Supporting Information for

Core-Shell Structured Mesoporous Silica Spheres: A New Immobolized Strategy for Rhodium Catalyzed Asymmetric Transfer hydrogenation

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Experimental

1. General remarks

All experiments, which are sensitive to moisture or air, were carried out under an Ar atmosphere using the standard Schlenk techniques. (*S*,*S*)-1,2-diphenylenediamine [(*S*,*S*)-DPEN], (*R*,*R*)-1,2-diaminocyclohexane [(*R*,*R*)-DACH], triethanolamine (TEA), cetyltrimethylammonium chloride (CTAC) and $[Cp^*RhCl_2]_2$ were purchased from Sigma-Aldrich Company Ltd. Compound $[(S,S)\text{-DPEN-SO}_2\text{Ph}(\text{CH}_2)_2\text{Si}(\text{OMe})_3]$, $\{(1R,1R)\text{-DACH-}[(\text{CH}_2\text{PhSi}(\text{OMe})_3]_2\}$ were synthesized according to the reported literature [a) *Chem Commun*. **2011,** *47*, 2583.] The products of the ATH were analyzed by a GC using a Supelco β-Dex 120 chiral column (30 m×0.25 mm(i.d.), 0.25 μm film) or a HPLC with a UV-Vis detector using a Daicel OJ-H chiralcel columns (Φ 0.46 x 25 cm).

2. Characterization

Rh loading amount in the catalyst was analyzed using an inductively coupled plasma optical emission spectrometer (ICP, Varian VISTA-MPX). Fourier transform infrared (FTIR) spectra were collected on a Nicolet Magna 550 spectrometer using KBr method. X-ray powder diffraction (XRD) was carried out on a Rigaku D/Max-RB diffractometer with Cu*K*α radiation. Scanning electron microscopy (SEM) images were obtained using a JEOL JSM-6380LV microscope operating at 20 kV. X-ray photoelectron spectroscopy (XPS) measurements were performed on a Perkin-Elmer PHI 5000C ESCA system. All the binding energies were calibrated by using the contaminant carbon (C_{1s} = 284.6 eV) as a reference. Liquid-state ^{1}H NMR, ^{13}C NMR, and Solid-state ^{29}Si MAS NMR and ^{13}C CP MAS NMR spectra were recorded on a Bruker AV-400 spectrometer. Elemental analysis was performed with a Carlo Erba 1106 Elemental Analyzer.

3. Preparation of Cp*RhTsDPEN-MSS (2): TEA (14.3 g, 95.6 mmol) and TEOS (1.557 g, 7.84 mmol, 85 mol % of the total amount of required TEOS), and 230.5 mg (0.461 mmol, 5 mol % of the total TEOS) of **1**, followed by heating for 20 minute at 90 °C without stirring (solution 1). Meanwhile, 2.41 mL (7.29 mmol) of CTAC and 21.7 g of water (solution 2) were preheated at 60 °C, added to solution 1, and stirred for 20 minute. The resulting solution was was then left to stir overnight at room temperature. The resulting mixture was then centrifuged (10000r/min) for 10 minute, redispersed in EtOH, and extracted template. Extraction of the organic template from the mesoporous silica spheres was performed by heating the colloidal suspension for 45 minute at 90 °C in a solution containing 2.0 g of ammonium nitrate in 90 mL of absolute ethanol. After being separated *via* centrifugation (10000r/min) for10 minute, the mesoporous silica spheres was then redispersed in EtOH and

refluxed for 45 minute in a solution of 10 mL of concentrated hydrochloric acid and 90 mL of absolute ethanol. After that the solution was filtrated and washed by absolute ethanol, the solid was dried at room temperature under vacuum overnight to afford catalyst **2** (1.02 g) as a white powder. IR (KBr) cm^{-1}: 3448.5 (s), 2979.7 (w), 2932.5 (w), 1637.4 (m), 1549.8 (w), 1500.2 (w), 1453.1 (w), 1384.3 (w), 1085.2 (s), 964.3 (m), 797.5 (m), 701.3 (w), 566.8 (w), 464.1 (s). Elemental analysis (%): C 10.22, H 3.79, N 0.97, S 0.14. S_{BET}: 762.6 m^2/g, V_{pore}: 0.68 cm^3/g, d_{pore}: 2.81 nm. ^{29}Si MAS NMR (300 MHz): Q^3 (δ = -101.6 ppm), Q^4 (δ = -111.2 ppm), T^2 (δ = -57.5 ppm), T^3 (δ = -67.5 ppm). ^{13}C CP MAS NMR (161.9 MHz): 134.6, 128.2 (Ar-*C*), 76.2 (NH-*C*H-Ph), 59.6 (OCH_3), 17.5 (CH_2-Ar), 3.4 ($SiCH_3/CH_2$) ppm. The FT-IR, ^{13}C CP MAS NMR, ^{29}Si CP MAS NMR spectra were presented in figure S1-S3

4. Preparation of Cp*RhTsDPEN-DMSS (3). To a stirred suspension of **2** (1.0 g) was added a solution of 2.41 mL (7.29 mmol) of CTAC and 21.7 g of water that were preheated at 60 °C and stirred for 12 hours at room temperature. Next 183.2 mg of TEOS (0.922 mmol, 10 mol % of the total TEOS) was added in four increments every 30 minute, and the resulting solution was then left to stir overnight at room temperature. The resulting mixture was then centrifuged (10000r/min) for 10 minute, redispersed in EtOH, and extracted template. After being separated *via* centrifugation (10000r/min) for 10 minute, the solids was suspended in 20 mL dry CH_2Cl_2 and NEt_3 (1.30 mL, 21.5 mmol) and $[Cp^*RhCl_2]_2$ (0.050 g, 0.092 mmol) were added at room temperature. The resulting mixture was stirred at room temperature for 12h. The mixture was then filtered through filter paper and rinsed with excess CH_2Cl_2. After Soxlet extraction in CH_2Cl_2 solvent to remove homogeneous and unreacted start materials for 24 h, the solid was dried at 60 ^oC in vacuum for 12 h to afford **3** (1.14 g, 95.2% relative to **2**) as a light orange powder. ICP analysis shows that the Rh loading-amount was 4.12 mg (0.040 mmol) per gram catalyst. IR (KBr) cm^{-1}: 3439.6 (s), 2980.3 (w), 2928.7 (w), 1637.4 (m), 1561.7 (w), 1542.8 (w), 1509.6 (w), 1457.6 (w), 1384.3 (w), 1086.7 (s), 959.1 (m), 800.7 (m), 701.3 (w), 573.1 (w), 461.2 (s). Elemental analysis (%): C 12.35, H 4.03, N 0.86, S 0.13. S_{BET}: 761.0 m^2/g, V_{pore}: 0.58 cm^3/g, d_{pore}: 2.58 nm. ^{29}Si MAS NMR (300 MHz): Q^3 (δ = -101.9 ppm), Q^4 (δ = -111.2 ppm), T^3 (δ = -67.1 ppm). ^{13}C CP MAS NMR (161.9 MHz): 134.1, 129.8 (Ar-*C*), 95.5 (Cp*-*C*), 75.1 (NH-*C*H-Ph), 59.6 (OCH_3), 17.5 (CH_2-Ar), 8.2 ($CpCH_3$), 3.4 ($SiCH_3/CH_2$) ppm. The FT-IR, ^{13}C CP MAS NMR, ^{29}Si CP MAS NMR, XPS and TG/DTA curves were presented in figure S1-S5

4. Preparation of Cp*RhTsDACH-DMSS (4). Prepared according to the above general procedure 3 using TsDACH-derived silane instead of TsDPEN-derived silane, the solid was dried under reduced pressure overnight to afford Cp*RhTsDPEN-IBOIHS (**4**) as a light red

powder. ICP analysis shows that the Rh loading-amount was 4.63 mg (0.045 mmol) per gram catalyst. IR (KBr) cm^{-1}: 3446.1 (s), 2941.9 (w), 2872.8 (w), 1630.4 (m), 1450.5 (w), 1410.8 (w), 1383.6 (w), 1327.9 (w), 1308.7 (w), 1089.3 (s), 961.5 (m), 803.6 (m), 576.7 (w), 462.4 (s). Elemental analysis (%): C 17.27, H 4.25, N 1.11, S 0.14. S_{BET}: 723.2 m^2/g, V_{pore}: 0.53 cm^3/g, d_{pore}: 2.59 nm. ^{29}Si MAS NMR (300 MHz): T^3 (δ = -67.6 ppm), Q^2 (δ = -92.5 ppm), Q^3 (δ = -102.1 ppm), Q^4 (δ = -111.0 ppm). ^{13}C CP/MAS (161.9 MHz): 4.3 ($\underline{C}H_2$-Si), 7.4 ($\underline{C}H_3$-Cp*), 15.3 (Ph$\underline{C}H_2$), 23.6, 28.3 ($\underline{C}$ of cyclohexyl group without connected to N atom), 54.8 ($\underline{C}H_3$-O), 76.3, 73.0 (PhN-$\underline{C}H_2$), 93.8 ($\underline{C}$-Cp), 126.8 ($\underline{C}$H of Ar) ppm.

5. Asymmetric transfer hydrogenation of ketones in aqueous medium. A typical procedure was as follows: The catalyst **3** (25.00 mg, 1.0 μmol of Rh based on ICP analysis), HCO_2Na (0.13 g, 0.19 mmol), ketone (0.25 mmol) and 4.0 mL water were added in a 10 mL roundbottom flask in turn. The mixture was allowed to react at 40 °C for 8h. During that time, the reaction was monitored constantly by TLC. After completion of the reaction, the magnetic catalyst was separated was separated *via* centrifuge (10000 r/min) for the recycle experiment. The aqueous solution was extracted by Et_2O (3 × 3.0 mL). The combined Et_2O was washed with brine twice and dehydrated with Na_2SO_4. After the evaporation of Et_2O, the residue was purified by silica gel flash column chromatography to afford the desired product. The conversion and the ee value could be determined by chiral GC using a Supelco β-Dex 120 chiral column (30 m × 0.25 mm(i.d.), 0.25 μm film) or a HPLC analysis with a UV-Vis detector using a Daicel OJ-H chiralcel columns (Φ 0.46 x 25 cm).

Figure S1. FT-IR spectra of MSS and the catalyst **2-3**.

