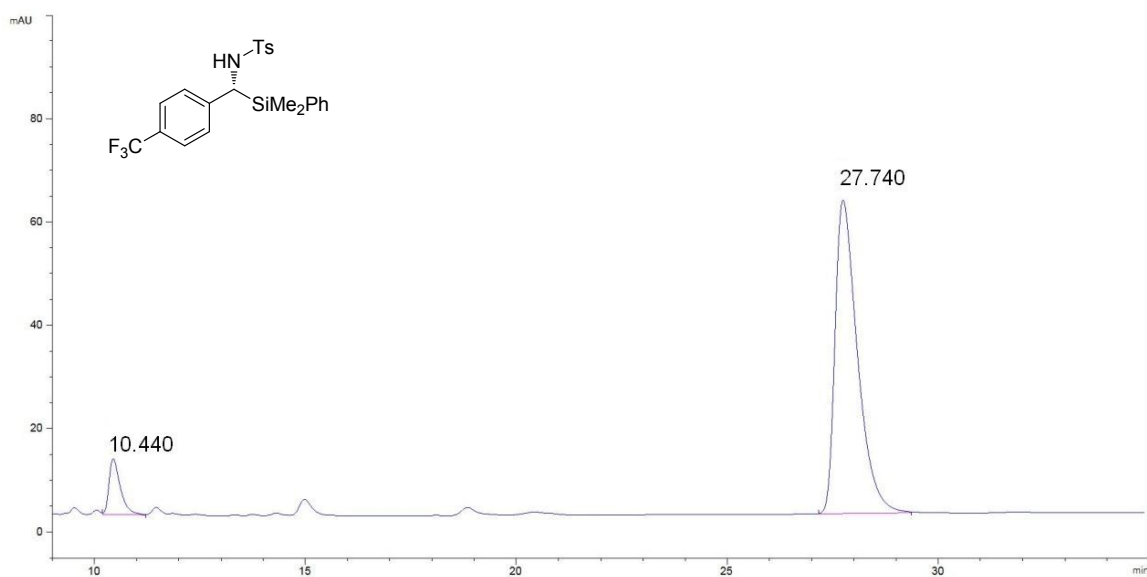
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	8.270	227.01025	2448.21753	51.3678
2	12.664	154.16188	2317.83350	48.6322



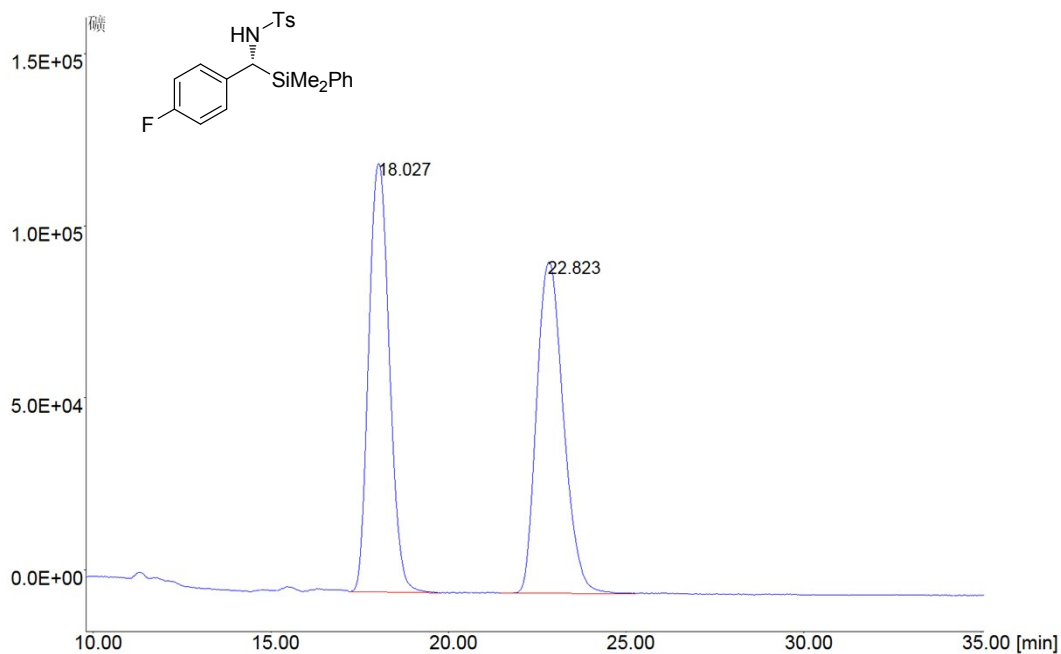
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	8.697	53.25219	3846.46753	8.0212
2	13.559	397.07953	4.08153e4	91.9788



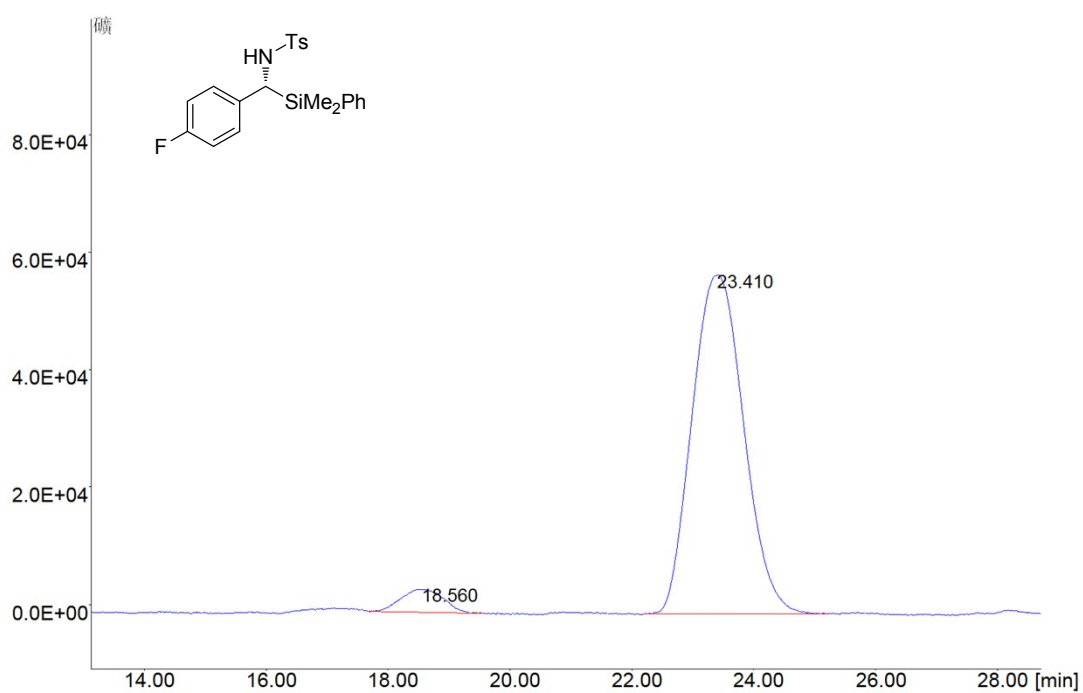
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	10.431	111.86909	2063.85913	49.7765
2	28.325	56.75205	2082.38940	50.2235



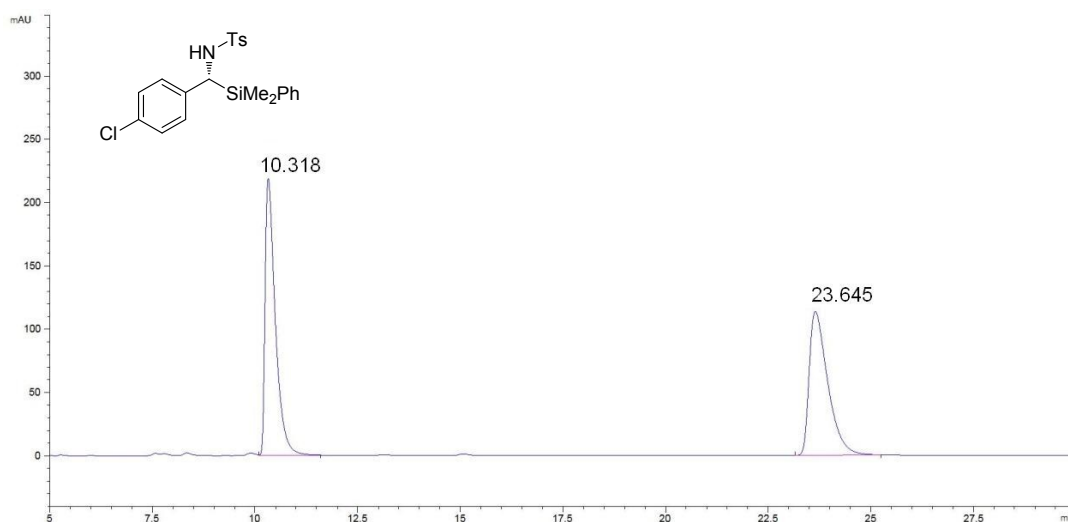
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	10.440	10.86173	203.32571	8.3191
2	27.740	60.67012	2240.74487	91.6809



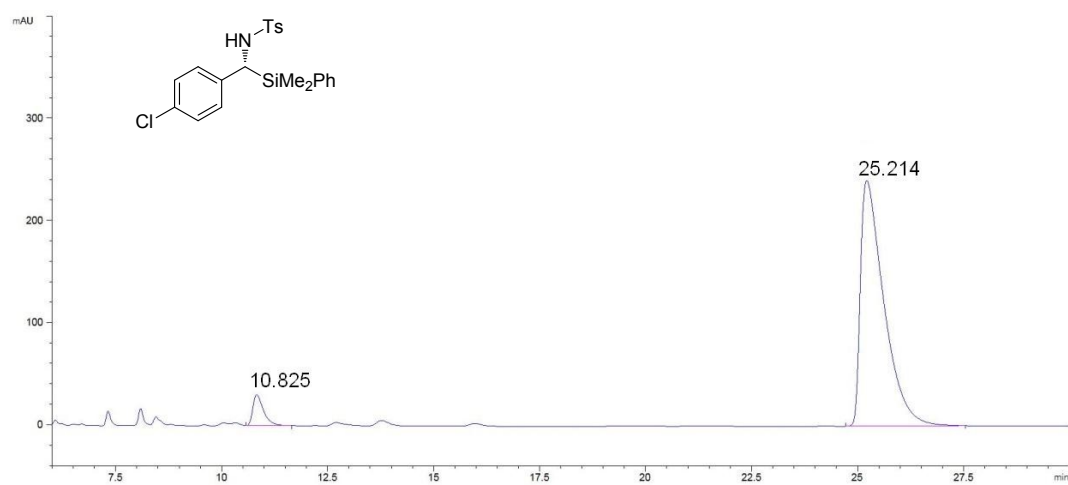
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	18.027	124586	4931369.252	49.697
2	22.823	96436	4991493.713	50.303