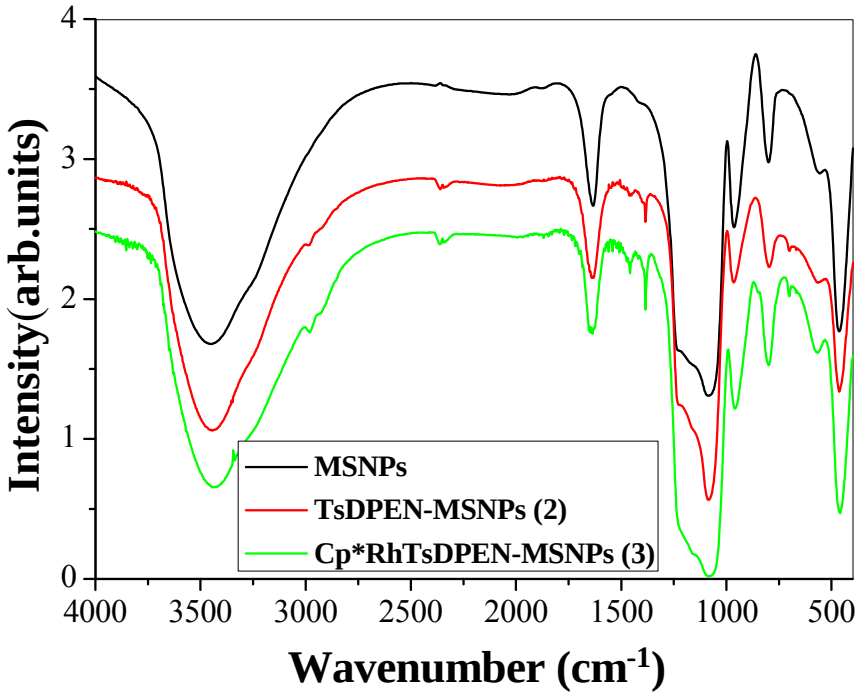


Figure S2. Solid-state ^{13}C CP MAS NMR spectra of **2-3.**

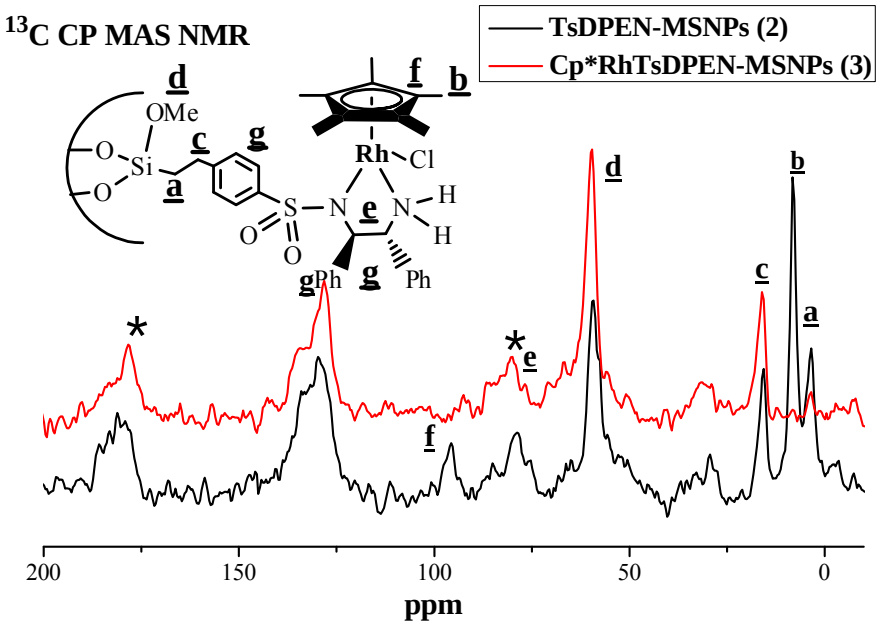


Figure S3. Solid-state ^{29}Si MAS NMR spectra of **2-3.**

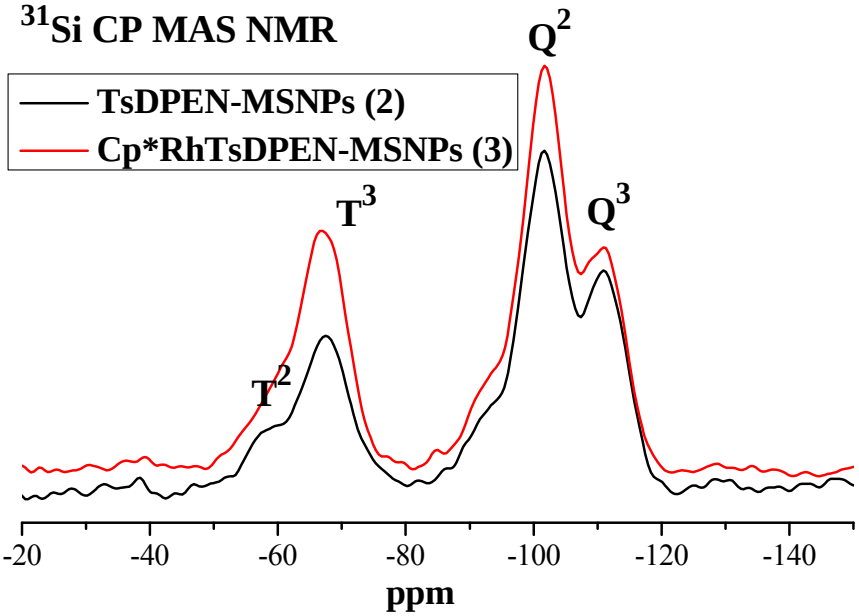


Figure 4. XPS spectra of the homogeneous Cp*RhTsDPEN and **3.**

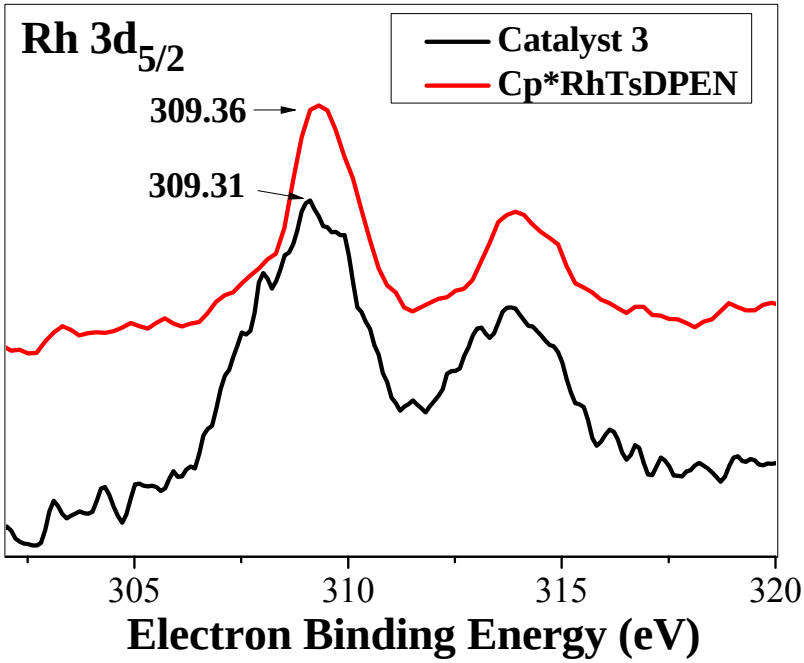
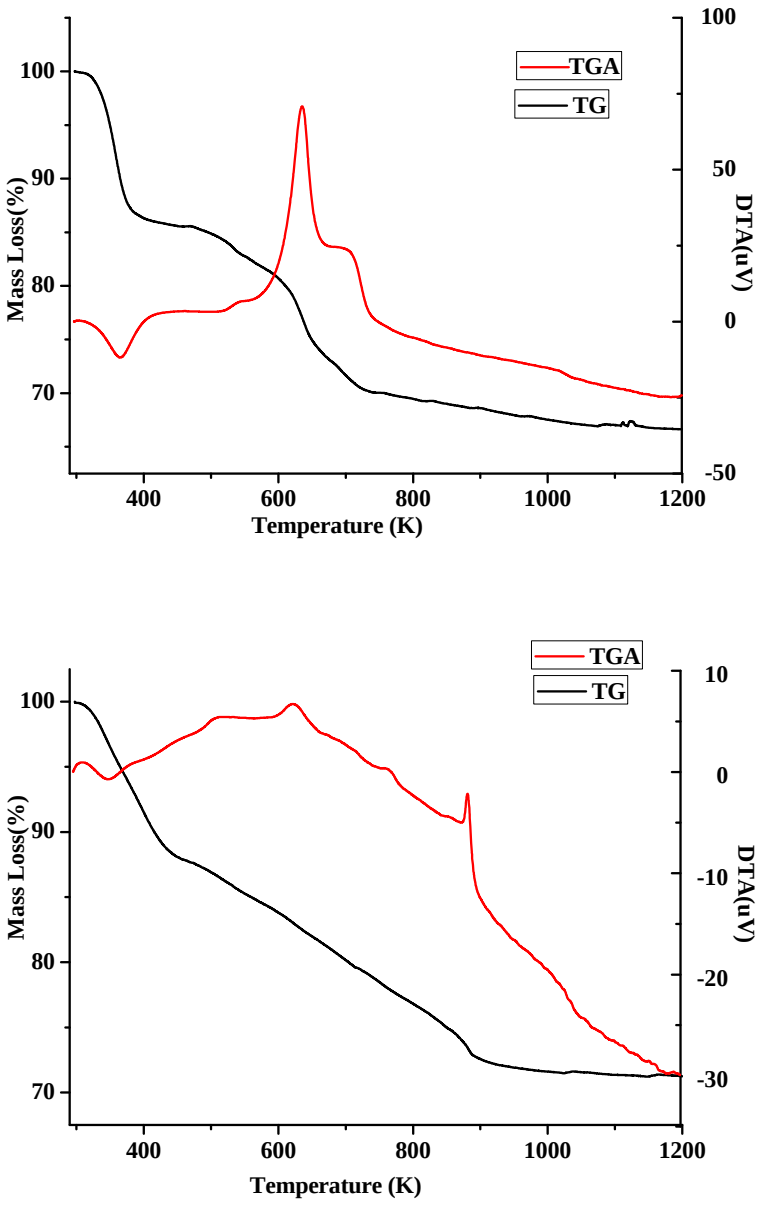


Figure S4. TG/DTA curves of the DMSS and the catalyst **3**.

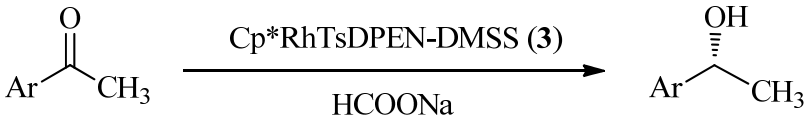


Explanation: The TG/DTA curve of DMSS and the catalyst **3** were treated in the air as shown in Figure S5. An endothermic peak around 444K with weight loss of 11.9% could be attributed to the release of physical adsorption water while the another endothermic peak around 444-900K with weight loss of 16.4% could be assigned to the release of the residual CTAC surfactant (cetyltrimethylammonium chloride) in the core-shell extracted samples (V. Cauda, A. Schlossbauer, J. Kecht, A. Zürner, T. Bein, *Am. Chem. Soc.*, 2009, **131**, 11361). Apparently, totally weight loss of the residual CTAC surfactant was 16.4% in 88.1% DMSS materials when eliminated the part of water, meaning the 18.6% weight loss of the residual

CTAC surfactant per 100% materials.

In sharp contrast to TG/DTA curve of DMSS, it was found easily that a similar endothermic peak around 444K with weight loss of 14.4% in the heterogeneous catalyst **3** were strongly similar to that of parent DMSS due to the release of physical adsorption water. It was worth mentioning that two new typical exothermic peaks were combined into one complicated exothermic peak around 636-701 K with weight loss of 9.5% could be assigned to the oxidation of Cp*RhTsDPEN organic molecules (including Cp* ring and TsDPEN moiety, alkyl fragments and part of the residual CTAC surfactant). Because the totally weight loss of organic moieties (including Cp*RhTsDPEN organic molecules and the residual CTAC surfactant) was 33.0% per 85.6% DMSS materials when eliminated the part of water, meaning the whole weight loss 21.7% (including the residual CTAC plus Cp*RhTsDPEN organic molecules) per 100% materials. Apparently, in sharp contrast to the weight loss of the residual CTAC surfactant in DMSS material, the true weight loss of Cp*RhTsDPEN organic molecules was 3.1% (21.7-18.6) per 100% materials.

Table 1. Asymmetric transfer hydrogenation of aromatic ketones.[a]



Entry	Ar	Conv. (%)[b]	Ee. (%)[b]
1	Ph	>99(88)	96 (96)
2	4-FPh	>99	95(95)
3	4-ClPh	>99	95(94)
4	4-BrPh	>99	93
5	3-BrPh	97. 8	95
6	4-MePh	>99	92(93)
7	4-OMePh	>99	95(97)
8	3-OMePh	>99	96(98)
9	4-CNPh	>99	89(91)
10	4-CF_3Ph	>99	93
11	4-NO_2Ph	>99	87 (88)
12	2-naphthyl	>99	95

[a] Reaction conditions: catalysts (25.00 mg, 1.0 μmol of Rh based on ICP analysis), HCO_2Na (0.13 g, 0.19 mmol), ketone (0.25 mmol) and 2.0 mL water, reaction temperature (40 °C), reaction time (1.0-6.0 h). [b] Determined by chiral GC or HPLC analysis (see ESI in Fig. S6).

Translation of Chinese to English is as follows:

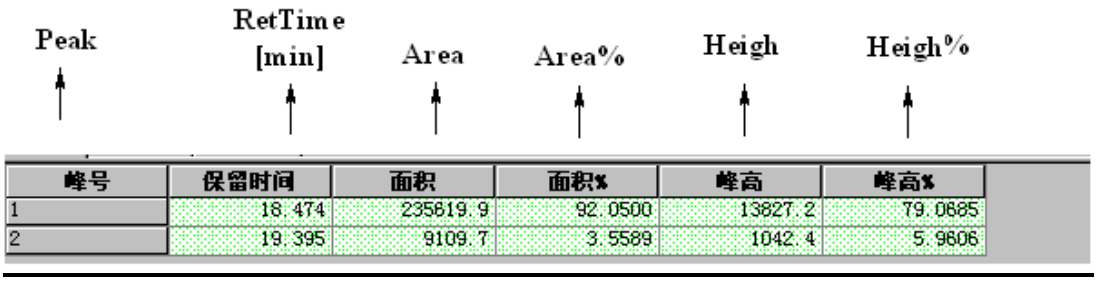
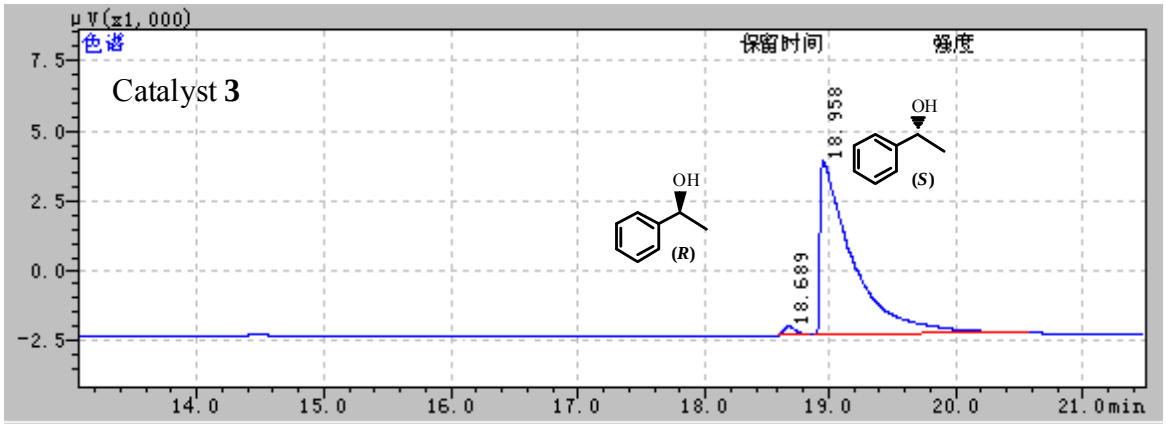


Figure S6. The catalytic activity and enantiomeric excess were determined by chiral GC using a Supelco β-Dex 120 chiral column (30 m×0.25 mm (i.d.), 0.25 μm film)

Asymmetric transfer hydrogenation of acetophenone.