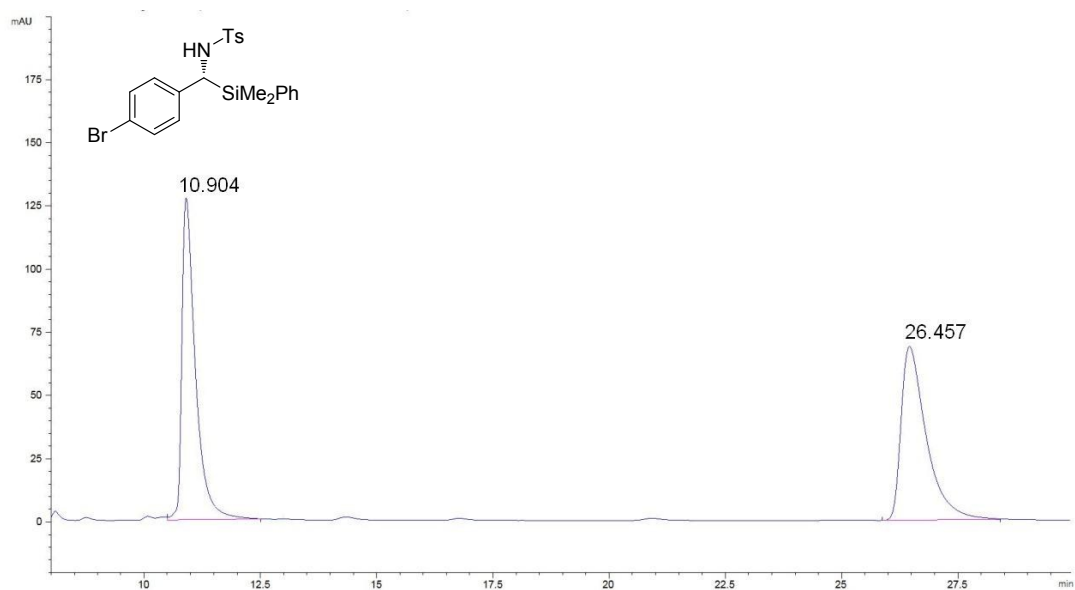
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	18.560	3946	188364.510	5.288
2	23.410	57722	3373959.485	94.712



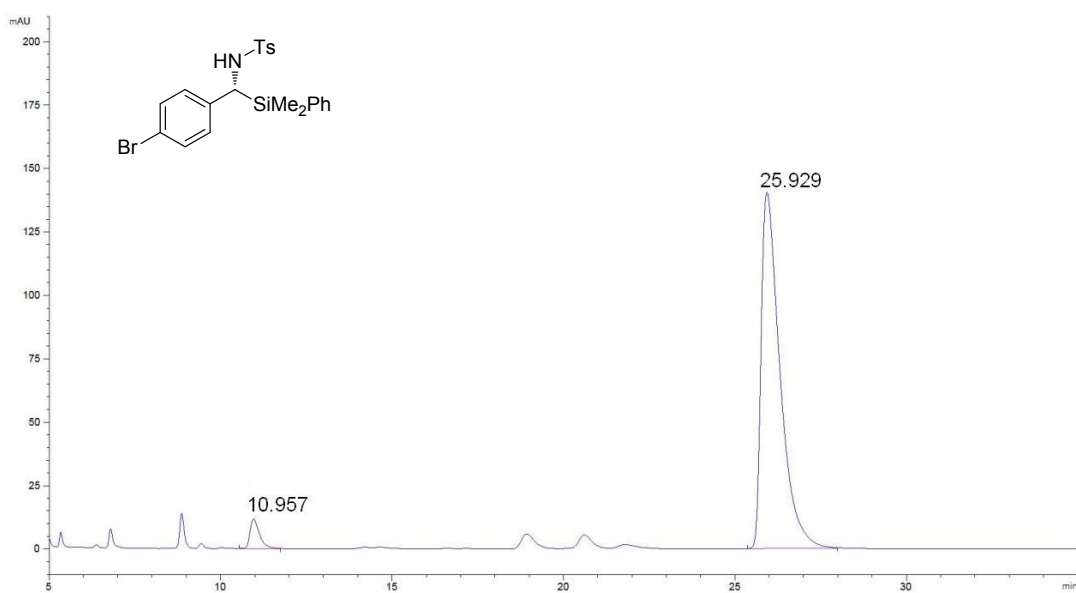
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	10.318	219.18790	3802.24683	51.4258
2	23.645	113.88053	3591.40942	48.5742



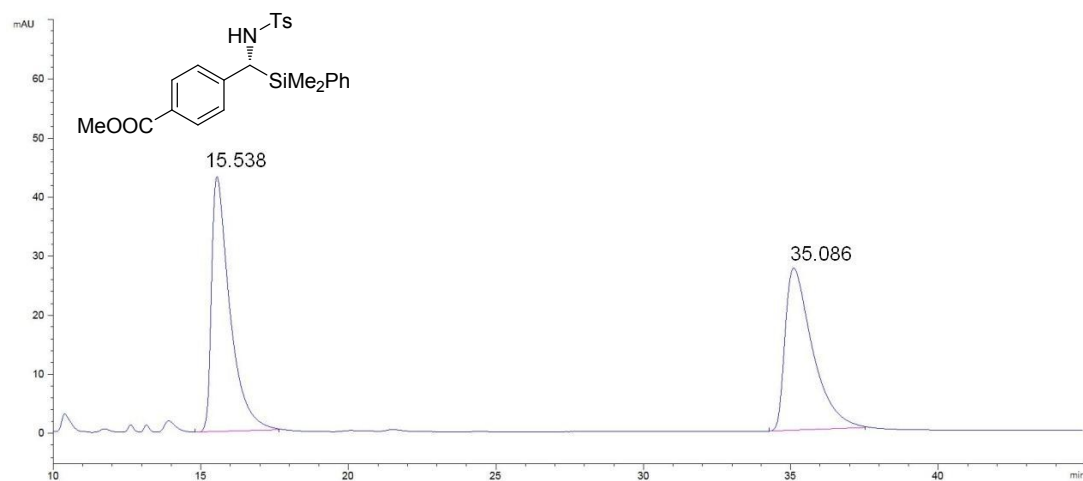
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	10.825	30.53401	545.49011	5.5681
2	25.214	240.40266	9251.13281	94.4319