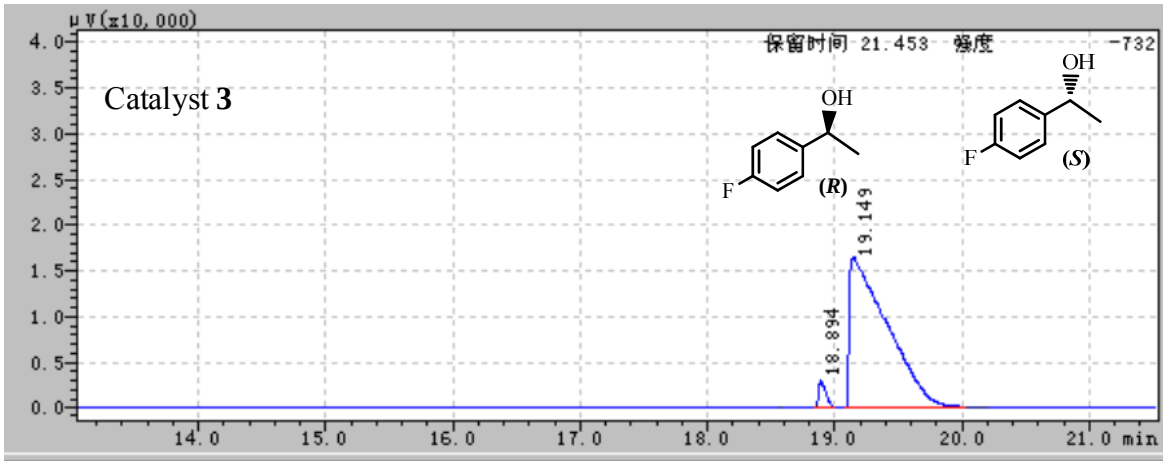


结果 - 峰值表

峰值表 | 分组结果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	18.689	1843.6	1.6149	314.1	4.8422
2	18.958	112321.4	98.3851	6173.6	95.1578

Asymmetric transfer hydrogenation of 4-fluoroacetophenone.

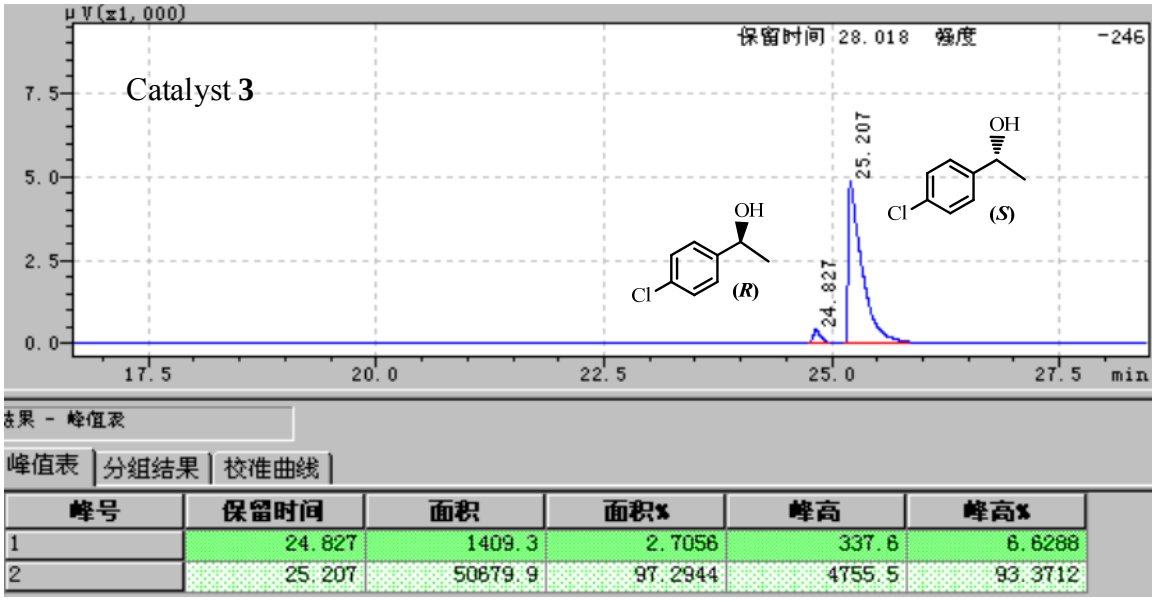


结果 - 峰值表

峰值表 | 分组结果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	18.894	9302.1	2.6453	2515.9	13.2608
2	19.149	342343.9	97.3547	16456.5	86.7392

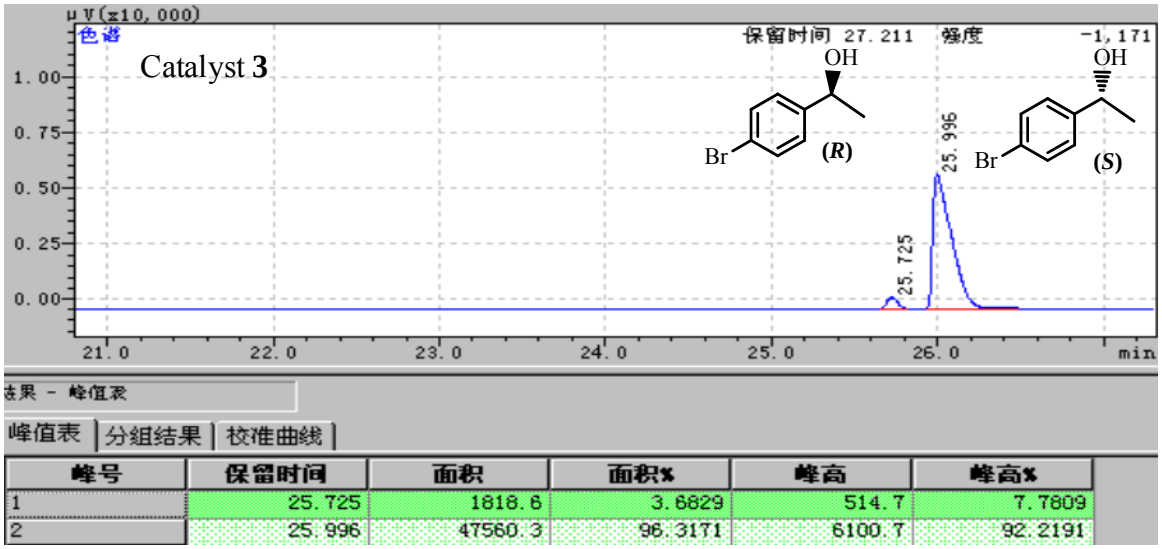
Asymmetric transfer hydrogenation of 4-chloroacetophenone.



峰值表 | 分組結果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	24.827	1409.3	2.7056	337.6	6.6288
2	25.207	50679.9	97.2944	4755.5	93.3712

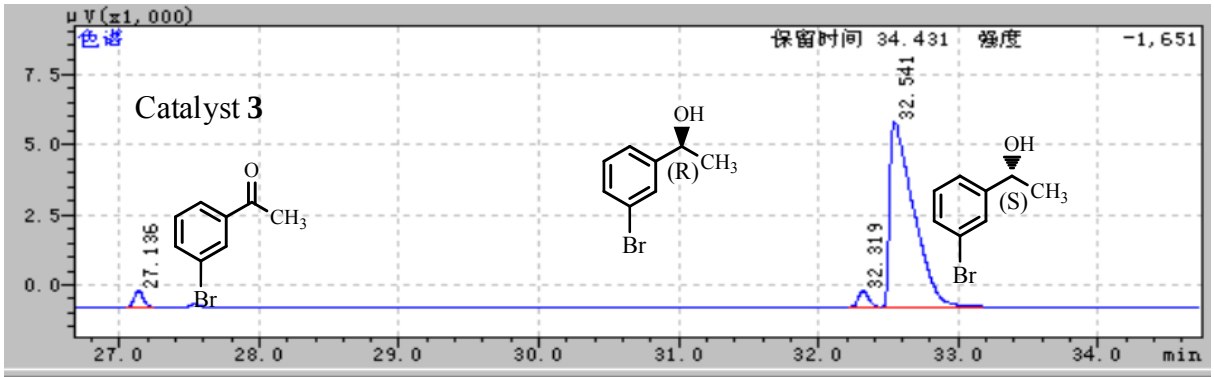
Asymmetric transfer hydrogenation of 4-bromoacetophenone.



峰值表 | 分組結果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	25.725	1818.6	3.6829	514.7	7.7809
2	25.996	47560.3	96.3171	6100.7	92.2191

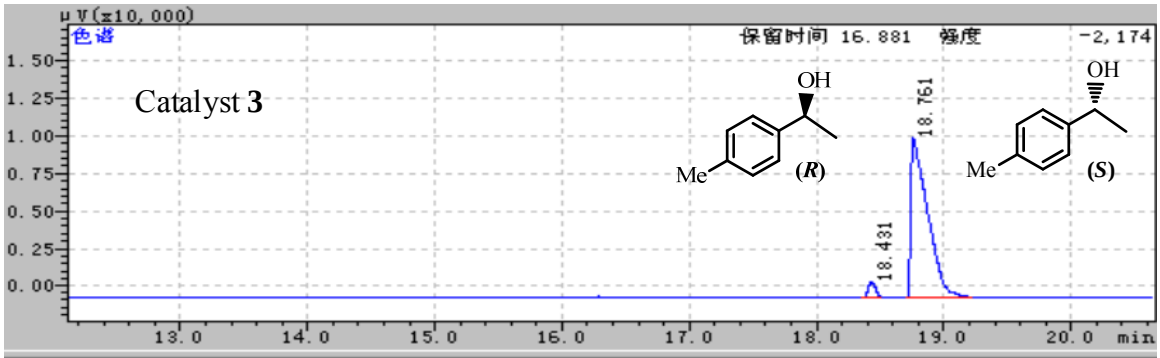
Asymmetric transfer hydrogenation of 3-bromoacetophenone.



峰值表 | 分组结果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	27.136	1843.0	2.2287	497.8	6.5991
2	32.319	2077.8	2.5128	473.3	6.2735
3	32.541	78772.0	95.2587	6572.7	87.1274

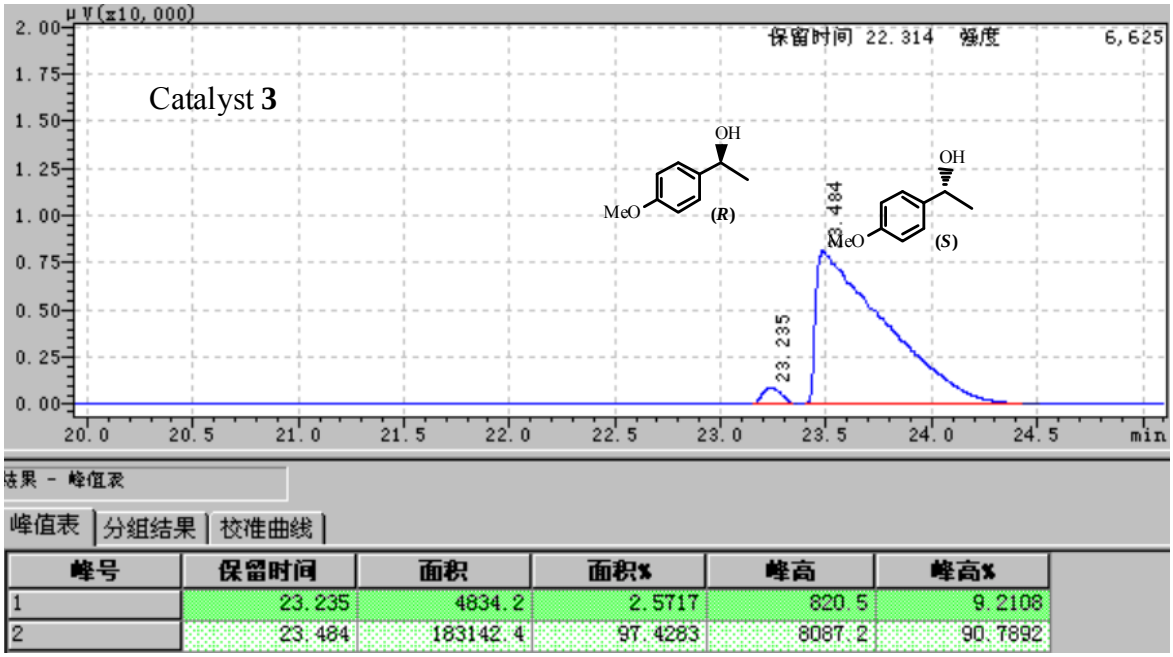
Asymmetric transfer hydrogenation of 4-methylacetophenone.



峰值表 | 分组结果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	18.431	4156.7	4.0559	1125.4	9.5559
2	18.761	98329.1	95.9441	10652.0	90.4441

Asymmetric transfer hydrogenation of 4-methoxylacetophenone.