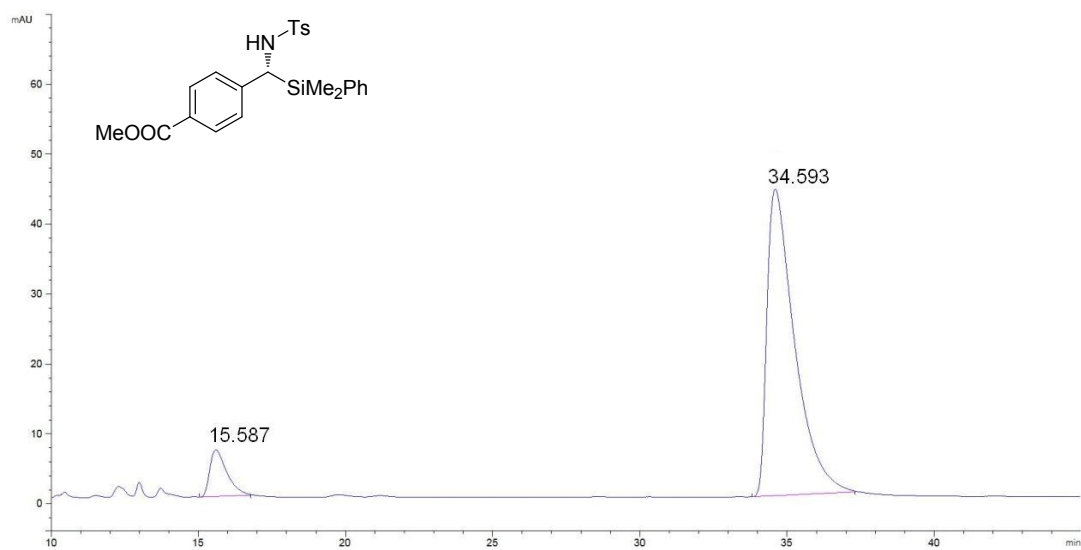
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	10.904	127.35865	2592.40063	49.9915
2	26.457	68.71407	2593.28394	50.0085



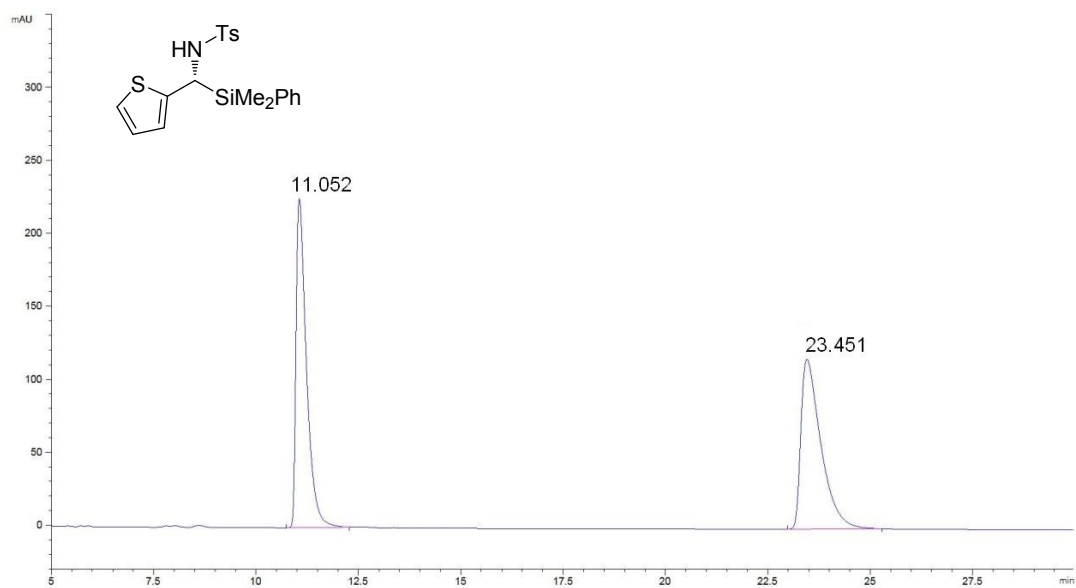
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	10.957	11.73598	228.06062	4.0792
2	25.929	140.51793	5362.78857	95.9208