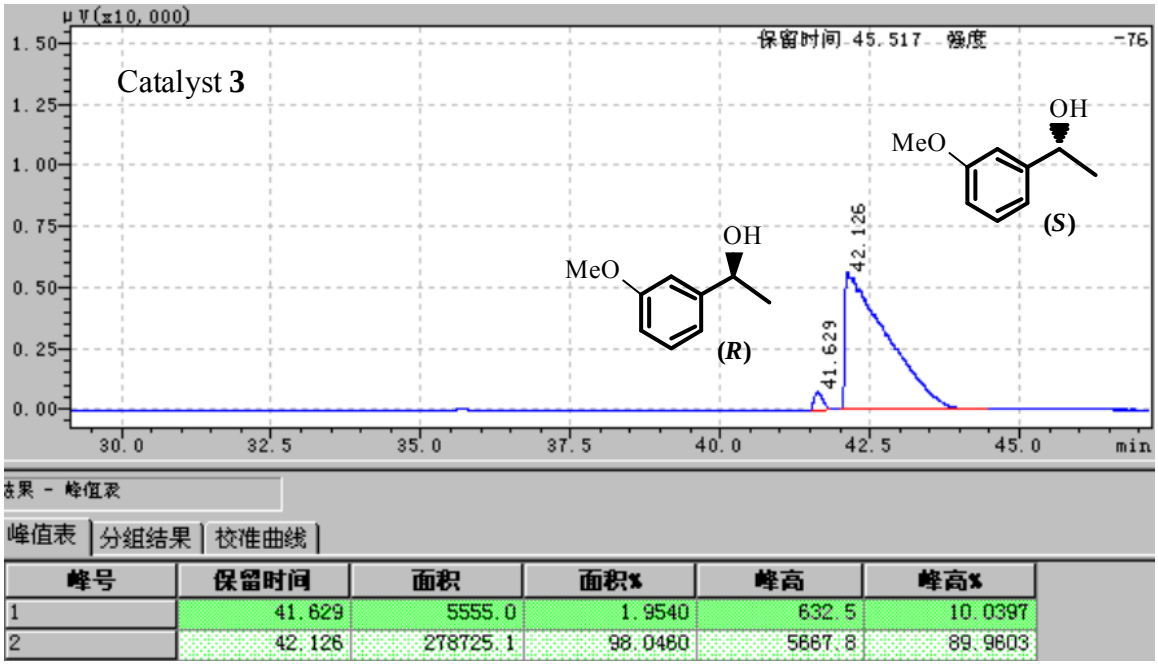


结果 - 峰值表

峰值表 | 分组结果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	23.235	4834.2	2.5717	820.5	9.2108
2	23.484	183142.4	97.4283	8087.2	90.7892

Asymmetric transfer hydrogenation of 3-methoxylacetophenone.

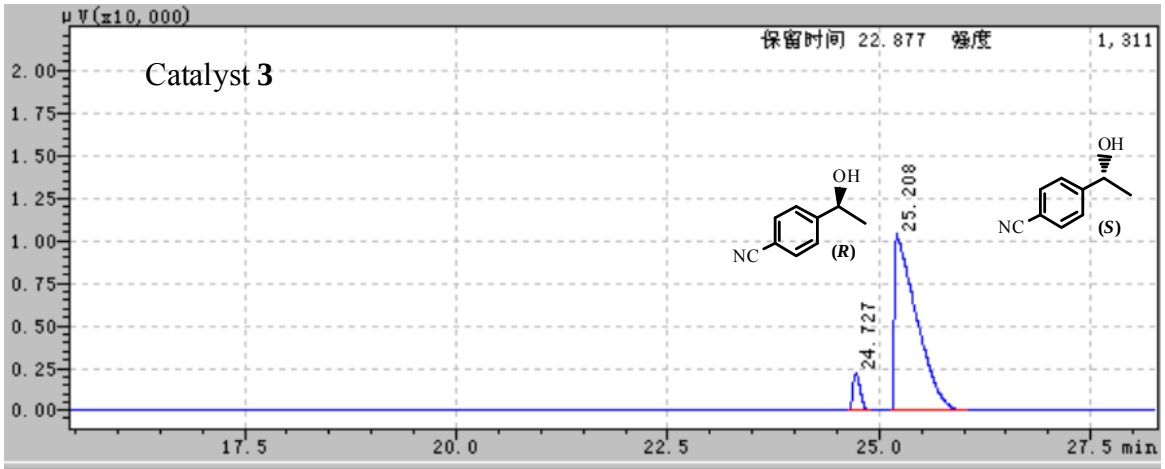


结果 - 峰值表

峰值表 | 分组结果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	41.629	5555.0	1.9540	632.5	10.0397
2	42.126	278725.1	98.0480	5667.8	89.9603

Asymmetric transfer hydrogenation of 4-cyanoacetophenone.

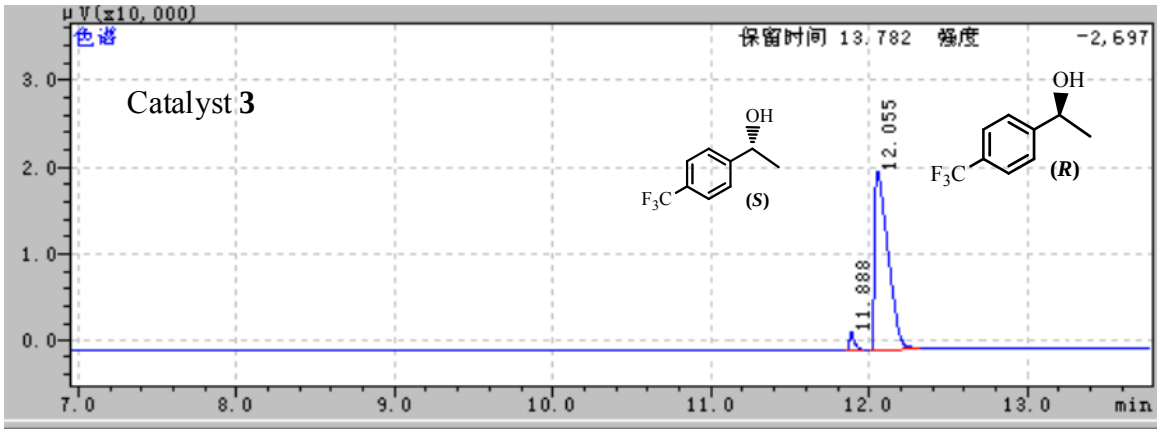


结果 - 峰值表

峰值表 | 分组结果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	24.727	10976.2	5.4963	1993.7	16.1432
2	25.208	188725.5	94.5037	10356.4	83.8568

Asymmetric transfer hydrogenation of 4-trifluoromethylacetophenone.

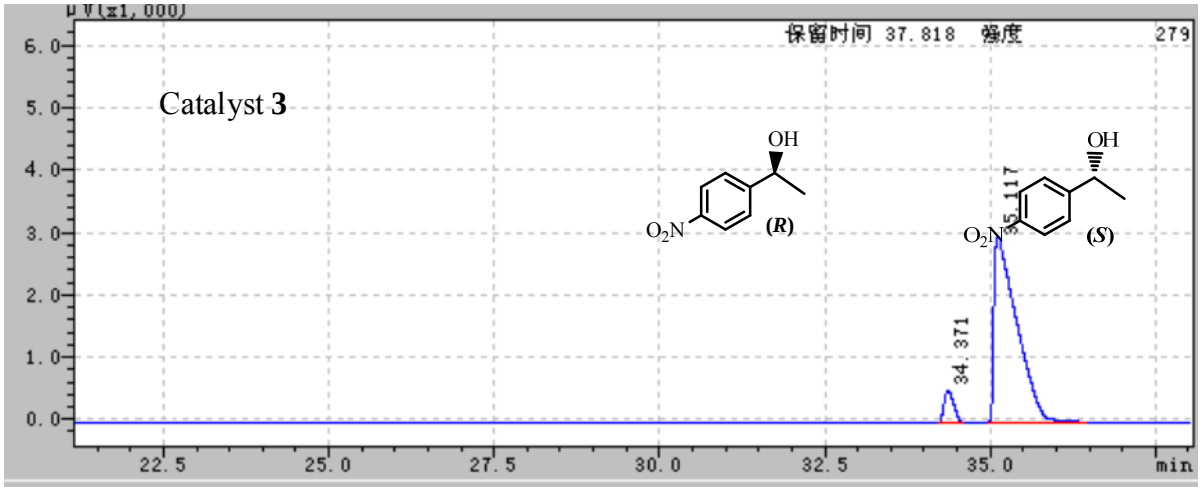


结果 - 峰值表

峰值表 | 分组结果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	11.888	4253.0	3.3652	1959.5	8.7073
2	12.055	122129.0	96.6348	20544.5	91.2927

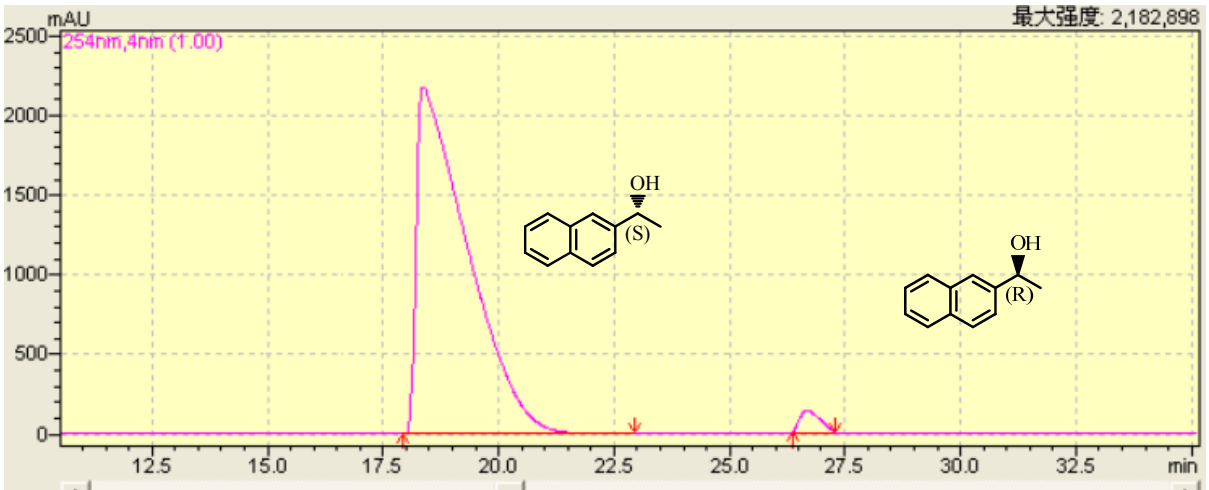
Asymmetric transfer hydrogenation of 4-nitroacetophenone.



峰值表 | 分組結果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	34.371	4920.0	6.4766	506.9	14.4945
2	35.117	71045.7	93.5234	2990.0	85.5055

Asymmetric transfer hydrogenation of 2-acetonaphthone. (Daicel OJ-H chiralcel columns: 1.0 mL/min, 2-propanol：n-hexane=7:93, T=40 °C.) ref: [Liu, P. N.; Gu, P. M.; Wang F.; Tu, Y. Q. Org. Lett., 2004, 6, 169.].



化合物表视图

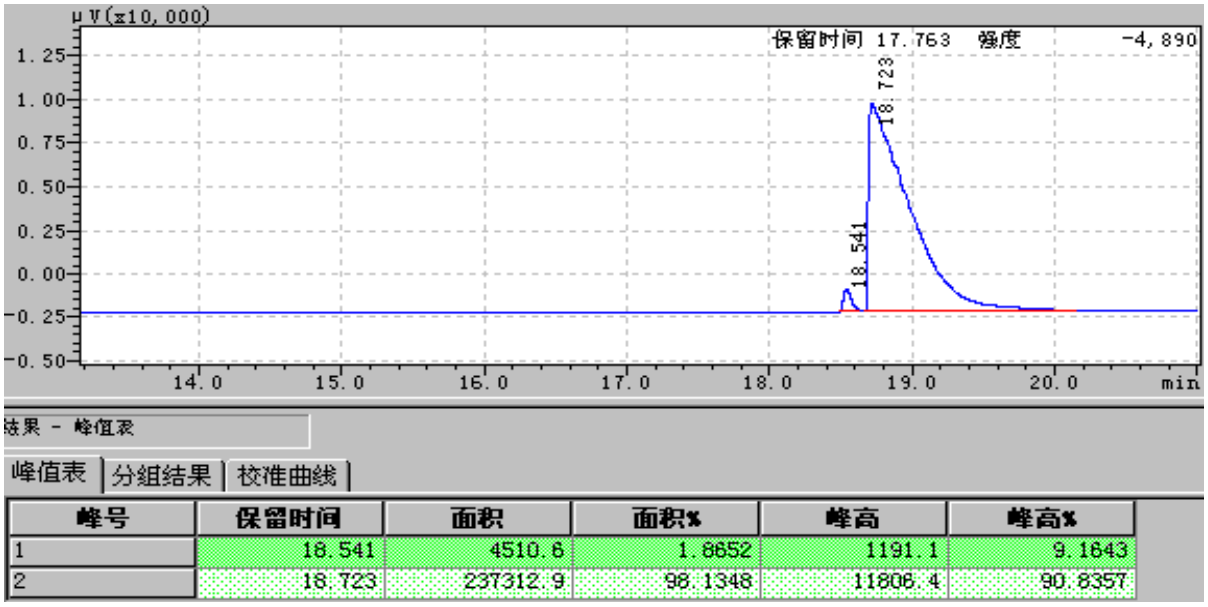
ID#	名称	保留时间	峰#	面积	高度	面积%
1	RT18.347	18.347	1	167576328	2181032	97.6468
2	RT26.677	26.677	2	4038430	130959	2.3532

Table S1. Reusability of the catalyst **3** using acetophenone as a substrate.