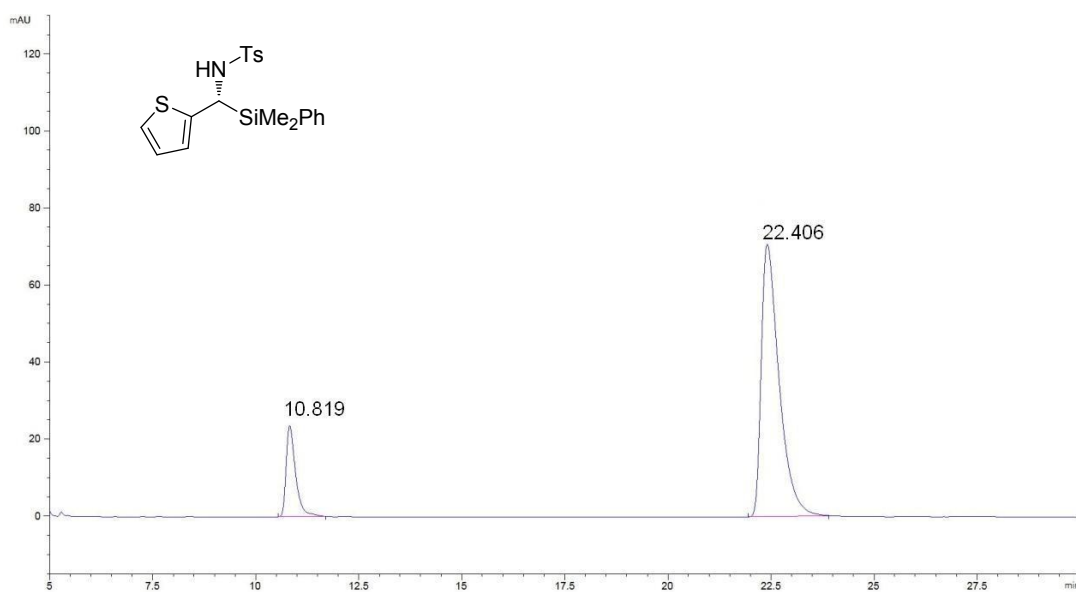
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	15.538	43.20168	1873.03955	51.2106
2	35.086	27.47478	1784.48669	48.7894



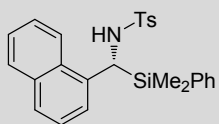
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	15.587	6.69303	269.95477	8.6013
2	34.593	43.82766	2868.58179	91.3987



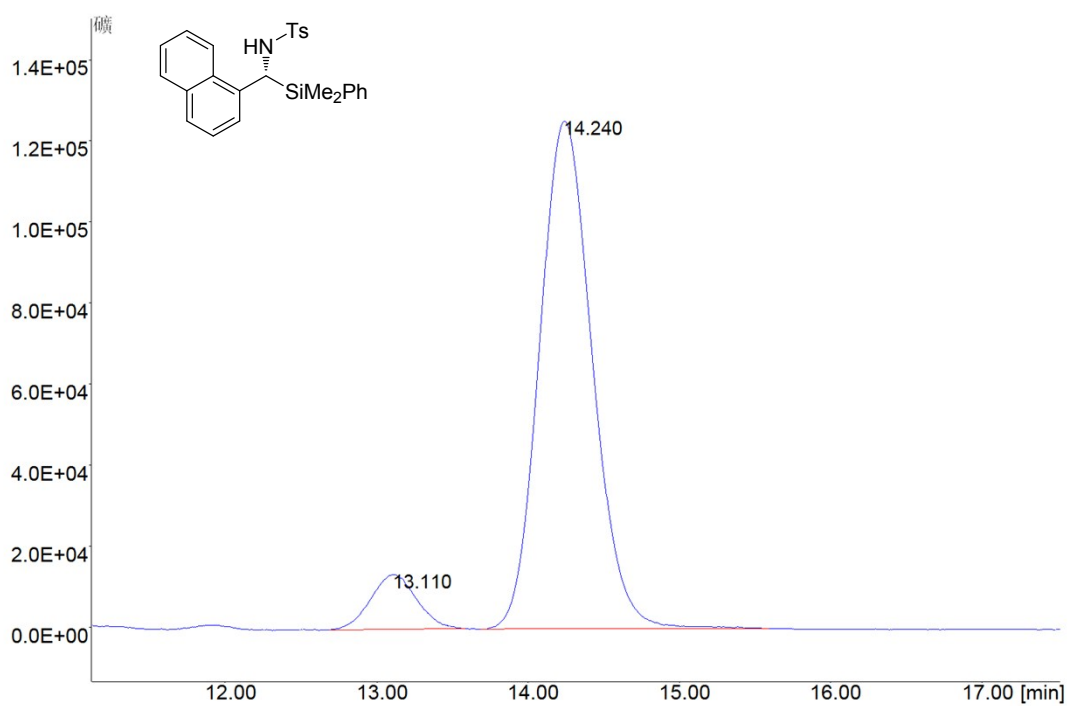
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	11.052	225.61734	3987.07617	50.1758
2	23.451	116.38721	3959.14307	49.8242