Run	1	2	3	4	5	6	7	8	9	10	11	12
Conv.	99.9	99.9	98.9	99.4	99.9	99.8	99.9	99.9	99.4	99.9	99.9	99.9
E.e	96. 8	96.2	96.4	96.2	96.2	96.0	95.7	95.7	95.2	94.5	94.6	93.2

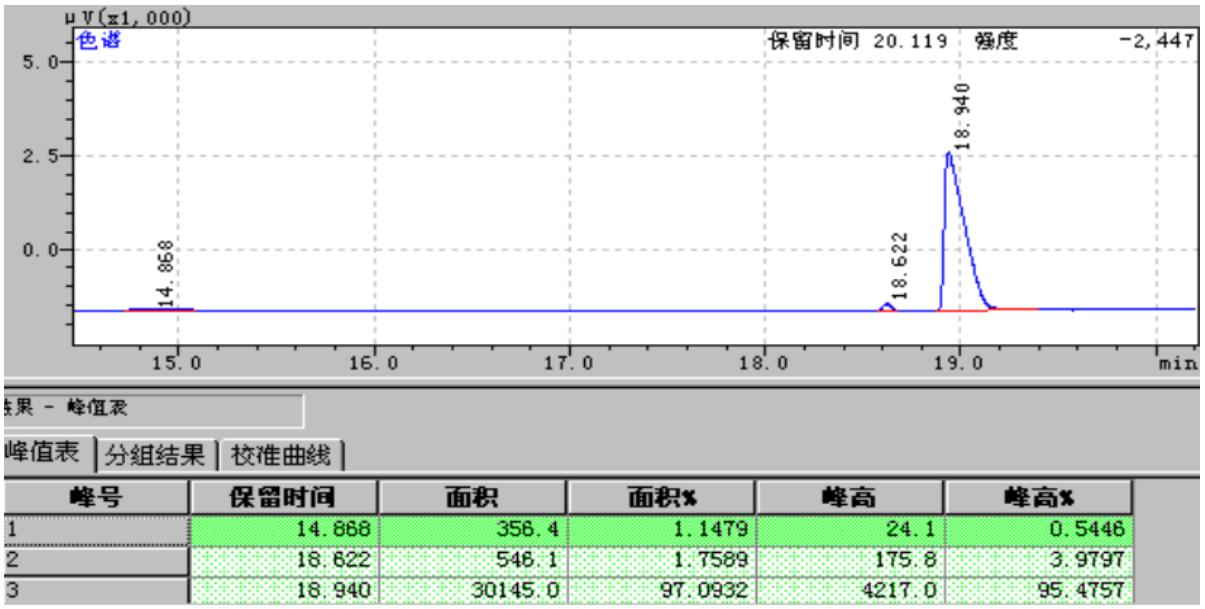
Figure S7. Reusability of the catalyst **3** using acetophenone as a substrate.

Recycle 2 of the catalyst **3** using acetophenone as a substrate.



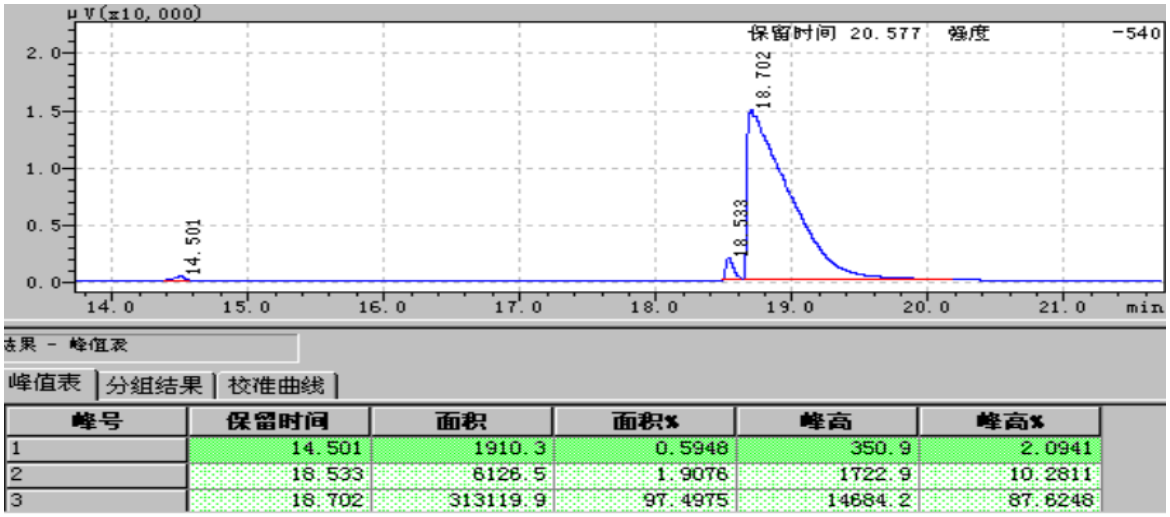
峰号	保留时间	面积	面积%	峰高	峰高%
1	18.541	4510.6	1.8652	1191.1	9.1643
2	18.723	237312.9	98.1348	11806.4	90.8357

Recycle 3 of the catalyst **3** using acetophenone as a substrate.



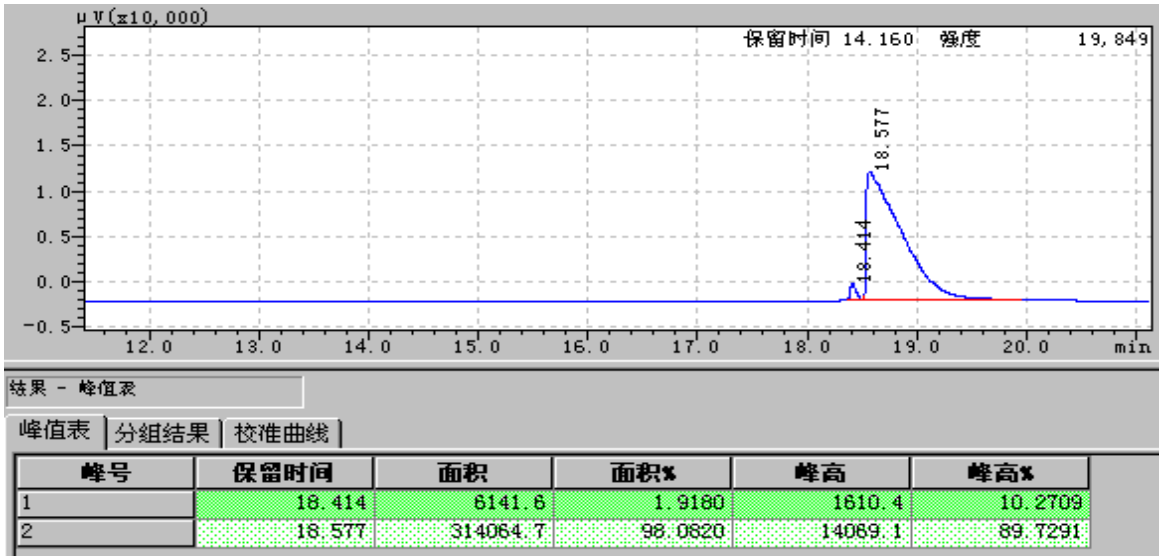
峰号	保留时间	面积	面积%	峰高	峰高%
1	14.868	356.4	1.1479	24.1	0.5446
2	18.622	546.1	1.7589	175.8	3.9797
3	18.940	30145.0	97.0932	4217.0	95.4757

Recycle 4 of the catalyst **3** using acetophenone as a substrate.



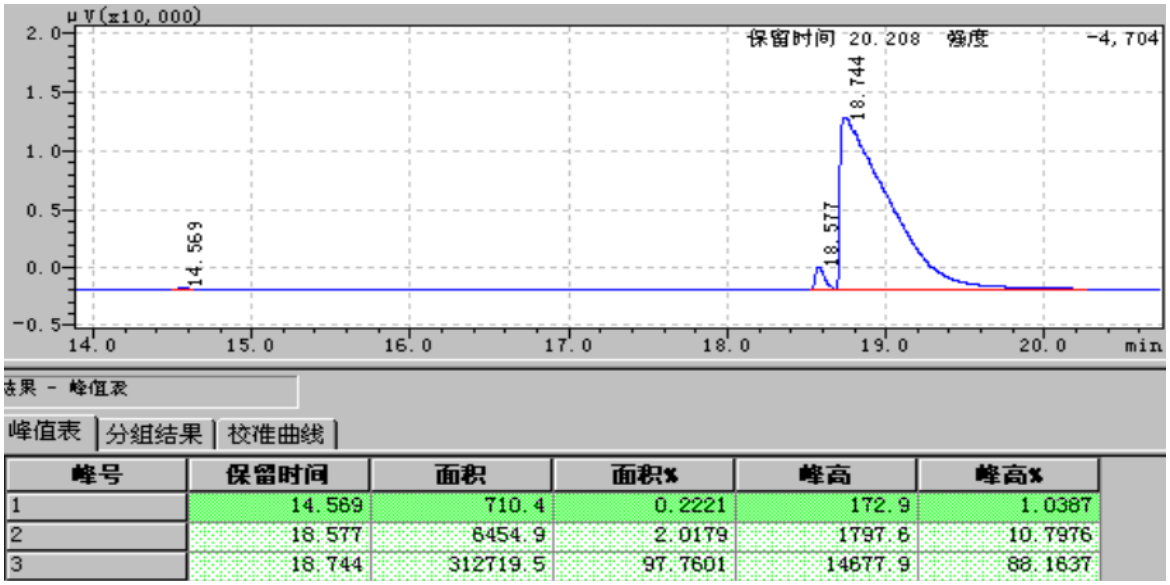
峰号	保留时间	面积	面积%	峰高	峰高%
1	14.501	1910.3	0.5948	350.9	2.0941
2	18.533	8126.5	1.9078	1722.9	10.2811
3	18.702	313119.9	97.4975	14684.2	87.6248

Recycle 5 of the catalyst **3** using acetophenone as a substrate.



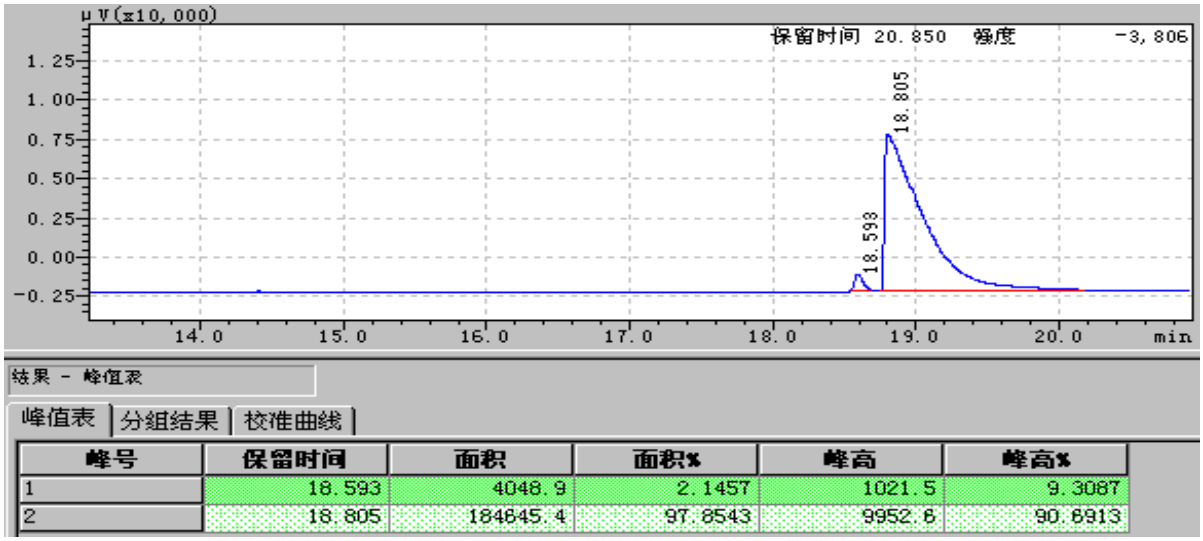
峰号	保留时间	面积	面积%	峰高	峰高%
1	18.414	6141.6	1.9180	1610.4	10.2709
2	18.577	314064.7	98.0820	14069.1	89.7291

Recycle 6 of the catalyst **3** using acetophenone as a substrate.



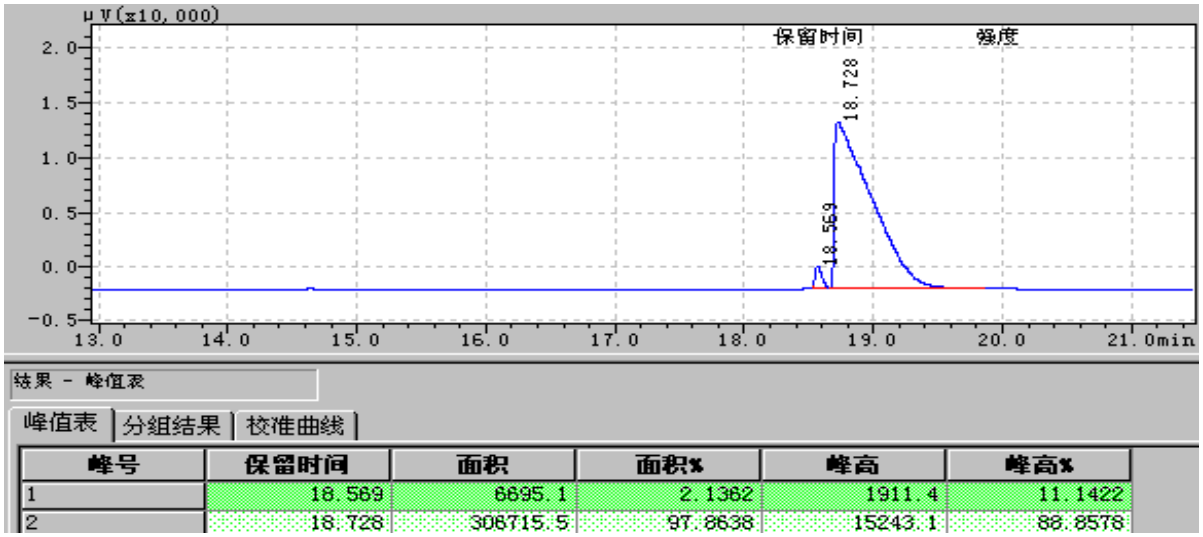
峰号	保留时间	面积	面积%	峰高	峰高%
1	14.569	710.4	0.2221	172.9	1.0387
2	18.577	6454.9	2.0179	1797.6	10.7976
3	18.744	312719.5	97.7601	14677.9	88.1637

Recycle 7 of the catalyst **3** using acetophenone as a substrate.