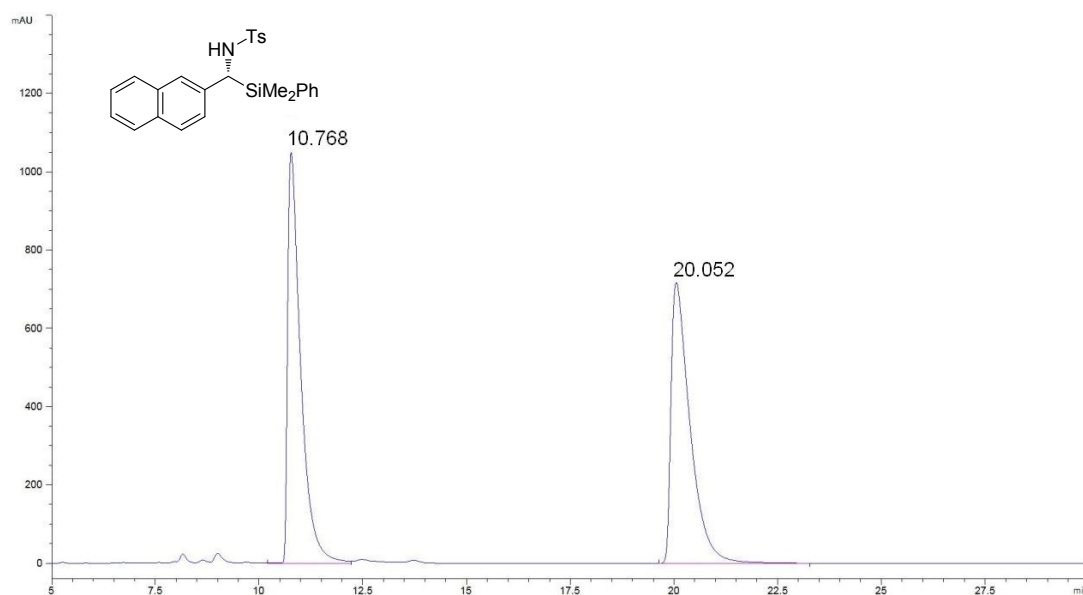
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	10.819	23.69459	382.05460	15.2171
2	22.406	70.74444	2128.63330	84.7829



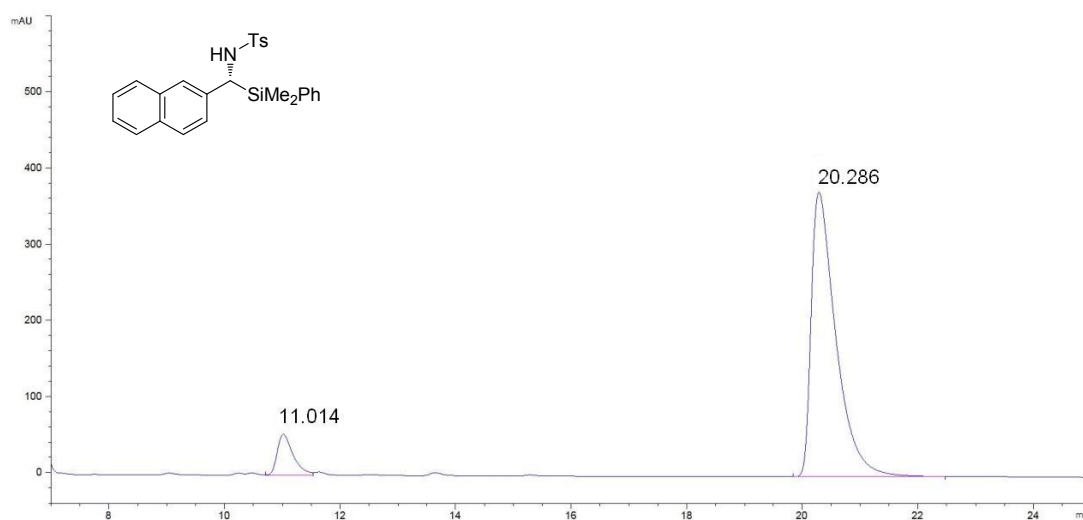
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	12.677	167546	3417984.400	50.154
2	13.977	148049	3397059.510	49.846



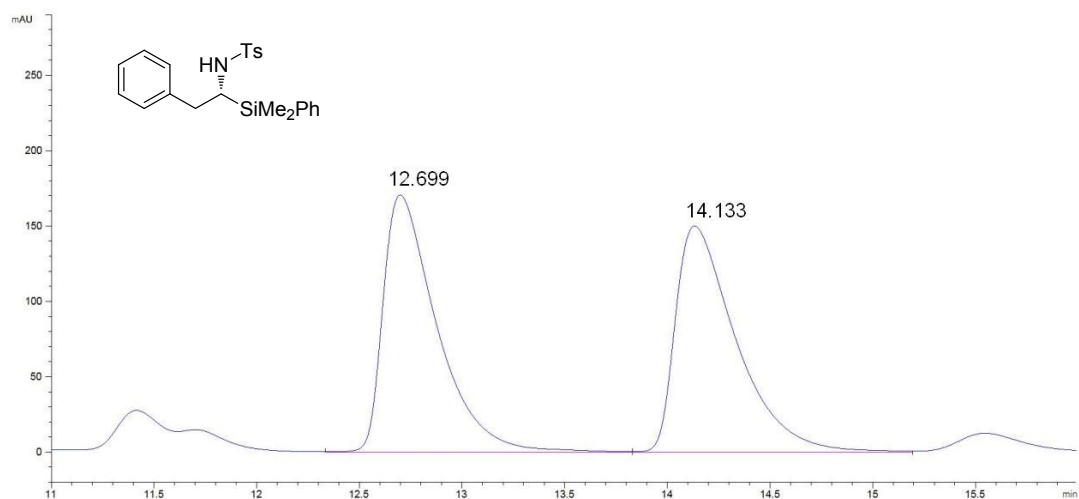
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	13.110	13450	284427.262	8.574
2	14.240	125247	3033036.439	91.426