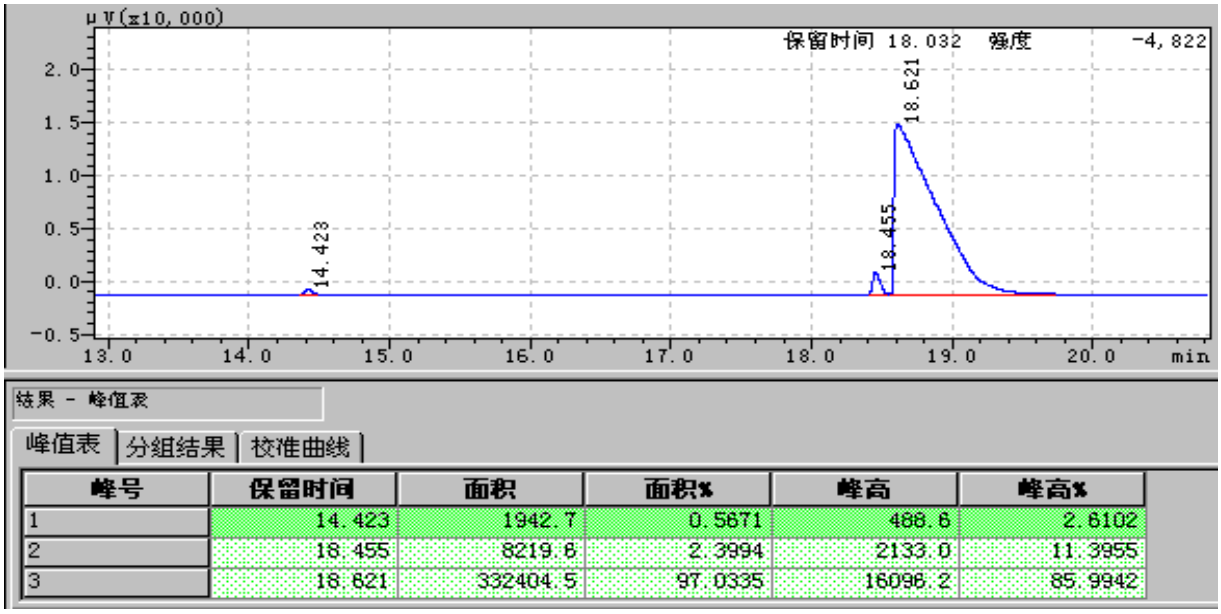
峰号	保留时间	面积	面积%	峰高	峰高%
1	18.593	4048.9	2.1457	1021.5	9.3087
2	18.805	184645.4	97.8543	9952.6	90.6913

Recycle 8 of the catalyst **3** using acetophenone as a substrate.



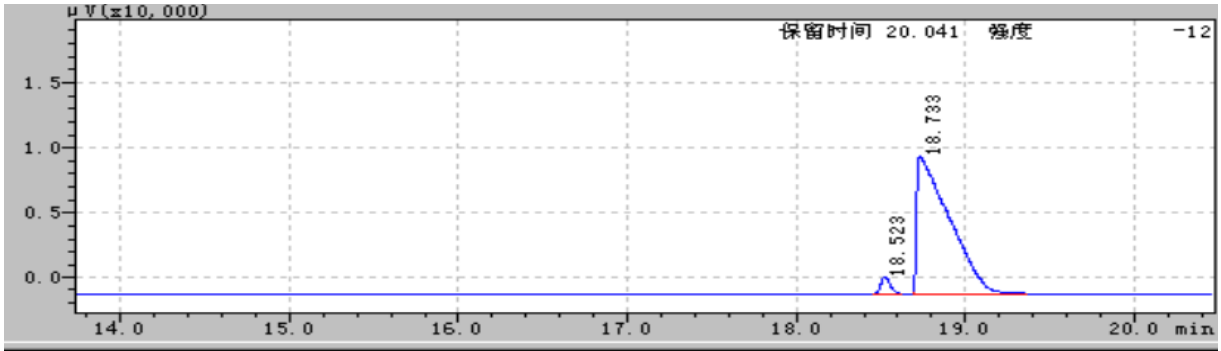
峰号	保留时间	面积	面积%	峰高	峰高%
1	18.569	6695.1	2.1362	1911.4	11.1422
2	18.728	306715.5	97.8638	15243.1	88.8578

Recycle 9 of the catalyst **3** using acetophenone as a substrate.



峰号	保留时间	面积	面积%	峰高	峰高%
1	14.423	1942.7	0.5671	488.6	2.6102
2	18.455	8219.8	2.3994	2133.0	11.3955
3	18.621	332404.5	97.0335	16098.2	85.9942

Recycle 10 of the catalyst **3** using acetophenone as a substrate.

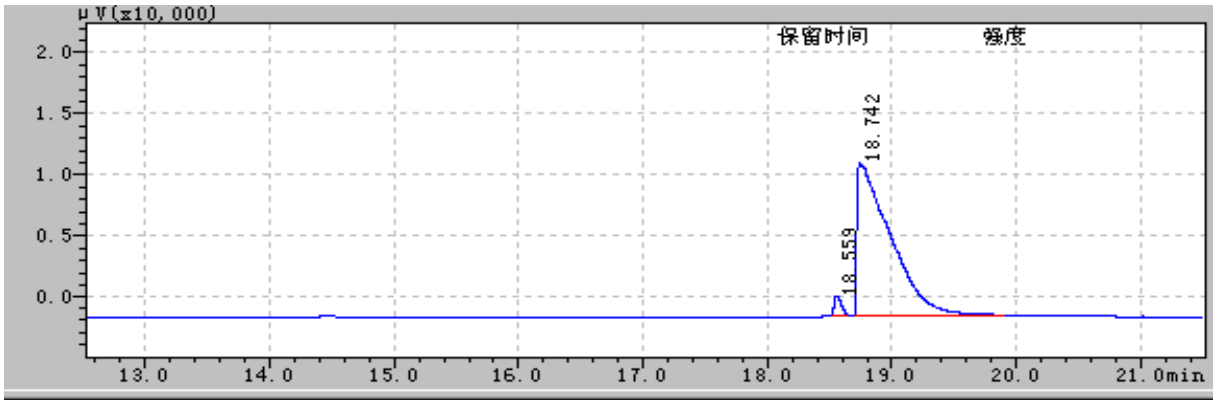


结果 - 峰值表

峰值表 | 分组结果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	18.523	3919.0	2.6700	1113.2	9.5341
2	18.733	142860.0	97.3300	10582.8	90.4659

Recycle 11 of the catalyst **3** using acetophenone as a substrate.

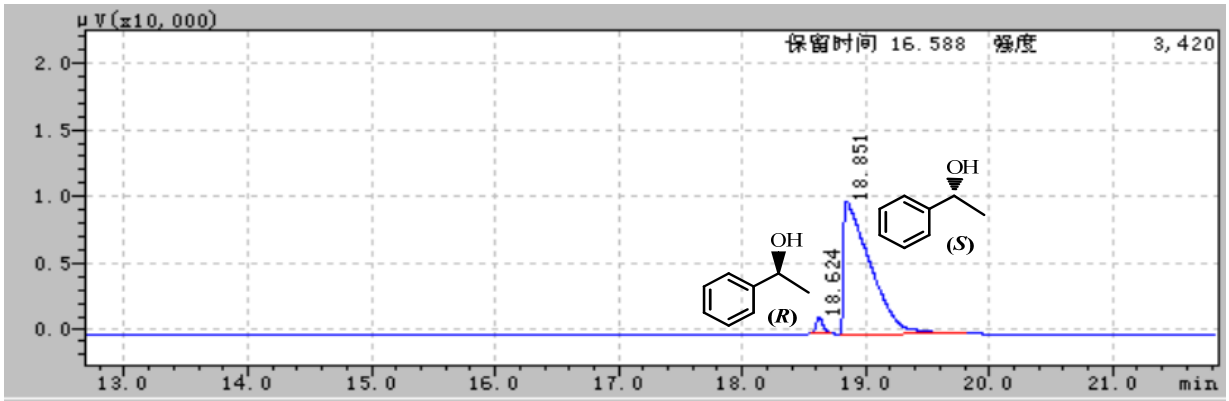


结果 - 峰值表

峰值表 | 分组结果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	18.559	6614.6	2.7097	1694.6	11.8938
2	18.742	237494.1	97.2903	12553.1	88.1062

Recycle 12 of the catalyst **3** using acetophenone as a substrate.



结果 - 峰值表

峰值表 | 分组结果 | 校准曲线

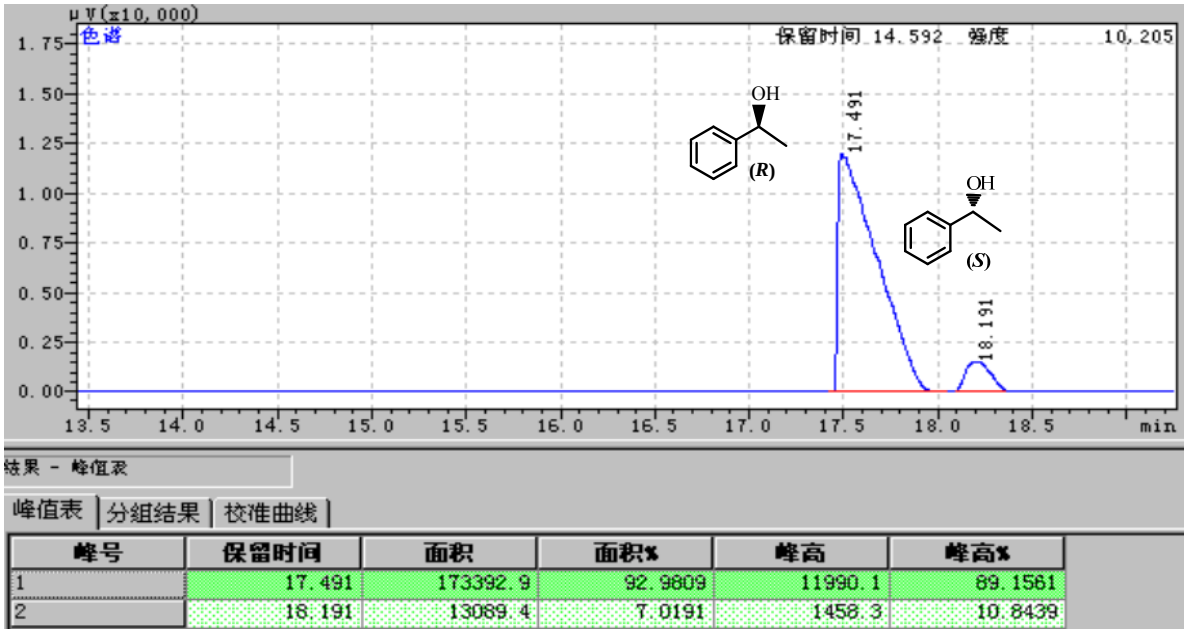
峰号	保留时间	面积	面积%	峰高	峰高%
1	18.624	5359.5	3.3735	1261.2	11.1643
2	18.851	153510.5	96.6265	10035.3	88.8357

Table S2. Reusability of the catalyst **4** using acetophenone as a substrate.

Run	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Conv.	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	99.9	95.1
E.e	86.9	86.0	85.9	85.8	85.6	84.5	84.4	84.5	84.1	84.5	83.7	84.5	83.4	83.4	83.0

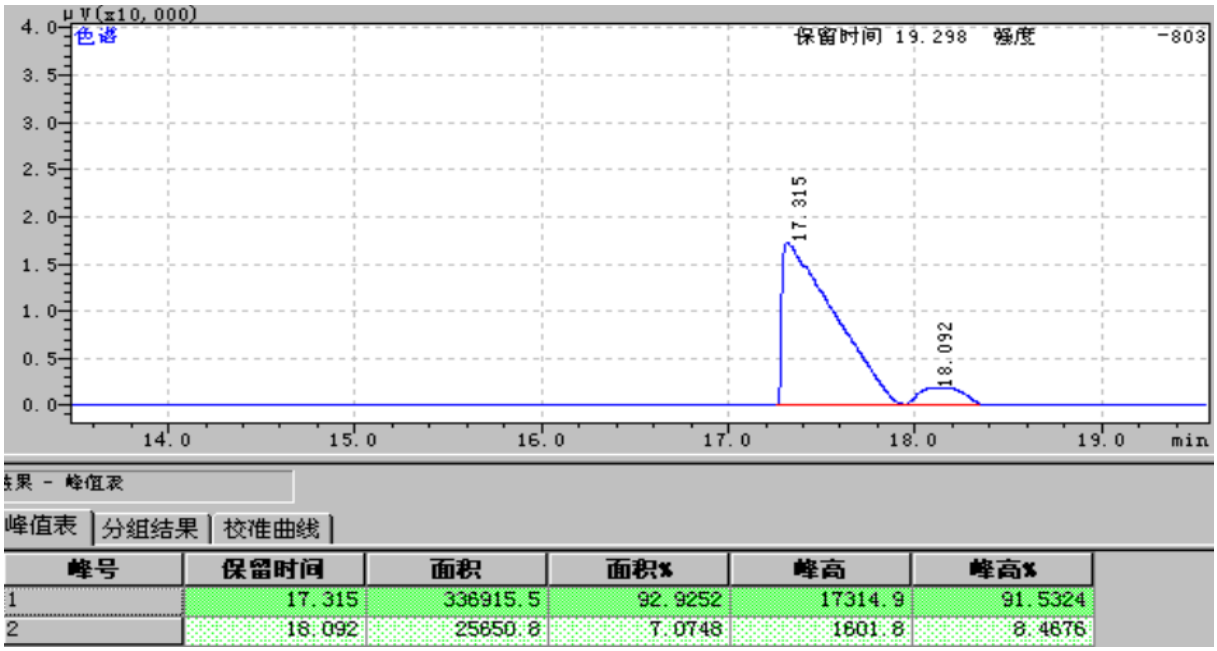
Figure S8. Reusability of the catalyst **4** using acetophenone as a substrate.

Recycle 2 of the catalyst **4** using acetophenone as a substrate.



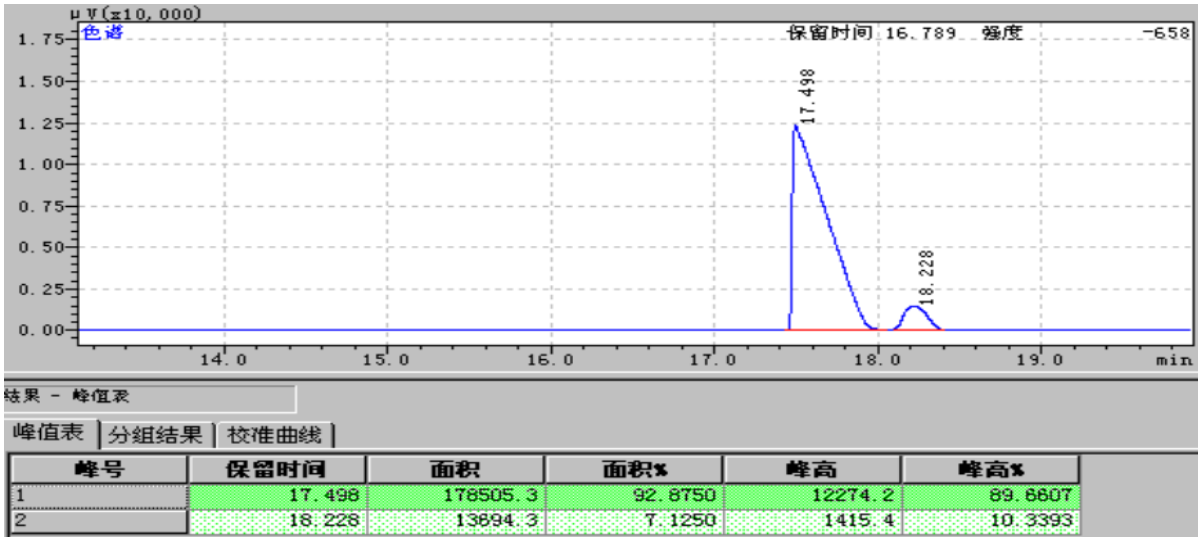
峰号	保留时间	面积	面积%	峰高	峰高%
1	17.491	173392.9	92.9809	11990.1	89.1561
2	18.191	13089.4	7.0191	1458.3	10.8439

Recycle 3 of the catalyst **4** using acetophenone as a substrate.



峰号	保留时间	面积	面积%	峰高	峰高%
1	17.315	336915.5	92.9252	17314.9	91.5324
2	18.092	25850.8	7.0748	1601.8	8.4676

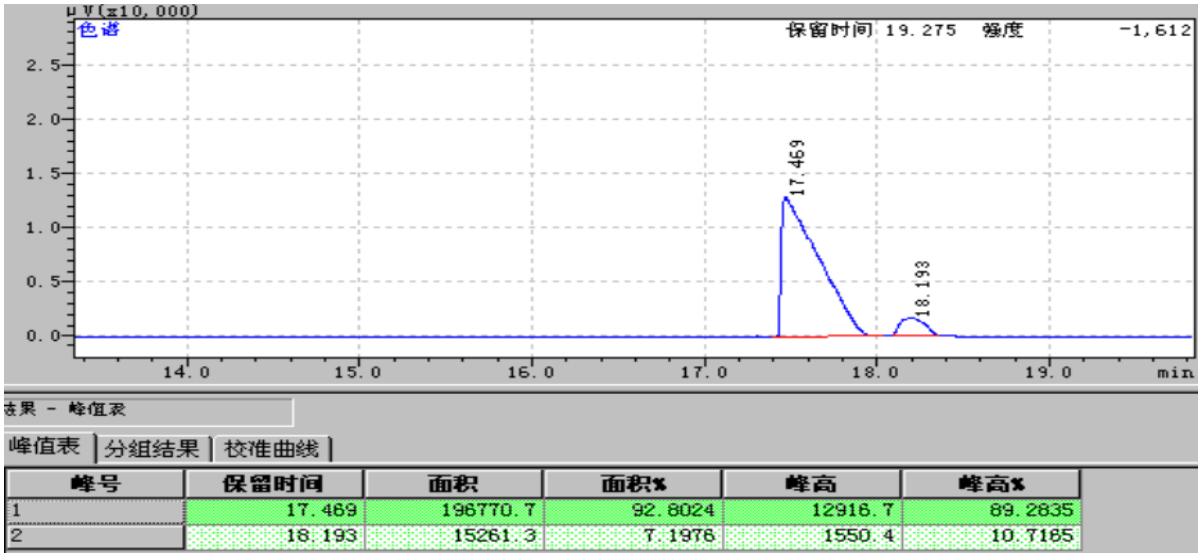
Recycle 4 of the catalyst **4** using acetophenone as a substrate.



峰值表 | 分组结果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	17.498	178505.3	92.8750	12274.2	89.8607
2	18.228	13894.3	7.1250	1415.4	10.3393

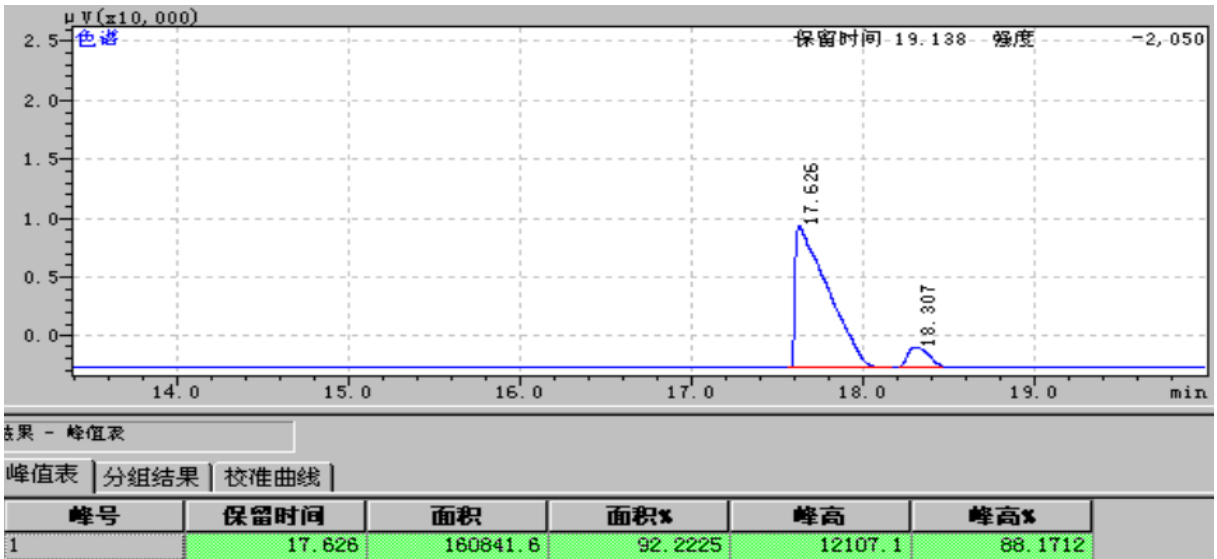
Recycle 5 of the catalyst **4** using acetophenone as a substrate.



峰值表 | 分组结果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	17.469	196770.7	92.8024	12918.7	89.2835
2	18.193	15261.3	7.1978	1550.4	10.7185

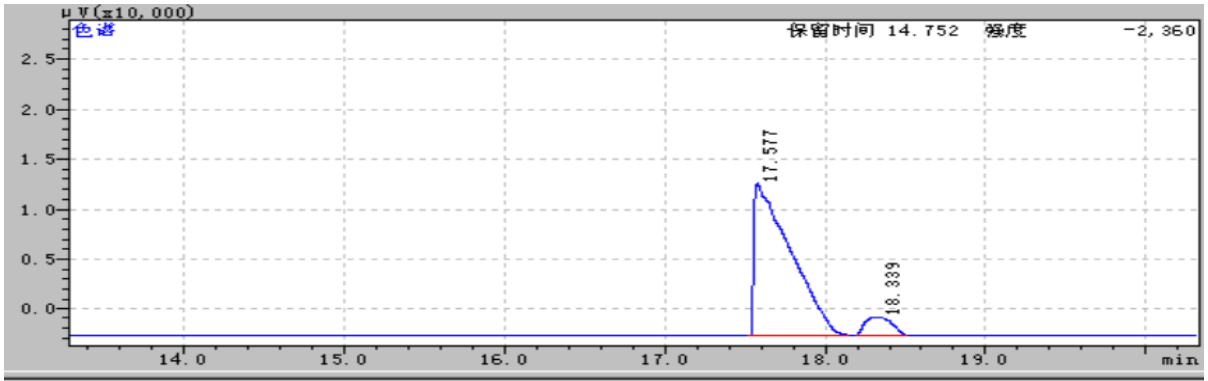
Recycle 6 of the catalyst **4** using acetophenone as a substrate.



峰值表 | 分组结果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	17.626	160841.6	92.2225	12107.1	88.1712
2	18.307	13564.5	7.7775	1624.2	11.8288

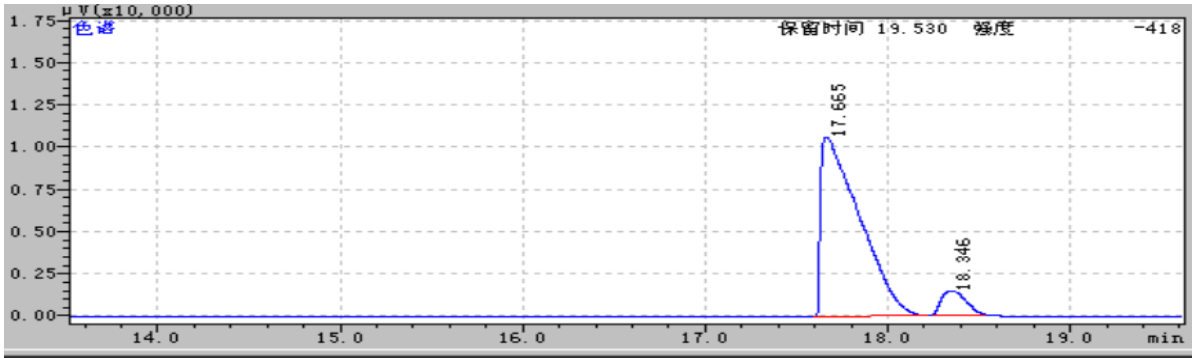
Recycle 7 of the catalyst **4** using acetophenone as a substrate.



峰值表 | 分組結果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	17.577	243893.8	92.2032	15349.7	89.6995
2	18.339	20623.8	7.7968	1762.7	10.3005

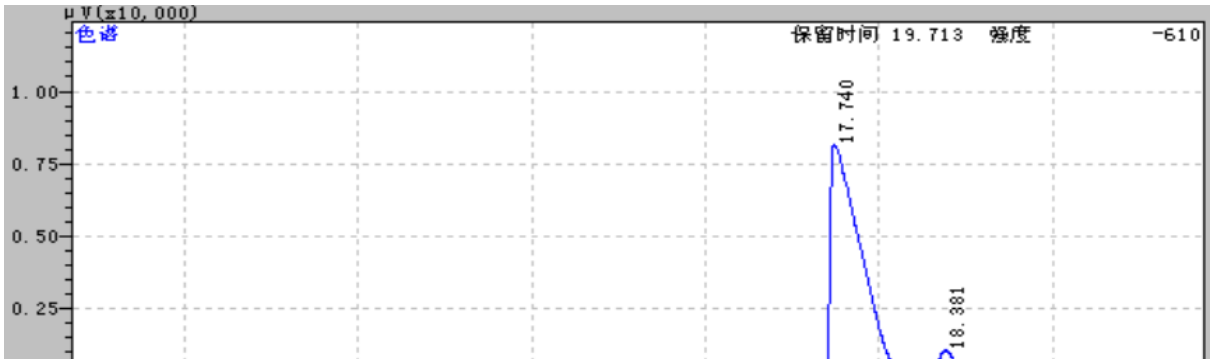
Recycle 8 of the catalyst **4** using acetophenone as a substrate.