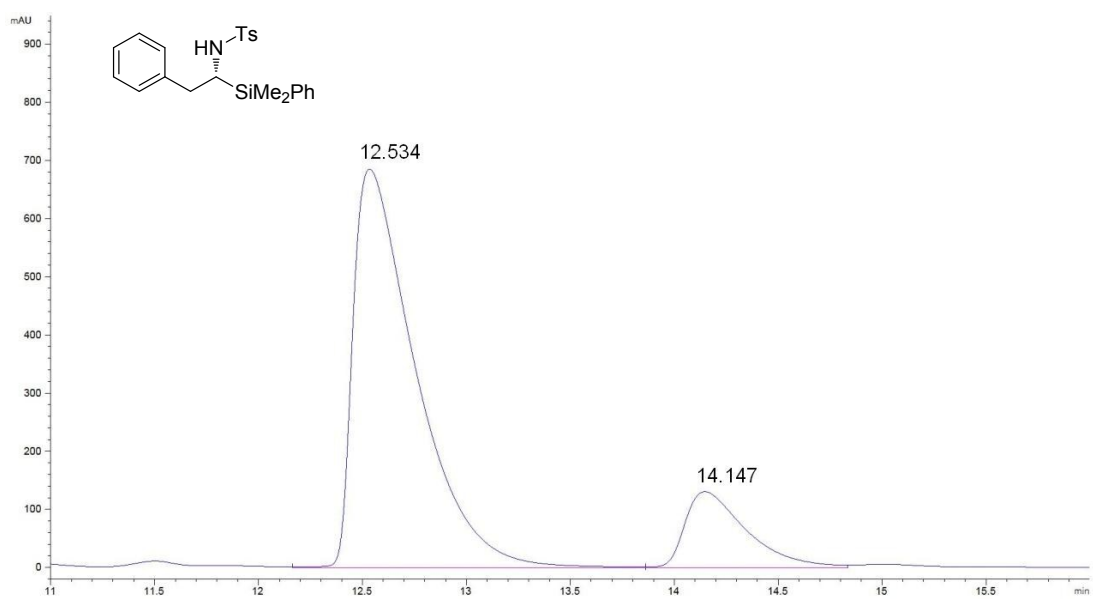
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	10.768	1050.05835	2.30558e4	50.1319
2	20.052	717.49396	2.29344e4	49.8681



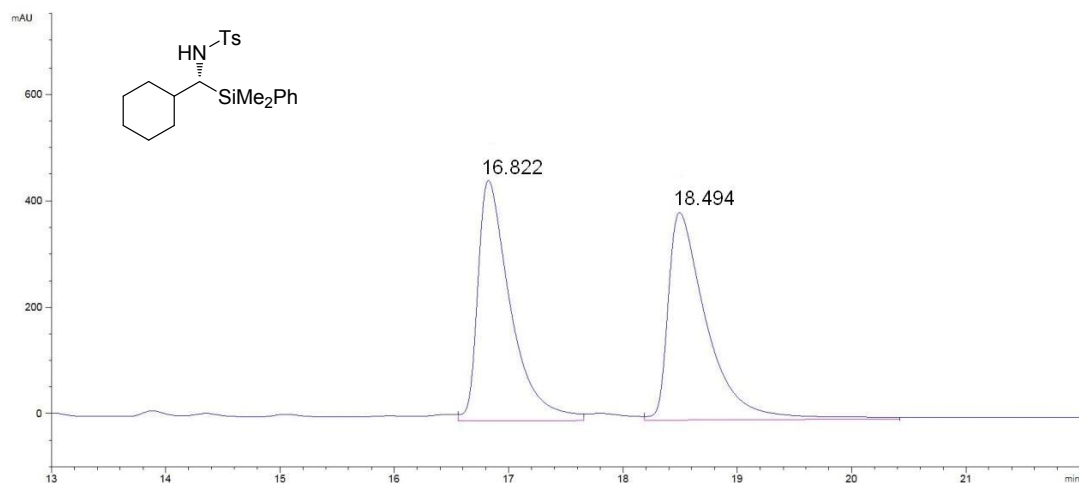
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	11.014	53.91323	1046.29517	8.6055
2	20.286	373.60645	1.11121e4	91.3945



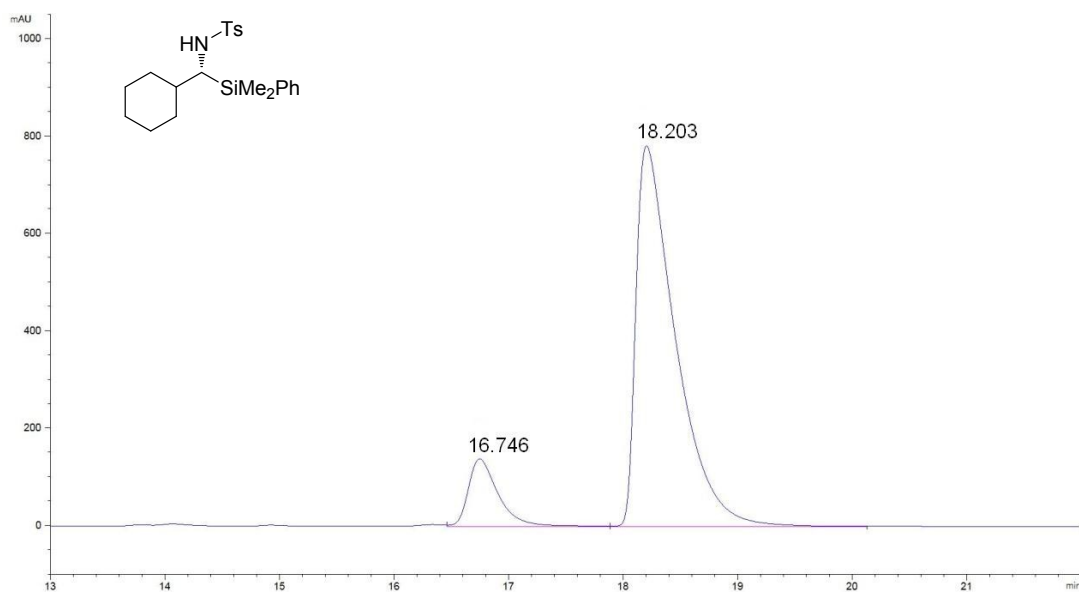
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	12.699	170.82329	3133.99243	50.2123
2	14.133	150.28955	3107.49707	49.7877