峰值表 | 分組結果 | 校准曲线

峰号	保留时间	面积	面积%	峰高	峰高%
1	17.665	159323.4	92.2399	10723.8	88.2598
2	18.346	13403.8	7.7601	1428.4	11.7402

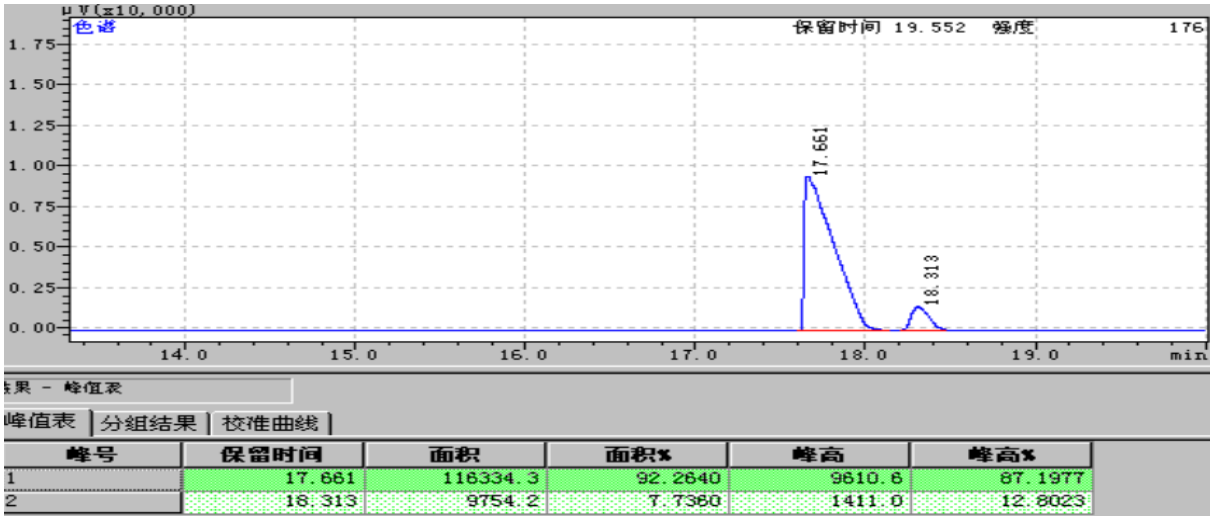
Recycle 9 of the catalyst **4** using acetophenone as a substrate.



峰值表 | 分組結果 | 校准曲线

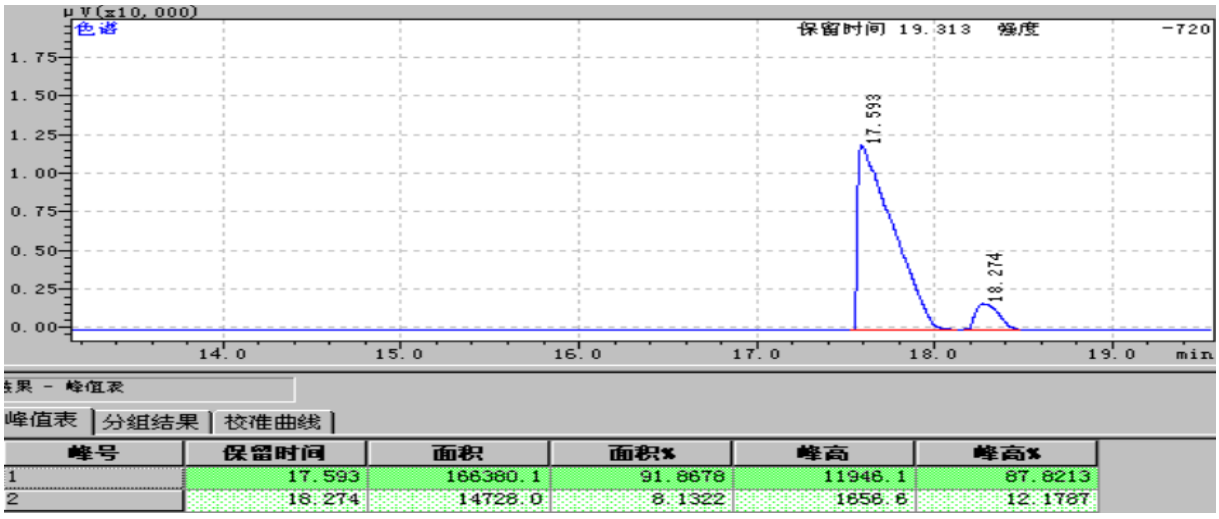
峰号	保留时间	面积	面积%	峰高	峰高%
1	17.740	104351.2	92.0231	8329.2	87.6555
2	18.381	9045.8	7.9769	1173.0	12.3445

Recycle 10 of the catalyst **4** using acetophenone as a substrate.



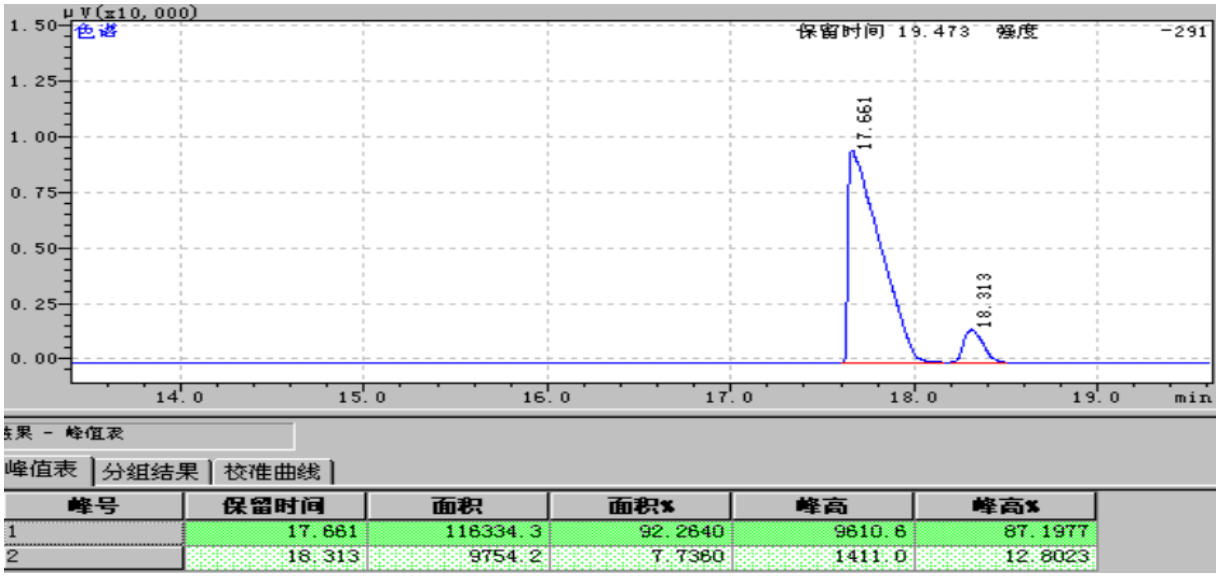
峰号	保留时间	面积	面积%	峰高	峰高%
1	17.661	116334.3	92.2640	9610.6	87.1977
2	18.313	9754.2	7.7360	1411.0	12.8023

Recycle 11 of the catalyst **4** using acetophenone as a substrate.



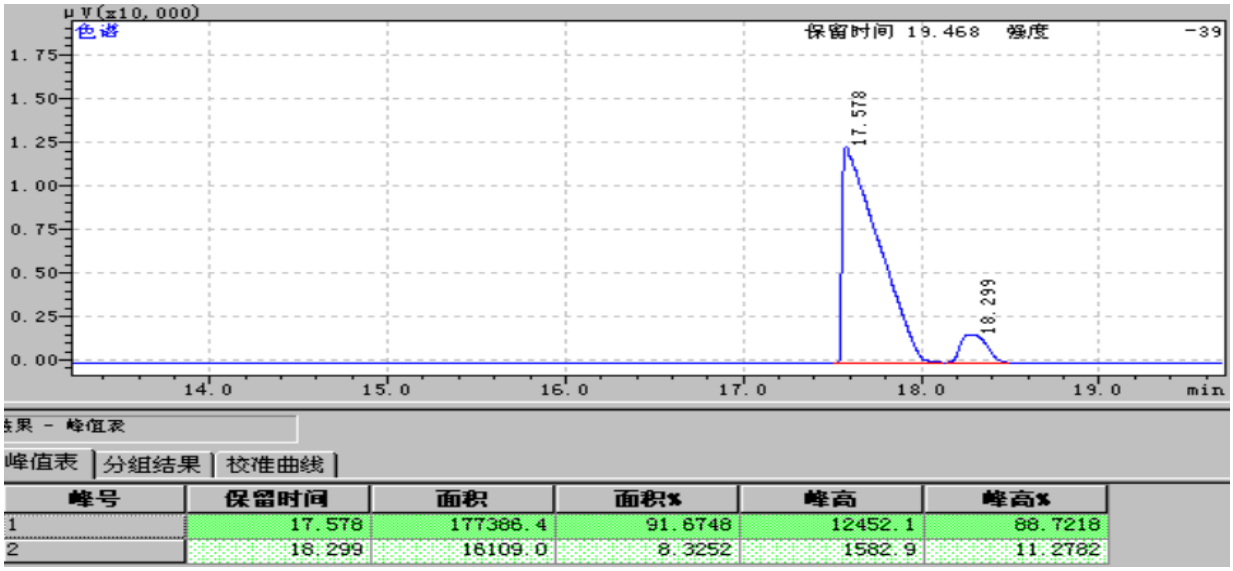
峰号	保留时间	面积	面积%	峰高	峰高%
1	17.593	166380.1	91.8678	11946.1	87.8213
2	18.274	14728.0	8.1322	1658.6	12.1787

Recycle 12 of the catalyst **4** using acetophenone as a substrate.



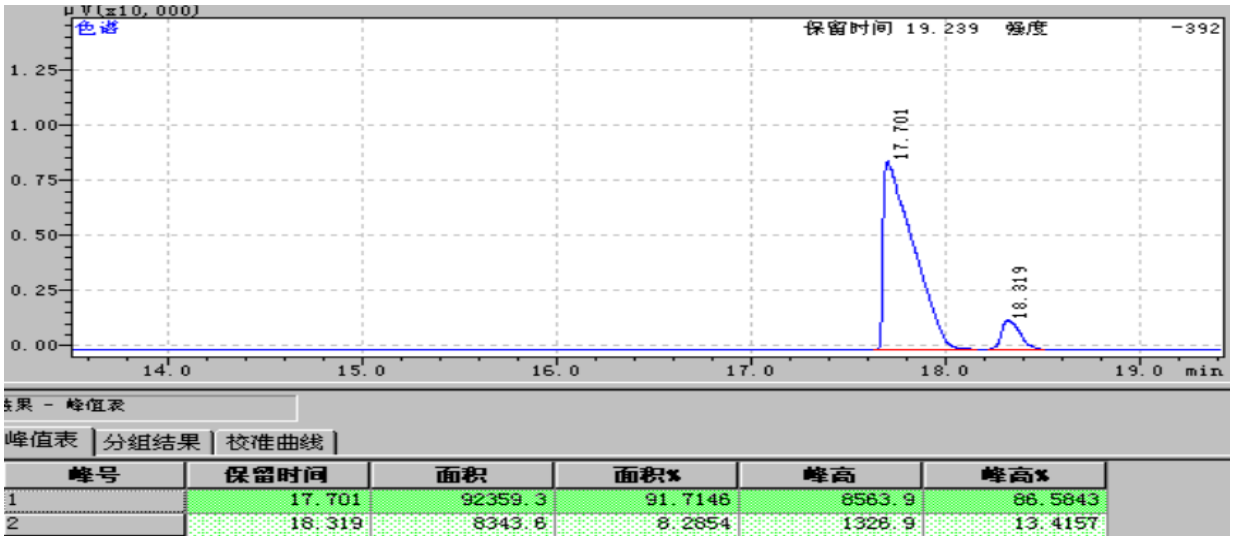
峰号	保留时间	面积	面积%	峰高	峰高%
1	17.661	116334.3	92.2640	9610.6	87.1977
2	18.313	9754.2	7.7360	1411.0	12.8023

Recycle 13 of the catalyst **4** using acetophenone as a substrate.



峰号	保留时间	面积	面积%	峰高	峰高%
1	17.578	177386.4	91.6748	12452.1	88.7218
2	18.299	16109.0	8.3252	1582.9	11.2782

Recycle 14 of the catalyst **4** using acetophenone as a substrate.



峰号	保留时间	面积	面积%	峰高	峰高%
1	17.701	92359.3	91.7146	8563.9	86.5843
2	18.319	8343.8	8.2854	1328.9	13.4157

Recycle 15 of the catalyst **4** using acetophenone as a substrate.

峰号	保留时间	面积	面积%	峰高	峰高%
1	14.040	5931.2	4.9509	1435.4	12.4375
2	17.764	104194.3	86.9730	8785.7	75.9521
3	18.394	9875.3	8.0762	1340.0	11.6104