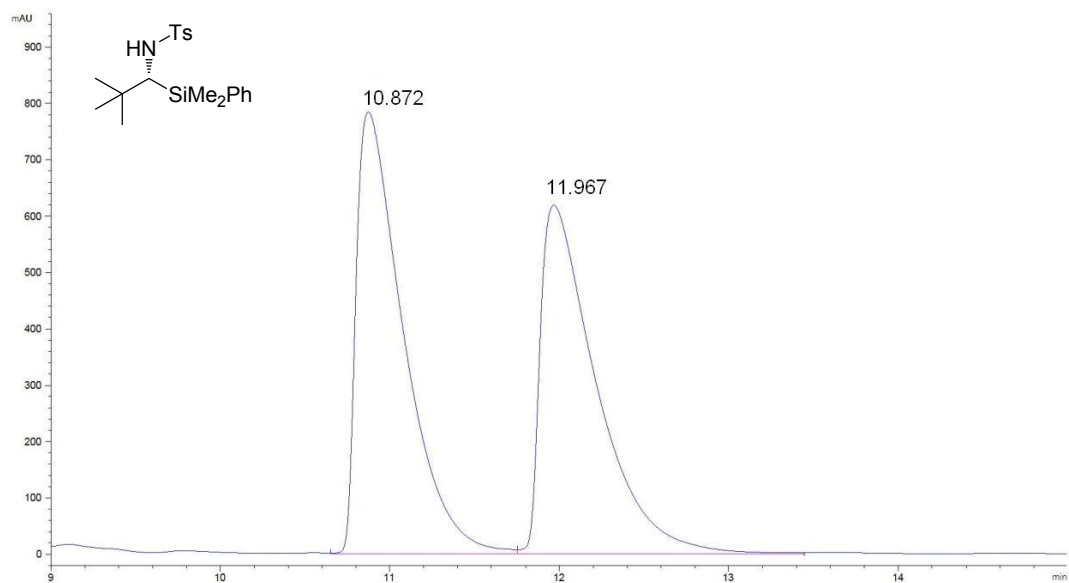
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	12.534	686.34778	1.43927e4	84.1858
2	14.147	131.26068	2703.64624	15.8142



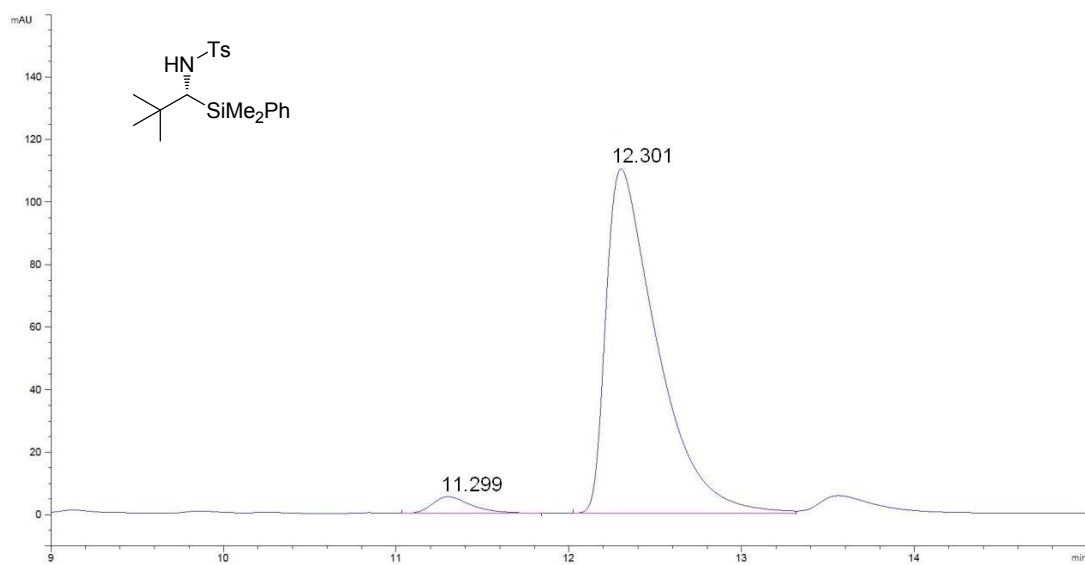
Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	16.822	452.53885	9027.23633	49.4148
2	18.494	390.32150	9241.03223	50.5852



Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	16.746	139.58635	2576.57935	12.0382
2	18.203	782.82770	1.88267e4	87.9618



Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	10.872	784.77838	1.51555e4	51.6165
2	11.967	619.16205	1.42062e4	48.3835



Number	Time (min)	Height (mAU)	Area (mAU·s)	Area%
1	11.299	5.34523	85.90823	3.6511
2	12.301	110.14614	2267.01147	96.3489